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AND ITS PRACTICAL APPLICATIONS

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Chart for Use in Transmission Line Problems.

A chart devised by Prof. L. A. Herdt for the convenient calculation of the size of copper conductors in transmission lines is described on page 36 of this issue, the chart itself being printed on a separate sheet for ready reference. The chart is in reality a large-scale reproduction of that small portion of the vector diagram of e.m.f. relations in a transmission system which deals with the resistance and the reactance volts. By drawing this portion of the diagram to an enlarged scale, work with the chart is greatly facilitated, because almost all of the required calculations are limited to this portion, while the few involving the omitted portion can be made by means of certain simplifying assumptions that introduce only slight errors. The simplifications relate to the use of the sine or tangent line as a substitute for the arc, so that the errors are not large when the angle is small. Moreover, on account of the fact that the successive sizes of B. & S. gage wires differ by more than 25 per cent it is evident that the small error due to the trigonometric substitution is of no importance in problems connected with transmission lines where the choice is always limited to standard sizes of wires.

The Water-Power Situation.

The past season of extraordinarily low water throughout the East, a report of which we publish in other columns, has sorely tried the managers of many hydro-electric plants, and has compelled the use of steam reserves to a very unusual extent. In fact, the situation has been a serious one and has created not a little alarm. The question of the real economy of water powers has been often raised and the answer this year has not always been satisfactory to the owners. In developing a water power without large storage one is constantly between the devil and the deep sea. If the plant is designed for average flow, say, the normal June figure, which is often taken, it is quite certain to run far below this rating during parts of the three subsequent months. If, on the other hand, it is planned for the average August or September flow, water in large amounts will be flowing over the dam the rest of the year. If much of the machinery is idle for three months in the year, the plant is heavily burdened with fixed charges. If one undertakes a costly development one ought to be able to use the water on a large scale in order to make both ends meet. Much depends, of course, on the nature of the load undertaken. If, as commonly happens, it is mainly motor service, the load does not vary much with the seasons and the deficit of power has to be made up by costly steam reserves. A load consisting chiefly of lamps to a considerable extent adjusts itself to the seasons, and if storage sufficient for a day or two can be obtained, the service can be very economically conducted. On Eastern

streams such storage would generally be able to tide over the brief midwinter periods of low water.

But in the case of Eastern streams which have been extensively developed even such storage is rarely available, the reservoir capacity being commonly measured in hours instead of days, and even a lighting load requires considerable reserve. Mr. Dunham, of the Hartford plant, who has had a long experience with hydro-electric work, reports that owing to the large fixed charges and the uncertainty of flow, his power from water costs about the same as if it were generated by steam, and in fact it would not surprise us if in this case the balance might turn out to be in favor of the latter. There is good reason to believe that, counting everything, a number of other Eastern plants are in the same fix. Far too little attention is paid to minimum flow conditions in designing hydro-electric plants. The data on flow are often very imperfect, and long chances are taken on the real minimum on the basis of a dry year like the one just ended. Deficit of water implies either shutting down part of the load or supplying it from a steam plant, which adds a serious burden of fixed charges. It has in the past often been possible for water-power companies to sell a large amount of their output as purely secondary power, to be shut off in times of low water. When this can be done the situation is greatly relieved. But hydro-electric plants can rarely find a good market for secondary power at the present time. They commonly supply relatively few large consumers—such as those which originally clustered about the chief water powers—able at short notice to run independently of the full water supply. The consumers demand primary power available every working day in the year, and object to the trouble of maintaining their own reserve plants even when there would be real economy in so doing.

Under existing conditions it is pertinent to inquire regarding possible remedies. Probably the main thing is to proceed more carefully in planning the original development, so as to know beforehand the probable extreme conditions which must be met. And the next thing is to exercise rigid economy in making the hydro-electric development. One can perhaps afford to be lavish in building a plant which may be worked at full output 24 hours per day, if such a thing be possible, but to expend good money on fancy "fixings" in a system, the greater part of which will lie idle most of the time, is simply foolish. Yet it takes some strength of mind to resist the pleadings of interested parties who admonish one to "stick to the latest 'standard' practice," pointing out as an example a plant put through by smooth-talking promoters who felt the need of something imposing to show the bondholders where their money went. An over-built plant constructed to suit the latest tenets of the "catalog engineers" is very likely indeed to come to grief during a long period of low water, whereas a development of conservative size built without any expensive frills and with an eye solely to utility can pull through without much difficulty and without expense that drags down the profits for the rest of the year. And whatever the nature of the plant, a great help in any case is load that can be put on and taken off as occasion may require. It is to be hoped that some of the electrochemical industries can be made available in this function. Most of them are now worked as continuous processes, but if secondary power can be had very much cheaper than absolutely continuous power, it may pay well to take advantage of it, especially if the output of the works can be so regulated as to utilize a large amount of water that now runs to waste. In short, it may pay in the near future for a hydro-electric company to undertake electrochemical industries with the view of fully utilizing its own secondary power.

Electrical Growth in 1908.

It will doubtless be generally agreed that the trade and commerce of the United States were not carried to any new high levels in the past year. So far from expansion being the case, the data are known in regard to many lines of industry, and with great uniformity they reveal restriction. Unquestionably there has been a revival since the uncertainties of the Presidential election passed away, but it has not gone so far as expected, being checked again by the tariff agitation. The year began in great gloom, but while recovery was noted as the months advanced, not unfrequently has there been felt the sickening sense of hope deferred. What can be said is that the tendency is now all one way, toward normal activities in every branch; and the stock exchanges are busy, as usual, discounting the return of prosperity by a brisk advance in the prices of securities. Trade has been stimulated moreover by somewhat lower prices for raw materials, although these have held their own in an extraordinary manner through the period of dull demand now lasting nearly 15 months. There is a feeling that on the whole the recovery has been about as rapid as proper conditions of lasting health would admit.

To sum up the results in the electrical field during such a year is unusually difficult. Admittedly 1908 was not much, if any, better than 1907, on the whole; but was it better than or equal to 1906? The bases for accurate estimates are quite difficult to find, and the area to be surveyed is more extensive than ever. The temptation to the cautious is to set the figures a little lower than 1907 and to present smaller totals. The following table may be taken as a fair approximation to what probably was done as the electrical business in the way of sales and earnings in 1908:

	1907.	1908.
Electrical apparatus	$275,000,000	$250,000,000
Electric railways	350,000,000	350,000,000
Central stations	225,000,000	225,000,000
Telephony	200,000,000	200,000,000
Telegraphy and cable	55,000,000	50,000,000
Isolated plant supply	100,000,000	75,000,000
Miscellaneous	50,000,000	40,000,000
	$1,255,000,000	$1,190,000,000

It will be seen that a slight actual falling off in sales of electrical apparatus is assumed, and the larger companies all report this to be the case; although there are numerous instances where smaller concerns, more flexible, have actually done a larger business than before. It is assumed that the totals will stand for trolleys and lighting, without any gain, and yet some gains are reported. The Interborough Subway System has beaten all its records. The Chicago Edison overran its highest previous peaks a month ago, while the Brooklyn Edison gave its increase in definite percentage. In telephony there has possibly been a gain, but none is assumed. One of the largest systems in the country, that of New York, has been under repression for a year; and in other cities there was marked dullness. This, however, was offset by activity in many smaller towns and in the country districts, leaving the gross income at least equal to that of the previous year. Telegraphy

has been struggling against the effects of the strike, and it is understood that cabling has felt the world-wide slackening of commerce. Isolated plant service and supply unquestionably fell off. Very few new plants were put in and a great many had slight call upon them, with factories and mills shut down or on half time. In like manner the miscellaneous uses of electricity were checked, from moving-picture work and phonographs down to train signaling and push-buttons. All have had to await the turn of the tides of industry, now happily to be seen swelling and filling their banks up to the longing expectant brims. Meantime we feel that the above estimates may be taken as conservative. As new facts emerge from day to day, the items might vary a little here and there, but the aggregate given is rather a minimum than a maximum.

Determination of the Mean Spherical Intensity of a Source of Light.

The ordinary photometric method of measuring a source of light determines, as is well known, a polar curve of mean intensity commencing at the zenith, and descending, through the equator, to the nadir. The polar curve of intensity supplies directly the maximum candlepower of the source, and also the candlepower at any particular angle of elevation or depression, but it does not show the mean spherical candlepower. In fact, a trained photometrist, comparing two correctly drawn polar intensity curves, taken from two different light sources, may be unable to decide which of the two sources has the greater mean spherical intensity. It is necessary either to use a spherical candlepower photometer for the comparison of the two light sources, or to evaluate the mean spherical candlepowers from the polar intensity curves by some process of reduction.

There are two known kinds of reduction from the polar intensity curve to the mean spherical intensity, namely, graphical processes and computative processes. Each of these kinds of reduction has its advantages and disadvantages. The graphical processes dispense with computation, employing geometry instead of arithmetic. The computative processes are inherently swifter than any graphic process of like precision, when a large number of reductions have to be made, and when the observations are all tabulated with a view to rapid computation, especially if the slide rule is used. Moreover, some persons prefer geometry to arithmetic, and *vice-versa*. There are two known diagrams for effecting the graphic process of reduction, namely, the Rousseau diagram and the Kennelly diagram. The former develops a certain area from the polar curve, the surface of which area measures the mean spherical candlepower. The latter develops a certain straight line from the polar curve, the length of which line measures the mean spherical candlepower. Both diagrams require a certain number of equal angular zones to be selected. The former usually adopts 10-degree zones; the latter usually adopts 20-degree zones. There are two well-established principal computative methods for reducing the polar curve observations to the corresponding mean spherical intensity, as described; for example, in Palaz's "Treatise on Industrial Photometry." Each of these methods multiples the mean intensity through a certain angular zone by a constant related to the spherical surface area of that zone, and the sum of all these zonal products is the mean spherical intensity required.

In a recent issue Mr. E. W. Weinbeer contributed a notable article, in which a particular variety of the computative method is carried out with the aid of an ingenious specially constructed slide-rule designed solely for this purpose, and, second, a mixed geometrical and computative method, in which some of the steps of the ordinary computative process are effected geometrically, including geometrical addition. The second method is neither purely geometrical nor purely arithmetrical, but a blending of the two. There can be little doubt that when the polar intensity curve is suitably laid out, Mr. Weinbeer's slide-rule method will beat any geometrical method in swiftness. His slide rule assigns ten units to each zonal candlepower, and, in nearly all parts of his scale, a unit is divided into halves. Some numerical adjustment of the scale of magnitude might be needed, in particular cases, to adapt this slide-rule scale to the polar curve radii. For instance, a lamp that varied in intensity between 25 candles and 0 candle would give a polar curve whose radii would be ill adapted for precise use with the new slide-rule unless all were multiplied, say by 4. Apart from this detail, the Weinbeer slide-rule method bids fair to be most useful in the hands of a photometrist who has to reduce many polar curves. The weak point of the method is that if any error has been made in the steps of the slide-rule computation there is nothing in the final result to reveal the error; whereas, in either of the two diagrams above referred to the geometrical construction is a permanent check on the result, and is always open to inspection in case of doubt. It must also be remembered that the slide-rule result is not a mean-spherical intensity, unless the polar curve is limited to either the upper or lower hemisphere. The slide-rule result is a mean hemispherical intensity. In the case of, say, an ordinary incandescent lamp, the slide-rule process should be repeated for both the upper and lower hemispheres, taken from the polar curve, and the arithmetical mean of the two slide-rule results will be the mean spherical candlepower. For most practical purposes, however, these considerations do not materially affect the intrinsic value of the Weinbeer methods, which will doubtless meet with wide application.

Public Service Commissions.

An address delivered recently by Mr. Thomas M. Osborne, member of the New York Public Service Commission, Second District, criticised the use of what he termed a political catchword, "government by commission." Whatever may have been the origin of this phrase, the idea which it suggests is one that has been instrumental in checking the progress of radical proposals toward the regulation of all public utility corporations of the country. It appears to be now generally accepted that when free of extreme features of commission control, the supervision of the affairs of public service corporations may be conducted by the State on a wholesome basis, which should work to the ultimate benefit of the corporations as well as of the people they serve. It thus seems that acquiescence and co-operation in the strong demand for regulation on a proper basis should be the controlling attitude of public utility corporations. If reasonable regulation is not accepted willingly, it appears likely that one of two results will ensue eventually: Either (1) regulation will take a form that will be wholly unwise and objectionable, or (2) the hostile element of the public will agitate for the purpose of creating a movement toward municipal ownership. Neither of these courses would

streams such as to the community at large, either would mean a long period of conflict between interests which should work in such harmony as is compatible with the necessarily somewhat conflicting interests of buyer and seller. The question of what constitutes reasonable supervision is one on which it is difficult to preserve the balance evenly if the desire is to assure justice to the various interests concerned. If laws are enacted that are measurably acceptable to the people of the community, to the corporation furnishing the service and to the members of the commissions which adjudicate upon the claims presented, there still enters the personal equation which affects all calculations even under prescribed methods of control and operation. The intent of the law, however, may be to assure good service without discriminative rates to the public, and, on the part of the public, the acceptance of rates which under ordinary circumstances will afford a reasonable return on the investment. If, by proper accounting and financial methods, the investment is safeguarded for the owners of the bonds and stocks and the property is administered with efficiency, the outcome, in a developing community that needs the service rendered, should be beneficial to all. If supervision by the State contributes to the production of these ideal conditions it will be of public service in its broadest sense and cannot fail to include the protection of the corporation from political and other evils that are real.

The fact that the desires of the public toward public utility corporations appear to have crystallized definitely in the direction of State regulation is well understood by observers of the situation, and might be unimportant to repeat were it not that the tendency which has found expression in the enactment of laws in several States is now manifest in drafts of new bills which are pending or awaiting introduction in the law-making bodies of many commonwealths. Without using improper means of influence, the corporations should be able to cooperate in the work of framing tentative laws based on the principle of supervision. The public service commission's laws of New York, representing the apotheosis of the radical idea of State regulation, was made possible in its present form only by the disclosures of the life insurance investigation and various corporate abuses that came to light about the time that was concluded. The clamor about scandals aroused public sentiment to such an extent that legislation on this subject, for which a way had been prepared by agitation started originally for political purposes, took on a radical aspect that was alarming. Though it be admitted that the agitation respecting corporations which has convulsed the country had its origin in unworthy political motives, and that the evidences of corporate abuse of power in some quarters strengthened the arguments of those who beset the corporations, the movement would probably never have reached the full extremes to which it finally went if officials of other companies had endeavored to meet the attacks half-way and striven to secure legislation that would be reasonable.

An indication of the effect which the lessons of 1908 will have upon the legislation of 1909 may be found in the drafts of some of the measures which are now under consideration. In the State of Connecticut, for instance, the preliminary draft of the public utilities act, which has been submitted to the public for criticisms and suggestions before the commission which framed the measure makes a final report to the General Assembly, contains a section making specific provision for court review of the decisions of the proposed commission. The omission of a provision of this nature from the public service commission's law of New York State has been criticised widely and with much justice. The principle of public utility regulation is now so fortified as a national doctrine that to contest it is futile; all effort should therefore be concentrated to insure that its application will promote, not hamper, the development of needed service and protect the property rights involved.

The Tungsten Lamp Situation.

A word of warning seems to be in order about the 25-watt tungsten lamp. It is certainly a most handy size and one that is bound to be popular, but it must be dealt with rather cautiously. It is somewhat more fragile than others of its kind and while it gives excellent life if let alone it will not generally stand rough treatment. If there is need to clean the shade the lamp should first be lighted and current kept on until the cleaning is done. It is of just about the size of the ordinary 16-cp lamp and unluckily, therefore, fits the old 16-cp fixtures and shades. Therefrom spring difficulties in illumination. The larger part of 16-cp fixtures have the lamps pointing downward at an angle and so located that the lamp is in pretty plain view. Now, with a carbon filament this is bad enough, but it is easy to get frosted lamps and so reduce the intrinsic brilliancy to reasonable limits. Up to the present there has been difficulty in getting frosted 25-watt tungsten lamps, so that this size, which really goes into the most exposed places, is commonly bare and with its enormous filament brightness, is always ready for mischief. There ought to be a special effort on the part of the manufacturers to put out frosted lamps, which are the only ones suitable for use in a large proportion of existing fixtures.

As to the general properties of the present crop of tungsten lamps, they are reasonably satisfactory. More care is being taken with the anchoring, so that it is practicable to burn most of the sizes, perhaps all, out of the perpendicular without any specially bad results—indeed, in most cases with impunity. The commonest fault is blackening, which now and then is very troublesome. When a tungsten lamp does blacken it usually makes a thorough job of it in rather short order. As the manufacture shifts more and more to tungsten, this trouble from blackening will very likely be reduced, but until it is there will be plenty of wrathful users bemoaning dim lamps to be replaced at a dollar or so each. The average working life, barring blackening, seems to be lengthening and the ordinary claim of 800 to 1000 hours of life is well substantiated. It is quite likely that by a rather small sacrifice of efficiency this life might be very considerably increased, and, indeed, it yet remains to be shown what the most economical efficiency really is. The most striking thing in the present stage of tungsten lamp exploitation is the number of arc lamps that are being replaced all over the country. The common 4-amp or 5-amp enclosed arc is a marvel of inefficiency, and three or four 100-watt tungsten lamps will generally replace it with excellent results. Hence there is a procession of arc lamps headed for the scrap-heap. They will have few mourners except the central-station men

who bought them when they became the fashion. Next to the arc lamp the Welsbach is the chief thing superseded by the tungsten lamp. In the green ghastly stage it is an easy victim of the tungsten lamp salesman, and not even the inverted form can often hold its own. The tiny 2 ft. per hour mantle is less easy to kill off, chiefly because it is used largely in residence work where the electric rates are commonly high. But the change to tungsten lamps is now going on with extraordinary rapidity, and with the 25-watt size in hand, economical residence lighting will be an easier problem.

SOME QUESTIONS OF RATES.

The increasing use of tungsten lamps raises some rather important questions regarding methods of charging for current and a suitable basis of rates. As the starting point, the central station must confront the fact that for approximately equal lighting the consumer who uses tungsten lamps requires only about a third of his previous supply of energy. Fear of real loss of income we have every reason to believe to be unfounded, since cheaper supply invariably tends to larger use. But in the case of a very large number of American stations the price of current contains implicitly a charge for lamp renewals, and the question at once arises as to what shall be done with this renewal factor when the relatively costly metallic-filament lamps come into extensive use. Suppose for the sake of argument that this renewal factor is 10 per cent of the total price, which is probably not very far amiss. Does not the customer who installs tungsten lamps thereby relieve the station of the renewal factor and hence virtually pay a premium of about 10 per cent for the current he uses under the new conditions? If so, is this not, so far as net income is concerned, a partial offset for the reduced consumption? Thus while the current sold is greatly diminished by the new lamps, the station virtually gets a slightly better price for it so long as it does not go in for free renewals, or renewals below cost.

On the other hand, the plant that can undertake free renewals of costly and somewhat fragile lamps must indeed be in a charitable frame of mind. To break even on free renewals the tungsten lamp should have something like four times the life of a carbon lamp if it is to remain at or about the present cost. At present the tungsten costs perhaps four times as much as the carbon lamp, but its life so far is, roughly, only about twice as long, so that in furnishing it free the station had to double the renewal costs—that is, upon our previous hypothesis, a free renewal policy is equivalent to a cut of fully 10 per cent in actual price, superimposed on the reduction of output. Only stations operating at a pretty stiff margin of profit could take such a suggestion philosophically. Besides, there is a certain additional moral hazard, so to speak, in the use of a costly lamp, which must have an exceptionally long life to even up its high price, particularly when it is somewhat fragile to boot. The life of a lamp as ordinarily figured does not include the element of accidental breakage. The carbon lamp, indeed, is not subject to this save in the form of actual fracture of the glass. The tungsten lamp involves then a new element of risk which must be taken into account in reckoning its real life—the chance of filament breakage. In careful hands and with the certainty of paying for breakage, this risk is not great. In the service of the ordinary consumer and at the risk of the central station, we are inclined to think that the breakage is a considerable one. It is probably too early to secure any data on the fate of tungsten lamps in service complete enough to serve for the estimate of the relative importance of breakage, but we are inclined to think that in case of free renewals the laboratory life, so to speak, would be shortened by something like a half.

This means that a free renewal policy would be equivalent, under present conditions, to a cut in price certainly nearer 20 per cent than 10, and we do not believe the stations are generally ready to stand for it. They can, however, pursue a middle course. There is some price at which the lamps could be supplied which would be equivalent neither to an increase nor to a reduction of price, but to holding the renewal factor practically unchanged. This would practically amount to furnishing renewals at some figure really slightly below cost so far as the lamps are concerned; a figure equivalent, so far as the station is concerned, to the old renewal costs and no more. Such an arrangement is certainly fair to everyone and gives a good opportunity for a sliding scale as the cost of the lamps decrease or their life increases. Ultimately the renewal factor or some of the new lamps may get down to the old basis, in which case free renewals will be in order. Until then, free renewals, if tried, mean simply a deliberate cut in price which may or may not be justified by the strategic conditions. That is a matter which every central-station man must judge for himself, but let no one be self-deceived in the matter. The new lamps are not yet down to standard form, life or cost. Many uncertain factors must be eliminated before one can fairly count up the average hours of life, and even then the moral hazard is hard to estimate. It is then a time for going slowly, for making no rash moves and, above all, for watching the performance of the lamps as they are kept in service. They cannot be kept track of too closely, especially with respect to blackening and breakage.

ELECTRIC HEATING.

About the only lesson conveyed by the usual discussion of the economics of electric heating is the utter futility of purely academic consideration of an intensely practical subject. It is, of course, true that electric heating is not in an ideal condition as regards economy. In fact, no one would be disposed to claim that at present prices, electrical energy for heating is prepared to go into general competition with fuel on the cost basis. On the other hand, even deliberately classing electric heating as a luxury is no argument against its use, and no augury against its popularity. It is altogether a mistake to suppose that things which pertain to personal comfort and convenience can be judged on a cost basis, however sordid and business-like may be the general tendencies of society. People buy articles, not because they are the cheapest that can be obtained to serve their purpose, but because they suit and please. Assuming that one is not forced to rigorous economy, he buys his winter overcoat not because it offers the maximum protection against cold per dollar of its price, but because he is pleased with its style, color and fit, and finds it sufficiently warm. Not all the statistics of the late Edward Atkinson could persuade mankind to feast on knuckle-bones and shins cooked to within the limit of possible mastication in his cele-

brated Swedish oven, so long as sirloin steaks and roast turkey could be had. The average American does not practise petty economy in his every-day living unless he is driven to it.

Thus it has come about that electric light, in the past confessedly dearer than gas light per candle-power-hour under ordinary conditions, has driven the latter out of general use save in cases where there is need for close economy. In the case of electric heating, people are quite willing to pay more than would be called for by other means of heating if they are thereby convenienced. At, say, 10 cents per kw-hour, electric heating is in general distinctly a luxury, but it is still one that people indulge in extensively as is made evident by the very large sales of the smaller electric heating appliances. As the price of energy is reduced more and more, heating devices come into use. At prices below, say, five cents per kw-hour, the great convenience of electric cooking on a considerable scale begins to outweigh considerations of cost, and at, say, three cents per unit, electric heating appliances for rooms would be widely used. In absolute cost even at these figures coal and gas would have perhaps the better of the argument, especially if they were as intelligently applied as is electricity; but it is convenience that counts, and the use of one heating means or the other is not strictly on the dollars and cents basis. The few central stations that have really made a careful study of electric heating find it a valuable addition to their income even if the price charged for current be very modest.

Without going into refined estimates, one finds that electrical heating devices in anything like their customary use will on the average add to the income of the central station at least their own cost yearly. So if such apparatus can be placed on the value of, say, $10,000, the gross station income will be $10,000 or more. This is not an amount to be neglected. At just what point electric heating costs become equal to the cost of heating by gas or coal is a matter of far less importance than the point at which people will cheerfully take up electric heating from preference. It is not necessary that big problems of heating should be taken up in order to get a big income for the station. It is the scores and hundreds of flatirons, chafing-dishes, little stoves, coffee urns, soldering irons, glue pots and the like that count in making the start in the electric heating business. Once under way the rest will look out for itself. When these small items are common, cooking ranges and portable air heaters begin to come along, together with a horde of heaters for use in the arts of which people seldom hear. When a deliberate attempt to get such business is made by offering whenever feasible a special rate for it, just as one does for motors, experience seems to show that business comes. But the price at which electric heat becomes, not cheaper than other forms, but freely salable as against them, is generally lower than the lighting rates, especially to the small consumer. This personage gets the short end of the bargain nearly everywhere, and consequently can be relied on to support the gas company which does not discriminate against him. And lighting by gas, he generally takes to cooking and heating by gas, and electric stations wonder why electric heating cannot be made to go with a rush. It will and does go with a rush when it is given a fair chance, and at a remunerative price. The big work in heating may come in due time, but the little work should be encouraged now.

Development in Alternating-Current Apparatus.

In alternating current apparatus there have been several interesting developments during the past year. The split-pole synchronous converter is now so well known and thoroughly understood that it is difficult to realize that less than a year ago the possibilities of its operating successfully were questioned with evident sincerity by electrical engineers who had given considerable study to its characteristics. It will be recalled that this machine is arranged for delivering a variable direct e.m.f. at the commutator while a constant value of alternating e.m.f. is impressed upon the collector rings. The change in conversion-ratio is obtained by altering the distribution of the flux over the pole area. That such an alteration could produce the desired result has been recognized for many years, but a large majority of the designers of alternating-current machinery had been led to believe that, coincident with the change in flux distribution, circulating currents would be introduced into the alternating-current system. However, both theoretical considerations and practical tests have proved that the flux distribution may be altered in such a way as to produce the same effect as shifting the brushes on the commutator—without, however, involving sparking. Thus the direct e.m.f. can be varied throughout a certain range without causing complication in the alternating-current circuit.

The past year witnessed the commercial application of a new type of single-phase commutator motor possessing certain advantageous characteristics with reference to the suppression of sparking under running conditions. It would seem that this so-called series-repulsion motor can be so adjusted as to eliminate entirely the cause for trouble at the commutator throughout a very considerable range of speed. Its operation furnished evidence that the greatest disadvantages ever urged against the commutator type of alternating-current motor has been overcome so far as running conditions are concerned. However, the elimination of the cause for sparking in commutator motors under starting conditions remains as yet an unsolved problem. That the effects produced by the cause have been minimized to a thoroughly satisfactory degree by the use of preventive resistance leads is proved conclusively by the fact that motors thus equipped, after propelling locomotives in heavy railway service for more than 40,000 miles, show relatively little wear and are now in first-class condition. A record of this nature should go far in dispelling any doubt that may have existed concerning the ability of the single-phase commutator motor to meet the severe service requirements of steam railroad electrification.

A development which has been under way for several years, but which has been kept somewhat under cover until during the past year, relates to the substitution of "alloy steel" for "standard" steel in transformer cores. The newer core material, in which silicon appears as one of the chief "impurities," possesses two advantageous properties: it can be kept continuously at a high temperature without "aging," and—of even more importance—it experiences a much lower hysteresis loss than does "standard steel" operated at the same magnetic density and cyclic frequency; on the other hand, its permeability is slightly lower than that of older core material. On account of its non-aging property, the temperature at which transformers with silicon-steel cores may be operated is limited

by the temperature of destruction of the insulating material rather than by the core material. It is noteworthy in this connection that, while the A. I. E. E. rules limit the maximum temperature to 75 deg. C., German practice allows a maximum temperature of 90 deg. C. Assuming that insulating materials can be obtained to operate safely at a temperature of 85 deg. C., a permissible rise of 60 deg. C. above 25 deg. C. rather than a 50 deg. C. rise would allow an increase in rating of approximately 23 per cent. That is to say, a 10-kw transformer at a rise of 50 deg. can be rated at about 12.3 kw if allowed to operate at a 60-deg. rise. The increase here indicated would probably be considered excessive in the light of former practice, but transformer manufacturers have already shown an inclination to increase the permissible temperature rise in certain lines of transformers, thereby providing less expensive equipments for customers who are willing to replace transformers at certain intervals.

The lower specific energy loss in the alloy-steel when substituted for standard steel in transformer cores has been availed of by a large number of manufacturers. In order to take full advantage of this characteristic, it has been necessary to increase the operating magnetic density by a considerable percentage and consequently to increase the exciting volt-amperes by a much larger percentage. The last-mentioned increase is of no practical importance in transformers operated normally at relatively low density—that is, in high-frequency transformers—but it might become of some importance in low-frequency transformers. In any event, the alloy-steel can be directly substituted for standard steel without increasing the density or altering the exciting volt-amperes appreciably, but with a considerable decrease in the core loss. In addition to the improvements in constructive material for transformers, changes have been made in the arrangement of the coils and core of certain lines of transformers. Among the changes may be noted the use of a cross-shaped core for the magnetic path of the transformer. In this form a considerable part of the core surrounds the coils, while the coils surround a large part of the core, so that the old distinction between the "shell-type" and the "core-type" does not properly apply to this transformer. The transformer can be considered as one of the core type having coils on only one leg, the other leg being divided into four parts placed at 90 deg. intervals; it can also be treated as one of the shell type with two superposed paths in mechanical quadrature. In view of these considerations, it is more than probable that manufacturers who in the past have advocated the core type of construction will continue to refer to the new form as a core-type transformer, while the advocates of the shell-type will continue to claim that it is a development from the latter type of transformer.

Electrotechnical Progress During 1908.

The year 1908 has been marked by a distinct advance in the direction of controlling and operating high electrical pressures. Looking back upon the history of electrical progress and discovery, we may recognize that the eighteenth century was devoted to the study and development of high-tension electrical phenomena. The frictional machine was the generator, and the pressures employed were of the order of myriads of volts. Hardly any useful application was made from all of the knowledge thus acquired. The acquaintance with the world of electrical phenomena seemed to have begun at the wrong end—in the electrostatic region instead of in the electromagnetic region. Insulators and dielectrics were the order of those days. The study of conductors had to wait. The nineteenth century brought a great change. The voltaic battery supplanted the frictional machine, steady volts took the place of unsteady impulses by myriads. Soon the electromagnetic phenomena found utilization, first in electroplating, then in bell-ringing, next in wire telegraphy, afterward in electric lighting, electric telephony and electric power transmission. In these later applications pressures began to climb kilovolt by kilovolt. Already, in the early years of the twentieth century, electric power transmission is extensively practised at 60 kv, occasionally at 80 kv, while the pressure of 110 kv has been under successful trial. Again, after the lapse of a century, the insulator and the dielectric are becoming the predominating feature of electric transmission, as compared with the conductor and the metal. It would seem as though progress in this direction had to be arrested for a century in order to enable the practical difficulties to be outflanked.

During the last year, much technical progress has been made in the study of high-voltage phenomena, and much more achievement may be hoped for in this direction before long. The electrification of steam railroads has made distinct progress during the year, much attention having been directed to this field of future endeavor. It has come to be recognized that under present conditions economy does not lie in the electrification of every steam railroad. Nevertheless, it has been already demonstrated practically that certain conditions of railroad traffic can be operated not only more conveniently, safely, reliably and swiftly, but also more economically by electricity than by steam locomotives. Improved designs of electric traction motors have been developed, and the economic radius of electric railroad operation has been increased. The influence of this development of electrical engineering is likely to be manifested in all branches of engineering. Until electric power transmission attained considerable magnitude, mechanical engineers had but little necessity to become acquainted with electrical laws, devices and machinery. The electrical engineer, as a specialist, was able to take charge of electrical apparatus as it came into operation. With the rapid growth of power transmission, however, it became inevitable that, in future, all mechanical engineers should become acquainted with electrical machinery and systems, in order adequately to cope with the demands of their own profession. The rapid growth of electric railroading, on quondam steam lines, has left the matter completely determined beyond the peradventure of a demonstration. In future, no man can be fully trained in the professional needs and essentials of mechanical engineering who has not studied and become familiar with at least the elements of electrical science, systems and machines. Every mechanical engineer who is up to date will have to be more or less of an electrical engineer, and the barriers between these two branches of engineering have been destroyed. Per contra, every electrical engineer, who is up to date, must be familiar with the conditions of mechanical engineering.

Good advance has been made in wireless telegraphy and telephony all over the world, not only in applications, but also

in technical knowledge. Distances of several thousand miles have been covered in wireless telegraphy, and of several hundred miles in wireless telephony. Improvements have also been initiated both in Europe and America in wire telegraphy by which high-speed automatic telegraphy tends to take the place of low-speed hand telegraphy on important trunk lines. Two electrical exhibitions of importance were opened to the public during the year, one at Marseilles, and the other at Manchester, England. The public interest in such exhibitions is much greater than used to be evidenced at similar displays a decade ago. The public recognizes more and more that electricity is in every man's purview, and that electrical apparatus finds its way into most households.

Two electrical commissions were convened during the year in London under somewhat unfortunate condition as to dates, not being close enough together to be united, or remote enough to be distinct. The commission on electrical units adopted definitive values for the determination of the concrete international ohm and international ampere, as the fundamental units, leaving the volt, watt and other practical units to be derived from these two. The benefit to be expected from the work of this commission are not so much to be looked for in the details of the resolutions adopted, but in the implied adhesion of all the Government laboratories represented to one and the same manipulation, procedure, and set of concrete standards; whereby we may hope that the electrical units certified in each country may in future be consistent, and for all practical purposes identical each to each. The international electrotechnical commission council meeting was noteworthy, on the one hand by the absence of American participation, and on the other hand as evincing a spirit of earnest good will in laying the foundations for future international conventions in the direction of unifying the various national codes of rules for standardizing and rating electric machinery. The principal step taken to this end was the adoption of a resolution that all measurements referred to or designated in future by the commission shall be expressed in the metric system of weights and measures, as the official international system, non-metric countries contenting themselves with equivalents. Such action was in reality a foreseen conclusion, and no other basis of international electrical action would be conceivable, much less practicable, in view of the metric nature of electrical units. Nevertheless, since electrical engineering acquires each year more definitely the rôle of defining and maintaining all engineering magnitudes, this action of the commission means that eventually all engineering magnitudes must come to be expressed in metric terms. Thus, slowly do the burdens of tradition fall from the shoulders of modern engineering.

Telephony.

While it is often contended that the telephone industry is one of the national industries least subject to financial disturbances, in a retrospect of the past year telephony reflects strongly the general business conditions. On the construction side little has been undertaken in the way of new development, everyone being apparently content with the carrying to completion work already under way or actually needed for the protection of the existing service. The period has, however, not been an uneventful one owing to the great strides of the commercial branch. During the last decade the pressure of development was so great that telephone companies were glad to meet, at almost any cost, the demands of the public. There was no definitely accepted scheme of organization, each company meeting the situation presented as best it could. The recent period of "marking time" has, however, afforded a much needed respite, and as a consequence there has been a much-needed readjustment of organization. Companies have combined to reduce administration expense in some instances, or in others to warrant the more complete separation of various functions of operating work, each under the supervision of an expert. Operating expenses have been subjected to the closest scrutiny, and whenever compatible with good service, economies have been effected. There has been a marked improvement in the accounting departments of many of the smaller companies, especially among the Independents, who, largely through their associations, have been influenced to adopt uniform methods of accounting. The accounting relations with toll line companies have been largely changed by the central "clearing house" plan, now adopted in many localities and under careful consideration in others.

In territories where service is rendered by more than one company, the competing interests appear to be less mutually aggressive than in the past, the one becoming conscious of the unfairness of the low rates introduced by it because in many instances they are not living rates, and the other, in a measure at least, admitting the strength of competition. The net result is a movement toward an amicable solution of the dual service problem, through concessions of all three of the parties interested at first hand, the public being the third party. There is, however, a fourth element to be considered—namely, the toll line companies, for annulment of local competition throws the two existing systems of toll lines in direct competition on the merit basis. Apparently fearing the results of this, there has been a tendency in some localities for toll line companies to oppose any combination of the local services.

The long-distance toll-line system has now been extended as far as Denver, Col., and the importance of long-distance telephone service has been further evidenced by the opening of an underground cable toll line from Chicago to Milwaukee. This is, of course, "loaded" to maintain the transmission standard. There are now at least three of these underground toll lines of approximately 100 miles length each, and loading in general has been brought nearer to a standard. The repeater is also playing its part; while its successful operation is yet hemmed around by many awkward conditions, still it seems now only a matter of further knowledge of the controlling factors to bring it to a form adapted for general use. In the department of central-office equipment there has merely been a development along previously clearly indicated lines. The automatic switchboard has more than held its own, while the manual switchboard has slowly progressed toward the semi-automatic by the introduction more generally of automatic ringing and signaling devices. The semi-automatic class of exchange has also progressed encouragingly. The adaptability of the telephone for train dispatching was long ago made evident in interurban railway work, and its recent wide adoption by steam roads seriously affects the future position of railroad telegraph operators.

ELECTROCHEMISTRY IN 1909.

The development in the electrochemical and electrometallurgical industries during 1908 has not been along the radical lines which characterized the period of the establishment of the carborundum, artificial graphite and calcium carbide industries, but has rather been confined to progress along conservative lines. It is doubtless for this reason that few of the principal electrochemical industries of Niagara Falls were affected by the recent financial crisis. This is particularly true with respect to carborundum and artificial graphite, both of which products are finding an ever-increasing field of usefulness in multifarious industries. While the latest invention by Mr. E. G. Acheson in the production of "deflocculated graphite" has hardly any of the spectacular features inherent in some of his earlier discoveries, yet the invention appears to open for artificial graphite an almost unlimited field of application for lubrication purposes. The electrolytic processes of caustic soda and chlorine, chlorates, etc., have held their own very well, and the works using the Townsend cell in Niagara are making considerable enlargements. In the older chemical industries, electrochemical methods are also being more and more employed; but as the object in such cases is usually to make old and well-known products at less cost or of better quality, good care is generally taken to keep such developments secret.

The poor condition of the metal market, due to the financial and industrial crisis, has naturally greatly affected the related electrometallurgical industries. This was the case with the large electrolytic copper refineries of this country. After the enormous enlargement which they had undergone during the past few years, most of them were forced to operate during 1908 on a largely reduced scale. The greatest change, however, relates to the aluminum industry. After a long period of prosperity and steady prices the closing months of 1908 witnessed a slump in the price of aluminum, comparable with that of copper in 1907. How it came about is quite evident. Only a few years ago the existing aluminum companies—one in this country and five abroad—were hardly able to fill the demand, and all were forced to make very great enlargements. Concurrently, the fact that the aluminum process was no longer protected by patents in Europe attracted outsiders, and seven new companies started operation in Europe. Almost simultaneously came the financial crisis and the depression in the various industries, but especially in the automobile industry, resulting in a large reduction of the demand for aluminum. The supply was now much greater than the demand; the international syndicate could no longer control the market and was dissolved on Oct. 1. The price of aluminum in this country is now between 21 cents and 25 cents per pound, corresponding, on the basis of equal conductivity, to copper at 10½ cents to 12½ cents per pound. To the electrical industry as a consumer of aluminum the present situation certainly offers opportunities which should be carefully considered. In spite of the depression which has been prevalent in the iron and steel industries, the electric furnace for steel refining has made remarkable progress, though chiefly in Europe, but some remarks by Mr. C. M. Schwab at the recent tariff hearings in Washington indicate that the steel makers of this country are about ready to go ahead with electric steel refining. The electric furnace has already proved its superiority over the crucible process for making special steels, but its chief application will be as an accessory to existing open-hearth and Bessemer converter plants, to produce at a slightly enhanced cost a steel much superior in chemical composition and homogeneity. There are now in operation or course of erection 24 Héroult steel furnaces, 11 Stassano, 10 Kjellin, 10 Roechling-Rodenhauser, and 8 Girod, besides some smaller ones of other types. The aggregate charging capacity of the above furnaces (excepting five Héroult furnaces, the capacity of which has not yet been definitely decided) is 165,000 kg (181 tons). Two of the Héroult furnaces included in the above figures are in this country, all the others being in Europe. There are also several induction furnaces in use in this country, which are not included in the above figures as no exact data are available. It is probable that the most important development of electrometallurgy in the near future will be the general introduction of the electric furnace in the steel industry, not to supersede the existing furnaces, but as an accessory for further refining.

The quiet and conservative way of making steady and gradual advances and improvements which has lately characterized the electrochemical industry has finally brought us nearer to the full realization of the old fond dream of electrochemists—the fixation of atmospheric nitrogen. Technically, at least, the problem is solved, and even in two different ways, but commercial success still depends on exceptionally favorable local conditions, such as very cheap power. The one solution is the direct combination of the nitrogen and oxygen in atmospheric air by means of an electric spark or arc discharge. The advances made by Birkeland and Eyde over the older work of Bradley and Lovejoy are the use of larger furnace units, the employment of the arc instead of the spark discharge, and a very greatly simplified construction of apparatus, chiefly due to the use of a magnetically deflected, rapidly moving arc. Both capital investment and cost of operation have thereby been reduced. As a result of the commercial success, the Notodden plant is to be enlarged from a capacity of 40,000 kw to four or five times that figure. But this success must be interpreted with reference to the low cost of electric power at Notodden, which is reported to be only about $5 per hp-year. Nothing like this cost can at present be approached in this country. For some time it was thought that the results of Birkeland and Eyde came near perfection because they almost reached what is theoretically possible on the assumption that we have a purely thermal effect (the only function of the arc being to provide the necessary high temperature). It now seems that this hypothesis was wrong. If an arc is used in a somewhat lower temperature region, there seems to be added a specifically electric effect to the thermal effect, with correspondingly higher efficiency. This new development, which makes the situation appear much brighter, has been due to quiet work during many years of the Badische Anilin und Soda Fabrik. This process employs a very simple apparatus, an arc enclosed in a tube through which air is passed in whirling motion. An experimental plant of 2000 hp is stated to have been so successful that plans have been made for a 120,000-hp plant. The second and entirely different solution of the problem of fixation of atmospheric nitrogen is the manufacture of calcium cyanamide from calcium carbide and nitrogen. Cyanamide can be used either directly as a fertilizer or as a starting point for the manufacture of other chemicals, like cyanides. There are several cyanamide works in operation abroad and a large factory —the first one in this country—is now about to begin operation at Niagara Falls.

Disposal of the Heany Patent Fraud Case.

At Washington last week the Heany tungsten patent case, that has attracted so much attention on account of the allegations of fraud, was disposed of by the bringing in of a verdict of guilty against Everding, the patent attorney, and the acquittal of Heany, the inventor.

The specific charges in the criminal case related to two applications filed by Mr. John Allen Heany, one on Dec. 29, 1904, for a patent on certain "Improvements in the Manufacture of Filaments and Electrodes for Electric Incandescent and Arc Lamps," and the other on Jan. 19, 1905, which latter application resulted in the issue to Mr. Heany on Dec. 3, 1907, of United States Patent No. 872,936, for a "Tungsten Electric Incandescent Lamp." In both cases, Mr. Heany appointed Henry E. Everding, a patent lawyer of Philadelphia, his attorney to prosecute the applications, which were referred to Division 37 of the Patent Office and thereafter were examined by N. W. Barton, one of the assistant examiners in that division. When the patent of Dec. 3, 1907, was issued and the application thus made public, the disclosure therein of the development of practically the entire art of making tungsten filaments, almost to the date of issue, with the application date back in 1905, gave rise to such suspicion of its genuineness that a complete investigation of the whole file was made by the Patent Office itself. The evidence in this file was turned over to the Department of Justice, and the indictment followed. A subsequent investigation of the December, 1904, application brought to light other evidence in the specifications of that case too, and further indictments were found by the grand jury.

The indictments in the two cases were tried together and contained many different counts charging forgery, the destruction of public records and a conspiracy to defraud the United States. The persons charged as defendants were the lawyer, Everding, the Patent Office examiner, Barton, and the inventor, Heany. Before the trial began Barton withdrew his plea of not guilty and pleaded guilty to all counts of the indictments in both cases, and the trial proceeded against Heany and Everding. At the close of the Government's case, counsel for Heany moved that a verdict of not guilty be directed on the ground that a case had not been proved against his client, and the Court denied the motion on the ground that it was a question for the jury to decide. Heany offered no evidence, and the jury found that he was not guilty and not a party to the crimes charged. Everding practically admitted that he was guilty of all the charges made in connection with the application of January, 1905, which went to patent, but denied that he was guilty of any wrongful act in connection with the application of December, 1904, and claimed that the application in that case was in the same condition as when originally filed. Witnesses were called in support of the contention, and a direct issue raised between them and the witnesses of the Government. The Government was bound to satisfy the jury beyond a reasonable doubt that the wrongful acts charged were actually committed and by one or more of the defendants named; and the verdict of guilty was found against Everding on all counts of the indictments submitted.

The next steps by the Government are awaited with interest, in regard to the patent of 1905 and the application of 1904.

Large Power Trunk Line Transmission Under Way in New York State.

The Boston *Commercial*, a financial journal closely in touch with prominent electrical and copper interests, states that one of the most elaborate schemes of electrical development that has been thus far formulated east of the Rocky Mountains is now being slowly worked out through New York State and Michigan, with the plan of ultimately forming a trunk line system of electric transmission service from the Hudson River to Chicago. It is probable that from 5 to 10 years will pass before the plans are completely carried out. The companies concerned at the eastern end of the vast district under consideration are the Hudson River Electric Power Company, the Niagara, Lockport & Ontario Power Company and the Ontario Transmission Company. At the western end of the line the work is understood to be under the direction of W. A. Foote, of Grand Rapids.

The Hudson River company now supplies the Utica & Mohawk Valley electric traction interests with power, including the electrified West Shore Railroad between Utica and Syracuse, current being generated at the Hudson River. West of Syracuse the Niagara, Lockport & Ontario Power Company covers a field that includes every city, village and hamlet between Syracuse and Detroit. The power that is distributed by this organization is generated by the Ontario Power Company, of Niagara Falls, and the Niagara, Lockport & Ontario Power Company is in practically the same hands. The control of the Ontario Transmission Company is held by the Ontario Power Company, so that any construction work that may be necessary in Canada to carry out the several projects can be done by and in the name of the Canadian corporation. The Ontario Power Company has a plant on the Canadian side of the falls, designed to develop 200,000 hp when completed. The capacity of the generators now installed is 66,000 hp. This company is preparing plans for the construction of a penstock that will increase its capacity by 100 per cent, or to 132,000 hp. The obstacle of the Detroit River in transmitting power to the west is removed by the construction of a tunnel under the river by the Michigan Central Railroad, through which the line can be carried if desired.

South of Lake Erie the Niagara, Lockport & Ontario Power Company is building a transmission line to Erie, Pa., and has surveyed and mapped out a route for the main line into Cleveland. It is probable that the transmission of Niagara power will end at Cleveland, on account of the cost. West of Cleveland and from there to Chicago the cost of coal is low, tending to offset the advantages of hydro-electric transmission. It is probable that the line passing through Toledo, Elkhart, South Bend and Laporte will undoubtedly be supplied with steam generated current, with the coal from Ohio, Indiana and Illinois mines. A northern line from Detroit through Ann Arbor, Jackson, Battle Creek and Kalamazoo to Michigan City will be supplied with hydro-electric power from streams in the southern counties in Michigan. West of Michigan City steam power will be necessary. The conservation of resources and energy is the key to the work being done along the line from the Hudson to Chicago.

In New York State many thousands of dollars are being expended on water course investigations, and studies are being made concerning variations of flow and stream peculiarities. The water powers are passing into hands that will be able to assemble small amounts, and thereby secure a quantity of commercial value, while the owners will be able to a considerable extent to safeguard the supply of water in the rivers to which the smaller streams are tributary. Some of the power being used in Detroit is now being transmitted at low voltage from the eastern part of the State. An interesting phase of the problem is the location of trunk line railroads along the route of the proposed transmission trunk line, with a possible future bearing upon electrification.

Cambridge (Mass.) Electrical Department in Trouble.

The exhaustion of the appropriation for payment of salaries in the electrical department of the city of Cambridge, Mass., has caused considerable reduction in its working force. The city has been appealed to for an additional appropriation, but thus far without result. On Dec. 28 Mayor Wardwell notified the Council that an early consideration of the matter was necessary, calling attention to a letter from the electrical department commenting on the suspension of employees on account of lack of funds, and adding that the city electrician had

been instructed to keep enough men at work to afford the necessary protection to the lives and property of the citizens until the City Council shall have made the necessary appropriation. A new turn in the matter has been an order putting the fire-alarm telegraph system in charge of the fire chief, which reverts to a former arrangement.

Navy Long-Distance Wireless Plant.

On Jan. 5 proposals for furnishing long-distance wireless plants for the Navy will be opened, consisting of a sending station at Washington, having a range of 3000 miles, and two equipments for vessels having a receiving range of 3000 miles and a transmitting range of 1000 miles. The circular for prospective bidders is a formidable document which, if taken too seriously, might well deter any manufacturer from submitting a proposal. Aside from forms, there are 33 paragraphs, of which 31 consist mainly of conditions to secure the government from any possible loss, or exercise of any generosity toward a manufacturer who might, in his zeal to meet the need by the government for such a plant, too lightly pass over the difficulties incident to its design and construction—these precautions recalling the interesting game of "Heads I win, tails you lose." Apparently exhausted in the work of preparing these safeguards, the writer of the document confines to two paragraphs the specifications to guide the successful bidder, as follows:

"The station to be capable of transmitting messages at all times and at all seasons to a radius of 3000 miles in any navigable direction from Washington, D. C. Such messages must not be interrupted by atmospheric disturbances, or intentional or unintentional interference by neighboring stations. The station to be capable of transmitting and receiving messages with entire secrecy. The contractor must supply the necessary concrete buildings, with living accommodations for four operators, towers, ground connections, wiring and apparatus complete. Such to be erected at or near Washington, D. C., the exact location to be decided at a later date.

"Two sets of apparatus installed on board vessels of the United States Navy, to be capable of transmitting and receiving messages at all times, in all seasons and in all latitudes, to and from a distance of 1000 miles, and to receive messages from the high-powered station above-mentioned at a distance of 3000 miles at all times, the apparatus to be capable of transmitting and receiving messages at the maximum radius with entire secrecy and without the possibility of interruption due to atmospheric conditions or intentional or unintentional interference. These sets to include as an adjunct wireless telephone apparatus capable of establishing and maintaining satisfactory communication to a distance between ships of 100 miles. Such communication to be sustained without adjustment of instruments or interruption therefrom for periods of at least 5 minutes. This ship apparatus must be so constructed as to be installed in a room with 100 sq. ft. deck space. The antenna must be so disposed as not to require a change in the height or distance between masts or to materially change the outward appearance of the vessels."

System of Accounts Adopted by New York Commission.

The New York Public Service Commission, First District, has issued a classification of accounts for electrical corporations, to be introduced as of Jan. 1 1909. The order accompanying the accounts for corporations with annual revenues in excess of $500,000 and the titles of the primary accounts are substantially uniform with those prescribed by the commission of the Second District and published in the ELECTRICAL WORLD of Dec. 12, 1908, page 1281. The commission of the First District has issued a supplementary order prescribing a condensed system of operating expense accounts for corporations with annual revenues not in excess of $500,000.

A report to the Commission of the First District by Commissioner Milo R. Maltbie, on the subject of uniform accounts, has been made public. Commissioner Maltbie constituted a committee which had in charge the preparation of uniform systems of accounts for the various classes of corporations under the jurisdiction of the commission. Mr. Maltbie states in the report that the committee has considered that the fundamental purposes of the law were: (1) To establish uniformity between all corporations of the same class. (2) To establish systems of accounts which will show clearly and accurately the specific source of all income and the purpose of every expenditure. (3) To state the fundamental principles according to which accounts shall be kept, so as to prevent the charging of items to wrong accounts.

In discussing the purpose to have accounts that will permit analysis of revenues and expenditures, Mr. Maltbie says that the public service corporations are using the property of the public and that the public is, therefore, in a sense a partner in the enterprise; that many corporations have a virtual monopoly and that experience with a policy of non-interference "has shown that the welfare of the individual, of the city and of the State is not adequately protected without regulation and control."

Mr. Maltbie discusses the relative points of view of the investor and the speculator in the securities of public service corporations. He declares that "an important reason for the general approval of highly differentiated forms of accounts is that they serve to protect and profit the thrifty and honest corporations. It is not the purpose of public regulation by reducing rates to take from a corporation all of the proceeds of enterprise and thrift that it may earn beyond a reasonable dividend. If a thrifty and intelligent corporation can, at a smaller expense to itself, supply a public service than a careless and incompetent corporation, the former should not be compelled to charge the public less than the latter. To do so is to discourage progress and economy. The systems of accounts reported will show what corporations exercise care, economy and ingenuity in operation and good judgment in the selection of employees. Present obscure and varying methods of keeping accounts furnish no basis of comparison, and a tendency is to put the thrifty and unthrifty in the same class and seek to deprive the stockholders of the thrifty corporation of their fair rewards."

In discussing the fundamental principles underlying the accounts, Commissioner Maltbie suggests the dangers of insufficient expenditures for maintenance, permitting the payment of dividends because no reserve is created for renewals, and of too large an expenditure on the plant from earnings.

Mr. Maltbie emphasizes the need of provision for depreciation and amortization in the accounts if the integrity of the capital investment and the correctness of the charges to "cost of operation" are to be insured. He says on the subject of depreciation:

"A true statement of expenses will include an allowance for the replacement of tangible and intangible capital, based on the most intelligent estimate that can be made of the probable life of such capital.

"In order that 'capital' may not be impaired, a corporation must provide not only for repairs and eventual replacement, but also for depreciation due to obsolescence and inadequacy. Cities are expanding and conditions are changing, so that occasionally certain portions of the physical property have to be reconstructed because the original plans have been outgrown or rendered useless thereby. Street railway tracks, for example, sometimes have to be moved to new streets because the direction of traffic has changed. Central stations or works are removed to new locations because urban growth has made their first locations undesirable and uneconomical. These changes often come very gradually and sometimes infrequently, but all expenditures for such purposes should be paid out of earnings and not out of capital."

The report refers also to the requirement that discount on securities issued shall not be considered a proper capital charge and to the stipulation that the account "franchises" shall be charged only with the amount "actually paid to the State or to a political subdivision thereof in return for the granting of

franchises or rights, exclusive of taxes or other annual charges."

Respecting appreciation, Commissioner Maltbie makes the following statement:

"It should be noted that the systems of accounts do not recognize appreciation in the value of property as an offset for depreciation. The policy adopted by many public service corporations of depending upon the increase in the value of their assets consequent upon community growth or changes in market values is not recognized as proper. Of course, ultimately the accounts will reflect these facts. If a piece of real estate is purchased for $100,000, if that amount is charged to capital, if it increases in value to $200,000 and it is found wise to sell it for that sum and purchase another piece of land equally suitable for $150,000, the ultimate result may be that 'land' will be represented in capital at an amount of $150,000 instead of $100,000; and that the surplus account will be increased by $100,000, which may be used as a reserve or distributed in dividends. The fundamental principle of the accounts, however, is that any appreciation shall not appear in the accounts until it is an actuality and until the amount of such appreciation has been determined by an actual sale of the property or the substitution of more expensive property. What shall be done when such a case arises is naturally a matter to come before the commission. It is not necessary in the systems of accounts to lay down a hard and fast rule."

New York Commission Prohibits Discrimination in Rates.

Following the completion of the investigation by the New York Public Service Commission, First District, for the purpose of determining whether an order should be issued "against discrimination and unreasonable preference by electrical corporations" a final order has been promulgated by the commission. The text of the order in full is as follows:

"Section 1. No electrical corporation shall directly or indirectly, by any special rate, rebate, drawback, or other device or method, charge, demand, collect or receive from any person or corporation a greater or less compensation for electricity or any service rendered or to be rendered, than it charges, demands, collects or receives from any other person or corporation for doing a like and contemporaneous service with respect thereto under the same or substantially similar circumstances or conditions.

"Section 2. No electrical corporation shall make or give any undue or unreasonable preference or advantage to any person or corporation, or to any locality, or to any particular description of service in any respect whatsoever; or subject any particular person or corporation or locality or any particular description of service to any prejudice or disadvantage in any respect whatsoever; but nothing in this section shall be construed as applicable to contracts with or service rendered to the City or State of New York.

"Section 3. No electrical corporation shall charge, demand, collect or receive a greater or less or different compensation for supplying electricity for light, heat or power, or for any service rendered, than the rates and charges applicable to such service as specified in its schedules filed with the Public Service Commission and posted and in effect at the time; nor shall any electrical corporation refund or remit in any manner or by any device any portion of the rates or charges so specified; nor extend to any person or corporation any privileges or facilities in connection with such service, except such as are regularly and uniformly extended to all persons and corporations under the same or substantially similar circumstances or conditions.

"Section 4. No electrical corporation, or any officer or agent thereof or any person acting for or employed by it, shall assist any person or corporation to obtain electricity for light, heat or power or to obtain any service at less than the rates then established and in force in accordance with the schedules filed with the Public Service Commission for the First District and published in accordance with the order of the said commission.

"Section 5. This order shall take effect at once and shall continue in force until abrogated or modified by the commission.

"Section 6. Every electrical corporation hereby affected shall notify the Public Service Commission for the First District, on or before Dec. 26, 1908, whether the terms of this order are accepted and will be obeyed."

Commissioner Milo R. Maltbie, who has had charge of the investigation, has made a report of progress to the commission on the subject of electric lighting contracts, rates, schedules, etc. It states that in respect to the form of retail lighting contract the companies had been urged (1) to simplify their form of contract, (2) to make it more like an application, (3) to standardize this form so that every company would be using the same form so far as possible, (4) to omit the minimum term of one year and allow the contract to be cancelled by either party upon a short notice, (5) to reduce to a minimum the regulations regarding the use of service and the relationship of the consumer to the company, and (6) to omit the requirement of a guarantee or the collection of a minimum charge in case the amount of current used by the consumer did not equal the guaranteed use.

All of these suggestions, with the exception of the last, were accepted, Commissioner Maltbie says, by all of the companies, and are now in operation. Five companies out of the nine under the jurisdiction of the commission have accepted the suggestion that guarantees and minimum charges be done away with.

Mr. Maltbie, in criticising the forms of wholesale contracts, states that the practice of offering a "rate or method of supply which will just bring to" the company, and no more, a certain class of business, "develops certain objections. The first is that under such conditions rates are likely to be valued upon the principle of charging what the traffic will bear and often without due regard to the cost of furnishing the service. This may lead, and does in some cases, to a fixing of price to certain consumers at a point below the cost of supply and to other consumers much above the cost of the service. Of course, in practically every private business, certain consumers are supplied at less than cost to some extent; but it becomes a serious matter when the number of rate schedules is large and each one is fixed at a point which will just secure the business. The second feature, which has been the cause of many complaints and of considerable annoyance, judging from the complaints made to the commission, is that a variety of contracts and schedules of rates makes it extremely difficult for many consumers to tell what form of contract or schedules would be most advantageous to them.

"These difficulties would be removed if the schedules were simplified and if one form of contract and one schedule of rates were in force. This was brought out in the investigation by the experience of the Westchester Lighting Company, which has but one contract for all power users. This contract contains a schedule of prices with a base rate of 10 cents. As the use increases, the discount from this base rate increases, so that a consumer who averages for a month 173 hours' daily use pays 9 cents per kw-hour for the current consumed. If he doubles his average daily use of his connected installations he pays 6 cents per kw-hour, and so on, with the result that the actual amount paid per kw-hour ranges from 10 cents to 4 cents, according to use. Under such a schedule the consumer pays in each month according to the use of that month, and is not confronted with the problem of changing his contract with every fluctuation in the amount of current consumed."

Mr. Maltbie concludes that it is "necessary that the forms of contracts should be as simple as possible, as few in number as possible and so adjusted that the actual amounts paid per kw-hour will gradually change from the highest rate for small consumption to the lowest rate for large users, while at the same time providing that every class of persons shall be charged an equitable amount and that every person in the same class shall pay at the same rate.

"The New York Edison Company and the United Electric Light & Power Company will put into force at the beginning of the year a new form of contract combining contracts

'Wholesale A' and 'Wholesale B.' This new form will remove some of the objections now existing and will lower certain rates, but it is not entirely satisfactory; there are certain objectionable features which must still be remedied."

In addition to the forms of contracts in general use Commissioner Maltbie takes up special contracts providing for special rates or containing special clauses. The vast majority of these contracts, he states, did not contain rates which differed substantially from the standard forms, the principal difference in most cases being in the form of a special order giving the consumer a privilege not generally given to others. In discussing this subject Commissioner Maltbie says:

"Opinions may differ as to whether the existence of contracts having such special clauses, not to be found in all contracts were applicable, produces discrimination and, therefore, renders such contracts voidable on the ground that they are discriminatory and in violation of the principle that all public service corporations must treat all consumers in a class equally. In my opinion such special provisions should not exist, except as between classes of consumers, and every person should be fully advised of all schedules of rates, forms of contracts, regulations as to supply and all other important terms, so that he may make his own selection of contract and not be forced or induced to adopt a system of bargaining or dickering in order to secure what some other consumer may have obtained by such means.

"Considerable discussion was given to this subject in the course of the investigation and at special hearings upon a proposed form of order. It will undoubtedly be beneficial to the companies and to the consumer to make public all forms of contracts, rates, etc., and to adhere to them strictly until experience shall have shown the necessity for a change, and then to make public all changes and to apply them to every one without exception. An order is transmitted herewith for adoption requiring all electrical corporations to file with the commission and post for public inspection schedules showing all rates of change, forms of contract and riders applicable thereto." This order, as adopted, is to take effect on Jan. 15, 1909.

"Besides the contracts with special clauses or riders the investigation developed," Commissioner Maltbie continues, "that six of the operating companies had contracts in force under which current was supplied at lower rates than to consumers generally." In discussing the reasons advanced by the companies in justification of certain rates, Commissioner Maltbie says:

"It may be open to question whether the practice of making experimental contracts with a few consumers is proper or improper, and probably this practice has not so far been abused, but it is possible of abuse and ought to be very carefully guarded if it is to be permitted in any case.

"As to the second class, it is true that a contract which a company will make with any applicant who meets the conditions cannot ordinarily be considered a discriminatory contract, unless the conditions which separate this class of consumers from others are unreasonable and without justification. In my opinion, the companies should be allowed considerable leeway in arranging their rates and in classifying their consumers, but there is a limit beyond which this cannot be carried without injustice, and the observations made in this report regarding general contracts apply with equal force here. The principal objection, however, to the few contracts of which I am now speaking is that the failure to make them public has prevented consumers generally from being aware of their existence, and probably has prevented persons from taking advantage of them who would have found it advantageous to do so, if they had known of their existence.

"The third class of contracts is, of course, purely discriminatory, and in violation of the principle of equal treatment. Such contracts ought not to exist, and it is probable that any consumer of that class who does not have the special rates could go into court and make it impossible for the company to collect the higher rate called for in his contract. Fortunately, the number of these contracts is not large and has been steadily decreasing during recent years. In fact, many contracts that were in force when the commission was created have since been voluntarily cancelled by the companies; others are now being cancelled, and it is probable that within a few weeks they will have been eliminated entirely."

The conclusion reached by Mr. Maltbie is that "conditions have greatly improved within the last decade. The principle is more and more being recognized that all terms and conditions of supply should be public, that equality of treatment should everywhere apply, and that methods and practices should be standardized so that each consumer will be on an equal footing with every other consumer in the same class."

Progress of Radio-Telephony.

By Lee De Forest.

While the installation of radio-telephone apparatus on 26 ships of the United States Navy, prior to their "Round-the-World" cruise, demonstrated the great utility of wireless telephone communication for inter-fleet work, it also demonstrated the necessity for making this apparatus more nearly automatic, to put it into the hands of unskilled operators, or whoever wished to use the instruments.

Lessons were learned from these installations which no amount of theory or laboratory experiment could have taught. Following upon reports of the engineers who went with the fleet to Trinidad, the aforementioned improvements were developed and were installed upon the fleet when it arrived at San Francisco, and on its way to Honolulu. Reports from the latter point as well as those received from Western Australia indicate that the radio-telephone service has been rendered much more efficient by these automatic adjuncts.

About the same time the improved apparatus was demonstrated before the French Government at the Eiffel Tower station. Using the small antenna similar to those on shipboard, voice communication was maintained from Paris to Melun, 60 km (36 miles), and later at Marseilles, 130 km (80 miles). During two nights, when the high antenna on the Eiffel Tower was in use, it was reported by the French Government wireless operator at the Mediterranean station near Marseilles, that gramophone music was heard over that distance, approximately 550 miles.

Following these demonstrations in Paris, the French naval officers, especially Lieutenants Colin and Mercedier, continued experimenting with apparatus which they built following the De Forest designs, and have since reported very satisfactory results from Eiffel Tower to Dieppe, 150 km (93 miles).

The Italian Government purchased four sets of radio-telephone apparatus for marine work, which the writer installed at Spezia last May.

The apparatus has been still further improved during the last summer, and in September, at the request of the British Admiralty, an official demonstration was made between H. M. S. *Furious* and *Vernon* at Portsmouth, England. During these tests perfectly clear and accurate voice communication was maintained up to a distance of 60 English miles, although this was by no means the limit attainable with these instruments on shipboard. As a test of accuracy during these tests, long lists of numerals were read into the transmitter on board the *Furious* and written down at the receiving station on the *Vernon*. A comparison of these figures, e.g., at the distance of 44 miles, shows an accuracy of 98 per cent.

Further development and refinement has progressed since the Admiralty installation. The apparatus is being continually simplified and its range increased, so that it is now fair to say that the radio-telephone is to-day applicable to a large number of vessels which cannot afford to carry a Morse operator, and which will be content with 100-mile communication.

Significant of large development in the near future is the fact that a contract has been made with the Metropolitan Life Insurance Company for the use of its new tower (680 ft. high) as a wireless telephone and telegraph station. This will give the tallest antenna of the world, except that at Eifel Tower, and it is reasonable to expect some long distance records from this station during the coming year.

A. I. E. E. Veterans.

A correspondent has sent the following list of present members of the American Institute of Electrical Engineers of 20 years or more standing—that is, of those still retaining their membership in that body who joined within the first five years of its life, or from 1884 to the end of 1888. Associate members are designated by (A):

1884.

A. G. Bell, Washington.
C. F. Brush, Cleveland.
C. L. Buckingham (A), New York.
C. R. Cross, Boston.
E. N. Dickerson (A), New York.
Philip Diehl, Elizabeth, N. J.
C. A. Doremus (A), New York.
G. F. Durant (A), New York.
T. A. Edison, Orange, N. J.
S. D. Field, Stockbridge, Mass.
G. A. Hamilton, New York.
E. J. Houston, Philadelphia.
F. W. Jones, New York.
T. D. Lockwood, Boston.
C. O. Mailloux, New York.
T. C. Martin (A), New York.
G. C. Maynard, Washington.
J. F. Morrison (A), Baltimore.
J. C. Reilly (A), Brooklyn.
Elihu Thomson, Lynn, Mass.
T. N. Vail (A), New York.
W. B. Vansize, New York.
Edw. Weston, Waverly Park, N. J.
Joseph Wetzler, London, Eng.
Charles Williams (A), E. Somerville, Mass.

1885.

Adams Bosch, Newark, N. J.
C. L. Clarke, New York.
Leo Daft, Rutherford, N. J.
John Millis, U. S. Army.
R. W. Pope (A), New York.
E. P. Roberts, Cleveland.
T. A. W. Shock (A), York, Pa
S. S. Wheeler, New York.

1886.

Samuel Insull (A), Chicago.
A. R. Ledoux (A), New York

1887.

Thomas Ahearn, Ottawa, Can.
E. M. Barton (A), Chicago.
E. G. Bernard, Troy, N. Y.
C. S. Bradley, New York.
P. T. Brady (A), New York.
J. S. Brown, New York.
C. A. Coffin (A), New York
G. H. Condict, New York.
Louis Duncan, New York.
R. N. Dyer, New York.
F. R. Fielding (A), Virginia City, Neb.
H. A. Foster, New York.
W. J. Hammer, New York.
H. McL. Harding (A), New York.
F. B. Herzog, New York
E. E. Higgins, New York.
H. F. R. Hubrecht, Amsterdam, Holland.
C. J. R. Humphrey (A), New York.
R. M. Hunter, Philadelphia.
F. E. Idell (A), New York
W. J. Jenks, New York.
W. P. Judson (A), Oswego, New York.
E. K. Knowles, Brooklyn.
H. W. Leonard, New York.
E. L. Nichols, Ithaca, N. Y.
R. J. Nunn (A), Savannah, Ga.
J. W. Lieb, New York.
S. B. Paine, Boston, Mass.
I. F. Porter, Davenport, Ia.
R. J. Pratt, Honolulu.
E. E. Ries, New York.
Almon Robinson (A), Lewiston, Me.
F. W. Roebling (A), Trenton, N. J.
L. W. Serrell (A), New York.
C. F. Sise (A), Montreal, Can
G. H. Stockbridge (A), New York.
C. A. Terry, New York.
Ernest Thurnauer, Paris, France.
W. D. Weaver, New York.
E. R. Weeks, Kansas City, Mo.
F. R. Welles (A), Paris, France.
H. M. Whitney (A), Boston.
A. E. Winchester, New York
E. L. Zalinski (A), New York

1888.

E. G. Acheson, Niagara Falls.
H. W. Blake (A), New York.
W. E. Case (A), Auburn, N. Y.
Lewis Dearing (A), Denver, Col.
Carl Hering, Philadelphia.
J. W. Howell, Harrison, N. J.
A. A. Knudson, New York.
P. A. Lange, Manchester, Eng.
John Langton, New York.
W. D. Marks, New York.
C. W. Parks, U. S. Navy.
Frederick Reckenzaum, New York.
E. W. Rice, Jr., Schenectady, N. Y.
A. L. Rohrer, Schenectady, N. Y.
Sir D. L. Salomons, London, Eng.
Frederick Saxelby (A), New York.
Nikola Tesla (A), New York.
H. C. Townsend (A), New York.
W. S. Turner, New York.
Montgomery Waddell, New York.
Leonard Waldo, New York.
C. J. Wharton, London, Eng.
W. H. Wiley (A), New York.
Fremont Wilson, New York.

The founding of the Institute in the spring of 1884 was immediately due to the International Electrical Exhibition held later that year in Philadelphia, which was expected to have a considerable attendance of foreign electricians. In consequence, it was felt that there should be some national electrical organization to co-operate with the exhibition authorities in the reception or entertainment of distinguished visitors and lend aid in organizing and carrying out any professional work that might come forward in connection with the exhibition. At a preliminary meeting held April 15, with Dr. N. S. Keith in the chair, the details of organization of the proposed body were placed with a committee consisting of Messrs. N. S. Keith, Geo. A. Hamilton, W. A. Hovey, Wm. H. Eckert and Geo. L. Beetle. The committee reported at a meeting held May 13 in the rooms of the American Society of Civil Engineers, when the plan of organization submitted was adopted and the following officers were, upon its recommendation, elected: President, Dr. Norvin Green; vice-presidents, Messrs. A. G. Bell, C. D. Cross, T. A. Edison, G. A. Hamilton, C. H. Haskins and Frank L. Pope; managers, Messrs. C. F. Brush, W. H. Eckert, S. D. Field, Elisha Gray, E. J. Houston, C. L. Hilling, F. W. Jones, G. B. Prescott, W. W. Smith, W. P. Trowbridge, T. N. Vail and Edward Weston; treasurer, R. R. Hazard; secretary, N. S. Keith.

The total membership of the Institute 20 years ago was 350, of which number 125 were full members. In 1900 the corresponding figures were 1183 and 374 respectively. At present the total membership is 2971, of which 502 are full members.

Patent Treaty with Germany.

The terms of a treaty between the United States and Germany relating to patents has been agreed upon, and it is stated that the completed treaty will soon be brought before the U. S. Senate. According to newspaper statements, the treaty was negotiated by Patent Commissioner E. B. Moore, and has for its object reprisal on Great Britain owing to its recent action in requiring the actual working in Great Britain of patents granted to foreigners.

Electric Signs for Chicago Elevated Railway.

Mr. F. J. Gurnsey, superintendent for the Loop Managers' Association, Chicago, Ill., has announced that he is planning on installing large illuminated electric signs on all of the elevated railroad stations located on the loop of the Chicago Elevated Railways. According to his plans, a large sign reading "Elevated Stations" will be installed on the elevated structure at the principal street corners. Numerous smaller signs, reading "To All Trains," will be installed at the entrances to the elevated stations. Mr. Gurnsey's plans also include the additional installation of a large number of incandescent lamps on the platforms and in the waiting rooms of all elevated stations. Mr. Millard B. Hereley, city traction expert, is working with Mr. Gurnsey to bring about these improvements.

Association of Edison Purchasing Agents.

The fifth regular meeting of the Association of Edison Purchasing Agents was held at Buffalo, N. Y., on Dec. 18, 1908. Included in the transaction of business was the election of officers for the ensuing year. The only change in the personnel of the officers was the election of Mr. C. A. Harding to succeed the late Mr. R. C. P. Holmes. The present officers are: Mr. H. F. Frasse, president, purchasing agent, Edison Electric Illuminating Company of Brooklyn; Mr. C. A. Harding, vice-president, chief clerk, purchasing department, Commonwealth Edison Company, Chicago, Ill.; Mr. H. C. Lucas, second vice-president, purchasing agent, Philadelphia Electric Company; Mr. James B. Eaton, treasurer, purchasing agent, Rochester Railway & Light Company; Mr. Andrew Banks, Jr., stock controller, purchasing agent, Consolidated Gas Electric Light Company, of Baltimore; Mr. J. W. Brennan, secretary, purchasing agent, The Edison Illuminating Company, Detroit, Mich.

The next regular meeting of the association will be held at the same time and place as the convention of the National Electric Light Association as provided for in the by-laws.

Water Power for Denver Light & Power Systems.

The Denver Gas & Electric Company officials and those of the Central Colorado Power Company have come to an agreement under which the Denver Gas & Electric Company is to use energy supplied from the water-power plants of the Central Colorado Power Company. At first the steam plant in Denver will be operated as before until the reliability of the long-distance transmission lines which cross several mountain ranges has been established. The Central Colorado Power Company has under construction a mammoth water-power development and system of transmission lines. Its first power plant will be at Glenwood on the Grand River. Another which is under way is near Boulder, about 20 miles from Denver. The company has already nearly finished many miles of very heavy transmission line on steel towers, and has water-power rights for enough power to supply the whole State of Colorado. The enterprise has been the subject of considerable interest, not only on account of the heavy engineering features, but because of the speculation as to where the market for so much power would be found. The company has done a large amount of

construction work without any large contracts for its use. This agreement with the Denver Gas & Electric Company will take a considerable percentage of the output from the first development.

American Water-Power Resources.

Dr. M. J. McGee, secretary of the Inland Waterways Commission, presented some interesting statistics in the report of that commission read at the recent Joint Conservation Conference at Washington. The total rainfall, including snow and that on water areas, was given as 215,000,000,000,000 cu. ft. a year. Half or more is evaporated. About one-third flows into the sea. The remaining one-sixth is either consumed or absorbed. Of the 70,000,000,000,000 cu. ft. flowing annually into the sea less than 5 per cent is used for power. It is estimated that 85 per cent to 95 per cent of the volume is wasted in freshets or destructive floods. There are in mainland United States 232 streams navigated for an aggregate of 26,115 miles, and as much more is navigable by improvement. The theoretical power of the streams is over 230,000,000 hp. The amount now in use is 525,000 hp. The amount available, according to this report, at a cost comparable with that of steam installation, is estimated at 37,000,000 hp; and the amount available at reasonable cost is placed at 75,000,000 hp to 150,000,000 hp.

The estimate is made that the inland waterways of the country could be improved in 10 years at a cost of $50,000,000 annually with such results that there would be a saving in transportation annually of $250,000,000; an annual saving in flood damage of $150,000,000; an annual average saving in forest fires of $25,000,000; an annual benefit in cheaper power of fully $75,000,000, and an annual saving in soil erosion benefiting farm production.

"It is estimated that the income derived from power developed by works for the improvement of navigation would alone, at current market rates, utilize in cooperation with States and citizens, compensate the entire cost of maintenance and continued development after the initial expenditure of $500,000,000 as a working capital."

Electricity at the Sportsmen's Show, Boston.

One of the noteworthy features of the Sportsmen's Show now being held in the Mechanics Building, Boston, is a novel wireless telegraph exhibit under the auspices of the Acme Wireless Construction Company of Cambridge, Mass. The apparatus is mounted in a log cabin, and is designed along lines shown to be most satisfactory for woodland service. Equipment of this type is now guaranteed to operate successfully over distances of about 30 miles in the woods and from 60 to 150 miles in the clear. The wave length used is about 1500 meters.

The equipment consists in the main of a transmitting helix with adjuster for tuning the helix and antenna to the desired wave length, a transmitting key designed to carry the current necessary to operate the equipment, a power plant consisting of a 2½-hp gasoline engine and a 110-volt, 15-amp generator specially designed for close regulation under inductive load, a loosely coupled receiver, transformer and aerial. All this apparatus is portable and the largest piece carried separately weighs only 50 lb. The aerial consists of from 5 wires up, suspended horizontally above the ground at a height of from 80 to 100 ft., and about 80 ft. long, deadened on each side to trees. The wire preferred for this service is No. 12 rubber-covered. The voltage at the base of the antenna averages from 40,000 to 60,000. This set is specially designed for use in summer homes and camps situated on islands remote from the mainland, and in locations where the laying of a cable or the erection and maintenance of an overhead line would be out of the question. The cost of a set of this type is about $600. Maximum selectivity and immunity from interference are secured by the loosely coupled receiver. Smaller apparatus for amateur use was also exhibited. Similar equipment has been used successfully on the battleships of the Atlantic fleet, and in U. S. Navy Yards.

Rules for Wires Crossing Railroads in Iowa.

The rules adopted by the Railroad Commissioners of Iowa for wires crossing railroads are the result of a conference at which electric light, railway, telegraph and telephone companies were represented. The order requires that all poles sustaining wires which cross railroad tracks shall be of sound timber, cedar or better, with not less than 6-in. tops where more than two wires are carried, and not less than 5-in. tops in any case, and placed in the ground to a depth of not less than 5 ft., well tamped, braced and guyed if necessary, of sufficient height so that the wires shall not be less than 24 ft. above the top of the rails, after allowing for sag. The cross arms shall be braced with iron braces, and locust hedge or steel pins shall be used. Pin guards shall be attached to the ends of all cross arms where crossing poles are not in a straight line with the pole on either side. Crossing poles shall be braced or head-guyed, and such poles, braces or guys may be placed on the railroad company's right of way lands, but must not interfere with the safe operation of the railroad.

In line construction poles shall not be set further apart than 115 ft. at railroad crossings and in no case shall crossing poles be set nearer than 10 ft. from the nearest rail of the main line track, and shall be provided with double cross arms to be placed upon the poles in a gain of sufficient depth to maintain the cross arms at right angles to the poles.

In all cases where any wire-using company shall desire to place its wires under the tracks of any railroad company, it shall, at least five days before so doing, serve a written notice upon the agent of the railroad company at the station nearest to the place where such crossing is to be made. The wires, cables or conduits used in such crossings shall be placed at least 3 ft. below the bottom of the rails of the track.

The foregoing rules do not apply to the feed or trolley wires of an electric railway, but such wires shall be placed at least 22 ft. above the tops of the rails of any railway crossed thereby. They shall be carried on or supported from sound cedar trolley poles with not less than 7-in. tops, or suitable iron trolley poles of sufficient height and strength.

Whenever the wires of any telephone or telegraph company or other persons, firm or corporation making use of aerial wires shall cross the right of way of any railroad company where the wires of either company are subjected to 700 volts or more, safety appliances shall be installed and maintained at the expense of the company desiring the crossing, which shall furnish adequate protection against the danger to life and property incident to contact between the wires of the companies in question. The form of the protection may be determined by the companies interested by mutual agreement, and in the event of their disagreement, shall be determined by the Board of Railroad Commissioners.

Where it is impracticable to use poles at railroad crossings on account of buildings, cross-arm fixtures must be attached to the building with machine bolts passing through the wall. The use of screws or nails for fastening fixtures to buildings will not be allowed.

Where reconstruction of wire-carrying lines is made necessary to make them conform to these regulations, the expense of such reconstruction shall be borne by the party last occupying the ground where such reconstruction is made necessary, and each party shall make all reconstruction on its own lines, unless by mutual agreement.

In special cases where compliance with the above and foregoing rules would work a hardship upon any company in extending its wires over or under any railroad, or of any railroad company extending its railroad across the line of any wire-using company, application may be made to the board to make such order for crossing as deemed reasonable and just.

The above and foregoing rules and regulations shall be in full force and effect from and after this date, as to all new construction, and all persons, firms or corporations, are required to change existing construction at crossings so as to comply with the foregoing rules by Jan. 1, 1910.

CURRENT NEWS AND NOTES.

ZINC SMELTING PLANT.—The Canada Zinc Company, Nelson, B. C., has started the first of its furnaces for the reduction of zinc ores by electricity.

BRITISH TELEGRAPHS.—The returns for the British governmental telegraph and telephone services for the year ended March 31, 1908, show a deficit of $4,145,654, an increase of $1,017,965.

P. R. R. TUBES READY FOR ELECTRICAL EQUIPMENT.—The contractors for the P. R. R. tunnels under the North River, New York, have about finished their part of the work, and the four tubes will be turned over in a few weeks for the electrical equipment.

PANAMA CANAL ELECTRIC LIGHTING.—A 400-kw steam-driven generator has been installed at the Empire power plant, Canal Zone, which will furnish electric light to the district between Gorgona and La Boca. The district between Gorgona and Matachin continues to be lighted from the Gorgona power house.

EARTHQUAKES IN MONTANA.—Advices from Montana state that Virginia City has recently experienced some 30 earthquakes, and that one on Dec. 27 put the electric plant out of commission and interrupted the lighting service. The disturbances coincided with severe earthquakes in Southern Italy. The lighting plant at Virginia City is about 10 miles from town.

BRITISH POSTOFFICE WIRELESS.—The first postoffice wireles station in England was opened by Postmaster-General Buxton on Dec. 11. The station is situated at Bolthead, on the Devonshire coast, and is intended primarily for communication with ships at sea. Mr. Buxton, in a speech at the opening, intimated that a series of similar offices would be scattered throughout the United Kingdom.

ILLUMINATING ENGINEERING SOCIETY.—The annual meeting and election of the Illuminating Engineering Society will be held on Friday, Jan. 8, at 8 p. m., at the Machinery Club, New York City, preceded by dinner at 6 p.m. It seems unfortunate that this meeting should coincide with that of the Electrical Engineers, at which Prof. Elihu Thomson discusses one of the aspects of illumination.

A. I. E. E. MEETING.—The next regular meeting of the American Institute of Electrical Engineers will be held in the Auditorium of the Engineering Societies Building, 33 West Thirty-ninth Street, New York City, on Friday, Jan. 8, 1909, at 8 p. m. Prof. Elihu Thomson, of the General Electric Company, West Lynn, Mass., will present a paper entitled "Conditions Affecting Stability in Electric Lighting Circuits."

AMERICAN ROENTGEN RAY SOCIETY.—This body is holding its ninth annual convention in New York this week. The meetings are being held in the Academy of Medicine and the exhibit of apparatus, etc., is made in the Engineering Societies Building. Dr. E. W. Caldwell, of New York, is president, and Dr. G. C. Fulton, Pittsburgh, secretary. The members are all interested in the electro-therapeutic uses of the ray.

CONCRETE POLES.—The Pennsylvania R. R. Co. has placed in experimental service at New Brighton, Pa., a line of reinforced concrete 30-ft. telegraph poles tapering from 14 in. at the butt to 6 in. at the top. Several years ago the same company set 53 reinforced concrete line poles near Maples, Ind., which have been giving excellent satisfaction. Importance is attached to the increased strength of the new poles, which withstand the strain of the line, even on curves, without any bracing

CHICAGO CENTRAL-STATION interests are getting together in a geographical sense. The North Shore Electric Company, which does the electric light and power business in the suburban area around Chicago, has moved its headquarters from the Chamber of Commerce to the tenth floor of the Home Insurance Building, 205 La Salle Street. This building adjoins the Edison Building, 139 Adams Street, which is the main office of the Commonwealth Edison Company. The two companies are operated on a friendly basis, and Mr. Samuel Insull is president of both.

MOVING PICTURE SHOWS.—A commotion was caused in New York last week by the sudden prohibition issued by Mayor McClellan of all moving picture shows. This left the 10-cent shows in operation under a different form of license from the police commissioner. The cheaper shows have been attacked as often immoral and often given in dangerous places, where fire would be disastrous. It is stated that 500 such places of all kinds exist in New York, representing an investment of $50,000,000, with 12,000 employees. A great many of them are users of electricity, and their moving picture requirements are extensive. The proprietors of the shows have organized for protection and to secure more liberal treatment.

DAMS ACROSS NAVIGABLE STREAMS.—The subcommittee of the House Committee on Interstate and Foreign Commerce, to which the matter was referred, has reported in favor of amending present laws so that the Secretary of War may fix charges for the privilege of constructing a dam. It will make an alternative recommendation that this money either be devoted to restoring conditions of navigation to the original state before the dam was constructed or be turned into the treasury, to be applied to the improvement of navigation generally. The subcommittee also has accepted the recommendation of the President that there be a specific time limitation on permits and has fixed 99 years as the limit, but did not favor his proposition to levy a tax on the power used.

GERMAN TROLLEYS.—U. S. Consul-General Richard Guenther, of Frankfort, says that while the steam railroads of Germany have had a considerable reduction in their earnings since the middle of last year, as they are largely depending upon freight traffic, the tramway companies show increased gains. Thus 53 of the latter companies, whose income is derived almost totally from passenger traffic in the cities, during the fiscal year 1907-8 earned 9 per cent clear on their combined share capital of $77,911,000, whereas their net earnings in the preceding year figured at 8 per cent. Seven of the tramway companies paid no dividends, 46 paid their stockholders from 2 per cent to 10 per cent, and three companies declared a 10 per cent dividend. The trolley lines in the smaller cities do not work very profitably.

POWER IN BRAZIL.—At the recent Conservation Conference in Washington, Ambassador Nabuco, of Brazil, spoke of the immense resources belonging to the Southern Republic in the rivers Amazon and Sao Francisco and said: "The present century, I hope, will see that immense canalization all ploughed by steam and electricity. When the connection of the Amazon with the sources of the River Plate, to which we supply nearly the whole of its waters, will be established, the earth will see an inland water system of a magnitude never dreamed before. I think we ought to be proud of those immense prospects of river and forest combined, by the side of powerful falls, destined to supply all the electricity we may need. With that vision of the future I do not like to speak of our rivers as they appear to-day. Take the Sao Francisco. The men of science who have been on its banks agree that the Sao Francisco is a great river of the future and that the central region it drains will show one day immense wealth. I think it is a good thing for a nation to have a part of its assets under lock, kept for a time of greater progress all round, both in agricultural sciences, in metallurgy and in electricity."

Quarry Street Station of the Commonwealth Edison Company, Chicago.

By WILLIAM KEILY.

SUCCESS in the central-station business depends primarily, of course, on the kind of men who are engaged in it. Good men are required—men who are hard-headed but broad-minded, far-seeing yet prudent, boldly imaginative in planning for the business of the future without being visionary, enthusiastic and inciting enthusiasm in others, yet at all times sensible, judicious, "safe and sane." Such men have discovered that two considerations are of vital importance—reducing the cost of production to the lowest point by scientific engineering and disposing of the output in large quantities at low price by scientific salesmanship. It is well to bear these two closely related principles in mind, for the application of them in Chicago has resulted in the building of the Quarry Street generating station of the Commonwealth Edison Company. This plant, just placed in operation, has a present equipment rated at 28,000 kw and is designed for an ultimate equipment of 84,000 kw. It is the purpose of this article to describe briefly the physical characteristics of this unusually important station, but a valuable lesson would be overlooked if the significance of its creation were not pointed out.

The president of the Commonwealth Company declared not long ago that to-day in cities of the first rank the central-station industry has come to be a vast manufacturing business, and he pointed out that if the electric-supply companies are to maintain their positions they must go more and more into the wholesaling of energy to large users, such as street-railway companies, elevated-railway companies, and possibly later on to the larger transportation companies of the country.

As Mr. Insull has shown, there is probably no other business benefited more in the way of reduced cost of production by increased amount of output. These two factors are correlated and mutually beneficial. They have been greatly stimulated by the introduction of the steam turbine, which is especially conducive to the economical production of electric energy in very large quantities, both from the viewpoint of capital expenditure and operating cost.

Following the policy here outlined, taking prompt advantage of modern engineering development in power-house design and applying the advanced ideas of modern salesmanship the Com-

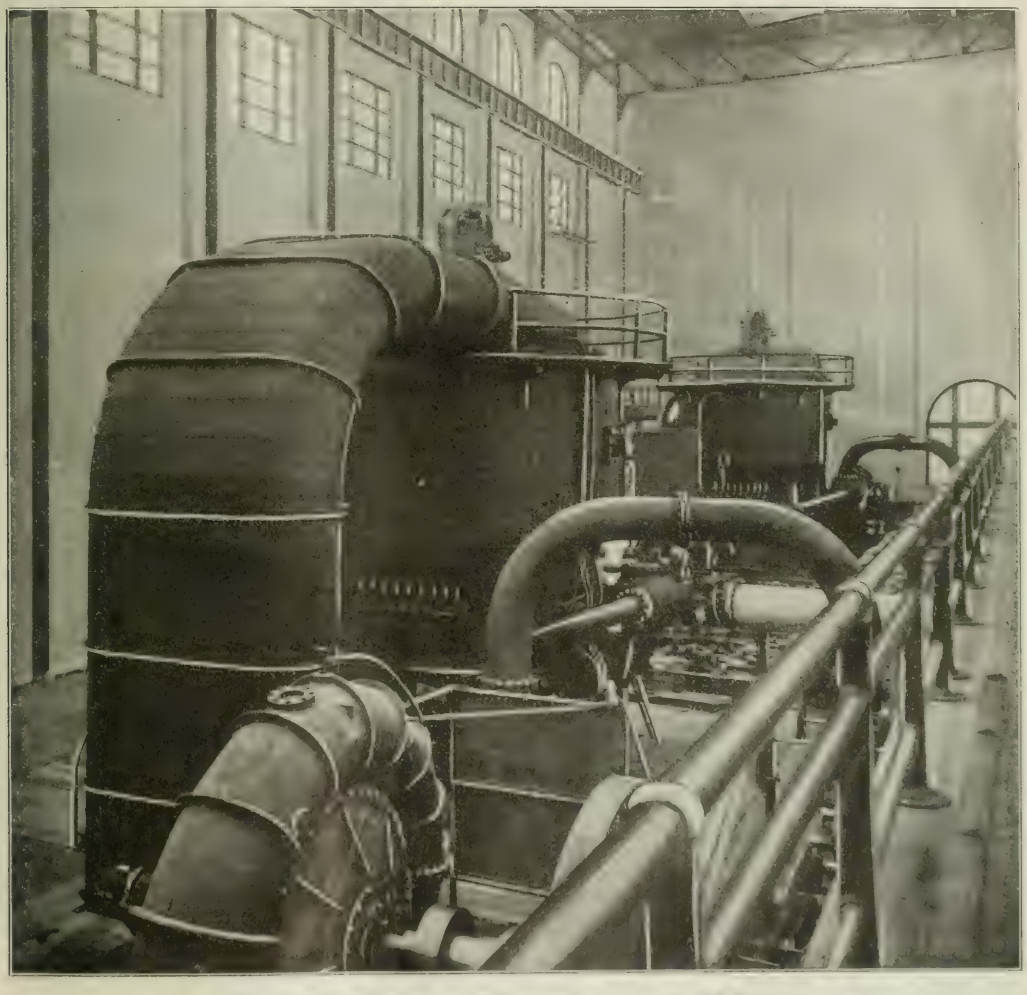


FIG. 1.—TURBINE ROOM IN QUARRY STREET STATION OF COMMONWEALTH EDISON COMPANY.

monwealth Edison Company has been conspicuously successful, as of course is well known to everybody in the electrical industry. Its annual report for the year ended Sept. 30, 1908, showed gross earnings of $9,500,000 and net earnings of $3,126,000. The capital stock is $30,000,000. There are four large generating stations and 33 substations. On the date mentioned the company's commercial business amounted to the equivalent of 4,137,650 16-cp lamps connected. But, in addition, the company is supplying electrical power amounting approximately to

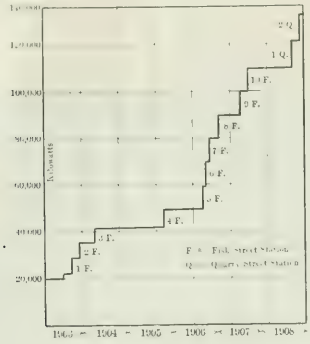


FIG. 2.—DIAGRAM SHOWING INCREASE IN GENERATOR EQUIPMENT.

75,000 hp, under contracts running from 5 to 10 years, to street railways and other public-service corporations which have found it to their interest to purchase power.

The new Quarry Street station, with its present rating of 28,000 kw in two units, is practically devoted to generating energy for railway load. Fisk Street station, the pioneer steam-turbine power house of this country, was put into operation in 1903 and proved to be remarkably economical in cost of energy production, and particularly so in the case of the later units. It has now 10 turbo-generators, with a rating of about 100,000 kw. This station efficiency permitted the company to go after wholesale business at prices which were astonishingly

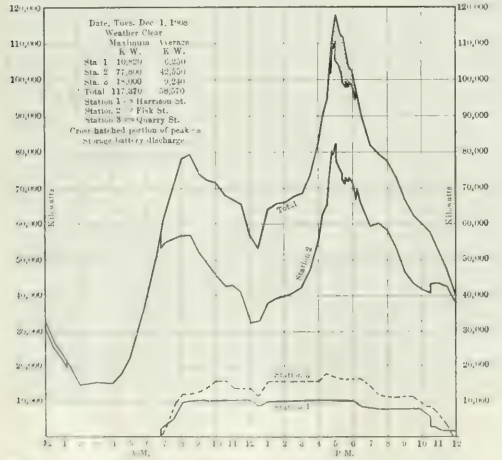


FIG. 3.—DIAGRAM SHOWING PROPORTION OF LOAD CARRIED BY DIFFERENT STATIONS.

low. In one railway contract the energy-consumption charge runs as low as 0.4 cent a kw-hour, but there is also a "minimum primary charge" of $15 per maximum kilowatt per year and the rate is based on a probable demand of 40,000 kw, a 10-year period and an exclusive contract. The connected load grew very rapidly, and although the Fisk Street station is completed to only three-fourths of its ultimate rating, work was begun last year on an entirely distinct generating station, just across the river from Fisk Street, on Quarry Street. It was decided to create an entirely new plant to add to the factor of safety in reliability of operation.

The accompanying diagrams show the rapid increase in generator equipment and also the load curves for Dec. 1, 1908. The total load is shown to have reached over 117,000 kw. One of the curves shows the proportion of railway load and also the growth in total business in five years. The other load diagram shows the proportion of the load of Dec. 1 carried by

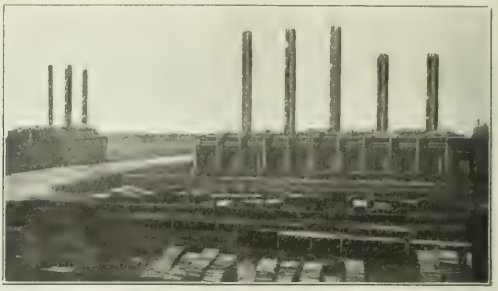


FIG. 4.—VIEW OF FISK AND QUARRY STREET STATIONS.

the three generating stations in use on that day. In this curve the cross-hatched peak is the storage battery discharge. Ordinarily the battery is used only for standby service, but on this particular day the load was unexpectedly heavy, and the batteries were discharged to assist the generating stations as indicated.

What has been said heretofore is intended to point out the reason for the existence of the Quarry Street station. No attempt will be made to describe the complete generating, transmission and distributing system of the Commonwealth Edison Company. That was done in a comprehensive article in the ELECTRICAL WORLD of May 16, 1908. Since then the new station has been put into service, although still unfinished, and a

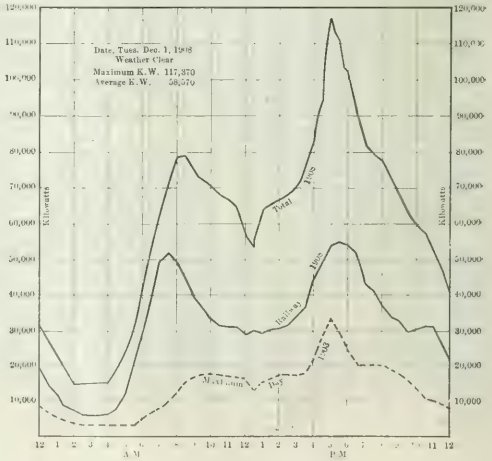


FIG. 5.—LOAD DIAGRAM SHOWING TOTAL LOAD, RAILWAY LOAD AND LOAD IN 1903.

general outline description of it is now attempted. However, in relation to the system as a whole, it may be of interest to point out that, in conjunction with the North Shore Electric Company, which is in friendly hands, it supplies energy from Waukegan, Ill., south to Kankakee, Ill., a distance of about 100 miles. North of Waukegan one of the transmission systems extends 50 miles farther to Milwaukee, so that the ex-

treme range of application of energy generated in these steam-driven stations is 150 miles.

GENERAL CHARACTERISTICS OF THE QUARRY STREET STATION.

The Fisk Street station lies on the south branch of the Chicago River, about three miles southwest of the center of the central business district in a straight line. The new Quarry Street station has been built on land secured by the company directly across the river, which here has an east-and-west direc-

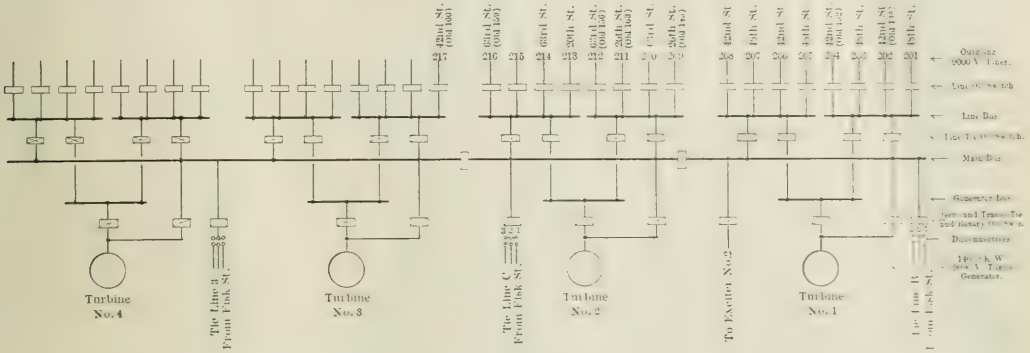


FIG. 6.—ELECTRICAL CONNECTIONS SHOWING ARRANGEMENT OF UNITS OF SWITCHING EQUIPMENT.

tion. A ferry service is maintained. The two stations are quite distinct; a breakdown in one would not affect the other; nevertheless they are operated together—that is, there is one chief engineer for the two, and the station force of 350 hands can be shifted from one to the other as needed. Thus the two great stations mutually support each other.

The general layout of the Quarry Street station differs somewhat from that of the Fisk Street station. This is due principally to real-estate limitations. Owing to the narrower site the boilers are in two parallel rows instead of the equipment for each unit extending at right angles to the turbine room

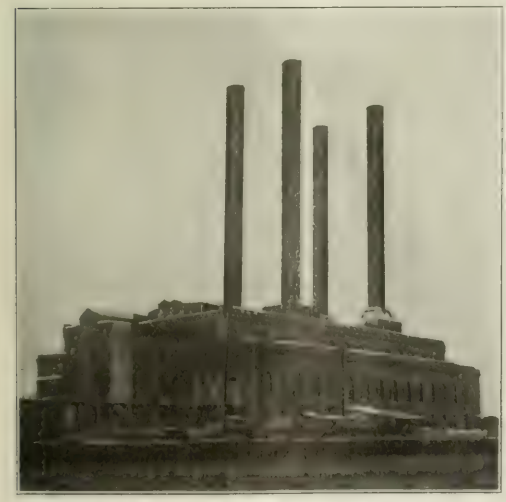


FIG. 7.—QUARRY STREET STATION FROM RIVER

as at Fisk Street. For the same reason the switch house is included in the station building instead of being a separate structure as at the older station. Although the Fisk Street station has a record of steam consumption of 12.04 lb. per kw. hour, nevertheless it is expected that the efficiency of the new station as a whole will be better than that of its more imposing neighbor.

Completed as planned, the building will be 463 ft. long and 208 ft. wide. The portion now built is a little over half of this, or about 270 ft. long and of the width mentioned. The station comprises four sections, separated by fire walls, and extending longitudinally the whole length of the building. These are the train shed, on the north side, where the coal cars are received, next the boiler room, then the turbine room, while the switch house forms the southern section. In the south-west corner is the Quarry Street substation, while various offices, lavatories, test rooms and the like are provided. Elaborate provisions for welfare work for the men are not needed, owing to the proximity of the Fisk Street station.

The finished station is designed for six 14,000-kw turbo-alternators. Two of these are now in service. The present building will hold another unit, but extensions will be required for any additional units. The piling is in, however, for the complete building.

Architecturally, the building is dignified, yet less ornate than the Fisk Street station. This is in accord with the engineering design, which, for so large a plant, is comparatively simple and compact. However, the building is thoroughly well and substantially constructed. The exterior, of the red pressed brick which the Commonwealth Edison Company long ago adopted as standard, is imposing; the interior is pleasing and spacious, with very excellent provisions for light and air. The turbine room, in particular, at present 268 ft. long, 56 ft. wide and over 60 ft. high, impresses one by its size; it contains the largest prime movers in the world in point of rating, but they do not



FIG. 8.—VIEW OF BOILER ROOM

look large in it. This is partly due to the fact that while they are large they are not relatively so considering their great output.

Natural light in abundance is admitted by skylights, monitors and side windows. Over the turbine room there is one large central monitor, and there are also two-part windows in the southern outside wall above the switch house, which, like the

tain shed, is not as high as the rest of the building. The opening of these windows is effected from the floor of the turbine room by compressed air.

The operating room or gallery is in the switch house, but extends through into the turbine room with a curved glass front. It will be in the center of the southern wall of the turbine room when completed and about 35 ft. above the floor. From this point the operator can survey not only the generating units, but also the accessories, such as boiler-feed pumps, oil pumps, oil filters, etc., which are not placed in a dark corner of the boiler room, as is sometimes the case. The turbine room is finished in white enameled brick. There is a visitors' gallery running along the north wall, and another interesting feature is a permanent railroad track extending for the whole length of the building between the row of turbines in the center and the south wall of the room.

DISTINCTIVE ENGINEERING FEATURES.

It seems fair to say that the Quarry Street station embodies the very latest advances in electric power-house design. The dominant idea, of course, has been to secure the greatest attainable economy of operation, combined with safety and reliability of operation. To this end the plant seems to represent distinct progress in the art in the following particulars:

1. Size of the units, which are rated at 14,000 kw. These machines are not only the largest dynamo-electric machines now in operation anywhere, but it is believed that the turbines are the largest prime movers in use for any purpose. Possibly there are marine engines larger than these individual units of 18,500 hp, but, if so, the writer has not heard of them.

2. The ventilation of these very large units is entirely new. The generators may be operated at their maximum output without overheating.

3. The degree of vacuum obtainable in winter is probably the best known in the art, being 98 per cent of the absolute zero of pressure.

4. By a boiler setting new to central-station power-house design practically smokeless combustion is secured.

5. The plant will require a minimum of labor.

6. A split-pole rotary converter is installed in the substation in this power house. It is the first machine of its type.

7. Electrical connections in the switch house are compact and comparatively simple, with several new features, including specially designed disconnector switches at the base of the oil switches which add much to the safety of operation.

8. It is believed that the station represents the lowest cost of maximum output yet attained in this country. A superior record of economy in operation is hoped for—even better than that of Fisk Street.

STEAM GENERATION.

Coal is brought into the station in cars run on the two tracks in the train shed. Here it is dumped into hoppers emptying into a longitudinal McCaslin conveyor and taken to a crusher at the western end of the train shed. Transverse conveyors transport the fuel to bunkers over the boilers holding 150 tons for each individual boiler. The ash conveyor presents no novel features; it is similar to that at Fisk Street.

Arranged in two rows parallel to the turbine room are eight water-tube Babcock & Wilcox boilers for each unit, or 16 at present. Each boiler has 5000 sq. ft. of heating surface, exclusive of the superheating surface. The boilers are designed for 225-lb. gage pressure and for a maximum steaming capacity of 35,000 lb. per hour. The superheater is designed to give from 150 to 175 deg. Fahr. of super-temperature when the boiler is operated at 30,000 lb. of steam per hour. The automatic chain-grate stokers are 8.5 ft. x 11.5 ft.

The boiler setting represents a new departure in power-house design adapted from recent marine practice. The furnace is placed under what is ordinarily the rear header of the boiler. This arrangement makes a somewhat higher setting than usual, but it enables a great improvement to be made in boiler efficiency. It embodies the idea of a long flame chamber expanding in volume to aid combustion as opposed to the



FIG. 9.—INTERCONNECTED TRANSMISSION SYSTEMS OF COMMONWEALTH EDISON AND NORTH SHORE ELECTRIC COMPANY.

old practice of a short flame chamber and contraction in volume, which prevented complete combustion. In consequence of this arrangement objectionable smoke will not be produced, even though the boiler with its furnace be driven to the maximum capacity of the latter. Owing to the greatly increased size of the combustion chamber, complete combustion is obtained before the hot gases come in contact with the heating surfaces of the boiler. Thus, the operation of the plant is practically smokeless, while the efficiency of the boiler is increased and there is a distinct advance in economical working.

Four steel stacks 12 ft. in inside diameter and extending 250 ft. above the boiler-room floor are provided for the present equipment. In the boiler room is a hand-power 5-ton Whiting crane.

TURBINES AND TURBINE ROOM EQUIPMENT

The central feature of the ultimate Quarry Street station as planned will be the row of six 14,000-kw turbo-alternators. The two now in use are placed on the center line of the turbine room. They consist of five-stage Curtis steam turbines direct-coupled by means of a vertical shaft to General Electric 9000 volt, three-phase, 25-cycle, four pole, revolving-field generators The speed of operation is 750 r.p.m., and the units are rated at 14,000 kw on the new maximum continuous rating: that is, for 24-hour service. The machines stand about 27 ft. above the floor Including the condensers in the basement, the entire height of each unit is 33 ft. 4 in., while the diameter is 14 ft. 8 in. The turbines are placed in right and

Unit No. 2 are much farther apart than are Nos. 2 and 3; the average distance apart is less than might be supposed from considering the placing of one set alone.

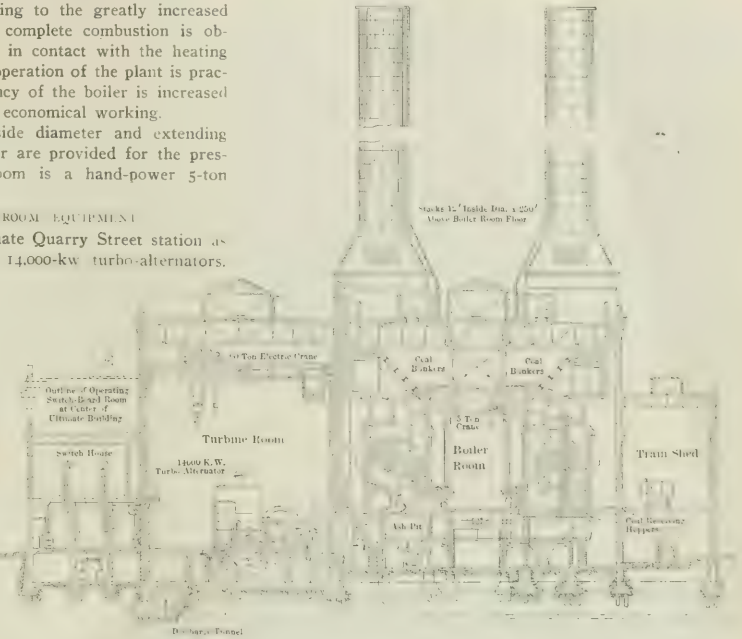


FIG. 11.—CROSS-SECTIONAL VIEW OF STATION

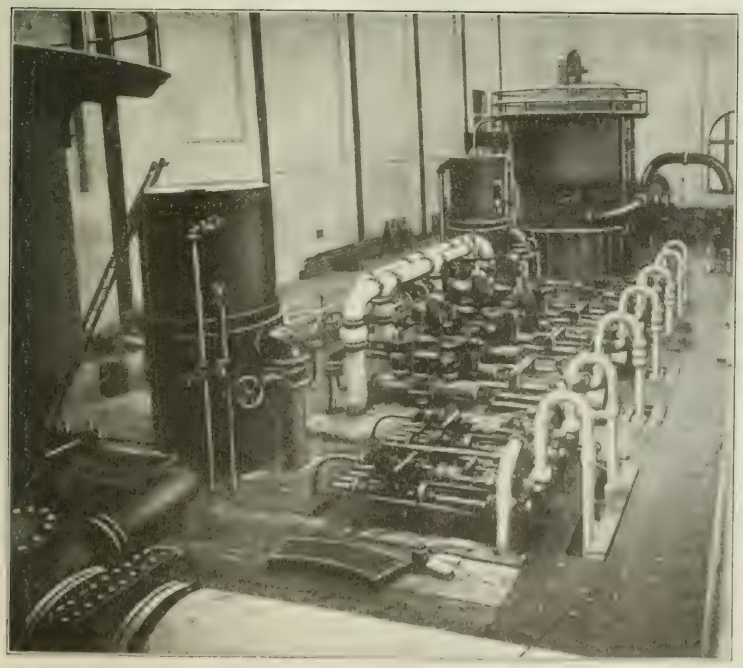


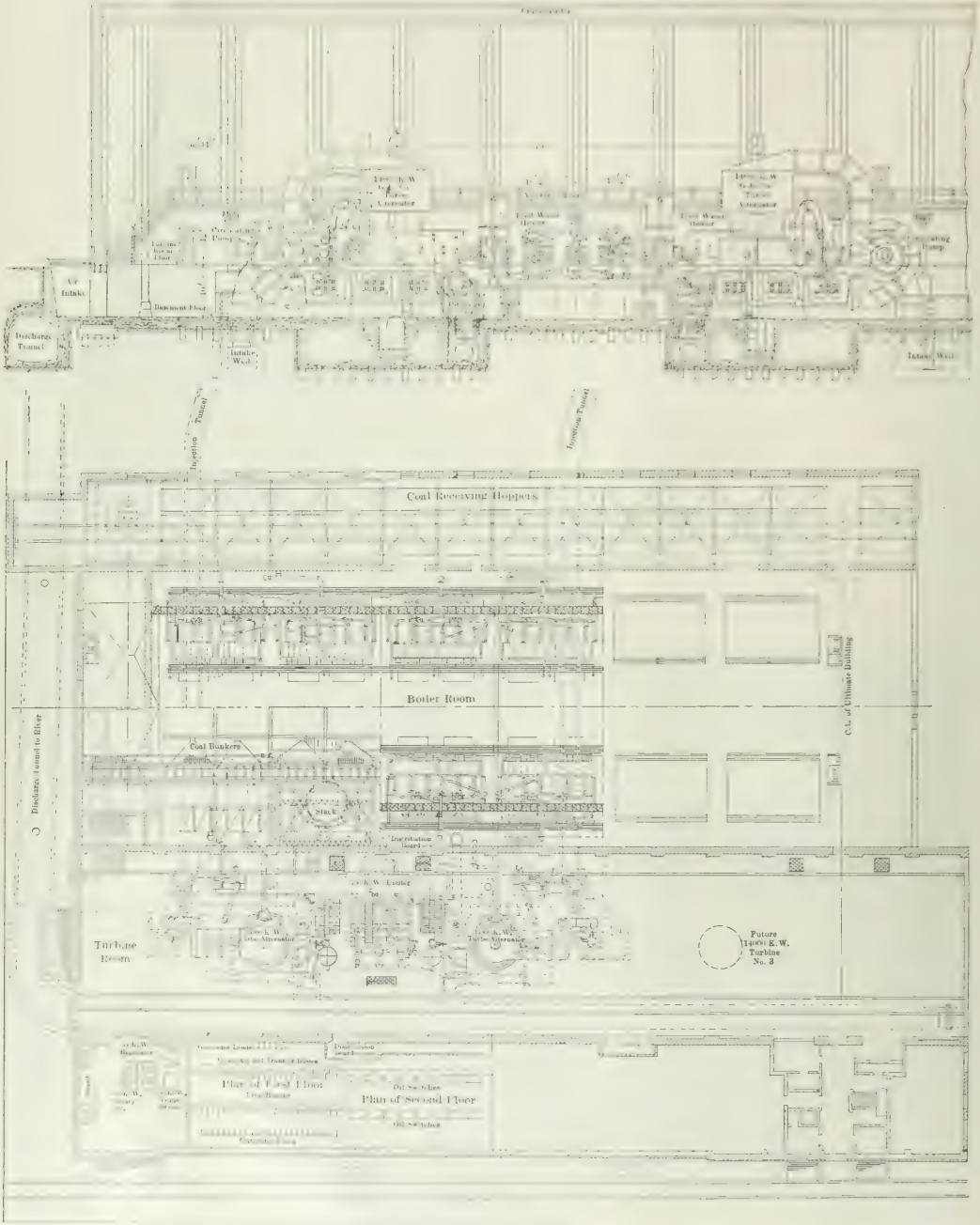
FIG. 10.—VIEW OF TURBINE ROOM SHOWING AUXILIARY APPARATUS BETWEEN UNITS.

From their output standpoint the machines do not impress one as so very large. This is partly because with these enormous revolving masses on an upright shaft the center of gravity has been kept as low as possible to lessen vibration. The condensers, particularly, are designed to take up space horizontally rather than vertically. They are in the basement and partially extended out two thirds under the respective turbines and one-third to the right or left under the space used on the floor above for auxiliaries. This is a new and important development, for it contributes greatly to the absolute steadiness of running which is so greatly desired. Each condenser has 25,000 sq. ft. of surface.

Another very important and novel feature is the means adopted to secure ventilation of the generator. Heretofore it has been difficult, with the ordinary power-house construction, to provide the ventilation necessary to allow the large turbine units to operate at their most efficient outputs. The Quarry Street station has been designed with this point continuously in view. In the basement is a specially constructed air chamber connected with the out-

left order, or back to back. Two units constitute a set, and between them are placed the auxiliaries. Thus Unit No. 1 and

side air. A great elliptical air duct equal in area to a circle over 6 ft. in diameter, which leads from this chamber to the top of the turbo-generator, is a very conspicuous feature of the machine; it catches one's eye the moment he enters the room. Vanes are placed on the encased revolving field core, which thus acts as a gigantic fan and pulls air through the duct, thoroughly ventilating all parts of the machine. The heated air is blown out through the laminations of the stationary armature and rises to the top of the turbine room, where are the noticeably numerous window openings already described, the usefulness of which is now doubly apparent. This arrangement necessarily takes up a good



12 AND 13.—ELEVATION OF TURBINE ROOM AND PLAN VIEW OF QUARRY STREET STATION.

deal of space, but it is simple, automatic and very effective.

In the main shaft, between the turbine and the generator, is inserted a flexible friction coupling which normally transmits the load unaffected. It is intended, however, in emergency, as in case of a short-circuit or the machine getting out of phase.

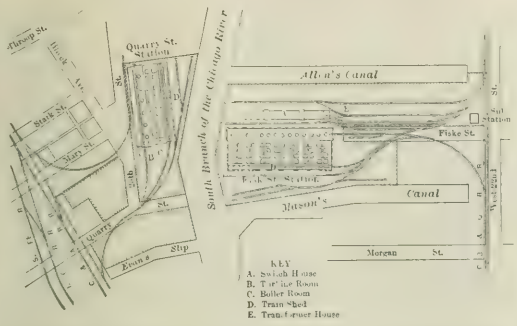


FIG. 14.—PROPERTY PLAN OF FISK AND QUARRY STREET STATIONS.

to be the part that will yield to the stress, thereby protecting the unit from serious injury. This is another new feature, tried for the first time in the Quarry Street station.

Space will permit of only a cursory reference to the turbine auxiliaries, which are, however, very carefully planned to obtain the great ends—economy, safety and reliability. Everything is in duplicate, so that the chance of breakdown is remote. There are two volute circulating pumps, each driven by a 125-hp Corliss engine. The water of condensation is removed from the condensers by two rotary pumps driven by Kerr steam turbines. For each two units of turbines and boilers three horizontal boiler feed pumps are provided, located between the turbines, as stated. There are also four step-bearing oil pumps, two oil accumulators, dry-air pumps, oil filters, etc. All are in plain view of the turbine-room operating force.

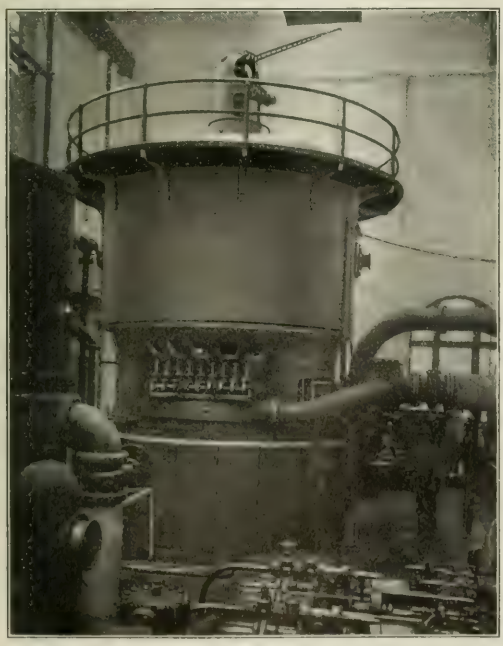


FIG. 15.—NEAR VIEW OF 14,000-KW TURBO-GENERATOR.

Excitation of the main generators has been most carefully provided. For the six ultimate units five 150-kw exciters will be installed, three driven by horizontal Curtis steam turbines and two by 25-cycle, 220-volt induction motors. One of each of these types is included in the equipment of the present plant. In addition there is an excitation storage battery of 70 cells in the basement. Furthermore, in an emergency the split-pole rotary converter of the substation could be used for excitation.



FIG. 16.—OIL SWITCH COMPARTMENTS.

Two switchboards are placed on the turbine-room floor. One is for the exciters and consists of three panels, the middle one for the storage battery. A feature is that all of the motor-operated rheostats are placed on top of the board in plain view. The other board is for the distribution of energy for the local 115-230-volt Edison three-wire, direct-current service. Here also is an additional safeguard, for this board is inter-



FIG. 17.—VIEW OF BUSBAR COMPARTMENTS.

connected with the Twenty-second Street substation across the river by two 1,000,000-circ.-mil feeders.

Spanning the turbine room is a Whiting traveling crane with a lifting capacity of 90 tons. It is equipped with four motors.

The six leads from each of the generators are in tile ducts cemented in. They follow the under side of the air duct down to the basement and continue to the switch house adjoining.

Mention may be made here of the fact that the total lift of the water supply of the circulating system has been very carefully minimized, so that the static head imposed on the system may be as small as possible. Apparently no chance to effect a little economy in operation has been overlooked. There is a common discharge tunnel for circulating water for the whole station. In the completed station there will be four intake tunnels, two for two units each and two for one unit each.

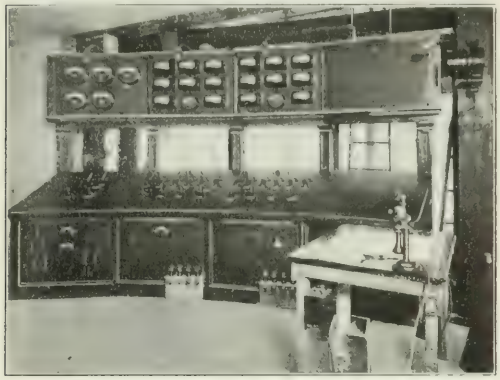


FIG. 18.—SWITCHBOARD IN OPERATING GALLERY

SWITCHING APPARATUS

The switch house forms the southern portion of the building, but is not as high as the main section containing the boiler and turbine rooms. It has two stories and basement, with the addition of a third story in the longitudinal center of the ultimate building for the operating switchboard room. The second story contains the high-tension oil switches, while the busbars and other high-tension connections, together with the instrument transformers, are located on the first floor. Low-tension and high-tension cable runs are placed in the basement, where there is ample room.

Four 9000-volt units of switch equipment, each with eight transmission lines, are accommodated in the present switch house, while the arrangement is such that 20,000-volt bus and switch equipment may be installed in the future without difficulty should the development so require. Provision is made to operate all units in parallel or separately with certain units at the Fisk Street station, which is ordinarily done by means of two tie lines, each capable of transmitting at least 12,000 kw.

The basement and the first floor are divided for their entire length into three chambers, but the second floor contains all of the oil switches for four switching units in one room. The oil switches are arranged in two rows, the north row serving as group or tie switches between the generator, transfer and line buses, and the south row for the outgoing high-tension transmission lines exclusively. Eight switches are built together in each row to insure stability and economize space. Fig. 16 gives a view of the oil switch compartments and shows the arrangement of the switches in two rows.

Simplicity in design characterizes the high-tension buses and their connections and compartments. All buses run east and west only, and are arranged in vertical position, each conductor being enamel-coated, in special grooved compartment and supported on porcelain insulators. All busbar barriers and netting are made of "Elecrete," a new form of concrete designed for electrical use. All copper bars and rods, properly insulated, are separated by barriers, and the instrument transformers are likewise contained in Elecrete compartments with special cabinets for fuses within easy reach. These cabinets are provided with doors of asbestos board. A view of the busbar compartments is given in Fig. 17.

The generator leads for each phase, consisting of 1,000,000-circ.-mil lead-covered cables, after leaving the series transformers, are taken to the generator and transfer bus oil switches, enabling energy to be furnished to the feeders of any switching unit. The transfer bus is located above the generator bus on the same wall and runs throughout all switching units, sectionalized at certain points by means of oil switches, while the generator bus is individual for each unit. The line buses are two in number for each switching unit, with four transmission lines connected to each bus. A special Elecrete wall for supporting series instrument transformers and terminal bells on the eight outgoing lines is built along the south wall of the switch house. It has also the necessary compartments for the shunt-instrument transformers. In order that any of these transformers may be easily replaced, all of them are set on the floor.

A distinctive feature in the design of the high-tension bus chamber is the straight, forward connection from the bells of the generator leads to the bells of the outgoing transmission lines. Great precaution has been taken to minimize the danger to life and property from the manipulation of the high-potential circuits. For instance, all oil switches are equipped with self-locking and self-unlocking disconnective switches, in order to "kill" either switches, buses or connections in case of cleaning or repairing. These disconnective switches were specially designed for the Quarry Street station, and add a valuable element of safety. Again, a signal board is provided in the oil-switch room. It has a number of signal lamps connected to shunt-instrument transformers of the generator leads and to high-tension lines. This indicates, from an outside source, whether any of these lines are "alive" before any disconnection of oil switches is done. In the design of all switching apparatus the element of safety has been considered of paramount importance.

In the basement of the switch house the south chamber is provided with two bays where the ducts from the street enter from the transmission lines. A steel structure, with several

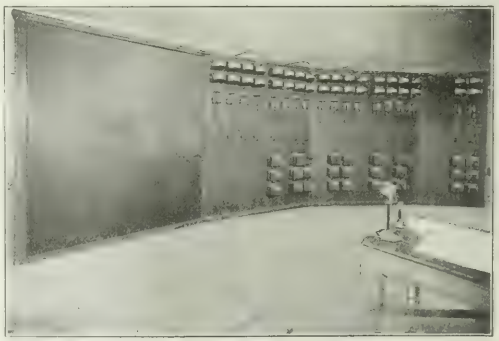


FIG. 19.—SWITCHBOARD FOR OUTGOING LINES

trays, has been built, and it facilitates the drawing in and connecting of any new line. All present lines leave the station in three-conductor, 250,000-circ. mil.

OPERATION AND CONTROL

All instruments and control wiring consists of single conductors grouped in fiber conduits from the terminal boards in the high-tension bus chambers and in iron conduits from the oil-

switch room to the operating room. The series and shunt leads for the instruments are also grouped in separate fiber conduits. A special room running along the north wall of the oil-swifch room is reserved to take care of terminal boards and conduits for the four switching units. In this room all conduits are exposed, whereas all pipes in floors and high-tension compartments are concealed.

The operating room, on the third floor of the switch house, but also opening into the turbine room, contains all switchboards for the operation of all generators and lines. Machine control and line control are effected on two distinct boards ar-

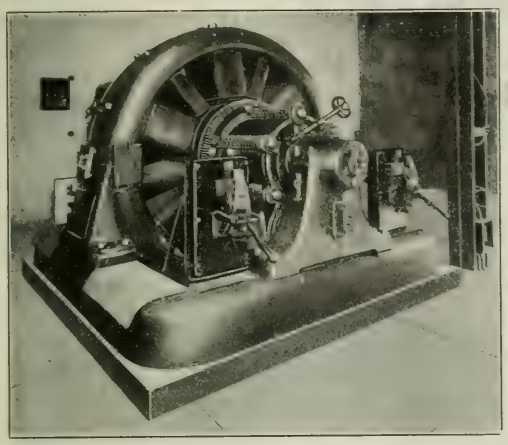


FIG. 20.—SPLIT-POLE ROTARY IN SUBSTATION

ranged in curving form and nearly opposite each other. This gives the switchboard attendant an unobstructed view of all meters and controlling instruments. He is also in position to take a general survey of the whole turbine room. The line panels are vertical, but the generator and exciter board is arranged with a benchboard, and there is an open space between the benchboard and the vertical instrument panels above through which the generators controlled by that board can be seen by the operator without shifting his position. Fig. 18 shows the switchboard.

All oil switches, generator field switches and field rheostats are remote-controlled by means of an auxiliary low-tension system operating at 115 volts. Instruments and switches are mounted on Monson slate, back-connected with wires ending at terminals carefully lettered. The wiring is designed in such a manner that no crossings are necessary, due to careful run of conduit in the operating gallery, where a false floor of Tennessee marble is laid. Mounted on the rear of the panels, but operable from the front, are some interesting new devices known as "test adapters," which make the work of testing meters an extremely simple operation. Instead of the usual methods, including disconnection of wires and the attaching of testing leads by testing men, a simple movement of the adapter by the operator puts the instrument in connection for testing. A testing panel, with standard meters permanently installed, is interconnected with this system. At the rear of the panels the wiring is particularly to be commended for its simplicity and neatness.

A complete signal system between each turbine and its boilers and the corresponding control panel on the switchboard will be at the operator's command. A bulletin board will indicate the actual load on each turbo-generator.

SUBSTATION.

A local substation with the usual arrangement of transformer, rotary converter and switchboard is placed on the first floor at the west end of the switch house. It is of unusual interest because it contains, in commercial service, the first experimental split-pole rotary converter ever built. This type of machine does away with the potential regulator. It has been described in recent papers read before the American Institute of Electrical Engineers, by Mr. J. L. Woodbridge, Mr. Charles W. Stone and Prof. C. A. Adams. (See also ELECTRICAL WORLD, page 386, Feb. 22, 1908.) In any synchronous converter the direct-current voltage has a definite ratio with respect to the alternating-current voltage impressed upon the collector rings and this can be varied within certain limits by changing the width of the pole arc. The function of the regulating pole is to vary the width of this arc and hence the ratio of alternating- to direct-current e.m.f. by assisting or opposing the flux in the main pole. The machine is of 500-kw rating. The output is used at present for supplying energy to lamps and motors in the station. Energy is used also for charging the battery and may be used, as stated, for excitation. The substation switchboard is connected with the Twenty-second Street substation, which may be drawn upon in emergency.

FIRE PROTECTION.

Unusually complete fire protection is afforded at the Quarry Street station. A 1000-gal., 125-lb., centrifugal motor-driven fire pump delivers water to a permanent piping system, with hydrants placed at convenient points about the building and property. An ample supply of hose on reels is accessible for the fire brigade made up of station employees. The piping system has a further connection to the river, by which a fire-boat could force water through it. In addition, there is a similar connection on the street, to which fire engines could be attached. Moreover, the building is as nearly fireproof in construction as human ingenuity can make it.

THE MEN WHO DID THE WORK.

Following is a list of the names of the engineers, architects and principal contractors:

Consulting mechanical engineers, Sargent & Lundy; electrical engineers, engineering staff of the Commonwealth Edison Company; architects, Shepley, Rutan & Coolidge; general contractors, Wells Brothers Company; boilers and stokers, Babcock & Wilcox Company; turbo-generators and exciters, General Electric Company; condensing equipment, H. R. Worthington; boiler-feed pumps, Dean Brothers, of Indianapolis; overhead traveling crane, Whiting Foundry & Equipment Company; coal and ash-handling machinery, John A. Mead & Company; condensing tunnels, Nash Brothers; foundations for machinery, Falkenau Construction Company; boiler setting and lining of ash pits, H. A. Bishop; high-tension switching equipment and control, General Electric Company; excitation battery, Electric Storage Battery Company.

A GLANCE AT THE FUTURE.

It is an interesting commentary on the marvelously rapid development in the art of planning electric power stations and building machinery that the first four turbo-generators in the Fisk Street station, none of them more than five years old, are to be taken out next summer. They have had their day and will be replaced by an equal number of 12,000-kw units. By this change the rating of Fisk Street will be increased by 22,000 kw without any addition in the boiler room except the extension of two stacks and slightly increased grate service.

The Harrison Street station in its day was considered the most economical of the reciprocating-engine stations. Later, under the same management, the most economical of turbine stations was developed. The Harrison Street station has a rating of from 16,000 kw to 18,000 kw with its present engines and generators. Remodeled as a turbine station, it could be made to yield from 40,000 kw to 45,000 kw. Contrasting these figures, it would seem to be within the bounds of possibility to look forward to the day when the last piston engine shall have been abolished in the great stations of the Commonwealth Edison Company.

Bituminous Gas-Producer Electrical Generating Plant.

By Elbert V. Harvey.

THE Garford Company, Elyria, Ohio, manufacturer of automobiles, has a very complete and thoroughly modern manufacturing plant, one of the features of which is a bituminous gas producer, furnishing fuel for engines and other manufacturing purposes.

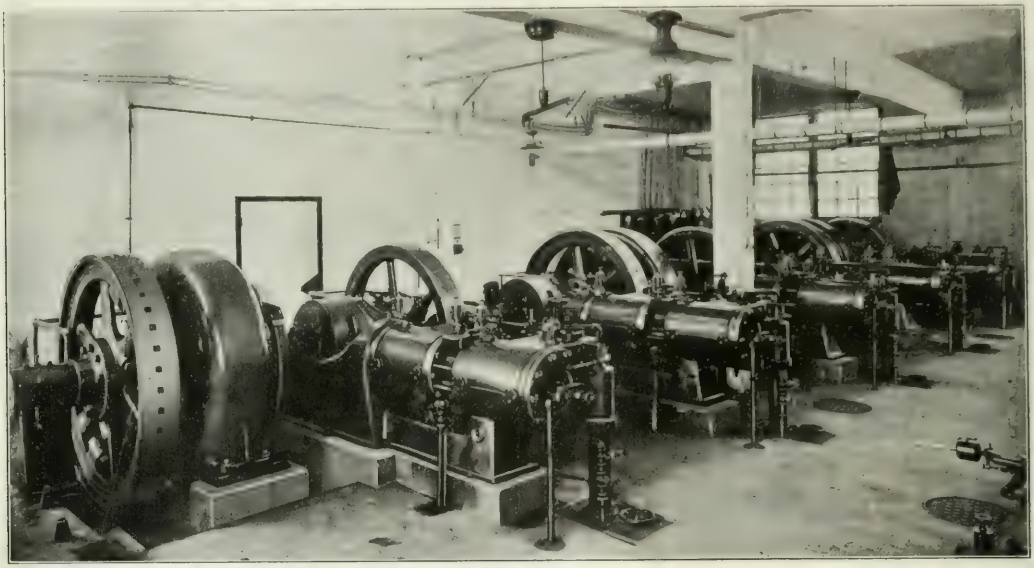


FIG. 1.—VIEW OF ENGINE ROOM OF GARFORD COMPANY AT ELYRIA, OHIO.

Like many manufacturing concerns in the Cleveland district and in other natural gas centers, the Garford Company is established on a gas basis. There is cheap natural gas—that is, gas at 25 cents per 1000 cu. ft. for power purposes, and 15 cents per 1000 cu. ft. for furnace purposes. The natural gas is good, and the prices afford a lower fuel cost basis than can readily be obtained by other means.

But the supply of natural gas, however, cannot be depended upon. The gas companies, both in Cleveland and elsewhere, realize that their most legitimate and permanent field is in supplying the individual householder, storekeeper, and the like, and refrain from making contracts with manufacturers with guarantees of ample supply and continuous service. They agree only to give gas when they have a surplus, and as a matter of fact, during every cold snap the gas supply to manufacturers is either cut off or reduced. It is apparent that manufacturers like the Garford Company, with a plant representing more than $1,000,000 investment, cannot afford to run the risk of shut-down on account of the failure of fuel supply. Therefore, while the company avails itself of the low cost and

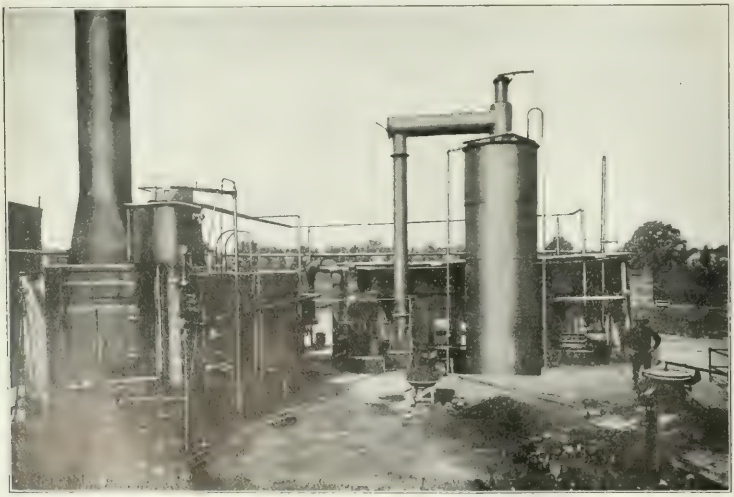


FIG. 2.—VIEW OVER CHARGING PLATFORM SHOWING ALSO GAS WASHER AND TAR-BURNING BOILER.

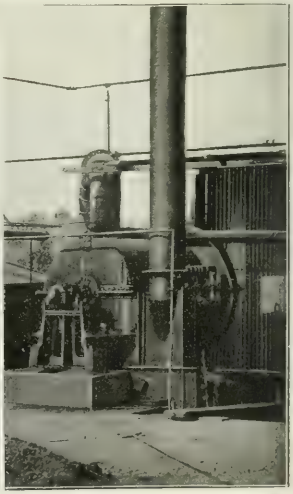


FIG. 3.—ROTARY GAS WASHER.

convenience of natural gas, notwithstanding the instability of the service, as a safeguard it has put in a producer equipment as insurance against shut-down and also for future use when the natural gas gives out or rises in price.

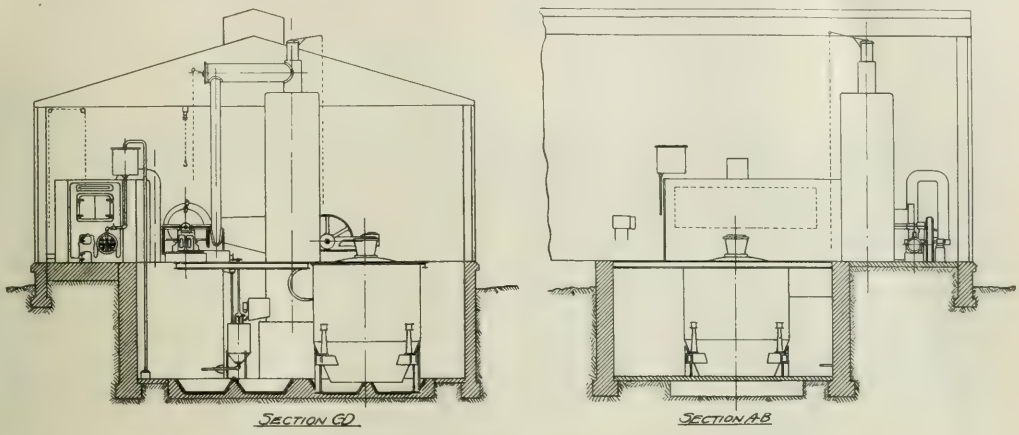


FIG. 4.—SECTIONAL ELEVATIONS OF GAS-GENERATING PLANT.

In the spring of 1907 the company announced to the manufacturers of producers that it was in the market for producer equipment. A large number of bids were received, but only three of them received consideration, viz., those made by concerns who had at that time successful plants operating on bituminous coal. The contract was finally awarded to the Industrial Gas Company of New York. The gas plant selected is an updraft produced with a mechanical tar separator. It is designed to furnish a gas containing the light hydrocarbons of bituminous coal, but entirely free from tar, thus furnishing a clean gas but one comparatively high in heat units.

The plant installed consists of one updraft produced with open water-sealed bottom and four tuyeres for air and steam supply; a cooler, where the gas is cooled by water shower; a rotary gas washer, by which the tar is removed from the gas; a dry scrubber, in which the gas is dried and freed from dust; a small auxiliary steam engine to operate the gas washer; an auxiliary steam boiler fired by tar and gas to supply steam to the engine and to the producer for gas making; a tar outfit by which the tar is collected and burned under the boiler, and the necessary connections and auxiliaries to make up a complete

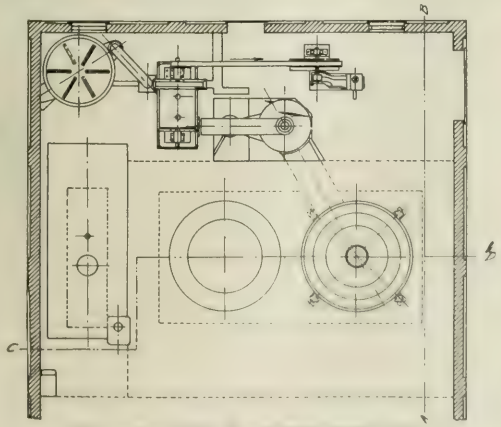


FIG. 5.—PLAN VIEW OF GAS-GENERATING PLANT.

gas-making, gas-cleaning and gas-delivering apparatus. No gas holder is used.

The gas is used in five 100-hp, direct-connected Alberger gas engines, and also in Brown & Sharp case-hardening furnaces and in other furnaces. Owing to the past slack season the arrangement for using the gas in all furnaces has not yet been completed. The gas generator is of the updraft type; each of the four tuyeres is blown by a separate Eynon-Evans steam induction blower, giving good distribution and consequently

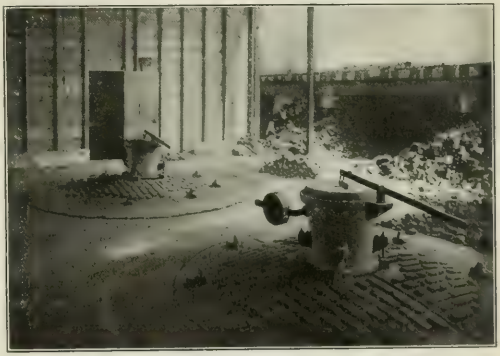


FIG. 6.—STEEL FRAME CONCRETE CHARGING PLATFORM.

large capacity and freedom from clinker, and making possible the use of slack coal. The plant was tested out and accepted

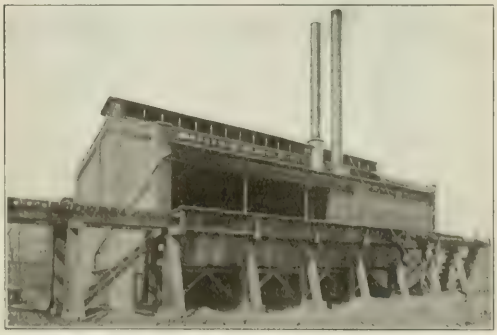


FIG. 7.—GAS HOUSE 2000-HP BITUMINOUS PLANT.

while running 24 hours per day on Ohio bituminous slack coal.

The gas washer is composed of a steel drum cylinder revolving in an enclosing case. The drum is provided with wings,

and as the gas is passed longitudinally through the drum it is given a whirling and spiral motion by the wings, and also subjected to water spray. The tar and water are mixed into an emulsion and thrown out by centrifugal force, the gas passing out cleaned. The machine thus churns the tar out of the gas and simultaneously throws it out of the machine. The

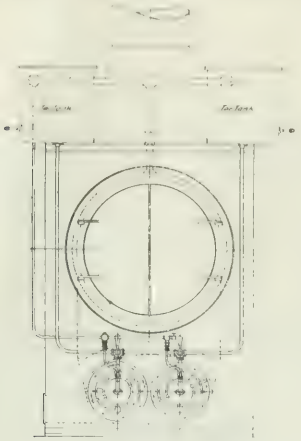


FIG. 8.—FRONT VIEW OF TAR-BURNING BOILER.

machine is built for 24-hour service every day in the year, and the results at Elyria show that it can be counted on to meet these conditions, at least as well as the best electric motors and steam turbines. In other words, the gas washer meets the demands for continuous service in a commercial, practical way.

The tar outfit is an adaptation of a fuel-oil equipment. The tar is atomized by steam and blown into the combustion chamber in the same way as would be oil, but the essential difference lies in the fact that tar is by nature a sticky and non-fluid material. To make it flow it must be heated, and to accom-



FIG. 9.—SECTIONAL ELEVATION OF TAR-BURNING BOILER.

plish this the entire tar outfit is steam heated. This apparatus was largely experimental when first installed at Elyria, but there has shown itself to be entirely reliable for 24-hour service.

The producer supplies fuel to gas engines having an aggregate rating of 500 hp and consisting of 2½ sets 16-in. x 16-in., 225 r.p.m., "Buffalo" Alberger, twin-tandem, four-stroke cycle, single-acting horizontal gas engines, rated at 200 hp each, direct connected to three 130-kw, 230-volt, direct-current Crocker Wheeler generators, the armatures being mounted upon the engine shafts between twin cranks. The half engine carries a 130-kw generator operated at one-half load, the other half to be installed later.

The table herewith shows the cost per hour to the Garford Company on an average load of 175 kw 3000 hours per year, amounting to a total of 525,000 kw-hours at the switchboard, and gas used in furnaces, averaging an equivalent of 4000 cu. ft. of natural gas per hour during 3000 hours, or a total of 12,000,000 cu. ft. per year. The plant ran successfully for a long period on Ohio slack, but comparative tests determined it was cheaper to use Pittsburgh run-of-mine, on which the plant is now operating. This coal averaged 13,500 lb.-Fahr. heat units per pound, and costs $1.10 at the mine, with $1 freight and 10 cents unloading charge, making the total cost of $2.20 per ton of 2000 lb. in the bins.

FUEL.	Lb.	
Coal burned in producer for gas for engines at 2.18 lb. per kw-hour at switchboard, 175 kw per hour =	383	
Coal burned in producer for furnaces requiring 85 lb. to produce equivalent of 1000 at 4000 cu. ft. per hour	340	
Coal burned in producer for gas burned under boiler	75	
Coal burned under boiler	75	
Total coal per hour	873	
Total coal per day during working hours	8,730	
Stand-by losses at night	500	
Total coal burned per day	9,230	
Cost per year of 300 days, 1385 tons at $2.20		$3,046
The steam furnished by boiler and the coal used by boiler is divided as follows:		
Steam for washer engine, 36½ hp	1,260	
Steam for producer	326	
Steam for tar outfit	286	
Total	1,872	
Supplied by 80 lb. tar	940	
Supplied by 75 lb. coal burned as gas	492	
Supplied by 75 lb. coal burned on grate	440	
Total	1,872	
LABOR		
One head gas man, 25 cents per kw-hour, 4000 hours	$1,000	
One helper, 15 cents per hour, 4000 hours	600	
One extra man for ash, etc., 18 cents per hour, 1500 hours	270	
Total		1,870
One gas-engine engineer at	$1,500	
One assistant, 22½ cents per hour, 3000 hours	675	
Total	$2,175	4,045
WATER	Gal.	
Gas engine water, 16 gal. per hour	8,400,000	
Washer water, 1000 gal. per hour	3,000,000	
Cooler, 1750 gal. per hour	5,250,000	
Boiler, 250 gal. per hour	750,000	
At 6 cents per 1000 gal.	17,400,000	1,044
MISCELLANEOUS SUPPLIES.		
Oil	$320	
Waste and packing	60	
Sparking plugs	50	430
REPAIRS.		
Estimated by engineer		520
OVERHEAD CHARGES.		
Fifteen per cent on total cost of plant, engines, generators, switchboard, foundations, producer house, engine house, piping, wiring, labor and freight of $51,620		7,743
Total annual cost for power and gas		$16,828

SUMMARY.

	Cost of 525,000 kw-hours.	Cost of equiv. 12,000,000 cu. ft. nat. gas per year.
Coal, 54 per cent for power, 46 per cent for fuel	$1,635	$1,411
Labor, power, all of engine plant, plus 54 per cent of gas plant	3,185	860
Water	795	299
Miscellaneous expenses	330	100
Repairs	440	80
Overhead charges, 15 per cent on investment; power, all engine plant, plus 54 per cent of gas plant; fuel, 46 per cent of gas plant	6,505	1,238
	$12,890	$3,938
Cost per kw-hour		
Operating		1.2 cts.
Total cost		2.45 cts.
Cost for the equivalent of 1000 cu. ft. natural gas:		
Operating		22½ cts.
Total		33 cts.

In considering the cost of producer gas as compared with natural gas, the Garford Company does not take into consideration the investment, as its engine plant has not been changed on account of the installation of producer equipment, and fur-

ther because the producer plant was put in as an insurance against the loss of natural gas supply. The figures given show that it is making producer gas from bituminous coal at a total cost of 33 cents for the equivalent of 1000 cu. ft. of natural gas and at an operating cost of 22½ cents for the same equivalent, and that it is producing energy at a total cost of 2.45 cents per kw-hour at the switchboard and an operating cost of 1.2 cents per kw-hour. These figures indicate an exceedingly low fuel cost for a plant of this size and show that it is practically a matter of indifference to the company from a financial point of view whether the present cheap supply of natural gas is continued or discontinued. This type of producer gas plant is particularly suited to large installations.

Storage Batteries in Mining Service.

By George A. Iler.

What is supposed to be the first storage battery installed for mining service in that part of the country was placed in service at Prudence, Fayette County, West Va., in the plant mining the Sewell Seam of coal. Prudence, which is one of the 28 mines owned and operated by the New River Company, of MacDonald, West Va., and Boston, Mass., is equipped with electric haulage throughout.

The power house for supplying the electric locomotives and



FIG. 1.—STORAGE-BATTERY STATION.

motor-driven mine fans is constructed of red brick with a fire-wall separating the boiler and engine rooms. The boiler equipment consists of three 150-hp return tubular boilers, supplying steam to two 200-hp engines, each engine being belted to a 150-kw, 250-volt generator. At one side of the tipple, and forming a part of it, is an 8000-ton coal bin over the railroad tracks, which enables the mine to run even though there be a shortage in cars. This feature makes it paramount that the machinery shall run every day and without any delays.

There are several openings, all drifts, each opening being ventilated by a large motor-driven fan. The first opening is about ¼ mile from the tipple and turns off inside the tunnel, a 30-hp ventilating fan providing air for this opening. The next opening is at Lyman, 1¼ miles distant, a 30-hp motor-driven fan being installed at this location. The remaining opening is at Jones' Hill, 2½ miles from the tipple, where there is a 20-hp ventilating motor.

The greater part of the coal mined comes from the last named place and at this point a 4-ton electric mine locomotive is utilized to move empty cars, gather the loads, and transfer to the main side track, from which a large locomotive hauls them to the tipple. Each mine car weighs 1400 lb. and holds 2500 lb. of coal.

The 4-ton locomotive usually makes up trains of about 15 loads for the 15-ton locomotive, which makes an express trip every 60 minutes to the tipple. A second 15-ton locomotive makes similar trips to the first "Roght" and Lyman every 60 minutes, with an average for the day of 10 cars for each trip; this average is low now on account of decreased coal shipments. This makes about 450 tons daily run, or 790 ton-miles at the time data were taken. Since that time the output has run as high as 800 tons per day. With the above brief outline in mind, I will describe conditions before and after the installation of the storage battery.

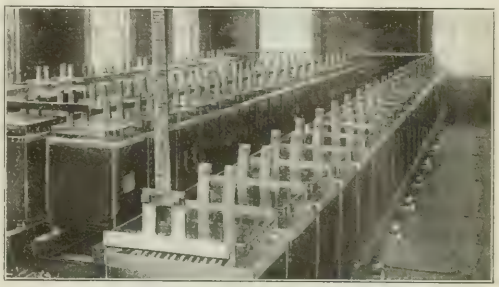


FIG. 2.—INTERIOR VIEW OF STORAGE BATTERY PLANT.

Both generators were required to run every day at considerable overloads for short periods of time, and the locomotives had to be run on schedule, so that only one would be using power. There is a telephone at each mine station to facilitate this method, but with all this preparation we found it impossible to operate satisfactorily for the following reasons:

The voltage was so low, due to line drop (as there are only two 4-0 copper wires, including the trolley) that the locomotives would at times come to a standstill, the voltage falling as low as 25 at the motors. Moreover, the ventilating fan motors would decrease in speed to such an extent that the no-voltage release on the starters would open the circuits, resulting in drainage to the commutators and starters, while the mine would be without air circulation. Starting the locomotives was accomplished by a series of jerks, with the result that the armature repair bill on three locomotives for one year was approximately $1,000. In the power house the engines would pound



FIG. 3.—AMMETER CHART, WITH BATTERY OUT LINE.

badly, owing to the heavy current required to start trains on low-voltage; belts would slip from the pulleys against the pedestal bearings and be damaged, with the general result that at quitting time each day it was hard to say whether or not we would be able to run on the day following.

Several proposals were made by different engineers to remedy all of these troubles. One was to use more copper; another was to change the whole plant to a 500-volt equipment, another

was to use a booster. These solutions were, however, expensive and more or less unsatisfactory.

Finally the writer installed a storage battery of 86 cells of Bijur storage batteries in glass tanks, the present capacity being 540 amp-hours, with an ultimate capacity of 720 amp-hours at the normal eight-hour rate of discharge. The tanks and connecting straps for each cell are large enough to accommodate

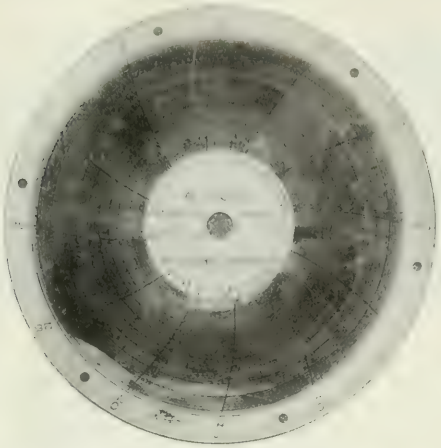


FIG. 4.—VOLTMETER CHART, WITH BATTERY ON LINE.

four additional plates, thus providing for future increase without change in the existing equipment. Fig. 2 shows the battery.

The battery house is built of red brick and has concrete floors. A separate room is provided in the battery house for the switchboard; this apartment does not communicate with the battery room, the doors and windows in the latter being fastened at all times. The main-line track runs within 6 ft. of the battery house, and when it is necessary to replace the battery circuit-breaker the motormen, having access to the switchboard room, can do so when they pass with a trip. Any form of signal to announce that the circuit-breaker has opened is unnecessary, as the men operating the locomotives can tell immediately whether or not the battery is in service.

Tests were made before and after the installation of the battery to show the exact operating conditions in each case. These tests were made by means of a Bristol recording voltmeter, using smoked charts which make a complete revolution in one hour. Fig. 3 shows the line voltage at the point where the battery is installed before the battery was put into service. Fig. 4 shows the line voltage at the same point with the battery floating across the line. A comparison of these two charts will show that there is always sufficient power for the motors to operate safely without danger of burnout, and at the same time we are enabled to carry out a satisfactory schedule in handling the coal. Moreover, the line voltage never falls so low as to prevent a reliable air supply being assured.

Shortly after completing the battery installation, one of the generators was badly damaged and had to be shut down for several days for repairs. Just at that time we were supplying power for our Harvey mine over a 4-0 transmission feeder one mile long. We found, however, that we were able to keep both the Harvey and Prudence mines going with only one generator and the battery. It was difficult to do this before with both generators and three boilers. We now find it easier to supply steam with two boilers than it was with three before.

The only attention given the battery is to look it over once a week and take readings of specific gravity and add water to make up for loss by evaporation. The battery has at times been put to some severe use, being subject to discharge at rates considerably over the normal, and has been called on for continuous work to such an extent that the specific gravity of the electrolyte has dropped to extremely low points.

Divisch, a Lightning-Rod Pioneer, 1754.

By Brother Potamian, Sc. D., Lond.,
Professor of Physics in Manhattan College, New York.

It is a matter of history that Franklin erected an *experimental* lightning rod over his house in Philadelphia in the month of September, 1752. We say experimental because the rod was not intended by Franklin for the protection of his home, but rather as a means of drawing electricity from the clouds. Moreover, owing to its want of continuity, it was obviously a source of danger rather than protection. The conductor was made of iron with a sharp steel point rising 7 ft. or 8 ft. above the roof of the building, the other end being sunk 5 ft. in the ground. The two parts of the conductor, viz., the "sky" and the "ground," were separated from each other by a horizontal distance of 6 in. Each rod carried a little gong at its end, with an insulated clapper hanging midway between them. Franklin, being an economist of time, adopted this musical kind of annunciator to warn him of the approach of an electrified cloud. When the clapper played between the insulated gong and the grounded one, the philosopher knew that he had only to step on the landing outside his room in order to avail himself for the purpose of his researches of electricity generated in the vast laboratory of nature. More fortunate than Prof. Richmann, of St. Petersburg, who was killed outright in the summer of 1753 while experimenting with an insulated conductor, Franklin was able to charge Leyden jars with electricity drawn in this way from the clouds and to show by comparison with the electricity developed in his laboratory that cloud-masses are sometimes charged positively and sometimes negatively.

Though the electric chimes, as they are called in textbooks, bear Franklin's name, it may here be said that he was not the inventor of that tuneful piece of electrical apparatus. Seven years before Franklin adopted the device, Andrew Gordon, a Scotch Benedictine, who held the chair of natural philosophy in the University of Erfurt, in Saxony, invented and described it in his *Versuch einer Erklärung der Electricität*. As the question of priority is not without interest in the case of Franklin, we will translate the description which Gordon gives of his bells on page 38 of his book. After stating that he was led from certain experiments which he had made to try an electrical method of ringing bells, he adds: "For this purpose I placed two small wineglasses near each other, one of which stood on an electrified board, while the other, placed at a distance of an inch from it, was connected with the ground. Between the two, I suspended a little clapper by a silk thread, which clapper was attracted by the electrified glass and then repelled to the grounded one, giving rise to a sound as it struck each glass. As the clapper adhered somewhat to the glasses, the effect on the whole was not agreeable. I, therefore, substituted two small metallic gongs suspended one from an electrified conductor and the other from a grounded rod, the gongs being on the same level and one inch apart. When the clapper was lowered and adjusted, it moved at once to the electrified

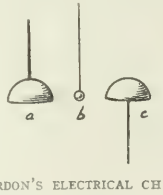


FIG. 1.—GORDON'S ELECTRICAL CHIMES, 1745.

bell from which it was driven over to the other, and kept on moving to and fro, striking the bells each time with pleasing effect until the electrified bell lost its charge." In the illustration, *a* is connected with the electrified conductor; *b* is the insulated clapper; *c* the grounded gong.

Gordon's book was published in Erfurt in 1745; Watson fully described the "German" chimes in his famous "Sequel," 1746;

while the year 1752 is that in which Franklin applied the chimes to his experimental rod to apprise him of the approach of an electric storm, an application which was original and quite in keeping with the practical turn of mind that characterized our journeyman-printer, philosopher and statesman. Unquestionably, Franklin had all the ingenuity and constructive ability needed to make such an appliance; but there is no evidence that he actually invented it. Though Franklin neither claimed nor disclaimed the chimes as his own, all his admirers would have preferred less reticence on his part when the discoveries and inventions of contemporary workers in the electrical field were concerned, for he attained sufficient eminence to permit him to look appreciatingly and encouragingly on the efforts of others.

Though Franklin erected his rod for the purpose of experiment, he was, nevertheless, well aware of the efficiency of lofty pointed conductors in protecting edifices and ships against the effects of lightning. He expressly says so, and notably in *Poor Richard's Almanack* for 1753, which article contains an excellent set of rules for the erection of lightning conductors for ships and edifices. "It has pleased God in His infinite goodness to mankind," he says, "to discover to them the means of securing their habitations and other buildings from mischief by thunder and lightning. The method is this: provide a small iron rod (it may be made of the rod-iron used by the nailers) but of such a length, that one end being 3 ft. or 4 ft. in the moist ground the other may be 6 ft. or 8 ft. above the highest part of the building. To the upper end of the rod fasten about a foot of brass wire, the size of a common knitting-needle, sharpened to a fine point; the rod may be secured to the house by a few small staples. If the house or barn be long, there may be a rod and point at each end, and a middling wire along the ridge from one to the other. A house thus furnished will not be damaged by lightning, it being attracted by the points and passing through the metal into the ground without hurting anything. Vessels also, having a sharp-pointed rod fixed on the top of their masts, with a wire from the foot of the rod reaching down round one of the shrouds to the water, will not be hurt by lightning."

It is well known, as Dr. Rotch, Director of the Blue Hill Observatory, recently pointed out, that the matter for these almanacs was prepared by Franklin himself under the pen-name of Richard Saunders. As the above passage appeared in the almanac for 1753, it is obvious that it must have been ready sometime toward the end of 1752. Furthermore, we know that it was actually in the hands of the printer in the middle of October of that year, for the *Pennsylvania Gazette* for Oct. 19 says that the almanac was then in press and that it would be on sale shortly. Whence it follows that the year 1752 is the year of the invention of the lightning rod and not 1753 or 1754 as often stated.

Strange to say that in the year 1754 experiments with lightning conductors were made in the heart of Moravia on a scale that transcended anything previously attempted in London, Paris or Philadelphia. The accompanying illustration shows the conductor which Divisch (also Diwisch) raised at Prenditz (also Brenditz) in the summer of 1754 to demonstrate publicly the efficacy of such apparatus for breaking up thunder-clouds and neutralizing the destructive energy pent up in their electric charges. Prenditz, it would appear, suffered severely from electric storms; and it was mainly for the safety of the locality that the country priest devoted himself with earnestness to the study of electrical phenomena.

As such a man deserves to live in the memory of posterity, we have sought out the leading facts of his career mainly from Father Alphonse Zák, of Pernegg, in Lower Austria, a distinguished writer of the order to which Divisch belonged, and have woven such details as we obtained from him and others into the simple narrative that follows.

Procopius Divisch (Prokop Diwisch) was born on Aug. 1, 1696, at Helkowitz-Senftenberg in Bohemia. He spent his youth at Znaim, where he studied the humanities and philosophy at the college conducted by the Jesuit fathers in that Moravian town. In 1719, when in his twenty-third year, he decided to quit the common ways of the world in order to lead the higher life in the Premonstratensian Order at Kloster-Bruck. At the ripe age of 30, Divisch was ordained priest in 1726, after which he taught philosophy and theology to classes of young aspirants to the ecclesiastical state. In 1733 he went to the University of Salzburg and won his double Doctorate in theology and philosophy. Three years later, in 1736, he was appointed parish priest of Prenditz, a small town on the road to Austerlitz, since of Napoleonic fame. Here he remained for five years, returning in 1741 to Bruck as Prior of the Kloster or monastery situated there. At the end of the seven years' war of the Austrian succession, he quitted Bruck, in 1745, for his parish at Prenditz, where he spent the last 20 years of his life in the pastoral ministrations of his sacred office and in electrical experimentation, of which he was very fond.

The curative property of the new agent was heralded throughout Europe about this time in terms of unmeasured praise. Some of Divisch's ailing parishioners, believing him to be an expert in electrical manipulation, applied to him for a little alleviation of their woes. The good-hearted priest did not turn them away, but thought it desirable to treat them to the therapeutic effect of such sparks as he could get from his home-made frictional machine. The results were various, depending probably on the confidence and imagination of the patient. Several remarkable cures seem to have been effected either by



PROCOPIUS DIVISCH.

the electric spark or by the persuasive powers of the operator, or by both combined, with the result that people far and wide were divided in their opinion of the Pastor of Prenditz. Some physicians said that he was interfering with their practice, and even clergymen found fault with him for indulging in work which they thought unsuited to the cloth. A general impression, too, seems to have prevailed that his electrical experiments, especially those with his lightning conductor, were likely to prove harmful in more ways than one.

On the other hand, Divisch had admirers in high places, among whom were the Emperor Francis I. of Germany and his imperial consort, Maria Theresa. Having been invited to Vienna, Divisch repaired to the Austrian capital, where, with the aid of Father Franz, another electrical devotee, he gave a demonstration of the wonderful capability of the new form of energy before the grandees of the empire.

When he came to the electrical property of points, he showed their discharging power in a very original way, one which must have made his assistant uneasy for a while. At times, the machine worked by Father Franz gave excellent results; at others, it failed to generate. It was noticed by the critical few that when the machine failed, Divisch was close by; while when it worked normally he was at some distance away. After a number of such alternations of success and failure which sorely perplexed the assistant, himself a man of renown in Vienna, Divisch explained the occurrence by saying, with a merry twinkle in his eye, that the failure of the machine to

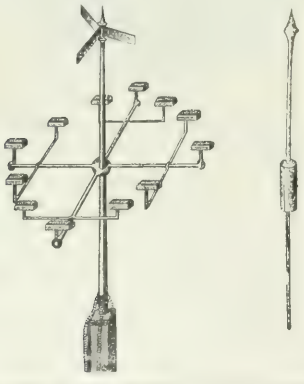
generate which he was close to it, apparently seeking out the cause of the breakdown, was due to a number of pin-like conductors which he had secreted for the purpose in his peruke and which neutralized the charge on the rotating generator!

The identity of the lightning of our skies with the artificial electricity of our laboratories was suspected by many before the middle of the eighteenth century. Englishmen like Hauksbee, Hall, Gray, Freke, Martin and Watson; Germans like Boze and Winkler and Frenchmen like Abbé Nollet, had already published their suspicions and conjectures anent the matter. Franklin, too, had indicated 12 points of analogy between the two in 1749 in his letter to Collinson of London. Though he felt the force of the analogical argument, he also felt that the matter could not be definitely settled without an appeal to experiment. Accordingly, he added: "The electric fluid is attracted by points; we do not know whether this property is in lightning. But since they agree in all the particulars wherein we can already compare them, is it not probable that they agree likewise in this? Let the experiment be made."

In writing to Collinson in July, 1750, he tells his London friend how the experiment may be made: "On the top of some high tower or steeple, place a kind of sentry-box, big enough to contain a man, and an electrical stand (insulator). From the middle of the stand, let an iron rod rise and pass, bending out of the door, and then upright 20 ft. or 30 ft., pointed very sharp at the end. If the electrical stand be clean and dry, a man standing on it, when such clouds are passing low, might be electrified and afford sparks, the rod drawing fire to him from the clouds."

The experiment was made by Franklin himself by means of his kite two years later, in the summer of 1752, and also by the lightning rod which he erected over his own house in the autumn of the same year. Doubtless Divisch heard of the marvelous effects obtained from d'Alibard's insulated conductor at Marly in May, 1752; at any rate, he prepared a conductor of his own and carefully described it in a letter which he sent shortly after the death of Prof. Richmann, of St. Petersburg, in 1753, to the celebrated Euler, then Director of the Academy of Sciences of Berlin.

This remarkable lightning conductor (Figs. 2 and 3) was at



FIGS. 2 AND 3.—THE DIVISCH LIGHTNING-CONDUCTOR

tached to the upper end of a series of poles 130 ft. in height, erected in an open space some little distance from the rectory. As will be seen from the illustration, it bristled with points, for the Bohemian wizard argued rightly that five points would be more efficient than one, and 50 more efficacious than five. The weird-looking structure destined to ward off the lightning of heaven had no less than 325 well-distributed points. Lodge says in his *Lightning Conductors:* "Points to the sky are recognized as correct; only I wish to advocate more of them, any number of them, like barbed wire along ridges and eaves. If you want to neutralize a thunderbolt, three points are not as effective as 3000." This was written in 1892; nearly 140 years before that date, we find a simple parish priest of an obscure village in Moravia using precisely such a multiple system of short, pointed conductors for the protection of life and property. This lightning conductor or "atmospherical machine," as Divisch called it, was erected by him at Prenditz on June 15, 1754. On the top of the rod will be seen three light vanes which were added in the interest of the feathered race in order to prevent incautious members from incurring the risk of electrocution by alighting on the apparatus during a storm. The wind whirled the vanes round like the cups of an anemometer, and thus kept the birds away from the zone of danger.

Several trials came to the electrical pastor, and from quarters least expected. It happened in the second year after the

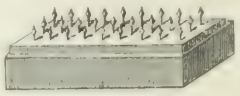


FIG. 1.—SET OF POINTED RODS

erection of the apparatus that the summer was unusually dry, in consequence of which the crops failed almost completely. The farmers of the neighborhood were always suspicious of the strange-looking mast at Prenditz; and, be it said, that they were more than diffident about the propriety of interfering with the forces of nature even under the plea of protection, forgetting that they took great care to protect themselves against heat and cold, rain, snow and hail. The country ladies, no doubt, used parasols for one kind of protection; and the gentry, umbrellas for another. Anyhow, the people of Prenditz and the good folk around did not like the lofty mast with its outstretched arms and bristling rows of suspicious-looking iron points connected to the ground by means of four long, heavy chains. For the nonce, they deemed their pastor a queer fellow, who thought that he could avert the anger of heaven by the oddest kind of a machine which they ever laid their eyes on. It was argued in the councils of the hamlets that whatever advantages Divisch claimed for his "machine," they were all of a negative character. It *prevented* the lightning stroke, he said; that might be, but they did not *see* the prevention. What they did see and keenly realize was the failure of their crops. That affected them very closely; and if, as they supposed, the apparatus of Prenditz had anything to do with it, the sooner they got rid of the machine the better. Divisch, it must be said, was liked by his people; but despite his popularity, the men of violence carried the day and the machine was doomed. Popular passion, excited by personal interest, got the better of the consideration due to the pastor. On an appointed day, a band of bellicose farmers came down on the village and wrecked the apparatus which had cost the priest so much thought and manual labor and on which knowingly and justly he relied for the protection of the homesteads of his rustic flock.

This recalls a similar incident of mob violence which occurred at St. Omer in the north of France, where a manufacturer of that quaint old town who had been in America and seen the usefulness of lightning-conductors, proceeded to erect one over his own house. Hardly was it completed before the populace gathered together; and, when passion was sufficiently aroused by inflammatory remarks of the demagogues, the house was attacked and the conductor torn down. The manufacturer complained of the inaction of the "gardiens de la paix" and appealed to the courts to uphold his right to protect his home against lightning. He entrusted his case to a brilliant young lawyer, as yet unknown to fame, but one destined to achieve unenviable notoriety during the revolutionary period. This, the first defender of the lightning-rod in a court of justice, was Robespierre.

The news of the untoward event soon reached the ears of the Premonstratensian's superiors at Kloster-Bruck; and, as they very wisely considered that the duty of a country priest is primarily to attend to the spiritual welfare of his people, rather than to invent machines for their protection against

the bolts of heaven, they advised him to yield to the prejudice of his flock and not reconstruct the objectionable apparatus.

Father Divisch accepted the friendly advice of his superiors and obeyed like a good Premonstratensian monk. The remains of the shattered "meteorological machine" were sent to the abbey at Bruck, where they could be seen for many years afterward. As a consequence of this act of vandalism, Divisch gave up experimenting with lightning rods and with electricity itself. The villagers were satisfied, but the world at large lost the benefit that might accrue from the researches on atmospheric electricity which Divisch would have carried on during the remaining 19 years of his life.

In giving up electricity, the disappointed priest turned his attention, first, to acoustics and then, practical man as he was, to the construction of musical instruments. It was not long before his genius brought out an orchestrion of wind and string instruments which was played like an organ with hands and feet, and which was capable of 130 different combinations. Prince Henry of Prussia offered a considerable sum of money for the invention, but Divisch died while the preliminaries of sale were arranging and negotiations were broken off. The instrument remained for many years in the abbey at Bruck, where it was in daily use for the canonical office.

It is a curious coincidence that Franklin was also interested in musical instruments. He is credited with having devised an improved form of glass harmonica, one of which he presented to Queen Marie Antoinette.

Despite the bitter experience of Divisch, the introduction of lightning conductors into Italy was warmly advocated some years later by Padre Toaldo (1719-1797), an admirer and correspondent of Franklin. It was through his influence and personal activity that the magnificent thirteenth-century Cathedral of Siena was protected with lightning conductors after having been repeatedly struck during the centuries and seriously damaged. Toaldo published in 1774 his celebrated work on the protection of public edifices and private buildings against lightning; it contributed greatly to reassure public opinion on the value of "Franklinian rods," as the conductors were commonly called.

It is a matter of regret that Franklin used the words "the electric fluid is attracted by points" in the passage quoted above inasmuch as in the popular mind such "attraction" courts rather than averts danger. This is not so; for the rod no more "attracts" lightning than a rain-pipe attracts a downpour. Franklin knew very well the twofold protection of his rods, the *preventive* by which they tend to ward off the stroke by gradually and silently neutralizing the excessive energy of the cloud; and the other, the *preservative* by which they convey the discharge safely to earth when struck. He even complains of people who concentrate their attention on the preventive function, forgetting the other entirely, adding that "Wherever my opinion is examined in Europe, nothing is considered but the probability of these rods preventing a stroke, which is only a part of the use which I proposed for them; and the other part, their conducting a stroke which they may happen not to prevent, seems to be totally forgotten, though of equal importance and advantage." (1755.)

The experience of more than a century shows that the lightning-rod affords protection in the great majority of cases; but it would be, at least, a mild exaggeration to say that it never failed when properly constructed.

At one time it was customary to make the rods rise to a considerable height above the building in the belief that the diameter of the circle of protection was four times the height of the rod. Such a rule was an arbitrary one which facts soon showed to be unreliable and unsafe. It is now recognized that there is no such thing as a definite area of protection.

Were this a literary article, we would point out that either of the expressions "electric" storm or "lightning" storm is preferable to *thunderstorm*, because electricity or lightning is the active agent or principal feature of the impressive phenomenon. No one thinks of calling a hailstorm by the descriptive term of *putter* storm; yet that would be just as logical and appropriate an appellative in one case as thunderstorm is in the other. The expression *thunder and lightning* is illogical because it puts the effect before the cause.

Thundertube is certainly a startling misnomer applied to the long, narrow, glazed tubes formed in siliceous materials by the fervid heat of the flash but not in any way by the soundwaves produced by the crash. *Thunderbolt* does not mean despite the common opinion, a white-hot mass that accompanies the discharge; it is purely and simply the flash itself. A glowing mass that happens to come down in the track of the discharge is a *meteorite*, a body of cosmic and not of terrestrial origin, a visitor from space that chose the rarefied path of the flash for its descent to earth.

Again, there are no *thunder clouds* in nature, only electric clouds; nor is there ever *thunder in the air* save when the lightning breaks from cloud to cloud or leaps from cloud to earth, or strikes from earth to cloud. But though thunder is only occasionally in the air, electricity always is. We have a normal electrical field in all seasons, times and places.

Though it is the lightning that kills and not the thunder, we would not object to the following inscription, which we found on a tombstone:

"Here lies [so and so], oh! what a wonder,
She was killed outright by a peal of thunder,"

because the suddenness of the peal may have given the aged lady a shock from which her failing heart was unable to recover.

We are well aware that such criticism of technical terms in popular use will have no reform effect whatever; because as long as people will say "the sun rises" and "the stars set," they will continue to speak of thunder and lightning, of thunder clouds and thunderstorms, thundertubes and thunderbolts. Though containing an element of error, these expressions have the sanction of centuries; and so, they have come to stay.

Returning to Divisch, that worthy priest and able electrician died at Prenditz in his sixty-ninth year on Dec. 21, 1765, and was buried in the little churchyard where he had blessed many a grave during the 25 years of his ministration. A simple inscription marks the place of his interment, but a monument will soon be erected to his memory which will tell the passerby where sleeps the Premonstratensian pioneer of the lightning rod.

The chief work of Divisch in print contains his views as a philosopher on the electricity of the atmosphere and is entitled *Theorie von der Atmosphärischen Electricität*, Tubingen, 1765. For the events of his life, the following may be consulted: Gerber, "Hist. biogr. Lexikon," 1812; Meidinger, "Geschichte des Blitzableiters," 1888; Goovaerts, "Ecrivains, artistes et savants de l'Ordre des Prémontrés," 1900, and "Die Gartenlaube," 1878

Effect of the Recent Drought Upon Water-Power Plans

The drought of the last six months has been the most serious the country has experienced in a number of years. From all sections bereft of snow-capped mountains have come reports of the trouble and loss due to water famine. In New England mills were shut down or run on part time; in the Middle States, pebbles and rocks marked the route over which small rivers once flowed, and throughout the whole East manufacturing and generating stations depending on water power were greatly inconvenienced. In order to ascertain to what extent hydroelectric light plants were handicapped by the drought, a number of letters were sent to companies in the East, requesting information on water power conditions and also on the emergency methods used to carry the load. The replies secured from a number of these plants are given below:

Mr. Silas Faber, Treasurer, Moravia Electric Light, Heat & Power Company, Moravia, N. Y.:

We are located on a stream called Dutch Creek, which is supplied as a rule by springs and drains in the neighborhood of from 10 to 20 sq. miles. Where our plant is located we have

a fall of 120 ft. Our dam is of concrete, 12 ft. high, 120 ft. long and impounds approximately 576,000 cu. ft. of water when full. During June we were able to maintain service from 4:30 p. m. until 8 a. m., without any trouble. Beginning with July 1st, we were obliged to cut down service to the hours 5:30 p. m. to 1 a. m., which we mainained until about the first weeek of August, when we were obliged further to curtail to the hours 6:30 p. m. to 12 midnight. About Aug. 18 we were forced to resort to our steam auxiliary for two nights each week, Sunday and Friday. On Sept. 5 we began some needed repairs to our penstock, being thereby obliged to operate with steam until Oct. 8, since which time we have been able to operate on an average of from 12 to 36 hours per week at our water plant. With the exception of a few minor mishaps, we have given almost uninterrupted service for the hours mentioned. In the immediate neighborhood there are only two or three small water powers which are used to operate feed and saw mills. The low water has had a more serious effect upon these than upon our plant because they are all operated on lower pressure.

Southern Dutchess Gas & Electric Company, Fishkill-on-Hudson, N. Y.:

We have two water turbines of a total capacity of 360 hp, which usually run short in the summer months, but we can generally get the full power for about nine months. We are now getting about 25 per cent of their rated power and have not done much better for the three months past.

Mr. L. N. Wheelock, Manager, Claremont Power Company, Claremont, N. H.:

Our new hydro-electric plant at Cavendish began operation Oct. 5, and it is difficult to state just what effect the drought has had, as we have not yet operated a full season; we have, however, had about the flow that we figured as a minimum, although we are told the river is the lowest it has been known for 40 years. Our plant on Sugar River at Claremont has been practically useless for the past four months, giving less than one-fourth of the low water power. We have a steam plant and a Diesel oil engine plant at Claremont which has tided us over.

Keeseville Electric Company, Keeseville, N. Y.:

On the Ausable River the power has been quite seriously affected by the long-extended drought of this summer, and in fact the two previous winters have been rather against us on account of the light amount of snow and the great amount of frost, which resulted in freezing up the springs. The watershed of the Ausable River is a very interesting one, in that it is well forested, much more so than that of most rivers. The run-off on the average is very satisfactory per square mile of water-shed, and the powers are for that reason as a rule quite reliable. The fact is that we have had no rains of any amount since early summer and our water supply has been short. This fault is to some extent aided by the fact that the Rogers Company at Ausable Forks, some 12 miles above us, stores up the water from the west branch and discharges it at its convenience, which makes a little difficulty for us. Fortunately, we have some reserve power under temporary lease which we can use and which will probably pull us out of our troubles this winter. The trouble is not alone with the interests which we have, but with other interests on the stream also. In this connection it might be of interest to note an observation of conditions on the Ohio by one who recently visited Parkersburg, W. Va. The water there was then so low that it was said that at places one could cross the Ohio dry-shod stepping from stone to stone. It is said also that such conditions have not existed for 80 years before.

Mr. Henry Burden, 2d, President and Treasurer, The Cazenovia Electric Company, Cazenovia, N. Y.:

We have a head of 12 ft. and an average flow of about 5,000 cu. ft. per minute. We operate a pair of 21-in. Victor horizontal turbines that give 94 hp at 233 r.p.m. A 14 in. belt transmits power of the wheels to a jack shaft whence the generators are driven by belts. The past summer we have had fair assistance from our water, but, of course, it has been nothing to what it should have been to be satisfactory. We have to use a 125-hp engine backed by three 70-hp boilers equipped with Jones stokers to furnish us power for peak loads and summer load when we are supplying power for our local canning establishment. We have thus far been able to meet all emergencies, but our profits will be severely cut this year, as we have had to buy nearly twice as much coal as would usually be the case. Not much lumbering has been done here for many years until this season. The high prices offered for wood in any form are beginning to have effect, and wholesale cutting has begun in some quarters. We shall try and induce people to plant as well as hew down, as we think only by this method can our power sources be preserved.

Mr. A. C. Dunham, President, Hartford Electric Light Company, Hartford, Conn.:

We have a record of two water powers which we have been using for 10 years, but have not used the whole of the power developed for more than five years, since which time it has gradually become a smaller and smaller percentage of our total output. The two powers are installed for an output of about 2500 kw, which they will easily give us on a full run of water. We have actually received from them in the five years about 1300 kw average, and we have come to the conclusion that, as the powers are on the Farmington River, which has a reservoir at Otis of sufficient capacity to run the entire plant three months without increase of water, these powers are as good as any in New England which are fed by a large watershed; in other words, if anyone develops a water power which justifies a certain rated capacity in machinery, they can expect in New England to get about one-half of this power delivered through a term of years. Of course, this has gradually changed our views about the value of water power. For the last three months we have practically received only about 20 per cent of our rated capacity in the average. You will readily see that a concern which is doing an active and growing business must expect to put in steam machinery to supplement the water power of about one-half of the capacity of the latter. For instance, if we do business as now, absorbing our entire water power, and considerable more in steam besides the water power insurance, we must reckon that insurance at about two-fifths of the rated capacity of the water power; and when you compute the cost of the installation, which is about three times greater for water power installed in the best manner and at the lowest price, the steam installation being also of the most modern description, the water power will cost fully three times what steam power will cost to do the same work. Now, when all the computations are made and the difference in the labor, interest, wear and tear and general maintenance been ascertained, as nearly as we can make the figures, we find that our water power and steam power are almost equal in cost per kw-hour delivered. Nothing is gained by putting in water power unless in places like Niagara Falls, or the snow regions of the West where the water power is constant. In fact, you have an overhead expense which is continuous in the water power as against an overhead expense in steam which may not be continuous, which is in favor of steam. At the present time, and for the last three months, we have been losing not only what we paid on contract for water power, but we are losing on the water power which we own and do not rent.

Mr. John S. Bleecker, Manager, Columbus Power Company, Columbus, Ga.:

The drought that has been serious in other sections of the country did not affect us to any marked degree. Our low-water conditions this past season were normal, requiring the operation of our auxiliary steam plant about the same as last season. In view of the comparatively large forest area in the water-shed of the Chattahoochee River, the flow of the stream has not, for some years, approached the minimum flow on record. There is available at low water approximately 2000 kw, and the deficit has been taken care of by our auxiliary steam plant, built with a view to meeting all requirements of this nature.

Mr. S. A. Roelofs, Vice-President, Pennsylvania Power Company, Ellwood City, Pa.:

Owing to the destruction by fire of our water-power electrical

plant early in March last, we have not suffered any inconvenience by reason of the drought, as the water end of the plant has not yet been rebuilt. The company furnishing water to the public in this city and the territory adjacent thereto, which is closely connected with this company, has its pumping plant on the Slippery Rock Creek, which has its source in Butler County, Pa., and is made up largely of springs. The water company has suffered no inconvenience whatever so far as the supply was concerned, notwithstanding the fact that the creek has been lower the last three months than at any time in the last decade. At its lowest stage it flowed about 11,000,000 gal. of water per 24 hours, as determined by weirs placed at different points in the creek. Our daily requirements do not exceed 2,000,000 gal.; consequently, as stated above, we suffered no inconvenience whatever.

Mr. C. W. Hazleton, Treasurer, Turners Falls Company, Turners Falls, Mass.:

During the past four months the flow of the stream at this point has been approximately two-thirds of what we consider normal or average low-water flow. The natural conditions in the territory constituting our watershed are without doubt similar to those existing at the present time on all natural streams that have no large amount of storage, and, as a result of those conditions at low water, power and output have had to be shut off accordingly. All of the evidence relating to our condition goes to show that the present drought is exceptional both as to extent and duration. There is no question, however, but that the cutting off of the forests and destruction of other natural growth by fire has an important bearing on the average amount of water available for power purposes during a normal low-water season; and it is also as clearly evident that the remedy, to some extent, for this inequality of run off and flow lies in the carrying out of the effort now being made to preserve the forests and prevent as far as possible a change in natural conditions that have so much to do with the regulation of the flow of streams.

Mr. J. D. Mires, Assistant Secretary, The Earlville Electric Light Company, Earlville, N. Y.:

Concerning the present water-power conditions in this locality, we seem to be getting our share of the general drought. We have the only water power in this village, and if we were to lay aside our memorandum of the high-water marks, we might be unable to locate the stream again. Under normal conditions we have about 75 hp, except in times of especially high water or in periods of drought in the latter part of the summer. Probably it would be safe to assume that our power would average about 50 hp for 24 hours throughout the year. We are using this power for two purposes—to carry on the manufacture of wagons during the regular hours, and to furnish power for the Earlville Electric Light Company at night. The units are one 35-hp and one 60-hp Genesee turbines, also one 60-hp Porter engine, and about two months ago we installed a 150-hp "Straight Line" engine. The electric light company uses the power for driving a 60-kw alternator, but when the water power diminished during the past few months until there was only about 35 hp available, and that for not more than two to five hours, we found it necessary to put in a steam engine large enough to carry the entire load. We can hardly see the reason for diverting the available water power of the Chenango River to the Erie Canal, when such use compels us to resort to steam for power whenever we have a drought.

Mr. H. E. O'Neil, President, St. Regis Light & Power Company, St. Regis Falls, N. Y.:

The river on which we are located is exceptionally good as regards uniform flow. The stream is not large, but has a great deal of natural storage. We are located on the east branch of the St. Regis River at St. Regis Falls, and above the plant it is nearly all level water, while below it is nearly all rapids. The level water above aggregates about 50 miles in river length, and in addition there are other great natural reservoirs, including Meacham Lake, Osgood Pond, St. Regis Lakes and many smaller ponds. We have never been troubled seriously for water except in 1903 and this year, and only very slightly. We operated our plant by water every day, and satisfactorily, except that there was low voltage part of the time. However, I do not think that our experience is the rule.

Mr. R. W. Hemphill, Jr., General Manager, Washtenaw Light & Power Company, Geddes, Mich.:

While we operate three water-power stations on the Huron River in this vicinity, we also have an auxiliary steam plant. We are unable to tell the exact proportion of current generated by steam or by water, as we operate from the same line shaft. We do know, however, that we have had the greatest drought in this region of which there is any record, the record running back 38 years.

Mr. L. C. Piser, Shushan, N. Y.:

We supply a small town of about 400 with electricity for light in connection with our shirt manufacturing plant. We also use electricity in our factory for turning machines, light, etc. We have been more or less bothered since September by low water, but during the last month the matter has reached an acute stage. The town is not large enough to support a steam plant, and unless we have a continued rainy spell for at least 10 days before the river freezes up, we will be forced to drop our outside lighting and run our factory by gasoline. Our plant is situated on the Battenkill, which rises in the Green Mountains and feeds the Hudson. It is fed by numerous mountain brooks, and at the approach of cold weather these shrink in volume, the smaller ones disappearing entirely. There is some talk of a state dam above us to regulate the spring freshets, storing the water for use in dry seasons. During heavy rains we have freshet conditions which do considerable damage and at the same time interfere with our power for 24 to 48 hours at a time on account of backwater. Our wheels, two in number, are rated at about 90 hp. A gristmill next us has three old-style wheels which take a large amount of water and which run 24 hours a day or nearly so. Across from us is a machine shop which runs one wheel rated at about 60 hp. In normal seasons, with the water spilling nicely over the crest of the dam, we have water to spare and the stream could probably support twice the wheels now running.

Mr. A. Thornton, Secretary and Manager, Heuvelton Electric Light Company, Heuvelton, N. Y.:

The water conditions of our plant became serious during the drought, when the water was the lowest ever known in this vicinity. We met the condition by putting in a new 60-in. water wheel, making three now in use. The horse-power as given by water-wheel tables for normal conditions, is as follows: For a 56-in. wheel, 40 hp; for a 56-in. wheel, 80 hp; for a 60-in. wheel, 90 hp. The head is 9 ft. During normal seasons 500 hp could be developed.

Mr. W. T. Thayer, Vice-President and General Manager, Chasm Power Company, Chateaugay, N. Y.:

The recent drought has not affected the output of our plant as yet. We have, therefore, not been obliged to use any auxiliary or supplemental power. The Chateaugay River, on which our plant is located, is the outlet of Upper and Lower Chateaugay Lakes. At the outlet of these lakes there is a dam, and we have control of the water at the dam, thus enabling us to have a constant flow of water during the dry season.

Mr. W. S. Stratton, Superintendent, Wadhams and Westport Electric Light & Power Company, Wadhams, N. Y.:

We operate at Wadhams a 300-kw three-phase generator, 24-hour service, for supplying power in the iron ore mines at Mineville. During the drought the output was reduced about one-third per day. The Boquet River furnishes the water, giving a 48-ft. head. On Sept. 1 a 100-kw generator was installed to run the lights here and at Westport. At Kingdom, seven miles away, we have a 400-kw generator, which was run in parallel with Wadhams. Kingdom generated full power up to Sept. 15, when the storage of water gave out, and power cannot be furnished until rain falls or the snow melts. To provide against another drought the storage has been increased by adding 3 ft. to the height of the dam. The water used at Kingdom is used again at the Wadhams power house.

Chart for the Calculation of the Size of Copper Conductors in Transmission Lines.

By L. A. Herdt.

FOR the calculation of the size of copper conductor in alternating-current transmission lines the ordinary vector diagram, Fig. 1, giving the relation of the e.m.fs. on line, load and generator, is well known.

Mr. R. D. Mershon in his article originally published in the *American Electrician*, June, 1897, and reproduced in the *Electric Journal* of March, 1907, worked out a chart as an extension to this vector diagram and with this chart the drop in alternating-current lines can be easily calculated. Assuming the size of wire and knowing the amount of power to be delivered, the power factor of the load, voltage at the receiving end, distance of transmission and frequency, if the resistance volts and inductance volts are expressed as a percentage of the delivered

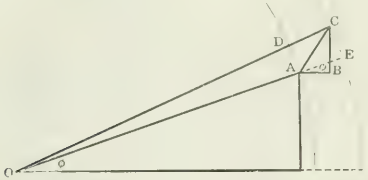


FIG. 1.—CURRENT AND E.M.F. TIME-PHASE RELATIONS.

e.m.f., the line loss and line drop are obtainable in per cent from the chart.

If specific losses and line drop are assumed, the problem which the engineer is called upon to solve is to find for a given amount of power delivered, at a given voltage, the proper size of the wires and their spacing. In this case the use of Mershon's chart will necessitate several trials before the size of the wires is derived.

The present article is intended to describe a chart giving the size of wire and spacing for an assumed *line drop, which, expressed in per cent of the receiver voltage, determines the regulation.**

The foundation of this new method is the ordinary diagram of Fig. 1.

The line drop is *DC*, the difference between *OC* the generator voltage and *OA* the receiver volts. That is, *DC*, the radial distance between two circular arcs with *OC* and *OA* as radii, gives the regulation volts or line drop. In this diagram Φ is the angle between the receiver voltage and the load current; *AC* is the impedance drop of the line; *AB* the resistance volts, and *BC* the inductance volts.

If the line *OA* be extended to the outer circle, *AE* also represents the regulation volts and the angle $EAB = \Phi$.

This diagram as a vector diagram can be drawn to scale for any particular problem in line transmission, but again it may be drawn showing the regulation volts or line drop per mile per ampere for any line.

Fig. 2 shows a chart with the resistance volts per mile of line per ampere as abscissas and the inductance volts per mile of line per ampere as ordinates, for different sizes of wires at different spacings. In this way there is obtained a series of

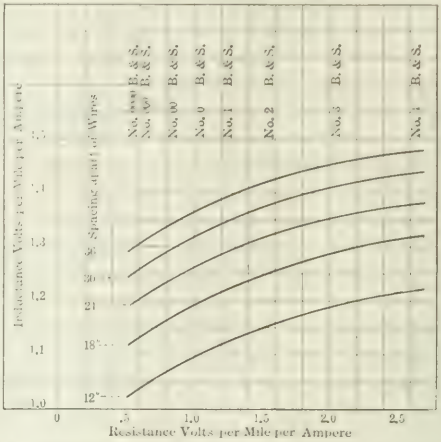


FIG. 2.—CHART OF RESISTANCE VOLTS AND INDUCTIVE REACTANCE VOLTS.

curves, one above the other, each being the locus of the point *C* in the vector diagram of Fig. 1, for some particular spacings of the wires. These curves are referred to only the point *A*,

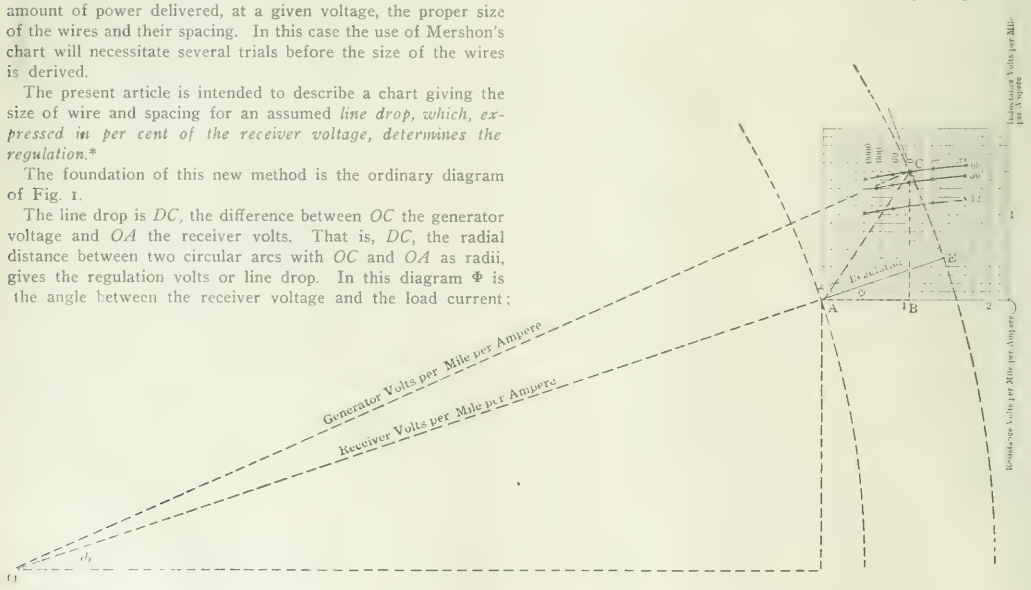


FIG. 3.—DIAGRAM SHOWING THE SIGNIFICANCE OF THE CHART ILLUSTRATED IN FIG. 2.

and the line *AB*, in the vector diagram of Fig. 1, for their position.

If this chart is placed at the point *A*, as shown in Fig. 3, and the line *OA* is extended a distance *AE* equal to the line drop or regulation volts per mile of line per ampere, the size of wire showing this line drop will be given by the point of intersection of an arc drawn from the point *O* and radius *OE*, with the curve worked out for the particular spacing assumed.

*In the [illegible] the case of [illegible] necessary at the [illegible] receiver end [illegible]

EXAMPLES TO ILLUSTRATE USE OF CHART

A.—TO FIND THE SIZE OF WIRE FOR A GIVEN LINE DROP OR REGULATION.

Example 1.—Power to be delivered, kw, single-phase 250
E.m.f. at receiver, volts..... 2000
Distance of transmission, feet.....10,000
Power factor of load, per cent..... 80
Frequency, cycles..... 60
Distance apart of wires, inches..... 18
Line drop allowed, per cent of receiver voltage..... 23

(a.) *Calculation of line drop per mile per ampere.*

$$\frac{250\text{ kw}}{.8} = 312.5 \text{ kva.}$$

Line current at 2000 volts $= \frac{312{,}500}{2000} = 156.25$ amp.

Line drop 23 per cent of 2000 volts = 460 volts.

Line drop per mile per ampere $= \frac{460 \times 5280}{10{,}000} \times \frac{1}{156.25}$

$= 1.55$ volts.

(b.) On the chart, place a set square on the 80 per cent power-factor line where the above value of 1.55 volts is obtained; the intersection of the set square with the 18-in. spacing (60 cycles) curve, shows a size of wire No. 0 B. & S.

Example 2.—Power to be delivered, hp, three-phase 4000
E.m.f. at receiver, volts.....40,000
Distance of transmission, miles..... 85
Power factor of load, per cent..... 80
Frequency, cycles..... 60
Distance apart of wires, inches..... 60

(a.) *Calculation of line drop per mile per ampere.*

$$\frac{4000 \times 746}{0.8 \times 1000} = 3735 \text{ kva.}$$

Single-phase equivalent load = 1865 kva.

Current at 40,000 volts $= \frac{1{,}865{,}000}{40{,}000} = 46.6$ amp.

Line drop allowed = 40,000 × 0.20 = 8000 volts.

Line drop per mile of line per ampere =

$$\frac{8000}{85} \times \frac{1}{46.6} = 2.02 \text{ volts.}$$

(b.) On the chart place a set square on the 80 per cent power-factor line where the above value of 2.02 volts is obtained; the intersection of the set square with the 60 inches (60 cycles) spacing curve, shows approximately No. 1 as the size of wire.

B.—TO FIND THE SIZE OF WIRES FOR A GIVEN LINE LOSS.

Example 3.—Power delivered, kw, three-phase... 4300
E.m.f. at receiver, volts.....30,000
Distance of transmission, miles.... 27
Spacing of wires, inches..... 24
Power factor of load, per cent..... 70
Frequency, cycles..... 25
Line loss, in per cent of power delivered 10

(a) Calculation of resistance volts drop per mile of line per ampere.

$$\frac{1}{2} \cdot \frac{4300 \text{ kw.} \times 1000}{0.70 \times 30{,}000}$$

= 102.4 or equivalent single-phase current.

Resistance volts loss for 10 per cent line loss = 30,000 × .10 = 3000 volts.

Resistance volts loss per ampere per mile of line

$$\frac{3000}{27} \times \frac{1}{102.4} = 1.085 \text{ volts}$$

(b) On the chart find 1.085 on the base line, giving the resistance volts per mile per ampere, and vertically up to the 24-in. spacing curve for 25 cycles, the size of wire will be found to be approximately No. 0 B & S wires.

C.—THE SIZE OF WIRES AND SPACING GIVEN, TO FIND THE LINE DROP AND LINE LOSS FOR A GIVEN POWER FACTOR.

Example 4.—Power delivered, kw, three-phase... 4300
E.m.f. at receiver, volts.....30,000
Distance of transmission, miles..... 27
Power factor of load, per cent..... 70
Spacing of wires, inches..... 36
Frequency cycles..... 60
Size of wires, No. 2-0 B & S.

(a) On the chart, place a set square from No. 2-0 on the 36-in. spacing curve (60 cycles), at right angles to the 70 per cent power-factor line, when the regulation volts will be found to be 1.54 volts per mile per ampere.

(b) *Calculation of total line drop.* (The value of the current is taken from Example 3, the same amount of power being delivered at an equal power factor.)

1.54 volts per mile per ampere × 27 miles × 102.4 amperes = 4250 volts;

$$\frac{4250}{30{,}000} = 14.2 \text{ per cent regulation.}$$

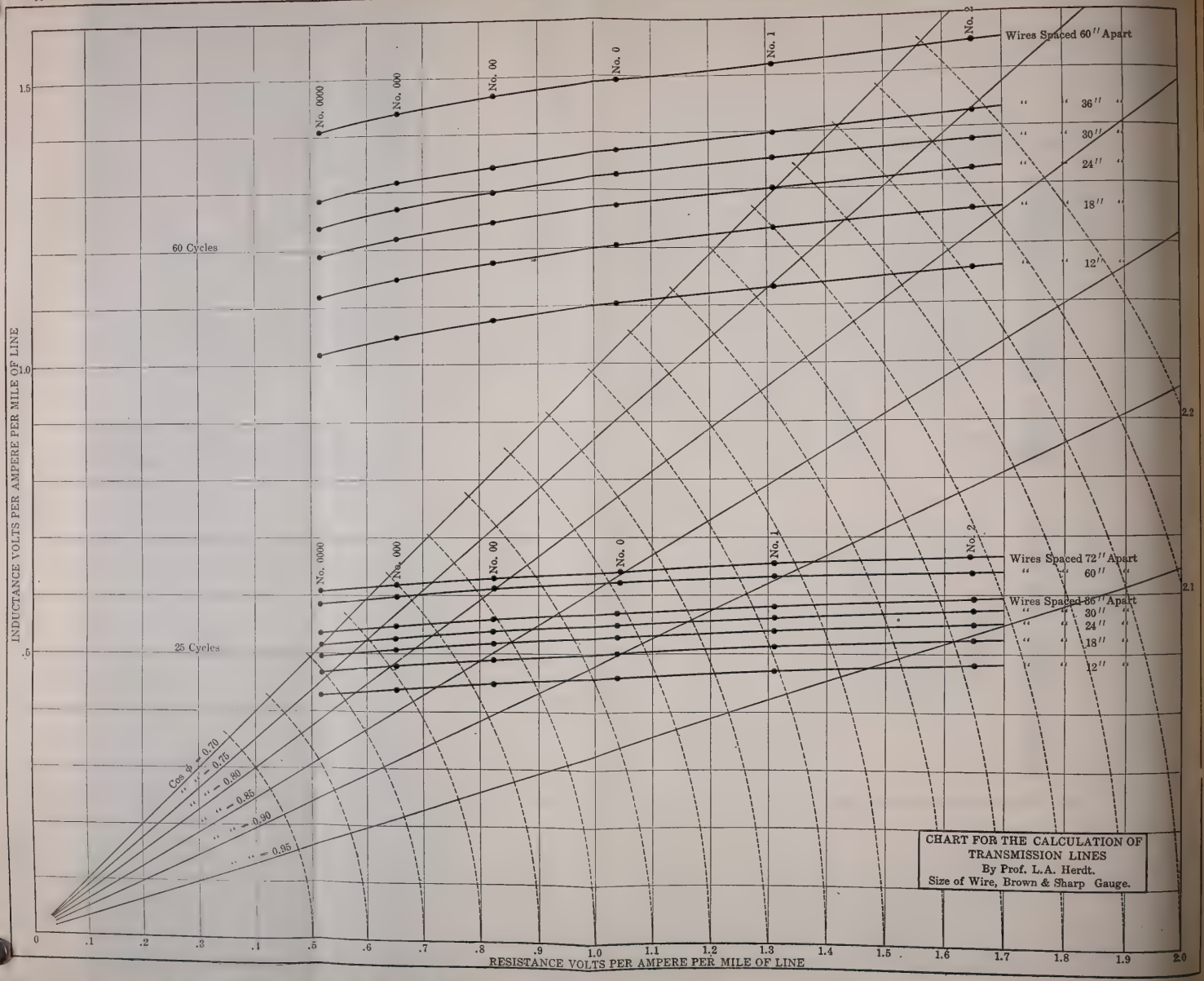
To find the line loss

(a) On the chart from No. 2-0 follow the ordinate to the base line, when the resistance volts per mile per ampere will be found to be 0.824.

(b) *Calculation of total line loss.*

0.824 volts per mile per ampere × 27 miles × 102.4 amp = 2275 volts

$$\frac{2275}{30{,}000} = 7.58 \text{ per cent line loss.}$$


Wires Spaced 60" Apart
" " 36" "
" " 30" "
" " 24" "
" " 18" "
" " 12" "
Wires Spaced 72" Apart
" " 60" "
Wires Spaced 36" Apart
" " 30" "
" " 24" "
" " 18" "
" " 12" "
No. 0000
No. 000
No. 00
No. 0
No. 1
No. 2
60 Cycles
25 Cycles
Cos φ = 0.70
" " = 0.75
" " = 0.80
" " = 0.85
" " = 0.90
" " = 0.95
INDUCTANCE VOLTS PER AMPERE PER MILE OF LINE
RESISTANCE VOLTS PER AMPERE PER MILE OF LINE
CHART FOR THE CALCULATION OF TRANSMISSION LINES
By Prof. L. A. Herdt.
Size of Wire, Brown & Sharp Gauge.

In Fig. 3 this point, which is *C*, shows at the intersection, for 60-in. spacing, that No. 0 is the size of the wire.

If in place of the arc *CE* a line at right angles to *AE* from the point *E* be drawn, it will give practically the same intersection point *C*. By doing so one avoids all references to the point *O* and the whole diagram consists only of the chart shown in section squares. The chart can then be enlarged to any desirable size. The approximation employed in the method—namely, that a straight line at right angles to *AE* can be taken in place of the arc *CE*—evidently involves an error, but this error is very small in comparison with the changing of the size of wire by one number on the B & S gage. If, however, the size of wire is given, the regulation volts or line drop determined from the chart will be somewhat larger than the true value. With leading current, or unity power factor of load, and frequencies above 60 cycles, the error introduced is large and the chart is, therefore, inaccurate for determining regulation.

For power factors—lagging current—less than unity and a line drop not exceeding 20 per cent of the receiver voltage with frequencies of 60 and lower, the error is negligible and the use of the chart will give values of regulation as close as can be obtained by any other graphical method known to the writer, or even from analytical methods when using the slide rule to shorten the work.

Fig. 4 is a chart drawn for both 60 cycles and 25 cycles and for power factors from 70 per cent to 100 per cent and for sizes of wires from No. 0000 B & S to No. 2 B & S. Curves are shown for standard spacings from 12 in. to 60 in. (Resistance volts and inductance volts per mile of line per ampere are taken from the table found in "Drop in Alternating-Current Lines," by R. D. Mershon.) This chart is printed on a separate sheet as a supplement.

The chart (Fig. 4) can be used to determine either:

A:—The size of wire for a given line drop or line regulation

B:—The size of wire for a given watt loss in the line.

C:—The line drop and the watt loss for given sizes of wires.

D:—The effect on the line drop of the power factor of load with given sizes of wires.

As a matter of fact, any problem in line transmission, in whatever aspect the problem may be presented, can be solved with the use of this chart.

USES OF THE CHART.

(A) When the line drop expressed in per cent of the e.m.f. delivered is given, to find the size of the wires:

Calculate the line drop in volts per mile of line per ampere, and for the assumed power factor of load on the line marked cos Φ lay off from the origin (point *O*) a length equal to this line drop in volts per mile per ampere. (The dotted circles drawn from point *O* give, on the different cos Φ lines, different values of volts per mile per ampere and this distance can thus be ascertained by inspection.)

At this point place a set square making a line at right angles to the cos Φ line chosen above and its intersection with the curve on the chart for the spacing assumed will give the nearest size of wire to be used.

(B) When the watt loss in the line expressed in per cent of the delivered power is given, to find the size of wire:

Calculate the volt loss per mile of line per ampere. This value is equal to the resistance volts per mile per ampere, and is measured along the base of the chart. Following the ordinate from this point to the interesection with the curves, the size of wire will be ascertained.

(C) When the size of wire and spacing is given, to find the line drop and line loss for a given power factor:

From the point on the chart corresponding to the size of wire at the spacing given, place a set square at right angles to the power factor line. The length cut off on the power factor line from point *O* represents to scale the line drop per ampere per mile of line. Multiplying this value by the amperes in the line and by the length of the line in miles, the value of the total line drop will be obtained, and this value can be expressed as a percentage of the e.m.f. delivered, thus giving the per cent regulation.

To determine the line loss, follow the ordinate from the point on the chart representing the given size of wire and the spacing to the base line, the length cut off from the point *O* on the line representing resistance volts, gives the resistance volts per ampere per mile of line. Multiplying this value by the amperes in the line and the length of line in miles the volts lost are obtained and can be expressed as a per cent of the received voltage.

The above is thought to be sufficient to explain the construction and use of this chart, but a few examples may be of value.

ILLUSTRATION OF THE USE OF THE CHART.

Example 1. Line drop assumed. Find size of wire. (Single-phase.)

Power to be delivered, kilowatts	250
E.m.f. at receiver, volts	2,000
Distance of transmission, feet	10,000
Power factor of load, per cent	80
Frequency, cycles	60
Distance apart of wires, inches	18

Line drop allowed: 23 per cent of received voltage.

Find the size of wires.

(a) Calculation of line drop per mile per ampere

$$\frac{250 \text{ kw}}{0.8} = 312.5 \text{ kva.}$$

Line current at 2000 volts $\frac{312,500}{2000} = 156.25$ amp.

Line drop 23 per cent of 2000 volts = 460 volts.

Line drop per mile per amp $\frac{460 \times 5280}{10,000} \cdot \frac{1}{156.25} = 1.55$ volts

(b) On the chart place a set square on the 80 per cent power factor line where the above value of 1.55 volts is shown, the intersection of the set square with the 18-in. spacing 60-cycle curve will give a size of wire of No. 0 B & S exactly.

Working this problem backward analytically, to check the above, and using the resistance volts and reactance volts per ampere for No. 0 B. & S. wires—namely, 0.197 and 0.228 ohm respectively, the line drop or regulation volts will be found equal to 460—that is, 23 per cent of the receiver voltage.

Example 2. Line drop assumed, to find the size of wires — Φ (Three-phase.)

A three-wire, three-phase transmission of which the conductors are symmetrically related may, so far as watt loss and line drop are concerned, be replaced by two single-phase circuits having no inductive interaction and identical with the three-phase line as to size, wire and distance between wires.

To calculate a three-phase transmission, calculate a single-phase circuit to carry one-half the load at the same voltage. The three-phase transmission will require three wires of the size and distance between centers determined for the single phase system.

Power to be delivered (three-phase), horse-power	4,000
E.m.f. at receiver, volts	40,000
Distance of transmission, miles	85
Power factor of load, per cent	80
Frequency, cycles	60
Distance apart of wires, inches	60
Line drop, per cent	20

Find the size of wires.

(a) Calculation of line drop per mile per amp per ampere

$$\frac{4000 \times .746}{0.8 \times 1000} = 3.730 \text{ kva}$$

Single-phase equivalent load = 1865 kva

Current at 40,000 volts = $\frac{1,865,000}{40,000} = 46.6$ amp

Line drop allowed 40,000 × .20 = 8000 volts

$$\text{Drop per line mile per amp} = \frac{8000}{85} \cdot \frac{1}{60.6} = 2.02 \text{ volts.}$$

(b) On the chart place a set square on the 80 per cent power factor line where the above value of 2.02 volts is shown the intersection of the set square with the 60-in. (60 cycle) spacing curve gives approximately No. 1 as the size of wire.

Example 3. Given the line loss, find the size of wire and also the per cent regulation. (Three-phase.)

Power delivered (three-phase), kilowatts	4,300
E.m.f. at receiver, volts	30,000
Distance of transmission, miles	27
Power factor of load, per cent	70
Frequency cycles	25
Line loss, per cent of power delivered	10

Find size of wire for 24-in. spacing, also the percent regulation.

(a) Calculation of resistance volts drop per mile of line per ampere.

$$\frac{1}{2} - \frac{4300 \times 1000}{0.70 \times 30{,}000} = 102.4 \text{ equivalent single-phase current.}$$

Resistance volts loss for 10 per cent line loss $= 30{,}000 \times 10 =$ 3000 volts.

Resistance volts loss per ampere per mile of line

$$\frac{3000}{27} \times \frac{1}{102.4} = 1.085 \text{ volts.}$$

(b) On the chart find 1.085 on the base line marked resistance volts per mile per ampere, and vertically on the 24-in. spacing for 25 cycles the size of wire is found to be approximately No. 0 B & S.

(c) To find the line drop. On the chart place the set square from No. 0 B & S on the 25-cycle curve 24-in. spacing at right angles to the cos $\Phi = 70$ line, the regulation e.m.f. $=$ 1.11 volts per mile per ampere.

Calculation of line drop:

1.11 volts per mile per ampere $\times$ 27 miles $\times$ 102.4 $=$ 3070.

$$\text{Regulation per cent} = \frac{3070}{30{,}000} = 10.2.$$

High-Potential Underground Transmission in Boston.

At the regular monthly meeting of the Boston branch of the American Institute of Electrical Engineers, held on Nov. 18, the A. I. E. E. paper on "High-Potential Underground Transmission," by Messrs. Junkersfeld and Schweitzer, was abstracted by Mr. L. L. Elden, electrical superintendent of the Boston Edison Company. Mr. Elden supplemented the paper with a large number of additions and comments relative to the operation of the Edison system in Boston, which are reproduced in abstract as follows, omitting extended reference to the original paper:

The principal source of alternating current in Boston is the L Street station in South Boston, from which radiate 22 transmission lines at 2300 volts, 4600 volts or 6600 volts. These lines, including 29 others between substations, comprise about 120 miles of underground cable and 100 miles of overhead lines and serve 22 substations. A general diagram of the Edison high-tension system is shown herewith. In all but one case at least two transmission lines are provided for each substation, different routes being frequently utilized. The load is supplied by 37,000 kw of machinery, the largest unit being an 8000-kw turbine. If 8000-kw units are used in the future extension of the L Street station, the aggregate normal load will be 100,000 kw.

In the Boston Edison distribution system both radial tandem and ring combinations of lines are used, but the latter is employed only in emergencies. One of the most serious operating problems is the proper adjustment of the automatic relays for the protection of the underground cables, generating and substation apparatus. The 6600-volt busbars are connected to the turbo-generators without automatic switches. Mr. Elden illustrates a typical transmission line supplying current to a direct-current station in the city proper. The lines were 4-0, and are tested to about three times their current rating with two seconds time on the time-limit relay. Owing to the substation conditions, the adjustment is reduced to one-half second at the latter point, and all transformers or converting apparatus taken off the substation are tested at about three times the motor-generator amperes for instantaneous tripping, so that trouble with this apparatus never disturbs the transmission-line circuit-breakers. The same equipment and adjustment are used in the alternating-current substations. In a typical case the adjustment is reduced to 400 amp one second between the plant and the first substation. From here to the next substation the amperes are reduced, leaving the time the same. At the next substation the time is reduced as well as the amperes, say, to ¾ second, and so on, trying to prevent the interruption of the larger capacity equipment by the failure of smaller apparatus. The standard transmission cable used by the Boston company is No. 4-0 paper-insulated cable with 7/32 insulation over all, with ⅛-in. lead sheath guaranteed for operation at 15,000 volts. The Boston company did not commence to use 6600-volt cable until 1902, although 2300-4600-volt cable had been in use since 1898. The early experience in Chicago and elsewhere showed the necessity for avoiding sharp bends and making splices with extreme care.

The standard end-bell consists of a spun brass shell to which the lead sheath of the cable is solidly connected by a wiped lead joint. The outer wrapping of the insulation is allowed to project through the base of the bell for a few inches and is then cut away to permit the separation of the conductors for jointing to outside wires. Hot paraffin compound is then poured into the bell to seal up and protect the joints. The Boston Edison Company has had general success with paraffin so far. The protection given to cables in manholes is somewhat different from the method used in Chicago. In Boston all such cables are securely wrapped with asbestos tape of sufficient thickness to withstand severe applications of fire from other burning cables, a plan that has been satisfactory up to date. Semi-annual potential tests were made at the beginning of the company's high-tension cable construction, but were discontinued as the system became larger. The danger of accident from these frequent high-potential applications was thought to be too great to justify the tests. Testing is now limited to new, altered or repaired cable, which, before being put into service, are subjected to a test of double working voltage for one minute. The Boston tests have up to the present been limited to insulation tests.

When the relative station loads and the size of the cable systems are considered, the Boston company probably suffers less from severe strains on the cables than either the New York or Chicago companies. Only one occurrence has taken place in the Boston system during the entire period of 6600-volt operation which has indicated a surge. A ground was caused by a rat on an oil switch at an alternating-current substation about seven miles from L Street. The ground was immediately indicated at the power plant, but before the line affected could be located, a short-circuit occurred, throwing out the automatic oil switches on both the lines supplying the substation. The lines were instantly restored to service and continued to operate in a normal manner. At the substation it was found that a short circuit had occurred at the terminals of the switch in the next cell on the duplicate line, which was alive but not connected to any of the apparatus in the substation. The current jumped a space of about 7 in. in open air by a circuitous route to reach contacts on top of the switch, which were enclosed in tall porcelain protectors, the arc later spreading to the bus leads and short-circuiting the other line in this manner. The pressure required to make such a jump is purely problematical, since tests on this switch showed no evidence of

breakdown up to 30,000 volts between terminals or to the frame. The lightning arresters also failed to indicate any passage of current to ground or between phases. About a week later a ground was indicated on one of these cables about three miles from the substation, and a pinhole puncture was found through both lead and paper insulation. This was undoubtedly made at the time of the short-circuit at the station, but was of such high resistance that considerable time was required to complete the permanent breakdown of the cable insulation.

Mr. Elden then discussed the high equipment capacity of substations where motor-generators have replaced engine-driven machinery, showing that in some cases if steam-driven units were used the limitations of head room would greatly reduce the available equipment, while in a commercial building installation the company concentrates from four to six times as much equipment as could be installed with engine-driven units. In one 1200-kw station that has been superseded by substation equipment, the space taken up at one end of the station for considerably more than 1200 kw did not exceed the area used for one single 300-kw generating unit.

In the discussion Mr. Elden stated that the failures in the transmission system are the smallest items of disturbance that the company has. The overhead system gives 10 times as much trouble as the cable system, and the cable troubles occurring have largely happened in the cases of cables newly installed. The manufacturers in six of the cases have made the cable good, as having been undoubtedly defective. In the other two cases, which were due to mechanical injury, they were not held responsible. The matter of cable trouble lies largely in the load which is attempted for transmission over any single cable. At 6600 volts the top load is held to be 250 amp. The shutting off or disturbance caused by the loss of a single cable line may result in affecting a number of substations under the radial system of operation, but if the company attempted to protect that phase by having all switches closed in all the substations, it could not get clear without a worse disturbance. As it is now, the duplicate line stands ready for business, and the operator, if he does not get his current shortly, avails himself of the duplicate line and restores the original conditions as soon as possible. The cable troubles are small after the cables are seasoned.

Mr. M. V. Ayres, electrical engineer of the Boston & Worcester Street Railway, then discussed the successful operation of three-phase, lead-covered, 13,200-volt cable on the lines of his company for an overhead section of about 2¼ miles. In one case the lead sheath was grounded by a broken trolley wire, but the cable did not break down until the pole carrying it had been on fire fully 15 minutes. It is surprising how many slight injuries a cable will stand without failure. Prof. D. C. Jackson, of the Massachusetts Institute of Technology, outlined the efforts of the Commonwealth Company of Chicago to command all the power business of the city, pointed out the remarkable development in station output now illustrated by the large Edison systems, and urged the need of more analytical studies of the insulation problem, with special commendation of the oscillograph as a commercial instrument. Mr. N. J. Neill emphasized the effect of seasoning on cable reliability and pointed out the importance of carefully studying the problem of lightning protection. He did not think it wise to impose severe excess voltage tests on cables. He felt that the strength of the disturbance can be reasonably well examined by spark gap tests. Mr. Elden then stated that the relays used in Boston

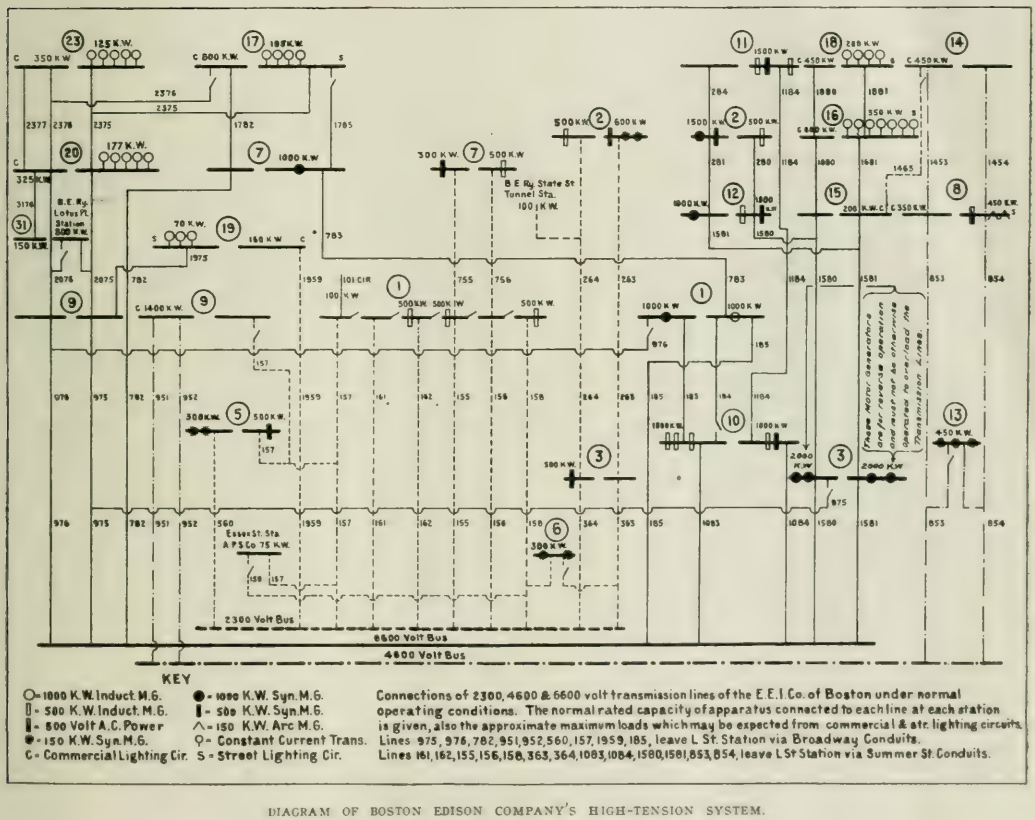


DIAGRAM OF BOSTON EDISON COMPANY'S HIGH-TENSION SYSTEM.

are giving on the whole very satisfactory service, although they require frequent adjustment. The bellows type is used. Mr. G. W. Palmer, electrical engineer of the Boston & Northern and Old Colony Street Railway Companies, cited five years' successful use of 13,200-volt cable transmission on the Old Colony system, there having been not a single instance of disturbance of operation since the cable was installed.

The meeting was closed by Mr. Elden, who emphasized the amount of power now behind defective cables when anything goes wrong, and the severe mechanical effects of heavy short circuits in cable runs. The New York company is at present operating the largest load of any company in the world, having at the peak load 120,000 kw connected and operating on one bus—an incredible load to concentrate on a short-circuit. As the company grows some steps will have to be taken in the future to limit the amount of current. A device has been developed by the New York company to detect cable troubles, and this has been quite successful in all but four cases in a year's operation enabling the cable to be selected and get it disconnected from the system before the trouble occurred. This is a long step toward the satisfactory operation of any cable system. Mr. Elden was inclined to favor a reasonable high-potential test before putting a new or repaired cable into service. Some arranged to apply a 30-minute test at double normal working pressure after the cable has been installed, but this test is never repeated on a cable unless a failure occurs. The Chicago company operates a motor-generator at variable voltage, raising the potential on the defective cable very gradually until the test limit has been reached. After letting it soak for a few minutes they pull it off and throw the cable upon the system, and in but one or two cases has the cable broken down after the test, due to the fault which was being repaired. The New York company uses a static transformer, but does not, according to Mr. Elden's recollection, run higher than one-third above the normal working voltage. The Boston company is thinking of duplicating this general type of test, bearing in mind that the manufacturers do not approve a continued application of high excess voltage on account of the danger they feel thus is thrown upon the permanence of the insulation.

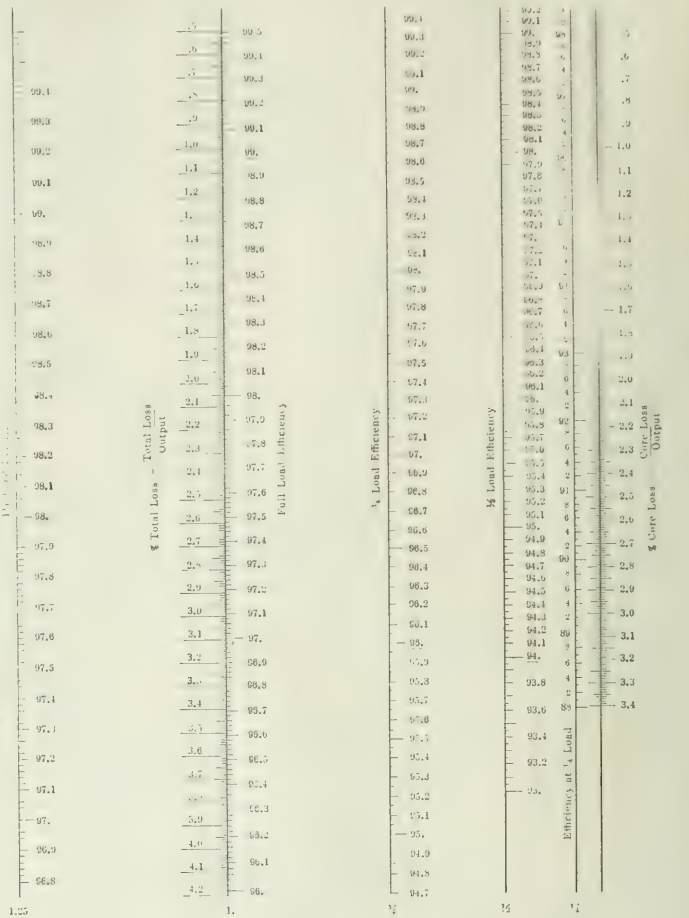


CHART FOR SHOWING EFFICIENCIES AND LOSSES OF TRANSFORMERS.

Chart for Determining the Efficiencies of Transformers.

By Henry C. Stanley.

The accompanying chart has been devised for determining the efficiencies of transformers at one-quarter-load intervals from one-quarter load to 1¼ load. It enables one to ascertain the efficiency at these loads when the constant core loss and the copper loss at full-load are known; when the efficiencies are known for two loads the losses can be ascertained at once by [illegible] of the

The chart consists of five vertical scales for showing efficiencies and two vertical scales for the losses. For each transformer there exists a relation between the points on these seven scales, such that when any two points are located the [illegible] by

The vertical line on the extreme right, reading downward, is the per cent core loss. On the fifth vertical line from the right, reading downward, is the total per cent loss. The figures indicating this loss are placed on the left side of this line. This total loss is the sum of the per cent core loss and the per cent copper loss. In order to simplify the use of the chart the per cent losses are given in terms of the output or kilowatt rating of the transformer. On the second line from the right are efficiencies at one-quarter load, and on the third line from the right are the efficiencies at half-load; on the fourth line from the right are the efficiencies at three-quarter-load; on the fifth line from the right are the efficiencies at full-load, as indicated by figures on the right side of this line; on the sixth line from the right, or the line at the extreme left of the chart, are the efficiencies at 1¼-load.

To read efficiencies with any given losses use must be made of a straight-edge about 1½ times as long as the chart is wide. This straight-edge should be laid on the chart so as to intersect the vertical line representing the per cent core loss at the given per cent and at the same time to intersect the vertical line representing the total loss at the given per cent. When this setting is made the straight-edge will intersect the other vertical lines at the efficiencies for loads which they represent. A substitute for a straight-edge is a thin, transparent piece of celluloid about 1 in. wide, and of the required length, having a scratch down the center. For obvious reasons this scratch

should be on the side next to the chart; that is, on the under side of the celluloid. The most convenient way to set the celluloid is to stick a pin through the scratch on one end of the strip and place the point of a pin at any given per cent core loss. With the strip pivoted at this point it can readily be swung around to any required per cent total loss, after which the efficiencies can be read where the scratch intersects the different vertical lines.

As intimated above, an important feature of the chart is that the straight-edge can be set to any two given efficiencies for any two loads whatsoever, on which setting the efficiencies at all other loads can be directly read, as can also the per cent core loss and the total per cent loss. The chart has proved a great time saver in the above respect in that it is a rather difficult operation to determine the per cent core loss and the per cent copper loss for any given efficiencies.

Rheostatic Starters for Induction Motors.

By Dr. Benj. F. Bailey.

The principal defect of squirrel-cage induction motors, as compared with other types of alternating- and direct-current motors, is lack of starting torque. At best, most induction motors of this type will develop not to exceed about twice normal synchronous full-load torque, and to do this require from five to seven times normal full-load current. The shunt-wound direct-current motor, on the other hand, will develop double full-load torque, with approximately double full-load current, while the series-wound direct-current motors will develop the same torque with approximately 1.5 times the full-load current. In the induction motor, therefore, there is a fundamental difficulty to be overcome, and a consideration of the best starting devices is of importance.

The designer can, to a certain extent, control the starting torque. For a uniform rotating magnetic field, the torque is proportional to the square of the secondary current times the secondary resistance. The secondary current is approximately proportional to the primary current and, for reasonably small variations of secondary resistance, the current taken at starting will be practically the same, and the starting effort produced will be approximately proportional to the square of the primary current times the resistance of the secondary. Consequently, the starting torque is nearly proportional to the secondary resistance. Unfortunately, however, the slip at full-load is also proportional to the resistance of the secondary; consequently, the designer is forced to choose between two evils: high starting torque and great slip and low efficiency, or low starting torque and small slip. The proportions to give these two factors must be decided by the designer from his experience and judgment.

A general tendency of American motor manufacturers is to make the maximum starting torque of the motor connected directly across the line equal to about 175 per cent of the synchronous full-load torque. In starting, it is impracticable to connect large motors directly across the line, both on account of the large current taken, which affects the voltage, and on account of possible injury to a connected apparatus, due to sudden starting.

For reducing the starting current use is made of two kinds of devices, the "compensator or auto-starter" and the rheostatic starter. The "compensator" is an auto-transformer, consisting of either a three-phase transformer or of two V-connected single-phase transformers. They are ordinarily arranged with taps to give approximately 50, 65 and 80 per cent of full-load voltage. The rheostatic type of starter (for the three-phase motor) usually consists of three resistors arranged to be inserted one in each phase at starting, the resistance being gradually decreased in much the same way as the resistance of a direct-current starter is decreased. It is principally to examine the relative effects of the latter two devices that this article is written.

In the first place, it is well to understand clearly the purpose of the starting device used with the induction motor. It is not used to avoid injury to the motor, as in a direct-current installation, because the machine would rarely be damaged by being connected directly across the line. It is, however, true that injury might be caused by this procedure to other apparatus connected to the system. Neither, in general, is the amount of power taken at starting of any great moment, as the rating of the alternator supplying energy to the circuit is ordinarily, though not invariably, much greater than that of the motor. In general, the purpose of the starter is to limit the line current to such a value as not to cause undue fluctuation in the voltage which might affect the lamps or other motors connected on the same circuit.

The great fluctuation in voltage when a squirrel-cage induction motor is started from rest is due not so much to the current taken as to the low power factor. A current that is in time-phase with the e.m.f. reduces the voltage of the circuit very little. When, however, the current lags 90 time-degrees behind the e.m.f., the reduction of the voltage is much more marked. In the case of the generator, the current reaches its maximum at such a time that the ampere-turns of the armature directly oppose those of the field coils; consequently, the voltage is greatly reduced, unless the machine has an exceptionally large ratio of field-circuit to armature-circuit ampere-turns. In other words, the regulation of an alternator on low power factor is poor. The same thing applies to the transformer and line, the drop in voltage of the transformer being usually four or five times as great for the same current at zero power factor as at unity power factor. If, therefore, the current which the induction motor takes at starting is considered as divided into two components, one in time-phase with the e.m.f., the other lagging 90 time-degrees behind it, the one in phase reduces the voltage but little, while the component lagging 90 degrees reduces it very greatly.

It can easily be shown that the wattless component of the starting current is the same whether an auto-starter is used or whether the motor is started by resistance alone. It is evident, without proof, that the value of the volt-amperes received by the motor at starting will depend solely upon the voltage impressed upon its terminals. The auto-starter must obtain from the line this value of volt-amperes and in addition thereto the wattless volt-amperes for providing its own magnetization and the power volt-amperes for overcoming its own losses. When the rheostatic starter is used there must be supplied from the line the volt-amperes taken by the motor and also the power volt-amperes consumed in the rheostatic starter.

Hence, it is seen that the component of the current actually reaching the motor, which causes the reduction in voltage when the motor is started, is the same whether an auto-starter or a rheostatic starter is used. The case is, however, a little worse with the auto-starter than this statement would indicate. Auto-starters are usually built up with a number of coils slipped over the same leg of the transformer and taps are taken off over a certain number of turns. This arrangement leaves all of the "primary" turns at one end of the transformer coil, and the "secondary" turns at the other end. The conditions are, consequently, the best possible for a large leakage and the auto-starter itself introduces a considerable additional wattless component of current. In other words, it requires a consider[illegible] magnetizing component current to supply its own magnetic leakage flux. It is stated [illegible] these two starters the auto-starter requires a larger wattless component of current from the line than does the rheostatic starter, and consequently the fluctuation in voltage is fully as great with the auto-starter as with the rheostatic starter. It should be noted that the current which actually reaches the motor and consequently the starting torque are precisely the same in the two cases.

There is another respect in which the rheostatic starter is superior to the auto-starter. As soon as the motor gets under way the current becomes less; this change, of course, reduces the IR drop through the rheostat and consequently a higher voltage is applied to the motor. Thus rather less current will be

required in the motor or a greater torque will be available than if an auto-starter were in use. With the auto-starter the starting voltage and the maximum available torque remain practically constant until the motor is connected directly to the line. In starting certain loads, such as a fan, where the torque required increases somewhat with the speed, or even where it remains constant, this is a decided advantage in favor of the rheostatic starter. For a given value of starting current, the motor will attain a higher speed with the resistance starter than it would with an auto-starter and the circuit is not opened during starting. This avoids burning the contacts. The disturbance, when the motor is finally thrown on the line, is, therefore, less. Moreover, it is more easily feasible to provide these starters with intermediate steps; in fact, they are very rarely, if ever, built any other way, whereas the tendency with auto-starters is to provide only two steps, the starting position and full-voltage running position.

The resistor starter, of course, takes more power than does the auto-starter. In starting very large motors the power required may be a considerable factor, due to the generator and prime mover being, in many cases, of little, if any, greater rating than the motor. In such cases the auto-starter undoubtedly has the advantage. It should be noted, however, that this advantage is greatest when it is least needed; that is, when the motor starts with only light torque and consequently a considerable reduction in voltage can be made by the starter. If taps giving 85 per cent of the full line voltage are used the motor with auto-starter receives 85 per cent as much current as it would if connected directly across the line, but it takes only 72 per cent as much current or power from the supply system. With the rheostatic starter the current at the same voltage would be 85 per cent, so that the volt-amperes saved by the auto-starter over the value required for the rheostatic starter would amount to not more than about 33 per cent.

To test the above conclusions, a 20-hp, 220-volt, three-phase, 60-cycle, squirrel-cage induction motor was connected with both a rheostatic starter and an auto-transformer starter in series. Either starter could be set in the full running position at will, thus short-circuiting it. Considerable care was taken so to select the two starters that the voltage applied to the motor at the instant of starting would be the same whichever was used. The energy was obtained from a commercial circuit, fed from a large generating station; the transformers were ample in size, having a total rating of about 40 kw.

Five readings which were taken gave the following averages:

Volts on line.	Rheostatic starter.	Auto-transformer starter.
Motor off	230	229
Volts line-starting	212	210.7
Volts motor	97.8	98.5
Drop in voltage	18	18.3

It will be noted that the drop with the auto-transformer starter was a trifle greater than that with the rheostatic starter; however, the current in the motor was also slightly more. From this test it appears that the two starters were on an equality as regards disturbance to the line voltage.

In addition to the above a number of other trials were made under various conditions. The drop in voltage at the instant of connecting the motor was found to be the same in the two cases.

SUMMARY.

The rheostatic starter is much cheaper than the auto-starter, but requires in starting more current from the line in proportion to the ratio of the voltages of the auto-transformer. The power used would probably not amount to more than 15 per cent. This difference decreases as soon as the motor gets under way. The wattless component of the line current required by the motor is somewhat less with the rheostatic starter, consequently the disturbance to the line voltage, on attempting to start the motor by the two methods, is approximately the same. The starting can be made somewhat more gradual with the rheostatic starter since it is feasible to introduce a number of contacts, and the disturbance on finally connecting the motor to the line, even though only two contacts are used, is less than with the auto-starter. Since the rheostatic starter is cheaper and gives equally good results as regards regulation, it would seem as though it should be preferred for most motors, at least in the small and medium sizes.

Arc Lamps in 25-Cycle Service.

By H. C. Reagan.

In view of the general belief that arc lamps cannot be operated at a frequency lower than 40 cycles per second, and because difficulty has been experienced in designing arc lamps for 25 cycles, it is believed that an account of results obtained with arc lamps actually used on a 25-cycle system will be of general interest.

In addition to the well-recognized fluctuation in the light at the low frequency, the ordinary arc lamp used at 25-cycles exhibits an excessive pumping action of the lamp mechanism which has a destructive effect upon the electrodes and causes a disagreeable chatter. This action is attributable to the low rate of change in the magnetizing force of the solenoids upon the plungers.

The mechanical and magnetic difficulties incident to these actions have been overcome in the lamp above referred to, and some of these have been in use for several months at 25 cycles by a certain single-phase railway for head-lanterns on cars and for illuminating the generating station, car houses and yards.

In these lamps the mechanism controlling the electrode is so constructed that it will move up or down in a magnetic field according to the mean value of the current, but will not cause the electrode to vibrate in unison with the low-frequency current. The plungers float in the varying magnetic field and do not come in contact with any portion of the mechanism, so that hammering is avoided. The mechanism can be employed with electrodes placed one above the other or side by side, as may be desired.

Although a flicker is noticeable when the lamp is viewed directly, the objects illuminated by the lamp do not show any effect of flicker. The passengers have experienced no difficulty in reading newspapers and written matter at the station. Moreover, no wavering of light was noticeable when the ground was covered with snow. Observations made with the lamp in a room having white walls have not shown any flicker of the shadows cast by objects upon the walls. No difficulty has been experienced by workmen in using tools under 25-cycle arc-lamp illumination.

The general use of 25-cycle arc lamps would result in the elimination of frequency-changing apparatus when energy is obtained from long-distance transmission circuits.

Incidentally it may be mentioned that the cars upon which the 25-cycle head-lamps are used operate over direct-current circuits at the terminals of the road. The lamps are so constructed as to be applicable to both direct-current and alternating-current service. The change from one type of current to the other is accomplished automatically without any attention on the part of the motorman.

Forced Draft for Steam Boilers.—III.

By W. H. Wakeman.

The principle by which air is sent into the ash pit by the direct application of steam jets should be considered in connection with forced draft. While the steam jet may not be the most economical method that can be used for this purpose, so far as the consumption of steam is concerned, still, on account of its low first cost, ease of application and flexibility in operation it is extensively used. If natural draft has always been used in a plant, and the manager or the chief engineer desires to investigate the possible results of using forced draft, it is a good idea to fit up one boiler with steam jet apparatus and give it a trial. If its operation is satisfactory it may be applied to other boilers, or if not fully approved it may be

modified to suit conditions. In case it proves objectionable it is an easy matter to discontinue its use, and the experiment will usually be worth all that it costs.

Fig. 1 illustrates a wooden box fitted into the ash pit doorway of a tubular boiler for the purpose of making several experiments by means of the steam pipes shown inside of it. The feed pipe is ¾ in. in diameter, but the upper and lower outlets are made of ½-in. pipe. The horizontal pipes are capped at the right-hand, and each of them contains 15 holes

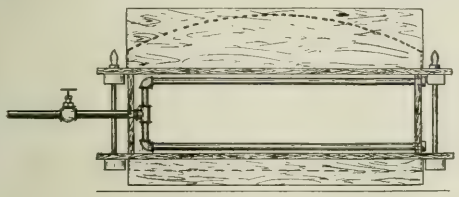


FIG. 1.—WOODEN BOX FITTED IN ASH-PIT DOOR.

5/32 in. in diameter. Fig. 2 is a plan of this box as it appeared when steam was coming out of these holes.

During the first trial this box was only 7¼ in. deep, consequently the blast was not strong because the steam jets spread into the open ash pit too soon for good results. When this depth was increased to 14½ in. the result was much better, as the column of air was confined within these limits for a longer time and hence was compelled to move forward. When the depth was made 21¾ in. the result was no better. Originally

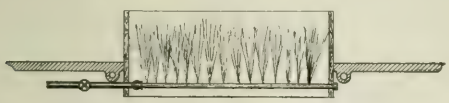


FIG. 2.—PLAN OF BOX, WITH STEAM JETS.

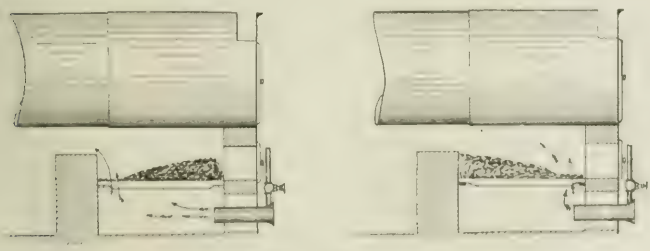
the box was 7 in. high and 30 in. long, thus leaving about 4 in. between the horizontal pipes, hence when the jets were turned to blow parallel to the top and bottom boards there was too much space that was not fully covered. Turning the upper row downward and the lower row upward until they mingled at about 18 in. from the pipes made a slight improvement. The nipples which are shown in the reducing tee were taken out, shorter ones substituted until the ells were practically in touch with the tee, and the box was reduced accordingly, making it about 4½ in. high. This created a stronger draft, although the inlet for air was much smaller than before. Each alternate hole was then stopped with a brass plug, and steam again admitted. As the holes were 2 in. apart before, they were 4 in. now, and this proved to be too far, as it allowed air to blow back between them. The consumption of steam was reduced 50 per cent, but it was not an improvement when all points were considered.

During a portion of this trial the boiler was cut out, or, in other words, the outlet valve for steam was closed, thus isolating it from others that discharge into the common header when the whole plant is in service. This was done for the purpose of observing the effect of allowing holes to burn through the fire. These were not very large, as no effort was made to create abnormal conditions. It is a well-known fact that thin spots or holes in a fire greatly reduces its efficiency because cool air rushes through them, following the course which presents the least resistance. However, it may be a surprise to learn that by allowing the fire to burn thin near the bridge-wall, as illustrated in Fig. 3, the steam pressure was lowered 5 lb. in a few minutes. In this case the cool air rushed almost directly up against the boiler as it passed over the bridge-wall, still the same conditions are frequently found in practice. When a fire burns low in front, as shown in Fig. 4, the effect is not so bad, because the air passes over the fire and assists combustion, especially where bituminous coal is used. In a certain plant that the writer is familiar with, the rule is to allow 4 in. of the front to be practically bare, thus allowing air to come through freely. Bituminous coal is used and only natural draft is employed. These points are mentioned because it could not be done with screenings burned with a strong forced draft.

It is much better to purchase steam jet apparatus from parties who have conducted experiments and demonstrated correct methods for economy of steam consumption and best results generally, than to use makeshifts that could not be sold in the open market. Although home-made apparatus appears cheap, usually because only a small portion of the real cost is considered, it is really very costly in many cases, and very unsatisfactory when the results secured are carefully considered.

Fig. 5 illustrates a series of small steam jets that are scientifically arranged so as to force a maximum quantity of air with a minimum of steam. The tube through which air is drawn and forced is long and when in full operation it is apparently filed with steam, although a portion of the rushing mixture is air, therefore no opportunity is offered for a back action that allows any part of the intended effect to be lost.

Fig. 6 shows one of these blowers in operation, taking air from a point near the boiler room floor. No way has been discovered for preventing a disagreeable noise with this kind of blower, caused by steam issuing from small orifices and a large quantity of air rushing at high speed through a small space; but where this noise is not objectionable it gives satisfactory results, as it creates a very strong draft. If it is practical to locate a blower of this kind in the side wall of a boiler setting, it is a good idea so to place it, but where several boilers are set in a battery the side walls are not available for this service. It is possible to locate the blower in the front wall, but it is not always convenient. In such a case it may be put in one of the ash pit doors, as illustrated in Fig. 7. The door can be opened without shutting off steam if desired, but it is customary to shut the upper valve, as the blast is not wanted when this door is open. Three swing joints are shown in the illustration, constituting a kind of universal joint which allows the door to be opened at pleasure without removing the piping. The lower valve is used to regulate the blast when its full effect is not desired.



FIGS. 3 AND 4.—STEAM JET APPLIED TO ASH PIT.

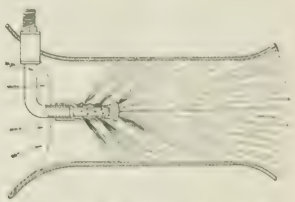


FIG. 5.—DETAIL OF STEAM-JET BLOWER.

Advocates of forced draft for burning the various kinds of

small anthracite coal always claim that the installation of this system makes it unnecessary to build an expensive chimney, but a note of warning should be sounded along this line, as there is danger of wasting money in erecting a chimney that will not be satisfactory in service. Not far from the writer's office there is a plant where buckwheat coal is used almost exclusively for making steam to drive the machinery. Even when the boilers are carrying a normal load, fire comes out all around the furnace doors, and much of the products of combustion are delivered into the boiler room instead of going into the chimney, which is round in form, 4 ft. 6 in. in diameter and 60 ft. high, and is located near the boilers. The grates are 6 ft. 9 in. wide and 8 ft. long, therefore each furnace contains 54 sq. ft. of surface, and as there are three of them the total grate surface is 162 sq. ft. The ratio of stack area to grate surface is 1 to 10. In another plant which has a good natural draft, there is a substantial round chimney 5 ft. in diameter and 75 ft. high. Each furnace has 30.25 sq. ft. of grate and as there are five boilers the total grate surface is 151.25 sq. ft., giving a ratio of 1 to 7.7. When one considers that the latter is sufficient to give satisfactory natural draft, it certainly appears as if the former would take away the smoke and flames, but it does not. It ought to be large enough to give the same ratio, or 5¼ ft. in diameter, and if it were 6 ft. it would be better. The reason for this is that although in the former case the chimney is not intended to create the necessary draft, it was expected to prevent the existing condition of affairs, which is a great nuisance to everybody working in the plant. The volume of air going into these furnaces is too great for the chimney, although two of the furnaces have but 5 per cent of air space in the pin-hole grates, while the third is fitted with another kind that gives 12 per cent. The foregoing is not a theory, but a condition, and the moral is to make the chimney as large for forced draft as it would be for natural conditions. This refers to the diameter and not to the height, but it ought to be high enough to carry the smoke and gases above the surrounding buildings. If

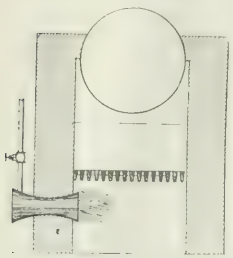


FIG. 6.—BOILER FITTED WITH STEAM-JET BLOWER.

necessary or advisable to substitute mechanical draft, difficulties will not arise. On the other hand, if a short chimney is built and forced draft apparatus only is installed, it is not possible to utilize natural draft without building the chimney higher, which is not always practicable, as the foundation may not be sufficient for a much heavier chimney, and other conditions do not always favor the change.

A certain manufacturer who adopted forced draft and low-priced coal several years ago, stated very emphatically that the saving was not as great when all points were considered as the daily reports showed. This was due to the fact that in a few years it was necessary to renew his boiler plant, when otherwise he would not have had this heavy expense to meet, as other plants that are operated less strenuously have lasted much longer and are still in good condition. The nominal saving made in this particular case was more than $100 per week, and if this was not a paying investment where only four boilers were included, it is evident that less saving in other plants will be more unsatisfactory as time passes. All phases of the question should be intelligently considered when these matters are presented, and a decision reached that is based on a knowledge of the fundamental principles involved in connection with those that relate to the superstructure.

Fig. 8 illustrates a device for creating a draft which takes its supply of air from the upper part of the boiler room where ventilation is needed more than at other points as a general rule. Fig. 9 shows the operation of a very ingenious system of forced draft. Steam is taken from the boiler through the pipe 2 to operate an ordinary damper regulator 3 which controls a damper lever in the usual way, thus shutting off the natural draft when the required pressure of steam is secured, and at the same time holding the heated gases in contact with the boiler until the pressure falls enough to open the damper, which is usually about 1 lb. As long as the damper is closed, steam is shut off from the blower, but when the lever 4 is operated by means of the small chain 5, the balanced valve 6 is also opened and admits steam to the blower 7. The steam passes through the pipes shown, which are located in the combustion chamber, and also the superheater 8, and the blast is delivered through the bridge-wall into the ash pit. An improved shaking grate completes the installation, and this enables the fireman to clean the fire without opening the furnace doors. It is claimed that less than 3 per cent of the steam generated is used to operate the blower, owing to the automatic regulation, which prevents a wasteful use of steam and controls the escape of heat to the chimney. This constitutes in reality a balanced draft system, for if a handker

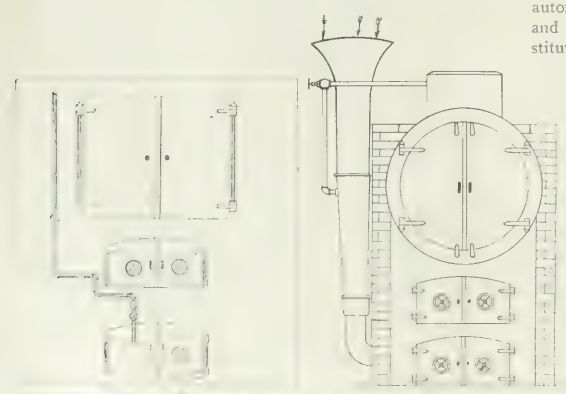


FIG. 8.—ARRANGEMENT OF STEAM JET CONNECTIONS

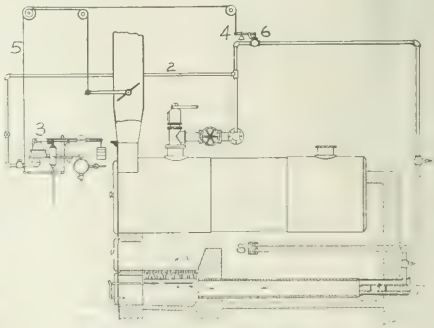


FIG. 9.—SYSTEM OF FORCED DRAFT.

the saving made by the adoption of forced draft is as great as its advocates claim, when the daily consumption of fuel is alone considered, it is sufficient to warrant its introduction to places where it has never been used before. It is not necessary to lay special stress on the claim that the first cost of installation is much less.

In order to be on the safe side new plants should be built to use natural draft for making steam, then if it becomes

chief is held before the furnace doors it will neither be drawn into the furnace nor blown out by escaping gases and presents ideal conditions so far as preserving boilers from the effects of unequal contraction are concerned, due to drafts of cold air rushing into the furnace when the fire is replenished. If the consumption of steam does not exceed the percentage above named, it is not an expensive method, but such economy cannot be secured by ordinary home-made apparatus.

LETTERS ON PRACTICAL SUBJECTS

REVOLVING ELECTRIC SIGNS.

Some of the most striking and attention-arresting electric signs are those which make free use of the commutator or controller for periodically lighting and extinguishing sign lamps. True, the effect may be made very striking, but it is expensive as well. This is particularly the case when the work must be done at considerable speed, and the commutator revolves at a comparatively high rate of speed. Signs are occasionally seen which produce very striking effects of periodic light and darkness without the use of single make or break contact. This effect may be easily produced by mounting the entire sign, or a portion of it, upon pivots, journals or trunnions, and then revolving the mounted portion by means of gearing and a small electric motor, which could be operated by the same energy which lights the sign lamps. The effect of a sign or a portion of a sign, while slowly revolving, is very striking. An ordinary rectangular sign placed horizontally and revolved upon vertical pivots forms a sign which compels attention from one end of its cycle to the other. True, a sign of this kind requires considerable room, but the space necessary may be greatly lessened by placing the axis horizontally and revolving the sign vertically. Indeed, a sign may be arranged in this manner which will revolve most of the time without a motor or any other driving apparatus. The principle of such a sign is the double curved sign now commonly used by barbers. This little striped sign revolves as long as the wind blows and the addition of a few glow lamps and a contact ring and brushes produces one of the most startling signs yet placed before the public. The wind does all the revolving necessary, thus relieving the user of the cost of a motor. This, of course, is bad for the central station, but it will sometimes enable a sign installation to be made where the use and expense of a motor would not be considered. Two or more signs revolving in the same frame, perhaps in different directions and at various rates of speed, form a sign which will compel the attention of the most stolid. When the wind is not blowing, a reliable standing sign is displayed, but when the wind blows good and hard then there is certainly an interesting electric sign to attract the attention of the public.

WILLOUGHBY, OHIO. JAMES F. HOBART

EFFECT OF SMALL CHIMNEYS.

Many of the small lighting and power plants built years ago with no thought or expectation of greatly increased load, have added to their generating equipment and, in some instances, to their boiler equipment also, without taking the chimney into consideration, and when everything was supposedly provided for, the engineer wonders why steam cannot be kept up to meet the demand of the engines. The writer has found this condition to exist in many small plants where small boilers were replaced by larger boilers and where in consequence of the change the chimney was no longer large enough. The writer has a case in mind where a well-constructed brick stack was built for two 60-hp boilers. Each of the boilers had 62 3-in. tubes, or a tube area of approximately 377 sq. in. It should be evident that the stack must have as much area as the boiler tubes if the heat in the stack were the same as that in the boiler. The heat in the stack, however, is less than that in the boiler, so that the area of the stack could be slightly less than the aggregate area of the tubes if the two were in a vertical position. The writer has found in practice that the area of the stack should be at least 10 per cent more than the area of the flues, so that unless the area of the stack is equal to that of the flues, the boilers might just as well be operated with some of the tubes plugged up. The stack in question was built square with an opening 23 in. x 24 in. No doubt the opening was intended to be 2 ft. square, but the bricklayer made a mistake, so that the actual area of the chimney section was 552 sq. in. The area of the flues of one of the boilers was 377 sq. in. and there being two boilers, the aggregate area of all the flues was 754 sq. in., whereas the area of the stack was less than this. The stack was well built and had walls thick enough to permit an opening 28 in. square; but it was another of those engineering blunders that one finds as a monument to the engineer who did the work. When determining the proper height of the stack, the surroundings must be taken into consideration. A 50-ft. stack surrounded by tall buildings will not draw as well as a stack of the same height standing free in the open. The stack under consideration was 50 ft. high and if one refers to the regular table on stack capacities he will find that a stack with a height of 50 ft. and with a side of 24 in. is rated at 65 hp, assuming 1 hp as equal to 5 lb. of coal burned per hour. The stack in question was slightly smaller than this, so that in reality it was only large enough for a single boiler. This plant operated thus for years with two boilers under fire the greater part of the time, and as a result the combustion was poor and the steam generated low compared with the flue consumption caused by poor combustion and clogged flues. When it was found necessary to add more boilers, the conditions became worse. Two boilers which were capable of generating 200 hp on a low rating were installed before it was discovered that the stack was too small. Reference to a chimney table showed that it required a stack 90 ft. high and with a square side of 35 in. The old stack was torn down and a new one erected. Many other plants are operating under just the conditions of the plant cited, with poor draft, poor combustion and big losses. In the plant cited, after the change was made in the chimney, it was found that nearly 1 ton less of coal was burned on the night run, and at this rate it did not take long before the cost of the new stack was offset by the saving effected in fuel cost.

LYNCHBURG, VA. C. R. MCGAHEY

KEEPING BELTS ON PULLEYS.

Sometimes belts are very perverse in their action, running to one side or the other of a pulley, seemingly without any reason whatever for so doing. But whenever such action takes place, on one pulley or on both, there is some very good reason for such action on the part of the belt. The writer saw a belt running nearly 2 in. off one side of a generator pulley, and the attendant had tried all manner of ways without avail for bringing the belt to track fair upon the generator pulley. The generator had been twisted around as far as it could go, nearly 2 in., and it had even been moved sideways. The driving pulley had been moved along on the shaft, but nothing seemed to cure the difficulty.

The attendant said that the belt had never run fair on that pulley, but since a new leather belt had been procurred the trouble was a great deal worse than before. Careful calipering did not reveal any difference in diameter between the edges of the pulley-face. The pulley seemed to be crowded a sufficient amount, and the attendant was at sea as to what was the matter with the pulley. After removing the pulley and replacing it in the opposite position from which it had been run upon the shaft, the belt just as promptly ran off one edge of the pulley, but it was on the other side from which it ran before. In other words, the belt always ran off the same side or edge of the pulley no matter which way that edge chanced to be faced. This proved beyond all doubt that the trouble was in the pulley and nowhere else.

That it was in the pulley was proved by removing the pulley again and placing it on a smooth, flat surface in such a position that the hub of the pulley was vertical.. Then, a common steel square, such as is used by the carpenter, was placed against the pulley, the blade of the square bearing on the true surface. Two chalk marks were made on the square, one at the edge of the pulley; the other mark was made as close to the center of the crown as could be determined. The pulley was 10-in. face, and when the marks were looked over it was found that the crown mark was nearly 1 in. from the center of the

pulley-face. The center of the belt always tries to run to the center of the crown, and that being out of center, caused the belt to run off that side or edge of the pulley which is closest to the crown-line. The proper remedy for a pulley defect of this character is to send it to a machine shop and have the crown brought to the center of the pulley-face. In this case it was not possible to spare the pulley long enough to permit a machine-shop operation, so some other method had to be followed, and it was decided to send for another pulley so as to have a duplicate at hand in case of breakage; then, when the new pulley arrived, the old one was to be turned off as found necessary. Meanwhile a scheme was devised whereby the belt could be brought back upon the center of the pulley and kept there.

The pulley was "lagged" until the crown was in the center of the face. The material required was some strips of cloth or thick paper. Some 10-oz. canvas was at hand, so that was used after being cut into narrow strips about 1 in. wide. Some common resin and a little machine oil were the other ingredients necessary. The resin was melted in a babbitt ladle. A litttle machine oil was squirted in and well stirred to mix thoroughly. Then a little of the mixture was removed upon a stick and allowed to cool. If it proved too soft or too hard more resin or more oil was added as was needed to bring the mixture to the most sticky condition imaginable.

After the resin and oil had been mixed to suit, it formed a sort of wax well known to all paper-mill workers as "lagging wax." It was kept warm when in use, so warm that the wax was soft like molasses. The belt was left on the pulley and a little wax was spread on one side of a strip of canvas. Then the strip was laid on the inside of the belt, waxed side up, and carefully wound around the pulley in such a position as to build up the diameter of the pulley in the middle of its face. Strips of canvas were wound on until the belt ran true with both edges of the pulley-face. It was found necessary to wind on only two strips of canvas in this case before the belt ran as true as could be desired. This lagging was allowed to run until it wore off, which required nearly nine months' daily running. Then the new pulley was put on and the old one trued up in a lathe, when that, too, ran all right.

Buffalo, N. Y. John Jackson.

THE BREAKING OF STEAM PIPES.

A steam-pipe accident recently came to the notice of the writer in which the pipe simply broke from its own weight while hanging suspended from overhead hangers. The pipe was 1 in. in diameter and there was about 20 ft. between supports. This distance was too great, it must be admitted, but even with lesser distances the strain upon pipes at the junction with fittings is not comprehended or even understood by many engine tenders. A 1-in. pipe 12 in. long weighs 1.67 lb. and its diameter at the bottom of the threads is about 1.25 in. The strain upon the metal at the point of contact between pipe and fitting may be roughly taken as $1.67 \times 6 + 1.25 = 8$ lb. Thus a pipe fixed at one end (unsupported at the other end) must carry a strain of 8 lb. at the roots of the thread.

When a piece of pipe is 10 ft. long and is suspended as above, the strain upon the metal is apparently 10 times that amount (8 lb.) for the single foot which is 10 ft. away from the fitting, but this is not true. The center of the tenth foot is 114 in. distant from the fitting, hence the 1.67 lb. of pipe has a leverage of 114 against 1.25, and its moment at the fitting would be $1.67 \times 114 \div 1.25 = 152.3$ lb. In like manner, the ninth foot, also the eighth and all the other feet, may be separately calculated and their several moments added together to obtain the total strain upon the pipe at the bottom of the threads close to the fitting.

The stress due to the first length of pipe was 8.016 lb., approximately. The sum of the stresses on the first and tenth feet is $152.3 + 8.016 = 160.316$, taking one-half this for an average load on each foot of pipe, from 1 to 10, which is found to be $160.316 \div 2 = 80.158$. Therefore, the 80 lb. is the average load or moment caused by the weight of each foot of pipe. To obtain the total load on the metal at the fitting, the average load must be multiplied by the length of the pipe in feet, 10, hence the total load which must be carried at the junction of pipe and fitting is $80.158 \times 10 = 801.58$ lb. stress upon the metal.

Taking the stress above calculated as 800 lb., in round numbers, the reason why the pipe breaks under that stress, which does not seem great to be carried by the metal, may be sought. But by a little thought it is found that the 800-lb. stress is not on each square inch of the metal. Instead, it is only upon whatever fibers of metal chance to be exactly 0.625 in. from the center of the pipe on the top side thereof. In other words, the 800 lb. represents extreme fiber stress to which the pipe metal may be subjected under the conditions noted above. Thus, once the average weight of 1 ft. of pipe has been computed and the fiber stress which may be caused by the given weight of pipe calculated, the stress caused by 1 ft. must be multiplied by the square of the length of the pipe (not by its length alone) in order to ascertain the total amount of strain caused at the junction of pipe and fitting by the unsupported weight of the length of pipe.

As the extreme fiber stress in steel should not exceed 12,000 lb. to 15,000 lb. to the square inch of cross-section, it is easily understood why this pipe broke under its own weight. It is obvious that the extreme fiber stress would be greater as the diameter of the pipe decreased, weight and length remaining the same. Therefore, were the outer fibers to break under the strain, the inner fibers would be subjected to a greater load and would break in their turn as soon as the outermost fibers failed and allowed the entire load to fall upon the inner fibers. Perhaps there is a section of pipe metal ½ in. x 1/16 in. which must carry the 800-lb. fiber stress. This amount is only 1/32 sq. in. of section, and, if loaded with 800-lb. stress, it would be equivalent to 25,600 lb. to the inch, extreme fiber stress. As the metal should only carry 12,000 lb. to 15,000 lb., as stated, it is not to be wondered at that the pipe broke under its own weight.

New York City. James Francis.

ELECTROLYSIS OF WATER PIPES AND RAILS.

Having had considerable trouble in a recent case of electrolysis of water piping, and finding very little to help me in the way of information on the subject in books or journals, I am sending an account of causes and cure and what information I could gather from engineers having had the same or similar troubles. It appears that the conditions in any two places may vary quite considerably as to voltage drop and current flow. A current of 5 amp flowing from ordinary piping to rails will materially weaken the piping in the course of one year, and a voltage drop of 6 volts is considered quite bad; all damage being done to the piece from which the current flows, due to the decomposition of earth salts at that point. In the case of one city in northern Pennsylvania the Council called for an investigation, which showed that, at various parts of the town, there was a current flow from the rails to the water pipes or from the pipes to the rails, varying from 0 to 30 amp. A bond was then made from piping to rail through an ammeter near the power house and readings here showed from 0 to 150 amp flowing, while at other points in the town which had previously shown current flowing, there was now no flow, indicating that the connection at the power house relieved the pipe lines, preventing further electrolysis. In the case of a city in North Carolina, tests showed a flow of current indicated by voltage drop of from 15 to 25 volts, which was corrected by careful bond testing and repairing. In addition, 500 circ. mil wire was laid from the busbars to points showing excessive leakage in the tests, which stopped all leakage.

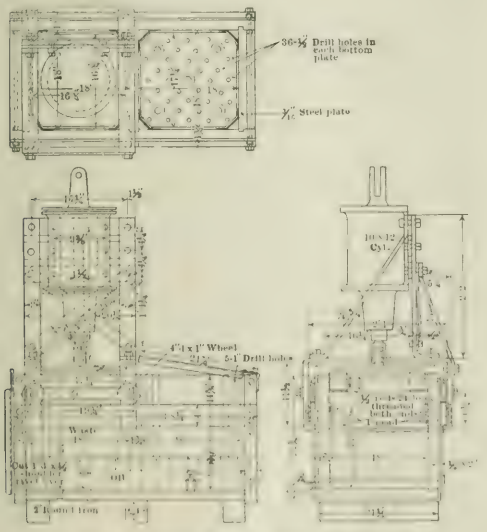
In another instance under personal attention, tests were made at various points in the town, showing current flows of from 0 to 60 amp in each direction, according to locality. Salts in earth at this place are very injurious, having eaten entirely through a No. 00 copper wire in the course of two years. Connection was made through 500 circ. mil wire from

water lines in power house to busbars and the tests on the outside were repeated showing practical elimination of the flow from pipes to rails. A careful rebonding of the rails eliminated all the trouble. An interesting phenomenon was the action due to the relative position of cars to test points. In some cases it made very little difference where the cars were, while in other places the intensity of the current increased as the cars approached, and in some cases reversed the direction after the car had passed. The writer would suggest as a remedy for all cases of electrolysis of piping, that generous connection be made from the pipes to busbars at power house as the quickest way of preventing troubles with water companies and consumers. This would doubtless prevent any electrolysis of the pipes but would not protect the rails, which must be kept carefully bonded, especially at all soft or marshy places.

BRADFORD, PA. H. E. HASTINGS.

TANK FOR RECLAIMING OIL AND WASTE.

In power-house operation the item of oil and waste, while not so large as some of the other items which appear in the expense sheet, is nevertheless heavy enough in large power houses to make the recovery of oil and waste desirable. The writer noticed in the shops of one of the large Eastern railway companies an oil press operated by air pressure and a waste tank which were utilized for this purpose. The accompanying illustration shows the details of the equipment. The tank into which the waste is thrown after being used is divided into two 18-in. x 18-in. sections, a 1¾-in. block extending nearly to the bottom. These sections are divided in turn horizontally by trays carried high enough to leave an oil chamber about 6 in. deep. The trays are made of steel plate ⅜ in. thick to withstand the pressure exerted from a 50-lb. air line and 36 ½-in. holes in the bottom of the tray permit the oil to pass through.



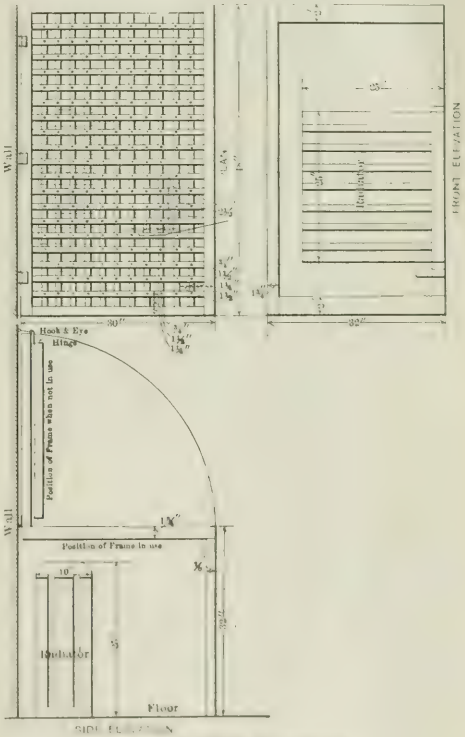
PNEUMATIC OIL PRESS FOR RECLAIMING WASTE AND OIL.

For utilizing the compressed air an old 10-in. x 12-in. cylinder and piston attached to a 17¾-in. x 17¾-in. x ⅝-in. plate bearing on the waste are provided. The braced framework on which this apparatus is carried is mounted on wheels so that it can be rolled from one chamber to the other by means of a track along the top of the tank. In operation it is customary to fill one compartment with oily waste and then allow the press to work while the other compartment is being filled. When the first lot has been squeezed dry, the press is shifted to the other chamber where it repeats the process. In the meantime, the waste in the first chamber is teased and the unglazed portions returned to stock after the dirt in them is taken out. The reclaimed oil is drawn off from time to time through only one faucet, thus accounting for the space left between the base of the tank and the bottom of the division block. The tank is provided with two hinged tops, so that one chamber can be kept under cover while the other is under the press. The construction of the tank permits the easy removal of the trays whenever cleaning is necessary.

BROOKLYN, N. Y. PATRICK COLLINS.

BLUE-PRINT FRAME.

In blue-print work it is very desirable to have some means for drying the prints rapidly. In winter it is an easy matter to use the radiator for drying purposes; but the chances are that the blue-print frame will warp. In the pent house on the roof of the Milk Street headquarters of a Boston railway there is in use an interesting blue-print drying frame designed by a member of the engineering department of the company. This device was built to prevent warping when wet prints are laid upon it over a steam radiator on which the prints are dried when exigencies so dictate. The sketch herewith shows the make-up of the frame, which is made of white pine, halved and screwed at intersections, and is designed to fold up against



FRAME FOR DRYING BLUE-PRINTS.

the wall when not in use. The openings in the lattice work enable the heat to be applied efficiently to the damp or wet prints and the frame can be made easily and at trifling cost.

BOSTON, MASS. H. DURING.

HIGHWAY SIGNAL SYSTEM FOR RAILWAYS

The accompanying illustrations show the wiring diagram of signal circuits and other details of construction, including the design of a contact-making trolley hanger which serves to feed energy to the signals direct from the trolley wire, of an inter-

esting signaling system for the intersection of highways and railway lines. Six 10-cp lamps and a 10-in. gong are connected in series with a signal wire paralleling the trolley wire. The former is a single iron wire carried on the trolley poles for about 1300 ft. approaching a crossing. The signal system has

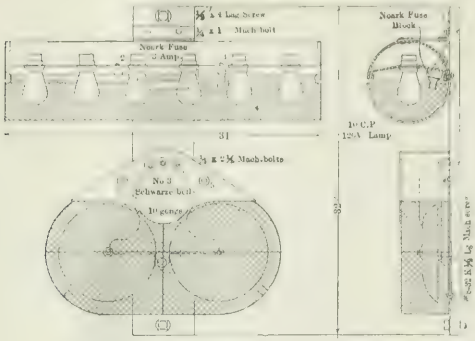


FIG. 1.—DETAILS OF LAMPS AND BELL.

been erected on double-track lines of the Twin City Rapid Transit Company and its operation is very simple, since contacts need be made only as the cars are approaching the intersection between the highway and the track. The contacts, which permit energy to pass from the trolley wire to the signal wire lighting the lamps and operating the bell while a car is approaching a crossing, are made in the form of signal trolley hangers. The hanger, as shown in the illustration, comprises an 18-in. stick of maple 1⅜ in. square in section. It is thoroughly boiled in paraffin, and trolley ears are fastened to the ends of this stick. The wood supporting the trolley ears is hung from the span wire by means of two bronze springs, which are assembled under tension and which, when the trolley wire is lifted by the passage of the trolley pole and wheel, permit of contact points fastened on the hanger stick to rise and make connection with brass contact plates connected with the trolley hangers. The contact points are connected to the signal wire, and the hangers are used to support the trolley at each span of the approach. Their springs are so adjusted that when a car is between two spans both adjacent hangers make contact and, therefore, there is no actual break in the circuit through the hangers to the signal wire from the time a car passes onto the first signal span until it passes the crossing. The process of making connections is simply a transfer of contacts from one signal hanger to the other with the arcing taking place only at the last hanger, that located nearest the signal bell. Such a simple arrangement for feeding energy to a crossing bell has an advantage over some other types of crossing signals in that no matter how many cars may approach the crossing the bell will continue ringing as long as there is one car under the trolley wire supported by the signal hangers. The lamps at the top of the signal post are enclosed, as shown in the engraving, in a sheet-steel hood bolted to the post. The lamps and gong are connected in series, so that not only the attention of a highway traveler may be attracted, but so the motorman on an approaching car may know that the gong is ringing if he sees the lamps burning.

MILWAUKEE, WIS. HERBERT COWING.

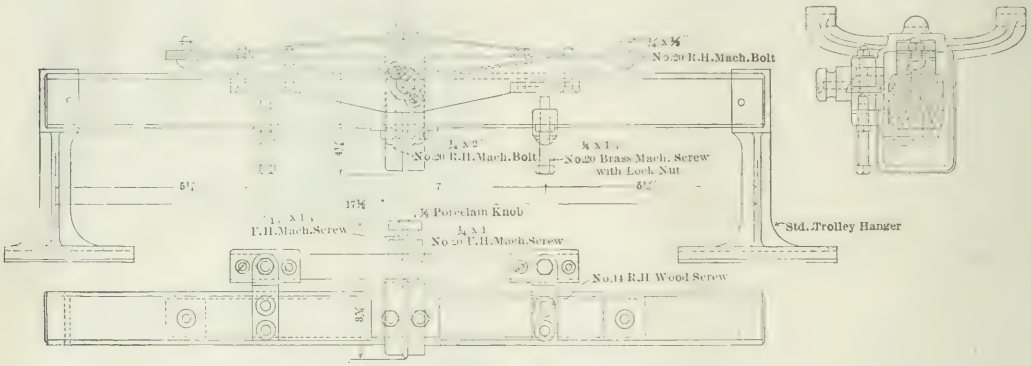


FIG. 2.—DETAILS OF TROLLEY-OPERATED CONTACT-MAKING HANGERS

WIRING OLD RESIDENCES.

There have recently appeared in your columns some interesting articles on securing business in old residences. The writer recently took charge of a plant in a small city where the lighting company did not do any wiring. The contractors were charging exorbitant prices and simply demolishing a house to wire it; consequently the lighting business suffered. We made a 30-day offer to wire residences for the cost of material, doing the labor gratis, and assured the property owners that wiring could be installed without damaging decorations. The result was that we were overwhelmed with applicants and secured a great many new customers, connecting over 500 lamps, which to a small central station is a very nice additional load. By charging the ordinary retail price for material we came out about even on the labor, the customers were pleased and we obtained the business. In the ordinary frame residence, which is common to all small cities, pine floors prevail. This makes it easy to install knob and tube work by removing one board or by pocketing and fishing; but where wires are fished they must be protected by flexible conduit. Wall outlets and switch loops can be easily fished. In this way a job can be brought up to requirements and is quite cheap for an old house. A bit with a 4-ft. shank welded on will greatly facilitate the installation of this class of work.

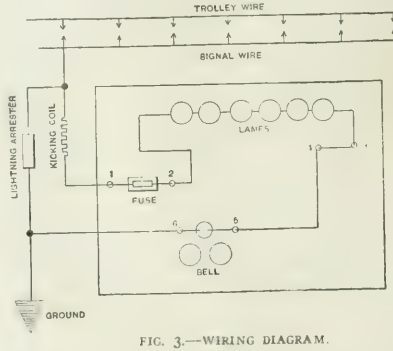


FIG. 3.—WIRING DIAGRAM.

OZARK, ARK. G. C. ABRAMS.

QUESTIONS AND ANSWERS

What would be the proper size of transformer for a load of 90 incandescent lamps of 32 cp? At the present time there is a 38-kw transformer with 1100-volt primary and a secondary winding, giving 6.6 amp feeding this circuit. D. S. B.

A 10-kw transformer will carry the load specified.

Will you kindly inform me what causes the singing noise in a motor or generator? My opinion is that it is due to the friction of the surrounding air and I would like to know if I am correct. H. A. S.

The friction of the surrounding air is responsible for some of the noise. Changes in magnetic conditions and vibration also add much to the hum. See answer to R. K. below.

Kindly advise me upon what principle overload circuit-breakers of high ampere capacity and without magnet coil operate? I suppose that the current carrying studs and laminated bridge in some way act as a coil. C. H. B.

In a circuit-breaker of 1000 amp and over, no coil is necessary as the main current in passing through the circuit-breaker passes around a magnetic circuit and one turn at 1000 amp gives 1000 amp-turns.

Why does a shunt-wound motor speed up when the field circuit is opened? A. T. I.

If the field circuit of a shunt-wound motor is opened while the armature is connected to the line, the armature will take an excessive current because it has a low value of magnetic field and cannot generate the necessary counter e.m.f. that limits the current under ordinary working conditions. Violent flashing and a burned commutator usually follow such procedure.

In hunting for troubles in direct-current motors, where should one begin in order not to waste too much time? L. C. C.

The weakest part of a direct-current motor is the commutator, and if this is watched, together with the brush holders, nearly all ordinary faults can be detected. Open circuits are shown by burning or arcing at the end of the commutator. Field circuit trouble is generally shown by a severe arcing on the brush holders, and the commutator has a burned or blackened appearance.

Kindly give me the answers to the following questions: What is the temperature of the glower of a Nernst lamp? What is the temperature of the filament of a tungsten lamp? What is the temperature of the filament of the carbon lamp? What is the temperature of the electric arc? What is the temperature of the mercury vapor arc? R. S.

The temperature of the Nernst glower is stated to be between 2200 deg. C. and 2450 deg. C. The temperature of the filament of the tungsten lamp is approximately 1850 deg. C. The carbon filament of the ordinary incandescent lamp has a temperature about 1660 deg. C. The arc between the two electrodes of the open arc lamp has a temperature of 3500 deg. C. The temperature of the mercury vapor lamp varies. In one case the figures given are as follows: Temperature at the anode, 148 deg. C.; temperature at the cathode, 164 deg. C., and the temperature midway between the cathode and anode is stated to be 164 deg. C. The data given are, of course, only approximate and for ordinary conditions of operation.

Will a set of wet cells operate a gas engine ignition system as satisfactorily as dry cells? I have eight ordinary carbon-zinc wet cells connected to a gas engine coil which is marked 6 volts. The engine will not run on these cells, although I have known other engines to run on such batteries. The engine runs satisfactorily on four dry cells, which give a much better spark. How can I get the wet cells to operate? A. E. H.

Generally speaking wet cells are better and more reliable than dry cells. The lower cost and portability of the dry cell, however, render it better for certain classes of service than the wet cell. The probabilities are that the porous cups or carbons in the wet cells are worthless. Immerse the cups or carbons in boiling water for about one-half hour and then let them dry well. If after this treatment the battery does not work when the carbon is inserted in the sal-ammoniac solution, the probabilities are that new carbons are required, provided that fresh sal-ammoniac solution and good amalgamated zincs are used. There is a feeling among users of wet batteries that the solution and the zincs only require replenishing and that the carbons last indefinitely and require no attention. Such is not the case.

Will you kindly suggest a remedy for a 110-volt, bipolar, shunt-wound dynamo which fails to build up? I have tried reversing the field terminals and every other connection I can think of. The machine has not been run for over a year, but I do not imagine that there is any serious trouble with it, for it will generate readily when its field coils are excited with energy from another machine. C. A. F.

The usual causes for such action on the part of a generator are as follows: Residual magnetism too weak or destroyed; reversed connections or reversed direction of rotation; short circuit in the machine or in the external circuit; field coils opposed to each other; open circuit; brushes not in proper position. A short circuit in the external circuit will keep a shunt-wound dynamo from building up its field magnetism until the external circuit is opened. Slight short circuits within the machine may bring about the result mentioned. Two many lamps or other load might also cause the defect, in which case the load should be disconnected in starting. The fact that the dynamo operates satisfactorily when its coils are energized from an external circuit indicates that the connections are not reversed and that the magnetism is too weak. Place a voltmeter first across the external source and then across the armature, taking the corresponding readings; the latter reading should exceed the former. If this is not the case, test for all the causes mentioned.

Is it advisable to bank a 5-kw, single-phase transformer with a 10-kw transformer or a 2-kw transformer on a 2300-volt primary circuit with 110-volt secondary circuit or should only transformers of the same size be operated in parallel? H., L. & P. Co.

Transformers of different sizes may or may not operate satisfactorily in parallel. The prime requisite is that the total series impedance of one shall be to the total series impedance of the other inversely as the rating of one is to the rating of the other. In this case the currents of the two transformers will be in correct proportion. However, even in this event, unless the ratio of the resistance of one transformer to the reactance of that transformer is the same as the equivalent ratio in the other transformer, the arithmetical sum of the currents in the two transformers will be slightly greater than the total load current. We have published some excellent articles on this subject in the weekly editions, two articles appearing in the issue dated Nov. 21, 1908.

In an article, "Magnetic Variations and Dead Points in Motors," there appears an expression, $\frac{1}{n(n+1)} \times$ pole pitch. I would appreciate any information as to what can be judged from the result of this expression. R. K.

If the slot pitch of the rotor of an induction motor was such that there were $n+1$ teeth and slots under a field pole at any instant, and if there were n stator teeth and slots per pole, the proper conditions would exist to give minimum change in magnetic reluctance with different rotor positions, provided n represents an integer. If the quotients of pole pitch divided by slot pitch of stator and rotor bear any other ratio than that shown, the magnetic variations will increase and consequently the magnetic vibrations and noise will increase. This may be shown by an example: Suppose the pole pitch is 10 in., primary slot pitch 1 in., and secondary slot pitch 0.9 in. Then the distance the rotor will move in passing from a position of initial reluctance to the next successive position of equal reluctance is $\frac{1}{10 \times 11} \times 10 = 1/11$ in. If the secondary slot pitch is slightly smaller, say, 0.825 in., the number of teeth and slots under a pole will be 12 and the distance between positions of equal reluctance will be $\left(\frac{1}{10} - \frac{1}{12}\right) \times 10 = 1/6$ in., or nearly twice the distance obtained with the first assumptions. An inspection of the equation also shows that as the value of n is increased the variations in reluctance will decrease. There is, therefore, a tendency for a machine which has a comparatively small number of teeth per pole to make more noise than one having a larger number.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Some Experiments on Electric Cooking.

In a Chicago family, where there is a complete set of electric cooking apparatus, some experiments have been made to determine the monthly consumption of electrical energy where all of the cooking was not done electrically, but where a combination of two methods was used. These experiments were made by a central-station man to determine the probable monthly energy consumption if electric cooking were introduced as an auxiliary to other methods, as it would be in the large majority of cases.

In one of these tests an attempt was made to imitate conditions as they would be in a family where a coal range is used for heavy baking. All light ordinary cooking not needing an oven was done by electricity. There were four to five persons in the household. This resulted as follows:

Total kw-hours for 30 days	77.2
Person meals	398
Kw-hours per person meal	0.194
Maximum demand	19 amp.

Previous tests in the same family showed that from 105 to 120 kw-hours would ordinarily be used per month to do all the cooking electrically, hot water being supplied by other methods. This test indicates what a large proportion of the total energy used for exclusive electric cooking goes into the oven, and indicates the desirability of effecting more efficient methods of baking, utilizing the fireless cooker principle of heat insulation.

Another experiment, lasting 38 days, was made to determine the amount of current used by the electric iron, chafing dish and coffee percolator in the same family. In this family it has been the custom ever since electric cooking apparatus was installed to make considerable use of the chafing dish, as it is found to be one of the most convenient electric cooking utensils. Besides the regular chafing dish uses (as it was of the Simplex type), the chafing dish could be removed and the plain stove top was frequently used for making toast. The consumption of the iron, chafing dish and coffee percolator was found to be at the rate of 20 kw-hours per month. This figure is of considerable interest because it indicates what can be done in many houses without a special cooking circuit.

Influence of Rates on Central-Station Residence Business.

Before a recent meeting of the British Institution of Electrical Engineers, Mr. W. R. Cooper presented a paper entitled "Domestic Electricity Supply (Including Heating and Cooking) as Affected by Tariffs," in which he discussed present systems of central-station rates and suggested a system differing from any of these. The paper opens with the following statements:

I.—Almost all existing tariffs have discouraged the use of electric energy for domestic power purposes because they were devised primarily for consumers requiring light. The maximum-demand system, though excellent in theory, is now harmful; and the combination of a flat rate therewith is not satisfactory because it involves duplicate wiring.

II.—The load on any station must consist of a lighting load superimposed on a power load, and no tariff will eliminate the peak due to the former. But by encouraging the domestic power load through suitable tariffs the lighting peak may become much less important relatively.

III.—For the purpose of devising tariffs the load may be divided into the power load (including some lighting), which is more or less uniform for a great part of the day, and the lighting load, consisting of the familiar peak. The charges peculiar to this peak load must be met by a yearly payment, or special rate, the rate per unit being otherwise small. Consideration of tariffs based on ratable values, on two-rate meters and on the "wattage" of lamps installed, favor the latter.

IV.—Taking into account the special circumstances of domestic supply it is estimated that the flat-rate part of the tariff might be fixed profitably at ¾d. to 1d. per unit for consumers taking energy for lighting.

V.—Although the prospect of heating houses entirely by electrical energy is remote, electric heating must be regarded as a very promising auxiliary to other methods. Electric cooking is handicapped by the cost of heating water electrically. Its special advantages should, however, ensure its extended use as an auxiliary method.

The subject is then discussed under the heads of existing tariffs; essentials of a satisfactory tariff; possible tariffs; limits for the flat-rate part of the tariff; the economic aspect of heating and cooking. The conclusions of the paper are as follows:

1. The use of any tariff involving a maximum demand, or duplicate wiring, is inherently adverse to the use of electric power for domestic purposes.

2. A simple flat rate is inadmissible.

3. The tariff should require payment of a fixed sum per annum, based on the total "wattage" of the lamps installed plus a low payment per unit used.

4. The latter payment should not exceed 1d. per unit, and may frequently be, say ¾d., owing to the special circumstances of the case.

5. Such a tariff would greatly encourage electric heating as an auxiliary to other methods.

6. Although electric cooking cannot be expected to displace cooking by coal, it should take an important position, equal or superior to that of gas cooking at the present time, if the price per unit does not exceed 1d.

7. The load factor of stations supplying only a lighting load would be materially improved.

8. The load so obtainable is highly important to stations at present dependent almost exclusively on lighting, and should receive very careful attention at the present time as affording an antidote to any diminution of the output due to the use of metallic-filament lamps, and to possible legislation as to the greater utilization of daylight.

Central-Station Notes from Fairbury, Neb.

The Fairbury Light & Water Company, of Fairbury, Neb., has a combined waterworks and electric light plant which is a good example of a well-managed undertaking of this kind which has paid steady dividends for a number of years past, the regular dividend rate being 8 per cent.

The electric generating capacity of the plant is 260 kw in three units. The smallest of these is a 35-kw, 1100-volt, single-phase, 60-cycle Wood alternator, belted to a condensing Corliss engine. This is operated to carry the all-day load. Another simple condensing Corliss engine drives a 75-kw Westinghouse revolving-field alternator, and a tandem-compound condensing engine drives a 150-kw Wood alternator. Condensing water is obtained from a river near by. The water supply for the waterworks is obtained from wells near the plant and from a spring some distance away, which is piped to the plant. All of the pumping is done by steam.

The boiler equipment consists of one upright boiler, made by Vincent Kenney, of Omaha, of 250-hp capacity and two horizontal return flue boilers, rated at 75 hp each. The coal used is Kansas lump, costing $4 a ton. The high price of coal accounts for the use of condensers throughout in such a small plant, which is unusual where coal is cheap.

Some consideration is being given to the installation of an

electric pump to pump water during light-load periods, as the steam pumps are not very economical in their present condition, and it is thought that coal might be saved by carrying both water pumping and electric power loads from a single condensing Corliss engine through the medium of an electric motor.

The station is located in a good brick building which is now becoming somewhat crowded. One condenser pump takes care of all the Corliss engines and waterworks pumps. The regular routine is to operate the large upright boiler most of the time. On Sunday nights the smaller boilers may be started. The belts of the plant are in remarkably fine shape, and have a record rarely equaled. One 20-in. double leather belt has been in operation 15 years, and at the present time looks almost like new. "Cling surface" has been used on these belts.

The plant is operated in eight-hour shifts, one man to a shift. There is also a chief engineer, who does not take a shift. The employees of the plant consist of one manager, three firemen to operate the three shifts, one chief engineer and three wiremen. The company does wiring of buildings. The total number of employees is therefore eight.

The company has made a remarkable record in the rapid introduction of single-phase motor service. Day service was begun in May, 1908. By October 74 hp in motors, ranging in capacity from 3 hp to 15 hp, had been connected. The motor business by October was bringing in gross revenue of $150 per month. The day load was in the neighborhood of 37 amp at 1100 volts, single-phase.

The rates for residences are 17 cents per kw-hour, with $1 minimum bill. The commercial rates are somewhat mixed. The company operates 35 street arc lamps, 6.6-amp, series alternating current, for which it receives $93.60 per lamp per year. The peak load in December, 1907, was 150 amp at 1100 volts. By September, 1908, the peak had reached an equal figure. Many tungsten lamps are to be seen around the business district, but there is the general short-sighted inclination of consumers to use these lamps bare without proper diffusing and reflecting equipment.

The annual electric earnings of the plant are about 23 per cent, and the water earnings about 13 per cent of the total permanent investment, making the total gross annual earnings about 36 per cent of the investment. About 60 electric irons have been introduced. The company is under the management of Mr. R. D. Russell, vice-president.

Introducing Household Electrical Appliances.

BY J. O. LITTLE.

In introducing household electrical appliances, naturally the line of argument is quite different from that which may be found quite effective with respect to industrial application of electricity. The manufacturer who considers electric drive in comparison with mechanical drive reasons from an entirely different viewpoint than the housekeeper who is considering a washing-machine or sewing-machine motor. He has always had to pay for power; she has never had any power bills, only bills for labor, and she is slow about making a direct comparison. He is seeking economy of production and figures on that basis. He learns that the motor means greater convenience, greater cleanliness, economy of floor space, less waste of finished product, greater flexibility, increase in output, etc. He reduces all these to one item, the cost of power per unit of output, and draws his comparison.

The housekeeper, on the other hand, if she has always done her own washing and ironing and sewing, fails to give due consideration to the value of her own time; if she has always hired the work done, she concludes that she couldn't get along without hired help anyhow and that these articles would mean an unnecessary expense. Take the case of the woman who has always done her own work. She has two distinct aims: one to accomplish her household duties regularly, the other to have some time left in which to take recreation, either in pleasure in the common acceptance of the term, or in church or charitable work, with which pleasure is intermingled. She may take pleasure in her regular household duties, but it is only the pleasure that comes from doing one's duty. She draws a distinct line between this and the pleasure that she looks forward to as something to afford her a change of atmosphere. However frugal she may be, she always saves a little pin money to spend for pleasure. She may spend this in various ways, but a certain portion usually goes for downright pleasure. She works hard and what she needs and is entitled to is relaxation of mind and body. If the work were less hard she would need less relaxation. If she could stay at home and rest all morning, she wouldn't care much whether she went to the bargain matinée or not.

Now, right here is where the electrical appliances come in, and specific arguments to that effect are not difficult to formulate. She can lighten her work by their use, and a very little of the money that would otherwise go for relaxation will foot the bill for current. Less than the price of a glass of soda water will save her all the fatigue of a day's sewing; the price of the cheapest seat at a bargain matinée or the difference in price between the best and next best seat at a regular performance will more than buy enough current to do the entire washing and ironing.

It is a question for the housekeeper to decide whether it is better to lighten the domestic load and have a little less money to spend on less needed recreation, or to let the load remain as it is and need much more and get a little more, recreation. When she comes to look into the question more carefully, it seems that there can be but one possible answer, viz., that it is better to lighten the burden; better to prevent excessive fatigue than to try to counteract it. If it means a little less money for recreation, it will mean more time, greater strength and better spirit for it. The cost of doing the more burdensome household duties, adding the items of interest and depreciation to the cost of current, is too small for serious consideration by any but the housekeeper who counts the nickels and dimes most carefully, and she is the one who needs their assistance most.

It is a question if a house that is thoroughly equipped with electrical appliances is not better off than a similar house with a servant. Electricity takes care of washing, ironing, sewing and sweeping, in splendid fashion, and leaves the operator little to do except to look on and engineer the work. The cost of the necessary apparatus and current to operate it is but small when compared with a servant's wages and board.

As for the combination, electricity and hired help, there are two things especially that should not be denied the servant—the electric washer and wringer, and the sweeper or vacuum cleaner. Washing is a hard task and if there is only one domestic, it generally has to be done out of the house; if at home, all the other duties of the day fall upon the housekeeper. But if the electric washer is used, the labor is lessened and the time required for the operation is shortened. The servant can have a large washing done by the middle of the forenoon and be fresh for her other duties. The few cents that the energy costs is a small price to pay for the freedom that it gives the housekeeper on washday, to say nothing of the feeling of contentment with her work that it inspires in the servant.

Vacuum cleaning is sanitary and sweeping is not; no further argument is needed, servant or no servant, especially in a household where there are small children. If it lessens the labor of the servant, she will be better contented and more willing to remain.

The electric iron permits faster and better work and it is a question for the housekeeper to decide if it isn't worth a few cents more to save the servant's time for other duties.

Some housekeepers argue that a servant will consume just so much time anyhow and that the iron is too expensive a thing to give her. They fail to consider that the cost per week of owning the iron is almost negligible and that a good servant will appreciate its benefits and use the time it saves her, for other duties. They should bear in mind, too, that its benefits

are not confined to the laundry, for the different members of the family will find plenty of use for it in other parts of the house; mother and daughter for pressing and ironing laces and other articles not to be entrusted to domestics; father and son for pressing trousers and neckties in emergency cases.

When it comes to the sewing-machine motor it is not a question of the servant, but of the sewing girl who comes to

A Flat Rate Business at Wichita, Kan.

The [illegible] & Power Company, of Wichita, Kan., operates [illegible] in the country, the most remarkable flat rate circuit lamps in the down [illegible] circuit are included the special street and outline lighting [illegible], and the flat rate sign, window [illegible] three phase circuit is run



FIG. 1.—NIGHT SCENE ON A WICHITA STREET.

sew by the day or week. Looking at it in the worst way, she will manage (if she works by the day) to accomplish no more than she would have accomplished if you hadn't had the motor. The experience adds just about five cents a day to her wages. But if she is honest and works right ahead, she will accomplish much more (twice as much on plain work) than is possible with a foot power machine, and thus save her employer many times five cents. Manifestly it is better to get a girl who does not loiter and give her the motor-driven machine.

By keeping in mind the special economic situation with respect to the household, many other lines of argument similar to the above can be brought to bear in a campaign for increasing the central-station income from residence business.

from the power house a distance of about three blocks to the center of downtown distribution. This circuit is turned on every day as soon as window lighting is necessary and turned off at midnight.

Seven blocks on Douglas Avenue and six blocks on Main Street, the principal business streets, constitute the "Great White Way" of Wichita. Although the city has only 45,000 popula-



FIG. 2.—WICHITA STREET SHOWING SPECIAL LIGHTING.

tion, the density of special street lighting on these 13 blocks is probably not equaled in any other city in the country. There is one 6.5-amp, alternating-current, 110-volt multiple arc lamp for every 25 front feet, thus making eight of these arcs for every 100 lin. ft., or an expenditure of 3680 watts per 100 ft.

These lamps are suspended on catenary construction, the

catenary cables being hung from pole to pole along each side of the street. The lamps, of which there are 405 in all, are suspended at a uniform height of 10 ft. 6 in. They are equipped with opalescent globes and steel shades which confine most of the light to the street and sidewalk and do not interfere with outlining, signs or window lighting.

The installation was made at the expense of the central-station company. The merchants, block by block, entered into contracts with the company (originally for one year, and since renewed for a second year), all the merchants in a block signing an agreement to pay $4 per month for each lamp. Each merchant pays for the lamps in front of his property. The average time of burning is 5.5 hours per night. Figs. 1 and 2 show the appearance of the streets.

Besides the 186-kw load afforded by this special street lighting, this flat-rate circuit has enough sign, window and outline business to give it a load of 310 kw. The window and outline lighting is figured on a rate to yield the company a gross revenue of about 7 cents per kw-hour. This feeder has a separate panel and is provided with a recording watt-hour meter. It is found in practice that the gross revenue from this flat-rate feeder yields 5 cents per kw-hour in summer and 6.5 cents per kw-hour in winter, as measured at the station busbars. The flat-rate business, as stated before, is carried by a three-phase feeder run from the power house, which supplies 25-kw transformers in the business district.

INTERIOR WIRING AND ILLUMINATION

Illumination of Wild West Show.

What is said to be the largest outdoor area ever artificially illuminated with any approach to the ordinary intensity of indoor illumination was the field at the Minnesota State Fair, Minneapolis, Minn., a few weeks ago, on which was given the spectacular reproducion of "Fort Ridgeley in '62." In this event more than 800 people, including 350 Indians, took part.

The field on which this reproduction was held comprised about 360,000 sq. ft. of land, the plot being 900 ft. x 400 ft. in area. It was illuminated by 26 Excello flaming-arc lamps distributed approximately 100 ft. apart around the outer edge of the field. Each lamp was equipped with a reflector and with



FLAMING ARC LAMPS AT MINNESOTA STATE FAIR.

the exception of the lamps located on the side farthest from the grandstand, the reflectors were arranged to direct the light toward the center of the arena. The lamps located at the far side of the field were arranged to illuminate the scenery which supplied the background for the staging of the spectacle. The reflectors used were of the ordinary sheet-steel type, the inner surface of which was painted with white enamel paint. The energy for lighting the amphitheater was obtained from the lighting circuits of the city.

As is shown by the accompanying illustration, the spectators' seats were arranged along one side of the field on which the play was staged. The lamps were suspended on poles located at the outer edge of the arena in such a way that they completely encircled the field. The feed wires were so placed that none was carried across the field. By this arrangement the view of the spectators was unobstructed and a clear field was had for developing the illumination, which afforded an even, well-balanced effect in all parts of the field. Intensity of illumination at various points during the progress of the event was found to be so high and well distributed that the details of the reproduction could be plainly seen from every point of vantage. The power consumption of the installation was found to be about 0.04 watt per square foot of surface lighted.

The officials of the fair states that they were exceedingly well pleased with the results accomplished by the system of illumination used and assert that the conditions under which the spectacle was enacted more nearly approached daylight than was ever before found possible in the reproduction of spectacle of similar magnitude.

The Illumination Design of a Clothing Store.

By J. R. CRAVATH.

Some of the problems dealt with in designing the illumination of the large clothing store of Block Brothers Clothing Company, St. Joseph, Mo., recently completed, may interest others engaged in illumination work. This store, which occupies a new building erected especially for the use of this concern, comprises three floors, of a total area of about 33,500 sq. ft., not including the basement, which was also wired with a view to its ultimate use for merchandising purposes.

A typical floor plan is shown in Fig. 1, which is a plan of the third floor. The building has reinforced concrete floors. This feature, of course, necessitated the location of all the outlets and the letting of the contract for wiring before any of the floor construction was begun. The floors consist of a reinforced concrete slab on which cinder concrete is placed as a filler between the slab and the hard maple floor. Conduit was laid on the reinforced concrete before the cinder concrete was poured. An extra deep Krantz steel outlet box was used so that the conduit could be run straight into the box, an arrangement much preferable to using a shallow box with troublesome short bends to reach it.

At the outset three possible systems of lighting naturally presented themselves for consideration; namely, by arc lamps, incandescent lamps and Nernst lamps.

The only system of lighting a high-class store of this kind by arc lamps which seemed at all suitable was that employing special ceiling construction and light-balancing selective diffusers over each arc lamp. As the architect's plans for the building had been practically completed before the writer's work began in planning the illumination, this system could not be considered. Arc lamps without light-balancing ceilings were not thought suitable because of the unsteadiness of the light. Added to these considerations was the fact that higher efficiency incandescent lamps were at that time a practical certainty, and it seemed likely that the common arc would be soon outclassed in efficiency.

This left as the two possible systems to be considered Nernst lamps and incandescent lamps. At that time (August, 1907) the tungsten lamp was still in the future as a commercial factor, although its perfection seemed certain at that time. It, therefore, seemed wise to make plans in such a way as to provide for the use of tungsten lamps when they should become commercially available. Inasmuch as it seemed then as if considerable time might elapse (possibly 18 months or two years) before the tungsten lamp would be available, it also seemed wise to provide for the use of either the Nernst or Gem incandescent lamps at first. The outlets were accordingly arranged with a view of using tungsten, Gem or Nernst lamps. For several reasons it was considered better to arrange for several medium-sized units in each bay or section, rather than to depend on a cluster in the middle of each section. The principal

object of thus subdividing the light sources was to reduce shadows and produce uniform illumination.

It was decided by the owners after an inspection with the engineer of some stores in which the illumination in foot-candles was approximately known that an illumination of 3 foot-candles would be satisfactory for this store. Consequently, the estimates were made with a view to providing this amount of illumination. The first problem was to provide this with the sizes of lighting units commercially available and with a symmetrical arrangement of lamps with reference to the ceiling panels. From information at that time available, it seemed certain that either with the Nernst lamps then available or with Gem lamps an illumination of 1 fot-candle could be produced with an expenditure of not over 0.5 watt per square foot, so that 3 foot-candles would require 1.5 watts per square fot.

From an inspection of Fig. 1 it will be seen that the building is of L shape. One part has a frontage of 160 ft. on Sixth Street and 101 ft. on Felix Street. This portion is unobstructed by pillars or columns. The other portion, which extends back 59 ft. to an alley, has the usual pillars. The large ceiling panels along the Sixth Street side of the building were about 22 ft. 3 in. x 12 ft. 2 in., and contained about 270 sq. ft. At 1.5 watts

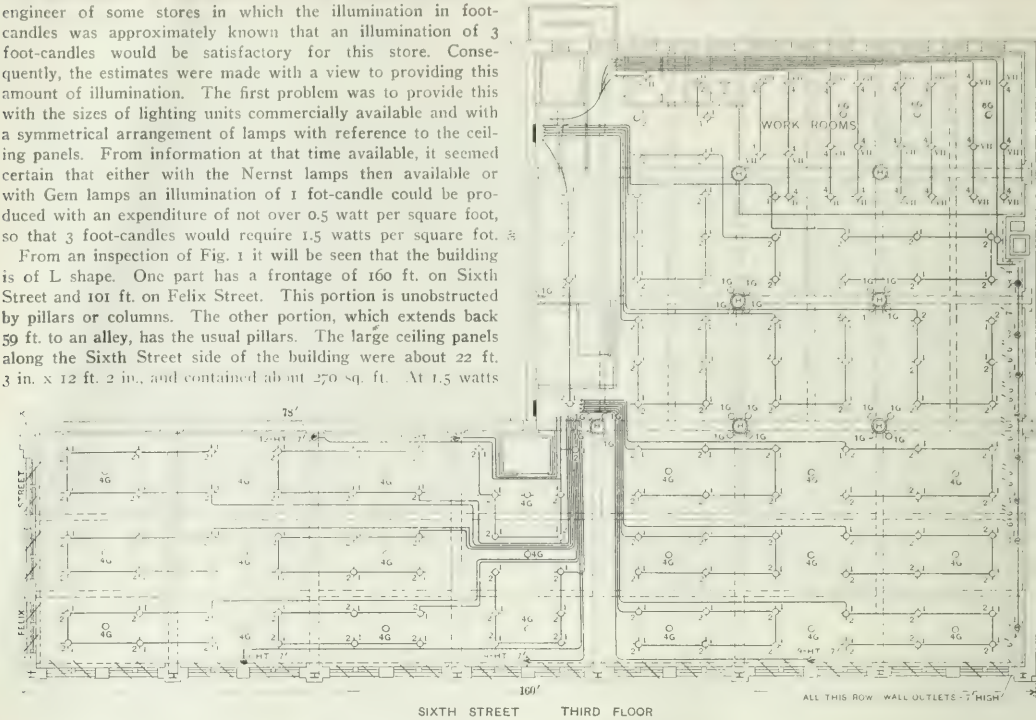


FIG. 1.—TYPICAL FLOOR PLAN, SHOWING OUTLETS.

per square foot these panels would, therefore, require 405 watts. It was decided to wire these panels for four 110-watt units, thus permitting the use of the 110-watt single-glower Nernst lamp, which had just been brought out at that time, or the tungsten lamps later. The panels on the alley side of the building being approximately 11 ft. 1 in. x 19 ft. 10 in., with an area of about 220 sq. ft., called for 330 watts at 1.5 watts per square foot. It was decided to provide for three 110-watt units in each of these small panels.

The next problem was to group these units in such a way as to get the greatest possible use of each 660-watt circuit and also have the group operated symmetrically from any one circuit. This latter provision was, of course, for the purpose of producing a symmetrical appearance when only a part of the lamps in the store were operated, and also to make it possible to light a certain section effectively without lighting other sections where artificial illumination might not be needed at the time. At a number of points flush floor outlets for showcase lighting were provided, these outlets being located as far as possible in places designated by the store-fixture architect. Provision was also made for possible boulevard lamps along the curbline and for an electric sign on the marquise over the Sixth Street entrance. The total connected load in the building, using the maximum 110 watts at each outlet for general lighting and the maximum capacity of show-case outlets, was estimated at about 96 kw. The cost of wiring, not including fixtures or any work





FIGS. 2 AND 3.—ARRANGEMENT OF LAMPS FOR LIGHTING STORE.

beyond the outlets, was $45.80 per kilowatt and $6.50 per outlet.

Some unusual precautions were necessary in planning the circuits supplying the various lamps because of the possibility that Nernst lamps would be used at some outlets for general store lighting, while incandescent lamps would be necessary at other outlets. As the Nernst lamps then offered were of the 220-volt type, and as it did not seem desirable to have 220-volt incandescent lamps, the circuits upon which incandescent lamps might be used had to be kept independent of those upon which Nernst lamps might be used. Provision was also made in the cut-out cabinets for the change of any circuit from 110 to 220 volts, or vice versa.

It was the desire of the owners to provide gas for breakdown use. This was done by arranging for a four-burner chandelier of inverted gas-mantle burners in the center of each large panel and brackets carrying inverted-mantle burners around each pillar. Mantle burners were provided for because of the use of natural gas and because of the larger amount of light to be obtained per burner, although in general the use of gas mantles for breakdown service is not to be recommended.

So much time elapsed between the making of the wiring plans and the completion of the building that the lamp situation underwent a considerable change. The tungsten lamp had been in commercial use several months before it was necessary to make the final decision as to the kind of lamp to be employed. The recent Westinghouse Nernst lamps of higher efficiency than the old types had not appeared on the market and the conditions seemed to point without question to the use of the tungsten lamp. While it seemed certain that the maintenance cost of these lamps would be high at the outset, it also seemed certain that this maintenance cost would be considerably reduced soon by the reduction in cost of lamps and an improvement in their durability.

The arrangement finally adopted for the general lighting of the store (see Figs. 2 and 3) was to place in each outlet a 60-watt frosted-tip tungsten lamp. It is well established that the height of lamps above the floor in a large store of this kind, where many units are used, makes little difference in the illuminating results if proper reflectors were used, as each lamp helps its neighbors more the higher the lamps were placed above the floor, thus counteracting the decreased illumination received from any one lamp at a point directly below that lamp. It is desirable to place the lamps high so as not to interfere with vision. The fixtures are 2 ft. 6 in. over all on the second and third floors of the building, where the ceiling height is about 16 ft. and 3 ft. over all on the first floor, where the height is about 18 ft. This length of fixture brings the lamps low enough from the ceiling so that the ceiling appears more evenly illuminated than if the lamps were placed close to the ceiling. At the same time, the fixture is short enough so that the store does not look like a fixture display room—an effect to be feared where there is so large a number of fixtures as were necessary here. The form of fixture adopted finally was a combination of square rod and chain, as seen in Figs. 2 and 3.

The reflectors used were naturally a matter of much consideration because of the necessity of combining good efficiency with neat appearance. It was hoped at one time that it might be possible to secure a prismatic reflector ball of high enough efficiency so that the use of an open reflector would not be necessary, as it was thought that a ball would present a much neater appearance. It appeared, however, after tests that a reflecting ball in which the upper half is a prismatic reflector and the lower half frosted glass is inherently inefficient, the loss being so great that it could not be considered for this work. With the elimination of this possibility, the only suitable glassware to use appeared to be an open reflector of the deep-bowl type. Of these general types two kinds were available, the opal bowl and the prismatic bowl. As regards illuminating performance and diffusion or softening of the light in a large interior of this kind, these two types seemed to be nearly on a par. The total absorption of the opal bowl is slightly greater, and the amount of light thrown upward toward the ceiling is greater. It is considerably cheaper than the prismatic bowl and easier to clean. With these facts before them, the owners chose the prismatic type on the ground of appearance. The reflector used in the general lighting is Holophane 6061.

With 60-watt lamps at each outlet the current density now is 0.82 watt per square foot. While no measurements have been made upon the illumination, it is judged to be in the neighborhood of 4 foot-candles, this judgment being based upon casual inspection and upon figures obtained in similar rooms where the illumination has been measured. Conditions with the store and lamps clean and new are, of course, favorable to high results. The ceilings are nearly white and the walls a light olive green. The woodwork is dark, of a greenish tinge, and the floors of maple. The results are very satisfactory to the owners and the illumination is considered by them and the general public at St. Joseph one of the several notable features of this new store.

In drawing up the specifications for the fixture and lamp equipment, the plan was employed of giving each outlet a Roman numeral which would not become confused with any of the other standard symbols used. Referring to Fig. 1, outlets marked by *I* are the regular standard one-light pendants used for general store lighting, each carrying a 60-watt frosted-tip tungsten lamp with reflector and Form H holder. Outlets marked *II* are provided with an outlet box receptacle, this receptacle being provided with a ceiling lamp and pendant switch by having a Benjamin series current tap screwed into the receptacle and the cord for a pendant switch led out through the current-tap bushing. This current tap has a standard metal shell which will take the regular shade holders.

The general plan for outlets not in the main portion of the store, where the requirements were uncertain at the time the specifications were drawn, was to specify an outlet box receptacle. This receptacle would permit the use of an extension plug with a dropcord or the use of a current tap with lamp, reflector and pendant switch, as before mentioned. In the workrooms, the specifications called for more outlets than in the store because the requirements would be more exacting.

Outlets marked *IV*, in the show windows, were equipped with "poke-bonnet" reflectors, each taking a pair of 50-watt tantalum lamps. The conditions of the beamed ceiling and the wishes of the owners would not permit the use of anything but a trough type of reflector. The windows are 5 ft. deep and vary in height from 12 ft. to 7 ft. In the higher windows a more concentrating reflector than the "poke-bonnet" would have been desirable.

There are in all 379 tungsten lamps in use for general lighting purposes in the store and workrooms. In the windows 144 tantalum lamps are required. There is also a large sign on Sixth Street and another on Felix Street, each sign containing about 100 4-cp sign lamps. There are a few carbon-filament lamps used in the basement, storage rooms and passages. The kw-hour consumption in October was 4900 and in November 4400, a very reasonable expenditure for the brilliant illumination of such a large store. With the old methods of lighting it might easily have been two or three times this amount to produce the same results.

As regards the method used for the general lighting, namely, a large number of units placed close to the ceiling, the results attained as to uniformity of illumination and freedom from annoying shadows by this method are certainly very satisfactory. This system is also decidedly decorative in its general effect. Almost as good results could probably have been produced by a smaller number of outlets to each ceiling panel, though at the expense of more decided shadows and less decorative effect. In view of all the contingencies as to various sizes and kinds of lamps which had to be provided for when the outlets were located, however, a smaller number of outlets did not seem advisable. The illumination is now ample for all present requirements. Should standards of illumination in competing stores be gradually raised so as to make more illumination desirable in this store after a few years, the circuit capacity is sufficient to substitute 100-watt lamps for the present 60-watt lamps in each outlet.

Lamp Posts vs. Street Arches.

By Albert Scheible.

One of the interesting tendencies of the past year in electric-light practice has been that toward a superior lighting effect in the business sections of the smaller cities. For this purpose two methods have been tried successfully at a number of points in the Central West. One consists in suspending incandescent lamps on stringers across the streets, these stringers being sometimes raised to a peak over the center of the street, and at other times supported by intermediate wires or by piping so as to have the lights form an arch. The other method endeavors to meet the same demand for display street lighting by installing closely-spaced lamp posts, using posts from 8 ft. to 14 ft. high and fitted with from one to five tungsten lamps, the tendency being toward the use of posts about 10 ft. high, with at least two or three lamps to the post. Judging from current reports, both of these methods of display lighting are quite effective in making the corresponding streets stand out brightly in comparison to other streets, so as to draw the trade to them, both from the rest of the city and from the surrounding country. Both types are also "contagious," as they readily stimulate similar lighting for other streets of the same cities and for adjoining places. Thus the recent experience in Michigan, where the adoption of display street lighting in one city is stimulating fully half a dozen neighboring towns toward the similar effects, shows how rapidly such a movement can spread.

Every case of such display lighting means considerable in the way of added revenue for the central station. During the coming year this proposition of having unusual lighting effects in the business streets promises to be a live topic at a great many points, and in most of these it may devolve upon the local central stations to advise as to the method of lighting adopted. Of course, the entire work of installation, including the lamps and supports, is usually paid for by the business men of the blocks thus illuminated, who sometimes band themselves together as a special association for that purpose; but the arrangement and spacing of the lights adopted generally depend on the advice given by the local central-station manager, who, therefore, has the chance to recommend either the use of arches or that of lamp posts. This is fortunate for the electric-light man, for his choosing between the two, or at least influencing the selection, may materially affect the resulting additions to his revenues from sources other than the immediate supply of current for this display street lighting. If the additional sale of current was to be limited to that needed for the unusual street lighting, the central-station manager might be indifferent as to the method adopted. However, there would seem to be a decided difference between the two plans in their effect on indoor lighting, and proper consideration of this should govern the advice given to the business men.

In comparing the two methods, the ease of installing the arches or suspended stringers of lamps and their generally lower first cost count for them, but they involve overhead construction, which is not in harmony with the tendencies of the time. They are more likely to damage in case of high winds, and the overhead wiring means another obstruction to the firemen. Then there is the more serious question of the comparative intensity of the light on the streets and walks, which really are the surfaces to be illuminated. The use of arches or stringers puts the lamps up high, so that a considerable proportion of the light is spent on the upper stories of the buildings, instead of its being practically confined below the level of the second story, as in the case of 8-ft. to 14-ft. lamp posts. This is particularly true with the comparatively horizontal light distribution for the tungsten lamps, unless reflectors are used over the lamps, and reflectors on suspended lamps would sway wildly in every wind.

While much of the light from the arch or stringer lamps is thus wasted as far as its intended effects are concerned, it also means an objectionable glare for persons living in the upper stories of such buildings. However, their interests are less important from the central-station man's point of view than the effect of the lowered intensity of street and walk lighting on the light needed for the show windows and stores. With the high suspended lamps, the intensity of illumination on the walks is generally low enough so that the present methods of store and window lighting are ample. But, if the lighting is done by lamp posts, the use of the same electrical energy will mean a so much more intense lighting of the walks and store fronts that the lighting of both stores and show windows must also be increased considerably. Of course, it would be poor policy to call attention to this feature until the display lighting is actually installed, after which time the comparative dimness of the interiors will furnish a ready field for additional lamps of higher candle-power than formerly used, and therefore for additional revenue to the central station.

Incidentally, the adoption of ornamental posts with underground wiring means an up-to-date form of construction, which in its permanency and artistic effect should appeal to the far-sighted merchant, in preference to the stringers or arches, no matter how appropriate these might seem for makeshift lighting during some brief celebration. Taken by themselves, the arches or stringers will bring an added revenue for the central station, but they cannot readily stimulate that additional revenue from indoor lighting which must follow the use of closely spaced lamp posts. Hence, the shrewd central-station man will do well to look carefully into the merits of the lamp-post system, and to advocate it in preference to the other method. It is more permanent, more artistic, more effective in throwing the light on streets and walks, less objectionable to the people upstairs and more dignified. In short, the lamp-post system is more worthy of the needed expenditure on the part of the merchants, so that the electrical adviser is amply justified in urging it upon the business men of his city. Then, if this involves some extra effort on his part, and possibly concessions in helping the merchants to a low cost of installation, he will be well repaid by the stimulus given to more intense show window and store lighting as soon as the added street lamps are installed.

Letters to the Editors.

The Condenser in Telephone Circuits.

To the Editors of Electrical World:

Sirs:—My attention was recently called to a paper by Lord Rayleigh on "Accoustical Notes" which appeared in the August number of the *Philosophical Magazine*. In this paper Lord Rayleigh gives a brief discussion on telephones, and suggests that the introduction of a condenser of suitable magnitude in the electrical circuit will probably improve telephony. He says: "Such experiment as I have been able to make did not exhibit any improvement in articulation as the result of including a condenser in the circuit. It is possible that the simple theory above stated is too much interfered with by complications such as eddy currents in the iron or hystereses in the action of the condenser. . . . It is probable that this subject has already received attention from those engaged in the endeavor to improve the telephone as a practical instrument; if not, I think it would be worthy of investigation."

I trust I will be pardoned in pointing out that in my paper on "The Influence of Terminal Apparatus on Telephonic Transmission," which appeared in the *Bulletin* of the Bureau of Standards, Vol. V., p. 231, I have discussed the same problem from the mathematical standpoint at some length, and I think that the theory is given there in quite complete form. My results show that the introduction of a condenser in the circuit ought to have a beneficial effect. We must wait, however, for experiment to give us the final and conclusive verdict of the case. I wish to bring this subject again to the attention of your readers with the hope that the knowledge that such an eminent authority as Lord Rayleigh thinks it a subject worthy of investigation may encourage and stimulate those who are in a position to do so to make an experimental investigation of the subject.

Washington, D. C. Louis Cohen.

Reform of Patent Laws.

To the Editors of Electrical World:

SIRS:—Apropos of the discussion in your columns on the need of reform in our patent laws, I should like to say that although I have never taken out an unassigned patent, yet I am a reader of the *Patent Office Gazette*, and as such am constantly impressed by the large number of trivial patents issued to people who will probably never get the amount of the Patent Office fees out of them, to say nothing of attorney's fees and other expenses.

A late number of the *Gazette* shows a patent granted to a certain party for a method of building brick chimneys which, judging from the illustrations and claims, consists simply of setting a row of bricks on the edge of the chimney on the side next the sloping roof. Such devices have been used ever since chimneys have been built, and even if the idea were new, how in the world will any man be able to collect royalties on such a patent? I think the inventor has been the victim of some patent attorney who advertises "a patent secured, or no charge." The Patent Office constantly plays into the hands of such people by taking for granted that because the records of the office do not show a device, it must be new. A patent is supposed to be granted for a "new and useful invention" and it seems to me that some discrimination should be exercised in the consideration of both of these qualifications.

COLUMBUS, OHIO. DUDLEY T. FISHER.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Output and Economy Limits of Machinery.—J. C. MACFARLANE AND H. BURGE.—A paper read before the (Brit.) Inst. Elec. Eng. In this paper the authors consider (a) the factor limiting the output obtainable from a given core-size of a medium-speed dynamo-electric machine; (b) the present-day practice with regard to this, and (c) the directions in which extension of this output-limit and economy in active material may be expected. The authors give numerous diagrams representing modern practice. One of these is reproduced in Fig. 1, showing the relation between output-factors and armature core dimensions for small, square direct-current dynamos. In the author's opinion the best machine is the one which complies

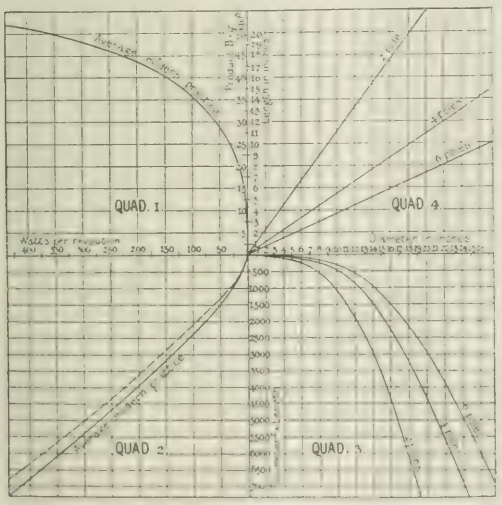


FIG. 1.—RELATIONS BETWEEN OUTPUT FACTORS AND ARMATURE CORE DIMENSIONS.

with the specified conditions with the least weight, size and cost. These advantages can be secured with only a slight sacrifice in temperature rise in direct-current machines, power factor in induction motors and regulation in alternators. The present instalment deals with direct-current machinery and with induction motors. The paper is to be concluded.—Lond. *Electrician*, Dec. 11.

Transformers.—A. P. M. FLEMING AND K. M. FAYE-HANSEN.—A paper read before the Manchester section of the (Brit.) Inst. Elec. Eng., giving some practical and theoretical considerations on transformers. The following types are used on a large scale: shell type with rectangular coils; circular shell type; core type with rectangular and with round coils. Typical designs were worked out for each type, and some figures were given as a comparison in the case of a 100-kva, 50-cycle transformer on the basis of iron-weight plus copper-weight multiplied by three as giving a figure approximately proportional to the cost of actual material. From the figures given it was seen that the difference in the amount of material for the four types was very small. The rectangular shell type is in all cases (especially for high copper space factors) slightly superior to the other types, while the circular-shell type for low copper space factors (that is, for high voltages) is somewhat inferior to the other types. The difference in electrical performance between the types is too small to be of importance in practice, though the difference in losses for the types is of the same order as the difference in the cost of the active material. With suitably designed windings any regulation can be obtained with any of the above types. For the shell types it will generally not be advisable to use the single concentric winding, as the regulation at low power factors will be too poor. The double concentric winding, however, gives fairly good results, but for practical reasons this arrangement of winding is very seldom used for the rectangular shell type. For the core type the single concentric winding gives fair regulation, and the triple concentric winding very good regulation. If the interleaved winding is adopted, the core type requires a larger number of coils than the shell types for obtaining the same regulation. The possibility of obtaining any reactance for any type of transformer is also of interest from the point of view of banking of transformers of different types, for it is evident from the figures given by the authors that it is possible in any type of transformer to arrange the winding so that it will operate in parallel with any given transformer of the same or of other type when the data regarding ratio, connections and impedance voltage for the existing transformer are known. As regards the cooling of the copper, the core types are better than the shell types. Especially is this so in the case of the circular core type. The cooling of the copper of the rectangular core type, and still more of the rectangular shell type, can be greatly improved when the sandwich winding is adopted by spreading the coils—that is, by bending them outward outside the iron. The authors then discuss the influence of special steel alloys of good magnetic quality on transformer design. If a special alloyed iron having approximately 60 per cent losses at the same induction and frequency compared with ordinary iron is employed, then the same maximum efficiency can be obtained at 46.5 per cent of the original weight. If the same efficiency is required at the same output as with ordinary iron, the product of induction and current density can be approximately 2.75 times as large as before. The authors then deal with the most economical ratio of copper and iron losses. In many hand books it is stated that the ideal condition is to obtain

the maximum all-day efficiency. This, however, is not correct, as it is based on the assumption that the price per kw-hour is constant, independent of the load of the generating station. It must, however, be taken into account that the iron loss goes on always, and, therefore, corresponds to 100 per cent load factor, while the copper loss has its maximum when the load is maximum; that is, the copper loss increases the peak load, so that the kw-hour of copper loss will cost considerably more than the kw-hour of iron loss. To treat the subject mathematically in a simple manner, the authors assume that the load per day consists of full-load for a time of 24 *a* hours, corresponding to the load factor *a* (the rest of the time no load at all), and that the price per kw-hour alters with the load *a* as per curve, Fig. 2. The authors then show that the

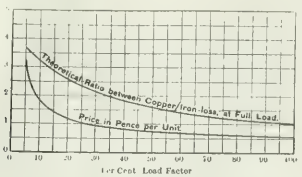


FIG. 2.—CURVES OF LOSSES AND PRICE PER UNIT.

theoretical ratio between copper and iron losses at full load is under these conditions best represented by the upper curve in the diagram. It is, however, good practice to make the ratio between copper loss and iron loss still smaller than the theoretical ratio. The authors, therefore, recommend that for ordinary voltages the ratio between copper and iron loss at full load should not be larger than about 80 per cent of the values given in the curve. The authors then compare different methods of cooling and point out that the depreciation of insulation and the aging of the iron depends on the temperature attained. This temperature should not for any length of time exceed about 85 deg. C. (German standardization rules 95 deg. C., A. I. E. E. 75 deg. C. at full load and 90 deg. C. at overload). With transformers of the forced-cooled type, the temperature of the cooling medium (air or water) can usually be easily kept low enough, and the air temperature of the transformer chamber is of secondary importance. In the self-cooled types, however, particularly for large units, special precautions must be adopted to ensure adequate ventilation of the transformer chamber. The best arrangement of the insulation is then discussed, and it is pointed out that in ensuring the best disposition of the insulation sight should not be lost of mechanical rigidity. In the extended discussion which followed, G. Harlow referred to the advance in transformers due to the use of alloy steels. Reductions in size and price, due to their use, are not possible for transformers having a frequency lower than approximately 30. Below this frequency it is not possible to increase the flux density as at present used in low-frequency transformers built with normal iron, owing to the excessive no-load current which results from any increase in the induction. Consequently what might be expected and was obtained in low-frequency transformers due to alloyed steel was a considerable increase in efficiency, but very little reduction in price. The rating with the alloyed steels is entirely limited by the large no-load current resulting when inductions higher than 14,000 are used, at which induction the no-load current is approximately 10 per cent. "Unfortunately the new alloyed steels are no better with regard to permeability than the steel hitherto used." Consequently, in order to still further cheapen the production of transformers having a reasonably high performance, the need of the transformer builder is an alloyed steel having the same losses as those recently produced, but having a much higher permeability at inductions between 14,000 and 20,000 lines per square centimeter.—Lond. *Elec. Eng'ing*, Dec. 10; Lond. *Electrician*, Dec. 11.

Lamps and Lighting.

Selective Radiation.—E. P. HYDE.—An abstract of an (American) Physical Society paper. The recent development in high-efficiency metallic-filament lamps has aroused new interest in the measurement of the high temperatures of glowing metals, and has raised the question as to whether the high efficiencies are due primarily to the high temperatures at which the filaments operate, or to a selective radiation, where by selective radiation is meant that the distribution of the energy in the spectrum of the radiating body at a given temperature is different from that of a "black body" at the same temperature. A recent photometric study of the relative properties of the newer metallic and the older carbon-filament lamps has led to the establishment of two new photometric methods by which a positive qualitative criterion may be had of relative selectivity of two radiating filaments. According to the first method if one filament is maintained at some definite voltage or current (i. e., at some definite temperature) and the voltage of a second filament is changed until the distribution of energy in the visible spectra of the two as determined by a spectrophotometer is the same, then if the two filaments had identical radiating properties, the energy curves of the two would be identical throughout the entire spectrum, and the temperatures of the two filaments would probably be the same. If this were the case, the ratio of the energy flow in the visible spectrum to the total energy flow radiated in the visible spectrum can be measured by determining the mean spherical candle-power and the total power radiated can be determined by measuring the power input, since there is no convection and very little conduction. If the radiating properties of the two filaments were identical, the watts per mean spherical candle under the above conditions would be the same for the two filaments. Conversely if under the above conditions the watts per mean spherical candle are different, one of the filaments must be radiating selectively with respect to the other. According to the second method, the two filaments are brought to the same distribution of energy in the visible spectrum in the same way as that employed in the first method. If, now, a determination is made of the percentage change in candle-power corresponding to 1 per cent change in power supplied to the lamp for each filament, these two coefficients of change of light corresponding to the 1 per cent change in power would be the same if the radiating properties of the two filaments were identical. Conversely if the two coefficients are different, one filament must be radiating selectively with respect to the other. In the actual use of these two methods the determination of the agreement in the visible spectrum of the energy curves of the two filaments has been made, not with a spectro-photometer as described above, but by means of a color match in an ordinary Lummer-Brodhun contrast photometer. If one lamp is maintained at some definite voltage and the voltage of a second lamp is changed until the color of the light radiated by the two lamps is the same, as observed in the photometer, it has been found that the spectro-photometric curves of the two filaments agree excellently. The color-match method is simpler and perhaps even more exact than the spectro-photometric method, provided there is no strong selectivity within the visible spectrum.—*Phys. Rev.*, December.

Metallic Filament.—A note on a recent British patent (20,223) of the "Z" Electric Lamp Syndicate and H. Zerning. Powdered tungsten trioxide is mixed with powdered zinc, and then the mixture is heated in an atmosphere of hydrogen. The zinc oxide formed is removed by heating with hydrochloric acid, and the remaining hydrogenous compound of tungsten is mixed with a binding agent consisting of nitrocellulose, amylacetate and castor oil. The liquid produced is squirted into filaments in the usual way. After the filaments have been heated in iron vessels, coated with a paste of zirconium hydride and amylacetate, they are sintered by passing a current through them in the usual manner.—Lond. *Elec. Eng'ing*, Dec. 10.

Electric Lamps Displacing Gas.—A note on a discussion before the Council of St. Marylebone on the proposal to adopt electric lighting in all the streets in the borough in which mains are laid. It was proposed to use the old gas lamp-posts, merely substituting two metal-filament lamps for the

present incandescent gas fitting in each lamp, and to connect each lamp-post separately to the ordinary service mains. The municipal lighting committee would pay an annual sum to the Electricity Department, which would bear all capital charges connected with the change-over. The Council adopted the scheme of street lighting by osram lamps. The cost is estimated at $43,250, compared with $44,090 for gas.—Lond. *Elec. Eng'ing,* Dec. 3 and 10.

Incandescent Lamps.—J. FINDLAY.—An abstract of a paper read before the Rugby Engineering Society in which the author dealt with the subject of carbon- and tungsten-filament incandescent lamps, and urged the view that it was uneconomical to run tungsten lamps at specific consumption lower than 1.25 watts per cp.—Lond. *Elec. Eng'ing,* Dec. 3.

Graphitized Filament.—A note on a recent British patent (5416) of the British Thomson-Houston Company relating to the manufacture of "metallized carbon filaments," and consists in impregnating the rough filament with sodium chloride previous to carbonizing. It is stated that filaments treated in this way are free from spots of high resistance, and are more uniform in cross-section.—Lond. *Elec. Eng'ing,* Dec. 10.

Generation, Transmission and Distribution.

Waste Heat of Gas Engines.—C. P. POOLE.—The author discusses the following three methods of utilizing the waste heat of gas engines for driving steam units: The first is to heat all of the jacket water with the exhaust gases, evaporate it into high-pressure superheated steam by means of coal-fired boilers, and use the steam in engines or turbines; the second is to follow the same course, but fire the boilers with gas taken from the same producers which supply gas to the engines; the third is to make and superheat as much steam as possible with the exhaust gases alone, using the steam in a low-pressure turbine. Each of these three methods is shown not to be practicable, the reasons being outlined. The author concludes that until an efficient low-pressure gas turbine is developed, waste heat from gas engines can be most profitably applied to heating. A hot-water heating system as an adjunct to a gas-power plant could easily utilize between 60 and 70 per cent of the exhaust heat and all of the heat on the discharged jacket water; such an auxiliary system would bring the gas engine nearer to the steam engine in applicability where sensible heat must be supplied by the power plant. However, a gas-power plant would not furnish as much heat as a steam-power plant of the same output.—*Power,* Dec. 8.

Draught.—An account of the discussion which followed the recent paper by W. N. Y. King on natural and induced draught. The basis on which a comparison of cost should be made was discussed, and several speakers emphasized the desirability for entirely redesigning a natural draught system when it is to be converted to induced draught. Several combined systems were mentioned.—Lond. *Elec. Eng'ing,* Dec. 3.—The original paper of King may be also found in Lond. *Elec Review,* Dec. 11.

Firing Boilers.—F. R. WADLEIGH.—An article giving illustrations and suggestions on methods of firing stationary boilers economically, especially on the regulation of air supply, cleaning, kindling and banking fires, and on smoke prevention.—*Power,* Dec. 8.

Traction.

Brakes.—After the recent issue of the report on brakes of the committee of the (British) Tramways & Light Railways Association (already abstracted in the Digest) the (British) Municipal Tramways Association issued a report on the same subject. Although in some ways there is divergence in the points of view taken in the two reports, the final conclusions do not conflict. Both committees emphasize the importance of the human element, recommending the more thorough training of drivers, and realize the dangers of rails not properly cleaned; while the municipal committee inclines to the view that an ideal brake could be designed to meet all conditions, the report of the Tramways & Light Railways Association favors the consideration of each case separately. The practical result of the municipal committee's deliberations and investigations is that "a brake which can be applied instantaneously either by hand or power from a single lever to both rails and wheels is desirable, and so designed that the track shoes take the full allowed percentage of the car weight before the wheel brake comes into operation. Having regard to the average tramway conditions, this arrangement is most likely to fulfill best the general requirements. Tests and experience under service conditions will show what percentage of the total weight of the car may be efficiently transferred to the track shoes, and in this connection it must be remembered that one of the most important effects of such shoes is to clean the metals. A brake of this description will practically obviate the necessity of the use of sand for braking purposes and this is most desirable." An independent brake for pure emergency purposes is not considered to be desirable. Special automatic devices are necessary to prevent a car from running back on a gradient through failure of the supply of energy. So long as sanding apparatus is necessary for braking cars attention should be paid to the design of the hopper and the operating gear. The hopper should be of ample size. The gear should be of good mechanical design, and so arranged that both rails are sanded simultaneously, and that the driver should be able to apply sand at the rear end from his platform in the event of the car running backward. The committee also sees an advantage, for braking purposes, of steel tires as against chilled iron.—Lond. *Elec. Eng'ing,* Dec. 10.

New Single-Phase Railways Abroad.—Notes on several new single-phase railways to be equipped by German companies. The contracts of the Allgemeine Elekt. Ges. include one for the Padua-Fusina Railway, in Italy, 21.7 miles in length, with a trolley potential of 6000 volts at 25 cycles. Ten motor-cars will be used, each equipped with two 80-hp motors. Another line is the Lotschbergbahn, in Switzerland, on which a trolley e.m.f. of 15,000 volts at 15 cycles will be used. One locomotive, equipped with two 800-hp motors, will be employed. A coal-mine road at Menzelschacht, in Germany, 3.1 miles in length, will also be equipped with a locomotive with three 40-hp motors; 220 volts at 40 cycles will be used. The company also has a repeat order for the Blankenese-Ohlsdorf line for 25 cars, each to be equipped with two 180-hp motors. The present total single-phase motor rating of the roads in operation or under contract with this company amounted in November of this year to 42,480 hp. The latest contract of the Siemens-Schuckert Company is that for the Wiesentalbahn, between Basel and Schopfheim, in Germany, 34 miles in length, on which a trolley potential of 10,000 volts at 15 cycles will be used. There are 10 locomotives, each equipped with two 450-hp motors. The aggregate rating of single-phase railway motors of this company in operation and under contract amounted in October to 33,490 hp.—*Elec. Railway Jour.,* Dec. 19.

Electric Locomotives.—P. DAWSON.—A continuation of his long illustrated serial on electric traction on railways. The author having discussed the advantage of electric locomotives over motor cars, and having considered gearless locomotives, now passes on to the geared-motor type. The pros and cons of gearless as compared with geared locomotives are discussed, as are also the advantages which, under given conditions of operation, electric locomotives possess over the latest and most economical steam locomotives.—Lond. *Electrician,* Dec. 11.

Mountain Railway.—An illustrated description of the new mountain railway near Bozen, in the Tyrol, known as the Rittnerbahn. It is partly a rack railway, and whereas locomotives with shunt-wound continuous-current motors are used to take the cars up and down the steep gradient, the cars, which are equipped with ordinary series-wound traction motors, run by themselves on the horizontal portions of the line. The rack portion is on the Strub system. When descending the gradient, the locomotive motors return energy to the line. Energy for working the railway is supplied over a three-phase line from a water-power station some 20 miles away, continuous current at 750 volts being obtained from a substation about half way along the line.—Lond. *Elec. Eng'ing,* Dec. 10.

London.—Comparative statistical tables of the cost of operation on the different tube railways in London during the last year, with an editorial discussion of the subject.—Lond. *Electrician,* Dec. 11.

Installations, Systems and Appliances.

Electrical Industry in Germany; Proposed Tax on Electricity.—The complete issue is filled with an account of the recent meeting of the Berlin Electrical Society to protest against the proposed tax upon electricity and gas. The general secretary of the German Association of Electrical Engineers, G. Dettmar, criticises the proposed tax at length and in detail. He thinks that the tax will not bring the amount of money which is expected and that the cost of collecting the tax will be very high. A very serious matter is that the tax is based, partly at least, on the self-cost of generating electric energy, while no exact rules are given for finding a means of production. A tax on coal, peat, water powers, etc., would be much simpler. The collection of the tax will represent a means of supervision of the electrical industry by the government and many troubles are to be expected. The following statistical data were given relating to the first of April, 1909: There will be in operation in Germany at that date 1850 central stations, with a total rating of 1,100,000 kw. These stations sell per year about 900,000,000 kw-hours, representing a value of $40,000,000, of which $25,000,000 are for lamps and $15,000,000 for motors; the connections of the central stations amount to 1,400,000 kw, of which incandescent lamps are 630,000 kw, arc lamps 120,000 kw, and motors 650,000 kw. Besides the central stations there are in operation a great many isolated plants, the total rating of which is 6,000,000 kw, generating about 6,600,000 kw-hours per year. The connections of the isolated plants are 6,800,000 kw, of which incandescent lamps are 1,300,000 kw, arc lamps 700,000 kw and motors 4,800,000 kw. The total connections of incandescent lamps in Germany are, therefore, 1,930,000 kw, of arc lamps 820,000 kw, and of motors 5,450,000 kw. In the discussion the proposed tax was defended by private counsellor Dr. C. L. Weber, the "father of the proposed tax." He said that the government would have preferred a direct tax on coal, but did not propose it, as it was sure the parliament would reject this tax. Almost all other speakers spoke very strongly against the proposed tax. Dr. Beumer, M. P., also protested strongly against any tax on coal, peat or water power; raw materials should not be taxed. Several speakers, among them Kohlrausch, emphasized that the industry did not fear so much the expense as the troubles they would have with the agents of the tax commissioners. In view of the official protest of the German Society of Civil Engineers, the electrical engineers (as an interested party) will not make a special and elaborate appeal to the government.—*Elek. Zeit.,* Dec. 10.

Electrical Industry in England and Germany.—K. Perlewitz.—A communication claiming that Mordey's recent comparison of electricity supply in England and Germany is unfair because incomplete figures have been chosen for Germany (as the private stations have not been considered) and a wrong basis of comparison has been used.—Lond. *Electrician,* Dec. 11.

Electricity Tax in Germany.—A translation in abstract of the memorial presented by the German Society of Civil Engineers to the German Parliament, making an urgent appeal to reject the proposed electricity and gas tax.—Lond. *Elec. Eng'ing,* Dec. 10.

Contact Springs and Brushes for Switchboards.—R. Edler.—The first part of a long illustrated paper read before the Vienna Electrical Society. There is now a tendency toward standardization in the construction of contact springs and brushes for switchboards. The author recommends also the standardization of their dimensions. Rules are also given on their calculation. The paper is to be concluded.—*Elek. u. Masch.* (Vienna), Dec. 6.

High-Tension Insulators.—L. Conge.—An illustrated description of various high-tension insulators for overhead lines exhibited at the Marseilles exposition. Insulators of porcelain, glass and hard rubber made by different companies are described. *L'Indus. Elec.,* Dec. 10.

Electrophysics and Magnetism.

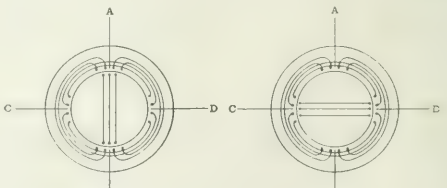
Properties of Current-Bearing Matter.—P. R. Heyl.—The fifth article of his serial on possible effects of electric current on various physical properties of matter through which the current is passing. This article describes some experiments on the effect of an electric current upon the refractive index of copper. The result is negligible. With electrolytic copper and sodium light, using a current density of about 50 amp per square centimeter, there is no change in the index as great as 2 per cent.—*Phys. Rev.,* December.

Discharges of Electricity from Glowing Bodies.—E. Rutherford.—A lecture before the Manchester section of the Brit. Inst. Elec. Eng., giving a review of our present knowledge of the discharge of electricity from glowing bodies and its relation to ionization phenomena.—Lond. *Electrician,* Dec. 11

Law of Induction.—F. Emde.—A continuation of his highly theoretical paper on the fundamental induction law. In the present instalment the author discusses the law of induction as expressed in the form of partial differential equations.—*Elek. u. Masch.* (Vienna), Dec. 6.

Units, Measurements and Instruments.

Phase-Shifting Transformer for Testing.—C. V. Drysdale.—One of the most troublesome operations in connection with the testing of wattmeters or watt-hour meters is the obtaining of a supply at any required power factor, and the varying of it in a suitable manner. The author recommends the use of a small phase-shifting transformer, which can be fixed on the testing table by the side of the instruments, and which can be adjusted instantly to any power factor by the operator who is taking the readings. In construction it is like an ordinary induction motor, having a primary or stator which is wound with two sets of coils at right angles when the supply is two-phase or single-phase, or with three sets of coils at 120 deg. for three-phase supply. This produces a rotating field in the center. A re-entrant drum winding with suitable tappings may also be used. The secondary is in the form of a cylindrical rotor, and is provided with a single diametral winding. In Fig. 3, which shows diagrammatically a phase shifter for a two-phase supply, *AB* and *CD* are the terminals of the two phases. The stator coils are equivalent to two diametral coils at right angles. In this the secondary coil is shown with its plane parallel to that of the primary coil *AB*. It, therefore, has an e.m.f. induced in it in phase with the potential difference on *AB*, while the second primary coil has no effect as the flux produced by *CD* passes the secondary coil without cutting it. If, now, the secondary coil is turned through a right angle, as in Fig. 4, it is evident by the same reasoning that the e.m.f. induced in it will be in phase with *CD*, and that *AB* has no effect. Since in a two-phase supply the two circuits have equal voltages with a difference in phase of 90 deg., it follows



FIGS. 3 AND 4.—DIAGRAM OF PHASE-SHIFTING TRANSFORMER.

that turning the secondary coil through 90 deg. shifts the phase of the voltage induced in it by the same amount, without altering the voltage. Since, also, the magnetic field is a uniformly rotating one, it is evident that the phase angle must increase uniformly as the rotor is turned, and by the same amount. The phase-shifting transformer enables the behavior

of any wattmeter or watt-hour meter to be ascertained almost at a glance if a reliable standard wattmeter is in circuit. It is then only necessary to observe the instrument under test on unity and zero power factor. Any error of calibration is shown by the reading on unity power factor at two frequencies, while the zero power factor test shows the error due to phase displacement in the meter. Fig. 5 shows the connection

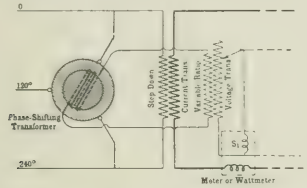
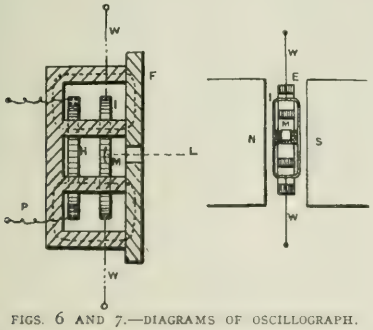


FIG. 5.—CONNECTIONS OF PHASE-SHIFTING TRANSFORMER.

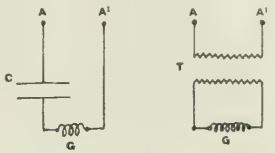
of the phase-shifting transformer for a three-phase supply system. The author finally describes tests of the transformer and its construction.—Lond. *Electrician*, Dec. 11.

Plotting Wave-Forms.—M. ABRAHAM.—An illustrated description of an instrument for projecting wave-forms on a screen. The instrument, which is simpler and less expensive than the oscillograph, consists of two parts. One of these is a special form of galvanometer, containing a swinging mirror, which is made to follow all of the variations of the current. The mirror swings back and forth, and would trace only a line of light upon the screen were it not for the fact that there is interposed between the mirror and the screen a second apparatus which serves to spread out the light coming from the mirror, so as to give the form of the wave upon the screen. The action of the galvanometer will be understood from Figs.



FIGS. 6 AND 7.—DIAGRAMS OF OSCILLOGRAPH.

6, 7, 8, 9 and 10. Suspended by two wires is a light aluminum frame *I* of rectangular shape, carrying in the center a concave mirror which measures 6 mm x 8 mm, and is consequently of a much larger size than is used in the oscillograph (Fig. 6). The aluminum frame is made to swing rapidly under the influence of the current. Around the frame is fixed an E-shaped piece of laminated iron *P*, which is provided with a covering piece *F* of the same metal, so as to form a closed magnetic circuit. Upon the same iron core, and lying next to the aluminum frame, is mounted a small rectangular coil of wire *H*, which is fixed and so disposed that when a current is passing in it the resulting magnetic flux will take the path shown by the dotted lines. The entire device, as shown in Fig. 7, is mounted between the poles of a permanent magnet *NS*. Should there be no current passing in the coil, the flux in the iron core will take a transverse direction in the latter. The construction in the galvanometer allows of the production of induced current in the swinging frame *I* in such manner that the movement of the latter will follow exactly the variations of the current to be observed. In order to obtain this result there is produced outside of the instrument an intermediate current which is in quadrature with the current (or e.m.f.) to be observed. In the case of an e.m.f., a condenser is disposed in series with the galvanometer, as seen in Fig. 8, and the whole is placed in the main circuit AA^1. For taking the current wave, on the other hand, the circuit is connected through the primary coil of a small transformer whose secondary coil is closed upon the galvanometer (Fig. 9). In practice two separate galvanometers are used, and these are placed side by side, so as to throw the two waves upon the screen. The intermediate current is thus sent into the fixed coil of the galvanometer, and this coil acts as the primary of a small transformer, whose secondary consists of the short-circuited aluminum frame. Were the permanent magnet not used in this case, the result would be a simple attraction of the frame toward the coil, without a rotation of the former. By employing the transverse flux from the permanent magnet, acting together with the flux which the coil tends to set up in the core, there is a resultant action which causes the coil to rotate about its axis, producing a deflection of the beam of light from the mirror. Under these conditions, the coil is made to follow all of the variations of the original e.m.f. of the current. The second part of the apparatus, known as the "synchronoscope," is used in order to spread out the beam of light which comes from the oscillating



FIGS. 8 AND 9.—DIAGRAMS OF CIRCUITS.

mirror, so as to give the wave-form upon the screen. This movement is proportional to the period of the wave. In Fig. 10 is shown the principle of the synchronoscope. The two galvanometers, one for the current and the other for the e.m.f., are mounted side by side on the right, and their mirrors are represented at M M^1. The mirror M receives a beam of light from an arc lamp by means of the adjustable mirror B which is fixed to the frame of the apparatus. This beam is reflected to the left and passes through the synchronoscope before reaching the screen. A revolving prism lies at the center of the synchronoscope and receives the two beams—the second beam coming from the mirror M^1 in the same way. The prism, which is totally reflecting, is caused to rotate rapidly in synchronism with the wave by means of a toothed wheel of soft iron, which is mounted so as to rotate between the poles of an electromagnet; the latter is connected to the source of current, and this combination makes a very simple and effective synchronous motor. The light which comes from the prism is not sent directly upon the screen, but is further reflected by a set of fixed plane mirrors which are disposed round the prism. These mirrors are placed so as to be about tangent to a parabola at whose focus is placed the center of the

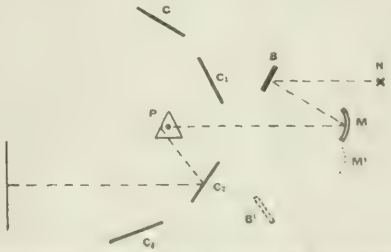


FIG. 10.—DIAGRAM ILLUSTRATING PRINCIPLE OF SYNCHRONOSCOPE.

prism, and they are shown at C, C_1, C_2, C_3. During the rotation of the prism, the beam from each of its faces is reflected upon the four mirrors in succession, and at each reflection the curve is thrown in the same place upon the screen, so that for one revolution of the prism there are 12 successive projections of the wave on the screen. In practice, the wave is thus traced

as a continuous line of light, and the e.m.f. and current waves have their proper relative positions.—Lond. *Elec. Rev.*, Dec. 4.

Manganine Resistors of Standard Resistance.—S. Lindeck.—A communication on the influence of atmospheric humidity on electric standard resistors. It is pointed out that in the climate of Berlin the periodic variation in the 1, 10 and 100 ohm manganine standard resistor was very small, while larger variations were found in 1000- and 10,000-ohm resistors, yet they were only one-fifth of those noticed by the Bureau of Standards in Washington. It is emphasized that 1000-ohm resistors are not so important as those of 1 ohm, which directly incorporate the unit. The writer agrees with Rosa and Babcock, of the Bureau of Standards, that not only is manganine very well adapted for resistors of standard resistance, but that the method of mounting the resistors and protecting them from the oxidation of the air or oil by shellac or varnish is very satisfactory, provided they are also protected from the effects of atmospheric humidity.—Lond. *Electrician*, Dec. 11.

Electrolytic Prepayment Meter.—A note on a recent British patent (23,450) of E. Schattner and R. Amberton. In electrolytic prepayment meters, the supply ceases when the level of the electrolyte falls below the level of one electrode. According to this invention an auxiliary electrode is connected in parallel with the above electrode, but through a resistor. The auxiliary electrode remains in the liquid after the main circuit is broken, and so the lamps are only dimmed instead of being extinguished.—Lond. *Elec. Eng'ing*, Dec. 10.

Apparatus for Cable Tests.—A description of an apparatus, devised by Delon and exhibited at the Marseilles exhibition, for producing a high direct-current voltage for cable tests. Its principle is as follows: If one pole of a sinusoidal e.m.f., with the effective value e, is connected to earth, the potential of the other pole varies between $+e\sqrt{2}$ and $-e\sqrt{2}$. The apparatus of Delon consists of a revolving commutator, which connects this latter pole of the e.m.f. with one conductor of a two-conductor cable at the moment when the potential is $\times e\sqrt{2}$ and connects it with the other conductor of the cable at the moment when the e.m.f. is $-e\sqrt{2}$. If the contacts are made at the exact moments the two conductors of the cable will assume a potential difference of $2e\sqrt{2}$. At the Marseilles exposition a transformer raises the alternating e.m.f. from 190 to 125,000 volts. By means of the special commutator a direct e.m.f. of about 300,000 volts is produced between the two conductors of the cable. The commutator revolves at a speed of 1500 r.p.m. The cable consists of two conductors, each of which contains 19 wires 2 mm in diameter. The two conductors are separated by 12 mm and are insulated with impregnated paper.—*Elek. u. Masch.* (Vienna), Dec. 6.

Measuring the Slip of Induction Motors.—C. F. Guilbert.—The author has modified the method of Seibt, who uses the contact device of Joubert, by means of which a circuit carrying an alternating current of the same frequency as the supply circuit is closed and opened once or several times during a revolution. The present author pastes a circular piece of cardboard on the end of the axle of the motor, a sector of the circle being cut out of the cardboard. A brush slides against this cardboard, and, therefore, makes electrical contact with the axle whenever it touches the cut-out sector. The brush is connected to a source of alternating current of the same frequency (for instance, a transformer) and a lamp or voltmeter, the circuit being closed through the axle. The author calculates the most favorable angle of the sector in order to obtain the best indications with the lamp or the voltmeter. Two methods are described.—*La Lumière Elec.*, Dec. 5.

Unusual Frequencies for Testing.—F. J. Moffett.—The writer refers to a case in which he had to test some single-phase apparatus designed for connection to a supply system at 80 periods. The highest periodicity which could be obtained from the works supply system was 50, and some means had to be taken to increase the frequency to the desired value. To the three-phase supply system the stator windings of a three-phase slip-ring motor were connected. The rotor pulley was belted to that of a variable-speed direct-current motor, and driven backward—that is, in the opposite direction to which it would have rotated under normal conditions, the slip being approximately 190 per cent. By adjusting the speed at which the rotor was driven it was possible to obtain from the rotor slip-rings exactly the periodicity required.—Lond. *Elec. Eng'ing*, Dec. 3.

Telegraphy, Telephony and Signals.

Telephone Exchange.—T. Devereux.—An illustrated description of a new British telephone exchange which is approaching completion in Cardiff, where hitherto the British Post Office and the National Telephone Company have been in competition. The new exchange has been built by the Post Office and is to be rented to the National Telephone Company (whose existing exchange is fully loaded) until the expiry of the company's license in 1911. A feature is a new subscribers' operator's cord circuit, in which a repeating coil is not employed. —Lond. *Elec. Eng'ing*, Dec. 3.

Miscellaneous.

Lightning Rods.—An account of a set of rules on the construction of lightning rods proposed by a committee of the Swiss Association of Electrical Engineers, consisting of Dengner, Blattner and Hubert.—*La Industrie Elec.*, Dec. 10.

NEW APPARATUS AND APPLIANCES

Chicago Electrical Show.

Final preparations for Chicago's January Electrical Show are well under way and the sale of space has been large. Notwithstanding the fact that the scheme of decoration employed last year was outlined as a permanent proposition, at a cost of $25,000, changes will be made for the decoration of the coming show which will cost approximately as much as was expended a year ago. Assistant Manager John J. Schayer, who has had charge of this year's show owing to the illness of Homer E. Niesz, feels particularly gratified with the results as they now stand. The list of exhibitors to date is as follows: Crane Company, Commonwealth Edison Company, Wagner Electric Company, Federal Electric Company, Cutler-Hammer Company, Pyro One-Light Sign Company, Shelton Electric Company, Lindstrom, Smith & Company, Western Insulation Company, National Battery Company, Perfection Vacuum Cleaning Company, Chicago Fuse Wire & Manufacturing Company, Electric Appliance Company, The Excello Arc Lamp Company, Kellogg Switchboard & Supply Company, The Stoltz Electrophone Company, Stromberg-Carlson Telephone Manufacturing Company, Mathias Klein & Sons, Telephony Publishing Company, Manhattan Electrical Supply Company, Ft. Wayne Electric Works. Electrical World, Benjamin Electric Company, *Electrical Record*, Central Electric Company, International Correspondence Schools, McRoy Clay Works, Chicago Pneumatic Tool Company, Robbins & Myers, Appleton Electric Company, United Pump & Power Company, Commercial Appliance Company, Electric City Publishing Company, Taussig & Babcock, Westinghouse Electric & Manufacturing Company, Autolectric Sign Company, General Electric Company, American Steel & Wire Company, National Acme Manufacturing Company, Hahl Automatic Clock Company, Swedish-American Telephone Company, Swedish Electric Vibrator Company, Popular Electricity Publishing Company, Peerless Light Company, Palm Engineering Company, Pacific Electric Heating Company, Duntley Manufacturing Company, National Automatic Advertising Company, Jewell Electrical Instrument Company, Roth Brothers Company, Cres-

cent Company, H. W. Johns-Manville Company, Red Cross Antiseptic Company, Northern Electrical Manufacturing Company, A. W. Kratz, Illinois Electric Renovator Sales Company, Hurley Machine Company, Murphy Electricity Rectifier Company, National Electric Lamp Association, Electrocraft Publishing Company, Electrical Testing Laboratories, American Electric Fuse Company, The Caloric Company, The Allis-Chalmers Company, North Shore Electric Company, Simplex Company, Cyclone Storage Battery Company, Electric Storage Battery Company, F. B. Badt & Company, Chicago Telephone Company, Mechanical Appliance Company, Western Electric Company, The Connersville Blower Company, Electric Cleaner Company, Pelouze Electric Heater Company, C. S. Neville & Company, Mears Ear Phone Company and National Carbon Company. The show will run from Saturday, Jan. 16, to Saturday, Jan. 30.

An Automatic Electric Air-Pump.

Where an air pressure of 30 lb. or less is required in considerable volume, a convenient service is given by the motor-driven air compressor of the Varwig Manufacturing Company, 120 Opera Place, Cincinnati, Ohio, as illustrated herewith. Such use ranges from beer pumps in saloons to air-brush work in draughting rooms. The outfits are furnished ready to connect to the electric circuit and to the same distributing air pipes used for any other system, by connecting the air outlet cock at the back of the storage tank. The working parts are enclosed in a strong brass globe, on top of which is a glass jar containing water through which the air is drawn before being pumped into the air tank. This method filters the air, leaving it free of all impurities.



AIR-PUMP.

The outfit is also provided with a 6-cp red incandescent lamp as a pilot light on the motor, showing when it is in operation. There is an automatic switch regulating the motor, so that the pump can be made to start up automatically when the pressure falls to a certain point. Hence a uniform pressure is maintained. Cleaning and oiling from time to time are the only matters requiring attention. The gage and all the brass parts of the device are well plated.

Self-Welding Wire Joint.

The Harvard Electric Company, Chicago, Ill., has placed on the market a copper self-welding wire connecting joint which is made, both as to length and weight, in accordance with the

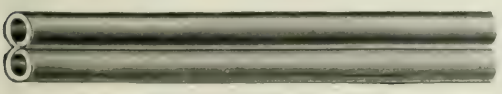


FIG. 1.—SELF-WELDING WIRE JOINT.

A. T. & T. specifications. It consists of two longitudinal metal barrels, the inner sides of which have beveled edges, as shown



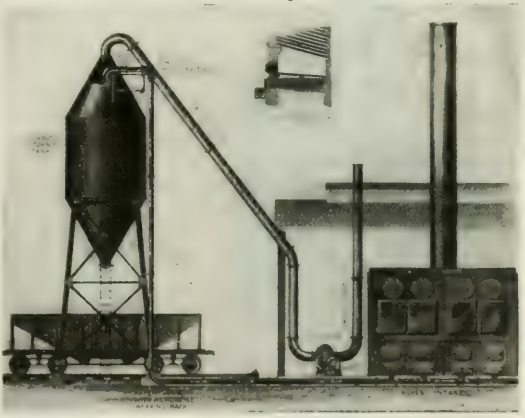
FIG. 2.—CROSS-SECTION OF WIRE JOINT.

in the accompanying illustration. These beveled edges serve as a guide for the rest of the sleeve by creeping around the inside of the barrels when they are twisted, allowing the two sides of the sleeves to overlap themselves as much as is necessary to conform to the inequalities of the wires which are being joined. When the joint is properly applied, the connection is said to be almost perfect and to possess great strength. Users of the joint claim that moisture cannot penetrate into it after it has once been twisted. The joint can be used satisfactorily in connecting wires which do not differ more than two gages in size.

Suction Conveyor for Removing Ashes.

For the removal of ashes from under boilers various mechanical conveyor systems are in use. Nearly all of these have moving parts which are subject to rapid deterioration owing to the character of the material which they handle. The Darley Engineering Company, of New York, manufactures a suction conveyor system which has no moving parts and in which every part is rigid save the motor and exhauster and with these the ashes do not come in contact. The conveyor pipe is made of iron or of steel, and as far as it is possible to do so, it is run in straight lines.

The separator, which is in reality an expansion chamber, also serves as a storage tank for the conveyed material. The separator is placed at the end of the conveyor run and serves to catch and hold the material until it can be drawn by gravity through an undercut gate into carts, cars or barges. The separator is usually built in a cylindrical form, but may be given other shapes and the material used may be steel, iron or con-



SUCTION CONVEYOR FOR REMOVING ASHES.

crete. The exhauster, which is similar in appearance to a centrifugal pump, consists essentially of a rotating impeller surrounded by a suitable case with an intake air opening at the center and a discharge opening at the circumference. For small, simple layouts the ordinary exhaust fan can be used, whereas for certain complicated and extensive work a cycloidal blower is usually adapted for the purpose. The exhauster may be either motor- or steam-driven. Just before entering the separator the conveyed material passes through a water jet located in the conveyor pipe. This jet serves to cool the hot material and also to eliminate all dust. In removing ashes the intakes are placed in front of the ash-pits or in any other desired location, and the ashes are hoed or shoveled from the ash-pits into these intakes, whence they disappear through the pipe line. The intake opening is slightly smaller in diameter than that of the pipe line, and when not in use a cast-iron cover is placed over the intake. Flanged fittings are used throughout in setting up the conveyor pipe and as the hardest wear comes on the elbows, a split elbow having an interchangeable wearing back of hard iron is used. The accompanying illustration shows a suction conveyor in use.

Remote-Control Oil-Switch.

It is generally conceded that for controlling alternating-current circuits having potentials above 600 volts, the oil type of switch is most satisfactory and practically meets the conditions of modern requirements. Fig. 1 herewith shows a remote-control oil switch brought out by the Central Electric Company, of Chicago. The switch is of the non-automatic, electrically-operated type, arranged to be opened and closed by means of tripping and closing coils actuated by a simple momentary contact push-button switch shown in Fig. 2. The switch is entirely self-contained, the operating coils, switching mechanism and oil tanks being mounted on a common support and secured by the same.

The switch will not open automatically upon overload unless arranged so that the trip coil is actuated by means of overload relays in turn operated by energy from the secondary of series transformers connected to the line. The laminated contacts are carried by a center support which in turn is operated by a soft iron plunger located within the fields of the closing and opening coils.

When the closing or upper coil is energized, the plunger draws the laminated brushes into close contact with the stationary connections and locks the entire mechanism firmly in position by means of a toggle which passes slightly beyond the dead center.

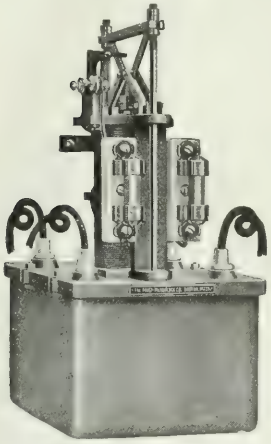


FIG. 1.—REMOTE-CONTROL OIL SWITCH.

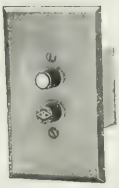
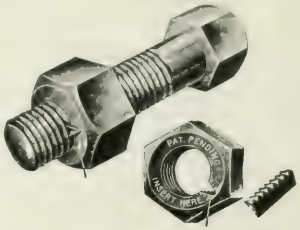


FIG. 2.—PUSH-BUTTON SWITCH.

The toggles are so arranged that the greatest pressure on the contact is obtained when the switch mechanism is locked in its closed position. When the opening coil is energized, the plunger is drawn down and pulls the toggle across the center and releases the mechanism which immediately falls to the open position. The main contacts are provided with an arcing device so that the actual break takes place entirely on these tips and leaves the main contacts in good condition when the switch is again closed. The operating coils are only energized momentarily, small auxiliary contacts actuated by the operating mechanism opening the circuit as soon as the main contacts are in the open or closed position. The coils can be wound to operate from either direct- or alternating-current circuits and for various voltages up to 440. Circuits having potentials higher than 440 volts can supply the energy for the tripping and closing coils through transformers. The switch can, of course, be operated in many different ways, such as from relays controlled by time-limit devices, overload or underload devices, speed-limit relays, etc. The switch is also well adapted for use in opening the primary of constant-current transformers through the medium of special relays which act upon the breaking of the secondary circuit. For low-potential work the switch is operated without oil and has been used in connection with the wiring systems of large factories, churches, theaters, etc.

Vibration Lock-Nut.

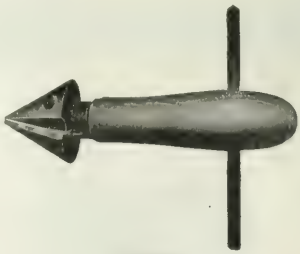
The accompanying illustration shows a self-tighening and positive locking nut brought out by the L. S. Brach Supply Company, New York City. One of the main features of this nut is the fact that it will lock secure at any point on the bolt, and unless it is taken off in a proper but simple way the nut cannot be removed. The nut, it is claimed, does not distort or damage the threads of the bolt, but holds them with a positive grip by the teeth of a hardened key or wedge. The nut is similar to the usual nut and is made in cold or hot pressed material with either hexagon or square head. It has a longitudinal V-shaped slot holding a threaded, wedge-shaped key forming part of the nut. Because of the angle, this key plays no part in the operation of the nut while the latter is run on the bolt; but in an attempt to remove the nut the key is carried over against the other side of the slot forcing the teeth against the bolt so as to grip it with great force. The nut may be removed by inserting a pointed wire or piece of wood in the larger opening on the side of the key which will prevent the key from acting as a wedge and permit the removal of the nut in the usual manner. A peculiarity of the nut is that vibration tends to tighten it automatically, so that not only does this prevent the nut from working loose, but all lost tension caused by wear is taken up.



VIBRATION LOCK-NUT.

Reamer for Greenfield Single-Strip Flexible Steel Conduit.

The accompanying illustration shows the reamer for the Greenfield single-strip type of flexible steel conduit made by the Sprague Electric Company. It can be used for conduit in sizes from 5/16 in. to 1¼ in. For larger sizes than 1¼ in. diameter, a three-cornered scraper, or a common file, will be found satisfactory. This reamer can be used for rigid as well as for flexible conduit. Cutting Greenfield conduit with the ordinary hacksaw leaves only a small burr and this can be easily removed by the above reamer.



REAMER.

Electrically Operated Oil Switch.

The accompanying illustration shows a 30,000-volt, electrically operated oil switch which has been developed and placed on the market by the Kelman Electric & Manufacturing Company, Los Angeles, Cal. The switch is entirely self-contained and may be installed in any way desired by simply placing on the floor and connecting up, or in galleries, or in brick or concrete compartments as may be required.

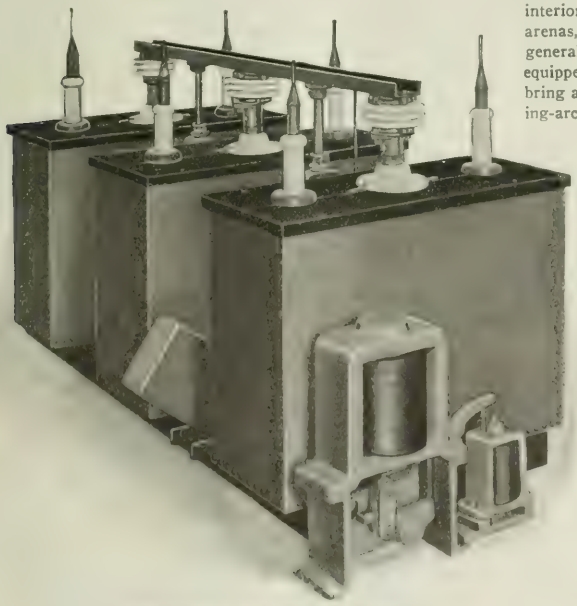
The operating solenoids are wound for 110 volts, direct current, the closing solenoid requiring approximately 2300 watts and the opening solenoid approximately 300 watts. The switch is opened by means of springs placed on the guide rods, the opening solenoid being required simply to release the lock which holds the switch in the closed position.

The switch is made non-automatic or automatic as may be required. In the latter case the automatic overload release is actuated by means of series relays which operate by closing the circuit of the opening solenoid, thus tripping the switch. These relays are mounted on insulators which may be installed in any convenient manner. The laminated iron cores are attached to one end of a rod of treated wood, to the other end of which are attached the contacts which serve to close the circuit of the operating solenoid. This wooden rod, in addition to the insulating tube within which the core operates, provides ample insulation at this point.

The switch is controlled by means of a small single-pole, double-throw switch placed on the switchboard or operating table. Mounted on the switch and operated by it is a small switch which automatically opens the circuit of the closing solenoid as the switch is closed. In the automatic switch the circuits of the operating solenoids are so arranged that if the switch is closed on an overload or short circuit, it will immediately open and will remain open until such time as the operator desires, even though he still holds his control switch in the closing position. In other words, the switch cannot "pump in and out on a short." In the event of failure of the operating current while the switch is in an intermediate position in the act of being closed, it will immediately return to the open position. Signal lamp contacts are provided to indicate the open or closed position of the switch by means of colored lights.

The fixed contacts are secured to porcelain insulators which are mounted on a wooden support placed well down in the oil. The movable contacts are of the knife-blade type and form part of a simple pantograph by means of which a horizontal break is secured, which occurs at a point in the tank which leaves two-thirds of the total volume of oil above the break. This form of contact and switch mechanism has been successfully used for the past five years in Kelman switches. The covers for the oil tanks are made in two pieces, either one or both of which may be readily removed, for purpose of inspection of the contacts, without disturbing any other part. The entire mechanism in each tank is so arranged that it can be easily lifted out without disturbing the other tanks or without drawing off the oil.

These switches are made in sizes from 15,000 to 100,000 volts, either non-automatic or automatic as may be required.



ELECTRICALLY OPERATED OIL SWITCH.

Flaming Arc Lamp with Inner Prismatic Globe.

As is well known, the ordinary flaming-arc lamp with inclined electrodes gives a distribution of light which is rather downward than outward, the maximum being obtained at an angle of about 30 deg. in a vertical plane and the greatest amount of light being radiated between the angles of 15 deg. and 75 deg. While such a distribution renders the flaming-arc lamp with inclined electrodes suitable for illuminating restricted areas in front of stores, etc., it does not make the lamp especially suitable for general street lighting, where a better distribution at points distant from the lamp is needed. A better distribution is also required for general illumination of large interiors, such as storage warehouses, covered docks, arenas, etc. In order to render its lamps suitable for general lighting the Excello Arc Lamp Company has equipped them with prismatic inner globes which bring about the desired distribution. Fig. 1 shows a flaming-arc lamp equipped with an inner prismatic globe, the outer globe being removed for the purpose of illustrating the inner globe more clearly. In order that a comparison might be made between the ordinary flaming-arc lamp and one equipped with an inner globe, tests were made for the company by the Electrical Testing Laboratories. For this purpose a 10-amp. direct-current lamp, with positive electrode of 10 mm and negative electrode of 9 mm in diameter,



FIG. 1. ARC LAMP WITH PRISMATIC INNER GLOBE.

was used. Two globe equipments were supplied; the first consisted of an 11-in. clear-glass globe with ventilating ash tray at the bottom; the second consisted of a clear-glass 11-in. globe with ventilating ash tray at the bottom and an inned globe approximately 5½ in. in diameter and 4¾ in. deep, having a 2⅛-in. aperture at the bottom. This inner globe, from the bottom to a point within 2 in. of the top, was provided with horizontal glass ribbings of prisms calculated to redirect the light rays.

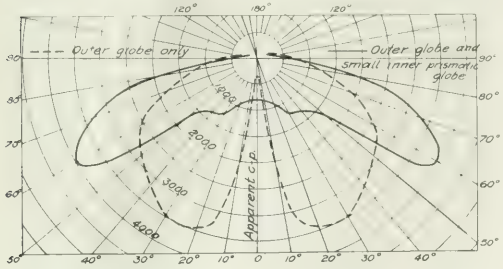


FIG. 2.—DISTRIBUTION OF LIGHT FROM FLAMING-ARC LAMPS.

The lamp was permitted to burn for about two hours before any tests were undertaken. It was operated upon one side of the three-wire system, the average line voltage being 118 volts. By means of an adjustable external resistor, the current through the lamp was maintained at about 9.5 amp. The light distribution was determined by means of the Matthews arc-lamp photometer having mirrors located at 15-deg. intervals. The vertical plane throughout which the distribution was investigated is one located approximately at 45 deg. to the vertical plane of the arc stream. In the photometric measurements a Bunsen photometer with Leeson disk was employed, and an incandescent electric lamp was used as the standard of candle-power. At each point at least 100 individual settings were made. The results shown below are average values obtained from a series of such settings:

DISTRIBUTION OF LIGHT.

Angle in vertical plane.	Flaming arc with clear prismatic inner and clear glass outer globes. Apparent candle-power. Max.	Avg.	Min.	Flaming arc with clear glass outer globe. Apparent candle-power. Max.	Avg.	Min.
165	...	...	...	66	64	52
150	153	144	129	109	98	89
135	169	161	152	148	140	130
120	185	147	126	206	177	150
105	295	260	175	298	268	237
90	515	440	300	732	638	528
75	3,320	2,735	2,140	1,665	1,505	1,400
60	4,870	3,970	3,240	2,890	2,585	2,435
45	1,856	1,404	1,136	3,149	3,095	2,640
30	1,384	1,212	1,028	3,715	3,460	2,490
15	964	861	735	3,515	3,240	2,900
0	943	836	748	280	248	210

SUMMARY OF TEST RESULTS.

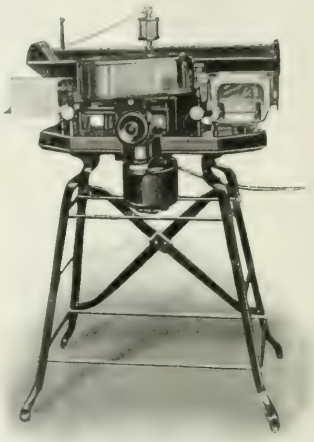
Amperes	9.5	9.5
Volts, line	118	118
Volts, terminal	57	58
Volts, arc	18	49
Watts	1,115	1,122
Watts, terminal	539	551
Watts, arc	454	465.5
Mean spherical cp	1,135	1,122
Mean lower hemispherical cp	2,120	2,285
Watts per mean spherical cp-terminal	0.475	0.441
Watts per mean spherical cp-arc	0.400	0.371
Watts per mean lower hemispherical cp-term'l	0.254	0.241
Watts per mean lower hemispherical cp-arc	0.214	0.204

The results of light distribution, as shown in the table, are presented diagrammatically in the curve. This shows at a glance the difference in the distribution of the light from the lamp fitted with a prismatic inner globe as compared with the same lamp not thus equipped.

Electrically Operated Mailing Machine.

A labor and time saving device which finds a wide application in business houses, etc., in handling the outgoing mail, is the electrically driven envelope sealer, stamper and counter illustrated herewith. The machine will readily perform its various operations on 150 letters per minute, and may be speeded up to turn out considerably more when required.

The letters in bunches are held against an automatic feed, which permits only one envelope at a time to pass its flap over a metal disk which revolves in water. As the envelope advances, the stamps are fed forward, cut off, moistened and rolled upon the passing letter. After the envelope flap is moistened and the stamp simultaneously attached, the letter passes between a series of rolls under pressure, and then emerges and is automatically stacked. A counter records each stamp as it passes upon the envelope, and thus furnishes a check upon the amount spent for postage. Moreover, the stamps cannot be removed from the machine except by the clerk to whom the key is entrusted.



ELECTRICALLY OPERATED MAILING MACHINE.

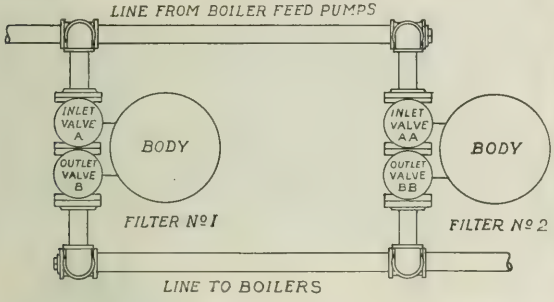
The source of power being furnished by an electric motor, no mechanical labor is involved in the operation of the machine except the feeding of the letters in bunches. The motor is attached by a flexible lamp cord to an ordinary electric lighting socket, and to start the machine it is only necessary to turn the switch. There is no interruption until the work is completed, and the number of envelopes sealed and stamped in a given time is much greater than is possible in the case of a manually operated machine.

The Schermack Mailing Machine Company is the manufacturer of the sealer, stamper and counter illustrated, and the Westinghouse Electric & Manufacturing Company furnishes the electrical attachments. Only a ⅛-hp motor is required for the latter, so that the cost for current is negligible.

Linen Terry for Clarifying Feed Water.

Linen terry has long been recognized in marine practice as a superior filtering medium for the removal of oil, grease and other floating impurities in the feed water. In addition to excellent filtering qualities, terry cloth has the added advantage that it may be put into the smallest space, cleaned without difficult labor, and the cloths may be used over and over. The cartridge shown in Fig. 2, from a Blackburn-Smith feed-water filter and grease extractor, is an effective method of using the terry, which also permits easy removal for cleaning. The filter proper in this case consists of cartridges similar to that shown, the size and number of each being determined by the amount of water to be filtered per hour. Each cartridge consists of two concentric, perforated brass cylinders, the lower one of the inner one being set into the partition which separates the filtering and outlet chambers. The filtering me-

dium is shaped somewhat like a stocking, the closed end being drawn down tight over the cylinder, the rest reversed over the outer cylinder and the end clamped at the top by a brass cap. As the water passes toward the center of the cylinders and into the outlet chamber it must pass through the two layers of terry. Any impurities not caught by the first layer are sure to be retarded by the second. A spare set of cartridges can always be kept in readiness, so that they may replace the fouled cartridges within the filter at a moment's notice. Renewing the filtering media is accomplished by lifting the cover from the filter-chest, pulling off the outer cylinder and the foul cloth from each cartridge and slipping on the clean cartridges as shown in the illustration. The frequency of renewing the terry cloth in any filter using this material varies according to conditions peculiar to each plant, and can be determined by

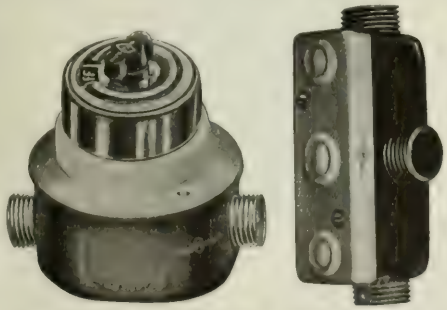


FIGS. 1 AND 2.—CONNECTION OF APPARATUS AND CARTRIDGE OF FEED-WATER FILTER.

a short operation of the filter. Foul terry cloth can be boiled in soda and kept in readiness for the next cleaning. Terry cloth filters are usually so made that they can be by-passed, and the cleaning operation can be completed without shutting down the plant. If the water is exceptionally dirty, it may be worth while to use two filters, so arranged that either can be operated without reference to the other. Fig. 1 illustrates two Blackburn-Smith feed-water filters so piped that each may be thrown into service or cut out at will; thus one filter may be cleaned while the plant is running and the other is supplying clean water to the boilers. The filter is made by James Beggs & Company, New York, who can also supply the terry cloth.

Conduit Fittings.

For the system of wiring employing exposed conduit for factory and many outdoor structures, a number of fittings have been designed. In many instances the number of fittings is



FIGS. 1 AND 2.—APPLICATION OF CONDUIT FITTINGS.

very large, making it difficult for a contractor to figure on a job with any certainty of knowing exactly what fittings he would require. To overcome this trouble, the Marshall Electric Company, of Boston, Mass., has designed a universal steel fitting shown herewith. A knockout box about the size of the pipe coupling has three knockouts on one side, one in each end, one in the bottom and one in the side opposite the three knockouts. These knockouts are removed by the constructor as he comes to the place where the fitting is required. When the hole is knocked out, a square-headed nipple is inserted. This nipple will not turn in the box and a pipe with a coupling on the end may be screwed into this nipple, or the fitting with the nipple

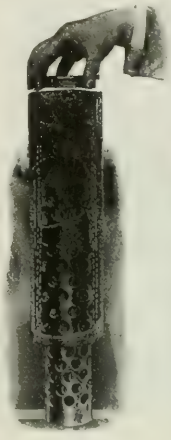




FIG. 3.—NIPPLES.



FIGS. 4 AND 5.—KNOCKOUT BOXES.

may be turned into the pipe coupling. The box is provided with the usual covers. For the accommodation of switches, rosettes, sockets and receptacles, the octagonal or round box is used. This box has a flat face to make a tight joint against the pipe coupling, and the upper flange is turned over so that the cover may be secured by two lugs which set under this flange by simply tightening up the screws.

Plain metal covers, porcelain covers adjustable to one, two and three wires are provided, as well as the universal cover applicable to all switches, rosettes and receptacles. This cover has two pivoted lugs tapped for screws, which can be adjusted in or out by taking hold of both at the same time. Two segments of metal are partly knocked through so that if it is desired to enlarge the hole in the cover they can be removed with a hammer or with a pair of heavy pliers. Being made of steel, this line is not subjected to the breakage of the cast-iron fittings.

Boiler Compounds.

By A. Eugene Michel.

The majority of scale-forming and corrosive elements in feed water can be most effectively and economically prevented from doing harm by the careful use of a scientifically prepared boiler compound. Scale-forming elements can be dealt with in three ways: treatment of feed water before it enters the boiler; treatment within the boiler, or scale removal at periodic intervals.

The first two methods apply also to corrosive elements, which must be rendered absolutely harmless as soon as discovered, if the boiler is to be preserved. If scale and corrosion are to be prevented by external feed-water treatment, there is required additional apparatus in the form of a purifier, filter, settling tank, separator, or a combination of these which may or may not accomplish the purpose thoroughly and completely. If, on the other hand, the feed-water impurities are permitted to form scale which gets thick enough to cause trouble, an initial expenditure becomes necessary for cleaning apparatus, which in itself is a source of repair expense.

The use and action of boiler compound is quite a contrast

to the drudgery of scale removal, or other preventive methods. As compound acts entirely within the boiler, no other apparatus save a feeding device is required. This, as a rule, may be obtained free from the manufacturer of the compound. The engineer has only to spend a few minutes each day in renewing the supply of compound to keep the heating surface clean and at highest efficiency, and the boilers need only be blown two or three times a day, and occasionally washed out with a hose. There is no investment save the cost of the compound. If the compound is correctly prepared and used, there will be found, upon emptying the boiler, nothing but a little soft mud which may be washed away with water, or if allowed to dry, may readily be blown away as dust. But success with any boiler compound depends upon its adaptability to the feed water, and upon using the right quantity to accomplish the purpose. It is simply the neglect of these conditions that causes dissatisfaction with compounds. Water carrying a large percentage of impurities requires a proportionately large percentage of chemicals to render these impurities harmless, while other water might require a lesser amount of chemicals.

There are elements that will dissolve the scale, although their use is not practical. Soda ash, acid salts, free mineral acids, caustics, acid compositions, etc., are sometimes offered, disguised by coloring matter. Caustic soda or slacked lime, for instance, will control the corrosion and deposit, but the quantities required would be enough to convert all the boiler water into a foamy mass which would cause trouble. Again, the same mixture is oftentimes used for all conditions. Just what this might mean may be judged from the difference between the impurities in the following two waters:

Sample No. 1.

	Grains per gal
Solids	22.829
Organic and volatile matter	1.011
Sodium chloride	3.415
Sodium carbonate	11.170
Sodium sulphate	1.450
Calcium carbonate	2.452
Magnesium carbonate	1.516
Iron oxide and alumina	.714
Silica	1.101
Free carbonic acid	6.511

Sample No. 2.

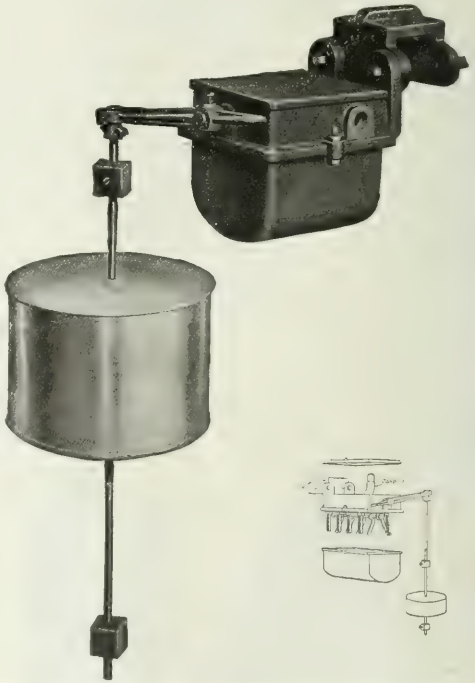
	Grains per gal.
Solids	39.923
Organic and volatile matter	6.235
Sodium chloride	5.239
Sodium sulphate	4.101
Calcium carbonate	2.145
Calcium sulphate	16.038
Magnesium carbonate	1.923
Magnesium sulphate	4.242
Free carbonic acid	14.141

The above samples are chemically opposite. No. 1 is of an alkaline nature and under the influence of boiler heat and pressure would tend to foam and prime. The scale from this water would be like mud. As the water inside the boiler would be converted into steam, the sodium salts would concentrate in solution in the water, increase the gravity of the solution, and retard free steaming. If this water was treated with a boiler compound containing alkalis, the harmful constituents already present would do still more harm and increase the foaming tendency. Sample No. 2 tends to form a heavy crystalline scale, so hard that if struck with a hammer it would chip like porcelain. In addition to chemicals required to neutralize the various calcium and magnesium salts in solution, the compound should, in this case, show an alkali reaction.

It is peculiar that if the two waters were mixed, a heavy precipitate due to the action of the impurities of one upon those of the other would occur and greatly improve both waters. This is just what the compound does, as well as rendering the precipitate non-adhesive. It is clear that the compound should contain the right amount of each of the right constituents to do its work well. It is also evident that this is a matter of individual investigation for each plant, by a competent chemist, and then of following his instructions carefully in applying the remedy he offers. There is nothing to fear from the use of boiler compounds when these conditions are heeded and the Bird-Archer Company, of New York, guarantees [illegible]. A competent staff of chemists analyzes the water or samples of scale from the plant where the compound is to be used before giving a remedy. Explicit instructions go with each shipment of compound, and where these were followed, there has been no difficulty in preventing corrosion or scale formation. It is even practical to use compound to dissolve old scale of long standing, and this can be done without in any way injuring the boiler, its fittings, packing, gaskets, or cutting the cylinder lubricants. A properly prepared compound will not cause the boilers to prime or foam, and it will not contaminate the steam in any way to effect products which come into contact with it.

Tank and Sump Switch.

The Smith Electric Company, of New York City, has brought out the tank and sump switch shown herewith. The operation and interior mechanism of the switch are quite simple. The switch is brought into action by the pressure of the float against either of the stops, the pressure being communicated to the knife blades by the rod suspended on the rocker arm. The snap action of the switch is accomplished by a spring fastened at one end to a pin on a lever carried by the same shaft as the rocker arm. As the pin moves in either direction past the center of the rod carrying the blades, the spring causes the blades to move with a snap. The switch is weatherproof and can be made watertight if desired. The stops on the rod upon which the float moves can, of course, be set at any desired positions so that the time of opening and closing the circuit may be varied to suit conditions. The switches are made with one, two, three and four poles, the latter being intended for two-phase systems when the requirements demand the opening of all mains. Where it is necessary to take care of high voltages, the switch is made oil break.



FIGS. 1 AND 2. TANK AND LAMP SWITCH AND DETAIL OF SWITCH MECHANISM.

The Cooling of Transformers.

The method employed for cooling transformers is often dictated by the local conditions, whereas, in some installations the method is a matter of choice. However, it is the practice of one manufacturing company to build self-cooling transformers rated at from 50 kw to 150 kw for use in plain boiler-iron tanks; boiler-iron tanks with radiating strips are used with transformers rated at from 50 kw to 250 kw, while corrugated tanks are employed with self-cooling transformers of from 50 kw to 500 kw in rating. These transformers are wound for e.m.f. not exceeding 50,000 volts. Oil-immersed, water-cooled transformers for any voltage are built in any



FIG. 1.—TRANSFORMER COOLING COIL.

rating above 100 kw. Air-blast transformers are built for e.m.fs. not exceeding 25,000 and in ratings from 60 kw to 1000 kw.

The cast-iron tanks used by the Wagner Electric Manufacturing Company are made of a special foundry mixture. When received from the molding floor the tanks are sandblasted, and then chemically treated to fill the pores in the iron in order to prevent leakage. The corrugated tanks are made of leaded sheets (terne-plate), and the boiler-iron tanks are made of



FIG. 2.—TRANSFORMER.

steam boilerplate; both types are provided with cast-iron bases and tops. The cast-iron base is provided as a support to the tank proper, but is in no way depended upon to hold the oil, as it is difficult to make an oiltight riveted joint between a boiler-iron shell and a cast-iron base. The tank proper—a self-contained cylindrical shell, riveted and calked to a standard boiler head forming the bottom of the tank—is arranged to hold the oil. A cast-iron ring is riveted to the top of the tank, and the transformer cover is bolted thereto, with a dirt-proof and moisture-proof casket between the ring and cover. The tanks, after completion, are filled with a light, volatile oil, and tested for leaks for several days.

The tanks of large oil-immersed transformers are equipped with oil gages and thermometers, for indicating the oil level

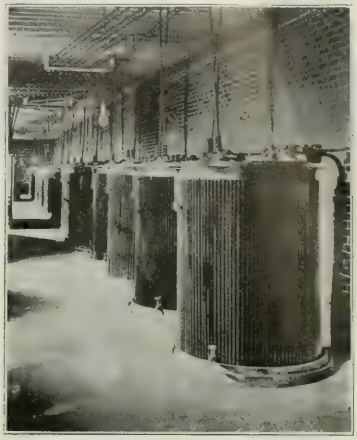


FIG. 3.—TRANSFORMERS IN SERVICE.

and the operating temperature of the transformer, respectively.

In the air-blast transformers the cooling air, delivered by a fan blower, is supplied through suitable ducts and controlled in amount by regulating the speed of the fan, or by adjusting the gate in the base of the transformer itself. Instead of simply admitting the air at the bottom of the transformer and allowing it to escape at the top after passing up through the transformer structure, in the Wagner air-blast transformers the air passages are so arranged that the cooling air, after passing up through the coils, is deflected downward again so as to traverse the iron circuit, and then allowed to escape through a separate passage in the base.

The water-cooled transformers are so designed that in case of necessity the core can be removed from the case with very little effort and without disturbing in any way the location, connections or arrangement of the cooling coil, or of the feed or intake pipes to the latter. The cooling coil is made of seamless copper tubing.

The magnetic circuit of Wagner transformers is of special alloy steel, which it is claimed practically eliminates aging, as well as materially reduces the first cost.

In order to make it impossible for the transformer to get out of position in the case during transportation, it is bolted through the shell to the cast-iron base, thus relieving the shell of all strain and at the same time providing a rigid form of construction.

It is claimed that the transformers illustrated in Fig. 3 have been in service for 10 years without requiring one dollar for repairs.

Rotary Motor for Scaling Boilers.

The greatly increased importance now assigned to heating surface effectiveness, as necessary to steam boiler economy, has directed the efforts of engineers toward improved means of cleaning scale from boiler tubes. This has resulted in a new air-driven or steam-driven rotary motor adaptable to many uses other than tube cleaning, for which it was originally designed and is specially suited. It is now generally accepted that water-tube boilers are best cleaned by the very rapid rotation of a cleaning head or tool passing through the tube in

advance of a cylindrical body or gage that fits the cleaned tube and will not move forward in the tube until the scale is cleared away in front of it. A high speed of rotation is usually depended upon to produce either a rapid succession of rotary blows from a hinged tool, or rotary toothed cutters are forced against the scale in the tube by the centrifugal action due to their rotation. The earlier devices consisted of a motor outside the boiler driving the tool within the tube through a jointed or telescoping shaft. The high speed required and con-

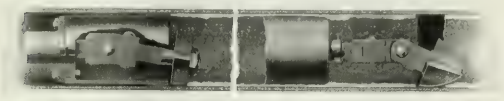


FIG. 1.—NEW AND OLD WAY OF CLEANING TUBES.

siderations of space and convenience practically prohibited the use of a long shaft in favor of a high-speed motor carrying a cleaning tool ahead of it, the motor and tool together (on the end of a hose) passing through the boiler tube. This is now the form of nearly all tube cleaners. There are several other devices for the purpose, but the total number of them in actual service is comparatively small.

In fire-tube boilers the scale is on the outside of the tube and the problem is to knock it off the tube without injury to the tube itself. This now appears to be accomplished most thoroughly and safely by a suitable head rotated inside the tube at the proper speed to give a hammering action. With this rotary motion there is no danger of striking continually on one spot of the tube and damaging it. In short, the fire-tube cleaner comprises the same motor, somewhat differently equipped, as used in water tubes and for cleaning both water-tube and fire-tube boilers, the requirement is for a rotary motor of great power and speed and of very small external diameter. For bent tubes the motor must also be very short to get around the bends. Nothing but the simplest device can reasonably be expected to long withstand the severe hammering to which a boiler-tube cleaning motor is subjected in use. The motor must be surely self-starting while in the tube, must be incapable of injury from overspeed or overload, and it can expect but little skilled care or attention. The motor

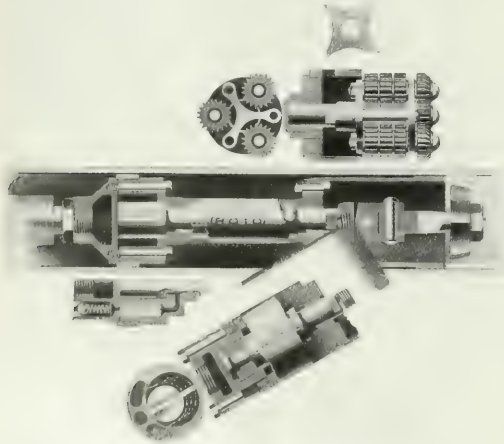


FIG. 2.—DETAILS OF TUBE CLEANER.

illustrated herewith is driven by either compressed air or steam and its general construction is evident from the illustrations. In the larger sizes and for straight tubes the single-bearing construction is used, while for smaller sizes and for bent tubes the piston is supported at both ends. The motor consists of only three essential parts, a rotary slotted piston, a sliding blade carried thereby and a cylinder. The single blade balances itself in centrifugal action and no spring is required as would be needed if two or more blades were used in a circular bore. The result is sure and strong self-starting, low initial and running friction, high speeds, great power, cool running and minimum wear of blade and cylinder. The use of a single blade also gives a full width of support in the slot of the piston and allows much greater eccentricity, displacement and power of the motor than would be possible with divided blades. The cylinder is not circular in bore, but of a form such that the round-edged blade will exactly fit across it in all positions of



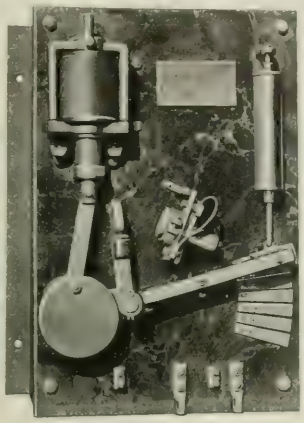
FIG. 3.—PISTON AND BLADES.

the slotted piston during its revolution. The success of the motor has been largely due to the successful designing and construction of automatic machinery for forming this cylinder bore to its peculiar curve, thus enabling a single blade to be used and allowing the motor to be simplified to the absolute limit of a positive-action flued pressure engine. The blade and piston are both of hardened steel and ground to size. The features of most general interest in the motor are its simplicity, large power per size and weight, high speed and great speed variation possible, its small initial friction, the low air or steam pressure on which it will operate, easy reversibility by a simple three-way cock and its very small inertia. The motor reverses as rapidly as the reversing cock can be operated. In the smaller sizes the motor operates with a no-load speed of more than 10,000 r.p.m. As a tube cleaner the power of the motor is said greatly to exceed that of the same diameter of water-driven turbine, so that only a small part of the available space is used for the cylinder, and the motor is armored with hardened steel rings to protect the cylinder from the hammering resulting from the greatly increased power, speed and work. As equipped for tube cleaning, several novel devices have been adopted to keep the cleaner at work on the scale and moving forward as rapidly as the scale is removed. The motor is manufactured by the Roto Company, of Hartford, Conn.

Auto-Starter for Motors.

The Automatic Switch Company, of New York City, has brought out another auto-starter for motors which combines many features of interest. The device is shown herewith. The starting solenoid shown at the upper left-hand corner fulfills the double purpose of closing the main line circuit and releasing by a gravity-actuated mechanism the resistor arm whose speed is governed by the consistency of the oil in the dash-pot. This is made possible owing to the peculiar construction of the solenoid. Usually magnets of the size shown with a long stroke have a weak pull at the start, which pull is rapidly increased until at the end of the stroke it reaches a maximum and strikes with a hammer blow. To get a strong pull at the start without the hammer effect at the end of the stroke, the company employs a hollow core with an adjustable rod having a slightly smaller diameter than that of the bore of the core. When the core is in its lowest position, the rod is not more than ½ in. away from the core and as the core is pulled up the rod tends to lag behind with a dash-pot effect and thus to prevent the core from striking the upper part of the frame hard enough to be objectionable. When the magnetic influence at the upper end is greatest the core comes to within ⅛ in. of the end of its stroke and presses the copper contact button on the flexibly-supported carbon contact, causing the latter in turn to press a button against a support and open a contact bridging a high resistance unit in series with the magnet. By this means the current is reduced to a fraction of its former value and considerably lower than the safe carrying capacity of the coil. It is essential that the speed of the core should be as great as

possible, since otherwise the arm would fall and bridge some of the starting resistors before the line switch was closed. By means of three cotter pins the moving mechanism can be re-

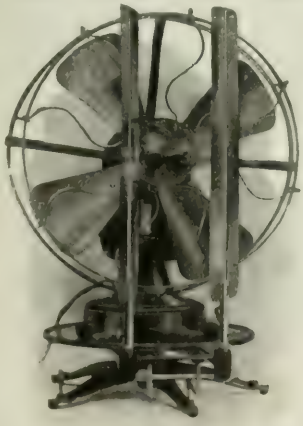


AUTO-STARTER FOR MOTORS.

moved for inspection and repair. Sand-packed resistor units are used in connection with the starter and the whole is mounted on a sheet-steel frame.

Oscillator for Electric Desk Fans.

The accompanying illustration shows the application of an oscillating device brought out by the Simplex Manufacturing Company, of New York, for electric fans. The device consists of a little table set on ball bearings on which a stationary desk fan is clamped, as shown. Attached to the table are two vanes against which the wind from the moving fan blades impinges. The vanes being set at an angle, the table turns until a lever attached to the paralleling mechanism to which the vanes are fastened strikes a stop on one of the feet of the base. This serves to set the vanes in an opposite angle, which in turn causes the table to revolve in the reverse direction also until the lever hits another stop when the direction is again changed. The dis-



OSCILLATOR FOR FANS.

tance through which the table swings may be adjusted by placing the stops nearer or farther apart, and if it is desired to have the breeze blow in one direction, the table may be adjusted for that purpose. The oscillator is purely mechanical in its operation and any type of desk fan can be used with it.

Automatic Time Switches.

The particular forms of automatic time switches shown in the accompanying illustrations have been developed for severe duties. Fig. 1 illustrates a device for controlling two separate

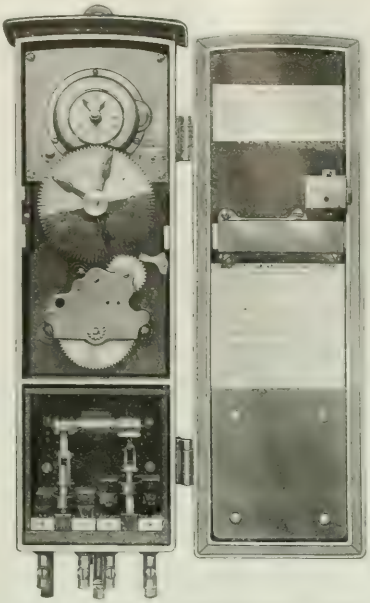


FIG. 1.—DOUBLE-POLE DOUBLE-BRANCH SWITCH.

circuits at intervals—that is, to close one circuit earlier than another, and open both at the same time, or one circuit before the other, and close both at the same time. This switch is

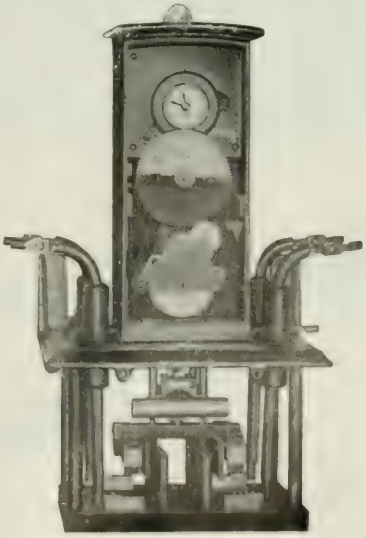


FIG. 2.—DOUBLE-POLE SWITCH.

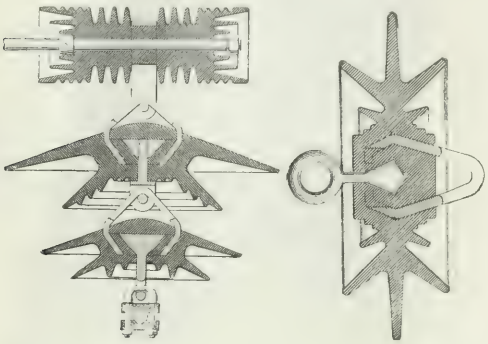
built for e.m.fs. not exceeding 250 volts and for currents from 25 to 200 amp.

The switch shown in Fig. 2 is constructed for e.m.fs. not exceeding 3000 volts. It is of the self-wind type, controlled by the standard clock and propelling mechanism. It is built

either double-pole or triple-pole for 25 or 50 amp. These switches have been placed on the market by Albert & J. M. Anderson Manufacturing Company, 289 A Street, Boston, Mass.

New Types of High-Tension Insulators.

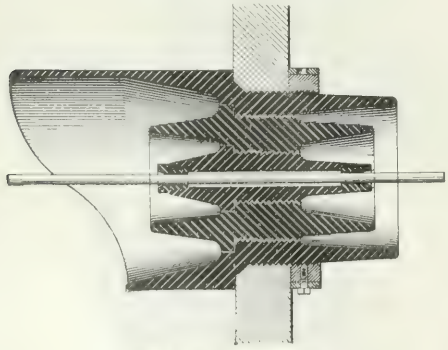
The accompanying illustrations show three types of high-tension insulators for which patents have been issued to Mr Louis Sternberger, and which are claimed practically to cover the entire field of application of insulators to the transmission of electric power up to the highest voltage that now appears will be reached in the future. In the design of the flexible suspension type shown, provision is made not only for insulating the conductor, but also for insulating the cross-arm or support,



FIGS. 1 AND 2.—SUSPENSION AND DISK STRAIN INSULATORS.

which in effect insulates the insulator. Owing to the flexibility of this structure all direct strain on the insulating material is avoided. The dead weight of the conductor, including snow or sleet and the effect of wind-pressure, is supported by insulating material which is wholly under compression. The form of the metal suspension members makes it quite impossible for the line to drop, even though the insulating material were totally destroyed.

The disk type of strain insulator shown provides large interrupted insulating surfaces for limiting surface leakage, while the design prevents moisture, soot or dust from forming a continuous conducting path extending from one strain member to the other over the surface of the insulator. The form of the strain members and their relation to each other and to the insulating disk are such as to provide an insulator of exceptionally great mechanical strength combined with the highest form of electrical insulation. This disk type of strain insulator may be used separately, or a number of them may be linked together for supporting a line or used in any other desired relation where currents of very high potential are employed.



WALL INSULATOR.

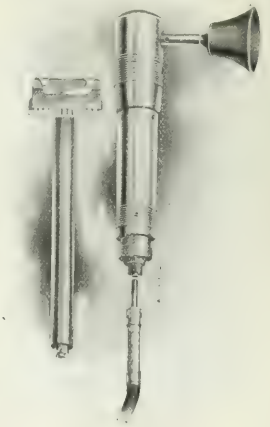
In the wall or barrier insulator shown, the several sections of which the bushing may be composed are separable; should either of the parts become injured or destroyed, it may readily be removed and a new section put in place, thereby avoiding the loss of the entire bushing. It will, of course, be evident that either one of the several bushings may be made of any predetermined length. The bushing is provided with a "protector" which shields the exposed parts from rain, snow, sleet, etc., and which may be made integral with the bushing or attached separately thereto. The central bushing is provided with detachable members for supporting the line centrally with relation to the bushing. By means of these members the central bushing may be made watertight, thereby maintaining at all times a dry surface within the bushing. Finally, an insulating locking member is provided for securing the bushing relatively to the wall or barrier, thereby obviating the trouble and expense incident to cementing a bushing into place or removing it. These bushings may be mounted into or removed from the wall very readily.

The insulators described are now being manufactured by the Electrose Manufacturing Company, Brooklyn, N. Y.

Electric Razor.

An electrical razor is one of the latest devices placed on the market by the Shelton Electric Company, Chicago, Ill. This razor is similar in design to the well-known safety razors so widely used throughout the United States. It consists of a handle, a blade and a blade holder. The handle is attached to the blade holder by a screw thread and the blades are held in the holder by a spring. The razor is designed to be used in connection with the company's "Twentieth Century Vibrator" and attaches directly to the spiral shaft of the vibrator. Inside of the handle of the razor is located a rotary eccentric which gives the blade a vibratory movement, this movement being sufficient to cut the hair as the blade of the razor is drawn down across the beard. The blade is protected by a safety device which makes it impossible to cut the flesh.

The blade of this razor is 1½ in. long and ¾ in. wide. The handle is about 5 in. long and the razor weighs complete 3½ oz. The device, being finished in nickel, has an attractive exterior appearance. The razor can be operated at variable speeds; and the faster the vibrator is operated the closer to the face the beard is cut. The company claims that for an ordinary, medium, shave it is necessary to draw the blade but once over the face.



ELECTRIC RAZOR.

Electrically Driven Saw-Mill.

The Central Pennsylvania Lumber Company has erected at Sheffield, Pa., a new lumber mill for sawing rough boards, as well as finished lumber, in which, as is the case with nearly all new mills, electric power is employed for driving the entire equipment. Wherever possible the machines are direct-connected to their driving motors. Three-phase, 60-cycle, 400-volt

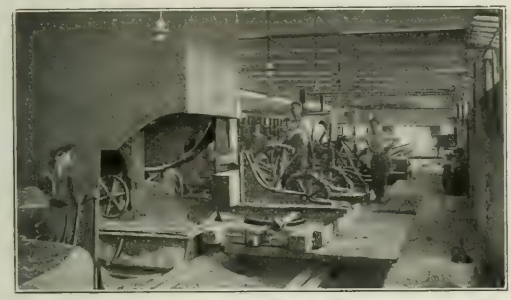


FIG. 1.—BAND MILL AND CARRIAGE, DRIVEN BY 150-HP BELTED MOTOR.

alternating current was determined upon as being the most satisfactory under all the conditions of service, and a complete power equipment, including boilers, engines, generator, motors and all the necessary measuring instruments and controlling devices, has been installed and arrangements made to burn the refuse from the mill under the boilers.

The logs are conveyed up the incline from the pond to the mill by a "log chain" or "log jacker," driven by a 15-hp back-geared motor running at 840 r.p.m. The chain is 190 ft. in length and carries 33 steel dogs for gripping the logs. The logs are first sawed into lumber by 8-ft. band mills, each of which is operated by a 150-hp motor running at 580 r.p.m. From both the band mills the sawed lumber is carried by line rolls

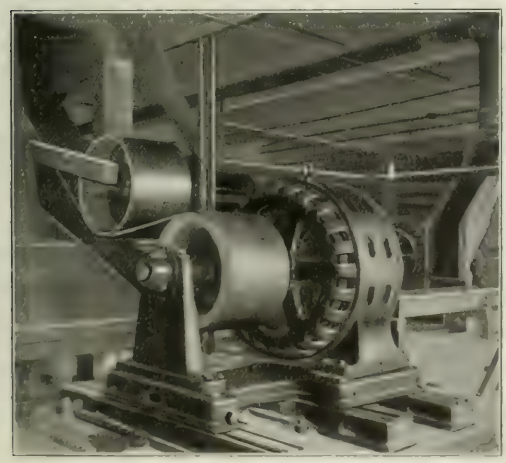


FIG. 2.—150-HP MOTOR DRIVING 84-IN. RE-SAW.

and transfers to a re-saw mill. Each set of 17 10-in. x 24-in. rolls is operated by a 7½-hp, 1120-r.p.m. motor through a back gear on the motor. The re-saw is driven by a 150-hp motor, 580 r.p.m., connected by belt to the lower band wheel shaft and gives to the saw a peripheral speed of about 6750 ft. per minute.

From the re-saw the 1-in. and 2-in. material is carried by conveyors to the two gang edgers, each of which has eight saws 24 in. in diameter, operated by a 50-hp, 1700-r.p.m. motor direct-connected to the shaft of the edger. After the lumber has passed through the edgers it is carried by line rolls to the trimmers, one of which has eight saws and the other 10. Each set is operated by a 30-hp motor running at 840 r.p.m. The motor also operates a pintle chain for conveying the lumber away. The lumber after being trimmed is conveyed on a chain through the assorting shed, where it is loaded onto cars by manual labor. The chain travels at the rate of 32 ft. per minute, being driven by a 15-hp, back-geared motor running at 1120 r.p.m.

From the band mills and the edgers the slabs are carried to slasher saws, which are saws mounted on a shaft 4 ft. apart. The slasher is operated from a 30-hp, 840-r.p.m. motor, which also operates six conveyor chains, each 100 ft. in length. A hog, for cutting the refuse into chips, is driven by a 75-hp motor, 690 r.p.m., direct-connected. It has a large rotating element weighing approximately 2000 lb., which carries 24 knives on a diameter of 60 in. Owing to the weight of the moving element of the hog, the starting conditions are particularly severe, but the motor, which is of the slip-ring type, brings the machine up to speed quickly without undue overload. The main refuse conveyor for carrying refuse to the boiler room is operated by a 10-hp, 1120-r.p.m. motor.

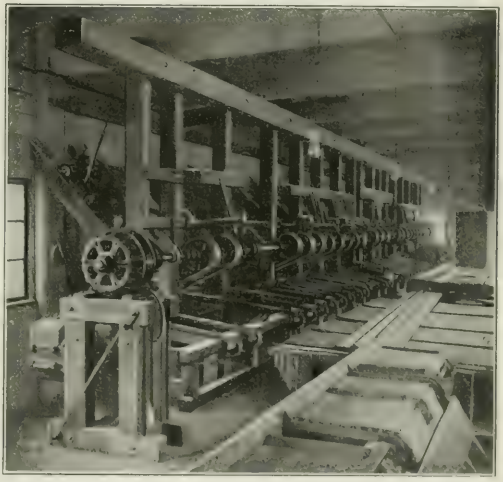


FIG. 3.—30-HP MOTOR DRIVING TRIMMERS.

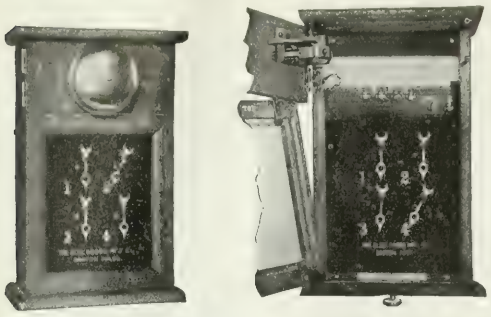
The woodworking equipment was supplied very largely by Clarge Brothers, and the motor equipment by the Westinghouse Electric & Manufacturing Company. The entire equipment represents a very good indication of what can be done by the individual application of electric motors to woodworking machines.

New Type of Annunciator.

An improvement in the well-known magnetized-needle form of annunciator now being placed on the market is shown in the accompanying illustration. In the old type of instrument false indications not infrequently resulted through the needles coming within the influence of the magnet cores while vibrating after being reset. In the new type the needles are attached to the face plate instead of to the set back rod. A V shaped slot in the set-back bar engages a lug on the needle which passes through the plate, thus returning the needle to its normal vertical position. No resetting oscillation is possible, as the slot brings the needle to immediate rest. Another feature of the new annunciator is that raising the set-back rod does not impart to the needles any general movement. In early types

where resetting "jiggles" all the needles, a strong magnet core often would reattract a needle, causing false indication.

The bell mechanism is attached to a frame hinged to the case. This allows the testing of the bell or lines to be done



FIGS. 1 AND 2.—VIEWS OF ANNUNCIATOR.

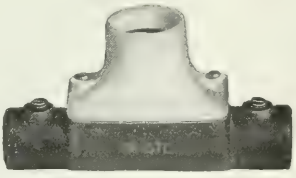
without the removal of the bell from the case. The case is plain, with round corners; the terminals have lugs to prevent the wire slipping and are soldered to the wires from the magnet coils. A telephone terminal is added to one form, which enables telephones to be connected to the system, which is accomplished with no more wiring than that used for the ordinary annunciator. If the building has been wired, a telephone can be substituted for the push button at any outlet and a telephone for the attendants' use placed in the same room with the annunciator. The annunciator is also made with the operator's set attached to the case. This new type has been named the "Hub" and is made by the Electric Goods Manufacturing Company, Boston, Mass.

Conduit Fittings.

The H. T. Paiste Company, of Philadelphia, Pa., has brought out a line of conduit fittings which provide numerous possible combinations with the least number of parts. The fittings are uniform not only with respect to all covers, etc., but with all styles of Fielding molding receptacles and rosettes used so extensively in molding work. The conduit fittings have an opening of such size and shape that all standard Fielding receptacles can be used in conjunction with them. The opening is the same in shape and size for ½-in., ¾-in. and 1-in. conduit, so that the receptacles fit every type of fittings, and a one-hole cover, for instance, that fits the ½-in. size fits all others up to 1 in. Fig. 1 shows a straight fitting for ½-in. conduit, and Fig. 2 shows the fitting with a receptacle applied. The fitting is attached to the conduit by pipe threads located inside the sleeve and by means of a set-screw adjustment the work may be lined up with exactness. Five types of fittings have been on the market; the straight-through fitting, the end fitting, side-drop fitting, end-drop fitting and the branch fitting. To these have been added an elbow fitting and a snap-switch fitting. The former can be used for making a short right-angle turn and also a pull outlet. The opening is placed on the outside of the bend, as shown in Fig. 3, and all inside lines are easy curves with smooth surfaces. The design is such that the wires can be pulled straight through and then fed through the other arm without any abrasion or other injury. The elbows are galvanized inside and out and are furnished with soft rubber gaskets and plain steel covers.

The receptacles are wired just as in molding work; the button part rests on the two inward projecting lugs in the opening of the fitting, and the wires loop up and set under the receptacle set screws. The cover is fastened with two brass screws, provided with each fitting. In the design of the many special fittings for the "pipe taplets," as they are called by the manufacturer, many labor-saving improvements have been embodied. In the branch fitting, for instance, shown in Figs. 4 and 5, a branch line may be connected without soldering and taping. The button part rests over the opening of the pipe fitting, the mains are looped up over it and the wires bared to set under set screws. The branch wires are connected to the other set screws, as shown in Fig. 5, and the cover screwed in place. If instead of a branch, an outlet for two-wire molding is desired, a cover with the necessary holes is provided, the wiring connections being made as in the case of a branch connection. For standard types of snap switches an additional fitting for all types of pipe taplets is employed, as shown in Fig. 6. The switch fitting is first attached with long brass screws, the loose yoke fitting which forms part of the device being taken out and fastened loosely to the switch. The latter is then placed on the fitting so that this loosely hanging yoke piece slips through rectangular recesses and the whole is turned so that the handle of the switch is square with the fitting. Then, by tightening the screws which hold the switch to the yoke, the whole is securely fastened. The 5-amp fitting is similar to the 10-amp fitting, except that it has a smaller opening to accommodate the smaller base of that size switch.



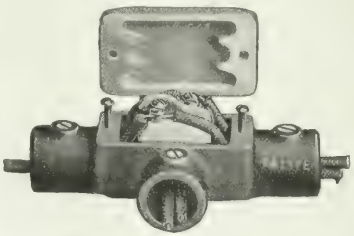


FIGS. 1 AND 2.—STRAIGHT CONDUIT FITTING, WITHOUT AND WITH RECEPTACLE.



FIG. 3.—ELBOW FITTING.





FIGS. 4 AND 5.—BRANCH CONDUIT FITTING, WITHOUT AND WITH WIRING.

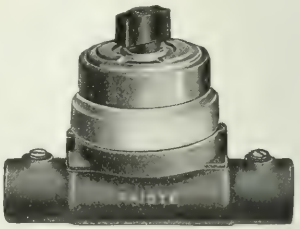


FIG. 6.—SNAP SWITCH FITTING.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The end of the holiday season brings encouraging reports of the business that has been done. Taking the country as a whole, the holiday trade has been better than in 1907, and, in fact, the volume of business in money is about equal to 1906. In the metal industries business is quiet, as is always the case at this season of the year. Only small orders for pig iron have been placed; no considerable order for steel rails has been reported since the Pennsylvania contract was made and structural material is being ordered in very light tonnages. In the wholesale and jobbing business there is the same quiet that always prevails at the end of the year. In fact, no orders are being received except for odd lots to fill up broken stocks. Inventories are being taken and the decks are being cleared for next year's business. As to this latter, there is a very general agreement that the coming year would be better to a large extent than the past one. Reports from collections are fair and there appears to be little disposition on the part of buyers to go in more extensively than they can readily afford. Business failures for the five days ending Dec. 23 were 196, against 311 the week previous, 248 in the like week of 1907, 161 in 1906, 212 in 1905, 218 in 1904.

THE COPPER MARKET.

The copper market is a trifle firmer than it was a week ago and while the bid price is no higher the holders are more rigid in their demands. This better tone is due entirely to the renewed activity of the speculative interests both in this country and in Europe which have been covering contract sales made abroad by purchases in this market. While it seems evident that a few smelters are growing nervous over the persistent steadiness with which prices are held, there has not been sufficient interest displayed by consumers to cause any upward movement. It is known that the commitments of European speculators are still large, and this knowledge of itself has a hardening tendency. Just before the holidays there were a few sales made in this market at 14⅜c. for January, February and March delivery but the average price was lower. At present quotations consumers show no anxiety to contract extensively for future deliveries. Buying for immediate needs is about the only buying that appears. In the meantime statistics continue to indicate steady accummulation. While exports for December will be larger than for many months, they do not when added to the consumption account for all of the copper that has come into sight. At the present time the production of the mines in this country is about 90,000,000 lb. per month and the imports have been recently about 20,000,000 lb. To offset this there have been exports averaging less than $50,000,000 lb. and a domestic consumption of less than 45,000,000 lb. The conclusion that there is an accumulation is therefore unavoidable, although it is persistently denied by selling agencies and producers. One authority has published estimates of the surplus stocks of copper at the end of the year as 225,000,000 lb. in Europe and 210,000,000 lb. in this country. This would indicate an accumulation during the year in the United States of 75,000,000 lb. as the government figures placed the surplus Jan. 1, 1908, at 135,000,000 lb. That these figures are so largely estimates and arrived at by inference is one of the serious handicaps of the copper market. The leading producers and dealers recognize this deficiency of exact information as was made evident recently when all the principal interests represented in New York met in conference at the office of Phelps, Dodge & Company. It was given out at the time that the sole purpose of the meeting was to make arrangements for the collection and tabulation of statistics on copper production and consumption. At this meeting a committee was appointed to formulate plans for systematizing the statistics of the copper industry. It was reported, and largely believed, in the market that the meeting was for the purpose of forming a "gentleman's agreement" among producers to maintain copper prices in the same way that steel prices are maintained. This was vigorously denied by the leading participants in the meeting, but the market continues to grow firmer. It might also be remarked that copper stocks have advanced several points within the past 10 days and good buying has developed. The exports from this country for December up to and including Dec. 28 have been 20,955 tons. Prices quoted on the Metal Exchange on that date were:

Lake	14¼	@	14½
Electrolytic	14	@	14¼
Castings	13⅞	@	14⅛

Following are the London quotations:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	63	12	6	63	7	6
Standard copper, futures	64			64	5	0
Market	Firm.			Easy.		
Sales of spot				150 tons		
Sales of futures				700 tons		

Extreme fluctuations for 1908:

	Highest.	Lowest.
Lake copper, spot	14⅞	12⅝
Electrolytic copper, spot	14⅛	12¾
Casting copper, spot	14¼	12⅛
London, spot	£64 12s 6d	£58 5s 0d
London, futures	65	59 15 0
London, best selected	68	61 0 0

THIRD AVENUE CONTRACTS.—The Third Avenue Railroad Company, of New York City, through Frederick W. Whitridge, receiver, has awarded the Westinghouse Electric & Manufacturing Company—as foreshadowed in the ELECTRICAL WORLD of Dec. 19, 1908—the contract for equipping the new substation at Webster and Brook Avenues, in the Bronx. The installation will include four 1500-kw rotary converters and 12 550-kw air-blast transformers. The railroad company wants the equipment delivered as rapidly as it can be prepared. In addition to this the Westinghouse Electric & Manufacturing Company was successful in securing the contract for 200 motor equipments for the 200 new cars which the company is ordering at this time. The equipments will be the Westinghouse No. 310 motor, which is of a special interpole, box type designed and made expressly for the Metropolitan Street Railway, which has equipped 127 new cars with them. The motor equipments are expected to be delivered in June.

WESTERN ELECTRIC COMPANY'S BUSINESS.—The gross sales of the Western Electric Company for the year which ended Nov. 30—the date on which its fiscal year ends—are estimated to be about $30,000,000. During the year the quantity of stock carried has been considerably reduced and many economies in operation have been practised. Labor conditions have shown but slight changes during the year, the average of wages having neither advanced nor declined. At the present time the company has on its pay rolls about 13,000, which is 3000 less than were employed a year ago. Sales during the year have been largely restricted to the smaller types of apparatus. The new switchboard for the Paris telephone exchange was one of the largest orders handled.

LARGE CONTRACT FOR BLOCK SIGNALS.—The Union Switch & Signal Company has been awarded a contract for 500 miles of automatic block signaling on the Chicago, Rock Island & Pacific Railroad. A short time ago the company was given a contract for 750 miles of automatic block signaling on the St. Louis & San Francisco, which road is a part of the Rock Island system. Therefore, the two orders are essentially one, and together they make the biggest automatic block signaling contract ever placed at one time except the contracts for the signaling of the Harriman lines, which the company received two years ago. It is expected that all of this work will be completed within 14 months or 15 months.

AMERICAN DIESEL ENGINE COMPANY.—The United States Court of New York has appointed John L. Wilkie receiver of the American Diesel Engine Company, with offices at 11 Broadway, New York, and factory at Providence, R. I. The company has been manufacturing oil and gas engines, and the receivership was brought about by an acknowledgment of its inability to meet its obligations. Adolphus Busch, of St. Louis, who was formerly president of the company, is a creditor to the extent of $200,000 for money loaned on notes.

BRUCE PEEBLES REORGANIZATION.—Advices from Edinburgh, Scotland, state that Bruce Peebles & Co., Ltd., of that city, have been reorganized. The business has been conducted without any interruption, and its control is now in the hands of an entirely new and influential board of directors. The new board consists of the following gentlemen: Messrs. A. W. Tait, W. B. Mountain, C. J. Shiells, Alex. Mackenzie, C. H. M'Euen and F. E. Andrews. The secretary of the company is John M. Peebles.

REPORTS OF LARGE ELECTRICAL COMPANIES ENCOURAGING.—Reports from the largest manufacturing concerns in the electrical apparatus field are extremely encouraging. Officials of the General Electric Company announced that there has been a very substantial increase in orders recently, and that the outlook for the future is satisfactory. Additional hands are being taken on each week at the corporation's various plants. The company's lamp works at Harrison, N. J., are being operated at full capacity. The Schenectady shops are being run at about 70 per cent of capacity, and the West Lynn (Mass.) works are employing 7000 workmen. The first half of December, it is reported, showed a gain of 4 per cent over November, and the great number of inquiries that are being received promise a heavy business early in 1909. The Westinghouse Electric & Manufacturing Company reports a steady increase of business. More employees are being put to work every week, and it is anticipated that by the end of January the shops will all be running at normal capacity. Posters have just been placed in the Westinghouse Air Brake Company's plant, at Wilmerding, Pa., announcing that with the beginning of the new year the men will resume work at full time. The notices apply to the employees of both the shops and the foundry, where some of the men have been working short turns. The Allis-Chalmers Company states that orders are coming in in good volume and that inquiries lead the management to expect a heavy increase in business. A good many orders are being placed for municipal water and power plants, although the bulk of the company's new business is for mining machinery. All of the plants of the company are in operation, although not at full capacity. The Western Electric Company is operating at 80 per cent of normal capacity, and is booking many orders for small apparatus.

Financial Intelligence.

THE WEEK IN WALL STREET.

The holiday week was almost entirely one of advance. After a reaction that lasted several days and which continued for the first day of the week under review the market took a turn and continued upward without interruption. This recovery was not accompanied by any particular large business, but there were sufficient willing purchasers to make the sustaining of prices an easy matter. It is pretty generally conceded that the weakness in steel stock and in those kindred issues which are held by the same interests was attributable to Mr. Carnegie's testimony before the Ways and Means Committee of Congress. One of the most encouraging features of the business during the short week was the unabated demand on the part of investors for good bonds. On one day, Dec. 22, there were sold on the Stock Exchange, $10,800,000 worth of bonds. This was the largest single day's transactions in bonds since 1904. The $11,000,000 Chesapeake & Ohio 5 per cent issue was so largely oversubscribed that the books had to be closed within a very few minutes after their opening. When the Boston & Maine made offers covering a similar amount the subscriptions reached $35,000,000. It is now said that there will be a new issue of $15,000,000 by an industrial company within the next two weeks, and the greedy bond grabbers are industriously endeavoring to get advance information as to what this issue will represent. The money market during the week has been just about as cheap as heretofore, but loans have been somewhat contracted. This has been shown in the bank statement, and is in a measure responsible for the limiting of transactions upon the Stock Exchange. The banks have called their loans not because there was any particular scarcity of cash but because the demands from abroad and the necessities of meeting the dividends at the end of the year have created a conservative sentiment. On Dec. 28 call money was quoted at 2¾ @ 3½ and 90-day loans at 3½ @ 3¾. The quotations in the table are those of the close Dec. 28.

NEW YORK.

	Dec. 21.	Dec. 28.	Shares Sold.		Dec. 21.	Dec. 28.	Shares Sold.
All.-Ch	13¾	16	1,000	Int Met., pfd..	43⅞	47⅝	72,410
All. Ch., 1st pfd	48⅜	50	5,375	Mackay Cos....	74	73	700
Amal Cop.....	77⅝	84½	174,675	Mackay Cos.,pfd.	69	70	300
Am. D. T.....	3*	3½*	———	Manhattan Elev	150¼	154½	7,120
Am. Loco.....	84¼	88¼	16,195	Met. St. Ry....	35	42¼	1,500
Am. Loco., pfd	109½	111	470	N.Y. & N J Tel	112*	112*	———
Am Tel & Cbl	78*	78*	———	Steel, com.....	52⅛	54¾	409,264
Am. T. & T....	127	129	9,800	Steel, pfd.....	111⅛	112¾	15,454
B. R. T.....	59¼	68	236,650	W. U. T.....	65¾	68⅜	2,710
Gen. Elec....	153¼	160½	3,470	West'h., com...	84½	85½	5,200
Int. Met., com .	18½	19	94,022	West'h., pfd ...	120*	120*	———

PHILADELPHIA.

	Dec. 21.	Dec. 28.	Shares Sold.		Dec. 21.	Dec. 28.	Shares Sold.
Am. Rys.	40*	43¾*	— —	Phila. Elec. ...	11	11¼	———
Elec. Co. of A..	11	11	———	Phila. R. T....	21⅜	23⅛	———
Elec. Stor. B'ty.	44¼	46½	———	Phila. Traction..	90	90½	———
E. S. B'ty, pfd..	49*	49*	———	Union Traction..	49	50⅜	———

CHICAGO.

	Dec. 21.	Dec. 28.	Shares Sold.		Dec. 21.	Dec. 28.	Shares Sold.
Chi. City Ry....180*		180*	———	Chi. Tel. Co....129		127½	———
Chi. Rys., Ser.1.118*		116	———	Met. El., com...	18	18*	———
Chi. Rys., Ser.2.	45	45½	———	Nat'nal Carbon.	86*	85	———
Com. Edison...	105¾	107	— —	Nat. Carb., pfd.	112*	112*	———
Chi Subway...	26	30⅛	———				

BOSTON.

	Dec. 21.	Dec. 28.	Shares Sold.		Dec. 21.	Dec. 28.	Shares Sold.
Am. Tel. & Tel..127⅜		129½	———	Mass. E. R.,pfd.	57½*	58	———
Cum. Tel.	125⅛	125⅛	———	Mex. Tel.	2¼*	2½	———
Edison El. Ill...	241	241	———	Mex. Tel., pfd.	5½*	5½*	———
Gen. Elec.....	156	160½	— —	N. E. Tel.....	126	126¾	———
Mass. Elec. Ry.	12	12⅛	———	W. Tel. & Tel..	7⅜*	7⅜*	———
				W. T. & T., pfd	78½*	78½*	———

*Last price quoted.
Shares sold are for week Dec. 21 to Dec. 24.

DIVIDENDS.

American Car & Foundry Company, New York, N. Y., quarterly, preferred 1¾ per cent, payable Jan. 1.

American Car & Foundry Company, New York, N. Y., quarterly, common, ½ per cent, payable Jan. 1.

American Locomotive Company, New York, N. Y., quarterly, preferred, 1¾ per cent, payable Jan. 21.

Bell Telephone Company, St. Louis, Mo., quarterly, common, 2 per cent, payable Jan. 20.

Central & South American Telegraph Company, New York, N. Y., quarterly, preferred, 1½ per cent, payable Jan. 8.

Garvin Machine Company, New York, N. Y., semi-annual, preferred, 3½ per cent, payable Jan. 1.

Mexican Telegraph Company, New York, N. Y., quarterly, preferred, 2½ per cent, payable Jan. 15.

Michigan Light Company, Kalamazoo, Mich., quarterly, preferred, 1½ per cent, payable Jan. 2.

Michigan Light Company, Kalamazoo, Mich., quarterly, common, 1 per cent, payable Jan. 2.

New England Telephone & Telegraph Company, Boston, Mass., quarterly, common, 1½ per cent, payable Jan. 15.

New York & New Jersey Telephone Company, New York, N. Y., quarterly, common, 1¾ per cent, payable Jan. 15.

North America Telegraph Company, Minneapolis, Minn., annual, common, 6 per cent.

Pennsylvania Company, Philadelphia, Pa., semi-annual, preferred, 4 per cent, payable Dec. 31.

Toronto Railway Company, Toronto, Ont., quarterly, preferred, 1½ per cent, payable Jan. 2.

United Gas Improvement Company, Philadelphia, Pa., quarterly, preferred, 2 per cent, payable Jan. 15.

United State Telephone Company, Cleveland, Ohio, quarterly, preferred, 1½ per cent, payable Feb. 15.

United Traction & Electric Company of New Jersey, quarterly, preferred, 1¼ per cent, payable Jan. 20.

NORTHERN CALIFORNIA POWER COMPANY, CONSOLIDATED.—The directors of the Northern California Power Company, Consolidated, at a meeting in Chicago, declared a dividend of 10 cents per share, payable Dec. 22 by check. This is the first monthly dividend since the reorganization of the Northern California Power Company and is at the rate of 6 per cent per year. The Northern California Power Company paid regular dividends of 5 cents per share until October, 1907. The Northern California Power Company, Consolidated, has recently closed important contracts for additional power from its plant. Its original contract to supply 5,000 hp to the California Gas & Electric Company was changed and increased on Dec. 4 to 10,000 hp. The company will deliver 5,000 hp in January and will probably be in a position to deliver 10,000 hp by July, 1909.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.—The report of all the associated Bell telephone operating companies (not including the long-distance lines) of the American Telephone & Telegraph Company for the 10 months ended Oct. 31, 1908, was issued on Dec. 16. It shows as follows:

Jan. 1 to Oct. 31.	1908.
Telephone revenue	$99,168,600
Expenses for operation and maintenance	72,515,400
Balance from operation	$26,653,200
Sundry earnings (net)	4,296,600
Total net	$30,949,800
Interest	6,388,400
Balance for dividends	$24,561,400

The statement of earnings of the company for October follows.

October.	1908.
Telephone revenue	$10,261,800
Expenses for operation and maintenance	7,401,000
Net from operation	$2,860,800
Sundry earnings (net)	430,400
Total net	$3,291,200
Interest	621,400
Balance for dividends	$2,669,800

MASSACHUSETTS ELECTRIC COMPANIES.—At the annual meeting of the stockholders of the Massachusetts Electric Companies, Boston, on Dec. 16, Mr. Richard Olney, Mr. Charles E. Cotting, Mr. Eugene U. Foss, Mr. Percy Barker and Mr. Charles Francis Adams, Jr., were re-elected trustees for five years, and it was voted to authorize the trustees to sell 7236 shares of the preferred stock of the Boston & Northern Street Railway and 3726 shares of the preferred stock of the Old Colony Street Railway at $110 a share, as authorized by the Railroad Commission. President Abbott is quoted as having said: "It seems unwise to adopt any scheme for dealing with back dividends until the company is again fully restored to a 4 per cent preferred dividend basis. If earnings warranted, it was hoped to pay 2 per cent in July. However, the trustees were confident that dividends at some rate could be steadily maintained, and it was only after reaching this decision that they decided to authorize the 1 per cent declared."

VIRGINIA PASSENGER & POWER COMPANY.—The holders of the securities of the Virginia Passenger & Power Company, Richmond Passenger & Power Company, Richmond Traction Company and controlled properties have been notified by the committee representing the bondholders of the companies that as appeals have been taken from the decree of foreclosure and sale made by the Circuit Court of the United States for the Eastern District of Virginia it will not be possible to issue the proposed new securities on Jan. 1, 1909, and accordingly there can be no interest payments on that date. The Appellate Court has set down the appeal for argument on Jan. 13, 1909, and it is anticipated that the case will be reached early in February, which will make it possible to issue new bonds soon thereafter. At that time all past due coupons on the new bonds will be paid. More than 90 per cent of all the securities for which provision is made in the plan of reorganization have been deposited.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.—A special meeting of the stockholders of the American Telephone & Telegraph Company, New York, has been called for Jan. 7 for the purpose of authorizing an increase in the capital stock of the company from $250,000,000 to $300,000,000. This new stock and the 69,413,000 of unissued stock of the company will be applied for conversion of the $150,000,000 of 4 per cent convertible bonds of the company into stock. In issuing the call for the meeting, President Vail said: "The bonds, by their terms, are convertible after March 1, 1909. The present issued capital stock of the company is $180,587,000. The authorized capital stock is $250,000,000. As the unissued capital stock, $69,413,000, is insufficient to meet the conversion of these bonds, if made, further stock amounting to more than $40,000,000 being required, a proposition will be submitted to stockholders to increase the capital stock of the company by the sum of $50,000,000."

ILLINOIS TUNNEL COMPANY.—President McRoberts, of the Illinois Tunnel Company, Chicago, is quoted as saying in regard to the claim of the city of Chicago that 20,000 telephones will become vacant by February 1909: "We can dispose of this plant to financially responsible telephone people, who will develop it. I consider it a bona fide offer, but we must have a clear title. It would take us at least two years to make this dead telephone property of ours pay. The city must decide whether it wants a second telephone system. We can give it, or we are willing to trade with the city in a proposition to do away with the telephone feature of our franchise."

DIVIDEND AND INTEREST DISBURSEMENTS.—It is estimated that the dividend and interest disbursements for January, 1909, will exceed $210,000,000. A recent statement gives the following total comparative disbursements:

	1909.	1908.	1907.
Dividend payments	$75,218,000	$76,936,000	$71,347,000
Interest payments	133,492,000	115,327,000	110,948,000
Totals	$208,710,000	$192,263,000	$182,295,000

About $800,000,000 of bonds and $300,000,000 of notes were issued during the year and account largely for the increase in interest disbursement in January, 1909, over the two preceding years.

MIAMI & ERIE CANAL TRANSPORTATION COMPANY.—A conference was held recently between the Cincinnati stockholders of the Miami & Erie Canal Transportation Company, Cincinnati, Ohio, and Mr. D. B. Spandaner and Mr. S. Spandaner, bankers of Baltimore, and, it is said, that an application will soon be made to the courts for the sale of the canal property and the discontinuance of the receivership. The company was organized to build an electric railway along the Miami & Erie Canal between Cincinnati and Dayton for passenger service and for hauling canal boats.

CONSOLIDATED RAILWAY, LIGHTING & REFRIGERATING COMPANY.—The assets of the Consolidated Railway, Lighting & Refrigerating Company, New York, have been sold for $2,008 to a reorganization committee consisting of Isaac L. Rice, formerly president of the company; A. G. Fromuth, formerly vice-president of the company, and J. L. Watson, formerly secretary and treasurer of the company. The reorganization plan includes the organization of a new company with $8,000,000 capital stock divided into 320,000 shares of a par value of $25 each.

MACON RAILWAY & LIGHT COMPANY.—Mr. W. J. Massee, president of the Macon Railway & Light Company, Macon, Ga., and his associates have purchased the holdings of common stock of the Happ estate and others, thus giving Mr. Massee and his associates control of the property. It is said, unofficially, that Mr. Massee will remain as president of the company and that negotiations are under way with the Central Georgia Power Company for a long term contract to supply power to the Macon Railway & Light Company.

BIRMINGHAM RAILWAY, LIGHT & POWER COMPANY.—Isidore Newman & Sons, New York and New Orleans; the Altheimer & Rawlings Investment Company, St. Louis, Mo., and the United States Trust Company, Louisville, offer at 103½ and interest the small unsold portion of a block of $1,000,000 "refunding and extension mortgage 6 per cent gold bonds" of the Birmingham Railway, Light & Power Company, Birmingham, Ala., dated May 1, 1907, and due May 1, 1937, without option of prior payment.

CHICAGO TELEPHONE COMPANY.—Lee, Higginson & Company, Boston, offer for subscription at 102 and interest $3,000,000 of 5 per cent first mortgage bonds of the Chicago Telephone Company. The bonds are dated Dec. 1, 1908, and are due on Dec. 1, 1923, but are subject to call at 105 and interest on or after Dec. 1, 1913, upon three months' notice.

UNITED ILLUMINATING COMPANY.—The stockholders of the United Illuminating Company, New Haven, Conn., will be offered the right to subscribe at par for $300,000 additional capital stock of the company, making the total stock issued $1,500,000. The subscriptions are to be payable in four equal installments between April 1 [illegible] and Oct. 1, 1909.

NATIONAL GAS, ELECTRIC LIGHT & POWER COMPANY.—The National Gas, Electric Light & Power Company, Detroit, Mich., has sold to Bioren & Company and Townsend Whelen & Company, both of Philadelphia, $500,000 of its 6 per cent collateral trust notes to retire the $3,000,000 of 5 per cent notes maturing on Jan. 1.

EDISON ELECTRIC COMPANY OF LOS ANGELES.—The Edison Electric Company, Los Angeles, Cal., has called a meeting of the stockholders of the company for Feb. 20, 1909, to vote on a plan to issue $10,000,0000 of bonds.

LITTLE ROCK RAILWAY & ELECTRIC COMPANY.—The Little Rock Railway & Electric Company, Little Rock, Ark., has increased its annual dividends from 4 per cent to 5 per cent by the declaration of the semi-annual dividend of 2½ per cent on the $1,500,000 of common stock, payable Dec. 31.

ROCHESTER, CORNING & ELMIRA TRACTION COMPANY.—The Rochester, Corning & Elmira Traction Company, Rochester, N. Y., has filed with the Carnegie Trust Company, New York, as trustee, a mortgage to secure an issue of $1,000,000 of 5 per cent 30-year gold bonds.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
American Telephone & Telegraph Company, New York, N. Y.:					
November, 1908	$2,090,845	$169,390	$1,921,455	$638,868	$1,282,587
November, 1907	1,950,268	164,694	1,785,574	681,578	1,103,996
Birmingham (Ala.) Railway, Light & Power Company:					
November, 1908	188,414	138,069	50,715	44,468	15,246
November, 1907	202,141	*135,800	66,341	42,579	23,762
Brockton & Plymouth Street Railway, Plymouth, Mass.:					
October, 1908	9,767	6,216	3,551	2,151	1,400
October, 1907	9,057	6,716	2,341	2,250	91
Cape Breton Electric Company, Sydney, N. S.:					
October, 1908	22,166	12,750	9,416	4,955	4,460
October, 1907	22,878	12,889	9,989	4,852	5,137
Dallas (Tex.) Electric Company:					
October, 1908	134,140	73,767	60,373	27,554	32,819
October, 1907	125,771	72,291	53,481	28,481	25,000
Detroit (Mich.) United Railways:					
November, 1908	577,208	374,685	202,523	132,818	69,705
November, 1907	565,835	370,259	195,576	134,619	60,967
El Paso (Tex.) Electric Company:					
October, 1908	44,913	33,544	11,369	7,107	4,262
October, 1907	46,474	30,776	15,708	5,993	9,714
Electric Light & Power Company of Abington & Rockland, North Abington, Mass.:					
October, 1908	5,109	2,884	2,225	328	1,897
October, 1907	5,060	2,386	2,674	452	2,222
Galveston-Houston Electric Company, Galveston, Tex.:					
October, 1908	94,348	52,842	41,506	20,192	21,313
October, 1907	89,940	53,521	36,419	19,671	16,748
Houghton County Traction Company, Houghton, Mich.:					
October, 1908	21,654	10,941	10,712	5,380	5,333
October, 1907	20,652	12,765	7,887	4,823	3,074
Jacksonville (Fla.) Electric Company:					
October, 1908	38,509	21,144	17,365	8,145	9,220
October, 1907	33,697	20,332	13,365	7,149	6,216
Knoxville (Tenn.) Railway & Light Company:					
November, 1908	47,968	*22,859	25,110	11,483	13,626
November, 1907	50,713	*25,692	25,021	11,420	13,601
Little Rock (Ark.) Railway & Electric Company:					
November, 1908	59,091	*27,956	31,135	10,255	20,880
November, 1907	57,754	*28,977	28,777	8,653	20,124
Massachusetts Lighting Companies, Boston, Mass.:					
November, 1908	46,929	.....	.....	.....	.....
November, 1907	44,510	.....	.....	.....	.....
Memphis (Tenn.) Street Railway:					
November, 1908	136,376	*87,560	48,816	35,312	13,504
November, 1907	125,979	*85,324	40,655	34,435	6,219
Northern Texas Electric Company, Fort Worth, Tex.:					
October, 1908	119,299	56,103	63,195	15,187	48,008
October, 1907	114,460	58,164	56,295	13,886	42,409
Portland (Ore.) Railway, Light & Power Company:					
November, 1908	370,378	165,331	205,047	.....	.....
November, 1907	347,598	178,534	169,064	.....	.....
Puget Sound Electric Railway, Tacoma, Wash.:					
October, 1908	147,152	95,977	51,174	44,257	6,917
October, 1907	141,985	92,056	49,929	40,297	9,632
Savannah (Ga.) Electric Company:					
October, 1908	51,071	30,304	20,767	15,911	4,856
October, 1907	51,313	35,564	15,749	14,855	894
Seattle (Wash.) Electric Company:					
October, 1908	401,935	233,624	168,310	97,084	71,226
October, 1907	374,379	208,598	165,781	84,072	81,709
Tampa (Fla.) Electric Company:					
October, 1908	47,354	30,170	17,184	4,380	12,804
October, 1907	45,572	34,058	10,614	759	9,855
Twin City Rapid Transit Company, Minneapolis, Minn.:					
November, 1908	526,574	259,780	266,794	143,667	123,127
November, 1907	497,420	264,410	233,018	131,142	101,877
Whatcom County Railway & Light Company, Bellingham, Wash.:					
October, 1908	31,758	17,766	13,991	9,026	4,965
October, 1907	32,379	17,949	14,431	7,181	7,250

*Including taxes.

GENERAL NEWS

Construction News.

AUBURN, ALA.—The Council has granted a 30-year franchise for lighting the town of Auburn. Electricity for operating the system will be supplied from the electric plant of the Alabama Polytechnic Institute. C. C. Thach is president of the institute.

MONTGOMERY, ALA.—The People's Electric & Ice Company has taken over the properties and holdings of the Edison Electric Company and the Exchange Ice Works, together with the franchises under which they operate. The new company, it is said, proposes to increase the output of the plant. A. G. Forbes is president and C. E. White treasurer and general manager.

MARICOPA, ARIZ.—The Arizona Mercantile, Transportation & Smelter Company, which is said to operate mines in Arizona, has applied to the Mexican Government for a concession to build an electric railway through a narrow strip of this country in order to reach St. George's Bay, a proposed deep water harbor situated in the extreme upper end of the Gulf of Lower California. It is planned to make Maricopa, Ariz., the United States terminus of this line. The road will be about 160 miles long and will be used chiefly for freight.

PHOENIX, ARIZ.—The Clara Consolidated Gold & Copper Mining Company is making arrangements to install an electric plant in connection with its smelter.

WICKENBURG, ARIZ.—The citizens are considering the question of installing a municipal electric light plant.

HOLLY GROVE, ARK.—The question of installing an electric light plant in Holly Grove is under consideration. E. W. Burruss is interested in the project.

ARBUCKLE, CAL.—The question of installing an electric light plant in the town is under consideration. William H. Ash is interested in the project.

COLUSA, CAL.—The Board of Supervisors has granted a franchise to C. K. Sweet to erect transmission lines for the distribution of electricity.

DELANO, CAL.—The Mt. Whitney Power Company, of Visalia, Cal., has filed an acceptance of the electric light franchise in Delano.

GEORGETOWN, CAL.—Notice of appropriation of 10,000 inches of water of the middle fork of the American River has been filed by George L. Threlkel. The water will be utilized for power and mining purposes.

GRIDLEY, CAL.—The City Trustees have awarded the contract for installing the street lighting system to Robert M. Beebe for $2,330.

LOS ANGELES, CAL.—Plans are being considered by the Edison Electric Company for the construction of a central power plant to furnish electricity for all of the beach towns from Santa Monica to Naples. The cost of the plant is estimated at about $500,000.

OAKLAND, CAL.—The Home Telephone Company has filed a petition with the Board of Supervisors asking for a franchise to extend its telephone service into the suburbs. The residents of Fruitvale and Melrose have petitioned to have the service extended to those towns.

RED BLUFF, CAL.—The Northern California Power Company is extending its plant on North Battle Creek, north of Manton, increasing the output of the plant by 3000 hp, making the total rating 10,000 hp. A high-tension transmission line five miles long is being erected from this plant to South Battle Creek plant, which is now being constructed to furnish electricity for the construction work. The South Battle Creek plant will have an output of 5500 hp when completed. The transmission line now being erected to furnish energy for the construction work at the last-named plant will later feed the distributing lines for the Chico and Reading system. As soon as the South Battle Creek plant is finished work will commence on another plant, about five miles west and down the creek, to be known as the Inskin plant.

REDDING, CAL.—A deed has been filed by Roderick McArthur, of San Francisco, transferring to the Lava Bed Power Company 100,000 inches of water of Fall River, to be taken out of the river a mile above Fall River Mills and conveyed by a 14-mile tunnel through the mountain to Pit River, where a great fall will be obtained. The cost of the tunnel is estimated at $1,000,000. The water is to be utilized to generate electricity.

SAN RAFAEL, CAL.—The Board of Supervisors is considering the question of installing a lighting system in the county farm.

SANTA CRUZ, CAL.—M. H. Grover, of the San Vicente Lumber Company, has submitted a proposition to the City Council to furnish electricity for lighting the city at a low price.

DENVER, COL.—The right of way for an incline railway from the Moffat Road near Crags to Eldorado Springs has been granted by the State Land Board to Charles M. Enfield. The cost of the railway is estimated at $100,000.

DENVER, COL.—Extensive improvements and extensions are contemplated by the Colorado Telephone Company, for which an expenditure of between $200,000 and $800,000 has been authorized. Additional cables will be placed in underground conduits in Denver at a cost of $50,000. The company will also make extensive improvements in New Mexico, which will involve an expenditure of about $250,000. Improvements will be made at the Fort Collins exchange, including the installation of a switchboard. The Greeley station will be made larger, and the system in Evans will be improved.

PUEBLO, COL.—The Pueblo Suburban Traction & Lighting Company is considering the question of installing additional boilers in its power plant, and possibly a coal conveyor. The company is also planning to develop a lake for condensing purposes.

TELLURIDE, COL.—Bonds to the amount of $2,000,000 have been sold by the Telluride Power Company, the proceeds of which will be used to extend and improve its electric power systems in Colorado, Utah and Idaho. The company owns and operates five power plants and supplies electricity for lamps and motors in the towns of Telluride, Ouray, Ames, Pander and Ophir, Col.; Provo, Logan and Bingham, Utah. It also supplies part of the power for operating the system of the Utah Light & Railway Company, of Salt Lake City, and to the large mines in the vicinity of its plants. The Telluride Power Company is now constructing a large power plant at Alexander, Idaho, 125 miles north of Salt Lake City.

TRINIDAD, COL.—The Southern Colorado Power & Railway Company contemplates the construction of about two miles of additional track to its local system.

EAST BERLIN, CONN.—The citizens are considering the question of lighting the village by electricity. The New Britain division of the Connecticut Company holds a charter to light the town, and at present is furnishing electricity for lighting residences in Worthington and Kensington. It is expected that a town meeting will be called in the near future to vote on the proposition.

NEW HAVEN, CONN.—The stockholders of the United Illuminating Company have authorized the directors to issue $300,000 additional stock, bringing the total capitalization up to $1,500,000. The proceeds derived from the sale of the new stock will be used to finance important improvements and extensions, which the company is making in connection with its systems in New Haven and Bridgeport.

NORWICH, CONN.—The hydro-electric plant of the Uncas Power Company, located on the Shetucket River at Scotland, Conn., is completed and is now furnishing electricity to operate the municipal electric light plant in Norwich. The machinery at the municipal electric plant will be kept in readiness for emergencies. The Scotland power house has an output of 1200 kw, while the municipal steam plant is rated at 800 kw.

SOUTH WINDHAM, CONN.—The Connecticut Company is installing machinery in its power plant at South Windham, Conn., to increase the output of the station to supply electrical energy to operate the electric railway between Norwich and Willimantic, Conn. Electricity for operating the system will be furnished from the Greenville plant and distributed by the South Windham station.

WASHINGTON, D. C.—A South American consul reports that a concession has been granted by the government in the country in which he is located to a local firm for the establishment of an electric light plant in a town of about 9000 inhabitants. Manufacturers may secure further information by addressing No. 2902, Bureau of Manufactures, Washington, D. C.

WASHINGTON, D. C.—Notices of advertisements have been forwarded by Consul Archibald for the following public works: 1. A City Council meeting has been called for the purpose of making a loan of $250,000 for the purpose of extending the electric light works at Port Elizabeth; 2, for the extension of the city electric light systems at Christchurch, New Zealand, according to a notice in the *New Zealand Gazette*, a loan is to be made for $85,000; 3, contracts will be awarded soon for supplies for the Belgian State Railway at the Brussels Exchange. For further information address No. 2904, Bureau of Manufactures, Washington, D. C.

AUGUSTA, GA.—It is reported that Acting Mayor L. L. Kent is advocating the erection of a municipal electric light plant.

AUGUSTA, GA.—The Augusta-Aiken Railway & Electric Company has entered into a contract with the City Council of North Augusta to furnish electricity to light the streets of the city. The street lighting system will consist of 30 tungsten lamps.

GAINESVILLE, GA.—An order has been signed in Atlanta by Judge Newman, of the federal court, for the foreclosure of a mortgage on the Gainesville Electric Railway. The mortgage is held by the Knickerbocker Trust Company, of New York, trustee, and the sale of the property is ordered to take place on Feb. 20. The company's indebtedness is fixed at $250,000.

GRIFFIN, GA.—Extensive improvements to the municipal electric light plant are recommended by Superintendent J. W. Hammond, which include the installation of a 300-hp engine direct connected to a 250-kw 2300-volt three-phase generator, with necessary piping, exciter, switches, meters, etc., a 500-hp boiler, with stack, valves, etc. H. H. Bass is chairman of board of water, light and sewer commission.

HAWKINSVILLE, GA.—The town has voted to issue $15,000 in bonds, the proceeds to be used to establish a municipal electric light plant.

BOISE, IDAHO.—Orders have been placed by the Boise & Interurban Railroad Company with the Westinghouse Electric & Manufacturing Company for machinery for the substation at Pierce, which will double the output of the station. The additional energy will be required when the double tracking of the road from Boise is completed. The cost of the machinery is estimated at $12,000.

BELLEVILLE, ILL.—The City Council has granted a franchise to Joseph Loenger, Peter Fellner and Phillip Knapp to construct and operate an electric light, heat and power system in Belleville.

PEORIA, ILL.—Plans are being made by the Peoria Railway Terminal Company to construct about two and one-half miles of additional track during the next year.

ROCK ISLAND, ILL.—The capital stock of the People's Power Company has been increased from $1,000,000 to $2,000,000. The company proposes to make extensive improvements to both its electric and gas plants.

MONTICELLO, IND.—The Tippecanoe Electric Power Company has increased its capital stock to $100,000. The company is constructing a modern concrete power dam in the Tippecanoe River at this place.

NEW CASTLE, IND.—The city authorities have employed an expert to find out just what the cost of operating the municipal water and electric light plant is, and just what revenue they bring to the city.

SOUTH BEND, IND.—Arrangements have been completed by the South Bend Home Telephone Company for improvements to its plant, which will involve an expenditure of about $50,000.

WABASH, IND.—The Wabash Light & Power Company has awarded a contract to the Ft. Wayne Electric Works for the installation of additional electrical equipment and machinery. George L. Smith will have charge of the work.

FAIRFIELD, IA.—The Fairfield Gas & Electric Company is contemplating remodeling its plant, at an expenditure of from $35,000 to $40,000.

PITTSBURG, KAN.—The Joplin & Pittsburg Railway Company is planning to construct two extensions to its system during the coming year, which will call for the construction of from 10 to 30 miles of track. The company proposes to build one extension from Pittsburg to Cherokee, Kan., and the other to Mulberry, Kan.

MIDDLESBORO, KY.—The Middlesboro Home Telephone Company has increased its capital stock from $15,000 to $25,000.

BELFAST, MAINE.—The Penobscot Bay Electric Company has petitioned for permission to erect its transmission lines on Swan Lake Avenue and the so-called back road to Searsport for the distribution of electricity.

BRUNSWICK, MAINE.—The Brunswick Electric Light & Power Company has commenced work on the construction of a new power station in the Cove. When completed the company will utilize the water power formerly used by the old pulp mill.

BALTIMORE, MD.—The Consolidated Gas & Electric Light Company has submitted a proposition to Mayor Mahool and Superintendent of Lamps and Lighting McCuen, offering to furnish electricity to all the municipal departments at a flat rate of six cents per kw-hour, which will mean a saving of about $3,000 annually to the city. The city now pays an average of 7 1/10 cents per kw-hour. The city has decided to accept the offer, which will go into effect at once.

BOSTON, MASS.—The city has decided to abandon the city's heating and lighting plant at the Wareham Street storage building, as it can secure the service from private companies at a much less cost. George W. Morrison, superintendent of the department of public buildings, has made contracts with private concerns for lighting and heating the building, to cost $1,450 a year, which formerly cost the city $3,800 annually.

CAMBRIDGE, MASS.—The Cambridge Electric Light Company has petitioned the State Board of Gas and Electric Light Commissioners for permission to issue $20,000 in additional capital stock, the proceeds to be used for payment of floating debt and for extensions to its plant.

CLINTON, MASS.—Work has been commenced by the Connecticut River Power Company on the construction of its power station, to be located in Clinton on the Fitch Road. The cost of the building and equipment is estimated at $25,000.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company has filed a petition with the Selectmen for a franchise to extend its transmission lines from Nash's Mills to the town farm; also to erect poles on Power Square and Power Court, on Lincoln, Riddell, Haywood and Chapman Streets.

LAWRENCE, MASS.—Permission has been granted to the Lawrence Gas Company to erect and maintain transmission lines on Lowell, Cross, Essex, Broadway, Lawrence and Arlington Streets for the distribution of electricity.

LEE, MASS.—The 225-hp engine in the plant of the Lee Electric Company broke down Dec. 11, causing a loss of about $2,000. The electric company has made arrangements with the Monument Mills plant at Glendale to supply electricity to operate its system until repairs can be made, which will take about three weeks.

NEWTON, MASS.—Plans are being made by the Newton Street Railway Company to double track about five miles of its railway during the

NORTH ABINGTON, MASS.—Electricity for operating the Rockland & Abington Electric Light & Power Company system is now supplied from the East Bridgewater station. The local plant will not be dismantled.

SOUTHBRIDGE, MASS.—The Central Mills Company is installing a generator in its plant to furnish electricity to light its mills.

UPTON, MASS.—A petition has been presented to the Board of Selectmen by the citizens of the town asking the board to grant the Upton Electric Light Company permission to erect transmission lines on the principal streets of the town. The board has refused to grant the company permission, as it was not willing to furnish electricity to light the town hall for half price during the life of the franchise asked for. The company has submitted a proposition to the Selectmen offering to furnish 32-cp incandescent lamps, 17 to the mile, at $15 per lamp per year, on a moonlight schedule. It is estimated that the town could be lighted by electricity for $1,000 per year. The town appropriated $700 in 1908 to light the streets with kerosene lamps.

WATERTOWN, MASS.—The Board of Selectmen has entered into a contract with the Newton & Watertown Gas Light Company for lighting the streets of the town for a term of 10 years. The company agrees to replace the 25-cp incandescent lamps now in use with tungsten lamps of 40 cp, and also a reduction in the price of electricity to private consumers from 18 cents to 12 cents per kw-hour after Jan. 1, 1909. Under the new contract the 47 arc lamps will cost the town $4,060, and $7,941 for 533 incandescent lamps, which will reduce the cost of street lamps $959 per year. Electrical energy for operating the system is furnished by the Edison Electric Illuminating Company, of Boston, Mass.

WEST BOYLSTON, MASS.—The citizens have voted to have the streets of the town lighted by electricity. The Marlboro Electric Light Company has submitted a proposition to install a plant and light the town, or, should the town prefer to operate its own system, to furnish electrical energy for the same. In return for a five-year contract the company offers to install a plant in the town and furnish 120 tungsten lamps of 40 cp on a moonlight schedule until midnight for $18 per lamp per year, and to furnish five lamps free. The company also gives the town the privilege to purchase the plant at any time after completion by giving six months' notice at net cost plus 10 per cent of the contractors' charges and 15 per cent on the cost of labor. The cost for town equipment not to exceed $11,530 and the amount for 25 commercial customers not to exceed $50 each, making a total of $12,780. In case the town should prefer to own the plant from the start the Marlboro Electric Light Company agrees to build the plant and to supply electricity at 2300 volts for a term of five years at five cents per kw-hour. The company agrees to have the plant installed and ready for operation by July 1, 1909, if awarded the contract.

ANN ARBOR, MICH.—Arrangements are being made by the Michigan State Telephone Company to repair its overhead system in this city at a cost of about $40,000.

AU SABLE, MICH.—The Eastern Power Company has been granted franchises by the village of Au Sable, Oscoda Township and Omer to construct and maintain transmission lines for the distribution of electricity for lamps and motors.

BESSEMER, MICH.—The City Council is considering the question of establishing a municipal electric light plant. The present contract for electric lighting expires within a year.

DETROIT, MICH.—The Public Lighting Commission is considering plans for increasing the output of the municipal electric light plant, which include the installation of one 2000-kw turbo-generator and a 300 or 400 hp boiler. Frank Mistersky is general superintendent of the plant.

MUSKEGON, MICH.—Plans are being made by the Grand Rapids-Muskegon Water Power Company for further development of the water power of Muskegon River, with a third power station. The company is purchasing land along the river near Big Rapids. George L. Erwin is secretary.

FERTILE, MINN.—Owing to the owners of the local electric light plant and the Village Council being unable to come to an agreement, the electric lighting service will be discontinued after Jan. 1, 1909. The company claims to be unable to furnish the service at the present rate, 10 cents per kw-hour, and wishes to increase the price by 50 per cent. Charles H. Sparber is electrician.

KASOTA, MINN.—The citizens have voted to issue bonds to the amount of $1,000 to install an electric lighting system.

ST. PAUL, MINN.—The Great Northern Railroad Company is installing a telephone system for train despatching purposes on the Minot division, which is 239 miles long. When completed the telephone system will be extended from Williston to Culbank, Mont., a distance of 437 miles, and also along the Butte division, 507 miles in length.

ST. PAUL, MINN.—The contract for street lighting for 1909 was awarded by the Board of Aldermen to the St. Paul Gas Light Company. The bid of the company for furnishing electricity for arc lamps, both on the underground and overhead systems, was $1 less per arc lamp than paid under the present contract. For arc lamps furnished in the underground system the company agrees to furnish at $95 per lamp per year and those by the overhead system at $85 per lamp per year. For all additional lamps for the overhead system above the 89 now in use the city is to pay at the rate of $8 per month per lamp, and for all additional arc lamps in the underground system $9 each per month. The city now has 800 lamps operated under the underground system. For furnishing and main-

taining incandescent lamps on the river bridges and piers and alleys the rate is $2 per lamp per month.

VERNDALE, MINN.—An election will soon be held to vote on the proposition of granting a franchise to K. Bagne to construct and operate an electric light plant in Verndale.

WADENA, MINN.—K. Bagne, of Verndale, Minn., is considering the question of furnishing electricity for lamps in Wadena.

HATTIESBURG, MISS.—Plans are being considered by Mayor J. H. Donald for the construction of a municipal electric light plant, for which a preliminary survey has been made of the Bouie River, just above its confluence with Leaf River, two miles from the city. The cost of the plant is estimated at $150,000. J. H. Putnam, of Hattiesburg, Miss., is engineer.

DOWNING, MO.—Plans are being made by J. M. St. Clair & Son to rebuild the telephone exchange at Downing, and also to establish a system at Grand Cane, La.

KANSAS CITY, MO.—The Council has passed an ordinance locating lamps from Santa Fé to Mulberry Street; also locating 200 other lamps.

ST. LOUIS, MO.—The Downtown Lighting Association, organized to select a uniform lighting system for the business district of St. Louis, will commence work on Jan. 1. The association proposes to install the system and turn it over to the city, provided the latter agree to maintain it. The district to be lighted is bounded by Market Street and Washington Avenue, Twelfth and Fourth Streets.

SALEM, MO.—An election will be held to vote on the proposition to issue bonds for the extension of the city's electric light plant.

LEWISTON, MONT.—The Fargo Electric Company, of Fargo, N. D., was awarded the contract for installing the electric fixtures in the court house, for $4,000.

STEVENSVILLE, MONT.—Two applications for electric light franchises have been presented to the City Council. One was presented by C. B. McCarthy and the other by G. W. Messer and Mr. Featherstone.

BLUE SPRINGS, NEB.—Black Brothers are contemplating installing an electric light plant in Blue Springs in the near future.

NEWPORT, N. H.—The Newport Electric Light Company is building a large addition to its power house and will install additional equipment, including another boiler, a 750-hp engine and generator.

BELLEVILLE, N. J.—The township committee has decided to advertise for bids for street lighting before signing the contract submitted by the Public Service Corporation, which now furnishes the street lighting service at the rate of $12 per year for each incandescent lamp. The contract has expired and the company proposes to raise the price to $15 per year for each lamp. It is said that the Newark Block Lighting Company may submit a proposition to light the town.

NEWARK, N. J.—A factory has been rented for the Radial Telegraph & Telephone Company at 16-22 Boyden Place, Newark, N. J., which will be equipped with machinery for the manufacture of wireless apparatus. All machines will be motor driven, and it is understood that no purchases have yet been made. The Ellsworth Company is fiscal agent for the company.

MANCHESTER, N. Y.—Arrangements are being made by the Lehigh Valley Railroad Company to light its yards and buildings in Manchester by electricity. A contract for wiring has recently been let.

MASSENA, N. Y.—The St. Lawrence River Power Company has awarded a contract to the Dayton Globe Iron Works, Dayton, Ohio, for two water turbines, with a total rating of 12,000 hp. The turbines, together with generators, will be installed during the coming spring.

SCHENECTADY, N. Y.—Electricity for operating the Schenectady Railway is now received from the new generating station erected by the General Electric Company on the Hoosick River near Schaghticoke. The plant has an output of 15,000 kw.

SCHENECTADY, N. Y.—The Schenectady Power Company is reported to be making plans for the construction of another large storage dam on the Walloomsac Creek, near Walloomsac. A power plant will be erected at the dam to generate electricity, which will be transmitted to Johnsonville on the present transmission line.

CHARLOTTE, N. C.—The Southern Power Company is hurrying the completion of its plant at Rocky Creek station, in South Carolina, where 40,000 hp will be available within a few weeks, in order to meet contracts for power. The contract has also been let for the completion of the plant at Ninety-nine Islands, on the Catawba River, in South Carolina, where 18,000 hp will be available. This latter contract amounts to $[illegible]. The Southern Power Company will have an output of [illegible] hp. Of this amount about four-fifths has been taken by cotton mill plants in the Piedmont section of North and South Carolina.

ELIZABETH CITY, N. C.—The construction of an electric railway to the town of Weeksville is being promoted. It is proposed to organize a company with a capital stock of about $[illegible].

HIGH POINT, N. C.—The Southern Power Company has perfected arrangements with the High Point Electric Company to bring its transmission lines into the town.

HIGH POINT, N. C.—The North Carolina Electric Company has been purchased by E. D. Stock and others, and it is reported that the original plans of the company put into execution, according to a statement made a few days ago by Mr. Stock.

HETTINGER, N. D.—The question of establishing an electric light plant in Hettinger is reported to be under consideration.

BOWLING GREEN, OHIO.—The Lake Erie, Bowling Green & Napoleon Railway Company contemplates extending its system from Bowling to Tontogany, a distance of six miles, during the next year.

DELPHOS, OHIO.—The Delphos Manufacturing Company has arranged to increase its steam power plant and will install a number of generators. Motors will be placed in each department to operate the machinery.

KENMORE, OHIO.—Thomas L. Childs, promoter of the Turkeyfoot Traction Company, has applied to the Village Council for a franchise to construct and operate an electric railway in Kenmore.

WARREN, OHIO.—S. Stoughton, of Warren, Ohio, is interested in a project to construct an electric railway from Painesville.

ARDMORE, OKLA.—L. S. Dolman is advocating the development of the water power of the Washita River to be utilized to generate electricity. It is said that sufficient power could be developed to operate all the manufacturing plants in the city; also to operate the street and interurban electric railways.

EL RENO, OKLA.—We are informed that the El Reno Gas & Light Company contemplates the installation of an additional unit to supply energy for the street railway system. The additional equipment will probably include a 500-kw, 25-cycle unit. The cost of the work is estimated at $20,000. H. H. Stephens is general manager.

GUTHRIE, OKLA.—The Guthrie Street Railway Company, it is stated, will commence work at once on the extension of its Oklahoma Avenue line to Capitol Hill.

HOOKER, OKLA.—Bonds to the amount of $20,000 have been voted by the city for the construction of an electric light plant and water works system, to be completed and in operation by May 1.

NEWBERG, ORE.—The Yamhill Electric Company contemplates the installation of an additional boiler of 250 hp.

PORTLAND, ORE.—The Oregon Electric Railway Company contemplates extending its electric railway from Albany to Salem during the coming year. G. W. Talbot is general manager.

CHARLEROI, PA.—The West Penn Electric Company contemplates the erection of a power plant in Charleroi, Pa., if satisfactory arrangements can be made with the town.

FORD CITY, PA.—The citizens on Dec. 17 voted to issue $16,000 in bonds, the proceeds to be used for the construction of an electric light plant. D. O. Crouch is clerk.

JOHNSTOWN, PA.—W. E. Hildebrand is interested in a project to construct an electric railway from Johnstown to Somerset. The railway will be operated under the name of the Johnstown & Somerset Street Railway Company, and will probably use the Pennsylvania & Maryland line for right of way and connection.

PHILADELPHIA, PA.—Plans are being prepared for the Hydro-Electric Company for a water power plant to be erected on Main Street, Manayunk, on the Schuylkill River.

PHILADELPHIA, PA.—The Spreckels Sugar Refining Company, of Philadelphia, Pa., has awarded a contract to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., for a complete power plant. The equipment will include two 900-hp turbines and generators, 12 75-hp motors, switchboard and other necessary apparatus.

READING, PA.—Application will be made to Governor Stuart for a charter on Jan. 5 for the Penn Electric Company by John C. Amendt, Thomas C. Yarrington, Jr., and Harry F. Kantner. The company proposes to supply electricity in Reading and Berks Counties for lamps and motors.

SCRANTON, PA.—Plans are being considered to increase the output of the plant of the Scranton Electric Company to meet the demands for electrical energy between Scranton and Carbondale, at an expenditure of about $250,000. The work contemplates centralizing the power in the central and suburban plants and abandoning several substations.

SHARON, PA.—Application will be made Jan. 5 for a charter for the Mercer County Trolley Company, which proposes to construct an electric railway line in Greenville, and ultimately connect Sharon and Mercer. James M. Campbell, Lyle W. Orr, Frank Filer and S. D. Downs are interested in the project.

SOUTH BETHLEHEM, PA.—The City Council is considering the question of establishing a municipal electric light plant.

WASHINGTON, PA.—The Washington & Canonsburg Railway Company contemplates the construction of six miles of new track during the coming year.

WASHINGTON, PA.—[illegible] has been granted a charter for the Slatedale Electric Light, Heat & Power Company for the purpose of supplying electricity for light, heat and motors in the Township of Washington and surrounding country. Wilson Rex, H. W. Bloss, C. J. Bloss and [illegible] Wentzel are interested in the project.

BLACKSBURG, S. C.—The city is contemplating a bond issue of $15,000, the proceeds to be used to establish an electric lighting system and for street purposes.

RUTHERFORDTON, N. C.—The Southern Power Company, of Charlotte, N. C., has completed a deal whereby the company has secured options on about 4,000 [illegible] on the Westmore River, extending from Westmore Creek to Getty's Shoals, for future development.

SPARTANBURG, S. C.—The Electric Manufacturing Company, which has developed an electric power plant at Gaston Shoals, on Broad River, 30 miles distant, is building transmission lines to Woodruff, S. C., to supply electricity to the cotton mills of that town; preparations are also being made to supply several textile plants at Cowpens. Electricity for operating the electric railway system at Spartanburg and the municipal lighting are also furnished by this company.

MADISON, S. D.—It is reported that plans are being considered to rebuild and enlarge the municipal electric light plant.

SIOUX CITY, S. D.—The property of the Citizens' Telephone Company, which was purchased last September by Harry Wescott, of Sioux City, has been assigned to the New State Telephone Company, which has already taken charge of the system and will operate it in connection with its telephone lines in Iowa.

DYER, TENN.—The Dyer Ice & Coal Company is contemplating installing a new engine in its plant and also contemplates establishing a meter system. F. E. Menzies is manager.

McKENZIE, TENN.—Application will be made by the town to the next Legislature for permission to vote on the proposition to issue $50,000 in bonds, the proceeds to be used to establish a street lighting system and for other purposes.

AUSTIN, TEX.—The Austin & Lockhart Interurban Railway Company, which has been promoting the construction of an electric railway between Austin and Lockhart, a distance of about 30 miles, is said to be almost ready to start construction work.

BEEVILLE, TEX.—It is reported that the Beeville Water & Light Company will rebuild its water and light plant. J. C. Hanie is secretary and manager.

BROWNSVILLE, TEX.—Col. S. W. Fordyce, of St. Louis, Mo., and associates, owners of the old Rio Grande Railway, which runs from Brownsville, Tex., to Point Isabel, a large pleasure resort, will soon begin the work of converting the line into electric traction. This road is 22 miles long.

COLLEGE STATION, TEX.—R. T. Milner, president of the Agriculture and Mechanical College, has recommended to the Legislature the construction of an electric railway from College Station to Bryan by the State; cost estimated at $70,000.

DEL RIO, TEX.—The capital stock of the Del Rio & Western Telephone Company has been increased from $20,000 to $60,000.

EL PASO, TEX.—The County Commissioners have granted J. A. Happer a franchise to construct an electric railway from the Fort Bliss Electric Railway to the Government Hill addition.

HARLINGEN, TEX.—Leon Hill, of Harlingen, Tex., is promoting the building of an electric railway between Harlingen and Brownsville.

PORT ARTHUR, TEX.—John W. Gates, of Port Arthur, Tex., is said to be back of a project to build an interurban electric line between Beaumont and Port Arthur. The proposed line will be about 20 miles long, for which surveys have already been made.

SAN ANTONIO, TEX.—The proposition of building an interurban electric line between San Antonio and New Braunfels, a distance of 30 miles, is said to be under consideration by the Stone-Webster syndicate, of Boston, Mass.

SHERMAN, TEX.—The North Texas Telephone Company has increased its capital stock from $52,000 to $60,000.

TERRELL, TEX.—Arrangements are being made for the construction of a municipal electric light plant. W. C. Drake is superintendent.

AMERICAN FORK, UTAH.—Surveys are being made by Richard R. Lyman, of Salt Lake City, Utah, consulting engineer, for a power plant to be constructed by the Utah County Light & Power Company at a cost of more than $100,000. A steel pipe line is to be erected in connection with the plant.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has awarded a contract to James Kennedy, of Salt Lake City, for the construction of a large conduit in this city to cost $22,000.

EMPORIA, VA.—The Greensville Water Power Company has awarded contracts to Stamper Brothers & Ragland and Holland & Myers, of Richmond, Va., for the construction of a dam across Meherrin River in connection with the construction of a proposed hydro-electric plant. The dam will cost about $150,000. The company will expend about $75,000 additional in equipment and in taking over the local electric light and telephone systems, both of which will be rebuilt. P. E. Burgwyn, of Richmond, Va., is engineer.

SOUTH HILL, VA.—An ordinance providing for granting a franchise for the construction of an electric light system has been approved by the Mayor.

MONTPELIER, VT.—A bill has been introduced into the Senate to incorporate the Montpelier & Essex Junction Traction Company. The company will be capitalized at $50,000 and proposes to construct an electric railway to extend through Berlin, Middlesex, Moretown, Waterbury, Richmond, Hinesburgh, Jericho, Colchester and Underhill. The incorporators are: F. M. Corry, L. E. Taft, W. T. Dewey and E. H. Deavitt, of Montpelier, Vt.; A. L. Hewitt, of Berlin, Vt.; D. E. Moody, of Waterbury, Vt., and others.

OLYMPIA, WASH.—The State Building Commission will call for bids for the installation of electric fixtures in the Governor's mansion.

SEATTLE, WASH.—The capital stock of the Loyal Heights Railway Company has been increased from $300,000 to $1,000,000, the proceeds to be used to double track the railway and extend it to the Country Club. The company operates an independent car line from Ballard to Golden Gardens. H. W. Treat, E. B. Cox and others are interested in the company.

MORGANTOWN, W. VA.—Arrangements are being made by the Morgantown & Interstate Railroad Company for extending its system from Morgantown to Star City, W. Va., and Point Marion, Pa., which will require the construction of about 12 miles of track.

SPOONER, WIS.—The contract for furnishing the village with meters in connection with the municipal electric light plant was awarded to the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa.

VANCOUVER, B. C., CAN.—Arrangements are being made by the British Columbia Electric Railway Company to construct an electric railway from Vancouver to the eastern boundary of Hastings town site. R. H. Sperling is general manager.

BRIDGEWATER, N. S., CAN.—The Micmac Mining Company has made application for a charter to develop water power on the Port Medway River, from which it is proposed to erect a transmission line to the Liepigate mining district for furnishing electricity to the Micmac and other mines. The company also proposes to operate an electric railway for passenger and freight service.

OTTAWA, ONT., CAN.—Owing to low water in the Bonnechere River, the plant of the Renfrew Power Company has been compelled to close down.

WOODSTOCK, ONT., CAN.—A. N. Warfield, Toronto, Ont., is arranging the preliminary work in connection with the construction of the Woodstock & Guelph Electric Railroad.

ESTEVAN, SASK., CAN.—A rural telephone company is being formed to build a telephone line from here to Ambrose and Hamar. For further information address H. Yardley.

KILLAM, SASK., CAN.—Plans are being made to construct a telephone line from Killam to the district south of town. For further information address J. A. Neely.

CHIHUAHUA, MEX.—Governor Enrique C. Creel, of Chihuahua, former Mexican Ambassador to the United States, and associates, who own the local street railway system, are converting it into electric traction and making many other improvements to the property.

GUADALAJARA, MEX.—The Compania de Tranvias, Luz y Fuerza, which owns and operates the electric railway and light and power systems in Guadalajara, has recently increased its capital stock from $3,000,000 to $8,500,000. It is said that this company contemplates many important improvements during the coming year.

GUADALAJARA, MEX.—Manuel Gallardo Cuesta and associates are interested in a project to build an electric railway between Guadalajara and Chapala, about 80 miles in length. It is reported that ex-Governor David R. Francis and son, of St. Louis, Mo., are interested largely in the enterprise.

GUADALAJARA, MEX.—The Soledad Development Company has taken preliminary steps toward building an electric railway between Guadalajara and Mezquital del Oro, situated in the State of Zacatecas, a distance of about 65 miles. Power for operating the road will be furnished from a hydro-electric plant which will be installed on the Santiago River, near Guadalajara. The proposed road will do a freight as well as passenger business.

HERMOSILLO, MEX.—A company is being organized at Hermosillo, State of Sonora, to acquire the branch line of the Sonora Railroad which runs from La Union Junction to Hermosillo. It is planned by the prospective new owners to adopt electric traction and to establish a passenger service between its two terminal points.

MATAMOROS, MEX.—Col. S. W. Fordyce, of St. Louis, Mo., and associates, who purchased the Matamoros & Santa Cruz mule car line several months ago, will rebuild the road and install electric traction as soon as the proposed international bridge is built across the Rio Grande River at Brownsville. The Matamoros & Santa Cruz Railway runs between the ferry landing opposite Brownsville, Tex., to Matamoros, a distance of about three miles. It is planned by its new owners to extend it to the National Railroad Depot, a distance of about two miles from its present terminus.

MEXICO CITY, MEX.—Extensions and improvements are being considered by the Mexico Tramways Company and arrangements completed with the government officials, according to the statement of Dr. F. S. Pearson, of New York, president of the company. The work contemplated will involve an expenditure of about $5,000,000 gold during the next three years.

ORIZABA, MEX.—The Compania Empresa Electrica, which has been organized at Orizaba, will expend about $300,000 in the construction of an electric railway system in that city.

TAMPICO, MEX.—S. Pearson & Son, Ltd., who built and own the new electric street railway system in Vera Cruz, will, it is reported, construct a similar system in the City of Tampico and build interurban lines to various towns in that section. This firm is developing extensive oil fields in the Tampico territory.

New Industrial Companies.

THE SECURITY LIGHT & TANK COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $10,000, by Henry Bandlow, Frank Matthies and Arthur J. Shutan. The company proposes to do a general electrical, heating, manufacturing and merchandise business.

THE McPHERSON-WILLARD FORGE & MACHINE COMPANY, of Camden, N. J., has been incorporated, with a capital stock of $75,000, by White D. Willard, Phillip L. Swank and Theodore Carter. The company proposes to conduct an electrical and mechanical engineering business.

THE JOHN B. CARTER COMPANY, of East Orange, N. J., has been incorporated by C. O. Geyer, F. E. Ruggles and G. G. L. Valle, of East Orange, N. J. The company proposes to do a general contracting, engineering and construction business. The company is capitalized at $150,000.

THE NATIONAL ELECTRIC WIRING & FIXTURE COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, by Rudolph W. Yates, George Smithlin and Henry N. Brande, all of New York, N. Y. The company proposes to do electrical work of all kinds.

THE BENTON INSULATING COMPANY, of Elmira, N. Y., has filed articles of incorporation, with a capital stock of $50,000, for the purpose of manufacturing electrical apparatus . The incorporators are: C. F. Riddle, E. J. Baldwin, T. Allison, of Elmira, N. Y., and J. S. Wheeler, of Penn Yan.

THE WEST JERSEY ELECTRICAL & CONSTRUCTION COMPANY, of Camden, N. J., has been chartered, with a capital stock of $25,000, by F. Fithian, H. T. Sutherland and L. S. Fithian, of Camden, N. J. The company proposes to do a general contracting, mechanical and electrical engineering business.

THE WESTERN ENGINEERING COMPANY, of New York, N. Y., has been chartered, with a capital stock of $6,000, to do a general contracting, mechanical and electrical engineering business. The incorporators are: Samuel McCullough, of Brooklyn, N. Y.; G. Q. Dean and Fred Knowlton, of New York, N. Y.

THE STELLAR COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $9,000, by Benjamin B. Hamlin, Jr., of New York, N. Y.; William G. Conn., of Brooklyn, N. Y., and Ashton M. Boney, of New York, N. Y. The company proposes to establish a physical, electrical and chemical laboratory.

THE WILLIAM H. WOOD LOCO FIRE BOX & TUBE PLATE COMPANY, of Camden, N. J., has been chartered, with a capital stock of $500,000, by John Creth Marsh, Frank B. Rhodes and William R. T. Kolp. The company proposes to manufacture fire boxes, tube plates, etc.; also to carry on a mechanical and electrical engineering business.

THE NEW ERA NOVELTY COMPANY, of East Orange, N. J., has filed articles of incorporation, with a capital stock of $100,000, and proposes to manufacture mechanical, electrical and chemical devices for household and general use. The incorporators are: W. R. Moore, of East Orange, N. J.; C. W. Groo, of Newark, N. J.; D. E. Denniston, of South Fallsburg, N. Y.

New Incorporations.

PELL CITY, ALA.—The St. Clair County Telephone Company has been chartered, with a capital stock of $10,000, by L. Cooke, J. F. Cooke, E. Cooke and others.

BOONEVILLE, ARK.—Articles of incorporation have been filed for the Booneville Light & Water Company, with a capital stock of $50,000, for the purpose of constructing and operating water works system, electric light and power plant and telephone exchange. The officers are: John T. Thayer, president; Joseph Ellerkamp, vice-president, and W. Earl Harrell, secretary and treasurer.

BERKELEY, CAL.—The Sierra Electric Power Company has filed articles of incorporation, with a capital stock of $500,000. The company proposes to develop the mountain streams of the Sierra and erect a large generating plant in the mountains for the distribution of electricity in Berkeley.

VISALIA, CAL.—The Lindsay Home Heat, Light & Power Company has been chartered, with a capital stock of $50,000. The directors are Charles F. Burr, W. S. Berry, L. H. Green, C. O. Cowels and P. T. Ostrander.

COLORADO SPRINGS, COL.—The San Bernardo Mining & Power Company has been incorporated, with a capital stock of $50,000, by Thomas J. Fisher, Edmond C. Van Diest and Horace G. Lunt.

HAHIRA, GA.—The Hahira Telephone Company has been formed with L. M. Stanfill, president, and R. Y. Scruggs, secretary.

BLUFFTON, IND.—The Bluffton Berne & Celina Traction Company has filed articles of incorporation with a capital stock of $50,000. The company proposes to generate and distribute electricity in addition to the operation of an interurban railway 17 miles long, connecting the cities named in title and intermediate towns. The principal office will be in Bluffton.

PAXTON, IND.—The Paxton Telephone Company has been incorporated with a capital stock of $—. The object of the company is to build, equip and operate a telephone system and exchange in Paxton and throughout the eastern portion of Sullivan County. Jacob Cox, John and Alva McCammon and John Nesbit are directors.

FRANKFORT, KY.—Articles of incorporation have been filed with the Secretary of State for the Davis Telephone Company, of Whitley County. The company is capitalized at $1,000 and the incorporators are: A. B. Johnson, M. A. Maurey, W. B. Davis and others.

WILLIAMSBURG, KY.—The Davis Telephone Company has been incorporated by A. B. Johnson, M. A. Maurey, W. B. Davis and others.

LEBANON, MO.—The Laclede County Telephone Company has been chartered, with a capital stock of $10,000, by J. E. Dickens, B. C. Hooper, Thomas Gilmer, Martin D. Johnson and others.

DISNEY, NEB.—The Spring Branch Telephone Company has been incorporated, with a capital stock of $5,000. W. S. Roberts, of Disney, is president of the company.

KEARNEY, NEB.—Articles of incorporation have been filed for the Kearney Water & Electric Power Company, with a capital stock of $310,000, by N. P. McDonald, Arthur A. Scoutt and William J. Scoutt.

CAMDEN, N. J.—Articles of incorporation have been filed for the Martinsburg & Charleston (W. Va.) Gas & Water Company, with a capital stock of $300,000. The incorporators are: William P. Huston, John H. Blyo and William Goodwin. The company proposes to deal in electricity and gas.

CLAREMORE, OKLA.—Articles of incorporation have been filed for the Claremore Street Railway Company, with a capital stock of $300,000, by W. J. Perdue, C. F. Goabey, O. C. Wing, H. Jennings and Hiram Stephens. The company proposes to construct a street railway in Rogers County.

WAURIKA, OKLA.—The Waurika Ice & Electric Company has been chartered, with a capital stock of $50,000, by M. C. Irwin, M. Griffin O'Neal, of Dallas, Tex.; F. B. Martin and E. W. Gnatt, of Waurika, Okla.

HALFWAY, ORE.—The Panhandle Co-operative Telephone Company, of Pine Valley, has been incorporated, with a capital stock of $4,500. Charles B. Davis is president.

OREGON CITY, ORE.—The Clackamas Southern Railway Company has been incorporated by F. M. Swift, David Loring and A. E. Clark. The company proposes to construct an electric railway to connect Oregon City with the Molalla Valley in Clackamas County, with a southern terminus at Scott's Mills on Butte Creek. Preliminary surveys have been completed and most of the right of way secured. The railway will be about 35 miles in length and the company expects to develop water power to generate electricity to operate the road.

MARION CENTER, PA.—The Marion Center Telephone Company has been organized, with the following-named officers: H. P. Wetzell, president; Dr. L. N. Park, vice-president; Dr. A. H. Stewart, secretary, and William C. Griffith, treasurer.

MERCER, PA.—The Blacktown Telephone Company has been incorporated, with a capital stock of $1,150, to erect and operate a telephone system in Mercer County, with principal exchange in Blacktown. The directors are: F. W. Gilson, of Mercer, Pa., treasurer; W. R. Nelson, Earl S. Rudolph, J. C. Williamson, of Springfield Township; W. W. McMasters, of Findley, and A. W. Urey, of Pine Township.

MT. CARMEL, PA.—The Mt. Carmel & Locust Gap Transit Company has been incorporated, with a capital stock of $30,000, to build a railway from St. Marys Cemetery and Locust Gap, a distance of two and one-quarter miles. The directors are: Edmund W. Samuel, of Mt. Carmel, Pa., president; William Kiefer, Jr., Thomas J. Kiefer, Joseph D. McConnell and Robert D. Heaton.

PHILADELPHIA, PA.—The Allegheny & Northwestern Railroad Company has been incorporated, with a capital stock of $70,000, to construct a railway between Mars and Evans City, a distance of seven miles. The directors are: John G. McPherson, president; David Dilinger, William E. Heller, C. S. Jarvis and J. L. Killip, all of Philadelphia, Pa.

PITTSBURG, PA.—The Scott Township Street Railway Company has filed articles of incorporation, with a capital stock of $30,000. The directors are: W. E. Kusen, of Pittsburg, Pa., president; A. J. Schmidt, of Pittsburg, Pa.; C. August Stuetz, of Bellevue, Pa.; W. P. Heckman, of Avalon, Pa., and J. D. C. Miller, of Sewickley, Pa.

PITTSBURG, PA.—A charter has been granted to the Banksville & West End Street Railway Company by W. E. Kusen, A. J. Schmidt, C. A. Steutz, W. P. Heckman and J. D. C. Miller. The company is capitalized at $18,000 and proposes to construct a street railway three miles long in the vicinity of Banksville.

SUNBURY, PA.—The Sunbury Electric Company has been chartered, with a capital stock of $5,000. The directors are: Boyd A. Musser, of Scranton, Pa., treasurer; Guy Webster, of York, Pa., and William H Lyons, of Sunbury, Pa.

HAYTI, P. O. VIENNA, S. D.—The Hamlin County Farmers' Telephone Company has been chartered, with a capital stock of $25,000.

FORT WORTH, TEX.—The Polytechnic Light & Power Company, of Polytechnic Heights, has been incorporated, with a capital stock of $15,000, by D. R. Aikin, R. H. Fulton and E. V. Evans.

GRAND SALINE, TEX.—The Grand Saline Light & Power Company has been chartered, with a capital stock of $10,000, by U. S. Meeks, Joseph Reetz and C. E. Strassberg.

SOMERVILLE, TEX.—Articles of incorporation have been filed for the Somerville Electric Light & Manufacturing Company, with a capital stock of $10,000, by R. E. Bledsoe, J. D. Gidings, E. F. Reynolds and others.

RUTLAND, VT.—The Otter Creek Electric Railway Company has

been organized, with a capital stock of $50,000, for the purpose of constructing an electric railway connecting Rutland, Clarendon, Wallingford, Danby, Dorset and other towns. H. B. Barden, of Wallingford, Vt., is interested in the project.

SEATTLE, WASH.—Articles of incorporation have been filed for the Peninsula Light & Power Company, with a capital stock of $400,000. The company proposes to develop water power on the Dusewallips River and to furnish electricity for lamps in Bremerton, Port Orchard and Charleston. R. S. Chapman, of Tacoma, Wash., is president, and John Arthur, of Seattle, is vice-president.

WALLA WALLA, WASH.—Articles of incorporation have been filed for the Columbia & Walla Walla Traction Company, with a capital stock of $1,000,000. The company proposes to take over the property and holdings of the old Columbia & Walla Walla Traction Company. The following named officers have been elected: Dr. N. G. Blalock, president and general manager; M. R. Hanger, of Dayton, Wash., first vice-president; L. C. Davidson, secretary, and George Kellough, treasurer.

CONCORD, W. VA.—The Capon Telephone Company has been incorporated by G. K. Kump and others.

STURGEON BAY, WIS.—The Sawyer & Western Telephone Company has been incorporated, with a capital stock of $600, by Christopher Hanson, John A. May and George O. Whitford.

GALLINGERTOWN, ONT., CAN.—The Stormont Telephone Company has been organized, with a capital stock of $1,500, and the following-named officers: Dr. E. E. Brown, of Aultsville, president; W. A. Edwards, of Gallingertown, vice-president, and W. H. Alexander, of Pleasant Valley, secretary and treasurer.

MOUNT FOREST, ONT., CAN.—The Mount Forest, Wellington & Grey Telephone Company has been incorporated with a capital of $10,000. The directors are R. O. Kilgour, J. J. Cook, Mount Forest; W. H. Wallace, Egrement Township.

Legal.

CURRENT TO FARMERS.—An interesting question as to service came up recently in Iowa. Last spring several farmers between Alden and Iowa Falls, along the line of the electric light circuit running between the towns, brought an action to compel the company to furnish electric currents to them for light and power. At the November term of court in Eldora Judge Lee held that each farmer must prosecute his own case alone, and that all of the plaintiffs could not join in the action. Accordingly the case of A. G. Wood vs. the Peterson Heat, Light & Power Company was tried. Judge Lee has rendered his decision in favor of the defendant company. It appeared from the evidence that at the time the line was constructed the president and secretary of the company represented to farmers along the line that they could be furnished with the electrical energy, and as a matter of fact they were so furnished for a time until the transformers burned out, when the company refused to replace them, and the action was brought to compel the company to re-establish the service. The court found, however, that no valid contract had been made between the parties, and dismissed the action. It is certainly striking to find farmers going to law to compel electric service.

ELECTRIC LIGHT COMPANY NOT LIABLE FOR INJURIES TO TRESPASSERS.—An electric light company is not liable for the death of a trespasser on the roof of a building through coming in contact with a live wire, which had become charged with electricity through the failure of the company to comply with city ordinances. The case in which this holding was reached may be thus briefly stated: A negro boy about 12 years old went with a companion near the same age to the roof of the Dundee Building, in Fort Worth, Tex., passing up a stairway and out through a trap-door, and was there instantly killed by coming in contact with a live guy wire, which had become charged with electricity through the failure of the company to comply with one or more of the penal ordinances of the city of Fort Worth. This suit was brought by the parents of the deceased boy against the company to recover damages on account of its failure to comply with the ordinances.

In the case of City of Greenville vs. Pitts (Texas), 107 S. W., 50, referred to in the certificate, it was distinctly held that the city was not liable for the injury inflicted in that case, for the reason that the plaintiff went upon the building in pursuit of his own business, without invitation or express permission from the owner thereof. This was in accordance with the ruling in the case of Brush Electric Light & Power Company vs. LeFevre, 57 S. W., 640, which is also referred to in the certificate. The reasoning of the court upon which that opinion is based is that, since there was not a scintilla of evidence that the awning over which the wires were stretched "had ever been used by any person as a place of resort, either for pleasure or business," therefore the injury could not have been anticipated, and the defendant was not liable. In that case there was an attempt to plead an ordinance, making it the duty to keep its wires insulated, but a special demurrer was sustained to the allegation for vagueness of pleading. There is not a suggestion in the opinion in the case that if the ordinance had been well pleaded it would have made any difference. It is almost universally held that the violation of a statutory duty is negligence *per se*. But as we understand it this is the difference between negligence at common law and the violation of a statutory duty—"only this and nothing more." When a plaintiff sues for the neglect of the provisions of a statute or of the ordinance of a city, and proves such [illegible] has established the first postulate in his case; that is, the negligence of the defendant. But this does not preclude the defendant from showing that he has been guilty of contributory negligence. Burnett vs. Fort Worth Light & Power Company, Court of Civil Appeals, of Texas, 112 S. W., 1040.

Personal.

MR. R. T. FEWELL has taken charge of the plant of the Carolina Light & Power Company in Rock Hill, S. C.

MR. T. SERDUKE, The Madison, Seattle, Wash., is desirous of receiving from manufacturers catalogs in the line of telegraphic apparatus; especially supplies adapted to export. He states that he would like to get two copies of each catalog sent.

MR. E. R. MASON, who has been connected with the sales department of the Chicago branch of the Electric Service Supplies Company and its predecessors for the past 11 years, has been appointed manager of the New York office of the company. He assumed his new duties on the 1st of January.

MR. J. E. COWLES, formerly chief electrician of the Hot Springs Water, Gas & Electric Works, Hot Springs, Ark., has been appointed superintendent of lighting of the Little Rock Railway & Electric Company, Little Rock, Ark. He succeeds at Little Rock Mr. T. R. Phillips, who has found it necessary to go farther South on account of ill-health.

MR. W. J. McCORKINDALE, manager of the Marquette County Gas & Electric Company, of Ishpeming, Mich., is the subject of an appreciative sketch in *Iron Age*, published in Ishpeming. A page of the journal is devoted to an account of the Marquette plant, the occasion of the article being a luncheon in the car barn, at which toasts had leading citizens as respondents.

MR. WALTER E. HOLLOWAY, who was with the Safety Insulated Wire & Cable Company for nearly 20 years, and for a long time its purchasing agent, has now opened an office on his own account in the Produce Exchange Annex, New York City, where he will give special attention to dealings in rubber, copper and cotton yarns, utilizing his knowledge and experience in these and kindred lines.

MR. G. S. SHINNICK, assistant to Mr. W. A. Gibbs, district manager of the Ohio Electric Railway Company, Columbus, Ohio, has become general manager of the Mattoon Light, Heat & Power Company and the Mattoon Railway Company, both of Mattoon, Ill. He is also secretary and a director of the Licking Light & Power Company, of Newark, Ohio. He has had nine years with the various parts of the Ohio Electric system.

MR. ALEX. HENDERSON at the recent meeting in Buffalo of the Rejuvenated Sons of Jove offered a sentiment in proposing a toast that is enjoying considerable fame in electrical circles, but is here given, correctly: "A single roseleaf passed before a man while he is alive is productive of more happiness and joy than a mountain of flowers heaped on his grave." Mr. Henderson's eloquence is timely for the new year.

MR. H. A. JOHNSON, engineer of car equipment of the Metropolitan West Side Elevated Railway, Chicago, Ill., has been appointed master mechanic of the company, assuming part of the duties of Mr. E. T. Munger, who has been appointed general superintendent of the Hudson & Manhattan Railroad, New York. Mr. Johnson is a graduate of Purdue University, and has been connected with the Metropolitan West Side for the past three years.

MR. J. CLIFFORD RENNARD, who was until recently assistant chief engineer of the New York Telephone Company, and has since been engaged in consulting work as an electrical engineer, has just returned from the West, where he has been engaged in an inspection of fire alarm telegraph systems for the National Board of Fire Underwriters. Mr. Rennard has his headquarters at 77 East Fifty-sixth Street, New York, and will give his attention to telephony, telegraphy and signaling, as well as the other departments of the field.

MR. J. B. N. CARDOZA has resigned as assistant to the general manager of the Norfolk & Portsmouth Traction Company, Norfolk, Va. He left the Berkley (Va.) Street Railway several years ago to become superintendent of maintenance of way of the Norfolk & Portsmouth Traction Company and served in this capacity until the opening of the Jamestown Exposition in June, 1907, when he was appointed assistant general manager. He has now opened an office in Norfolk as a consulting engineer, and will pay particular attention to electric railways and other electrical utilities.

MR. J. E. WOODWELL, of the firm of L. B. Marks and J. E. Woodwell, New York City, has been retained by Messrs. McKim, Mead & White, architects, as consulting engineer for the entire mechanical and electrical equipment, including the heating and ventilation, electric lighting and power, mail handling devices, etc., of the new U. S. Post Office to be erected at the Pennsylvania Terminal Station in New York City. The cost of this installation will be upward of $500,000. The firm has retained Prof. S. H. Woodbridge, of the Massachusetts Institute of Technology, as associate consulting engineer for the heating and ventilation of this building.

MR. THOMAS F. RYAN, under medical advice, has announced that hereafter he will be actively connected only with the Morton Trust Company, the National Bank of Commerce and the American Tobacco Company, having withdrawn from official connection with all the other companies in which he is interested. Among the companies from which

he has retired as a director are the Central Crosstown Railroad, New York; Thirty-fourth Street Crosstown Railway, New York; Metropolitan Street Railway, New York; New York City Railway, New York; Union Elevated Railroad, Chicago; the Consolidated Gas, Electric Light & Power Company, and the Electric Storage Battery Company.

MR. E. T. MUNGER, heretofore superintendent of motive power and equipment of the Metropolitan West Side Elevated Railway, Chicago, Ill., has become general superintendent of the Hudson & Manhattan Railroad, operating under the Hudson River between New York and New Jersey. He was graduated from the University of Wisconsin in 1892, and became connected with the Hall Signal Company as draftsman and construction foreman. In 1894 he entered the employ of the National Switch & Signal Company, but resigned a year later to become foreman of construction of the Metropolitan West Side Elevated Railway, in charge of wiring cars, stations and power houses. In 1898 Mr. Munger was appointed engineer of the Englewood & Chicago Railway in charge of the construction and installation of that company's storage battery surface line between Englewood and Blue Island. On the completion of the road he became general manager of the Havana Telephone & Electric Light Company, Havana, Ill., but re-entered the service of the Metropolitan West Side Elevated Railway in 1903 as master mechanic, and continued in that position until March 14, 1908, when he was appointed superintendent of motive power.

MR. WALTER J. JONES, who has been associated for the past three years with the late Dr. F. A. C. Perrine, will continue the consulting engineering practice of Dr. Perrine at the offices, 60 Wall Street, New York City. Mr. Jones was educated at high schools, and after four years in the pattern shop and three and a half years in the drawing office of the Dickson Manufacturing Company, he engaged for five years in the equipping of street railways and the installing of power plants in a number of States. Following this varied experience, he occupied during the next 10 or 11 years responsible positions in the engineering departments of the Suburban Electric Light Company, Scranton, Pa.; the Bergen County (N. J.) Gas & Electric Company; in the sales department of the Stanley Electric Manufacturing Company (Denver and Chicago offices), and as engineer of the American Construction Company, New Orleans. He left the last mentioned company in 1905, and, returning North to engage in general engineering, soon became associated with Dr. Perrine. Mr. Jones is carrying through to completion the work that Dr. Perrine had on hand at the time of his death, including work for the Bishop Creek Gold Company for a power plant and stamp mill, and a hydraulic mining installation for the British Guiana Gold Company. He is consulting engineer for the United States Roller Bearing Company and for the Interstate Railways Company. For the latter he is building a power plant of 10,000 kw at Reading, Pa. This will involve the building of the power plant and changing of the present steam plant into a main synchronous-converter substation, from which will be operated the street railway system, low-tension lighting and power system and street arc lamps of Reading. He will also install four or five other substations in the vicinity of Reading, to supply the interurban trolley systems. The plants include the re-equipment of the water power plant about six miles from Reading.



MR. WALTER J. JONES.

Trade Publications.

AIR COMPRESSORS are described in detail in illustrated catalog No. 100 of the Thos. H. Dallett Company, York and Twenty-third Street, Philadelphia, Pa.

MACHINE TOOLS for making small duplicate parts from metal bars are outlined in Folder No. 515 of the National-Acme Manufacturing Company, Cleveland, Ohio.

POLYPHASE MOTORS, of the wound-rotor and squirrel-cage induction type, are treated in an instructive manner in Bulletin No. 82 of the Wagner Electric Manufacturing Company, St. Louis, Mo.

NERNST LAMPS.—The December issue of *Lux*, a miniature magazine published by the Nernst Lamp Company, Pittsburgh, Pa., contains many bright items on the subject of illumination by Nernst lamps.

ALTERNATORS, of the polyphase revolving-field type, are dealt with in Bulletin No. 1109 of the Fort Wayne Electric Works, Fort Wayne, Ind. The various constructive details are illustrated and described.

MACHINE SHOP SUPPLIES, including hydraulic machinery, pneumatic machinery, shears, punches, rolls, etc., are illustrated and described in the December issue of *Peterson's Monthly Journal and Stock List*.

CRANE CONTROLLERS, of the variable mechanical pressure carbon resistor type, are discussed instructively in a well-illustrated 40-page catalog issued by the American Electric Fuse Company, Muskegon, Mich.

TELEPHONE PROTECTION.—The Harvard Electric Company, 136 Liberty Street, New York, has issued folders for calling attention to its line of protectors for telephone lines, including fuses and lightning arresters.

GAS ENGINES.—A discussion of the saving that may be obtained in the consumption of coal by substituting gas producers and engines for steam boilers and engines is given in a bulletin issued by the Model Gas Engine Works, Peru, Ind.

ELECTRICALLY DRIVEN TOOLS, including drills, grinders, buffers, notching presses and winding machinery, are illustrated and described in a bulletin issued by the James Clark, Jr., Electric Company, Louisville, Ky. The tools are driven by direct-current motors.

THEFT OF ELECTRICAL ENERGY and its prevention are discussed in a booklet issued by the Pettingell-Andrews Company, Boston, Mass. Illustrations with diagrams of connections are given of a device designated as the "O K connection block," which removes the temptation.

STORAGE BATTERIES for the ignition of gas in engines are listed and described in a bulletin issued by the Radio Battery Company, 16 Boyden Place, Newark, N. J. The bulletin also contains brief descriptions with price lists of charging outfits, rectifiers, hydrometers and voltmeters.

HESS-BRIGHT.—The Hess-Bright Manufacturing Company, Philadelphia, has issued and distributed a perpetual calendar to fit the vest pocket. The company will have a fine exhibit of a scientific nature at the Automobile Shows in New York, illustrative of ball bearings and tests of them.

STEAM ENGINES, of the single-valve side-crank type, are described in detail in Bulletin No. 20 of the Ridgeway Dynamo & Engine Company, Ridgeway, Pa. These engines are built as simple, tandem-compound or cross-compound machines, and are intended especially for driving electric generators.

VIBRATORS.—The Shelton Electric Company, Chicago, Ill., has issued a 36-page catalog devoted to its electrically driven vibrators. Illustrations are given of rheostats, vibrator outfits, hand massage instruments, electric centrifuges, sinusoidal devices, head lamps, hair dryers and curling irons.

ELECTRIC IRONS.—No. 5 of Vol. I. of *Hot Points*, issued by the Pacific Electric Heating Company, Ontario, Cal., calls attention to the fact that the Commonwealth Edison Company, Chicago, has placed an order with it for 5,000 irons. The reasons for the success of its irons are thoroughly discussed.

DIRECT-CURRENT MOTORS of the protected and enclosed types, rated at from 0.03 hp to 20.0 hp, are illustrated, described in detail and listed in Bulletin No. 40 of the Eck Dynamo & Motor Company, Belleville, N. J. The bulletin also contain miscellaneous data to aid in the selection and installation of motors.

M. & M. SPECIALTIES.—The Machen & Mayer Electrical Manufacturing Company, Twelfth and Buttonwood Streets, Philadelphia, has already got out its catalog for 1909 covering its lines of electrical specialties. It has also issued a catalog of its new "M. & M." panel-boards. These are of the multiple push-button switch type.

TELEPHONES.—Circular No. 1078 of the Western Electric Company, Chicago, Ill., is devoted to magneto-telephone wall sets recently placed on the market. In these telephones the binding posts are placed out of sight, and the bell generator and switch-hook have been redesigned, so that the appearance has been much improved over that of older types.

ELECTRIC PYROMETERS of the combined indicating and recording type are illustrated and briefly described in bulletin No. 100 of the Bristol Company, Waterbury, Conn. These pyrometers are especially valuable for annealing furnaces, case-hardening furnaces, water-gas mains, blast furnaces, galvanizing plants, gas producers or open-hearth furnaces.

WIRELESS TELEPHONY.—The Radio Telephone Company, 49 Exchange Place, New York, has issued a series of bulletins dealing with wireless telephone apparatus.. Bulletin C-1 relates to condensers of variable capacity, D-2 to combination syntonizers and receivers, L-2 to inductors of variable inductance, L-4 to inductors of wide range of variability, L-5 to loose-coupling apparatus and T-1 to sensitive telephone receivers.

TEXTILE MILLS.—The Western Electric Company has issued an interesting bulletin on electricity in the textile industry, illustrated by some typical installations and special drives where the company's apparatus is used. The reading matter embodies a discussion of the use of electric motors in ensuring steadiness of the driven machines at a higher speed, with consequent increase in output. Among the views are those of warping, redrawing frames, quilling machines, winding and throwing machines, folding machines, etc. The pamphlet shows, in addition, generators, motors and lamps, with descriptive text, and devotes a page to intercommunicating telephones.

GENERAL ELECTRIC FAN MOTORS.—Fan motors for 1909 is the subject of a catalogue just issued by the General Electric Company. This catalogue contains illustrations, descriptive matter and prices of the entire line of its fan motors for the coming season. This line embraced motors for both alternating and direct current in desk, bracket, ceiling, floor column and counter column types of standard sizes. It lists also ventilating motors and miscellaneous small power motors for alternating and direct current, as well as various supply parts of the standard fan motors. The catalogue, No. 4632, quarto size, is attractively printed in green and gray and will be furnished on application to the nearest sales office or to the publication bureau, Schenectady, N. Y.

Business Notes.

THE VAN DORN ELECTRIC MANUFACTURING COMPANY, of Cleveland, Ohio, has opened an office at 239 Fourth Avenue, Pittsburgh, Pa. James A. Bradley will have charge of the Pittsburgh office.

THE CHICAGO X-RAY COIL COMPANY has opened up offices at 1125-26 Masonic Temple, Chicago, Ill., where the latest improvements in this company's electrotherapeutic apparatus are exhibited.

THE STAVE ELECTRICAL COMPANY, New York, manufacturer of the "Stave" flaming arc lamps, has opened a Chicago branch at 1101 Monadnock Block. This will be a great convenience to the Western trade.

WOOD PRESERVER.—The C. A. Manufacturing Company, of Austin, Tex., has arranged with the Western Electric Company, of Denver, Colo., to take charge of its stock of "C. A. wood preserver," thus adding Denver to the list of distributing points.

ILLUMINATING ENGINEERS TO DESIGN GLOBES.—The Phoenix Glass Company, of New York, Pittsburg and Chicago, has retained the Bureau of Illuminating Engineering, 437 Fifth Avenue, New York, to act as consulting and designing illuminating engineers in the matter of designing or redesigning glass globes and reflectors, as manufactured by them, so that beauty and utility will be sensibly blended. Mr. Albert J. Marshall, chief enginer of the bureau, will have direct supervision of this work. In carrying out these ideas the effect of light on the eye will receive very careful consideration.

GRINDING GLASS.—A new method for grinding glass has been discovered, it is stated, by the Onward Manufacturing Company, who have factories at Menasha, Wis., and Berlin, Ont., and are manufacturers of the Onward sliding furniture shoe, which takes the place of the wheel castor. This discovery is a grindstone made from one-half best Portland cement and one-half silica sand. It must be thoroughly mixed and tamped even. The advantage of this stone is that when properly made there will be no hard and soft spots, and it will grind glass without scratching. The cost is about 10 per cent of the common grindstone. Some have been used successfully for one year.

CAPITAL AND LABOR.—During the recent holidays Mr. James Inglis, president of the American Blower Company, Detroit, Mich., made an address to the employees at the works, expressing satisfaction at the cordial relations that existed between the management and the men without break for more than a quarter of a century. Two years ago the company distributed a large sum of money, in giving each employee $1 and an additional dollar for each year of continuous service. The largest sum paid was $24, that representing the entire life of the company. No one received less than the $1. Last year, owing to the business depression, nothing of the kind was done, but this year the same plan, as outlined above, was again adopted.

ELECTRICITY AT THE CORN SHOW.—At the National Corn Show at Omaha, Neb., early in December, was exhibited electrical apparatus suggesting the use of electric power and light for the farm. The Northern Electrical Manufacturing Company, of Madison, Wis., co-operated with the Alamo Manufacturing Company, of Hillsdale, Mich., in showing generating units. There was a 1¾-kw generator driven by a 3-hp vertical gasoline engine in operation supplying current for illuminating the exhibit, operating an electric piano, a flatiron, etc. An emergency circuit was maintained for supplying light for the entire exhibit in case of a breakdown in the city circuit. Another feature was a direct-connected Alamo engine and 3-kw Northern generator all finished in white enamel and nickel plated. The exhibit did much to encourage the use of electricity for modern homes and farm service. The 1¾-kw generating unit was honored by the authorities of the exhibition as a prize to the best one-half bushel of wheat.

LINK-BELT ORDERS.—The Link-Belt Company, of Nicetown, Philadelphia, Pa., has recently received an order for a locomotive coal, ashes and sand station for the Philadelphia & Reading Railway at Ninth and Wallace Streets, Philadelphia. The plans of the station call for reinforced concrete bins, supported by an under-structure of steel, covered with concrete. There will be 12 pockets for coal, two to each of six coaling tracks. Total capacity, 2,000 tons. Ashes will be kept in two pockets having a capacity of 250 cu. yd. Sand storage: six hoppers, three on each side of station, to hold 48 cu. yd. of sand. The conveying machinery comprises duplicate systems, and each will have a capacity of 100 tons per hour of coal, and of ashes 250 cu. yd. in 10 hours. Other installations in Pennsylvania include elevating and conveying machinery at cement mills, paint works, hat manufactory and fueling equipment for a mining company. An open-top carrier will be installed for a contracting firm in New York and an ash hoist for a manufacturing concern in North Carolina.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Lloyd Lyon, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West 39th St., New York. Next meeting at Hotel Schenley, Pittsburg, Pa., Jan. 26, 27 and 28, 1909.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, United Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, 559 Frick Building Annex, Pittsburg, Pa. Next meeting, October, 1908.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago. Next meeting, Detroit, June 23, 24 and 25, 1909.

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, Walter S. Mower, London, Ont.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York.

ASSOCIATION OF CAR LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Chicago & Illinois Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, S. E. Mumford, Detroit, Mich.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Indianapolis, Ind.

CHICAGO ELECTRIC CLUB. Secretary, S. M. McFedries, care J. L. [illegible]

[illegible] Secretary [illegible] September, 1909

EASTERN STATES INDEPENDENT TELEPHONE ASSOCIATION OF PENNSYLVANIA, NEW JERSEY, MARYLAND AND DELAWARE. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 500 Fifth Ave., New York. Next meeting, Imperial Hotel, New York City, Jan. 19, 1909.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York Board of Directors meets second Friday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B Chapin, 154 Nassau St., New York.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, V. R. Lansingh, 33 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, Lewis H. Woods, Imperial Hotel, Broadway and 32d St., New York.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., 1909

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Ia. Next meeting, Cedar Rapids, Ia., April 21 and 22, 1909.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Next meeting, Des Moines, March 9, 10 and 11, 1909.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Cedar Rapids, Ia., April, 1909.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., October, 1909.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meetings, second Tuesday in October each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-Treasurer, Ludwig Kemper, Albert Lea, Minn. Next meeting, Nicollet Hotel, Minneapolis, Minn., March 18 and 19, 1909.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss. Next meeting, Jackson, Miss., June 15, 1909.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Schweer, Windsor, Mo.

MISSOURI ELECTRIC LIGHT, GAS & STREET RAILWAY ASSOCIATION. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, April 15, 16 and 17, 1909.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, Boston, Mass., June 10, 1909.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Temporary chairman, J. D. Crary, Aberdeen, Wash. Next meeting, Seattle, 1909.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, Roger N. Kimball, Kenosha, Wis. Next meeting, Milwaukee, Jan. 20 and 21, 1909.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio. Next meeting, Columbus, Ohio, March 18, 1909.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaebr, Schofield Building, Cleveland, Ohio. Next meeting, Canton, Ohio, May 21 and 22, 1909.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburg, Pa., 1909.

PENNSYLVANIA ELECTRIC ASSOCIATION. E. L. Smith, Towanda, Pa., secretary.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell. Boston, Mass. Monthly meetings, fourth Monday each month. Next annual meeting, fourth Monday in February, 1909.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D. Next meeting, Yankton, S. D., Jan. 13 and 14, 1909.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, J. A. Myler, Jr., 609 Juanita Building, Dallas, Tex. Next meeting, Dallas, Tex., May, 1909.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next meeting, New York, March, 1909.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., October, 1909.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1 each year.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 22, 1908.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

907,139. JUNCTION OR OUTLET BOX; John Fountain, Jr., Elizabeth, N. J. App. filed Oct. 31, 1907. A cast metal box with wrought metal sides; the openings in the sides being filled with cast metal disks.

907,140. ELECTRIC STERILIZER FOR FOOD PRODUCTS; M. R. Frei, Denver, Col. App. filed May 27, 1908. The vessel into which the liquid is to be poured is provided with outlet openings, and electrodes have their terminals projecting into said openings.

907,155. MANUFACTURE OF SPAR INSULATORS; F. M. Locke, Victor, N. Y. App. filed Nov. 24, 1905. Makes an insulator entirely of feldspar by subjecting it to a very high heat, then molding it into an insulator form and allowing it to cool.

907,161. VACUUM-TUBE ELECTRIC APPARATUS; Danel McFarlan Moore, Newark, N. J. App. filed Feb. 7, 1906. The gaseous tension in the tube is kept uniform by a valve which controls the feed of air or other gas to the tube. Means magnetically actuated by the varying magnetic field of a transformer regulate the position of the valve.

907,166. SIGNAL SYSTEM WITH CONTINUOUS RAIL CONNECTIONS; Daniel J. McCarthy, Wilkinsburg, Pa. App. filed April 2, 1907. Each signal is connected to one relay and two transformers each of the same phase are caused to supply current through the track to the relay. Either transformer supplies insufficient current to operate the relay, but their combined action controlled by the movement of the train operates the relay.

907,176. ELECTRIC MOTOR; George W. Richardson, Wissahickon, Pa. App. filed Jan. 22, 1907. For heavy mill work. The frame has three bearings on opposite sides. These receive the motor shafts at two motors that are arranged side by side in the frame and of an intermediate shaft in the frame, geared to the two motor shafts.

907,194. WALL SOCKET BASE; Samuel E. Steele, Pittsburg, Pa. App. filed Aug. 1, 1907. For electric lamps. Provides means whereby the screw may lead to the base either through the rear or through the sides.

907,204. TELEPHONE SYSTEM; William W. Dean, Chicago, Ill. App. filed Aug. 21, 1901. A telephone system having a relay battery permanently connected to the line, which relay is under the control of the subscriber, a ground tap connected with the talking circuit and controlled by the relay and the telephone associated with the cord circuit, having its operation affected by current flowing over a circuit forming a portion of the said talking circuit and the ground tap.

907,246. TROLLEY-HARP WASHER; Hugh W. Kimes, Dayton, O. App. filed April 20, 1908. Means for attaching the washer to the harp. Details.

907,251. ELECTRICAL-WIRING KNOB; Harry Wallace Lawrence, Denver, Colo. App. filed June 10, 1908. A porcelain insulating post for supporting the terminals and intermediate portions of wires. The post is cut transversely so as to make two sections. The wire passes into a gripping recess formed on the ears of the two sections.

907,269. SIGNALING ON TRAINS; J. F. McElroy, Albany, N. Y. App. filed April 30, 1908. A guard-signal system for multiple-unit trains. A number of car units form a series train-circuit. Guard-switches collectively close the circuit. The driver is informed by the signal at his end when the guards have closed the circuit. Details in construction.

907,296. ELECTRICAL CONDENSER; William C. Shinn, Lincoln, Neb. App. filed Aug. 14, 1908. Used in connection with static electric machines. Consists of a cylinder with inner and outer coatings midway between the terminals. A wing on a rod makes contact with the inner coating. Caps close the cylinder and make it air and moisture tight.

907,320. DEVICE FOR TRANSMITTING SOUND WAVES; Arthur Dare, Philadelphia, Pa. App. filed Feb. 24, 1908. A transmitter for telephones having two connected compartments, one forming the mouthpiece and a series of non-resonant tubes arranged between the compartments.

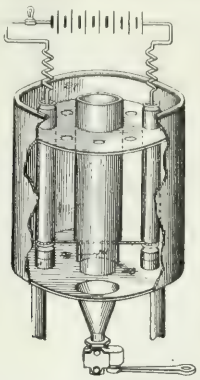
907,339. LIGHT-SIGNAL FOR ELEVATORS; James Monroe Graham, New York, N. Y. App. filed July 22, 1907. Avoids the inconvenience of watching all the signals and sometimes losing a car by providing up and down signal push buttons, and pairs of different colored lights representing each operating elevator arranged in order adjacent to the push buttons.

907,344. ELECTRIC SWITCH; Monroe Guett, Hartford, Conn. App. filed Nov. 1, 1904. A push-button switch in which the poles are advanced a quarter turn and locked in place, and the operating parts return to normal position by a spring.

907,378. STORAGE-BATTERY CELL; P. Kennedy, New York, N. Y. App. filed Oct. 4, 1906. Provides for quickly filling and removing liquid. The jar has an opening at the top which is closed by a cover in two parts, which may be removed without disturbing the terminals.

907,380. MEANS FOR REGULATING ELECTRIC CIRCUITS; Henry Leitner, Woking, England. App. filed March 12, 1907. Regulators for storage battery systems also using a dynamo. The dynamo is a self-regulating variable speed machine with which a rheostat having a movable arm adapted to cut resistances in and out of the lamp circuit co-operates. A motor operating the arm is under the control of a volt meter connected to the lamp circuit. A series of resistances in the shunt field of the dynamo prevent overcharging the battery.

907,399. ELECTRIC HORN; D. P. Perry, Chicago, Ill. App. filed Jan. 27, 1906. The sound producing diaphragm is protected against



907,140—Electric Sterilizer for Food Products.

moisture and dust. Two diaphragms are used with a tapper electrically operated for rapidly beating one of the diaphragms.

907,406. INSULATOR FOR HIGH-TENSION LINES; Norman Rowe, Guanajuato, Mexico. App. filed Jan. 29, 1906. A hollow body, non-conducting, is provided with one or more petticoats. A binding rod of non-conducting material connects caps on opposite ends of the body.

907,419. CONSTANT-LEVEL DEVICE FOR STORAGE BATTERIES; E. W. Smith, Philadelphia, Pa. App. filed Oct. 4, 1904. Eliminates inaccuracy in the working of a storage battery, due to change of level by evaporation, by providing a water supply bottle which feeds water to the battery and a float device actuated when the level of the liquid falls.

907,425. ELECTROPLATING APPARATUS; Abraham Van Winkle and J. T. Daniels, Newark, N. J. App. filed June 29, 1907. A revoluble work support is arranged next to a rotary brush which brushes the work while it is being electroplated.

907,426. ELECTROPLATING APPARATUS; Abraham Van Winkle and John T. Daniels, Newark, N. J. App. filed July 29, 1907. Endless chains support the cylindrical bodies in bulk, in the bight of the chains. The entire apparatus is within the tank.

907,462. TRACTION VEHICLE; C. W. Coleman, Westfield, N. J. App. filed April 5, 1907. A traction engine for agricultural use which draws behind it a trailer. Both trailer and engine are controlled from the seat of the traction vehicle by one man. The engine is driven by a gas engine and the control is electrical.

907,470. TELEPHONY; Hiram D. Currier, Chicago, Ill. App. filed July 20, 1908. A telephone line and transmitting station, a plurality of receiving stations having telephone receivers included in conductors in bridge of the telephone line, the conductors offering different degrees of effective resistance to the voice currents.

907,474. COMPRESSED AIR ENGINE FOR CONDUIT WIRE DRAWING; H. C. Dickinson, Mobile, Ala. App. filed April 8, 1907. Special means are provided for guiding and centralizing the engine in the conduit by means of a truck and centralizing rollers.

907,481. ARRANGEMENT OF CONTACTS FOR SWITCHES; Otto Engel, Berlin, Germany. App. filed March 31, 1908. Makes use of a plurality of conducting segments with insulating layers between. Details.

907,482. SEMAPHORE; John Erickson, Chicago, Ill. App. filed Sept. 19, 1906. Particularly adapted for giving a signal when the selector of an automatic telephone switch is moved to an off-normal position. A flat semaphore blade is moved away from a shield by a motion of the selecting arm.

907,487. STORAGE BATTERY ATTACHMENT; R. J. Fleischer, Milwaukee, Wis. App. filed July 5, 1907. A weighted hydrometer attachment fitted with a gage and weighted with a chain, which latter collapses when the hydrometer is all the way down in the battery.

907,488. APPARATUS FOR OPERATING MECHANISM FROM A DISTANCE; Gustave Gabet, Rochefort-Sur-Mer, France. App. filed Sept. 29, 1905. Wireless telegraph for operating parts of torpedo boats and the like. A pallet wheel driven by clockwork is advanced at each impulse of the wave train. This closes suitable electric circuits. Details.

907,522. CAR-BARN TROLLEY ATTACHMENT; J. W. Perry, New York, N. Y. App. filed June 6, 1908. For preventing fires in car barns using the underground trolley. When the car enters the barn the current collecting plow is removed and the car actuated by a supplementary trolley and trolley pole, which is lifted into temporary contact with the supplementary wire when required.

907,526. BURGLAR ALARM; Samuel Mathias Reist, Minersville, Cal. App. filed May 2, 1907. A window or door alarm in which the trigger closes an electric circuit to ring a bell, the trigger being actuated by the movement of the door or window. Details.

907,542. GROUND-JOINT CONNECTION FOR ELECTRIC CONDUCTORS; John C. Vogel, Philadelphia, Pa. App. filed Feb. 29, 1908. For grounding electric conductors. A flexible band is wrapped around the conductor and suitable plates tighten the band about the body of the conductor.

907,543. GROUND-JOINT CONNECTION FOR ELECTRIC CONDUCTORS; John C. Vogel, Philadelphia, Pa. App. filed July 3, 1908. In addition to the apparatus of 907,542, the patentee provides a lock for connecting the free end of the band with one of the plates.

907,567. ALTERNATING-CURRENT WATTMETER; C. A. Brown, Chicago, Ill. App. filed Dec. 3, 1903. A torque on the movable element proportional to the watts is produced by means of a single energizing circuit which receives its current by induction.

907,568. ALTERNATING-CURRENT WATTMETER; C. A. Brown, Chicago, Ill. App. filed Nov. 27, 1905. A modification of the specific form of meter described in patent No. 907,567.

907,578. ALTERNATING-CURRENT COMMUTATOR DYNAMO-ELECTRIC MACHINE; Wladimir Doinikoff, Karlsruhe, Germany. App. filed March 6, 1908. Avoids sparking in alternating-current machines having a commutator by providing an auxiliary iron core upon which the connecting wires between the commutator and armature are wound and commutating poles suitably arranged to influence the connecting wires.

907,581. TELEPHONE SYSTEM; Alfred H. Dyson, Chicago, Ill. App. filed Nov. 14, 1904. Details in a signaling system for telephones.

907,582. TELEPHONE SYSTEM; Alfred H. Dyson and Francis W. Dunbar, Chicago, Ill. App. filed June 21, 1905. Details in an automatic switch telephone system.

907,598. METHOD OF PRODUCING COLORED LIGHT RAYS; P. C. Hewitt, New York, N. Y. App. filed April 3, 1901. Improvement in the art of fluorescence which makes use of a reflector having a fluorescing surface so that the light reflected therefrom is mingled with the light from the source, the source being a mercury-vapor lamp.

907,600. TRANSMITTER; R. M. Hopkins, Yonkers, N. Y. App. filed May 11, 1908. A telegraph transmitter having a knotted disk and contact device operated by passage over the notches of the disk and one or more adjustable pieces adapted to close one or more of the notches to prevent operation of the contact device.

907,604. KEYBOARD TELEGRAPH SYSTEM; C. K. Jones, Rosedale, Kan. App. filed April 28, 1908. Details in a system for increasing the speed of transmission.

907,614. COMBINATION AND MANAGEMENT OF ELECTRIC CIRCUITS AND THEIR APPLICATION TO RAILWAY SIGNALING SYSTEMS; Joseph Lemire, Drummondville, Quebec, Canada. App. filed Oct. 3, 1907. The track is divided into sub-blocks. A signal operating circuit includes an element of each independent circuit. A plurality of pairs of contacts are arranged in the signal operating circuit and means controlled by each sub-block open the contacts of one pair and close those of the remaining pair.

907,637. PROCESS FOR SEPARATING CREAM FROM MILK; R. W. Padden, Kansas City, Mo. App. filed Aug. 12, 1905. A series of electrical impulses are passed through the milk by an alterating current of high potential or by a uni-directional current.

907,658. TELEPHONE SYSTEM; Harry G. Webster, Chicago, Ill. App. filed Jan. 13, 1906. A telephone line extends from a substation in two limbs to a central office and a two-strand link circuit makes connection with the limbs. A signal under joint control of the operator and subscriber is controlled by the operator by closing a circuit including portions of the link circuit and a number of cells of battery, and the signal is controlled by the subscriber by a circuit also including the same battery cells and parts of the link circuit.

907,659. TELEPHONE EXCHANGE SYSTEM; H. G. Webster, Chicago, Ill. App. filed Feb. 12, 1906. Improvement in telephone system; see 907,658.

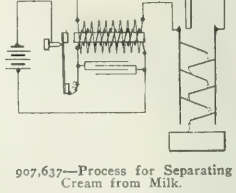
907,660. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed Feb. 12, 1906. A relay with means under the control of one station for closing a circuit through an energizing winding of the relay so as to change the normal position of its contacts and means under the control of the other station for shunting current from the winding to reduce the energization to an amount insufficient to cause the change, a signal and a controlling electromagnet, with its winding in the shunt path.

907,661. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed Feb. 19, 1906. A telephone line extending in two limbs between two stations with a high resistance heat coil and a high resistance electromagnet in circuit and means for completing a talking circuit over the line, excluding the heat coil and connecting the magnet and bridge of the line limbs.

907,662. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. A central office with a signaling circuit extending by two limbs from the central to a plurality of stations, signal receiving devices at the stations associated with one line limb and means controlled over the opposite line limb for controlling the connection with the devices and other signals permanently connected to the opposite line limb.



907,598—Method of Producing Colored Light Rays.



907,637—Process for Separating Cream from Milk.

907,668. BLOCK-SIGNALING APPARATUS; Stephen A. Wood, Providence, R. I. App. filed Feb. 14, 1906. A lamp circuit which is normally open is automatically closed when the first car enters a block, and is again automatically opened and closed when a subsequent car enters the block.

907,686. AIR-BRAKE APPARATUS; C. E. Duffie, Omaha, Neb. App. filed April 27, 1907. In combination with the train line, a main reservoir and means for opening the line to atmosphere, means for cutting off the main reservoir from the line and electrical means for holding both of said means in inoperative position.

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Smaller Exports.

The world-wide diminution of commercial activity has continued to give evidence of its persistent nature in the figures of export and import trade. Quantities as well as values have suffered, and in this international exchange of commodities few signs of recovery are to be noted. The electrical exports, already shrunken far below the levels of other years, are still discouragingly small for November, and it is evident that the year will round itself out with relatively insignificant totals. The figures for November are again considerably below the level of the last two years. The exports for the month of electrical appliances and instruments were $463,588 as compared with $542,524 in 1907. The exports of heavy electrical machinery were only $295,915 as compared with $700,276 in 1907. They could hardly go much lower. The total of instruments for the 11 months was $5,045,392 as compared with $7,209,844 in 1907 and $7,553,111 in 1906; and of machinery $6,369,163 as compared with $8,897,419 in 1907 and $7,638,898 in 1906. There is evidently no possibility of closing up such gaps in a single month. The data must be viewed with fortitude, but not necessarily with resignation.

On the other hand, copper, which is now a great electrical product, seems to be going abroad in great quantities. What on earth they are doing with it would be a difficult thing to explain; they are certainly not using it, and meantime in this country a stock of over 210,000,000 lb. appears to have stacked up. The quantity sent was not great in November, the amount of pig, ingot, bars, plate, etc., being 45,439,665 lb., or about half as much as in 1907. But, on the other hand, the total for the 11 months is 613,784,924 lb. as compared with 426,671,051 in 1907, and 420,612,664 in 1906. Here is a difference of very nearly 200,000,000 lb.; and no one can be persuaded that it is being consumed abroad. No such conditions of absorption exist in any copper-using industry, but if anything the demand is below that of previous years. Some kind of mystery seems to lurk in the movement. Possibly the market here is automatically relieving itself of big domestic accumulations. But it does look as though there was a terrible lot of copper piling up awaiting someone's buying and the return of good times. Electrical consumers can well afford to exercise patience and should look for a lower market if production is maintained at such a rate.

A Swedish Hydro-Electric Installation.

Our issue for Jan. 2 contained an editorial comment on the advantages to be gained from the storage of water for hydro-electric installations. On page 101 of the present issue there appears a description of a Swedish plant in which storage is to be carried to such an extent that the minimum flow, which previously reached a value as low as 10 cu. m. per second throughout four months of each year, will be increased to 20 cu. m. per second. In the installation described the regulation

of the flow will present no great difficulty because the water is obtained from Lake Vsnen and from Lake Rottnen, which, by means of inexpensive dams, will be treated as storage reservoirs. In the meanwhile, until the arrangements for regulating the flow of the water from the lakes have been completed, the electric company has been enabled to make advantageous agreements with certain consumers now electrically equipped for the use of their idle generating machinery in case of low water; this machinery, which the service of the company will render superfluous, will be held as reserve for the company's benefit during the early stages of development. This equipment represents one of the very few cases where the installation of machinery in excess of the power obtained at minimum flow is justified.

The electrical portion of the Swedish equipment described is similar in many respects to installations commonly employed for similar purposes in this country, but differs therefrom in certain details. The European standard frequency of 50 cycles can hardly be regarded as a compromise between our 25 cycles for general transmission and 60 cycles for distribution to lamps, but it is sufficiently high for any type of lamp and is not excessive for most types of motors. The e.m.f. of 40,000 volts for a 60-mile transmission line, or about 700 volts per mile, corresponds to values selected for such distances in this country. An interesting element of the line is a short section in which a cable with a hemp core is used. The advantage claimed for this cable is that the strain is distributed over the strands more nearly uniformly than when a wire core is employed. It would seem that such a construction might increase the factor of safety in a seven-strand cable by about 17 per cent. The use of this cable is limited to road crossings, where extra precautions are taken to eliminate all danger-to-life features. Elaborate protective devices have been installed at railway crossings, whereby any falling conductor becomes grounded before it reaches a position in which it could cause damage to persons or animals. The plan of grounding everything not forming a part of the conducting or the insulating system has been used throughout the whole installation, including the generating stations, the transmission lines and the substations. The arrangement is such that any defect in the insulation will cause a conductor to be grounded, thereby affording maximum protection to life with a negligible increase in the liability to shut-down in case of insulation failure.

Rates for Utilities.

This week the United States Supreme Court has issued two important decisions on the rates that may be fixed for utilities. One ruling affects the famous 80-cent gas laws in New York, and the other applies to an ordinance reducing the price of water at Knoxville, Tenn. The same principle governs broadly in both cases, viz., that if it is not shown that the rates are unfair and confiscatory they are not unconstitutional. Incidentally, in the New York gas ruling it is held to be unconstitutional to insist on certain standards of pressure and candlepower required by the law; and the penalties imposed are held to be void. Moreover, the valuation of the franchises at the time of consolidation is held to be fair, but the gain in franchise value that was predicated is also regarded as not substantiated. It is early yet to express any deliberate opinion on the decision, of which only a memorandum was given out by Justice Peckham, but at this time we must note the apparent limitation of the company to a 6 per cent return on its investment. We find it hard to see why a company should not legally be entitled to earn more if efficient management will enable it to do so, sharing its greater gains with the public. There is no a very warm invitation to new capital in such a rate, and all the public utilities are in constant need of new capital. In passing, we note that on the news of the decision the price of the gas stock fell to about 140. But that is not a bad price for a 6 per cent security—if it were a bond.

National Advertisers and Electric Signs.

Electric sign advertising is well established as a form of publicity around all large cities, but it is probably true that there are so many undeveloped possibilities in connection with it that the present state of the electric advertising art may be looked upon as only a beginning. A number of concerns doing advertising the country over are making considerable use of electric signs in various cities. Nevertheless most of the efforts of the new-business departments of large central stations have been devoted to canvassing local advertisers rather than to traveling over the country for the purpose of enlisting the interest of concerns which are introducing their products to the entire country. As intimated by Mr. Henry L. Doherty at the last National Electric Light convention, a movement is on foot to educate the national advertisers to the possibilities of electric-sign advertising. As noted elsewhere in this issue, the central station at Denver has begun to make active efforts to secure this class of business by sending out a representative to visit these national advertisers, and the results to date have been most encouraging. Any work of this kind done by one company at this stage of the business helps all, as there is much to be done to get electric-sign advertising recognized as fully as the other means used by large advertisers.

A Fallacy in Lighting Design.

It has been customary in planning many lighting installations to provide for two intensities of illumination by having each cluster, chandelier or group of lamps arranged with two or three circuits, so that the number of lamps turned on can be varied. We do not wish to decry the employment of this plan where there is good reason for it, or where it involves but little expense or complication. However, there has been a tendency to run this idea into the ground, and to add needless expense and complication to a lighting installation through a misunderstanding of the actual requirements. The number of places where two or three intensities of artificial illumination are required is much less than might commonly be supposed. For example, in providing for the general lighting of offices or stores, it is erroneously argued that during cloudy weather, or for a short period before darkness each evening, it will be desirable to turn on less than the whole number of lamps on a fixture, cluster or group because of the assistance given by daylight in the general lighting of the room. As a matter of fact, the occupants of the room will demand more artificial illumination during the transition period from daylight to darkness than they will demand after darkness has fully set in. Daylight illumination is usually of much higher intensity than artificial illumination. During the transition period from daylight to artificial light, the eye has not become accustomed to working with the low intensities of artificial light, and, furthermore, the presence of natural light coming through the windows tends to keep the iris of the eye contracted to accord with daylight con-

ditions. Therefore, nothing short of the full amount of artificial illumination that is ever available will satisfy the users during the transition period from daylight to darkness. The legitimate place for the use of two or three circuits to give different illumination intensities is where a high degree of illumination is not required all of the time during the hours of darkness, but where it is, nevertheless, desirable to have some light. Such a condition sometimes obtains in the halls of public and office buildings, although frequently the same object can be accomplished by turning off the lamps on some of the fixtures rather than having two or three intensities from one fixture. In the lighting of these halls during the daytime, however, it will usually be necessary, if any artificial light is used at all, to turn on everything available, in order to bring the illumination in the halls up to an intensity as near as possible to what the eye is accustomed by daylight.

The Economics of Lighting.

The coming of new and efficient illuminants has awakened great interest in the economics to be secured by their use. What is even more important, it has stimulated actively in making the best use of all illuminants. If one stops to consider the subject, it is at once apparent that the result sought is illumination, and the means whereby one secures it is by the input of energy in some form for which one has to pay. And so far as cost is concerned, the effectiveness of the installation is determined not merely by the efficiency of the illuminant, but also by the cost of securing an illumination of one or several foot-candles over the required area. In fact, doubling the efficiency of the illuminant may be less economical than doubling the efficiency of its utilization, since the new sources of light generally cost more to install and maintain than the older ones. To secure the highest economy one must not only use the most efficient sources, but must employ them to the very best advantage. The dollars and cents side of the problem is evidently important, yet it has been sadly neglected, not by intention so much as by lack of proper care. The result has very often been far more serious than it would seem at first thought.

One must remember that the cost of lighting a room or a building is a continuing charge, so long as room or building is in use. An inefficient installation is a steady item of expense which, if capitalized, may amount to a sum worth serious consideration. For example, suppose some unskilled person has laid out the lighting of a church and has used, by reason of improper location and shading of the lights, twice as many incandescent lamps as were necessary to give the result. If the whole charge thus incurred amounts to $50 per month, one-half of it, or $25, per month represents the cost of the ignorance of the man who did the work. This especial example chances to be from an actual case. If one capitalizes this charge, say at 5 per cent, the fact appears that it would have paid to spend several thousand dollars in getting that particular job of lighting thoroughly well planned and executed. The same thing constantly occurs on a smaller scale. Assume, for example, that a man is building a house and that his architect designs a fine large library to be finished in dark wood and dull green or red paper. It is a demonstrable fact that such a finish, even with a very light ceiling, requires to produce a given illumination about three times as much light as if the finish were light. If four 16-cp incandescents would do the work in a light room, 12 will be needed with the dark walls. Assuming half a cent per lamp per hour as the cost of energy, and that the lamps are used three hours per night for 300 nights per year, the continuing charge against the dark finish amounts to $36 per year. There is no doubt that such finish may be artistically good, but the owner should be brought squarely face to face with the question as to whether it is worth to him an increase of $3 a month in his running expenses. One often finds rooms, too, in which the finish and the improper location of inadequate fixtures unite to produce a condition in which proper lighting is practically impossible.

Even such cases can sometimes be helped by a complete revision of the fixtures and wiring plan, but the long bill which comes with such work in a finished building is not always gratefully received. One can find numberless rooms in which similar thoughtlessness is evident and costly. If well-planned lighting were extremely difficult or expensive, there might be some excuse for this state of things, but, on the contrary, it is neither. The most fruitful sources of failures lies in the fact that lighting is frequently an afterthought and, by the time it comes under consideration, is considered almost as an extra expense coming upon the top of extras already burdensome. The job of wiring goes to the lowest bidder on the cheapest plans, and while he may do honest work, the result is likely to be bad. If people fully realized the continuing charges against badly-planned lighting, they would be willing to go to some expense to gain final economy. Proper lighting can be very readily predetermined, and there is really no excuse for failure unless the character of the fittings is radically changed after the lighting plans have been executed. This should very rarely be necessary if there has been reasonable foresight at the start. In cases where there may be radical alterations of finish after the completion of the building, one should, as it were, take out insurance by putting in a wiring system capable of taking care of the worst conditions likely to be met later, even if part of the outlets is capped and left out of sight. And the same precaution should be taken when a building is subject to considerable change of use. A small amount expended at the start will often obviate heavy alteration charges against the lighting system, as well as the steady waste due to inefficient methods.

Electric Railway Development in 1908.

Since the most important application of electricity to the existing and future problems of transportation will lie in its gradual utilization in trunk-line service, it is opportune to consider the tendencies in this direction in the last 12 months. This larger aspect of the uses of electricity in transportation comprehends its more general adoption in three ways: (1) For long distance tunnels; (2) at congested terminals of steam roads which furnish transportation service to suburban communities; and (3), in strictly trunk-line service where severe grades or the density of traffic are sufficient to justify the investment and service required to make the use of electricity as a motive power profitable. Development in all of these directions has been slow within the last year, more on account of financial than any other reason. Important electrification work, however, has been completed or is projected and calls for mention here as indicating a certain development of the times.

The creation of trunk lines of electric railway may be effected through the electrification of existing steam railroads or the consolidation of so-called interurban properties. The construction of interurban track, notably in the Central West, has proceeded to a point where it has made long rides possible; many links of connection between different properties have been built and through routes established, which will lead in time, inevitably, to consolidations and greater systems, permitting economies and improved service for the public.

Important installations which were completed during the year comprise part of those contemplated by the New York Central & Hudson River and New York, New Haven & Hartford roads, the St. Clair tunnel and the Hudson & Manhattan Railroad. Extensions of both the New York Central and the New Haven electric service will be made. The plans of the management of the Pennsylvania Railroad with respect to the New York tunnel were progressed further by the decision to use direct current. Noteworthy installations are assured through the electrification of the Cataract tunnel line of the Great Northern Railway and the work undertaken and projected on Western lines of the Southern Pacific Company. The decisions of the Illinois Central Railroad in relation to the proposed electrification of the terminal at Chicago and of the Chicago, Milwaukee & St. Paul Railway regarding the mountain division of the Pacific Coast extension, assure notable improvements. Unless conditions change in 1909, there is no reason to doubt that further efforts to extend the uses of electricity in the larger problems of long-distance transportation service will be considered without serious delay.

Voltage Strains Due to Circuit-Breaking in Direct-Current Systems.

It is well known to all who have experimented with direct-current circuits in a practical way, that when such a circuit is closed suddenly under full voltage, the current does not rise to its full strength for an appreciable period of time; and, on the other hand, when such a circuit is suddenly broken, the current persists for an appreciable interval, usually in the form of an arc. The first condition is utilized in practical work, as a safeguard against short circuits, because a man accustomed to switchboard and connecting work gets into the habit of flashing a contact quickly before closing it finally. The elastic recoil of the metal connections, when they are first struck together, separates them in a small fraction of a second, and before a current, destined to be violent, can attain large proportions. The second condition has to be safeguarded in various ways to prevent disastrous results, and circuit-breakers of various kinds are used for preventing the arc following metallic rupture from becoming dangerous.

The cause generally accepted for the above-mentioned behavior is electromagnetic inertia. When current flows in a circuit, it establishes magnetic flux linked therewith. This magnetic flux resists being created, changed or dissipated. It possesses energy. Energy must be expended electrically by the voltage source in creating the magnetic flux, and this energy disappears back into the circuit, as the energy of extra current, when the circuit is broken. The greater the inductance in the circuit, the greater will likewise be the magnetic energy associated with a given current strength, and the greater the voltages involved in changing the current. Moreover, as the current in the circuit increases, the magnetic energy that must be dissipated when the current dies away, increases as the square. One of the well-known devices for safely breaking a powerfully inductive circuit, such as the field-magnet circuit of a large dynamo, is to cut in resistance, such as incandescent lamps, before metallic rupture. Field-magnet switches are commonly provided with an auxiliary contact for throwing in such non-inductive resistance before the rupture of the circuit contact. By this means the current is allowed time to weaken before it is broken at the contacts, and since the magnetic energy released falls off as the current squared, the final flash is reduced to safe dimensions.

Mr. L. Silberberg, in his article on page 107, this week, examines mathematically the behavior of voltage and current in a direct-current circuit, of negligible capacity, when a circuit is broken by introducing non-inductive resistance at a definite rate, some power of the time elapsing from first insertion. He shows that, in general, the voltage will rise to a certain maximum, while the current falls off with a speed which reaches its maximum at the same instant. Theoretically there will be a certain way of cutting in resistance that will make the least voltage rise. In such a case there would theoretically be no arc. The magnetic energy of the circuit would be all absorbed in the extra included resistance. The case is then considered of an arc formed between the carbon points of a rapidly and widely opening circuit-breaker, assuming that the cross-section of the arc varies as the current at any instant, and that the length of the arc is in direct proportion to the elapsed time. In particular cases of such action it is computed that the voltage keeps on rising until the magnetic energy is all expended and the current stops. The induced voltage then collapses instantly. It is not pretended, however, that the above assumptions apply rigidly. The actual conditions are probably more complex, and can only be inferred from experimental observation in such cases with the oscillograph. It seems quite likely, however, that, in general, opening a circuit on extra non-inductive resistance can be relied upon to produce a maximum voltage before metallic rupture; whereas, opening a circuit on an arc between swiftly moving electrodes produces a maximum voltage at the final rupture of the arc.

The Central Station.

In spite of a year of rather hard times the central-station business has upon the whole held its own remarkably well. It is sensitive to business conditions in some particulars, yet persistent effort has held up the volume of business in a very gratifying manner. It is not, of course, to be expected that the business of central stations can hold a rapid rate of increase indefinitely, and the time must come when the rate slackens unless new channels of output are found. Such channels can be found and ought to be sought more vigorously now than ever before. If one sits down and looks over the field of demand for central-station output, he will find that it has been very irregularly tilled. Even in the case of lighting—that old standard crop that has been in the past so profitable—the harvest is not what it might be and ought to be. So far as the larger cities are concerned, and to a certain extent everywhere, the failure is in neglect of the business to be derived from the relatively small consumer. He is not so profitable an individual as the large consumer, but as a class he is, or ought to be, an ample source of profit. Anyone who has doubts about this may well be recommended to sit down and carefully read the yearly

report of his particular competing gas company. If he stops to consider it, he will find that the aforesaid company has as its chief source of income the small consumer, and that upon the profits made from him it earns its often liberal dividends.

Now, of course, an adept bookkeeper can solemnly figure out that the small consumer is a source of net loss. Perhaps at times he may be, but if he were so as a rule the gas companies would die of starvation. If the electric central station finds its steady charges on behalf of the chap who uses only 25 kw-hours per month or so, are prohibitive, that central station needs to look sharply after its methods. Then as the next step, it would be worth while to examine the gas-engine situation. Every gas-engine user is potentially a customer for an electric motor. Why is he not an actual customer? A hard drive after motor business generally brings its reward if the central station is really out after business. Then, finally, comes the electric heating and cooking apparatus. A recent discussion of this topic indicates that such apparatus uses current up to about its own price yearly—certainly a mass of business worth going after. In point of fact, the customer who yields the largest ratio of profit on most central-station service is neither the very large one nor the very small one, but on most schemes of discount he is nearer the latter than the former

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The one conspicuous thing in central-station practice this year has been the irruption of the tungsten lamp. Everyone has wanted for years a more efficient incandescent lamp, and now that he has got it, wonders how on earth he had better manage the thing. By and large, the problem is working itself out pretty well, yet the details are still puzzling. It is far too early yet to get reliable reports of progress from the few stations that have undertaken to give free renewals of tungsten lamps. Such a policy is, of course, equivalent to a very material reduction in rates—a reduction proportionately larger as the consumer's price per kw-hour is lower. Whether a given company can comfortably stand the reduction depends on the price that it is getting at the start. On the other hand, throwing the whole of the cost of the new lamps on the consumer in lieu of free replacement of carbon lamps, would be equivalent to raising the price of energy, while at some point between this and free renewals, the virtual price of energy remains unchanged. The whole situation is therefore in great measure under control, though it is not easy to lay down the wisest course. One very encouraging feature of the case is that there seems to be not the slightest danger of any material decrease of demand for energy owing to the greater economy of the new lamps. Increased use by old customers and the acquisition of new ones keep the balance at least even. The only loss worth considering is the wholesale scrapping of arc lamps that have been replaced by tungsten lamps. That is, of course, only part of the depreciation due to change in the art that always enters into station economies—in this case rather more suddenly than usual. It is very clear that the enclosed arc in its familiar form is doomed, and is being rapidly supplanted. There is no ground in this for considering that all arcs are doomed, although thus far it is not altogether easy to pick out the forms most likely to survive. The question of proper color value is the chief one here to be considered for commercial lighting, and it seems now to be best met by some of the intensive carbon arcs with slender electrodes—a type that deserves greater prominence.

THE STORAGE BATTERY.

There has been no noteworthy advance in the storage battery art nor its engineering applications, during the past year, which is to be attributed to two causes. One of these has naturally been the widespread stagnation in industrial enterprises of every kind which marked the year 1908, and the effects of which were felt more seriously in the storage-battery field than in any other branch of the electrical industry, thus greatly reducing the incentive to experimentation and original development. The other cause is that by the middle of the year 1907 the art had attained such a high state of perfection that all existing engineering requirements were adequately met. In the matter of technical detail, however, it is interesting to note what might be termed a reversion to the types of Planté plates as they existed some years ago. For many years the efforts of all designers of Planté plates have been toward increasing the active area, and therefore the minuteness of subdivision of the base lead, which forms both the material from which the active oxides are produced and the conducting support on which they are carried. Improvements in scoring and grooving machinery, in casting thin leaden webs under pressure, and lead squirting through dies, were continually made, and the resulting electrodes became more and more subdivided, with a consequent increase in exposed area, and therefore of capacity, for a plate of given weight and dimensions. Under continuous service, however, it became evident that positive electrodes of this character had short lives, owing to the gradual but inevitable loss of peroxide and its automatic replacement from the underlying lead support. Slowly manufacturers have had forced on them the understanding that the life of a positive plate of the Planté type is a direct function of the thickness of the base lead, and within the past year two of the larger manufacturing companies have modified their positive plates by increasing the thickness of the leaden webs, thereby greatly increasing the durability of the plates, as well as their weight and cost, and decreasing the capacity per square foot of active surface.

During the year 1907 there were a few applications of storage batteries to alternating-current systems supplying energy to fluctuating loads. The first efforts along this line, while successful, exhibited certain crudities inseparable from experimental mechanism. During the past year the auxiliary devices necessary for battery installations in connection with alternating-current systems have been greatly improved and almost brought to the condition of standard apparatus. Among other of the auxiliaries which have received attention and consequently undergone improvement during the past year, the split-pole rotary converter and the alternating-current boosters may be mentioned as the principal ones. The former machine has been frequently referred to in these columns and is now well known in the art. It is, in effect, a rotary converter which may have its voltage varied on the direct-current side, within wide limits, with a constant alternating voltage impressed on the slip rings, and, of course, operates reversibly. By automatically varying the voltage on the direct-current side, charge or discharge of the battery is effected on the usual manner.

The alternating-current booster is used with the ordinary rotary converter, which latter always gives at the commutator a voltage that bears a definite ratio to the impressed alternating voltage. The function of the alternating-current booster

is to raise or lower the voltage of the alternating current supplied to the rotary converter, and thereby to vary the direct-current voltage in accordance with the requirements of the load fluctuations on the system, in this manner causing charge or discharge of the battery with load changes. The alternating-current booster is simply an alternating-current generator in series with the rotary converter, being connected between it and the supply circuit. Its field excitation is controlled as to direction and magnitude by any form of automatic field regulator which is applicable to the field regulation of the ordinary direct-current booster. The voltage applied at the slip rings of the rotary converter is changed with load changes in the main alternating-current circuit, by the action of this booster, and the regulation of alternating-current systems thus accomplished.

One real benefit which may be attributed to the otherwise unfortunate financial conditions that have prevailed during the past year is the reduction of prices of storage batteries. For each small reduction in the cost a new field of application is opened. A peak may be taken by batteries more economically than with generating apparatus if the cost of the former be reduced. It may therefore be expected that with improvement in industrial conditions, storage batteries will be used more extensively than they have been in the past, if the prices accord with the necessary economic considerations.

Electric Power Transmission.

The record of the year just gone in electrical power transmission has not upon the whole been a very striking one. It has been a sort of plain, uninteresting "standard" practice, from which, however, rises one towering landmark in the Grand Rapids 110,000 volts. The rather hard times have checked anything like successful promotion of hydro-electric enterprises, and while a considerable number of minor plants have gone into operation, there has been no one of them save in the instance mentioned that has been distinguished above the ordinary. To tell the truth, hydro-electric transmission had just at the present time fallen into a rather bad way. The time has gone by when desirable hydraulic privileges could be had for a song. Getting a plant through the various stages from the acquisition of the riparian rights to the sale of power is a pretty serious business since people have been aroused to a perhaps exaggerated idea of the present value of water. The revelations of scant water supply and high costs contained in a recent issue were no surprise to the engineers who have followed the game, although they may come as a shock to the neophyte. In the last analysis, however, they need not be at all discouraging, albeit they point a moral.

Comparisons between the costs of water power electrically transmitted and steam power are apt to be fallacious in that they are not reduced to the same plane of reference, so to speak. Steam plants are as a rule installed in the interest of some already existing enterprise to do a certain existing task as economically as possible. The costs are kept down by rigorous competition and a definite knowledge of the results to be accomplished. The general expenses and fixed charges are down to bed rock and the output is predetermined. A hydro-electric plant, on the other hand, is a thing that is generally "financed" by somebody with an eye to profit on the bonds and rarely with the discretion that would be exercised were it being paid for directly by its permanent owners. There is, therefore, a tendency to development on the basis of possible rather than certain profits, and very often both the immediate market and the development are exaggerated, with the result that both fixed and operating charges are too high. That many plants so built can still compete as they do successfully with steam, is the strongest possible evidence of the real value of hydro-electric properties. But it is not in the least surprising to find that in many cases steam power can under the circumstances fully hold its own. Even in hydraulic plants which are conservatively financed, high development costs and unfavorable load conditions may seriously increase the expenses. Usually the hydraulic plant is really duplicated by a steam plant installed by way of auxiliary, which still further increases the expense. The best economic results can be looked for only when the plant does not have to carry any large burden of this kind.

Networks operated from a group of plants give about the best chance for low costs since in such case the dead capital can be reduced to a minimum, assuming that the network is not the result of a costly consolidation process. The great step forward in working voltage taken by the Grand Rapids plant is from this point of view especially encouraging. Operation at 110,000 volts implied the probability of covering economically an extent of territory hitherto considered quite impracticable. As compared with the highest pressures hitherto used, it cuts down the cost of conductors to about one-third of the former figure. This sounds big, and is big if large amounts of power are to be transmitted over very long distances. But in point of fact, while saving in the copper is important, in the ordinary transmission line the conductors represent only a quarter to a half of the total costs on which fixed charges have to be paid. What profits it a man to gain $300 or $400 a mile on his copper by raising the voltage, if he expends twice these amounts in steel and insulators? As a matter of fact, the Grand Rapids line is pretty economically constructed, but it is safe to say that it will be for some time exceptional in this respect. We Americans are very backward in the matter of economical line construction. We have been bluffed to a standstill by Ananias Mossback, the Oldest Inhabitant, with his tales of the terrible storms of 1821, and build lines as if we were going to string the chain cables of a battleship instead of No. 1 B. & S. There is very little object in going to extreme voltages unless one is prepared to take full advantage of the reduction in his copper and is willing to plan his line as an engineering structure. When this is done, we shall begin to realize the enormous value of high voltage in prompting the organization of extensive networks aggregating the power of groups of hydro-electric plants and reducing greatly the amount of reserve plant necessary for the system. There are some excellent lessons in this particular to be learned on the coast even now. Meanwhile, the bold step forward in the 110,000-volt transmission gives practical experience, the value of which can hardly be overestimated, in the control of the pressures that sooner or later must come into wide use and are necessary to the conservation of the world's resources.

Prime Movers and Electrical Generators.

The industrial depression of the past year has not been conducive to bold experiments or wide departures from accepted standards in electrical generation practice. At the same time this very condition has induced a more careful study of the conditions of economy, and definite progress has been made in the standardization of certain of the factors entering into the

general problem of the economical development of power, and in a more definite and intelligent appreciation of their relative importance. In the matter of fuel supply, the condition has changed but little. Coal still prevails as the standard for power-plant service and this condition seems likely to continue until the arrival of some readjustment below the horizon of the present outlook. When oil or liquid fuel, however, can be bought at a price per barrel equal to or less than about one-fourth the cost of coal per ton, the oil will prove the more economical fuel, and in sections of the country where these conditions prevail the standard fuel is of the liquid type. Perhaps the most significant feature in connection with the problem of the efficient combustion of fuel is the increased attention which the question of draft and its regulation has recently attracted. The use of carbon dioxide indicators or recorders is becoming more common in marked degree, and the regulation of draft as a factor of fundamental importance is more adequately and widely recognized than ever before. An interesting illustration of the importance assigned to this factor is found in the design of the new Pacific Light & Power Company's plant at Redondo, Cal., the details of which were recently published in these columns.

The problem of the boiler has been one simply of selection between a large number of varieties, all of the water-tube type and exhibiting the same underlying principles of design. The problem of the prime-mover remains much as it was a year ago. On the whole it may, perhaps, be fairly said that the turbo-generator combination has acquired a still more definite status as the typical unit for normal or average conditions as presented in central-station practice, especially in large sizes. As already pointed out in these columns, this is not due to superior degree of any one factor, but rather to a general estimate of superior adaptation to the all around demand and conditions of central-station service. In this connection note should be made of a most interesting series of answers obtained by a committee of the American Street and Interurban Railway Engineering Association in response to a series of questions which they submitted to a large number of users of prime-movers of both turbine and reciprocating types. These replies, abstracts of which have here appeared, indicate a wide divergence of opinion on certain of the points submitted, while on others a general trend of view may be determined. The individual replies, in fact, are of small value except as they may be interpreted in the light of the special circumstances of the case, and in the absence of detailed analysis in the light of such circumstances, only certain general indications can be drawn. As they stand, however, they indicate, as often repeated in these columns, that under generally similar and comparable conditions the turbine and reciprocating engine belong both in the same class as regards economy; that the anticipated superiority of the turbine in the matter of quickness of starting has not been realized, as a period of warming up, especially with large units, is quite as important as with the reciprocating engine; that the labor costs of operation are somewhat in favor of the turbine, and that the general costs of maintenance are likely to compare somewhat in the same manner.

Some attention has been directed to the possibilities offered by the reciprocating engine and the so-called low-pressure turbine in tandem combination. The possibility of useful adaptation of such a combination should be held in mind with reference to use in the case of suitable conditions, and it seems not unlikely that there may develop some field of usefulness for such hybrid combination of prime-mover types. Some progress should be noted in the line of turbines of medium and small size, but the field of medium and small-sized power units has been and is still definitely held by the reciprocating engine. This covers a field of the widest extent and of the highest industrial importance, and includes small power stations, isolated lighting and power plants, mills, industrial plants of all types and the auxiliary steam machinery of large central power stations. With the improvement and marketing of small turbine units in sizes of 25 hp and upward, a third factor will appear in the field, and in central-station practice it is not unlikely when steam-driven auxiliaries are preferred that the small turbine will find a field of useful service.

The internal combustion engine as a prime mover in central-station practice has perhaps acquired a somewhat more definite status during the year. At the National Electric Light Convention of last year a report, abstracted in these columns, was submitted by a committee appointed to investigate the general question of the relation of the internal combustion engine to central-station requirements. The general conclusions of the committee were that while complete installations of a character that would have a direct bearing on central-station practice have not existed a sufficient length of time to furnish operative data of any great value, gas engines in large sizes have been in service long enough to demonstrate that continuous service is obtainable; that gas engines in standardized designs are available in sizes ranging up to 5000 hp; that builders differ widely as to ratings, making it difficult for the buyer or designer to make intelligent comparisons; that speed regulation has been so improved that the most reliable builders are now prepared to guarantee parallel operation with either 25-cycle or 60-cycle electrical units; and lastly, that the producer has not reached a stage of development corresponding to that of the engine. This report presents the case with respect to large rather than medium or small plants, and indicates that the gas engine in the case of the former class will lag until somewhat more of assurance can be furnished regarding the requirements of reliability, continuity of service and general cost of maintenance.

In small sizes and for isolated service of all types the internal combustion engine is making rapid progress and is demonstrating adaptability of a high order. This places it immediately as a factor in the field of small or isolated lighting and industrial power. Where economy in the cost of power is a matter of primary importance, the use of engines of this type is fixed by a fuel cost per hp-hour not exceeding in any marked degree that for the steam prime mover. This excludes the use of gasoline, kerosene, the various forms of engine distillate and municipal gas at usual rates, but leaves the various forms of producer gas drawn immediately from coal or oil as the fuel source. The producer using coal as fuel and of various types and forms has achieved a very considerable measure of success and there are good prospects of equally satisfactory results with the use of oil as fuel. With these fuels readily available and with an economy of about 1 lb. per hp-hour, and with an investment lying between the fuel and the engine not larger in marked degree than that represented by the boiler in the steam-driven plant, the internal combustion engine in moderate sizes bids fair to acquire rapidly a position of increasing importance in the industrial world, and as such will find increasing service in other than the larger electrical generating plants.

United States Supreme Court Decisions Uphold Rate Making.

The United States Supreme Coutr, at Washington, on Jan. 4, handed down two important decisions both of which supported the principle of rate making by proper authorities, as applied to public utilities. One case was that of the Consolidated Gas Company of New York against the 80-cent gas laws of 1905 and 1906, under which the gas consumers of the city have paid in $9,000,000 in excess of the rate, under a ruling by the lower U. S. Circuit Court that $1 should be paid, until the status of the laws had been determined by the final tribunal. The legal fight over the constitutionality of the laws has waged for some three years and has been a sharp contest in all the courts. Apparently in its decision, which is unanimous, the Supreme Court does not specifically say that the laws are constitutional, but holds that they have not been shown to be unconstitutional. In anouncing the decision of the court, Justice Peckham said:

"First—At the time of the consolidation the value of the franchises of the constituent companies was fixed by them at $7,781,000, and that amount formed part of the capital of the complainant for which it issued the stock. The consolidation was effected pursuant to the State statute, and the State has never questioned the validity or fairness of the valuation.

"Since the consolidation the stock so issued has been dealt in up to the present time as valid stock of the Consolidated Company, capitalized pursuant to the statute at not more than the fair aggregate value of the property, franchises and rights of its constituent companies. The State should not now be heard to question the value of the franchises at the time of the consolidation. The method of arriving at the value of these kinds of franchises and how they should generally be tested in the fixing of rates are questions not now before the court and are left undecided. The case before the court is decided upon its own peculiar facts.

"Second—The estimated increase in the value of these franchises as made by the trial court at the time of the commencement of this suit is only an estimate and is not based upon evidence sufficient to warrant the finding of any increase whatever over the amount agreed upon at the consolidation.

"Third—The evidence leaves it in doubt whether the value of the property used by the company in its business is as great as found by the trial court after reducing the value of the franchises to the sum agreed upon at consolidation.

"Fourth—But taking the value as found by the court, after reducing the value of the franchises, the result gives a return of almost 5½ per cent. A reduction in the value of the real estate, plants, etc., of a small amount only would bring the return to if not more than 6 per cent. A possible increased consumption of gas would probably increase the earning of the company without a corresponding increase of cost.

"Under all the circumstances the complainant has failed to make out its case with that degree of clearness necessary to warrant the interference of a court of equity before an actual and bona fide test has been made under the practical operation of supplying gas at the rates mentioned in the statutes.

"Fifth—There is no rule as to any particular rate which any corporation subject to legislative control in the matter has a right to obtain without legislative interference. It depends upon circumstances and locality. In this particular case with reference to the risk attending the business and the locality where it is carried on, the complainant is entitled to a return, if it is possible, of 6 per cent upon the fair value of its property actual ly used in its business of supplying gas.

"Sixth—There is no discrimination between the individual consumer and the city, by fixing the price of gas for the city at five cents per 1000 cu. ft. less than is permitted in the case of individual consumers, so far at least as the complainant is concerned.

"If the amount obtained from the total gas sold to the city and the individual is enough to secure the requisite return upon property, it is all the complainant can require, and the question of discrimination between city and individual is one in which the complainant can have no interest.

"Seventh—The rate proposed must be with reference to the value of the property at the time when the rate takes effect. The company is entitled to the benefit of any increase in value at that time. This at least is the general rule, and if there be any exception to the rule, this case does not come within it.

"Eighth—Any increased expense arising from the increased candle-power of the light demanded by the statutes was included substantially in the expenses of the year (1905) with reference to which the inquiry was made.

"Ninth—The provision in the acts requiring a certain pressure is unconstitutional. The proof unquestionably shows great possible if not probable danger of explosion in the mains or other pipes, if the pressure demanded were applied to them as they now are. To eliminate such danger would require strengthening all the mains and other pipes, which would involve an expenditure of many millions of dollars upon which no return could be obtained at the rates prescribed by the acts. The provision can be separated, however, from the rest of the statute and the balance thereof made valid. The pressure must be sufficient to produce a light of the candle-power mentioned in the acts.

"Tenth—If the court below is right in its construction of the penalties, as to their amount, etc., such penalties are void, but are separable from the rest of the acts, and the balance can be effectually carried out.

"Eleventh—This is not a case for the valuation of good-will. The complainant has in fact a substantial monopoly of the gas business in the city of New York, and those who wish to use gas must take it from complainant. In this case, as there is no possibility of competition, there should be no allowance for good-will.

"Twelfth—As it may possibly be that a practical experience of the effect of the acts by actual operation under them might prevent the complainant from obtaining a fair and just return upon its property used in its business of supplying gas, the complainant, in that event, ought to have the opportunity of again presenting its case to the court. Therefore, the decree is reversed with directions to dismiss the bill without prejudice."

The decision was concurred in by the entire court.

The Supreme Court also reversed the judgment of the Federal Court in Tennessee enjoining the city of Knoxville from enforcing an ordinance reducing the price of water to consumers. The court below, said Justice Moody, had made errors in determining the value of the property and the amount that would be a fair return on the investment, and therefore the price fixed by the ordinance was not confiscatory. The action of the water company also was premature and the State courts should have been first appealed to for relief

Regulations of New York Commission Governing Schedules and Forms of Contracts.

Final regulations have been adopted by the New York Public Service Commission, First District, prescribing the form and governing the construction and filing of schedules of rates and forms of contracts of electrical corporations. An abstract of the tentative form of the order of the commission on this subject was published in the ELECTRICAL WORLD of Nov. 14, 1908, page 1053. The final order follows closely the intent and language of the tentative order, but a few changes were made in response to representations of the companies. The tentative provision that every schedule should contain an exact copy of the form of bill to be rendered under each contract, showing how bills are computed, was omitted from the final order. The original form provided that printed copies of all schedules and supplements in force, or to be placed in force, should be kept on hand at every office in sufficient supply to meet promptly any reasonable demand, but the final order does not go further in this respect than to provide that such copies shall be kept posted in two conspicuous places in the offices.

Nothing in the order is to be construed as applicable to schedules of rates and forms of contracts relating to service rendered to the city or State of New York, except that every corporation is required to file with the commission a copy of every contract relating to such service within 10 days from the date of contract.

The order is to take effect on Jan. 15, 1909, and to continue in force until abrogated or modified by the commission. All schedules, contracts and riders filed and posted before Jan. 15, 1909, are to go into effect on Jan. 15. Every corporation within the jurisdiction of the commission was required by the terms of the order to notify the commission on or before Jan. 2 whether the terms of the order would be accepted and would be obeyed.

American Patent Revoked in Great Britain.

On Jan. 4 the British Comptroller-General of Patents revoked an American patent under the new British patent law, on grounds which indicate that the law is to be drastically enforced. The patent was for an American sewing machine in which a few minor parts were removed and replaced by others made in England. The defendants pleaded that it was scarcely possible to manufacture the machine entirely in England owing to the lack of the necessary tools and the highly skilled labor that was essential, but it was ruled that the American patentees had not adequately worked the patent by merely making a small number of substituted parts.

Condensed Operating Expense Accounts for New York Electrical Corporations.

Under the system of accounts for electrical corporations, prescribed by the New York Public Service Commission, Second District, for introduction beginning Jan. 1, 1909, some of the accounts are condensed for companies with gross operating revenues from electric operations of less than $500,000 a year, but $100,000 or over. A second condensation is made for corporations with similar revenues of less than $100,000 a year, and a third for corporations with less than $25,000 a year. The condensation applies principally to the operating expense account, except in the third condensed scheme.

The titles of the primary accounts in the complete scheme for corporations with revenues of above $500,000 were published in the ELECTRICAL WORLD of Dec. 12, 1908, page 1281. The primary operating expense accounts for the corporations with smaller revenues are as follows:

CONDENSED OPERATING EXPENSE ACCOUNTS

For Corporations with Gross Operating Revenues of $[illegible] to $500,000 a Year.

I. Production expenses.
- Station superintendence and labor.
- Fuel for power.
- Water for power.
- Lubricants for power.
- Production supplies and station expense
- Repairs of power plant buildings.
- Repairs of furnaces, boilers and accessories.
- Repairs of steam engines.
- Repairs of hydraulic power plant.
- Repairs of gas power equipment
- Repairs of power plant electric equipment.
- Miscellaneous station repairs.
- Steam from other sources.
- Power gas from other sources.
- Electric energy from other sources

II. Transmission expenses.
- Transmission subway rent.
- Transmission pole and fixture repairs
- Transmission underground conduit repairs
- Transmission system repairs.
- Substation labor.
- Substation supplies and expense
- Repairs of substation buildings.
- Repairs of substation equipment.

III. Electric storage expenses.
- Electric storage expenses.

IV. Distribution expenses.
- Electric distribution supervision
- Electric distribution clerks and expenses
- Setting and removing meters and transformers
- Distribution subway rent.
- Distribution pole and fixture repairs
- Distribution underground conduit repairs
- Distribution system repairs
- Repairs of electric services
- Repairs of transformers
- Electric meter operation and repairs

V. Utilization expenses.
- Commercial arc operation.
- Commercial arc repairs.
- Commercial incandescent operation
- Repairs of incandescent [illegible]
- Consumers' installation expenses.
- Municipal street arc operation.
- Municipal street arc repairs.
- Municipal street incandescent operation
- Municipal street incandescent repairs

VI. Commercial expenses.
- Commercial administration—electric.
- Promotion expenses—electric.

VII. General and miscellaneous expenses.
- General officers and general office clerks.
- General office supplies and expenses
- General law expenses.
- Miscellaneous general expenses.
- Insurance.
- Relief department and pensions.
- Electric franchise requirements.
- General amortization—electric.
- Electric expenses transferred—Cr.
- Joint operating expense—Cr.
- Accidents and damages.
- Law expenses connected with damages
- General stationery and printing.
- Store and stable expenses.
- Undistributed adjustments—balance
- Duplicate electric charges—Cr.

SECOND CONDENSATION OF OPERATING EXPENSE ACCOUNTS

For Corporations with Gross Operating Revenues from Electric Operations of Less Than $100,000 a Year.

I Production expenses.
- Station superintendence and labor.
- Fuel for power.
- Other station supplies and expenses.
- Repairs of power plant buildings.
- Repairs of [illegible] power plant
- Repairs of [illegible] equipment
- Repairs of power plant electric equipment.
- Miscellaneous station repairs.
- Steam from other sources.
- Power gas from other sources
- Electric energy from other sources.

II. Transmission expenses.
- Transmission subway rent
- Transmission repairs.
- Sub-station labor, supplies and expenses
- Repairs of sub-station buildings.
- Repairs of sub-station equipment.

III. Electric storage expenses.
- Electric storage expenses.

IV. Distribution expenses.
- Electric distribution office and superintendence
- Setting and removing meters and transformers
- Distribution subway rent.
- Repairs of distribution mains
- Repairs of electric services.
- Repairs of transformers.
- Electric meter operation and repairs.

V. Utilization expenses.
- Commercial arc operation.
- Commercial arc repairs.
- Commercial incandescent operation
- Consumers' installation expenses.
- Municipal street arc operation.
- Municipal street arc repairs.
- Municipal street incandescent operation
- Municipal street incandescent repairs

VI. Commercial expenses.
- Commercial administration—electric.
- Promotion expenses—electric.

VII. General and miscellaneous expenses
- General administration.
- Insurance.
- Relief department and pensions.
- Electric franchise requirements.
- General amortization—electric.
- Injuries to persons and property
- General stationery and printing.
- [illegible]
- Miscellaneous adjustments—balance

The primary accounts "rent [illegible] rents" and "miscellaneous rent deductions," shown under "income deductions" in the schemes for corporations with gross operating revenues of $500,000 or over, are omitted in the first and second condensed schemes and in their place the account "other rent deductions" is substituted.

The third condensed scheme for corporations with gross operating revenues from electric operations of less than $100,000 a year differs from the second condensation of operating expenses in the second condensed scheme in the omission of the primary accounts "[illegible]" in the general [illegible] expenses." The third condensed scheme has [illegible] the same as for the corporations of the other classes. The primary accounts [illegible] the following primary accounts [illegible] in the "first condensation": "rent [illegible] electric rent revenue," "break-down service," and "other mis[illegible]." In the place of these accounts [illegible] "other operating revenue" instead of the six for

which provision is made in the other classifications. It has but four accounts under "income deductions," as follows: "interest deductions," "rent deductions," "miscellaneous contractual deductions from income" and "amortization deductions." The following four of the "appropriation accounts," as contained in the amplified classifications, are omitted: amortization elsewhere unprovided for," "appropriations to reserves," "gifts to controlled corporations" and "other appropriations." The account "miscellaneous appropriations" is substituted.

New England Electrical Outlook for 1909.

By H. S. Knowlton.

The outlook in the New England electrical field for the year now opened is bright with promise of improved business conditions and a wider extension than ever before of electrical applications in all industrial and social activities. It has taken New England a long time to shake off the effects of the late business depression, although the shock of the 1907 disturbance was at no time as severe as in sections of the country less strong financially. It is generally felt in New England that while the improvement in business conditions has been devoid of spectacular features, it has been steady and conservative, leaving little to take back from week to week as new demands for industrial activity have developed. The central stations are in a strong position with the opening of the year, and a continuance of careful management is sure to find its reward in the next few months. Telephone traffic has also been excellent, and the electric railways felt the effects of the depression less than did many other lines of business, although suffering from the universal disease of high operating cost compared with the figures of a few years ago.

With the opening of January and the turning of faces toward the spring trade, the power business of the New England central station ought to show a healthy growth. Now is clearly the time for the solicitor to put in his best work in securing power contracts for the coming months. It is a wise company which will now give its soliciting department free rein for a while, and if the late depression in business has depleted the force, renewed confidence all along the line can be stimulated by the enlargement of this department in the interest of general prosperity. The small manufacturer whose plant has been running on half time on power generated by his own plant can now be approached with special advantage from the point of view of central-station service. It is probable in not a few cases that part of his machinery has been standing idle so long and with so little attention that to put it back in shape again will cost a considerable sum of money, and here is the opportunity to talk central-station power with impressive force.

The central stations of New England have, in common with others in all parts of the country, been closely occupied with lighting problems associated with the tungsten lamp for the past year or two. The success attained in this field has been noted in these columns from time to time, and there is no question that the gas companies have been hard pressed by the advent of the low candle-powered tungsten units. The days are beginning to lengthen, however, and while there will be little disposition to slacken up the campaign for more and better illumination, particularly in residential service, the time is riper for a thorough study of the power possibilities. This class of business means so much to the station load factor and subsequent economy of power production in the summer days, yet far ahead, that it is worth making a more determined effort to secure. There are yet cities in New England which are practically asleep from the standpoint of community power saturation.

The electric railways of New England are likely to need continued economical operation for a long time to come. In Massachusetts, in particular, the necessity of breaking away from the time-honored unit of fare of 5 cents has become clearly established in a number of important instances among the suburban lines, and in certain rural or smaller urban companies. The Railroad Commission has thus far taken a broad view of the fare problem, and seems disposed to protect the rights of capital, while requiring good service in return. The managers are almost universally anxious to give good service, and the public is gradually beginning to realize that good service cannot be given unless an adequate return is enjoyed on the investment. There is little chance of a material lowering in the cost of electric railway materials and labor costs at present. Investment in securities of this class will clearly be confined to projects of demonstrated worth during the next few months. It is probable that with the easier money market various interurban projects that have been temporarily eclipsed will assume new life, notably in the vicinity of Boston. One of the most important questions lately raised and bearing upon the cost of operation and possible returns during the near future is the rate of fare that will have to be charged, even on city systems, in cases where the companies are obliged to meet interest and sinking fund requirements on improvements of enormous expense. There is food for thought in the recent masterly paper of Mr. Jas. L. Richards before the Massachusetts Street Railway Association describing the effect of huge investments in tunnels and subways upon the Boston Elevated Railway Company's dividend rate. A tunnel costing over $7,000,000 per mile calls for an enormous 5-cent traffic before even the fixed charges upon it can be paid.

The outlook for further technical advance in public service corporation administration is attractive. Thanks to the exhaustive figures of operating cost now available, in Massachusetts particularly, the trend of the times toward the more economical production of service can be studied quantitatively. The choice of station motive powers is approaching a most interesting stage, with the advance of gas and oil-engine practice and the expansion of water-power developments. The widening interest in forest preservation in New England is encouraging, and it is to be hoped that all possible pressure will be brought to bear upon Congress at the present session in behalf of the Appalachian Forest Preservation project. The progress of steam railroad electrification is likely to be stimulated more in New England in the coming year with the established success of the installations outside New York City and the gradual extension of the New Haven's electrical zone eastward.

Meeting of Toronto Section of the Institute.

The Toronto section of the Institute met for its regular monthly meeting on Dec. 18. The local membership was highly pleased with a visit from Mr. H. G. Stott, past president of the Institute, and superintendent of motive power, Interborough Rapid Transit Company, New York, who presented the paper for the evening, "Notes on the Cost of Power." Previous to the meeting 37 members enjoyed an informal luncheon at the St. Charles café with Mr. Stott as their guest.

The meeting proved the most interesting and successful since the inception of the local section. The attendance numbered 114, including 80 members of the Institute, 34 visitors from other local engineering societies being present.

Mr. Stott dealt very fully with the subject of his paper. Complete curves were presented, showing the relation between load factor and fixed charges for different plant costs; the cost of power per kw-hour and per kilowatt rated capacity at all percentages of rated load for reciprocating steam plant, steam turbine plant, reciprocating and low-pressure steam plant, gas-engine plant, gas-engine and steam-turbine plant and by hydraulic turbine plant. Typical summer and winter railway load curves were then shown, together with typical winter and summer lighting load curves and typical industrial curves, which were followed by a series of curves showing the variation in the total cost of power during the day for each of the several plants previously discussed when operating with the various typical loads.

The total cost of power and the operating cost of power for the various plants were also graphically shown. The subject

matter of the paper proper, in connection with these curves, proved intensely interesting and resulted in a long discussion in which, among others, the following participated: W. N. Ryerson, Dean Galbraith, Prof. Thos. R. Roseburgh, C. H. Mitchell, P. W. Sothman, N. L. Aitken, R. G. Black, Wm. G. Angus, W. A. Bucke, Edward Richards, A. L. Mudge, H. W. Price, H. F. S. Strickland, H. E. M. Kensit and W. A. Hare.

Effect of Drought in North-Eastern New York.

Mr. Harry C. Gray, manager of the Consolidated Electric Company, of Greenwich, N. Y., sends the following information as to the effect of the recent drought on the power conditions of his plant:

"The water flow in this vicinity is the lowest in the history of our oldest inhabitants. The stream on which we operate, the Battenkill, is a tributary of the Hudson River and rises in the Green Mountains, in Vermont. The headwaters are well timbered and for that reason the flow has held up better than in many other streams. Records covering ordinary years show an average of 212 cu. ft. per second for the dryest month and for the month of greatest flow, 243 cu. ft. A careful record kept for the month of October last shows the average flow to have been 73.9 cu. ft. per second, or about one-third of what this stream has been credited with heretofore for the dryest month of the year. The plant has a good storage, and with a head of 54 ft., service has been kept up without interruption. It may be added that no water has run over the crest of the dam since July 1. The months of November and December are even slightly worse than October."

Data on Chicago Electric Railway Rehabilitation.

At the noonday meeting of the Chicago Electric Club, held on Dec. 30, 1908, Mr. Ralph H. Rice, who is associated with the Chicago Traction Board of Supervising Engineers, gave some interesting data on the work of rehabilitation of the Chicago City Railway, the Chicago Railways and the Calumet & South Chicago Railway properties. The Board of Supervising Engineers acts in a general way as consulting engineers for these three railway companies. Mr. Rice gave some very interesting data in relation to the work that has been accomplished by these railways since the ordinance which placed these properties under the supervision of the board was granted. He stated that during the 18 months the ordinances have been in force, approximately $25,000,000 has been spent in the rehabilitation of the properties. At the close of the address several of the members of the club questioned the speaker closely in relation to the probable life of the track construction that is being installed on these several properties. In response, Mr. Rice stated that in his opinion electrically-welded rails are not weakened from the heat applied at the time the weld is made. In a few instances changes of temperature in the atmosphere have caused breaks to appear in the welded rails, but he said that without exception, so far as he was aware, the breaks occurred at points located some distance from the welded joint. As a usual thing the break appeared at a point just beyond the part of the rail that was heated during the welding process.

The noonday meetings of the Electric Club have proved so valuable and have brought out so many interesting talks and discussions that it was voted that the club should engage a stenographer to report all of the meetings and that a stenographic report be furnished to each member of the club. It is expected that much good will come from this recording and distributing the minutes of the meetings, as recently, for instance the speakers at the weekly meetings [illegible] prominence, and without exception their [illegible] extremely interesting to men engaged in [illegible] the electrical industry.

CURRENT NEWS AND NOTES.

RUBBER.—An interesting article on rubber and its "relatives" appears in the December issue of the bulletin of the International Bureau of American Republics, and the magazine contains also a great rarity of other very interesting matter.

CHINESE MAGNETIC SURVEY.—It is reported from China that a magnetic survey is to be made of that country and that Dr. Edwards, of the Carnegie Institution, Washington, who is to carry it out, has been at Shanghai preparing for it.

COAL CONSUMPTION IN GENERATING STATION.—In a paper read by Mr. F. H. Corson before the (British) Institution of Civil Engineers, on Dec. 22, it was stated that recent tests of coal consumption in 34 principal generating stations in the United Kingdom showed values ranging from 3.6 lb. to 15 lb. per kw-hour, the average being 7.7 lb.

TROLLEYS IN JAPAN.—According to recent advices from Japan, the Osaka-Takaradzuka electric railway of 15½ miles and the Minomo-Arima branch of 2½ miles will be constructed at a cost of $1,437,500. A loan of $650,000 has been arranged with English capitalists, at the rate of 7.9 per cent. It is understood that the parties furnishing the capital have secured the contract for installing the plant.

CHEMICAL ENGINEERS.—The American Institute of Chemical Engineers had its first annual convention in Pittsburgh last week. It has already over 100 members. The following officers have been elected: President, Samuel P. Sadtler, Philadelphia; vice-presidents, Charles F. McKenna, New York; H. A. Hunicke, St. Louis, and Edward G. Acheson, Niagara Falls, N. Y.; secretary, John C. Olsen, Brooklyn; treasurer, William A. Booth, Syracuse, N. Y.; auditor, Richard K. Meade, Nazareth, Pa.

ENGINEERING EDUCATION.—With regard to the recent discussion in these pages on the subject of giving greater breadth to engineering education, a reader sends us the following example of breadth, but not necessarily of depth: "I was graduated from . . . University last June in the electrical engineering course. Before entering, however, I mastered the typesetting branch of the printer's trade. Hence this application for work in the publication department of your company. I believe that with my technical knowledge and wide experience at the printer's trade I am qualified to fill a position in the publication department."

CONTROL OF CORPORATIONS.—It is stated with some apparent degree of authority that President-elect Taft is working out the details of a plan designed to increase the efficiency of government regulation of corporations doing an interstate business. The proposed plan will need legislation from Congress decreasing the powers of the Interstate Commerce Commission, greatly increasing the powers of the Bureau of Corporations in the Department of Commerce and Labor and creating a practically new bureau in the Department of Justice. The Interstate Commerce Commission is to be relieved of its duties as an investigating body and will enjoy only quasi-judicial functions. The jurisdiction of the Bureau of Corporations, on the other hand, will be extended over all corporations doing an interstate business. It will take up the detailed work of investigating and preparing cases. This bureau, acting upon individual complaints or upon its own initiative, will lay the results of its investigations before the Interstate Commerce Commission for decision. It will originate all cases. The new bureau in the Department of Justice will work in co-operation with the Bureau of Corporations and the Interstate Commerce Commission when legal aid is necessary. It is said that the proposed plan does not contemplate the licensing of corporations, but that nonco-operating corporations will probably be obliged to [illegible] by the Bureau of Corporations.

CHICAGO STREET LIGHTING.—Mr. William Carroll, city electrician of Chicago, in his annual report for 1908, says that great reduction in the cost of electric street lighting has been effected by utilization of the power obtained from the Chicago Drainage Canal. Two new distributing stations for adapting this current to the requirements of the arc-lighting circuits have been erected during the year. There are now 9452 street arc lamps in service, while 2911 others are nearly ready for use.

CHICAGO NIGHT COURSES OF ELECTRICAL ENGINEERING.—Lewis Institute, Chicago, Ill., began on Monday, Jan. 4, 1909, giving evening courses of instruction in electrical engineering, the winter term to continue for 10 weeks. The classes will be conducted from 6 o'clock to 10 o'clock on Monday, Tuesday, Wednesday and Thursday evenings. The courses announced for the first, second, third and fourth years, respectively, are engineering principles of electricity, direct-current motor and generator testing, alternating-current transformers and transmission, and alternating currents.

AUSTRALIAN WATER POWERS.—In a recent interesting paper before the engineering section of the Royal Society of New South Wales, Mr. E. Kilburn Scott summarized data as to hydro-electric development in Australia. The continent is singularly lacking in natural water powers, but offers many excellent opportunities for reservoiring. He gave details of a scheme for Trawood, on the Goulburn River, with a dam 1800 ft. long and 180 ft. high impounding over 60,000,000,000 cu. ft. of water, generating 10,000 hp continuously, and 20,000 hp for six months in the year. He stated that the Barron Falls, still undeveloped, would yield 3800 electrical horse-power at the generator terminals the year around, and 5000 hp with water storage. He gave a table of three developments totaling 4850 hp, one each in Tasmania, New Zealand and New South Wales. The longest transmission is 19½ miles; the highest pressure 35,000 volts.

ANNUAL UNDERWRITERS' MEETING.—Mr. C. W. Goddard, secretary of the Underwriters' National Electric Association, states that the annual meeting of the Electrical Committee of this association will be held in March, 1909, in New York City. The day and place of the meeting will be announced later. As usual, the provisions of the National Electrical Code as they now exist will be the principal matter for consideration, and it is requested that any desired changes in, or additions to, the code, be forwarded to him in Boston on or before Feb. 1, 1909, in order that they may be printed in the bulletin, and the committee and other interested parties may thus have opportunity to consider them in advance of the meeting. Final action on suggestions not received in season for consideration by the committee before the meeting can only be taken by unanimous consent. The meeting will be open to all interested, who will not only be welcome, but are urged to be present and give the committee the advantage of their experience and advice.

TELEPHONE POLITENESS.—A recent circular of the British postoffice contains a long notice with heads for standard expressions to be used by telephone operators engaged on trunk work. It says: "In order that abrupt and uncouth expressions may be avoided in the telephone service, telephonists engaged at trunk exchanges are in the future to make use of the following expressions in connection with their work, and the supervising officers should impress upon the staff generally the necessity of adhering to the authorized form of words." Entering into details this official guide lays stress upon the advisability of using the word "please" where it can conveniently be introduced. "The telephonist answering a call should announce her presence by saying: 'Trunk number, please?' Failing to hear what the subscriber says, she should say: 'What is your number, please?' and so on. "When a subscriber's [illegible] should call the telephonist should say: 'What is your number, please?' If the subscriber should be kept waiting for more than the regulation time the telephonist should add: 'Sorry to have kept you waiting.'"

ELECTROLYSIS DEFINED.—In a letter to the Rochester (N. Y.) *Democrat and Chronicle*, one E. H. Terhune calls attention to the "disastrous results, constantly augmenting in their scope and evil nature, that are being brought about through the increasing use of the force of nature in the shape of electricity." Warning the reader that "No one but a fool closes his ears to words of wisdom," and after incidentally referring to the danger to the stomach and respiratory organs from the nitric acid produced by high-tension wire, the following chunk of wisdom is presented: "No one can possibly dispute the fact that all of the accumulated force that is distributed on wires throughout the world is depreciating the capacity and the adjustment of nature just that much. Nature's force, ordinarily obedient to a general law, promotive of good, thus becomes abnormally distributed; it is taken from the air or the earth, as the case may be, in one place; a proportion is constantly going back to the earth in many places. Distributed in this way, it produces a condition which we call 'electrolysis.'"

LIGHTING AT RICHMOND, VA.—There was a severe storm recently at Richmond, Va., when the city authorities ordered the cessation of the lighting service, for the safety of the citizens. Mr. George H. Whitfield, the general superintendent for light and power of the Virginia Passenger & Power Company, writes us as follows in regard to the incident: "We experienced a very unusual snow storm in which the snow was wet and heavy and clung to the wires, weighting them down just as sleet would do. The result was that the telephone and telegraph companies suffered very great loss by the breaking of wires and poles. We had only one wire and one pole broken, but the crossing of our wires by the telegraph and telephone wires was so extensive that the city authorities considered it would be more dangerous to life and property to turn on the street arcs than to be without them, and accordingly ordered that they should not be turned on. Of course we had our linemen working day and night clearing up our lines; and the result was that at the time when the papers reported that the city was in utter darkness, we were supplying every one of our customers in the city and suburbs, except the city itself. This fact was pointed out to the newspaper people, but they preferred not to spoil a good story by changing it."

ACCIDENTS IN INDUSTRY.—A bulletin of the Bureau of Labor, by Mr. F. L. Hoffman, gives some startling figures as to the severe accident liability of workmen in the United States. The number of lives lost in a year by accidents to employees while at work is between 30,000 and 35,000. Census reports covering the years 1900 to 1906 show that out of over 1,000,000 deaths of males, more than 9 per cent were due to accident. A large proportion of these deaths are due to causes related to the occupations of the injured persons. The report takes up these accidents in five groups, viz., factories and workshops, electrical industries, mines and quarries, transportation by rail and transportation by water. Of those employed in factories and workshops probably the most exposed class are the workers in iron and steel. Reports of 8456 accidents to this class of workmen for the years 1901 to 1905 show that 4.1 per cent of the accidents to men employed in rolling mills were fatal. Among nut and bolt workers in Pennsylvania the returns of the chief factory inspector show the fatal accident rate during 10 years to have been 5.4 per 1000, and in miscellaneous steel and iron work 4.3 per 1000. According to the industrial insurance returns and data, the fatal accident rate of electricians and of electric linemen is excessive. Of 645 deaths of electricians 14.7 per cent and of 240 deaths of linemen 46.7 per cent were due to "accident." Even conceding frequent carelessness and contributory negligence, the waste of human life is serious if regarded merely from the economic standpoint

A Recent Swedish Hydro-Electric Plant.

By P. FRENELL.

IN the south of Sweden two large water power developments have recently been planned. One, owned by the South Swedish Power Company (Sydsvenska Kraftaktiebolaget), has its area of distribution in the southwestern part of Sweden,

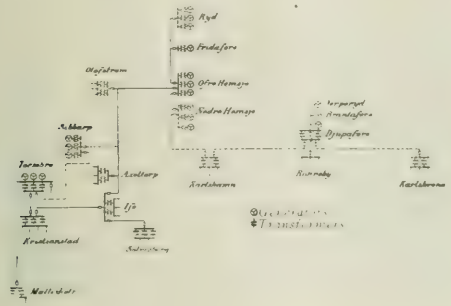


FIG. 1.—INTERCONNECTIONS OF STATIONS.

especially in the towns of Malmö, Helsingborg, etc., and the other, owned by the Hemsjö Power Company (Hemsjö Kraftaktiebolag), distributes its energy in the southeastern part of the country, the principal towns being Kristianstad, Sölvesborg, Karlshamn and Karlskrona. The equipment of the first

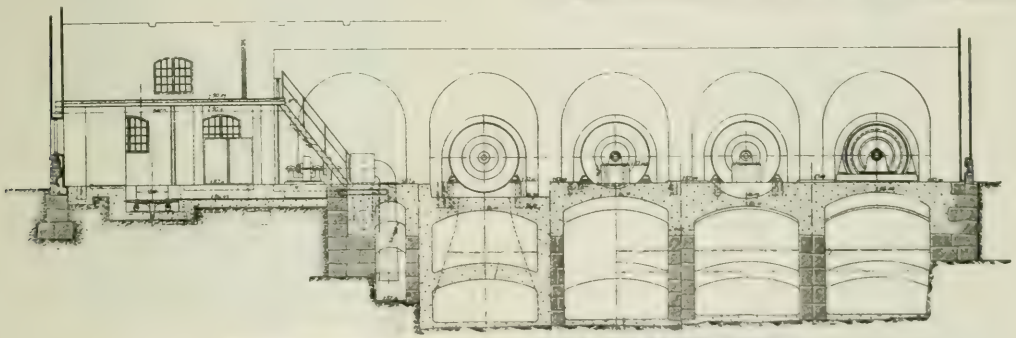


FIG. 3.—SECTIONAL ELEVATION OF GENERATING STATION AT UPPER HEMSJÖ.

of these two companies is not yet in operation, as the power stations, transmission lines and transformer stations will not be completed until the latter part of 1909. The latter, however,



FIG. 2.—MAP OF DISTRICT IN WHICH COMPANY OPERATES.

has been in daily operation since the beginning of 1908. As this plant represents the latest electrical developments in Sweden, a description of its features might be of some interest.

The map, Fig. 2, shows the hydrographical situation of the district in which the company operates. In the district are three rivers: the Helge, the discharge for Lake Möckeln; the Mörrum for Asnen and Ronneby for Lake Rottnen.

All these rivers have many falls, of which the largest ones belong to the power company and are as follows:

Torsebro waterfall in the Helge	3000 hp
Ryd (two falls) in the Mörrum	4000 hp
The Upper Hemsjöfall in the Mörrum	3300 hp
The Lower Hemsjöfall in the Mörrum	2800 hp
Verperyd, Brantafors, Djupafors in the Ronneby	3500 hp
Sibbarp in the Blistorp Brook	5000 hp

It is now 10 years since the work at the waterfalls in the River Mörrum, the Hemsjö Fall, began.

An open canal, about a mile in length, was dug and the power station building erected, intended to contain four turbo-generator sets with the necessary raising transformers and switching apparatus.

While these works were going on a conflict arose with the owners of the fishing rights in the Mörrum River, the fishing proprietors being of the opinion that the power plant would interfere with the fish on account of the water passing through the turbines. The conflict did not come to an end before the year 1905, and consequently no energy could be delivered until that time. In the next year the Hemsjö Power Company was organized, the object of the company being to supply energy to the towns of Kristianstad and Sölvesborg and to the cement mills at Maltesholm and Ifö. The total consumption is about 3000 hp, which is just the amount the power station at Hemsjö can deliver during eight or nine months of the year. During the other months, however, the same power cannot be got as the regulation of Lake Asnen has not yet been accomplished.

To enable the company to fulfill its contracts with the consumers special agreements were made that when there was a



[illegible] STATION AT UPPER HEMSJÖ.

[illegible] of water the company should have the privilege of using the customers' steam and gas machines that had become superfluous through the electrification. By this arrangement the company has obtained a reserve supply of 1500 hp.

OUTLINE OF THE SYSTEM.

In the diagram, Fig. 1, may be seen the completed parts drawn in full lines as well as the future ones which have been marked in dotted lines. The power station at Torsebro, with a transmission line to Kristianstad, is also shown here in full lines, being under erection and expected to be completed in

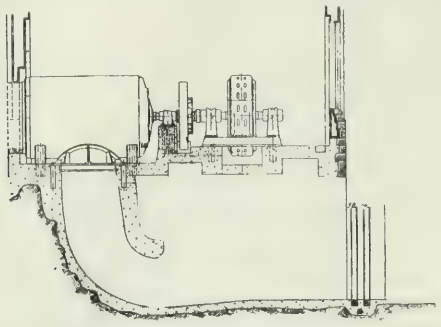


FIG. 5.—CROSS-SECTION OF GENERATOR ROOM.

the near future. The amount of power at present at the command of the Hemsjö Company is about 20,000 hp.

Transformer stations have been built at Axeltorp, Ifö, Sölvesborg, Kristianstad and Maltesholm. In the future there will also be transformer stations at Karlshamn, Djupafors for Ronneby, and Karlskrona.

Of the waterfalls above mentioned those situated at the Mörrum River have a variable quantity of water. In order to get a more constant flow of water Lake Asnen is to be regulated. Under the present state of things the amount of water in the Mörrum River decreases to 10 cu. m per second during four or five months, but keeps at 20 cu. m per second during the other months of the year. After the regulation of Lake Asnen one might count upon at least 20 cu. m all the year round. On calculating the effect of the Upper Hemsjö power station a water flow of 20 cu. m has been taken as a basis. The fall is 50 ft. Consequently the total amounts to 3000 hp. Three 1000-hp units have been installed.

At the Ronneby River the regulation of Lake Rottnen has lately been consented to by the Swedish government, so that

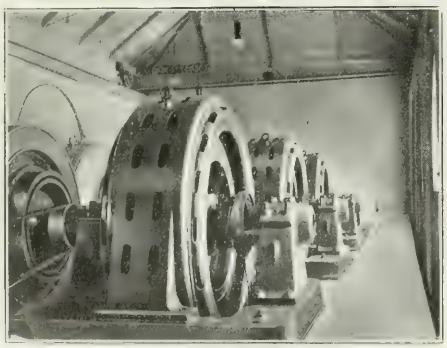


FIG. 6.—INTERIOR OF STATION AT UPPER HEMSJÖ.

a constant waterflow of about 3500 electrical hp throughout the year has been obtained for the power stations at Djupafors, Brantafors and Verperyd. When water is lacking the company has made an agreement with the Fridafors Company to receive 100 hp from a power station some five miles north of Hemsjö. These two power stations are, therefore, working in parallel, [illegible] means of a 40,000-volt transmission line. The energy is delivered on the busbars at Hemsjö.

In Fig. 2 are shown the transmission lines between the different places mentioned above. All of the lines are insulated for 40,000 volts.

At Axeltorp a transformer station has been erected for the kaolin works at that place. The consumption is about 200 hp for motors and lamps.

At Ifö another transformer station has been erected for the cement and kaolin works. The consumption is from 1000 to 1200 hp. From this station a line branches off to Sölvesborg.

In Kristianstad the greater part of the power is being used for private industries and some of it for municipal electricity and water works. On account of the shape of the town being long and narrow and of the great distances between the consumers, a double transformation has been necessary. The primary station transforms from 40,000 volts down to 5000 volts and the secondary stations from 5000 to 500 volts. The primary and secondary stations are connected by cables.

At Maltesholm, the rating of the transformer station is the same as that of Ifö. In Sölvesborg the electric energy is chiefly used for lamps, there being no motor users of any importance. A double transformation has also been necessary. The secondary e.m.f. in the primary station is 1750 volts, the e.m.f.

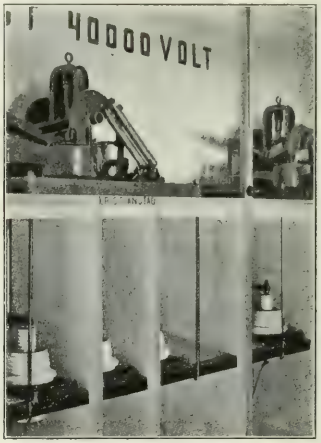


FIG. 7.—OIL SWITCHES.

being reduced to 220 in two secondary stations, which are connected with the primary through a cable for one of them and through an overhead line for the other one. The lighting distribution system is being fed with energy at the latter distribution. The lamps, being connected between the neutral and outer conductors, are subjected to an e.m.f. of 125 volts, which is suitable for the new types of incandescent lamps.

THE UPPER HEMSJÖ POWER STATION.

As mentioned above, the dam and the canal for the station were constructed some years ago. The water is led through a long canal to the station. The dam is built for four steel tubes, each one connected to a turbine with a horizontal shaft. The internal diameter of the tube is 2300 mm and the thickness is 6 mm. At each of the tube entrances hand-operated ice-gates and sluices are arranged in the usual way.

In the power station, the exterior of which is shown in Fig. 4, there are placed three turbines giving a little more than 1000 hp at a fall of 14.5 m. The speed is 300 r.p.m. The turbines have double wheels and are directly connected to their respective generators by means of flexible-leather couplings, which are combined with flywheels as the moment of inertia of the rotating parts of generator was found to be insufficient. In addition to the large turbines in the power station there are also two small 80 hp turbines, each one directly connected to a di

rect-current exciter generator. The 1000-hp turbines have hydraulic generators of the servo-motor type. The inlet for the smaller turbines can be regulated by hand from the instrument balcony; there is also a common automatic regulator which, by means of a belt, can be connected to either of the two turbines. Consulting engineers for the hydraulic parts of the power station, including the dams, canal, tubes and water tur-



FIG. 8.—WATER INLET AND OUTLET OF TRANSFORMER.

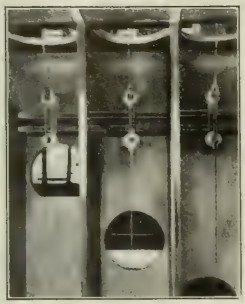


FIG. 9.—DISCONNECTING SWITCHES.

bines, have been Aktiebolaget Vattenbyggnadsbyran, Stockholm. The tubes, turbines and regulators with accessories were manufactured by the Karlstad Mechanical Works.

The electrical equipment of the power station consists of three three-phase, 900-kva generators (Fig. 6). The generator e.m.f. is 3800 volts at a frequency of 50 cycles per second. The efficiency of the machines is 92.8 per cent at a power factor of 0.75 and 900 kva output, and 93.8 per cent at unit power factor and 675 kw output. Both values are based on the inclusion of the losses in the generator-field circuits and in the rheostat. The regulation of the generators between normal full-load and no-load amounts to 21.6 per cent at a power factor of 0.75 and to 7.9 per cent at 1.00 power factor.

Each of the step-up transformers in the station is directly connected to its corresponding generator without any intervening busbars. The conductors between them consist of 3 sq. mm x 70 sq. mm lead-clad and ironclad three-phase cables, laid into channels in the floor. The transformers which increase the e.m.f. from 3800 to 40,000 volts are of the three-phase type, oil-



FIG. [illegible]—WATER [illegible] STATION.

insulated and water cooled. [illegible] shows the water inlet and outlet on the transformers. In the outlet is an automatic device which [illegible] the switchboard attendant in case the water should stop running. This device consists of a [illegible] At one end of the lever there [illegible]

runs from the transformer before getting into the final outlet. Below the other end of the lever there is an electric contact. When this contact is closed a signal is given to the attendant by means of an ordinary bell. The contact is closed by gravity by the lever as soon as the water pressure on the cup from the running water is diminished or stops altogether. Inside the transformers there are tubes shaped into spirals through which



FIG. 11.—RAILROAD CROSSING.

the water passes. The oil tank is very strongly constructed of boiler-plate and angle bars. In addition to the above-mentioned signal device each transformer is provided with a dial thermometer so that the temperature of the oil can be observed from a distance. In Fig. 8 are also shown the signal device, the oil stand and the disconnecting switches to the neutral. The transformers are placed on wheels and rails for facilitating the making of repairs. The transformers are by these occasionally removed from their places with a small truck which can be moved alongside them out to the generator room. The purpose of this arrangement is to use the same crane for the repairs of both the transformers and the turbines and generators.

Between the generators and transformers, oil fuses are inserted in order to protect the generators against short-circuits in the cables leading to the transformers. To render a shut-down at ordinary overloads impossible these fuses are rated at 100 per cent above the normal current.

Before proceeding to a detailed description of the high-tension switchgear a few words may be said about the fundamental principles which have been applied in its design. The switchgear is so arranged that [illegible] disconnected and repaired whenever necessary without causing [illegible] with the exception of the [illegible] where there are no duplicates. The [illegible] of the stations was that two sets of high-tension busbars would [illegible] too much room in the building and the [illegible] unnecessary expense. Another reason for [illegible] was the character of the system of installation used. The busbars are erected on specially designed [illegible] separated by [illegible] walls. For these reasons



FIG. [illegible]—[illegible]

there are almost no possibilities for a short circuit or breakdown on the busbars.

The disconnection of the different parts is made possible by oil switches in conjunction with disconnecting switches. An oil switch can break a very large amount of power, but this apparatus requires considerable inspection and repair. For this purpose use is made of ordinary knife-type disconnecting switches, which are so simple and solid in their design that no repair will be needed. These switches can be operated by means of an insulated hook.

The high-tension sides of the transformers are connected to busbars through oil switches situated just above the transformers. (Fig. 7.) These switches are designed to open the circuit of two transformers, because in case of a short-circuit on one of the transformers the two others deliver their energy to the first one. The switches are equipped with automatic reverse power, which are adjusted to break at a 25 per cent reversal. The relays, which are placed behind the switch board, receive their operating current from series transformers connected to the leads between the main transformers and the busbars, and they receive the necessary e.m.f. from three-phase shunt transformers connected through fuses to the busbars. The operating current for the oil-switches is supplied from a direct-current source. In addition to disconnecting for reverse-current the relays also disconnect for overload. Each lead is opened twice in the oil switches, the rupture being accomplished within closed porcelain oil-cans. Contact and disruption is done by means of metal rods electrically joined at their upper ends. The switches are operated electrically by direct current obtained from the exciter circuits. Between the switches and the busbars disconnecting switches are inserted, as shown in Fig. 9, in order to make repairs possible. The two lines to Kristianstad and Fridafors tap off from the busbars. Disconnecting switches are inserted between the busbars and the oil switches. The oil switches are of the same type and design as those described above. The one for the line to Kristianstad, however, is automatic for overload and the one to Fridafors for reverse power. On account of an agreement between the Hemsjö Power Company and the Fridafors Company energy is to be delivered only in the direction from Fridafors to Hemsjö.



FIG. 13.—IRON POLE AT TELEPHONE CROSSING.

Each of the outgoing lines is protected with lightning arresters consisting of horn gaps connected in series with water resistors. The water in the resistors is arranged circulating

The static electricity on the lines is discharged through a water-jet apparatus connected to the busbars through disconnecting switches. The apparatus is illustrated in Fig. 10. Choking coils are inserted to prevent high-frequency currents from entering the transformers.

The lines pass through the walls of the building by way of two glass squares which support a glass tube through which the conductor passes.

In case of a short-circuit to ground on the lines there might [illegible] limit the current to a safe value the neutral on the high-tension side is not directly grounded, but instead there has been placed between the neutral and the ground a resistor calculated to withstand from 2.5 to 3.0 times the normal current on each transformer for 10 seconds, during which time the automatic switches will open.



FIG. 14.—CARRIAGE FOR REACHING IRON POLES.

In the power station each one of the high-tension conductors is separated from the others by fireproof concrete walls. This method has been recommended as the safest both from the electrical and the operating point of view. To allow the concrete walls to be as thin as possible yet strong they are built upon a skeleton of iron wire which is fastened to the stem flange of a T-iron. The iron limits the walls toward the passages and is therefore turned with its foot flange outward. The distance between any high-tension conductor and these walls or any other grounded parts is never less than 250 mm, but is in general somewhat larger.

In order to protect the attendants inside the station against every danger from high potentials, all iron parts, such as the turbine frames and generator frames, the iron skeleton of the building and all iron required for high-tension and low-tension apparatus are connected together and grounded. Thus all the T-irons for the fireproof walls are grounded. By this precaution no danger to life arises from any weakness of the insulation.

The switchboard consists of nine marble panels mounted on an iron structure, one panel being for the two exciters, one for each of the three generators, one blank panel for a future generator, one panel for the synchronizing apparatus, and three panels for outgoing lines. There are two push-buttons for the turbine regulator, used when synchronizing the generators. On the turbine regulator there is placed a small direct-current series motor acting on the regulator's handle by means of a worm wheel. By pushing one of the buttons the motor is rotating in a certain direction and by pushing the other one the motor is rotating in the reverse direction.

It has already been mentioned that Sölvesborg gets energy for lamps directly from the three-phase system. On account of the large amount of power distributed to other places so great variations in voltage would have arisen that the light in the town would have suffered had no special precautions been



FIG. 15.—DYNAMOMETER FOR STRETCHING WIRE.

taken. In order to get as constant a voltage as possible an automatic Thury regulator has been installed at Hemsjö. This regulator, which is driven by a small direct-current motor, actuates a pinion rod which operates the field rheostats by means of pinions. Thus the three field rheostats are operated simultaneously so that the voltage of the three generators vary simultaneously. The operation of the regulator is accomplished by means of a shunt coil connected to the secondaries of the potential transformers for the outgoing line to Kristianstad. The potential drop of 6.5 per cent between Hemsjö and Ifö, where the line to Sölvesborg branches off, is compensated for in the regulator circuits.

The energy for lighting the power station is obtained from a three-phase transformer connected to one of the generators. This transformer can be connected to either of the two generators by means of a double-throw switch. The lighting of the machine room is accomplished chiefly by means of arc lamps.

THE TRANSMISSION LINE.

The transmission line between Hemsjö and Fridafors consists of three 16-sq. mm wires, between Hemsjö and Kristianstad of three 25-sq. mm wires, and on the lines Kristianstad-Maltesholm and Ifö Sölvesborg of three 16-sq. mm wires, all wires being of hard-drawn copper. The conductors are arranged in an equilateral triangle with 1250 mm (4 ft.) sides and mounted on insulators of the Rörstrand type. The insulators are supported by wrought-iron arms 1 in. in diameter. Each arm is fastened to the wooden pole by means of ⅝-in. wood screws, and can withstand a force of 220 lb. at its outer end without being permanently deformed. The arms are carried on pine poles 40 m (44 yd.) apart. The poles are from 7 in. to 8 in. in diameter at the top, and the height over the ground is from 28 ft. to 30 ft. and they are from 5 ft. to 7 ft. in the ground. The poles are not impregnated. In order to obtain equal induction in the three conductors they are transposed, a full transposition being achieved on 90 poles in 6 steps.

The line is protected against lightning by horn arresters placed at 10-km intervals. The gap on these arresters is slightly less than the flashing surface of the insulators, being set at 5 in. The purpose has been to establish a few weak points along the line through which the transient charge will pass when lightning, which is very common in this district of the country, occurs.

The total length of the transmission line is 95.6 km (60 miles). There are railway crossings at 10 places, a typical crossing being shown in Fig. 11. A steel tower is placed on each side of the railway with overhanging bridges. The distance between these bridges is so chosen that if a wire gets broken the ends of it do not come in contact with the train. In order to standardize these crossings as far as possible and yet to suit the different profiles of the railroads the iron towers are made in three different lengths and their foundations go more or less deep into the ground. The towers rest on four legs, which consist of the extended iron structure clad with concrete. The concrete is drawn up to about 5 ft. above the rails. This arrangement has the advantage that persons and animals will be protected from shocks from any high potential produced when one of the high-tension conductors comes in contact with the iron structure. These potentials will always occur unless the resistance to ground is very low. It is well known that the concrete is an insulating material, although not a very good one, when dry. Even in rain that part of the concrete which is always above the ground is a fairly good insulator. All of the crossings are grounded by copper plates sunk into the earth. It has been found by measurements that the iron towers themselves have in general a lower resistance than the copper plates.

There are a great many high-road and telephone crossings which, in acordance with the Swedish law, must be provided with ground connections. At many crossings it has been very difficult to find places where the ground resistance could be kept down to the limit given by the government—namely, 200 ohm.

On account of the line crossing agricultural country between the railway station and the power station at Hemsjö iron poles have been put up for a distance of about 700 m (750 yd.). The lines to Kristianstad and Fridafors have been put on common poles. The pole construction is shown in Fig. 12. Four iron poles are spaced 200 m apart. Two of these poles, called strain poles, have been designed not only to take strains sideways, but also in the direction of the line. The two intervening poles are arranged for taking strains sideways in the direction of the line only. The spacing between the conductors on these poles is 2.0 m (6 ft. 8 in.). As there is a road crossing at the place illustrated hard-drawn copper cable has been used for the conductors. The construction of this copper cable may be mentioned especially as it differs considerably from the ordinary design. It consists of six copper wires, the core wire being of hemp. By this arrangement all of the wires will be affected by the same strain. In ordinary cables with a wire core the center wire has to take up the greater part of the load and consequently has a tendency to pull apart, whereby the cable as a whole will be weakened in mechanical as well as in electrical respects.

At Kristianstad the line coming into the transformer station, as well as the one leaving, has had to be erected across swamps inundated during the greater part of the year. It was necessary therefore to use iron poles instead of wooden ones. Fig. 13 gives a view of the transmission line north of the transformer house. The poles have been designed for double lines, as the future line from the Torsebro power station is to be extended to the transformer station. All of the poles are of the strain type, as each one must take up the strain from the deviations of the line. Their general appearance differs also somewhat from those at Hemsjö.

The first pole shown in Fig. 13 is of special interest, as there is a telephone crossing at this place. The telephone wires have been run through the iron structure of the pole, the insulators being put on iron racks, which are insulated from the pole. This arrangement has been used in order to prevent the telephone wires from receiving tension from the pole in the event of a break or an insulation fault on the telephone wires. To protect the telephone wires against an occasional breakage on the high-tension conductors, guard irons have been placed on each side of the pole both above and beneath the wires. The guard irons extend beyond the utmost conductor and the upper pair have been bent upward to catch falling conductors. As the iron poles to the north and west of the transformer house at Kristianstad are inaccessible both by land and by water during the greater part of the year, a special steel cable for conveying persons and material has been erected below the conductors. A special kind of wagon has been constructed resembling a scale, in which the workmen pull themselves along as seen in Fig. 14.

To obtain the proper tension in the wires during erection, use was made of the special dynamometer shown in Fig. 15. The wire or the cable is fastened between two clamps. By means of links the upper one is connected to the foremost part of the apparatus, which [illegible] which the wire rope for stretching the conductor is wound. During stretching the wire rope is fastened with one end to the insulator pin or to the top of the insulator and with the other one to the drum. The drum is turned by a handle, a catch preventing its backward movement. On the side of the apparatus there is a hand for indicating the tension in kilograms. This little apparatus has proved very useful in simplifying [illegible]. Its weight is only 3 kg [illegible].

The [illegible] of the transmission line to the transformer stations and to the generating stations has been accomplished in the following way. [illegible] the conductors two insulators have been put up in series with each other. These have first been joined at the tops with binding wires and then the [illegible] by a loop to the outer insulator.

The loop hooks into the binding wire like links, so that in case of breakage in the outer insulator the line remains fastened to the inner insulator and hence does not fall to the ground. By this method the anchorage strain from the line is evenly divided on two insulators.

It might be of some interest to give a few data of the line. Since the line was completed impedance and no-load measurements were made on the section between Hemsjö and Kristianstad, whereby the following line constants referred to the kilometer as the unit of length were obtained.

Resistance = 0.6902 ohm.

Inductance = 1.1899×10^{-3} henry.

Isolation-resistance = 5.764 megohm.

Capacity = 0.010335×10^{-6} farad.

The measurements were made at a temperature of + 2 deg. C. and the insulators were covered with snow in a thawing condition. The value of the isolation-resistance can therefore be considered as the lowest attainable.

SUBSTATIONS.

Primary transformer stations have been erected at Ifö, Maltesholm and Sölvesborg. The primary voltages for these stations have been calculated for the system at full load, due regard being taken to the series resistance and reactance of the lines and the shunted capacity. The different e.m.fs. amount

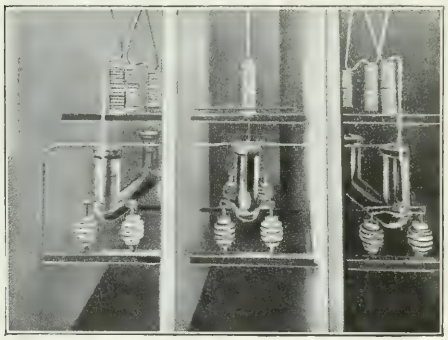


FIG. 16.—LIGHTNING-ARRESTER EQUIPMENT.

to 37,300 volts for Ifö, 36,700 for Kristianstad, 36,300 for Maltesholm, and 37,000 volts for Sölvesborg.

When selecting the units for the transformer stations one had to decide between either the single-phase or the three-phase type of the self-cooling, oil-insulated transformers, as the water-cooled transformer was out of question, there being no water at the places where the transformer stations are situated. On this account one was restricted to sizes not exceeding 500 kva, as this is about the largest economical rating for self-cooled transformers. If three-phase transformers had been selected two units would have been necessary and one spare unit would have been required for each of the stations at Ifö and Maltesholm. Hence, one-third of the transformer rating would have been spare. Furthermore, space would have been needed for three sets of high-tension gears. Of the single-phase type four units are used, including a spare one—that is, only one-quarter of the transformer rating is spare and only one set of high-tension gear is needed instead of three. Moreover, the single-phase transformers are safer in service than those of the three-phase type on account of their simpler design. From these considerations the single-phase transformers were chosen for both these stations, the rating per unit being 370 kva.

The circumstances at Kristianstad are almost analogous with those at Ifö and Maltesholm. It was desirable to install transformers for 2000 hp at this station in the beginning, and it was therefore advantageous to divide the transformers into two 1000-hp groups. The single-phase system proved to be the best here also, because for six single-phase transformers only one spare is needed. In Sölvesborg, however, the value of the power was so small that only the three-phase type could be taken into consideration and two 100-kva units were chosen. All of these transformers are of the self-cooled, oil-insulated type.

The high-tension installation in all of the transformer stations has been arranged on the cell system. The conductors are enclosed between fireproof walls and barriers. For the barriers use has been made of a special kind of brick called Frazzi brick, consisting of terracotta. The brick is hollow and shaped as slabs, the dimensions being 2¼ in. x 10 in. x 24 in.; it has proved very good for the purpose, as it is strong, light and very homogeneous, fireproof and to a certain degree insulating in electrical respect. It resists an electric arc and does not crumble when heated and suddenly covered with water.

The vertical barriers have been erected with the brick edgewise and one end to the wall to which the barrier is attached; the other end is guided by a vertical U-iron finishing and limiting the wall outward. Anchor bolts have been placed at intervals in the supporting wall. These bolts are drawn through the holes in the Frazzi slabs and the U-iron. The U-irons and bolts are very advantageous from the electrical point of view, as the former limit the barriers and are grounded.

At the horizontal walls the Frazzi brick has been framed between two U-irons connected by bolts through the holes in the slabs. This construction is also very solid and the barriers are self-supporting at almost any span.

In every transformer station there has been provided for each of the incoming and outgoing lines a lightning arrester consisting of two arresters of horn-type connected in series on each phase, and a water resistor connected in parallel with one gap (Fig. 16). There is also in every station a lightning arrester of the multigap type consisting of a number of small gaps and carborundum resistors.

The incoming Hemsjö line passes through disconnecting switches, choke coils and an oil switch to the high-tension busbars. From these the line to Maltesholm branches off through disconnecting switches and oil switches. The low-tension side of the transformers has fuses and non-automatic oil switches. The e.m.f. is 5000 volts. The conductors on both the high-tension and low-tension side consists of bare hard-drawn copper wire. The neutral on the secondary is grounded. The transformers are enclosed in fireproof chambers on the bottom floor of the building, the switchgear being on the upper floor.

It might be of some interest to give a few data regarding the cost of the plant in question. The cost for the different parts has been approximately as follows:

Hydro-mechanical equipment, including tubes, turbines and regulators of the Upper Hemsjö Power Station	$17,500
Electric equipment of the Upper Hemsjö Power Station	36,000
Buildings, etc., at the Upper Hemsjö Power Station	23,000
The transmission lines	87,500
Telephone lines	5,000
The primary and secondary transformer stations, cable system and distribution system	72,300
Transformer station buildings	18,700
Total cost	$260,000

The transmission lines have cost on an average $1,460 per mile. This rather high cost can be explained by the very high price of copper during the year 1907. The company had to pay $2.70 per pole to the owners of the ground for right of way. The telephone lines cost $86 per mile.

The contractors have been the Maschinenfabrik Oerlikon, Switzerland, for the power station; the Luth & Rosén Electric Company, Stockholm, Sweden, for the transmission lines, and the Förenade Elektriska Aktiebolaget, Stockholm, for the transformer stations. The consulting electrical engineers for the company have been the Elektriska Pröfningsanstalten, Stockholm. The writer has superintended the erection of the power station, transmission lines and transformer stations for these engineers.

Voltage Strains Due to Circuit-Breaking in Direct-Current Systems.

BY L. SILBERBERG.

THE relation of current and voltage when uniform direct current exists in a circuit is as unchanging as the law of gravitation. With the resistance of the circuit known an application of Ohm's law defines this relation very simply. Moreover, the circuit-breaking devices of most direct-current lines act uniformly in the service for which they were designed and are surrounded by a medium whose characteristics change but little. The question then arises: Is it not probable, during the operation of circuit breaking, that the transient values of current and voltage still bear to each other a relation which remains the same as long as the constants of the circuit and the manner of breaking it remain unchanged?

In the following calculations an attempt is made to define these transient current and voltage values, in order to ascertain what strains a circuit may undergo during the opening period.

CURRENT REDUCED BY RHEOSTAT BEFORE CIRCUIT IS OPENED.

The method of opening a circuit by increasing the resistance is used most frequently in connection with low-voltage release attachments on motor-starting rheostats. Field-circuit currents of generators also may be reduced in the same way. It is known that no abnormal voltages are encountered unless the circuit is highly inductive and the resistance is cut in with considerable rapidity. Evidently when the resistance and inductance of the circuit are constant, the rapidity with which an outside resistance is cut in is largely responsible for the current and voltage values that ensue; and any attempt to investigate these values demands a knowledge of the variable resistance inserted.

The equation for resistance of a conductor is

$$R = \frac{\rho l}{A} \qquad (1)$$

where R = resistance, ρ = a constant, called the resistivity, l = length of conductor, and A = area of cross-section of conductor. If the conductor taken is an ordinary rheostat, and the resistance R is assumed to vary from zero to a finite value after the time t, the following conditions exist: ρ is still a constant, being the resistivity of the resistance material; A is still a constant, being the cross-section of the resistance material; therefore, $\rho \div A$ is constant. l is a variable, depending on the amount of resistance inserted in the time t, the action of the rheostat decreeing that l increases as t increases. The length l can be made to increase directly as the time, as the square, cube or any exponent of the time. In general, it is assumed that l varies as t^n, or $l = ct^n$, where c is a constant.

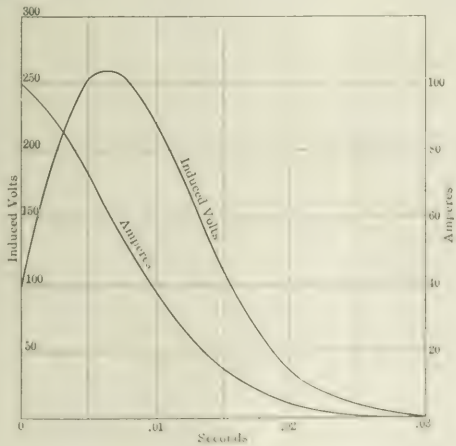


FIG. 1.—PROBLEM 1.

Rewriting equation (1),

$$R = \frac{\rho}{A} ct^n \text{ or combining } c \text{ and } \frac{\rho}{A} \text{ into the constant k,}$$

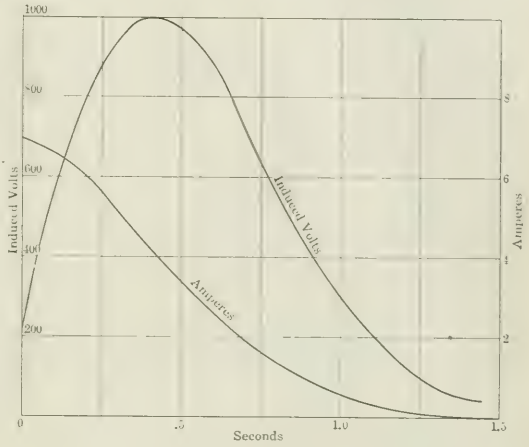


FIG. 2.—PROBLEM 2.

$R = kt^n$ is the equation defining the variable resistance inserted. If

i_o = initial current, in amperes, in circuit,
e_o = initial pressure, in volts,
r = resistance in ohms,
L = inductance in henrys,
i = current in amperes after time t,
e = pressure in volts after time t,

then if, at the instant of starting the reduction of current in a circuit, the impressed voltage were withdrawn, the current due to the induced volts could be written

$$i = \frac{-L\frac{di}{dt}}{r + kt^n}, \text{ or}$$

$$-L\frac{di}{dt} = i(r + kt^n)$$

$$\frac{di}{i} = -\frac{1}{L}(r + kt^n)\,dt.$$

Integrating,

$$\log_e i - \log_e c = -\frac{1}{L}\left(rt + \frac{kt^{n+1}}{n+1}\right)$$

where c is a constant of integration.

$$\log_e \frac{i}{c} = -\frac{1}{L}\left[rt + \frac{kt^{n+1}}{n+1}\right]$$

from which

$$i = c\,\epsilon^{-\frac{1}{L}\left[rt + \frac{kt^{n+1}}{n+1}\right]} \qquad (2)$$

When $t = 0$, $i = i_o$, which value substituted in (2) gives

$$i_o = c.$$

Therefore,

$$i = i_o\,\epsilon^{-\frac{1}{L}\left[rt + \frac{kt^{n+1}}{n+1}\right]} \qquad (3)$$

the transient current,

$$e = i(r + kt^n)$$

$$e = i_o(r + kt^n)\,\epsilon^{-\frac{1}{L}\left[rt + \frac{kt^{n+1}}{n+1}\right]} \qquad (4)$$

the transient voltage.

Two examples illustrating the application of these equations are given:

(1) In a circuit of 1 ohm resistance and .35 millihenrys inductance a current of 100 amp is flowing due to an e.m.f. of 100 volts impressed upon it. What will be the resultant current and induced voltage values, if a rheostat is made to introduce a constantly increasing resistance at the rate of 500 ohms per second?

(2) In an alternator field having a resistance of 33.2 ohms and an inductance of 112 henrys, a current of 6.93 amp is flowing, due to an e.m.f. of 230 volts impressed upon it. What will be the values of current and induced voltage if a rheostat is made to introduce a constantly increasing resistance at the rate of 500 ohms per second?

Figs. 1 and 2 show the solutions of problems 1 and 2, respectively. It is seen that the voltage equation has a maximum value in each case. The time at which the maximum value would occur in equation (4) could be determined by equating the first derivative of voltage with respect to time to zero and solving for t. By carrying out this operation t is seen to be involved in the equation

$$(r + klt^n)^2 = n\,k\,L\,t^{n-1} \qquad (5)$$

from which, in a numerical case, t can be found by a cut-and try process. Substituting this value in equation (4) makes it

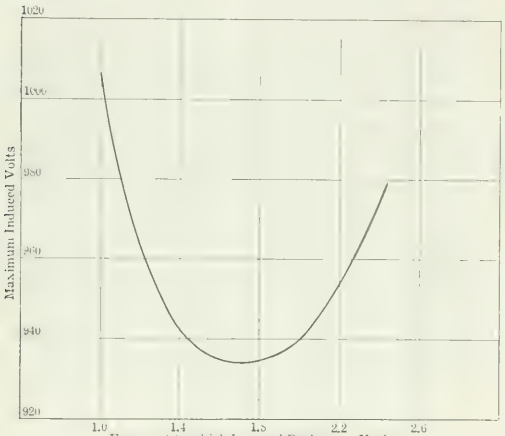


FIG. 3.—CURVE OF VARIATION OF MAXIMUM INDUCED VOLTAGE

possible to determine the maximum value of the induced voltage without plotting a curve.

The constant k can be defined as the resistance, in ohms, that has been inserted after the first second of time. In problems 1 and 2 this resistance is taken as 500 ohms and n is taken as 1; that is, the resistance varies directly as the time. If k were kept the same, but the resistance were made to vary as the square of the time, it is evident that another set of voltage values would be obtained and, therefore, a different maximum value of the voltage would result. In general, it may be said that every change in the exponent n produces a corresponding change in the value of the maximum induced voltage, all other conditions being held the same. Fig. 3 shows a curve of this variation, the same circuit being used as in problem 2. The curve shows that for this particular circuit and speed of inserting the resistance, if the resistance in ohms could be made to vary as the 1.7 power of the time in seconds, a smaller value of the induced voltage would result than if the resistance were varied in any other way. In general, it can be shown that the phenomenon is true for any circuit, viz., that when the resistance and inductance of a circuit and the speed of inserting resistance in it are given, there is a way of inserting this resistance that will cause less induced voltage than any other way.

Other phenomena shown by equations (3), (4) and (5) are that, when all other conditions of the circuit are held the same: (1) An increase in the resistance of the circuit causes a decrease in the induced voltage and a quicker subsidence of the current. (2) An increase in the inductance of the circuit causes an increase in the induced voltage and a slower subsidence of the current.

It can be shown, also, that the energy consumed in stopping the current is the same, regardless of the way in which it is stopped; for

$$W = \int_0^{\infty} i\,e\,dt$$

$$= i_0^2 \int_0^{\infty} (r + klt^n) \cdot \qquad dt$$

$$- \frac{i_0^2 L}{2} \int_0^{\infty} \qquad$$

$$\left[2 \left(r \qquad klt^n \right) \right] dt$$

$$= -\frac{i_0^2 L}{2} (0 - 1)$$

$$= \frac{i_0^2 L}{2}$$

CIRCUIT OPENED BY A CARBON BREAK CIRCUIT-BREAKER.

When (as is the common practice now) a circuit is opened by a single-pole carbon break circuit-breaker, an ordinary statement of the occurrence would be that the carbon contacts fly apart the full length of their throw with great speed. An arc is formed which flies upward and dies away.

If it were not for this arc, the circuit would be broken almost instantaneously; and it might be said that the arc is a temporary conductor created by the circuit in order to protect itself against the effect of being opened too rapidly. Considered as a conductor, then, the arc should have length, cross-section and resistivity and be subject to the same law of resistance that governs other conductors, i. e., $R = \frac{\rho\, l}{A}$.

Since the area of cross-section depends on the current flowing it ought to be possible to substitute i for A and by giving ρ another value, the equation should still hold. Another question presents itself: how does the length of an arc, formed under the above conditions, vary with the time? Counting time from the instant that the contacts have reached the end of their throw the arc might be considered as a straight beam, perfectly elastic and flexible, stretching between the contacts. Due to the pressure of air below it, from convection, this beam may be said to be acted upon by a set of forces of the same value and distributed uniformly along its length. Therefore, in order to preserve the same stress among all of its particles, it tends at any instant to assume the shape of the moment diagram of a beam so loaded, i. e., a parabola. The rate at which the vertex of the parabola rises is probably not far from being uniform and, for purposes of calculation, it is assumed to be so. Therefore, since the length of arc of this curve increases almost at the same rate as the path traveled by the vertex, it also may be said to increase uniformly. In other words, the length of path traveled by the current during this transient period varies directly as the time.

When an arc rises for a considerable distance above the contacts before rupturing, another set of forces assume some prominence; they are the lines of force surrounding the path of the current and tend to force the arc apart as the shape of it approaches a loop. No calculations are based on these, however.

If, then, the cross-section of this arc conductor is assumed to vary directly as the current and the length of it to vary directly as the time, we may rewrite its resistance equation in the form $R = \frac{\mu\, t}{i}$. The current, during the period of circuit-breaking, is due to the impressed voltage plus the induced voltage and could be written

$$i = \qquad - L \frac{di}{dt} \quad \text{or}$$

$$r + \frac{\mu\, t}{i}$$

$$i\,r + \mu\, t = e_0 - L \frac{di}{dt}.$$

from which $$\frac{di}{dt} + \frac{r}{L} i = \frac{e_0 - \rho t}{L}$$

Multiplying by the integrating factor $\epsilon^{\frac{rt}{L}} dt$,

$$\epsilon^{\frac{rt}{L}} di + i\,\epsilon^{\frac{rt}{L}} \frac{r}{L} dt = \frac{e_0}{L}\,\epsilon^{\frac{rt}{L}} dt - \frac{\rho}{L}\,t\,\epsilon^{\frac{rt}{L}} dt$$

or

$$\epsilon^{\frac{rt}{L}} i = \frac{e_0}{L}\int \epsilon^{\frac{rt}{L}} dt - \frac{\rho}{L}\int t\,\epsilon^{\frac{rt}{L}} dt$$

$$= i_0\,\epsilon^{\frac{rt}{L}} - \frac{\rho}{r}\,t\,\epsilon^{\frac{rt}{L}} + \frac{\rho L}{r^2}\,\epsilon^{\frac{rt}{L}} + c.$$

where c is an integration constant.

When $t = 0$, $i = i_0$ which values substituted in the above, gives

$$i_0 = i_0 + \frac{\rho L}{r^2} + c$$

$$c = -\frac{\rho L}{r^2}$$

Therefore,

$$\epsilon^{\frac{rt}{L}} i = i_0\,\epsilon^{\frac{rt}{L}} - \frac{\rho}{r}\,t\,\epsilon^{\frac{rt}{L}} + \frac{\rho L}{r^2}\,\epsilon^{\frac{rt}{L}} - \frac{\rho L}{r^2}$$

$$i = i_0 - \frac{\rho t}{r} + \frac{\rho L}{r^2}\left(1 - \frac{1}{\epsilon^{\frac{rt}{L}}}\right) \qquad (6)$$

the transient current.

$$e = e_0 - L\frac{di}{dt} = e_0 - \frac{\rho L}{r}\left(1 - \frac{1}{\epsilon^{\frac{rt}{L}}}\right) \qquad (7)$$

the transient voltage.

The circuits used in problems 1 and 2 will be used again to illustrate the application of the above equations of current and voltage. The problems may be re-stated as follows:

(3) A circuit having a resistance of 1 ohm and an inductance of 35 milhenrys has a current of 100 amp flowing in it due to an impressed e.m.f. of 100 volts. What will be the current and voltage values during circuit-breaking?

(4) A circuit having a resistance of 33.2 ohms and an inductance of 112 henrys has a current of 6.93 amp flowing in it

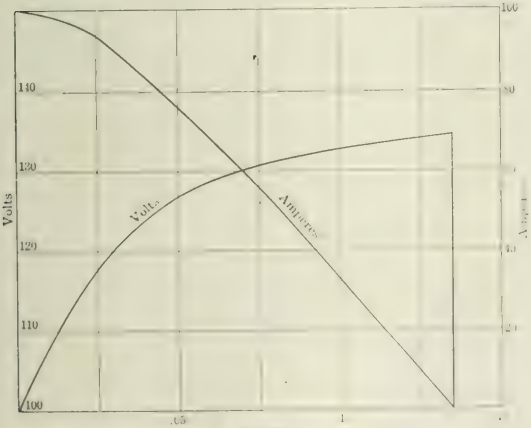


FIG. 4.

due to an impressed e.m.f. of 110 volts. What will be the current and voltage values during circuit-breaking?

It is understood that a carbon [illegible] is used in these problems. The solutions are shown on Figs. 4 and 5. It is seen that the maximum voltage value is reached when the current reaches zero. The instant when the current reaches zero could be determined without plotting a curve if the time at which the current reached zero were known. If i in equation (6) is put equal to zero, then

$$\frac{\rho}{r}\left(t - \frac{L}{r}\,\epsilon^{-\frac{rt}{L}}\right) = i_0 + \frac{\rho L}{r^2}$$

$$t + \frac{L}{r}\,\epsilon^{-\frac{rt}{L}} = \frac{r}{\rho}\,i_0 + \frac{L}{r} \qquad (8)$$

from which t could be found, in a numerical case, by a cut-and-try process.

In general lighting and power work circuit-breakers are rarely used in circuits having an appreciable inductance, and the

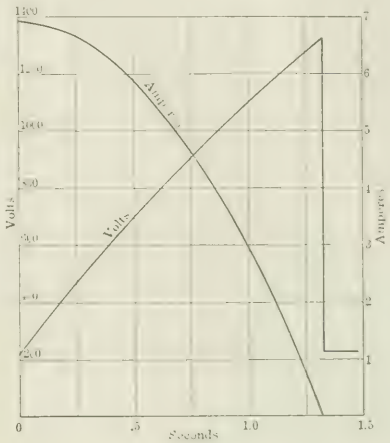


FIG. 5.—PROBLEM 4.

voltage strains are seldom injurious. In railway feeder circuits, however, especially those with the third-rail, the material and size of the conductor and its low resistance are liable to make the ratio of inductance to resistance unduly high. This ratio, as can be seen by equation (7), is largely responsible for the voltage strain encountered when circuit breaking. As an example, suppose such a circuit, having a resistance of 0.4 ohm and an inductance of 2 henrys, was opened by a short-circuit current of 1500 amp. As found by equations (7) and (8), the time for the arc to rupture would be 2.68 seconds and the maximum voltage 2675 volts. Thus, it is seen that, while the inductance of this circuit is only a small fraction of that in problem 4, the voltage strain when circuit breaking is about twice as great.

The value of the constant ρ has been assumed as 1000 in the foregoing problems. It probably never has been determined experimentally; it should be about constant for conditions under which circuit-breakers are usually placed.

Electrolytic Detectors.

In *Der Elektrotechniker*, of Vienna, Mr. H. J. Reiff describes the electrolytic detector of Schloemilch, in which a direct current is passed through an electrolytic cell between a platinum plate and a [illegible] platinum plate electrode with the antenna), the resistance of the cell is changed. Branly has found that by raising the temperature to [illegible] the sensitiveness of the cell can be made a maximum. The sensitiveness of the cell seems to depend on the [illegible] which the smallest bubbles are [illegible] at the electrode by the [illegible] are [illegible] from the electrodes by [illegible] the cell or by [illegible] an alternating current against the electrodes, the sensitiveness of the cell is increased.

Pulley Data: Ratio of Diameters, Distance Between Centers and Arc of Contact.

By F. C. Helms.

IN the laying out of power plants and shops in which belts and pulleys are to be used, it is desirable to have the mathematical formulas, which are used for calculating the various dimensions, arranged in the form of curves, charts or tables, thus enabling one to obtain the desired results with the

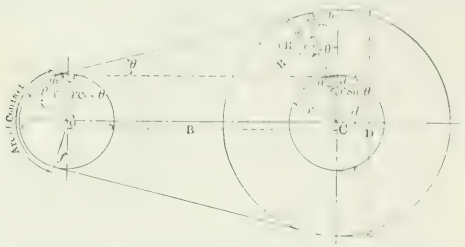


FIG. 1.—DIAGRAMMATIC SKETCH SHOWING RELATIONS BETWEEN VARIOUS FACTORS OF BELT-DRIVE.

expenditure of the least amount of mental energy. The curves shown in Figs. 2 and 3 are presented with this object in view.

Fig. 1 gives a diagrammatic picture of the relations existing between the various factors, such as the ratio of the diameters D/d; the distance between centers B, and the arc of contact on the smaller pulley.

From Fig. 1 the following formula for the distance between centers B in terms of the ratio of the diameters D/d and the angle Θ can easily be derived:

$$B = \frac{(D\,d - 1)}{2\ sin\ \Theta}\,d \qquad (1)$$

which is in a form convenient for calculating the value of B in terms of the ratio of diameters and the arc of contact on the

$$\frac{180^\circ - \text{arc of contact}}{2}$$

It is evident that curves plotted between the ratio D/d and

will be straight lines passing through the origin, hence it will be only necessary to calculate one or two points for each value of the arc of contact, which will enable one to draw straight line curves for as many values of the arc of contact as may be desired.

The following calculations of equation (1) are added simply to show the tabulated method:

$D \div d$	$D \div d - 1$	$\frac{D/d - 1}{2 \sin \Theta}$			
Arc of Contact		175°	170°	165°	160°
1	0	0	0	0	0
4	3	34.4	17.2	11.5	8.65
7	6	68.8	34.4	23.0	17.3

The curves in Fig. 2 were plotted from calculations as indicated above. They enable one to determine at a glance the distance between the centers of the pulleys which should obtain (when the ratio of diameters is fixed, the size of either pulley being known) in order to obtain a given arc of contact on the small pulley.

The curves in Fig. 3 give the arc of contact which will be obtained on the small pulley for several values of the ratio $D \div d$ when the centers of the pulleys are separated by any distance from 0 up to $35d$. These curves were plotted directly from the curves in Fig. 2, although equation 1 can be transformed into the following form:

$$Sin\ \Theta = \frac{D\,d - 1}{B}\,\frac{d}{2} \qquad (2)$$

and calculations of the value of sin Θ made for several definite values of $D \div d$, where B will be the varying factor, d being made unity for convenience. The arc of contact can easily be obtained when we know the value of Θ.

To show the use of the curves take the following case: Suppose that there is an engine running at 150 r.p.m. and equipped with a belt pulley 127 in. diameter and 48 in. face. This gives a belt speed of 5000 ft. per minute. It is desired to install a 60-cycle, 500-kw alternating-current generator to be driven by this engine, and there is available a distance of approximately 30 ft. between the center lines of the pulleys. What is the maximum r.p.m. at which the generator can be run to obtain an arc of contact of 165 deg. on the small pulley?

One may start with the assumption that a four-ply leather belt 46 in. wide will transmit 500 kw at a belt speed of 5000 ft. per minute with an arc of contact of 165 deg. on the small pulley. The calculation of the size of this belt requires the use of a formula or another set of curves designed for this purpose. It is also possible to run a four-ply belt approximately 0.75 in. thick on a pulley as small as 30-in. diameter. Taking this latter diameter of 30 in. and making a preliminary calculation of the r.p.m. of the generator there is obtained:

$$S = \frac{5000}{30/12 \times \pi} = 637$$

Selecting 600 r.p.m. and 12 poles for the generator, there will be obtained a frequency of $\frac{600 \times 12}{2 \times 60} = 60$ cycles per second.

Now calculating the diameter of the generator pulley required at 600 r.p.m.,

$$d = \frac{5000}{600\pi} \times 12 = 31.8''$$

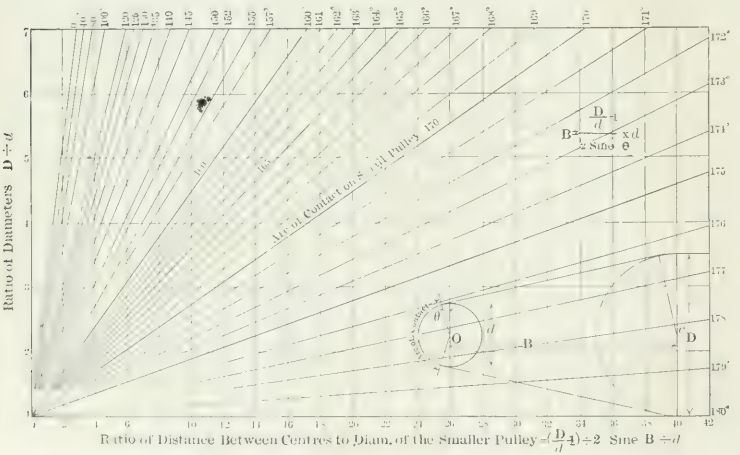


FIG. 2.—CURVES PLOTTED BETWEEN RATIO OF DIAMETERS OF PULLEYS AND RATIO OF DISTANCE BETWEEN CENTERS TO DIAMETER OF SMALLER PULLEY FOR VARIOUS VALUES OF ARC OF CONTACT ON SMALLER PULLEY.

Hence, $D/d = 127/31.8 = 3.9$ and the arc of contact equal to 165 deg. with which to enter the curves.

With these values of D/d and the arc of contact, from the curves in Fig. 2 one can find the ratio of the distance between the centers B to the diameter of the small pulley d or B/d=11.5; hence $B = \frac{11.5 \times 31.8''}{12} = 30.5$ ft., which is approximately equal to the specified distance of 30 ft. available.

Again, suppose there is given the diameter of the small pulley $d = 3$ ft., $B = 30$ ft., or $B/d = 10$, and also the ratio

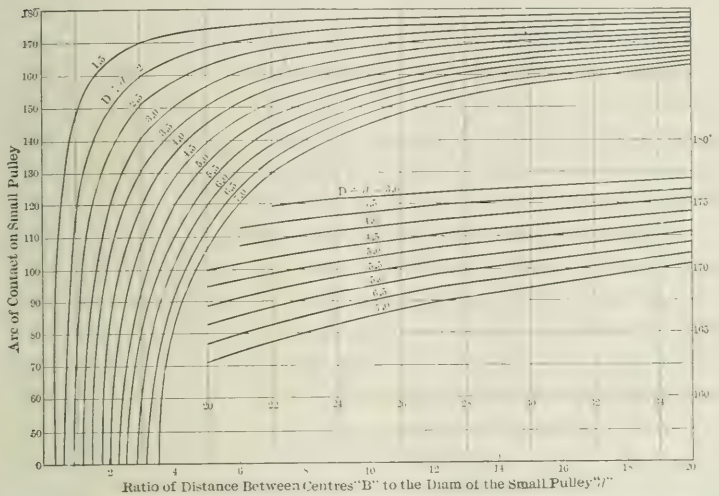


FIG. 3.—CURVES PLOTTED BETWEEN ARC OF CONTACT ON SMALLER PULLEY AND RATIO OF DISTANCE BETWEEN CENTERS OF PULLEYS "B" TO DIAMETERS OF SMALLER PULLEY "d" FOR VARIOUS VALUES OF RATIO OF DIAMETERS OF PULLEYS.

$D/d = 3.5$, what arc of contact will be obtained on the small pulley?

Referring to Fig. 3, the vertical ordinate through 10 meets the curve labeled $D/d = 3.5$ at point 165.5 deg. which gives the desired arc of contact. Instead of having D given, suppose it is desired to find the diameter D which, with the above data, will give an arc of contact of 160 deg. In this case use is made of Fig. 2, where the ordinate through $B/d = 10$ meets the 160 deg. arc of contact line at the point $D/d = 4.47$; hence, $D = 4.47 \times 3. = 13.4$ ft.

The Theory of Lightning.—I.

By Daniel S. Carpenter.

GREAT progress has been made in adapting natural forces and resources to our use, yet there are some forces which as yet we are unable to control. One of these is lightning. To illustrate its destruction of life and property, in 1898 records show that in the United States 367 persons were killed by lightning. The property loss which could be directly traced to lightning strokes was $1,441,880. The value of the live stock killed by it was $48,275; 7558 fires owe their origin to it. In 1900 the records show that 713 persons were killed and 973 injured by lightning. This is a large increase and is probably due to a more complete and extensive system of obtaining records. If every case could have been recorded there is no doubt but that the number would have been still larger.

Power transmission systems suffer greatly from it unless they are well protected. The loss occasioned by the crippling of lines or apparatus and the consequent failure to maintain continuity of service, the expense required to procure effective lightning protection, and the inconvenience to which the public is subjected by interruption of service, justify the maintenance of a corps of experts by the large commercial companies who devote their time to the study of lightning and lightning protection or possibly lightning prevention.

The accumulation of charges of electricity on the clouds is closely associated with the condensation of vapor and the formation of raindrops. Investigation has revealed the fact that the atmosphere is electrified and that there exists a potential gradient in the direction of the vertical. The higher strata of the air have a positive potential against ground during fair weather. The strata of the air in which the clouds float thus have a potential difference against ground amounting perhaps to thousands of volts. The minute particles of vapor floating in the air must necessarily assume a potential. If the surrounding air was dry and the moisture particle was a conductor of such form and magnitude as to prevent the charge from escaping, under these ideal conditions the conductor would assume the potential of the air in which it floats. But these ideal conditions do not exist, for the vapor particles begin to unite to form drops before this value is reached. The positive electrification of the air acts inductively upon the minute particles of vapor. The negative electricity escapes from these and they assume a potential. Experiments show that when an electric field is directed upon vapor particles or very fine drops they combine, and the vapor assumes a heavier and darker appearance. We have the same process on a large scale here. Under the influence of the electric field or electromotive intensity due to the electrification of the air and the vapor particles, the combination of vapor particles to form drops is greatly facilitated. It appears that the number of particles which unite to form drops is a function of the electromotive intensity within the limits between which this influence is manifested—i.e., there would be a great tendency toward the union of particles in obedience to this influence, but the influence would become less effective as the drops grew larger, for equilibrium could not result unless a condition was reached in which the influence could produce no further union. This certainly would be a very interesting field for investigation. From the very nature of the process it is clear that large quantities of electricity must accumulate on the clouds during the agglomeration of vapor particles into raindrops. The clouds are imperfect conductors, thick dense cloud masses being separated from one another by spaces in which there is comparatively little vapor. This can be seen if one observes the clouds closely, and the observations of balloonists prove it to be a fact. The charge on each cloud must act inductively on all the other clouds within the field of influence. This adds greatly to the cloud charges, as will be clearly evident later.

Suppose that n^3 vapor particles unite to form one raindrop, considering both to be spherical in shape, as this must be approximately true. The radius of the raindrop will be n times as great as that of one of the particles, while its capacity considered as an isolated sphere will be n times as great. The [illegible] as that on one of the particles of moisture, while its potential will be n^2 times as great. Suppose that ultimately the raindrops [illegible] a drop considered as an isolated sphere would [illegible] where Q is the charge and r [illegible] Suppose that $Q = 4$, then, if the charge

were uniformly distributed, $\frac{Q}{r}$ would represent the potential and would be equal to $\frac{4}{.126}$ 31.7 electrostatic units. Reduced to volts this equals 9510 volts. Thus, the potential of a raindrop cannot be enormously high and of the magnitude of lightning potential.

A spherical conductor whose diameter is .252 centimeter, if surrounded by dry air and removed from the influence of all other conductors, will be just large enough to hold a charge of 4 electrostatic units under ordinary conditions as to temperature, pressure and humidity. For the pressure of the charge of an electrified conductor, which manifests itself as a mechanical force acting in the direction of the exterior normal to the surface of the conductor against the surface of the surrounding dielectric is $2\pi\sigma^2$ dynes per square centimeter, where σ is the density of the charge on the conductor in electrostatic units per square centimeter. If the conductor is surrounded by dry air the greatest value of $2\pi\sigma^2$ at ordinary conditions in regard to temperature, humidity and pressure of the atmosphere is 800π. This corresponds to a density of 20 electrostatic units per square centimeters. In the case of an isolated and insulated sphere, $C = r$, where C is the capacity and r the radius. As $\sigma = \frac{Q}{\pi d^2}$, for the case where $2\pi\sigma^2 = 800\pi$, we have $d = \sqrt{\frac{Q}{20}}$. For $Q = 4$, $d = 0.252$ centimeter.

If the value of Q, the charge of a vapor particle, and d, its diameter, are known, one could calculate the maximum value of n approximately at which the charge would escape from the raindrop. Since $Q = n^3 Q_1$ and $d = nd_1$, $\sigma = \frac{n^3 Q}{\pi (nd_1)^2} = 800\pi$ or $n = \frac{800\pi^2 d_1^2}{Q_1}$.

But the raindrops are not isolated spheres. The case of a cloud of charged raindrops corresponds to the case of a large number of insulated conductors, to each of which initially a charge of electricity of the same sign has been imparted. Let A_1, A_2, A_3 . . . . An represent n such conductors. If P_{11}, P_{12}, P_{13} . . . . P_1n represent the potential functions on A_1, A_2, A_3 . . . . An due to a unit charge on A_1, then Q_1P_{11} Q_2P_{12} . . . . Q_1P_1n will represent the corresponding potential functions due to Q_2 units on A_1. Similarly with Q_2 units on A_2, Q_3 units on A_3, etc. The potential function of Ak due to its own charge of Qk units and to the charges on it induced by the charges Q_1, Q_2 . . . Q_n on the other conductors will be—

$$V_k = Q_1P_{1k} + Q_2P_{2k} + Q_3P_{3k} + \ldots + Q_kP_{kk} + \ldots + Q_nP_{nk}. \qquad (A)$$

It is thus seen that the potential of the drop is a function of many variables. Let Q_1 and S_1, Q_n and S_n represent the charge and area of a particle of vapor and of a raindrop respectively, the raindrop being formed by the union of n^3 particles of vapor. Then $Q_n = n^3Q_1$, $S_n = n^2S_1$ and $\frac{Q_n}{S_n} = n\frac{Q_1}{S_1}$, i.e., the density of the charge on the raindrop is n times as great as that on the particle of vapor and the mechanical force which tends to cause the charge to leave the conductor is n^2 times as great, for $2\pi\sigma_n^2 = 2\pi(n\sigma_1)^2 = 2\pi\sigma_1^2 \times n^2$. It must result from this rapid increase of potential and mechanical pressure that the air in contact with the drop will quickly break down and become conducting at some point. If the drop was an isolated conductor surrounded by perfectly dry air, when the charge was again in equilibrium, it would be distributed over the surface of a conductor consisting of the original conductor surrounded by an envelope of conducting air. The air immediately in contact with the surface of the conducting air would not be broken down and conducting, but would be the seat of great activity. As the potential increases, streamers and brushes would dart out into the surrounding air. This presents a luminous appearance in the dark. This is called corona, and exists about small conductors charged to a high potential. It is very destructive of insulation.

The raindrops are surrounded by moist air, and the distribution of the charge is modified by induction from the charges on the other raindrops near by and by the potential gradient. So the density is greater at some places than at others, and it is probable that the density becomes so great at some point that the charge readily escapes into the air.

Considering the second member of equation (A), it has been found that the first term will be n^2 times as great for the drop as for the particle. As vapor is continually rising, when the particles have united into drops there would still be other particles with charges and the quantity of electricity would be increased over that which was present when the first drops were forming. The particles that were uniting into drops in the presence of the charged raindrops would have a higher potential than the first set and their tendency to unite would be greater.

In the case of a conductor no charge exists in the interior. In the case of the cloud, which is an imperfect conductor, the tendency will be for the electricity after escaping from the drops to pass to the surface of the cloud. This tendency will be greatly increased by the electromotive intensity due to charges on the clouds in that vicinity.

Taking the simplest case, suppose that the cloud is spherical in shape, the case being that of a hollow conductor with a charge on its surface and innumerable small charges within. No electromotive intensity exists in the interior due to the free charge on its surface or the external charges, except that due to the increase in the magnitude of these charges and sudden changes in their distribution.

The potential of a raindrop in the cloud will be $V_1 + V_2$, where V_1 is the potential due to the raindrops and particles of moisture within the cloud, and V_2 is that due to the charge on the cloud. With the charge on the cloud constant and in equilibrium the value of V_2 would be constant and the same at all points within the cloud.

The charge on the cloud's surface shields the raindrops and vapor particles within the cloud from the influence of charges without.

After heavy charges have accumulated on the clouds, the electromotive intensity will be the resultant of the normal potential gradient and that due to the cloud charges and so may be in any direction and will change as clouds discharge or as the charges rearrange themselves on their respective clouds. Suppose that a cloud discharges. Its potential is reduced to a very low value. The electromotive intensity in the direction of this cloud becomes momentarily very great as equilibrium is being restored by readjustment of charges on the other clouds, thereby causing the particles of moisture to unite very rapidly and the influence of the electromotive intensity in the formation of raindrops reaches a state of maximum intensity. This action results in the formation of large drops and the accumulation of a second charge on the cloud's surface. The practically instantaneous establishment of a strong electromotive intensity causes the particles to flash into drops of such magnitude that the electricity can escape and then sweeps the charges from the drops toward the cloud's surface, causing a second discharge immediately after the first. This is the explanation of multiple flashes and the heavy rainfall of large drops which often occur after a lightning flash. The number of discharges in a multiple flash will increase with the size of the cloud and the presence of heavily charged clouds in the vicinity. These will produce a strong electromotive intensity after each discharge, and, of course, the larger the cloud the longer will be the time required for all its electricity to reach its surface. As water is continually evaporating and the vapor rising, the process of the charges collecting on raindrops then escaping and passing to the surface of the clouds will be repeated over and over again.

Considering the lowest clouds—the clouds in the lowest horizontal layer—which are the ones seen when the sky is overcast and the ones in which most of the flashes which are seen originate, it is noteworthy that there are no charged clouds below these. Thus, heavily charged clouds above, if their charges are of the same sign, repel their charge to the lower surface, increasing the cloud's potential and the density of the charge

there, thereby assisting in establishing conditions favorable to a discharge to earth. Where two clouds have charges of opposite sign, the density of the charges will be greatest on the portions which are the nearest to one another. It is probable that the attraction between clouds having charges of opposite sign alters their form in such a manner as to facilitate a discharge between them. Applying the nomenclature used above to clouds instead of raindrops, there is obtained the charge on A_k,

$$M_K = V_{1qk} + V_{2qk} \ldots + V_{kqk} \ldots + V_{nqnk},$$

where the q's are functions of the p's in the value of V_k.

The electromotive intensity at a point is the resultant of that due to several cloud charges and will vary with changes in these.

In confirmation of this theory, we may quote from the experience of the balloonist, M. Lecoq. His ascent was so timed as to bring him within the range of an approaching thunderstorm. At the height of 600 meters the balloon moved rapidly toward the storm cloud as if attracted by it. At 7:40 p. m., and at a height of 1100 meters, it entered a mass of gray-green cloud, which was momentarily lit up by fitful lightning flashes, followed by immediate and deafening thunderclaps. The discharge appeared to take place between this cloud and another directly overhead, and the balloon was tossed to and fro between cloud and cloud, and set spinning round in a manner both bewildering and dangerous, and which reminds one of the well-known experiments in which pithballs are placed between oppositely electrified plates. That these oscillations were due to electrical attraction and repulsion seemed to be proved from the fact that a strong gale was blowing at the time, which could be felt in the car, and which the balloon did not therefore wholly obey. As a rule, an aeronaut scarcely feels the wind, however strong, since the balloon is carried along at the same rate. Neither M. Lecoq nor his companion felt any ill effects beyond the usual sense of oppression which accompanies such atmospheric conditions. There were no brush discharges visible upon the cordage of the car, but gusts of warm air were felt every now and then, which expanded the gas and carried the balloon further aloft. In one of these upward movements the balloon rose to a height of 1600 meters. At this altitude the storm attained its great intensity, constant discharges taking place between the cumulus in the middle of which the balloon was floating and a cirrus formation above it. M. Lecoq says: "I was particularly struck by the very violent agitation of the air and by the ascending and descending whirls which existed in the heart of the cloud, as well as the very strong attraction experienced by the balloon and light bodies floating in the air."

The above description confirms the existence of an electromotive intensity of great strength and subject to sudden changes of great magnitude during thunderstorms.

As soon as a discharge takes place the potential gradient at that point will be greatly changed and the point of discharge will become a region of low potential, in which direction the electromotive intensity will suddenly become very great, and the electricity will flow toward this point to increase the charge and restore equilibrium. When a discharge takes place, equilibrium is suddenly destroyed, and all objects are sharply impelled along the line of greatest electromotive intensity. This must result in sudden movements of the balloon, as a charge must be induced on it. This is confirmed by its attraction for light objects floating in the air. After each discharge there must be a complete and sudden readjustment to new conditions before equilibrium is restored. In the immediate vicinity of a heavy discharge, such as the position of the balloon in the above case, this effect must be very great.

As the distance between clouds is less than the distance to earth, their influence upon one another will be much greater and we will expect much more frequent discharges between them than between cloud and ground.

To summarize: There exists a potential gradient in the air Under the influence of this gradient minute particles of vapor assume a potential and under the influence of the electromotive intensity they unite to form raindrops. When the raindrops have acquired a certain charge the potential becomes so great that the electricity escapes from the drops and passes to the outer surface of the cloud, as in a conductor, the charge is on the surface. Its escape from the drops and passage to the surface of the cloud is facilitated by the potential gradient and by the ultraviolet light from lightning flashes which take place in the vicinity and by the ionization of the air due to flashes. The charge distributes itself over the surface of the cloud, the distribution being modified by the presence of charges on other clouds—that is, by the potential gradient—and by the induced charge on the earth.

We will next study the surface of the earth considered as a conductor upon which charges are induced by the cloud charges.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Street Lighting Statistics.

By H. THURSTON OWENS

The subject of street lighting, or public lighting, as it is sometimes called, is now receiving the attention which the subject demands, and the writer has been informed that the government intends issuing a report covering the year 1907, which will be much more comprehensive than any hitherto published.

There are more variables in street lighting data which affect the price than in service supplied to consumers, but in a report covering the whole country the items which it should reasonably contain are as follows: The number of each kind of lamps, the hours per year of burning, and the cost per [illegible]

The government report for the year 1905 covered all cities of over 30,000 population, of which there were 154, and the various types of lamps were divided, [illegible]

If the lamps were only divided into [illegible] improvement to classify much [illegible] place the open flame vapor lamps [illegible] lamps, as the last named are [illegible] "Welsbach" undoubtedly refers to [illegible] equitable heading would be "Mantle Gas Lamps."

In the yearly report of the Boards of Gas and Electric Light Commissioners of the Commonwealth of Massachusetts the figures on street lighting are given by companies and the electric lamps are classified on a different basis from the gas lamps. The matter covering electric lamps is divided, as shown in Table II.

The information given covers a much greater scope than [illegible] fact, could be somewhat simplified so as readily to admit of additions and, therefore, totals for the whole State which would be much more illuminating. The average daily number does not vary greatly from the total number in use and the number of [illegible]

Lamps of various consumptions have similar nominal candle-power, so that the change from nominal candle-power to watts [illegible] the average maximum candle-power would be still better, but [illegible] Massachusetts are presented as [illegible]

As no mention is made of the type or the cost, the data are [illegible] comparisons of company operations. The [illegible] gives a efficiency [illegible] average, even

if compiled for somewhat similar lamps, would not be a true indication of costs.

The matter of hours of lighting also varies considerably, as will be seen from the following data abstracted from the Massachusetts report for 1907:

LIGHTING SCHEDULES

Private plants, gas and acetylene (not given)	—
Private plants, electric, all night	29
Private plants, electric, part all night and part half night	11
Private plants, electric, half night	110
Municipal plants, electric, all night	7
Municipal plants, electric, half night	16

TABLE I.—UNITED STATES GOVERNMENT, 1905.

	—Electric lights—		—Gas lights.—		Vapor lamps.	Oil lamps.
	Arc	Incandescent	Welsbach	other	—	—
City						

TABLE II.—MASSACHUSETTS, 1907, ELECTRIC LAMPS.

	Number of public lamps	Nominal candle-power	Average daily hours per night	Number of nights per month	Price paid
Company					

TABLE III.—MASSACHUSETTS, 1907, GAS LAMPS.

	Number of lamps supplied	Increase	Decrease	Price received per M, including expenses	Expense of lighting and care of lamps per M
Company					

TABLE IV.—PROPOSED FORM FOR GOVERNMENT REPORT.

	—Electric lamps.—							
	—Arc.—		—Incandescent.—		Lamps.	Oil, etc.		
	Open.	Enclosed.	Under 25 cp	25 cp and over	Mantle, open flame	Mantle, open flame	Total
City	2,000	1,200	2,000	1,200			

Following is the classification for electric lamps, including those used in street lighting, recently adopted by the Census Office, after consultation with leading officers of the National Electric Light Association and the managers of some of the larger central stations:

Class.	Type of lamp.
Arc lamps:	
Direct current	Open
	Enclosed
Alternating current	Open
	Enclosed
Incandescent lamps:	
Sixteen candle-power	
Thirty-two candle-power	
All other	
Other varieties [Nernst, vacuum, vapor, etc. (state kind)]	

In a report covering the whole country, the only totals which could be profitably compiled would be those covering the types of lamps, and Table IV is suggested in this connection.

The number of lamps should cover the number of posts and not the number of lanterns or globes. Costs per year should be given in a separate table under the same headings, and the hours of lighting per year in another, although they could perhaps be combined.

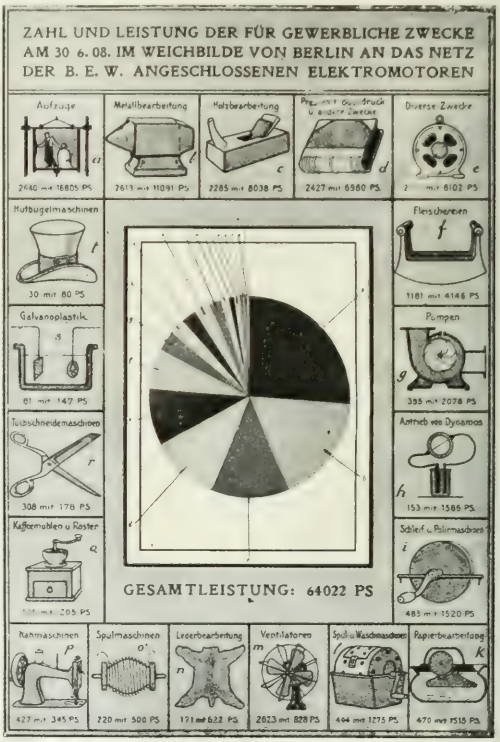
A Central-Station Traveling Man.

The past fall the Denver Gas & Electric Company, which has for some years been noted for its progressive commercial methods, made a move which is one of the first of its kind in central-station commercial practice. Early in the fall Mr. G. E. Williamson, the company's sign specialist, was sent on a trip East for the purpose of calling on a number of the concerns which do a large amount of national advertising and presenting to them the advantages of electric-sign advertising in Denver. Mr. Williamson also visited the larger Eastern central stations and learned as much as possible about recent Eastern ideas in novel and striking electric signs.

As a result of this trip, which is believed by the Denver company to be the first of the kind made by a central-station traveling representative, a number of good sign contracts with national advertisers are well on their way to being closed up. Another very satisfactory result of the trip is that by virtue of the new ideas gained by Mr. Williamson as to striking signs, contracts in Denver for seven large animated signs were closed before Jan. 1.

A Graphic Method of Showing the Application of Electric Motors in Berlin.

The Berlin Electrical Works, like some of the American central-station companies, publishes a monthly bulletin showing various applications of electricity for industrial, commercial and artistic purposes. In the December, 1908, number, it published a unique chart on which are shown a series of pictures symbolizing the purposes for which the company has furnished the amounts of power given in each picture. For instance, an anvil represents the metal industry. Under the anvil is given the amount of horse-power used in the business together with the number of motors. A pair of scissors serves to indicate the clothing or tailor industry; a hide, the leather industry; a book, the printing industry. These pictures form a border for a large multi-colored disk which is divided into



GRAPHIC ILLUSTRATION OF USES OF MOTORS IN BERLIN.

segments corresponding to the proportionate amount of electrical energy used for the purposes indicated. Each segment is identified by a letter opposite each of the symbols. It appears that, at the present time, the total amount of electrical energy sold by the Berlin Electrical Works for industrial purposes in 64,022 hp. The smallest item is made up of 30 motors whose combined capacity of 80 hp is applied for hat-ironing machines, and the largest of 2640 motors, with a total of 16,805 hp, for elevator service.

Central Station Rates.

A paper presented by Mr. R. S. Wallace at the annual meeting of the Illinois State Electric Association on "Rates and Their Relation to the Cost of Manufacture" is of value to those who have not followed the rate question closely for a number of years past, as it touches upon practically all the essential points to be considered. Mr. Wallace classifies fixed expenses as interest, taxation, insurance and depreciation, and the variable operating expenses as fuel, station labor, distribution labor, maintenance, supplies and general expense. He also calls attention to the fact that in specific instances some of these items which he classifies as variable are practically fixed. In a num-

ber of the smaller plants the item of station labor is practically fixed, because it would not be possible to operate the plant with less than one man on a shift. There is also a certain amount of fixed fuel loss connected with the operation of any central station, which loss is continuous as long as the plant is in operation. In making rates for business which does not come on the peak, the management of the small plant is apt to forget how little such non-peak business actually adds to the cost of running a plant, and consequently makes rates so high that the business is not obtained. Of course, non-peak users should bear a share of the cost of the service, but power used at non-peak periods is, to a certain extent, a by-product which can be sold at very low rates, in order to increase the total revenue of the plant, because it adds so little to the actual operating expenses. Below is an abstract of the paper by Mr. Wallace and of the discussion which followed the presentation.

The author states that he does not propose to present any new principles or ideas in reference to rates and their relation to cost, but will attempt to show that rates can and should be adjusted with reference to cost—not the average cost of all energy sold, but the particular cost of energy sold to consumers of various classes. That the cost of serving consumers of one class is different from that of serving another class has been recognized, although perhaps not generally, for over 25 years. That the principles involved are correct has been established in the courts and fully recognized by the commission. The following abstract is from a recent decision of the Wisconsin Commission:

"Short-hour users are more costly to the plant than long-hour users and consequently should pay higher rates. In fact, the instances are comparatively few where the short-hour users can be charged enough to cover the cost of carrying them." It has frequently been charged that differential rates based on load factor are discriminating and would be so held by the courts, but in the light of recent decisions it would seem that such views will be held only by those incapable of understanding the facts and many of the short-hour consumers.

The cost of generating electricity can be divided into two parts. The first is that incident to the use of capital and the second that incident to the operation of the plant in which the capital has been invested. Classifying the items of cost under their proper heads, we find in the first column what we will call fixed costs or constant expense, namely: Interest, taxes, insurance and depreciation. Under the second head, which we will call operating costs or variable expense, are the following items: Fuel, station labor, distribution labor, maintenance, supplies and general expense.

It is clear that the items of expense first enumerated, within reasonable limits, do not depend upon the amount of current generated, but are in proportion to the station capacity or connected load. The items given in the second list are nearly, if not exactly, proportional to the amount of current generated. If in specific instances any item in the second list is found to be fixed regardless of the amount of current generated, it should be transferred to the first list. It is possible also that the item of depreciation may vary slightly, depending upon the amount of current generated, but ordinarily it may be considered a fixed expense. The items of constant or fixed expense are proportional to the connected load or the maximum demand created thereby, and therefore each unit of connected load or maximum demand should be charged with its pro rata share of the fixed expense created, and likewise the variable expense being proportional to the amount of current generated each unit of current must be charged with a pro rata share of the variable expense.

Let us assume for the sake of illustration that for each kilowatt of load connected to a given station there has been expended $200 for the installation of station, lines, meters and other equipment. We will also assume that the investment costs are for interest, 5 per cent; taxes and insurance, 2 per cent; depreciation, 6 per cent; making a total of 13 per cent.

The annual fixed expense is, therefore, $26 for each kilowatt of connected load, and we should receive $26 per annum for each kilowatt connected, plus an amount sufficient to cover the variable expense incident to supplying current. Assuming that the variable expense is 3 cents for each kw-hour delivered, the total cost of current supplied to a consumer who uses his total connected load 365 hours per year, or one hour per day, will be 10.1 cents per kw-hour. If his use of current extends to two hours per day the cost will be 6.5 cents, and if three hours will be 5.4 cents per kw-hour, etc. The costs assumed as the basis of these figures are, of course, arbitrary and are used merely to illustrate the application of the principle. Theoretically, to arrive at a rate which will include a profit, the constant expense portion of the cost should be increased by an amount sufficient to pay the desired rate of dividend, but in practice it is better to divide the profit between the two portions of the rate. The first or constant expense portion of the rate will be designated as the standing charge and the variable expense portion the running charge.

Countless rate schemes have been devised with the principles outlined as a basis. Among those best known are the Wright "maximum-demand" rate, the so-called "multiple rate" and the Doherty "readiness-to-serve" rate.

The Wright maximum-demand rate was devised to overcome certain objections to the "readiness-to-serve" rate and requires the use of a demand meter in addition to the ordinary watt-meter for each consumer. This meter registers the maximum amount of current used at one time or the maximum demand created by the consumer's lamps and appliances. The maximum-demand meter is read and set back to zero each month by the regular meter reader, the reading obtained being used in computing the consumer's bill. Usually the consumer is required to pay a high (primary) rate, say, 15 cents per kw-hour, for 30 hour's (one hour daily) use of the amount of current indicated by the demand meter. All current used in excess of 30 times the maximum kw-hours is charged at a lower (secondary) rate, say, 5 cents per kw-hour.

Thus the consumer automatically fixes his rate on the basis of the demand he has made upon the system and the length of time he has used it, which is an equitable basis in that he pays for service in proportion to its cost. The high-rate portion of his bill covers the standing charge plus the running charge necessary to cover the current included in this portion of the bill, and the low rate portion covers only a running charge, all standing charges incident to the demand indicated having been covered by the high-rate portion of the bill. To illustrate the scheme, we will assume that the meter reader reports the maximum meter indication as 1 kw and the wattmeter registration as 60 kw-hours (two hours daily use of maximum). Applying the rates stated, we find the amount of the bill as follows:

30 × 1 kw = 30 kw-hours, at 15 cents	$4.50
Current in excess of 30 kw-hour, or 30 kw-hour, at 5 cents	1.50
	$6.00

Average rate per kw-hour, 10 cents. Had this consumer used 150 kw-hours, equal to five hours' use daily, instead of 60, his bill would have been $10.50 at an average rate of 7 cents per kw-hour.

The objections to this system of rates are the expense of installing and maintaining the demand meters, the possibility of a consumer creating a demand and then using a very small amount of current, thus not paying the cost incident to the demand he has created. This objection is of special importance when the maximum rate fixed by law or otherwise is comparatively low, say, 10 cents, as the number of hours' use of the maximum must be made greater than where the rate is higher, thus increasing the number of consumers who do not use their maximum the specified number of hours, and therefore do not pay adequately for the service they receive.

In case where the demand is equal to the connected load, such as signs, window and display lighting, demand meters are unnecessary, and if such lights are burned only during specified hours a straight meter rate can be computed which will be equivalent to that resulting from the application of the demand-meter rate.

There is a further objection to this scheme in that the demand is measured every month in the year, whereas it is the annual peak or maximum demand on the system which determines the fixed expense. However, the objections mentioned have not proved at all serious in practice, and the scheme as applied by many companies has worked out admirably.

The multiple-rate scheme is similar to the one just described, except that the connected load is substituted for the maximum demand as indicated by the maximum-demand meter. Thus the consumer who had 20 50-watt lamps connected would pay the rate for 30 hours' use of 1 kw, or 30 kw-hours, and the low rate for current in excess of that amount. Obviously if the full connected load is the basis used, the high rate per kilowatt should be less than in the example previously stated, or the number of hours' use required at the high rate should be less to produce equal results. Although 30 hours are the usual number, less than 30 being seldom used, it would seem better policy to reduce the number of hours rather than the rate, and thus limit the number of consumers who are short. In some instances where this rate scheme is used a fixed percentage of the connected load is taken as the basis instead of the entire load, but the percentage varies as between different classes of consumers, such as residences, stores, saloons, etc. The objections to this scheme are the difficulty of knowing what each consumer's connected load is, and what additions are from time to time made thereto. A further objection is that it discourages the liberal installation of lamps; but there are two sides to this argument, for if it discourages decorative lighting for use at Christmas time only, it is a good thing. This objection loses most of its weight if, instead of basing the rate on the entire connected load or a fixed percentage thereof, only the lamps installed in specified rooms, as parlor, living room, dining room, etc., are counted, leaving out the lamps usually installed for convenience rather than use in closets, stairways, basement, etc.

Under the Doherty "readiness-to-serve" scheme the consumer pays a fixed charge which is in proportion to the size of his installation, and an additional charge of, say, $1 per month, which is the same for all consumers. The fixed charge covers the items of constant expense as enumerated above and is the standing charge, while the $1 charge covers the expense of handling the consumer's account, meter expense and other items which are more nearly proportional to the number of consumers served than to the amount of current supplied or the load connected.

To the standing charge of from $24 to $40 per year per kilowatt connected, which may vary in different localities, is added, say, $12 per year per consumer, and, say, 5 cents per kw-hour as registered by meter. Although bills are rendered monthly, a rate of this kind is essentially applicable to annual contracts alone, for it is obvious that a consumer could not be carried through the month of December only for one-twelfth of the annual fixed charge without loss.

To illustrate the application of this rate, assume that a consumer has 20 50-watt lamps connected, and the meter indicates that 60 kw-hours (one hour daily) have been used, the monthly bill will then be at the minimum rate above.

Standing charge...	$5.00
Consumer charge...	1.00
Running charge, 60 kw-hours, at 5 cent-	3.00
	$6.00

The average rate is 10 cents per kw-hour. Had the meter registered 150 kw-hours, which is equivalent to five hours' use per day, the bill would have been $10.50, or an average rate of 7 cents per kw-hour. This rate obviously distributes the standing charge in direct proportion to the fixed expense whatever may be the load factor.

The objections to this scheme are that it may discourage the liberal installation of lamps and that consumers occasionally object to paying a specific amount per month, whether they use much or little current. An argument sometimes used with prospective consumers, especially power consumers, is that central-station service permits them to adjust their expense in proportion to the amount of business done, but the rate does not change on account of this argument. His fixed expense goes on just as if the consumer generated his own energy.

The one argument most frequently urged against all of the so-called demand-rate schemes is that so few consumers can understand them, but the very general adoption of such rates by central stations seems to indicate that this objection is not so important as many may have been led to believe. Numerous modifications of the scheme outlined have been devised, some perhaps for the sake of simplicity, but many for the purpose of adapting the scheme to assumed local conditions or the notions of the inventor.

Having established a rate on the basis outlined, whether it be according to one scheme or another, it may be modified to meet special conditions which arise from time to time, provided such modifications do not change the basic rates; in other words, each consumer pays the rate to which his load factor entitles him under the established rate regardless of the manner in which his bill is computed. For instance, a case may arise in which a consumer objects to paying a standing charge monthly, but will not object to guaranteeing a minimum use of current per year with a specified demand at a fixed price per kw-hour. It frequently happens in such cases that a consumer's annual load factor can be estimated very closely and a satisfactory contract made on such a basis.

It is common practice to allow a discount from the low rate or running charge portion of the bill if the bill exceeds specified amounts, the rate of discount increasing as the bill increases. This is a concession to the large consumer which is justifiable if the concession does not exceed unreasonably the difference in the cost of serving the large consumer as compared with the smaller. Lower rates are regularly made to large consumers than to smaller, regardless of load factor, and are seldom questioned; but there is no equitable reason for such concession beyond that warranted by lesser cost of service, although it is a general opinion that the courts would sustain them on the grounds of competition, either actual or possible.

The sliding scale of discount for quantity rates is seldom questioned, although a less equitable scheme, especially as applied to sales of electricity, could not be devised. This is the time-honored and accepted scheme of water rates, which perhaps accounts for its being tolerated so generally when applied to central-station service. A moment's consideration of the sliding scale is enough to condemn it. It places a premium on wastefulness. It is impossible to devise a schedule which does not at every step offer an opportunity to consumers to get more energy for less money.

The mention of water rates suggests flat rates, which are perhaps deserving of a moment's attention. Since the advent of satisfactory wattmeters, flat rates have practically disappeared, except in special cases. They are used in small towns for installations of a few lights where the expense of meter installations and maintenance is considered too great. Electricity generated by water power is frequently sold at flat rates to mills and factories, the charge being based on the maximum demand and a specified number of hours' use per day. Flat rates for sign and window lighting are daily coming into more general use, and are based on the prevailing meter rates with specified load and hours of burning, the switching being controlled by the central station.

Referring again to the demand-rate schemes, it is general practice to reduce the secondary rate as the load factor improves; in fact, the multiple-rate schemes sometimes cover 8 or 10 secondary rates, each applying to a specific portion of the energy used. Usually power and light are sold on different schedules, the rates for power being generally the lower, as is customary when applying straight meter rates. Rates for power may reasonably and equitably be lower than for light because of the generally better load factor, and the fact also that the demand made on the station is not necessarily coincident with the annual peak, whereas with light it is quite certain to coincide. The diversity factor is greater with motor load than light. Special rates are sometimes made for motor load

which is entirely off the peak, and there is no doubt that such rates can be made equitable, but, excepting rare cases, satisfactory contracts are difficult to arrange. Switchboard sales, or what may be called sales of "raw product," are generally made under special rates. "Special rates," a phrase that should be eliminated from the rate-maker's vocabulary in dealing with the public, as here used refers to rates made for service rendered under extraordinary conditions which are not covered by the established rate schedules. The public generally has little faith in rate schedules and believes, through misconception and the failure of central stations to adopt equitable standards, that each consumer's rate is the measure of his ability to drive a good bargain.

In conclusion, we should remember that the charge for service rendered should bear some relation to the cost of rendering it. That the straight meter rates cannot possibly approximate the cost of service. That differential rates have been held equitable and legal in many decisions, and should be required where the difference in the cost of supply exists. That as public servants we must not favor one at the expense of another; that we must not sell to one at less cost and make good our loss by excessive profits from another. That while fully realizing the importance of acquiring and retaining the approval and confidence of the public, we must not for the sake of it sacrifice the basic principles which we know are essential to success, because there is public demand for something else.

DISCUSSION.

In the discussion of Mr. Wallace's paper, Mr. William L Clarke, of Paris, thought that the lighting schedule of charges in use in his own town was exactly what was characterized by the speaker as the most inequitable thing that could be devised. In self-justification he said that he did not devise it. Where he had devised rates they had been based upon the number of hours' use per day and he thought this the only equitable plan.

Mr. Frank J. Baker, of the North Shore Electric Company, said that a great many electric-light companies had taken the easy business which they may have thought was the profitable business because they obtained a comparatively high rate for it, but which is, as a matter of fact, the most unprofitable business they could take. It is now necessary to take the business which requires lower rates and yet be able to make that low rate in a manner which is subject to explanation and legal defence, if necessary. It is difficult to disturb rates which have been existing for years, but opportunities present themselves in new customers and especially in the power business. The salvation of an electric light company in a small town is in a 24-hour service and power business. In regard to the Doherty rate, in which there is a fixed charge per horse-power on motors installed, Mr. Baker said that one of the strongest arguments made to the manufacturer on electric power is that its cost will go up and down in the same manner as his own cost of production. A manufacturer does not like to tie himself up to a fixed charge which he will have to meet whether he has good business or poor business. His company has a power rate of 10 cents per kw-hour for the first 30 hours' use per month of the connected load; five cents for the second 30 hours' use of the connected load and three cents for the third and all continuing hours' use.

Mr. Kingman said that a scientific way of selling energy is the only way. The great difficulty is to show customers and have them see that the method is just and equitable. It is here that we will get benefit from regulating commissioners. When a commission shows that a rate is just, equitable and based on scientific principles, companies will be able to get closer to the public. Otherwise, the public might feel skeptical.

Mr. Clarke, of Paris, spoke of the possibility of making a lower rate for power business which will not be on during lighting hours. He spoke of a 45-hp motor in a grist mill on a contract of this kind, the owner of the mill of his own volition shutting the mill down before dark. In case he wants to operate longer hours, he [illegible] The rate on this customer [illegible] with a minimum bill of $45 per month. The central station operates an exhaust heating system and obtains coal for $1 per ton, delivered.

Mr. Frank J. Baker also called attention to certain industries which cannot by any possibility operate during lighting hours. For example, stone quarries not equipped with artificial light. Practically every stone quarry within 30 miles of Chicago is at present figuring on equipping with electric power. His company has one customer of this kind taking 400 hp, and is figuring with four others. The question of using electric power for stone quarries he believes could be called settled. Mr. Wallace called attention to the fact that brickyards are usually on the non-peak class also.

INTERIOR WIRING AND ILLUMINATION

Wiring a Finished Dwelling Without Defacement.

There have appeared in these columns from time to time articles on the wiring of old buildings, particularly with reference to minimizing the amount of cutting and the damage to decorations, etc. The number of new buildings in a city bears no comparison with the number of old buildings, and the latter are near existing street circuits, which is not always the case with new dwellings. To be sure, there is no hope of installing electric lamps in many of the old buildings; but in a large percentage of these electric circuits could be installed were it not for excessive first cost in many instances, coupled with the dam-



[illegible] DRAWING ROOM.

[illegible] obstructions attending the installation of wires. With reference to the high first cost of installation, it [illegible] contractors who have made a specialty of wiring old buildings and who have succeeded in [illegible] lowering the cost of wiring such structures [illegible] in excess of what it would have cost to wire the building when new. The cost is somewhat greater in wiring a building with a view to minimizing the damage to walls and decorations, since much more wire and labor are required in getting around obstructions, which would not have to

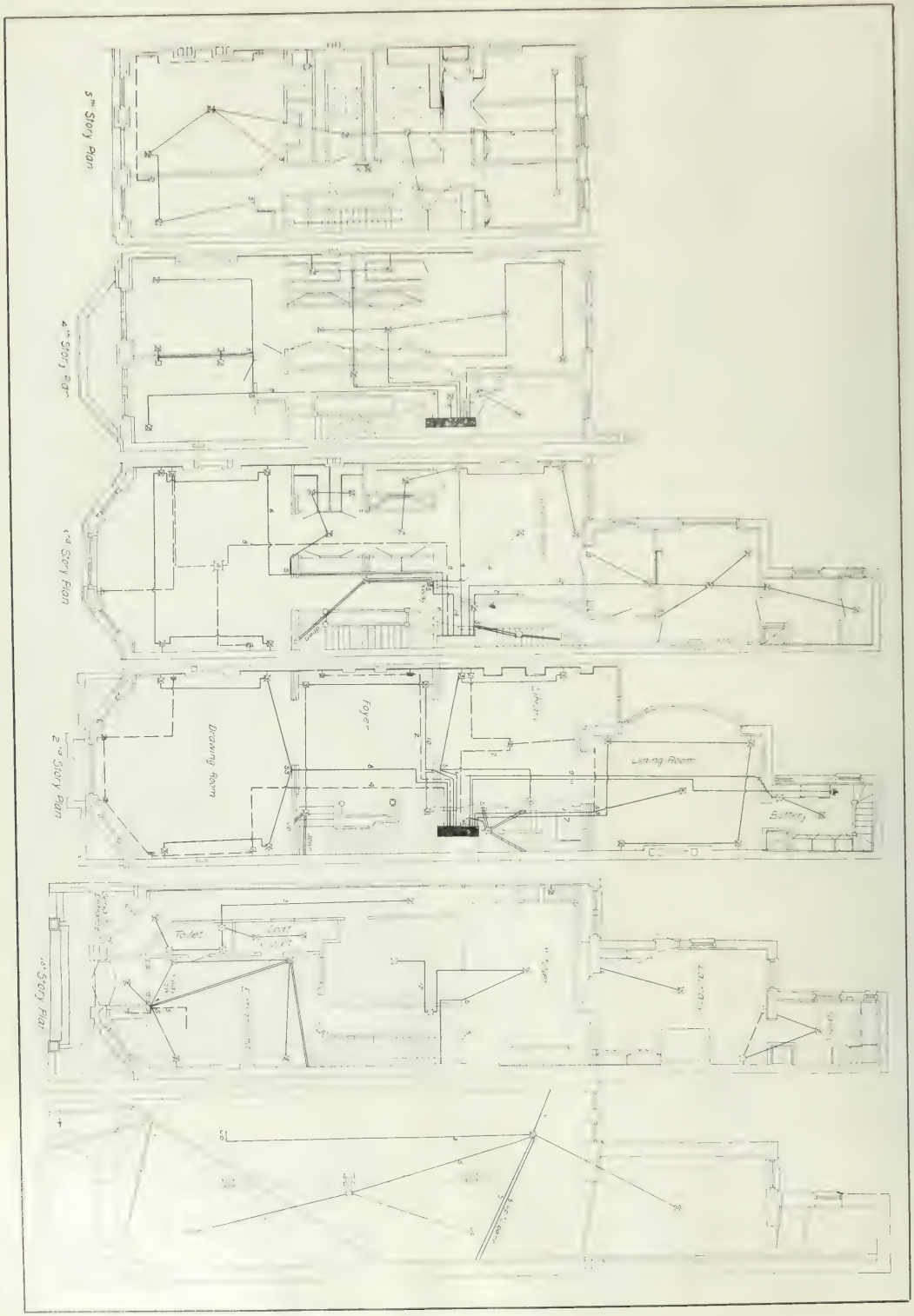


FIG. 2. WIRING DIAGRAMS OF THE VARIOUS FLOORS.

be wired around were cutting and patching permissible or if the building were being erected.

An excellent example of a house wired from top to bottom without damage to walls, ceilings or decorations is given in the Colgate residence on West Seventy-sixth Street, New York City.



FIG. 3.—SWITCHES IN HARDWOOD WAINSCOT OF DINING-ROOM

This is a five-story dwelling located in one of the most fashionable sections of the city, and the work of wiring it was entrusted to Messrs. Peet and Powers, of New York. There are in the neighborhood of 150 outlets in the ceilings, walls, baseboards and floors, and one ignorant of the actual conditions could not but believe that the dwelling was wired when it was erected. That the installation of the wires under the stipulations was not an easy task may be inferred from the plan view of the various floors shown in Fig. 2; but that the work did meet the conditions of sparing the walls, ceilings and woodwork from

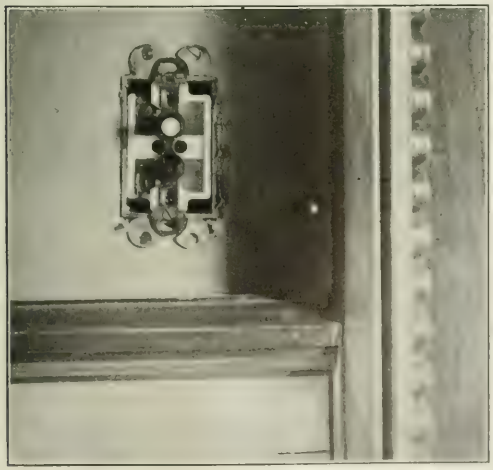


FIG. 4.—SWITCH IN OWNER'S BATHROOM

damage and defacement is evident from the various views shown herewith.

The energy for the lamps is taken from the underground street mains of the local electric light company. Two panels are provided, one on the second floor which controls the circuits in the cellar, first floor and second floor; and one on the fourth floor which controls the circuits on [illegible] floors.

immediately above and below it. The panels are placed in closets at the head of the stairways and flexible armored cable was used throughout in wiring. The house has furring strips between the lath and timbers and between the lath and walls so that fishing from pocket to pocket in floors was rendered easy. In the diagram the various circuits are numbered, and with few exceptions there are 12 lamps on a circuit. In placing the base receptacles, switch boxes, etc., holes were cut just large enough for the box in each instance, and the wires were fished from outlet to outlet in many cases, and from outlet to pockets, and from the latter to other pockets or to switch boxes, etc., as the case might be.

Fig. 1 is a view of the drawing-room, in which four three-lamp brackets and five two-lamp base receptacles are installed. These are fed from circuits No. 8 and No. 4, respectively, and the bracket lamps are controlled from switches on the jamb of the rolling doors leading into the room. The base receptacles are wired from the floor, a pocket being taken up under the receptacle and a number of pockets made in the floor to facilitate the installation of the cable. The illustration shows the fish wire and cable pulled from a pocket cut to wire the lamps in the ceiling outlet in the entrance hall of the floor below. The bracket lamps in this room are also wired from the floor below, the outlet being first set and the wires fished. The circuit runs from the panel board on that floor to the switches, being placed under the floor and brought up between the partition in which the doors roll to the switch outlets. From here the circuit descends to the floor again, running between the lath and timbers to a pocket and thence over between timbers to a pocket under the bracket whence it is fished to the outlet. The drawing room is elaborately decorated and the illustration shows that the only defacement were the pockets in the hardwood floor. The pockets were made very small, and the wood was fitted in place again by a carpenter so as to leave no trace when the spot was refinished. The fixtures, of course, covered the boxes for the bracket lamps, and the plates for the base receptacles obscured the outlets for the latter. There are no ceiling outlets in the drawing room.

Fig. 3 shows the outlets in the hardwood wainscot for the switches controlling the lamps in the dining-room. The bracket lamps are fed from circuit No. 7, and the ceiling outlet for six lamps is fed from circuit No. 1, which also supplies energy to



FIG. 5.—BRACKET OUTLET IN OWNER'S BEDROOM

lamps in the kitchen on the floor below. A special circuit, No. 11, is run from the panel board to an outlet in the pantry back of the dining-room for heating circuits. The base receptacles in the foyer hall are connected to circuit No. 2. The brackets, base receptacles and floor receptacles in the library are fed from circuit No. 6. Circuit No. 9 runs to the pantry back of the dining-room and thence down to the bracket in the kitchen on the

floor below and to a ceiling outlet in the passage in the rear of the kitchen. A base receptacle in the dining room and another in the kitchen are also connected to this circuit. The entrance hall brackets are connected to circuit No. 8 and the brackets in the foyer hall are tied from circuit No. 10. There are 12 circuits in all which are led from the panel board on the second floor.

Fourteen circuits run from the panel board on the fourth floor, one circuit being left blank. There is nothing special in the wiring of these floors except that some very fine instances of fishing from outlet to outlet are shown. The bathroom adjoining the owner's chamber is fitted with tile wainscot and tile floor. The roof being directly overhead, it was necessary to fish up from the switch outlet, shown in Fig. 4, to the two-lamp bracket outlet on the wall opposite. The circuits in the bedroom and bath to the rear of this bathroom were similarly fished, there being no hanging ceiling overhead, and it being out of the question to cut the roof. The switch circuit to the two-lamp bracket does not run from the door jamb indicated, but from the other side of the door near the wash basin, so that the fish wires were manipulated in the same vertical plane and not at an angle as the engraving would indicate. The setting of the switch box is admirably shown in Fig. 4. The engraving also



FIG. 6.—CEILING OUTLETS IN BEDROOM.

illustrates with what nicety the wall was cut and the box set. The switch plate covers the box in a manner leaving nothing to be desired so far as finished appearance is concerned. Fig. 5 also shows how a decorated wall in the owner's chamber was cut and the bracket outlet installed. The box fits exactly and one would be justified in imagining that the wall was decorated after the box was installed, but such was not the case. A view of the large front bedroom on the fifth floor is shown in Fig. 6. In the ceiling of this room are a center chandelier outlet and a two-lamp outlet directly over where a dresser will be placed. The plan view shows how these circuits are run and the photographic view shows that the ceiling was not cracked or marred by the installation of the electric circuits.

The entire installation is a model of its kind. The owner being a wealthy man, expense did not figure to a very great extent, although there was no waste of time nor was the price per outlet excessive for the work performed. The dwelling is elaborately furnished and decorated, and while good workmanship was required in running the circuits and setting the outlets, etc., the nature of the work was such that any first-class [illegible] accident and [illegible] it in the same manner.

New Telephone Patents.

TELEPHONE RECEIVER.

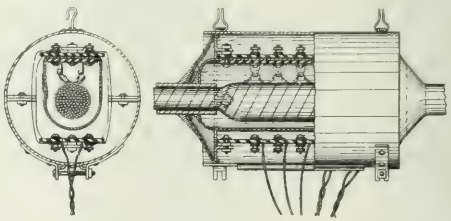
In the telephone receivers heretofore manufactured, the diaphragm has been so positioned with regard to the field as to be continually under strain due to the pull of the field. In some instruments the diaphragm has even been initially dished against this pull. In a receiver invented by Mr. N. Baldwin, of Heber, Utah, the normal fields are balanced, in so far as concerns any action across the plain of the diaphragm. To accomplish this result the soft iron pole pieces are U-shaped and the edge of the diaphragm lies between the two legs. The base of each leg is attached to its own pole of the polarizing permanent magnet, thus the pull from the pole pieces is practically nil across the diaphragm, as the opposing pole faces are of the same polarity. The receiver windings are carried by the legs of the U-shaped pole pieces, and are so arranged that the telephone current augments one pole and decreases the other to cause the response of the diaphragm. This change takes place at both pole pieces simultaneously and in such a manner that the two poles assist each other in causing vibration of the diaphragm.

ADJUSTABLE DROP.

Mr. E. E. Yaxley, of Chicago, has been granted a patent for an improved adjustable drop. The drop is arranged with a tubular shield and the armature is presented to the front or mounting end of the coil. This arrangement enables the coil or any replacing coils to be slipped in freely from the rear. Coils are secured by a pin and slot having the form of a bayonet catch. The coil cores are bored out to form a receptacle for a spiral spring, opposed to the armature's action and adjustable from the rear by a screw driving down upon the rear end of the spiral spring, and transmitting its pressure against the motion of the armature, thereby effecting an adjustment. The Monarch Telephone Manufacturing Company has obtained this patent by assignment.

CABLE TERMINAL.

A new form of cable terminal for aerial use is shown in the accompanying illustration. This terminal is designed for mounting directly in the cable, so to speak, and to afford terminals for a multiple tap. A glance at the sectional portion of



M'MEEN CABLE TERMINAL.

the drawing shows just how the lead sheath is sealed into the terminal, how the wires are attached to the terminals in the sealing cover, etc. The terminal is provided with hooks for its support from the messenger. Mr. J. E. McMeen, of Galesburg, Ill., is the inventor of this terminal.

ANTISEPTIC DEVICE.

A patent granted to T. M. La Jord, of New York City, describes an antiseptic device of rather novel construction. A piece of fairly stiff cardboard is punched out in special form and then by folding is made into an antiseptic container adapted to clamp itself over the transmitter mouthpiece. The cardboard when folded is square; when cut it becomes a cross. Thus, to make the square, the four arms of the cross are folded back upon the center. The edges of the flaps thus made are cut to form a circle somewhat smaller than the transmitter mouthpiece and they are held together by an elastic band caught in notches in their edges. A window is cut in the center of the

cross. The antiseptic screen is placed behind this window. In use, the flaps are sprung over the mouthpiece and the pressure of the elastic band holds the device in position.

FIRE-ALARM ATTACHMENT.

G. F. Milliken, of Boston, and F. W. Cole, of Newton, Mass., have jointly patented a combined automatic fire alarm, burglar alarm and telephone system. Through the agency of special relays and interrupters, the alarm contacts are made to superimpose upon the telephone system distinctive signals to indicate the class of danger existing in any emergency.

LETTER TO THE EDITORS.

The Electromagnetic Gun.

To the Editors of Electrical World:

SIRS:—In all of the criticisms of the electromagnetic gun I have yet to find one that considers the possibilities of the flywheel. For example, a 10-kw motor in 15 minutes could store up in a flywheel 9000 kw-seconds of energy—equal to 6,640,000 ft.-lb. A flywheel having a weight of 21¼ tons would store this amount of energy at a velocity of 100 ft. per second on its circumference of gyration. Suppose, that on the shaft of the flywheel there were placed a generator of small resistance and compensated inductance. If the circuit of this generator were suddenly closed through proper solenoids it should be able to furnish a speed of 2000 ft. per second to a projectile weighing 106 lb., assuming no losses. The length of gun required would depend on the inductance and resistance of the electric path, which determines the time-constant—the time in which the current would rise to a value equal to $0.632\,E \div R$—if the impressed voltage were kept constant. The impressed voltage in this case would not be constant because the flywheel must decrease in speed in order to give off its stored energy. The inductance effect could, of course, be partly cut down by capacity. The details of this effulgent device can be worked out by those who have the time—and the courage.

CHICAGO, ILL. H. S. QUACKENBUSH, JR.

[An outfit consisting of a 10-kw motor, a 21-ton flywheel having a peripheral velocity of 7000 ft. per minute, coupled to a generator (the size of which our correspondent neglects to specify) capable of transferring the energy from the flywheel at the instantaneous rate of, say, 18,000 kw to an electromagnetic gun 500 ft. in length, or 180,000 kw to a gun 50 ft. long, could hardly be considered a commercial competitor to a self-contained gun of the time-honored type 25 ft. in length weighing less than 10 tons, and requiring a charge of powder weighing 42 lb.—EDS.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Brush for Rectifiers.—A note on a British patent (25,624) of M. Walker for the construction of a brush for commutators and rectifiers or "permutators." To prevent sparking, the collecting brushes are moved into such a position relatively to the magnetic field that the e.m.f. produced in the short-circuited coil is sufficient to entirely reverse the current. If the e.m.f. is too large, however, "over-commutation" will occur, as the reverse current will be larger than the armature current. To prevent this action the inventor employs a double brush, between the two halves of which an "electric valve" is placed. The valve thus prevents the current from reversing, while the coil is short-circuited.—Lond. *Elec. Eng'ing*, Dec. 17.

Lamps and Lighting.

Regulation of Arc Lamps.—J. TEICHMÜLLER.—The first part of an illustrated paper in which the author endeavors to give an exact explanation of the principles which determine the regulation of arc lamps with inclined electrodes, placed side by side, and with an electromagnet for deviating the arc. The usual explanations of the regulation of arc lamps assume electrodes of ideal uniformity and with a perfectly steady arc. The author's theory takes into account the disturbances which are always present in practice. The paper is to be concluded.—*Elek. Zeit.*, Dec. 17.

Filaments from Refractory Oxides.—A note on a British patent (25,655) of E. von Seemen, for making conducting filaments from such oxides as alumina, silica, lime, magnesia, or compounds of these. This result is accomplished by fusing these materials with a small quantity of an oxide of the iron group in the presence of oxygen. A filament, made of, for instance, from 85 per cent to 90 per cent of magnesia, alumina or silicate of magnesia, with from 15 per cent to 10 per cent of iron or chromium oxide, is a good conductor.—Lond. *Elec. Eng'ing*, Dec. 17.

Generation, Transmission and Distribution.

Electric Winding in Mines.—G. HEDLEY.—A paper describing the electrical winding system used at the Maritime pit of the Great Western Colliery Company. This is the first electrical winding engine [illegible] South Wales, and for that matter in the United Kingdom, being required to wind 175 tons [illegible] 1110 ft. in 70 winds. Given favorable conditions as to loads, depth and, above all, banking conditions, combined with a low price for electrical energy, it could be shown that electric winding could be performed, at least as safely as, and at no greater cost than, with steam. Among the points which had altered the conditions in favor of electric winding might be mentioned the increasing value of small coal in South Wales and the decreased cost of electric energy. It was a controversial point as to the price at which energy could be supplied, but he claimed to have obtained figures varying between 0.5 cent and 0.8 cent per kw-hour, including 10 per cent for interest and depreciation with colliery power stations varying between 1000 kw and 5000 kw installed, using coal at $2 per ton. Electricity supply company figures were generally somewhat higher, but they might be expected to come down to the figures stated in the course of time. As regards the winder under notice, the Westinghouse system was adopted, whereby a three-phase motor was used capable of receiving energy directly from the mains. The absence of recuperative energy with this system was met by an ingeniously designed drum, which, if properly handled, stopped without any braking being required after the current was cut off. The plant had been in continual use for about four months, and the engine had proved to be easily able to deal with the requirements. The cost of winding at one trial was brought down well under 4.46 cents per ton, which steam winding would have cost.—Lond. *Elec. Review*, Dec. 11.

Coal.—W. JONES.—An article giving some fundamental considerations on coal. In selecting coal it is necessary to consider the work for which it is intended: the coal of the highest heating value is not always the best for every purpose. To burn coal successfully the furnace must be designed according to the [illegible] make frequent analyses of the gases in the flue. In the case of soft coal the [illegible] to 15 per cent of CO_2.—*Electrochem. and Met. Ind.*, January.

Hydro-Electric Power in Australia.—J. S. SCOTT.—The author gives data on some hydro-electric installations in Australia; 1300 hp [illegible] at Launceston, Tasmania; 3300 hp at [illegible], New Zealand, and 250 hp at Hillgrove, New South Wales, [illegible] water. Australia is singularly lacking in natural water power. It is shown, however, that it [illegible] opportunities for impounding water by erec-

tion of dams both for irrigation and power purposes.—Lond. *Elec. Engineer*, Dec. 11.

Superheat.—J. P. Fletcher.—The author discusses the relative advantages and disadvantages of integral and separately fired superheaters. He is strongly in favor of the integral system.—Lond. *Elec. Engineer*, Dec. 11.

Producer Gas.—O. Nagel.—An illustrated article describing several furnaces for operation with producer gas for use in chemical and metallurgical industries.—*Electrochem. and Met. Ind.*, January.

Traction.

Regenerative Braking with Series Motors.—A note on a British patent (22,868) of the British Thomson-Houston Company for regenerative braking with direct-current series motors. The armature and the field circuits of each motor are connected in series as usual, but the voltage across the field coils is varied by means of a special source of supply. In this way a definite speed is fixed, below which the machine runs as a motor, and above which it runs as a generator; in each case the machine runs with a series speed-torque characteristic. To supply the extra field excitation, a homopolar machine, with a set of collector rings for each motor, is provided. Series-parallel control of the motors is possible, as usual.—Lond. *Elec. Eng'ing*, Dec. 17.

Suspended Railways for Industrial Plants.—Von Harffstengel.—An illustrated paper on suspended electric railways (telpherage) for transmission of materials in industrial plants, especially in coke plants, metallurgical works, etc.—*Elek. Zeit.*, Dec. 17.

Installations, Systems and Appliances.

Electric Heating in Textile Plants.—Cremer-Chapé.—In textile works the cloth is pressed and simultaneously heated to get a smooth or bright surface. The author discusses the advantages of electric heating for this purpose and shows that this method is cheaper on account of saving of labor and also gives the best results.—*Elek. Zeit.*, Dec. 17.

Records of Mains.—J. W. Beauchamp.—An illustrated paper read before the Leeds section of the (Brit.) Inst. Elec. Eng. The author describes the methods of keeping records of the positions and nature of mains and services in use at Sheffield, and also proposes a more complete system. It involves a key map of the area, ordnance sheets and maps with indications of stations, feeders, etc., other diagrams, and card indexes and note books.—Lond. *Elec. Eng'ing*, Dec. 17.

Plate-Glass Switchboard.—An illustrated description of a plate-glass switchboard for the use of students, giving a complete view of the path taken by the electric current from the front and also showing the position of the switches from the back.—*Jour. of Elec.*, Dec. 19.

Wires, Wiring and Conduits.

Cheap House Wiring.—An article pointing out the dangers arising from the use of flexible cord wiring on walls. There is no objection to its use on ceilings, apart from esthetic considerations. But wires laid on the surfaces of walls need some kind of protection. "Some years ago a method of wiring in flexible metallic tubing was proposed. This is now slowly coming into use for motor wiring on machinery. . . . There are possibilities in this method for surface wiring in small properties. A good quality of flexible inside a small flexible tube would lend itself to quick work, and this metallic protection need only be used on walls, say, up to the cornice, where a multiple connection box would be fixed, from which the flexibles would start. Being metallic, the tube would need earthing. If there were a demand for it, a flexible fiber or papier-mâché tube could be made on the same lines as the flexible metallic tube, and such would be as safe as wood casing and much more easily and cheaply erected."—Lond. *Elec, Review*, Dec. 11.

Welding of Aluminum.—A note on a recent British patent (24,283) of M. U. Schoop on his process of welding aluminum, which consists in using a flux produced by adding fluorides of calcium, potassium or boron to a mixture of chlorides of alkali metals.—Lond. *Elec. Eng'ing*, Dec. 3.

Electrophysics and Magnetism.

Conductance.—An illustrated article giving formulas for finding the heat conductance and resistance of composite bodies. The problem is exactly analogous to that of finding the electric conductance of composite bodies consisting of several materials of different resistivity.—*Electrochem. and Met. Ind.*, January.

Selective Radiation from Various Solids.—W. W. Coblentz.—An illustrated account of an experimental investigation of the radiation from electrically heated solids, among them rods made from zirconium oxide, oligoclase, albite, orthoclase, beryl, rutile, porcelain, magnesia, glass, opatite and topaz. He also studied the emission spectra of various solids placed in the form of a paste upon a heater (Nernst "heater-tube"). Among the materials investigated in this way were zirconium oxide, cerium oxide, thorium oxide, and various other oxides and mixtures of oxides. In general the results on the oxides furnish an excellent illustration of the shifting of the maximum of intensity of emission toward the short wave lengths with rise in temperature, just as is known for metals which emit continuous spectra. In this respect the various emission curves of zirconium oxide are particularly conspicuous. In addition to what may be termed "general emission," in which the maximum shifts with rise in temperature, the curves of zirconium oxide are unique in having a sharp band of selective emission which neither shifts nor broadens with rise in temperature. Many of the oxides have an emission band in common in the region of 2.85 μ, and it is not impossible that this band be due to the oxygen atom which is in common with all of them. In a broad sense, the intensity and sharpness of the emission bands are a function of the electrical conductivity. The best insulators, e. g., the refractory silicates, the oxides of zirconium, erbium, etc., have the sharpest emission bands, while the better electrical conductors, such as the oxides of cerium, iron, zinc, etc., have a high emissivity but no sharp emission bands throughout the infra-red. The molecular weight of the base seems to affect the sharpness of the bands to as great an extent as does the electric conductivity.—*Bull. Bureau of Standards*, Vol. V, No. 2 (November).

Luminous Equivalent of Radiation.—P. G. Nutting.—A long theoretical paper in which the author endeavors "to establish a scientifically precise yet practically manageable relation between light and its sole measurable constituent, radiation."—*Bull. Bureau of Standards*, Vol. V, No. 2 (November).

Electrochemistry and Batteries.

Pump for Storage Battery Cleaning.—A description of a portable duplex pump, devised by F. Misling, for removing the

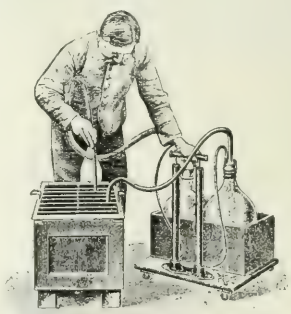


FIG. 1.—STORAGE BATTERY PUMP.

residue which collects at the bottom of accumulator cells, and at the same time filling in an equal volume of fresh acid. As shown in Fig. 1, it consists of two simple air pumps and two strong glass vessels, one for the residue and the other for the fresh acid. One pump compresses the air in the latter vessel,

the other pump exhausts the air from the former vessel. In neither case does the acid come into contact with the pump. The tube used for insertion into the cell is made of celluloid, and its shape can be readily altered by means of hot water so as to introduce it into any form of cell.—Lond. *Elec. Review,* Dec. 11.

Induction Furnace.—F. A. J. FITZGERALD.—An illustrated account of experiments on the efficiency of the induction furnace as a melting apparatus. The tests show the possibility of heating of the charge in the induction furnace very quickly. Curves give the variation of the kilowatts and of the power-factor during the experiment. The latter varied between 0.7 and 0.6. —*Electrochem. and Met. Ind.,* January.

Electric Steel Works.—J. W. RICHARDS.—An illustrated sketch of what is called the largest electric steel works, now being erected by the Girod Steel Company in Savoy. Twenty-two thousand hp of water power have already been developed. The furnace house contains at present two 2-ton furnaces and two 10-ton furnaces. The latter will be normally operated at from 8 tons to 12 tons charge, using energy at 60 volts and 32,000 amp. The normal output of these is reckoned at 50 tons per day, but there is room and corresponding works capacity for four times as many furnaces, and an eventual output of 200 tons per day. The smaller furnaces are intended particularly for making special and high-price steels, the larger ones for carbon and nickel steels.—*Electrochem. and Met. Ind.,* January.

Electric Smelting of Iron Ore.—J. HARDEN.—An article in which the author considers the smelting of iron ore in the electric furnace in comparison with blast-furnace practice. The comparative figures given show the impossibility of the electric furnace competing with the blast furnace under average conditions.—*Electrochem. and Met. Ind.,* January.

Aluminum.—An illustrated description of three new British aluminum works of the Aluminum Corporation, Ltd., and of the British Aluminum Company. The new bauxite works of the Aluminum Corporation are also described.—*Electrochem. and Met. Ind.,* January.

Aluminum.—M. DE KAY THOMPSON.—An illustrated note on a laboratory experiment on the electrolytic reduction of aluminum. The effect especially studied was the covering of the graphite anode with a film of gas which interrupts the circuit. —*Electrochem. and Met. Ind.,* January.

Ozone.—A. W. EWELL.—A note on the thermal production of ozone giving a description of laboratory experiments.—*Electrochem. and Met. Ind.,* January.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—An illustrated description of the Bolt Head station of the British postoffice, near Kingsbridge, South Devon. It will give facilities for communication with ships at sea, under the provisions of the International Radiotelegraphic Convention. Most of the apparatus installed is of the latest Marconi pattern. When working, both the transmitting and receiving circuits are connected to the antenna, and the same operator can receive while transmitting. This has been rendered possible by the use of a small spark-gap inserted in the antenna, across which the receiving apparatus is connected. During transmission, the current surges bridge this gap, which is then practically non-existing. Means are provided for automatically short-circuiting the telephone when contact is made in the transmitting circuit. Another novel feature is the provision of variable couplings in the high-frequency oscillation transformers for the purpose of enabling sharper waves to be produced. The receiving apparatus includes the latest pattern of the Marconi multiple tuner. A mast, 160 ft. high, supports an umbrella-type antenna of stranded copper wire.—Lond. *Elec. Eng'ing,* Dec. 17.

Reflections of Waves on Telephone Lines.—J. BIRKE. A mathematical paper, contributed from the German Telegraph Research Bureau. When a wave is transmitted over a telephone line, consisting of successive portions of different construction, then part of the wave is reflected at any joint where two different portions of the line are connected together. The author gives the fundamental formulas and discusses the following three cases, in which the line consists of two short different portions or of two long different portions or of a long and a short portion respectively. Under ordinary conditions of practice the reflections can be observed, but are hardly so detrimental as to require special provisions. In special cases, however, when loaded cables of the Pupin type are connected with overhead lines, it is to be recommended to make special provisions; otherwise unnecessary expense would be required for inductance coils, the effect of which would be counteracted in part by the reflections.—*Elek. Zeit.,* Dec. 17.

Units, Measurements and Instruments.

Fundamental Units.—F. A. WOLFF.—His complete paper on "the principles involved in the selection and definition of the fundamental electrical units to be proposed for international adoption." The paper deals chiefly with the question whether the ampere or the volt should be the second fundamental unit. In view of the preference indicated for the coulometer at recent conferences, the reproducibility of the cell and coulometer should first be definitely established by systematic international co-operation, which would also result in bringing to light unrecognized defects in the proposed specifications.—*Bull. Bureau of Standards,* Vol. V, No. 2 (November).

Weston Standard Cell.—F. A. WOLFF.—An account of an experimental investigation showing that Weston cells can be set up which exhibit extremely little hysteresis in the temperature range from 0 deg. to 40 deg. C., even when subjected to large and rapid temperature variations. Such cells maintain their e.m.f. values under prolonged heating or cooling. The relation between the e.m.f. E and the temperature t in degrees C. is best represented by the formula:

$$E_t = E_{20} - 0.00004075\,(t-20) - 0.000000944\,(t-20)^2 - 0.0000000098\,(t-20)^3$$

No indications were found of differences arising from the methods of preparation of the mercurous sulphate employed.—*Bull. Bureau of Standards,* Vol. V, No. 2 (November).

Electric Sounding Device.—A description of a simple sounding device of A. Schortau. As shown in Fig. 2, it consists of a chamber C, with corrugated walls, filled with mercury. Two resistor wires w and w_1 in a glass tube T dip into the mercury, and the whole is made watertight. The pressure of the water upon the flexible walls of the chamber drives the mercury up the tube to a distance depending upon the depth, thus short-circuiting a portion of the resistor wires and changing the resistance of the instrument. The resistance is measured on board ship, so that the depth is determined without hauling up the "lead." —Lond. *Elec. Review,* Dec. 11.

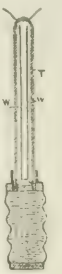


FIG. 2.—SOUNDING DEVICE.

Distributed Capacity of Resistor Coils.—S. L. BROWN.—The author refers to the recent attempt of Taylor and Williams to construct a resistor coil which would be free from inductance and capacity. This coil was made of No. 40 Advance wire, wound in a bifilar coil on a spool 12 cm in diameter. The wires were twisted together and consecutive turns were 5 mm apart. The twisting of the wires prevented the introduction of inductance by winding the wires into a coil. The separation of consecutive turns eliminated any measurable capacity that might be caused by the crowding of the wires into a compact coil. Therefore, the inductance and the capacity of such coil are reduced to the inductance and the capacity of the two wires lying side by side. Measurements which were made with this coil showed that the preponderance of either inductance or capacity was too small to be measured. The capacity was increased by immersing the coil in petroleum, thereby increasing the specific inductive capacity of the medium between the wires, and still no capacity could be detected. The presumption that the capacity due to the adjacent wires in the bifilar turns of an ordinary resistor coil is only a small fractional part of its total capacity seemed to be justified. Therefore it was concluded that the inductance and the capacity of the [illegible] ideal coil had been effectively reduced below

measurable quantities. The present author has constructed a similar coil and shows in this paper, both by the calculation and by experiment, that the coil is not free from capacity.—*Phys. Rev.*, December.

Terminal Apparatus in Telephonic Transmission.—L. COHEN.—A mathematical paper on the influence of terminal apparatus on telephonic transmission. In general, whatever influence the line may have in distorting a telephonic wave when the wave reaches the receiving instrument part of it will be reflected, and will merely dissipate itself on the line, and part will be absorbed and furnish the energy necessary to operate the instrument. Either portion of the wave, however, be it the part reflected or absorbed, is a function of the frequency, and therefore every harmonic is affected differently. This will necessarily produce a certain amount of distortion. The extent of the distortion that the wave will suffer in passing through the receiving instrument may under certain circumstances be considerable. The final expressions obtained by the author for the potential and current at the end of the line are of very simple form and convenient for numerical calculation of the distortion due to the terminal apparatus. In the case of a 30-km line it is found that the receiver increases the distortion, but that the introduction of a condenser will improve the transmission. There is considerable improvement possible in this direction. In the case of a 300-km line the receiver is found not to influence telephonic transmission materially.—*Bull. Bureau of Standards*, Vol. V., No. 2 (November).

Wireless Telegraphy.—H. POINCARÉ. The second lecture on the theory of wireless telegraphy. In the present installment the author deals with the study of the field in the neighborhood of the antenna.—*La Lumière Elec.*, Dec. 5.

Miscellaneous.

Switzerland.—Statistical tables on imports into and exports from Switzerland of electrical machinery and appliances in 1906 and 1907. The largest items are, of course, dynamo-electric machinery and transformers. The imports of 1907 had a value of $314,600, the exports $3,486,600.—Lond. *Elec. Rev.*, Dec. 11.

Continuity of Education.—F. P. FISH.—An address to the graduating class of the School of Mines of Columbia, pointing out that every graduate of a university should have the definite aim to continue his education throughout his life and should endeavor to broaden his interests in human affairs.—*School of Mines Quarterly*, November.

NEW APPARATUS AND APPLIANCES

Air Heater for Use with Live or Exhaust Steam, Hot or Cold Water, or Brine.

Air and water within the pipes are the bane of most steam air heater coils and radiators. It will be found that in many of them the steam is not forced to circulate positively through the coils, but can pass directly within the "header" casting from the inlet to the outlet without going through the pipes at all, and, contrary to the usual assumption, this very thing may happen if there is air in the pipes. The loops of pipe employed in such heaters, in fact, make nice air pockets. From an ex-

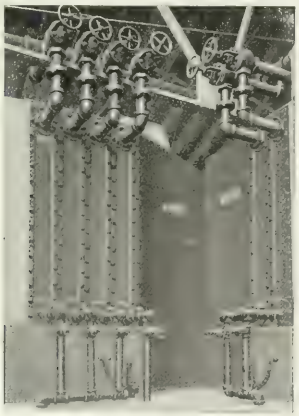
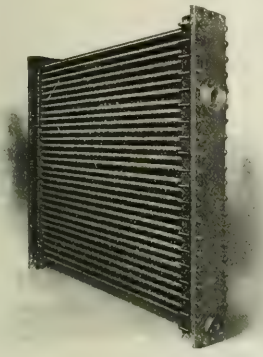


FIG. 1.—HOT BLAST HEATER

amination of the accompanying diagram showing the course of circulation in the Green steam air heater, it will be seen that the current of steam must flow straight ahead through half the tubes, then back through the other half down to the bottom outlet, driving before it any air that may be present. This is the natural direction of flow, since the air is heavier than the steam. With this heater, the preliminary "blowing out" sometimes practised for the removal of air is really effective. The heater, it is said, cannot become air-bound, and all of its surface is active in transmitting heat. Currents of steam and water are always in the same direction and, should water of condensation accumulate, it would be pushed through positively in the same manner that the air is pushed through, as before described. This positive circulation principle enables the steam heater to be used as a hot-water heater, or as an air cooler, since hot water, cold water or cold brine can be circulated continuously through the pipes and with small expenditure of power. The inlet and outlet openings are so placed that the same head or pressure acts upon each tube, insuring an even distribution of the circulating fluid. By arranging the sections in two groups and circulating cold water or brine through the one group and warm water or steam through the other, the heater becomes an effective air dryer, possessing an advantage in that the cooling process does not introduce into the air a mist of water particles. The cleaning of the heater, whether of oil, grease or scale, is simple and easy. After removing one or both of the headers the tubes can be swabbed or scraped out at once and by holding a candle at one end and looking through from the other, their condition is easily seen. The headers stand in a vertical position at the sides of the heater casing and when the covers are removed all the tubes are exposed in convenient position for inspection or cleaning or for removal or repair. The tubes are rolled into the headers like boiler tubes and can be removed or replaced by anyone who has skill enough to replace a tube in a boiler. If it is not desired to put a heater out of service for tube repairs, steam can be shut off from the injured section while the two ends of the defective tube are plugged. The cover plates on the tube headers also are easily replaced. They are held in position by a row of hood bolts, the threaded ends of the bolts projecting through holes in the header cover plate. The making of a joint has been simplified by substituting a rope for the usual gasket. This rope can be laid roughly in place in the groove without fitting, cutting or cleaning, and when the cover is drawn down tightly against it by means of the heavy hook bolts it is tight against the highest steam pressure.

The advantages described above relate to the individual heater sections. When using the sections of the heater assembled in hot-blast heating and drying outfits, or for similar purposes, other advantages appear. The individual sections are light, compact and easily handled. Their size and shape permit of their being introduced through narrow doors and stairways. The cost of an air tight wall on two sides of the heater is

saved, since the header covers fit close to one another, making a good joint and leaving only the bottom and top sides of the header stack to be covered or enclosed. If it is desired to protect the headers with a non-conducting covering this can easily be applied in large removable sheets, since, except for the bolts and nuts, the covers present a smooth and even surface. The sections can be so connected up that some will be



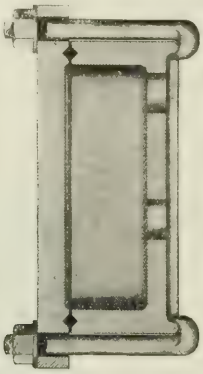


FIG. 2.—INDIVIDUAL SECTION OF HEATER. FIG. 3.—CROSS-SECTION OF HEATER HEADER.

using live steam, say, while others are using exhaust steam or hot water, the valves being so arranged that individual sections can be thrown from one system to the other at will. The heater is made by the Green Fuel Economizer Company, Matteawan, N. Y.

Clamp-Type Outlet and Ceiling Boxes.

The accompanying illustrations show the general construction and features of the clamp-type outlet and ceiling boxes manufactured by the H. Krantz Manufacturing Company, of Brooklyn, N. Y. Each outlet of the box is provided with a threaded extension, the inner edge of which is formed into an insulat

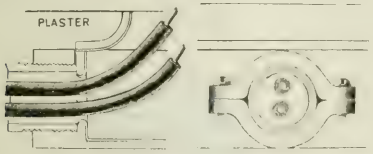


FIG. 1.—CONDUIT CLAMPED TO BOX. FIG. 2. END VIEW SHOWING CONDUIT CLAMP CLOSED.

ing bushing. The threaded end of the conduit is placed in the threaded extension of the box; the clamp is then placed over the conduit and fastened to the box by means of two screws, as shown. A feature of the box is that no bushings and locknuts are required. Moreover, the labor expense is lessened consid-

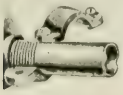
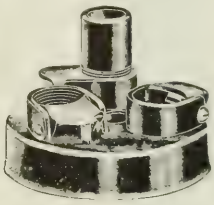




FIG. 3.—SIDE CONDUIT CLAMP. FIG. 4.—TOP CONDUIT CLAMP.

erably because of the clamping feature. The top conduit clamp used in connection with the ceiling box is shown in Fig. 4, and the ceiling box itself is shown in Fig. 5. This type of box is especially adapted for such work and is so constructed that all work in connection with the fastening of the conduit is performed from the inside of the box. This makes it possible to use the box without defacing the ceiling in any way. The hole in the ceiling being only the size of the box, the latter is set up to the conduit and the tightening of the set screw under the clamp, as shown, securely locks the conduit to the outlet box. The bracket box is shown in Fig. 6. It is made of sheet steel and stamped in one piece. The lower portion of the clamp is rigidly secured to the box by means of wings which are





FIGS. 5 AND 6.—CLAMP TYPE CEILING AND BRACKET BOXES.

riveted on the inside. The covers are fastened with four screws to ears on the inside of the box, which is adaptable for both ceiling or wall outlets, and is made with various combinations of outlets. The boxes may be obtained with porcelain lining, which forms an insulating coating that is moisture proof and is not affected by chemicals. The enamel is smooth and hard and adheres to the iron well, a sharp blow being required to chip it. The enamel cannot be cracked by screwing the pipe into the fitting unless enough force is used to split the fitting.

Oil Circuit-Breakers for Use in the Motors.

The oil circuit-breakers illustrated herewith, being intended for use with induction motors, have been so built as to withstand abuse from inexperienced operators. The breakers consist merely of a standard knife switch immersed in oil, with the addition of several arcing contacts for the protection of the main contacts. The auxiliary contacts are made removable, so that they can be replaced should they be burned away in the course of time. The circuit-breaker is made for either switchboard or wall mounting. Fig. 1 shows a circuit-breaker of the latter type, with a single overload coil, and low voltage release. The purpose of the latter is to disconnect the motor from the line should the current supply be interrupted for some



FIG. 1.—CIRCUIT-BREAKER WITH COVER REMOVED.

reason. The operating links are so constructed that it is impossible to close the circuit-breaker while either low-voltage or overload conditions exist. In some cases a panel is provided for mounting an ammeter above the switch, as shown in Fig. 2. The circuit-breakers are made in either two-pole, three-pole or four-pole combinations for currents up to 200 amp, for 600

volts or less, and for currents up to 100 amp for 2500 volts. For the higher voltages barriers of hard fiber are mounted be-

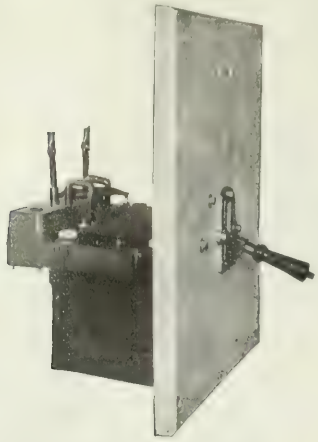


FIG. 2. OIL CIRCUIT-BREAKER.

tween the switch blades to prevent arcing across. These breakers are built by the Hartman Circuit Breaker Company, Mansfield, Ohio.

Electric Heating Iron.

The accompanying illustrations show the features of the electric heating iron made by the Pelouze Electric Heater Company of Chicago, Ill. The electricity is controlled at the iron by a simple motion of the hand and when not in use the iron is tipped back until it rests on the end of the handle and the switch is pushed down to cut the iron out of circuit. The heat-





FIG. 1.—POLISHING IRON. FIG. 2.—IRON AS DISK HEATER.

ing element is complete in itself, including all contacts, and is easily replaceable. When furnished with a support the iron can be converted into a stove or heating disk. The heating element is composed of a coil wound in a flat plane and it operates directly on the bottom of the iron. The heat is so distributed that while the body of the iron is uniformly heated, the point





FIG. 3.—COMPLEMENTAL PARTS OF IRON. FIG. 4.—METHOD OF CONTROL OF TEMPERATURE.

and the edges receive extra heat, so that delicate work can be performed without danger of scorching from an overheated center. The iron, which is balanced and has a handle supported only at one end, requires 3.8 amp at 110 volts. It is built in three sizes, has a bottom temperature of 500 deg. Fahr. and is said to be quick starting; that is, ready for work in three minutes.

Separately-Excited, Revolving-Field, Belt-Driven Alternators.

In the generators illustrated herewith the field structure consists of laminated pole-pieces dovetailed into a laminated iron spider, the punchings being stacked and riveted together. Two methods of building the field coils are used. For the 50-kw and 75-kw sizes the wire is wound on spools which are slipped over the pole-pieces and held in place by the enlarged pole tips. In the larger sizes the field coils consist of a single strip of flat copper wound on edge so that one surface of every turn is exposed to the air. This construction permits effective insulation

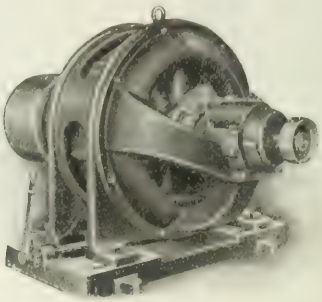


FIG. 1.—BELT-DRIVE ALTERNATOR.

between each turn of the field winding and insures a low temperature in operation.

The collector rings for the field circuit are mounted on insulating bushings located on the shaft and are exposed to the air on all sides. Two or more carbon brushes are provided for each ring.

These generators have been especially designed for use in isolated plants where mixed lighting and motor loads are the rule rather than the exception. It is practically impossible in such cases to obtain good voltage regulation by hand control, and some form of automatic voltage regulator must be used. For this service the makers recommend the Tirrill regulator for automatically varying the field current, so as to maintain prac-

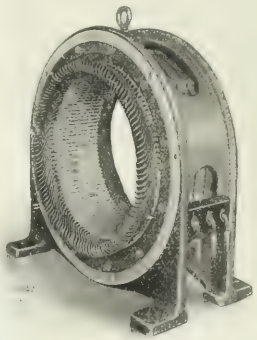


FIG. 2.—ARMATURE OF ALTERNATOR.

tically constant voltage at the busbars, or at the center of distribution, as may be desired. When intended for operation as synchronous motors, the machines are equipped with a squirrel-cage winding located in the revolving-field pole-pieces, so that they may be started from rest as induction motors. These machines are built with either two-phase or three-phase windings and for 240, 480, 600, 1150 and 2300 volts by the General Electric Company, Schenectady, N. Y.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Holiday quiet has been predominant in trade during the past week. It is always the case that business is practically stagnant between Christmas and New Year's. The big buying which usually occurs in retail lines just before the holidays practically exhausts the resources of purchasers. In jobbing and wholesale houses there is litttle being done except inventory taking. It is the habit of all such establishments to spend the last week of the year taking stock of what has been done and preparing to start afresh with the beginning of the new year. Dullness at this time is, therefore, not surprising and is, in fact, anticipated. Taken altogether there is a distinct note of optimism as to the future. While the more intelligent observers do not expect any great boom in business during 1909, they do anticipate a steady increase in all lines of legitimate trade until the normal basis of 1906 and of the early portion of 1907 is attained. This may be retarded for some months by the agitation of the tariff. It is not believed that it will be seriously interfered with by any action that Congress may take in regard to lowering duties. Business men are confident that while tariff rates will be materially reduced there is little likelihood of their being cut at any particular point to a sufficient degree to interfere with legitimate business. The only serious trouble that is feared is a prolonged discussion of the matter. What merchants want and what manufacturers want is a speedy settlement. It is the uncertainty that retards business, that causes all branches of industry and trade to feel like waiting until the basis is fixed. It is pretty well known that wholesalers and retailers alike are lightly stocked. This, of course, means that heavy purchases will be necessary when the consuming public begins to demand goods. The only real active market during the past week was that of raw wool. In Boston there were large sales made of Western fleeces—estimated to be about 10,000,000 lb.—and the price is higher and firmer. This, of course, indicates that the manufacturers of woolen goods are preparing for active work during the coming season. There were few orders for iron and steel products recorded during the week, and in the rail market it appears that all prospective purchasers have been holding off in order that their contracts may be made in 1909. Business failures for the week ended Dec. 30 numbered 299 against 222 the previous week, 345 in the week which ended Jan. 2, 1908, 185 in the similar week in 1907, 220 in 1906 and 278 in 1905.

THE COPPER MARKET.

During the last few days of the old year there was a trifle more activity displayed in copper, although the sales for domestic consumption were small. There was some renewed activity in Europe, which, of course, stimulated the local market to some extent. There were in this market considerable amounts taken by the foreigners for January shipment, and there were also some sales made for February and March exportation. The takings of domestic consumers were confined to small lots, although the wire drawers and electrical manufacturers were in the market to some extent. In the last two days of 1908 probably 3,000,000 lb. were sold in this market, but a good portion of this was arbitrage business where purchases were made here to cover speculative sales made in Europe. The appearance of the report of L. C. Graton, of the United States Geological Survey, for 1907, an abstract of which will be given next week, made its appearance, but caused little interest. The figures are only valuable for showing how right and how wrong the previous estimates have been and for the frank admission that no figures are very accurate under the present loose methods of collecting returns. One of the most important figures contained in the report is that at the beginning of the year there was a stock on hand of 1,235,745,000 lb. This figure is particularly interesting in connection with the advance estimate of 1908 statistics which the government gave out Dec. 31. These calculate, in round numbers, that the production in the United States in 1908 was approximately 900,000,000 lb., or about 30,000,000 lb. more than in 1907. The imports for the year have been at least 210,000,000 lb., which, taken together with the carry-over on Jan. 1, 1908, make a total stock of copper of 1,235,000,000 lb. which came in sight during the year. The exports for the year are about 650,000,000 lb., and according to the best estimates of local statisticians, the domestic consumption has been 372,000,000 lb. Deducting this estimated disposition of copper from the known supply, we have left in stock on the first of January, 1909, in this country 213,000,000 lb. As has been previously stated, the accumulations in Europe amount to something like 225,000,000 lb., so that there is apparently a surplus of 438,000,000 lb. for the consumers of the world to draw on. These figures will, of course, be denied by the producers and selling agencies, and there is no guarantee that they are accurate. It must be remembered, however, that they are the best that can be collected; that they are gathered by an entirely disinterested agency and that their government backing gives them a semi-official character. Speaking of the future, the latest government bulletin says: "The prospect is bright at present for a still larger copper production in the year 1909, but it is evident that the principal producers will, more than in recent years, gage their operations by the consumption of the metal, which cannot at this time be safely forecasted." Whether the producers will gage their output by the demand is a question. They have not done so in 1908, and as there seems to have been no trouble about keeping prices steady during this year of industrial depression, why should there be any anxiety over 1909, when the consumption of copper may be expected to increase? During the week under review the price of copper has actually been advanced, and there have been no reports of price shading and large contracts for future delivery at current figures have been declined. Quotations on the Metal Exchange Jan. 4 were:

Lake	14¾ @ 14⅝
Electrolytic	14¾ @ 14⅝
Castings	14 @ 14¼

Following are the London quotations:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	64 2 6	63 17 6
Standard copper, futures	64 15 0	64 12 6
Market	Firm.	Easy.
Sales of spot		500 tons
Sales of futures		1,000 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Lake copper, spot	14¾	13⅝
Electrolytic copper, spot	14¾	13⅝
Casting copper, spot	14¼	12⅝
London, spot	£64 17 6	£56 5 0
London, futures	65 15 0	56 17 6
London, best selected	68 10 0	0 0 0

ENGINEERING IN BRAZIL.—It is announced by the *Brazilian Review* that the government of the State of Espirito Santo has signed a contract with Dr. Augusto Ramos for the installation of water supply, electric lighting and a drainage system at Victoria, the capital of the State. Work must be commenced within 30 days and completed within 14 months. The water supply will amount to about 25,000,000 gal. every 48 hours, and the electrical energy will amount to about 800 hp. This concession is considered valuable owing to the extensive mineral resources of the interior of the country.

PLANT FOR INDIA.—U. S. Consul-General William H. Michael, of Calcutta, reports to the Department of Commerce and Labor that a British company, having failed to put in an electric lighting plant in Lucknow, India, according to the terms of a franchise granted to it about three years ago, the municipality of that city proposes to cancel the franchise and make other arrangements. The municipality passed a resolution inviting tenders by advertisement for lighting the city by gas or electricity.

LIGHTING IN SOUTH AMERICA.—A Consul in South America reports to the Department of Commerce and Labor that a concession has been granted by the government in the country in which he is located to a local firm for the establishment of an electric lighting plant in a municipality of about [illegible] inhabitants. Manufacturers of electric lighting apparatus may secure sales by addressing the firm whose address is given by the Consul.

BRITISH THOMSON-HOUSTON CONTRACTS.—The British Thomson-Houston Company, Ltd., of Rugby, England, reports as follows some of the more important motor home contracts secured by its power and mining department: Carling How Mines (Durham), five three-phase motors, 6½ to 175 hp, aggregating 321½ hp, together with controllers, switchgear, mechanical gearing, emergency brake and three-throw ram pump; Sheffield Coal Company, one 250-kw a.c. generator, seven three-phase motors, 30/80 hp, total 320 hp, controllers, resistances, transformers and switchgear; Joshua Whiteley & Company, Ltd., Albion Mills, Huddersfield, 23 three-phase motors, 6/55 hp, totaling 928 hp, together with switchboards, control panels, necessary wiring, etc.; J. & P. Coats, Ltd., Glasgow, eight three-phase motors, 300/325 hp, total 2600 hp, with controlling gear, panels, etc.; Pease & Partners, Darlington, one 125-kva generator, one 45-hp and one 70-hp motors (total 115 hp), with switchboard controllers and resistances, also two 15/25-hp motors, total 40 hp, control panels, etc., also two 25/120 hp, 145-hp motors, one 130-hp transformer, controllers, resistances and switchgear; Fife Coal Company, Leven, 19 three-phase motors, 25/50 hp, 660 hp, with controlling gear; Aveling & Porter, Ltd., Rochester, eight three-phase motors, 2¼/16 hp, 105¾ hp, with rheostats, wiring, etc.; London Corporation (for Central Criminal Court), eight 8-hp, 64-hp d.c. motors, with starters and panels; Gwynnes, Ltd., testing plant for Borough of Hammersmith, one 120-kw motor-generator set, one 110-kva generator; one 146-hp motor; one 10-kw exciter, one 140-kw transformer with switchgear; Greeves, J. & T. M., Ltd., Belfast, eight three-phase motors, 2/60 hp, 92 hp, with switchgear; Glenboig Union Fire Clay Company, Ltd., Glenboig, N. B., 20 three-phase motors, 1225 hp, with controllers, resistances, panels, etc.

WESTINGHOUSE MACHINE COMPANY.—The business of the Westinghouse Machine Company is showing some improvement, and several good sized orders have been received at the East Pittsburgh shops within the last few days. Among these orders was one for a large steam engine from the Pennsylvania-Arizona Mining Company, of Poland, Ariz., which will be used to operate the power machinery of a copper mine. The city of Frankfort, Ind., has ordered a 750-hp steam turbine; the American Iron & Steel Company, which is erecting a new plant at Lebanon, Pa., a 1500-hp steam turbine outfit; the American Plate Glass Company, a 1000-hp gas engine, an electric generator, and a switchboard for a complete power plant for its new factory at James City, Pa.; the Standard Underground Cable Company, Pittsburgh, for its plant at Perth Amboy, N. J., a 1000-hp horizontal double-acting gas engine; the Rockland Light & Power Company, of Nyack, N. J., a 1000-hp turbine equipment; the Youngstown Sheet & Tube Company, a 3000-hp turbine set, and the Warren Street Railway Company, of Warren, Pa., a 500-hp gas engine. An interesting feature of the new orders which have been coming to the East Pittsburgh plant of the Westinghouse Electric & Manufacturing Company recently is the very large demand for motors and power-house machinery from mills, mines and other large industrial establishments. Among the companies for which these shops are turning out motors for machine-driving purposes are the Anaconda Copper Mining Company; the Dixie Portland Cement Company, of Iola, Kan.; the Southern Power Company, of Charleston, S. C.; the American Trading Company; the American Iron & Steel Company; the Mead-Morrison Manufacturing Company, of Cambridge, Mass.; the Connellsville Iron Works, of New Haven, Pa.; the Mesta Machine Company, of Homestead, Pa.; the Fairmont Coal Company, of Fairmont, W. Va.; Hoover & Mason, mill engineers, Chicago, Ill.; Boyts-Potter Company, Connellsville, Pa.; the Manufacturers' Outlet Company; the United States Electrical Tool Company, of Cincinnati, O.; the Whiting Foundry & Equipment Company, of Harvey, Ill.; the Tompkins Engineering & Construction Company, of New York City, and the Youngstown Sheet & Tube Company, of Youngstown, O.

TO MANUFACTURE NEW GAS ENGINE.—The New York Air Brake Company, through a subsidiary company—the New York Machine Company—is preparing to manufacture gas and fuel engines on a large scale. The company is not ready as yet to give out its plans for developing this engine, but the apparatus is being manufactured at the plant in Watertown, N. Y., and will be offered for inspection in about 30 days. The new company, of which William N. Shaw, treasurer of the Air Brake Company, is president, believes that the new engine which it will offer will be a great fuel saver and that it will work a practical revolution in the gas-engine industry. The original design of the engine, it is understood, was made in Russia, and the American rights are owned by the American Machine Company. The highest capacity of engine that will be attempted at the present time will be 500 hp, but there is no reason why higher powers should not be made in the future. It is claimed, among other things, that the new engine will produce 1 hp per hour for every pound of coal consumed.

Financial Intelligence.

THE WEEK IN WALL STREET.

After a week of dull trading and advancing prices the stock market suddenly exploded with a loud noise on Jan. 4, when the decision of the Supreme Court, adverse to the Consolidated Gas Company, was made public. This decision, which practically upholds the 80-cent gas law, came after two lower courts had ruled that it was unconstitutional. It means that the gas company will receive 20 per cent less in its gross receipts and will have to return to the consumers the $9,000,000 collected in excess of the 80-cent rate since May, 1906. The stock of the gas company broke from 165¼ at the opening to 138, and closed at 141, a net loss from the close on Saturday of 23 1-4 points. The transactions amounted to 51,725 shares. So great was the rush to sell that the tape was sometimes almost an hour behind the actual trading. The effect on the general market was to break many of the higher-priced stocks, and almost every issue on the list closed the day at a decline. So great was the interest in the gas decision that the Street for the moment overlooked the fact that the Supreme Court had finally decided that the Government could not re-open the case involving the tremendous fine imposed upon the Standard Oil Company. At a less excited period such a decision as this would have been received as a distinct victory for corporate interests, and would have done much to strengthen the market and inspire confidence. An alliance of the principal financial interests of the country was made early in the spring to sustain the stock market. The quotations at the end of the year show how remarkably successful the efforts of these interests have been. Whether this alliance will continue to uphold the market or whether we may expect a general effort to secure profits is now the problem. No one knows what the program will be, but there has been a persistent rumor that January had been fixed as the date when the partnership bull movement would be dissolved. The public is not yet buying stocks liberally, and this may prevent any loosening of the grip upon the market which the insiders now have. In the meantime there is a vast investment demand for bonds and all issues offering good security are rapidly gobbled up. It is now said that the advance subscriptions to the $30,000,000 Frisco issue have been

NEW YORK.

	Dec. 28.	Jan. 4.	Shares Sold.		Dec. 28.	Jan. 4.	Shares Sold.
Am. Ct.	16	15⅝	1,700	Int.-Met., pfd...	47⅞	46¾	35,920
Am. Ch., pfd.	50	49	2,000	Mackay Cos.	75*	76	700
Amal. Cop.	84½	82⅞	92,450	Mackay Cos., pfd.	70	70	300
Am. Ice	35*	35*	———	Manhattan Elev.	154½	152	1,500
Am. Loc.	58¼	56½	14,550	Met. St. Ry.	42⅝	40	1,400
Am. Loc., pfd.	111	114*	450	N.Y. & N.J. Tel	112*	112*	———
Am. Tel. & Cbl.	78*	78*	———	Steel, com.	54¾	52⅞	233,791
Am. T. & T.	129	127¼	6,920	Steel, pfd.	112¾	112⅞	12,945
B. R. T.	68	69½	108,365	W. U. T.	68¾	68½	5,200
Gen. Elec.	160½	156	8,300	West'h., com.	85½	85	1,820
Int.-Met., com.	19	17¾	43,225	West'h., pfd.	120*	120	———

PHILADELPHIA.

	Dec. 28.	Jan. 4.	Shares Sold.		Dec. 28.	Jan. 4.	Shares Sold.
Am. Rys.	45¾*	45	———	Phila. Elec.	11¾	11¾	———
Elec. Co. of A.	11	11⅛*	———	Phila. R. T.	23⅛	23½	———
Elec. Stor. B'ty.	46½	47	———	Phila. Traction.	99½	99*	———
E. S. B'ty, pfd.	49*	49*	———	Union Traction.	50⅛	51½	———

CHICAGO.

	Dec. 28.	Jan. 4.	Shares Sold.		Dec. 28.	Jan. 4.	Shares Sold.
Chi. City Ry.	180*	180*	———	Chi. Tel. Co.	127½	127	———
Chi. Rys., Ser. 1.	116*	116*	———	Met. El., com.	18*	17	———
Chi. Rys., Ser. 2.	45½	45⅛*	———	Nat'nal Carbon.	85	85*	———
Com. Edison.	107	108	———	Nat. Carb., pfd.	112*	111	———
Chi. Subway.	3⅜	2⅝	———				

BOSTON.

	Dec. 28.	Jan. 4.	Shares Sold.		Dec. 28.	Jan. 4.	Shares Sold.
Am. Tel. & Tel.	129½	127½	———	Mass. E. R., pfd.	58	60	———
Cum. Tel.	125⅞	126	———	Mex. Tel.	2½	2⅛*	———
Edison El. Ill.	241	247	———	Mex. Tel., pfd.	5⅜	5*	———
Gen. Elec.	160½	157	———	N. E. Tel.	126¾	126¾*	———
Mass. Elec. Ry.	12⅝	12	———	W. Tel. & Tel.	7¾*	8	———
				W. T. & T., pfd.	78½*	81	———

*Last price quoted.
Shares sold are for week Dec. 28 to Jan. 2.

so heavy that the subscription books will be closed as soon as they are opened. There is some interest felt in the report that the Pennsylvania Railroad will increase its indebtedness by $60,000,000. As the money which the Pennsylvania raises by bond issues is always put into tangible improvements, its issues are always popular. Money continues to be cheap, although rates are not so low as they were a couple of months ago. On January 4 call loans were made at 2 and 3 per cent, and 90-day paper was quoted at 3 and 3 1-4 per cent. The quotations in the table are those at the close Jan. 4.

DIVIDENDS.

Aurora, Elgin & Chicago Railway, Chicago, Ill., quarterly, common, 1 per cent, payable Jan. 11.

Aurora, Elgin & Chicago Railway, Chicago, Ill., quarterly, preferred, 1 1-4 per cent, payable Jan. 11.

E. W. Bliss Company, Brooklyn, N. Y., quarterly, preferred, 2 per cent, payable Jan. 2.

E. W. Bliss Company, Brooklyn, N. Y., quarterly, common, 2 1-2 per cent, payable Jan. 2.

Evansville (Ind.) Light Company, quarterly, preferred, 1 1-2 per cent, payable Jan. 2.

Gamewell Fire Alarm Company, New York, N. Y., quarterly, 1 1-4 per cent, payable Jan. 2.

Halifax (N. S.) Electric Tramways, Ltd., quarterly, 1 1-2 per cent, payable Jan. 2.

Indianapolis Traction & Terminal Company, Indianapolis, Ind., initial dividend of 1 per cent, payable Dec. 31.

Knoxville Railway & Light Company, Knoxville, Tenn., quarterly, common, 1 per cent, payable Dec. 31, 1908.

Knoxville Railway & Light Company, Knoxville, Tenn., preferred, quarterly, 1 1-2 per cent, payable Dec. 31, 1908.

Lancaster County Railway & Light Company, Lancaster, Pa., quarterly, common, 2 per cent, payable Jan. 1.

Lancaster County Railway & Light Company, Lancaster, Pa., quarterly, preferred, 1 1-4 per cent, payable Jan. 1.

National Light, Heat & Power Company, New York, N. Y., quarterly, preferred, 1 1-4 per cent, payable Jan. 2.

Standard Underground Cable Company, Pittsburgh, Pa., quarterly, 3 per cent, annual extra 3 per cent, and special extra of 7 per cent.

Washington Water Power Company, Spokane, Wash., common, quarterly, 1 3-4 per cent, payable Jan. 20.

COMMONWEALTH EDISON COMPANY.—The Commonwealth Edison Company, Chicago, has sold $10,000,000 of 5 per cent first mortgage bonds to a syndicate composed of the Illinois Trust & Savings Bank, Merchants' Loan & Trust Company, Northern Trust Company, First Trust & Savings Bank, Harris Trust & Savings Bank, N. W. Halsey & Company, and Russell, Brewster & Company, of Chicago. About $7,000,000 of these bonds will be used for immediate refunding purposes, leaving about $3,000,000 for extensions and improvements. The securities to be retired include $5,000,000 of 5 per cent three-year gold debenture bonds of the Chicago Edison Company due on Nov. 1, 1910; $1,483,000 of 6 per cent debentures of the Chicago Edison Company due on Jan. 1, 1913; $500,000 of 5 per cent debentures of the Commonwealth Electric Company due on Aug. 1, 1909, and $260,000 of 4 per cent first mortgage bonds of the Chicago Sectional Electric Underground Company.

EDISON ELECTRIC COMPANY OF LOS ANGELES.—Announcement was made in the ELECTRICAL WORLD of Jan. 2, 1909, page 77, of a meeting of the stockholders of the Edison Electric Company of Los Angeles, called for Feb. 27, 1909, to vote on a plan to issue $30,000,000 of bonds. In connection with the proposed issue, Mr. John B. Miller, president of the company, is quoted as saying: "This is a measure designed to enable the company to keep pace with the increased demand for gas and electricity in all of its districts. The company has prepared a program involving the expenditure of several million dollars in Southern California during 1909 and 1910, but the money for these expenditures will be provided from the sale of bonds, the stock remaining in the treasury. These bonds will be marketed in the East, as money is needed for extensions in and about Los Angeles."

BOSTON ELEVATED RAILWAY.—The annual meeting of the stockholders of the Boston Elevated Railway was held in Boston on Jan. 4, 1909. The directors of the company were all re-elected. At the meeting, the annual report of the company for the year ended Sept. 30, 1908, was presented. It shows gross earnings, $14,074,600; operating expenses, $7,454,385; net earnings, $4,620,310; fixed charges, $3,780,247; surplus, $840,063 and balance after dividends $[illegible]. The company's balance sheet of the company, dated Sept. 30, 1908, shows assets of $35,428,644, and liabilities of $35,428,644. A summary of stockholders of record on Oct. 1, shows a total of 3657, of whom 3214 reside in Massachusetts and hold 115,512 shares of the total of 133,000 shares of stock outstanding.

BLACKSTONE VALLEY GAS & ELECTRIC COMPANY.—Stone & Webster, Boston, Mass., recommend for investment $1,750,000 of collateral trust 5 per cent gold bonds of the Blackstone Valley Gas & Electric Company, Pawtucket, R. I., due Jan. 1, 1939. The bonds are offered at 97½ and interest, yielding more than 5⅛ per cent. They cover the gas and electric lighting properties in the cities of Pawtucket and Woonsocket and in the adjacent towns located in the Blackstone Valley, Rhode Island. The net earnings of the company for each of the last three years show more than twice the interest requirements for the $1,750,000 of bonds.

LAKE SUPERIOR CORPORATION.—Horatio G. Lloyd has announced that Robert Fleming, London and New York, was the purchaser of the securities of the Lake Superior Corporation, Sault Ste. Marie, Mich., from Philadelphia institutions. It is understood that Mr. Fleming represents English and Canadian capitalists who with Edward J. Berwind and his associates now control the Lake Superior Corporation. The Lake Superior Corporation wil be refinanced and members will be elected to the directorate of the company to represent the new interests.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., paid interest due on outstanding bonds Jan. 1 and set aside $500,000 for the sinking fund and $220,000 to pay obligations, preliminary to the opening of the new balance sheet. The company began 1909 with about $12,000,000 in cash, $5,000,000 in current accounts receivable, $1,500,000 in current bankable funds, and it has other assets that can be converted into cash as market conditions permit.

CONSOLIDATED RAILWAY, LIGHTING & REFRIGERATING COMPANY.—Mr. Isaac L. Rice, chairman of the reorganization committee of the Consolidated Railway, Lighting & Refrigerating Company, of New York, has announced that more than 142,000 shares of a total of 211,158 have consented to the reorganization plan and that no further deposits of stock will be accepted under the terms of the plan, which provided for an assessment of 25 cents a share.

WASHINGTON WATER POWER COMPANY.—Lee, Higginson & Company, Boston, are offering for subscription $3,000,000 of 30-year bonds of the Washington Water Power Company, Spokane, Wash. The proceeds of the issue are to be used to refund $3,000,000 of notes due on July 1, 1911. In the exchange note-holders are offered a bonus of $15 cash on each $1,000 of notes. The limit of exchange is Jan. 31, 1909.

ILLINOIS TUNNEL COMPANY.—The Illinois Tunnel Company, Chicago, Ill., has agreed to report annually to the city comptroller of Chicago and to give full publicity of all its accounts, in consideration of a two-year extension of time within which its automatic telephone department must install 20,000 telephones. The plant will be maintained at its present standard and the company will give a new $100,000 bond.

FRONTIER TELEPHONE COMPANY.—The stockholders of the Frontier Telephone Company, Buffalo, and the Inter-Oceanic Telephone & Telegraph Company have voted to sell their properties to the Federal Telephone & Telegraph Company, which was incorporated recently with a capital stock of $6,000,000. Among the directors of the Federal Telephone & Telegraph Company are B. G. Hubbell and H. H. Person, Buffalo.

NEW YORK TRANSPORTATION COMPANY.—The directors of the New York (N. Y.) Transportation Company are reported to have under consideration the advisability of placing a first mortgage on the property of the company to secure between $[illegible] and $[illegible] for equipping the company's cabs for the use of gasoline instead of electricity as motive power.

H. M. BYLLESBY & COMPANY, Chicago, Ill., owners and [illegible] a number of electric light and power, gas and electric railway properties in the Middle West and the South, report that the year 1908 has been one of progress with it and its subsidiary companies. During the year the company [illegible] bond securities than ever before in any one year. The company's bond security department, which was [illegible] about a year ago, has assumed such a permanent

character that it has been found necessary to appoint a manager who will devote his exclusive attention to this department. Mr. R. A. Wilson, a well-known bond security expert of New York City, has been placed in charge of this department. During the year just closed a very commendable increase in the year's gross business has been reported by the following companies, the properties of which are controlled by H. M. Byllesby & Company: Oklahoma Gas & Electric Company, Oklahoma City, Okla.; Enid Electric & Gas Company, Enid, Okla.; Mobile Electric Company, Mobile, Ala.; Ottumwa Railway & Light Company, Ottumwa, Ia.; Fort Smith Light & Traction Company, Fort Smith, Ark.; San Diego Consolidated Gas & Electric Company, San Diego, Cal. The increase of business shown by these properties was brought about through the gradual growth of the cities, through property betterments, systematic soliciting business methods, and the introduction of electric utensils for household uses. Because of this increase of business at each of these plants, it has been necessary during the year to make many improvements in the electric generating stations. In addition to these power plant improvements, many extensions of the feeder lines were made throughout the cities in which the companies operate. The parent company reports that improvements to the generating stations are now being made to the properties of the companies named as follows: At San Diego, Cal., the company is installing a new 1,000,000-cu. ft. gas generating set and a 1500-kw generator, direct connected to a cross-compound Corliss engine. The improvements in this city will exceed $200,000. At Enid, Okla., the company is adding to its local plant a 400,000-cu. ft. oil gas-producing set. The improvements at the electric light plant in that city will include three B. & W. 300-hp boilers and a 500-kw generating set. H. M. Byllesby & Company expects that 1909 will be the most active year in its existence. Besides the general improvements that will be made to its several properties it will develop three very large water power projects in the West, preliminary work on which has already been begun. The company has recently finished the construction of a water power plant of interesting design at Sioux Falls, S. D.

BOSTON & WORCESTER ELECTRIC COMPANIES.—The Boston & Worcester Electric Companies and the Boston & Worcester Street Railway have issued statements of their earnings for the year ended Sept. 30, 1908. The Boston & Worcester Electric Companies owns the capital stock of the Boston & Worcester Street Railway. It reports a total income from its stock holdings and other sources of $141,661. From this sum was deducted dividends, interest on $235,000 of three-year notes and miscellaneous expenses amounting to $141,047, leaving a surplus of $613. The statements of earnings of the Boston & Worcester Street Railway shows gross receipts of $553,613 and operating expenses of $282,917, leaving the net income $270,696. The charges for the year are given as $155,965, leaving a surplus of $114,731. As dividends amounting to $121,500 were paid there was a deficit for the year of $6,768.

NEW JERSEY & PENNSYLVANIA TRACTION COMPANY, TRENTON, N. J.—J. R. Nutt, secretary of the Citizens' Savings & Trust Company, Cleveland; Myron H. Wilson, vice-president of the Cleveland Trust Company, Cleveland, and James G. Cannon, president of the Fourth National Bank, New York, have been selected as a committee to represent the bondholders of the New Jersey & Pennsylvania Traction Company and the Trenton, New Hope & Lambertville Traction Company, in which Mayor Tom L. Johnson, of Cleveland, and the estate of Albert Johnson are interested.

HUDSON RIVER WATER POWER COMPANY.—The committee of bondholders of the Hudson River Water Power Company, Saratoga Springs, N. Y., of which Mr. F. J. Lisman is chairman, has announced that proceedings to foreclose the mortgage will be instituted promptly, as a sufficient number of bonds have already been deposited. The holders of the receipts from another committee, of which Mr. James R. Hopper is chairman, will be given the option of depositing their receipts with the committee of which Mr. Lisman is chairman in lieu of bonds.

HUDSON RIVER ELECTRIC POWER COMPANY.—The Public Service Commission of the Second District of New York has granted permission to the receivers of the Hudson River Electric Power Company, Glens Falls, N. Y., to lease the steam power plant and property of the company at Utica and the substations at Little Falls, Frankfort and Oriskany to the Utica & Mohawk Valley Railway.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
Aurora, Elgin & Chicago Railroad, Chicago, Ill.:					
November, 1908	$109,912	$64,969	$44,942	$27,723	$17,219
November, 1907	108,653	63,192	45,461	28,033	17,427
Cleveland, Painesville & Eastern Railroad, Cleveland, Ohio:					
November, 1908	21,858	13,550	8,308	.....	.....
November, 1907	22,474	12,984	9,490	.....	.....
Edison Electric Illuminating Company, Brockton, Mass.:					
October, 1908	19,218	10,020	9,197	2,861	6,336
October, 1907	19,393	9,896	9,496	1,051	8,445
Houghton County Electric Light Company, Houghton, Mass.:					
October, 1908	23,273	11,171	12,101	4,080	8,021
October, 1907	24,306	11,634	12,672	2,962	9,709
Illinois Traction System, Champaign, Ill.:					
November, 1908	360,679	196,382	164,296	.....	.....
November, 1907	335,889	195,595	140,293	.....	.....
Lake Shore Electric Railway, Cleveland, Ohio:					
November, 1908	68,352	40,716	27,636	.....	.....
November, 1907	69,836	46,667	23,168	.....	.....
Lowell (Mass.) Electric Light Corporation:					
October, 1908	30,673	17,824	12,848	2,849	9,999
October, 1907	29,056	15,686	13,370	3,323	10,046
Minneapolis (Minn.) General Electric Company:					
October, 1908	86,679	34,790	51,889	32,596	19,293
October, 1907	76,921	37,184	39,737	26,646	13,090
Nashville (Tenn.) Railway & Light Company:					
November, 1908	138,598	79,271	59,327	32,507	26,820
November, 1907	139,559	87,182	52,377	31,232	21,145
Paducah (Ky.) Traction & Light Company:					
October, 1908	16,706	10,268	6,437	6,590	152*
October, 1907	19,075	12,374	6,700	6,883	182*
Pensacola (Fla.) Electric Company:					
[illegible]	18,345	10,432	7,913	4,261	3,652
[illegible]	20,045	14,296	5,749	4,360	1,389
Toledo (Ohio) Railways & Light Company:					
[illegible]	219,885	117,372	102,513	71,960	30,553
[illegible]	220,754	116,957	103,797	67,925	35,872

* Deficit.

GENERAL NEWS

Construction News.

GLOBE, ARIZ.—George W. P. Hunt has applied to the City Council for a franchise to construct and operate an electric street railway through Globe.

BENTONVILLE, ARK.—It is said that the construction of an interurban electric railway from Bentonville, Ark., to Joplin, Mo., is assured. The railway will be 168 miles in length.

HOLLY GROVE, ARK.—Arrangements are being made by E. W. Burruss to install an electric light plant in Holly Grove, the cost of which is estimated at $3,000.

LITTLE ROCK, ARK.—It is reported that Eastern capitalists have agreed to furnish the greater portion of the funds needed for the construction of an interurban railway connecting Hot Springs and Little Rock by the Little Rock & Hot Springs Electric Railway Company. The railway will be 51 miles in length and will cost about $1,500,000. Bids for the construction of the road will be asked for in the near future.

BERKELEY, CAL.—The City Council has granted the Southern Pacific Company a franchise to operate an electric railway over California, Ninth and Ellsworth Streets in Berkeley, for which the company bid $25,000. Duncan McDuffie was granted a franchise by the Council for an extension of the present Grove Street railway in Northbrae on Marin and Alameda Avenues, for which he paid $250.

NORWALK, CAL.—J. R. Gordan is reported to have been granted a franchise by the town to install an electric light and power system.

PASADENA, CAL.—It is stated that the City Council is contemplating calling an election the latter part of January or early in February to vote on the proposition to issue bonds to complete the municipal electric light plant. The plant can be completed, it is said, for less than $150,000.

RIVERSIDE, CAL.—Bonds to the amount of $50,000 have been issued by the Corona Home Telephone & Telegraph Company, the proceeds to be used for improvements to its system.

WARD, COL.—Arrangements are being made by the Mount Audubon Power Company for the construction of a hydro-electric plant, which will be located about 1½ miles northeast of Ward. The water will be conducted from the St. Vrain River to reservoirs near Duck Lake, from which it will be carried in a 20-in. pipe with a fall of 500 ft. in a distance of one mile. Actual construction work will commence on the plant in the spring, and when completed will furnish electricity to mines of the district. The plant will cost about $75,000 and will have an output of 1500 hp. J. E. Haggard is president and general manager.

MANCHESTER, CONN.—The Glastonbury Light & Power Company will make improvements to the street lighting system in the North End. Orders have been placed for four transformers, which will be placed in the power station of the Connecticut Company.

NEW LONDON, CONN.—Announcement has been made by the New London & East Lyme Street Railway Company that it will petition the incoming Legislature for charter amendments granting the company permission to extend its railway to the Connecticut River.

NEW LONDON, CONN.—The Groton & Stonington Street Railway Company will petition the next session of the Legislature for amendments to its charter allowing it to extend its system through several streets of Groton Borough and to Eastern Point.

NORWICH, CONN.—The Norwich & Westerly Railway Company has filed a petition with the Secretary of State, asking the State Legislature for an amendment to the resolution incorporating the Norwich, Mystic & Westerly Street Railway Company so that it may be allowed to furnish electricity for lamps and motors in the towns of Preston, Ledyard and North Stonington.

PUTNAM, CONN.—The Putnam Light & Power Company, it is said, will petition the Legislature for an amendment to its charter, granting it permission to extend its transmission lines to Woodstock and erect a distributing system in that town to furnish electricity for lamps and motors.

SOUTH NORWALK, CONN.—The Reed & Volk Electric Company has been awarded a contract to furnish the municipal electric light plant with incandescent lamps. The contract calls for 10,000 lamps.

UNIONVILLE, CONN.—The Union Electric Light & Power Company will apply to the General Assembly for amendments to its charter giving the company permission to generate and distribute gas in the towns of Farmington, Canton, Avon and Burlington.

WILMINGTON, DEL.—Anthony Higgins, representing the Commercial Light, Heat & Power Company, which was granted a franchise in 1907 to erect an electric light plant in Wilmington, has applied to the Directors of the Street and Sewer Department for an extension of time from Dec. 1, 1909, to Jan. 1, 1911, for the fulfilment of its agreement in connection with the franchise.

WASHINGTON, D. C.—The contract for furnishing a switchboard for the new building for the National Museum, Washington, D. C., has been awarded to the Walker Electric Company, for $9,475.

WASHINGTON, D. C.—Bids will be received until Feb. 9 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing ammunition hoists and electrical equipments at the navy yard, Puget Sound, Wash., as per schedule 766.

WASHINGTON, D. C.—Consul-General William H. Michael, of Calcutta, reports that a British company having failed to install an electric light plant in Lucknow, India, according to the terms of the franchise granted about three years ago, the Council proposes to cancel the franchise and make other arrangements and has passed a resolution inviting bids for lighting the city by gas or electricity. For further information address No. 2915, Bureau of Manufacturers, Washington, D. C.

PENSACOLA, FLA.—Plans are being made by the Pensacola Investment Company to construct an electric railway from Pensacola to Magnolia Bluff. It is said that the company is now negotiating with Stone & Webster, of Boston, Mass., for the construction of the railway. It is proposed to connect with the system of the Pensacola Electric Company at some point on Sixteenth Avenue, and will run to Bayou Texas, crossing the bayou, passing through East Pensacola to Magnolia Bluff.

DALLAS, GA.—Bids are invited for the construction of a reinforced concrete dam and power house to be erected on Punking Vine Creek, four miles from Dallas, Ga., for the Paulding County Electric Company, the cost of which is estimated at $64,000. W. S. Lotus, of Dallas, is president; D. G. Zeigler & Company, of Atlanta, Ga., and Jacksonville, Fla., are consulting engineers.

JESUP, GA.—Bids are being asked for the construction of a reinforced concrete, cement and crushed stone dam and power house, and also for the construction of an electric railway 24 miles in length on Goose Creek, six miles north of Jesup, for the Goose Creek Railway & Power Company. The cost of the work is estimated at $600,000. D. G. Zeigler & Company, of Atlanta, Ga., and Jacksonville, Fla., are consulting engineers.

PALMETTO, GA.—Arrangements are being made for the installation of an electric light plant in Palmetto. B. W. Cochran is interested in the project.

LEWISTON, IDAHO.—It is reported that Spokane and Eastern capitalists, headed by Judge George W. Bolt and W. N. Bourke, of Spokane, Wash., are organizing a company to construct a local and interurban electric railway system and lighting plant in Lewiston, Idaho. The railway will be about 90 miles long. The cost of the electric light plant is estimated at $100,000 and the railway system, approximately, $7,500,000.

OROFINO, IDAHO.—The Orofino Electric Company is constructing a hydro-electric plant in Orofino. The cost of the plant is estimated at $10,000. F. J. Engelhorn is manager.

SANDPOINT, IDAHO.—Plans are being considered by the Humbird Lumber Company for the construction of two power plants in connection with its Sandpoint and Kootenai mills and a pumping station at Kootenai.

WHITE BIRD, IDAHO.—The plant and holdings of the White Bird Electric Company have been purchased by B. Davis, who, it is said, will install additional machinery. The plant is operated by water power.

BLOOMINGTON, ILL.—The McLean County Telephone Company is planning to complete the work of rebuilding its toll lines during the coming year, which will involve an expenditure of about $20,000.

CHICAGO, ILL.—The directors of the Chicago & Southern Traction Company have authorized an extension of the company's system from Kankakee, Ill., to Lafayette, Ind.

CHICAGO, ILL.—The Illinois Inland Traction Company has completed the survey and secured franchises and rights of way for its proposed railway from Crete to Momence, Ill., a distance of 20 miles. Work on construction of the road will commence early in 1909. W. H. Conrad, vice-president of the Chicago & Southern Traction Company, is one of the promoters of this project.

CHICAGO, ILL.—The Chicago, Milwaukee & St. Paul Railroad Company is in the market for the following equipment: One 48-in. draw cut [illegible] with [illegible] per minute with 3 to 1 return cut motor driven.

CHICAGO, ILL.—The Board of Trustees of the Sanitary District of Chicago has submitted a proposition to the Board of Education offering to supply electricity for lighting the school buildings at two cents per kw hour. The city now pays the Commonwealth Edison Company 10 cents per kw hour under a contract which does not expire until 1910. It is said if the Board of Education accepts a new contract which is now under consideration the company will furnish electricity for 3½ cents per kw hour.

ELGIN, ILL.—The Council committee on gas and street lighting has completed its estimate for expenditures for the year amounting to $28,314, which includes 50 new street lamps at $42 each and $1,000 for additional lighting in the business and residence districts, $3,000 for gas testing machine.

GALVA, ILL.—The Kokomo Telephone Company has applied to

the Town Board for a franchise to establish a telephone service in Galveston, Ill.

HARMON, ILL.—Plans are being made by the Green River Telephone Company for the construction of a direct telephone line from Harmon to Amboy.

MONMOUTH, ILL.—It is reported that the Rock Island Southern Railroad Company will place contracts within 60 days for the construction of a power plant on Edwards River. The company will require two 1500-kw turbines and necessary boiler equipment. W. W. McCullough, of Monmouth, is general manager.

PAXTON, ILL.—Plans are being considered by the Paxton Electric Company to install a 20-ton ice plant on the property adjoining its power house. The company will also install early this year a complete ash-conveying system, and is also contemplating extending its transmission lines to Lodi, a distance of about four miles.

VANDALIA, ILL.—A certificate has been filed with the Secretary of State by the Vandalia Telephone Company showing an increase in the capital stock of the company from $15,000 to $50,000.

INDIANAPOLIS, IND.—The Merchants' Heat, Light & Power Company is planning to build an additional plant in the western part of the city, bids for the construction and equipment of which will be asked in the near future. Edward L. McKee is president.

KENTLAND, IND.—The Kentland Light & Ice Company is planning to construct a combined electric light, water and ice plant. Bids will soon be asked for the construction of the plant. Hugh Hill is president.

WARSAW, IND.—Plans are being made by the Commercial Telephone Company for the erection of a new circuit six miles in length.

BELLEVUE, IA.—Arrangements are being made to rebuild the municipal electric light plant immediately. The equipment will include an 85-hp suction producer gas engine, a three-phase 60-cycle 1100-volt generator. A direct-connected centrifugal pump will be installed to operate the water works system.

EAGLE GROVE, IA.—Arrangements are being made by the Citizens' Light & Power Company to establish a 24-hour service in Eagle Grove.

FAIRFIELD, IA.—It is said that the Fairfield Gas & Electric Company has withdrawn its proposition to furnish electricity to light the city and to operate the pumping station.

KEOKUK, IA.—The Mississippi Valley Telephone Company has filed amendments to its charter increasing its capital stock to $50,000.

PATON, IA.—The Hawkeye Telephone Company is planning to extend its telephone line from Perry to Paton.

GARDEN CITY, KAN.—Sargent & Lundy, Jackson and Michigan Boulevards, Chicago, Ill., consulting engineers, are reported to have been awarded the contract for the construction of the proposed power plant to be located in Garden City, by the Kansas-Colorado Power Transmission Company.

MOUNDRIDGE, KAN.—Bids will be received at the office of A. Ringwald, City Clerk, until Jan. 18, for furnishing material and constructing an electric light plant and water works system. Separate bids will be received as follows: 1. For furnishing material and labor (except cast-iron pipe, hydrants and valves, electrical machinery, pumping machinery, gasoline engines) and constructing water works and electric light system. 2. For furnishing cast-iron pipe and special castings. 3. For furnishing hydrants and valves. 4. For furnishing one 300-gal. per minute triplex power pump. 5. For generator, switchboard, transformers and arc and tungsten lamps. 6. For furnishing and erecting two 50-hp gasoline engines. 7. For furnishing material and erecting steel tower and tank 100 ft. high, having a capacity of 30,000 gal. The above material and work to be furnished in accordance with plans and specifications on file at the office of Burns & McDonnell, Scarritt Building, Kansas City, Mo. Anyone desiring extra copies of the plans and specifications may secure them from the engineers by making a payment of $5 to cover the cost of the prints.

LEXINGTON, KY.—The Midland Electric Company, recently incorporated, has taken over the franchise purchased from the city by Mr. Beckley.

SHELBYVILLE, KY.—The capital stock of the Shelbyville Water & Light Company has been increased from $20,000 to $40,000, the proceeds to be used for extension and improvements to its system.

BIDDEFORD, MAINE.—The Pepperell Company is making arrangements to install a 1500-kw, 600-volt Allis-Chalmers 60-cycle, turbo-generator set in its factory to furnish electricity to operate its plant. Additional boilers will be installed in the boiler plant.

CAMDEN, MAINE.—The Camden Water Power Company, recently incorporated, will utilize what is known as the Molineaux Mill privilege. The water power will be used to generate electricity, which will be utilized for lamps and motors. Work will commence at once on the project. E. Frank Knowlton is president of the company and C. W. Babb is treasurer.

LEWISTON, MAINE.—We are informed that surveys have been completed and the rights of way secured for the proposed electric railway to be constructed by the Portland, Gray & Lewiston Railroad Company. The railway will extend from Portland to Lewiston through Falmouth, Gray and New Gloucester. The officers of the company are: E. W. Grosse, of Berlin, N. H., president; J. D. Clifford of Lewiston, Maine, [illegible] Maine, treasurer; J. V. [illegible]

SACO, MAINE.—The York Manufacturing Company has ordered a steam turbo-generator set of the General Electric Company, Schenectady, N. Y., to be installed in its new plant, now being erected in Saco. Additional boilers will also be installed in the plant.

BALTIMORE, MD.—Edward Brady & Son, Baltimore, Md., have been awarded the contract for the construction of the new power house for St. Joseph's Hospital. The cost of the building is estimated at $15,000 and the equipment $10,000. The plant will furnish heat and light for the hospital.

BOSTON, MASS.—The contract for installing the electrical system in the schoolhouse on Moore Street, East Boston, Mass., has been awarded to the M. B. Foster Company for $1,844.

CLINTON, MASS.—The Gibbs Loom Harness & Reed Company has recently installed a Phoenix generator in its plant to provide electricity for lighting the factory.

MANSFIELD, MASS.—The Board of Commissioners has voted to substitute 250-watt, 5.5 amp tungsten series lamps for street series arc lamps now in use here. All of the arc lamps will be discarded.

METHUEN, MASS.—The Southern New Hampshire Street Railway Company is contemplating the construction of a new power station in Methuen. At present electricity for operating the system is transmitted from the power plant at Portsmouth, N. H.

PITTSFIELD, MASS.—The Board of Aldermen has granted the Pittsfield Street Railway Company a franchise to double track its lines from Park Street to Pontoosuc Lake.

ALLEGAN, MICH.—Arrangements are being made by the Trans-Michigan Street Railroad Company for the construction of its proposed railway, which will connect Allegan and South Haven, Mich., a distance of about 30 miles. The power plant and repair shops will be located in Allegan. William Pyatt, of Chicago, Ill., is president.

LANSING, MICH.—The Western Michigan Power Company has been granted a franchise by the Township Board to erect its transmission lines in Lansing. The company has also secured rights of way in Calhoun, Eaton, Kalamazoo and other southern counties. The headquarters of the company are at Cadillac, Mich.

SOUTH HAVEN, MICH.—The Chicago, Benton Harbor & Grand Rapids Railroad Company has been granted a franchise to construct an electric railway through South Haven. Joseph W. Hosmer, William E. Dodson and George S. Hannaford, of Chicago, Ill., are interested in the enterprise.

WYANDOTTE, MICH.—Preparations are being made by the Interstate Telephone Company to install an exchange in Wyandotte, Mich.

HOKAH, MINN.—Plans are being considered by the new owner of the Weber flour mill to install an electric light plant in connection with the mill and furnish electric lighting service in the town.

RENVILLE, MINN.—The construction of an independent telephone system in Renville is under consideration by the business men of the town.

STILLWATER, MINN.—A new telephone company has been organized by the farmers south of Stillwater Junction with the following officers: Edmund Wolff, president, and R. O. Ulrick, secretary and treasurer.

COLUMBIA, MO.—Application has been made to the City Council by J. W. Grain and others for a franchise to construct telephone lines in Columbia in connection with the erection of a rural telephone system between Columbia and other points in this vicinity.

JEFFERSON, MO.—A. T. Sparta, of New York, N. Y., is reported to be interested in a project to construct an electric railway from Jefferson City to Columbia, Mo., via Fulton.

KANSAS CITY, MO.—The Oklahoma & Golden City Railway Company contemplates the construction of an electric railway connecting Springfield, Mo., Pawhuska, Okla., and Jefferson City, Mo. The overhead trolley system will be used. W. K. Palmer, Dwight Building, Kansas City, Mo., is chief engineer. Winfield S. Pope, of Jefferson City, Mo., is president.

MAYSVILLE, MO.—The City Council has granted a franchise to W. T. Wingate to operate an electric light system in Maysville.

MISSOURI VALLEY, MO.—A contract has been made by J. E. Jones, W. M. Jones, Homer E. Jones, Bernard C. Jones and E. E. Jones with William Hayes, manager of the Missouri Valley Light Company, for material for the installation of a complete electric light plant to supply electricity for their farms.

ST. LOUIS, MO.—Bids will be received at the office of the Board of Public Improvements, New City Hall, St. Louis, Mo., until Feb. 5, for furnishing electricity for lighting certain public buildings, lighting streets, avenues, boulevards, parks and other public places of the city of St. Louis.

TIFFIN, MO.—Plans are being made by the El Dorado Springs, Tiffin, Monegaw Springs & Lowry City Railroad Company to commence work on the construction of its proposed electric railway. The railway will consist of about 30 miles of track and the overhead trolley system will probably be adopted. The power station will be located on the Osage River. Dr. C. A. Edgar, of El Dorado Springs, Mo., is president, and J. S. Harrison, of Tiffin, Mo., secretary and general manager.

MISSOULA, MONT.—W. A. Clark has been granted a 99-year franchise by the Board of Aldermen of the new town of Shaughnessy to construct and operate an electric railway in the town.

VICTOR, MONT.—The Bitter Root Telephone Exchange Company is planning to install exchanges at Victor and Corvallis.

ALBION, NEB.—The citizens are considering the question of establishing a lighting and heating system in Albion. An election will soon be held to vote on the proposition to issue bonds to install the plant.

ST. EDWARD, NEB.—The question of establishing an electric light plant in this town is under consideration.

BELLEVILLE, N. J.—James M. Seymour, Jr., representing the Newark Block Lighting Company, has notified the Township Committee that his company will make application for a franchise if the committee would consider the proposition. The company proposes to construct a plant, provided a 20-year franchise is granted.

HOBOKEN, N. J.—The Mutual Electric Light & Power Company, of Newark, N. J., has applied to the City Council for a franchise to lay conduits in the city for the distribution of electricity in Hoboken. The company agrees to place all its wires underground and to furnish electricity at a maximum rate of eight cents per kw-hour and to give a discount of five per cent on all bills paid within five days. In return for the franchise the company offers to pay to the city three per cent of its gross earnings. James M. Seymour, Jr., of Newark, is president of the company.

MORRISTOWN, N. J.—Plans are being made by the Morris County Traction Company to place contracts for the construction of a new central power station, together with three substations, during the next six weeks; also for the construction of about 20 miles of track.

SANTE FE, N. M.—The Santa Fé Electric Telephone Company has commenced work on the installation of a cable system throughout the city and will soon commence work on the erection of toll lines to Espanola and Lamy.

BALLSTON SPA, N. Y.—The Board of Trustees has renewed the contract for street lighting with the Ballston Spa Light & Power Company for a term of two years.

DUNDEE, N. Y.—Arrangements are being made by the owners of the Dundee electric light plant to sell, charge and care for electric vehicles in the near future. We are informed that the town is making liberal offers of factory sites with other inducements for manufacturing purposes.

FILLMORE, N. Y.—The Public Service Commission of the Second District has authorized the Genesee Valley Power Company, of Fillmore, to issue bonds to the amount of $18,000, the proceeds to be used for payment of outstanding notes of the company and for acquisition of property and for extension and completion of its system.

GENEVA, N. Y.—Bids will be received until Jan. 18 by L. P. Haviland, chairman of the Building Committee of the New York State Agriculture Experiment Station, Geneva, N. Y., for furnishing switchboard and feeder, cables, motors and interior wiring for four staff residences at the New York State Agriculture Experiment Station, Geneva, N. Y. Drawings and specifications may be consulted and blank forms of proposal obtained at the New York State Agriculture Experiment Station, Geneva, N. Y., or at the office of Franklin B. Ware, State Architect, Albany, N. Y.

HUNTINGTON, N. Y.—Work has commenced on the proposed extension of the plant of the Huntington Light, Heat & Power Company, which will include the installation of a 300-kw, 60-cycle, two-phase, 2400-volt, Westinghouse Parsons turbo-generator set, making the total output of the plant 450 kw. The improvements as now planned will cost from $20,000 to $30,000.

KATONAH, N. Y.—The Katonah Light Company has been granted permission to issue capital stock to the amount of $10,000 by the Public Service Commission of the Second District, the proceeds to be used for extensions and improvements to its plant.

LESTERSHIRE, N. Y.—An electric power plant has been installed in the Faatz-Reynolds Felting Works to furnish electricity for operating the entire plant.

MIDDLETOWN, N. Y.—The capital stock of the Orange County Telephone company has been increased from $10,000 to $50,000.

NEWBURGH, N. Y.—The Poughkeepsie Light, Heat & Power Company has assigned to the Newburgh Light, Heat & Power Company all its interests in right of way in the town of Marlboro from the town of Lloyd to the village of Marlboro; also the site in Marlboro for a substation.

NEW YORK, N. Y.—The contract for installing electric equipment in School No. 114 on James, Oak and Oliver Streets, Borough of Manhattan, has been awarded by C. B. J. Snyder, Superintendent of School Buildings, to Cowden & Young, of New York, N. Y., for $13,893.

ONEIDA, N. Y.—It is reported that a movement is on foot to organize a light and power company with a capital stock of $100,000. It is said that a meeting will be called immediately after the holidays when some definite action will be taken.

SCHENECTADY, N. Y.—We are informed that the Schenectady Power Company does not contemplate the construction of a dam on the Walloomsac Creek, near Walloomsac, as reported in the issue of Jan. 2.

SENECA FALLS, N. Y.—The [illegible] Water, Power & Light & Cayuga Lake Traction Company has been granted a franchise by the Town Board to extend its railway from the east line of Seneca Falls to the west short of Seneca Lake, along the highway. The company has also been granted a franchise to extend [illegible] through Seneca Falls.

CARTHAGE, N. C.—Plans are being made by the Carthage Telephone Company for the extension of its [illegible] lines to Bonnie, Big Oak, Lick Springs and Bisnet.

LEXINGTON, N. C.—The directors of the Decotah Cotton Mills, recently incorporated, are planning the construction of a cotton mill with a capacity of 10,944 spindles and accompanying looms. Both steam and electricity are being considered for motive power.

MEDORA, N. D.—Franchises have been granted to the Dakota & Montana Telephone Company and to the Northern Telephone Company to erect and maintain telephone systems in Billings County.

BUCYRUS, OHIO.—It is reported that the electric light company has offered its plant to the city for $35,000.

CADIZ, OHIO.—Surveys are nearly completed and arrangements being made for the construction of the proposed electric railway of the Wheeling, Cadiz & Tuscarawas Traction Company, connecting Uhrichsville, Cadiz, Martins Ferry, Wheeling, W. Va., and intervening towns. The railway will consist of 55 miles of track. The power station will be located at Cadiz, and will furnish electricity for lamps and to manufacturing concerns along the route. A. E. Townsend, of Cadiz, Ohio, is president and general manager.

CINCINNATI, OHIO.—The Cincinnati & Suburban Bell Telephone Company has instructed Architect Harry Hake to prepare plans for a branch exchange building in Avondale.

CINCINNATI, OHIO.—Plans have been filed by the Cincinnati Traction Company for a new power house to be erected on Keck Street between Foster and St. Andrews Street. The cost of the building is estimated at $32,000.

McCOMB, OHIO.—Plans are being considered to install a 100-kw 250-volt direct-current generator in the municipal electric light plant. C. S. Hoskinson is manager.

RICHWOOD, OHIO.—The Council on Dec. 24 turned down the petition, containing the names of 250 taxpayers, asking that an election be held to vote on the proposition to establish a municipal electric light plant for Richwood. The town has been without a street lighting service for some time.

WARREN, OHIO.—The Hydro-Electric & Gas Company has completed its two dams at Newton Falls and has commenced work on rebuilding the cofferdam at Leavittsburg, which was recently washed out.

WARREN, OHIO.—Under a compromise arrangement, the City Council has agreed to amend the franchises granted the Hydro Electric Company and the Warren Water & Light Company in such a way that they will not be required to pay into the city treasury 1 per cent a month of their gross earnings.

EUGENE, ORE.—Proposals will be received until Jan. 11 for the construction of a 2400-hp plant on the McKenzie River to furnish power for pumping water from the river to Eugene.

MARSHFIELD, ORE.—The Coos Bay Railway & Terminal Company recently incorporated, is planning to commence work on the construction of its railway in the spring. According to the present plans, the railway is to extend from North Bend to Marshfield and then on to Millington and from North Bend across Pony Inlet to Sunset Bay, which is being made into a summer resort. The power plant for operating the system is located at Porter, half way between North Bend and Marshfield. The plant is nearly completed and is designed to furnish electricity for lamps both in Marshfield and North Bend as well as for operating the railway. Henry Hewitt, of Tacoma, Wash., is president, and Seymour H. Bell is treasurer and manager.

PORTLAND, ORE.—Mayor Lane in his annual address recommended an appropriation of $190,000, the proceeds to be used to establish a distributing system to furnish electricity for street lamps. If it is decided to erect a system, the city will purchase electrical energy to operate the same.

WILLAMETTE, ORE.—The Willamette Improvement Association has adopted resolutions endorsing Mayor Lane's attitude toward the construction of a municipal electric light plant.

CONNELLSVILLE, PA.—Plans are being made by the West Penn Electric Company to erect a power plant in Fayette County at a cost of about $1,500,000. The plant will be a duplicate of the power station at Fayette and will have an output of about 22,000 hp. The power station will probably be located in the southern part of Fayette County near the Monongahela River. The plant will furnish electricity for the West Penn Railways Company's system. L. H. Conklin, of Connellsville, Pa., is general superintendent.

MALVERN, PA.—The Rapid Creek Supply Company contemplates the installation of a producer gas plant, additional generators and the [illegible] Pa., [illegible] Wilmington & Company and 9 Broad Street New York, N. Y., [illegible] George L. Dutton, superintendent.

PHILADELPHIA, PA.—Plans are being considered by the merchants [illegible] the Chelten Avenue section. The question has been taken up by the lighting committee with the City Council and an official of the Philadelphia Electric Company and a scheme outlined for installing many additional lamps.

PHILADELPHIA, PA.—The Kensington & Lardenthown Street Railway [illegible] work on the construction of the proposed electric railway, connecting Middletown, Royaltown, Elizabeth [illegible] Mount Eagle. A branch railway will also be built to Lebanon. The road will be 30 miles long and the overhead trolley

system will be adopted. The power plant will be located in Conewago and will furnish electricity to towns along the route. William Trimble, of Minneapolis, Minn., is president. Headquarters are at 1324 Real Estate Trust Building, Philadelphia, Pa.

PHILADELPHIA, PA.—The City Council has granted the Delaware Tunnel Railroad Company a franchise to construct a tunnel under the Delaware River. The company has already secured the necessary legislation in New Jersey. Beginning at Market and Second Streets, on the Philadelphia side, one tube will extend to Chestnut Street and thence across the river to Third Street in Camden. The north tube will extend from Third Street in Camden across the river to Second and Arch Streets in Philadelphia and will join the first tube at Market Street. The combined mileage will be a little over four miles.

SOMERSET, PA.—Application will be made Jan. 11 for a charter for the Somerset Street Railway Company by John A. Berkey, Frank B. Fluck, Clarence L. Shaver, James C. McSpadden, John C. Lowry, A. L. G. Hay and A. K. Miller. The company proposes to construct and operate a street railway from Rockwood to Somerset.

WEST LEESPORT, PA.—The Rural Telephone Company is planning to build a telephone line from West Leesport to Reading. Harry B. Adam, of Leesport, and Edwin Kauffman, of West Leesport, are interested in the enterprise.

WILLIAMSPORT, PA.—The Citizens' Electric Company contemplates increasing the output of its plant and will install additional equipment, including boilers, engines and generators. Jonas Fischer is president and manager.

YOUNGSTOWN, PA.—The contract for furnishing electricity for lighting the streets and public buildings in Youngstown, Pa., has been awarded to the West Penn Electric Company, of Connellsville. The company will extend its transmissioon lines at once to this city, and will also furnish electricity for lamps and motors for commercial and private consumers.

PONCE, P. R.—The contract for constructing the municipal electric light plant in Ponce has been awarded to Bellman & Sanford, 149 Broadway, New York, N. Y., for $23,630.

PASCOAG, R. I.—The citizens have voted to authorize the operating committee to secure the services of an electrical engineer to investigate the municipal electric light plant and ascertain the cost of remodeling the plant so as to improve the service.

BLACKSBURG, S. C.—The citizens on Dec. 21 voted to issue $15,000 in bonds, the proceeds to be used for the construction of an electric light plant and other purposes. P. H. Freeman is chairman of Public Works Commission.

CHARLESTON, S. C.—Bids will be received by J. H. Dingle, city engineer, until Jan. 20 for one 450 gal. per minute vertical centrifugal pump, with electric motor for operating the same.

ST. MATTHEW, S. C.—Bids are being asked for the construction of 50 miles of electric railway and a reinforced concrete dam and power house for the Calhoun Railway & Power Company, to be located on High Hill Creek, six miles north of St. Matthew. The cost of the work is estimated at $800,000. D. G. Zeigler & Company, of Atlanta, Ga., and Jacksonville, Fla., are consulting engineers.

DEADWOOD, S. D.—The Burlington Railroad is making arrangements to install a telephone system in the Black Hills. The company operates nearly 200 miles of road in the Hills.

RAPID CITY, S. D.—The Rapid City & Wyoming Railway Company has been granted a franchise to construct and operate a street railway in Rapid City, which will be several miles in length. The company is authorized to use either gasoline or electric motors for motive power.

SIOUX FALLS, S. D.—Plans are being made by the Sioux Falls & Sioux City Electric Railway Company to begin work on construction of its proposed railway some time this year. The railway will be about 90 miles in length and will connect Sioux Falls, S. D., and Sioux City, Ia., and intervening towns. The present plans call for the construction of two power stations, one to be located at Sioux Falls, S. D., and the other at Sioux City, Ia. George W. Burnside, of Sioux Falls, S. D., is general manager.

HENNING, TENN.—A new telephone line, known as the Mac Telephone Company, is being erected from Mac to Glimp, where it will connect with the Cumberland Telephone Company's line.

MEMPHIS, TENN.—It is reported that the Trustees of the City Hospital contemplate the installation of a light plant.

MEMPHIS, TENN.—Work has commenced on the construction of the new interurban electric railway between Memphis and Lakeview, a distance of 12 miles. This line is to be part of the plan of the Clarksdale, Collierville & Covington Company, which proposes to operate a system of electric interurban railways to a number of smaller towns, all centering at Memphis. Motor cars will be operated during the coming summer and until the electric plant is completed. H. E. Craft is interested in the project.

WALLAND, TENN.—Arrangements are being made by the Schlosser Leather Company to change the motive power of its plant from steam to electricity. About 160 hp will be developed and will include the construction of a concrete dam 150 ft. long, 11 ft. high, across the Tennessee River, three-quarters of a mile below Walland. The cost of the work is estimated at $15,000. The contract for the work has been awarded to the Eastern Construction Company. W. A. P. Schorman will have charge of the work.

FORT WORTH, TEX.—The Northern Texas Traction Company is extending its system to Washington and Fostepeco Heights and adjacent communities. The extension will be about two miles long. H. T. Edgar is general manager.

WICHITA FALLS, TEX.—The Southwestern Telegraph & Telephone Company is planning to install a telephone system in Wichita Falls, at a cost of about $30,000.

OGDEN, UTAH.—The directors of the Ogden Rapid Transit Company are contemplating the extension of several of its interurban lines, including an extension through Ogden Canyon and on to Huntsville and Eden Valley.

RICHMOND, VA.—The joint committee on water and electricity of the Council has adopted the recommendation of a subcommittee for converting the old pump house into an electric light and power plant, according to the plans and specifications submitted by E. W. Trafford, consulting engineer.

SOUTH HILL, VA.—The city is considering the question of granting a franchise for the construction of an electric light system in South Hill. For further information address Mack Pritchett, clerk.

SOUTH HILL, VA.—We are informed that a telephone and electric light franchise will be sold Jan. 18 to the highest bidder. Mack Pritchett is clerk of the Council.

ABERDEEN, WASH.—The Grays Harbor Railway & Light Company has decided to extend its transmission lines to Cosmopolis and South Aberdeen to furnish electricity for lighting both towns. The cost of the work is estimated at between $10,000 and $15,000, work on which will begin soon.

CHEHALIS, WASH.—The City Council has granted a 35-year franchise to W. J. Patterson, Theodore Hoss and A. Welch to construct and operate an electric railway in Chehalis. Under the terms of the franchise the company is to have free use of the streets for the first five years; the following 20 years the company is to pay the city the sum of $250 per year and for the last 10 years of the franchise $500 per annum. The same parties have already secured a franchise in Centralia, Wash.

KENNEWICK, WASH.—The Columbia Basin Light & Power Company has applied to the City Council for permission to erect a high-tension transmission line from its plant to Washington Street and thence to Garden Tracts.

PUYALLUP, WASH.—Plans are being made to commence work on the construction of a new substation in Puyallup for the Puget Sound Electric Railway and the Tacoma Railway & Power companies. The cost of the station complete is estimated at from $35,000 to $40,000.

SPOKANE, WASH.—Rights of way are now being secured by the Spokane, Columbia & Western Railway Company for its proposed railway, which is to extend from Spokane to Reardan, Davenport and Peach, a distance of about 70 miles. The railway when completed will be operated as part of the Spokane & Inland Railroad. Clyde M. Graves, of Spokane, is president.

TACOMA, WASH.—The report of the city controller on the municipal electric light and power plant shows a profit of $90,000 for the past year. According to the report the charges against the plant are as follows: For electrical energy purchased, $110,000; cost of operation, $75,000; cost of repairs, $20,000; interest on investment of $875,000, $40,000, making a total of $245,000 for the year. Receipts are as follows: For electricity sold to private customers, $281,000; electricity furnished for street lamps and public buildings, $54,000, making the total $335,000, which gives the city a profit of $90,000.

CLARKSBURG, W. VA.—Dr. George I. Keener has been granted a 50-year franchise by the County Court to construct and operate an electric railroad from Weston to Bendale.

PARSONS, W. VA.—Contracts have been placed by the Cheat Valley Telephone Company for the construction of a telephone line between St. George and Kingwood.

WELLSBURG, W. VA.—Arrangements are being made by the Wellsburg, Bethany & Washington Traction Company to extend its railway from Bethany to Washington, Pa., a distance of about 21 miles.

BRISTOL, WIS.—The Bristol Telephone Company has increased its capital stock from $3,000 to $8,000.

EDGERTON, WIS.—Application has been made to the City Council by the Cincinnati Construction Company for a franchise to construct and operate an interurban or an electric street railway on certain streets of the city.

HUDSON, WIS.—The Northwestern Telephone Exchange Company has sold all its holdings in the State of Wisconsin to the Wisconsin Telephone Company, which assumed control Jan. 1, 1909.

JEFFERSON, WIS.—The municipal electric light plant was put into operation Dec. 25. A 24-hour service will be established.

KENOSHA, WIS.—Plans are being considered by the Chicago, Kenosha & Milwaukee Electric Railway Company to construct an interurban railway connecting Waukegan, Kenosha, Racine and Milwaukee. The company has applied to the State Railroad Commission at Madison, Wis., for permission to construct an electric railway from Kenosha to the State line and is also securing rights of way through this city. The officers of the company are: George G. Wilcox, president; Volney Foster, Jr., of Evanston, vice-president, and Frank Grover, secretary and treasurer.

KILBOURNE, WIS.—The Central Wisconsin Transit Company is planning to commence work on the construction of its proposed railway early this spring. Burns & Company, of Isabella Building, Chicago, Ill., have been awarded the general contract for the construction of the road. The railway will be about 65 miles in length and will connect Kilbourne, Portland, Friendship and Grand Rapids, Wis. Both steam and electricity will be used for motive power. J. J. Burns, of Chicago, Ill., is president and general manager.

RIVERSIDE, WIS.—Arrangements are being made by the J. M. Kohler & Sons Manufacturing Company to install individual motors to operate its plant at a cost of $15,000. The contract for a switchboard has been awarded to Acker & Schiffendor, of Sheboygan, Wis., for about $4,000.

WAYSIDE, WIS.—The Wayside Telephone Company contemplates extending its telephone line through Maple Grove.

EDMONTON, ALB., CAN.—The Preston Car Company, of Preston, Ont., has been awarded the contract to supply cars for the municipal electric railway system at $3,225, f. o. b. this city. With the motors the cars will cost $5,400 apiece. The tenders without motors ranged from $3,225 to $4,985.

ARMSTRONG, B. C., CAN.—The City Council has decided to purchase the electric lighting plant of the Armstrong Electric Light & Power Company and to operate it as a municipal enterprise.

VANCOUVER, B. C., CAN.—James D. Schuyler, of Los Angeles, Cal., has recommended that the British Columbia Electric Railway Company build a dam 75 ft. high at the mouth of Coquitlam Lake to form a large reservoir and thereby increase its power supply very materially.

RUSSELL, MAN., CAN.—The Russell Telephone Company has increased its capital stock from $5,000 to $25,000, the proceeds to be used for extension to its system.

WINNIPEG, MAN., CAN.—The Winnipeg Electric Company has offered to supply the city with all the power required for civic and other purposes for $24.66 per horsepower per year, permitting the city to fix any rate it pleases with the consumers. The matter has not yet been taken up by the City Council, but a number of Aldermen have stated that the offer will not be considered, as the Council is pledged to municipal ownership. F. E. Cambridge is city electrician.

SYDNEY, N. B., CAN.—N. J. McLean, of Fourchu, N. B., has commenced a survey for the proposed electric railway to extend from Sydney to East Bar.

HALIFAX, N. S., CAN.—The Wentworth Home Telephone Company has been granted a franchise to construct about 35 miles of telephone lines in Wentworth County.

BRANTFORD, ONT., CAN.—Plans are being made by the Brantford Street Railway Company to remodel its entire system and also to construct an extension from Brantford to Dover within a few months.

FREELTON, ONT., CAN.—Malcolm McPherson, of Freelton, has been appointed to purchase the right of way for the proposed electric railway to run between Freelton and Guelph. For further information address John Patterson, of Hamilton, Ont.

ORILLIA, ONT., CAN.—Since the completion of the dam at Ragged Rapids the town has made material reduction in its charges for electricity for lamps furnished by the municipal plant. In future the charges for commercial lighting will be from 28 cents to 18 cents per month per lamp, and for residences from 20 cents to 18 cents.

OTTAWA, ONT., CAN.—A charter is being applied for for an electric railway to run from Ottawa to Morrisburg, a distance of 143 miles. The estimated cost of railway is $2,000,000. For further information address C. S. Cossitt, of Brockville, Ont.

SUDBURY, ONT., CAN.—The Ontario Railway and Municipal Board has approved a by-law of the Town of Sudbury providing for an expenditure of $19,000 for extensions to the water works and electric light plants.

TORONTO, ONT., CAN.—The Government will appoint a telephone commissioner, owing to the large number of rural telephone companies being incorporated.

TORONTO, ONT., CAN.—The Hydro-Electric Power Commission promises to deliver power to this city by Dec. 19, 1909. K. L. Aitken is engineer in charge of the city's interests.

WELLAND, ONT., CAN.—G. H. Burgar, of Welland, is endeavoring to secure a franchise for an electric railway company to build several lines in the vicinity of Welland.

EMARD, QUE., CAN.—The St. Paul Electric Power Company, of Montreal, has purchased the local electric lighting plant, owned by J. L. Marchand, for $149,000. The plant was built two years ago and holds a 30-year franchise.

SASKATOON, SASK., CAN.—The Northwestern Telephone Company has issued additional stock to the amount of $[illegible], the proceeds to be used to assist in the formation of rural telephone companies. The company has decided not to engage in the construction of long-distance lines, leaving it entirely to the Saskatchewan Government.

New Industrial Companies.

THE ELECTRIC SHADED SIGN COMPANY, of North Yakima, Wash., has been chartered with a capital stock of $[illegible]. H. Hess, Schott, John Hulse and James F. [illegible]

THE PHILADELPHIA MULTIPHONE COMPANY, of Philadelphia, Pa., has been chartered with a capital stock of $100,000 by A. P. Pitner, G. W. Codar and D. B. Wilwar, of Philadelphia, Pa.

THE AURORA ELECTRICAL COMPANY, of Aurora, Ill., has been chartered with a capital stock of $2,500 to deal in electrical goods. The incorporators are: F. L. Beesaw, T. J. Merrill and F. W. Hartsburg.

THE TRI-CITY ELECTRIC COMPANY, of Moline, Ill., has filed articles of incorporation with a capital stock of $50,000. The company is an Iowa corporation doing an electrical contracting and manufacturing business.

THE FIDELITY ELECTRIC CONSTRUCTION COMPANY, of New York, N. Y., has been chartered with a capital stock of $2,000 by Harry Barth, Leo Weiss and Ida Bernstein, all of New York, N. Y. The company proposes to do a general electrical construction business and mechanical equipment.

THE SOUTHWESTERN CONTRACTING & ENGINEERING COMPANY, of New York, N. Y., has been chartered with a capital stock of $30,000 by Harry Peel, Henry J. Wallach and Marvin E. Parrott, all of New York, N. Y. The company proposes to do a general engineering and contracting business.

THE AMERICAN-CHINESE ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000, to do engineering work in America and China. The incorporators are: Theodore M. Foote, of Brooklyn, N. Y.; Frank Lee Lowe and Goon Chung, of New York, N. Y.

THE METAL GOODS MANUFACTURING COMPANY, of Portland, Maine, has filed articles of incorporation with a capital stock of $10,000 and the following named officers: C. L. Marston, president and clerk; C. J. Lawrence, both of Yarmouth, Maine. The company proposes to manufacture electrical and mechanical apparatus.

THE PRATT ENGINEERING COMPANY, of Atlanta, Ga., has been incorporated with a capital stock of $700,000 by N. P. and George L. Pratt, George F. Hurt and others. The company proposes to engage in all branches of engineering work, contracting and construction, manufacturing machinery, and equipment and construction of electric and steam railways.

THE OVERHEAD & UNDERGROUND CONSTRUCTION COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $3,000. The incorporators are: Joseph W. Putnam, of East Orange, N. J.; Charles A. Florence, of New Rochelle, N. Y., and Walter M. Whitney, of New York, N. Y. The company proposes to carry on a general contracting and engineering business.

New Incorporations.

PHOENIX, ARIZ.—Articles of incorporation have been filed for the Phoenix, Tempe & Mesa Railway Company. The directors are: S. J. Tribolet, L. M. Hoghe, I. Diamond, Andre W. Neilson, Harry J. Bennett, M. L. Vieux and George Hageman.

DANVILLE, ARK.—The Danville Electric Company has been incorporated by D. F. Montgomery, A. M. Falls, C. T. Meadors, George Leming, I. R. Graydon, C. C. Sharpe, W. T. Blackburn and others. Officers: D. F. Montgomery, president; I. B. Graydon, vice-president; George Leming, secretary; A. M. Falls, treasurer. The object of the company is to furnish electricity for light and power for the city and to establish a water works plant.

TURLOCK, CAL.—The Turlock Home Telephone & Telegraph Company has been formed to operate a local telephone exchange. The officers are: John I. Randolph, president; J. C. Williams, vice-president; A. J. Eddy, secretary; H. T. Adams, treasurer, and W. T. Thornburg, manager.

FAIRBURN, GA.—The Fairburn & Atlanta Railway & Electric Company has been incorporated, with a capital stock of $75,000, to construct an electric interurban railway from Fairburn through Stonewall and Red Oak to College Park, a distance of about 11 miles. The incorporators are: J. F. Golightly, of Atlanta, Ga.; W. T. Roberts, J. H. Harris, W. H. Mims, L. M. Hobgood, J. E. Longino, J. H. Longino, W. H. McLarin, D. A. Carmichael, all of Fairburn, Ga.

REUBENS (P. O. KIPPEN), IDAHO.—Articles of incorporation have been filed for the Reubens Rural Telephone Company, with a capital stock of $2,000, by James Bonnallie and others.

WAUKEGAN, ILL.—The Waukegan, Rockford & Elgin Traction Company has been formed to construct an electric railway from Waukegan to Marenga, work on which will begin early this year, and later to build a branch from Fox Lake to Elgin. The cost of the first project is estimated at $1,500,000. The promoters are: J. L. Pope, who, it is said will be president of the company; Paul McGuffin, of Libertyville; J. C. Foley, Theodore H. Durst, Claire C. Edwards and R. D. Wynn, all of Waukegan, Ill.

CLYDE, IA.—Articles of incorporation have been filed for the Farmers' Telephone Company, with a capital stock of $400, by George Gilbertson, James E. Moore and Frank Baker.

ELDORADO, KAN.—The Eldorado Light & Water Company has been incorporated at $50,000. The company proposes to purchase and equip a lighting plant at Eldorado. John P. Holmes is president of the company. Incorporators include John F. Holmes, S. H. Morgan and J. J. Hudson, all of Eldorado.

LEXINGTON, KY.—The Midland Electric Company has filed articles of incorporation, with a capital stock of $100,000. The company proposes to generate and distribute electricity for lamps, heat and motors, also steam or hot water for heat, in the city of Lexington and other places in the State. The incorporators are: Warren E. Griffin, of Philadelphia, Pa.; Pendleton Beckley, of Louisville, Ky.; Arthur Lipper, of New York, N. Y.; J. E. Cope Morton, of Devon, Pa., and Norton M. Griffith, of Philadelphia, Pa.

SCIENCE HILL, KY.—The Science Hill Telephone & Exchange Company has been chartered, with a capital stock of $3,000, by William Lowery, T. W. Denney, A. Y. Hayes and others.

Legal.

ENJOINED FROM ERECTING ELECTRIC PLANT.—In the test case brought against the Board of Public Service of Lima, Ohio, to enjoin it from erecting an electric light plant, Judge Killits, of Bryan, has handed down a decision, in which he holds that the board is exceeding its power in attempting to contract for an incomplete or inoperative plant and trusting that the pressure of necessity or the favor of the City Council will result in procuring more funds to finish the plant. The board is enjoined from erecting a plant under the present plans, upon which bids have been received, but is granted the right to prepare new plans so that the cost may come within the limits of the funds at its disposal.

AUTOMOBILE IGNITION.—It appears that steps have been taken by the Apperson Brothers' Automobile Company, of Kokomo, Ind., of which Elmee Apperson is president, to notify all manufacturers and importers of and dealers in automobiles in this country of the existence of his two patents in connection with the manufacture of internal explosion motors. The first patent has been held by Mr. Apperson for some time and the second was granted to him on the 1st of December. Both patents have to do with the ignition of motors, and, it is declared by Mr. Apperson, cover broadly the use of two or more separate igniting devices provided with separate circuits with means of throwing the ignition devices into or out of action simultaneously or independently.

Obituary.

MR. JEROME CARTY.—The death is announced in Philadelphia on Dec. 30 of Mr. Jerome Carty from a second stroke of apoplexy, the original attack of which seized him several months ago while he was West. He is survived by a son, Harry Carty, and a daughter, Mrs. F. A. Baird. Mr. Carty was born Oct. 20, 1845, at Springfield, Pa. He graduated in law from the University of Pennsylvania in July, 1866. He was confidential assistant of Charles Henry Lex until 1872, when he began practice for himself. He handled coal land sales involving many millions for various estates. Mr. Carty occupied a prominent position in Europe and the United States in the telephone litigation in opposition to the Bell company, taking an active part in various arguments in which he was associated with Col. Robert G. Ingersoll. From time to time he was interested also in other electrical litigations and projects.

Personal.

MR. JOHN J. CARTY, chief engineer of the American Telephone & Telegraph Company, is at present on the Pacific Slope and is not expected to return East for several weeks.

MR. JOSEPH C. GRAVES, who for 15 years was associated with the Otis Elevator Construction Company, has resigned and will become vice-president of the American Elevator Company.

MR. MAURICE QUAIN, formerly with the Cranbrook Electric Light Company, Cranbrook, B. C., has been appointed superintendent of Kootenay Telephones, Ltd., with head office at Cranbrook, B. C.

MR. W. N. RYERSON, for several years superintendent of the Ontario Power Company, Niagara Falls, Ont., has resigned to accept a position as manager with the Great Northern Power Company, of Duluth, Minn.

MR. E. F. GARDNER, manager of the Shore Electric Company, of Red Bank, N. J., has accepted the position as general manager of the New Jersey Consolidated Water & Light Company, at Deal Beach, N. J.

MR. ROBERT C. HOUSE, who was superintendent for M. W. Forney Company, New York, has resigned and entered the sales department of the Safety Insulated Wire & Cable Company, 114 Liberty Street, New York City.

MR. JOHN B. GUTHRIE will hereafter be the sole representative of the American Steam Gauge & Valve Mfg. Company, of Boston, Mass., in the Pittsburg district, and will have offices in the Columbia Bank Building, corner of Fourth Avenue and Wood Street, Pittsburg.

MR. D. D. PENDLETON, who was connected with the Westinghouse Electric & Manufacturing Company, of Pittsburg, for some fifteen years, [illegible] manager of the American Boiler Economy Company, manufacturers of the Copes feed water regulator, [illegible] located in the Frick Building, Pittsburg, Pa.

[illegible] The consulting engineering firm of Connell, Sykes & [illegible], New York City, as consulting engineers, has by mutual consent been terminated by the retirement of Mr. H. W. Sykes. Messrs. H. W. Connell and H. E. Connell, heretofore of the said firm, have formed a partnership under the firm name and style of Connell & Connell, and will continue as consulting engineers at the same address.

Calendars.

THE COOPER HEWITT ELECTRIC COMPANY, Pittsburg, Pa., has issued a three-months' calendar, intended particularly for the manufacturer. It gives timely hints as to the installation and operation of mercury-vapor lamps.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, following the practice which it established some years ago is distributing to its various customers very artistic calendars for 1909, which are attractive enough to merit a place on the walls of any office to which they may be sent.

STUART-HOWLAND COMPANY is distributing among its customers a calendar of large size, which instead of the usual picture has a map of the world, showing the principal steamship routes, with a border of the flags of all nations in colors. The upper left-hand corner contains a picture of the company's building in Boston.

HAZARD CALENDAR.—The Hazard Manufacturing Company, Wilkesbarre, Pa., has issued a calendar for 1909, each sheet of which contains illustrations of some of the company's products. Wire cables, rubber-covered wires, telephone and telegraph wires, magnet wires, etc., are thus shown. The monthly calendars are printed in large and legible figures.

GEORGE W. JACKSON, INC., Chicago, Ill., is sending out a January calendar, on which appears a cut made from a photograph showing the details of the steel sheeting construction on the Kinzie Street Bridge, Chicago, Ill. This firm does a general engineering, contracting and manufacturing business and makes a specialty of steel bridges, structural steel and machinery for subways, tunnels and heavy foundations.

Trade Publications.

SNAP SWITCHES.—The General Electric Company has recently issued a booklet, No. 3701, in which are listed and illustrated snap switches, both indicating and non-indicating, flush switches of the rotary and push-button type, pendant and ceiling switches.

"UNIVERSAL" ELECTRIC IRON.—The Pelouze Electric Heater Company, 403 Ohio Street, Chicago, Ill., in a new circular describes and illustrates its "Universal" electric iron. Several advantages are claimed for this device, among which is its availability as an electric stove or heating disk.

CHAIN BLOCKS.—Yale & Towne Manufacturing Company has just issued its new chain block catalog, describing not only its line of chain hoists, both hand and electric, but trolleys, trolley blocks, etc. This is an even more expensive and carefully considered production than any published by the concern relative to this specialty.

ELECTRIC SPECIALTIES.—The 1909 catalog of the Machen & Mayer Electrical Manufacturing Company, Philadelphia, Pa., contains illustrations, descriptions and prices relating to flush switches, flush receptacles, pendant switches, wall cases, conduit boxes and panel boards. The company has also issued a bulletin devoted exclusively to panel boards.

AMERICAN SCHOOL OF CORRESPONDENCE, Chicago, Ill., is sending out circular matter describing its new "Cyclopedia of Applied Electricity." This cyclopedia contains much authoritative information on the latest electrical developments. It is compiled from the regular textbooks used in the correspondence courses of the school. There are six large volumes.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is distributing a bulletin descriptive of the Hartman type auto transformer and circuit breaker for use in conjunction with polyphase induction motors. These starters are primarily designed for use in mills and factories, and by means of overload, underload and low voltage coils secure the maximum degree of protection. Copies of this bulletin will be sent upon request.

MINIATURE LAMPS.—Bulletin No. 8 issued by the engineering department of the National Electric Lamp Association, Cleveland, Ohio, deals entirely with miniature incandescent lamps of the carbon filament type. It contains a complete list of the regular types of miniature and candelabra carbon lamps for decorative purposes, battery inspection, automobile headlights, telephone and various special service. These lamps are all shown and are described in detail, inclusive, of such interesting and less usual types as the little unbased festoon lamp and the long-stemmed battery inspection type. The special styles include dental, surgical, etc.

BIRD'S-EYE VIEW OF BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company, Birmingham, Ala., has issued a folder containing a bird's-eye view of the Birmingham district. The covers are brown and gray. There is a general view of the city at the top, and typical scenes are shown of the extraction of coal, limestone and iron, at the bottom, grouped artistically and surmounted by the cupolas of belching furnaces, as indicative of the natural resources of Birmingham. The descriptive matter is illustrated by half-tones of the principal points of interest in the city and of scenes along the company's trolley lines. The bird's-eye view of the city is 38 in. long by 14 in. wide.

Business Notes.

FEDERAL SIGN SYSTEM, Chicago, Ill., has opened up a new rental office at 119 West Third Street, Louisville, Ky. Representatives of the firm state that a large amount of new business has already been secured through the efforts of the new office.

LUNKENHEIMER VALVES.—Our attention has been called to the fact that the valves furnished by the Lunkenheimer Company, of Cincinnati, Ohio, for the Isthmian Canal Commission are guaranteed for 200-lb. working pressure and not for 20-lb., as was stated in an item in this column in the issue of Dec. 5.

COMMERCIAL TESTING & ENGINEERING COMPANY, consulting fuel engineers and chemists, has opened offices and laboratories in the Old Colony Building, Chicago, Ill. The company announces that it is thoroughly prepared to make mechanical and chemical tests in boiler room economies. The officers of the company are Edward H. Taylor, president; Harry W. Weeks, vice-president; W. D. Stuckenberg, treasurer; B. J. Maynes, secretary.

THE F. BISSELL COMPANY, of Toledo, Ohio, manufacturer of electrical supplies, has leased the property at 402 and 406 Erie Street for its factory. The new factory will be used for the production of the various articles that have been manufactured by the company at the old location. Walter L. Bissell has been made treasurer of the company to fill the place made vacant by the resignation of L. N. Bardol, who is now with the Toledo-Massillon Bridge Company.

OLIVETTI INSTRUMENTS.—The famous European firm of C. Olivetti & Company, of 4 Broggi, Milan, Italy, is desirous of placing an American agency with some reliable person or concern. It may not be generally known that the electrical measuring instruments of this concern are in wide use all over Europe and enjoy a high reputation for central station, power house, laboratory use, etc. Mr. C. Olivetti, the president of the company, is at present in this country on a visit.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., has opened a branch factory at 63 West Washington Street, Chicago, Ill. During the past year this company has secured such a favorable business in the Middle West and the East that it found it absolutely necessary to open up a factory in Chicago for the manufacture of its well-known "Hot Points" flatiron. The main floor of the factory is 22 ft. x 100 ft. in size. The front portion of the building is utilized for office, storeroom and shipping room purposes, and the balance of the building is occupied by the machine shop and assembling room. The new factory is very conveniently arranged for the quick assembling of the various parts which go to make up the "Hot Points" iron. The main castings of the iron are sent to Chicago from the company's Ontario (Cal.) factory, where a large foundry is maintained for the casting of the bottom part of the iron. The resistance wires, brass core castings, handle, screws and other parts used in the assembling of the iron are purchased in the Eastern market. The assembling room of the new factory is provided with all the necessary and most modern machinery, which will allow the work of assembling the parts to be done very quickly. Along one side of the assembling room is located a small track, on which cars, carrying the parts of the irons to be assembled, are operated. By the use of these cars the main castings of the iron are placed on one of the cars at one end of the assembling room and shoved along from one workbench to another until the process of assembling is completed. When the car arrives at the end of the room opposite from the starting point the irons are completed. They are then carefully tested, and the meter readings are accurately stamped on each iron. The platform of the car is then placed on a portable truck and taken to the shipping room. By this method of assembling the parts, the iron is handled but once after the main casting is brought into the factory. The company announces that it has made several notable improvements in its irons and expects to demonstrate these improvements for the first time at the Chicago Electrical Show, which will be held at the Coliseum, Chicago, Ill., from Jan. 16 to 30, 1909. Mr. Henry F. Holland is the Chicago manager of the company.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED DEC. 29, 1908.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

907,712. PROTECTED HIGH-POTENTIAL RAIL; A. H. Armstrong, Schenectady, N. Y. App. filed July 21, 1906. A third rail, a return conductor, a protective covering for the rail and an electric connection, including a resistance between the covering and the return conductor.

907,714. ELECTROMAGNETIC RELAY; G. Babcock, Rochester, N. Y. App. filed May 31, 1906. An electric relay with a movable core, a bulb containing an electrical conducting liquid controlled by the core and spring mechanism adjusting the position of the bulb, a winding disposed about the core which is adjustable with relation to the core.

907,715. DRIVING-WHEEL FOR ELECTRICALLY-PROPELLED VEHICLES; D. Balachowsky, Paris, and P. Caire, Levallois-Paris, France. App. filed May 8, 1907. The motor is embodied in the wall structure and certain of the elements are used as brake rings.

907,717. CHOKE-COIL FOR MOVING-PICTURE MACHINES; H. J. Beck, Phillipsburg, Pa. App. filed July 30, 1908. A U-shaped core with a coil-supporting plate mounted upon one of the side pieces of the core and a resistance coil mounted upon said supporting plate.

907,726. TROLLEY-WHEEL; C. M. Bradfield, Grand Rapids, Mich. App. filed March 28, 1908. A trolley wheel with railway bearings. Details.

907,738. POLE-PIECE FOR DYNAMO-ELECTRIC MACHINES; A. Churchward, Chicago, Ill. App. filed Aug. 23, 1901. A laminated pole piece having the metal portion of the laminæ cut away.

907,740. SWITCH-BOX; A. G. Clark, Schenectady, N. Y. App. filed April 18, 1908. For use with track switches of a block system, in which a casing with two shafts journaled in the casing is provided. A crank on one shaft is connected to the track switch and a second crank on the shaft is connected with a link and a second shaft, on which latter shaft the switch contacts are mounted.

907,751. TESTING SYSTEM FOR TELEPHONE LINES; W. W. Dean, Chicago, Ill. App. filed June 29, 1903. Relates to improvement on a prior patent. Isolates the common portion of the testing circuit from the cord circuits, so that if the latter are short-circuited the testing relay is not operated.

907,752. ELECTRIC CONTROLLER; W. S. Deeds, Pittsburg, Pa. App. filed Feb. 18, 1908. Details in the construction of a drum controller for a wireless armature induction motor.

907,763. CONTROLLER CHECKING DEVICE FOR STREET RAILWAY CARS; Nathan Fallek, Denver, Col. App. filed Sept. 9, 1907. A controller check electrically operated, comprising an operatively arranged controller, crank with a ratchet wheel movable with the crank, a locking pawl and an electromagnet for actuating the pawl.

907,787. INCANDESCENT ELECTRIC LAMP SOCKET; G. W. Good bridge, Bridgeport, Conn. App. filed July 31, 1907. The socket has a cap with a number of projections on the flange which receive corresponding tongues on the shell.

907,788. INSULATOR CLIP; A. R. Hall, Leonardsville, N. Y. App. filed Oct. 21, 1908. The clip comprises a U-shaped member and a stirrup of wire, which engages the member and secures the line wire to it.

907,811. RESISTANCE ADJUSTING DEVICE; H. P. MacLaren, Chicago, Ill. App. filed April 24, 1907. Details in a variable resistance for electric motors.

907,834. INSULATOR; G. B. Marshall, Scranton, Pa. App. filed Oct. 9, 1908. A spike insulator adapted to be driven between the bricks in a wall, one side of the spike forming the clip to hold the button or washer.

907,852. BATTERY CONNECTOR; H. W. Munyan, Worcester, Mass. App. filed Feb. 21, 1907. The connector consists of a continuous conductor with resilient oil terminals in one integral piece with the conductor which forms compressible springs at the ends thereof.

907,866. LIGHTNING ARRESTER; Albert Oleson, Toledo, Ohio. App. filed Aug. 1, 1906. A pair of fuse wires connecting separated terminals of the circuit and a mass of high conductivity is connected with the ground, and is located between the terminals. It carries away the current when the fuse wires blow out.

907,872. OIL ON THERMAL CUTOUT; C. N. Pratt, Rochester, N. Y. App. filed June 6, 1907. Extinguishes the arc caused by the flashing of a fuse by an oil bath. A conduit connects with the interior of the receptacle containing the oil, the outer end of the conduit being sealed by liquid.

907,884. MOTOR COMPRESSOR; W. J. Richards, Milwaukee, Wis. App. filed Nov. 4, 1907. For air-brake systems on electric railways containing a crank case, a motor frame and a compression compartment frame and a removable cover on the under side of the crank case forming an oil well.

907,891. COMMUTATING DYNAMO-ELECTRIC MACHINE; K. Sulzberger, Charlottenburg, Germany. App. filed Jan. 16, 1906. A field magnet, an armature provided with a commutator and a commutating pole which is slotted, the slot being dissymmetrical with respect to the axial plane through the middle of the pole.

907,899. TROLLEY GUARD AND REPLACER; J. J. Schultz and W. C. Taggart, Richmond, Ind. App. filed May 25, 1908. Details in a trolley replacer.

907,911. APPLIANCE FOR CONDUIT WIRING; J. S. Stewart, New York, N. Y. App. filed Nov. 23, 1907. Lamp receptacle for an outlet box, the box having an open side and a pair of lugs projecting inwardly, with an independent retaining device engaging the lugs and bearing against the body to retain it in position against the bottom of the box.

907,931. APPARATUS FOR REGULATING THE VOLTAGE OF AN ELECTRIC CURRENT; Wynant James Williams, Albany, N. Y. App. filed March 19, 1908. A translating device is caused to [illegible] in proportion to the load by using a coil of considerable self-inductance surrounded by a coil in series with the load circuit.

907,960. TELEPHONE ATTACHMENT; G. J. Boelen, The Hague, Netherlands. App. filed June 4, 1907. The [illegible] starts a talking machine, which co-operates with the telephone. Details.

907,[illegible]. SEPARATOR FOR STORAGE BATTERIES; R. N. Chamberlain, Dobbs Ferry, N. Y. App. filed May [illegible]. A separator for storage batteries consisting of a flexible holder of non-conducting material [illegible].

907,[illegible]. TELEPHONE TRANSMITTER; W. W. Dean, Elyria, Ohio. [illegible] Relates to an improvement on a prior [illegible] by placing in the local branch has a [illegible] which may become quickly charged. The cells [illegible] current, but prevent the passage of ringing current.

907,[illegible]. TROLLEY; Joseph Franklin, Philadelphia, Pa. App. filed May [illegible]. A trolley in which the wheel is supported by two telescoping [illegible] being adapted to run in opposite directions without [illegible].

907,985. PUSH BUTTON CONTROLLED PLUNGER ELEVATOR SYSTEM. Lloyd C. Fenlow, Montclair, N. J. App. filed April 25, 1908. A brake apparatus is connected directly with the plunger of the elevator and is operated with a hydraulic motor independently of the speed-control change valve apparatus.

907,986. COMBINED ELECTRIC BRAKE AND PUSH BUTTON PLUNGER ELEVATOR SYSTEM. Lloyd C. Fenlow, Montclair, N. J. App. filed Jan. 8, 1907. An electric brake apparatus for the plunger positively holds the car stationary at a desired landing.

908,043. TROLLEY SWITCH. A. Palmros, Fairmont, W. Va. App. filed Jan. 12, 1901. A movable tongue switch plate directs the trolley from one conductor to another. Details.

908,063. WHISTLE; Henry W. Aylward, New York, N. Y. App. filed Jan. 22, 1908. An electrically operated whistle for warships. The whistle is blown by steam and the valve is controlled electrically.

908,068. TROLLEY HARP; Thomas F. Brennan and Thomas J. Mullen, New York, N. Y. App. filed June 3, 1908. Details in the construction of the collar for the axle of the trolley.

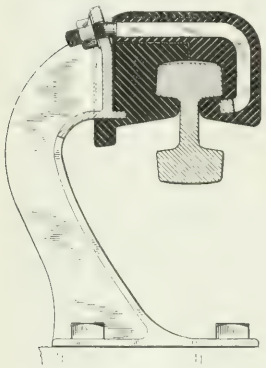
908,089. INSULATOR; J. C. Gibson, Owensboro, Ky. App. filed May 9, 1908. Insulator made of two sections, one with a wire receiving groove and the other screwing down upon the first section.

908,097. MAGNETO ALTERNATING CURRENT GENERATOR. A. Herz, Vienna Austria-Hungary. App. filed Feb. 13, 1905. Puts the primary circuit in short circuit and breaks it at each half period. A closed circuit around the arms of the magnet receives an induced current to prevent demagnetization of the magnet.

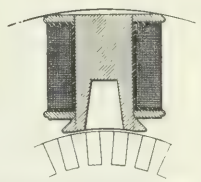
908,098. WINDING FOR ROTATING FIELDS; H. Hertz, Chicago, Ill. App. filed Jan. 5, 1906. Special winding for high-speed generators with heavy conductors in slots in the armature core. The winding starts at the outer one of the connectors and proceeds inward, then outward.

908,117. LIGHT REGULATOR FOR ELECTRIC LAMPS; Thomas E. Murray, New York, N. Y. App. filed Feb. 11, 1907. The regulator contains a liquid insulator, with a rotary shaft, a contact plate thereon and buckets which project the insulator upon the bearing surface of the contact.

908,118. LOCKING DEVICE FOR FUSE PLUGS; Thomas E. Murray, New York, N. Y. App. filed June 9, 1908. A fuse-plug body having



908,136—Third-Rail Insulator.



907,578—Pole Piece for Dynamo-electric Machines.

a cylindrical threaded portion, a flange, and above said flange a flaring cup-shaped portion with slots in its wall.

908,123. OIL SWITCH; J. B. Opsahl, Chicago, Ill. App. filed Sept. 26, 1907. The oil is subjected to pressure and acts directly upon the movable contact to operate it. The oil is circulated so as to give a clean supply.

908,126. ART OR METHOD OF TREATING AND UTILIZING CHLORIN GAS; E. C. Paramore, Philadelphia, Pa. App. filed Feb. 5, 1907. Removes the odor from chlorin gas by washing it with acid, cooling it, heating it highly, then electrifying it, and finally liquefying the gas.

908,130. METHOD OF PRODUCING SILICON; H. N. Potter, New Rochelle, N. Y. App. filed May 22, 1905. The process of eliminating silicon carbid from silicon, consisting in reacting upon the said carbid by means of silicon dioxid and fluid silicon.

908,135. ELECTRIC METER; W. H. Pratt and C. E. Holmes, Lynn, Mass. App. filed June 5, 1905. Integrating meters of a commutating motor type. The actuating coil has its axis perpendicular to the shaft and a circular permanent magnet damps the movement of the shaft.

908,136. THIRD-RAIL INSULATOR; L. M. Randolph, Newark, N. J. App. filed May 2, 1907. Improves the insulation by having the overlapping flanges so arranged that one part overlaps the other to cover the joint between them.

908,166. ROSETTE; J. S. Stewart, New York, N. Y. App. filed Dec. 23, 1907. The terminal supporting member has gripping jaws and a retaining device separate from the cover of the box holds the member in place.

908,167. ELECTRICAL DISTRIBUTION SYSTEM; P. H. Thomas, Montclair, N. J. App. filed Nov. 8, 1904. A mercury vapor device is placed in series across the circuit, with a resistance in series therewith and the circuit containing the translating device is arranged in shunt to the mercury vapor device. This maintains a uniform potential for the translating devices.

908,179. FUSE-PLUG AND CIRCUIT CLOSER. F. I. Vindemore, Fairview, N. J. App. filed March 7, 1908. Circuit-closer for high-potential circuits, including a fuse detachably secured to a base, a circuit-closer and an electromagnet carried by the detachable member for operating the circuit-closer.

908,180. THIRD RAIL; W. J. Wilgus, Yonkers, and Frank Julian Sprague, New York, N. Y. App. filed May 27, 1905. An inverted third rail, insulated and provided with a protective cover, the latter [illegible] the rail and pro-

testing it between the points of suspension. The holding blocks for the rail are of non-conducting, moisture proof material.

908,189. RAILWAY SIGNAL. H. M. Abernethy, Cleveland, Ohio. App. filed March 25, 1908. An electrically operated block signal system in which the semaphore blade is operated by a device arranged to be [illegible] by an electric motor.

908,194. TELEPHONE SYSTEM. W. W. Dean, Chicago, Ill. App. filed Dec. 4, 1905. Relates to an improvement in a local telephone battery telephone system by placing in the local branches of suitable electrolytic cell which may become quickly charged. The cells stop the flow of steady current, but permit the passage of ringing current.

908,195. AUTOMATIC ELECTRIC GAS-RANGE LIGHTER. M. L. Osborn, North Ingram, Pa. App. filed Aug. 12, 1907. The lighting gas-stove. Details.

908,204. ELECTRIC CONTROLLING MEANS. C. G. Haddy, Stamford, Conn. App. filed Aug. 19, 1908. For controlling the lowering speed of hoists by means of a supplemental resistance, with means for placing the armature and field in series and excluding the resistance, which means are also operative to reverse the armature circuit and place it in parallel with the field winding and the supplemental resistance, and the latter in series with the field.

908,297. APPARATUS FOR IONIZING PETROLEUM AND ITS DISTILLATES; D. Martini, London, Eng. App. filed May 29, 1908. Changes petroleum into an explosive mixture for use in gas engines, by changing the petroleum into a spray, mixing it with the gas and ionizing and expanding the mixture.

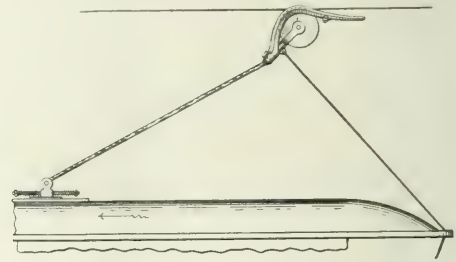
908,300. COMBINED GAGE AND SIGNAL DEVICE; M. G. Melvin, Scranton, Pa. App. filed Dec. 3, 1907. A "Bourdon" tube gage, which closes an electric switch to ring a bell when the pressure rises or falls beyond a predetermined amount.

908,307. SWITCH; L. H. Moulthrop, Bridgeport, Conn. App. filed Sept. 12, 1908. A push-button switch in which a rock lever is actuated by the buttons. A snap make-and-break is provided by a special construction of the means for operating the contact piece.

908,328. ELECTRIC SWITCH; J. G. Peterson, Hartford, Conn. App. filed Dec. 17, 1907. A rotary snap switch in which the stop ratchet can be simply dropped into place and held without fastening means of its own. Details.

908,357. METHOD OF PRODUCING SILICON CARBID; F. J. Tone, Niagara Falls, N. Y. App. filed July 11, 1908. Embeds a resistance in a charge of silicious and carbonaceous material, initially heats the charge by combustion, and then passes current through the resistance to produce silicon carbid.

908,378. METHOD AND MEANS OF HERMETICALLY SEALING A CONDUCTOR IN GLASS; C. O. Bastian and George Calvert, London, Eng. App. filed Oct. 19, 1906. The glass is provided with a



907,869—Trolley Guard and Replacer

passage and the conductor with means which on cooling hermetically seals the passage at one point, while upon heating it closes the passage at another point.

908,379. SWITCHING DEVICE FOR ALL RAILWAYS; William F. Bath, Murray, Idaho. App. filed Sept. 19, 1905. A special mechanism locks the switch in the desired position and gives a signal to show that the switch has been operated.

908,386. SAFETY PORTABLE MANUAL GENERATOR FOR IGNITING MINERS' SAFETY LAMPS; J. C. Bowie and J. H. Phelps, Cardiff, Eng. App. filed Oct. 11, 1907. Provides a special cup into which the miner's lamp, which is lighted by the generator, can be fitted, thus avoiding danger of explosion.

908,389. ELECTRICAL CONNECTION; W. H. Briggs, Richmond Hill, N. Y. App. filed May 9, 1908. A battery connection with a terminal clip having a spring loop uniting wings which engage a binding post. Details.

908,397. CONTROLLER FOR ELECTRIC CIRCUITS; M. W. Day, Schenectady, N. Y. App. filed June 27, 1907. For controlling the field of a generator, by means of a fixed resistance in series with the field and a variable resistance arranged to be connected in shunt either to the field or to said fixed resistance.

908,407. ELECTRIC FURNACE; P. L. T. Héroult, La Praz, France. App. filed Oct. 3, 1907. A stuffing box for the electrode of an electric furnace provided with loose granular conducting material.

908,408. SYSTEM OF MOTOR CONTROL; G. H. Hill, Schenectady, N. Y. App. filed Aug. 23, 1907. A train controlled system in which variations in voltage on the line are prevented from influencing the current in the control circuits to such an extent as to interfere with the operation of the contactors by utilizing a resistance with means for cutting the resistance in and out as the voltage exceeds or falls short of a certain amount.

908,427. ELECTRIC METER; G. E. Stevens, Lynn, Mass. App. filed June 8, 1905. An integrating wattmeter provided with a friction compensating coil with means for adjusting it in two different planes.

908,428. ELECTRICALLY CONTROLLED SECONDARY CLOCK; S. P. Thrasher, Hartford, Conn. App. filed March 20, 1908. An electrical mechanism is controlled by a master clock, the mechanism operating gravity devices for driving the clock.

908,432. IGNITING DEVICE FOR MINERS' SAFETY LAMPS; F. A. Wicke, Barmen, and Rudolf Gartenmeister, Elberfeld, Germany. App. filed July 8, 1908. A platinum wire becomes incandescent and ignites a primer which, in turn, ignites the wick of a miner's lamp, thus avoiding explosion.

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Latest Central Station Statistics.

The Bureau of the Census has just issued the broad figures of the central station industry for 1907, these being the statistics of the regular five-year period required by law. We give the data place on another page, and hope soon to follow them with corresponding figures for the electric railway, telegraph and telephone industries. It is a large undertaking, but is well within the capacity of the Census Office and is carried out with painstaking care. The figures are as near absolute accuracy as it is possible for anyone to come in this country, and in their general extent and detail are not approached by those of any other civilized nation. The next step, indeed, will be in the direction of international effort and comparison of result.

Since the last figures were compiled, those of 1902, we have made an effort to keep pace by an annual estimate, and are now glad to find that our approximations are very close and exact. An estimate has been made of a billion-dollar investment up to 1908. The returns show $996,000,000. The actual capitalization will of course be larger, reaching our estimates of from $1,200,000,000 to $1,500,000,000 at least. The income is given as $175,000,000 in 1907. This does not include the large business done by electric railway companies operating lighting plants. Our total figure for 1908 of $225,000,000 is probably within a million or two of exactitude. The arc lamps are given as 555,000 and the incandescents as 41,000,000. Our estimate of incandescents has been "over 30,000,000," but the difficulty comes in with many companies that report 16-cp equivalents, including all the hundreds of thousands of fan motors on their circuits, the heating apparatus, the cooking appliances, etc. The truth lies somewhere between 30,000,000 and 40,000,000.

The percentages of increase are notable all along the line. The investment and the income have doubled in five years. the kw-hour output has increased 133 per cent, the generator capacity has increased 207 per cent, the "incandescent" service has increased 129 per cent, and the motor capacity has jumped 276 per cent. These are all notably encouraging figures. Let us all take hope from them. The industry is evidently growing steadily at a rate of about 20 per cent a year, and bids fair to keep it up.

A Little More Light in Radium.

The recent work of Rutherford tending to show that the helium atom is the positive charge carrier in the case of radioactive substances, brings at last some phases of the radium problem within a measurable distance of solution. If confirmed, which it should be as soon as possible by independent

investigators having no theories upon the subject, it brings an opportunity for examination of the questions involved from the chemical side which, for lack of material and any definite method of attack, has been sadly neglected. Helium is a well-defined substance which is obtainable in finite quantities instead of in infinitesimals, and can be made the starting point of chemical investigation. As to the facts, there is no particular reason to suppose that Rutherford is in error other than the general doubt that hangs about the investigation of minute traces of things in vacuum tubes. Anyone who is familiar with such work gets somewhat cautious, and lack of a conservative viewpoint is likely to cause trouble, as in the case of Sir W. Ramsay's lithium from copper. Now, if one were working with an unknown and unstable substance having properties akin to those possessed by several kindred unknown substances, and found out that in each case there was given off during a period of unknown instability, let us say nitrogen, would not one be justifiably inclined to think that the substance in question contained combined nitrogen which was given off by ordinary decomposition; and would not one set industriously about trying to find out the rest of the combination?

Now, in the case before us we clearly have the property of activity commitant with what appears to be the splitting off of a comparatively simple and well-known gas, which happens to be the positively charged element of the combination. It is not long ago that upon the strength of this the radium contingent would have loudly proclaimed that positive electricity was nothing more or less than helium upon just as valid ground as they have held the accompanying sub-atomic débris to be negative electricity. On the present showing such treatment would obviously put the cart before the horse. If one finds that a substance which is radioactive spontaneously gives off helium, does it give off helium because all radioactive elements degrade into helium and other things, or is it radioactive because that especial sort of instability is common with certain compounds of helium not unusual in certain rare minerals? And is the helium in said minerals there because it has been derived from the decomposition of thaumaturgic new elements or merely because it was there in combination, like sulphur or hydrogen, and is easily driven out? And by the way, what becomes of the rest of the combination when radium breaks up and gives off emanation? One starts with so-called radium bromide ordinarily. When emanation appears, which is associated with helium, where does the bromine go and what else happens? It is more than a year since the finding of helium was announced, but of the promised information regarding the company in which it was found nothing has yet leaked out. This latest work seems to offer about the first chance for tackling the properties of radioactive substances from the chemical side. In organic chemistry the synthesis of a natural substance is the investigation of its breakdown products; the next, patient efforts at rebuilding with some of these products as starting points. The time seems to be about ripe for an attack on the problems of radioactivity from the chemical side, possibly via helium.

Space Utilization of Electromagnetic Windings.

Many thousands of electromagnetic coils are wound every year for duty in a great variety of applications. Telephony demands a great number, because every telephone switchboard outfit usually employs at least two coils per subscriber's line. Telegraphy demands a large number for relays, sounders and the like. Electric power transmission and distribution demand many, in motors, dynamos, transformers, automatic switches, relays, etc. The same fundamental mechanical and electromagnetic principles apply to all of these coils, and these fundamental principles are expressed in many text-books. Speaking in a rough and general way, there is nothing simpler than a determination of the turns, weight and m.m.f. of a winding from the size of the wire used and the geometrical dimensions of the winding space. Nevertheless, if we examine into the matter in detail, so as to attempt a fair degree of accuracy, there is much uncertainty in the matter, and it is very hard to arrive at any of these values, within, say, 1 per cent. Fortunately, it is seldom that such a degree of precision is practically demanded in the predetermination or analysis of coils, but it is desirable to have conveniently at hand the data upon which to base a careful estimate when the occasion arises for a particularly close computation.

A very important factor in dealing with the properties of a winding is the coefficient of space-utilization, or the ratio of the volume occupied by copper to the volume of total winding space in a coil. This coefficient depends not only on the thickness of the insulating cover on the wire, but also upon the care with which the wire is wound. If the wire is wound carelessly and hastily with a free use of paper between layers, the coefficient of space utilization in the coil may fall below 25 per cent; whereas with fairly large wire of square cross-section and thin insulation, carefully wound, the coefficient may exceed 80 per cent. Some of the influences affecting the space utilization coefficient are discussed by Mr. Charles R. Underhill in the article on page 155 of this number. He shows that two influences tend to increase the coefficient in a coil of any given dimensions, wound with insulated wire of given size—namely, (1) imbedding of the turns of one layer between the adjacent turns of the underlying layer, and (2) the compression of the insulating coatings under the tension of winding and the pressure of superincumbent layers. On the other hand, there are certain influences which tend to diminish the coefficient—namely, (1) the loss of one turn in each layer, due to incomplete filling at the ends of the layer, and (2) the inclination of the spirals in each successive layer alternately to one side and to the other of true perpendicular planes.

The article shows that if the imbedding action were perfect for round wire, so that every turn lay depressed throughout its periphery between the two adjacent turns of the underlying layer, the total thickness of the winding, after the first layer, would be reduced in proportion to the cosine of 30 deg., or 0.866, as compared with wire that was nowhere imbedded. This would involve a reduction of winding volume of 13.4 per cent, after the first layer. But examination shows that, in practice, each layer is completely imbedded at one diameter, and rides up, or is not imbedded, at the diameter perpendicular thereto; so that the saving in volume effected by imbedding, with carefully wound coils, can only be half the above amount, or 6.7 per cent, which is equivalent to increasing the coefficient of space utilization by 7.2 per cent. The influences which conspire to diminish the coefficient, even in the face of careful winding, tend to offset the gain due to imbedding. One of the most interesting dis-

closures of the article is the statement of experimental results, discussed in connection with Fig. 12. It appears that sizes of single silk-covered magnet wire, ranging from No. 21 to No. 34, were wound carefully by hand to a depth of eight layers in a steel bobbin of ½-in. internal diameter and 1-in. interflange.

According to the results, given in Fig. 12, the actual winding depth of the eight layers was always seven-eighths of the total thickness estimated from the size of the wire, assuming neither compression nor imbedding. As pointed out in the article, this means that there was in each case a compression amounting in utilization coefficient to about 6 per cent. It is curious to find the reported compression so nearly uniform. One would naturally have supposed that it would have varied with the diameter of the wire. It must be remembered, however, that, in practice, coils are often padded to a considerable extent with paper, so that the interesting conditions discussed in the article are often honored more in the breach than in the observance.

The Nature of Lightning.

We publish elsewhere in our columns some very interesting speculations of Mr. D. S. Carpenter regarding the genesis of lightning and the sources of some of its striking peculiarities. So little is known regarding the nature and sources of atmospheric electricity that every such suggestion is helpful. It remains to-day almost as much a mystery as in the far gone years when the skinclad Norseman heard in the storm the mighty blows of Thor's hammer. From the theoretical standpoint the greatest difficulty is presented by the constitution of a thundercloud, consisting as it does of discrete charged bodies distributed in a partially insulating vaporous medium of unknown condition of ionization. It is a condition that almost defies analysis, and it is certainly extremely difficult to form any definite physical conception of the laws of surface charge in a volume so constituted. It would be indeed interesting to consider whether the ordinary laws of static charge which tacitly assume a homogeneous surface conducting sheet hold at all for a charged cloud in their usual sense. If they do, is such a condition stable or is it the condition precedent to immediate discharge? Sometimes one notes discharge between clouds in the form of a brilliant sheaf of discharges looking quite like a photograph of the volley of sparks from an inductorium, while again there may be an apparently single tremendous discharge sometimes accompanied by induced discharges between other clouds. This diversity of phenomena suggests very forcibly a great diversity in the precedent electrical conditions.

One of the most troublesome things to account for in any general theory of lightning is the potential difference between cloud and cloud which produces the class of lightning just referred to. Difference in condition of aggregation to which Mr. Carpenter refers seems as plausible a source as any, yet the potentials involved are so enormous as to introduce serious difficulties even on this hypothesis. Flashes apparently take place between cloud and cloud over distances greater than from either cloud to earth, say, half a mile or more. Storm clouds generally lie low down, and there are some reasons for thinking that the lower strata accumulate inductively or through the downward drift of growing particles, a great excess of potential. The lightning as seen from above a cloud is often a mere blue glare far more suggestive of brush discharge than of the intensive phenomena of a flash. In such case is the appearance due to participation of the higher strata in the flash or is it the immediately subsequent readjustment of potential? It is very desirable to accumulate experimental evidence on points like this through a study of the time functions involved in lightning. In particular, these are very important from a practical standpoint as modifying the principles of lightning protection. Data derived from electric lines are for this purpose of relatively little value since they must always be, as Mr. Carpenter suggests, complicated by the constants of the line. There is good reason to think that an actual discharge, taking place as it does through a somewhat highly resisting air path between very large capacities, is a far more deliberate phenomenon than used generally to be supposed, and virtually non-periodic. The periodicity ascribed to lightning is generally a surge periodicity due to the line upon which observations are made. The thing which ought if possible to be ascertained is the steepness of the main wave front, which determines the behavior of the discharge toward inductances and capacities in its path.

The curving instance cited by Mr. Carpenter, in which a lightning stroke broke through 4½ ft. of masonry to get at a gas pipe, is a case in point. A gas pipe is certainly a bad conductor in the inductive sense and it would be interesting to know the alternative path which it abandoned. Another feature of lightning which is puzzling from any standpoint is the globular variety, which is well attested and yet does not seem to fit any ordinary theory of electric discharge, though the late M. Planté, if we remember correctly, did succeed in simulating it in discharges over semiconducting surfaces. As a purely practical matter, it must always be remembered that in nearly all instances the seemingly eccentric variations in the path of a lightning stroke are very small compared with the total length of the path and hence lose some of their significance, especially as one generally is unable to say whether the variations are of the main stroke or merely branches. So far as lines are concerned, the vast majority of so-called lightning discharges are purely induced effects or mere branches. When the real thing comes along there is mischief doing. Alternative paths to ground are only palliatives at best. Lightning arresters and grounded wires are luckily now and then effective, but the protection they afford is very limited even at its best.

A high factor of safety in the line insulation seems to be the most important consideration, for it enables the line to defy the inductive surges due to the lightning which might break down ordinary insulation. One may assume, for instance, that a large group of such indirect "lightning" phenomena involve no more than 100,000 volts. A line designed for regularly carrying this voltage would probably pass unscathed through storms that would put a 25,000-volt line out of business with the first jolt. One of the most useful things to be done is a systematic study of the actual induced potentials due to lightning discharges with a view of ascertaining the real conditions that must be encountered in carrying electric lines through dangerous territory. It is hard, as experience has shown, to prescribe remedies for unknown ills.

The Latest Central-Station Statistics.

The Bureau of the Census has just issued a preliminary report on the central-station industry of the United States—not including the large amount, however, of lighting and power work done by the electric railway systems. The figures given below are exclusive of Alaska, Porto Rico, Hawaii and the Philippine Islands.

The statistics relate to the years ending Dec. 31, 1907, and June 30, 1902. The totals include central stations only. They do not include isolated plants or plants that were idle or in course of construction.

	1907.	1902.	Per cent of increase.
Number of establishments	4,741	3,620	30.9
Commercial	3,492	2,830	23.4
Municipal	1,252	815	53.6
Total cost of plants	$990,613,622	$502,146,856	97.5
Total income	$175,042,338	$85,700,866	104.9
Lighting service	$125,255,114	$70,348,147	79.3
All other electrical service	$43,859,577	$14,048,458	212.2
All other sources	$6,027,647	$1,514,000	298.1
Total expenses	$134,106,911	$68,001,257	97.1
Salaried employees:			
Number	12,990	6,996	85.7
Salaries	$11,733,787	$5,663,580	107.2
Wage-earners:			
Average number	34,612	23,330	48.5
Wages	$23,686,537	$14,983,112	58.1
Supplies, materials and fuel	$44,458,568	$22,915,932	94.0
All other expenses (including interest on bonds)	$54,318,019	$24,518,751	121.5
Steam and gas engines (including turbines):			
Number	7,674	6,095	25.9
Horse-power	2,684,228	1,392,122	92.8
Water wheels:			
Number	2,474	1,390	78.0
Horse-power	1,347,487	438,472	207.3
Total kilowatt capacity of dynamos	2,642,403	1,218,735	116.8
Output of stations, total kw-hours	5,858,121,860	2,507,051,115	133.7
Estimated number of lamps wired for service			
Arc lamps	(2) 555,921	385,698	44.1
Incandescent lamps	(2)41,807,944	18,194,044	129.8
Stationary motors served:			
Total horse-power capacity	1,649,026	438,005	276.5

(1) Exclusive of income for current used for light and power that was furnished by railway companies, and which is included in the report for steam and electric railways.

(2) Exclusive of lamps used by the establishments reporting to light their own properties.

The final report will contain an analysis of the above totals and present detail statistics by States and for other phases of the industry.

Court of Patent Appeals.

The measure for a Court of Patent Appeals which the American Bar Association has been furthering at Washington for the past six years has recently been the subject of hearings before the Committee on Judiciary of the House of Representatives.

The bill provides for a court of five justices, of whom the chief justice shall be appointed by the President and the four others shall be designated by the chief justice of the Supreme Court of the United States from among the judges of the Federal, circuit and district courts. Two of the four judges are to sit for three years each and two for six years, and appointment shall be made for six years thereafter. The bill places the salary of the chief justice at $12,000 per annum and the others will receive additional salary, making a total of $11,500.

Until 1891 the Supreme Court of the United States decided patent cases, and in the course of one of the hearings Mr. F. P. Fish said these decisions were "monumental." The court was relieved of this duty when the Court of Appeals was established, and it is to restore, approximately, the satisfactory conditions prevailing when the Supreme Court was the court of last resort that patent lawyers have been striving for legislation.

One of the prime reasons cited in favor of the proposition was that, in the opinion of Mr. Fish, patent lawyers and patent judges become "bad lawyers and bad judges" when they handle only patent cases. Mr. Fish said that although making a specialty of patent practice he never permitted himself to give his attention exclusively to this class of work, because of its peculiar effect upon his method of thought. It is on this principle that the bill proposes that the patent judges shall be taken from and returned to the circuit and district benches. Mr. Fish cited as an illustration the interesting instance of a very learned and able judge of one of the Federal courts who was also a skilled mechanic, and of whom he said that his expert knowledge of mechanism actually had warped his judicial faculty.

Argenta (Ark.) Municipal Lighting Plant.

The city of Argenta, Ark., put its new municipal lighting plant in service on Dec. 31, on the evening of which there was a reception at the generating station presided over by Mayor W. C. Faucette. The equipment consists of two 250-hp tandem-compound Ideal engines direct-connected to two 150-kw, three-phase, 2300-volt generators, and a 100-kw motor-generator set for the supply of current to the street railway, the voltage being converted by it to 500 volts direct current. The switchboard comprises an exciter panel, two commercial panels, one arc light panel and a street railway panel. The plant was erected by Mr. George F. Brockman, who remains with it as superintendent of light and power. Mr. Brockman has erected a large number of stations in this country and Mexico, including plants at Cold Springs, N. Y.; Quincy, Fla.; Ensanda, Lower Cal.; Wynnwood, Okla., and Jackson, Ala.

Electrical Row in Winnipeg, Man.

A controversy between City Electrician Cambridge, of Winnipeg, Man., and the Winnipeg Electric Railway Company, which has a monopoly of the street car service, commercial lighting and power business of that city, may cost the city some thousands of dollars in increased insurance risks as well as $2,000 for an expert inquiry. The city electrician created a panic by attributing two fires, one of which occurred in a large business block on Main Street, and the other in the Imperial Bank Building, to stray currents from the street railway track on Main Street. This particular track was only completed in 1908, the company using 96-lb. rails double bonded with 4-0 compressed terminal flexible bonds, while there is also a 500,000 circ. mil cable between each pair of rails, and each rail is bonded to this cable in two places. For more than a year past the Winnipeg business men have been trying to secure a reduction in the insurance rates and have installed a high-pressure water service at a cost of over $1,000,000 for this purpose, but this alarm is expected to prevent any reduction of fire risks until next April or May, when Professor L. A. Herdt, of McGill University, reports to the city on the matter. An amusing feature of the scare was the explanation given regarding the cause of the fire in the business block when it was gravely stated that the current might have flowed along a water pipe or lead-covered telephone cable to a metal ceiling and up a hole in the ceiling and set alight the woodwork of the floor. The actual cause of the fire appears to have been a lighted match or cigar stub dropped near a barber's chair through a hole in the floor left by moving back a row of wash basins.

Figures of the Production and Use of Copper.

In a U. S. Geological Survey report by Mr. L. C. Graton, just issued, the world's production of smelter copper in 1907 is set down as 1,589,809,300 lb., of which the United States contributed over one-half, or 868,996,500 lb. Of this American product, 592,326,608 lb. was electrolytically refined, or about two-thirds; Lake copper being 178,534,141 lb. and casting 13,410,678 lb. The direct use by the electrical industries is the largest domestic factor in consumption, being given as 220,000,000 lb., the other items being: Brass manufacture, 150,000,000 lb.; copper sheets, 30,000,000 lb., and castings, 85,000,000 lb.

The above figures do not show, however, the full importance and extent of the electrical refining. It will be seen from the subjoined statement that foreign copper to the amount of 245,000,000 lb. was also electrolytically treated here and that

in fact the enormous total of 845,706,283 lb. was electrical. He says: "The quantity of electrolytically refined copper produced in the United States in 1907 from domestic materials of primary origin was 592,326,608 lb., as compared with 648,614,592 lb. in 1906. This was produced mainly by the refining of blister or converted copper, but 34,917,988 lb. in 1907 and 24,017,833 lb. in 1906 were derived from anodes of Michigan copper refined for purification or for silver content. The year's production of the electrolytic refineries from domestic material of secondary sources was 8,316,861 lb., as compared with 15,382,129 lb. in 1906. Materials of foreign origin electrolytically refined in 1907 in the plants of this country yielded 245,062,814 lb., as against 191,370,022 lb. in 1906. The total output of electrolytic copper by American refineries during the year 1907 was therefore 845,706,283 lb., of which 837,389,422 lb. was from primary sources. In 1906 the total electrolytic production was 855,366,743 lb., of which 839,984,614 lb. was from primary sources. The cathodes resulting from electrolysis are commonly melted and cast, according to specifications of the buyer, into wire bars, ingots, cakes, or other forms.

"In addition to the 845,706,283 lb. of electrolytic copper, the refineries turned out approximately 8,466,630 lb. in the form of bluestone. This quantity of copper, which is about 1.04 per cent of the total copper subjected to electrolytic refining during the year, virtually represents the loss attendant upon this process, and indicates an average recovery of about 99 per cent of the copper received. An average recovery higher than this certainly could be made, and probably would be made if the bluestone were not a product which generally commands a good price and if it did not afford by its formation certain advantages of internal operation, as, for example, the neutralization of excess sulphuric acid in the electrolyte."

Mr. Graton goes into an interesting discussion of the relative merits of "electrolytic" and "Lake," and comes to the conclusion that practically no advantage or superiority whatever remains on the side of "Lake," a term which he regards as out of date and idle. "The old contention as to quality of product between the producers of Lake copper and those of electrolytic copper has recently been aired and apparently settled." As to American production of copper in general, it is shown that the average yearly growth since the industry became important has been 9.9 per cent; but for the past seven years has only been 5.5 per cent.

Failures of Electrically-Welded Rail Joints.

Failures in the electrically-welded joints of railway tracks in city streets, where the rails are practically embedded in the pavement, are so few as to be negligible. This is in direct opposition to the careful teaching of our schoolboy days to the effect that spaces must be left between the rails to allow for the expansion and contraction of the metal due to variation in temperature. But it is to be observed that the rail in the city street, made continuous by welding, is protected from sudden alterations of heat or cold by the fact that only its top surface is exposed to the weather.

In a recent talk before the Electric Club of Chicago, Mr. R. H. Rice, of the Board of Supervising Engineers, Chicago Traction, said that experience with electric track welding has shown a failure of less than 2 per cent of the joints. Of this small proportion of failures nearly all, in Chicago, occurred in outlying streets, where the pavement outside the tracks was insufficient, showing that it is the protection of the rail, rather than any flaw in the old theory, that makes the continuous rail possible.

Apparently the stresses due to expansion and contraction are taken up in the metal itself, and in cold weather, for instance, the rail is undoubtedly in a state of tension. Mr. Rice mentioned an instance where it became necessary to cut the welded rail of a street-railway track to effect some repair. When the workman's saw was within an inch or two of the bottom of the rail the remaining metal was ruptured by the strain, and the severed ends pulled apart for a distance of about 1½ in.

Discussion of U. S. Patent System.

The members of the Chemists' Club, Society of Chemical Industry, American Electrochemical Society, and of the Institute of Chemical Engineers met at the Chemists' Club, 108 West Fifty-fifth Street, New York City, on Friday, Jan. 8, for the purpose of listening to and discussing a number of papers on the general subject of the "U. S. Patent System: Its Use and Abuse." Four papers were read as follows: "Patents: Trade Secrets and Trade Names as Factors in Industrial Development—Their Relative Functions," by Mr. W. Hastings Swenarton; "Some Defects in the Practice of Our Patent System and Suggested Remedies," by Mr. Louis C. Raegener; "Some Suggestions as to Desirable Improvements," by Dr. B. C. Hesse, and "The Inventor's Standpoint," by L. H. Baekeland. Prior to the reading of the papers, Mr. F. I. Allen, past Commissioner of Patents, made some introductory remarks of a historical and descriptive nature.

None of the authors had any fault to find with the present patent system. Indeed, judging from the tenor of their remarks, there is little to be desired in the way of change in the Patent Office itself. This attitude, so much at variance with the opinion of most inventors, may possibly be partly accounted for by the fact that two of the speakers are patent attorneys and a third has taken patents out in other countries where the expense is greater, the time shorter, and where the inventor is compelled to work his patent. Dr. Hesse suggested that an annual tax be placed on all patents. The tax should not be large enough to prove a hardship to patentees who have put their patents into use and would act as a deterrent to worthless patents and others got out for exploitation purposes.

All of the speakers, however, were agreed that the present practice and procedure of trying a patent case are antiquated, time-consuming, abnormally expensive and generally unsatisfactory. Final judgments are practically unobtainable and pecuniary judgments are so rare that any well-advised infringer need hardly fear them. Mr. Raegener, speaking from an experience of many years as a practising attorney, said that the burden of proof rested on the complainant, and added the rather surprising statement that the law very jealously protects the poor infringer against injustice. He cited the fact that there are nine Circuit Courts of Appeal and that the law in a certain circuit is not necessarily the law in another circuit, so that it is not uncommon for judges to reach diametrically opposite conclusions on identical cases. The result is that an injunction sustaining the validity of a patent is only good in the district over which the Circuit Court has jurisdiction. No appeals from the Circuit Court of Appeals lie to the United States Supreme Court, although one may petition the latter court to review a decision. The United States Supreme Court will, however, not grant such petitions unless some matter of wide public importance is involved. With the integrity of the judges Mr. Raegener finds no fault; but their capacity and ability in patent cases, he says, are as varied as the colors of the rainbow. The patent lawyer, in Mr. Raegener's estimation, is inexperienced and careless who does not carefully select his tribunal so far as this is possible. As to the possibilities of remedying the defects noted, he cited the method of trying cases in England and in Germany. In the former, patent cases are tried in open court and the successful party recovers, say, two-thirds of the price paid to lawyers and experts. In the latter country, the patent is valid after five years, and during the five years is virtually valid unless a procedure is brought during that period to vacate the patent. In neither country are there numerous courts having jurisdiction. The testimony in patent cases, Mr. Raegener said, should be taken before judges who could apply the rules of evidence at once and thus get rid of all padding of the records.

The discussion of the topic was very short. One speaker pointed out the marvelous grasp of the legal mind on difficult and intricate subjects displayed at times by judges in patent cases, and another said that Bill No. 21,455 creating a United States Court of Patent Appeal is at the present time before

Congress and will doubtless be passed. He suggested, however, that everyone interested should impress the Senator or Congressman of his district with the desirability of such legislation so as to leave no question as to the need of such a court.

Stability in Electric Lighting Circuits.

Professor Elihu Thomson presented a paper entitled "Conditions Affecting Stability in Electric Lighting Circuits" at the meeting of the American Institute of Electrical Engineers held on Jan. 8. The paper dealt chiefly with constant-current series circuits containing arc lamps operated either by direct-current generators, by alternating-current transformers, by reactive devices in alternating-current circuits or by rectified alternating currents from transformers. The instability in such circuits is attributable to that property of the arc which results in its resistance decreasing with increase of current.

Professor Thomson traced briefly the history of the development of constant-current generators, and explained the methods employed for insuring stability. In the Thomson-Houston arc-lamp machine stability was secured by using saturated field cores made of iron of high retentivity and by arranging the pairs of brushes on the three-part commutator so as to obtain a certain restricted arc of contact between adjacent segments. In the Brush arc-lamp generator the stability was due largely to the proportioning of the proper extent and relative sections of the pole horns adjacent to the armature on each side; the drooping voltage-current characteristic also has considerable effect upon the stability.

In the constant-current transformer, the general impedance of the system, including the lamp magnets, results in a full potential with increased current at a rate sufficient to insure stability. The development of the mercury-arc rectifier and its apparent special adaptability to the rectification of small currents at high voltage has naturally led to its employment in conjunction with constant-current transformers for securing direct current suitable for series-arc circuits. Instability may be caused under certain conditions by too high or too low a temperature in the rectifier, change of vacuum, or momentary flashing from anode to anode. Control of the working temperature has been obtained by oil immersion, which has proved very satisfactory. Professor Thomson stated that some mercury-arc rectifiers now in service have been used over 5000 hours.

Prior to the general discussion of the paper, communicated discussions were read from Dr. A. E. Kennelly and Mr. Alexander Dow. Dr. Kennelly pointed out that while the method of ballasting the circuit with extra impedance is especially applicable to constant-potential circuits, although wasteful of power, the method of providing the generator with a drooping, external characteristic is especially applicable to constant-current circuits. The problem of restoring stability, he said, was complicated by kinetic actions, such as the time interval of arc-mechanism response, of engine-governor response, of field-magnet response, etc., so that even with the accumulated experience of 30 years, the problem as presented in a series arc circuit is very complex. He called attention to the fact that the property of diminution in resistance with current is utilized in wireless telephony to throw a vertical conductor into sustained electric oscillation, by means of voltaic arcs shunted by condensers.

Mr. Alexander Dow related some interesting experiences with arc machines, as did Mr. E. W. Rice, Jr., who told of how he arranged a lamp as a super-sensitive stability regulator for a number of arc lamps placed on exhibition in Boston in 1882. He also told of his experience with the short-circuit band of copper around the field core parallel to the windings. Prof. D. C. Jackson spoke of the characteristics of the old Wallace arc lamps with plate electrodes of gas-house carbon and also of the contest between the short or hissing arc and the long or silent arc prior to the introduction of the Brush or Thomson dynamos. The former he said was looked upon as a curiosity, while the latter was charged with being a monstrosity. Both machines, however, proved their right to exist. Prof. Jackson looked upon the function of the blower somewhat differently than did Prof. Thomson. The Thomson-Houston machine, he said, shows an obvious blowing out of the arc, which, however, is not like the blowing out of a candle where the flame is blown from the wick by a blast. The air blast crosses the path of an arc existing between commutator segments, stretches it to the point of rupture and replaces the heated gases by air which is cool and unpolarized, and therefore will not support a renewal of the arc until it is re-established by the action of the brushes.

Mr. C. M. Green, who has been connected with the later development of the arc machine, gave the results of some earlier observations of the effect of armature reaction, which in his opinion is the keynote of all arc machines. Under poor load conditions, the point of commutation is on the following pole piece and as the load is decreased or the lamps cut out, the point of commutation goes still further and further on to the following pole piece. The regulation of the various arc machines is accomplished in different ways. In the Thomson-Houston and Ft. Wayne machines the final adjustments on regulation are accomplished by means of varying the armature reaction; by overlapping the brushes in the Thomson-Houston machine and by separating them in the Ft. Wayne machine. In modern arc machines there are no short-circuited bands around the field coils; the voltage per commutator segment is as high as 3000 without an air blast and with laminated pole pieces and the temperature rise instead of being 270 deg. C. above the surrounding air as heretofore, is only about 11 deg. C. Saturation of the iron, he considers to be one of the most essential features for stability in the operation of the machine, in fact Mr. Green doubts if there is any other machine manufactured having a higher saturation of the iron than the Brush arc machine. Generally speaking, arc machines do not operate well at reduced currents and their kw-load is reduced practically in proportion to the scope of the current. It is considered true that as arc generators are loaded, the brushes go forward; but in constant-current apparatus, the brushes go backward. The polarity of the direction of current flowing in a Brush arc generator or Thomson-Houston machine can be told from the nature of the spark on the commutator. The spark on the negative brush has a regular worm form tapering down, only on the horizontal brush it has a straight line running through it.

Mr. J. B. Taylor called attention to the stability of illumination, stating that while there might be a steady current in the arc, the latter may wander from one side to the other of the electrode. It seemed to him that in some of the underground cable systems for arc lamp circuits there was a condition not unlike that made up on purpose for the singing or oscillating arc in high frequency service. The capacity of the cable is around in the arc in series with more or less reactance in the lamp mechanism.

Dr. C. P. Steinmetz showed that the unstable electric circuit discussed in Prof. Thomson's paper has a significance far beyond the arc circuit. While the electric arc is the best known example of unstable electric circuits, instability occurs in other electric systems. Synchronous and induction motors drop out of step; such motors often start and fail to run up to speed; there is surging and hunting of synchronous converters; electric apparatus at the end of every long transmission line acts strangely, etc. The reasons for these phenomena were explained by Dr. Steinmetz, who also considered the question in various other lights. He drew attention to one feature not brought out and that is the constancy of current of the Brush arc machine regardless of the speed. In a constant-potential generator the voltage fluctuates more than the speed. In the Brush arc machine the current remains the same until the machine stops. Even when it is just slowly turning over, full current still exists. Dr. Steinmetz also spoke of the characteristics of the early Stanley arc machine. Going minutely into some characteristics of the arc and mercury arc, he showed how some of the principles were employed for lightning protection.

Work of the Engineering Staff of Wisconsin Tax and Railroad Commissions.

A paper on the "Work of the Joint Engineering Staff of the Wisconsin Tax and Railroad Commissions" was read before the Western Society of Engineers, Chicago, on Dec. 16, 1908, by Prof. William D. Pence, engineer of the two commissions and professor of railway engineering, University of Wisconsin. The most important work done by the staff is the valuation of the physical property of public utility corporations. Recent valuations comprise the properties of 52 steam railroads, 24 street and interurban railways, with 10 associated lighting and heating properties, and 24 public utility plants. The cost of reproduction of all of these properties was ascertained to be as follows:

Property, new, $277,318,009; present condition, $222,887,929. The values fixed for the street railways (with the associated lighting and heating properties) and the public utilities properties were as follows:

	Cost of reproduction.	
	Property, new.	Present condition.
Street railway properties	$26,783,620	$21,208,010
Public utilities properties	6,405,521	5,440,605

Under the law providing for the supervision by the Railroad Commission of the capital issues of public utility properties five properties have been valued and the following results determined: Property, new, $305,576; present condition, $270,008.

Professor Pence described the organization of the staff in 1903 under authority of the law providing for assessment of steam railroad properties, and the subsequent changes under later laws affecting street railway and other utility properties.

"The 1905 law prescribing the ad valorem basis of assessment for street railroad properties provided for the valuation work to begin," Professor Pence said, "on the initial inventory data of June 30, 1907, but the work was actually undertaken some six months earlier than that date because of a complaint lodged with the Railroad Commission respecting street car fares in Milwaukee. To meet this emergency the staff was reorganized and greatly extended in January, 1907, and since that date a staff of from 20 to 30 members has been required continuously to meet the joint demands of the two commissions."

The working organization of the staff includes the following subdivisions: (1) Administrative, (2) office staff, (3) civil engineering staff, (4) mechanical engineering staff, (5) electrical engineering staff, (6) gas engineering staff, (7) gas and electric service inspections, and (8) miscellaneous. Professor Pence outlined the organization, and the following details indicate the scope of the work of two of the groups:

"Electrical Engineering Staff.—Engaged in the inspection and valuation of those details of the physical property of steam and electric railways and public utilities plants which are usually constructed, purchased or operated under the direction of electrical experts or engineers, including electrical machinery and appliances in power plants and elsewhere; electric railway rolling stock; electrical distribution systems, overhead and underground; telephone plants; signaling appliances; tools, stores and supplies related to the above items, etc. Also investigations, in co-operation with other departments, with a view to suggest improvements in the operating conditions of electric railways, power plants, telephone properties, etc.

"Gas and Electrical Service Inspections.—Engaged in inspections and investigations of gas and electrical service; studies with reference to the establishment and revision of standards of service and the formulation of rules for the same; tests and calibrations of instruments used in service measurements; investigations with reference to the electrolysis of water and gas mains, etc. Also investigations, in co-operation with other departments, with a view to suggest improvements in the operating conditions of gas and electric plants."

In speaking of the qualifications for membership on the staff and of the preponderance of technical graduates employed, Professor Pence said:

"Membership on the staff is based upon ascertained fitness for the special service for which the appointment is made. There is entire freedom from political or other influence both in the matter of appointment and in the tenure of position on the staff.

"The present membership of the technical staff consists almost exclusively of graduates of engineering schools, and about 60 per cent of the permanent staff are graduates of the University of Wisconsin. Seven members of the regular staff are also members of the faculty of the College of Engineering, University of Wisconsin, among this number being the engineer in charge, the chief mechanical inspector and the expert on light and heat. Five other members of the teaching force of the engineering college also render occasional service on the commissions' staff. It is proper to say in this connection that this is but one of many instances in Wisconsin of active participation by university men in professional service on behalf of the State. Such participation is encouraged by the board of regents and president of the university both on account of a recognized obligation to the State which provides support, and because of the stimulus given to the work of the university through outside contact of this kind."

Regarding the methods followed in making valuations Professor Pence said:

"The valuations reported to the commissions by the engineering staff have been confined throughout to the physical property, without regard to intangible elements. For a given inventory covering the items of any particular property, a definite value is fixed upon a fair basis as to unit prices, etc., and the results are reported by the staff at a definite amount, irrespective of the uses to which the figures are to be applied. These determinations are, by intention, entirely free from bias. Every reasonable effort is made to get at the exact truth in regard to local conditions. The figures are subject to revision upon finding evidence of defects of inventory, errors of judgment or other element likely to vitiate results. After submitting the valuation reports to the commission opportunity is given for further conference and hearing upon any or all items of the physical valuation.

"In certain public utilities cases the owners, and in a few cases the cities as well, have employed experts to give testimony on values before the Railroad Commission. In one or two such cases the State engineering staff has submitted to the representatives of the utilities company and the city an 'informal' valuation report to serve as a basis for preliminary conference and discussion. This preliminary report, after due consideration in the light of added data and information, is succeeded by the 'tentative' valuation report which is submitted to the Railroad Commission as a part of the formal record in the case to be considered with other evidence. Before making up a final decision in the case the commission gives the engineer an opportunity to review the record and submit a supplementary report, in which are presented revisions or comments bearing upon the original or 'tentative' valuation report."

In the valuation of the Milwaukee street railway properties a staff of 23 persons was employed, Mr. Bion J. Arnold and Mr. George Weston, of Chicago, assisting in the work. The final report included the entire property owned by the Milwaukee companies, known locally as the "Beggs properties," viz., the city railway lines (123.6 miles) and the associated lighting properties (The Milwaukee Electric Railway & Light Company), the country or interurban railway lines (144.2 miles) and the associated lighting properties at Racine and elsewhere (Milwaukee Light, Heat & Traction Company), and the Milwaukee steam heating company (Milwaukee Central Heating Company). The total physical valuation, including all the property owned by the several companies as of Dec. 31, 1908, amounted to $24,[illegible] for the property new and $14,814,849 for the property in existing condition.

Of additional electric railway lines which were valued about one-half are operated in association with public utility properties supplying electric lighting and power service.

Professor Pence said that the methods now employed by the engineering staff in the valuation of the physical property of

public utility plants are in many respects in close agreement with those adopted early in 1907 for the valuation of the electric railway properties of the State for the joint purposes of the two commissions. These methods in general embrace:

1. The preparation of a detailed descriptive inventory.
2. Field examinations of the property by a trained staff.
3. Determination of the "cost new" of each item.
4. Estimation of the depreciation on each item of property.
5. Calculation of the present value.
6. Summing up the detailed valuations by groups.

An abstract of the portion of the paper which refers to the valuation of public utility plants follows: "As an initial step in each important utilities valuation it is customary for the commission's engineer to hold a joint conference with representatives of the company and the city.

"The preparation of preliminary inventories or descriptive check lists of the properties has been entrusted to the responsible officials of the public utilities companies wherever practicable.

"The field examinations of the physical property begin with a careful checking up of the inventory. Throughout the progress of these field investigations due consideration is given to the fact that the public utilities law provides for periodical revaluations of each property examined, necessitating a permanent record from the very start. This view of the situation, coupled with the rate-making feature, has naturally led to an open-minded attitude on the part of the commission's staff and of the interested parties with respect to rectifying any discrepancies discovered in the descriptive record.

"With a view to establish a definite and reliable basis for fixing costs, extensive investigations have been made relative to existing commercial conditions, with the result that a vast amount of cost data as to the purchase and installation of the various kinds of physical property embraced in the public utilities plants is now available in the confidential records of the engineering staff. This information has been gathered from many sources, one of the most important of these being the actual contracts and other records of costs kept in the offices of the various public utilities companies of the State.

"The records of the utilities companies are made available to the commission or its authorized agents by the terms of the public utilities law. These records, combined with the confidential quotations and cost data of many kinds supplied through direct solicitation by manufacturers throughout the country, provide a substantial basis upon which the unit costs are kept up to date. In responding to the requests for information, the manufacturers in a number of instances have found it necessary to carry on considerable research work. In such cases it has been the practice to offer to defray the necessary clerical expense involved in compiling the desired information. In but few instances, however, have these offers of reimbursement been accepted. The invaluable assistance thus extended by the manufacturers is believed to have resulted not only from their being frankly and fully informed at the outset as to the special purposes for which the information would be employed, but also because of their desire to co-operate in an important public movement based primarily upon substantial justice to all concerned. It scarcely need be said that the figures obtained from manufacturers are treated as confidential and used only for the specific purposes for which they are solicited.

"It should be stated in this connection that the utilities companies of the State have shown but little disposition to interfere with this free co-operation on the part of the manufacturers. In the very few instances where such interference has actually been noted, the utilities officials have usually been quick to respond to the suggestion that such action was not only short-sighted but also in direct violation of the spirit of fairness pervading this entire matter. In like manner, citizens and officials of certain cities of the State where a feeling of antagonism had previously developed against certain public utilities companies have in a number of instances desisted from what seemed to be an effort to withhold essential facts required by the engineering staff.

"In addition to the sources of information above referred to the members of the staff have been able to supplement their personal records of cost data through many voluntary contributions from the professional notes of prominent engineers and by figures gathered from publications of technical societies, the columns of trade and technical journals, etc. Reference may also be made to the accumulation of valuable data included in the sworn testimony given by experts at the formal hearings of the commission.

"In order to avoid extreme variations in unit prices due to the fluctuations in market quotations and also with a view to approximate as closely as practicable the conditions which usually prevail in building up public utilities properties, it has been the practice of the staff to use average prices for a term of years rather than to apply the current quotations or unit costs prevailing at the actual date of inventory. For this purpose the average price for the five-year period immediately preceding the date of valuation has been used whenever in the judgment of the staff such rule was practicable.

"In determining the allowance to be made for depreciation in value due consideration is given by the staff to the actual condition of each machine or other item of the property, taking into account the age of the device in connection with its probable ultimate efficient life, the character of the service, the standard or quality of maintenance, and such other elements as may aid in reaching a reliable judgment in the matter. In the steps leading up to such final conclusions, accumulated experience with reference to closely similar property, maintained to a like standard and operated under indentical or similar conditions as to service, etc., receives due consideration. An individual item of physical property is judged with reference to its agreement with or departure from the average of such related group or class of property in fixing the probable useful life and in estimating the depreciation. Results obtained by this method in the valuation of physical properties of Wisconsin railroad and public utilities companies aggregating many millions of dollars have established the trustworthiness of the method here described.

"The depreciation percentage is customarily applied against the net or service value found by deducting the scrap or residual value from the 'new value,' and the so-called 'present value' is determined in the usual way by combining the scrap value and the depreciation service value. The treatment of scrap values has perhaps been carried somewhat beyond the degree of refinement customarily used by most engineers engaged in water works and other like appraisal work, although, it is believed, not beyond what is consistent and proper, considering the magnitude and permanence of these Wisconsin valuations. However, undue refinements in this respect are guarded against, and in cases where the scrap value is slight or much in doubt, the depreciation percentage is applied directly to the cost new to determine the present value."

Different schemes of classification are used in the reports of tentative valuations of different classes of single or combined utility properties. The following, for combined electric railway and light properties, indicates the scheme:

1. Land (right of way and other).
2. Track and track structures.
3. Cars and car equipment.
4. Electrical distribution system.
5. Power plant equipment.
6. Buildings and miscellaneous structures.
7. Office furniture and appliances.
8. Tools, implements, etc.
9. Horses, wagons and miscellaneous.
   Total of items 1-9.
10. (See note below.)
    Total of items 1-10.
11. Stores and supplies.
    Total of items 1-11.
12. Paving.
    Total of items 1-12.

NOTE.—Group 10 is the addition of a percentage to cover engineering and supervision, interest during construction, contingencies, etc.

"It was early seen," Professor Pence said, "that the proper

administration of the law would necessitate the establishment of a central laboratory equipment for the purpose of investigating the various kinds of public utilities service, with a view to the fixing of legal units and standards and also to putting the same into practice on a permanent and uniform basis throughout the State. After some preliminary discussions and conferences arrangements were made whereby the laboratory facilities of the University of Wisconsin were made available for the purposes of the Railroad Commission, with the understanding that there should be reciprocal use of the instrumental equipment to be purchased subsequently by the commission."

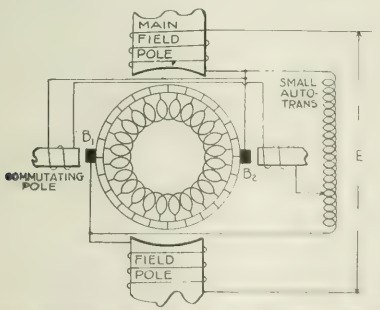
After some progress had been made in investigation a general conference or hearing was held (March, 1908) at which the owners and operating officials and experts of the various gas and electric companies of the State were given an opportunity to express their views.

After giving consideration to all available information the commission formulated a set of rules governing standards for gas and electric service which were officially adopted on July 24, 1908, to become effective three months thereafter.

Commutation in Alternating-Current Series Motors.

In a paper presented before the Worcester Polytechnic Institute Branch of the A. I. E. E. on Jan. 8, Dr. A. S. McAllister outlined the difficulties relating to commutation encountered in alternating-current series motors. These difficulties are not attributable to the alternation in the armature current, but are caused by the rate of change in the field flux. There is produced in the armature coil under the brush by transformer action an active e.m.f. which in a large 25-cycle motor would usually reach a value of from 6 to 20 volts. It is the rupture of the current produced by this e.m.f. that causes the vicious sparking in the plain alternating-current series motor.

Although no simple methods have been devised for eliminating this e.m.f. under starting conditions, many effective schemes



ALTERNATING-CURRENT COMMUTATOR MOTOR WITH SHUNT CONNECTED COMMUTATING POLE WINDINGS

are now employed to neutralize it under running conditions, and the resistance-lead method of minimizing the current produced by this e.m.f. under both starting and running conditions has proved absolutely satisfactory.

The best arrangement for eliminating the transformer e.m.f. under the brush is one involving a construction similar in all important details to that of the direct-current interpole motor. However, the method of obtaining the desired result differs in one important detail: instead of connecting the coils on the interpoles in series in the armature circuit, they are joined in parallel with the armature in such a way as to allow the e.m.f. impressed upon these coils to be decreased as the speed is increased.

A convenient arrangement by means of which the cause for sparking can be entirely eliminated under speed conditions is indicated in the accompanying diagram. The leg in the commutating poles is in time-quadrature to the main field flux, and hence the speed-generated e.m.f. in the coil under the brush is in time-phase (opposition) with the e.m.f. generated in the same coil by the transformer action of the main field flux. The e.m.f. on the commutating pole coils should be caused to vary directly with the value of the main field flux and inversely with the speed of rotation; this condition can readily be obtained by means of the auto-transformer. For the purpose of improving the power factor it is desirable to place on the field core a compensating coil conductively associated with the armature; this feature is not essential to perfect commutation, and is not shown in the illustration. By connecting resistance in parallel with the main field winding the power factor may be increased to unity, or the motor may be caused to draw leading (condenser) wattless current from the system.

Boston Edison Employees' Lecture Course.

The opening lecture of the course on electrical engineering which Prof. Sydney W. Ashe has been engaged to give before the employees of the Boston Edison Company was delivered Jan. 7. There is every indication that this course will prove the most popular and be the most largely attended of any feature that the Boston Edison Employees' Club has ever planned. The meetings were attended by over 250 men, and additional applications are being made for tickets. The plans for this course of lectures received the serious consideration and hearty support of the officers of the company.

It has been so arranged that an afternoon lecture accommodates those employees whose hours prevent their attendance in the evening, and there was an unexpectedly large number present at the first meeting Thursday afternoon. The larger attendance will naturally come at the evening meeting, held at 7 o'clock. All the lectures are given in the large auditorium and library in the Edison Company's new building at 39 Boylston Street, in Boston. This room was designed with special reference to the convenience of employees of the company, and is fitted with ample seating arrangements for lectures and other semi-public gatherings. There is a large stage at one end and long, broad tables provided for employees who wish to use books from the library.

Members of the Edison Employees' Club are admitted on payment of $1 for a course ticket. Employees of the company who are not members of the club are admitted at $2 each for the course, while those who are interested in the subject but are not connected with the company may attend on payment of $3 for the course.

Third Annual Meeting of the Illuminating Engineering Society.

About 65 members of the Illuminating Engineering Society gathered at the Machinery Club, 50 Church Street, New York City, on Friday evening, Jan. 8, to attend the annual meeting of the society, which was preceded by an informal dinner. At the speakers' table were Dr. Louis Bell, president; Mr. W. H. Gartley, president-elect; past presidents Mr. C. H. Sharp and Mr. L. B. Marks; Mr. V. R. Lansingh, secretary, and Dr. A. H. Elliott, treasurer.

Dr. Bell's presidential address dealt largely with the present status of the society. He noted with much satisfaction that the members of the organization were gradually making a serious and dignified profession of illuminating engineering and were gaining for the art and science the recognition of both the technical and the public. Gratifying and even remarkable progress had been made during the three years of the existence of the society, but this served only to show how far illuminating engineering was from the goal of its ambition. The work for the year had been marked by a gratifying unity of effort among the diversified interests represented in the society's membership, and by a feeling of good fellowship among the members which had been enhanced by the generous publication of engineering data on the part of certain members who had presented papers.

Reports covering the year's work were presented by various

committees. In particular, the treasurer's report was gratifying in that it showed the financial affairs of the organization to be in a very satisfactory condition—far more so than during any of the previous years. It was taken as a most encouraging omen that a society whose membership dues are only $5.00, and which place in the hands of each member monthly transactions, can get through the year with a satisfactory cash balance on hand.

The report of the committee of tellers, appointed to count the ballots in the election of officers for 1909, was read. The following officers were elected: President, Mr. W. H. Gartley, Philadelphia; vice-presidents, Mr. Charles O. Bond, Philadelphia; Mr. J. S. Codman, Boston; Mr. George C. Keach, Chicago; secretary, Mr. Preston S. Millar, New York; treasurer, Dr. A. H. Elliott, New York. Directors: Dr. A. S. McAllister, New York; Mr. G. Ross Green, Philadelphia, and Mr. E. N. Wrightington, Boston.

President Gartley immediately took the chair and addressed the society briefly. To his mind the danger to be guarded against during the coming year was apathy on the part of those members to whom the association must look for a large part of its advancement. Some of the interest which was aroused by the enterprise when it was new might wane, now that the society is established on a permanent basis.

President Gartley stated that the proposal had been made to the council that consideration be given at this time to the classification of the membership into active and associate members, and called for expressions of opinion on the subject for the guidance of the council. After considerable discussion, which evidenced anything but unanimity of opinion on the part of the membership, it was voted that the president be requested to appoint a committee to consider the matter of possible classification of membership, and report to the council.

Chicago Electrical Show.

One of the features of the Chicago Electrical Show, which is to be held at the Coliseum, Chicago, Ill., from Jan. 16 to Jan. 30, will be an exhibit of the United States Navy, which will occupy the entire Coliseum annex and consist of a complete electrical equipment of a modern battleship. During the show representatives of the United States Navy will be in attendance at the exhibit to furnish information desired in relation to the electrical equipment of war vessels, which service will be of value relative to the submitting of bids and the furnishing of electrical equipment for the navy.

Tuesday and Wednesday, Jan. 26 and 27, will be known as telephone men's day at the show. On Thursday, Jan. 28, there will be a reunion of former Thomson-Houston electric men, at which anyone who was ever connected with the Thomson-Houston Electric Company will be an honored guest. It is announced that Weber's band has been engaged to furnish music at the Coliseum during the entire show.

Electric Furnaces.

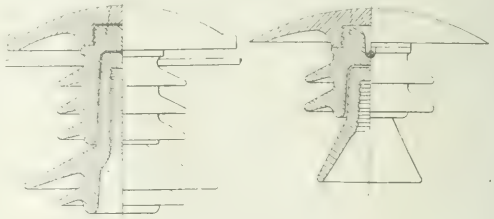
In the ordinary manufacture of silicon carbide, a mixture of silica and carbon is subjected to heat in an electric furnace, the heat being generated by a passage of current through a resistor. At the beginning of the heat the temperature of the resistor and the charge mixture is substantially that of the surrounding air and the whole mass must be raised to a high temperature before the reaction begins. In heating the charge up to this critical temperature, a large amount of electric energy is required and the expense may be large. In order to decrease the cost of operation, Mr. Frank J. Tone, according to a patent issued Dec. 29, 1908, proposes to utilize the heat of combustion in initially bringing the mixture up to the reacting temperature. Heated gases are passed through the charge of sand and coke in which the heating resistor is embedded. In order to support the combustion use is made of an amount of coke in excess of that required for the formation of silicon carbide.

A method of producing silicon free from silicon carbide was patented by Mr. Henry Noel Potter on Dec. 29. The inventor states that fluid silicon does not dissolve carbon, but does dissolve silicon carbide. He proposes to maintain the silicon in a fluid state in contact with silicon dioxide under fluid silicon. According to one arrangement, use is made of an electric arc furnace having vertical coaxial electrodes, the lower one being surrounded near the arc by a bed of silica upon which surrounding the arc is a mixture of silicon dioxide, silicon carbide and oxygen, approximately in the proportions of 62.4, 31.4 and 6.2, respectively. It is claimed that an output of 50 grams of silicon can be obtained per kw-hour of energy expended.

A patent issued on Dec. 29 to Mr. P. L. T. Héroult discloses means for improving the stuffing-boxes for electrodes of an electric furnace. The stuffing-box is provided with a packing of loose graphite, the shape being such as to facilitate the feeding of the electrode through the packing. The graphite serves as the conductor for conveying the current to the electrode.

Umbrella-Type Insulators.

The chief point to be kept in view in designing insulators for very high voltages is to avoid superficial disruptive discharges, especially when the insulators are exposed to heavy rains. The outer petticoat, on the top of which the conductor is secured, extends outwardly to a considerable extent to protect the smaller and lower petticoats from water. When the upper petticoat has got wet, its potential is the same as that of the conductor, wherefore its upper surface is quite inefficient from the point of view of insulation. Moreover, the water drops, falling down from the upper petticoat, when succeeding each other at short intervals, offer an easy path to the disruptive discharges between the



FIGS. 1 AND 2.—UMBRELLA-TYPE INSULATORS.

edge of the petticoat itself and the supporting pin or the crossarm. For the above reason high-tension insulators usually are very large and very difficult to manufacture.

According to a United States patent issued on Dec. 8 to Mr. Guido Semenza, of Milan, Italy, the different tasks are accomplished by different parts of the insulator and the troubles depending upon the rain are obviated so as to afford an insulator the efficacy of which against external disruptive discharges is claimed to be almost as high in wet as in dry weather. This result is attained by making the insulator of two distinct parts; the lower one, which is the insulator proper, is intended to support the conductor and does not require any outwardly extending upper petticoat; the upper part, which is termed the cap, is secured above the insulator proper and may be formed of any insulating material whatever as it is intended only to protect the lower petticoats of the insulator proper from rain, rendering the water drops dripping from said upper cap innocuous.

Figs. 1 and 2 show two arrangements. According to Fig. 1 the spigot-shaped top of the insulator proper is fitted with screw threads for securing the cap thereto; a lower circular recess is intended to receive the conductor, if it is to be tied to the insulator laterally. According to Fig. 2 the top is fitted with a central recess wherein the conductor rests, in the case of central tying being resorted to.

The following advantageous features are claimed for the above arrangements:

(1) The cap has no insulating function, so as to allow of its

being composed of a material of low dielectric rigidity, while its size, even if very large, does not give rise to special difficulties of manufacture as is the case with the large petticoat insulators now in use.

(2) The water dripping from the cap does not come into contact with the conductor and does not, therefore, render the superficial disruptive discharges easier.

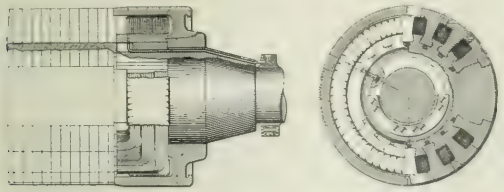
(3) The gutters prevent the water from the cap dripping on the conductor. The latter, therefore, receives only the direct rain, which, owing to the conductor having a certain sag, follows the same up to a certain extent before leaving it.

(4) The petticoats situated below the cap are completely protected thereby and will therefore remain dry.

It is said that the insulator proper may henceforth be made much smaller and its manufacture will prove much easier and cheaper than is the case with the present types.

Field Core for Turbo-Alternator.

The accompanying illustrations show a type of rotor construction for turbo-alternators for which two United States patents were issued to Mr. Karl Sulzberger, of Charlottenburg, Germany, on Oct. 27. The arrangement is such that "framed" coils may be conveniently secured to the rotor even when the opposite turns of coils are separated by many degrees of arc, while the finished rotor presents a smooth external surface. Dovetailed grooves are cut in the core body for holding in



FIGS. 1 AND 2.—FIELD CORE FOR TURBO ALTERNATOR.

place certain sets of blocks that are inserted after the coils have been laid upon the core. In assembling the rotor, the windings are placed upon the core body with each coil side resting on the appropriate ribs between the ends of the coils, and projecting beyond the end of the core a distance equal to or greater than the thickness of each block. The blocks are inserted radially in the space between the end of the core and the inner end of the end connections of the coils and then moved axially into place.

Manufacture of Tungsten Filaments.

A patent was issued Jan. 5 on the manufacture of tungsten lamp filaments to Anton Lederer, of Vienna, who has been associated with Auer Welsbach in the development of the osmium and tungsten lamp. The application of the patent was filed April 3, 1906. The process consists in mixing with an oxide of tungsten and carbon a small percentage of finely divided aluminum or magnesium which mixture upon the passage of an electric current through the filament becomes reduced to a relatively pure tungsten. It has been shown by Moissan that the oxides of aluminum and magnesium are volatile at high temperature, and it follows that when these materials are exposed to the heat of incandescence, they will be volatilized after having been converted into their oxides in the process of treatment. For best results about 0.1 to 0.5 per cent of finely divided aluminum or magnesium are added to the tungsten oxide and carbon paste.

Another patent was issued on the same date to Hermann Zerning, of Halensee, Berlin, Germany, on a method of decarbonizing metallic filaments, such as the tungsten filament. It is stated that it is necessary to obtain the finished filaments as free from carbon as possible, because a small [illegible] of carbon influences considerably the resistance or strength and usefulness of the filaments. The invention consists in decarbonizing the filaments by means of nitrogen gas or nitrogenous gases produced by the action of phosphame (PN_2H), with or without an addition of phosphorus, in a vacuum. The nitrogen contained in phosphame passes off at a relatively low temperature and forms, in a free state, with the carbon, cyanogen or oxide compounds of the same. The phosphorus which becomes free simultaneously is able to combine with the oxygen still present or to exert its reducing action on the metal oxide impurities which may still be present in the filament. The phosphorus is of special importance if the filament contains a considerable quantity of oxygenous impurities. The amount of phosphame depends on the nature of the binding agent and is larger according as this agent contains more carbon. Where tar is employed as the binding agent, the proportion of phosphame in the finished paste amounts to 4 per cent. The action described takes place immediately when the filament is made incandescent in a vacuum, which then becomes absolutely free from carbon. Another process is described wherein the filaments are treated in quantity in a furnace in which a vacuum is produced, and still another in which the filament is decarbonized after it has been inserted in the bulb of an incandescent lamp. In this case powdered phosphame is mixed with alcohol and applied to the filaments or a phosphame paste is placed for evaporation on the filament supports; or the phosphame may in this case be located outside in a space connected with the lamp.

Controlling Admission of Sound to Transmitters.

An apparatus for controlling the admission of sound to transmitters has been patented by Mr. A. Dare, of Philadelphia. The base of the mouthpiece is a cylinder completely filled with parallel small tubes. Upon this slides a hollow cone, having a row of holes through its wall. The front of this cone is closed by a bank of small tubes, and the mouthpiece shaped to fit the face of the user is outermost. The volume of tone reaching the diaphragm is varied by changing the gap between the opposing ends of the small tubes.

CURRENT NEWS AND NOTES.

NEW YORK ELECTRICAL SOCIETY.—The next meeting of the New York Electrical Society will be held at the Engineering Societies' Building, 33 West Thirty-ninth Street, New York, Wednesday evening, Jan. 20. Dr. J. F. Kelly will address the meeting on the subject of "The Development of the Electric Piano Player."

TROLLEY STORAGE BATTERIES.—The newspapers have had a good deal to say lately about the adoption of Edison storage batteries for New York street cars, notably the Third Avenue line. There has, in reality, been some discussion of such projects, and Mr. Edison has been approached on the subject by responsible persons. At the same time, it must be noted that these statements are decidedly anticipatory. An official comment from Orange is as follows: "Mr. Edison does not care to have any statement made with regard to the battery. When he is fully satisfied himself that everything is all right, he will let the public know."

CABLE RATES.—Vice-President Ward, of the Commercial Cable Company, has addressed to a committee of the New York Board of Trade and Transportation an argument as to the agitation for lower cable rates. He points out that the existing cables have all they can do to take care of the "peak of the load" during the short international business hours, and this is what makes maintenance high. Less than 1 per cent of the public use the cables, and when rates were reduced to 12 cents per word the business increased [illegible] was only 10 per cent during the two years and four months and receipts were diminished nearly one-half. Business was done at a loss and [illegible] was an absolute necessity. Mr. Ward quotes official reports against government ownership of cables and says: "The Atlantic Cable rate is the lowest in the world, except where a government pays the deficit by taxes."

NORWEGIAN HYDRO-ELECTRIC SCHEME.—Consul Felix S. S. Johnson, of Bergen, Norway, reports that a proposition is now being considered by the City Council of that place to utilize the water power of the streams in and about Bergen by a connecting system of tunnels and conduits.

NEW YORK EDISON SHOWING FOR 1908.—It may be interesting to note that on Jan. 1, 1909, the New York Edison Company had connected to its system a load of 6,805,991 16-cp equivalents. Itemized, this load is divided as follows: 3,480,719 incandescent lamps, 32,516 arc lamps, 1106 vapor arc lamps, 1103 kw in heating apparatus, 4430 kw in storage batteries and 205,373 hp in electric motors.

RADIUM BY THE TON.—In an article in the February *Harper's Magazine*, Professor Joly, of the University of Dublin, discussing the subject of radium and the internal heat of the earth, says that there are 20,000 tons of radium dissolved in the waters of the seas and "more than 1,000,000 tons of radium contained in the sediments which are deposited over the floor of the ocean."

SUPERVISION OVER PUBLIC SERVICE CORPORATIONS IN INDIANA.—A bill has been prepared for introduction in the State Legislature of Indiana providing for the enlargement of the powers of the Indiana Railroad Commission, so that it may have supervision over the rates charged by gas, water, telephone and city railway companies as well as other corporations serving the public.

GAS ENGINES SUPPLANTING DUTCH WINDMILLS.—Consul-General S. Listoe reports from Rotterdam that the windmill is no longer popular in Holland and is being supplanted by gas-engine pumping plants. As windmills are there principally used for the purpose of pumping water out of drain ditches, which must be done regularly in order to keep the fields and meadows dry, their uncertainty for this work is now recognized, and gas motors are gradually being introduced.

ILLUMINATING ENGINEERING SOCIETY.—The regular monthly meeting of the New York section of the Illuminating Engineering Society will be held Thursday, Jan. 14, at 8:15 p. m., in the United Engineering Societies' Building, 33 West Thirty-ninth Street, New York City. This is the annual meeting of the section and in addition to illustrated papers on the subject of "Street Lighting" by Mr. W. C. Allen, electrical engineer, District of Columbia, and Mr. S. G. Rhodes, engineer, meter and test department, New York Edison Company, an election will be held to fill the offices of chairman, secretary and two managers.

MORE CONTROL.—In his message to the Legislature, Governor Hughes, of New York, emphasizes the necessity of the closer control of water powers, and states that "it is deemed clear that 550,000 hp of energy is annually allowed to run to waste because no well-devised and comprehensive plan for the general and systematic development of water powers has been undertaken by the State." He also recommends that telegraph and telephone companies be placed under the supervision of the Public Service Commissions. Attention is also drawn to the present inadequacy of rapid transit and subway systems in Greater New York and the lack of public funds to supply [illegible]

SOCIALISM IN CANADA.—A special dispatch from Winnipeg, Canada, of Jan. 9, says: "An amazing wave of public ownership is sweeping over the prairie provinces. It is announced that Alberta is selling $2,000,000 of bonds in London to construct a public telephone system. The premiers of three provinces are discussing a plan of public ownership of great grain elevators throughout the West. The Winnipeg Council has awarded contracts for more than $1,000,000 on a civic power plant, to cost $5,000,000 with all equipment. Edmonton is investigating a plan to develop a great power scheme for Alberta towns at Athabasca Falls, 150 miles away. New York, Montreal and London capitalists are purchasing the bonds."

OWNERSHIP IN JAPAN.—If we are to credit the sober statements of Prof. W. D. McClintock, of the University of Chicago, there were more suicides in Japan last year than in any 12 months in that nation's history. The professor attributes the increase to hard times, partly caused by government ownership, the pessimistic spirit of the people and the breaking down of the old religion. "The cost of living in Japan," said Professor McClintock in a talk before the George Howland Club, "is very high, and the people are complaining of the huge war debt. Japan, like many other countries, is face to face with the labor problem. The government owns the railroads, telegraph and telephone lines, and the business men declare that the experiment has not been successful."

ELECTRICITY FOR THE FARMER.—At State College, Pa., on Jan. 6, electricity as a means of lessening the drudgery of farm life was discussed by Prof. J. P. Jackson before the husbandmen attending Farmers' Week at the State School here. He showed how loneliness could be obviated by the use of telephones, how the new tungsten lamp made electric lighting of houses and barns possible at a rate little above the cost of kerosene. He pointed out the use of electric machinery for ploughing, cultivating, feed-chopping, threshing, wood-cutting and milking. Methods of lightening the housework, such as by electric churns, refrigerators, sewing machines, irons, ice cream freezers and meat choppers, were discussed to the gratification of the women. Utilizing water power was also explained. The speaker said that the streams of Pennsylvania could furnish all the electrical energy needed by farmers.

THOMSON-HOUSTON REUNION.—The proposed reunion of old Thomson-Houston employees, who were with the company before it became part of the General Electric Company, will take place in Chicago on Jan. 28, during the Electrical Show. There will be a banquet and "experience meeting" that night. The affair is in charge of the following committee: George Cutter, South Bend, Ind., chairman; H. L. Monroe, Monadnock Block, Chicago; P. H. Korst, Janesville, Wis.; Geo. P. Nichols, Old Colony Building, Chicago; I. E. Price, Canton, Ill. All veterans of the "T.-H." are invited to communicate with the members of this committee. It is hoped that Mr. C. A. Coffin, Prof. Elihu Thomson, Mr. E. W. Rice, Jr., and others who were among the creators of the great and progressive company with which their life work has been identified, will participate in this gathering. It is 25 years since the apparatus was shown at the first Electrical Exhibition in Philadelphia.

TELEPHONE TRAIN DISPATCHING.—The officials of the Santa Fé Railroad have announced that the entire Santa Fé system will soon be operated by telephone instead of telegraph. Telephone instruments and telephone apparatus necessary for installing a complete dispatching system has been purchased by the company for installation on 454 miles of the main line of the Santa Fé Railroad from Kansas City to Corwith, Ill. The company is now equipping its lines with telephones between Emporia, Kansas, and Kansas City, a distance of 205 miles, and is already operating the lines between Emporia and Newton, Kansas, a distance of 73 miles, by telephone. As soon as the telephone installations are completed at the Kansas City terminal the work of building the lines toward Chicago will be begun. It is expected the substituting of the telephone for the telegraph will involve an expense for the company of approximately $2,000,000. The officials of the Santa Fé Railroad are quoted as being very enthusiastic over the proposed change in the method of dispatching trains.



PANORAMIC VIEW OF ROCHESTER, N. Y., INDICATING LOCATIONS OF ELECTRIC GENERATING STATIONS

System of the Rochester Railway & Lighting Company.

THE city of Rochester is situated in the County of Monroe, State of New York, about seven miles south of Lake Ontario and its central portion is nearly 263 ft. above mean lake level and 510 ft. above mean tide-water. The city is bisected by the Genesee River, which flows through it from south to north. Within the corporate limits the river has three falls and several rapids, having an aggregate descent of about 257 ft., affording power to many manufactories. The drainage area of the river at Rochester is 2365 sq. miles. The Erie Canal also passes through the city, besides the following named railroads: New York Central & Hudson River Railroad, West Shore Railroad, Erie Railroad, Lehigh Valley Railroad, Buffalo, Rochester & Pittsburg Railroad, and the Pennsylvania Railroad. The habitable area of the city is 17.68 sq. miles, and the estimated population, according to the State enumeration, is 204,000. Rochester has recently been put in the first class.

Electrical energy for all purposes is supplied by the Rochester Railway & Light Company, which company also furnishes energy for the street railway system and operates the gas works. Within the city limits the railway company operates 36 miles of double-track road and 13 miles of single-track road, besides a double-track railroad from Rochester to Charlotte, on Lake Ontario, on the west side of the Genesee River, and another double-track road on the east side of the river to the lake. In addition, an electric railway is operated to Sea Breeze, at the junction of Irondequoit Bay and Lake Ontario, and another line from Rochester to Glen Haven, near the head of the bay. This line extends to Sodus Point, a distance of about 40 miles. The company also operates the Rochester & Eastern Rapid Railway running between Rochester and the thriving city of Canandaigua, a distance of approximately 27 miles.



FIG. 1.—STATION OF THE ROCHESTER RAILWAY & LIGHT COMPANY ON MIDDLE FALLS.

The Rochester Railway & Light Company was incorporated in New York May 26, 1904, and is a consolidation of the Rochester Gas & Electric Company and the Rochester Light & Power Company. Included in the present company are the following old gas and electric companies: Rochester Gas Company, Citizens' Gas Company, Municipal Gas Company, Rochester Electric Light Company, Brush Electric Light Com-

pany, Edison Electric Light Company and the Citizens' Light & Power Company. The history of electric lighting in Rochester since the formation of the first company is interesting. In 1880 the Rochester Electric Light Company was organized, Mr. L. P. Ross being its president, and Mr. G. A. Redman, who up to a few years ago was still actively connected with the lighting company in Rochester, as director. This company started business in a room in the Bee Hive Building and shortly afterward moved to the Whitney property on the Upper Falls, where it remained until it was consolidated with the Rochester Gas & Electric Company. The Brush Electric Light Company was organized in 1881, starting business with two machines, at the corner of Water and River Streets and afterward moved to the Lower Falls on the west side of the river, having purchased a portion of the water-power rights. A few years later the company acquired all the water-power rights of the Lower Falls and built a large stone building on the east side of the river. It was merged with the Rochester Gas & Electric Company in 1900. The Edison Electric Light Company was formed in 1886, and began business with a steam-driven plant on Edison Street, soon after purchasing several important water-power rights on the Brown's Race and erecting a stone building at that point. This company was merged with the Rochester Electric Light Company in 1891. The first arc lamps placed in service brought $1 per lamp per night, the charge gradually diminishing to 75 cents, then to 50 cents and finally to 25 cents per night. The rate for electrical energy was at first 20 cents per kw-hour, and latterly 14 cents per kw-hour, but about four-fifths of the business was conducted on flat rates. Its equipment at that time consisted of Brush, Thomson-Houston and Western Electric arc machines and Edison bi-polar machines. At the time of the first consolidation, in 1891, Mr. J. Lee Judson was president of the company.

The Citizens' Light & Power Company commenced operations in 1892 and built a plant on Brown's Race in 1893. Brown's Race is an artificial waterway 30 ft. wide by 7 ft. deep, running from the Genesee River at Central Avenue to Brown Street, where the overflow returns to the river. The Citizens' Light & Power Company built its plant on the river bank below the race, where a head of 93 ft. was available. The original plans called for a building eight stories high, but this was finally modified and a building three stories high and a wheel pit were erected. The company started with one or two machines, but at the time of the destruction of the plant by fire, on Nov. 25, 1900, there were installed three 500-hp waterwheels, two 600-hp Corliss engines and one 600-hp Woodbury tandem-compound engine, all of which were connected with four jack-shafts to the floor above by rope-drives. In the boiler room there were eight 125-hp horizontal tubular boilers, and on the floor above the shaftroom there were six 150-kw double-current Westinghouse dynamos, belt-driven from clutch pulleys on the jack-shaft below. The generators gave 380-volt, two-phase, 50-cycle current from one end, and 500-volt direct current from the other end, the idea being to operate all of the alternating-current ends in multiple from the alternating-current switchboard, and to control all the direct-current ends from the direct-current switchboard. The final arrangement consisted in running the alternating-current ends together and installing two 150-kw multipolar machines for the 500-volt direct-current work, as there was usually a pyrotechnical wind-up when an attempt was made to operate both ends of the double-current machines at once. There were also at that time two Western Electric 60-light series arc machines in operation. After the plant was destroyed, it was bought by the Brady interests, who built a modern station, designed by Mr. T. E. Murray, of New York. The Citizens' Light & Power Company was acquired by the Rochester Gas & Electric Company in 1902.

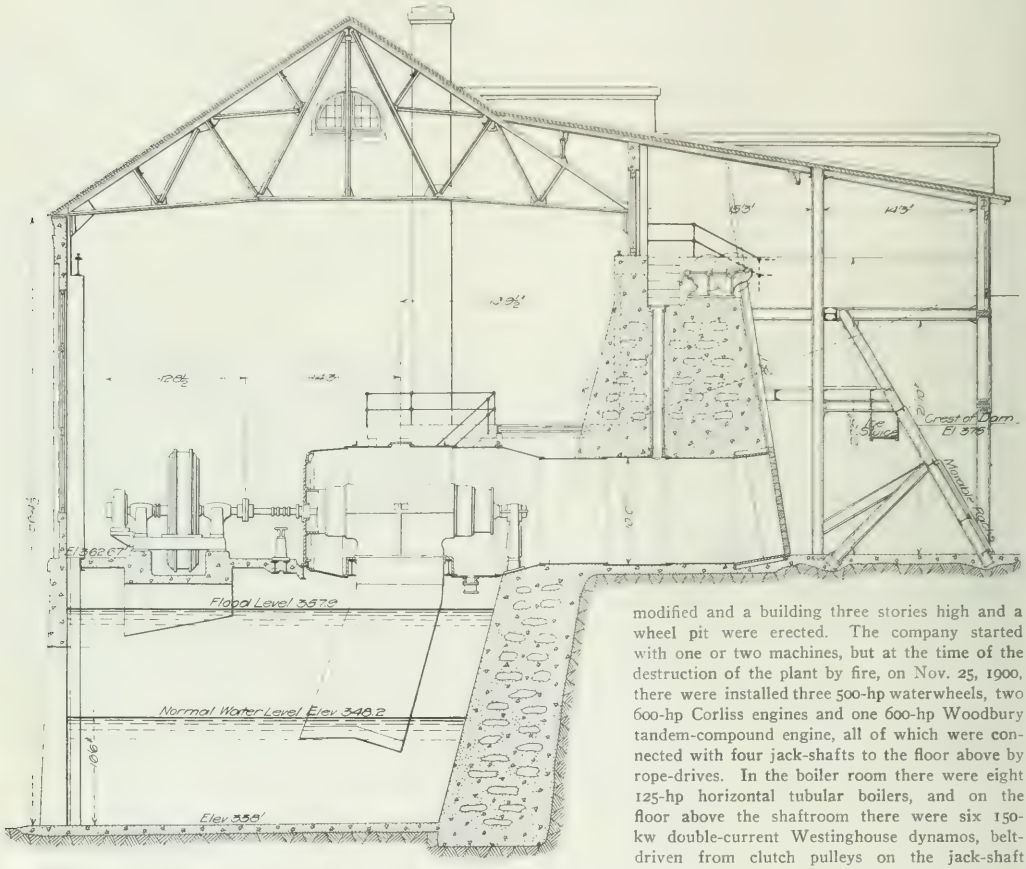


FIG. 2.—SECTIONAL ELEVATION OF STATION NO. 15 OF THE ROCHESTER RAILWAY & LIGHT COMPANY

The generating stations at present operated by the Rochester Railway & Light Company and their locations are as follows:

Name.	Location.	Character.
Station No. 1	Mill and Commerce Sts.	Steam power
Station No. 2	Brown's Race and Furnace St.	Steam and water power
Station No. 3	Mill St., opposite Factory St.	Steam and water power
Station No. 4	Central Ave. and No. Water St.	Water power
Station No. 5	Driving Park Ave. & St. Paul St.	Water power
Station No. 6	So. Water St. and Aqueduct	Water power
Station No. 15	Middle Falls	Water power
Station No. 26	Graves St.	Water power

Stations 7, 8, 9, 10 and 11 are used entirely for street railway purposes and are situated in Charlotte, Penfield, Ontario, Sodus and Webster.

From the above, it is evident that the chief source of power is the Genesee River, although steam-driven generators are used and electrical energy is also transmitted from the Niagara Falls plant of the Ontario Power Company. During certain portions of the year the water power furnished by the Genesee River is all that can be desired, but during dry weather the river is so low that it is necessary to use steam to carry the load. For this reason a brief description of the river may be of interest

the Upper Falls to the foot of the Lower Falls there is a total drop of about 231 ft., an average of 115.5 ft. per mile. From the Lower Falls to Lake Ontario there is only a difference of about 2 ft. In the foregoing description no account has been taken of the several dams across the river, the description applying to the river in its natural state. The distance measured along the meander is taken at approximately 145 miles, and the catchment area is 108 miles measured in a straight line. The average width of the catchment is about 22 miles.

The clearing of the forests and draining of lands, together with improvements in the drainage of towns along the Genesee Valley, have resulted in a rapid run-off, so that the flow of water at Rochester varies from a maximum of 54,000 cu. ft. per second to a minimum of 150 cu. ft. per second. It would thus seem that with so erratic a stream the problem of continuous electric supply would be a rather difficult one. However, the engineers of the Rochester Railway & Light Company have taken advantage of every opportunity for utilizing the flow of the river, and the arrangement of the stations along the river and the electri-

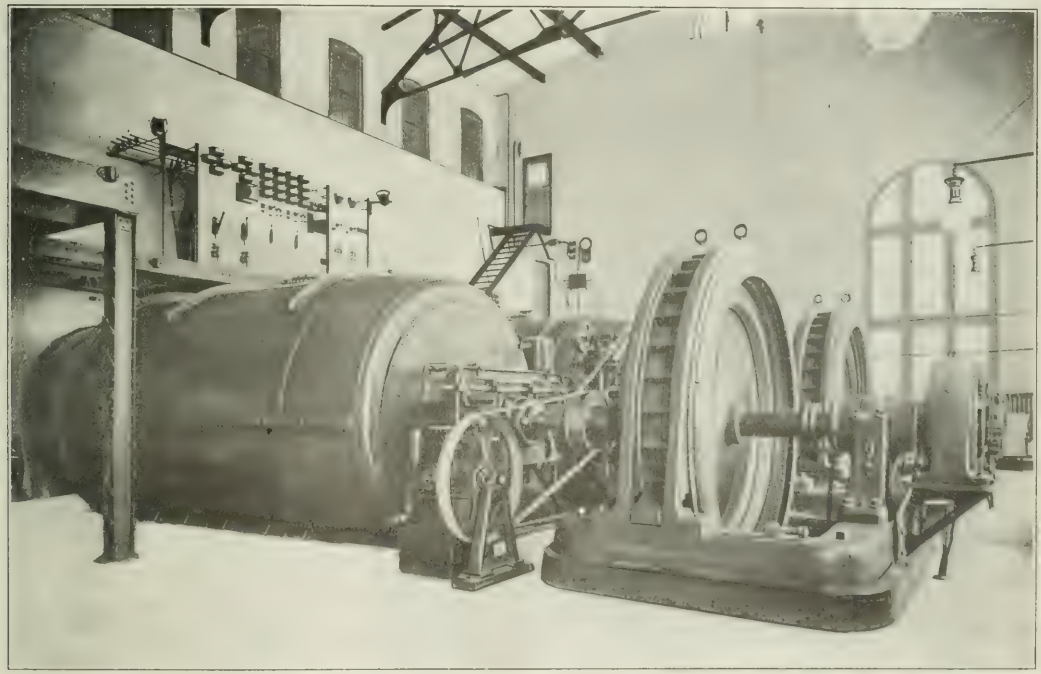


FIG. 3. INTERIOR OF STATION NO. 15 OF THE ROCHESTER RAILWAY & LIGHT COMPANY.

The Genesee River rises in Potter County, Pennsylvania, 15 miles south of the New York State line. At Genesee Forks, Cryder Creek, East Branch, Middle Branch and West Branch unite. The total catchment area of these streams below the mouth of the creek is 143 sq. miles. The streams have a fall of about 47 ft. per mile. The valleys are narrow and there is little opportunity for storage upon them. From the State line to Wellsville, a distance of about 10 miles, the average fall is 31 ft. per mile. A short distance above Wellsville broad flats begin, which continue with little interruption to Portage. At Portage the river falls 330 ft. in three miles. From the foot of Portage Falls to Mount Morris the average fall is at the rate of 10.6 ft. per mile. From Mount Morris to Rochester, above the feeder dam, the distance is about 46 miles, and the average fall per mile is 1.2 ft. The flats along this portion of the river are the great storage ground. From above the feeder dam at Rochester to above the Upper Falls the distance is two miles and the average fall in the river is 13.5 ft. per mile. From above

cal interconnections between them have resulted in an extremely flexible and interesting system.

The company has in all eight generating stations, some of which are also substations, and eight substations. Two of the latter are strictly railway stations with rotary-converter equipment, and three are for commercial lighting service and are equipped with motor-generator sets.

STATION NO. 15.

Station No. 15, situated on the west bank of the river at the Middle Falls, [illegible] generating plant owned by the company [illegible] spring of 1907. The location of the plant is well shown in Figs. 1 and Figs. 2 and 4 show cross-sectional and plan views from which the layout is readily apparent. The equipment in this station consists of two [illegible] S. Morgan Smith Company, of York, Pa., direct-connected to two 500-kw, 4150-volt, three-phase, 60-cycle General Electric alternators. The switchboard [illegible] two generator panels, two feeder panels and two

exciter panels. The entire station layout is the acme of simplicity. The generators are equipped with exciters fastened to a bracket beyond the outboard bearing and driven from the main shaft. Between the generator and its water-wheel is a Sturgess water-wheel governor with switchboard control. As is probably known, poppet valves are used in this controller for regulating the passage of high-pressure oil to the main cylinder. A centrifugal governor belted from the water-wheel shaft operates a pilot valve controlling the operating cylinder. The latter in turn controls the main cylinder which operates

load is apparent. By holding back the water for the time indicated, or until it is required, a peak load of 3750 kw-hours can be carried without any additional investment. The available head of water at this station is 27 ft.

The efficacy of this simple expedient of using flash boards to impound water at a point where no other means of storage exists was well shown during the recent drought. On Jan. 6 water went over the dam at Rochester for the first time since July. During the interim water conditions were very acute. At times there was barely enough water for the condensers of

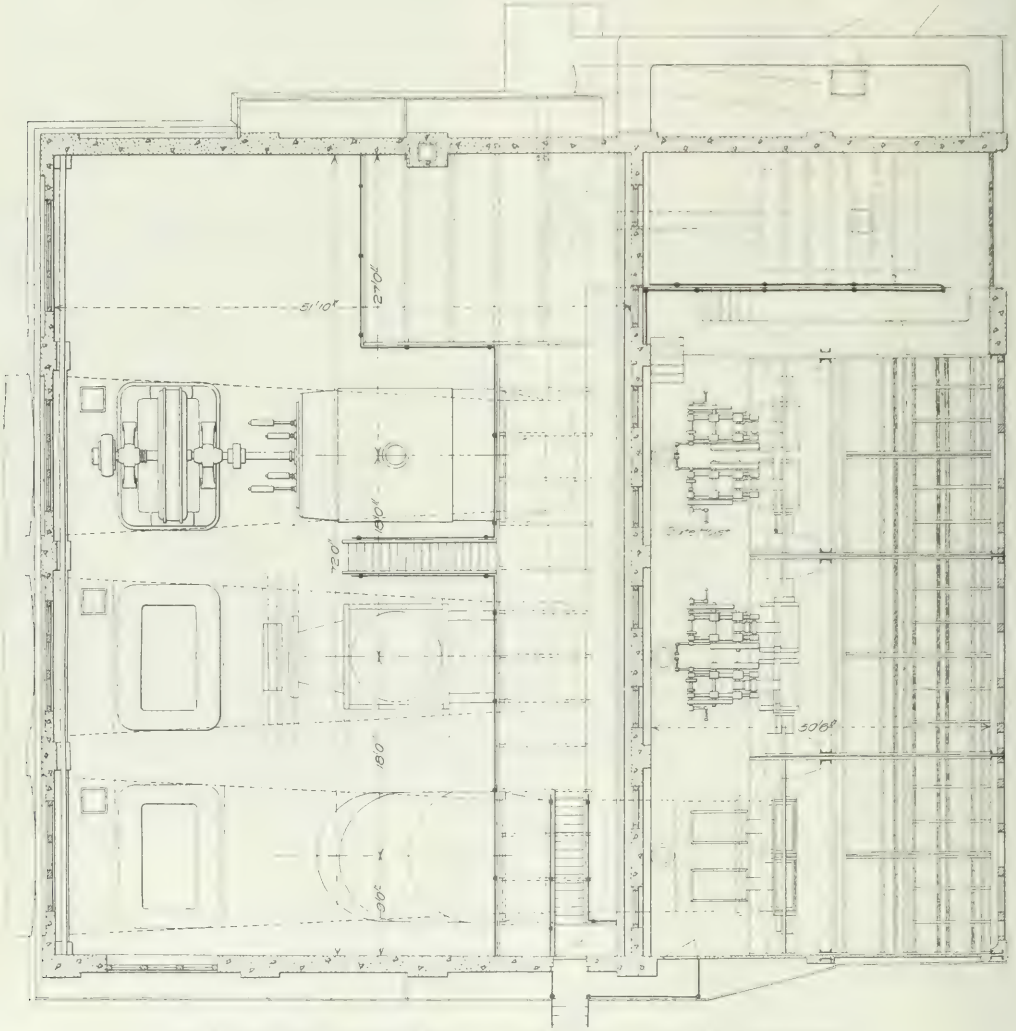


FIG. 4.—PLAN VIEW OF STATION NO. 15 OF THE ROCHESTER RAILWAY & LIGHT COMPANY.

on the main gate shaft. In order to prevent racing, a compensator is used to give stability to the governor.

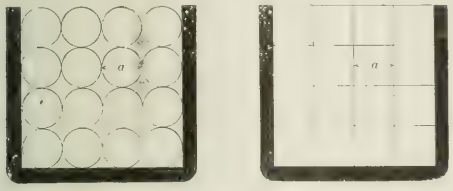
The structure is built of reinforced concrete and the intake gates are inclined at an angle to the flow of the stream, so that the tendency is to keep the racks clear of floating ice, refuse, etc. The location of the station is particularly well chosen in that there is a pondage or storage capacity of about 8,000,000 sq. ft., and by means of flash boards 2 ft. high and by partially shutting down the gates for 20 hours, a storage capacity of 16,000,000 cu. ft. of water, equivalent to an output of 1500 kw for 2½ hours, can be secured. The advantage of this at peak

the engines at Station No. 3. During the emergency the latter station, as well as the other steam stations, were run overloaded. Station No. 15 and Station No. 5 were shut down during the day when water was scarcest and the water impounded at Station No. 15 until the peak load at night, when the water was allowed to pass through the turbines at Station No. 15 and then through the turbines in Station No. 5 farther down the river. In this way the company was able to carry peak loads without serious difficulty in the face of the fact that the water in the Genesee River had not been so low in a period of over 20 years.

Factors Governing the Space Utilization of Electromagnetic Windings.

BY CHARLES R. UNDERHILL.

THE coefficient of space utilization of an electromagnetic winding is, usually, defined as being the ratio of volume of copper to volume of winding space. Hence, under ideal conditions the space utilization would be 1, or 100 per cent. Such an ideal winding might be a hollow cylinder of solid copper or it might consist of an infinite number of turns of bare square wire whose cross-section should be vanishingly small. The reason why the ideal condition could not exist, otherwise, in a winding space such as on a bobbin with flat-faced heads or



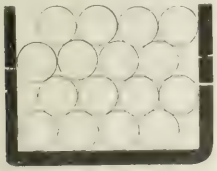
FIGS. 1 AND 2.—SPACE UTILIZATION OF ROUND AND SQUARE WIRES.

washers (neglecting the insulation on the wire) is due to the turning back of the turns of subsequent layers over those of preceding layers, which causes a loss of one turn per layer.

In practice the wire is not only insulated, but is usually of circular cross-section. Hence, a comparison of the round-wire and square-wire windings in Figs. 1 and 2 will show that the space utilization of the winding in Fig. 1 will be only $\frac{\pi}{4} = 0.7854$ of that in Fig. 2, the dimension a being the same in both cases.

In the round-wire winding the layers have a tendency to imbed, i. e., the turns of subsequent layers sink between the turns of preceding layers at certain points. At the point where the turns of adjacent layers cross one another they appear as in Fig. 1. Diametrically opposite this point there is a similar crossing point, but at the ends of a diameter at right angles with this one, the turns of the upper layer sink into the grooves between the turns beneath it, as in Fig. 3. The transition from one of these conditions to the other is, of course, gradual.

From Fig. 4 it will be seen that the space consumed by the wire when imbedded is proportional to $2r^2\sqrt{3} = 3.46\,r^2$, where r is the radius of the wire. In the other case, however, where the wires on subsequent layers lie exactly on top of those of the preceding layers, as in Fig. 1, the space consumed is proportional to $4r^2$. It is, therefore, fair to assume that the actual



FIGS. 3 AND 4.—SPACE UTILIZATION BY IMBEDDED WIRES.

space consumed in a wound magnet is proportional to the average between the two conditions, or [illegible]

Since the number of turns N is proportional to the reciprocal of the square of the radius of the wire, N is proportional to [illegible], or in terms of d, (d = diameter of bare wire, d_1 = diameter over insulation) N is proportional to

$$4\left(\frac{0.268}{\quad}\right)$$

Hence, there is, theoretically, a gain of 7.2 per cent due to imbedding, which, under the conditions thus far considered, makes the space utilization $\Psi = 0.7854 + 0.072 = 0.8574$, or $\Psi = 85.74$ per cent.

The loss due to turning back, previously mentioned, is proportional to $\frac{1}{mL}$, wherein m represents the turns per unit length, and L the interflange length of the winding space. In the above it is assumed that the turns are at right angles with the axis of the winding. Fig. 5 shows that while this loss is not great for small wires, it may be considerable for large wires where L has a small value. Under these conditions $\Psi = 0.8574 - \frac{1}{mL}$ Thus, a winding consisting of No. 10 B. & S. bare wire wound between two faces 2.54 cm apart would have a loss of approxi-

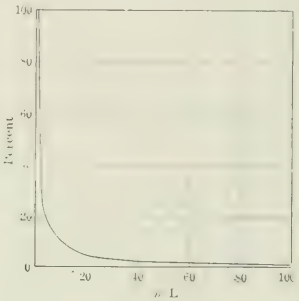


FIG. 5.—LOSS OF SPACE BY CHANGE OF PLANE OF WINDING.

mately 10 per cent due to the turning back of the turns. In this case $\Psi = 0.8574 - 0.10 = 0.7574$. This, however, is an extreme case.

There is another effect due to the turning back of the turns at the ends of the layers which results in an additional loss throughout the entire winding. This effect was discussed in a previous article,* but will be briefly mentioned here. Since an electromagnetic winding consists of spirals, the inclination of which are alternately right and left, there will be an inclination of the turns toward the axis of the winding. This inclination will be greater for small and less for large diameters of turns; hence, the diameter of the average turn should always be taken for the average inclination.

If l = the distance between adjacent turns, center to center, and M = the average diameter of all the turns, then the loss due to this effect will be as represented in Fig. 6. This illustration shows very clearly that the so-called "haphazard"

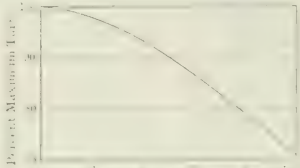


FIG. 6.—LOSS OF SPACE BY SPIRALING.

and similar windings have a lower value for Ψ than have those wound in layers. In this case with a No. 16 B. & S. cotton-covered wire winding, evenly wound in layers, and in which the average diameter, $M = 1$, the loss due to the inclination would be approximately 1.7 per cent.

[illegible] the space occupied by the conductor to that of the insulation covering it has not been considered. The space utilization ratio or practical utilization for round wire [illegible] Fig. 7 shows the utilization and the utilization

[illegible] Dec. 21, 1907.

ratios for insulated round wires. In this the other factors, such as imbedding, etc., are not considered.

The space utilization of an electromagnetic winding is equivalent to the conductivity ratio of the conductor itself, where the

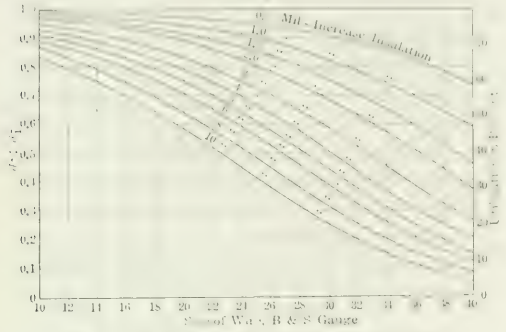


FIG. 7.—LOSS OF SPACE BY INSULATION ON WIRES

dimensions of the winding space are limited. This may be appreciated by reference to Figs. 8 and 9. In Fig. 8 the turns and length of wire are constant, and the resistance and size of wire are variable. In this case, if a given winding space be occupied by, say, 5000 turns with a coefficient of $\frac{d^2}{d_1^2} = 0.25$, and an exactly similar winding space contains 5000 turns, but with the coefficient of $\frac{d^2}{d_1^2} = 0.5$, the latter winding will contain the same number of turns and length of wire as the former, but will have only one-half of the resistance with the cross-section of the wire doubled. Here the size of wire varies directly, and, consequently, the resistance varies inversely as $\frac{d^2}{d_1^2}$. Hence with constant e.m.f., the m.m.f. and watts will vary directly as $\frac{d^2}{d_1^2}$.

In Fig. 9 the resistance is constant and the turns, cross-section and length of wire are variable. In this case the number of turns and length of wire vary directly as $\sqrt{\frac{d^2}{d_1^2}}$, and the cross-section of the wire varies directly as $\left(\frac{d^2}{d_1^2}\right)^2$. With constant e.m.f. the m.m.f. will vary directly as $\sqrt{\frac{d^2}{d_1^2}}$, and the watts will remain constant.

In Fig. 10 the cross-section of wire is constant and the resistance turns and length of wire are variable. It is, of course,

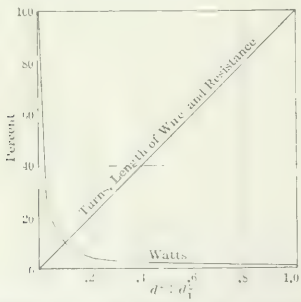


FIG. 8.—CHARACTERISTICS OF WINDING OF CONSTANT NUMBER OF TURNS AND LENGTH.

obvious that the three variables vary directly as $\frac{d^2}{d_1^2}$. With constant e.m.f. the m.m.f. will be constant, and the watts will vary inversely as $\frac{1}{a}$.

The effect of an increased space utilization is more marked in a winding of small than one of large diameter, and it varies directly with the length L of the winding. Fig. 11 shows the various relations, p_{min} and p_{max} being the minimum and maxi-

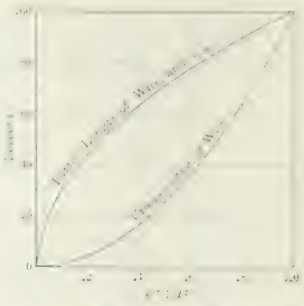


FIG. 9.—CHARACTERISTICS OF WINDING OF CONSTANT RESISTANCE.

mum perimeters, respectively; p_a the average perimeter, and T the thickness, or depth, of the winding.

As a test of the imbedding theory, the writer constructed a solid-steel bobbin exactly 2.54 cm in length between heads, hav-

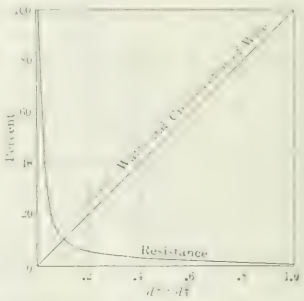


FIG. 10.—CHARACTERISTICS OF WINDING OF CONSTANT CROSS-SECTION.

ing a core 1.27 cm in diameter. This was wound by hand by an experienced operator with various sizes of single-silk-covered magnet wire ranging from Nos. 21 to 34 B. & S. gage. The

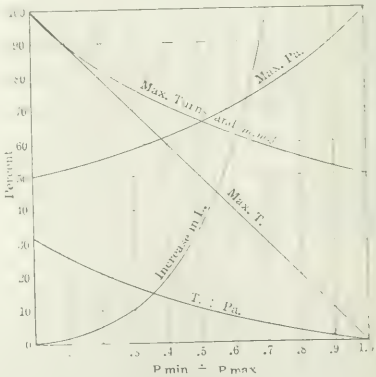


FIG. 11.—EFFECT UPON CHARACTERISTICS OF WINDINGS OF VARYING THE PERIMETERS.

values for d_1 were observed by means of a ratchet-stop micrometer. Fig. 12 shows the relation (for eight layers) between thickness of winding T and the calipered diameter of the insulated wire. Even with 7.2 per cent allowed for imbedding, there

was found to be an additional "flattening out" of the insulated wire, due to the vertical compression of the wire, owing to the tension. This averaged approximately 6 per cent.

For a constant thickness of insulation it would appear that the flattening effect would vary with different sizes of wire, but since the tension on the wire, during the winding process, decreases as the diameter of the wire decreases, it remains practically constant for the sizes of wire mentioned above. An examination of the wire when removed from the experimental

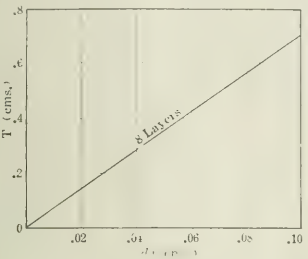


FIG. 12.—TEST OF AN 8-LAYER MAGNET WINDING.

bobbin showed that the wire had not been appreciably stretched in winding. The apparent gain of approximately 6 per cent was found to be compensated by a loss of approximately 6 per cent in the turns per unit length.

The formula used for calculating the actual average thickness of the winding per layer is

$$t = \frac{T}{0.933\ (n-1)+1} \qquad (1)$$

wherein n = the number of layers,
and T = thickness, or depth, of winding.

It will be observed that in this formula an allowance of 7.2 per cent has been made for imbedding.
By transposition,

$$n = 1.072\left(\frac{T}{t}-1\right)+1 \qquad (2)$$

and

$$T = t\,[0.933\ (n-1)+1] \qquad (3)$$

The loss due to inserting paper into the winding at intervals may be determined by removing the paper from the winding, wrapping it around the core and calculating the new volume of the winding space. The losses in winding due to carelessness, splicing and in insulating joints, etc., are factors which may be determined only by experience. The tension on the wire should be constant and so adjusted that at a maximum it will not stretch the wire.

A Classification of Electrical Engineering Data.

By George W. Lamke.

In order that all notes, catalogs, etc., on any electrical subject could be located in the shortest possible time, the study of a classification of electrical engineering data was undertaken to meet this requirement. There was only one classification available, in print, at the time this study was taken up. This was published in the *Electrical World and Engineer*, Vol. 46, page 910, by Mr. George Parsons. In the February, 1906, number of *The Electric Journal*, Mr. Parsons published a revised system of classification which he found necessary owing to the rapid growth of the electrical industry and to the amount of data accumulating. A later classification, and one going into minutest details, was given in Bulletin No. 9 of the University of Illinois Engineering Experiment Station. Each of these classifications has merit, but one required a large number of cross references and the other went into details which are not at all necessary for the average engineer. The classification given below requires very few, if any, cross-references, and goes into sufficient detail for a general classification. The arrangement is a logical one and is new and unique in at least one particular.

A "General" topic is given first, under which head are placed all books, catalogs, pamphlets, etc., which treat of a variety of electrical subjects and which for that reason cannot be placed under any particular subhead. Under "General Theory" all books, pamphlets, etc., treating of the theory of a variety of electrical subjects are placed. Following this comes the subhead "Energy Conversion." Under this head is placed subject matter dealing with all types of machines which convert energy from one type to another. This arrangement makes it possible to place the subject "Electric Motors" with the subject "Electric Generators," at the same time giving it an equally important place, which the subject really deserves. After "Energy Conversion" the next logical step is the "Control" of the converted energy. As this classification is of electrical data mainly, electricity "Control" only is classified. There may be some

1	GENERAL.
11	Materials.
111	Magnetic.
112	Conducting.
113	Insulating.
12	Statistics.
13	Theory—General.
14	Measurements.
15	Testing.
16	Educational.
2	ENERGY CONVERSION.
21	Thermodynamic.
211	Boilers and Auxiliaries.
212	Steam Engines.
213	Steam Turbines.
214	Gas and Oil Engines.
22	Hydrodynamic.
221	Water Supply.
222	Dams.
223	Flumes.
224	Water Wheels and Turbines.
23	Electrodynamic.
231	General.
2311	Armatures.
2312	Fields.
2313	Frames.
2314	Commutators.
2315	Brushes.
232	Generators.
2321	Alternating Current.
2322	Direct Current.
233	Motors.
2331	Alternating Current.
2332	Direct Current.
3	CONTROL.
31	Switchboards and Acessories.
32	Meters.
321	Indicating.
322	Integrating and Recording.
323	Miscellaneous.
33	Protective Devices.
331	Circuit Breakers.
332	Fuses.
333	Lightning Arresters.
334	Relays.
34	Switches.
35	Voltage Regulators.
36	Boosters.
37	Rheostats and Resistances.
38	Miscellaneous Apparatus.
4	TRANSFORMATION—ELECTRICAL.
41	Frequency Changers.
42	Motor Generators.
43	Rectifiers.
431	Commutating.
432	Electrolytic.
433	Vacuum Tube.
44	Rotary Converters.
45	Transformers.
451	Constant Potential.
452	Constant Current.
453	Series.
454	Induction Coils.
5	TRANSMISSION.
51	Alternating Current Systems.
52	Direct Current Systems.
53	Lines and Accessories.
6	DISTRIBUTION.
61	Alternating Current Systems.
62	Direct Current Systems.
63	Lines.
631	Overhead.
632	Underground.
633	Interior Wiring.
7	UTILIZATION.
71	Electric Lighting.
711	Arc Lamps and Lighting.
712	Incandescent Lamps and Lighting.
713	Photometry.
72	Electric Railways.
721	Systems.
722	Operation.
723	Route.
[illegible]	Rolling Stock.
73	Electric Heating.
74	Electric Signaling.
75	Electro-Chemistry.
751	Storage Batteries.
752	Primary Batteries.
76	Electro-Magnets.
77	Telegraphy.
771	Land.
772	Marine.
773	Wireless.
78	Telephony.
781	Lines.
782	Switchboards
7821	Manual.
7822	Automatic.
783	Substation Apparatus.
7831	Manual.
7832	Automatic.
784	Wireless.

doubt as to whether "Electrical Transformation" or "Electrical Transmission" should come next, but, after a careful consideration, it seemed proper that the former should have the place since often many types of electrical transformers are used before the power is transmitted and distributed. "Transmission" and "Distribution" follow naturally, with "Utilization" last.

Each subject has been given a number according to the decimal system. Thus, at any time, this classification can be made a part of the "Dewey decimal system" by simply prefixing the number 621.3, which is the number assigned to electrical engineering in the Dewey system. These numbers also form a convenient numerical classification.

The method of applying this classification is as follows: An index guide-card [illegible] made out with the name of the subject on the tab. The corresponding number of the subject appears in the upper left-hand corner of the same card. These cards are placed in an ordinary card-file case in the order given by the classification and are used as guide-cards for a reference file. A separate card is made

for each reference, which bears the title of the reference, the name of the author and the volume and page of the period, al or book in which the given article appeared. Then follows a brief description of the article. Separate files are kept for notes and catalogs, and the tabs of the guide cards for these files bear only the number of the subject and are kept in numerical order. For more voluminous notes and pamphlets, and for catalogs, standard letter-size vertical files are used, while for less voluminous notes an ordinary card file, size 5 in. x 8 in., is found convenient.

Although four files are necessary for filing all data, excluding books, all data upon a given subject may be located very quickly. For example: If the subject of "Electrolytic Rectifiers" is under investigation, to find all available data the guide card in the reference file must first be found. The mental process in finding this card would be: Electrical Transformation; Rectifiers; Electrolytic. Back of this card would be found all references on the subject. The subject number is found from the guide card, and all data in the other files can be located in less than a minute by looking back of the guide cards bearing this number in each of the other files.

The writer does not claim completeness for this classification, but it will meet the general needs of the average electrical engineer. The classification lends itself to a much more detailed subdivision for those who are specializing in any one of the many electrical branches, and the special subject is then a part of the whole. Even the specialist has a large amount of general data which it is convenient to have classified, and the classification meets this general need as it stands.

Other subjects outside the scope of electrical engineering may be classified similarly and the general number assigned to such subjects in the Dewey system may be prefixed and one may then have all his data, books, pamphlets, etc., come under a general library classification. In the latter case a number of subjects given in the below classification could be more properly placed somewhere else than under electrical engineering:

The Theory of Lightning.—II.

By Daniel S. Carpenter.

In the first part of this article, published last week, the electric charges of clouds were considered. In this concluding part the surface of the earth, considered as a conductor upon which charges are induced by the cloud charges, will be studied. Some portions of the earth's surface are covered by rock formation in which no mineral matter occurs, by dry sand or other non-conducting material, all of which are very imperfect conductors and must be considered a part of the dielectric intervening between the cloud and the conducting portion of the earth below. Permanently moist earth is a fair conductor, and, where it occurs, it is found at a depth below the surface of the earth varying with the local conditions as to rainfall. Very often the severest thunderstorms are preceded by periods during which there is no rainfall, and the surface of the earth must be considered practically as a non-conductor for lightning discharges. Below the surface of the earth there are strata of porous soil which are always saturated with water and which very often extend over large areas and are, since the water contains salts, very good conductors. Water systems consisting of an extensive system of iron pipes, if they derive their water supply from these underlying strata, add to the area, the whole forming a large conducting sheet, overlaid by a sheet of earth of varying resistance which, in general, would have a much higher resistance than the underlying sheet just mentioned. It is thus seen that the surface of the earth may consist of:

(1) Non-conducting formations, as rocks, which may be of great extent and extend to a great depth, as, for example, the chalk cliffs of England.

(2) Non-conducting material at the surface with an underlying sheet which is conducting.

(3) Conducting sheet of water or other material at the surface.

(4) Non-conducting material at the surface with a conducting sheet underneath which outcrops or projects above the non-conducting surface sheet at points.

(5) Conducting material on the surface with an underlying stratum of lower resistance.

Thus, it may be said that a greater or less distance below the earth's surface there is a vast conducting sheet upon which the cloud charges induce charges. The charge on this sheet, similarly to the charge on the raindrop, is a function of a large number of cloud charges. The surface of this sheet is not regular, but will have points where more or less perfectly conducting objects project far above it and thus form a path along which a lower cloud potential will be able to establish a discharge than along any other path available. A stratum of soil, saturated with water, and forming a part of the conducting sheet at a place where the portion of the earth above the sheet is non-conducting, may outcrop at some point. A tree whose roots are either imbedded in moist earth or lie in close proximity to a system of water pipes may form such a path. The large iron pipes of a water system form a conductor of large external surface in contact with permanently moist earth at many points and can be said to consist of a large number of conductors of large external surface arranged in parallel and terminating in the conducting sheet of the earth. This is also true of trees. In order that they may replace the large amount of moisture lost by evaporation, their roots must penetrate to permanently moist earth and must terminate in a multitude of rootlets and root hairs. The root hairs of some trees give off a weak acid, which, reacting upon the soil, forms a salt soluble in water, thus reducing the soil to a condition in which it can be assimilated, and incidentally forming a sheet of very high conductivity in contact with the rootlets. We have here again a discharge path formed of innumerable conductors in parallel, which terminate in permanently moist earth. The woody fiber of the tree is not a good conductor, but the sap is, and so the tree forms an imperfect conductor with a good earth.

Metal rods, wires, ropes, etc., may form nearly an unbroken path from the top of a tower or church steeple to ground, thus rendering these objects liable to be struck by lightning.

After rain has been falling for some time the condition of the surface of the earth in regard to conductivity is modified somewhat, although surface water has a high resistance, one author stating that it is 25,000 ohms per cubic centimeter.

Some of the notable instances on record in which the conducting sheet of the earth did not coincide with its surface where the bolt struck are as follows: During a thunderstorm in the Tyrol lightning struck a pile of wood which lay on a rock, setting fire to the wood and splitting the rock. After the flames were extinguished, it was noticed that a stream flowed from the rubbish. Further examination showed that the water proceeded from the lightning-created cleft in the rock, and chemical analysis demonstrated that the water was impregnated with magnesium and iron in the form of sulphates. This was an instance where the conducting sheet came near the surface.

In the Maritime Alps a lightning discharge made a broad and deep fissure in the mountain-side for a distance of 20 m, detaching a solid mass measuring several hundred cubic meters before it reached a place where there was a good earth. Again, lightning strikes an electric circuit, leaps to ground and, not finding a good earth after scoring the ground up for some distance, passes to a telephone circuit and thence to earth by a bell wire quite a distance from the point where it entered the telephone circuit.

To earth means to the conducting sheet of the earth. The greatest care should be taken to make a good earth. Conductors of such form as to have a large external surface rather than a large cross-sectional area should be selected. Due to the enormous value of $\frac{di}{dt}$ in the expression $L\frac{di}{dt}$, it is very difficult to provide a conductor with negligible impedance. The current penetrates very slightly into the conductor, so the ex-

ternal surface must have a large area in order that the active portion of the conductor may be of sufficient magnitude to permit a free discharge to take place, which can only occur when the current density is not too great.

As the clouds are relatively very far above the earth's surface, the capacity of the cloud may be considered as that of an isolated conductor to ascertain its potential and charge. Consider the cloud a spherical mass whose radius is 500 ft. or 15,240 cm, its capacity as an isolated sphere will be 15.240 c.g.s. electrostatic units. Assume, now, that there are two raindrops 0.252 cm in diameter per 10 cu. in., each contributing a charge of two electrostatic units to the cloud charge. In the spherical mass there are $9{,}047{,}808 \times 10^6$ cu. in. This gives as the quantity of electricity contributed by all of the drops within the mass

$$\frac{2 \times 2 \times 9{,}047{,}808 \times 10^5}{10} = 30{,}191{,}232 \times 10^4$$

electrostatic units.

Suppose, now, that this charge is distributed uniformly over the cloud sphere. Since

$$V = \frac{Q}{C} = \frac{Q}{r} = \frac{36{,}191{,}232 \times 10^4}{1{,}524 \times 10^4} = 23{,}747{,}527,$$

in electrostatic units of potential, the cloud's potential would be in round numbers 7,125,000,000 volts. It is evident that no such potential could exist and that a discharge must take place before all of the electricity reaches the cloud's surface. Successive charges accumulate and a series of discharges—that is, a multiple flash—takes place as described above. But, due to the influences named above, a uniform distribution is not possible and the potential at some points will be much greater than at others. It is easily seen that the raindrops in the above example would



FIG. 1.—DISTRIBUTION OF CHARGE.

contribute sufficient electricity to charge the cloud several times to a very high potential.

It might be noted in passing that one must clearly distinguish between the potential of a conductor and the potential at a point due to charges. To illustrate, in the case of an isolated spherical conductor, the potential is $V = \frac{Q}{r}$, so that the smaller the value of r, the higher is the potential. The potential at a point due to charges q_1, q_2 . . . is $\Sigma \frac{q}{d}$, where d is the distance from the chosen point to one of the elements of charge and the summation is made between such limits as to include all of the charges. It is easily seen that as long as the total quantity of electricity remains the same, it matters not whether it is on large or small conductors, the value of $\Sigma \frac{q}{d}$ will not change if the average value of d is the same in both cases.

The capacity of a cloud to earth is often estimated by considering the cloud and earth as two parallel plates. By referring to Fig. 1 it is seen that the field is not uniform between the plates, so that the result indicated will be far too large. Still there is determined a high potential which could not exist, and thus there must be multiple discharges, in general.

Consider, for example, the quantity of electricity contributed by a cylindrical portion of the cloud, the radius of its base being 500 ft., and its height 1000 ft., situated at the lower surface of the clouds, where electromotive intensity would tend to repel all electricity to the lower surface of the cloud opposite the earth, and the attraction between the cloud charge and the earth's induced charge would exert a marked influence in increasing the density on this surface. Suppose that there are two raindrops .252 centimeter in diameter per 10 cu. in., each contributing a charge of 2 electrostatic units to the cloud charge. If all the drops contributed 2 units, we would have for the charge contributed by the whole of the cylindrical cloud mass $3.1416 \times (500)^2 \times 100 \times 1728 \times 2 \times 2 = 54{,}286.848 \times 10^4$ electrostatic units.

Suppose the cloud is 5000 ft. above the earth. To get an

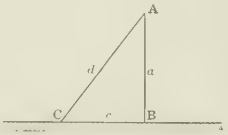


FIG. 2.—DIAGRAM SHOWING RELATIVE POSITIONS OF CHARGE AND CONDUCTING PLANE.

idea of the capacity of the cloud to earth we may use the formula $C = \frac{S}{4\pi d}$. This gives $C = 381$ electrostatic units. This value is too large, as the field of force between cloud and earth is not uniform. From the formula $V = \frac{Q}{C}$ we get

$V = 1{,}424{,}851{,}653$ electrostatic units $= 427{,}455{,}495{,}900$ volts.

In order to study the relative density of the induced charge on the earth's surface, take the simplest case, considering the cloud spherical in shape, so that its charge may be considered as concentrated at its center, and the earth's surface as a conducting plane. The lines of force will then be as represented by Fig. 1. The density of the electricity induced on a conducting plane due to a charge Q concentrated at a point distant a from it, is given by the equation $\sigma = \frac{Qa}{2\pi d^3}$ units per square centimeter, where d is the distance from the charge to the point of the plane at which the density is to be determined.

Fig. 2 is a diagram showing the relative positions of charge and conducting plane and also the distance d used in the equation

$$\sigma = \frac{Qa}{2\pi d^3}$$

The cloud charge is supposed concentrated at A, a point a feet above the earth's surface considered as a plane. C is any point on this plane, c feet from B and d feet from A.

Fig. 3 is plotted for the value of $\sigma = \frac{a}{2\pi d^3}$, Q having the value 1, a value of 5000 ft. being assumed for a, the distance of the charge above the earth. It is seen that the equation $\sigma = \frac{Qa}{2\pi d^3}$ represents a family of curves.

Fig. 3 represents the relative density of the charge induced on the earth, considered as a plane conducting sheet, by a charge supposed concentrated at a point 5000 ft. above the earth's sur-

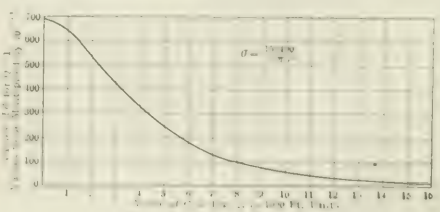


FIG. 3.—DISTRIBUTION OF POTENTIAL

face. The abscissas represent the distance from the foot of a perpendicular from the charge to the earth plane. The density falls off very rapidly, being only about one-tenth as great at 10,000 ft. from the foot of the perpendicular as at the foot, while at 4000 ft. it is about one-half. From this it is seen that the density of the induced charge does not become a small fraction of that

directly underneath a cloud charge supposed concentrated at a point until a point nearly two miles from the point directly underneath the charge is reached. As a cloud charge can not, in general, be considered as concentrated at a point, the point of negligible density will be farther away. Due to the unevenness of land, where hills and valleys occur, the curve of density will not be regular, but will have irregularities corresponding to the abrupt changes in the value of the distance from the charge to the point and in the contour of the surface. The presence of other cloud charges also modifies the distribution. This fact shows that the density of the charge on a transmission line does not reach a small percentage of the maximal value until a point nearly two miles from the point directly below the cloud is reached, and in the case of an induced charge of very great density the potential of the line will be so high when the charge is released that insulators may be punctured for some distance each side of the point directly below the cloud.

From investigations made by Dr. Walter in regard to the manner in which static sparks are formed, one is led to believe that probably a single lightning discharge may be divided into three stages, the establishment of the path from cloud to ground, the flow of the cloud's charge through this path and the disappearance of the flash. In establishing the path the discharge is of the nature of a brush discharge which starts from the positive charge and moves across the intervening dielectric with the velocity of light, breaking down the air, ionizing it, and establishing a conducting path from cloud to earth. The path of discharge forms a part of the cloud conductor, being extended downward with great rapidity. The successive points of the path, as the discharge reaches them, instantly assume an enormous potential, and, as the capacity of the path is very small, it is necessary that only very little electricity flow into the path to charge it to this high potential. Because of this enormous potential there exists a great strain upon the air directly in contact with the charge at the external surface of the path, as this is not conducting, which tends to the formation of branches or lateral discharges, so characteristic of this form of lightning. For this path to be established from cloud to earth, assuming the cloud to be one mile high and the brush discharge to move with the velocity of light, would require 5×10^{-6} seconds. As soon as the path is extended to the conducting sheet of the earth, as this cannot be raised to a high potential, there is a very great fall of potential at this point, which instantly extends back along the path, producing a steep potential gradient along the path, causing the lateral discharges to disappear, and a heavy rush of electricity to follow, draining the cloud charge and reducing the cloud potential at the point of discharge, so that the discharge ceases, and the third stage begins, it being the reverse of the first and consisting simply in the collapsing of the path upon the conducting sheet of the earth. If at a certain point of the path, two or more paths having practically the same impedance to the lightning discharge are available to ground, the discharge may pass to earth as a multiple discharge from this point.

As soon as the path is established from cloud to ground, the lines of force between the charges on the cloud and earth collapse upon the path and the charges rush along the surface of the cloud and earth's sheet toward the ends of the path. In flowing to this point the charge on the earth's surface will pass along the path of least resistance, which will be moist earth, water mains, if they occur in the path of flow, etc. It is evident that the discharge path will extend down through the surface sheet of the earth to an underlying sheet, if the latter has a much lower resistance.

It does not require as high a potential to establish the second and following discharges of a multiple flash, as these follow the path of the first, which has been ionized and is conducting. The luminous streak of highly heated air indicates that there is quite a resistance in its path.

No portions of conductors, whether earthed or not, such as large masses of metal, iron piping, etc., inside buildings, should be so installed as to lie near a lightning conductor, as they have electrostatic capacity, and a discharge will certainly take place to them, incidentally knocking a hole in the building and perhaps setting the building on fire. An instance is on record where a discharge burst through 4½ ft. of masonry to reach a gaspipe on the inside of the wall.

During a thunderstorm a person standing on the ground should not touch large masses of metal, as an iron ship or a penstock, unless these are thoroughly grounded. It is known that several men were killed by an induced charge while working on a ship in one of the navy yards.

There are two kinds of electric discharges which concern us here, the disruptive and the conductive. The disruptive discharge is sometimes spoken of as dielectric conduction. It is a discharge through a dielectric with the manifestation of energy. If the conductor is composed of material which has a high conductivity and is of sufficient proportions to allow a discharge to take place without too great current density, we have the requisite conditions for a conductive discharge. If the conductor is discontinuous at any point, so that a dielectric is interposed between the different portions, a disruptive discharge will take place through the dielectric, accompanied by the manifestation of enormous energy in the case of the lightning flash. The object of a lightning conductor is to predetermine the easiest path in that vicinity for the lightning discharge, and to change the charge from a disruptive to a conductive discharge from the point where it enters the conductor, thus preventing the manifestation of energy in the zone where it would endanger life or property. If such a protective device is to be relied on it must be installed with the greatest care.

Due to the suddenness of the discharge—i.e., the very great value of $\frac{d\,i}{d\,t}$ —every conductor has some impedance, whether the lightning flash is oscillatory or not. Investigation shows that discharges through a dielectric are oscillatory, in general. In view of this fact, considering the great length of the dielectric, compared with the conductor which the flash traverses in discharging, the extremely short interval required for a single discharge to take place, and the relatively enormous potential, it is probable that the lightning discharge is oscillatory. Alex. Larson gives the average time of a discharge in a multiple flash consisting of 40 discharges photographed by him as 156×10^{-4} sec. Comparing this interval with that required to establish the path it is seen that a single discharge extends over a relatively large interval of time.

The impedance which straight conductors may offer to the passage of heavy charges of high potential is due principally to their resistance and "skin effect." The best way to avoid this is to use conductors which have a large external surface.

It is interesting to consider what occurs on a transmission line when charged clouds are overhead. The charges on the clouds will induce charges on all conductors within the field of influence. Suppose a charged cloud is directly over a transmission line. This will induce charges of opposite sign on both line and conducting sheet of earth, the density being greatest directly underneath the cloud charge. If the line is supported on steel towers which are in contact with the conducting sheet of the earth, thus forming a part of it, and forming its highest points in that vicinity, the density will be very great at the top of the highest metal pins, and the line from these points to the nearest point of the cloud charge will be lines of maximum strain. As the transmission wire passes directly across the top of the insulator, it will pass through this path or line of strain. The density of the charge on the transmission line will be greatest at the point nearest the clouds, which will be at a tower, in general. An equal charge of opposite sign has been repelled by the cloud charge. A part of this escapes by leakage over insulators or by lightning arresters if it reaches them. Its distribution will be modified by the presence of other charged clouds which may be in a position to act inductively on the line, and every rearrangement of charges on the clouds will be accompanied by a rearrangement of the charges on the line setting up oscillations. These charges will also act inductively on the earth. The capacity of the cloud to the transmission line

is much less than that of the cloud to the conducting sheet of the earth, and so the cloud charge due to its high potential must ultimately reach the earth. Suppose that lightning strikes the transmission wire. The condition is then that of a condenser consisting of a line-wire and cloud and the conducting sheet of the earth, the latter terminating in a point separated from the line wire by a dielectric, consisting of a thin plate of porcelain, and maintained at zero potential, while that point of the former opposite the pin is suddenly raised to an enormous potential. The potential is sufficient to either puncture the insulator or arc over its surface. In the case of very heavy discharges of very great potential the insulator will be pierced and shattered.

Wooden poles considered as conductors have an enormous resistance and so cannot discharge freely. In this case the charge may spread some distance down the wire in each direction, giving rise to a very high potential on this portion and puncturing the insulators and shattering the poles as it passes to earth. This is especially true of insulators and poles before it begins to rain. This is easily seen from Fig. 3, the effect being to flatten the curve.

A cloud charge might be directly above a line at a spot where it would be necessary for it to pass some distance along the line before it could pass to earth. Such a discharge sometimes takes place, the charge passing to earth some distance from the point where it entered the system.

Such discharges in passing through the system must necessarily set up oscillations of the natural frequency of the line, as it comes to equilibrium. Since a lightning flash consists of many individual discharges, the recurrence of the above condition tends toward the formation of standing waves. If the natural frequency of the transmission line is such that the frequency of the lightning discharge corresponds to it or a multiple of it, a surge would result, and the successive discharges may be at such intervals as to have a cumulative effect, greatly increasing the magnitude of the surge.

Suppose the cloud discharges to some other point than the line. A heavy charge is suddenly set free on the line, the density and potential being greatest at the point nearest the cloud charge. An insulator at this point would be greatly strained and probably punctured. If a breakdown of insulation did not occur, providing a freely discharging path to earth, the charge would spread along the line, straining insulators, and entering the station, would pass over the lightning arresters to ground if they fulfilled their mission. In coming to equilibrium there is the formation of oscillations of the natural frequency of the line, as in the case of a direct stroke. It may be noted here that every discontinuity in capacity or inductance acts as a point of reflection in proportion to its magnitude.

From the above it is seen that two points are strongly emphasized in regard to protection from lightning, namely, a freely discharging conductor or arrester and good contact with the conducting sheet of the earth.

In the case of transmission lines, the aluminum arrester meets the requirements of a freely discharging arrester. In regard to grounds, they should present a large surface in contact with permanently moist earth, and every precaution should be taken to prevent their drying out, due to repeated service.

Lightning conductors installed on towers and overhead ground wires assist in conducting the lightning to earth without its penetrating the transmission system.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Lighting Development at Boonton, N. J.

The Boonton Electric Company, of Boonton, N. J., instituted a 24-hour service on Jan. 1, 1909. The company, which has recently changed ownership, serves a hustling manufacturing town of about 6000 inhabitants, and is pushing a vigorous campaign for the betterment of its service and for obtaining new business. Flatirons, hot-water heaters, and all other electrical household conveniences are being introduced; and the coming summer will see a large number of fans and signs in use.

Rates for light are low, being only 10 cents per kw-hour, while in addition free renewals are given on all standard lamps. The company gives to its patrons free expert advice on illuminating engineering, and is already making several model tungsten installations. An effort is being made to straighten out the daily load curve with a larger motor load, and already success in this is assured. The company quotes a very low sliding rate to power users, provided they "keep off the peak," which, except on Saturday evenings, is comparatively short.

Besides the commercial load, which is handled by 1100-volt feeders, the streets of Boonton are lighted by the company with 6.6-amp series alternating arcs in the center of the town, and with 3.5-amp series incandescents in the outlying sections. During the present year many changes and improvements in equipment are planned to enable the station to carry its daily increasing load.

Electric Light Situation in Central New York.

By WILLIAM H. STUART.

Central New York towns as a field for new business differ somewhat from towns in other sections of the country. While they are for the most part manufacturing centers, they are unlike New England manufacturing [illegible] in that they are not dependent on one or two large industries, but possess a number of smaller and varied ones. The class of labor employed is skilled and commands higher wages than is the case in New England. This in itself broadens the field for the introduction of electricity for lighting and at the same time does not narrow it for motor application.

The problem of securing new electric lighting business has been affected by at least three general conditions that have exerted considerable influence for and against its success. First, is the utilization of water power; second, the entrance of several hydro-electric companies into the transmission and distribution field, causing sharp competition and bringing about a reduction in rates; and third, the recent financial depression, which caused an almost complete abandonment of new business departments and work. These conditions brought about grave situations in addition to those obstacles characteristic of each locality which had to be overcome.

The hydro-electric developments, notably in the western portion of the state, where Niagara power is available, have reduced the operating and production expenses so as to allow the marketing of the energy at a price within the means of all. Gas is replaced entirely by electricity. In one city of 30,000 inhabitants the following conditions have been brought about by Niagara power, combined with good business methods. Gas is used only for cooking. The gas company has 202 consumers; the electric light company has all the rest. There are 1800 electric flatirons in use and a dozen gas-irons. In the small hotels and in one or two larger ones the alternative to the electric light is a candle, not a gas fixture being installed. The streets are lighted by arc lamps or series incandescent lamps. In an endeavor to create a demand for gas as an illuminant the gas company installed so-called gas lamps free of charge. The lamps were used for the heat that they gave, and the company [illegible] to remove them after a short time. The stores are illuminated entirely by electricity. The electric light company has not pushed cooking appliances, deeming it advisable [illegible] until electric cooking has been brought to a point com-

parable with gas as to price and service, although there are connected a number of electric cooking utensils. The methods employed by the company are aggressive and progressive. Besides being able to sell energy at a low rate, the company employs every means in the trade to get business. One of them is getting new houses wired and electricity used by the occupants. When the building department issues the permit a representative is immediately sent to the owner to induce him to wire the proposed building. Should a person build, say, a two-family house, all arrangements are made to have the house wired and just as soon as the wiring is complete a meter is set. No charge is made the owner of the house for energy consumed from the time the meter is set until an occupant is found. The amount of energy used is charged to advertising. The company has found that the light is not wasted by the owner, and it adds to the attractiveness of the apartment when it is viewed by a prospective occupant. This has proved a very profitable plan, as it guarantees the use of electricity, pleases the landlord, helps him show the premises, encourages the leasing of them and the owner in return takes pleasure in recommending that electricity be used and goes into detail in explaining the advantages of such service. Another scheme of the company is to encourage the installation of a small transformer, costing about $1.25, to operate the push-bell systems in the houses. The revenue from this use of electricity amounts to a very, very small item, yet it demonstrates the company's motto that nothing is too good for the consumer, and further impresses upon the consumer the many side uses of electricity.

In another section of the state a large hydro-electric company started with the primary object of supplying central stations with energy, but failing in some cities to drive a bargain, was compelled to enter the field to secure a market for itself and compete with the established companies for business. After securing a franchise and permission to do business in each city, this company immediately extended its high-tension lines and built a transformer station and strung wires through the streets of the city. The inducement offered by the hydro-electric company to the general public and to the customers of the established company was an offer to supply energy at whatever price the consumer would offer to pay. By this means it secured all the business that could be obtained off hand. The regular rate of the established company was 12 cents per kw-hour and to meet the operations of the new company they cut the rate to 5 cents per kw-hour and the new company immediately established its base rate at 5 cents, but gave a graduated scale of prices, depending upon consumption only, which brought the rate very low. These were the tactics employed wherever the hydro-electric company went. Naturally enough the amount of business done by both the old and the new companies in each locality was large. But the main proportion of business done was that which could not be accepted under normal conditions. Matters went on in this way until both companies, finding that they were playing a losing game, made overtures and agreed on a return to the old schedule which was in force before the competition started. In one city a curious situation developed. The business of the old company increased when the rates were raised to the old schedule from the very first month. During the first month of higher rates the old company cut off 17 consumers who could not afford to pay the rate and 19 new consumers were added. The 17 consumers cut off during the first month was the only loss sustained by the old company. Its average gain of new consumers from that time on was from 20 to 30 per month. These were customers of the hydro-electric company who felt that it was responsible for the increase in rates and that they might as well pay the money to the old company, which had suffered by the attack, rather than to the one which caused the disturbance. It is estimated that the hydro-electric company lost about 200 consumers during the first month of high rates, showing that the customers obtained by it were not very desirable, but had been attracted by the low rates. All sorts of methods were tried by the companies to obtain business when both were on an even footing. In one of the cities affected an amusement concern opened a large moving-picture show. The management applied for rates from both companies and decided to become a customer of the old company at regular rates. Upon learning this the other company made a proposition to the amusement company to the effect that while it could not agree to give it a lower rate, owing to a working agreement with the old company, yet, it would set the meter 30 per cent slow and thus the company would be able to use the energy at greatly reduced cost. This proposition was accepted and the amusement enterprise became a customer of the new company. When the first bill was received it was considerably higher than expected. The amusement people called in the managers of the old company and asked that they test the meter for them. The result of the test showed the meter 7 per cent fast instead of 30 per cent slow. On the strength of this the new company lost the customer which the old company gained. Methods of this nature have prevailed and had it not been for the honest and fair treatment of the public by the old company the business would have been entirely discredited. In their fight the old companies have only advertised the latest rate for energy, as they believed that the new company would receive as much benefit from a general advertising campaign as they would themselves. The effect of this competition has been that while the gain in the number of consumers has been considerable, yet the lowering and raising of the rates and number of free things given to secure a consumer, such as signs, motors, fixtures and wiring, now all done away with, has not produced a desirable effect, in that it has brought out consumers of the something-for-nothing type, and those who are always delinquent in the payment of bills. Considerable time will be required to weed out the undesirables and allow the companies to work on a sound business footing again.

The recent financial depression affected the electric lighting industry just the same as it did other business. The first department to suffer was the new business department. In some of the larger cities, where a force of 10 or 20 men was engaged in getting business, the number was cut down to one or two. All advertising was stopped. This condition obtained until this fall, when many of the companies re-engaged their entire force, continuing the work that was stopped. Others have at least one-half of the force at work at present and expect to resume former conditions shortly. A feature of the depression was that while the companies cut off entirely their new business work, and did not seek any business, the amount of business disconnected because of the general business depression did not in any city amount to much. In fact, the regular and usual loss due to moving, etc., each month, was not greatly exceeded in any one month during the past year, so that the central stations had practically no loss of business.

The rates on the whole, throughout the state, are uncommonly low and there are to be found several companies that work on a maximum demand scale. Flat rates are also to be found, but are only used in combination with the meter rates for special classes of service. The companies using these rates are gradually working away from this method of charging. The Saratoga Gas, Electric Light & Power Company has recently changed from a straight flat rate to metered rates in a small town which it supplies. The company did not issue a general statement, but after giving notice that such a change would be made, went to a hotel having a large connected load and set a meter on trial. The meter was read weekly and showed that the monthly bill by this plan would amount to some $150. This load netted $25 per month on a flat rate. To ascertain where the energy went, an examination was made. In the coal bin, closets, cellars and outhouses, 32-cp lamps were installed where 4-cp lamps would be sufficient. Moreover, the lamps were left burning from the time they were placed in the sockets until the filament broke. These were all replaced by lower candle-power lamps and were used only when needed. By such methods the bill was reduced to about $30 per month. The other consumers were all handled in this way and the system was quickly changed over without the loss of a customer.

Following is a list of the base rates in use in some of the cities:

Saratoga Springs, 13,000 inhabitants; rate 11 cents to 5 cents per kw-hour; sliding scale, based on consumption, 1-kw to 800 kw-hours.

Albany, 100,000 inhabitants; rate 10 cents to 3½ cents per kw-hour; sliding scale, based on consumption, 1-kw to 10,000 kw-hours.

Amsterdam, 28,000 inhabitants; rate 5 cents per kw-hour, with discount for prompt payment.

Little Falls, 12,000 inhabitants; rate 8 cents to 3 cents, sliding scale, based on consumption per connected equipment with a discount of 2 cents per kw-hour for prompt payment.

Rochester, 200,000 inhabitants; rate 8 cents to 2½ cents, sliding scale, based on maximum demand or daily use of connected load.

The advertising done by the companies has on the whole been thorough. Extensive campaigns of from one to two years' duration have been operated with success. Various schemes apart from a general routine were used, follow-up letters, small catchy prints, newspapers, car advertising, bill boards, signs and exhibits at fairs, etc., were all tried and played important parts in building up the business.

The show windows, rooms and spaces are all in good order and up to date. Where some of the companies have to make a combination display of gas and electric goods, the electrical appliances have an equal share in the display. In the city of Rochester, the Rochester Railway & Light Company has one of the finest show windows and display spaces to be found anywhere. The equipment consists of two very large show windows, one each side of the entrance, a large floor space immediately adjoining, and a goodly sized basement, light and airy. The windows are utilized for a general display of appliances, and also as a practical demonstration of the best methods of window illumination. The floor space has the gas heating and cooking units. The basement contains a fully-furnished, four-room apartment equipped with every available electrical appliance, connected up for practical and immediate demonstration. There are one or two companies in the state that do not handle an appliance or fixture, leaving it all to the contractors, and this idea has been followed up so that the contractors carry an elaborate stock and take means to display it. To get the contractor to pay attention to this end of the business the companies had to work up enthusiasm and keep it up by holding meetings, etc., and helping the contractors along in every possible manner. Some very fine displays have been thus obtained in three or more parts of the city, generally on the prominent thoroughfares where travel is greatest. The wiring and general installation work have been brought up by this co-operation to the highest point of efficiency.

All the companies are looking forward to a record-breaking year from January on. They have all been quietly at work laying out plans for a fresh, vigorous and systematic business campaign. Some of the methods in use heretofore will be discarded and new ones tried.

INTERIOR WIRING AND ILLUMINATION

Use of the Words Wire and Cable.

There has been and is a continual misunderstanding in the accounting departments of large contracting firms, supply houses, central stations, etc., as to the words "wire" and "cable." The line department, for instance, of an electric light company will report that it has on hand so many feet of cable, leaving the purchasing department to guess what is meant or to request more specific information. In order to simplify matters one large company has restricted the use of the word cable to lead-covered conductors used either overhead or underground. The word wire is used to signify all conductors which are not covered with a lead sheath. In making entries for orders on the storehouse and in reporting material used on return work orders, care is taken to specify whether it is wire or cable, giving the insulation and size, such as for example, "500 C.M. stranded, weatherproof wire, or No. 6 stranded, rubber-insulated wire. Inasmuch as rubber-insulated wire is sold by the foot, the report is made to state the number of feet of such wire. Weatherproof wire being sold by the pound, the quantity wanted or in stock is given in pounds. The reports or requisitions specify the number of feet of cable on hand or required. By this means all misunderstanding is avoided.

Concealed Knob and Tube Wiring.

Although in many cities of the first class, concealed knob and tube wiring is no longer permitted, owing to municipal ordinances prohibiting it, this old and original form of wiring is extensively used in non-fireproof buildings throughout the country. There are superior methods of construction from a mechanical as well as an electrical viewpoint; but these methods are very much more expensive and if the industry is not to be retarded, the cheaper method of wiring must persist so long as no hazard is involved. That safe knob and tube work can be and is installed is evident from the code rules covering such installations, for were there any extra hazard involved, the underwriters could be relied upon to wipe knob and tube work out of existence. There can be no doubt that in many cities the elimination of knob and tube work has been detrimental to the installation of electric circuits and hence to electrical interests. The high first cost of wiring dwellings is in the majority of cases the only reason for the non-use of electricity in such places. The cost of electricity is now so low that there is none so poor but what he can afford to use it; the installation cost is the only drawback. As showing what can be done in the way of wiring a building in approved fashion and yet at reasonable cost, a dwelling so wired may be cited. This is an eight-room cottage costing about $4,500. It is wired for thirty-one outlets, including switch openings, and has five circuits with eight lamps on each circuit. Inasmuch as 12 lamps are permissible on a circuit, it is evident that extra outlets can be provided if this is found to be necessary. The owner was well advised in arranging for this reserve, and where first cost is kept down no reserve is ordinarily provided. The total cost of the job, including everything except the fixtures was $65. Fourteen hours were required to make the installation, and the labor cost was $7.84, one journeyman and a helper being employed. Only the best material was used. Every outlet was equipped with an outlet box or plate. There were two three-way circuits and the workmanship was up to standard, the installation passing inspection without a violation. Were there one circuit less, the same number of lamps could be lighted and the price per outlet could doubtless be brought below $2. It is questionable whether the cost of such an installation could be made much lower. If builders of cottages costing $4,500 could be assured that the latter could be wired for electricity at a cost of approximately $2.50 per outlet, it is safe to say that every new cottage within reach of electric light mains would be wired. Ordinarily, however, the cost per outlet is many times the figure given.

Standard Electric Wiring in Small Towns.

BY W. J. CANADA.

The larger cities of the country are very generally making an organized effort to reduce the electrical fire hazard. In too many, of course, the inspection of wiring is of a perfunctory character, but in this wiring inspection shares the same fate as building restrictions in these same cities. This is a result of municipal politics, usually, which will disappear when building restrictions become embodied in State laws, and their enforcement placed in the hands of a State civil service. There are indications that this question is much nearer settlement than ordinarily supposed, and bills are under discussion before several State Legislatures placing inspection of electric wiring in the hands of a State board.

But the smaller city has been the place where any attempt to secure adequate supervision has met with insurmountable obstacles. Infrequent inspections from outside sources, generally by the underwriters, while they have done their part, have not much improved the general wiring conditions of the small city. Where frequent inspections have been made possible by arrangements to cover the expense of the inspector it has been by virtue of an unusual personality on the part of the inspector, and even in these instances much wiring is uninspected and defective. The inspection by a local contractor or by a lighting company's foreman, is ordinarily productive of nothing more than jealousies, suspicion of unfairness and petty graft. It is evident that none of these methods has solved the problem for the smaller city, or is the problem in any respect on the road to solution. Not the least discouraging feature in this connection is that the property owner and city official see this defect clearly, accept it as a necessary evil, and scout all attempts to institute a better system. This is all because the matter of restricting wiring has never been fully presented. The hazard of defective wiring is not fully known, the standard to be followed is vaguely defined, and the choice for inspector is the climax of the parody. It seems as if by the time it came to the appointment of an inspector all enthusiasm had failed and the first applicant had been welcomed.

It is true that conditions in small cities often appear thus hopeless, but as in many States small cities are quite numerous, and the betterment of their building conditions can hardly be considered of less value than that of still smaller centers of population. By just the degree that conditions in the small city are worse, by just that degree should standard wiring throughout it be desirable. For a score of years the underwriters have been the principal force back of efforts toward improvements tending to reduce fire losses from defective wiring. To be sure they find insurance more profitable with safer buildings, but rates become automatically lower, too, so that the profit is divided with the public. The work of the underwriters is met with frequent opposition, and ends in limited success, but construction is at least somewhat better as a result of the effort.

The Rocky Mountain territory has been obliged to face the problem presented by the small city very seriously, as it is a region of small cities, much scattered and with the difficulties of effective wiring supervision enlarged in the same degree. Organized efforts for better wiring had for a long time presented such an expense in this field that the underwriters had not attempted any general campaign. The rapid growth of these cities has, however, made necessary some recognition of the electrical fire hazard, and a campaign formulated, which has had very remarkable results, illustrating the effectiveness of well-considered movements of this kind.

A number of wiring installations are taken up with building owners, the defects pointed out, and these defects shown to be the natural result of carelessness or unregulated competition. The fire hazard and life hazard are dwelt upon and the whole difficulty is demonstrated to be due to lack of an enforced standard of safety and permanency for wiring construction. Indignation, somewhat vague in direction, but very real in quantity and quality, is the result. The property owner's next mark for dissatisfaction is the contractor. He, however, is usually gone, or he very capably demonstrates that competition entirely unregulated has forced him to adopt such poor wiring methods. Rarely does he attempt to justify such construction on the ground of sufficient safety; the few who do generally fall into public disrepute. Sometimes it is the public's belief that all things considered the lighting company is probably responsible for all the trouble; its rates are extortionate and it has frequently neglected to send men out when lamps failed or fuses blew. And most of all, the lighting company, with all the trust reposed in its consideration for its welfare by an over-confiding public, has never given it the least hint that its wiring was faulty and might possess fire hazards. Of course the fact is the lighting company has frequently stated that the building wiring was of too light capacity, and its connections probably unsoldered; but this was laid to the company's desire to shift responsibility from its own shoulders for dim lights and poor fuses, and the whole matter was soon forgotten. The lighting company which has been so short sighted as to do wiring in such a city is now in the most desperate difficulties. Many of these are deserved, for it should have weighed its responsibility for wiring in standard manner before entering the field. Its original idea has been occasionally the betterment of wiring, in which case the difficulty is not insurmountable and the lighting company is soon fully accredited as a co-operator with the now fully awakened public. Where the lighting company has entered the wiring field to cheapen construction below reasonable limits, in order to increase its load and consequent revenue, a certain revenue being of course indispensable, and sometimes difficult to get—or where mistaken economy of the service company's management employs a careless or ignorant wireman because of his cheapness—in either case, the lighting company is in a dilemma. It cannot plead ignorance, for it should possess knowledge. It cannot plead necessity in competition, for that is an admission of purposeful neglect for safety in construction. It will generally be found advisable for such a service company to plead the difficulties of procuring standard material or good workmen for prevailing wages. These arguments have at least the flavor of truthfulness, and may enable the lighting company to enter the movement with a cheerful countenance and a trumpet which may drown invidious remark.

All these stages, with the various undefinable and unpredictable complications by which each city displays its individuality, are now past. The interest of property owners, of contractors, of service company, is all secured, and the underwriters must maintain and direct this public interest to the end that it shall be able to perpetuate itself in concrete, visible form as a force in the community. Delays and mistakes are avoided and the fullest effectiveness secured when the underwriters retain some guidance of the movement until its culmination.

In this connection it is to be noted that the life hazard of electric wiring, while comparatively not great, is still such as to render its discussion advisable, and on this basis the underwriters are without direct interest. Still, the contractor and the lighting company have never called attention to this life hazard. They have feared to breathe a suspicion of such danger, with its possible reduction in electrical applications. If deaths or injuries have occurred they have been so skilfully and efficiently submerged in the passing affairs that the public has failed to raise a question and the accident is soon forgotten. By this method there prevails a general ignorance of causes and means of prevention. Brass shell, key socket, flexible cords, exposed contacts, and like life hazards, must be openly opposed. Concrete examples of injuries and deaths may be used with discretion. Construction is thus given its proper tendency toward regard for life as well as property.

The desirable form for securing permanency in restrictions, now so certainly needed by an enlightened public, seems to be the ordinance. Here, too, guidance is advisable, and not wet blankets. The ordinance is not necessarily the solution. The inspector is the very vital part. Manifestly the manager or foreman of the lighting company or the wiring contractor are not available; nor can the city afford living wages for a man of proper electrical knowledge and business ability. A paid fire chief may be the very man, or an electrical employee of a large manufacturing concern, not catering specially to that city's trade, is often available. If he is young, ambitious, honest and possessed of a business head, he is the man.

But all this preliminary arrangement raises the question of the need of an ordinance or the expense of $25 or so a month for its maintenance, if the underwriters' inspectors follow up the work satisfactorily. Experience has shown, however, that an ordinance is desirable, and with an inspector, assisted by the underwriters, the ordinance should be very explicit. If the inspector maintains his integrity and his interest, a thing entirely reasonable for an individual given a particular duty to perform, and if the inspector is the result of careful selection, substantial and safe wiring can be reduced to a system which

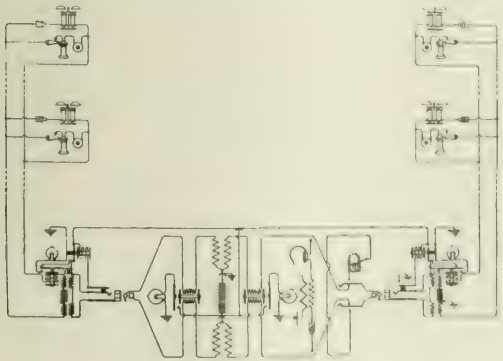
can be expected to keep on a good level, and even to better itself as the art advances.

By this means the small city can be placed in a condition where it demands and receives standard wiring as well as the larger city. The ordinance need not be long, it should preferably be very short, since it must be printed according to law. It need consist only of the establishment of the standard, the creation of an inspector, the forms for notification for all interested parties, and the penalty for violations of the ordinance. The standard will naturally be the National Electrical Code, with some greater definiteness in certain rules, such as definite requirements for grounding secondaries, and for maintaining reasonable spacing between lighting and other wires. In securing an ordinance of proper working form, adapted to the city's necessities in minor matters, but with the essentials always the same, the underwriters should be consulted, since they have held the same relations with other cities and are otherwise equipped to assist in the matter.

It is not to be supposed that for such effective diplomacy there are no prerequisites. The representative of the underwriters must first possess tact in abundance, and business directness of that kind which must always be employed to carry a matter to its conclusion. But he needs other qualifications. He must have a sufficient knowledge of the relations of tenant to owner, to foretell their attitudes on rewiring costs and operating costs accurately, and bring them together on some proposition. He must advise with the city government intelligently, must arouse its interest and enlist its active co-operation. He must appreciate the warfare of the electrical contractor with continuous or occasional unfair competition, and understand the contractor's wiring costs and soliciting difficulties. He must know the costs of producing energy, the franchise agreements, and the different business policies of lighting companies. He must be on technical and business equality with all these conflicting interests, and be able to harmonize them on a common ground, at which they by themselves cannot arrive. The smaller city is becoming a city of safe and permanent wiring, just as rapidly as such campaigns are conducted for those conditions. But there is in this work still another uncrowded field in which the underwriters may exercise their activity, with the certainty of better relations with the public and reduction of the fire waste as their inducement.

New Telephone Patents.

Mr. W. W. Dean has obtained a patent for an improved busy test circuit for a two-wire multiple switchboard of the Dunbar



DEAN TELEPHONE SYSTEM.

type. A test relay of high resistance is arranged to control the current in a tertiary winding of the operator's induction coil. One end of the winding of the relay is connected to ground while the other is connected to a common point from which the circuit branches in multiple to all cord circuits of the position. These circuits reach their individual cord circuits through, first, an auxiliary listening key contact, and, second, through the contact of a relay in the particular cord circuit. It will thus be seen that the busy-test relay while common to the position is limited definitely at any time to the cord circuit actually being used for testing.

Another patent granted to Mr. Dean covers a switchboard system designed to be "clickless." To this end the cut-off relays are made two-stage. The first operation controls the line lamp and the second the battery supply circuit. The resistances of the calling and answering cord circuits are not the same. When the latter is used the cut-off relay completes only a partial action, extinguishing the lamp and leaving the battery top unbroken. There is thus no click upon the line and as there is no ringing to be done, the battery top is not harmful. The low-resistance cutting cord, on the other hand, causes a complete action of the cut-off relay. No click is made, however, as the circuit is at this time open at the station, which has not yet been called.

Another system by the same inventor is shown in the accompanying illustration. It will be seen that the differential supervisory relays receive equal currents in both coils, as long as the local line relay is energized. When this drops off, however, a ground connection is so introduced as to unbalance the corresponding supervisory relay. All three of the above patents have been assigned to the Kellogg Switchboard & Supply Company.

LETTER TO THE EDITORS.

Droughts; Also Floods and Freshets, and Water-Power Plants.

To the Editors of Electrical World:

SIRS:—More may be said on the above-named subjects than is contained in your number of Jan. 2, 1909. Some German philosopher has remarked that "one of the principal teachings of history is that the teachings of history are not heeded in the affairs of men." In other words, each generation appears determined to educate itself by its own experience, and is disinclined to reason from the experience of others who have gone before. This is as true in matters of water power as in any others. Water-power engineering, constructing and administration is at least a century old in the United States, referring now to large water-power companies and factories driven by water power, rather than to saw and grist mills, and yet when water power came to be used to generate electricity, there came with it a seeming desire to treat it as a new art, by new men, many of them new themselves in any business, unless it was the design or management of electrical machinery. And so we have curious theories about building water powers to utilize only the lowest recorded run of a river; about primary and secondary power, and much more of the sort, all a matter of settled practice for not less than 50 years in any of the old-time water-power regions of the country.

I was brought up as an hydraulic engineer—my schooling and professional study once dear with in the office of James B. Francis, agent and engineer of the proprietors of locks and canals on the Merrimack River, at Lowell, Mass., and have followed that branch of the profession of civil engineering something over 40 years, including 10 years of administration of the water power of the Holyoke Water Power Company, at Holyoke, Mass., together with the construction work needed there during those 10 years, and as a result, have the following views on the subject matter of the Jan. 2 article referred to:

In any given up or down some mill stream that has been in use at numerous mill sites for a century or more, one finds the remains of the water turbines set up at the several mill sites

not to vary inordinately with respect to the quantity of water flowing in that stream. This last, it is true, itself varies from day to day throughout the year, and varies greatly, but its graphic presentation can be reduced to some degree of regularity by a very simple expedient, of which more presently.

The middle, or practically useful, discharge of the river on such streams is determined, or at the time mentioned will be found to have been already determined, by a kind of "survival of the fittest" process, as applied to water wheels and water turbines. If the wheel capacity put in by any one mill owner is, or has been, too small, then, in the course of years, too much power is wasted over the dam, and more wheel capacity is or has been added. If too much wheel capacity ever has been put in, in the course of years some of the wheels stand idle too long and before long they go upon the scrap heap.

Now, what is this practically proper wheel capacity and how is it to be determined at any mill site?

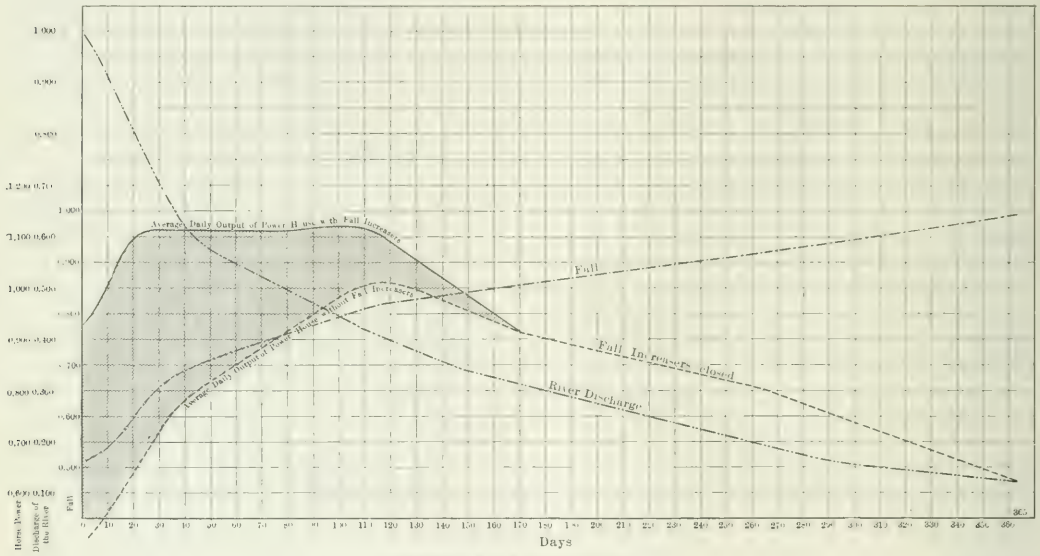
The discharge or flow of any river at any particular point when represented by a diagram showing the daily flows in consecutive order as they have been observed, is a most hopeless looking curve, using the word "curve" in its mathematical sense of a line that connects the ends of ordinates erected on abscissæ. But it can be converted into a sufficiently regular curve for purposes of power computations by the simple expedient of rearranging the 365 given quantities for any one year in the order of their size; the greatest or maximum flood flow as an ordinate on the first day; the next largest flow as the second-day ordinate, and so on down to the lowest day's flow for that year on the 365th day. (See diagram; also see a paper by the present writer in the 1907 *Transactions* of the American Society of Civil Engineers, on "Twenty Years' Run-off, at Holyoke, Mass., of the Connecticut River," in which the data for 20 such curves, representing the flow of the 20 years, 1881 to 1900, arranged in this manner, are tabulated.)

In such a curve or tabular column there will always be one day's flow, than which there are 182 that are greater, and 182 that are less than it; and, according to my observation and experience, it is this middle day's flow which represents the wheel capacity for which *it pays* to buy wheels or turbines, and dynamos, and to build wheelpits, power house, head penstocks and tail races.

This is not a hard and fast rule, and in the nature of things a hard and fast rule cannot be set up, but it will serve. Consecutive years will not show the same "middle quantity," and the attending circumstances can and should be caused to allow of a moderate variance from any such middle quantity found. Instead of 182 days' flow in the year less than the selected quantity, in certain cases, some 200 or 210 such quantities may be taken off before the daily flow representing wheel capacity is reached; but it will be found that such a procedure will not greatly add to the normal middle capacity first above described. At Holyoke, the range of all the middle quantities, on the 183d day, *for 20 years*, for 8144 sq. miles of drainage area, was from 5125 in 1880 to 13,220 cu. ft. per second in 1890, with a least daily flow, during the year, varying from 1600 in 1884 to 3650 in 1887, and a greatest day's flow varying from 115,000 in 1895 to 37,800 cu. ft. per second in 1889.

When more than one year's flow is thus taken as a guide, no arithmetical averages should be taken, but instead, after plotting all the records available, a middle and two enveloping curves may be drawn, which will give the middle curve to work from, and the two curves that will indicate the variations from the normal condition of things that may be expected to occur in the course of years.

Having thus found the curve that shows the future probable flow in the river, on each day of the year, we next draw a curve showing the *fall* that is appurtenant to or goes with the daily quantity of flow in the river on each day of the year. (See again the diagram, curve marked "Fall.") In times of freshet or flood this fall will be least; in times of a low flow in the river it will be greatest.



CURVES OF DAILY FLOW OF WATER.

From these two curves of flow and of fall, the curves of daily available power output of the power house may be computed and drawn, as on the diagram curve marked "Average Daily Power Output Without Fall-increasers."*

Generally, or roughly, speaking, such a curve of power output will vary from half the normal, or middle, power output, at low water in the river, to the normal, or greatest, or middle, output in the middle of the year; by reason of a lack of water enough each and every day to keep the power output of all the wheels, all of that time, and this full output hardly reached, it will again gradually fall to about one-half of the full output by

*This diagram, made for an actual case, represents probably—the full computations have not yet been made—the case of a water-power plant having slightly more wheel capacity than is most economically proper; having regard to cost of power house and water connections, turbines, dynamos, etc.

reason of an excess of water making the "back water" on the wheels; that is, diminishing the fall for the remaining half of the days of the year. Against the first-named low-water situation there is no practical remedy in the vast majority of cases except the addition of heat engines of some sort, steam or gas.

What the future may bring forth it is difficult to say. But so far, storage of water in reservoirs, to be fed down for power purposes during low flows in the year, has not proved a brilliant commercial success that I ever heard of. It had a fair trial on the Merrimack River under favorable topographical and financial circumstances, Lake Winnepesaukee furnishing the reservoir capacity and the management being vested in the well-manager water-power companies situated at Lowell and Lawrence, Mass., with the result that, after many years of operation of that reservoir, its use as a reservoir by those water power companies was abandoned. Wherefore I have said that against a diminution of power output by reason of a lack of water the proper remedy was the use of heat engines, and to this I will refer again.

Taking now the other half of the days of the year, with a power diminution caused by too much water, a complete remedy may be had by the use of the fall-increaser. This apparatus will keep the power output at its full quantity for the days named, by the use of the water which otherwise would waste unused over the dam, and will do this at a construction cost of only two or three years' value of the power it has produced, with practically no increase in operating expenses. (See again diagram, marked "Average Daily Output of Power House with Fall-increasers.")

If now heat-engine power is to be taken to raise the varying output of power during the low-water half of the year to a uniform full-power output (one that would be shown on a power diagram by a horizontal line), it is evident that such heat engines should have a maximum daily capacity of about half the full power output, if this full output is to be maintained strictly every day in the year. The kw-hours they will be called upon to produce will range from half the average daily load, on the driest day of the year, down to nothing at all on the middle day of the year, or for the year one-eighth the annual full output of kw-hours, roughly computing, or 10 to 12 per cent.

The cost of this one-eighth annual power output will be the interest on the first cost of the engines, plus the necessary fuel and partial attendance, the other part of the attendance being furnished by the attendance needed in the power house during the rest of the year. Now by far the greater part of this cost consists of the fuel cost, which stops when the heat engines stop, and diminishes as this supplementary power output diminishes. For this reason the use of supplementary heat-engine power was well developed not less than 50 years ago, and only the uninformed may find anything novel or startling in such use. It should be considered *the rule* to use such power as a proper supplement to most any water power, the power houses on rivers which are the outflow of the Great Lakes or of other great lakes only excepted.

So far I have been speaking only of average daily outputs of power. It is the office of mill-ponds, or comparatively small and contiguous reservoirs of water, to enable the plant to furnish during the low-water half of the days of the year the required variation in power output during the 24 hours of the day, or the peak load, which they ordinarily can easily do. And this consideration changes nothing in what has already been said.

I agree with your editorial that at the present stage of the development of power production what the consumer demands, and should be offered, is primary—or giving it its long-established name—*permanent* power. And I have endeavored to show how this can be readily accomplished by the supplementary use of heat engines, and of the fall-increaser, at a minimum of cost per hp-day or kw-hour of annual power output, and that this method of producing such permanent power (barring only the use of the fall-increaser, only recently made available for generating about one-eighth the annually needed full output of power, by utilizing water otherwise wasting over the dam) has been well understood by competent hydraulic engineers certainly for 50 years past, and has been common practice.

It is idle to seek to avoid the development of water powers of which so much has been done during the past 20 years. What with the certain and continual advance in the price of fuel, its possible occasional scarcity by reason of coal strikes or interruptions to its regular transportation, until the final day when all fuels for generating power shall have become exhausted, we may look forward to a time within a measurable distance, say, during the lifetime of our grandchildren, or else our great-grandchildren, when water power will have become the chief reliance for the generation of power throughout the areas of the earth.

A body of estimable gentlemen, located all of them east of the Alleghanys, may during the drought of 1908 write such letters as are printed in your issue of Jan. 2, but these same gentlemen, three months later, will probably feel very differently upon their daily outlook, and if approached with a similar inquiry would probably write a very different letter. They are the "foolish virgins" of the parable, and of the power producing community, and need not have again the experience they have just had or are yet having if they will exercise skill and forethought, nor need any member of the power-house sorosity have their experience.

As your correspondent views the situation, power houses should be built to sell permanent power only (no secondary or "surplus power"); they should not sell what they have not got, and they may, by the exercise of a proper skill and of forethought, meet all commercial demands for power likely to be made upon them severally.

NEW YORK. CLEMENS HERSCHEL.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Transformers as Choking Coils. J. D. COLLIS. A paper read before the Birmingham section of the (Brit.) Inst. Elec. Eng. The author describes a method whereby ordinary transformers could be used as choking coils for the purpose of testing alternators on inductive loads. In attempting to separate the inductive and resistance components of the "drop" in alternators on load, it is necessary to apply an inductive load about equal to the full-load current of the alternator under test. The smallness of the no-load current renders a transformer useless as an inductive load at the voltage for which it is designed unless by some special means the no-load current can be increased to a reasonably large value. In core transformers with butt joints this may be accomplished by temporarily opening the joints between the limbs and yoke, and inserting distance-pieces of non-magnetic material, but this is not always convenient. To provide choking coils for such a purpose is generally too costly, especially in the case of large alternators. If, however, the alternator is provided with transformers, either for stepping its voltage up or down, or both, the test may be easily carried out by the method described in the paper, which permits of a reduction of the permeability of the core of a transformer (thereby increasing its magnetizing current), without any interference with its construction. Briefly, the method consists in bringing the flux density of the core to a high value, by means of direct current sent through the secondary winding, so that when an alternating electromotive force is applied to the primary, the flux density undergoes variations about a mean flux density corresponding to low permeability, instead of about zero flux density corresponding

to high permeability as is ordinarily the case. Something must be done to prevent the direct motive force from driving an alternating current through the source of direct current. Two ways of doing this are shown in Figs. 1 and 2. In Fig. 1 the primaries of two similar transformers are connected in parallel, and the secondaries in opposition, the source of direct current being inserted as shown. In Fig. 2 the primaries are in series, and the secondaries in opposition as before. The inductance



FIGS. 1 AND 2.—ALTERNATIVE ARRANGEMENT OF TRANSFORMERS.

of the second arrangement is double that of the first, and by use of both arrangements a wide range of inductances may be obtained. In the absence of a specially designed choking coil, it is thus necessary to use two transformers for single-phase working. For testing a three-phase alternator at least three transformers are necessary.—Lond. *Electrician*, Dec. 25; Lond. *Elec. Eng'ing*, Dec. 24.

Starting Induction Motor.—A note on a British patent (892) of Crompton & Company; J. C. Macfarlane and H. Burge, for a double-rotor induction motor. In order to obtain a good starting torque with induction motors, it is necessary to have a high resistance in the rotor at starting, but this must be cut out when the motor is running at full speed, or the efficiency will be low. According to this invention two rotors, one with a high and the other with a low resistance, are mounted on the same shaft, and provision is made to move the low resistance rotor into the stator field automatically as the speed increases. Either a screw thread of fast pitch on the hub and spindle or an arrangement of weights acting centrifugally can be used for this purpose.—Lond. *Elec. Eng'ing*, Dec. 24.

Single-phase Commutator Motor.—R. GOLDSCHMIDT.—A continuation of his illustrated discussion of the theory of the repulsion motor. After having dealt with the Elihu Thomson type he now takes up the Latour-Winter-Eichberg type, and discusses the armature winding as an exciting winding; the compensation, e.m.fs., currents and fluxes in this motor, and its circle diagram.—Lond. *Elec.*, Dec. 18.

Lamps and Lighting.

Quartz-glass Mercury-Vapor Lamp.—An illustrated description of a quartz-glass mercury-vapor lamp shown at the recent exhibition of the Physical Society in London. The lamp consists of three distinct parts—the anode bulb, the cathode bulb and the vapor tube. The anode and cathode bulbs are different both as to size and shape. The sizes are as far as possible proportioned to the amount of heat developed at the respective poles, in order that the loss of heat at each end may be proportional to the heat generated. This is necessary if vapor is to be produced at the same rate at both electrodes, so that it may be possible for the lamp to burn continuously. Since it is never possible to obtain the precise proportionality required between the sizes of the two bulbs, an additional device has been employed to establish automatically a balance between the heat generated and the heat radiated. This device consists in drawing out the cathode bulb into a narrow neck, where it joins the vapor tube. The bulb and part of this neck are filled with mercury. The heat developed at the surface of the mercury is carried away by the mixing of the hot metal with the colder contents of the bulb; the wider the neck and the nearer the surface of the mercury is to the bulb the more rapidly will this transference of heat be effected. If at any instant the heat is carried away too rapidly, the mercury level in the neck will rise, and this will tend to retard the flow of heat to the bulb. By sufficiently contracting the neck and by making the cathode bulb of a suitable size, it has been possible to produce a lamp which burns for any length of time. The better the electrodes are cooled the greater is the current through the door. To produce a cooling effect the bulbs are surrounded by metal bond carrying cooling fins. On a 220-volt supply with a regulator resistance of about 30 ohms in circuit the lamp can be made to burn continuously with an arc between its terminals varying from 25 to 175 volts. At low voltages the arc fills the entire cross-section of the tube, while at higher voltages it becomes more and more constricted and ultimately forms a thread having a thickness of about 5 mm. "The light yielded by this lamp is said to be the greatest ever obtained. Thus, with 304 volts between the terminals and a current of 3.85 amp, [illegible] cp was developed, which corresponds to an expenditure of 0.182 watt per candle-power." In order, however, not to prejudice the life of the lamp it is usual not to run at a higher e.m.f. than 175 volts. Under these conditions it consumes 4 amp and develops a mean spherical candle-power of about 2860 cp, which is equivalent to 0.244 watt per candle-power. It is well known that the mercury lamp is very rich in ultraviolet rays, also that quartz glass is transparent to such rays down to a wave-length of 185 $\mu\mu$. With increase of temperature and pressure in the lamp a greater yield both of ultraviolet and of visual radiation is obtained for the same amount of power consumed. Also at the higher temperature a greater proportion of red rays are produced, thereby reducing to some extent the disadvantageous color of the mercury lamp. This lamp is said to be the richest available source for actinic rays of short wave-length. At the suggestion of L. Arons (the original inventor of the mercury-vapor lamp) a lamp is now made in which a liquid amalgam replaces the mercury, and it was this type which was shown at the exhibition. This lamp yields an extraordinarily rich line spectrum. The amalgam consists of about 59 per cent Hg, 20 per cent Pb, 20 per cent Bi, 0.5 per cent Zn, and 0.5 per cent Cd. At low voltages the amalgam lamp exhibits only the Hg-Cd-Zn spectrum; at about 100 volts the Bi and Pb spectra become visible in the neighborhood of the electrodes; at about 12 volts the whole arc exhibits line spectra, particularly rich in the ultraviolet region, of all the five metals. The electrical qualities of the amalgam lamp are the same as those of the mercury lamp.—Lond. *Elec.*, Dec. 18.

Incandescent Lamps.—J. FINDLAY.—A paper read before the Rugby Engineering Society. The physical defects most generally encountered in incandescent lamps, and for which the purchaser should look out, are loose caps, spotted filaments and bad vacuum. In buying lamps not only the price of the lamp, but the cost of the energy consumed, must be considered, and against this must be set the amount of light obtained from the lamp during its life. The author emphasizes the importance

Kind of lamp.	Mean spherical cp.	Watts per candle	Candles per kw.
Common 56-watt, carbon-filament incandescent lamp, rated at 3.5 watts per candle power, 16 horizontal candle-power	13.2	4.24	236
Common 50-watt, carbon-filament incandescent lamp, rated at 3.1 watts per candle-power, 16 horizontal candle-power	13.2	3.78	264
Three-phase, 204-watt Nernst lamp	51.0	3.26	307
"Gem" 125-watt, graphitized carbon-filament lamp of 50 horizontal candle-power	40.7	3.07	326
40-watt tantalum lamp, rated at 20 horizontal candle-power	14.5	2.75	328
Direct-current, 5.1-amp enclosed arc on 110-volt circuit, 1.5-in. carbons	213.0	2.63	380
Alternating-current, enclosed 5.7-amp arc, taking 388 watts on 110-volt circuit, 5-in. carbons	152.0	2.55	392
60-watt, 110-volt tungsten-filament lamp, burning at 1.25 watts per horizontal candle	37.0	1.62	617

of lamp tests. Even in the case of large private concerns, where energy is generated very cheaply, it is short-sighted policy to employ the cheap lamp. For the candle-power drops so greatly during the first 50 or 100 hours' burning that the total light emitted from a 16-cp lamp of this class is often no more than would be obtained from a properly-rated 8-cp lamp. A good many of the foregoing remarks may be applied with equal force to the tungsten lamp. This lamp is often overrated, a specific consumption of 1.1 watts per candle-power being too low for lamps used on the ordinary circuits, though it might be correct under ideal conditions, say, where the voltage was never more than 1 per cent above the normal. There is reason to believe that the life of a tungsten lamp burning at 1.25 watts per

candle is four times as long as it would be if burned at 1 watt per candle-power. This difference in specific consumption will be caused by a difference of 10 per cent in voltage, and will be accompanied by a rise of 40 per cent in candle-power and 5.5 per cent in current. The figures shown in the table are of various incandescent lamps at present in use.—Lond. *Elec.*, Dec. 25.

Regulation of Arc Lamps.—J. TEICHMÜLLER.—The conclusion of his long illustrated article. The author considers in detail the phenomena of the regulation of arc lamps, especially with lamps of inclined electrodes side by side, and discusses the effect of magnetic fields in the neighborhood of the arc. He contradicts the ordinary explanation of the regulating effect of a magnet, according to which the arc while burning comes nearer the magnetic field and is repelled. The author endeavors to give another explanation of the effect of a magnet field on regulation. He finally describes a method and apparatus for testing the quality of arc-lamp electrodes and the quality of the regulating magnetism of arc lamps.—*Elec. Zeit.*, Dec. 24.

Metallic-Filament Lamps.—B. DUSCHNITZ.—A continuation of his long illustrated serial on recent advances in the manufacture of metallic-filament lamps, based chiefly on patent specifications. In the present instalment the author deals with the latest methods of suspending the tantalum wire in the tantalum lamp of the Siemens & Halske Company, and with methods of suspending the tungsten wire in the tungsten lamps by the German Welsbach Company and the Wolfram Lampen Company.—*Elek. Anz.*, Dec. 13.

Generation, Transmission and Distribution.

British Refuse Destructor Plant.—An illustrated description of the generating station at St. Albans, which is a steam generating station, exclusively dependent on refuse for fuel. The destructor plant consists of two units of three cells each. Each unit is capable of burning from 25 tons to 30 tons of refuse per day of 18 hours. A guarantee was given by the makers of the destructor plant that for each pound of refuse burned 1.69 lb. of water from and at 212 deg. Fahr. would be evaporated at a pressure of 200 lb. per square inch, and at a temperature of 507 deg. Fahr. There are two engines, each of which drives two 75-kw, direct-current generators. They generate energy at 230 volts, one on either side of the 460-volt, three-wire supply network. Factories having a 115-volt system are also supplied with energy. In order to obtain a 115-volt supply, the generator armatures are fitted with two slip-rings connected to opposite points in the winding, and these are connected with compensators through double-pole switches mounted on the machine frames. A tapping is taken out from the neutral point of each compensator, so that the e.m.f between either terminal and the tapping is 115 volts if the total pressure across the machine in question is 230 volts. Connections from the tappings of the two compensators and from the common and outer terminals of the generators thus constitute a five-wire system, from which the energy for the factory can be given.—Lond. *Elec. Eng'ing*, Dec. 24.

Traction.

Electric Automobiles.—E. SIEG.—The first part of an illustrated paper read before the Berlin Electrical Society. For a speed of 15 miles per hour on a level road he says that a specific capacity of the storage battery of about 30 watt-hours per kilogram of total weight is required. German automobile companies use lead accumulators giving 30 watt-hours per kilogram and having 90 per cent amp-hour efficiency and from 75 per cent to 80 per cent watt-hour efficiency. He thinks that the Edison nickel-iron accumulator is much less suitable for automobiles, because it gives only 24 watt-hours per kilogram, 1.2 volts per cell, instead of the 2 volts of the lead cell, and 50 per cent watt-hour efficiency. The Edison plates, however, can withstand about 600 discharges against 150 of the lead cell, but this does not mean less maintenance cost, since the renewal of the plates, though less often, is very much more expensive. The author then discusses the most suitable type of motor for electric automobiles and emphasizes that it should be a series motor. Recent attempts to use a shunt motor are thought to be a mistake. The motors may be either high-speed machines connected to the wheels by gearing or low-speed machines directly coupled to the wheels. The latter system has the following disadvantages: A car equipped with a low-speed motor when running up a grade will be greatly reduced in speed without using less current; on heavier grades the current will increase to an extraordinary degree and the car will only creep. When running at half speed (half normal voltage) the energy consumption per ton-kilometer will be at least one-third higher than for cars with high-speed motors. Moreover, cars with low-speed motors require much more time to run up to full speed and the braking action is very slight, especially at low speeds. Speed regulation is obtained by series-parallel control of the two motors and by variation of the magnetic field of the motors. By increasing the magnetic field a low speed is obtained and at the same time a strong torque for running up a grade. By weakening the field high speeds on level roads are obtained. The division of the battery into two parts for series-parallel connection is not advantageous, since it leads to an unequal use of the cells and results in their earlier destruction.—*Elek. Zeit.*, Dec. 24.

Voltage Drop in Return Circuit of Single-phase Railways.—P. DAWSON.—A continuation of his long illustrated serial. In the present instalment the author considers mathematically the pressure drop due to induction in the return circuit of an alternating-current supply of electricity, and gives examples for a trolley wire and a conductor rail.—Lond. *Elec.*, Dec. 25.

Storage-battery Railway Cars.—A fully illustrated description of the accumulator railway cars of the Prussian State Railways, which have already been noticed in the Digest.—Lond. *Elec.*, Dec. 25.

Installations, Systems and Appliances.

British Central Station.—An abstract of last year's financial report of the Bolton municipal electricity works. The number of kw-hours sold exceeds the figure for the previous year by no less than 32 per cent, being 10,791,105 as compared with 8,152,052. This is, to a considerable extent, due to the great development of the motor load, which accounted for 5,080,639 of the total number of units. The traction load takes 4,110,085 units. The private lighting load is, however, by no means insignificant, since it accounted for 1,594,408 units. In spite of an increase of the cost of coal, the total costs, including all capital charges and depreciation, have been reduced by 0.1 cent per kw-hour sold, and now stand at the low figure of 2.24 cents. The latter figure is made up as follows: Generating cost per kw-hour sold, 0.94 cent; distribution cost, 0.06 cent; management cost, 0.06 cent; rents, rates and taxes, 0.08 cent; interest, sinking fund and depreciation, 1.10 cents; total, 2.24 cents.—Lond. *Elec.*, Dec. 25.

Wind Power for Isolated Plant.—J. BOTEM.—An illustrated description of an electric installation making use of wind power on a gentleman's farm near Hamburg. Formerly gasolene engines were used as prime movers. There are 400 incandescent lamps and five motors, having a total of 24.8 hp. Electric energy is also used for heating and cooking. The total connections amount to 40 kw. Formerly two gasolene engines of 12 hp and 20 hp were used, driving 110-volt, direct-current generators giving 65 amp and 100 amp respectively, together with a storage battery of 60 cells with a rating of 195 amp hours for a maximum discharge of 165 amp during three hours. The yearly consumption of gasolene was 10,000 kg at a cost of $625. In 1907 a wind turbine was installed in which the generation of energy began with a speed of wind of from 3 m to 4 m per second. The turbine was rated at 6 hp for wind of from 4 m to 5 m per second, at 14 hp for wind of from 6 m to 7 m, and 30 hp for wind of 8 m. In reality the turbine has a higher output, since it gives 30 hp with a wind speed of 8 m per second. The generator, which is equipped with interpoles, is designed for 80 amp at 110 volts and 1350 rpm for a wind speed of from 6 m to 7 m per second. The connections are shown in Fig. 3. The circuit-breaker, marked "automat I" in the illustration, breaks the connections between

the generator and the battery as soon as the wind speed decreases to such an extent that the voltage at the terminals of the generator would be less than the battery voltage. This circuit breaker consists of a two-core electromagnet *PP* with a main-current winding *a* and a shunt winding *c*. A permanent magnet *m* is placed between the poles, so as to be able to revolve around an axle. This magnet carries a lever *H*, the end of which has two copper arms reaching into two mercury cups. If the generator voltage tends to become smaller than the battery voltage, the current through the shunt winding *c* acts on the magnet *m* in such a way that the two copper arms are removed out of the mercury cups so that the connection between the generator and the battery is broken. When the wind increases the voltage at the terminals of the generator rises to the value of the battery voltage; the current in the winding *c* is then zero. If the generator voltage increases still further, the current in *c* changes its direction and the magnet *m* assumes the position shown in the figure so that connection is now made between the two mercury cups. The battery is then charged by the generator. The apparatus is designed so that this connection is made when the generator e.m.f. is five volts more than the battery voltage. As soon as current exists in the main winding *a*, the current in *c* is practically zero and *H* is held in the position shown in the figure. When the circuit in *a* decreases the circuit is broken and *c* comes again into operation. A second circuit-breaker, marked "automat II," prevents any overload of the generator due to a sudden strong

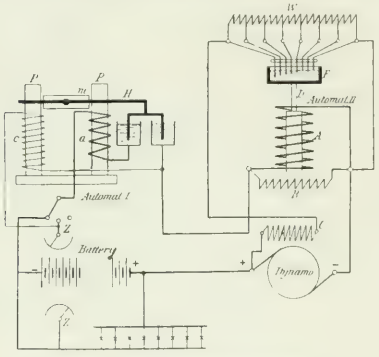


FIG. 3.—DIAGRAM OF CONNECTIONS.

wind. By means of this device portions of the resistor *W* are inserted in the exciting circuit *C* of the dynamo. This apparatus consists of a main current solenoid *A*, the core *D* of which holds a mercury cup *E*. By raising or lowering this cup more or less, a greater or smaller number of the portions of the resistor *W* are immersed in the mercury. It has been found that for 90 days in succession the wind power was sufficient without any necessity of using the gasolene-driven generator held in reserve. The total first cost of the installation, including wind-turbine, generators, battery, the reserve gasolene-generator, switchboard and instruments, was $8,175. The operating cost per year, including interest and amortization, is $1,136. Formerly, when the wind power had not been utilized, the first cost of installation, with two gasolene-generators and a battery, was less; namely, $5,150, but the yearly cost, including interest and amortization, was about 50 per cent higher; namely, $1,690.—*Elek. Zeit.*, Dec. 24.

Switchboard.—G. WOLFF.—An illustrated description of a new switchboard design of the Felten & Guilleaume-Lahmeyer Company. The board is built in sections, each of which is removable by means of a little car running on rails. The chief features are that all work done on the switchboard is carried out on the front side, and that by special devices any danger to the attendants has been removed. The construction is said to be especially useful for high-tension switchboards in indus-

Electrophysics and Magnetism.

Standard of Radioactivity.—The Council of the Roentgen Society has decided to act upon the advice of the committee appointed in 1906 to consider the possibility of preparing a standard for the measurement of radioactivity. This committee recommend that: "The gamma-ray ionization from one milligram of pure radium be regarded as a standard, and called a unit of radioactivity." The Council has deputed Mr. C. E. S. Phillips to prepare a set of three substandards of $RaBr_2$, and these are now maturing. Owing to the co-operation of Prof. E. Rutherford, comparison will be made with a specimen of the purest $RaBr_2$ at the Victoria University, Manchester. The quantity of radium in other specimens will be, by comparison with the substandards, capable of accurate measurement. It is, therefore, anticipated that by this means the exact description of medical, physical, or other work with radium will be facilitated, and that the possibility of fraud in the sale of expensive radium preparations will be eliminated.—Lond. *Elec.*, Dec. 25.

Heusler's Magnetic Alloy.—J. G. GRAY.—A paper in which the author describes a series of experiments carried out to investigate: (1) The magnetic properties of the Heusler magnetic alloy (consisting of copper, manganese and aluminum) at temperatures lying between 0 deg. C. and 400 deg. C—about the critical temperature of the material; (2) the alteration in magnetic properties brought about by heating and cooling the material; (3) the magnetic properties of the alloy at low temperatures in the quenched condition.—Lond. *Elec.*, Dec. 25.

Spark Gaps.—R. A. HOUSTUN.—An illustrated note on the electric resistance of spark gaps. The author describes the effect of changing the material of the electrode on the resistance of the spark gap for eight different metals, the other conditions being always the same. Zinc, aluminum, cadmium, tin, copper, iron, brass and nickel were tested. Cleaning of the surface has an effect on zinc, but no definite effect on the others.—Lond. *Elec.*, Dec. 25.

Flash-Over Voltages.—J. LUSTGARTEN.—An illustrated article in which the author discusses "the nature and properties of the gaseous ion by means of which the mechanism of the brush, spark and arc discharges can be satisfactorily explained."—Lond. *Elec.*, Dec. 18.

Electrochemistry and Batteries.

Electric Laboratory Furnace.—An illustrated description of several laboratory resistance furnaces shown at the recent exhibition of the British Physical Society. In one of them the resistor consists of very thin platinum ribbon wound on a porcelain tube. In small sizes the furnace can be used up to 1400 deg. C. In another furnace nickel is used as resistor, wound on a tube of silica. This furnace may be used to a temperature of about 1000 deg. C.—Lond. *Elec.*, Dec. 25.

Units, Measurements and Instruments.

Resistance Thermometer.—An illustrated note on the Harris resistance thermometer, shown at the recent exhibition of the British Physical Society. Its feature is that there is no necessity of balancing a galvanometer to zero in order to get a reading. The instrument depends for its action upon the principle of the two-coil ohmmeter, but one of the coils is wound differentially. One of the differential windings (*X* in Fig. 4) is shunted with a platinum thermometer, the other winding *S* being shunted with a resistor *s*, which is made variable so as to balance the thermometer at certain fixed temperatures. The control coil *D* of the ohmmeter system is also shunted with a resistor *d*, the resistance of which is determined by the degree of sensitiveness required, and may be made variable with *s*. These shunted windings are connected in series, and the circuit is completed through a battery and switch. By using a differential winding, the currents in which are respectively due to the resistances of the thermometer and *s*, in conjunction with a control coil, in which the current is proportional to a selected difference unit *d*, the advantage is gained of making the indicator read on both sides of what would be the zero point in a non-differentially wound ohmmeter, thus increasing the possible length of the scale from under 90 deg. of arc to something approach-

ing 180 deg. Moreover, as the deflection is proportional to the ratio of the difference in the currents in the differential windings to the current in the control coil, the sensitiveness for a given variation in the temperature of the thermometer may be made as great as is required by giving a suitable value to *d*, and is limited only by practical considerations.—Lond. *Elec.*, Dec. 25.

Resistance Box.—A note on Campbell's constant-inductance resistor box and constant-inductance rheostats, shown at the recent exhibition of the (Brit.) Phys. Soc'y. The arrangement of the

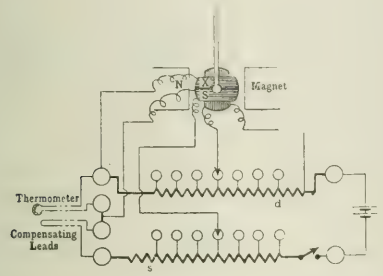


FIG. 4.—DEFLECTIONAL RESISTANCE THERMOMETER INDICATOR.

winding of these is such that the resistance can be altered without varying the inductance. This is secured by means of duplicate windings in copper and manganin, so arranged that as manganin resistance is cut out, or in, an equivalent number of turns of copper are cut in or out. The coils of the resistor box are immersed in oil.—Lond. *Elec.*, Dec. 25.

Rheostat.—A note on a fine adjustment rheostat shown at the recent exhibition of the (British) Physical Society. It comprises a slate cylinder carrying resistor wire wound in a spiral groove cut in its edge. This drum is carried on a spindle screwed for a few turns to the same pitch as the spiral in which the wire is wound. Pillars mounted on the slate base carry a casting tapped to take the screwed portion of the drum spindle, the other end of which is carried by a bearing in the slate base. A contact slides along one of the pillars supporting the top casting. The coarse adjustment is obtained by sliding the contact up and down the pillar, the fine adjustment being obtained by rotating the drum.—Lond. *Elec.*, Dec. 25.

Telegraphy, Telephony and Signals.

Continuous Oscillations by Rotating Disks.—R. RUDENBERG.—An investigation of the action on which the new arrangement of rotating disks depends, which is used by Marconi as a generator for continuous, or, rather, closely adjacent, trains of oscillations used at his high-power stations. The author first points out that the arc is able to produce oscillations of very high frequency only when it is supplied with some means for quickly getting rid of the heat liberated in it. Simon and Poulsen obtain this result by conduction, using metal electrodes, which can, in addition, be water-cooled. Marconi prefers the convection method, employing rotating disks as electrodes, at the periphery of which the current passes in the form of an arc. During operation the whole disk acquires a certain temperature which is practically the same at all parts and an increase of temperature takes place only at the edge where the arc passes. The lower the rise of temperature the higher the efficiency of the arrangement. The author calculates this rise of temperature as functions of the different factors. Even with a slow speed of rotation a very noticeable cooling effect is obtained. Copper is the best material to use.—Lond. *Elec.*, Dec. 25.

Wireless Telegraphy.—H. POINCARÉ.—Continuations of his serial of lectures on the theory of wireless telegraphy, dealing with the electromagnetic field around the vertical transmitting wire, the propagation of waves and their way of getting around obstacles, and the phenomena in the receiving antenna.—*La Lumière Elec.*, Dec. 5, 12 and 19.

Miscellaneous.

High-resistance Materials.—A note on a British patent (4657) of C. Ruzicka for high-resistance materials, the chief feature of which is the employment of metallic compounds or salts as fluxing or welding agents. The resisting composition may consist of 60 parts of coal tar, 12 parts of quartz, 24 parts of potassium feldspar, and 10 parts of potassium tetraborate. A molded rod of this mixture, 1 sq. cm in section and 10 cm in length, after being heated to a temperature of above 1000 C., has a resistance of about 10,000 ohms. Instead of coal-tar, resin may be the chief component. In the specification 9762 resistance materials of much lower specific resistance and suitable for use in heating and cooking apparatus are described. One of these consists of 20 parts of iron oxide, 33 parts of nickel oxide, 26 parts of calcium feldspar and 18 parts of bauxite. A material of still lower specific resistance is obtained if iron and nickel nitrates are substituted for the iron and nickel oxides respectively in the above composition. The mixtures are molded and baked at a high temperature as in the first case. In a further specification, 9763, a resistance material containing carbonized petroleum residue, potassium feldspar and quartz; and another consisting mainly of silicium carbide and potassium feldspar, are described.—Lond. *Elec. Eng'ing*, Dec. 24.

Insulating Material.—A note on a British patent (27,060) of J. Johnson, describing a hard material suitable for base-blocks for switches and other purposes. It consists of about 40 per cent sulphur and 40 per cent of either lampblack or mica, or a mixture of the two. Various earths or coloring materials may be added.—Lond. *Elec. Eng'ing*, Dec. 24.

NEW APPARATUS AND APPLIANCES

New Tungsten Reflector and Fixtures.

The use of tungsten lamps presents a new problem in electric lighting—that of securing a proper diffusion of the intense rays which are developed. One of the means being offered to secure better results with such lamps is a new type of glass reflector known as "Opalux" tungsten reflectors, which, it is claimed, so diffuse all the light given out that a maximum of illumination is secured at a minimum cost for current. Other features of the new reflector are its artistic appearance, mechanical stability, ease of cleaning and minimum liability to become soiled.

In the new "Opalux" reflector the diffusing surface is on the reflecting side. The reflector is a glass which is perceptibly translucent and it has a surface entirely different from that produced by the ordinary etching and blasting or sanding processes. While the "glaze" of the glass is entirely removed, the surface is of such a high degree of smoothness that it can be cleaned as readily as ordinary glass and at the same time does not give sufficient direct reflection to produce perceptible glare. The reflected light from this glass is of a pearly luster, slightly opalescent. The transmitted light is stated to show a variation of [illegible] and to illuminate the ceiling with a warm glow, entirely free from sharp contrasts in intensity. The ornamental detail has been designed to present no sharp corners or deep grooves, but an even surface very readily cleaned, and being made by pressing, the reflector has ample mechanical strength. Since in this glass the reflection is largely diffused, the contour or general shape of the reflector is varied to several forms without materially changing the distribution curve.

[illegible] the mistakes so frequently made of considering

the globes and shades an entirely distinct and separable part of a fixture, special fixtures have been designed for use with "Opalux" reflectors which insure that harmony and proportion of line in both fixture and glassware which are a most im-



FIG. 1.—OPALUX REFLECTOR.

portant feature in the decorative treatment of lighting fixtures. These fixtures are simple in design, and are intended to anticipate a demand for high-grade tungsten fixtures which will be artistic, attractive and durable, and at the same time harmonize



FIG. 2.—OPALUX REFLECTOR.

with any style of decoration used in buildings where tungsten lamps will be in service.

The accompanying illustrations show the flat and bowl type of "Opalux" reflectors, and one of the ceiling fixtures. The

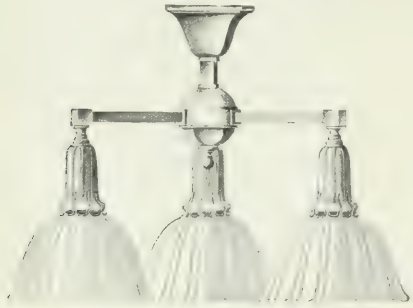


FIG. 3.—OPALUX TUNGSTEN EQUIPMENT.

reflectors and fixtures described are being marketed by the Pettingell-Andrews Company, of Boston, and the Central Electric Company, of Chicago.

Triangular Bit for Boring Square Holes.

The problem of boring square holes or holes of other shapes than round, has long attracted inventors and is, moveover, of considerable practical interest in view of the wide use of such holes for counter-sinking and for keys, wrenches, spanners, hand-wheels and similar articles. The present methods of making square holes, outside of punching and casting, such as first boring round holes and then working them up by hand or by means of a slotter or shaper, are laborious, expensive and much slower than the making of the round hole itself, which practically limits their use. The machine shown here-

facility and with nearly the same speed that the ordinary twist drill will bore round holes in the same material. At the same time the tool, while not altogether as simple as the flat drill, is not complicated nor expensive, and is easily made or

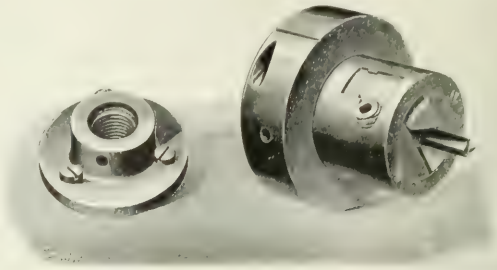


FIG. 1.—TRANSMISSION.

ground in the average machine shop. The only appliance needed for the use of this special tool upon such machines as lathes, drill presses and milling machines is a special chuck. The chuck is really a device of making the three-cornered boring tool or bit travel about in such a way as to strike out a square hole in the work. It consists of a driving part which is screwed onto the spindle of the machine, a guiding part which either rides upon the first part, or else is secured permanently to the frame of the machine, and a third part, or socket, into which the shank of the drill is screwed. This third part is caused to rotate by the first part, but has a slight freedom of motion in relation thereto, being guided as to its exact movements by the matrix or frame in the stationary part. Where square holes are to be drilled the shank of the tool is three-cornered, the sides of the shank being formed by segments of circles, struck from opposite corners as centers, the radius of these circles being the same and equal to one of the sides of the square hole which is to be drilled. The guide in the stationary part of the chuck is adjusted to the size of the hole to be drilled, so that the sides of the square opening are just equal to the radius by which the circles used for striking out the sides of the shank are formed. When one of the sides of the shank is either rolling or sliding upon one of the sides of the

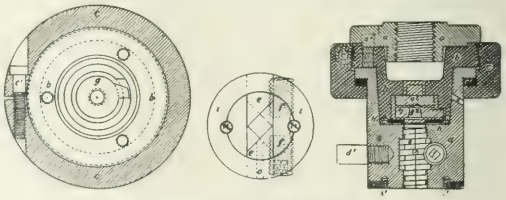


FIG. 2.—DETAILS OF TRIANGULAR BIT.

square guide, the opposite corner of the shank will be moving in a straight line in contact with the opposite side of the guide. The corresponding corner of the head of the tool would at the same time strike out a straight line in the work. This motion takes place on all four sides of the guide, except for a little space at each corner, the result being that the hole is square except for a slight rounding at the corners. If it is desired to bore out a complete square with sharp corners, a special tool is employed, having a shank considerably larger than the head of the tool, one corner of the shank being rounded instead of angular. The exact form of this round-cornered shank has been worked out empirically and a complete set of templets made for the different sizes of tools apt to be required in actual practice. The tools for both the round-cornered and sharp-cornered squares can be ground by means of a special attachment to the ordinary grinding machine. This device is being introduced in this country by the Radical Angular Drill Company, New York City.

Motor-Driven Box-Car Loader.

The box-car loader shown in the accompanying illustrations has been developed for loading coal in box-cars, where it will be safe from theft, and in order to comply with the requirements relating to the shipment of coal to the West, which necessitate the use of box cars which are employed for transporting grain from the West. The loader illustrated has been installed at the Silver Creek colliery of the Philadelphia & Reading Coal & Iron Company at New Philadelphia, Pa., for handling anthracite coal. It is driven by a 75-hp series-wound motor receiving energy through two trolley wires, the track not being used for an electrical circuit.

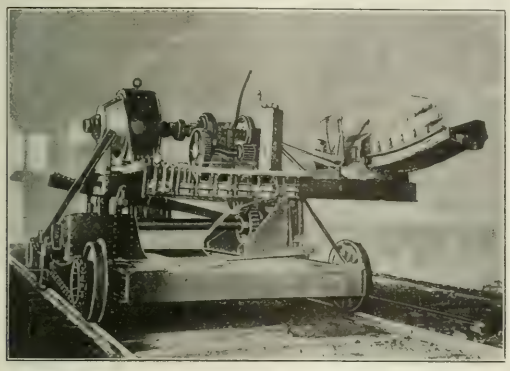


FIG. 1.—GENERAL VIEW OF BOX-CAR LOADER.

Coal is supplied from overhead bins to a hopper, from which it is distributed alternately to the ends of the car, the hopper being entirely inside the car when at work. The hopper rocks up and down and at the same time moves back and forth from one end of the car to the other. As it passes from one end to the other it receives coal from the chute and carries it to the end of the car; here it is emptied by the movement of a scraper which passes through the hopper, pushing the coal ahead of it. The motion of the hopper is reversed by reversing the motor, but a mechanical reversing device is used on the scraper. The motor is a 220-volt direct-current machine built by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

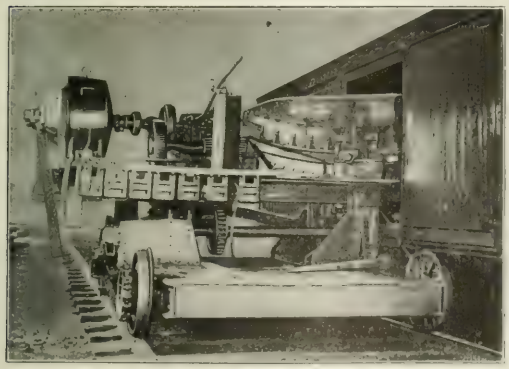
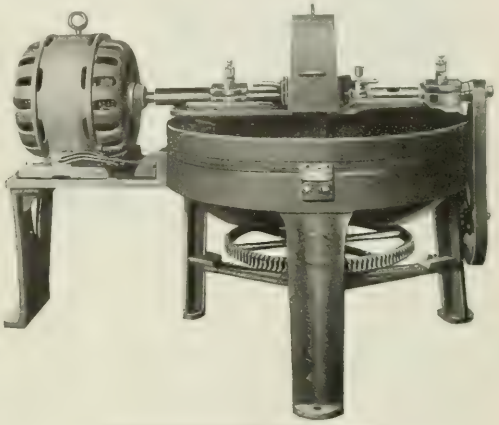


FIG. 2.—BOX CAR LOADER ENTERING CAR.

Largest Meat Cutter in the World.

A meat cutter, said to be the largest ever made, has been recently changed from steam to direct-connected motor drive, because of the delays formerly experienced in getting up steam which materially reduced the output of the grinder. The meat cutter in question, here shown, was built by the John E. Smith's Sons Company, of Buffalo, and is installed at the sausage factory of Jacob Moschel, Buffalo. It has a 43-in. bowl and six knives, each of which has a cutting edge 18 in. long. The power is supplied by a Westinghouse three-phase alternating-current motor of 20-hp capacity, which runs at a speed of 1420 r.p.m. Electrical energy is obtained from the circuits of the Niagara Falls Power Company.

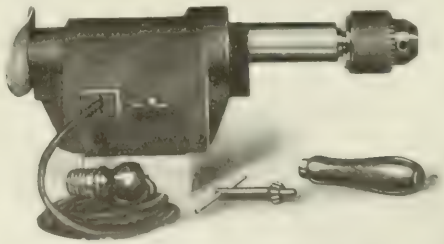
Mr. Moschel now cuts approximately 25,000 lb. of sausage a day. This cutter can handle the entire output if desired, as it has a capacity of 250 lb. in five minutes. One of the reasons for the change from steam to motor drive was also the saving in the expense for attendance of an engineer, as well as the greater convenience when motor driven. The attendant of the meat cutter does all the work of looking after the machinery that formerly required the entire time of another man, for with the electric motor "there really is no work to do," as stated by one of the men connected with this installation.



ELECTRICALLY DRIVEN MEAT CHOPPER.

Portable Electric Breast Drill and Grinder.

The main feature of the portable electric breast drill, made by the Willey Machine Company, of Jeffersonville, Ind., and shown herewith, is the simplicity of its construction. Only two gears are used and these are cut from bar steel. The drill spindle has two long bearings, with removable bushings of phosphor bronze, in place of the single, short bearing often met



[illegible] AND GRINDER.

[illegible] drills of this type. Owing to the low speed of the [illegible] the wear on the commutator, bushings, gears and bearings is comparatively slight. By removing two nuts the entire [illegible] can be taken apart for inspection of the enclosed [illegible]. All the electrical connections are attached to the [illegible] of the machine, and are not disturbed when it is taken apart for any purpose. A snap switch is located on the

side of the frame, convenient for starting and stopping the drill. Special attention has been given to ventilation, insuring cool running and high efficiency of the motor. A system of air ducts has been provided in the armature for this purpose similar to those found in larger electrical apparatus. The tool is made in four sizes, the largest of these having two speeds. The motors are wound for either direct or alternating current and

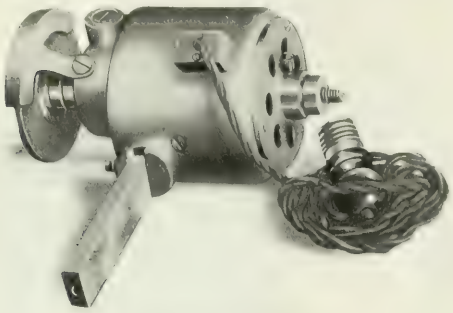


FIG. 2.—LATHE GRINDER.

for any voltage up to 250. The side handle can be quickly attached or removed as required by the work in hand.

The grinder shown in Fig. 2 is intended for lathes having compound rests. In applying the device, the compound rest is simply swiveled to the desired angle and the grinder clamped to the tool post, after which the center may be ground. The centers of lathes having plain rests can be ground by taking a succession of cuts the width of the wheel and grinding to gage. All of the connections, etc., of the motor are enclosed and the motor is wound for voltages up to 250. The grinder is made in two sizes.

Electrical Trade Society of New York.

The Electrical Trade Society of New York has issued in pamphlet form a report of its thirteenth annual meeting, held at the Electrical Club, New York, Dec. 8, 1908. President R. B. Corey presided at the meeting, at which the following officers for the ensuing year were elected: President, Mr. A. L. Miller, John A. Roebling's Sons Company; vice-president, Mr. P. M. Haight, Sprague Electric Company; treasurer, Mr. W. H. Roberts, W. R. Ostrander Company; secretary, Mr. Franz Neilson, 80 Wall Street, New York. The secretary's report shows that the number of members on Nov. 30, 1908, was 95; the total number of accounts handled during the year were 2939, involving $301,507, of which 2517, involving $241,306, were settled. The total number of names now recorded on the delinquent list of the society is 4750. The pamphlet includes the address of President Corey and an abstract of the statement of the secretary.

Silundum.

One of the latest products of the electric furnace and one which possesses interesting electrical properties is silundum, or silicified carbon. For the production of this material electric furnaces, the same as those used for the manufacture of carborundum, are employed. The pieces of carbon of various shapes are introduced into a mixture of sand and carbon—that is, acted upon by a granular core of coke as conductor for the electric current. Instead of sand and carbon, amorphous carborundum can be used enriched with sand to provide the necessary silicon for the carbon pieces to be converted into

Silundum being another form of silicon carbide has generally the same properties. It is very hard; it resists temperatures up to about 1600 deg. C. when heated in the air and does not oxi- [illegible] and is a conductor of electricity and its resistance is several times that of carbon. The hardness of silundum is variable and depends on the zone around the core of the furnace in which it is produced. Material from the amorphous zone is less hard than that obtained in the crystalline zone. It may be assumed that the hardness depends on the temperature in which the material is produced. The hardness may also depend on the amount of silicon taken up by the carbon. It seems that some pieces contain more or less silicon than others, but no analysis was made to ascertain this. At about 1700 deg. C. the silicon leaves the carbon and combines with the oxygen of the air.

Silundum cannot be melted and it behaves in this respect like carbon. The electric resistance of silundum is variable and depends on the kind of carbon and its hardness. Silundum made from porous carbons has a higher resistance than that made of hard carbon. The resistance depends also on the modification of the material. If produced in the amorphous zone the resistance is generally higher than in the crystalline zone.

The first use for which the material found application was for electric cooking and heating purposes. The electric heating industries for domestic as well as for industrial purposes demand for a large number of appliances a higher temperature than can be obtained by ordinary resistance wires. Platinum, of course, can be used, but this material is very expensive, especially so when thick wires or ribbons are used. Silundum replaces platinum for this purpose and is much cheaper.

Electric cooking and heating industries have developed in the last five years enormously and will continue to do so as electric energy becomes cheaper. The result is that there will be a demand for a large number of electric ranges that can be used for any cooking utensil, just like a gas range. The electric range demands, however, a concentration of electric energy to be converted into heat that cannot be obtained at present with any system without overheating the resistances or without increasing the weight of the heating plate, with the result that the time for preparing meals becomes too long if compared with heating by gas or coal. Silundum withstands very high heat, does not oxidize and can be used with the necessary high temperature needed for the purpose. Ranges are produced that have the glowing heat of a coal fire and they are used exactly as those heated by coal.

For industrial purposes there is a large field for heating apparatus for melting metals—brass, aluminum, lead, tin, etc.—and for electric ovens of high temperatures for laboratories. For these purposes the material fills a long felt want. Platinum and platinum-iridium have been used to a great extent for laboratory ovens, but the apparatus is very expensive and can be repaired only at great cost. Silundum can be used with just as high temperature as platinum and the first cost of the apparatus, as well as the repairs, are considerably lower.

For heating purposes the silundum rods can be used single in lengths up to 800 mm—depending, of course, on the diameter—as solid round, flat or square rods or tubes, or it may be made into grids, mounted in a frame and provided with contact wires.

Silundum withstands the attack of acids and experiments are now being made with a view to using it for electric bleaching purposes instead of platinum-iridium, carbon or graphite. In order to prevent the oxidation of carbon electrodes used for the manufacture of ferro-silicon it has been proposed to cover these electrodes with a layer of silundum.

Silundum can be nickel-plated or covered with a layer of platinum. It is a very refractory material and does not melt. It is, however, attacked when at high temperatures by molten metals, but this should not prevent its use as fireproof material. It is not necessary to silicify pieces to be used for fireproof purposes entirely, but only to a certain depth and according to the use for which they are destined. Carbon bricks, or any shaped pieces, can be covered with a layer of silundum at small cost. It is thus possible to obtain a material that for many purposes will be far superior to any fireproof material known so far. The material is marketed by the Roessler & Hassbacher Chemical Company, New York.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The situation in trade is one of preparation and anticipation. The usual post-holiday quiet is very much in evidence in all lines, both wholesale and retail. There are active preparations going on for good business that is anticipated within the next few weeks or within the next few months. Wholesalers and manufacturers expect a demand that will keep them busy. They are thoroughly prepared to take care of any demand that arises; in fact, there has been plenty of time for preparation because actual business for the last three months of 1908 was not more than 65 per cent of normal. Some business has been developed within the past week by the reduction sales in which almost all retailers indulge immediately after the holidays. It is always the policy of the retail merchants to clear out their shelves of all surplus stock that can be got rid of by forced sales at reduced prices. These are going on all over the country, and while they do not signify any increase in real business, they do turn into money certain quantities of surplus stock. This leaves the retailer in better condition for the coming year's business. He has his shelves fairly well cleared, and he has money to pay for new purchases. The severe cold wave which spread over the western portion of the country had its advantages and its disadvantages. It certainly, to some extent, stimulated the sale of goods for winter wear which had been retarded by prolonged warm weather. On the other hand, it, in a measure, retarded business because it came in the shape of a sudden freeze after a considerable spell of wet weather. This closed up many country roads and necessarily kept purchasers out of the market. In jobbing and wholesale lines invoicing has been concluded and salesmen are being started out with samples for new business. It is too early yet to make any reports as to the success with which these salesmen are meeting. The fact that they are on the road and that the wholesalers are pushing for trade must, of course, mean an increase in business. Whether they do all that is expected or do not they will certainly gather many orders. The iron and steel markets are quite dull, and prices are practically unchanged. But few sales of steel rails have been made, and as yet none of the important roads have come into the market since the beginning of the year. It is known, of course, that the railroads must buy so that this stagnation is merely temporary. There are not many orders being placed for structural material, but a number of inquiries are being made, and it is said that specifications are being drawn up for many extensive projects. The building industry is only active in small construction. This makes the lumber market good, helps the cement and brick market, but does not do very much toward aiding structural steel. The whole condition of trade is one of expectancy and optimism. Every one is looking for heavy business in the near future, but it is not here now. Business failures for the week which ended Jan. 7, as reported by *Bradstreet's*, were 329, as against 299 the week previous, 435 in the same week of 1908, 283 in 1907, 286 in 1906 and 295 in 1905.

THE COPPER MARKET.

The copper market is strong in price, firm in tone and there has been a slight advance during the past week. If the statistics of supply and demand are considered there is no reason for this feeling. The production of copper goes on more actively than ever, while it is not admitted by the selling agencies the stocks in this country must be very large, the stocks in Europe are known to be enormous and the demand from actual consumers is extremely light. The only explainable reason for the strength in tone is the fact that the powers which are under the market and are determined to uphold prices are encouraged to believe that the hardest part of their task is over. According to the preliminary estimate of the Government, the production of copper in 1909 is not likely to be more than 50,000,000 lb. greater than in 1908, and is not likely to grow materially in the next few years. The consumption, on the other hand, in the coming year and in future years will be vastly greater than in 1908. It is argued from these facts that having been able to sustain level prices during the past very lean year, there should be no trouble in the better years to come. The producers also point with confidence to the vast number of electrical projects that are simply waiting for normal business conditions to return before being pushed to completion, and to the fact that hand-to-mouth buying has for so long a time been the policy of all industrials that stocks in consumers' hands must in consequence be running low. The fact remains, however, that the United States is producing, including imports, about 110,000,000 lb. per month, and is consuming, including exports, not more than 90,000,000 lb. per month. This steady and enormous accumulation may be considered a guarantee for a long time to come that there will be no skyrocketing in copper prices. The fact that all current statistics of production and of sales have been unreliable has at times created an uncertainty in the market which the promoters of the uniform price level are anxious to avoid. With this purpose in view, the recent meeting of copper interests was held and the formulation of plans begun for maintaining a statistical bureau. It is said that the committee having these plans in hand is about ready to report, but no announcement has been made as yet. It is expected that the producers will—when accurate statistics are at hand—be able to exercise even greater control over the market than at present. Imports continue to be active, and since the first of the year have been more than 1500 tons. Exports for the month up to and including Jan. 11 were 6221 tons.

Prices quoted on the Metal Exchange Jan. 11 were:

Lake
Electrolytic
Castings

The London market was as follows:

	Noon.	Close.
Market	Weak.	Easy.
Sales of futures		400 tons

Extreme fluctuations for this year:

PLATINUM AND THE TARIFF.—Since the Ways and Means Committee of Congress has been considering the new tariff bill there have been all kinds of petitions received asking for increases of duties or the imposition of duty where none has heretofore existed. The question of a duty upon platinum utensils is a case in point. Under the present law these are admitted free, and those in favor of a continuance of this status say American manufacturers of platinum wares have been able at all times to compete with the Europeans, American platinum ware being sold abroad to a considerable extent. The Ways and Means Committee of Congress, however, has been petitioned by J. Bishop & Company, of Malvern, Pa., to put a duty on platinum apparatus and on platinum wire. In this communication the petitioner says: "We feel that this industry has been sadly neglected in the way of tariff protection, and there is no doubt but what the domestic requirements can be taken care of by American manufacturers. It is conceded that the products of our works are the finest made either in this country or abroad, and consequently the matter of quality can- We are confident that the business could be greatly enlarged and American labor given an additional field of employment if a duty is placed on manufactured platinum." The communica- would be satisfactory. The argument has also been made to the committee that the imposition of a duty on manufactured platinum of plants. It is believed that the foreigners who now sell in this market would be compelled to do their manufacturing on

Mr. Cyrus Osborne Baker, one of the largest importers and manufacturers of platinum in the country, had this to say about a tariff: "I cannot see the necessity of a tariff on platinum wares. I shall take no steps to secure one and the only result of a tariff would be to increase the price to the consumer. The talk of a tariff to protect American labor seems to me foolish. While, of course, labor in Europe is much cheaper than in this country, the labor cost of platinum apparatus is proportionately so small that it cuts little figure. With crude platinum selling at $24 per ounce—the present price, which is likely to go higher—the cost of the material is so many times greater than the cost of labor that a 25 per cent tax in order to protect labor would be a handicap. Our methods of manufacture in this country are, I think, superior to those in Europe, and I have no fear about being able to compete. We want to encourage the use of platinum and the cheaper the finished goods can be made the more this will be done. In this connection it is only necessary to call attention to some of our principal platinum industries, such as artificial teeth and incandescent lamps. At the present time, as I understand it, we furnish about 70 or 80 per cent of the artificial teeth used in the world. In this work 80 per cent of the cost for material is for the platinum used, so you can see the effect on the industry. A duty of 25 per cent on the platinum would increase the cost of the teeth 20 per cent and would practically destroy a foreign trade that now runs well up into the millions. The same is true with regard to electric lamps. At the present time, as I understand it, the value of the platinum in every carbon incandescent lamp is about one-tenth of the actual cost of the lamp. A 25 per cent increase in the cost of the platinum would mean a slight increase in the cost of the lamp. I do hope, however, that Congress will remove some of the inequalities in the platinum schedule that now exist. Platinum is placed on the free list and all the other metals in the platinum group, except rhodium and ruthenium. By some oversight these were not enumerated when the present law was drawn and they now pay 10 per cent ad valorem under the 'unenumerated' clause. Then there are the alloys of metals in this group which are not mentioned and while they are admitted free now any collector is likely to rule that they should pay and seriously interfere with business. We want the matter definitely settled."

STEAM TURBINE BUSINESS.—The Westinghouse Machine Company reports good progress during recent months in the steam turbine business despite the general depression. Out of the most important business covering some 20 machines ranging in size up to 10,000 hp, there is the usual activity in electrical, power and traction work, and a fair demand from various industries, including phosphate, cement and rubber mills, steel car works and oil refineries. Inquiry for exhaust-steam turbines is active, and several equipments have been contracted for. The most important orders are as follows: Metropolitan Street Railway, Kansas City, 15,000 kw; Narragansett Electric Light Company, Providence, R. I., 7,000 kw; Capitol Traction Company, Washington, D. C., 3000 kw; B. F. Goodrich, Akron, Ohio, 1500 kw; Tampa (Fla.) Electric Company, 1500 kw; Colorado Springs Electric Company, 1000 kw; Pressed Steel Car Company, McKees Rocks, Pa., 2000 kw. In addition to the above, there are equipments of 1000 kw and under for the Portland Cement Company, Denver; Coronet Phosphate Company, Plant City, Fla.; Bronx Gas & Electric Company, Westchester, N. Y.; Black Hills Traction Company, Deadwood, S. D.; Jacksonville Oil Mill Company, Jacksonville, Ala.; Fall Mountain Electric Light & Power Company; Bellows Falls Electric Company, Bellows Falls, Vt.; Tide Water Oil Company, Bayonne, N. J.; city of Logansport, Ind., and Bristol (Tenn.) Gas & Electric Company.

GENERAL ELECTRIC GETS LARGE MOTOR ORDER.—Among the recent good orders taken by the General Electric Company is one for 90 two-motor car equipments to be installed on the new steel cars being constructed for the Hudson & Manhattan Railroad Company by the Pressed Steel Car Company. These motors will be the standard 150-hp type with General Electric M. controls. Taken as a whole, the General Electric Company reports that the volume of its business varies little from that of the last three months of 1908. The plants are being operated on a basis of about 60 per cent where the larger apparatus is manufactured, and about 80 per cent for the smaller concerns. A special investigation of conditions, made by the company, leads to the belief that it will not be long before re-equipment will be begun on a generous scale. This applies especially to power houses throughout the country. In this connection the company especially anticipates future developments based on steam turbines, which, it is claimed, have established records for economy and efficiency all over the country. The General Electric also regards the tungsten lamp as a field where excellent business may be expected, and the company is preparing to be especially active in this field.

DEMAND FOR APPARATUS.—The new orders at the shops of the Westinghouse Electric & Manufacturing Company turned in recently are chiefly with the railway department. This includes one for the equipment of 200 cars for the Third Avenue Railway Company, of New York City, with a large amount of power-house apparatus, representing an expenditure approximating $500,000, as noted Jan. 2. Another contract of importance taken is an order for 55 mining locomotives from the Clinchfield Coal & Coke Company, of Clinchfield, W. Va., to be used for the transportation of coal in that company's mines. The East Pittsburg shops are also busy with the construction of a quantity of electric railway apparatus for the Spokane & Inland Railway Company, of Spokane, Wash., to be used in extension of that company's single-phase system. Two 4000-hp water-wheel generators are being furnished to the Southern Power Company, of Charlotte, N. C., along with a lot of auxiliary power-house machinery for the extension of that company's large power transmission system in the cotton-growing district of North Carolina.

PAPER MILL CONTRACT.—An important contract for electrical machinery has just been closed by the Oxford Paper Company, of Rumford Falls, Me., with the Western Electric Company. The machinery purchased includes five motor-generator sets, consisting of five 500-hp, 2,300-volt induction motors, driving 330-kw, 230-volt, direct-current generators, with motor-driven exciters and a 13-panel switchboard. Electrical energy is to be taken from the line of the Rumford Falls Power Company, which is increasing its plant for that purpose. This electrical machinery is to be used in a large new plant which the Oxford Paper Company is now building to manufacture for its own use, bleach liquor and caustic soda by a new electrolytic process invented by Jasper Whiting, of Boston, and developed under his direction during the past three years. The Whiting process employs mercury as an agent, and produces only chemically-pure materials. It is said to be exceptionally economical as regards the use of power and to require only a minimum amount of labor in its operation.

NEW HYDRO-ELECTRIC DEVELOPMENTS.—Mr. H. von Schon, consulting engineer, Wayne County Bank Building, Detroit, Mich., is preparing plans for a 6000-kw hydro-electric plant on the Sturgeon River, Michigan, including a dam 100 ft. high, the power to be transmitted to the copper region near Houghton. The proposals for material include wooden stave and steel plate pipe, hydraulic and electric generating equipment and transmission line fixtures. The same office is also engaged on plans for a hydro-electric plant at Cuyahoga Falls, Ohio for an Eastern syndicate. A fall 350 ft. will be utilized, and the storm run-off is to be stored. This will be the highest head development yet undertaken east of the Rocky Mountains excepting a plant planned by the same engineer at Eugenia, Ont., which has had a head of 400 ft. Mr. von Schon has also been retained by a syndicate to report on the hydro-electric development of Marble Falls, Tex., and the necessary surveys are now being made under his directions.

THE AMERICAN LOCOMOTIVE COMPANY has purchased a plot of 130 acres of land at Gary, Ind., from the Gary Land Company, a subsidiary company of the United States Steel Corporation, and plans are being drawn for a new plant which officers of the locomotive company say will be the most complete and best equipped locomotive works in the world. The land purchased is twice the extent of that occupied by the largest of its present plants, and when fully occupied will give employment to from 12,000 to 15,000 workmen.

TO BUILD BIG TUNGSTEN LAMP PLANT.—The Economy Electric Company, in conjunction with the Peerless Electric Company and the Hydro Electric Company of Warren, Ohio, will shortly begin the construction of a big tungsten lamp factory at Warren. It is proposed to make the factory one of the largest and most complete in the country.

STORAGE BATTERY OUTPUT.—In common with other branches of electrical manufacturing, storage batteries felt the effect of the depression last year, and this was noted in a recent issue of *Electrical World*. Mr. Charles Blizard, vice-president of the Electric Storage Battery Company, in commenting on this situation, considers the statements made as too pessimistic, and in an interesting letter says: "As a matter of fact, our business for 1908 was a considerably larger percentage of our business for 1907 than was reached by most of the other large electrical manufacturing companies. While there was a decrease in large contract work, it was compensated for by a very satisfactory increase in the use of storage batteries for miscellaneous classes of service."

GENERAL ELECTRIC COMPANY'S COPPER MINE.—During the year 1908 the General Electric Company secured from its Bully Hill mine, in California, about 3,500,000 lb. of copper, or about 10 per cent of the total requirements of the company for the year. The mine did not begin to produce until April, and after that time the output was about 400,000 lb. per month. The company hopes to double this amount in the future.

KEYSTONE TELEPHONE COMPANY.—The officials of the Keystone Telephone Company of Philadelphia announce that they will soon have direct trunk lines between Philadelphia and Pittsburg in operation. There is already long distance connection between these cities, but there are not enough circuits to make the service always available.

Financial Intelligence.

THE WEEK IN WALL STREET.

The effect of the decision of the United States Supreme Court in the Consolidated Gas case has been felt in the stock market all week. The hour before the decision was made public gas stock was selling at 165¼; within two days it went as low as 123. This was a decline of 42 points, and while there has been some reaction, the prevailing quotations are still below 130. The effect which this great decline had upon the market was not entirely of a sympathetic nature, although such a break in one issue of necessity affects the entire list. Much of the disturbance in other stocks was due to the selling made necessary by speculative holders in order to secure funds to protect their gas investments. Even with this the strength of the market was indicated by the fact that the general decline only averaged from 2 to 5 points on the week. The dealing in stocks for many months past has been almost entirely speculative and has been done largely by the professionals of the Street. The public has not been investing to any extent, and the regular traders who make a business of watching the ticker and buying and selling have been responsible for the bulk of the trading. Such dealers are rarely willing to take a heavy loss caused by a sudden flurry if they can command the means to protect their holdings. There is another feature connected with the Consolidated Gas decision which, while it has had no effect upon the price of the stocks, has caused considerable discussion among the financiers. This is the practical declaration by Judge Peckham that a public service corporation had a right to earn 6 per cent as a fair return upon its entire investment. It is argued, on the one hand, that such a limitation may interfere with the freedom with which money will be subscribed for new public service ventures, and on the other, that the way public service expenditures are capitalized 6 per cent would be an attractive return upon the actual investment. There is little likelihood that any sort of analysis will develop in the gas decision a menace to corporate interests. The refusal to permit the Government to review the decision overruling the $29,000,000 fine imposed upon the Standard Oil Company by Judge Landis has been regarded as a distinct victory for corporations. While there has been considerable disappointment over the tardiness with which commercial and industrial business has recovered toward normal conditions, and while there is a special disappointment over the fact that orders which were anticipated immediately after the first of the year for iron and steel products are not forthcoming, the general opinion of Wall Street is that improvement is at hand and this opinion is especially strengthened by the liberal growth in railroad earnings. The reports for November for many of the principal roads show enormous gains over the reports for November, 1907, and show very substantial gains over the previous months in 1908. More and more rolling stock is being daily employed and the earning capacity of the railroads, owing to the economies in operation, will compare favorably with those of the flush period. The money market is as yet undisturbed, but there is a feeling of uneasiness lest a time will soon come when substantial increase in rates will be necessary. There is great uneasiness in European centers over the political situation, and the Bank of England's rate of discount is sure to be higher. Already there are some shipments of gold engaged, and the threatened withdrawals by the United States Treasury may seriously reduce the surplus of the national banks. The fact that the expenses of the Government are running something like $10,000,000 a month in excess of its receipts causes a disquieting feeling among conservative financiers. So far this feeling has done nothing in the direction of curtailing the active investment in bonds. Every issue that is offered is rapidly taken up. Money rates Jan. 11 were 1¾ and 2 per cent for call loans, and 3 per cent for 90-day paper. The quotations in the table are those of the close, Jan. 11.

NEW YORK.

	Jan. 4.	Jan. 11.	Shares sold.		Jan. 4.	Jan. 11.	Shares sold.
All Ch.	15⅞	15	1,200	Int.-Met., pfd.	46	43¾	92,800
All Ch., pfd	40⅜	47¾	2,550	Mackay Cos.	70	75*	1,100
Amal. Cop.	82⅜	81⅞	181,195	Mackay Cos., pfd.	70	69¾	1,100
Am. D. T.	35*	35*	——	Manhattan Elev.	152	150	2,370
Am. Loc.	56½	55⅝	9,250	Met. St. Ry.	40	34¾	140
Am. Loc., pfd.	111*	111	350	N.Y. & N.J. Tel.	112*	113	50
Am. Tel. & Cbl	78*	78*	—	Steel, com.	52⅝	51¾	131,910
Am. T. & T.	127¼	126⅝	9,002	Steel, pfd.	112⅞	112⅞	15,496
B. R. T.	69¼	68⅛	177,095	W. U. T.	68	68¼	2,500
Gen. Elec.	156	155½	6,410	Wes'h., com.	85	84	3,100
Int.-Met., com.	17¼	15⅛	64,710	West'h., pfd.	120	120*	200

PHILADELPHIA.

	Jan. 4.	Jan. 11.	Shares sold.		Jan. 4.	Jan. 11.	Shares sold.
Am. Rys.	45	45½	——	Phila. Elec.	11¾	12¼	——
Elec. Co. of A.	11⅜*	11⅜*	——	Phila. R. T.	25½	26	——
Elec. Stor. Bty.	47	44	——	Phila. Traction.	90½*	91¼	——
E. S. Bty., pfd.	40*	40*	——	Union Traction.	51½	52¼	——

CHICAGO.

	Jan. 4.	Jan. 11.	Shares sold.		Jan. 4.	Jan. 11.	Shares sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	127	128	——
Chi. Rys., Ser. 1	116*	116*	——	Met. El., com.	17*	17*	——
Chi Rys., Ser. 2	45½*	45½*	——	Nat'nal Carbon	84*	84¼	——
Com. Edison.	108	108	——	Nat. Carb., pfd.	114	114*	——
Chi. Subway.	25¼	25¼	——				

BOSTON.

	Jan. 4.	Jan. 11.	Shares sold.		Jan. 4.	Jan. 11.	Shares sold.
Am. Tel. & Tel.	127½	126⅝	——	Mex. Tel.	5*	5*	——
Com. Tel.	126	126*	——	Mex. Tel., pfd.	5*	5*	——
Edison El. Ill.	247	247¼	——	N. E. Tel.	126¾*	131	——
Gen. Elec.	157	156	——	W. Tel. & Tel.	8	8*	——
Mass. Elec. Ry.	12	11⅝	——	W. T. & T., pfd.	81	81*	——
Mass. E. R., pfd.	60	59	——				

*Last price quoted.

Shares sold are for week Jan. 4 to Jan. 9.

DIVIDENDS.

American Light & Traction Company, New York, N. Y., common, quarterly, 2 per cent, payable Feb. 1.

American Light & Traction Company, New York, N. Y., preferred, quarterly, 1½ per cent, payable Feb. 1.

Bell Telephone Company of Canada, preferred, quarterly, 2 per cent, payable Jan. 15.

Bell Telephone Company of Philadelphia, preferred, quarterly, 1½ per cent, payable Jan. 15.

Central & South America Telegraph Company, New York, N. Y., preferred, 1½ per cent, payable Jan. 8.

Cincinnati, Newport & Covington Light & Traction Company, Covington, Ky., common, quarterly, ⅝ of 1 per cent, payable Jan. 15.

Cincinnati, Newport & Covington Light & Traction Company, Covington, Ky., preferred, quarterly, 1⅛ per cent, payable Jan. 15.

General Electric Company, Schenectady, N. Y., common, quarterly, [illegible] per cent, payable Jan. 15.

Lowell Electric Light Corporation, Boston, Mass., quarterly, [illegible] per share, payable Jan. 15.

Mexican Light & Power Company, Mexico, Mex., common, quarterly, 1½ per cent, payable Jan. 15.

Mexican Telegraph Company, New York, N. Y., quarterly, [illegible] per cent, payable Jan. 15.

Minneapolis (Minn.) General Electric Company, common, quarterly, 2 per cent, payable Feb. 1.

Minneapolis (Minn.) General Electric Company, preferred, quarterly, [illegible] per cent, payable Feb. 1.

Nebraska Telephone Company, Omaha, Neb., common, quarterly, [illegible] per cent, payable Jan. 10.

Pittsburgh Railways Company, Pittsburgh, Pa., common, quarterly, [illegible] per cent, payable Feb. 1.

WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY.—Mr. George C. Smith, an executive officer and director in many subsidiary Westinghouse companies, has been appointed by the new board of directors of the Westinghouse Electric & Manufacturing Company as its special representative in connection with its interests in a number of electric railway and power companies whose securities are held as investments. Among the companies are the Lackawanna & Wyoming Valley Rapid Transit Company and subsidiary companies; Niagara, Lockport & Ontario Power Company; Electric Power Securities Company, Niagara Falls; Grand Rapids, Grand Haven & Muskegon Railway; Atlanta Water & Electric Power Company. Mr. Smith's headquarters will be in the City Investing Building, New York.

RUTLAND RAILWAY, LIGHT & POWER COMPANY.—William A. Read & Company, Boston and New York; Redmond & Company, Philadelphia and New York, and Warner, Tucker & Company, Boston, offer for subscription at 95 and interest the unsold portion of $1,500,000 first mortgage 5 per cent sinking fund gold bonds of the Rutland Railway, Light & Power Company, Rutland, Vt., dated March 1, 1906, and due March 1, 1946. The bonds are redeemable at 110 and interest as a whole or in amounts of not less than $50,000 on any interest date after March 1, 1916. Mr. Robert L. Warner has been elected a director of the company to represent the bankers who offer the bonds for subscription.

NEW YORK STATE RAILWAYS.—The Guaranty Trust Company, New York, has issued a circular to the holders of the 5 per cent preferred stock of the Rochester Railway quoting a letter from Mr. Horace E. Andrews, president of the Rochester Railway, informing holders that the consolidation of the various electric railways in New York State of which control has been acquired by the New York Central & Hudson River Railroad and the Central Railway Syndicate is being perfected with the approval of the Public Service Commission of the Second District of New York. The name of the new company will be the New York State Railways.

CALIFORNIA GAS & ELECTRIC CORPORATION.—It has been decided to extend until Feb. 1, 1909, the terms of the agreement dated Jan. 20, 1908, which provides for the exchange of the general mortgage and collateral trust 5 per cent bonds of the California Gas & Electric Corporation, San Francisco, Cal., for the new issue of unifying and refunding mortgage 5 per cent 30-year bonds of the company, with a bonus of an amount of common stock of the Pacific Gas & Electric Corporation equal to 25 per cent of the par value of the bonds exchanged.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.—The stockholders of the American Telephone & Telegraph Company, New York, N. Y., at a special meeting on Jan. 7, voted to increase the capital stock of the company from $250,000,000 to $300,000,000, and filed notice of the increase with the Secretary of State of New York at Albany on Jan. 8. The new stock and the $69,413,000 of the unissued stock of the company will be applied for the conversion of the $150,000,000 of 4 per cent convertible bonds of the company into stock. The bonds by their terms are convertible after March 1, 1909.

COMMONWEALTH EDISON COMPANY.—The Commonwealth Edison Company, Chicago, Ill., is offering until Jan. 18 to exchange its first mortgage bonds for $1,483,000 of 6 per cent bonds of the Chicago Edison Company maturing July 1, 1909, and $5,000,000 of 5 per cent bonds of the Chicago Edison Company maturing Sept. 1, 1909. The Commonwealth Edison Company's [illegible] bonds are to be taken [illegible] at 101 and interest, while premiums of 3½ and 2½ are to be allowed, respectively, to holders of the 6 per cent and the 5 per cent bonds.

CHICAGO CONSOLIDATED TRACTION COMPANY.—The bondholders' committee of the Chicago (Ill.) Consolidated Traction Company has extended from Dec. 31, 1908, to Feb. 1, 1909, the time for the deposit of the following underlying bonds of the north division of the Chicago Consolidated Traction Company: Chicago Electric Transit Company; North Chicago Electric Railway; North Side Electric Street Railway; Chicago North Shore Street Railway, and Evanston Electric Railway. The Harris Trust & Savings Bank, Chicago, is depositary.

CHICAGO RAILWAYS.—As there are still outstanding $18,500 of the underlying bonds of subsidiary roads of the Chicago Union Traction Company, out of a total of $25,412,500, the Chicago Railways Company has authorized the Harris Trust & Savings Bank, Chicago, depositary, to accept deposits up to Feb. 1, 1909, so that the holders of the securities still outstanding may participate in the reorganization plan.

CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY.—The Consolidated Gas, Electric Light & Power Company, Baltimore, Md., has sold $2,475,000 of 4½ per cent general mortgage bonds held in the treasury to E. H. Rollins & Sons, Boston, and Drexel & Company, Philadelphia. Including the $2,475,000 of bonds just sold, there are now outstanding $5,200,000 of the 4½ per cent issue.

COMPANIA DE TRAMVIAS DE MEXICO, S. A.—Mr. F. S. Pearson, president of the Compania de Tramvias de Mexico, Mexico City, Mex., is reported to be negotiating for the purchase of the Chihuahua & Pacific Railroad, and the property of the Sierra Madre Land & Lumber Company, in behalf of the Canadian syndicate which controls the Compania de Tramvias de Mexico.

UNITED POWER & TRANSPORTATION COMPANY.—Mr. Charles Henry Jones and Mr. John W. Ellard have been appointed receivers of the Southwestern Street Railway by Judge Howland, in the United States Circuit Court, Philadelphia. The United Power & Transportation Company, Philadelphia, Pa., owns 7995 shares of the 8000 shares of the Southwestern Street Railway.

CICERO & PROVISO STREET RAILWAY.—The protective committee of bondholders of the Cicero & Proviso Street Railway, Chicago, Ill., has extended until Jan. 20 the time for depositing bonds with the Illinois Trust & Savings Bank, Chicago, depository. Of the outstanding issue of $1,948,000 more than $1,500,000 have been deposited.

MERCHANTS' HEAT & LIGHT COMPANY.—The stockholders of the Merchants' Heat & Light Company, Indianapolis, Ind., have authorized an increase of $500,000 in the common stock. The company proposes to erect an additional plant in the western part of Indianapolis.

WEST END STREET RAILWAY.—The committee of stockholders of the West End Street Railway, Boston, Mass., which was appointed to investigate the proposed merger with the Boston Elevated Railway has received the indorsement of holders of 131,209 shares of stock.

MILLIKEN BROTHERS.—Judge Holt, in the United States District Court, on application of Mr. William N. Cromwell, has signed an order extending the receivership of Milliken Brothers, New York, N. Y., to March 1, 1909.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges	Surplus.
Bangor Railway & Electric Company, Bangor, Me.:					
Year ended June 30, 1908	$528,282	$288,616*	$239,666	$131,850	$107,816
Year ended June 30, 1907	470,778	258,879	211,899	93,671	117,785
[illegible] Electric Company:					
November, 1908	10,671	6,051	4,620	..	.....
November, 1907	10,238	5,672	4,566	..	.....
[illegible] (Mo.) Railway & Light Company:					
[illegible]	543,514	300,966	242,548	153,899	88,649
[illegible]	518,424	276,030	242,394	151,099	91,295
[illegible] Company, New York, N. Y.:					
Quarter ended Dec. 31, 1908	197,500	48,500	149,000	.. ..	.. ..
[illegible]	212,000	43,000	169,000	.. ..	.. ..
Joseph (Mo.) Railway, Light, Heat & Power Company:					
[illegible]	83,259	36,848	46,411	..	.. ..
[illegible]	74,172	36,170	38,002	.....	.. ..
[illegible] Los Angeles, Cal.:					
[illegible]	362,529	116,721	245,808	103,400	142,408
[illegible]	301,752	100,821	200,931	61,728	139,203
[illegible] Railway Company, New York, N. Y.:					
[illegible]	305,383	282,132	25,221	17,112	8,109
[illegible]	371,592	297,846	73,856	17,112	56,742

GENERAL NEWS

Construction News.

CHICO, CAL.—It is reported that the Sierra Electric Power Company will soon commence operations in Chico. The company's plant will be located on Digger Creek, 15 miles from the foot of Mount Lasson, 50 miles north of Chico.

OAKLAND, CAL.—The Seventh Street Improvement Club has awarded the contract for furnishing and erecting 150 electroliers on Seventh Street to the United Iron Works, of Oakland, for $16,000.

OAKLAND, CAL.—The California Electrical Generating Company has issued a deed of trust to the Central Trust Company, of New York, giving as security all the holdings of the company. The company is capitalized at $7,500,000 and owns valuable rights in the Sierra, which it proposes to develop. It will generate and transmit electricity from the mountains to the bay cities. Guy C. Earl is president of the company and W. H. Spaulding is secretary.

OAKLAND, CAL.—The Big Bend power plant of the Great Western Power Company was put into operation Dec. 18. Only 15,000 hp is being generated at present; the amount will be increased immediately, and during the month of January it is expected that 50,000 hp will be produced. The transmission lines have been completed to Oakland. The company has expended so far $12,000,000. The output of the Big Bend plant is to be increased to 100,000 hp. It is said that the company next year will begin the construction of a large dam at Big Meadows, where another power plant will be located. When the system is completed the company will have a total output of 450,000 hp. H. P. Wilson is secretary.

OROVILLE, CAL.—The Oroville Water, Light & Power Company is constructing a transmission line from Oroville to the Big Blue Lead Mine near Bangor.

PASADENA, CAL.—C. W. Koiner, manager of the municipal electric light plant, in his report submitted to the City Council recommends the purchase of the distributing system and equipment of the Edison Electric Company at a fair valuation. The Council is considering plans to increase the output of the municipal electric plant to furnish electricity for commercial purposes, which will require an expenditure of about $150,000, as follows: For installing a 750-kw generating unit in the power station at a cost of $52,000; pole line equipment, extending the system to all parts of the city, making 1600 additional service connections, to cost about $100,000.

SAN ANDREAS, CAL.—Frank Z. Towle has filed notice of appropriation of 30,000 cu. in. of water of South Fork of Mokelumne River and 20,000 cu. in. of water in the Middle Fork of Mokelumne River.

GREELEY, COL.—The contract for furnishing electricity for lighting the streets and public buildings of Greeley has been awarded to the Home Electric Light & Power Company. The company agrees to furnish 7.5-amp arc lamps at the rate of $84 per lamp per year, with an all night and every night service, and five cents per kw-hour for electricity for the city library. Electricity for lighting the City Hall and other service is furnished free of charge. The company will at once install transformers, distributing system, lamps, etc. Robert McF. Doble, Majestic Building, Denver, Col., is consulting engineer.

HARTFORD, CONN.—The Rocky River Power Company will apply to the State Legislature for a franchise to develop water power in the Housatonic River in Litchfield County. The company proposes to erect dams across the river in the towns of Cornwall and Sharon to generate electricity to operate manufacturing plants in both towns.

MANCHESTER, CONN.—The Glastonbury Power Company has applied to the Legislature for amendments to its charter allowing it to lease the property and franchise to the Manchester Light & Power Company with power to do all things necessary to supply electricity and gas within the territory of the Manchester company.

MERIDEN, CONN.—Cornelius J. Danaher, of Meriden, has applied to the State Legislature for a charter to construct an electric railway from Meriden to Berlin, Conn., with a branch to the Berlin station; also from the Meriden-Mildale electric railway through Kensington to a connection with the Berlin-New Britain railway at Berlin Junction; also from a point on the latter route to connect with the Arch Street line in New Britain, Conn.

PUTNAM, CONN.—The Putnam Light & Power Company is installing a 150-kw generator, which will be operated by water power at the French River Textile Company in Mechanicsville. R. F. Thurston is manager.

WILMINGTON, DEL.—The Street and Sewer Commissioners have extended the contracts for lighting the city with enclosed arc lamps until March 1. The present contracts expired Jan. 1.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until Jan. 30 for installing one electric [illegible] at the Navy Yard, Mare Island, Cal. Plans and specifications may be obtained at the office of the bureau or to the commandant of the Navy Yard, Mare Island. R. C. Hollyday is chief of bureau.

WASHINGTON, D. C.—Bids will be received until Jan. 19 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various naval stations and navy yards the following supplies: Boston, Mass.: Schedule 788—Changing the frequency changer in the central power station to motor generator. Norfolk, Va.: Schedule 789—Furnishing and erecting a switchboard.

CEDARTOWN, GA.—Arrangements are being made by the Water and Light Department to install a duplicate generating unit in the municipal electric plant in the spring. A day service will also be established. W. T. Hardy is superintendent.

COVINGTON, GA.—Plans are being considered by D. W. Wilson, of the Oak Hill section, to install an electric light plant in connection with his mill, to furnish electricity for lamps in that district.

EAST POINT, GA.—Bids will be received by the Mayor and City Council until Jan. 19 for furnishing material and erecting at East Point, Ga., electric light plant, water works and sewerage system, as follows: One 150-hp boiler, 72 x 18 stack; two 750,000 gal. in 24 hours compound duplex pumps; one boiler feed pump; one 125-hp direct-connected four-valve engine; one air compressor and receiver; 75 hydrants; 700 tons cast iron pipe and specials, etc., and construction of pumping station; one 100-kw alternating-current generator, direct connected; 25 arc lamps and regulator, switchboards and feeder panels, including all instruments, and the erection of transmission lines. Specifications can be secured by applying to E. H. Davis, engineer, Griffin, Ga. J. C. McKenzie is mayor.

ELBERTON, GA.—Plans are being considered for extensions and improvements to the municipal electric light plant, which will include the installation of a larger alternator, a 50-hp motor and turbine pump. G. W. Hubbard is superintendent.

GAINESVILLE, GA.—We are informed that surveys have been completed by the Atlanta, Norcross & Gainesville Electric Railway Company for the first section of its proposed electric railway between Atlanta and Norcross. From Norcross the railway is to be extended through Buford and Flowery Branch to Gainesville. H. D. Jaquish, of Gainesville, Ga., is general manager and E. Philbrick, of Baldwin, is chief engineer.

HONOLULU, HAWAII.—Plans have been completed for the proposed power plant to be erected in Nuuanu Valley which will furnish electricity for lighting the city and to operate the pumps in connection with the water works system. Electricity will be transmitted from the plant in Nuuanu to the Beretania Street pumping plant, a distance of six miles. It is proposed to erect two smaller power houses.

IDAHO FALLS, IDAHO.—A. V. Scott, president of the Idaho Power & Transportation Company, writes that the company is planning to double the output of its present plant.

LAPWAI, IDAHO.—J. W. Fenderson, of Lapwai, contemplates installing an electric light plant in this place.

SODA SPRINGS, IDAHO.—The Soda Springs Electric Company is planning to extend its transmission lines to Alexandria and Davisville in the spring. A. L. Cook is superintendent.

ALTAMONT, ILL.—The Effingham County Telephone Company has increased its capital stock from $8,000 to $10,000.

AURORA, ILL.—The City Council has authorized the lighting committee to purchase incandescent lamps for the new electric light system.

CASEYVILLE, ILL.—The County Commissioners have granted a franchise to the East St. Louis & Caseyville Electric Railway Company to construct an electric railway through East Lansdowne Heights to Caseyville.

CHICAGO, ILL.—The City Council has granted the Illinois Tunnel Company a two-year extension of its franchise without any requirement that it extend its service.

CHICAGO, ILL.—[illegible] a report submitted to the city's special subway [illegible] has recommended [illegible] subways extending for more than three [illegible] in connection with the underground traction system, the cost of which is estimated at $[illegible]. The plans [illegible] provide for [illegible] tracks capable of [illegible] cars and [illegible] cars each hour.

CHICAGO, ILL.—[illegible] that the Atchison, Topeka & Santa Fe [illegible] its [illegible] line [illegible] Contracts have been let for the installation of the system between Kansas [illegible]. The cost of the entire work is estimated at [illegible].

CHICAGO, ILL.—Bids will be received at the office of the business manager of the Board of Education, 730 Tribune Building, Dearborn and Madison Streets, Chicago, Ill., until Jan. 20, for the following work: For masonry, sheet metal, composition roofing, structural iron, carpentry, [illegible] work, gas fitting, heat regulation, ventilation, etc., in the Blaine

School gymnasium addition and the Smyth School gymnasium; electric work in the Marshall High School addition; telephones and bells in the Tilton School and Trumbull School. Proposals must be made out on the regular printed forms to be obtained at the office of D. H. Perkins, architect of the board, and T. J. Waters, chief engineer, which may be seen at the office of the architect, 714 Tribune Building.

JOLIET, ILL.—Plans have been prepared by Charles Munroe, general manager of the Economy Light & Power Company, for lighting by electricity the whole business district of Joliet; also the removal of all telegraph, telephone and electric transmission lines from the streets.

MOLINE, ILL.—The People's Power Company has increased its capital stock from $1,000,000 to $2,000,000. It is said that the company proposes to make extensive improvements to its electric and gas systems. F. W. Reimers is general superintendent.

PEKIN, ILL.—The County Board is considering the question of purchasing an electric light plant for the county infirmary. For further information address the superintendent.

PROPHETSTOWN, ILL.—The capital stock of the Prophetstown Mutual Telephone Company has been increased from $6,500 to $10,000.

SORENTO, ILL.—The Sorento Electric Light Company is making arrangements to enlarge its plant in the spring and will be in the market for a 150-hp engine and a generator of from 75 to 100 kw. The plant will be changed from direct to alternating current system. Thomas Scharf is president and manager.

WORDEN, ILL.—The question of issuing $12,000 in bonds to establish a municipal electric light plant in Worden is under consideration.

BLUFFTON, IND.—A petition has been filed with the County Commissioners asking for a special election to vote on a subsidy of $10,000 in aid of the construction of the Bluffton, Berne & Celina Interurban Railway.

BROWNSTOWN, IND.—The Brownstown Water, Light & Traction Company contemplates the construction of an electric railway connecting Seymour, Brownstown, Salem, West Baden and French Lick, a distance of about 70 miles. The company operates an electric light plant and water-works system in Brownstown and expects to extend its transmission lines to Valloma in the near future to supply electricity for lamps. The power station and repair shops will be located in Brownstown. W. B. Holton, of Indianapolis, is president and general manager.

EVANSVILLE, IND.—Mayor Boehme, in his annual message, advocates the construction of a municipal electric light plant. The city's lighting contract with the Evansville Gas & Electric Light Company expires Aug. 11, 1910, and the Council is urged to take up the matter at once and, if possible, secure a municipal plant by the time the present contract expires.

FOWLER, IND.—The Fowler Utilities Company contemplates the installation of a new engine and generator, direct connected, meters, transformers, overhead material, electric drive for deep well pumps, new boiler settings and new switchboard. R. J. Chapman is manager.

FRANKFORT, IND.—The managers of the municipal electric light plant are planning to extend the transmission lines to Mulberry and Kirklin, Ind. W. H. Carter is superintendent.

INDIANAPOLIS, IND.—An appropriation is being asked of the Legislature for the construction and equipment of an electric light plant in connection with the State House.

INDIANAPOLIS, IND.—The Peoples' Light & Heat Company is planning to construct a plant at the coal fields and transmit electricity to Indianapolis, a distance of 75 miles. Paul H. White is secretary.

INDIANAPOLIS, IND.—The Indiana, Ohio & Illinois Railroad Company will commence work on the construction of its proposed electric railway in the near future. The railway will be about 200 miles long, connecting Indianapolis and Chicago, Ill., and intervening points. Thomas P. Kiser, of Indianapolis, Ind., is president and general manager.

INDIANAPOLIS, IND.—The stockholders of the Merchants' Heat & Light Company have voted to increase the capital stock of the company from $150,000 to $500,000 and the bonded indebtedness from $500,000 to $2,000,000, the proceeds to be used to enlarge and extend its plants. The company proposes to erect a new plant in the western part of the business section of the city.

JEFFERSONVILLE, IND.—Bids will be received until Jan. 22 at the general depot, quartermaster department, Jeffersonville,, Ind., for electrical supplies, etc., required for replenishment of stock, as per schedule, which will be furnished on application at this depot.

KENTLAND, IND.—It is reported that the Kentland Light & Ice Company, recently incorporated, will soon ask for proposals for the construction of a combined electric light, water and ice plant. Hugh Hill is president.

NEW ALBANY, IND.—The City Council on Jan. 4 instructed Mayor Best to advertise for bids for lighting the streets of the city and to furnish gas for a period of 10 years from July, 1910, at which time the contract with the United Gas & Electric Company expires.

[illegible]LEY, IND.—The Farmers' Independent Telephone Company, recently incorporated, is in the market for material and construction of an exchange and telephone plant in this town and throughout Vigo and Clay counties. Hartley Brill is president and Henry Haas secretary.

ST. PAUL, IND.—The Town Board will soon ask for bids to furnish material and labor for wiring the town for electric lighting, electricity for which is to be obtained from the Indianapolis & Cincinnati Traction Company.

[illegible], IND.—A movement is on foot to construct and equip an electric light plant in this city.

TOLESTON, IND.—The Michigan City Gas & Electric Company has applied to the Town Council for a franchise in Toleston. The Ganz Heat, Light & Water Company has also petitioned for a franchise in this town.

VINCENNES, IND.—Arrangements are being made by the Vincennes Electric Company to install a 150-hp Houston, Stanwood & Gamble boiler in its plant. A. J. Heitz is superintendent.

CLINTON, IA.—Work has commenced on the construction of the new power house for the Chicago & Northwestern Railroad Company. The plant will furnish electricity for lamps, heat and power for the bridge, interlocking plants, switches, depot and other buildings.

GREENE, IA.—The Greene Electric Light & Power Company has constructed a dam on the property purchased from the Greene Manufacturing Company and is planning to connect its electric plant with the water power plant this year. The company proposes to erect a new power house, which will be equipped with a water wheel, a 150-kw generator and switchboard. A day service will be established when the plant is completed. R. Miner is secretary.

GRUNDY CENTER, IA.—An election will be held Jan. 20 to vote on the proposition of granting a franchise to the Iowa Construction Company to construct and operate a street railway, electric power plant, gas plant and telegraph system in Grundy Center.

MISSOURI VALLEY, IA.—Plans are being considered by the Missouri Valley Electric Light Company to install a gas plant in the spring. H. E. Anderson is president and manager.

OSCEOLA, IA.—The Osceola Light, Heat & Power Company is planning to install an ice plant in the near future. J. E. Barnard is manager.

LARNED, KAN.—The C. W. Smith Electric & Ice Company contemplates extending its transmission lines to small towns, which will require the erection of about 20 miles of transmission line.

MADISON, KAN.—The Madison Light & Ice Manufacturing Company is planning to install a 150-hp boiler in its plant. F. L. Krueger is president of the company.

LEBANON, KY.—The Lebanon Light, Ice & Power Company is contemplating increasing the output of its plant and overhauling all its lines. R. T. Melton is superintendent.

OWENSVILLE, KY.—The City Council has voted to require the Cumberland Telephone & Telegraph Company to remove all its poles and wires from the streets of this city. It is claimed that the company is operating without a franchise.

THIBODAUX, LA.—The Board of Aldermen is considering the question of remodeling the municipal electric light plant or building a new one.

PEMBROKE, MAINE.—We are informed that the Pennamaquam Power Company is planning to rebuild its plant soon. E. Cushing is engineer.

PORTLAND, MAINE.—The Portland Railroad Company is planning to install a motor generator at the power house of the Cape division, and arrangements have been made with the Consolidated Electric Light Company to furnish electricity to operate the same.

RUMFORD FALLS, MAINE.—The Oxford Paper Company has placed an order with the Western Electric Company for machinery for the manufacture of bleach liquor and caustic soda by a new electrolytic process invented by Jasper Whiting, of Boston, Mass. The equipment includes five motor-generator sets, each consisting of a 500-hp, 2300-volt induction motor direct connected to a 330-kw, 220-volt direct-current generator. Electricity for operating the plant will be furnished by the Rumford Falls Power Company.

ANNAPOLIS, MD.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Jan. 19 to furnish a quantity of naval supplies at the Naval Academy, Annapolis, Md., as follows: Schedule 800—motor generator set. Schedule 804—pipe, dynamo, etc. Applications for proposals should designate the schedule desired by number. Blank proposals will be furnished upon application to the navy pay office, Baltimore, Md., or to the above bureau. E. B. Rogers is paymaster-general, U. S. N.

CAMBRIDGE, MD.—R. B. Fentress, of Baltimore, Md., and associates are making arrangements to install an electric light plant in Cambridge, contracts for the construction of which have already been awarded. It is proposed to incorporate a company under the name of the Cambridge Light & Power Company to operate the plant. The directors for the first year will be R. B. Fentress, W. H. Medford, Phillips L. Goldsborough, Albanus Phillips and John H. Burgess. Cambridge already has an electric lighting system installed by the gas company.

DANVERS, MASS.—The municipal electric light plant is making a good showing, and the income is such as to warrant a recommendation for a reduction in the charges for electricity for lighting purposes. It is said that Superintendent Lynch is to recommend to the town through the commissioners a reduction in the charge for arc lamps from $56 to $50 per year and for incandescent lamps from $15 to $12 per lamp per year; also for electricity to private consumers from 11 cents to 10 cents per kw-hour.

SHELBURNE FALLS, MASS.—The Heath Telephone Company has taken over the system of the Deerfield Valley Telephone Company. The headquarters on Bridge Street will be retained.

SHELBURNE FALLS, MASS.—The machinery in the new power station of the Shelburne Falls Electric Light & Power Company has been placed and will soon be put in operation. The company is planning to establish a 24-hour service in the near future.

TAUNTON, MASS.—The municipal electric light department is making extension to the street lighting system in Whittenton and is installing lamps on Danforth, West Britannia, Pleadwell, Van Buren, Waverly, Bay Streets and Power Avenue.

ANN ARBOR, MICH.—The Eastern Michigan Edison Company has come into possession of water power rights on the Huron River, formerly controlled by Frank J. Cornwell and John Duffy, of Ann Arbor. It is said that the company will furnish electricity in Ann Arbor, Dexter and Chelsea for lamps and motors.

BIG RAPIDS, MICH.—The electric plant of the W. E. Donley Electric Light & Power Company was recently destroyed by fire. The water turbine plant was only slightly damaged. It is said that the plant will be rebuilt at once.

CHASSELL, MICH.—The electric plant of the Worcester Lumber Company has been put in operation and is furnishing electricity for street lighting service. It is expected a residence lighting service will be established. The plant has an output sufficient to supply 1000 incandescent lamps.

CHELSEA, MICH.—Plans are being considered to increase the output of the municipal electric light plant, which will include the installation of a direct-current unit, direct connected, and a water-tube boiler. J. F. Maier is manager.

DETROIT, MICH.—Bids will be received at the office of the Public Lighting Commission, 40 Atwater Street, East Detroit, Mich., until Jan. 18 for the installation of an electrical generating plant in the municipal electric lighting plant in accordance with plans on file in the office of the commission. F. T. Bowler is secretary of the commission.

DETROIT, MICH.—Plans are being prepared by H. von Schon, Detroit, Mich., consulting engineer, for the construction of a hydro-electric plant on the Sturgeon River in the Upper Peninsular. The work will include the construction of a dam, 100 ft. high; wooden and steel plate pipes, hydraulic and electric equipment and transmission line apparatus. The plant will have an output of 6000 kw, which will be distributed in the copper region near Houghton, Mich.

STANDISH, MICH.—The Michigan State Telephone Company has leased all the lines of the Northeastern Telephone Company, which extends into 15 counties, including this county, north of Bay City and east of the M. C. R. R. to the Straits of Mackinac. The system includes over 600 miles of lines, which will be under the management of Superintendent Saunders, of Bay City, Mich.

STURGIS, MICH.—The Board of Public Works is contemplating changing the street lighting system from direct current to alternating current. B. T. Barton is manager.

WALTON, MICH.—The Township Board has granted the Western Michigan Power Company a franchise to erect its transmission lines in this town, for a consideration of $50 per mile. The general offices of the company are at Cadillac, Mich.

WYANDOTTE, MICH.—The Board of Public Works is considering the question of improving the street lighting system. It is proposed to rearrange the circuits and erect heavier wires.

BAUDETTE, MINN.—The managers of the municipal electric light plant are contemplating the installation of a new 75-hp steam engine in the plant next summer. J. A. Gjelhaug is superintendent.

MINNEAPOLIS, MINN.—Mayor J. C. Haynes in his message advocates the construction of a municipal electric light plant.

PARK RAPIDS, MINN.—A franchise has been granted to L. H. Hide to establish an electric lighting system in Park Rapids.

PINE CITY, MINN.—Plans are being considered by the Snake River Power Company to develop water power of Snake River. It is proposed to dam the river about seven miles east of Pine City and erect transmission lines to Hinckley and Rush City. J. M. Allen is interested in the enterprise.

WINONA, MINN.—The Winona Railway & Light Company will obtain electrical energy from the La Crosse Water Power Company after Jan. 15 for operating its system. N. M. Argobright is general superintendent.

McCOMB, MISS.—The McComb City Electric Light & Power Company is installing a 675-kw generator in its plant. A. H. Jones is general manager.

MERIDEN, MISS.—The Home Telephone Company is planning to extend its telephone lines to Whitfield, Ala. The company, it is said, contemplates an expenditure of about $[illegible].

BETHANY, MO.—Plans are being made for increasing the output of the municipal electric light plant, which will include the installation of a new generator. J. F. Slinger is superintendent.

KANSAS CITY, MO.—Bids will be received at the office of the County Clerk, Court House, Kansas City, Mo., until Feb. 3 for the construction of a power and laundry building and smokestack at the Jackson County Home for the Aged and Infirm, at the County Farm near Little Blue. Specifications for said work may be seen at the office of Smith & Rea, architects, Dwight Building, Kansas City, Mo. Samuel A. Boyer is county clerk.

MAITLAND, MO.—Arrangements are being made by the Maitland Electric Light & Power Company to increase the output of its plant in the near future and extend its transmission lines to two towns, one two miles distant and the other seven miles, to furnish electricity for lamps. A Munzel gas engine and producer, manufactured by the Minneapolis Steel & Machinery Company, of Minneapolis, Minn., will be installed. T. R. Mueller is president and manager.

SEDALIA, MO.—The Sedalia Ice, Light & Fuel Company is considering the question of increasing the output of its plant and will install a 150-kw, 2200-volt, alternating-current generator in the near future. E. R. Andler is manager.

SENATH, MO.—The Senath Telephone Company has increased its capital stock from $6,000 to $20,000.

BILLINGS, MONT.—Surveys are being made and rights of way secured by the Billings & Cooke City Railway Company for its proposed electric railway, which will extend from Billings to Cooke City, a distance of 110 miles. The company expects to resume work in April. Electrical energy for operating the railway will be purchased from the Madison River Power Company. George H. Savage, of Billings, is secretary and general manager.

GLENDIVE, MONT.—The Hughes Electric Light Company is contemplating the installation of a steam heating system. Frank O. Hughes is secretary and manager.

MISSOULA, MONT.—The County Commissioners have granted to H. R. Wharton, of Butte, Mont., representing the W. A. Clark interests, a 50-year franchise to operate a street railway on the new Higgins Avenue Bridge and also the privilege of erecting transmission lines for the distribution of electricity for lamps and motors.

ALBION, NEB.—The citizens on Jan. 5 voted to issue bonds for the construction of a municipal lighting and heating system.

TONOPAH, NEV.—Surveys have been completed and work will soon commence on the erection of the transmission line of the Nevada-California Power Company to Round Mountain and Manhattan. The line to Manhattan will be 36 miles long.

LITTLETON, N. H.—The proposition to construct a dam on the Connecticut River between Dalton and McIndoes, Vt., has been revived. A Littleton company has the franchise for such a project.

MILTON MILLS, N. H.—Plans are being considered by John E. Townsend, owner of the local electric light plant, for the installation of a storage battery.

AVALON (P. O. PEERMONT), N. J.—The citizens on Dec. 22 voted against the proposition to issue $12,000 in bonds for a municipal electric light plant.

MENDHAM, N. J.—Plans are being considered to establish a municipal electric light plant for the borough, for which surveys have recently been made.

NEWARK, N. J.—Arrangements are being made by Willis Depuy, manager of the electrical department of the Montclair branch of the Public Service Corporation for extending the electric lighting service to the Borough of Roseland, N. J. Contracts have been placed for lighting about 30 residences. The company expects to secure a contract for lighting the streets of the borough, the system to be ready for operation in the spring.

RUTHERFORD, N. J.—The Borough Council has entered into a contract with the Public Service Corporation for lighting the streets of the borough for a term of three years. The company is to furnish all incandescent lamps at $16 per lamp for the first year and the other two years at $18 each per year; arc lamps at $80 each for the first year and $85 per lamp for the next two years. The company is to furnish three arc lamps and one incandescent lamp free of charge.

BERGEN, N. Y.—The Public Service Commission has authorized the village of Bergen to construct and maintain a municipal electric light plant and water-works system.

BROOKLYN, N. Y.—Bids will be received at the office of Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Jan. 15: No. 1, for providing all labor and materials required for the inspection and maintenance of electrical apparatus at the Kings County Hospital, Borough of Brooklyn; No. 2, for providing all labor and materials required for the inspection, maintenance and repairs to the elevators and motors, regulating devices and machinery on the base, with all devices thereunto necessary to maintain such in operative condition at the Cumberland Street Hospital, Borough of Brooklyn. The bidder will state one aggregate price for each contract, described and specified, as each contract is entire for a complete job. Blank forms and further information can be obtained at the office of the supervising engineer at the above-mentioned place and specifications may be seen. Robert W. Hebberd is commissioner.

ITHACA, N. Y.—The Ithaca Telephone Company is making arrangements to construct a telephone line to Newfield, a distance of eight miles.

JAMESTOWN, N. Y.—Plans are being considered for the installation of a 500-kw steam turbine in the municipal electric light plant. Charles [illegible] is manager.

MEDINA, N. Y.—The New York & North Shore Traction Company has applied to the Public Service Commission of the Second District

for a certificate of necessity and convenience to extend its Nassau County system into Queens County.

NEW YORK, N. Y.—The Board of Public Service Commission has granted a certificate of public convenience and necessity to the New York, Westchester & Boston Railway Company with a certificate approving the franchise to construct the railway.

NEW YORK, N. Y.—Bids will be received by the State Commission in Lunacy at the office of F. A. Wheeler, Ward's Island, New York, N. Y., until Jan. 18, for supplying New York State Hospitals with incandescent lamps for one year. Applications for specifications may be addressed to F. A. Wheeler.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until Jan. 15, 1909, for providing all labor and materials for the inspection and maintenance of electric apparatus on Blackwell's Island, the central office, Bureau of Dependent Adult and Morgue, Borough of Manhattan, New York. Blank forms and further information may be obtained at the office of the supervising engineer of the department at the above office, where plans and specifications can be seen. Robert W. Hebberd is commissioner.

PATCHOGUE, N. Y.—The South Shore Traction Company has applied to the Public Service Commission for a franchise to extend its system through Jamaica, thence across the Queensboro Bridge.

PORTAGEVILLE, N. Y.—Plans are being made to erect a power plant at the grist mill dam and erect a transmission line to the Genesee Valley Blue Stone quarries, two miles distant. The equipment of the plant will include a 100-hp dynamo, two 15-hp motors with transformers.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has been granted permission by the Department of Public Works to construct and maintain an eight-duct conduit underneath the Erie Canal in Lyell Avenue.

SCHAGHTICOKE, N. Y.—An electric street lighting system of 40 incandescent lamps of 40 cp is being installed in this village. Electricity for operating the system will be furnished by the Schenectady Power Company, of Schenectady, N. Y.

MT. OLIVE, N. C.—Plans are being considered by the lighting committee to install a meter system or flat rate controller in connection with the municipal electric light plant. T. Eldridge is manager.

ROCKINGHAM, N. C.—It is reported that plans are being made for the reorganization of the Rockingham Power Company, which was recently placed in the hands of receivers. The company has a 30,000-hp power plant at Blewett's Falls, N. C., designed to furnish power to cotton mills in that section of the State.

BELFIELD, N. D.—The construction of an electric light plant in Belfield is under consideration.

AKRON, OHIO.—H. von Schon, of Detroit, Mich., consulting engineer, is preparing plans for the construction of a hydro-electric plant at the Cuyahoga Falls, Ohio, where a fall of 350 ft. will be utilized.

BUCYRUS, OHIO.—The injunction granted by Judge Babst on the petition of a taxpayer, restraining the city from issuing bonds for the construction of a municipal electric light plant, was dissolved by Judge Young on Jan. 4. The city voted to issue $90,000 in bonds for the construction of the plant.

CLEVELAND, OHIO.—The Massillon, Wooster & Mansfield Traction Company expects to commence work on construction of its railway this summer. The company proposes to furnish electricity for lamps. G. A. Bartholomew, of Cleveland, Ohio, is president and chief engineer.

ELYRIA, OHIO.—The Elyria Milling & Power Company is making extensive additions and improvements to its plant, which will include the installation of a 350-hp Trump water wheel, one 200-kw, 2200-volt, alternating-current Westinghouse generator, one 50-kw, direct-current Westinghouse dynamo and a 250-hp gas engine. J. E. Murbach is president and manager.

LIMA, OHIO.—Final plans and estimates for the construction of a municipal electric light plant have been submitted to the Board of Public Service by C. E. F. Ahlm, of Cleveland, Ohio, in compliance with the order of the court for an operative plant. According to the plans submitted the plant will cost $76,873, guaranteeing street arc lamps at $38.54 per year and to furnish electricity for commercial lighting at 2½ cents per kw-hour. The city is now paying the Ohio Electric Railway Company $85 per year for each arc lamp and from 6 to 12 cents per kw-hour for electricity for commercial purposes.

SPRINGFIELD, OHIO.—M. J. Bahin, city engineer, in his annual report to the Board of Public Service, recommends placing all electric and other wires underground in the business section of the city.

BARTLESVILLE, OKLA.—The Bartlesville Electric Light & Power Company is installing a 500-kw, 60-cycle, 2300-volt, alternating-current steam turbine, a 500-hp water-tube boiler and a new arc-lamp, street-lighting system, and about four miles of transmission lines. S. J. Smallwood is president and manager.

BLACKWELL, OKLA.—The Blackwell Electric Light & Power Company contemplates installing gas engines in its plant. Garrett Waite is president and manager.

PAWNEE, OKLA.—Plans are being considered to remove the municipal electric light plant about one mile from the present location. M. H. [illegible]

WILLETTA, OKLA.—The Willetta Light & Water Company [illegible] the construction of a power line to furnish electricity to a power [illegible] to H. Stagg, engineer.

CANBY, ORE.—M. J. Lee has been granted a franchise to erect a light and power system in Canby.

PENDLETON, ORE.—The Peacock Mining Company has filed notice of appropriation of 5000 cu. in. of water on the Walla Walla River, which will be utilized to generate electricity.

PANAMA.—Bids will be received at the office of the general purchasing officer, Panama Canal Commission, Washington, D. C., until Jan. 30 for furnishing electric motors. Blanks and general information relating to the contract (No. 4788) may be obtained from the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y., Custom House, New Orleans, La., and 1326 North Point Street, San Francisco, Cal.

AMBRIDGE, PA.—Surveys are now being made for the proposed electric plant of the Ambridge Electric Light, Heat & Power Company.

BIRDSBORO, PA.—The Birdsboro Electric Company is contemplating changing its system from single-phase 133 cycles to two-phase 60 cycles and establishing a day service. George Brooke, Jr., is president and manager.

CLARION, PA.—The Borough Council has granted the Clarion & East Brady Electric Railway Company a right of way through the borough. The company proposes to construct an electric railway from Clarion to East Brady via Sligo, a distance of 25 miles. G. E. Arnold, F. M. Arnold and T. S. Arnold, of Clarion, are interested in the project.

ELLWOOD CITY, PA.—Bids will be received by W. E. McElroy, borough clerk, until Jan. 19, for furnishing and installing complete the following equipment in the municipal electric light plant: One 140 to 150 hp vertical or horizontal gas engine, belted or direct-connected type; one 100-kw, two-phase, 2400-volt, 60-cycle, alternating-current generator, [illegible] and one switchboard. Plans and specifications on file in office of the borough clerk.

McKEESPORT, PA.—The contract for furnishing electricity for lighting the new filtration plant and grounds has been awarded to the Monongahela Light & Power Company, of McKeesport, Pa., for a term of five years, at 3½ cents per kw-hour.

STOYESTOWN, PA.—The contract for lighting the city with arc and incandescent lamps has been awarded to the Stoyestown Light, Heat & Power Company for a term of one year, beginning Jan. 1, 1909. The company will also furnish electricity for lamps and motors for residences and manufacturing plants. Daniel Long is president.

PROVIDENCE, R. I.—The combination of all gas and electric companies in the Blackstone Valley, including those in the cities of Providence and Pawtucket, has been effected, for which purpose the Blackstone Gas & Electric Company was incorporated last year. A collateral trust bond of $5,000,000 to the Slater Company to cover the bondholders of the company has been filed in Pawtucket by Stone & Webster, of Boston, Mass. The new company is the holding corporation of the Pawtucket Gas Company, the Pawtucket Electric Company, the Woonsocket Gas Company and the Woonsocket Electric Machine & Power Company.

FLANDREAU, S. D.—The Moody County Telephone Company has taken over the telephone systems owned by Miller Brothers in Flandreau, Egan and Colman, and proposes to make improvements to the systems in the spring.

YANKTON, S. D.—The Yankton Telephone Company is erecting a new exchange building in Yankton and will install a new switchboard and equipment to cost from $6,000 to $13,000.

CORNERSVILLE, TENN.—The Lewisburg Light & Power Company is planning to extend its transmission lines from Lewisburg to Cornersville to furnish electricity for lamps. S. T. Hardison, of Lewisburg, Tenn., is president of the company.

MEMPHIS, TENN.—The Merchants' Power Company has commenced work on the construction of its new annex to the main power plant on Keel Street. The new plant will be used as an auxiliary and will be equipped with a turbine engine with a rating of 1500 hp. It is said that the company contemplates furnishing electricity for residential lighting. Up to the present time the company has confined its service to commercial lighting. The cost of the addition is estimated at $50,000.

BRYAN, TEX.—The citizens have petitioned the City Council to call an election to vote on the proposition to issue bonds, the proceeds to be used to secure a better light and water service and for a sewerage system.

EL CAMPO, TEX.—It is reported that the new owners of the electric light plant, water works and ice factory, formerly owned by the El Campo Light, Water & Ice Company, contemplate making improvements to the plant. A. L. Strang, of New York, N. Y., is president of the company.

GRANBURY, TEX.—The Frisco Ice & Light Company is contemplating the installation of an additional 25-kw, 1100-volt generator and a 40-hp engine. R. E. Doyle is manager.

HUBBARD CITY, TEX.—The Union Central Light & Ice Company contemplates building a new electric lighting plant and an addition to its ice factory. W. A. Bass is president and manager.

JEFFERSON, TEX.—The Jefferson Ice, Light & Power Company contemplates installing a producer gas plant. John T. McDonald is owner and manager.

MARBLE FALLS, TEX.—The establishment of a hydro-electric plant at this place is under consideration by a syndicate. H. von Schon, of Detroit, Mich., consulting engineer, has been retained to investigate and report on the development considering water storage, for which surveys are now being made under his direction.

MARSHALL, TEX.—The Marshall Traction Company is planning to begin construction of its local street railway early this year. A contract has already been placed for the construction of three-fourths of a mile. The railway will be about four miles long and will be operated by electricity. M. Turney, of Marshall, is manager.

PORTSMOUTH, VA.—The City Council is considering the question of installing a municipal electric light plant, the cost of which is estimated at $75,000. The Council also contemplates advertising for bids for a franchise to install and operate an electric light plant in the city. The contract for street lighting with the Norfolk & Portsmouth Traction Company expires within a few months.

RICHMOND, VA.—The Virginia Passenger & Power Company is planning to make additions and improvements to its plant, which will include the installation of a 900-kw and a 750-kw alternator, a 4000-kw steam turbo-generator set, two 1500-hp water wheels and an 1800-hp boiler. G. H. Whitfield is general superintendent of light and power department.

BETHEL, VT.—The Gaysville Power Company is planning to install a 600-hp engine in its power house, contract for which has been placed. C. D. Cushing is superintendent.

BRATTLEBORO, VT.—Preparations are being made by the Estey Organ Company to equip its plant to be operated by electrical power, which will be furnished by the Connecticut River Power Company's plant when completed. A substation will be erected at the Estey company's plant, to which electricity will be transmitted at 10,000 volts. The station will be equipped with three transformers and a high-tension switchboard. The organ plant will be equipped with 60 motors, aggregating 400 hp, ranging from ¼ hp to 75 hp. The motors will be furnished by the Crocker-Wheeler Company, of Ampere, N. J.

WALLINGFORD, VT.—The Rutland Railway, Light & Power Company has decided to extend its transmission lines to Wallingford to furnish electricity for lamps and motors, and will also furnish energy to the Wallingford Manufacturing Company, which proposes to change its motive power from steam to electricity. It is expected that the town will vote to install electric lamps for street lighting, to take the place of the oil lamps now in use, of which there are 45.

BELLINGHAM, WASH.—The Home Telephone Company contemplates making extensive extensions to its local system, which will involve an expenditure of about $50,000.

BREMERTON, WASH.—The Peninsular Light & Power Company has been granted a franchise by the City Council to supply electricity for lamps and motors in Bremerton. The company also received a similar franchise in the town of Port Orchard. The company proposes to develop water power in Dosewallip River on Hood Canal to generate electricity, which will be transmitted to Bremerton and Port Orchard.

CLE ELUM, WASH.—The City Council has granted a franchise to Frank S. Farquhar, of Tacoma, Wash., to operate an electric railway in Cle Elum; also to furnish electricity for commercial purposes. The railway will be operated under the name of the Cle Elum-Roslyn Electric Railway & Power Company. The company will extend its railway to Roslyn, a distance of 10 miles. Application has been made to the Roslyn Council for a railway franchise.

FAIRFIELD, WASH.—Messrs. Nixon & Kimmel have applied for a franchise to erect an electric transmission line and telephone line between Waverly and Fairfield, for a distance of about 4½ miles. It is proposed to connect systems now in operation in the two towns.

HOQUIAM, WASH.—The Grays Harbor Railway & Light Company will replace its wooden poles with steel poles and install cluster lamps.

HOQUIAM, WASH.—The Pacific States Telephone Company will petition the City Council for a franchise in this city and if granted will expend from $8,000 to $12,000 in improving the service.

MONROE, WASH.—The Independent Telephone Company is planning to extend its telephone line to Cherry Valley.

SEATTLE, WASH.—The citizens on Dec. 29 voted to issue $800,000 in bonds, the proceeds to be used to enlarge and improve the municipal electric light plant.

SEATTLE, WASH.—R. H. Thomson, city engineer, has submitted estimates of the cost of installing arc lamps on Fourth Avenue and Fourth Avenue South, from Pike Street to Jackson Street, placing the cost at $30,000.

SPOKANE, WASH.—The Spokane, Columbia & Western Railway Company has applied to the City Council for a franchise to enter the city.

SPOKANE, WASH.—William A. Nicholls, president of the Big Bend Transit Company, states that his company owns water rights on the Spokane River capable of developing 25,000 hp, and will commence at once work on construction of an electric plant, starting with 10,000 hp.

TENINO, WASH.—It is reported that arrangements have been completed whereby the telephone exchange, the light and power company and the water works systems will be owned and controlled by W. Hays Hays and S. W. Fenton. The new owners propose to make extensive improvements to all three systems.

WALLA WALLA, WASH.—It is reported that the Spokane Inland Electric Railway Company contemplates extending its railway from its present terminus to Walla Walla, a distance of 75 miles.

BELINGTON, W. VA.—The capital stock of the Consumers' Heat, Light, Water & Power Company has been increased from $60,000 to $135,000.

ATHENS, WIS.—The Athens Electric Light & Power Company is contemplating the installation of larger generators. William L. Erbach is vice-president and manager.

BRILLION, WIS.—The Wayside Telephone Company has been granted permission to build its telephone lines into Brillion and connect with the local system.

LA CROSSE, WIS.—The City Council has decided to expend $500 to secure the services of an expert to make investigations and decide upon the feasibility of operating a municipal electric light plant in connection with the water works system. The cost of the plant is estimated at $45,000.

MILWAUKEE, WIS.—Bids will be received at the office of the Board of Public Works until Feb. 17 for furnishing and erecting complete in building and foundations to be furnished by the city of Milwaukee all the machinery and appurtenances necessary for the complete installation of a gas-producer and gas-engine electric lighting plant, according to plans and specifications on file at this office. The work to be completed within 10 months from date. Plans and specifications will be furnished to prospective bidders on the receipt of $25 as a guarantee for their safe return. August M. Gawin is comptroller.

KEMMERER, WYO.—The Frontier Supply Company is planning to increase the output of its plant by 150 kw. P. J. Quealy is president and manager.

CALGARY, ALB., CAN.—The Street Railway Commissioners have mapped out the route for the proposed municipal street railway system which will be built in the spring. With the exception of a line to Hillcrest, no suburban lines will be built until next year. For further information, address Mayor Jamieson.

EDMONTON, ALB., CAN.—The City Council has voted $280,000 for extensions to the electric light, power and water plants. For further information, address Mayor Macdougal.

EDMONTON, ALB., CAN.—The town of St. Albert has offered a bonus to the Edmonton Radial Railroad Company to construct a branch line to that town. For further information, address Mayor Macdougal.

KELOWNA, B. C., CAN.—The Hinton Electric Company, of Vancouver, B. C., is installing an electric lighting plant in Kelowna at a cost of $40,000.

PRINCE RUPERT, B. C., CAN.—A telephone system will be installed in Prince Rupert by the Grand Trunk Pacific Railroad Company for the use of the residents of the town.

WINNIPEG, MAN., CAN.—Tenders are being called for a 50-light outfit (magnetite lamps) for the municipal electric light plant. F. A. Cambridge is city electrician.

WINNIPEG, MAN., CAN.—Tenders were accepted at the last meeting of the Council for work on the civic power plant, costing approximately $1,500,000, all of which was excavation and concrete work, with the exception of wire.

WINNIPEG, MAN., CAN.—The Board of Engineers has recommended to the City Council that the contract for the general work at Point du Bois be awarded to John Gunn & Sons, for $779,100; for the erection of the transmission system, to the Power Construction Department, for $89,680; for aluminum transmission cable to the Northern Aluminum Company, for $148,050, and the contract for steel towers for the transmission line to the Manitoba Iron Works, at an estimated cost of $87,550 Smith, Kerry & Chace have charge of the engineering work.

BRANTFORD, ONT., CAN.—Arrangements are being made by the Lyons Electric Company to install a storage battery in its power house, and later the company expects to duplicate its plant.

GLENCOE, ONT., CAN.—The Council has awarded the contract for the erection of a gas producer power plant for the municipal electric light plant to the Colonial Engineering Company, of Montreal, Que. The contracts for electrical equipment and distributing system have also been awarded.

LONDON, ONT., CAN.—Superintendent Nixon, of the Grand Trunk Railroad, announces that the telephone system is to be used for dispatching trains on the London division.

LONDON, ONT., CAN.—A. E. Welch, general manager of the North Midland Railway Company, writes that surveys have been completed for its proposed road and it is expected to commence work on the construction of the road this spring. The railway will be 45 miles [illegible] Guelph, St. Mary's, Stratford and London. W. Scarlet, of London, Ont., is president.

TORONTO, ONT., CAN.—William Mackenzie, president of the Elec- [illegible] Company, states a bridge will be built by the company from here to Niagara Falls along the route of its transmission line.

WELLANDPORT, ONT., CAN.—The Dunnville, Wellandport & Beamsville Electric Railway Company will commence work in the [illegible] construction of its road from Dunnville through Wellandport to Beamsville, a distance of 23 miles. James A. Ross, of Welland- [illegible]

MONTREAL, QUE., CAN.—The Montreal Light, Heat & Power Company has decided not to continue for a short time to furnish electricity to [illegible] of the city at the rate paid under the present contract, which expired Jan. 1, 1909. It is said that the company will continue the service for 15 nights without charge to the city, and if no arrangement is made by that time the service will be discontinued.

SASKATOON, SASK., CAN.—The ratepayers have approved a by-law providing for extensions to the municipal electric lighting plant to cost $30,000. For further information, address Mayor Clinskill.

New Industrial Companies.

THE AMERICAN WIRE CABLE COMPANY, of Wilmington, Del., has been chartered, with a capital stock of $50,000, by Ernest L. Squire, J. A. Byrne, K. M. Byrne, of Wilmington, Del.

THE NEW JERSEY MONORAIL CONSTRUCTION COMPANY, of Wilmington, Del., has been incorporated, with a capital stock of $1,500,000, by E. D. Thompson, H. H. Haines, of Philadelphia, Pa., and H. Whitely, of Wilmington, Del.

THE SCHOTT ENGINEERING COMPANY, of Portland, Maine (architects and engineers), has filed articles of incorporation, with a capital stock of $1,000,000. The officers are: C. E. Eaton, president, and T. L. Croteau, treasurer, both of Portland, Maine.

THE EXCELLO ARC LAMP COMPANY, of Chicago, Ill., has filed articles of incorporation in Illinois to sell electrical appliances and fixtures. The company is a New York corporation and its Chicago office will be located at 118 West Jackson Boulevard, Chicago, Ill.

THE ACME METAL MANUFACTURING COMPANY, of New York, N. Y., has been chartered, with a capital stock of $5,000, by James H. Beets, L. Betts Hengerer and Charles D. Winters, of New York, N. Y. The company proposes to manufacture electrical advertising signs.

THE O. K. ENGINEERING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, to manufacture machinery and engines for heating and lighting plants. The incorporators are: Daniel Gerlach, Dora Gerlach and Amanda Gerlach, all of New York, N. Y.

THE LOCKWOOD ENGINEERING COMPANY, of New York, N. Y., has been chartered, with a capital stock of $50,000, by G. E. Cook, New York, N. Y.; T. Culhane, of Niskayuna, N. Y., and W. D. Lockwood, of Schenectady, N. Y. The company proposes to do a general contracting business.

THE TRIAD MACHINE COMPANY, of Paterson, N. J., has been incorporated, with a capital stock of $100,000, by George Cartwright, George E. Hannah and William Wright, of Paterson, N. J. The company proposes to manufacture mechanical, electrical, civil engineers' and machinists' tools.

THE W. E. CHIPMAN COMPANY, of Boston, Mass., has been incorporated with a capital stock of $50,000 and the following-named officers: William E. Chipman, president; William E. Ludden, treasurer and clerk, both of Boston, Mass. The company proposes to do a general electrical construction business.

THE ANTI-ELECTROLYTIC COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $500, to manufacture protective settings for metallic bodies in concrete. The incorporators are: Robert S. Crocker, Josiah Macy, of New York, N. Y., and Albert H. Vernam, of Morristown, N. J.

THE ECLIPSE ELECTRICAL CONSTRUCTION COMPANY, of New York, N. Y., has been chartered, with a capital stock of $1,000, by Cornelius Campbell, of Passaic, N. J.; Matthew H. Farrar and William R. Lockwood, both of Brooklyn, N. Y. The company proposes to do general contracting and electrical work.

THE WILLIAM HUNTER MACHINE COMPANY, of Hoboken, N. J., has filed articles of incorporation, with a capital stock of $25,000. The incorporators are: W. Hunter, W. Clark, of Hoboken, N. J., and J. H. Susse, of Union, N. J. The company proposes to carry on a business of mechanical engineering and general machinists.

THE O'BRIEN ELECTRICAL TUBULAR LAMP COMPANY, of Camden, N. J., has been chartered, with a capital stock of $300,000, to manufacture electric and gas lamps, globes, tubes, signs, novelties, etc., by Walter C. Waldron, Brooklyn, N. Y.; William P. Fairman, of Philadelphia, Pa.; Dennis J. O'Brien, Philadelphia, Pa.; Matthew Jefferson, of Camden, N. J.

New Incorporations.

CHENOA, ILL.—The Chenoa Telephone Company has been chartered, with a capital stock of $5,000. The officers of the company are: John N. Gentes, president; W. R. Shinn, secretary, and John F. Johnson, treasurer.

DORCHESTER, ILL.—The Dorchester Telephone Company has been [illegible] and a capital stock of $[illegible]. By D. M. Thompson, Henry H. Bauer and F. B. Luben.

[illegible] CLAND, IND.—The Kentland Light & Ice Company has filed articles of incorporation with a capital stock of $[illegible]. The company proposes to build and equip a combined plant to furnish heat, light, water and ice to the inhabitants of Kentland. Clearmont Rider is president.

WODEN, IA.—Articles of incorporation have been filed for the Woden Farmers' Telephone Company, with a capital stock of $2,000.

AUGUSTA, MAINE.—The International Light & Power Company has filed articles of incorporation, with a capital stock of $1,000,000, for the purpose of supplying gas and electricity. J. Berry is president and treasurer, and J. Williamson, clerk, both of Augusta, Maine.

KITTERY, MAINE.—The Automatic Electric Power Company has been incorporated, with a capital stock of $100,000. The purpose of the company is to operate water, gas and electrical works. The officers are: G. E. Burnham, president, and E. J. Burnham, treasurer and clerk, both of Kittery, Maine.

PORTLAND, MAINE.—The Atlanta, Birmingham & Coast Company has filed a certificate of organization with the Secretary of State. The company is capitalized at $3,000,000 and proposes to construct and operate railroads, telegraph and telephone lines; also electric and gas plants. The officers of the company are: Elgin C. Verrill and Philip G. Clifford, both of Portland, Maine.

ADAIR, MICH.—A new telephone company has been organized, to be known as the Casco Roadway Company, with the following named officers: Louis Maedel, president; William Eschenberg, vice-president; Henry Lutes, secretary, and Joseph Cobbledick, treasurer.

AU SABLE, MICH.—Articles of incorporation have been filed for the Eastern Michigan Power Company, with a capital stock of $10,000, by E. F. Loud, R. H. Loud, of Au Sable, Mich., and N. S. Potter, of Jackson, Mich. The company proposes to develop water power to generate electricity. The company is authorized to do business in all counties in this part of the State.

BROWNSVILLE, MINN.—The Brownsville Telephone Company has been organized for the purpose of consolidating all of the local farm and village telephone lines. The directors are: Charles Fetzner, William Licker and Stephen Enos.

LONG LAKE, MINN.—The Long Lake Rural Telephone Company has been organized and the following-named officers elected: George Sinclair, president; Gust Carlson, vice-president; John Sandegren, secretary, and A. N. Barb, treasurer.

CENTERVILLE, MO.—The Centerville Telephone Company has been formed to operate a telephone line extending from Newville to Centerville. The officers of the company are: Glen D. Williams, president; Glen D. Mains, vice-president, and Frederick Dunlap, secretary and treasurer.

BARTLEY, NEB.—The Bartley Mutual Telephone Company has been incorporated, with a capital stock of $12,000, by Edward Sughrause, D. L. Wolf and others.

COTTONWOOD GROVE, NEB.—The Cottonwood Grove Mutual Telephone Company has been organized, with a capital stock of $700, by John Henry, J. H. Hover and others.

EAST ORANGE, N. J.—The General Service Heat & Power Company has been chartered, with a capital stock of $100,000, by J. M. W. Kitchen, F. R. Wickes, H. H. Pickling, of East Orange, N. J. The company proposes to generate and distribute light, heat and power.

BROOKLYN, N. Y.—Articles of incorporation have been filed for the Flatbush Railroad Company by John C. Langan, of Brooklyn; J. J. Boughman, of New Cumberland, Pa., and P. S. Sadler, of Carlisle, Pa. The company proposes to construct and operate an electric street railway from the Brighton Beach line of the Brooklyn Union Elevated Railroad Company at Avenue Q to Avenue Q and Flatbush Avenue, Borough of Brooklyn, a distance of three miles. The company is capitalized at $30,000.

BUFFALO, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Federal Telephone & Telegraph Company. The capital stock is placed at $6,000,000 and the company proposes to operate telephone and telegraph lines in the principal cities, towns and villages in the State. The directors are: E. G. Hubbell, W. H. Andrews, C. C. Machemer, R. W. Chapin, G. A. Plimton and others, of Buffalo, N. Y., and G. D. Morgan, of Rochester, N. Y.

RENSSELAER FALLS, N. Y.—The Rensselaer Falls Electric Light & Power Company has been incorporated, with a capital stock of $2,000, to operate an electric light and power plant. The incorporators are: Frank Morrison, William S. Blair, Benjamin F. Morrison, Eugene Morrison, all of Rensselaer Falls, N. Y.

GREENSBORO, N. C.—A charter has been granted to the Randolph Power Company, with a capital stock of $100,000, to furnish electricity for light and power. The incorporators are: C. W. and H. C. Petty and M. W. Parrish, all of Greensboro, N. C.

COLUMBUS, OHIO.—The Arthur Telephone Company, of Arthur, Paulding County, has been incorporated by Claude Morris and others.

POLK, OHIO.—The Polk Rural Telephone Company has been incorporated, with a capital stock of $8,000, by John F. Smith and others.

TOLEDO, OHIO.—Articles of incorporation have been filed with the Secretary of State at Lansing, Mich., for the Ohio & Michigan Southern Railroad Company, with a capital stock of $17,000,000. The new company proposes to take over the property of the Toledo, Ann Arbor & Detroit Railway Company, which is a partially completed electric railway between Toledo, Ohio, and Ann Arbor, Mich., and equip the road for both freight and passenger service. The directors are : Andrew E. Lee, of Vermillion, S. D.; John O. Zazel, of Toledo, Ohio.; D. F. Niles, of Duluth, Minn., and N. A. Reese, of Chicago, Ill.

PAWNEE, OKLA.—The Coal Creek Telephone Company has been incorporated, with a capital stock of $500, by W. J. Nail, John Wolfe and J. M. McKill.

GRANTS PASS, ORE.—The Citizens' Telephone Company has been formed, with a capital stock of $30,000, by H. D. Norton, Arthur Conklin and E. A. Marsh. The company will soon apply for a city and county franchise.

HOOD RIVER, ORE.—Articles of incorporation have been filed for the Watt Development Company by J. F. and A. S. Watt, of Hood River. The company owns valuable water rights on Hood River, located about five miles from Hood River, known as the Tucker power site. It is said that from 5000 to 10,000 hp is available. Work on development will begin at once.

PORTLAND, ORE.—Articles of incorporation have been filed for the Columbia Telephone Company of Oregon by T. L. Evans, W. C. Hicks and Fred C. Reed. The company is capitalized at $1,200.

PORTLAND, ORE.—Articles of incorporation have been filed for the Portland Water Power & Electric Company, with a capital stock of $1,000,000. The company proposes to construct a dam and power plant on the Clackamas River near Estacada, work on construction of which will begin at once. W. H. Hulbert, former president of the Oregon Water Power & Railway Company; A. B. Crossman and R. L. Durham are interested in the enterprise.

PRICETOWN (P. O. FLEETWOOD), PA.—The Pricetown Rural Telephone Company has been organized and the following-named officers elected: S. J. Hill, president; D. H. Manwiller, secretary, and G. W. Brown, treasurer.

SCHAEFFERSTOWN, PA.—The Schaefferstown Rural Telephone Company has been organized to operate a telephone system in the southeastern portion of Lebanon County and part of Berks County. The capital stock is placed at $5,000 and the officers are: F. B. Horst, of Reistville, Pa., president; J. T. Gable, of Horst Hill, Pa., vice-president; Alvin Schaeffer, of Schaefferstown, Pa., secretary, and S. H. Bomberger, of Schaefferstown, treasurer.

IPSWICH, S. D.—The Union Township Telephone Company has been incorporated, with a capital stock of $10,000, by S. W. Mount, E. L. Bucklen, John Sloan, H. Strouble and George Fritz, all of Union Township.

SAN AUGUSTINE, TEX.—Articles of incorporation have been filed for the San Augustine Light & Power Company, with a capital stock of $6,000, by F. K. Nance, W. N. Foster and T. L. Foster.

TYRONE, TEX.—The Farmers' Telephone Company has been organized, with a capital stock of $2,000. The officers of the company are: W. M. Atkins, president; William Dixon, vice-president, and Robert Harville, treasurer.

NORTH YAKIMA, WASH.—The Wenas Telephone Company has been incorporated, with a capital stock of $5,000, by George Longmire and others.

MORGANTOWN, W. VA.—The National Telephone Company, of Monongalia County, has been chartered to control and operate the systems of the People's Telephone Company, of Morgantown, W. Va.; the Consolidated Telephone Company, of Fairmont, Va., and the West Virginia Western Telephone Company, of Parkersburg. The company is capitalized at $50,000, and the incorporators are: W. C. Handlan, S. W. Harper, of Wheeling, W. Va.; C. E. Manley, J. W. Barnes and E. F. Hardy, of Fairmont, W. Va.

RICHMOND, ONT., CAN.—The Malahide & Bayham Telephone Cooperative Association has been formed here, with a capital of $10,125.

THORNDALE, ONT., CAN.—The East Middlesex Telephone Company has been incorporated, with a capital of $30,000. The incorporators are: R. L. Guest, of London Township, R. [illegible] W. [illegible], of Thorndale, Ont.

REGINA, SASK., CAN.—The Regina Inter-Urban Tramway Company has been incorporated, with a capital of $[illegible]. The [illegible] W. M. Logan and J. [illegible], of Regina, Sask., R. [illegible], of Georgetown, Ont.; C. J. Harris, of Brantford, Ont., and J. H. Housser, of Toronto, Ont.

Legal.

DANGERS OF LIVE WIRES.—[illegible] of Ambre vs. Postal Telegraph Co. [illegible] by a telegraph company to "locate [illegible]" [illegible] were strung on the same poles with other wires which he knew belonged to and were used by an electric light company, was not chargeable with notice that the electric light wires were carrying a dangerous charge at 4 o'clock p. m., and his right to recover for injuries cannot be defeated on the ground that he was bound to assume that the electric light wires were "live wires."

Company Elections.

SHELBYVILLE, IND.—The directors of the Shelbyville Gas & Light Company have elected the following officers: E. A. Potter, Chicago, Ill., president; John H. Leefers, vice-president; O. D. Obadon, secretary, and G. H. Dunn, treasurer. The directors voted to make substantial improvements and extensions to the plant this year.

Personal.

MR. W. STANLEY, JR., has recently passed through a severe attack of pneumonia and has gone South to recuperate and to woo complete health.

MR. ROMIE W. WILSON has been appointed superintendent of construction for the Manchester Traction, Light & Power Company, Manchester, N. H., to succeed the late Mr. George N. Burpee.

MR. E. E. PEAKE has resigned as superintendent of the Sherman, N. Y., Electric Light Company to accept the position of secretary and general manager of the Genesee Valley Power Company, of Olean, N. Y.

MR. LESLIE R. HICKS, formerly in charge of the electric lighting department at Elgin, Ill., of the Aurora, Elgin & Chicago Railroad Company, has become electrical engineer of the Fall River (Mass.) Electric Light Company.

MR. C. D. WOOD, JR., has resigned his position as treasurer of the Electric Home Supply Company, of New York City. His present business address is the Heinrich Electric Novelty Company, 192 Fulton Street, Brooklyn, of which he is president.

MR. W. R. GARTON, general manager of the Lord Electric Company, returned last week from a five-week trip through Canada and the Northwestern States. He says that business conditions are vastly improved in the sections through which he traveled.

MR. HUGO REISINGER, of New York City, well known as an importer in the electrical trade, has been elected an honorary life member of the Metropolitan Museum of Art. He had a great deal to do with the present excellent exhibition there of contemporaneous German art.

MR. H. L. MONTGOMERY succeeds Mr. M. C. Turpin as general manager of the Auburn (N. Y.) Light, Heat & Power Company. Mr. C. A. Callendar, late assistant superintendent, is now superintendent. Mr. Eugene Creed succeeds Mr. Montgomery as New Business manager.

MR. H. A. OSTRANDER has resigned as superintendent of the municipal water and light systems at Salamanca, N. Y., and has accepted the management of the Salamanca Veneer-Panel Works, of Salamanca, N. Y. Mr. H. E. Heller will succeed Mr. Ostrander as superintendent of the water and light systems.

MR. J. W. PUTNAM, who resigned last month as assistant engineer of the Toronto & Niagara Power Company, has accepted the position of general manager with the recently incorporated firm of Overhead & Underground Construction Company, 2 Rector Street, in the new United States Express Company's Building, New York City.

MR. WALTER S. BISSELL has become the treasurer of the F. Bissell Company, of Toledo, Ohio. He has been associated with that concern for a number of years as one of its traveling salesmen, and brings to his new position a thorough knowledge of the electrical industry and trade, [illegible] and wide acquaintance with those connected [illegible] field.

MR. J. J. ESTABROOK, secretary and vice-president of the Engineering Specialty Company, of Stamford, Conn., resigned from that position [illegible] in the Havemeyer Building, Cortlandt Street, New York City, and will handle there a full line of standard and special motors, motor generators, etc.

[illegible] HENRY C. MORRIS [illegible] & Electric Company and the Bay City Gas [illegible] Mich., [illegible] Westbridge & Company, has resigned and will become connected with the [illegible] Texas, [illegible] Hannaman & Wilson, [illegible]

MR. H. VON SCHON, of Detroit, Mich., is preparing plans for a 6000-kw hydro-electric plant on the Sturgeon River, Mich., the power to be transmitted to the copper region near Houghton; also plans for an [illegible] electric development of Marble Falls, Tex.

MR. F. T. MUNGER, former superintendent of motive power and equipment of the Metropolitan West Side Elevated of Chicago, has been made general superintendent of the Hudson Tunnel system. He is a [illegible] University of Wisconsin of the class of 1880. He served

the Chicago Elevated from 1894 to 1898, and recentered its service in 1903, after five years' service on electric traction lines.

MR. DOUGLAS GORDON, who has been connected with an American engineering company as manager for a number of years, is making arrangements to establish himself in London next April, and desires to get in touch with American machine and supply manufacturers, with a view to selling their products in the British Isles. His present address is 165 Naples Road, Brookline, Mass. He will be glad to hear from electrical concerns.

MR. A. A. TIRRILL has resigned from the engineering department of the General Electric Company and will now devote his time to the manufacture of electrical supplies and specialties, for which he has recently incorporated an organization to be known as the Tirrill Manufacturing Company, of Schenectady, of which he is president. Mr. Tirrill is the inventor of the well-known Tirrill voltage regulator. His further work in the electrical field will be followed with much interest.

MR. WALTER STUART KELLEY, who has been connected with the Holtzer-Cabot Electric Company for several years as chief engineer, terminated his connection with them Jan. 1. Mr. Kelley has given his attention for some time largely to alternate-current design and has developed several new forms of remarkably light weight, including both generators and motors. An interesting example is a wireless set consisting of 3-kw generator and exciter with gasoline engine mounted on common base, weighing, complete, 375 lb.

MR. L. H. DAVIS, who has been general superintendent of railway, light and ferry properties of the Norfolk & Portsmouth Traction Company, Norfolk, Va., has been appointed general superintendent of floating properties of the company, including the Portsmouth, Norfolk and Berkley ferry systems, the ferry between Willoughby Spit and Old Point Comfort, the ferry between Newport News and Sewalls Point and the Pinners Point and West Norfolk ferry. Mr. H. Root Palmer has taken over the lighting department at Portsmouth as general superintendent of lighting, and Mr. J. L. Adams has taken over the railway department as general superintendent of railways. Because of Mr. Davis's residence in Portsmouth, he has been appointed general agent, reporting directly to Mr. E. C. Hathaway, general manager, and through him to the president.

Trade Publications.

THE ARTHUR JONES COMPANY, 84 Van Buren Street, Chicago, Ill., is sending out a new stock list on new and second-hand motors and generators, of which this company carries a large stock.

ART GLASS SIGNS.—The Auto-Electric Sign Company, 134 Van Buren Street, Chicago, Ill., has issued a circular calling attention to its color-changing art glass signs. These signs are made of galvanized steel and are strongly reinforced to withstand severe usage.

NEW TELEPHONE MOUTHPIECE.—R. E. Miller, Lakewood, N. M., inventor and patentee of a new telephone transmitter mouthpiece, is sending out circulars calling the attention of the trade to his new device. The mouthpiece is constructed in sections and contains a small chamber in which a disinfectant can be placed.

PNEUMATIC WATER SYSTEMS.—The United Pump & Power Company, Chicago, Ill., has issued a new catalog of the Perry pneumatic water systems. This company has recently secured patents on a new type of Perry automatic controller which is designed to be used in connection with pneumatic pumps.

POCKET TELEPHONES.—The Stolz Electrophone Company, 92 State Street, Chicago, Ill., has issued a small 16-page catalog, calling attention to its pocket telephone which has been devised for remedying defective hearing. The catalog contains cuts made from photographs of the Stolz electrophones and of various methods of using them.

MOTORS AND INSTRUMENTS.—The Wagner Electric Manufacturing Company, St. Louis, Mo., announces that new bulletins are in preparation on "Polyphase Motors," "Single-Phase Motors," "Synchronous Motors," "Alternating-Current Elevator Motors" and "Instruments." The company has recently sent out bulletins on "Central-Station Transformers" and "Power Transformers."

THE HARVARD ELECTRIC COMPANY, Chicago, Ill., is sending out circulars containing illustrations and descriptions of the Harvard battery and the Harvard copper test connectors. The company is also sending out an illustrated circular calling attention to its toll line protector, designed especially for telephone toll lines in rural districts and for other services where a large carbon lightning arrester without fuse is desired.

ADJUSTABLE-SPEED MOTORS.—A typographical error on page 1425 of our issue for Dec. 26 caused the statement to appear that a certain line of motors provides a speed variation of 62 to 1. The motors are adjustable-speed machines which, although not giving the range erroneously stated, have the exceptionally wide range of 6 to 1. They are well described in Bulletin No. 59 of the Northern Electrical Manufacturing Company, Madison, Wis.

SERIES ALTERNATING ARC LIGHTING.—In Bulletin No. 4631, just issued by the General Electric Company, is described its series alternating enclosed arc light system. The bulletin contains a detailed description of the constant current transformers, constant current transformer panel enclosed arc lamps, arc lamp cutouts and lightning arresters used in connection with the system, together with various connection diagrams and illustrations of parts.

ELECTRIC HEATING APPARATUS.—The Metropolitan Electrical Supply Company, Chicago, Ill., is sending out a special catalog and circulars calling attention to the electrical heating apparatus manufactured by the American Electrical Heater Company, for which it is the agent. Special attention is called to the electric laundry irons, which are put up in special decorated boxes for holiday gifts. This company is also handling a new style of luminous radiator which is also made the subject of circular matter.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., is issuing a comprehensive circular descriptive of "Opalux" shades and reflectors. The circular contains a number of photometric curves which were developed through tests made by the Electrical Testing Laboratories, of New York. "Opalux" shades and reflectors, when used with tungsten lamps, are claimed by the company to give the most satisfactory results, and should prove of great interest at this time when the subject of illumination is receiving so much attention.

MERCURY ARC RECTIFIERS.—Bulletin No. 4628 of the General Electric Company deals with the latest types of mercury arc rectifiers made by it. Designed primarily for 60 cycles, they will work on any frequency from 60 to 140 inclusive, and can be supplied for as low as 25. It is designed for operation on either 110 or 220 volts alternating, but tubes are furnished for any commercial secondary alternating current current voltage. A number of applications are shown with outfits for the purpose. These are accompanied by dimension diagrams.

SERIES LUMINOUS ARC RECTIFIER SYSTEM.—Those interested in street illumination will be also interested in the General Electric Company's Bulletin, No. 4620, describing its series luminous arc rectifier system, which forms a striking contrast to the older open arc system of lighting. The bulletin goes more or less into details and describes the various pieces of apparatus used in connection with the system, including are lamp hangers and cut-outs, constant current transformers, mercury arc rectifier tube, switches for use in connection with the system, etc. It contains also dimensions and connection diagrams.

MOTOR-GENERATOR SETS.—Bulletin No. 4633, devoted to the subject of motor-generator sets, has just been issued by the General Electric Company:—Direct current to direct-current sets, alternating current to direct-current sets, or vice versa, varying in capacity from 0.2 kw to 1500 kw, and alternating current to alternating-current sets between two periodicities, commonly called "frequency changers." The different sets are briefly described and illustrated, and illustrations of several installations of such sets are shown. The bulletin, quarto shape, contains, also, tables of weights and dimensions of the various sets.

JOHNS-MANVILLE CATALOG.—A new catalog, entitled "Pipe and Boiler Insulation," has just been issued by the H. W. Johns-Manville Company, of New York. This book is devoted to a thorough presentation of the problems of insulating all kinds of heated and cooled surfaces, such as pipes, boilers, furnaces, flues, ducts, etc., as well as insulation for refrigerating and cold storage work. The book is most complete and bears out the company's idea, "a covering for every condition." It is handsomely illustrated and printed. A copy can be secured by addressing the company's nearest branch and asking for Catalog No. 100.

Business Notes.

MR. RICHARD WICK, formerly associated with the Western Wire Sales Company, Chicago, Ill., has opened up offices at 356 Dearborn Street, Chicago, and will hereafter engage in the sale of bare and insulated wires and cables.

ELECTRICALLY-DRIVEN ARMATURE DISK PRESS AND FIELD-COIL WINDER.—James Clark, Jr., Electric Company, Louisville, Ky., has recently placed on the market a new electrically-driven notching press for armature disks and an electrically-driven winding machine for field coils.

THE AMERICAN ELECTRIC FUSE COMPANY, Muskegon, Mich., states that its "American Igniter" is receiving much favorable attention from prominent engineers of the country. This igniter is a new device designed for gasoline engine ignition purposes and is to be mounted directly on the timer or cam shaft of gasoline engines for automobile, marine or stationary-engine uses.

DE RONDE INSULATING PAINTS AND COMPOUNDS.—The Metropolitan Electrical Supply Company, Chicago, Ill., reports that it is making large sales of De Ronde's insulating paints and compounds, for which the company is the agent. The products are being specially recommended for electric and steam railroad uses and for dynamo and motor frames, switchboards, cut-outs, manholes and for other uses where a liquid insulator is required.

I. P. FRINK reports the following among the recent orders taken for interior lighting: Normal School, Albany, N. Y.; art gallery of the Lotus Club, New York City; Edward Brandis art galleries, New York City; Administration Building, Bronx Park, and the main entrance and hall of the Harkness Mansion at Fifth Avenue and Seventy-fifth Street, New York. This latter will be lighted by a special system of reflectors which will shine through art glass ceilings.

THE WESTERN WIRE SALES COMPANY, 356 Dearborn Street, Chicago, Ill., has recently been reorganized, Richard Wick, formerly one of the officials of the company, retiring. The officers of the company now are: C. T. Murdock, president; A. N. Allen, secretary, treasurer and manager. The company announces that it will carry on the manufacture of the same line of bare and insulated wires and cables as heretofore, and will cater to the same trade as it did previous to the reorganization.

THE MECHANICAL APPLIANCE COMPANY, Milwaukee, Wis., is building an electrical flour sterilizer and ager, to be used by the Alsop Process Company. This sterilizer consists of an iron box containing revolving rollers, connected to a high-pressure spark coil, to which current is furnished by a 500-volt generator located on the top of the sterilizer. An air blast is provided for blowing out the arc and creating a current of air through the sterilizer, which carries off the gases formed by the arc. These gases in passing through the flour sterilize and age it.

MR. JOHN STURGESS, who is well known in the electrical fraternity through his former connection with the Sturgess Governor Engineering Company, has recently become associated with the Lombard Replogle Engineering Company, Akron, Ohio, with which company he holds the position of general manager. Mr. Sturgess' wide and successful experience with governor design and operation cannot fail to be of great value to this company, which is specializing governor work. An improved type which is just to be put on the market is the result of the experience and collaboration of Mr. Lombard, Mr. Replogle and Mr. Sturgess.

DOSSERT & COMPANY, New York City, report that during the past week they received orders for solderless connectors as follows: 500 special stud transformer connectors from the Westinghouse Electric & Manufacturing Company; 100 cable taps from Henry Newgard & Company, of Chicago; cable taps for a number of large cables from the Falkenau Electrical Construction Company, of Chicago, for the United States Steel plant at Gary, Ind.; a variety of connectors and terminals from the city lighting plant, Holland, Mich.; cable taps from the General Electric Company, and 2-ways from the Brown Hoisting Machinery Company, of Cleveland, Ohio.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Conn., about Feb. 1 will carry in stock a large supply of its regular type "ES" and "PS" panels, ready for immediate shipment. This stock covers straight panels of these two types, 6 to 20 circuits and 2-2 and 3-2 wire. It has just completed a set of steel templates, 794 in number, which are used in drilling each individual panel of the "E," "ES" and "P," "PS" types, illustrated in its catalogue, so that no time is consumed in laying out the boards by hand. The company will also carry a full line of panel slate already enameled (including all slate sides), a complete stock of panel circuits assembled for mounting and bus bars already finished, which will insure the purchaser of rapid service. There is no delay incident to the usual method of laying out the boards by hand. The orders go at once to the factory, and the necessary slate, already polished and enameled, is placed under the proper template and drilled in a short time; and the circuits, which are already assembled, are in a few hours mounted on the board. In addition, the Trumbull company carries a complete line of templates which are used for drilling the fastening holes in the iron boxes, one template for each "E," "ES" and "P," "PS" panel listed in its catalog. By this new equipment not only can all orders be rushed through in record time, but with absolute certainty of correctness, and without hold-ups due to mistakes or delays in laying out and marking.

THE PACKARD ELECTRIC COMPANY, of Warren, Ohio, has recently completed a new substantial brick building comprising basement and two stories. This addition was necessitated by the natural growth of the business. A portion of the space is utilized for offices. The transformer department also has a new home in this building. A portion of the insulating materials is handled in the second story. This new building, together with several old ones in the rear, make a very complete little plant. Due attention has been given to possibility of further needs, in the recent purchase of an adjoining tract of land. This company manufactures the "Packard" transformers, which have been on the market since pioneer days. It is using the most expensive grade of silico-vanadium alloy steel. This company has also recently made important improvements in its cloth manufacturing department, and has designed and built new and expensive apparatus, of which N. A. Wolcott, manager of the company, is the designer. The output has been increased more than tenfold. Cambric bias-cut tape is another specialty which is developing very rapidly. The demand for this is occasioned by the fact that it is necessary to use material of this character in place of tape saturated with a rubber compound for all high voltage work. It is cut bias to give it great strength and elasticity. It is very tacky and nice to handle. The manufacture of insulating varnishes is receiving more attention than ever before. The capacity is sufficient to enable it to offer a select line of varnishes to the trade. Ignition cable is one of the company's strong specialty lines. This material has been on the market for the past eight years and has made an enviable reputation for itself.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 5, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

12,906. TELEGRAPHY; P. B. Delany, South Orange, N. J. Reissue. App. filed Nov. 20, 1908. Increases speed, relieves operator from strain and keeps messages secret from a wire tapper by producing short code dot signals and simultaneously transmitting a long signal whose length is determined by the number of dots, then converting at the receiver the long signal into the number of dots locally produced at the transmitting station.

12,907. ILLUMINATING DEVICE; A. W. Beuttell, New York, N. Y. Reissue. App. filed May 13, 1908. A novel mounting for double-ended incandescent lamps having tubular members with spring terminals therewithin to receive the ends of the lamp.

908,439. ELECTROPLATING APPARATUS; C. G. Backus, New York, N. Y. App. filed April 13, 1908. The electroplating cylinder is removable and carried by a pivoted support which allows its removal from the tank. The drum consists of longitudinal strips having openings therein which fasten in suitable heads.

908,444. TELEPHONE-HOOD; H. L. Burrhus, Hornell, N. Y. App. filed Dec. 20, 1907. The hood is lowered over the head of a person using the telephone so as to shut out noise. The receiver and transmitter are inside the hood.

908,463. INSULATOR; F. J. Hight, West Lebanon, Ind. App. filed Feb. 25, 1908. Split insulator for telephone wires containing insulating blocks with means for clamping the [illegible] together.

908,471. METHOD AND DEVICE FOR ELECTRICALLY REGULATING THE SPEED OF PRIME MOVERS, ESPECIALLY TURBINES; F. Von Merkl, Vienna, Austria-Hungary. App. filed Jan. 31, 1908. The regulating mechanism [illegible] is adapted to be operated by a plurality of single-phase alternating currents, one of which currents varies in phase with relation to the governed apparatus. When the speed of the turbine varies the current is displaced, a rotary field produced in the motor, which in turn operates the regulator.

908,483. BRUSH FOR DYNAMO-ELECTRIC MACHINES; E. T. Mug, Norwood, Ohio. App. filed Nov. 17, 1905. Improvement in pigtail brushes in which the carbon brush has a transverse channel and a channel extending therefrom to the top of the brush with fusible metal filling the channels and a conductor embedded in the metal.

908,484. DYNAMO-ELECTRIC MACHINE; E. T. Mug, Norwood, Ohio. App. filed Nov. 17, 1905. The yoke which carries the brushes of a multipolar machine is divided [illegible] provided with roller bearings.

908,504. COHERER; E. G. [illegible] Wis. App. filed March 25, 1908. Improvement on a [illegible] comprises a fixed carbon disk [illegible] cylinder with a spring forcing the cylinder against the disk.

908,538. ELECTRIC-LIGHTING GAS-BURNER; H. L. Baldwin, Washington, D. C. App. filed June 1, 1908. The lever which actuates the gas valve has a crosshead provided with wings which carry an arm that supports the movable electrode. A spring insures movement of the operating means to the limit of its throw after passing the dead point.

908,545. APPARATUS FOR DECOMPOSING ALKALI-METAL AMALGAMS; C. F. Carrier, Jr., Elmira, N. Y. App. filed May 25, 1907. Expedites the action between sodium amalgam and water by means of a body of graphite in contact with the amalgam and electrolyte of the bath.

908,546. CIRCULATING-PUMP FOR ELECTROLYTIC CELLS; C. F. Carrier, Jr., Elmira, N. Y. App. filed Dec. 19, 1907. A mercury conduit extends between the decomposing and oxidizing compartments of an electrolytic cell and a circulating pump circulates the mercury. Used in the manufacture of caustic soda by the aid of a mercury cathode.

908,547. TROLLEY RETRIEVER; N. W. Chamberlain and L. V. Moulton, Grand Rapids, Mich. App. filed April 3, 1908. Automatically takes up the slack of the cord and promptly draws the pole down when the wheel leaves the wire by means of a spring drum actuated by a take-up and retrieving spring.

908,[illegible]. TELEPHONE-TRANSMITTER; C. D. Enochs, La Crosse, Wis. App. filed Oct. 2, 1906. A pair of compound electrodes with insulating leaves separating the elements of the electrodes and projecting from the face, the leaves of one electrode interleaving with the leaves of the opposite electrode. Carbon granules are carried between the electrodes.

908,585. FIRE-ALARM; G. P. Leonard, Elkhart, Ind. App. filed March 22, 1907. Gives visual and audible signal, which latter may be thrown out when sending a still alarm, records the alarm and designates the nature of the alarm sent. Combines a visual and audible signal with an electrical device for controlling each apparatus and with means [illegible] other to display the visual signal.

908,603. METHOD OF TREATING ELECTROLYTIC SLIMES FOR THE RECOVERY OF METALS THEREFROM; A. J. McNab, Trail, B. C., Canada. App. filed Nov. 26, 1906. Particularly adapted for recovering silver from the slimes resulting from the electrolytic refining of lead bullion, as for example by the Betts process. The slime is treated with an alkali-sulphide, the solution separated, the metal separated from the solution by electrolysis and the residue roasted.

908,646. INDICATING FUSE; R. C. Cole, Hartford, Conn. App. filed Jan. 3, 1907. Gives a conspicuous visual indication of the condition of the fuse link within the enclosed fuse by means of an indicator wire having sufficient gas-producing capacity upon its electrical disruption to discharge the screen from the target.

908,647. MOISTURE-PROOF PACKING; R. V. Collins, New York, N. Y. App. filed Feb. 8, 1908. For packing the connection between a railway switch and the operating mechanism located in the ground [illegible] switch. Details

PROTECTIVE SYSTEM FOR ELECTRIC RAILWAYS [illegible]

CIRCUIT-BREAKER FOR AUTOMATIC SIGNALING APPARATUS; E. A. Wood, Dover, Mass. App. filed Nov. 2, [illegible]. Means are provided at the relay for automatically opening the circuit, [illegible] case of the accidental inversion of the relay. A mercury circuit closer produces the required result.

CLUTCH FOR ELECTRICALLY OPERATED [illegible]; Ray Dodd, [illegible]. App. filed [illegible]. [illegible] fixture which when the user gives up gas and sticks to electricity will [illegible] removed.

908,682. THERMOSTATIC SWITCHING APPARATUS; W. [illegible] Kelley, Newark, N. J. App. filed Aug. 30, 1905. A switch which is not affected by variations in external temperature and made of a single metal. An electric heater is connected in shunt circuit across the switch contacts in connection with an incandescent lamp whereby when the switch is opened and the heater in series with the lamp the operating current is cut down and when closed the heater is short-circuited and the current flows through the lamp.

908,682. MANUFACTURE OF GLOWING BODIES OF REFRACTORY METALS FOR ELECTRIC LAMPS; A. Lederer, Atzgersdorf, near Vienna, Austria-Hungary. App. filed April 3, 1906. Makes a paste which contains the metal oxide and about three-quarters of one per cent of finely divided metallic aluminum, molds it and reduces by an electric current.

908,686. DYNAMO-ELECTRIC MACHINE OF THE ENCLOSED TYPE; C. E. Lord, Norwood, Ohio. App. filed March 30, 1907. Maintains a circulation of air for cooling and prevents leakage by providing on the shaft near the openings blowers which force air outward through the annual clearance spaces so as to counteract leakage inward.

908,694. ROTARY SNAP ELECTRIC SWITCH; C. G. Perkins, Hartford, Conn. App. filed July 29, 1907. Provides means for indicating the position of the movable contacts and of the condition of the circuits connected with the switch by a shutter of contrasting color. Details.

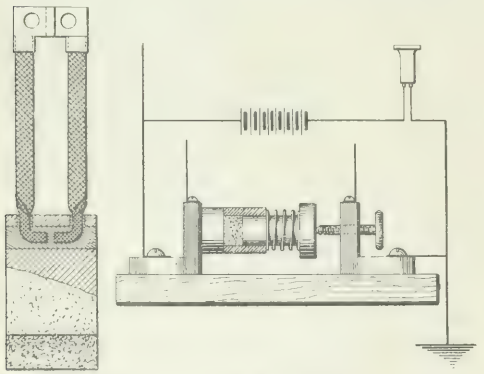
908,698. SIGNALING SYSTEM; S. A. Reed, New York, N. Y. App. filed Oct. 26, 1905. Relates to an arrangement of ground connections for telephone party lines utilizing condensers to maintain a balance and to afford an impedance sufficient to protect the talking circuit.

908,[illegible]. ELECTRICAL CLUTCH AND THE LIKE, A. P. Steckel, Buffalo, N. Y. App. filed March 23, 1908. Improvement on patent No. 744,423. One member has oppositely arranged separated magnet poles and a second clutch member has a series of [illegible] segments arranged to revolve between the poles.

908,712. ELECTRICAL HEATING APPARATUS; E. L. Van Dolsen, Berwyn, Ill. App. filed Feb. 23, 1906. An electrical soldering iron or the like provided with a support having a pocket wherein the tip of the iron is adapted to rest, the pocket receiving the excess solder whereby the iron is kept tinned.

908,719. TROLLEY-HARP; J. Wickstrom, Warren, Pa. App. filed July 6, 1908. The trolley harp comprises two plates with dove-tailed connection with a pin for the wheel mounted in recesses in one of the plates and held from rotation by the other plate.

908,725. RECEIVER; C. G. Ashley, Chicago, Ill. App. filed Jan. 10, 1906. A wireless receiver, including a source of light, an electrically operated mirror for governing a ray of light, another mirror, the two mirrors producing a resultant ray and a signal actuated by the ray.



908,[illegible]. Brush [illegible] Dynamo-Electric Machines.

908,726. PORTABLE ELECTRICAL TOOL; F. J. Backscheider, Cincinnati, Ohio. App. filed Sept. 27, 1907. A drill in which the operating motor is controlled by a switch which is automatically thrown off when the tool becomes stalled.

908,742. SPACE TELEGRAPHY; S. Cabot, Brookline, Mass. App. filed March 18, 1907. Prevents arcing at the spark gap and increases the power factor of the power circuit by means of an intermediate circuit with a condenser connected across it, so proportioned as to increase the power factor.

908,748. ELECTRIC BLOCK-SIGNAL; J. G. O. Combs and I. D. Combs, Walnut Grove, Mo. App. filed March 5, 1908. Prevents rear-end collisions by notifying the engineer of the train. The mechanism for operating the signal is duplicated so as to set the signal to indicate danger on entering the block and on leaving the station. Details.

908,814. CONDENSER; John Stone Stone, Cambridge, Mass. App. filed Dec. 28, 1905. A condenser for wireless telegraphy in which two dielectrics are used, one glass, the other air, the former having a high dielectric strength and the other perfect electrical elasticity.

[illegible] John Stone Stone, Boston, Mass. [illegible] [illegible] of the primary

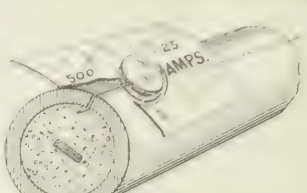
[illegible]

908,846. TELEPHONE RECEIVER; Jesse Temple Curtis, Bement, Ill. [illegible] phragm.

908,848. ELECTRIC SIGNAL-BELL; H. W. Eden, Detroit, Mich. App. filed Jan. 4, 1908. An improved contact point supporting post and improved insulating means for securing a binding post to the frame. Details.

[illegible] March 14, 1908. Avoids the time lost in running down "open keys" on train dispatching lines. An extra switch and circuit and a high voltage extra battery are provided at the terminal office which when switched on to the line wire forces its current through the resistance around any open key, works the relay of the key and warns the forgetful operator that he has left his key open.

908,895. ELECTRIC RAILWAY-SIGNAL; C. H. Smith, Lebanon, Pa. App. filed Dec. 7, 1907. A trolley contact actuated by the passage of



908,646 Indicating Fuse.

a car in one direction only, consisting of means located adjacent to the trolley wire, engaged by the trolley wheel to close a signal circuit so as to notify one of the approach of a train.

908,899. ELECTRIC BELL; E. P. Steen, Cripple Creek, Col. App. filed May 19, 1905. An improved single-stroke electric bell worked from an alternating current circuit comprising a gong, a coil, an iron core for the coil which acts as a hammer for the gong, the parts being so constructed that the magnetic circuit of the coil has a large air gap when the core is withdrawn and a small air gap when the core is within the coil.

908,918. BURGLAR-ALARM; John Wells, Forsyth, Mont. App. filed June 28, 1907. Door and window burglar-alarm controlled by a trigger actuated by the movement of the door or window. Details.

908,926. THREE-WIRE TELEPHONE SYSTEM; C. S. Winston, Chicago, Ill. App. filed March 12, 1906. Reduces the impedance in the talking circuit of a three-wire system. Provides a cut-off relay and a supervisory relay in the third wire and a second supervisory relay connected between a source of current and the sleeve strand of the cord circuit with a supervisory signal having a circuit jointly controlled by the supervisory relays.

908,930. METHOD OF DECARBONIZING FILAMENTS FOR INCANDESCENT LAMPS; Hermann Zerning, Halensee, near Berlin, Germany. App. filed Oct. 30, 1906. Completely decarbonizes a filament without injuring the metal by means of nitrogen gas produced by heating phosphan (PN_3H).

908,937. REMOVAL OF METALLIC PLATING, COATING OR FOULING FROM METALLIC OR OTHER SURFACES; T. R. Bayliss, et al., Northfield, near Birmingham, England. App. filed Feb. 18, 1908. Connects the article so as to make it an anode and confines an ammoniacal liquid against the surface of the articles, then introduces and rapidly rotates a cathode within the article.

908,979. AUTOMATIC SWITCH-LOCK; C. E. Duffie, Omaha, Neb. App. filed July 25, 1907. For automatically locking a railway switch upon the approach of a train by means of an electrical circuit with train operated means for opening and closing the circuit and train operated means for closing a shunt in the circuit around the first mentioned train operated means.

908,981. TROLLEY POLE ATTACHMENT; H. W. Eichbaum, Los Angeles, Cal. App. filed March 28, 1908. A simple means for operating signals, etc., from electric cars while in motion. A contact member is arranged adjacent to the trolley wire and is electrically connected with the signal and a [illegible]ally operated contact member is carried by the trolley pole and [illegible]ectrically connected through the car with the signal. Fluid pressure [illegible] place the contacts in the path of one another when the circuit is to be closed.

908,917. APPARATUS FOR PREPARING OXONE; D. E. Parker, Niagara Falls, N. Y. App. filed May 3, 1906. Makes oxone (formed by fusing peroxide of sodium) by an apparatus comprising a melting pot, electrodes dipping into the pot with means for connecting the electrodes to a source of energy. The melting pot is pivoted on standards beneath a hopper.

909,030. ELECTRICAL CONNECTOR; G. A. Schreier, Auburn, Ill. [illegible] filed Feb. 10, 1907. For use in connection with flexible conductors for mining motors when the train enters a room in the mine into which the trolley wire does not extend. The end of the flexible conductor may be quickly connected with a terminal socket and is automatically disconnected when the motor returns.

909,043. ELECTRICAL SPARK APPARATUS; E. C. Wilcox, Meriden, Conn. App. filed Nov. 25, 1905. The apparatus may be assembled in units, each unit having the usual primary and secondary coils, together with a vibrator.

909,057. ELECTRIC MOTOR; James Burke, Erie, Pa. App. filed Jan. 20, 1905. A plurality of motor armatures are arranged to drive a common shaft, being disposed around the shaft and geared thereto.

909,092. CALL-BELL; Saul Katz, New York, N. Y. App. filed Dec. 19, 1907. The bell may be connected up through three different circuits with a single battery to give three different signals dependent upon which of the three circuits is closed by its respective push button.

909,120. ELECTRIC-CURRENT GOVERNOR FOR DYNAMO-ELECTRIC MACHINES; Leopold Rosenbaum and Frank Voglhut, New York, N. Y. App. filed Jan. 30, 1908. Operates by centrifugal force to cut in resistance under excessive speed and to cut out resistance when the speed decreases. Brushes are carried by the centrifugal device and a rheostat with terminals surrounds the centrifugal and connects with the brushes to increase or decrease the resistance.

Electrical World

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THE STREET RAILWAY INDUSTRY.

Last week we were able to place before our readers the gross statistics of the central station industry, showing an investment in 1907 of a billion dollars and an income of $175,000,000. This week we present on another page the gross statistics furnished by the Census Office for the electric and street railway industry, showing a capitalization of three and three-quarter billions and a gross income from all sources reaching the magnificent amount of $430,000,000. The latter sum includes a large amount from the lighting and power side, the final adjustments for which would bring the light and power income over $200,000,000 and the "trolley" income to $400,000,000, not including the earnings of electrified sections of steam railroads. These totals, gigantic as they seem, are undoubtedly within a small per cent of actual accuracy and represent the reports of the companies themselves. Our readers will note the very close approximation to estimates presented in these pages each year, and especially those just printed. We hope to receive within a week or two the statistics for the telephone art. It would not be surprising if the earnings of that industry came out equal or superior to those of electric lighting, which, of course, is subject to the widespread competition of the isolated plant, a factor virtually unknown in the other two fields. Taking these three great branches, the telegraph field and the product of electrical manufacturing, it will be seen that our estimate of over a billion dollars annually for American expenditure on electrical service and apparatus is easily surpassed, though many have been inclined to doubt it.

Even a superficial study of the two sets of figures reveals many interesting points. The "investment" in central stations is given, but it would seem that the capitalization is about one-third that of the traction art, whose earnings are about two-and-a-half times as great. Per kilowatt-hour of output the contrast is even more striking. With 4,759,000,000 kw-hours the trolleys earned $430,000,000, while with 5,858,000,000 the central stations earned $175,600,000. The central stations have much the larger capacity, as they had in 1902, and now show 2,642,403 kw as compared with 1,727,030 kw for the trolleys. It is a striking fact that in all the broad data, the two industries appear to have doubled in the five years, with the greater gain on the side of electric lighting, due to the fact that it is [illegible] approximating [illegible] an all-day business.

It is to be noted that a high rate of profit is not discernible from these figures in either group. The central stations operate, roughly, on a 70 per cent basis of expenses, as compared with 60 per cent in the transportation field, but neither ratio leaves much margin to disturb the arithmetic of the U. S. Supreme Court as to the sweet and saving simplicity of 6 per cent. The apparent net income in the lighting field of $41,000,000 would barely pay 4 per cent on the actual investment, but it is really somewhat higher, as the interest on bonds is

taken into account as an expense; and the total capitalization is not given. It was $627,000,000 in 1902 and was therefore probably over $1,200,000,000 in 1907. In the traction field the outstanding stock was $2,000,000,000 and the dividends were $53,500,000 in round figures, or 2½ per cent. The interest on the outstanding bonds of $1,677,000,000 was slightly over $71,000,000, or less than 5 per cent.

Is There a Power Trust?

The recent veto message of President Roosevelt in condemning the granting of perpetual power privileges on streams under national control, makes certain statements which serve as a basis for the assumption that a formidable water-power trust is in virtual existence. On the authority of Commissioner Smith it is stated that with 5,300,000 hp in water-power plants in the United States, nearly 20 per cent of this amount in plants already developed or advantageous for development, is owned by 13 large companies, who also hold 10 or 15 per cent more by various indirect means. In short, 13 concerns hold about 1,800,000 hp. Proceeding from this basis the President draws the conclusion that a far-reaching power trust is in process of formation, and charges that: "The new legislation sought in their own interest by some companies in the West, and the opposition of other companies in the East to proposed legislation in the public interest, have a common source and a common purpose. Their source is the rapidly growing water-power combination. Their purpose is a centralized monopoly of hydro-electric power development free of public control." This is a pretty serious indictment if well-founded. But what are the facts regarding the alleged ownership?

Is Commissioner Smith prepared actually to state to what extent and just how the big thirteen hold their respective interests? If so he should give the facts the widest publicity. There is no use in mincing words about such matters. We are well aware that there are several large power concerns controlling groups of powers which they have wisely unified into networks with admirable results in ensuring a cheap and reliable power supply. We are also aware that electrical manufacturing companies have been for a decade or more active in selling power transmission apparatus and have helped along promising enterprises in every proper way. Such enterprises go to these concerns for a helping hand very naturally, and have time and again received it in one way or another. The financial allies of the big thirteen have doubtless taken good bonds freely, and have probably had proper representation upon the several directorates. Such assistance has been very potent in promoting the development of water-powers to the great benefit of the territories served. This, however, is a long way from the formation of a water-power trust. It is doubtless unfortunate that hydraulic enterprises have had to go through the financiering process, for, as we have more than once intimated, they have often thereby been burdened with formidable investment charges; yet they have very properly turned first to those who have had faith in the business and the courage of their convictions. If anyone thinks that the big manufacturing companies are jealous and greedy when it comes to independent power plants, let him try going to one of them with a project already organized and with cash ready for the purchase of equipment. He will get a welcome that would have turned the Prodigal Son green with envy.

There is, of course, no doubt that in the past few years people have come to recognize the value of water powers as investments and have taken them up for speculative purposes, but in this there has been no discernible unity of action. So far as we have been able to ascertain, the big thirteen are more jealous of each other than they are of outsiders. Much of what the President takes for concert of action it seems to us is chargeable rather to instinctive community of motive. Financiers always and everywhere can be trusted, secretly or openly, to oppose every form of government control that is likely to hinder their personal schemes. A banker in Maine and a banker in Texas, entirely unknown to each other, will put up the same protest, based on the same old arguments against public control, just as they would probably swear in approximately the same unstudied terms were they severally kicked. We doubt the existence of anything that can fairly be called a power trust, while realizing fully the possibilities of the future situation, and the real need of vigorous action to preserve for future generations their heritage in the hydraulic resources of the country. The government could very properly decline the aid of national resources unless those receiving it directly or indirectly put themselves unequivocally under government rate-regulating power, extending not only to the plant immediately concerned, but to every person or corporation allowed to receive the output for the purpose of selling it again. This would foster combinations just insofar as they might submit to governmental regulation; and such combinations are certainly for the public benefit in the case of electric supply, which comes pretty near to being a natural and useful form of monopoly.

Representation of Synchronous Converter Phenomena.

The actions that take place in a synchronous converter are by no means easy to compute. The machine takes, in general, several alternating currents differing in phase, at its slip rings. It delivers simultaneously a fairly steady direct current at its commutator end, but the actions by which the alternating currents are converted into direct currents, although easy to perceive in broad outline, are hard to represent either diagrammatically or arithmetically. The heating of the armature conductors depends, under the simplest conditions, on the phase relation between incoming currents and voltages, as well as on the amount of load. It is shown by Mr. Olin J. Ferguson, in his article on another page, that the graphic representation of the current strength in the coil of a converter armature is a limaçon, a curve whose properties were first analyzed in publication by the celebrated Blaise Pascal, in 1643. Mr. Ferguson shows that the area enclosed by the curve, when drawn to a suitable scale representing the armature currents, corresponds to the heating in the armature coil considered. This graphical method of representing the action is a distinct step toward simplifying the explanation of a converter's behavior. The area enclosed by the whole limaçon, or by any assigned polar portion thereof, happens to be capable of simple numerical expression.

Regulation of Rates.

The decision of the United States Supreme Court on the 80-cent gas law, affecting the Consolidated Gas Company of New York, is one that is likely to have far reaching effects in every branch of public corporate service. Particularly it is likely to

stimulate efforts at the control of rates hitherto checked by the probability that laws providing for regulation amounting to anything would be declared unconstitutional. Looking at the matter broadly, it is practically inevitable that regulation should come unless the place should be taken by municipal ownership; and of the two, regulation is no more to be feared by corporations and much less to be feared by the public than the alternative. The record of municipal government in American cities is too sinister to encourage any excursions into new fields of graft. As we have several times noted, the crucial point in municipal work is the proportion of politically active employees that a given branch of service is likely to demand. Municipal water works, for instance, generally do well, municipal gas works and electric light works rather badly, and Heaven help us if it comes to municipal tramways. The average street department is hard enough to keep out of mischief, but a street railway system is in a class by itself. The present decision, coupled with common knowledge of the difficulties of municipal ownership, practically ensures the continuance of a tendency toward regulation rather than anything more radical, for which even those regulated should be thankful. The decision also is rational in that it does not neglect the value of franchises as an element in the legitimate valuation of the property. On this point there has been a good deal of debate among publicists, some taking the view that a franchise issuing from the public was not a proper corporate asset in determining suitable prices.

A fairer and broader view it seems to us is that foreshadowed in this decision, that a franchise to do public work is "property and cannot be taken away and used by others without compensation. The important question is always one of value." A franchise becomes of actual value only when it is intelligently utilized, as it can be by good business management. From this point of view the corporations are virtually partners of the public in the values derived from franchises, the corporations being entitled to earnings based on their skillful use of the franchise, which gives it its value as an asset and the rights of the public being fully recognized in the right of regulating rates. It is only in virtue of operation under a public franchise that such regulation is defensible. So far as the physical assets of a gas or electric light company are concerned they are, as far as public rights are concerned, like a foundry or a shoe factory. It is only in the franchise rights that public and private interests find a point of contact. Therefore, if there is to be regulation of rates the value of the franchise is its logical reason for being, and should be taken into account as part of the property on which fair earnings are to be allowed. And the decision under discussion intimates pretty strongly that rates which, based on a valuation including this franchise value, give a return comparable with that of other first-class securities, will not be considered as confiscatory. On physical valuation alone the rate, low as it is, would give a net return larger than would ordinarily be expected from stable securities. The effect of the ruling on the public mind should be to encourage a feeling of fair play toward public enterprises, making it evident that the highest court is disposed to intervene if necessary in the interest of fair play.

The general public ought to realize far better than it does that most public service corporations are disposed to deal squarely, and that impudent grasping is the exception rather than the rule. Few people are in business for their health alone and fair returns upon investments are to be expected. Why should people expect gas or electric light to be supplied at cost instead of on a profitable basis like hats, shoes, flour and pork? And why should they insist on trying to regulate to a nicety the basis of sales of the former commodities without in the least understanding the basis of the business? The thing to be feared in public regulation of rates is not regulation itself, but ignorant meddling irrespective of the necessary conditions of trade. The cost of production of a commodity is brought to a minimum that will ensure low price to the consumer only by the exercise of extraordinary judgment in meeting the conditions of consumption in such wise as to best utilize the plant, whether it is making ice or kilowatts. But people who tinker with rates too often forget everything about details of manufacture and sale and set up conditions that, by increasing the cost of production, may and often do defeat the very reductions in price that are to be desired. In the electric supply business in particular it takes the wisdom of the serpent to work out a system of selling that will tend to minimize the cost of production and hence to lower prices. In the long run the tendency of prices for light and power has been steadily downward in the past while the prices of most things, necessities and luxuries alike, have for years been very conspicuously upward. We have never heard of a place where an electric light company has deliberately raised its prices, and we never expect to hear of one unless in some rare instance where there may have been for a brief period cutthroat competition. On the other hand, the lowering of prices is very common both in the case of gas and of electricity.

Regulation of rates is becoming popular, however, and it will probably continue. Whether it will do harm or good upon the whole is a matter not of principle, but of practice. If approached in a spirit of fair play for everybody, the desired result can generally be reached without much difficulty. If, on the other hand, the problem is tackled by doctrinaires who know nothing of the technique of the situation, or by demagogues who are merely looking for a little cheap notoriety, there is likely to be trouble all along the line. Practically very few bills for the regulation of rates appear to have been drawn by those who have knowledge of the conditions involved and of the real effect of the various provisions. There is too much of the lawyer and the politician and too little of the business man in the game as it is generally played. The relations of the public and the public service corporations ought to be of the simplest and most friendly kind, and to be settled on a strictly business basis, recognizing the rights of both parties; instead of this, they too frequently approximate a game of poker played by eminent counsel with the interests of the public and of the stockholders as chips. Call the determining body by what name you will, its decisions are seldom based openly on what common, everyday people would call a square deal. Even boards of arbitration, which in theory ought to do the work admirably, are often so beset with obstacles that they can make but small progress, and have insufficient authority to enforce the faithful carrying out of their judgments. And so, as in the case before us, the issues get pushed to the court of last resort. Even so, we [illegible] that a tangible issue was actually decided and not deftly sidestepped by a decision based on inconsequentialities. For what we have received may we be as thankful as circumstances permit.

President Roosevelt Attacks Electrical Corporations.

President Roosevelt in vetoing a bill authorizing the construction of a dam across the James River, Missouri, for the purpose of electric power, made the following statement:

"The total water power now in use by power plants in the United States is estimated by the Bureau of Census and the Geological Survey as 5,300,000 hp. Information collected by the Bureau of Corporations shows that 13 large concerns, of which the General Electric Company and the Westinghouse Electric & Manufacturing Company are most important, now hold water-power installations and advantageous power sites aggregating about 1,046,000 hp, where the control by these concerns is practically admitted. This is a quantity equal to more than 19 per cent of the total now in use. Further evidence of a very strong nature as to additional intercorporate relations, furnished by the bureau, leads me to the conclusion that this total should be increased to 24 per cent; and still other evidence, though less conclusive, nevertheless affords reasonable ground for enlarging this estimate by 9 per cent additional.

"In other words, it is probable that these 13 concerns directly or indirectly control developed water power and advantageous power sites equal to more than 33 per cent of the total water power now in use.

"This astonishing consolidation has taken place practically within the last five years. The movement is still in its infancy, and unless it is controlled the history of the oil industry will be repeated in the hydro-electric power industry, with results far more oppressive and disastrous for the people. It is true that the great bulk of our potential water power is as yet undeveloped, but the sites which are now controlled by combinations are those which offer the greatest advantages and therefore hold a strategic position. This is certain to be strengthened by the increasing demand for power and the extension of long-distance electrical transmission.

"The great corporations are acting with foresight, singleness of purpose and vigor to control the water powers of the country. They pay no attention to State boundaries and are not interested in the constitutional law affecting navigable streams, except as it affords what has been aptly called a 'twilight zone,' where they may find a convenient refuge from any regulation whatever by the public, whether through the national or the State governments."

An officer of the General Electric Company has issued the following statement in denial of the charge so far as that company is involved:

"The General Electric Company is not a party to any trust to control water power, nor is it to any considerable extent interested in water power through ownership thereof. It is interested in the development of water power as the latter affords a market for electrical apparatus, of which its manufactures largely consist.

"The General Electric Company has no interest in the Westinghouse Company, in the ownership or development of any water power, nor do the men named, so far as I know, control any water power in the interests of the General Electric Company. I do not know of a single water-power company controlled by the General Electric Company, except the power at Schaghticoke (the Schenectady Power Company), all of which power is delivered to the Schenectady plant of the General Electric Company."

Latest Statistics of Electric Street Railways.

Herewith are given the statistics just issued by the U. S. Bureau of the Census for street and electric railways for 1907, for the United States, exclusive of Alaska, Hawaii, Philippine Islands and Porto Rico. The final report now in preparation will contain a complete analysis of these totals and will present detailed statistics for other branches and phases of the industry; for instance, the gross income below companies' earnings from electric light and power, which may easily reach $20,000,000 or more.

The statistics relate to the years ending Dec. 31, 1907, and June 30, 1902. The totals include, as noted, reports of operating and lessor companies and a considerable number of electric light plants operated in connection with electric railways, but do not include reports of railways under construction during the census years; nor do they include reports of financing companies which were not engaged in actual operation of railways or light plants.

	1907.	1902.	Per cent of increase.
Number of operating and lessor companies	1,340	987	25.2
Length of line (first main track), miles	25,547.19	16,651.58	53.4
Total length of single track, miles	34,403.56	22,576.99	52.4
Number of cars, total	83,641	66,784	25.2
Passenger	[illegible]	60,290	16.1
All other	13,625	6,494	109.8
Number of motors	[illegible]	[illegible]	27
Steam and gas engines (including turbines), number	2,552	2,351	8.5
Horse-power	2,384,518	1,300,058	83.4
Water wheels, number	228	160	42.5
Horse-power	91,961	49,323	86.5
Total kilowatt capacity of dynamos	1,727,030	898,362	92.2
Output of stations, total kw-hours	4,750,130,100	2,261,484,397	110.4
Passengers carried, total	9,533,080,766	5,836,615,296	63.3
Fare	[illegible]	1,774,211,904	55.9
Transfer	1,995,658,101	1,062,403,392	87.8
Free	[illegible]	[illegible]	[illegible]
Total car mileage (passenger, express, freight, etc.)	1,518,343,584	1,144,430,466	41.4
Combined income account, operating companies.			
Earnings from operation	$418,187,858	$247,553,999	68.9
Income from other sources	†11,556,396	2,950,628	291.7
Gross income	429,744,254	250,504,627	71.6
Operating expenses	251,309,252	142,312,597	76.6
Net earnings (earnings less operating expenses)	166,878,606	105,241,402	58.6
Gross income less operating expenses	178,435,002	108,192,030	64.9
Deductions from income (taxes and fixed charges)	138,094,716	77,595,053	78.0
Net income	40,340,286	30,596,977	31.8
Dividends (operating companies only)	25,558,857	15,882,110	60.9
Surplus	14,781,420	14,714,867	0.5
Capitalization, operating and lessor companies.			
Capital stock authorized, par value	$2,508,054,336	$1,529,199,589	64.0
Capital stock outstanding, par value	2,097,708,856	1,315,572,960	59.5
Dividends on stock	53,589,399	33,039,171	62.2
Bonds authorized, par value	2,319,220,837	1,341,429,727	72.9
Bonds outstanding, par value	1,677,063,240	993,709,139	68.9
Interest on bonds	71,468,788	43,578,961	64.0
Total par value stock and bonds outstanding	‡3,774,772,096	2,308,282,099	63.5
Employees and wages, operating companies.			
Salaried employees, number	11,700	7,128	64.1
Salaries	$12,909,466	$7,439,716	73.5
Wage-earners, average number	209,729	133,641	56.9
Wages	$138,081,633	$80,770,449	71.0

*Not reported separately.
†Includes $3,255,618 income from interest on bonds and dividends on stock of other electric railways.
‡Includes permanent and other investments, such as securities of other electric railways, treasury stocks and bonds, gas plants, etc.: 1907, $388,394,092; 1902, $152,513,997.

The averages shown by the data embodied in the report are as follows:

Capital liability per mile of track	109,719	$102,240
Average horse-power per engine	934	353
Average horse-power per water wheel	403	308
Kilowatt capacity of engines and water wheels	1,847,453	1,006,623
Kilowatt capacity of dynamos	1,727,030	898,362
Kilowatt consumption per car mile	2.94	1.97
Fare passengers per mile of track	216,286	211,464
Fare passengers per car mile	4.60	4.17
Income per car mile	25.8c.	21.6c.
Average yearly salaries of officials	$1,103	$1,044
Average yearly wages of wage-earners	$658	$604

Niagara Power Treaty.

Secretary Root and Ambassador Bryce, of Great Britain, have signed a treaty for the settlement of differences between this country and Canada relating to Niagara Falls and the Great Lakes. The treaty requires that the level of Lake Erie must be maintained, and permits Canada to use for power purposes at Niagara 36,000 cu. ft. of water per second, and fixes the amount for the United States at 20,000 cu. ft., an increase of 1500 cu. ft. over the amount recommended by the International Waterways Commission, whose figure for the Canadian falls was accepted. The treaty provides for a commission to dispose of future problems that may arise in administering its provisions. As the level of Lake Michigan is not specifically fixed, the status of the Chicago drainage canal is not affected by the treaty.

Massachusetts Legislative Notes.

A bill has been introduced into the Massachusetts Legislature authorizing the Massachusetts Highway Commission to require, in cases where it considers it necessary from the standpoint of safety, street railway, telephone, telegraph, electric lighting and other corporations using overhead wires and trolleys, or other conductors, to place all such wires underground, in conduits, by 1914, in all cities and towns with a population of over 25,000, and by 1915 in all other places in the State.

The United Electric Light Company, of Springfield, has petitioned the Massachusetts Legislature, and a bill has been introduced to the effect that the company shall not be required to place in more than one mile of streets its wires and cables underground in each year, beginning in 1909.

Hartford Street Lighting Proposals.

The Hartford Electric Light Company has submitted proposals for street lighting to the city authorities under date of Jan. 4 in accordance with the specifications prepared by Dr. Louis Bell, of Boston, consulting engineer. The company proposes to light the streets for a term of five years as follows:

a. By arc lamps of the titanium type, taking not less than 4 amp, and not less than 300 watts at the arc, at $64 per lamp per year, if supplied from the underground system, and at $60 per lamp per year if supplied from the overhead system.

b. By arc lamps of the magnetite type, taking not less than 4 amp and 300 watts at the arc, at the same prices.

c. By tungsten lamps, taking about 250 watts at the terminals and operating at a specific consumption of about 1.25 watts per candle, at $35 per lamp per year if operated from the underground system, and at $30 if run on the overhead system.

d. By tungsten lamps of 125 watts, 1.25 watts per candle, at $17 per lamp per year, operated from the overhead system.

e. By tungsten lamps of 75 watts, 1.25 watts per candle, at $15 per lamp per year, operated on the overhead system.

f. By tungsten lamps of 50 watts, 1.25 watts per candle efficiency, at $14 per lamp per year, overhead system operation.

g. By tungsten lamps of 40 watts, 1.25 watts per candle, at $13.50 per lamp per year, operated from overhead system.

For the present system of street lighting which the company has been supplying for the past five years to the city, the company bids as follows: For each arc lamp, $56 per lamp per year for a period of five years; or $60 per lamp per year for a one-year contract, the lamps being either 6.25-amp series alternating-current enclosed arcs, or 4-amp direct-current constant-potential enclosed arcs. The lighting committee has taken the bid, which was the only one offered, under advisement.

Enlarging Chicago Drainage Canal Power Plant.

Contracts were awarded on Jan. 15, by the Sanitary District of Chicago, for a generator and six large transformers, which will be used to increase the equipment of the Drainage Canal power transmission from Lockport, Ill., to Chicago. The contract for the generator went to the Western Electric Company for $25,748, and calls for a 4000-kw, 60-cycle, 6600-volt, three-phase machine to be delivered June 1 next. It is only comparatively recently that the Western Electric Company has gone into the building of alternators, and this will be the largest machine it has turned out.

Mr. W. A. Jackson, a contractor, received the transformer contract, his bid being $18,500. He will use General Electric transformers. Three will step-up the generator voltage to line voltage (44,000 volts) and three will step-down the line voltage at the Chicago substation to primary distribution voltage (12,000 volts).

At present the working capacity of the power house at Lockport is 12,000 kw in three Crocker-Wheeler units of 4000 kw each. Two other units of the same size and make will be put into service soon, however, so that when the Western Electric machine is added in the summer the total rating of the plant will be 24,000 kw, or just double its present capacity. Specifications for meters and transformers for distribution and customers' circuits are now out. Mr. E. B. Ellicott, Sanitary District, Chicago, is the electrical engineer.

Another Patent Fraud Case.

On Jan 12 Mr Chas. E. Acker, of the late Acker Process Company, Niagara Falls, was indicted at Lockport, N. Y., for alleged fraud in connection with an application for a United States patent on a process for removing tin from tin scrap by means of chlorine gas. The indictment contains four counts, one for perjury and three for subornation of perjury. The case against the accused was worked up by the owners of patents which, it is alleged, the former endeavored to supersede by securing a subsequent patent on the process that it covers, but having behind it an earlier date of conception of invention. Copies of the indictments in the case applied for have not arrived as we go to press, and in the absence of a statement from Mr. Acker, at present only the side of the prosecution can be presented.

The indictment at Lockport was secured through the efforts of the Goldschmidt Detinning Company, of Chrome, N. J., which owns U. S. patents granted to Karl Goldschmidt and Josef Weber, of Essen, Germany, on detinning scrap tin. To these, as joint inventors, a patent was granted (No. 882,115) on a process for removing by means of chlorine gas tin from tin scraps, and a further patent on Sept. 8, 1906 (No. 831,223), on a modification of the same process. It is claimed that within three weeks after the issue of the first patent Acker filed an application in the patent office covering the same subject as that of the patent, and within three weeks after the issue of the second patent he filed an amendment to this application which contained, word for word, as well as the punctuation, 14 of the 16 claims of the latter. This was followed by interference proceedings on the claim that Acker had anticipated Goldschmidt and Weber in the invention at issue. Under the U. S. patent laws a foreigner is limited in date of invention to the date on which a corresponding patent in his own country was published, whereas a domestic inventor is allowed a latitude of two years or more prior to date of application. In the interference proceedings Acker filed a sworn statement to the effect that he invented the chlorine process of detinning at issue early in the year 1902; that early in December of that year he demonstrated the practicability of his invention in the laundry of his house in Niagara Falls; that he continued his experiments on an average of at least once a week at the same place until Christmas of 1902, and thereafter in the basement of the works of the Acker Process Company at Niagara Falls until April or May, 1903, after which the apparatus was returned to the cellar of his home, where he worked on the invention at least once a week until February, 1906. Four witnesses testified in support of this statement.

The complainants maintained that upon investigating the statement, they found first, that not one of the servants employed in Acker's house during the period mentioned knew anything of any chemical operations being conducted in the laundry, though one of the witnesses being a man who took care of the furnace in the residence during the larger part of the period named. It is further alleged that after the cross-examination by the complainants of this latter witness, the accused offered a bribe to have him make certain statements on the stand which he himself would there corroborate. A laundress also testified [illegible] approached by Acker with a view to having her testify as he wished. Three witnesses had given testimony that they had assisted in the operations in the laundry, but it is stated that when the district attorney sent for these witnesses and questioned them they confessed that the testimony given by [illegible] false, and made a like confession later in Patent Office proceedings. After careful consideration of the allegations of fraud final judgment was rendered against the Acker application.

Public Service Commissions and Electrical Engineering.

At the meeting of the Pittsfield, Mass., section of the American Institute of Electrical Engineers, held there on Jan. 8, Mr. T. C. Martin, editor of *Electrical World,* delivered an address on "Public Service Commissions and Electrical Engineering." He pointed out that the relationship of these new bodies and of the newer legislation to engineering was very close and intimate and must affect its future deeply. Such bodies, indeed, would not exist but for the work of the engineers and inventors, who had given us the modern arts.

If, however, in acquiring these material benefits we had lost any of our real personal freedom and political liberty, the whole lot would not be worth the having. If the rights of individual citizenship are under doubt of curtailment, it would be better to go back part of the road of civilization and travel slower or enjoy less light; for the sake of being unhampered by the fetters of our own luxuries. The assumptions of recent years have been, in some quarters, that we had paid in this sacrificial manner too high a price for what we got, and should rather look on Watt, Smeaton, Franklin, Stephenson, Bell, Edison, Elihu Thomson, W. Stanley, S. D. Field as enemies of their kind rather than as benefactors, because their ideas constitute the basis of monopoly. It is true these names are not pronounced loudly, or are hardly heard at all, in the storms of popular declamation that beat so strenuously on weary ears, but take them away and there would have been no need for "control." President Roosevelt could have gone to Africa for his big game seven years ago; there would have been none in this country.

Mr. Martin remarked that the public service policy was not altogether a novelty. Such bodies of limited scope have existed for many years in the various States; while the Interstate Commerce Commission is but another illustration of the applied idea on a larger scale. In fact, a vast body of legislation existed before these commissions came into being that dealt with the regulation and control of public service corporations, and all of that legislation has had to be repealed. Thus the law in New York repealed 10 previous laws by name, as well as those unnamed. The draft of the bill embodying the proposed law for Connecticut repeals by name no fewer than 16 chapters of the laws of various years and several scores of sections of the general statutes. These facts show simply what is perhaps well known to many, viz., that legislation of this kind is not a novelty. What does constitute the novelty is the amplitude given to the powers of these commissions over practically all the functions of the public utility corporations; and it was in relation to some of these delegated powers of the States that he proceeded to speak more specifically, dealing both with the laws and what has happened under their application.

We have to-day two Public Service Commissions in this country, New York and Wisconsin; but in New York the work has been divided between two bodies, and in Massachusetts there are three commissions which cover the same ground as the one commission does in Wisconsin. Outside these States the question of establishing such a commission is very seriously proposed, as, for example, in Ohio. Bills have been introduced in the last Vermont Legislature aiming at the same object. Other States, like New Jersey, have had the matter under agitation, and it really looks as though in a few years Public Service Commissions of the New York and Wisconsin type would become quite general throughout the country. Moreover, the drift of public opinion is also toward inclusion of all utilities and to wider powers over capitalization. Thus in national control, Senator Dolliver has introduced a bill this winter at Washington regulating closely the issuance of securities by steam railroads and putting telegraphs and telephones under the Interstate Commission. President-elect Taft is understood to be framing up changes in the law which will give the commission and the Bureau of Corporations very broad powers over all companies doing an interstate business. In New York State it is now proposed definitely to put the telegraph and telephone companies under the two commissions; and in the outlined Connecticut scheme all water, water-power and express companies are to be included. It is thus very evident that we are rapidly passing to a further stage of evolution of the public utility corporation, while each step raises questions of the most vital importance to all.

It is, of course, with regard to railroads that State regulation has gone furthest, and a brief summary of the facts as to that one department of activity will not be without interest. In 1902 there were already no fewer than 31 State railroad commissions; there were in 1908 eight more, making a total of 39, to which perhaps one or two may have been added during the year. Seven of the commissions were replaced by other bodies, so that in the five years 15 new commissions were appointed. These 39 are not all alike, some being "weak," as they are called, without power to fix rates, and others "strong," i.e., possessing the rate-making power. Of such a "strong" character are the commissions of New York, Ohio, Wisconsin, Colorado, Michigan, Nevada, Oregon, Vermont; but there are some which go further, and do not merely regulate rates, but themselves make complete rate schedules for State traffic on their own initiative. These commissions exist in Indiana, Washington, Montana, Nebraska and Alabama. "Weak" commissions without mandatory power over rates are found in New Jersey and Pennsylvania. The body in Pennsylvania has jurisdiction, however, over navigation companies, pipe lines, and telegraph and telephone companies. The Kansas commission has control over electric railways. The Georgia commission now has enlarged powers which really make it a public utilities commission, as it includes street railways, gas works, and electric light and power companies. This brief and necessarily incomplete summary gives an idea of the varied manner in which this great modern problems of adequate but reasonable control has been approached.

Mr. Martin quoted President Humphreys, of the American Gas Institute; President Farrand, of the National Electric Light Association, and Mr. T. N. McCarter, past president, American Street & Interurban Railway Association, to show in what language of distrust and deprecation these leaders of great public utility groups regarded the various efforts of the new commissions to enlarge their powers and aggrandize themselves. He then spent some time in showing how rates were affected, and referred to rulings and regulations as to lamps, meters, rates, breakdown service, accounting and other elements into which electrical engineering entered more or less deeply. He showed that already there were differences of practice, which would probably become greater as these new bodies increased in number. At the same time there might be advantage in having these various "experimental stations" and "testing laboratories" for the era of regulation was upon the art, and the best methods could be found none too soon.

What the Wisconsin Utilities Commission Has Done.

In a recent address before the National Municipal League and the American Civic Association, Dr. B. H. Meyer, president of the Wisconsin Public Utilities Commission, summed up the benefits of the work of that body as follows:

1. The Wisconsin legislation has taken the utilities, as well as the railroads, out of politics. I do not believe that many citizens can be found in the State of Wisconsin who would seriously claim that in either the primary campaign or in the campaign preceding the present November elections, the utilities as such had entered into politics. All students of municipal affairs well know that in this elimination of politics from the management of utilities we have removed one of the greatest and most persistent sources of corruption and bad government.

2. The utilities law tends to eliminate feuds between the citizens and the managements of public and private plants. The law assures to all communities good service at reasonable rates. This is placed within the reach of all impartially.

whether the commission advances or lowers the rate. The basis of its findings is published in every instance. These published facts should suffice to convince, and I believe do convince, the average citizen of the reasonableness and justice of the decision, if it is reasonable and just, and whether he likes it or not, he must abide by that decision. In this respect, cases affecting utilities are quite different from the most of the cases affecting railroads. In the case of utilities the controversy frequently degenerates into a bitter and partisan feud, affecting the entire population, which blinds both sides to a proper comprehension of the facts and to a sense of justice. Proceedings before the commission tend to clarify and educate public opinion.

3. The public utilities law raises the standard of morality through the eradication of the evil of discrimination, and the protection of a reasonable rate. To those who are quite familiar with the past evils of discrimination in railway rates, the extent of the discriminations in the rates in service utilities may be almost beyond comprehension. The whole State of Wisconsin was literally streaked and plastered with discriminations in the rates of utilities, and in all the rest of the country where the extent of such discriminations have not yet been determined, as they have been in Wisconsin, it is quite probable that discriminations similar in character and extent likewise exist. All rates, rules and regulations in effect in the State are on file with the commission, and these are the only rates and regulations which can be lawfully enforced and collected. Free and reduced-rate service has been absolutely prohibited. Thousands of individuals had been receiving free and reduced-rate service, and eradication of all such rates cannot help but serve as a moral tonic and raise the level of public and private morality within the State as a whole. For 32 of the reporting telephone companies, eight of every 100 subscribers received free or reduced-rate service. The process of equalization of rates had been going on for over a year. Consequently the actual extent of the unjust discrimination was doubtless very much greater at the time of the enactment of the law. I have every reason to believe that in every other State of the Union these discriminations still flourish at the expense of subscribers who pay the full rate. Similar discriminations exist in other classes of utilities.

4. The utilities law is working a revolution in business management. While some managements are doubtless models from a business point of view, they are not the general rule. Many of the utilities companies have not been operated on a business basis; in fact, it is probable that a good many of the managements did not have the remotest idea as to the exact standing from a business point of view of the plant they were operating. Uniform accounting, rules governing the service and the regulation of rates compel the adoption of business and scientific methods, which is resulting in nothing short of a revolution in management.

5. All of the effects of the law, taken collectively, are bound to place investments in public utility enterprises on a more stable foundation. The law works both ways. On the one hand, it protects the consumer against unjust and unreasonable rates and poor service, and, on the other, it protects the investor in his claim to a reasonable rate on the property which is devoted to public use. This legislation will probably remove public utility investments very greatly, if not entirely, from the field of speculation and place them in the class of conservative certain and stable investments.

A Report on Methods of Telephone Accounting.

A report has just been filed with the city of Chicago by the engineering firm of D. C. & W. B. Jackson, and Arthur Young & Company, the consulting accountants for the city, with regard to proposed methods of accounting for the telephone system. Interest attaches to the subject from the similarity developed to the methods employed in arriving at [illegible] other electrical service. The proposed new telephone ordinance reserves to the City Council comprehensive powers in the adjustment, changing and regulation of telephone rates after 30 months from the company's acceptance of the ordinance, which was Dec. 1, 1907, and thereafter at intervals of five years. For the purpose of an intelligent exercise of the right to regulate rates at the end of 30 months it is considered important that the information produced for the city shall particularly exhibit: (1) the investment required for furnishing each class of telephone service; (2) the cost of furnishing each class of service rendered, and (3) the revenue derived from each class for service rendered. The ordinance clothes the city comptroller with authority to prescribe the form and manner of keeping accounts and records by the company, and the report is in conformity with this authority. The object of the report is to formulate a system of keeping records and accounts to be adopted by the telephone company so that all the facts, data and information necessary to make proper and reasonable regulation of rates may be furnished to the city.

A more comprehensive system of record keeping and accounting than has heretofore been introduced by any telephone company is required to make apportionment of costs among the many different classes of service established by the ordinance, and this report is in a sense without the guide of precedent. To accomplish the purpose, the costs of giving service must be separated and properly apportioned among the different classes of service. The rate schedule of the ordinance requires the company to maintain a comprehensive service suited to all classes of users, which analyses into 15 different classes of service for "Chicago Exchange" users, seven classes of service for "Neighborhood Exchange" users, and two special classes embracing private lines and mileage extension lines. These are enumerated in detail in the report. They are all for service within the city. Toll service to points outside of the city is additional thereto.

The city probably will eventually desire to have a complete inventory and appraisal of the physical property of the telephone company. However, the plan of accounting laid out in the report expects that suitable subdivisions of the plant may be reached through accepting the divisions found in the telephone company's accounts, and deriving the further subdivisions by mathematical processes and engineering estimates. This will serve all the needs of the present, and a complete inventory can be ordered when the city finds that it would be desirable.

The investment and operating cost for telephone service may be divided into two principal parts: (1) a part which may be assumed to be independent of the amount of use of the telephones and is fixed for any class of service in substantial accordance with the apparatus required to give the type of service for that class, and (2) the remaining part dependent almost directly on the amount of use of the telephones; that is, on the extent of the telephone traffic. Illustrative examples indicating the necessity of this subdivision are given in the report. The phrase "Readiness to Serve" is adopted in the report to indicate the first part, and the phrase "Service Rendered" to indicate the second part. The setting apart of these two parts of plant from each other is difficult because of the lack of adequate means for keeping separate records of messages belonging to each class of service. The company maintains a count of the messages from all of those subscribers whose bills are based on messages, and it therefore keeps data from which a record may be made of the messages originated by each message class of service and by each of the regular measured-rate classes (omitting the commuted rate lines). It also makes a monthly count (called a "peg count") of all calls for one day in the month, but this gives no information as to the relative number of messages originated by the various flat-rate classes of service of the commuted lines.

The importance of obtaining a true record of the messages originated in each of the latter classes of service will be understood when it is known that much the greater part of the traffic [illegible] the company's central office comes from the flat rate [illegible] commuted rate lines. The results of a recent peg count

taken at central offices serving the business part of the city show that 17,011 lines in these classes originated no less than 632,796 calls during 24 hours, while the 36,668 measured-rate lines of the same central offices originated only 400,356 calls during the same 24 hours. Similar results are exhibited by the records of all the monthly peg counts.

As already indicated, a large part of the cost of giving service is proportional to the amount of the traffic, and it is an essential feature of the plan presented in the report that the records of traffic shall be complete. The great disparity in the traffic of the different classes must make a large difference in the cost of service, and the conditions relating to the cost in the different classes cannot be adequately known until arrangements have been devised for keeping classified records of the messages originated by the flat-rate and commuted-rate subscribers, as well as the others. The most satisfactory way of doing this is by putting a message register or meter on every flat-rate and commuted-rate line; but, owing to the fact that message registers are not yet installed, the company should organize a special force of clerks for counting and supervising the counting of these messages until registers are installed. The report points out that the company is now taking steps to organize such a force.

It is obvious that over 170,000 telephones cannot be considered individually, one by one, on account of the insuperable difficulty and cost of keeping records, but that they must be considered in groups of similar character. These groups are fixed by the schedule of rates imposed on the company by the ordinance. The service to meet each subscriber's needs most economically can be obtained by him from some one of the classes of service of the rate schedule, and subscribers of reasonably similar requirements are therefore attracted together in groups corresponding to the rate classes. The rates are so numerous and carefully adjusted that every user can get telephone service adapted to his needs. It is therefore convenient and proper to adapt the accounting methods so as to arrive at the average cost of service for each of these classes. In pursuance of this object the report shows a plan for apportioning the company's investment among the same classes, and segregating the revenue according to the classes.

Reports of New York Public Service Commissions for 1908.

Reports for the year ended Dec. 31, 1908, have been made to the New York State Legislature by the Public Service Commissions of the First and Second Districts.

REPORT OF THE FIRST DISTRICT COMMISSION.

A brief summary of the report of the commission of the First District, which has been published in advance of the publication of the full report of three volumes, shows that the surface, elevated and subway companies in New York City carry annually over 1,300,000,000 passengers, which is over 66 per cent more than the total number of passengers carried on the steam railroads of the entire country. These companies have a capitalization of over $533,000,000, and derive annually from their passengers over $62,000,000. The gas and electric companies have a capitalization of over $386,000,000, and the amount of gas sold annually is over 32,000,000,000 cu. ft., which is more than 20 per cent of the entire gas production in the United States. The income from the sale of electricity in New York City is over $20,000,000.

The commission refers to the reports of Mr. Bion J. Arnold, who was retained as special engineer to make an investigation of the subway as operated. Following the recommendations of Mr. Arnold the commission has requested the Interborough Rapid Transit Company to equip two experimental trains with side doors, and to install a system of speed control on the express tracks.

In addition to over 3000 complaints as to service rendered by transportation companies, the commission has received about 9000 complaints affecting gas and electrical corporations, chiefly as to the accuracy of meters. Nearly all of the complaints regarding gas and electrical corporations have been adjusted without formal hearing. In each of the few instances where an informal hearing before one of the commissioners has been required, the companies have accepted the findings and given the relief suggested.

Regarding the forms of accounts and reports, the commission says it found that little work had been done on behalf of electric railroads and gas and electric companies "other than by certain technical associations, whose systems were not compulsory, nor had they been generally accepted because of considerable differences of opinion within the associations themselves."

The problems which have arisen with gas and electric companies during the year have related principally to the instruments for measuring the service and to the conditions that the companies have sought to improve in their contracts for service. The report adds:

"The various types of electric meters in use in the city are being tested and examined to determine whether there are any that ought not to be used because of defects in principle or nature of construction.

"One of the conditions imposed by the companies when the electric inquiry was begun provided that a consumer could take electricity from no other source even including in the prohibition his own lighting plant. This condition was gradually driving out of use the private plants in the large buildings, for the owners could not run the risk of their own plants breaking down and be without the ability to get electricity from the company. The commission has brought about an agreement upon the part of the companies to give 'break-down' and 'auxiliary' service to owners of private plants."

REPORT OF THE SECOND DISTRICT COMMISSION.

The report of the Second District Commission states that at the close of the calendar year 1908 there were 854 corporations, municipalities and individuals engaged in serving the public in some capacity that by operation of law placed them under the supervision of the commission. Of this number 313 comprised electrical corporations and plants, divided as follows: Operating, 183; not operating, either inchoate or dormant, 17; not operating, lessor, 5; individuals operating plants, 60; municipalities operating plants, 48. There were 141 street railroad corporations, 48 coal-gas or water-gas and electrical corporations and 4 electrical and natural gas corporations.

Various fundamental decisions respecting capitalization are discussed in the report. It was held by the commission that the use of capital to be secured by the issue of stock, bonds or other evidence of debt must be necessary for one or more of the purposes specified in sections 55 and 69; that an enumeration of purposes for which stock, bonds and other evidences of debt may be issued is exclusive and not inclusive; that the stock and bonds may not be issued for purposes not enumerated in the statute, either with or without the authority of the commission. It was held that a scrip dividend, in the case of the Erie Railroad, is not one of such purposes; that a stock dividend, in the case of the Babylon Electric Light Company, is not one; and that the reimbursement of a treasury for previous payments made for one of the purposes named in the statute, in the case of the Lehigh & Hudson River Railway, is not one. It was pointed out that no capital would be secured to the company by the proposed issue of stock or scrip and that money secured by bond issues for the reimbursement of the treasury could be expended for any lawful purpose, although not a purpose named in sections 55 and 69 of the law.

An abstract of other decisions affecting capitalization follows:

"In the application of the Newburgh Light, Heat & Power Company the commission denied the application for authorization of preferred stock to the amount of $250,000, holding that the condition of the money market, taken in connection with the physical condition of the applicant corporation, did not justify a fixed charge of this amount.

"In the application of the Watertown Light & Power Company for authorization of an increase of its capital stock and bonded indebtedness, the commission adopted, unanimously,

certain propositions, as follows: (*a*) That it will not investigate or inquire into the correctness of the capitalization of the Watertown Light & Power Company authorized by the former Commission of Gas and Electricity; and therefore will not inquire in this proceeding into any alleged over-capitalization of the applicant existing at the time the application was made; (*b*) that the investigation upon this application for additional capitalization will be confined to the question whether such capitalization should be authorized by reason of the actual investment of the money to be secured thereby for purposes of the corporation recognized by law as a subject of capitalization.

"An interesting question early presented itself as to what extent the investing public might be justified in relying upon the authorization given by the commission as an implied certificate that the bonds or stock to be issued were worth their face value or any other amount. This question arose upon the application of the Hudson River Electric Power Company for leave to issue $3,232,000 bonds. The commission said: 'In passing upon the application for leave to issue additional capital stock, the commission will consider: (5) Whether there is reasonable prospect of fair return upon the investment proposed, to the end that securities having apparent worth but actually little or no value may not be issued with our sanction. We think that to a reasonable extent the interests of the investing public should be considered by us in passing upon these applications. The commission should satisfy itself that, in a general way, the venture will be likely to prove commercially feasible, but it should not undertake to reach and announce a definite conclusion that the new construction or improvement actually constitutes a safe or attractive basis for investment. Commercial enterprises depend for their success upon so many conditions which cannot be foreseen or reckoned with in advance, that the duty of the commission is discharged as to applications of this character when it has satisfied itself that the contemplated purpose is a fair business proposition.'

"In the case of the Watertown Light & Power Company upon practically the same point the commission held that the purchasers of securities authorized by it are not exempt from the business risks involved in the possibility of the corporation issuing the securities being over-capitalized."

The commission states that "in the three matters of discount on bonds, working capital, and allowance for promotion or services, the practice is understood to be different from that prevailing in Massachusetts. Since 1894, commissions in that State have had control of the amount of securities that public service corporations can issue for any and all purposes. Both the railroad and the gas and electric light commissions refuse to permit securities to be issued for discount on bonds. It is understood that the railroad commission apparently disapproves of an issue of stock or bonds to provide working capital, but that the gas and electric light commission permits this item to be included in a company's original capitalization."

In discussing the policy which it pursues in these matters the New York commission says it "has not found occasion to doubt the correctness of its conclusions upon these points. It has endeavored and will continue to endeavor to make its rulings such as to encourage the investment of capital and the promotion of enterprise. The interests of the public imperatively demand these results, and the commission believes that they are not in the slightest degree inconsistent with the protection of the public against those practices which have justly earned the condemnation of the public and led to the regulation of corporate capitalization by law."

The commission calls especial attention to the fact that in the preparation of uniform systems of accounts it "has kept in constant touch with the corporations themselves, has invited and profited by constant comment and criticism, and has endeavored in every way to make [illegible] practical as well as theoretically correct."

Mr. William J. Meyers, statistician of the commission, is given the credit of the "technical excellence and perfection of form" of the accounts.

The commission makes [illegible] to the schemes of accounts adopted:

"Uniformity has been sought for wherever it seemed to be practicable to obtain it. It has been recognized, however, that to attempt to secure uniformity of accounting where uniformity of fact does not exist, is to abandon the substance for the form, and there has been no attempt to push uniformity to such lengths as to secure merely specious results.

"The smaller corporations are less highly organized than the larger corporations, and the minuteness of classification of labor which is practicable in the larger is impracticable in the smaller. Furthermore, the managers of the smaller corporations are in more immediate contact with the detailed affairs of the corporation, and for that reason do not need the minuteness of accounting that is imperative in the larger concerns. This condensation has seemed practicable only in the various income accounts. The capital accounts are accounts that continue during the life of the corporation, and it is much more essential that the same scheme of accounts be continued throughout the corporation's entire history. The income accounts are closed annually, and a radical change in them produces little other inconvenience than to prevent comparisons with accounts of prior years. If the change is confined to a further subdivision of those of prior years, not even this inconvenience results. On the other hand, a change in capital accounts involves matters covering a very considerable period of time and the record of which is frequently too incomplete to permit reclassification. Growth is the normal course of affairs for a well-organized, well-managed public service corporation in a healthy and thriving community, and this fact, coupled with the well-founded conviction that there is necessarily a much more accurate accounting for capital than has prevailed in the past, has led to the provision of a single scheme of capital accounts for corporations of all grades in a particular class.

"The matter of reports to be required of public service corporations is intimately connected with that of the system of accounts to be kept by such corporations. The scheme of accounts and the scheme of reports are very closely connected, and the annual reports cannot be brought to show the situation fully and clearly until the scheme of accounts on which they depend has been brought into satisfactory form. An annual report of a corporation ought to furnish such information as should be filed regularly, not only for the information of the commission intrusted with the administration of such a law as the Public Service Commissions Law, but also for that of the investors furnishing the capital essential to the operations of the corporations, and for that of the much larger body of consumers for the satisfaction of whose needs the corporation exists and from whom are derived the revenues by which the corporation is supported. Much of this information is not given when the report is confined to a summary statement of receipts and expenditures. It is also necessary to know who are the individuals whose identity is frequently hidden behind the legal entity or fiction of the corporation; cases have occurred in times past where by hiding behind various corporate cloaks, individuals have been able to enrich themselves without rendering a fair return for the revenues collected from the public. The construction company and the supply company are familiar instances of such devices. For this reason it has been thought advisable, in the annual reports required of corporations, to go somewhat fully into the matter of intercorporate relationships.

[illegible] is the matter of new capital installed in service and old capital withdrawn from service."

Of the 1147 informal correspondence cases handled during the year, 40 related to the rates and service of electrical cor[illegible] been closed.

One section of the report is devoted to the work of the [illegible] Light and Power. An abstract of the part of this section relating to electrical work follows:

[illegible] of the Public Service Commissions Law provides [illegible] corporation or person shall furnish or put in use any [illegible] which shall not have been inspected, approved, [illegible] or marked by an inspector of the commission. Con-

ferences were had in 1907 with representatives of the electrical corporations under the supervision of the commission, and with meter manufacturers and experts, and after painstaking inquiry into all the problems presented, the conclusion was reached that a literal administration of the provision in question would be commercially impracticable and futile in results. We would again call attention to the fact that the accuracy of registration of electric meters is affected by many more conditions than apply to the accuracy of gas meters, to which a similar provision of the law refers. While this does not imply that the electric meter is less accurate as a measuring device than the gas meter, the fact emphasizes the necessity of meeting in some manner the inspection of these meters within the intent of the law. The attention of the commission has therefore been engaged in devising and putting in operation a system of inspecting consumers' electric meters, which would in effect answer the requirements of the law, and the administration of which would not impose a prohibitive expense upon the State. This system calls for tests made by the companies with standard instruments approved as to type, and periodically checked for accuracy, by the commission.

"Section 67 of the Public Service Commissions Law provides that every electrical corporation shall provide or keep in and upon its premises a suitable and proper apparatus, to be approved, stamped, or marked by the commission, for testing and proving the accuracy of electric meters furnished for use by it

"Thirty-four of the plants of 325 electrical corporations were found not selling electric energy on a meter basis, and were therefore not required to obtain standards. Of 291 electrical corporations operating electric meters, 218 were found either with no standards, or insufficiently equipped with standards. Recommendations were made to each of these companies, based upon the inspectors' reports, indicating the type of instrument best adapted to the need of each company, and resulting in 167 companies equipping themselves with satisfactory standards; 51 plants operating on a limited scale filed objections to incurring the expense. Consideration was of necessity given to such objections, and where upon investigation the commission was of the opinion the objections were well founded, compliance with the recommendation was for the time being waived. Fourteen other companies, unable for the present to finance the purchase of standards, entered into arrangement, with the approval of the commission, for the use of the instruments of companies operating in adjacent territories.

"A comparatively large number of the companies having reported by June 23, 1908, the installation of the apparatus recommended by the commission, a resolution was adopted providing that each electrical corporation provided with apparatus for testing the accuracy of electric meters furnished to its consumers report to the commission the customers' meters tested each month with such apparatus, beginning with August, 1908.

"The resolution of the commission and the rules and regulations prepared pursuant thereto go further than requiring a report of all new meters tested. Every test, whether initial, upon complaint or periodic, and the results shown, must be given. The next step under consideration is to require, if necessary, an initial test of all meters when furnished to consumers, and possibly also to require the systematic inspection of meters in use. The necessity of such an order will be determined upon consideration, among other things, of the character of the reports filed by the companies.

"The standards used by the companies in making these tests of consumers' meters are periodically checked by the commission's inspectors against portable standard instruments, these portables in turn being calibrated not less than once a month by comparison with the commission's laboratory standards in Albany.

"During the year inspections were made of 1812 standards belonging to 204 companies. Ten and one-half per cent of these standards were found inaccurate and ordered re-calibrated, and approximately 1 per cent of the total were disapproved as to type.

"During the year complaints were filed by consumers against 85 electric meters. The results of tests show 20 of the 85 meters to have been found defective or incorrect to the prejudice of the consumer, in that they registered 4 per cent or more fast on one or more of the load points at which tested. These incorrect meters were either replaced immediately with correct meters, or were calibrated to register within the limits of error allowed by law.

"Special investigations were made into the affairs of a number of companies for the purpose of ascertaining the methods employed by them in the transaction of their business, and in the maintenance and operation of their plants and distributing systems.

"Many disputes of a minor nature arising between individual consumers and companies, have been brought to the attention of the commission for settlement, generally at the instance of the consumer as complainant. The legal right of gas and electrical corporations to make a minimum charge for the supply of gas or electricity is the subject of many of these inquiries. Upon the advice of counsel, the commission in answering these inquiries has taken the position that unless forbidden in a local act governing in a particular municipality, a reasonable minimum charge may be made. What is a reasonable charge is a matter for determination after investigation of all the conditions under which the charge is made."

Rates and Franchise Valuation Discussed in Consolidated Gas Decision.

The memorandum of the decision of the United States Supreme Court in the case of the Consolidated Gas Company, of New York, and the 80-cent gas laws was published in the issue of Jan. 7, page 96. The full decision of the court, which was given out on Jan. 11, amplifies the summary contained in the memorandum in many important respects.

The court states that "the question arising is as to the validity of the acts limiting the rates for gas to the prices therein stated. The rates must be plainly unreasonable to the extent that their enforcement would be equivalent to the taking of property for public use without such compensation as under the circumstances is just both to the owner and the public. There must be a fair return upon the reasonable value of the property at the time it is being used for the public."

It is held that the case "must be a clear one before the courts ought to be asked to interfere with State legislation upon the subject of rates, especially before there has been any actual experience of the practical result of such rates. . . . In order to determine the rate of return upon the reasonable value of the property at the time it is being used for the public, it of course becomes necessary to ascertain what that value is."

The court then takes up the question of the value of the property, tangible and intangible. It states that "the value of real estate and plant is to a considerable extent matter of opinion, and the same may be said of personal estate when not based upon the actual cost of material and construction. Deterioration of the value of the plant, mains and pipes is also to some extent based upon opinion."

All these matters make questions of value, the court thinks, somewhat uncertain; while added to this is an alleged prospective loss of income from a reduced rate, depending upon the extent of the reduction and the probable increased consumption, constituting "a problem as to the character of a rate which is difficult to answer without a practical test from operation of the rate."

Respecting the action of a lower court in enjoining the enforcement of a rate that is confiscatory beyond doubt, the decision says: "There may be cases where the rate is so low, upon any reasonable basis of valuation, that there can be no just doubt as to its confiscatory nature, and in that event there should be no hesitation in so deciding and in enjoining its enforcement without waiting for the damage which must inevitably accompany the operation of the business under the objectionable rate.

"But where the rate complained of shows in any event a very narrow line of division between possible confiscation and proper regulation, as based upon the value of the property, found by the court below, and the division depends upon opinions as to value, which differ considerably among the witnesses and also upon the results in the future of operating under the rate objected to, so that the material fact of value is left in much doubt, a court of equity ought not to interfere by injunction before a fair trial has been made of continuing the business under that rate, and thus eliminating, as far as possible, the doubt arising from opinions as opposed to facts."

In giving the history of the company, the court indicates that the companies whose property was acquired by the Consolidated Gas Company were not called upon to pay anything for their franchises. In the consolidation the value of the franchises was set at $7,781,000. The court says it "cannot be disputed that franchises of this nature are property and cannot be taken and used by others without compensation. The important question is always one of value." The lower court had held that a fair method of fixing value of franchises in 1905 was to "assume the same growth in value for the franchise as is demonstrated by the evidence in the case of tangible property." Based on the increased value of personalty and realty, the lower court, therefore, thought the franchise valuation had appreciated to over $12,000,000.

The Supreme Court states that it is "not prepared to hold with the court below as to the increased value which it attributes to the franchises. It is not only too much a matter of pure speculation, but we think it is also opposed to the principle upon which such valuation should be made."

The rates of the company are subject to regulation by the Legislature, provided they are not made so low as to be confiscatory. From the creation of the companies to their consolidation in 1884, the companies had been free from legislative regulation upon their rates. The companies had been most prosperous and had divided large earnings. So far as the evidence presented before the Senate committee appointed in 1885 to investigate the consolidation showed there was nothing on Nov. 10, 1884, to indicate that the franchises would not be as valuable in the next 20 years as they had been in the past. The price charged by the various companies "may have been too high, and the dividends were excessive, but they were not illegal, and the valuation of the franchises computed upon these dividends and that state of facts cannot be called a violation of the law that expressly authorized it to be done, unless such valuation was too high."

The Supreme Court concludes, concerning the value of the franchises, that "although the State ought, for these reasons, to be bound to recognize the value agreed upon in 1884 as part of the property upon which a reseasonable return can be demanded, we do not think an increase in that valuation ought to be allowed upon the theory suggested by the court below."

The increase in consumption of gas and in the value of tangible property of the corporation is not regarded by the court as any reason for attributing a like proportional increase in the value of the franchise. The moment immunity from legislative interference with the price of gas ceased "the great value of the franchise would be at once and unfavorably affected, but how much so it is not possible for us now to see. The value would most certainly not increase."

The lower court "found the value of the tangible assets actually employed at the time of the commencement of this suit in the business of supplying gas by the complainant to be $47,831,435, to which it added the $12,000,000 as the value of the franchises as found by it, making the total of $59,831,435, upon which it held that the company was entitled to a return of 6 per cent, being $3,589,886.10. It also found its total net income for the year 1905 amounted to $5,881,192.45, almost 10 per cent upon the sum above named. Altering the finding of the court so far only as to place the value of the franchises at the time agreed upon in 1884, $7,781,000, the total value upon that basis of the property employed by the company would be $55,612,435, upon which 6 per cent would be $3,336,746.10, while the sum estimated as the return on 80-cent gas would have been $3,024,592.14, which is nearly 5.5 per cent on the above total of $55,612,435."

Limiting its conclusions concerning franchise value to the case before it, the Supreme Court says:

"What has been said herein regarding the value of the franchises in this case has been necessarily founded upon its own peculiar facts, and the decision thereon can form no precedent in regard to the valuation of franchises generally, where the facts are not similar to those in the case before us.

"There is no particular rate of compensation which must in all cases and in all parts of the country be regarded as sufficient for capital invested in business enterprises. Such compensation must depend greatly upon circumstances and locality; among other things, the amount of risk in the business is a most important factor, as well as the locality where the business is conducted and the rate expected and usually realized there upon investments of a somewhat similar nature with regard to the risk attending them. There may be other matters which in some cases might also be properly taken into account in determining the rate which an investor might properly expect or hope to receive and which he would be entitled to without legislative interference. The less risk, the less right to any unusual returns upon the investments.

"One who invests his money in a business of a somewhat hazardous character is very properly held to have the right to a larger return without legislative interference than can be obtained from an investment in government bonds or other perfectly safe security. The man that invested in gas stock in 1823 had a right to look for and obtain, if possible, a much greater rate upon his investment than he who invested in such property in the City of New York years after the risk and danger involved had been almost entirely eliminated.

"In an investment in a gas company, such as complainant's, the risk is reduced almost to a minimum. It is a corporation, which in fact, as the court below remarks, monopolizes the gas service of the largest city in America, and is secure against competition under the circumstances in which it is placed, because it is a proposition almost unthinkable that the City of New York would, for purposes of making competition, permit the streets of the city to be again torn up in order to allow the mains of another company to be laid all through them to supply gas which the present company can adequately supply.

"And so far as it is given us to look into the future, it seems as certain as anything of such a nature can be, that the demand for gas will increase, and, at the reduced price, increase to a considerable extent. An interest in such a business is as near a safe and secure investment as can be imagined with regard to any private manufacturing business, although it is recognized at the same time that there is a possible element of risk, even in such a business. The court below regarded it as the most favorably situated gas business in America, and added that all gas business is inherently subject to many of the vicissitudes of manufacturing. Under the circumstances, the court held that a rate which would permit a return of 6 per cent would be enough to avoid the charge of confiscation, and for the reason that a return of such an amount was the return ordinarily sought and obtained on investments of that degree of safety in the city of New York."

The Supreme Court therefore concurs with the lower court in the opinion that the company is entitled to 6 per cent on the fair value of its property devoted to the public use. The total value is considered, however, a "matter of speculation or conjecture to a great extent."

In stating that a test is necessary to demonstrate the reasonableness or unreasonableness of a rate, the court says: "There may be cases where the evidence as to the probable result of the rates in controversy would show they were so nearly adequate that nothing but a practical test could satisfy the doubt as to their sufficiency.

"The elevated railroads in New York when first built charged 10 cents for each passenger, but when the rate was reduced to 5 cents it is common knowledge that their receipts were not cut

in two, but that from increased patronage the earnings increased from year to year and soon surpassed the highest sum ever received upon the 10-cent rate.

"There is always a point below which a rate could not be reduced and at the same time permit the proper return on the value of the property, but it is equally true that a reduction in rates will not always reduce the net earnings, but, on the contrary, may increase them. The question of how much an increased consumption under a less rate will increase the earnings of complainant, if at all, at a cost not proportioned to the former cost, can be answered only by a practical test. In such a case as this, where the other data upon which the computation of the rate of return must be based are from the evidence so uncertain, and where the margin between possible confiscation and valid regulation is so narrow we cannot say there is no fair or just doubt about the truth of the allegation that the rates are insufficient."

The court also takes up the contention of the corporation that the State, having taxed it upon its franchises, cannot be heard now to deny their existence or their value as taxed. The court holds that "the fact that the State has taxed the company upon its franchises at a greater value than is awarded them here, is not material. These taxes, even if founded upon an erroneous valuation, were properly treated by the company as part of its operating expenses, to be paid out of its earnings before the net amount could be arrived at applicable to dividends, and if such latter sums were not sufficient to permit the proper return on the property used by the company for the public, then the rate would be inadequate. The future assessment of the value of the franchises, it is presumed, will be much lessened if it is seen that the great profits upon which that value was based are largely reduced by legislative action."

The court is also of the opinion that it is not a case for a valuation of good-will. In concluding, the court states: "Upon a careful consideration of the case before us we are of opinion that the complainant has failed to sustain the burden cast upon it of showing beyond any just or fair doubt that the acts of the Legislature of the State of New York are in fact confiscatory. It may possibly be, however, that a practical experience of the effect of the acts by actual operation under them might prevent the complainant from obtaining a fair return, as already described, and in that event complainant ought to have the opportunity of again presenting its case to the court. To that end we reverse the decree, with directions to dismiss the bill without prejudice."

Program for Minnesota Electrical Association

The Minnesota Electrical Association, which held its first meeting last February, will hold its second convention at the Nicollet Hotel, Minneapolis, March 18 and 19, 1909, for which the following program of papers has been announced:

"Proper Method of Purchasing and Using Coal," by Mr. Ludwig Kemper, Albert Lea, Minn. "Use of Tungsten Lamps from the Illuminating Engineer's Point of View," by Mr. J. R. Cravath, Chicago, Ill. "Use of Tungsten Lamps for Street Lighting, Particularly in Connection with a Decorative Scheme of Lighting," by Mr. H. J. Gille, Minneapolis, Minn. "Methods of Building Up a Day Load in Small Central Stations," by Mr. A. Wagner, New Ulm, Minn. "Heating Appliances as an Aid in Developing a Day Load," by Mr. E. L. Callahan, Chicago, Ill.

Other features will be a paper by Professor George D. Shepardson, of the University of Minnesota, subject to be announced later; report of the committee on fire insurance; address on taxation of public service corporations, by a member of the Minnesota Tax Commission; a complimentary dinner the evening of March 18, and a theater party. The latter two entertainment features are tendered by the electrical manufacturers, jobbers and supply dealers of the Twin Cities. The program is in the hands of the executive committee, Mr. W. R. Putnam, of Red Wing, Minn., being president. The secretary is Mr. Ludwig Kemper, of Albert Lea, Minn.

Lighting Chicago Railroad Under-Crossings.

Owing to the elevation of railroad tracks in Chicago, there are in that city 468 under-crossings at intersecting streets. About half of these are now lighted, and the city has started a movement to compel the railroads to illuminate all passages adequately, the claim being made that the under-crossing spaces are favorite lurking places of the vicious bent upon crime. Recent ordinances relating to track elevation provide for subway lighting; the railroads do not question their obligation in regard to these, but claim that they are not responsible for lighting when previous ordinances did not contain any requirement to that effect. According to statistics, of the 468 railroad subways, only 75 are properly lighted, 166 are partially lighted and 227 are not lighted. Eight hundred and seventeen additional arc lights will be needed to light all the passages properly, and the city law department will take measures against the railroads to assure such proper illumination.

Work of State Railway Commissioners.

Committees of the National Association of Railway Commissioners have been appointed by President Martin S. Decker, who has issued a circular discussing the work confronting the various committees before they report to the twenty-first annual convention, to be held at Washington, D. C., on Oct. 12, 1909. Mr. Decker recommends that the committee on "Powers, Duties and Work of State Railway Commissions" make a "voluminous report showing all of the State laws pertaining to regulations, with a table or diagram accompanying the report, and the text to further include a statement, as complete as practicable, of the work in different States. It would seem that the appropriate body to publish an up-to-date statement and account of State laws and State work as to railway regulation and other regulation of public service corporations is the National Association of Railway Commissioners, because it possesses all necessary facilities. Most of the work of the association has related in the past to steam railroads, but it has a committee to consider the system of accounts for electric railways.

New England Section of the N. E. L. A.

An important step in central-station organization has just been taken in connection with the work to affiliate State bodies with the National Electric Light Association. About 80 members of the association in the New England States have made application and received permission from the executive committee to organize a special geographical section. The Boston Edison Company gave these members a dinner at the Algonquin Club, Boston, Dec. 30, at which Mr. Charles L. Edgar, president of the company, was the generous and felicitous host. After the dinner an organization meeting was held.

Mr. W. C. L. Eglin, president of the National Electric Light Association, made a very able and interesting address describing the great work of the association and its growth and development from the date of its organization, February, 1885, down to the present time, calling attention to the wonderful amount of good it has accomplished during all those years and the great work it will have to do in the years to come. Speeches were also made by Messrs. W. W. Freeman, E. W. Burdett, R. M. Searle, G. R. Stetson, J. S. Whitaker, H. T. Sands, E. E. Larrabee, J. E. Davidson and John Campbell.

A nominating committee was appointed by Mr. Edgar, on motion of the delegates, consisting of Mr. Fred P. Royce, Mr. E. E. Larrabee and Mr. John Campbell, and brought in a list of officers to be balloted for, who were unanimously elected. They are as follows: S. Fred Smith, president, Salem, Mass.; J. E. Davison, vice-president, Montpelier, Vt.; Chas. H. Hodskinson, secretary and treasurer, Boston, Mass. Executive committee: J. A. Fleet, Portland, Me.; J. S. Whitaker, Portsmouth, N. H.; H. T. Sands, Haverhill, Mass.; A. B. Lisle, Providence, R. I.; Alex. Campbell, New London, Conn.

Meeting of Society of Wireless Telegraph Engineers.

At a meeting of the Society of Wireless Telegraph Engineers held at 192 Bay State Road, Boston, Mass., Jan. 4, Dr. R. T. Wells delivered an address on the subject of "The Inductance, Resistance and Impedance of Telephones as a Function of the Frequency of the Current Actuating Them." Mr. Sewall Cabot spoke upon the power rating of wireless telegraph stations, and Mr. John Stone Stone spoke on the audibility of wireless telegraph signals in their relation to the spark frequency at the transmitting station. He gave the results of a mathematical inquiry which indicates that the audibility of wireless telegraph signals is more a function of the harmonics than of the fundamental of the wave-train frequency.

The next meeting of the society will be held on Feb. 1, when Mr. C. E. Russell will present a paper on the subject of a "New Magnetic Detector," and Mr. E. D. Forbes another on "The Singing Arc."

Annual Banquet of Massachusetts Technology Alumni.

The annual banquet of the Technology Alumni Association was held in Horticultural Hall, Boston, on Jan. 14. The speakers were Governor Eben S. Draper, of Massachusetts, class of '78; Acting-President Arthur A. Noyes, of the Institute, class of '86; President-elect Richard C. Maclaurin; and Dr. Robert S. Woodward, of the Carnegie Institute of Washington. Dr. Maclaurin voiced the need of removal of the institute to a new site, in order to enable its development to continue, and anticipates the practical report of the Commonwealth of Massachusetts in this undertaking. Governor Draper spoke encouragingly of the Institute's problems under the forthcoming administration of President Maclaurin, and Dr. Noyes outlined the recent work of the institution. Dr. Woodward urged the co-operation of all attached to the institute in its future activities. Mr. Edwin S. Webster, class of '88, and a member of the firm of Stone & Webster, Boston, was elected president of the Alumni Association for the ensuing year.

Miller on Development of Telephone Industry.

Mr. Kempster B. Miller, consulting telephone engineer, addressed the noonday meeting of the Chicago Electric Club Jan. 13 on "The Development of the Telephone Industry." He took as a specific example of the general development that in Chicago. The Chicago Telephone Company now has, roughly, 180,000 telephones connected, this being the second largest telephone exchange in the world. The growth last year amounted to 35,000 instruments, which was equal to the entire growth of the first 23 years of the company's existence. Within a radius of 20 miles of New York City there are more telephones than in the entire British Isles. Chicago has the busiest telephone exchange in the world, if the number of calls per subscriber is taken as a measure, the average being 22 calls per line per day. There are 35 exchange buildings. The underground conduit amounts to 435 miles, there are 377,000 miles of underground wire, and the overhead wire foots up to 65,000 miles. The company employs about 5600 operators.

Mr. Miller said that the automatic exchange system had proved to be a success by demonstration in a number of large exchanges, and that it is being installed in other very large exchanges. There is a compromise between the purely automatic and the manual systems, called the semi-automatic. On this system the numbers are given orally to a telephone operator, who is provided with certain automatic apparatus for making the connection to complete the call. Mr. Miller seemed to think it inevitable that the manual system would be superseded either by the automatic or semi-automatic systems.

He spoke briefly on the telegraph situation. Both the Western Union and the Postal companies have machine transmission on certain New York and Chicago lines. These systems are not strictly high-speed, being of the same order of speed as a wire worked quadruplex. He thought, however, that some high-speed system would come into use, in which thousands rather than hundreds of words per minute would be transmitted.

Defense of Cable Rates.

At a meeting of the New York City Board of Trade and Transportation in December, the committee on foreign and insular trade was instructed to make an investigation as to whether or not cable tolls could not be reduced. In response to this inquiry Mr. George C. Ward, vice-president and general manager of the Commercial Cable Company, has sent to the committee a defense of the present rates. After entering a general denial that there is any combination or agreement between the cable companies, he says: "The statement that 25 cents per word is a high rate and that it discourages trade is not in accord with the facts as ascertained by experience. A number of years ago the Atlantic cable rate was reduced to 12 cents per word, and that low rate continued for two years and four months. This thorough and costly test proved that the reduction of the rate to such a very low figure produced only a 16 per cent increase in the volume of traffic, while the receipts were diminished by nearly one-half in cash. The cable business was done at a loss. The restoration of the rates to 25 cents per word was a necessity. Moreover, less than 1 per cent of the public use the cables, and a reduction of cable rates would merely mean increased profits to that 1 per cent to the ruin of the cable companies.

"Owing to the complaints that the restriction to genuine words did not give merchants a sufficient range of words to make up efficient codes the cable companies have gradually relaxed their rules and have admitted artificial or manufactured words, which are supposed to have some semblance to real words. It is almost impossible to transmit by cable such words rapidly and correctly, and yet any change or omission of even one letter would make an entirely different meaning. To transmit artificial code-words by cable is most difficult. To transmit them with speed is impossible. When it is borne in mind that 98 per cent of the cable messages are in cipher code and each code word represents at least 20 plain words, it will be seen that cablegrams in code bring the rate down to less than 2 cents a word for the translated message."

Boiler Corrosion from Electrochemical Causes.

Professor C. F. Burgess, of the University of Wisconsin, read a paper before the electrical section of the Western Society of Engineers at Chicago, Jan. 15, on "Boiler Corrosion from Electrochemical Causes." He supported the theory that most kinds of corrosion of iron and steel could be accounted for by electrolysis, and presented some slides and evidence to show that a galvanic couple necessary to produce electrochemical action may be produced in one of three ways, giving examples of each kind. One kind of electrolytic action he classed as caused by difference in temperature between different parts of the metal structure, this difference in temperature causing a difference in potential sufficient to produce galvanic action. Another class of corrosion he classified as caused by differences in composition of various parts of the steel structure. This would cause galvanic action between such different parts. The third kind he classed as due to a difference in mechanical treatment of different parts of the structure. Steel which is pressed or punched in a manner to make it harder or more dense than the surrounding structure will show a difference of potential with reference to the surrounding structure if an electrolyte is present.

Fort Wayne, A. I. E. E., Meeting.

The fifth regular meeting of the Fort Wayne Section of the American Institute of Electrical Engineers was held on Thursday evening, Jan. 14, in the rooms of the Fort Wayne Engineering & Manufacturing Company. The chair was occupied by the vice-chairman, Mr. J. J. Kline. The paper of the evening was presented by Mr. L. D. Nordstrum entitled "Some Considerations Involved in the Design of Direct-Current Generators and Motors." Mr. Nordstrum took up this question at first from the technical features involved in the design of a new line of electrical machines or the redesign of an old line. The watts lost in the machine and the effect of the heat on the insulation were then considered, followed by comparisons of the weights of copper and iron in the machine and the consideration of the cost for varying quantities of each. He presented curves showing the effect of the increase of copper and the increase of iron on the cost of the machine and the conditions necessary to build a machine, first, with the least cost and also the least weight. Those taking part in the discussion which followed were Messrs. J. J. Kline, E. A. Barnes, J. V. Hunter, A. L. Hadley and J. H. Haberly.

Street Lighting.

The meeting of the New York Section of the Illuminating Engineering Society, held on Jan. 14, was devoted to the presentation and discussion of two papers dealing with street lighting. A paper by Mr. Walter C. Allen discussed briefly a few features of European practice and treated quite freely the local conditions in the District of Columbia. Descriptions were given of the lighting equipment of the plaza in front of the new Union Station, where magnetite arc lamps and tungsten lamps are used, and the Connecticut Avenue bridge, where Nernst lamps are employed. A valuable feature of the paper is the report of illumination surveys made by the Electrical Testing Laboratories of New York along certain streets in Washington. The tests showed the following typical results:

Kind of lamp.	Cost per foot of street, cents.	Average illumination, foot-candles.	Average variation from mean, per cent.
Magnetite arc	27.5	0.062	106.9
Series enclosed arc (d. c.)	27.5	0.036	106.9
Graphitized carbon incandescent	25.2	0.012	29.6
Tungsten series	25.2	0.013	33.0
Mantle gas	32.1	0.028	24.8

The value for the cost is that for the lighting per foot of street in each case.

Mr. S. G. Rhodes presented a paper entitled "Street Lighting by Tungsten Lamps," which described series tungsten lighting systems used in Riverside, St. Nicholas and High Bridge Parks and along Riverside Drive in New York City. The energy is distributed by way of underground cables of the lead-armored or steel-armored type. The lead-covered cables were laid in fiber ducts, while the steel-covered cable was dropped directly into ditch.

DISCUSSION.

In reply to a question by Mr. H. Thurston Owens, Mr. Allen stated that the street lamps are used 3960 hours per year. Each arc lamp costs $85 per year; a 25-cp carbon-filament lamp, $20; a 40-cp tungsten lamp, $24; a 60-cp mantle gas lamp, $20.85; a 4-glower Nernst lamp, $65. These prices cover all items, including the equipment and the service.

Mr. L. B. Marks stated that in street lighting with tungsten lamps it is essential to shade the filament in order to decrease the visible intrinsic brightness. The mere fact that one street receives more light than another does not insure that the former is better lighted than the latter; the intrinsic brightness must also be considered.

Mr. E. L. Elliott remarked that, although little attention has been paid in the past to the intrinsic brilliancy of lighting sources in exterior illumination, a change is to be noted at present and this feature is now coming to the front. The tungsten lamp is far too bright to be exposed to direct view.

The retiring secretary of the section, Mr. P. S. Millar, announced that at the next meeting a paper will be presented by Messrs. E. P. Hyde and F. E. Cady, entitled "Selective Emissivity of Incandescent Lamps as Determined by New Photometric Methods." The following men were elected officers of the New York section:

Mr. E. L. Elliott, chairman; Messrs. J. J. Humphreys and C. A. Littlefield, managers; Mr. A. J. Marshall, secretary.

Influence of Cheap Electricity on Electrochemical Industries.

A paper presented at the December meeting of the Faraday Society (London) by Mr. E. A. Ashcroft had for title "The Influence of Cheap Electricity on Electrolytic and Electrothermal Industries." It was pointed out that the extent of future developments of electrochemical industries will depend on the limits to which the cost of electric energy can be reduced at suitable sites. In most cases an industry only becomes economically possible when the price of power has been reduced below a certain point, which varies more or less for every electrochemical industry. The author discusses, in particular, the lowest possible limits of cost for the production of electricity from water power, with special reference to conditions such as exist to-day in Norway. Some industries (the smelting of iron, the manufacture of lime nitrogen, and the complete treatment of complex sulphide ores may be instanced), to be worked commercially, will require a supply of energy at a cost of about $10 per kw-year, and this "low-grade limit" in the opinion of the author can only be obtained from what he calls water powers of Class I—namely, those in which natural conditions enable the development and regulation of power at a very low expenditure of capital—of the order $35 per horse-power capacity, including all necessaries up to the dynamo terminals. The author estimates the corresponding figure at Niagara to have been not less than $150. The number of powers of Class I are not very numerous, and their natural advantages will to some extent be neutralized by the values placed on the water-rights, but many examples exist, and the author gives full particulars of the cost of developing a concrete case in Norway of 7500-kw capacity. This fall costs $37 to develop and equip, and current can be sold at $12.50 per kw-year. At Meraker 3000 hp has been sold for $3.25, and at Notodden (both in Norway) for $9 per kw-year. The second-best source of energy in bulk to-day is what the author calls waterfalls of Class II—namely, those where a high cost of regulation or development is necessary to bring the water to the place of consumption, and to ensure an even supply all the year round. From these electricity can be sold for about $26 per kw-year, while the corresponding figures for oil engines, gas engines, and steam engines are given by the author as $36, $34 and $41 respectively.

Mr. W. R. Cooper pointed out that the cost of water power was frequently what it would fetch, and that it could not be likely to have a fixed value. The price of water power tended to rise, that from other sources tended to fall; water power should, therefore, be purchased outright by the consumers and not merely leased. Mr. Bertram Blount thought that the author had not done justice to sources of power other than water; the notion that very cheap power was required for all electrochemical industries was erroneous. He referred to the possibilities of electric zinc smelting among the industries requiring cheap power awaiting development. Mr. W. Murray Morrison was also of opinion that steam and gas power could be produced cheaper than stated by the author—the former, in some cases, for $15 per kw-year. The author's Class II water power he considered a bad specimen, and he further criticised in some detail other figures given in the paper. He thought that not enough margin had been left for contingencies. The source of the capital was an important consideration that had not been discussed; on it frequently depended the nature and cost of labor. No two schemes were alike, and every one must be considered on its merits, taking all conditions into consideration.

Mr. L. Gaster pointed out that the Niagara plant had been

designed for a far greater output than had up to the present been reached, and that, therefore, the limit of cost of production of power was far below the figures at present obtaining. He suggested the desirability of manufacturing such products as graphite and carborundum at European power centers. Mr. Charles Weiss drew attention to the conditions under which the water powers in the Bavarian highlands were being developed. Dr. H. Borns referred to some of the disadvantages of many water powers, such as inconstancy of supply. Prof. R. H. Smith also remarked on the ice difficulty, which was of frequent occurrence. He did not think it possible, in the case of water powers, to reach the low figures given by the author, and he took exception to the allowances for depreciation made in the paper. Dr. E. Feilmann suggested that very cheap power-gas schemes might be developed in connection with the peat-fuel industry, and he thought that large-scale experiments were being made in this direction. Mr. E. A. Ashcroft, in reply, said his principal purpose had been to draw attention to the very special kinds of water power that were still available, although rare, and not to contrast the various modes of power production. His figures, to which he adhered, represented a probable average. The ice difficulties referred to do not exist in Norway.

A Library for Electrical Men.

By Edward F. Stevens.

Electrical engineers, practical electricians, students and teachers of the science of electricity—everyone interested in electrical matters—doubtless feel at times the need of having immediate recourse to a library where best and newest technical information and data can be had quickly and without restriction to meet the perplexities that arise in the study and pursuit of their intricate profession.

To provide a center where any man so disposed can freely come and be adequately served is the effort of the Pratt Institute Free Library in Brooklyn in its Applied Science Reference Department. Four years ago Miss I. E. Lord, the librarian, discerning an unsatisfied want, and anticipating a new trend in public library endeavor, furnished the front room on the main floor of the library building with the books and papers of technology as an experiment in a new field; and secured to take charge of the room a man who could give all his time and attention to the question of the selection and the best use of technical literature. "Expert guidance" to the books is considered quite as important as the books themselves, and it is for lack of it that many libraries have failed to meet their opportunity in this important field. The response from the engineering public has been so distinctly favorable that the Applied Science Department is encouraged to pursue its aims with confidence, and is expanding its equipment with the fast increasing claims made upon it. The attendance for the first full year, ending Aug. 31, 1905, was 8767; for the year ending Aug. 31, 1908, it was 17,228.

The difficulties which the engineer meets in collecting a library of his own are always those of the extraordinary expense of specialized books, and the rapid changes which the knowledge of his subject is undergoing. These conditions act to deter many from attempting private collections beyond a few standard essentials or the accepted "pocket book" of their particular profession. And so an obligation rests upon the public library to make for its community a single effort which shall secure to every man a library virtually his own, and guarantee an efficiency and economy of administration and breadth of resource beyond the possibility of individual effort.

The Pratt Free Library tries to meet the problem in this way—the Applied Science Room is the working reference library and news reading room. The books reserved there are a selection representing the most approved practice in the various engineering branches, subject to constant revision and expansion with the appearance of newer and better books. More than 150 volumes stand to the credit of electric practice. There are also many files of bound periodicals, including a complete set of the *Electrical World* and the *Transactions* of the American Institute of Electrical Engineers, as well as the *Gazette* and *Specifications* of the U. S. Patent Office, and a file of over 1000 picked manufacturers' catalogues, with suitable indexes and helps for research. The trade catalog collection includes the Bulletins of the General Electric, the Westinghouse, Crocker-Wheeler, Western Electric, Fort Wayne and Sprague companies, besides catalogs of leading electrical supply houses. Current technical literature appears in over 130 journals grouped on reading tables by subject matter. Electricity has a table devoted exclusively to its own papers.

The important work of circulating technical books is not neglected. Admittance to the shelves in the lending department is allowed the public and liberal privileges for drawing books



ELECTRICAL LIBRARY

are granted to all borrowers. The circulating department keeps abreast of the Applied Science Room in developing along engineering lines.

The writer of this brief sketch, who conducts the Applied Science Department, expects and desires to lend his services to every visitor in the search of information required. All electrical men residing or sojourning in or about Greater New York are asked to feel a claim upon this department, and to take advantage of it as occasion arises. The Pratt Institute Free Library, on Ryerson Street, near DeKalb Avenue, is easily reached from Manhattan or different parts of Brooklyn by the Lexington Avenue L, and the Myrtle or DeKalb Avenue surface car lines.

Municipal Lighting in Disfavor at Middleboro, Mass.

Citizens of Middleboro, Mass., have become greatly dissatisfied with municipal electric lighting in that community, and a consumers' petition for reduced charges will probably be presented within a short time to the State Board of Gas and Electric Light Commissioners for hearing and adjudication. When consumers received their bills a few days ago for service riders were found stating that hereafter there would be minimum charges of [illegible] per year for the same amount [illegible] electricity. A charge of $2 per year is the rental for the use of meters. As a result, a strong sentiment has developed locally in favor of selling the plant to a private corporation. Many [illegible] have given the extra charge and have defied the local electric light board to cut off their service. Others state that they will go back to oil lamps before paying additional charges.

Superintendent Philbrook, of the lighting department, states that [illegible] several years ago by the local lighting board putting this rate into effect, but that he never has seen any public notice of it. It will cost $2 per year per meter for repairs, whether the meters are used or not. At the coming town meeting in March the matter will be taken up, and there is already a movement to sell the plant to private interests.

Memphis Central-Station Expansion.

The Merchants' Power Company, of Memphis, Tenn., will shortly build an annex to its steam plant on the outskirts of the city at a cost of about $50,000. About 1500 hp in additional generating capacity will be installed in the shape of a turbo-generator outfit. The principal business of the company has until lately been the lighting by underground service of the stores in the heart of the business district of the city. Practically all the distribution is now underground. The company competes with the Consolidated Gas & Electric Company, which is a progressive and active organization, paying particular attention to power requirements as well as illumination.

Non-Renewable Incandescent Lamps.

Two patents were granted Jan. 12 to Matthew M. Merritt, of Middleton, Mass., having for their object to prevent or render commercially impracticable the renewal of incandescent lamps, or in other words, the substitution of a new filament for the old one when the latter is burned out or otherwise useless or inefficient. The specification states that the means provided to this end render access difficult to the ends of the leading-in wires and in particular prevent or obstruct both the wiping and the raking action incidental to the installation of a new filament. This is accomplished by the use of a guard of porcelain or other suitable material consisting of a disk secured, in the case of an anchored filament, to the anchor wire about the same distance from the stem as the pasted joints and provided with diametrically opposite notches through which the ends of the leading-in wires pass. The anchor wire support may also be weakened so that while having sufficient strength to support the filament and guard, any attempt to remove the latter will break the anchor wire. Another form of guard is described which is stated to prevent effectually the use of any tool for working over the ends of platinum wires while the guard is in position.

Electric Railway Operations in Massachusetts.

The advance copy of the Massachusetts Railroad Commission's fortieth annual report was submitted to the Legislature on its assembly Jan. 6. The report covers the operations of 81 companies, of which 39 paid dividends averaging 5.29 per cent on the capital stock. In 1907 the average rate of dividends was 5.08 per cent. There are now 2848 miles of single track owned by electric railways in the State, an increase of 23.7 miles over 1907. The dividends paid ranged from 10 per cent to 1 per cent. The average cost of the street railways of the State per mile of main track, including the cost but not the length of side track, was $31,004 for construction, $11,103 for equipment, and $15,568 for land, buildings and other permanent equipment, making a total of $57,676 per mile. The capital investment per mile was $57,521, including the outstanding stock and the net debt.

The income of all the companies in the State for the year was $32,462,332, representing an increase of $259,000 over 1907. The operating expenses were $20,541,577, a decrease of $148,091 from 1907. The surplus for the year was $259,785 less than for the previous year. Since 1899 the capital investment per mile has increased about $12,480, and the total cost of the lines per mile about $14,700. The principal increase has been in the cost of construction, $8,200 per mile. The total car miles run in 1908, year ending Sept. 30, were 116,982,089 compared with 117,710,203 in 1907. The car miles run 10 years ago, in 1899, were 73,367,235. In this period the density of traffic in passengers per mile of main track operated has increased from a minimum of 188,787, in 1902, to 219,774 in 1908. The ratio of operating expenses to gross earnings dropped from 67.71 per cent in 1907 to 66.73 in 1908. The gross earnings per mile were $11,507. The net earnings per mile were $3,828, compared with $3,709 the preceding year. The average gross earnings per car mile were 29.31 cents, operating expenses, 17.70 cents, and net earnings, 8.75 cents, compared with 25.96 cents, 17.58 cents and 8.38 cents a year ago. The average gross earnings per passenger were 5.11 cents, operating expenses 3.41 cents and net earnings, 1.70 cents.

Municipal Electric Lighting Results at Wellesley, Mass.

Recent figures of operating results in the electric light department of the town of Wellesley, Mass., which purchases current from the Edison Electric Illuminating Company of Boston, show that the plan of buying electrical energy from a large central station and then selling it under the auspices of the local community is thoroughly successful. By this arrangement the town is treated like any other large consumer of electrical energy, current being delivered to it at a substation owned by the town in Wellesley Hills at a wholesale rate which is not expected to exceed four cents per kw-hour, according to the demand and total consumption. All the electricity used in Wellesley is generated at the L Street station of the Boston Edison Company, which is about 17 miles distant from the town substation. The transmission is by 6600-volt circuits. For local distribution in the town of Wellesley and in the Wellesley Hills section, the potential is reduced to about 2300 volts. All the commercial work of the town is handled by the electric light department, which has nothing to do with the generation of the current, but which oversees its distribution for street lighting, commercial lighting and general service, and for power.

In the year 1907 the electric light department devoted much time to getting into final running order, making arrangements for keeping supplies at the substation, and keeping complete records of all stock used. Complete records of the amount and voltage of the current passing through the substation were kept. The average cost of the current to the town at the switchboard of the substation was 3.90 cents per kw-hour. In 1907 about $920 was expended on the street-lighting system, and about $3,870 on the commercial-lighting service, making the total cost of the plant at the end of that year about $66,000. The value of the old street lighting system was taken at $12,000 at the time the contract was signed with the Boston Edison Company.

The department has aimed so far as possible to make house connections by underground construction, removing from the high-class residential territory all unsightly fixtures. Considerable trouble from broken lamps was experienced, some 187 cases occurring in the year. During 1907 about two miles of additional street-lighting wire were installed, and in the year as a whole there was an average of 774 street series lamps lighted daily, and the total number of hours of burning was 4400. In the fall of 1908 it was voted to burn lamps until morning, with the idea of continuing this service all night if it was successful. Early in 1909 it was decided to supply the service all night. The number of commercial subscribers increased from 280 to 321 in the year 1907, and the town renewed 3655 commercial lamps. Carbon-filament lamps of the ordinary type are renewed free, in case the inside of the glass is darkened or the filament is broken, but not otherwise. In 1907 a total of 1667 new lamps were installed, in new installations.

In 1907 the total number of kw-hours metered at the substation was 343,751. The commercial circuits used 251,120 kw-hours, and the substation itself 800 kw-hours. The cost of supplying the substation's own energy was thus less than 75 cents per week. The balance of current metered was delivered to the street-lighting panels in the substation. The consumers' meters registered 129,840 kw-hours, and the loss in the commercial circuits was 44 per cent. The net income of the department was about $17,000 or approximately $2.75 per capita. The service is almost entirely residential, although there were power sales amounting to about $500 in 1907. The cost of operating the department in the year, including salaries, construction, maintenance and interest, was about $30,000, of which the cost

of current was about $13,300. The rates for power charged are 11 cents per kw-hour, and for lighting, 14 cents, with 10 per cent discount on each class of service. The difference in the cost at the substation to the town and the prices charged to consumers goes into the street lighting expense, besides paying other necessary operating and fixed charges.

The latest results at hand are those for the fiscal year ending June 30, 1908, the returns for the complete year 1908 not yet being available. In this period the current purchased cost on the average 3.96 cents per kw-hour, and the Edison company delivered at the substation 354,690 kw-hours, representing a gain in business of 3.2 per cent over the previous figures quoted. Station wages were $840, or about 0.24 cent per kw-hour delivered at the substation, showing a cost per unit of from 30 to 50 per cent of the labor often required in small steam plants independently operated. Compared with the labor cost of the Edison company itself in its large stations, the cost of handling the input at the Wellesley substation is about the same per unit; and as there is practically no rotating machinery in the substation, a growth in the load will constantly decrease the cost of substation labor per kw-hour. In addition, the town has the advantage of being able to draw upon a practically unlimited supply of power, and the reliability of the service is much greater than in a small station of moderate capacity with apparatus not representing the latest developments of engineering design.

The maximum load in the substation was 131 kw. Small as this is, it brought for the business of the fiscal year a revenue of $14,000 to the Edison company. Substation repairs came to $32.70, and station tools and appliances to $122. The total cost of substation operation was therefore $995, or 0.28 cent per kw-hour. The cost of distribution was $3,208, and the town sold a total of 332,662 kw-hours. The minimum load was 16 kw. The work was handled by one foreman, one outside man and one substation man. By the arrangement now in force, the Edison company gets rid of all the detail work within the town, and is not required to meet the expense of bookkeeping, billing, meter reading, etc. At the same time the company maintains friendly relations with the town in every way, and is ready to do anything it legitimately can to facilitate the extension of electrical service according to the best plans. The employees of the exhibition department in Boston are available at all times to do anything in their power to popularize electrical service, in Wellesley as well as in Boston proper.

CURRENT NEWS AND NOTES.

WORCESTER (MASS.) EXPOSITION.—It is proposed by the Worcester County Mechanics' Association to have a mechanical and electrical exposition from March 27 to April 3, this year, in the Mechanics' Hall Building. Mr. H. F. Campbell is the superintendent.

OMAHA ELECTRICAL SHOW.—A number of the leading electrical supply houses and contractors of Omaha, Neb., and Council Bluffs are arranging to give an electrical show May 6-15 inclusive. Mr. G. W. Johnston is the president of the organization; A. G. Munro, vice-president; W. L. Burgess, secretary; J. R. Lehmer, treasurer, and J. M. Gillan, manager. The show will be given at the Auditorium.

UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION.—The date of the meeting of the Electrical Committee of the Underwriters' National Electric Association has been fixed for Wednesday and Thursday, March 24 and 25, at the rooms of the New York Board of Fire Underwriters, 32 Nassau Street, New York City, beginning at 10 o'clock on Wednesday morning.

WINNIPEG MUNICIPAL PLANT.—The Winnipeg (Man.) Electric Railway Company, which also controls the electric lighting plant, has made proposals to sell to the city its entire plant, or to reduce rates sufficiently to prevent the city from continuing work on its $5,000,000 municipal plant, designed for 60,000 hp. The company offered to sell electrical energy wholesale for $24.66 per hp-year to the city, the latter to resell at retail.

NEW JERSEY UTILITIES.—In his annual message to the New Jersey Legislature, Governor Fort urges the passing of a public utilities bill and says: "An intelligent, conservative board of public utilities commissioners, with adequate powers, will strengthen public confidence in the securities of all such companies and prevent harm to any interests. There is absolutely no reason not founded in cupidity against a public utilities commission." The State Board of Agriculture has now recommended such a commission.

PROPOSED RESTRICTION OF FRANCHISES IN INDIANA.—Governor Marshall, of Indiana, in his inaugural address recommended to the Legislature the passage of a law that will prohibit municipalities from granting franchises to public service corporations until the price the public is to pay to enjoy them is positively defined, and the municipality is allowed to share in the profits arising from operation. Further, after those things have been provided for, no second franchise shall be granted until the first has been annulled for fraud or failure to serve the public honestly and efficiently.

INDIANA ELECTRIC LIGHT ASSOCIATION.—A special meeting of the newly formed Indiana Electric Light Association is to be held at the Claypool Hotel, Indianapolis, on Jan. 26, when an interesting meeting is expected. The morning session will be given up to the meetings of the executive and advisory committees. The afternoon session will be occupied with papers and discussions as follows: "Effect of Public Utility Legislation," Henry L. Doherty; "The Tungsten Lamp," R. M. Cass, of the Indianapolis Light & Heat Company; "District Heating from Central Stations," S. B. Hofft, Merchants' Heat & Light Company, Indianapolis.

ELECTRICAL FIRES.—For years it has been the custom of the newspapers of Rochester, N. Y., to ascribe as a cause for all fires otherwise unaccounted for defective electric wiring. Recently the Rochester Railway & Light Company has had a fire-alarm system installed so that a corps of linemen respond to every fire in the city. The linemen look after the company's circuits and in numerous ways expedite the work of the firemen. Incidentally, by this means the company is apprised of the causes of all fires and an offending newspaper is called to account. One of the Rochester papers published an account of a large fire recently and in its dilemma said "as there was no electric wiring in the building, the fire could not be accounted for." In this way did the aggrieved reporter mete out retribution.

POWER PROJECT VETOED.—Consistently with his general attitude toward power enterprises, as expressed in recent documents and actions, President Roosevelt has sent to Congress a special message vetoing the bill for the construction of a dam across the James River, Stone County, Missouri, for hydro-electric purposes. He declares characteristically that the movement to secure control of the water power of the country is still in its infancy, but that "unless it is controlled the history of the oil industry will be repeated in the hydro-electric power industry, with results far more oppressive and disastrous for the people. It is true," he added, "that the great bulk of our potential water power is as yet undeveloped, but the sites which are now controlled by combinations are those which offer the greatest advantages, and therefore hold a strategic position." He says that "the bill gives to the grantee a valuable privilege, which by its very nature is monopolistic, and does not contain the conditions essential to protect the public interest. I consider myself bound," he continues, "as far as the exercise of my executive power will allow, to do for

the people, in prevention of monopoly of their resources, what I believe they would do for themselves if they were in a position to act."

ELECTRIFICATION OF MICHIGAN CENTRAL.—It is reported that the Michigan Central Railroad will electrify its terminals at Detroit and also the main line to Ypsilanti, a distance of 30 miles.

MINNESOTA PUBLIC SERVICE COMMISSION.—Governor Johnson in his annual message to the Minnesota Legislature strongly advocates the passage of a public utility law like that of Massachusetts, New York and Wisconsin.

LAND FOR COMMONWEALTH EDISON.—The Commonwealth Edison Company of Chicago has increased its holdings of land in the vicinity of its great Fisk Street station by the purchase of a tract 1040 ft. x 248 ft. on Center Avenue, adjoining its Fisk Street property. This land will not be occupied at once, as it is under lease to another party and has been purchased to provide for future needs under the far-sighted policy developed by the management.

ENGINEER, INDIAN SERVICE.—The United States Civil Service Commission will conduct an examination on Feb. 17 for a vacancy in the position of engineer at $720 per annum in the Indian Service at Fort Berthold, North Dakota. The salaries for selected candidates range from $480 to $1,000. The age limit is 20 years and over. The subjects are steam and electrical engineering, heating, refrigeration, hydraulics, gas engines, etc. Details can be obtained from the commission in Washington.

VIRGIN TO THE TELEPHONE.—There are probably a good many people in the United States who have never used a trolley car or a telephone, but probably they are not "leading citizens." In London, Judge Willis, of the Southwark County Court, has just confessed that he never used the telephone. He admitted that on several occasions he had seen the instrument in public places, but had never spoken or listened—had never felt an inner suggestion that he do so—and expected that he would never meet an emergency that would suggest it.

LONG TELEGRAPH CIRCUIT.—During the recent floods in Montana communication by telegraph and railroad between the cities of Butte and Missoula was interrupted for six weeks by a washout. The distance between the two places is 126 miles. A special dispatch was filed one night in the Butte office of the Postal Telegraph & Cable Company for a newspaper in Missoula, but as there were no direct wires a special circuit was made up as follows: From Butte to Chicago, St. Louis, Denver, Albuquerque, N. Mex., Los Angeles, Cal., San Francisco, Seattle, Wash., to Missoula, Mont. The length of this circuit was 7000 miles. The circuit, which was worked duplex throughout, passed through 15 States and Territories. It took just three minutes to organize it and get it to work.

TRACTION ACCIDENTS IN NEW YORK.—The returns secured by the Public Service Commission of the First District show that in New York City during 1908 444 persons were killed in "accidents" on the traction lines of all kinds, and 35,060 were injured. The figures do not reveal how many of these cases were due to personal negligence. Including the people killed, the cases of serious injury appear to the number of 2591. Of this total, 268 cases occurred on the steam lines, 302 on the elevated and subway lines and 2023 on the surface lines. June was the favorite month for casualties, but October had the fattest death roll. The fact may be noted, however, that the car lines in New York City carried 1,300,000,000 passengers in the year, or 60 per cent more than all the steam railroads of the country.

BOSTON Y. M. C. A. ELECTRICAL LECTURES.—Several lectures more or less related to the electrical industries are to be given this winter before the Boston Young Men's Christian Union in the thirty-seventh annual series of "Talks." On Jan. 9, Prof. George F. Swain, of the Massachusetts Institute of Technology, was scheduled to speak on "The Conservation of Our Natural Resources." On Jan. 16, Mr. J. Henry Neal, general auditor of the Boston Elevated Railway Company, will discuss "The Building of a Great Street Railway System"; Feb. 13, Mr. Francis W. Wilcox, of the General Electric Company, Harrison, N. J., will speak on the "Development of the Incandescent Lamp," and on Feb. 27, James O. Fagan, signalman, Boston & Maine Railroad, will speak on "Life and Work on the Railroad."

CELEBRATION AT PITTSBURGH.—The employees of the engineering and laboratory departments of the Allegheny County Light Company held their first annual banquet Thursday evening, Jan. 7, at the Hotel Dorset, East Liberty, Pittsburgh, Pa. Covers were laid for 40 employees, and an electrical menu was greatly enjoyed. Mr. H. E. White acted as toastmaster for the occasion. After all were seated, an electric sign, "Allegheny County Light Company," was turned on, all in red and white incandescent lamps, the room also being decorated with red and white incandescent lamps. After the dinner was served the toastmaster introduced Mr. H. N. Muller, electrical engineer of the company, who spoke to the employees upon the great demand for good, efficient men in the various electric lines. At the close of his address a short musical program was enjoyed. Several selections were given by the men's quartet from the laboratory. Other employees responded with short talks.

VALUATION OF PROPERTY.—D. D. Mann, representing the Winnipeg Electric Railway, met the power committee of the City Council of Winnipeg, Man., on Jan. 16, to discuss the sale of the property of the Winnipeg Electric Railway to the city. Mayor Evans said that the city was willing to take over the holdings of the company at a fair valuation, and asked Mr. Mann to set a price on the property. Mr. Mann said he could not act without the authority of the directors of the company, but that he knew that no arrangement for the sale to the city would be entertained by them if it did not provide for a consideration for the franchise. This value, he said, the directors felt should be fixed at 6 per cent of the annual net earnings of the company. This would mean that on the earnings of 1907 the company would want $16,645,000 for its property, and on the earnings of 1908 about $19,000,000. After the meeting, the Mayor and several Aldermen said that they considered the price proposed as excessive.

THE COLLEGE MAN.—In a recent communication to one of the journals published at Yale University, Mr. E. H. Harriman, the railroad magnate, says with regard to education: "A college education will be a great help if the man in going through college has kept the foundations of high school learning firmly fixed. On the other hand, if he has neglected his handwriting and forgotten his arithmetic in higher mathematics, nothing could be worse for him. If, however, he still retains these essentials he has a great advantage in that he has a broader view of the world and a greater knowledge of how to learn. Thus college education is, in the beginning, a real disadvantage, and I have found that in every case the high school boy does better work than the college man for the first few years. However, as soon as the college man has overcome these habits and has got back to first principles, he will go ahead much faster than his less educated rival. His mind is, naturally, better developed and more capable of grasping the fine points of the business. On the other hand, the high school boy as being younger is more adaptable and has not in most cases the irregular habits of the college man. No matter how well educated a man may be he must start in railroading at the very bottom."

Station No. 3 of the Rochester Railway & Light Company.

As pointed out in last issue, the water power furnished by the Genesee River at Rochester, while practically unlimited during a short season of the year, falls to so low a point during the other portions that it is only possible at times to get enough water from Brown's Race to run the condensers for the engines. Water storage on the Genesee River has been discussed from time to time, but thus far nothing has been done. The New York State Water Supply Commission in its report, just issued, has recommended the erection of a storage dam capable of holding 18,000,000,000 cu. ft. of water at Portageville, N. Y. This amount has been estimated to be sufficient to provide a yearly average flow of 800 cu. ft. of water per second for power purposes and will increase by nearly 20,000 the actual 24-hour horse-power now developed at Rochester. Inasmuch as the scheme of pondage at Portageville will cost in the neighborhood of $10,000,000, which would be apportioned among the benefited districts, there is little likelihood of the plan being carried through for at least some time to come. It is necessary, therefore, for the Rochester Railway & Light Company to keep some steam-driven stations in operation. The largest of these is known as Station No. 3, and it is located on Brown's Race at about the geographical center of the city.

The station is built on the westerly bank of the Genesee against the rocky cliff. The solid rock extending from the race on the west at an elevation of about 100 ft. above low water was channeled down to about a grade of 58 ft. for the main floor of the boiler room. Below this for a distance of 10 ft is a basement for the ash hoppers and ash troughs, while toward the river there is another step cut in the rock 30 ft. below the boiler room basement for the engine room. The latter room has mezzanine floors on either side which support steam piping, condensers and other auxiliary apparatus. The engine room proper is approximately 76 ft. square inside of the columns supporting the galleries and is spanned by an electric traveling crane of 35 tons capacity. The engines are set in two lines running north and south, with the shafts running east and west, leaving a 10-ft. aisle between the two lines of machines.

The roof of the boiler room is slightly higher than the street and between the building and the street runs Brown's Race, which comes within 10 ft. of the southerly end of the building. A bridge spans the race and over this all the coal and other fuel used in the station is passed. The boiler room is approximately 89 ft. x 69 ft. in the clear. Above the boilers is a coal

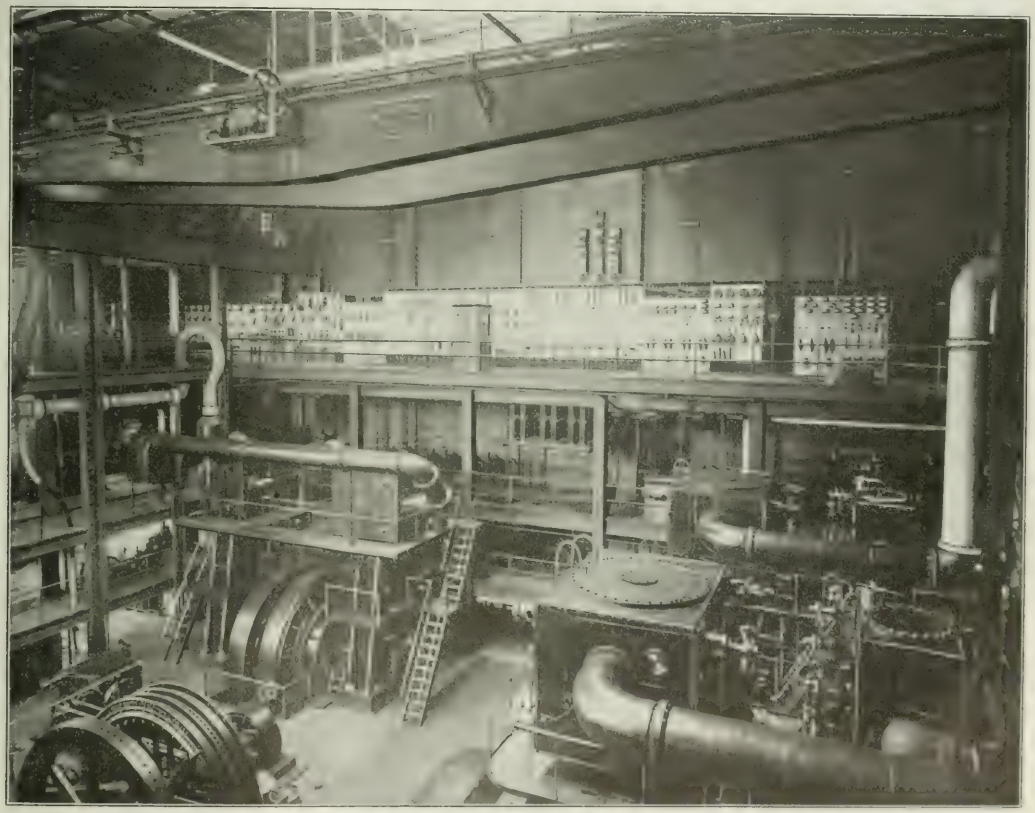


FIG. 1.—GENERAL VIEW OF GENERATOR ROOM OF STATION NO. 3 OF THE ROCHESTER RAILWAY & LIGHT COMPANY.

pocket which is 21 ft. wide at the bottom, with sides sloping at 45 deg., and 17½ ft. high to the bottom of the brick-arch roof beams. The boiler fronts, stokers, concrete ash hoppers and part of the side walls of the boilers are supported by the main boiler-room floor; but the boiler drums and tube sections are [illegible] beams which frame into the horizontal coal-pocket girders. The roof over the boiler house is made sufficiently strong to support coal wagons, which dump directly into the 1300-ton coal pocket through any one of 18 coal holes. The pocket is filled without trimming by hand by this means. The bridge forming a runway over the race has a 5 per cent grade, so that teams have no difficulty in delivering the coal to the roof. Fig. 2 shows a view of the runway leading to the roof of the station and also shows the cable runway to a cable tower on the west side of the race. Over the latter

runway many of the cables leaving the station are taken to underground conduits.

The foundations for the stacks are also in the boiler-house roof. The stacks themselves are 178 ft. above the base or foundation girders and are 10 ft. 3 in. in diameter. For 20 ft. above the base they are lined with firebrick. The stacks stand 41 ft. center to center, and their tops are approximately 185 ft. above the furnace grates. The up-takes from the boilers go directly upward into the bottom of the flue, which extends the length of the boiler house on each side and discharges into the bottom of the stacks near the center of the station.

The boiler equipment comprises 10 Aultman & Taylor water-tube boilers, each of which is rated at 650 hp. The boilers are set in four batteries of two each, occupying the four corners of the boiler house, with a single boiler set in the center of either side occupying the space immediately under the stacks. The boilers are set with no space behind them, cleaning doors being provided at the side instead of in the back. Two of the boilers are at present equipped for burning fuel oil, and the others are fitted with Ross stokers, made by the Harrisburg Foundry & Machine Works. Experiments made during the past year have caused the company to decide on a change in the boiler layout. The four boilers fitted with Ross stokers of the older type will have their furnaces changed. The fire box will be lowered 7 ft. into the basement, leaving a combustion chamber between the grates of the stoker and the bottom tubes approximately 12 ft. high and 5 ft. deep, the setting otherwise remaining the same. The boiler front, from the stoker to the lower tubes, will be lined with firebrick, and the bridge wall will, of course, be carried down to the bottom of the stoker pit. There is also an inclined firebrick arch over the coking grates which continues a suitable distance over the incandescent fuel. This serves as a sort of retort for coking the fuel and the gases being completely burned in the combustion chamber, there is an absence of smoke.

The effect of this deepening chamber is somewhat similar to that of a Dutch oven and after trying the scheme out on one boiler the company is so pleased with the results that the change in the others will be made shortly. In addition, experiments made on oil fuel have caused the company to decide to equip four boilers for burning fuel, but the exact form of setting has not been decided on as yet. Texas crude oil will be used. The oil is brought in cars, and from the latter flows by gravity to a 750,000-gal. tank standing 90 ft. below the track level. An auxiliary tank, 10 ft. below the track level feeds directly to the boilers, so that the oil will run from the cars to the storage tank and thence up to the auxiliary tank. The oil can also be pumped from the storage tank. So far as cost is concerned present experiments indicate that, considering the cost of coal alone and the cost of oil alone, it is more expensive to use the oil. From the viewpoint of upkeep, however, including labor, it is estimated that the oil will show a small saving. The chief advantage of the scheme, however, is the absence of smoke, the ease of operation and above all the rapidity with which the boilers can be made to generate steam, starting with the boilers cold.

The two remaining boilers are fitted with the improved type of Ross stokers, and these will not be changed. A very interesting change will be made, however, in the flues and method of running the boilers. Considering one row of boilers and numbering these 1, 2, 3, 4 and 5: boilers No. 1 and No. 5 will have depressed furnaces, boilers No. 2 and No. 4 will be fitted for oil burning and boiler No. 3 will remain unchanged. The coal-burning boilers will carry the steady load, and the gases will be constrained to pass from boilers No. 1 and No. 5 through boilers No. 2 and No. 4 and out through boiler No. 5 to the stack. If it is necessary to employ a fan to obtain the necessary draft in view of the circuitous route of the gases, a fan will be installed. Normally, the oil-burning boilers will not be operating only on varying load and at peaks. The boilers will, therefore, act as sort of economizers, and the arrangement will in all probability result in the generation of low-pressure steam at least. In cases of emergency, the oil-burning boilers can be brought into use at once and steam generated in about 20 minutes.

The Ross stoker is designed for burning bituminous coal, such as is used at Rochester, and which costs about $2.50 per ton. After the fuel leaves the coking plate and grates it passes down the inclined grates, each alternate bar being arranged to rise



FIG. 2.—DRIVEWAY LEADING FROM STREET TO ROOF OF STATION.

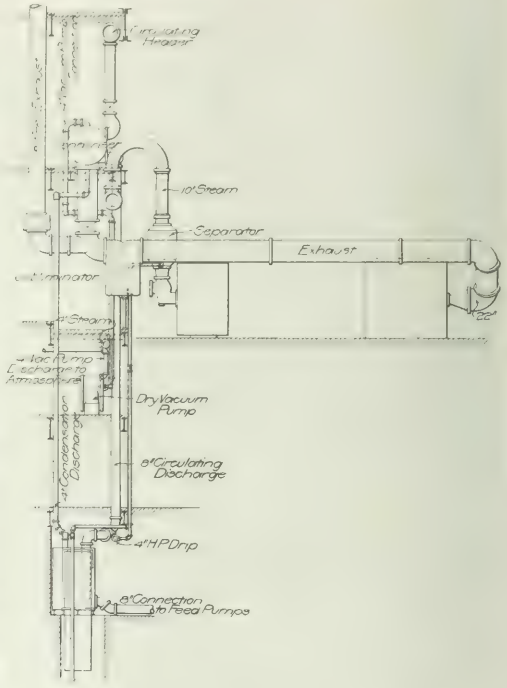


FIG. 3.—STEAM PIPE CONNECTIONS TO LARGE ENGINES.

at the lower end and move forward, breaking up and carrying the fuel downward toward the dumping grate at the bottom, making a constant and positive feed at all times. Separate adjustments control the movements of the coal pusher, coking grates and inclined grates, which are all independent. A series of small coking grates are hung from a rocking bar and arranged to move forward and backward in a horizontal direction. Their function is to carry the coal and coke from the dead plate to the main inclined grates. The latter are alternately movable and stationary. The movable grates are controlled by a regulator on the front of the stoker and move to a height of 4 in. upward and forward at the lower end and then backward level with the stationary grates. They are straight from the upper end to the dump grates and provided with overlapping and vertical flights on their sides so arranged that a suitable supply of air will pass between them. The dumping ash grate is balanced and reversible, and is operated by levers in front.

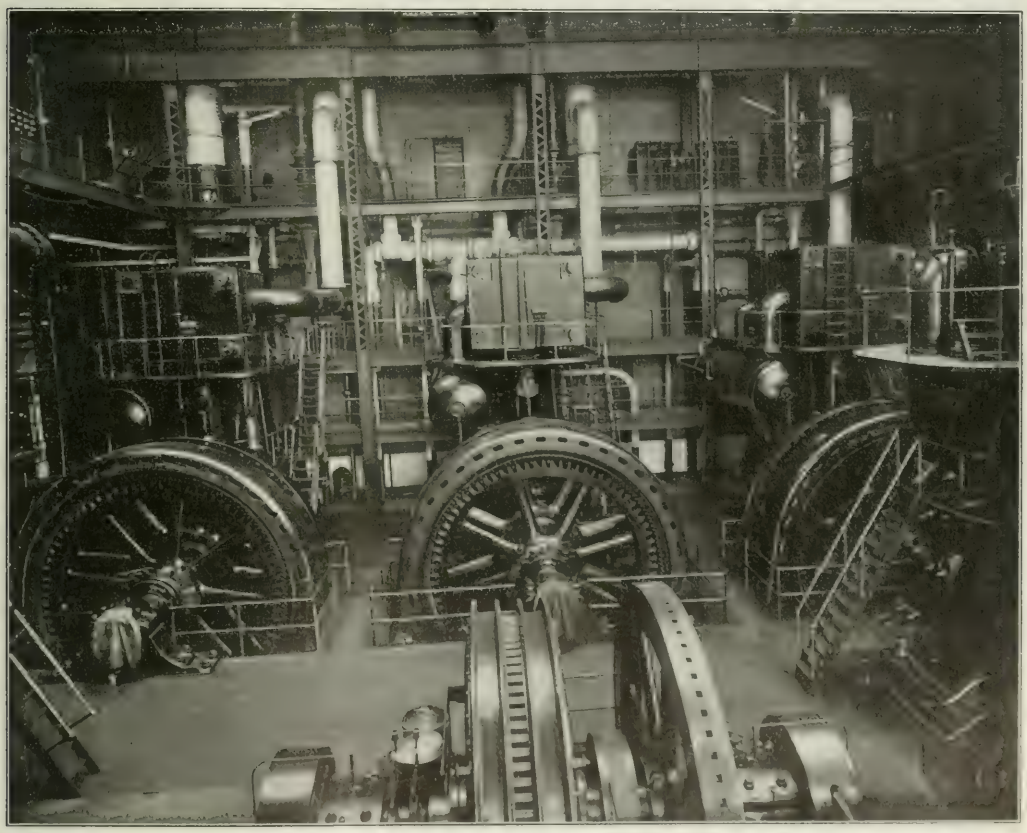


FIG. 3 VIEW OF ENGINES ALONG WEST WALL SHOWING STEAM PIPING.

The engine room, a view of which is shown in Fig. 1, is some distance above the river and has mezzanine floors on the east and west sides 6 ft. 10 in. wide. The first two mezzanine floors are on the same level with the engine platforms, the third mezzanine floor is on the same level as the main electrical-control floor and carries the primary and secondary feed-water heaters, and the fourth mezzanine floor is 6 in. below the top of the crane girders. Along the west side of the engine room are three vertical cross-compound engines built by the Southwark Foundry & Machine Company, of Philadelphia. Each engine is arranged to drive a 1360-kw, 4150-volt, 60-cycle alternator placed between the low pressure [illegible] and an outer pedestal. The engines are designed to run at a normal speed of 90 r.p.m., with an initial steam pressure of 160 lb. and a vacuum of 26 in. Under these conditions each engine will develop 1800 hp at 30 per cent cut-off and a maximum of 3000 hp. When running with most economical load, they require less than 13 lb. of dry steam per ihp per hour, including the steam used in the reheater, while the steam variation from no-load to full-load does not exceed 3 per cent from the normal. Under any change of load, the speed variation is said not to exceed one-fourth of one geometrical degree from the position of uniform rotation. The flywheel of each engine is 20 ft. in diameter and weighs, with the armature sleeve, close to 125,000 lb. The flywheel is made of cast-iron segments securely held together at the rim by tee-headed shrunk links and at the hub by means of fitted bolts. The armature sleeve is bolted directly to the spokes of the generator, thus relieving the shaft of any strain between the flywheel and generator. The engines are fitted with Porter-type governors capable of electrical control from the switchboard for synchronizing purposes. A Bulkley condenser is provided with each of the three engines. The usual automatic, free exhaust valve and connections are placed in each of the exhaust pipes and two Hoppes open heaters with [illegible] are connected to the engine exhaust pipe. The feed water is taken from the hot well, race, river or from the city water mains and is handled by three duplex, outside-packed plunger pumps. These pumps are designed to work against 250-lb. water pressure and any one is sufficiently large to handle the entire installation. From the pumps the feed water is taken through the Hoppes heaters and [illegible] into the feed mains which run underneath the boilers

immediately in front of the ash hoppers, where connections are made to vertical lines at the side of the boiler. The steam pipe connections for the three Southwark engines is shown in Fig. 4. The door shown on the upper mezzanine floor leads into the boiler room, being a few feet above the boiler-room floor. The main steam header supplying the engines is shown directly below and the two feeders from the boiler room are shown coming down at either side of the door.

Along the east side of the engine room there are two engines and a steam turbine; the Dickson engine shown in the foreground of Figs. 1 and 4 having been removed and a turbine placed there instead. The engine near the switchboard galleries is an 1800-hp, vertical cross-compound McIntosh & Seymour engine direct-connected to a 1000-kw railway generator. At the other end of the row is an 1800-hp Allis-Chalmers vertical cross-compound engine direct-connected to two 550-kw, 250-volt generators. Between these engines is a 3000-kw Curtis turbine driving a 4150-volt, three-phase alternator. The latter unit is fitted with an Alberger condenser, and the whole equipment requires less space than the old 500-kw Dickson-Stanley

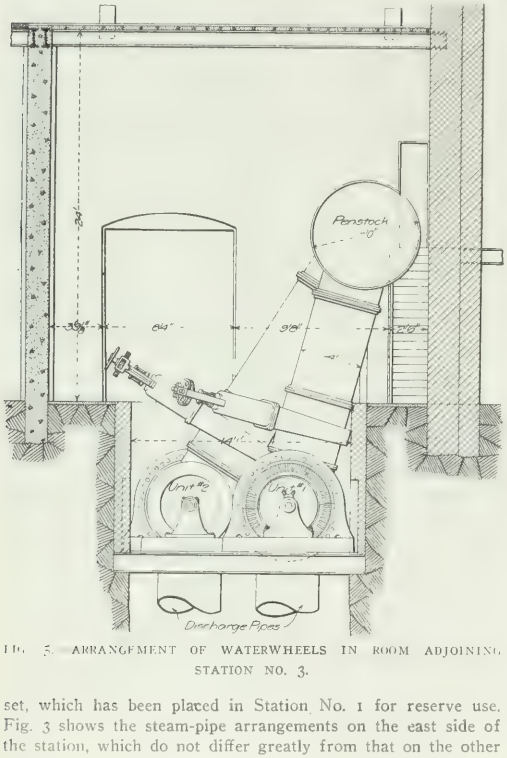


FIG. 5.—ARRANGEMENT OF WATERWHEELS IN ROOM ADJOINING STATION NO. 3.

set, which has been placed in Station No. 1 for reserve use. Fig. 3 shows the steam-pipe arrangements on the east side of the station, which do not differ greatly from that on the other side.

Normally when there is plenty of water in Brown's Race the condensing water is taken directly from the race without any pumping whatever, but during periods of slack water the condensing water is pumped from the river. The station possesses many advantages because of its peculiar location. Although coal must be carted to it, after it is dumped into the pocket there is no rehandling, nor is there any moving machinery employed in its distribution. The coal is delivered by gravity through chutes to the hoppers of the stokers. The ashes are dumped into a concrete trough under the furnace pits in the basement, whence they are washed into the river without further ado, and the whole problem of ash removal easily solved. Boiler feed water must be pumped because the tops of the boilers are not much below the level of the race, and at times water for condensing purposes must also be pumped. Ordinarily, however, there is enough water in the race so that the condensers may be fed by gravity from it, or, in other words, a spillway with intercepting condensers is provided at this point instead of farther down the river, where no advantage could be taken of it.

The generating apparatus in the station consists of three 4150-volt, three-phase, 60-cycle alternators, one 3000-kw turbo-alternator, one 1000-kw, 550-volt generator and two 550-kw, 250-volt generators. The three engine-driven alternators are of the Stanley type, and all the other generating apparatus is of General Electric type. In addition there are two 250-kw, 550-volt Bullock motor-generator sets used to feed a 500-volt motor circuit; a 500-kw, 550-volt General Electric motor-generator set for street railway work, a 90-kw, 125-volt General Electric motor-generator sets for excitation purposes; two 150-kw Edison machines direct-coupled to a 250-volt Edison generator used as a motor, also for exciter purposes; a 1000-kw chloride battery for railway work; a 640-amp-hour battery floating on the exciter bus and capable of supplying the entire excitation energy required by the station for one hour; a 500-kw, 275-volt motor-generator set for feeding the Edison system at this point, and a 125-hp motor direct-connected to a generator. This last set is used in connection with the railway battery for booster purposes and is arranged with carbon regulator. There are also in use for excitation purposes a 75-kw steam-driven set and induction-motor exciter set. The steam-driven set is used so as to make the excitation independent of any electrical disturbance which might affect the regular operation of the system, and also on account of the relatively high economy realized by utilizing the exhaust steam to heat the boiler feed water, as the station has no other steam auxiliaries except the boiler feed-pumps, stoker engines and condenser pumps.

Adjacent to the steam plant of Station No. 3 is an old water-power plant taking water from Brown's Race through a 7-ft. penstock and having a head of about 90 ft. Heretofore the generators in this plant were driven from belts and ropes, but lately the plant has been reconstructed and direct-connected units installed. The arrangement of the units is shown in Fig. 5. There are two 350-kw, 4150-volt alternators and one 300-kw, 550-volt direct-current generator installed in this plant.

At the south side of the engine room are three galleries set aside for electrical purposes. The two lower galleries are 12 ft. 6 in. wide, and the one on which the switchboard is placed is about 16 ft. wide. An addition is built to the southeast corner of the engine room which extends the full height of the building, 18½ ft. x 43 ft. In this switchboard and transforming apparatus is installed. All the electrical connections of the generators, exciters, etc., are brought to the operating switchboard in the gallery. The board is somewhat different from that shown in Fig. 1. Since the picture was taken the switchboard has been rebuilt to a large extent, although the general arrangement remains the same. There are now about 55 panels in the board, comprising panels for the generators, motors, tie lines, battery, railway feeders, Edison system feeders, alternating-current feeders, etc. The railway circuits are controlled from the left end of the board. The panels are standard throughout, but the excellence of the wiring back of the panels is worthy of comment. The oil switches are located on the gallery below and the constant-current transformers for the series arc-lamp circuits fed from this station are placed in the gallery above and to the left. From this station there are several three-phase distributing feeders for lamp and motor circuits, and on these circuits potential regulators are arranged. These are placed back of the switchboard. The exciter circuits run directly from the machines to the bus in conduit. All wiring from the transformers to the switchboard is in conduit with outlet boxes at the bottom of the board for the relay connections and at the top for the instrument connections. Condulets are used for outlets, and all the wiring being encased, the back of the board is singularly free from danger of contact. The motor-generator sets are located on the third gallery below the switchboard.

Station No. 3, being the main steam generating station of the company, is electrically connected with many of the other sta-

tions through numerous tie lines. There are tie lines to Station No. 2 on the Upper Falls for both railway and Edison lighting circuits; alternating-current tie lines with Station No. 15 on the Middle Falls, with Station No. 5 on the Lower Falls, with Stations No. 4 and No. 6 on the Upper Falls and on Johnson & Seymour Race, respectively, and there is also a tie line for railway circuits with Station No. 5. Inasmuch as the other stations are also tied together it is possible to transfer the load from almost any station to Station No. 3 and vice versa. The advantage of having the various stations electrically connected was well shown during the recent drought. Stations No. 2 and No. 3 and Station No. 1, which is usually only run in cases of emergency, are the only steam stations of the company. In the absence of water the first two were run overloaded for 24 hours a day during the season of drought and the last was run for two hours a day on the peak load. The tie connections are run underground, some passing out underground directly from the station and others crossing the river to the opposite bank.

The Influence of Frequency on the Equivalent Circuits of Alternating-Current Transmission Lines.

By A. E. Kennelly.

If a pair of single-phase wires form an alternating-current transmission line, as indicated by $A\,B$ and $A'B'$ in Fig. 1, they naturally possess distributed electrostatic capacity as well as distributed resistance, inductance and leakage. The distributed capacity is indicated diagrammatically in the figure by the numerous parallel lines connecting the two wires. It is customary, however, to compute the electrical behavior of such lines in regard to voltage-drop, or other particulars, under any assigned load, by assuming that each wire is operated with all of its capacity (to zero potential) connected in a single condenser, or lumped sum, between the middle point O along each wire, and the zero-potential axis $G\,G$ midway between them, as shown in Fig. 2.

Similarly, if three equidistant wires are employed in a three-phase transmission system, as represented in Fig. 3, each pair will possess distributed capacity, indicated by the parallel shading, as well as distributed resistance, inductance and leakance. It is customary, however, to compute the electrical behavior of the lines, under any assigned conditions of load, by assuming that each wire is operated with all of its capacity (to zero potential) connected in a single condenser between the middle point O along each wire and the zero-potential, or neutral, axis, $G\,G$, of the system, as shown in Fig. 4. It is known that if the same length and size of each wire is used in the single-phase line (Fig. 1) as in the three-phase line (Fig. 3), and if the distance separating the wires is in each case the same, then the capacity to be inserted in each condenser of Fig. 4 is the same as that in each condenser of Fig. 2. The star-voltage of the three-phase system must, however, be considered as acting on each wire, in Fig. 4, to ground or zero potential, whereas only the half-voltage of the single-phase system must be applied to each wire, in Fig. 2, to ground or zero potential.

It follows, then, that whether a wire belongs to a single-phase transmission system, as in Figs. 1 and 2, or to a symmetrical three-phase transmission system, as in Figs. 3 and 4, it is always capable of being treated as a single separate wire with a condenser connected to ground at the middle point of its length, in the manner shown in Fig. 5. The same proposition applies, moreover, with suitable modifications in detail, to each wire in any multiphase system, whether the distances between the wires are symmetrical or not.

Any uniform transmission-line wire may, therefore, be regarded as consisting virtually of a reactance coil $A\,B$ (Fig. 5) of assigned resistance and inductance, with a single condenser connected between its middle point O and the ground. If there be appreciable leakage or loss of energy of any kind in the dielectric, such as radiation or electric hysteresis, then a suitable conductive leak should be assigned to the condenser in shunt, or a suitable resistance should be inserted in series with the condenser.

This association of a divided reactance coil and condenser representing an actual line wire may be called the equivalent circuit of the line wire, or, briefly, the T, from the graphic resemblance.

If the total resistance and inductance of the T are respectively the same as those of the actual line wire, and also if the capacity of the condenser is equal to the total capacity of the wire to zero potential, then the T is a nominal electric imitation of the line-wire, disregarding the lumping of the capacity, and such a T may be called the *nominal* T of the line wire.

It has been shown elsewhere by the writer[1] that the nominal T requires to be corrected for lumpiness of capacity in a definite and simple manner. The correction is a function of the impressed frequency. The modified T, corrected for lumpiness, may be called the *equivalent* T of the line-wire considered. For any given length of line-wire, with uniform linear constants, worked at a single impressed frequency, there is one and only one equivalent T which is the complete substitute of the line-wire for all external conditions. That is, any uniform wire may be completely and precisely imitated in regard to all external relations by its equivalent T, so long as the wire is operated steadily at a single impressed frequency. Internally, or within the length of the line-wire, the distributions of current and voltage may differ considerably from those at the corresponding points of the equivalent T, and surges set up by electrical disturbances on the actual wire may differ both internally and externally from those on the equivalent T, but, in the steady state, the distributions of voltage, current and power

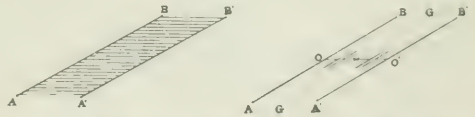


FIG. 1.—PAIR OF SINGLE-PHASE TRANSMISSION LINES. FIG. 2.—NOMINAL EQUIVALENT CIRCUIT OF SINGLE-PHASE PAIR OF WIRES. TWO EQUAL CONDENSERS CONNECTED IN SERIES BETWEEN MID-LENGTH POINTS OO'.

at the line terminals, or at any point in the same system outside the line, will be the same with the actual wire as with its equivalent T.[2]

Again, if instead of connecting all the capacity of the wire at the center of its length, we connect half of this capacity at each end of the wire, as in Fig. 6, we shall obtain an equivalent circuit consisting of a single reactance coil with a condenser to ground at each end. This type of equivalent circuit may be called for brevity, a Π, from the graphical resemblance. As in the case of a T-conductor, if we import the nominal total values of wire resistance, inductance, leakance and capacity into the Π conductor, we obtain a nominal electric imitation of the line wire, except for the lumping of the capacity and leakance

l linear inductance of the wire (henrys per mile or kilometer)
g linear leakance of the wire (mhos per mile or kilometer)
c linear capacity of the wire (farads per mile or kilometer).

into two condensers. Such a Π may be called the *nominal* Π of the line wire. Corrections must be applied to the electrical constants of the nominal Π in order to compensate for lumpiness.[3] The corrected Π may be called the *equivalent* Π of the actual line wire. It can be shown that the equivalent Π is the complete substitute for, and counterpart of, the real line wire at the line terminals, and at all external points of the connected system, in the steady state, for any single impressed frequency. Internally, however, the conditions are not, in general, the same in the real line wire as in its equivalent Π. Oscillatory

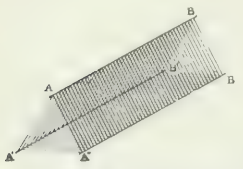


FIG. 3.—SET OF THREE-PHASE TRANSMISSION WIRES.

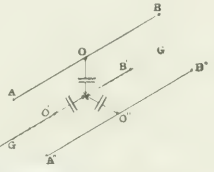


FIG. 4.—NOMINAL EQUIVALENT CIRCUIT OF THREE-PHASE SET OF WIRES. THREE EQUAL CONDENSERS CONNECTED IN STAR BETWEEN MID-LENGTH POINTS O, O', O''.

disturbances, or unsteady conditions, in general, produce different conditions with the real line wire and with its equivalent Π, both internally and externally.

In some computations, or for some purposes, the equivalent *T* of a line is the more convenient substitute; while for other computations or purposes, the equivalent Π is the more convenient substitute. Being, however, identical substitutes for all external relations, the same results can be obtained with either equivalent.

It is the object of this paper to present the computed values of resistances, reactances, inductances and capacities both in the equivalent *T* and in the equivalent Π, of a particular type of transmission-line, for different frequencies such as might be expected to occur in practice.

The transmission line assumed in the computation has a length *L* of 250 km (155.34 statute miles), and consists of three No. 000 A. W. G. aerial copper wires 0.41 in. (1.041 cm) in diameter, supported symmetrically on pole insulators at a



FIG. 5.—T CONDUCTOR EQUIVALENT TO AN ALTERNATING-CURRENT TRANSMISSION WIRE.

uniform interaxial distance of 72 in. (193 cm). The following values of linear wire resistance, inductance and capacity have been taken as constant at all of the frequencies considered:[4]

$r = 0.206$	ohm/km	$= 0.33$	ohm/mile
$l = 1.222285$	millihenry/km	$= 1.967$	millihenry/mile
$c = 0.0094828$	microfarad/km	$= 0.01526$	microfarad/mile

The linear leakance of the wires is taken as negligible.

With the above values, the following constants are involved in the total resistances, inductances and capacities both of the nominal *T* and the nominal Π, for each wire referred to zero potential return:

Resistance, 51.5 ohms. Inductance, 0.30557 henry. Capacity, 2.3707 microfarads.

It is assumed that this transmission line is operated three-phase, at an impressed fundamental frequency of 25 cycles per second, or at an impressed angular velocity of $\omega_1 = 157.08$ radians per second.

In practice, such a line might be operated at the sending end by an impressed effective e.m.f. between wires of from, say, 55 kv to 110 kv, corresponding to star voltages per wire of from 31.75 kv to 63.5 kv to ground or zero potential. In order to generalize and simplify the matter, we may assume an impressed effective star voltage of unity, or 100 per cent, at the sending end of each wire, so that the results will apply equally to any desired magnitude of impressed e.m.f.

It is further supposed that the impressed voltage, of fundamental frequencies 25 ∼, is accompanied by harmonics of odd order. It is known that, in three-phase systems, neither triple-frequency nor 3*n*-frequency harmonics can occur on the transmission lines, to any appreciable extent, in the steady state, being absorbed by the terminal apparatus, whether the lines are connected in star or in delta. The harmonics which may be expected to occur will be of 5, 7 and 11 times the fundamental frequency, as far as the 11th order inclusive. The e.m.f. of these various possible harmonics should not be large in well-constructed transmission alternators; but each may, in turn, be considered as unity, or 100 per cent, for convenience of reference. The length of line selected happens to be resonant to the frequency of 293.424 cycles per second, which is 11.737 times the fundamental frequency of 25 ∼. This first resonant frequency is, therefore, not an exact multiple of the fundamental frequency, but approximates to its 11th harmonic. It is evident, however, that if the alternator supplying this transmission system were driven at about 7 per cent above normal speed, the 11th-harmonic frequency would coincide with this resonant frequency of the line. The equivalent *T* and Π have, therefore, been computed for the fundamental, 5th, 7th and 11.737th, or resonant, frequency multiples. The results appear in the following tables:

TABLE I

EQUIVALENT T OF EACH LINE WIRE AT DIFFERENT FREQUENCIES

Frequency Cycles/ Seconds	Total Wire Impedance Ohms	Wire Inductance Henrys	Leak Impedance Ohms	Capacity Micro-farads
0	51.50 +*j*0	0.30557	∞	2.3707
25	51.669+*j* 47.952	0.30527	− 8.649−*j*2693.3	2.3637
125	55.594+*j*248.88	0.31688	− 9.545−*j* 579.15	2.1985
175	60.065+*j*362.124	0.32934	−10.610−*j* 445.75	2.0403
293.42	84.114+*j*714.594	0.38760	−16.351−*j* 358.48	1.5131

TABLE II

EQUIVALENT Π OF EACH LINE WIRE AT DIFFERENT FREQUENCIES

Frequency Cycles Seconds	Total Wire Impedance Ohms	Wire Inductance Henrys	Impedance of Each Leak Ohms	Total Capacity Micro-farads
0	51.50 +*j*0	0.30557	∞	2.3707
25	51.21 +*j* 48.01	0.30564	9.726−*j*5362.2	2.3745
125	44.077+*j*223.285	0.28430	8.67 −*j*1033.86	2.4631
175	37.418+*j*290.058	0.26380	8.87 −*j* 710.44	2.5603
293.42	16.435+*j*360.313	0.19544	9.355−*j* 359.65	3.0163

The first line in each table corresponds to zero frequency, and contains the constants for the nominal *T* and nominal Π respectively. That is, the nominal *T* and nominal Π require no correction for frequency 0. As the frequency increases, the equivalent *T* wire-resistance and inductance increase, while the equivalent Π wire-resistance and inductance diminish. It is just the opposite as to the wire capacity, which as the frequency rises becomes greater in the equivalent Π and less in the equivalent *T*.

It is easy to see why the line is resonant at the last frequency in the tables (293.42 ∼), by an inspection, say, of the equivalent Π. The line wire has a positive, or inductive, reactance of 360 ohms and the leak at the far end has a negative, or capacity, reactance of nearly the same amount; so that with these two in series, the line behaves at the sending end almost like a simple ohmic resistance of 25.79 ohms to ground, except for the capacity in the leak at the sending end.

METHODS OF COMPUTING THE VOLTAGE AT THE DISTANT FREE END OF THE LINE.

Several approximate methods are used by engineers for computing the voltage at the distant end of a transmission line when the load is entirely removed, and when the voltage at

[3] The correct impedance of the reactance coil *AB* (Fig. 6) in the equivalent Π is $z_0 \sinh \lambda a$ ohms, and the correct impedance in each of the two condenser branches is $z_0/\tanh \lambda a$ ohms, where the symbols have the same meanings as in the preceding foot-note.

[4] "The Inductance and Capacity of Suspended Wires," by E. J. Houston and A. E. Kennelly, *Electrical World*, Vol. XXIV, No. 1, p. 6, July 7, 1894.

the distant end is, in general, greater than the voltage impressed on the sending end of the line. These methods may be compared as follows:

(1) *Condenser Current in Nominal T.*

In this approximation, the nominal T of one line wire is first prepared as in Fig. 5. Let the vector impedance of each half of the choking coil AB be z' ohms; let Z' be the impedance of the condenser, and e the impressed star voltage at the sending end. Then the true charging current will be

$$i = \frac{e}{z' + Z'} \quad \text{amperes} \quad (1)$$

but z will usually be small compared with Z', so that, without large error

$$i' = \frac{e}{Z'} \quad \text{amperes} \quad (2)$$

The drop of pressure produced by this charging current in the reactance AO, Fig. 5, will be

$$e_1 = i'z' \quad \text{volts} \quad (3)$$

so that the voltage at the distant free end of the line is

$$e' = e - e_1$$
$$= e - e\frac{z'}{Z'} = e\left(\frac{Z' - z'}{Z'}\right) \quad \text{volts} \quad (4)$$

All of the above equations are vector equations. The error in them is partly that the T is only a nominal T, not corrected for lumpiness, and partly because of the disregard of the line impedance when determining the vector charging current i' in equation (2).

(2) *Vector Method on Nominal T.*

In this method, equation (1) is used for determining the charging current, instead of the simpler equation (2). The drop of pressure in the reactance AO is

$$e_1 = iz' \quad \text{volts} \quad (5)$$

and the voltage to neutral point at the far end of the line is

$$e' = e - e_1$$
$$= e - e\left(\frac{z'}{Z' + z'}\right) \quad \text{volts}$$
$$= e\left(\frac{Z'}{Z' + z'}\right) \quad " \quad (6)$$

The only error in this method is in the use of the nominal T of the line-wire instead of the corrected or equivalent T.

(3) *Hyperbolic Method.*

In this method no reference is made to an equivalent T, but the correct hyperbolic formula is used[6]

$$e' = \frac{e}{\cosh La} \quad \text{volts} \quad (7)$$

where a is the attenuation constant of the line. This method is believed to be fundamentally correct.

(4) *Vector Method on Equivalent T.*

This is the same as method (2) except that the equivalent T is substituted for the nominal T. Its error has thus disappeared.

(5) *Vector Method on Equivalent* Π.

In Fig. 6, let z'' be the vector impedance of the line-wire reactance coil AB, and Z'' the vector impedance of each of the two terminal condensers. Then with the far end free, the voltage there will be

$$e' = e \frac{Z''}{z'' + Z''} \quad \text{volts} \quad (8)$$

This method should also give arithmetically correct results. Summing up, therefore, methods (3), (4) and (5) should, and do, give the same arithmetically correct results, method (2) should give the next best results, while method (1) should be the least reliable, or should contain the largest error.

[6] "On the Fall of Pressure in Long Lines of Alternating Conductors," by A. E. Kennelly, *Electrical World*, Vol. XXIII, No. 1, p. 17, January, 1894. "Resonance in Alternating Current Lines," by F. L. Hopkins and A. E. Kennelly, *Trans. Am. Inst. Elec. Engrs.*, Vol. XIII, pp. [illegible], April 17, 1895.

The following table gives the voltages at the distant free end of the three-phase transmission line above considered, computed for the frequencies already discussed, and assuming the impressed voltage at the sending end to be 1.0 in each case:

TABLE III

VOLTAGE AT FAR FREE END WITH VOLTAGE 1.0 IMPRESSED AT THE SENDING END OF THE WIRE 250 KILOMETERS LONG

Frequency	(1) Condenser Method. Volts	(2) Vector Method Nominal T. Volts	(3), (4) and (5) Hyperbolic and Vector Methods Equivalent T and Π. Volts
25	1.00898 \ 0°.33′	1.00902 \ 0°.33′	1.00897 \ 0°.33′
125	1.2244 \ 2°.15′	1.2853 \ 3°.32′	1.2728 \ 3°.15′
175	1.4393 \ 2°.40′	1.7666 \ 6°.42′	1.6800 \ 5°.34′
293.42	2.234 \ 2°.53′	3.890 /154°.02′	13.945 /90°

The first line of the above table shows that the rise of voltage at the distant free end of the line here considered is less than 1 per cent, at the fundamental frequency of 25 ~. Moreover, all of the five different methods give, for practical purposes, the same result. That is, it is quite sufficient, for ordinary purposes, to use the nominal T to represent the line and to take the condenser as charged to full initial potential. In other words, it seems entirely justifiable at this frequency to ignore the refinements of hyperbolic analysis in the fundamental method No. (3), or the refinements which correct the nominal T, or nominal Π, for lumpiness. The voltage at the distant end of the line can be obtained closely enough for all practical purposes by the approximate method (1), even with lines 250 km (155 miles) in length, worked at the frequency of 25 ~, in the steady state.

At the fifth-frequency harmonic (125 ~), the table shows that the first approximation method (1) gives a distant-end voltage within 4 per cent of the arithmetically correct value, and the second approximation method (2) gives a value within about 1 per cent of the same result.

At the seventh-frequency harmonic (175 ~), it may be

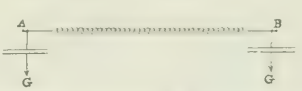


FIG. 6.—π-CONDUCTOR EQUIVALENT TO AN ALTERNATING-CURRENT TRANSMISSION WIRE.

seen that the first approximation method (1) gives a voltage 14 per cent low, and the second approximation method (2) gives a voltage about 5 per cent high, the arithmetically correct value being 1.680 lagging 5°.34′ behind the impressed voltage at the sending end. This latter result is reached by each and all of the alternative correct methods (3), (4) and (5).

At the resonant frequency of 293.42 ~ the approximate methods (1) and (2) are entirely inadequate, and give misleading results; whereas all of the three correct methods give a voltage of 13.945 lagging 90 deg. behind the impressed voltage at the sending end. Consequently, whatever voltage is applied at the sending end would be multiplied nearly 14-fold at the distant end freed, or without load. For instance, 100 volts between wires at the generator end should produce 1394.5 volts between any pair of the free distant ends. It is proper to point out that no such large resonant rise of potential has yet been reported on any actual line, and, until verified, this deduction must be regarded merely as a theoretical prediction. Lines of 250 km in length are not likely to be deliberately operated at nearly 300 cycles per second. Even if operated steadily at such a frequency, considered as an accidental harmonic to the fundamental working frequency, such a line would probably be loaded at the distant end, and if such loads are applied to the equivalent [illegible] of the line, it will be readily seen that the rise of voltage is markedly reduced, the balance between the positive reactance of the line and the negative reactance of the leak having been upset by the application of load. Similar considerations apply if a load be placed on the line at some intermediate point along it. In such a case, however, the line must be regarded as divided into two portions each of which is capable of being replaced by an equivalent T or equivalent

11. Again the magnitude of the 11th frequency harmonic voltage will probably be very small with respect to the magnitude of the fundamental frequency voltage, and will be added vectorially at right angles to the latter. A 5-per-cent resonant frequency component, in the case of the line here considered, would produce a voltage of 70 per cent at the far end, and add only 22 per cent to the total voltage there, as indicated by voltmeter.

If actual experiment should show that the resonant rise in voltage at the far free end of such a line is not so great as that set forth above, the discrepancy is likely to be found not in the methods of computation here indicated, but in the existence of dielectric or insulator leakage ordinarily regarded as negligible.

Conclusions.

Any transmission line, single-phase or multiphase, may be analyzed into single wires, each worked to zero potential and capable of being represented as a nominal T, or nominal Π. At the fundamental frequencies employed in transmission, no modification of these equivalent circuits is required, for ordinary engineering purposes, up to overhead lengths of 250 km, at least.

For higher harmonic frequencies, and especially for frequencies at or near resonance, it becomes necessary to substitute the equivalent T or Π for the nominal T or Π of the line wires.

The equivalent T or Π is the complete external substitute for any single length of uniform line wire operated at any single alternating-current frequency in the steady state.

Representation of Synchronous Converter Phenomena.

By Olin J. Ferguson.

In this discussion, the following symbols will be used:

n = number of rings of synchronous converter.

I_0 = direct current delivered.

E_0 = commutator voltage, line.

I_1 = maximum value of sine-wave current in an armature coil.

I_n = effective value of I_1.

E_1 = maximum voltage between adjacent collector rings.

E_n = effective value of E_1.

The e.m.f. ratios of a synchronous converter are graphically indicated by the vector diagram, Fig. 1.

$O E_0$ is the value of commutator voltage.

$$O E_1 = \frac{O E_0}{\sqrt{2}}$$

For an n-ring converter, lay off the angle $\frac{\pi}{n}$, measuring from the initial line $O A$. Then $O E_1$ is maximum alternating voltage, E_1, and $O E_n$ is the effective alternating E_n.

It is seen at once that $E_n = \frac{E_0}{\sqrt{2}} \sin \frac{\pi}{n}$.

For ordinary practice, the values of $\sin \frac{\pi}{n}$ are easily remembered.

Current ratios are calculable from these relations, taken with one further assumption that the output equals the input.

$$n I_n E_n = I_0 E_0.$$

Whence,

$$I_n = \frac{I_0 \sqrt{2}}{n \sin \frac{\pi}{n}}$$

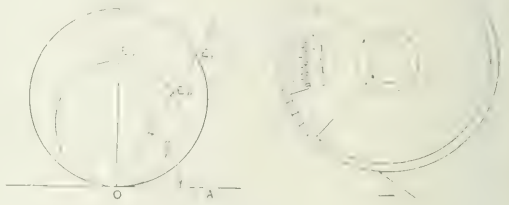
$$I_1 = \frac{2 I_0}{n \sin \frac{\pi}{n}}$$

The alternating-current sine wave is

$$i_n = I_1 \sin \omega$$

The different coils in a phase winding (that is, the coils between adjacent collector rings) may be numbered from zero at the center of the winding outward in each direction, as indicated in Fig. 2.

If that half of the direct current passing through one side of the armature winding is added to the sine wave of the alternating current there is obtained the displaced sine wave $i_n + \frac{I_0}{2}$



FIGS. 1 AND 2.—VOLTAGES AND COILS OF CONVERTERS.

shown in Fig. 3. Upon the other side of the armature winding there will be $i_n - \frac{I_0}{2}$, or the lower displaced sine wave. Actual current conditions in any one coil are thus represented by portions of both of these displaced waves used successively as the coil passes under a brush on the commutator. For example, the direct current in the coil at the center of the winding reverses at the instant the alternating current is zero (with unity power factor), so that there is obtained the current wave $a\,o\,z\,o'\,a'\,a''\,o''\,z''\,o'''$ . . . A coil later in the reversal in the same phase will have cross-overs from sine wave to sine wave at $^+1$, $^+1'$, $^+1''$ . . . or at $^+4$, $^+4'$, $^+4''$ . . . according to the amount of displacement.

In a coil preceding the center coil displacement is in the opposite direction and, hence, the reversals occur at $^-1$, $^-1'$, $^-1''$, . . . or $^-4$, $^-4'$, $^-4''$, ...

With a power factor equal to 1, the displacement of the reversals to z, z', z'' . . . cannot occur in any machine except the two-ring converter and even then one must consider as negligible the width of brush, width of commutator, bar, etc.

Fig. 3 represents, to scale, the conditions for the two-ring machine. Fig. 4 similarly shows the limits and the magnitudes for the three-ring converter.

In order to individualize the currents in successive coils, as is ordinarily done, Figs. 5 and 6 are taken from Figs. 3 and 4, respectively. In Fig. 3, curve O shows the current in the center coil of the two-ring machine. Curve z is for the end coil. Between $^+4$ and z several curves are not shown. In Fig. 6 curve $^+5$ indicates the current in the end coil of the phase-winding of the three-ring machine.

The heating in any coil would be represented by the curve obtained by squaring the ordinates of the current curve for

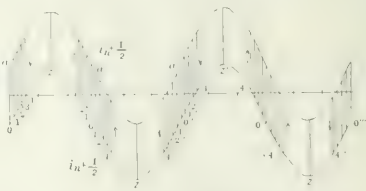


FIG. 3.—CURRENT IN A TWO-RING CONVERTER.

that coil. There is, however, a more striking means of showing this, by the use of polar co-ordinates and enclosed areas.

In Fig. 7 the sine wave of current is the circle $O P Q$. If the vector generating this circle is lengthened by the addition of $\frac{I_0}{2}$, the curve traced is the limaçon. A curve of the same type

results from subtracting $\frac{I_0}{2}$. A coil displaced from the center of the phase by an angle ω will have a current cycle *O A B P C D O*, first in a positive sense, then in a negative sense.

As the area enclosed by the current curve varies as the square of the current vector, this area represents the heating

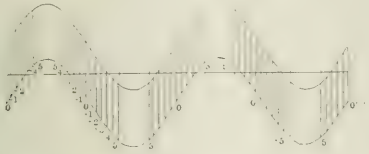
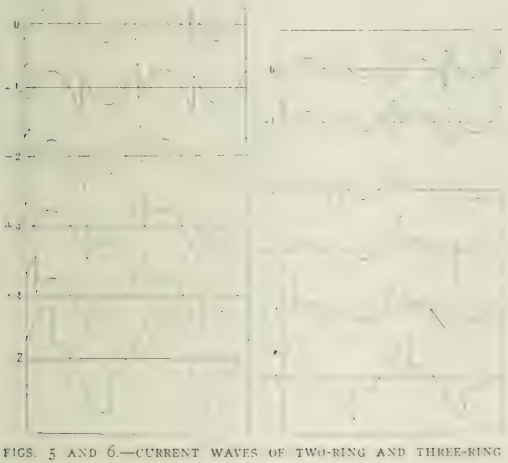


FIG. 4.—CURRENT IN A THREE-RING CONVERTER.

in the coil. A coil with a lesser displacement will have a current curve enclosing less area—meaning less heating.

In Fig. 8 is shown the comparative heating of coils displaced from the center of the phase winding of a two-ring machine by angles of 0, 15, 30, 45, 60 and 90 deg.

In Fig. 9 (drawn to the same scale as Fig. 8) the direct cur-



FIGS. 5 AND 6.—CURRENT WAVES OF TWO-RING AND THREE-RING CONVERTERS.

rent is of the same magnitude, but the maximum value of the alternating current is less, because it is for a three-ring machine. Hence, both the inner and the outer loops of the limaçon shrink, and the areas are less than for coils having the same displacement in a two-ring machine. A 60-deg. displace-

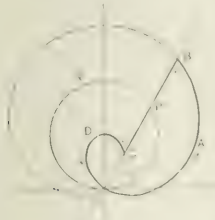


FIG. 7.—HEATING IN A FLAT-END COIL.

ment is the greatest possible with three rings and unity power factor.

Figs. 10 and 11 similarly represent, to scale, the heating for coils of four-ring and six-ring machines. The one is limited by a 45-deg. displacement, the other by a 30-deg. displacement.

The area enclosed by one of these curves is

$$\int_{\omega-\pi}^{\omega} i^2\, d\theta = \int_{\omega-\pi}^{\omega} \left(I_1 \sin\theta - \frac{I_0}{2}\right)^2 d\theta$$

The ratio of this area to $\int_{\omega-\pi}^{\omega} d\theta$ gives the square of the effective current. That is:

$$\frac{\int_{\omega-\pi}^{\omega} i^2\, d\theta}{\int_{\omega-\pi}^{\omega} d\theta} = \text{square of effective current} = h$$

$$h = \frac{I_1^2}{2} - \frac{2}{\pi} I_1 I_0 \cos\omega + \frac{I_0^2}{4}$$

This is a measure of the heat developed in one coil at a space angle ω from the center of the phase winding.

$$\frac{\int_0^{\frac{\pi}{n}} h\, d\omega}{\int_0^{\frac{\pi}{n}} d\omega} = \text{average heating of these coils from the center of the phase winding to end.}$$

Calling this average H,

$$H = \frac{I_1^2}{2} - \frac{2n}{\pi^2} I_1 I_0 \sin\frac{\pi}{n} + \frac{I_0^2}{4}$$

$$= \frac{I_0^2}{4}\left(\frac{8}{n^2}\sin^2\frac{\pi}{n} - 0.211\right)$$

But, the rating is inversely proportional to the square root of the heating, therefore, the rating $= \frac{1}{\sqrt{H}}$

Calculated thus upon the impracticable basis of equivalent



FIGS. 8 AND 9.—HEATING IN TWO-RING AND THREE-RING CONVERTERS.

heating, the ratings compared to the direct-current rating as unity are as found in the first row of Table I.

For a power factor of cos θ,

$$I_1 = \frac{2 I_0}{n \sin\frac{\pi}{n}\cos\theta}$$

that is, a larger maximum value of alternating current. Hence, the circles in the polar diagrams will be enlarged.

The expression for the square of the effective current in any coil will remain unchanged in form.

$$\frac{I_1^2}{2} - \frac{2}{\pi} I_1 I_0 \cos\omega + \frac{I_0^2}{4}$$

Fig. 12 shows the current cycle and the heating for a three-ring [illegible] for individual coils at 0 deg., 30 deg., and 60 deg. from the center coil.

The limits of the second integration becomes $-\frac{\pi}{n} - \theta$ to $\frac{\pi}{n} - \theta$ for a whole phase.

$$H = \left[\frac{I_1^2}{2} \cdot \frac{2}{\pi} I_1 I_0 \sin \omega \cdot \frac{I_0^2}{4} \omega \right] \frac{\pi}{n} \cdot \frac{n}{\pi}$$

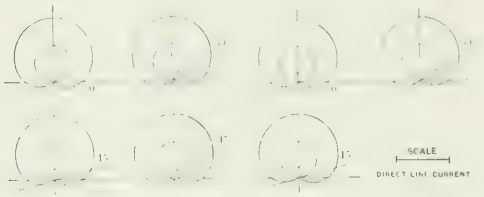
$$\frac{n}{\pi} \theta$$

$$[\omega] \frac{\pi}{n} \theta$$

$$\frac{I_1^2}{2} \frac{2n}{\pi} I_1 I_0 \sin \frac{\pi}{n} \cos \theta \frac{I_0^2}{4}$$

$$- \frac{I_0^2}{4} \left(\frac{8}{n^2} \sin \frac{\pi}{n} \cos^2 \theta \right) 0.211$$

From this expression is calculated the table of converter ratings at various power factors (Table I). Similarly, the



FIGS. 10 AND 11.—HEATING IN A FOUR-RING AND IN A SIX-RING CONVERTER.

added data of the power factor at which each machine may run with an output equal to its possible direct-current rating.

This table of ratings, based upon equivalent average heating of the entire phase, is, of course, wholly impracticable. So, also, from the standpoint of economy in construction would be the other extreme of basing the calculations upon the maximum heating.

In a further table the writer has assumed as a basis of comparison the average heating over that quarter of the phase winding at the end, where the heating is greatest.

With a lagging current this will be the end commutating first.

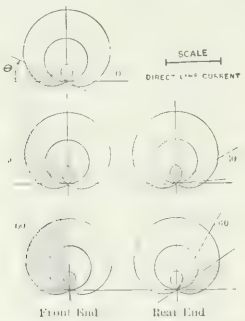


FIG. 12.—HEATING IN A THREE-RING CONVERTER. ANGLE OF LAG 25 DEG.

If x represents the percentage of the half phase winding to be used, the limits of integration for average heating becomes $\frac{x\pi}{n} - \theta$ to $\frac{\pi}{n} - \theta$. Hence, the average heating at power factor $= \cos \theta$ is

$$H_x = \left[\frac{8}{n^2} \sin \frac{\pi}{n} \cos \theta - \frac{16}{\pi^2} \left[1 - \frac{\sin \frac{(1-x)\pi}{n}}{\sin \frac{\pi}{n}} \left(\cos \frac{(1-x)\pi}{n} \right) \right] \right]$$

For the mean for one-quarter of a phase winding the value of x is 0.5.

Table II gives these results for various power factors in terms of comparative heating as well as the results obtained by using the quarter of the phase winding at the cooler end. Table III shows the same in terms of ratings. Fig. 13 contrasts these results for a six-ring machine.

One may, upon the other hand, calculate the average heating for any percentage of the half coil.

Tables IV and V represent the conditions when $n = 6$ and x

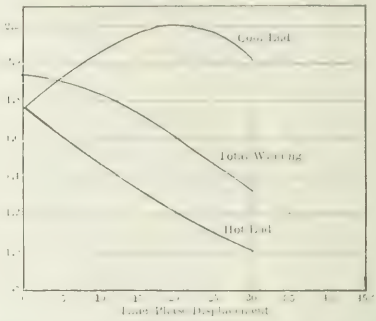


FIG. 13.—RATING OF A SIX-RING CONVERTER FROM TABLES I AND III

is varied from 0.1 to 1.0. As has already been noted, the heating in the front end of the phase winding with lagging current is greater. Based upon the fractional part x at this extreme, the mean heating will be much higher than it will be for the same limits at the rear end of the phase winding. For the sake of comparison both values are given and curves are plotted therefrom.

In Fig. 14 the abscissæ represent the value of x measured

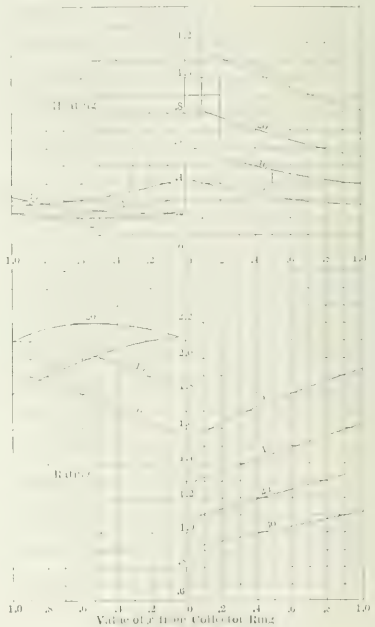


FIG. 14.—SIX-RING CONVERTER BASED UPON HEATING IN CERTAIN PARTS OF PHASE WINDINGS.

in each direction from the slip-ring, over which the heating is averaged—the right-hand side being for the front end of the coil with lagging current (rear end with leading current), and the left-hand being for the rear end of the coil with lagging

current (front end with leading current). The curves are calculated for angles of lag of 0 deg., 10 deg., 20 deg., 30 deg., as indicated.

The slip-ring position is at *O*. The middle coils of two successive phase windings are at $x = 1.0$ and 1.0. At any point of a curve, as 0.4, the ordinate represents the average heating of the portion of the phase winding between that point and the ring, or, in the lower curves, the rating for equivalent heating.

TABLE I.—CONVERTER RATINGS AT VARIOUS POWER FACTORS, BASED UPON THE AVERAGE HEATING.

Phase Displacement. Degrees.	P.F.	2-ring.	3-ring.	4-ring.	6-ring.	8-ring.	12-ring.	oo-ring.
0	1.0000	.851	1.331	1.622	1.928	2.053	2.191	2.300
5	.9962	.846	1.320	1.636	1.904	2.028	2.155	2.259
10	.9848	.832	1.288	1.559	1.835	1.949	2.066	2.155
15	.9659	.809	1.241	1.486	1.728	1.828	1.932	2.006
20	.9397	.784	1.173	1.411	1.611	1.688	1.773	1.836
25	.9063	.742	1.102	1.291	1.471	1.538	1.602	1.655
30	.8660	.698	1.020	1.182	1.328	1.380	1.434	1.474
45	.7071	.543	.756	.851	.932	.956	.982	1.000
60	.5000	.368	.493	.543	.583	.596	.609	.617
Power factor for unity rating.		.856	.785	.739	.728	.7165		.707

TABLE II.—AVERAGE HEATING OVER ONE-QUARTER OF WINDING.

Phase Displacement.	Power factor.	Two-ring. Hot.	Two-ring. Cool.	Three-ring. Hot.	Three-ring. Cool.	Four-ring. Hot.	Four-ring. Cool.	Six-ring. Hot.	Six-ring. Cool.
0°	1.0000	2.050	2.050	.814	.814	.511	.511	.325	.325
5°	.9962	2.265	1.865	.942	.702	.605	.431	.388	.274
10°	.9848	2.516	1.708	1.092	.608	.716	.386	.477	.249
15°	.9659	2.811	1.585	1.268	.532	.849	.317	.562	.216
20°	.9397	3.152	1.484	1.470	.472	1.005	.283	.679	.207
25°	.9063	3.555	1.419	1.711	.431	1.192	.266	.819	.215
30°	.8660	4.037	1.397	2.001	.415	1.414	.274	.995	.247

TABLE III.—RATINGS, BASED UPON TABLE II.

Phase Displacement.	Power factor.	Two-ring. Hot.	Two-ring. Cool.	Three-ring. Hot.	Three-ring. Cool.	Four-ring. Hot.	Four-ring. Cool.	Six-ring. Hot.	Six-ring. Cool.
0°	1.0000	.699	.699	1.109	1.109	1.399	1.399	1.754	1.754
5°	.9962	.665	.732	1.030	1.192	1.286	1.523	1.607	1.910
10°	.9848	.631	.765	.957	1.282	1.182	1.610	1.448	2.003
15°	.9659	.596	.795	.888	1.371	1.086	1.777	1.334	2.155
20°	.9397	.564	.822	.825	1.455	.998	1.830	1.213	2.198
25°	.9063	.531	.840	.765	1.523	.917	1.940	1.104	2.160
30°	.8660	.498	.847	.707	1.552	.841	1.910	1.003	2.013

TABLE IV.—AVERAGE HEATING OVER X WITH DIFFERENT ANGLES OF PHASE DISPLACEMENT.

X	30°	20°	10°	0°	10°	20°	30°
.1	.223	.221	.294	.398	.559	.811	1.159
.2	.225	.214	.279	.377	.551	.776	1.115
.3	.229	.210	.268	.358	.525	.743	1.073
.5	.245	.207	.249	.326	.478	.679	.993
.7	.262	.208	.234	.296	.434	.621	.917
.9	.276	.213	.231	.285	.416	.593	.880
1.0	.310	.228	.229	.268	.383	.544	.812

TABLE V.—RATINGS, BASED UPON TABLE IV.

X	30°	20°	10°	0°	10°	20°	30°
.1	2.120	2.128	1.848	1.580	1.314	1.111	.929
.2	2.110	2.163	1.891	1.630	1.347	1.130	.947
.3	2.090	2.182	1.933	1.671	1.380	1.160	.966
.5	2.020	2.198	2.003	1.750	1.448	1.213	1.003
.7	1.955	2.195	2.066	1.840	1.517	1.270	1.045
.8	1.902	2.168	2.080	1.874	1.551	1.298	1.067
1.0	1.798	2.097	2.088	1.931	1.618	1.357	1.110

Graphical Diagram for Power in an Alternating-Current Circuit.

BY J. IRVING BREWER.

It is a well-known fact that in a single-phase circuit where the curves of pressure and current are sinusoidal, the power fluctuates at twice the circuit frequency, and is negative during a portion of each half-cycle except when the power factor is unity. The mean value of the power in such a circuit is represented by the expression $P = EI \cos \Theta$, where E and I are mean effective values of volts and amperes, and Θ is the angle of phase displacement between them. The value of the power at any instant is, of course, equal to the product of the volts and amperes at that instant. This value of the instantaneous power may be shown by a mathematical development to take the form

$$P' = EI \cos \Theta + EI \sin x \sin (90 + \Theta),$$

where x represents the angle through which the pressure has passed from its zero value. This expression for the instantaneous power shows that the power curve is sinusoidal and that it may, therefore, be constructed by the projection of points of a circle.

Since E and I are the effective values of pressure and current, they are such as are indicated on the voltmeter and ammeter; and the corresponding maximum values, E_m and I_m, may, of course, easily be calculated, being $\sqrt{2}E$ and $\sqrt{2}I$.

Reference is now made to Figs. 1 and 1a. Let the lines $(a\,b)$ and $(c\,f)$ intersecting at g be the horizontal and vertical axes, and let the pressure and current vectors E_m and I_m rotate in a clockwise direction about the point g, as indicated in Fig. 1. The two circles on the point g, as center in Fig. 1, represent this rotation and the vectors are supposed to begin rotation with the E_m vector at the point marked o, to the left of g. These vectors are laid out with the phase angle Θ between them. The circles are divided into 24 points, 0, 1, 2, 3, etc., and these points projected across on the corresponding verticals, 0, 1, 2, 3, in Fig. 1a, give the pressure and current curves marked E and I in Fig. 1a. After having laid out the pressure and current curves thus, the ordinates of the power curve may, of course, be found by scaling the corresponding ordinates of the pressure and current curves and taking their product. The power curve may, however, be laid out graphically as follows: Through g draw the line $(g\,h)$ equal in length to twice the produce of E and I, or which is the same thing equal to the product of E_m and I_m, and let $(g\,h)$ make an angle with the line $(c\,f)$ equal to the phase angle Θ. Now let l be the mid-point of the line $(g\,h)$; then the horizontal line $(k\,m)$ drawn through l is the axis of the sinusoidal power curve. Moreover, the distance $(g\,w)$ between the line $(a\,b)$ and the line $(k\,m)$ is equal to the average power; this fact will be apparent at once because the line $(g\,l)$ is equal to EI, which relation at once gives the distance $(g\,w)$ as equal to $EI \cos \Theta$. If now a circle be constructed on the line $(g\,h)$ as diameter, the power curve may be constructed graphically by projecting the proper points of this circle. This circle may be called the power circle, and its radius-arm P, swinging about l as center, may be called the power vector.

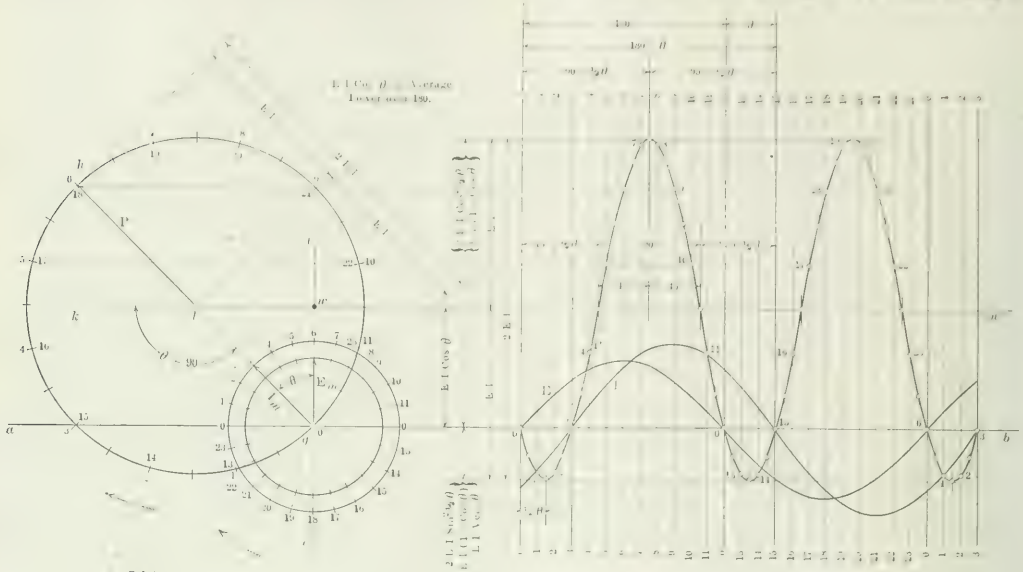
From the expression given earlier for the value of the instantaneous power P', it is clear that at the start, when x is zero, the pressure is zero and consequently the power will be zero. In which case it is seen that the power vector must start at an angle $(90° + \Theta)$ back from the horizontal, or must start at the point g, and rotate in the same direction as the pressure and current vectors. The power circle is divided into half as many points as the pressure and current circles, and the points 0, 1, 2, 3, etc., of the power circle projected across on the corresponding verticals 0, 1, 2, 3, etc., of Fig. 1a give the power curve marked P in Fig. 1a. It is to be noted that the power vector rotates twice around its circle while the pressure and current vectors rotate once. The total amplitude of the power wave is shown to be $2EI$, or $E_m I_m$, which is, of course, the same as the diameter of the power circle.

It is to be observed that if the phase angle Θ varies, the line $(g\,h)$, on which the power circle is described as a diameter, will swing about the point g as center and so also will the center l of the power circle swing about g. This is such that for a small phase angle Θ the power circle will occupy a position having its diameter $(g\,h)$ near the vertical, and for a phase angle Θ of nearly 90 deg. the power circle will occupy a position having its diameter $(g\,h)$ nearly horizontal. As the phase angle Θ increases, the axis $(k\,m)$ of the power curve will approach the axis $(a\,b)$, which is in accordance with the known fact that the average power will decrease; also as the phase angle Θ decreases the average power is shown to increase, which is again in accordance with the known fact. In all cases, independent of the value of the phase angle Θ, the power vector begins its rotation from the point g.

The upper g [illegible] a phase angle of lag, but the conditions applying to an angle of lag apply equally well to an angle of lead, since the pressure curve and the current curve [illegible] and all that is necessary to change [illegible] from lag to lead is to interchange the names of the pressure and current curves.

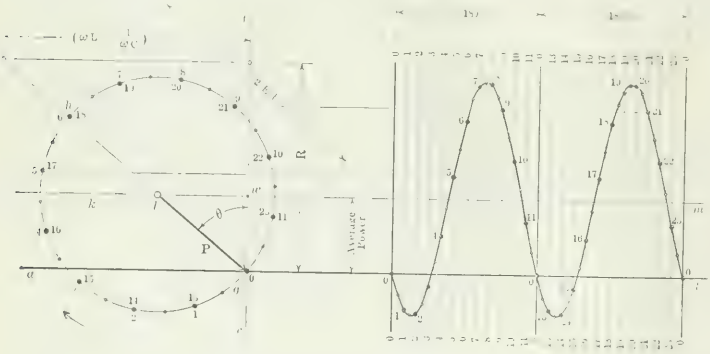
It is to be observed that by means of the foregoing diagram the power curve may be constructed without laying out the pressure and current curves, and may be constructed from the

data merely of the effective pressure, the effective current, and the phase angle. As a simple instance, assume one phase of a generator to impress a harmonic e.m.f. having an effective value of E of 200 volts at a frequency f of 60 cycles on a circuit having a resistance R of 80 ohms, a series inductance L of 0.6 henry, and a series capacity C of 0.00002 farad. The calculations show the reactance of this circuit to be 93.6 ohms, and the effective current to be 1.625 amp. The instructions for the construction of Figs. 2 and 2a are as follows:



FIGS. 1 AND 1a.—CONSTRUCTION OF SINUSOIDAL CURRENT, E.M.F. AND POWER CURVES.

Draw the horizontal axis ($a\,b$) and the vertical axis ($c\,f$) intersecting at g, then draw ($g\,h$) making an angle with ($c\,f$) equal to the phase angle Θ; the angle Θ may first be calculated and then laid out; in this case 49° — 28′; or the line ($g\,h$) may be located as follows: To some convenient scale lay out on the line ($c\,f$) a distance R corresponding to the resistance, in this case 80 ohms, and then lay out the distance marked ($\omega L - [1 \div \omega c]$) corresponding to the reactance, in this case 93.6 ohms. These distances determine the angle Θ. The power circle is constructed with the diameter ($g\,h$) equal to $2\,E\,I$, in this case $2 \times 200 \times 1.625 = 650$. This circle may be drawn to any convenient scale whatever. The power vector P starts at the point g and rotates clockwise through two complete rotations to give the power curve for one circuit cycle. The power curve is shown in Fig. 2a. That part of the curve above ($a\,b$) is positive power and that part below ($a\,b$) is negative power; ($k\,m$) is the axis of the power curve and the distance ($g\,w$) of the line ($k\,m$) above the line ($a\,b$) is the average power. After having thus constructed the power curve, if it is desired to show the pressure and current curves in their proper relation on the same diagram, this can readily be done by the process discussed in Figs. 1 and 1a.



FIGS. 2 AND 2a.—POWER CURVE FOR CIRCUIT HAVING SERIES RESISTANCE AND REACTANCE.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Water Condensing Plant, Sioux City, Iowa.

The Sioux City Gas & Electric Company recently completed the work of changing its power plant from one filled with small belt-driven units to one containing only direct-connected and large belt-driven units.

The condensing water features of this plant are interesting. The plant is not located on the river, but obtains its condensing water from wells. These wells are 400 ft. deep, but the suction lift of the condensers is only from 0 to 10 ft. To supplement the water obtained from the wells, during the peak load, water for condensing purposes is taken from a large gas holder on the premises. This is 130 ft. in diameter, and con-

densing water can be taken from it during the peak without lowering the water seal enough to be objectionable. The water in this gas holder is 7 ft. above the condensers, so that it flows by gravity to the condensers. The condenser discharge is regularly fed into a smaller gas holder on the premises.

Method of Checking Lamp Outages and Careless Trimming.

In nearly all large cities contracting for public lighting, the outage of lamps is reported daily by the police on blanks prepared for the purpose and the electric light company is notified by telephone so that repairs can be made. In Rochester, N. Y., the electric light company is penalized for all outages reported by the police. The contract with the city calls for 4000 hours' yearly burning of arc lamps. If a lamp is out a rebate equal to the charge made is deducted, and if the lamp remains unlighted for five hours it is equivalent to a night's outage. If the lamp is out the second night a deduction equal to twice the rate charged is made, and if the lamp is unlighted for three successive nights the deduction made is equal to five times the rate charged. The Rochester Railway & Light Company has therefore organized a patrol service to look after and report defects of this kind, with the result that in 1908 the outages were less than 1/10 of 1 per cent of the total hours' burning. Not a little of this good showing is attributed to the system of checking outages by means of a map and pegs.

Up to a year ago it was customary to report all outages to the line department; but it seems that figures did not impress themselves on the minds of the linemen. A map of the city was therefore brought into use, and as reports came in to the main office of defects they were sent to the line department as usual, and in addition at the end of the month the map was pegged up and sent first to the officers of the company and then to the line department. In pegging this map of outages, five kinds of pegs are used. A red peg indicates a lamp out one night, a blue peg two nights, a yellow peg three nights in succession, a plaid peg three nights not in succession and a tag shows that the entire circuit was out. The map appeals to the linemen as no figures can and shows at a glance where the outages are most frequent and on what circuits. By this means defects in lamps are checked as well as faulty circuits; but the chief use of the map is in detecting careless trimming, and for this purpose the scheme acts as a boomerang. Since the system was devised three trimmers were discharged because of slipshod work, and the efficiency of the trimming force has been raised considerably. A system of this kind can of course also be used to show the reliability of one lamp as compared with another, etc.; but for the purpose for which it was devised it has proved its worth many times over.

A Central Station with Its Peak Load in Summer.

One of the most remarkable central-station companies in the United States as regards the character of its load is the Norfolk Electric Light & Power Company, of Norfolk, Neb. Mr. E. A. Bullock, president and manager of this company, has accomplished with this little plant what practically every progressive central-station manager is striving to accomplish. He has succeeded in marketing electric power for various purposes in his community in such a way that the earnings for each month of the year are very nearly the same. He does not have the usual falling off of earnings during the summer with a large part of the plant investment lying idle.

Norfolk is a town of 4000 or 5000 inhabitants. The station capacity is something less than 200 kw, part being supplied by a small water power located at a mill and part by a steam plant. The water power is insufficient to carry the load most of the time, so that the steam plant has to be kept ready for operation at all times, and is actually operated most of the time.

The peak loads of the plant for the year occur on Tuesday afternoons in midsummer.

The December peak load caused by lighting is not quite as high as that caused by electric power and flatirons in midsummer. For example, the peak load last summer amounted to 65 amp at 2300 volts, or 149 kv-amp. The winter peak previous to the holiday December evenings only reached 50 amp, or 115 kv-amp. These unusual conditions of load are brought about by the use of electric power for refrigerating purposes and city waterworks pumping, together with 200 electric irons connected. The refrigerating motors are, of course, used only in summer, while the motor used at the city waterworks for pumping has its heaviest load in summer.

Among the motors which have the most influence on summer load are the following: Forty-five hp in motors used in an ice factory, of which Mr. Bullock, president of the company, is part owner. There is also an installation of 35 hp in the establishment of a butter company, part of which is used for refrigeration, and operated only in summer. The waterworks motor is of 30 hp, and is run fully loaded only in summer, as explained in detail later. While the monthly output in kw-hours is greater in the summer than during the December peak load period, it is sold at a lower rate for power purposes, so that earnings are about the same for each month in the year.

The ice factory pays for power at the rate of $1.60 per ton of ice manufactured. The central station also furnishes steam for the re-boiler in the ice factory. The ice factory equipment consists of one 40-hp and one 5-hp, two-phase motor. A 4-hp motor in an ice cream factory also adds to the summer load.

A list of the motor installations connected for this company's lines shows 155 hp in Wagner single-phase motors and 45 hp in two-phase motors, a total of 200 hp. The only two-phase installation in the town is that at the ice factory, and the company regrets that this was not single phase, as a single-phase motor causes less disturbance of the voltage when motors are started than the two-phase.

WATERWORKS PUMPING CONTRACT.

The company furnishes the motor and power for pumping water for the city under a six-year contract. The method of arriving at the price for pumping, while in some respects unusual, is one which proved very convincing to the city as to the saving to be effected. The cost of coal maintenance of pumping plant, oil and supplies for the past eight years of steam operation of the city waterworks was obtained from the city records. This averaged $175 per month and did not include labor. The company agreed to pump city water at a flat rate of $175 per month, thus saving the labor which up to that time had amounted to $70 per month, and which was soon to be increased to $110 because of the necessity of having two men to operate two shifts instead of one man operating one shift as before.

The company furnishes the motor, which is placed at the waterworks and is belted to a Fairbanks-Morse duplex double-acting pump. The motor is a 30-hp Wagner single-phase. A single-phase motor was chosen here because it necessitated the running of only two wires from the central station to the pumping station and also because of the automatic character of its starting and the small voltage disturbance caused thereby. It is started and controlled entirely from the electric power plant about a half-mile distant.

This pump operates against 75-lb. pressure and pumps to a stand pipe, so that there is some water storage and the pump can be shut down during the company's peak load. This motor is fitted with four different sizes of pulleys, which are changed as the pumping requirements of the city change from season to season. It is intended to operate the motor steadily most of the time, with the exception of six hours per day. At the lowest speed of the pump (that is, with the smallest motor pulley) the pump will lift 250 gal. per minute, and at the highest speed 500 gal. per minute. It is found that the friction head of the duplex double-acting electric pump is about 10 ft.

less than it was with the steam pump, on account of the greater pulsations caused by the latter.

In order to protect the company so that it will get revenue for new water consumers, it is agreed between the city and the company that the city will take on no more flat-rate consumers, all consumers being placed on water meters. The company is to get 5 cents per 1000 gal. for all water metered to these new consumers. No record is kept of the gallons of water pumped per day under this contract. It is probable in a plant of this size, however, that it runs from 100,000 gal. per day up, the greatest demands, of course, coming in midsummer, making it a very desirable load for the central-station company.

The rates in Norfolk are based on 10 cents per kw-hour maximum, with a minimum bill of $1 per consumer in residences and 40 cents per 56-watt lamp in stores. There is no regular published schedule of rates, but discounts are given depending entirely on the number of hours' use per month of the connected load. The lowest rate is 3.5 cents. The company has 400 meter consumers and 50 flat-rate fans and small motors. Ceiling fans are rented for the season from June 1 to Oct. 1 at the rate of $12 for one fan and $20 for two.

The company has gross earnings in the neighborhood of $5 per capita of population. As might be expected from the peculiar year-around character of the company's load, the earnings per kilowatt of station capacity are far above those usual among central-station companies, being about $139 per kilowatt of capacity annually. This indicates that the company is making remarkably good use of the apparatus and investment which it has.

INTERIOR WIRING AND ILLUMINATION

Wiring for Alternating-Current Circuits.

The Code is specific in recommending that for alternating-current systems the two or more wires of a constant-potential circuit must be drawn in the same conduit. It is not often that a contractor seeks to go the Code one better by putting in an excess of conduit; but the following illustrates such a case and its results. A contractor who never installed an alternating-current job before received an order to wire 12 arc lamps in a department store. He somehow got the impression that alternating currents were very dangerous, and wishing to make a good and safe job, placed each of the wires in a separate iron pipe. The result of his misdirected efforts can be imagined. The conduit became hot and the drop in voltage excessive. He sought for leaks and short circuits in vain until informed that the wires should have been placed in a single conduit and that the drop was caused by induction caused by the presence of the iron wall around each wire and that the iron pipe was hot because the pipe formed a closed magnetic circuit about the wire within it, causing a loss by hysteresis. The contractor accepted the explanation on blind faith and tried the remedy with the result that the trouble disappeared and a well-meaning wireman was set right.

Illuminating Engineering vs. Common Sense.

By Basil G. Kodjbanoff.

An electrician is presumably a person who is familiar with the theory and practical application of electricity; at least, that is what the word would imply. But so great is the desire of people to describe their work or their profession by a high-sounding name, that "electrician" has in fact come to mean anything from an arc-lamp trimmer to an electric-bell hanger. To be sure, both of these are honest and honorable employments, but they do not call for a degree of technical knowledge and skill that justifies the assumption of a professional title. Within the past few years there has sprung up a class of workers who have taken upon themselves the privilege and prerogative of doctoring lights; but instead of assuming the doctor's degree, they have called themselves "illuminating engineers." Their chief vocation has been to persuade the luckless user of any particular method of lighting that the system was all wrong, and that the only sure way to illumination salvation was by subscribing to their particular creed. The articles of faith constituting their creeds vary according to their professional training and commercial sympathies. Some believe that the arc lamp is the only real means of grace, while others consider this rank heresy and base their hopes on incandescents—and so on through the rest of the list of illuminants; while a large number of them show the glory of their attainments by wearing a perpetual halo of prism glass.

Now, it is true that some of the old lighting installations were poor and inadequate in comparison with the best results obtainable to-day; but the fact must not be lost sight of that the past few years have developed remarkable improvements in light sources and in the apparatus for using them, which have been produced without the permission or assistance of the illuminating engineering cult. Suppose the illuminating engineer, properly so-called, had not appeared on the scene, would we not have the tungsten lamp, the flaming-arc lamp, the mercury-vapor lamp and the inverted gas burner just the same? Or again, would the illuminating engineers be willing to wager their professional standing on the ability of the people to pick out the installations that they have designed from among those that have been laid out by the architect or electrical engineer?

The properties of light may be made the basis for a great many mathematical calculations; but so may many other of the common phenomena with which we constantly have to deal. The amount of stress or tensile strength required in drawing corks from different kinds of bottles would afford material for an elaborate investigation and might be of some use in the theoretical designing of a corkscrew built on engineering principles; but most people will prefer to use the corkscrews that they have, or let the waiter pull the cork, according to the custom that has long prevailed. The "illuminating engineer" figures the intensity of illumination down to the third decimal place, in spite of the fact that the eye is accustomed to work through intensities ranging up to at least 100,000 times the minimum. When all his figuring has been done, are the results any better than would have been obtained by any good electrical engineer or architect who has had experience coupled with observational power?

Unquestionably the increased number of light-sources and accessories of to-day requires a more careful consideration, wider experience and more discriminating judgment in order to secure the best results, than was the case 10 or 20 years ago. "Practice makes perfect," and it is pretty safe to say at the present time that the best results in illumination will be obtained by those who have had the most practice in using and installing the different kinds of lights. A few weeks' or months' apprenticeship in the sales department of a manufacturing concern handling some particular light-source or accessory, is hardly a fair substitute for the years of school and practical training deemed necessary to equip one for the various engineering professions; yet there is nothing to prevent such an apprentice from hanging out his shingle as an "illuminating engineer" at the present time.

The "illuminating engineer" at first did most of his talking about efficiency and economy. Finding, however, that this did not suit all classes—that there were many people who, having the price, preferred a $50 suit of clothes to a $15 hand-me-down which might give even longer wear—they began to sing another song pitched to the key of "artistic harmony." What the architect has taken years of study and practice to acquire, they apparently have received by direct inspiration. "Efficacy" and "satisfaction" are two passwords that now hold place along with "economy" and "efficiency."

I do not wish to be understood, however, as maintaining that there is not sufficient material and field of operations for a science and art of illumination. Not only is the subject as a whole sufficiently comprehensive to afford ample opportunities for the specialist, but it is capable of being subdivided into departments, each of which is sufficiently large to constitute a specialty. In fact, it is the very extensiveness of the field that demands an unusually high degree of knowledge and experience on the part of the specialist assuming to cover it. To use some of the recent terminology in a metaphorical sense, the knowledge of this specialist must be "extensive," "intensive" and "focusing." It must extend over very nearly the whole range of the natural sciences—physics, chemistry, physiology, esthetics; it must deal with the particular applications of these in a thoroughly intensive manner, and it must always keep the vision focused upon common sense derived from actual experience.

The trouble with illuminating engineering at the present time is that many of those professing to be specialists or "illuminating engineers" are, as Bob Ingersoll once said of the new convert, "like bumble bees—biggest when they are first hatched." The knowledge and skill requisite to constitute an engineering profession is not something to be put on like a garment; it is something to be acquired by study and growth. There are undoubtedly a large number of specialists to-day who are entitled to take the professional degree of Illuminating Engineer, although in most instances they would probably be among the last to assume it. Unquestionably also, others will arise as time, study and experience will permit, and within a reasonable lapse of time we shall have a science and art of illumination which will justify its name, and specialists who dignify the profession. At the present it is well to remember that not all is gold that glitters, nor are all the glittering schemes of the self-styled illuminating engineer golden.

Installation of Service Meters at Rochester, N. Y.

In wiring buildings in the fire district of Rochester, N. Y., the underwriters will not permit anything but rigid or flexible conduit and armored cable. This, of course, results in rather expensive wiring installations, which, while they militate against rapid electrical progress in the heart of the city, nevertheless



FIG. 1.—METERS IN THE CELLAR OF A ROCHESTER OFFICE BUILDING.

make excellent jobs both from the standpoint of the underwriters and also from the viewpoint of the wiring contractors. Taking advantage of this situation the Rochester Railway & Light Company has adopted a meter and service box which possesses numerous advantages, the chief of which is that it is impossible for a person so minded to tamper with the service outside of the meter and thus defraud the company.

The service and meter box are usually placed in the cellar or basement where the company's mains are introduced. All connections between the service end and the meter board are run in iron conduit, and this also is true where the service is taken in overhead. The connections from the bracket to the cellar or basement are run in conduit down the outside of the building, and the service bracket is ordinarily secured to the

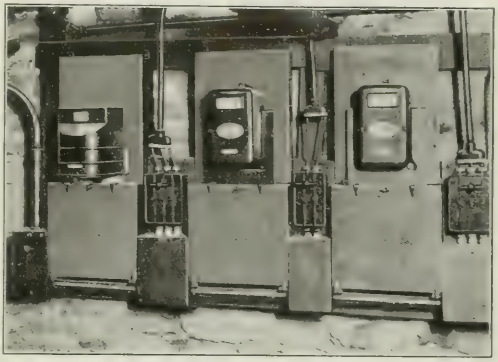


FIG. 2.—SERVICE BOXES FOR DIFFERENT STYLES OF METER.

wall of the building between the second and third floors or in the case of two-story buildings as close to the cornice as practicable. Typical meter installations are shown herewith. The service cut-out installed by the company is enclosed in an iron box and sealed. Such being the case, the underwriters allow the use therein of link fuses, which are cheaper than enclosed fuses, and since these are furnished and maintained by the company this feature alone means a considerable saving each year. Moreover, because the box is sealed, the underwriters require the customer to install a switch and cut-out on the house side of the meter and, by fusing the service box a little higher than the customer's main cut-out, the company experiences very little trouble with the link fuses in the service box blowing. On the other hand, if the customer places copper wire in his cut-out the house lines are still protected by the fuses in the company's service box, so that in this way overloaded circuits

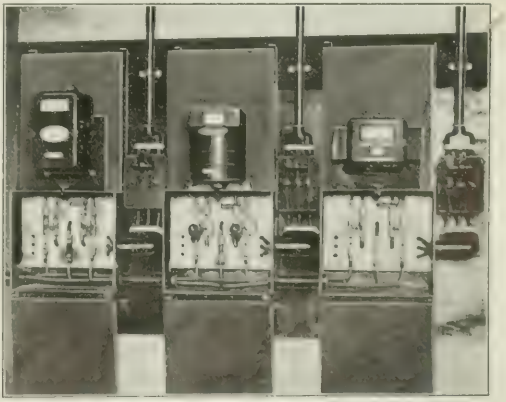


FIG. 3.—LATEST TYPE OF SERVICE BOX, SHOWING CONNECTIONS.

are eliminated, it being necessary in case the link fuses blow for the customer to notify the electric light company.

Another feature of the box is the ease with which tests can be made on the meter without depriving the consumer of electrical energy. The inspector who desires to inspect, test or change the meter, after breaking the seal on the service box removes two common plugs in holes provided for the purpose,

as shown in Fig. 3, which represents the latest form of service box. When the plugs are inserted two copper links are disconnected, cutting out the meter without interrupting the service of the consumer. The plugs which are used to bridge or bypass the meter are provided with handles of such length that the door of the service box cannot be shut until the plugs are removed, thus making it impossible for the inspector to close or seal the box and leave the meter bridged.

The meter and service box is standard for all makes of meters and a special iron gutter is used for those makes of meter requiring connections at the side. In case a customer's service is discontinued, the meter may be removed and the service box sealed, thus leaving the service box and meter board ready for the installation of a new meter if at some later date the consumer calls for a reintroduction of service, at the same time preventing theft of electricity while the meter is out. The company has found that owing to the simple method of bridging the meter and connecting instruments and artificial load without interrupting the service, a tester can test about 25 per cent more meters per day than was possible when meters were installed in other ways. The company has over 2000 of these boxes in use at the present time. The excellence of the installations is well shown in the engravings. The older types are shown in Figs. 1 and 2, the latter also showing incidentally the variation in work done by different contractors. It would seem that it ought to be an easy matter to bring the condulet fitting and conduit directly over and close up against the customer's cut-out and thus cover up the short lengths of rubber-covered wire shown exposed. The lighting company is, of course, not interested except in a general way with that end of the work, as all energy passing through the wires thus exposed has already been measured by the meter. As shown in Fig. 3, the extra box has been eliminated for the service wires, the latter passing through the bottom of the box with the meter connections and the house circuit coming out through a short piece of conduit fitted with an approved outlet.

New Telephone Patents.

PRIVATE BRANCH CIRCUIT.

In the ordinary private-branch exchange it is necessary for two operators to take part in each call to one of the stations from an outside point. One of these is in the main exchange and the other at the private branch exchange. Each introduces cord pairs in the circuit, and upon completion of a conversation each receives one disconnect signal automatically and her own disconnection serves to send the second signal to the other operator. In order to provide the automatic display of the disconnect before the exchange operator through from the branch exchange extension, Mr. F. Arens, of Cincinnati, has invented a new system of circuits for private branch exchanges. The type of branch exchange is one in which for trunk connections the local cord pair is clear of the supply battery, all currents necessary for the connection being received from the main exchange cord pair over the trunk line. In order to control the signals properly with such a system, before the extension station has answered, it is customary to bridge the circuit with a retardation coil. Mr. Arens modifies this shunt circuit by carrying it through relay contacts which co-operate in such a manner that as soon as the called extension station answers, the shunt circuit is locked open until after the branch exchange cords have been cleared.

Letter to the Editors.

The United States Patent System.

To the Editors of Electrical World:

Sirs: In the report in your columns last week of the recent discussion of the U. S. Patent System at the Chemical Club, New York City, it is stated that none of the speakers had any fault to find with the present patent system. This unanimity of opinion is perhaps not surprising in view of the fact that of the speakers, three are patent lawyers, while the fourth is a professional inventor. It seems fair to assume that in any reorganization of our patent system in the interest of the deserving inventor, the patent attorney, being human, cannot be expected to lend active support if such reorganization should appear to affect his own interests; and as one of the abuses of the present patent system is the outrageous expense to the independent inventor in getting an application through the Patent Office in case it intereferes with "feeler" applications or conflicts with "protective" patents, as well as the subsequent legal expense in maintaining an invention in an art plastered with "protective" patents, it follows that any reorganization to correct this condition would presumably not redound to the profit of the legal profession. Moreover, the interests of the independent inventor are so opposed to those of the company inventor and to some classes of professional inventors, that little if any encouragement can be expected from these toward any movement in favor of the first-mentioned.

Perhaps 90 per cent of patents are issued to independent inventors, though their participation in the monetary benefit from the patent monopoly probably falls much below the cost to them of securing their patents. What the present situation therefore appears to call for is the organization of independent inventors in protection of their special interests, for they cannot look to the patent lawyer or the manufacturing company—the normal factors in the patent situation—to originate and carry out a movement in their favor. Through such organization concerted pressure could be brought to bear on congressmen, which should be extremely effective, since inventors who would be interested in the movement reside in practically every congressional district in the country.

After the above was written the newspapers have reported another patent scandal similar to that of the tungsten lamp case. Can it be successfully maintained that no fault exists in our present patent system when in both the Washington and Lockport cases the agency of disclosure of alleged gross patent abuse was the "secret service" activity of a manufacturing company affected by the alleged fraud? What are the chances of discovery and exposure of patent fraud against the average inventor without company or financial backing? In view of the Washington and Lockport cases, what assurance is there that scores or even hundreds of similar cases would not, by similar means, be uncovered? Lacking such assurance, is not a thorough overhauling of the present patent system demanded on this one count alone?

New York. James L. Terhune.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Dynamos, Motors and Transformers.

Active Materials of Transformers.—Hidetaro Ho.—An account of an investigation of the fundamental principles of the loading of the active materials (copper and iron) of alternating-current transformers and polyphase induction motors. For a given transformer, working with a given frequency, the net copper section of which remains constant, the output, the efficiency, the regulation, the power factor, etc., depend upon two things—the current density and the magnetic induction; or on the loading (Beanspruchung) of the active materials, copper and iron. The author discusses F. W. Carter's theorem on the best distribution of the losses between

the magnetic and the electric circuit of a transformer. The best distribution of the losses for any given output of a given transformer is such that the ohmic loss is equal to 0.8 $H + E$, where H is the hysteresis loss and E the eddy-current loss, or in other words, the copper and the iron must be loaded so as to satisfy this equation. Under these conditions the maximum efficiency is obtained for a given output. In order to increase in the most advantageous manner the output of a given transformer working in accordance with Carter's formula, it is necessary to increase the net cross-section of the copper as well as the total value of the magnetic induction. The author then gives the equations of the output and the efficiency. Having considered the efficiency and the division of the losses corresponding to a constant output he then modifies his equations, to make them applicable to the case of a variable load. Finally the polyphase induction motor is discussed in an analogous way. He finds that the knowledge of the principles of the loading of the active materials enables one to see at a glance on the test curves of an actual machine what to do in order to improve the working by the change of the number of turns of the primary winding.—*Jour. College of Engineering,* Tokyo Imperial University, Japan, Vol. IV, No. 4, August, 1908.

Wave Form and Transformers.—L. D. ROBINSON AND O. HOLZ.—The third article of their serial on the influence of wave form of e.m.f. on core loss and exciting current in transformers. The author gives the results of an actual test made with a 4-kw, 2080- to 150-volt transformer.—*Gen. Elec. Rev.,* January.

Weight and Cost of Generators.—A. G. ELLIS.—An article in which the author deals with the relative weights and costs of alternating-current and continuous-current generators, and particularly the influence of the rated speed and the rated output on these quantities. The curves given are based on designs for a large number of machines. The conclusions are that high speeds are distinctly more suitable for alternating-current generators than for direct-current generators, both as regards operation and manufacturing cost. In both cases there is, for each rated output, a certain speed at which the rate and cost reach minimum values.—Lond. *Elec. Eng'ing,* Dec. 31.

Alternating-Current Commutator Motor.—A note on a British patent (6960) of the British Thomson-Houston Company (General Electric Company of this country). Commutator motors, in which both inducing and exciting windings are arranged on the stator, may be started with the armature short-circuited, and, for high speeds, have a shunt voltage impressed on the armature to reduce the strength of the inducing field, which has an injurious effect on commutation at high speeds. It may happen that the armature ampere-turns exceed the inducing ampere-turns in the latter case, and the object of the present invention is to prevent this from having a bad effect on the commutation by arranging the inducing winding so that it is concentrated near the pole tips, where commutation occurs.—Lond. *Elec. Eng'ing,* Dec. 31.

Armature Reaction.—H. SCHOLL.—An illustrated article describing some experiments for demonstration purposes on the armature reaction of direct-current dynamos and motors. The author describes the method of making use of armature reaction for the excitation of direct-current generators and motors without any special exciting current.—*Phys. Zeit.,* Jan. 1.

Mercury Rectifier.—R. P. JACKSON.—An illustrated article describing the principles of construction and the applications of the mercury-vapor rectifier. [illegible] *Penn.,* December.

Lamps and Lighting.

Street Lighting.—N. R. BIRGE.—An illustrated article on modern methods of street lighting. The author first describes the luminous arc lamp and its operation from an alternating-current circuit by means of a mercury rectifier tube. He then considers the costs of operating a 100-lamp open-arc system and a 100-lamp series luminous-arc system with rectifier. In the following table the first column gives the figures for the open-arc and the second column for the luminous-arc rectifier:

Interest and depreciation	$72.00	$684.00
Maintenance	1,430.00	[illegible]
Energy	5,010.00	2,28[illegible]
Total for 100-light system	$6,512.00	$3,659.00

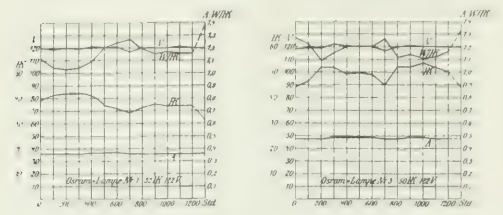
This shows an annual saving in favor of the luminous-arc rectifier system of $28.53 per lamp, or a total saving per year of $2,853. Therefore, the total net investment of $5,700 for the luminous-arc rectifier system will be paid for in about two years, after which the net annual saving will create a dividend of more than 50 per cent on the new investment. The author then deals with incandescent lamps and compares the cost of a carbon-lamp system with one of tungsten lamps, showing the great saving that can be obtained with the tungsten lamp. The station equipment for any series-incandescent system may be a part of the series-arc lighting outfit, with the lamps in series with the luminous-arc lamps; or it may be entirely separate. The former arrangement is generally the one employed in large towns and cities where both arcs and incandescents are used, and the latter in smaller places where only the incandescents are required. The author finally speaks of gas-incandescent lamps and emphasizes the wide variation of candle-power during the life of a Welsbach mantle. He finally compares lighting with 60-cp Welsbach mantles and 60-cp tungsten lamps. He finds the total cost per year (of 4000 hours) to be $8.15 for the tungsten lamp and $21.45 for the Welsbach mantle.—*Gen. Elec. Rev.,* January.

Street Lighting.—L. BLOCH.—A fully illustrated article on recent developments in the street lighting of Berlin. The author gives a detailed comparison of the various methods of street lighting now in use in Berlin. These methods include both high- and low-pressure gas lamps and flame and ordinary arc lamps. Measurements of illumination have in every case been made under actual working conditions, while in order to ensure a truer basis of comparison, in one or two instances the results thus obtained have been re-calculated for other heights of suspension. In conclusion, the author deals with the question of cost, but shows that from this point of view gas and electric lighting are not comparable, as so many opposing factors are present. With respect to illumination, his comparison of the two systems shows that the flame arc lamp is better than the inverted high-pressure gas lamp, as the continuous-current arc was better than the upturned high-pressure gas lamp. One or other of these may, however, be the cheaper, depending on the relative prices of gas and electricity.—Lond. *Electrician,* Jan. 1, 1909.

Flame Arc Lamps.—A note on a British patent (27,132) of the British Thomson-Houston Company (Allg. Elek. Ges. of Germany). In flame arc lamps with inclined carbons which contain mineral matter, the slag which is formed on the carbon tips frequently prevents the arc from striking when the circuit is closed. According to this invention, a metallic bridge with a knife edge is arranged at right angles to the plane of the carbons so that, when the lamp is switched on, the carbons strike this bridge. Any slag on the carbons is then removed, and the bridge forms a conducting path between the carbons so as to assist in striking the arc.—Lond. *Elec. Eng'ing,* Dec. 31.

Metallic-Filament Lamps.—O. BRANDT.—An illustrated account of tests of various metallic-filament lamps. Fig. 1 and [illegible] 50 cp respectively. The curve A represents the amperes, B the volts, HK hefner candles and W/HK watts per hefner candle. The ordinates represent hours. The tests were made with alternating current from a municipal supply network. While the voltage was normally 120 volts, it increased in the evening to 128 or 130, and these variations of voltage did not seem to have any bad effect on the lamps. The author then gives results of tests of Just tungsten lamps, sirius colloid lamps, zirconium lamps, and other new lamps, all of which showed a comparatively short life, which may have been due to the considerable variation of voltage. The author finally compares

the cost of operation of a 32-cp carbon-filament lamp and of a similar osram lamp. With a price of energy of 13.75 cents per kw-hour he finds that the cost of operation of the carbon



FIGS. 1 AND 2.—TEST CURVES OF OSRAM LAMPS.

lamp is twice that of the osram lamp. For 50-cp lamps the ratio is even greater—namely, 2.5 to 1.—*Elek. Zeit.*, Dec. 31.

Zirconium Lamp.—A note on a British patent (5415) of the British Thomson-Houston Company (General Electric Company of this country) for producing filaments of pure zirconium or alloys of zirconium. A squirting solution of zirconium oxalate (which is itself gelatinous in nature) is prepared by precipitation of hot zirconium nitrate solution with ammonium oxalate. Sufficient powdered carbon is then mixed with this to combine with the whole of the residual oxygen of the oxalate during the heat treatment. The absence of pitch or other carbonaceous binder ensures freedom from volatile hydrocarbons in the furnace, and consequently a filament entirely free from carbon is produced. In the case of filaments of an alloy of zirconium, the gelatinous zirconium ozalate forms the only binding agent for the mixture.—Lond. *Elec. Eng'ing*, Dec. 31.

Power.

Consumption of Fuel in Power Stations.—F. H. CORSON.—An abstract of a paper read before the (British) Institution of Civil Engineers. In 1903 the average coal consumption of 34 principal generating stations of the United Kingdom was about 7.7 lb. per kw-hour generated. The figures ranged from 3.6 lb. to 15 lb. In this list the central station of Blackburn stood at 10 lb. per kw-hour. In order to improve the condition, the steam-pipe system was overhauled and more effectively drained, and steam separators and driers were in consequence dispensed with. Engine stop valves were, where possible, attached directly to the main steam pipes. The steam ring was discarded, and generally the effective heat-radiating surface was greatly diminished. Better fitting boiler dampers were provided, the condition of the brickwork was improved, and the whole process of combustion was more thoroughly controlled by the institution of flue-gas analysis. These and similar alterations occupied about three years, and the fuel consumption fell during that time to about 6 lb. of the same coal per average kw-hour generated, a reduction of 40 per cent. Further detailed investigations of the various losses and improvements were then made. An extended test of the whole plant under ordinary working conditions was then arranged. The station comprises two adjoining stations of 2300-kw capacity each, containing 12 mechanically-fired Lancashire boilers, six fitted with superheaters; 15 high-speed engines driving generators from 60 kw to 775 kw in size, controlled from three switchboards; steam piping 3 in. to 14 in. in diameter; ejector and jet condensers fed from an overhead water-tank above the boiler house; low-speed, steam-driven feed pumps; four batteries of economizers totaling 1504 tubes; two chimneys, 150 ft. and 250 ft. high respectively. The test covered during 168 consecutive hours the combustion of about 230 tons of coal, the evaporation of 3.376 million pounds of water, and the generation of 99,295 electrical kw-hours. The net results show a consumption of 5.15 lb. of coal, and a total evaporation of 33.9 lb. of water per average kw-hour.—Lond. *Elec. Eng'ing*, Dec. 31.

Water-Power Stations.—H. VON SCHON.—A paper recommending the procedure in analyzing a hydro-electric project. The investigation should consist of three distinct functions, which should be treated as separate operations and topics—namely, the market, the approximation of output and cost, and the precise estimate of these; when thus approached there need be no costly disappointments. The initial treatment of the market and approximate output and cost topics need not be costly, nor do they require much time, while the expense of the precise determination of the two latter may reach 2½ per cent of the cost of small undertakings of this character and somewhat less for larger ones, and will require sufficient time to make the detail surveys and prepare the plans and specification. An account of the long discussion which followed the paper is also given.—*Jour. Western Soc'y of Eng.*, December.

British Power Companies.—Statistical tables giving information concerning various British power companies supplying power in bulk.—Supplement Lond. *Electrician*, Jan. 1.

Traction.

Tramways in Germany.—A statistical note stating that the total length of tramways in Germany on March 31, 1907, was 2153 miles; the number of two-axle motor-cars was 8378, of four-axle motor-cars 1164, and of electric locomotives 63. The number of fatal accidents was 170 and the number of injured 743, as against 146 and 669 in the preceding year. Some interesting information regarding the tramway undertakings in the principal German towns is given in the accompanying table.

Towns.	No. of inhabitants.	No. of persons carried. Millions.	Length of track. Miles.	Receipts per passenger. Cents.
Berlin	3,013,000	481.1	231	2.45
Hamburg-Altona	971,000	157.2	107	2.60
Munich	539,000	64.3	40	2.50
Dresden	517,000	87.5	57	2.63
Leipzig	503,000	86.4	56	2.30
Breslau	471,000	55.3	34	2.00
Cologne	429,000	76.7	45	2.18
Frankfort	395,000	68.6	43	2.38
Nuremberg-Furth	355,000	29.6	18	2.30
Elberfeld-Barmen	319,000	27.4	17	2.42
Hanover-Linden	308,000	39.5	24	2.60
Düsseldorf	253,000	34.6	21	2.28

—*Zeit. f. Kleinbahnen*, abstracted in Lond. *Electrician*, Jan. 1

Electric Railway Statistics.—Statistical articles and tables on electric railways in the United States in 1908, giving information on new interurban railways in the Central States with map; on electric railway receiverships; on electric railway track construction; on electric railway rolling stock ordered, and on signals installed on electric railways. The total new mileage represented in the tables is 1259.—*Elec. Railway Jour.*, Jan. 2.

High-Tension Current Collectors.—O. A. KENYON.—An illustrated article summing up the results of the Swedish electric railway tests with respect to the collecting of high-tension current from an overhead wire at high speeds. The conclusion reached by the author is as follows: The results of experiments made thus far seem to point to a type of collector which should consist of two parts—namely, a main part to take up the large variations in the height of the wire and an auxiliary part to take up the vibrations. The main part may be comparatively large and heavy and should be balanced for wind pressure and provided with springs arranged to exert a constant pressure irrespective of the position of the shoe. The auxiliary part, which should trail, must be light and designed to have a high natural period of vibration which will enable it to follow the most rapid vibrations of the car to which it will be subjected. The same issue contains two letters by T. Varney and W. S. Murray on comparative tests made with bow collectors and pantographs on the New Haven Road.—*Elec. Railway Jour.*, Jan. 9.

Electric Automobiles.—E. SIEG.—The conclusion of his illustrated paper. The author discusses the advantages of the electric automobile for street and suburban service (not for touring cars) and especially for fire-engine service. He also discusses the methods of suspension of the motors, the tire question, etc., and gives data on cost of operation and maintenance. A maintenance cost of the battery of 1.25 to 2 cents per kilometer is considered as normal.—*Elek. Zeit.*, Dec. 31.

Wires, Wiring and Conduits.

Distributing System.—H. B. GEAR.—A paper on the development of an alternating-current distributing system, discussing

the secondary distribution system, the network, transformers, primary mains, feeders, two-phase and three-phase systems, and construction methods, especially as to overhead work and underground lines.—*Jour. Western Soc'y of Eng.*, December.

Electrophysics and Magnetism.

Oscillations.—E. JACOB.—An account of an experimental investigation of the spark discharge in oscillation circuits. The investigation was made with the aid of an oscillograph and the logarithmic decrement of damping was determined as function of the spark length, current, electrode material, nature of gas, and subdivision of the spark gap. With constant current the damping increases with increasing spark length, while with constant spark length it increases with decreasing current. That electrode material which has the greater heat conductivity also shows a greater damping. The action of the surrounding gas is of the same nature. The damping increases with subdivision of the spark length. The phenomena are explained by the properties of the spark-gap as a high-frequency alternating-current arc.—*Phys. Zeit.*, Jan. 1.

Cooling Curves.—G. K. BURGESS.—A critical discussion of the different methods of obtaining cooling curves (temperature-time curves, differential curves, direct and inverse rate curves). The one from which the most comprehensive view of a transformation can be obtained is the simple temperature-time curve, when this method is made sufficiently sensitive. The curve that can be made the most sensitive and certain is the differential curve. For great range, combined with greatest sensitiveness, the most certain and complete data may be obtained by combining the temperature-time observations with those obtained by the differential method.—*Bull. Bureau of Standards*, Vol. V, No. 2 (November).

Thermodynamics.—C. P. STEINMETZ.—The first part of a serial on the principles of thermodynamics. The author explains why the conception of heat energy as the energy of irregular molecular motion is founded on a very reasonable basis. Molecular motion can be either progressive or rotary motion. According to the value of the molecular velocity, the material is in the solid or liquid or gaseous state. The author then shows how by very simple consideration it is possible to derive the fundamental gas laws.—*Gen. Elec. Rev.*, January.

Electrochemistry and Batteries.

Capacity of Lead Accumulators.—Y. FURUYA.—The author first sums up former researches on the influence of discharge rate and acid density on the capacity of lead accumulators, and then describes experiments of his own. His tests show that the time rate of the drop of voltage at the terminals of the cell near the end of the discharge is independent of the discharge rate (the discharge current). This means that when the voltage at the terminals of the cell has reached a certain value near the end of the discharge the further discharge curve is exactly the same whatever the rate of discharge. It is wrong to define the capacity by stopping at that point when the voltage at the terminals has become 10 per cent less than the initial voltage. The author recommends to define the capacity as that quantity of electricity which a fully charged battery gives out until the time rate of the drop of voltage has assumed a certain value. If discharge curves are taken with the given storage battery, but at different discharge rates and with different acid densities, the curves agree together in their later parts. The difference between a discharge curve at a low rate and a discharge curve at a high rate is only in the beginning part of the low-rate curve. This part does not exist in the high-rate curve, but is a direct prolongation of the latter beyond its initial point to the left. In this way it is possible to devise a graphical method of determining the time of discharge for different acid densities and for different discharge currents from one fundamental discharge curve (referring to a low-discharge rate and a high-acid density).—*Jour. College of Engineering*, Tokyo Imperial University, Japan, Vol. IV, No. 4, August, 1908.

Calculation of Battery Capacity for a Given Load.—W. LEDERS. W. Peukert has published the following formula which expresses the capacity of a cell as function of the length of discharge, provided the cell is fully charged and not discharged below 1.8 volts. The formula is $C^n t = a$. Where C is the discharge current and t the length of time the cell is discharged at a current of C amperes; n and a are constants, the former depending on the construction of the plate—namely, on the alteration in the composition of the active material and electrolyte surrounding the active material—and on the alteration in resistance of the electrolyte and active material as the discharge proceeds; whereas a is simply dependent on the current density—i. e., on the number of plates each cell contains. For this reason the two constants may have different values for different makes of cell. The above formula can be used to calculate theoretically the right size of cell—i. e., the required number of plates per cell for a given amp-hour demand should n and a be known. The shape of the load curve gives the required current at each moment, and these currents, when raised to the nth power, permit a new curve to be constructed whose area is $C^n t$, and whose value can be obtained with a planimeter. The cell whose constant a is equal to or near this value is the type required. In the present paper the author shows that Peukert's formula also holds good for storage batteries of English make. The constants for the same are given.—Lond. *Electrician*, Jan. 1.

Electric Heat.—An anonymous note in which the writer investigates the cost of heating by electrical means for such metallurgical processes as the electric furnace is suitable, and points out that owing to the much more efficient way the heat is applied, the actual costs of direct heating by fuel and electrical heating are not so different as might be imagined.—Lond. *Elec. Eng'ing*, Dec. 31.

Units, Measurements and Instruments.

Interrupter.—An illustrated note on a new interrupter for induction coils which is said to give strong effects without wear and tear of the contacts. The arrangement is shown in Fig. 3.

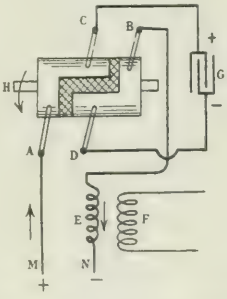


FIG. 3.—DIAGRAM OF NEW INTERRUPTER.

A commutator is fixed on an axle H driven by a motor and two brushes A and B are connected to poles M and N of a source of direct current. The other pair of brushes C and D are connected with the plates of an electrolytic condenser consisting of two aluminum plates in a solution of bicarbonate of soda. E is the primary of the induction coil, F the secondary. When the commutator revolves the condenser G is alternately charged and discharged. The fluctuation of the current in E produces an induced current in F. The electrolytic condenser consists of a cell [illegible] aluminium plates as electrodes. Its capacity is 500 microfarads.—[illegible]

[illegible]—At the recent exhibition of the Physical Society in London, the Marconi Wireless Telegraph Company showed a multiple tuner for tuning a wireless telegraph receiver so as to render it immune to interference from other stations. It can also be used for measuring the lengths of the transmitted and received waves and for estimating the distance of a known station. The instrument has been designed so as to stand severe climates and comparatively rough

usage, and is suitable for all wave lengths from 300 ft. to 8000 ft. Its general principle is shown in Fig. 4, where A represents the aerial, E the earth, R the receiver or detector. There are three separate circuits, termed the aerial circuit, the intermediate circuit, and the detector circuit. The aerial circuit passes from the aerial A, through the aerial tuning inductance I, aerial tuning condenser C_1 and aerial inducing inductance P_1 to the earth at E. The intermediate circuit consists of two equal inductances S_1 and S_2 connected in parallel to the intermediate tuning condenser C_2. The detector circuit consists of an inductance P_2 in series with the detector tuning

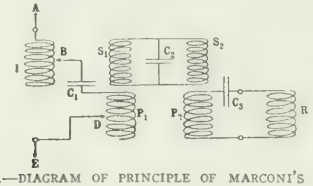


FIG. 4.—DIAGRAM OF PRINCIPLE OF MARCONI'S TUNER.

condenser C_3 and detector R. The inductances I and P_1 are adjustable at B and D respectively, and the condensers C_1, C_2 and C_3 are all adjustable, so that the three circuits can be tuned to the received wave length. The oscillations in the aerial circuit then induce (by means of P_1 and S_1) oscillations in the intermediate circuit, which in turn induce (by means of S_2 and P_2) oscillations in the detector circuit. In addition to the above adjustments, the two coils S_1 and S_2 may be rotated relatively to the coils P_1 and P_2 so that the couplings between the three circuits may be varied. The condensers C_1, C_2 and C_3 are continuously variable from zero to a maximum of 10 jars (a jar being 1000 cm), but the range of the instrument is increased by other condensers placed in parallel or series by means of the tuning switch. In addition to the parts shown in Fig. 4, the instrument is fitted with a micrometer spark-gap and shunt inductance (of the order of 80,000 microhenries) connected between the aerial and earth terminals to prevent the accumulation of an electrostatic charge in the aerial, with a change switch by means of which the whole of the tuned circuits may be cut out, and with a tuning switch by means of which the capacity in the intermediate and detector circuits may be increased to a maximum of 30 jars. When signals from the station to which it is required to communicate are received the aerial tuning inductance and the aerial tuning condenser should be adjusted till the strongest signals are obtained. The intensifier handle is set to 90 deg., and the tuning switch to the wave length roughly indicated by the amount of the aerial tuning inductance and condenser. Then the change-over switch is thrown over to position "tune," and the intermediate and detector condensers varied together till the best signals are obtained. After again adjusting the aerial tuning condenser to give the strongest signals, and if interference is found, the intensifier handle is adjusted to a small valve and the condensers are again adjusted. It will be found that the further the intensifier handle is turned from 90 deg. the sharper will the adjustments of the condensers become, and the greater will be the freedom from interference.—Lond. *Electrician*, Jan. 1.

Wireless Telegraphy.—H. POINCARÉ.—The conclusion of his serial of lectures on the theory of wireless telegraphy. The author discusses the transmission of electromagnetic waves in a certain direction.—*La Lumière Elec.*, Dec. 26.

Miscellaneous.

Porcelain.—H. T. HARWORTH.—A paper on the electric qualities of porcelain, with special reference to dielectric losses. The author gives curves of the charge of a porcelain condenser as function of the time of charge; of the dielectric constant of porcelain as function of the temperature; of the apparent conductivity of porcelain (ratio of current to potential) as function of the potential; of the time of electrification, and of temperature. The influence of temperature on apparent conductivity of porcelain is shown in Fig. 5. It will be seen that the increase of conductivity with temperature is very great. The following is the equation for the porcelain used in these tests: The specific conductivity of porcelain, calculated at 20 deg. C., is 0.2624×10^{-18} mhos. per cm. cube. There is a loss of energy in putting a porcelain condenser through a cycle of electrification. Dielectric loss per cubic centimeter in the time t seconds is $1.83 \times 10^{-12} V^{1.74} (f + 14.4)\ t$ joules where V is the root-mean-square potential gradient per centimeter and f is the number of cycles per second. The constant 14.4 is probably due to the porcelain not being a perfect insulator.—Lond. *Electrician*, Jan. 1.

Porcelain for Electrical Purposes.—A. ZOELLNER.—A discussion of the properties of porcelain as an insulating material from a physico-chemical standpoint. The different steps in the manufacture of porcelain insulators are described and it is emphasized that the most important chemical changes within the mass take place near the highest temperature used (about 1400 deg. C. to 1450 deg. C.). During the last 100 deg. C. of the heating process the final decomposition of the raw materials and the intimate interconnection of the crystals take place, providing the perfect density which protects against absorption of water. The treatment during this very last step increases greatly the resistivity of porcelain against variations of temperature and also its electric perforation strength. High-tension insulators intended for 40,000 volts have shown differences up to 10,000 volts in perforation strength according to comparatively small differences in the temperature used during manufacture. The silent discharge observed with high-tension insulators is intimately connected with air bubbles within the porcelain. These air bubbles slowly increase in size and finally a disruption discharge takes place. From an electrical stand-

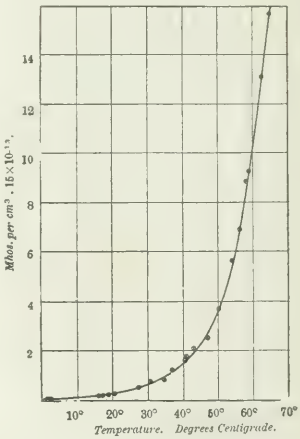


FIG. 5.—APPARENT CONDUCTIVITY OF PORCELAIN AS A FUNCTION OF TEMPERATURE.

point air bubbles in porcelain are, therefore, of greatest importance, even if the mass of the porcelain itself is faultless. The composition of the standard mass has been given by A. S. Watt as $0.25\ K_2O\ 1A1_2O_3\ 4SiO_2$ and this agrees almost exactly with the analysis of the author of the material used by a German insulator factory.—*Elek. Zeit.*, Dec. 31.

Multi-Tone Vibrating Transmitter.—An illustrated description of the Raymond-Barker multi-tone vibrating transmitter. This instrument is a development of the Cardew vibrating transmitter, and enables the principle to be utilized for codes made up of two notes, three notes, or any number of notes. The only receiver required for these multi-tone acoustic signals is a single telephone, although several telephones may be joined up if so desired. For reception of visual or recorded signals, respectively, a mirror galvanometer or a Kelvin syphon recorder may be used, the received signals emanating, in this last-mentioned case, from a two-toned transmitter sending positive and negative undulatory signals to the line.—Lond. *Elec.*, Dec. 18.

NEW APPARATUS AND APPLIANCES

New Magneto Telephone Set.

The Western Electric magneto telephone set shown here marks a departure in several respects in the design of this class of apparatus. The changes introduced have been with a view to making the set as a whole more efficient, the different parts more accessible for inspection and maintenance, and the outward appearance of the set more attractive.

One of the most noticeable of these changes to the average telephone user is the absence of the line binding post from the top of the set. As it has been the practice of the Western Electric Company for some years past to place the telephone protectors at the point where the line wires enter the building, and since all the inside wiring and the building itself are thus protected, no provision is made for the protector on the set, which are seldom, if ever, installed at the point where the line wires enter the building. Moreover, a protector of the usual design when placed on the set introduces danger of personal injury and of fire on account of its proximity to the user and to inflammable material, such as curtains; it is also liable to be tampered with and dust is apt to settle on it and ground the line. This practice dispenses with exposed binding posts on the telephone. The leading-in wires enter the set from the rear and this not only improves its outward appearance, but prevents accidentally short-circuiting its main binding posts. The top of a wall telephone set is a convenient spot on which to place articles, and many a telephone set with exposed binding posts at the top has been temporarily put out of service by some metallic object being unknowingly placed between them. Obviously, this would be impossible in the set illustrated herewith.

Accessibility to the working parts has been made a special feature in the design of the cabinet, in the mounting of the apparatus and in the left-hand swing of the door. Opening the door toward the left facilitates inspection of the generator while turning its crank—an important feature in time of need. The five-bar hand generator included in the set is stated to

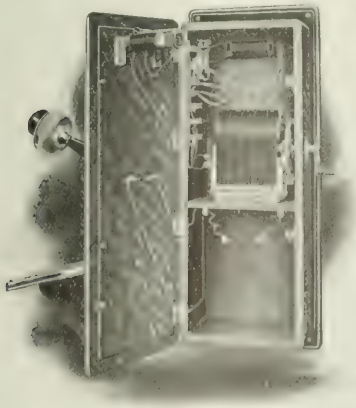


FIG. 1.—MAGNETO TELEPHONE SET OPEN.

show from comparative tests an efficiency of from 15 per cent to 70 per cent greater under practical working conditions than other hand generators on the market, and is guaranteed to ring the equivalent of forty 2500-ohm bells on a grounded full metallic line of No. 12 B. W. G. iron wire. The transmitter and receiver, are stated to have the same high talking qualities for both local and long-distance [illegible] as the transmitters and receivers supplied by the Western Electric Company to all telephone users. The ringer is easy of adjustment and gives a loud, clear signal. The switchhook is compact and self-contained.

Telephone sets of the description here noted are manufactured by the Western Electric Company for moderate and heavy-load bridging service where code ringing is employed,

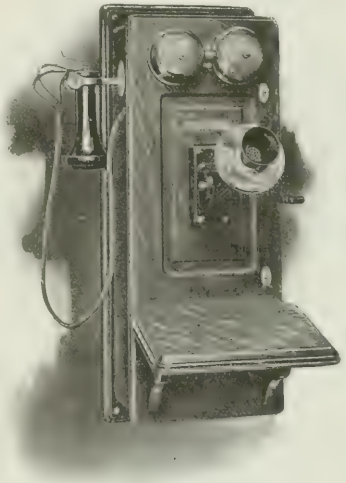


FIG. 2.—MAGNETO TELEPHONE SET.

either with or without a condenser in the receiver circuit. The condenser insures the ringing of the bells even if a receiver is left off the hook. Each set, as shown, is complete and ready for use with the exception of the dry cells.

Bevel Gear Cutters.

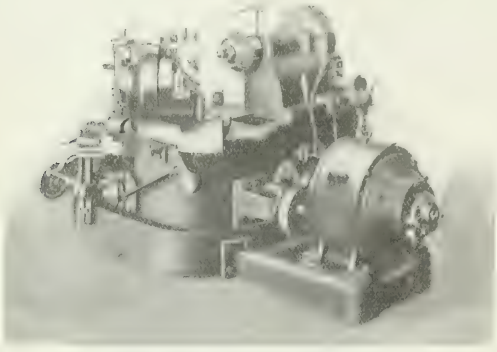
The use of cut instead of cast gears has grown enormously within the last few years, because of the demand for high-power gearings which shall run with a minimum of wear and noise. Correspondingly the machines which cut the gears have been developed greatly in this time to supply the heavy demand. The illustration shows a very compact and efficient machine provided with an individual electric motor, for planing bevel gears of any angle, eight or more to one, and any size up to 24-in. pitch diameter. This is known as the 24-in. automatic bevel gear planer, and is manufactured by the Gleason Works, of Rochester, N. Y.

This machine will plane bevel gear teeth to cone lines. The curve tooth of formers is produced by a machine which generates the curve. The resulting formers are absolutely correct, as the machines have been designed and built exactly for this work. The three formers necessary for cutting a gear, one for roughing, a second for the [illegible] and a third for the under side of the teeth, are in a revolving holder, so that they are brought into position successively without removal [illegible] to the next.

The gear planer is driven by a standard, constant-speed, [illegible] motor. Westinghouse, 5.5 hp., 1125 r.p.m. motor fully enclosed. This size of motor provides ample power to cut the largest size of gears for which the machine is designed. The motor is connected through a system of gearing to the planer,

and, as shown in the illustration, is mounted on a base bolted to the standard base of the gear cutter. This provides a compact unit which is independent of all belts and shafts, so that it may be located at any point in the shop which convenience dictates.

These gear planers cannot be continuously working from morning to night, for in common with machine tools in general, the work is of a more or less intermittent character with



MOTOR-DRIVEN AUTOMATIC BEVEL GEAR PLANER.

periods where the driving motor either runs light or may be shut down entirely. Motor drive effects a material saving in power because the machine takes power in proportion to the work it turns out, and thereby reduces the cost of planing the gears to a minimum. The individual motor tool also results in better headroom and freer access for crane service.

The Gleason Company also manufactures other sizes of gear planers and cutters, ranging from a capacity of 15 in. up to 180 in. as a maximum. On the smaller sizes a constant-speed motor is used, but for the four larger sizes an adjustable speed motor with a speed range of 2-to-1 is recommended.

Lamp and Scale for Galvanometers.

A lamp and scale, having several new features, has been recently placed on the market by the Leeds & Northrup Company, of Philadelphia, Pa. On account of the construction, it

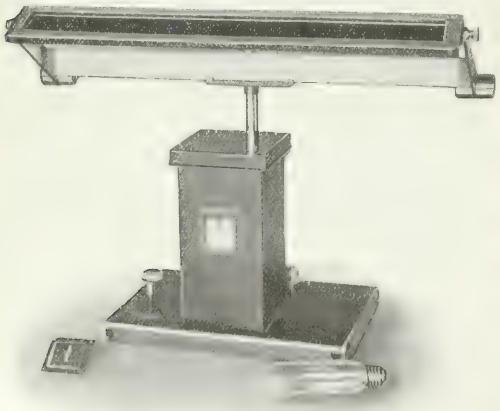


FIG. 1. LAMP AND SCALE FOR GALVANOMETERS.

may be used in a well-lighted room, or in one with no light but that contained in the instrument itself. This feature makes it applicable for use in wire factories and laboratories with natural illumination. When used in daylight, a straight-filament lamp and narrow-slot projector are used, resulting in throwing a brilliant white line on the scale. If used in a place too dark to read the scale without artificial illumination, a window of ground glass is introduced into the hood, in place of the slot, in conjunction with a special lamp to concentrate the light. This window has on it a black arrow and line which is projected on the scale. As shown in Fig. 1, the scale is

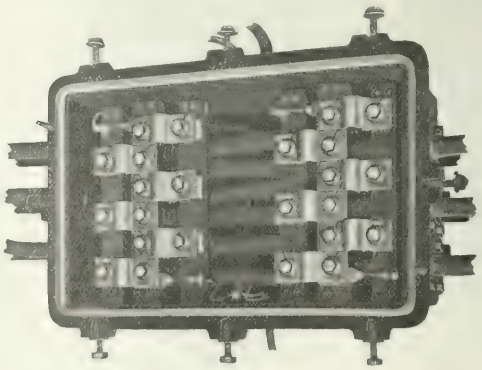


FIG. 2. SECTION OF SCALE.

thus brilliantly illuminated on both sides of the arrow, and the figures may be easily read, although the room is otherwise in perfect darkness. Every instrument is equipped with both outfits, which are easily interchangeable. Another feature of the instrument is the construction of the reading device. In place of the ground-glass scale usually employed, one of fine white cardboard on a mahogany back is substituted. The light, falling on this, makes a sharply defined image which the observer, standing behind the instrument, reads by means of a long, adjustable mirror. With this scale, the observer may stand to one side of the instrument and still be able to read as easily as if he were in front.

Cable Junction Box.

The accompanying illustration shows a cable junction box brought out by the Ricker Manufacturing Company, of Rochester, N. Y. This box is used to protect the mains and feeders of a two- or three-wire, 250-volt system at junction points; each cable being protected with a fuse and the box making a very convenient place to test for trouble. The box is especially adapted for a three-wire system with grounded neutral; the neutral being grounded to the box. A socket is provided in the side of the box where a lamp can be used for illuminating the manhole when work is being done in it or about the junction box. The cable terminals are designed to take mains up to 500,000 circ. mil and feeders up to 1,000,000 circ. mil. The box is watertight and being very compact does not require very much room in the manhole. Plenty of space is left for insulation and the fuses used are of standard make with large terminals, thus eliminating heat and the possibility of the fuse melting because of too small a contact. The flanges are made of



CABLE JUNCTION BOX.

brass and are countersunk, so as to allow a close wipe to the armor of the cable, shortening the distance lengthwise, and leaving additional space in the manhole for other uses.

Fourth Annual Chicago Electrical Show

THE fourth annual electrical show, which has been successfully put through at Chicago, was opened in a very businesslike manner the afternoon of Saturday, Jan. 16. Previous shows, notably the first, were more spectacular in their openings, which were in the evening and accompanied with packed aisles. This year's opening on an afternoon, at which admission was only by invitation of exhibitors or management, was more satisfactory to those who prefer real business and opportunity to look at exhibits to the pushing and crowding that seem to be inseparable from an evening opening with both a large invited list and paid admissions.

The annual electrical show has come to be one of the most popular of the numerous annual shows in Chicago. It attracts every evening as many people as the Coliseum, where it is held, can comfortably accommodate. One evidence of its general popularity is the fact that nearly all the cartoons in the Chicago morning papers the day of the opening had some reference to the show.

It was a matter of considerable [illegible] what the Electrical Trades Exposition Company [illegible] could devise to improve on last year's decorative scheme of lighting with its festoons and spheres of light and its generally brilliant effect. The answer was a [illegible] were even more lavishly lighted than usual with incandescent instead of carbon filament lamps. But instead of the former array of bright lights [illegible] a dark sky studded with twinkling [illegible] a dark background [illegible] a lot of small incandescent lamps [illegible] placed in drooping sockets. The effect was a pleasing variation from the former methods.

As to the exhibits themselves, the most striking things indicating the development of the last year in the field of [illegible] appliances are the use of [illegible] and the increasing number of vacuum [illegible] now offered [illegible] In both there have been notable improvements in the past year.

The central-station exhibit of the Commonwealth Edison Company this year is devoted to industrial power applications. Several small factories are in operation in the large space occupied by this company, among which may be enumerated a printing office, a bakery, a furniture factory, metal specialties factory, a knitting factory and numerous other miscellaneous applications.

The United States navy exhibit, which occupies the annex of the Coliseum, is very instructive to the public as to the lighter guns of the navy and their equipment.

AERO AUTOMATIC FIRE ALARM COMPANY, Milwaukee, Wis., is exhibiting an electro-pneumatic fire alarm which has been recently approved by the National Board of Fire Underwriters, and has many novel features. This device is operated by ex-



GENERAL VIEW OF CHICAGO ELECTRICAL SHOW WITH [illegible]

pansion of air in a small [illegible] bellows. The bellows works in conjunction with an adjustable orifice which allows for the escape of air during gradual heating [illegible] and closing the electric contacts in case of sudden rises in temperature. [illegible] and through the rooms in case of fire, [illegible] to the ground, where a small [illegible] Baird.

[illegible] palms, ferns and cut flowers and the floor is covered with Oriental rugs. A large reception room has been provided in [illegible] are invited to spend their spare time. The exhibit

was planned to represent the fact that the company is prepared to build complete power and electrical machinery for every class of service, including gas engines, Corliss engines and hydraulic turbines. At one side of the booth the company has an induction motor-generator set of 50-kw capacity. Other apparatus shown is a set of standard induction motors for alternating current and the company's new type-K motors for direct current; various sizes of power and lighting transformers, motor-driven centrifugal pumps and the blading and other parts which are used in the construction of steam turbines and generators. The exhibit is in charge of C. A. Tupper, the advertising manager of the company. The other representatives in attendance are: Mr. W. H. Whiteside, W. S. Heger, M. C. Miller, L. F. Bower, Henry Woodland, J. R. Jeffrey, E. T. Adams, W. J. Sando, L. E. Strothman, Geo. C. Forgeot, Max Rotter, W. W. Powell, James W. Gardner, L. M. Harvey, E. M. Gerry, C. A. Bickel, A. N. Brown, W. C. Robinson, R. Dill, W. S. Bishop, Russell Bower, J. R. Ferguson, W. H. Yates, J. M. Kingsbury, G. S. Burdick, W. G. Hammond, R. F. Smith, A. H. Wyman, J. S. Jackson, F. L. Neely, Wm. R. Crawford, I. L. Dimm, E. A. Wright, M. L. Embrey, R. T. Herdegen, C. D. Lutton, S. R. Kerr, C. S. Buell, Ervin Dryer, J. M. Denniston, D. K. Chadbourne, H. I. Keen, A. W. Catlin, Chas. M. Howe, R. H. Gaither, C. M. McDonald, C. M. Nicholson, L. St. J. Smith, H. A. Balding, W. J. Bishop, C. E. Searle, D. P. Davies, R. D. Tomlinson, L. C. Marburg, Willis Collins, C. A. Shearer, P. A. Himes, Alfred Ernst, E. W. Tucker, R. B. Williamson, L. E. Boyen, B. Frankenfield, C. B. Flory, W. F. Uhl, Charles C. Tappan.

American Telegraph & Telephone Company, Boston, Mass., has a booth in connection with the exhibit of the Chicago Telephone Company in which are located long-distance telephone booths. The company has a large map located at the front of its booth on which is shown the lines operated by the Bell Telephone Company throughout the United States and Canada.

American Automatic Advertising Company, Chicago, Ill., is exhibiting several of its automatic moving-picture advertising machines. Each one of these machines holds 24 different views which change automatically. These machines are designed to be used in display windows. They are operated by electricity, connection being made through the standard socket used for electric lights.

American Electric Fuse Company, Muskegon, Mich., is exhibiting and calling special attention to its American igniter, which has been designed especially for gasoline engine ignition purposes. It is in brief a self-contained timer coil and distributor and is so constructed that it can be mounted directly on the camshaft of a gasoline engine. It is especially recommended by the company for service on automobile, marine and stationary engines. The igniter is shown connected to a revolving spindle which is driven by an electric motor. The company also is showing at its booth a full line of lightning arresters of both aerial and switchboard types, including the well-known self-cleaning arrester, No. 600; also a full line of distributing frames for small telephone exchanges; a sample line of telephone protective apparatus as well as the American black insulated wire, wire splices and Allen-Bradley motor starters and controllers. The company is represented at the show by Frank G. Jones, G. W. Rodormer, R. C. Da Costa and George Padley.

American Steel & Wire Company is showing all of the electrical products manufactured by this company, including electric wires and cables, as well as trolley wire and a very complete line of rail bonds and rail-bonding tools; sample boards also showing a large variety of wire products both round and flat, including springs, wire rope, wire nails, etc. B. H. Rizer, representing the Chicago sales department, and C. R. Sturdevant, of the engineering department, are in attendance.

A. & J. M. Anderson, Boston, Mass., is showing sample boards of Anderson overhead line material; also knife switches, time switches, charging plugs and receptacles. The exhibit is in charge of William W. Hincher.

Appleton Electric Company, Chicago, Ill., is exhibiting a number of cabinets on which are displayed "Unilets" for rigid and flexible conduit work, as well as a number of samples of outlet receptacles and switches, various types of fuses, wire connectors, outlet boxes and a complete line of telephone protective devices.

Autoelectric Sign Company, Chicago, Ill., is exhibiting its translucent art glass signs and shades, which are used for advertising purposes. This company's signs are illuminated by a single incandescent lamp. The exhibit is in charge of John Nelson and Miss Ruth Knuckey.

F. B. Badt & Company, Chicago, Ill., are exhibiting a number of Polar flaming arc lamps, and Ward Leonard rheostats.

Baker Electric Company, Cleveland, Ohio, is exhibiting one of the latest types of Baker electric vehicles. This vehicle is connected by cable to a General Electric mercury-arc rectifier charging switchboard.

Benjamin Electric Company, Chicago, Ill., has a very attractive exhibit in which are shown the various forms of tungsten arcs manufactured by the company. A number of display boards show the type and variety of the company's wireless clusters and a number of samples taken from stock show the adjustable socket clusters and the general lighting specialties which this company handles. The representatives of the company attending the electrical show are G. C. Knott, H. E. Watson, W. D. Steel and A. N. Fox.

Central Electric Company, Chicago, Ill., has its booth very artistically decorated and lighted, the general arrangement being similar to that of the company's fixture studios on Fifth Avenue. The company is showing the adaptation of "Opalux" shades for tungsten lamps. Bulletins containing a complete set of curves, which show the results of tests made on illumination efficiency and on the radiation of light where these shades are used, are being distributed. One of the new devices shown by the company is a tungstometer, which is a portable pocket instrument, intended to be inserted in any lamp socket when it is desired to obtain the wattage or ampere readings of the electric lamps that are in use. The improved Central tungstolight is being shown in comparison with other kinds of illumination. Various types of Siemens flaming arc carbons which the company has on exhibition are proving very interesting to the visitors who are interested particularly in the commercial adoption of flaming arc lamps. There is also shown at the booth a complete line of P.-M. specialties, including control switches, meter connection blocks, ground clamps and other devices which have been developed by the Price-McKinlock Company, which is a subsidiary manufacturing company controlled by the Pettingell-Andrews Company, Boston, Mass., and the Central Electric Company, of Chicago. Samples of the full line of the Central specialties, which include Okonite wires, D. & W. fuses and Pittsburgh transformers, are also shown. The following representatives of the company are in attendance: Geo. A. McKinlock, Chas. E. Brown, H. W. Young, H. M. Livor, J. E. Livor, R. L. Kimble, C. C. Dawson, F. B. Switzer, A. S. Pearl, H. Caird, J. E. Ham, J. M. Lorenz, Louis Raggio, D. C Penniman, W. D. Dunsmore and W. H. Pearl.

Chicago Fuse Wire & Manufacturing Company, Chicago, Ill., is exhibiting its well-known fuse wire, fuse links and fuse strips; a complete line of fuse cut-outs and a complete display of enclosed fuses, which includes the N. E. and old-code types, which are designed especially for any required capacity from 1 amp to 1000 amp. In addition to the standard supplies shown, the company is exhibiting its sherardized outlet boxes and covers, which are treated by a new process of galvanizing. The following representatives of the company are in attendance: A. S. Merrill, Milton Mill, W. W. Merrill, T. C. McDonald, George C. Reid, C. E. Harland and W. D. Dana.

Chicago Pneumatic Tool Company, Chicago, Ill., has on exhibition a full line of portable electric tools, including several types of electric drills, grinders, hoists, etc., for use both on direct and on alternating current. These tools are connected up and are shown in full operation. The other tools shown are the pneumatic chipping and riveting hammers and drills. The company is represented by C. B. Coates, Edward Aplin, C. W. Hayes, W. C. Walker and G. W. Walker.

Chicago Telephone Company, Chicago, Ill., has a working

exhibit of what is said to be the largest-sized multiple switchboard that was ever built. This switchboard was installed in two sections, and during the afternoon and evening sessions of the show one chief operator and six operators and supervisors were employed in making connections and answering calls. This exhibit is made to acquaint the people of Chicago with the methods employed by the Chicago Telephone Company in giving good telephone exchange service. In addition to this there is located in the booth a long-distance telephone where demonstrations of long-distance service are being given.

COLONIAL ART GLASS COMPANY, Chicago, Ill., is showing a complete line of art glass shades and domes glazed in copper and hard metal. The exhibits are attractively displayed and give the booth a pleasing appearance. The representatives present are E. C. Gmelin and Helen Bergeson.

COLLINS WIRELESS TELEPHONE COMPANY, Newark, N. J., is showing three types of wireless telephone instruments for different transmission distances; also a complete wireless telephone system for talking both ways at the same time. The principal feature is a revolving carbon arc lamp, constantly presenting new surfaces for the arc with two blow-out magnets to maintain the arc in the middle of the carbons. This permits more current being used than would be possible with the ordinary arc lamp construction and gives a more powerful system. In practice on long-distance work as high as 5000 volts are used at the lamp and for medium distances commercial 220-volt circuit is used. In this system also the sender tunes to the receiver by means of variable inductance and condenser adjusting each until perfect resonance in the transmitter circuit and perfect tuning with the receiving station is obtained, as indicated by the resonance tube burning at maximum brilliancy. This resonance tube is a long glass vacuum tube with platinum electrodes. The tuning can be adjusted for any wave length desired to suit different receiving stations, each of which would have its own individual wave length. By this method of tuning such perfect resonance can be obtained that interference from outside sources is entirely eliminated. During the show high-frequency experiments, showing the transmission of energy from the aerial, will be given. The oscillations of the human voice will be shown by a lamp connected in the transmitter circuit and shunted on the oscillatory circuit. The company is represented by A. Frederick Collins.

COMMERCIAL APPLIANCE COMPANY, Chicago, Ill., is exhibiting the Germless glass telephone mouthpiece which is manufactured by this company. The representatives in attendance at the booth are W. M. Wood, H. S. Conover and G. W. Conover.

CONNERSVILLE BLOWER COMPANY, Connersville, Ind., is showing the vacuum-cleaning devices which it has developed, as well as some samples of its vacuum pumps and blowers. The practical application, efficiency, capacity and utility of this company's apparatus are being demonstrated. Worth W. Preston is representing the company at the show.

CRANE COMPANY, Chicago, Ill., is exhibiting a full line of cast-steel valves and fittings for superheated steam, an electrically operated gate valve, an electric control emergency stop valve and automatic stops and checks. There is also shown at the booth Crane's pop safety and relief valves, and attention is called particularly to the Klingertt packings which this company is recommending for use with superheated steam. J. A. Minwegen is in charge of the exhibit.

CRESCENT COMPANY, Chicago, Ill., is making a feature of its Baby gasoline torch and its Harter white glass clusters. The company is also showing a line of specialties, including the Crescent soldering stick and coloring fluids and Crescent wire lamp guards, which include the Protector "O" and Protector "H" and Luxon types. The Baby torch contains no movable parts to get out of order. It is [illegible] high and [illegible] in diameter and requires no pumping to make it ready for use. When a torch is needed all that is necessary is to turn the match to the burner and the torch is charged. It will burn steadily for two hours from one filling of gasoline. The company is represented by A. O. Eaton, F. W. Smith, V. Meyer, J. H. McGill and A. F. W. Meyer.

CUTLER-HAMMER MANUFACTURING COMPANY, Milwaukee, Wis., has devoted the entire space in its booth to the display of its well-known line of push-button switches and sockets. At the entrance of the booth is located a large working model of the company's three-piece push-button switch enclosed in a plate-glass box. This switch is so arranged that when the push-button is pressed a row of incandescent lamps are lighted in the booth. The rays of light from these lamps are directed onto the company's large sign, which is located at the rear of the booth. The push-button switches are connected with numerous lamps and electroliers, which have been installed in the booth in such a way that practical demonstrations of the value of Cutler-Hammer specialties are plainly evident. A two-circuit pendant switch is shown as it should be connected with an 18-lamp electrolier. One of the buttons of this switch controls six lamps and the other button controls 12 lamps. By this method of connecting the lamps with the pendant switch, the exhibit shows the possibility of obtaining 3 deg. of illumination, consisting of 6, 12 or 18 lamps, through the operation of a single switch. Another demonstration of the efficiency of the two-circuit switch is shown by the connection of an electric fan and an electric lamp, each of which is separately controlled by different buttons of the same pendant switch. Push-button porcelain lamp sockets are also shown in connection with tungsten lamps. These are shown to demonstrate the fact that the metallic-filament lamps can be lighted and turned off without endangering the lamp by excessive jarring. Other devices shown at the booth are flush switches and electric candelabra. A number of photographs and colored drawings illustrating various applications of the Cutler-Hammer push-button specialties can also be seen at the booth. The representatives of the company in attendance are R. M. Van Vleet, R. I. Phillips, Horace J. Dawson, Charles L. Klein and C. C. Lamb.



BATTLESHIP "ELECTRA"

DEL SALES COMPANY, Chicago, Ill., is giving practical demonstrations of the Del electric curling iron. This iron is [illegible] giving the Master [illegible] [illegible] a curl [illegible] [illegible] [illegible]

G. M. Dodge, of Valparaiso, Ind., exhibits his automatic self-teacher of telegraphy as well as his text book on telegraphy and calls attention to his institute at Valparaiso. G. M. Dodge, Brooks Conley and R. W. Elam are in charge.

Duntley Manufacturing Company, Chicago, Ill., has on exhibition four different sizes of portable electrically driven vacuum cleaners. This company's standard vacuum cleaners are equipped with chrome leather diaphragm pumps, and with a Universal ⅛-hp motor. This motor will operate on either alternating or direct current and on frequencies of from 25 to 80 cycles. The machine is contained in a double-walled metallic case, and is cylindrical in form. The vacuum developed when the pumps are in operation is from 5 in. to 8 in. with an air displacement of from 25 cu. ft. to 30 cu. ft. per minute. Each machine is equipped with 12½ ft. of hose and an electric cable 20 ft. in length and an attaching plug. By the use of an extra attachment the hose can be changed so as to utilize the exhaust of the machine for blowing the dust out of places that cannot be reached by the ordinary vacuum tools. These machines can be operated safely from any lamp socket, and are so constructed that the current consumption is not large enough to make the practice of thus attaching the machine unsafe. The company is also showing its standard vacuum sweepers, which are operated by a 1/16th-hp motor located in the machine, and which are intended only for the sweeping of floors. The company's booth is in charge of B. E. Harris, H. L. Lamphear and a competent corps of demonstrators.

Electric Appliance Company, Chicago, Ill., is exhibiting the Sangamo amp-hour meter which is designed for storage battery uses. This meter is particularly adapted for electric vehicles, for train lighting and for central-station storage battery work. It is so constructed that it indicates just how far the battery has been discharged and indicates in a backward direction while the battery is being charged so that the operator can tell by referring to the meter how well the batteries are being charged. Other apparatus shown at the booth include the Sangamo alternating-current and direct-current integrating wattmeters, Sangamo amp-hour meters, Packard tungsten lamps and transformers, Paranite rubber-covered wires and cables, Eureka massage vibrators, American Electrical Heating apparatus, Faraday signal bells and C. & S. intercommunicating telephones. The representatives of the company in attendance at the show are P. R. Boole, F. J. Alderson, F. D. Swartz, R. S. Mitten, H. M. Remington, J. K. Alline, J. B. McMullen and E. R. Field.

Electric Suction Sweeper Company, New Berlin, Ohio, is showing 12-in. and 18-in. suction sweepers for alternating-current and direct-current operation. This machine consists of a vertical enclosed motor having a centrifugal fan and revolving brush, similar to a carpet sweeper. All dust and dirt drawn up by the fan is discharged through a double silk bag, fastened over the fan orifice. This bag has an elastic neck, so that it can be easily removed for cleaning. The company is represented by S. M. Weir, T. J. Strasburger and A. W. Wasey.

Electric Storage Battery Company, Philadelphia, Pa., is showing its chloride accumulators in types D, E, F and G. These accumulators, which are shown in lead-lined and in glass tanks, are especially recommended for electric lighting, railway and telephone usage. The company is also showing a large photograph of a 10,000-amp chloride accumulator battery installation which it has recently made for the Chicago City Railway in Plymouth Court, Chicago, Ill. This battery is designed to successfully take care of the morning and evening peak loads of this railway. The company is also exhibiting accumulators for railway car lighting and railway signal and telegraph work. The batteries for the former purposes are being exhibited in the company's Manchester box and Tudor rolled combinations in both jars and lead-lined tanks. The Exide plates, which are recommended for sparking purposes for electric vehicles and for the lighting of vehicles of all types, are also shown. The company is represented by Godfrey H. Atkin, J. M. S. Waring, H. B. Marshall, F. T. Rinder, J. W. Rosholt, George Neth and H. S. Beck.

Electrical Testing Laboratories, New York, N. Y., are making daily tests of high-tension insulators, showing the method employed by the company in testing insulators intended for 100,000-volt lines. The transformer used for this test is designed for 250,000-volt current. The company is also demonstrating the intensity of the projections of arcs between magnetite pencil, flaming carbons and solid carbon electrodes, and is showing an instrument designed for the measurement of the spherical candle-power of incandescent lamps. The company has also on exhibition an instrument checking table, equipped with a potentiometer for checking up ammeters, voltmeters and wattmeters. The exhibit will be in charge of Norman D. Macdonald and Wilson S. Howell.

Electric Shoe Polisher Company, Chicago, Ill., has five of its new electric shoe polishing machines installed for use in the Coliseum Building.

Electrical World, New York, N. Y., has on exhibition at its booth samples of the *Electrical World* and of numerous technical books relating to the electric industry, all of which are published by the McGraw Publishing Company, of New York City. The company is represented at the show by J. M. Wakeman, H. T. Matthew, J. R. Cravath, E. J. Hunt, G. R. Blodgett and Louis Holstein.

Englewood Electrical Supply Company, Chicago, Ill., is exhibiting a full line of electrical novelties, including flashlights, electric cigar lighters, electric scarfpins, etc. The company is represented by L. E. Mayer, E. W. Cutler, G. I. Spinks and George A. Annable.

Excello Arc Lamp Company, New York City, is exhibiting its new 1909 Excello flaming arc lamps for both alternating current and direct current. The representatives of the company are H. M. Hirschberg, G. W. Armstrong, H. W. Towzer, T. W. Hall and W. J. Gille.

Federal Electric Company, Chicago, Ill., has its flashing signs arranged in a water-effect background, and is showing for the first time its new double reading electric signs. Other apparatus exhibited are a number of attractive tungsten cluster fixtures, Reynolds Dull flashers and various types of illuminated signs. The company is represented by J. M. Gilchrist, L. S. Shepherd, H. Lindauer and F. H. Welling.

Fort Wayne Electric Works, Fort Wayne, Ind., are exhibiting samples of their complete line of central-station equipments, including samples of their alternating-current generators, motors, arc lamps, integrating wattmeters, transformers, fan motors, etc. In addition to this display the company is making a practical display of its new "Compensarc," which is used for controlling the voltage for moving-picture machines when operated on alternating current. This "Compensarc" is a type of compensating transformer, operating similarly to a step-down transformer. This machine, which has but recently been placed on the market, when used in connection with moving-picture machines, is recommended to effect a saving in electric current consumption. It runs cool at all times, and is claimed to preclude the chance of fire resulting from overheating. This machine allows the introduction of moving-picture machines into the lighting circuit of any city without materially affecting the efficiency of the lighting service. The company is represented at the show by W. S. Goll, W. S. Hine, A. L. Pond, L. A. Carr, F. S. Wiemeyer, A. J. Francis, W. K. Eicher and H Plumley.

General Electric Company is exhibiting a full line of tungsten, tantalum and carbon-filament lamps, showing tungsten lamps of from 25 watts to 250 watts; also miniature tungsten lamps for automobile and battery service and tantalum lamps. The new 40-watt standard-size tungsten lamp and a 25-watt double-anchored filament tungsten lamp are also shown. An interesting feature of this exhibit is a photometer, with a 40-watt tungsten lamp balanced against a 32-cp carbon-filament lamp. Two type I induction integrating wattmeters, with 1-amp winding, are connected to show the relative amount of current consumption of the two lamps. These meters are arranged to give approximately full-load speed with one lamp burning. Adjoining this exhibit is a table on which are mounted two frames

suspended from an equal-arm balance. On one frame are mounted 18 25-watt tungsten lamps, using 450 watts, and giving 360 cp; on the other are 11 40-watt tungsten lamps using 440 watts and giving 352-cp. Above this balance are mounted nine 50-watt carbon-filament lamps which consume 450 watts and give 144 cp. This exhibit is to show the relative amount of illumination given by carbon-filament and tungsten lamps using approximately the same amount of current. A complete line of electric cooking and heating devices is also shown. These include electric flatirons weighing from 3 lb. to 24 lb., electric cigar lighters, percolators, radiant toasters, water heaters, air heaters, corn poppers, cereal cookers, boilers, frying pans, teakettles, stoves, ovens, gluepots, etc. Three electric kitchen combination cooking and baking outfits are shown in operation. Among the new devices shown are the 6-lb. gun-metal finish electric flatirons, similar to the 6000 irons recently purchased by the Commonwealth Edison Company, of Chicago; and an electric laundry-iron stand for use in places where a cord is objectionable. This stand will accommodate two irons, one being heated while the other is in operation. The iron to be heated is placed on an inclined plane in the center of the stand and the terminals engage two conduits in the stand, completing the circuit. Moving the iron breaks the circuit, so that no current is consumed except when the iron is being heated. Connection to this stand is made with the usual flexible cord and plug. A modified form of the electric cigar-lighter stand is shown suitable for use in stores and cafés. A new type of percolator is shown in 1½-pint, 3-pint and 4-pint sizes, which will start percolating 45 seconds after the current is turned on. The radiant toaster consists of an open-resistance frame with four vertical heating coils, and is arranged to toast two slices of bread at a time, and as the bread is held in a vertical position in the frames the objections raised to the old forms of electric toasters have been overcome. Both the percolators and the new design of water heaters are equipped with self-contained heater units. These heater units consist of a flat-ribbon resistance clamped between two mica disks, which are enclosed in a brass shell with crimped edges. A composition base on the underside of the heater unit carries the terminal pins and serves as an insulator as well as for preventing backward heat radiation. These units are interchangeable in different devices having the same current consumption, and have a lift equal to the standard cartridge unit. Several types of luminous radiators are shown, ranging from 1200-watt to 5000-watt capacities, with from four to eight heater tubes. A new mantle type of radiator is exhibited which is similar to the luminous radiator, and is arranged for permanent installation over a mantle. One of the features of this exhibit is a dry electric fountain, consisting of flashing colored lights under a pyramid of Holophane shades. The company is represented by F. H. Gale, W. H. Colman, E. L. Callahan, H. Schroeder, J. O. Case, F. T. Benson, R. E. Keller and Winifred S. Potts.

GENERAL COMPRESSED AIR & VACUUM MACHINERY COMPANY, St. Louis, Mo., shows the Thurman portable vacuum cleaning outfit for hotel and house use. The machine is operated by a ¾-hp motor and the entire equipment is mounted on a rubber-tired truck. The usual complete line of tools, including equipment for facial and body massage, is shown.

GRANT FLAMING ARC LAMP COMPANY, Chicago, Ill., is making an elaborate display of its type B alternating-current and direct-current 17-hour flaming arc lamps, and is showing the German-American Flaming Arc Company's new auto arc hanger. This latter hanger is designed for suspending arc lamps on high ceilings, and eliminates the heretofore objectionable wire loops which detract from the artistic effect of the ordinary installation of arc lamps. These hangers have already met with ready sale. Among other companies which have adopted these fixtures is the Indiana Steel Company. The Grant Flaming Arc Lamp Company is represented by H. W. Hulme and R. T. Merrick.

HAHL AUTOMATIC CLOCK COMPANY, Chicago, Ill., is exhibiting a pneumatic clock system, a program clock, a self-winding electric clock and a time stamp. The pneumatic clock system exhibited consists of a master clock of astronomical accuracy which is equipped with a self-compensating pendulum propelled by a spring automatically wound at the end of every minute. This clock is also equipped with a self-contained power device designed to operate a series of secondary clocks by alternate impulse and release of air, which is under a pressure of less than one ounce. The company is represented by Carl Mendius, H. W. Mendius, L. B. Montgomery, W. W. Billings and P. J. Hertz.

HINDE & DAUCH PAPER COMPANY, Sandusky, Ohio, has a very creditable exhibit of corrugated fiber goods, such as are used for packing lamps and other fragile articles. The representatives of the company are showing many samples of boxes made by the company in which are shipped electric lamps, lamp chimneys, lamp shades and all kinds of fragile glassware and other commodities. The company is represented by E. J. O'Hagan, E. J. Eiserman and Mr. Becker.

HURLEY MACHINE COMPANY, Chicago, Ill., is making a continuous demonstration of the Thor electric washer and reversible three-roll wringer which this company manufactures. The Thor electric washing machine is 24 in. x 25 in. in size and stands 34 in. high. The upper half of this machine is made of the best grade of red cypress and the lower half of the body, which contains the water, is made of galvanized iron with the joints and flanges brazed to make them rust proof. During the past few weeks the company has placed on the market the "Universal" joint, which fits on the flywheel of this washer and can be used on the crank of any standard electric household article that is now in use. By the use of this device ice-cream freezers, meat choppers, ironing machines, grindstones, emery wheels and many similar devices can be operated from the same motor with which the Thor electric washer and wringer is provided. The following representatives of the company are looking after the exhibit: Neil C. Hurley, B. G. Tompkins, A. J. Fisher, A. E. Carmichael, M. Y. Steen, E. J. Riedy, N. H. Haberle, Arthur Kee, Richard Ruffo, Miss A. McIver and Miss J. Erickson.

ILLINOIS ELECTRIC RENOVATOR SALES COMPANY, INC., Chicago, Ill., is showing both the commercial and the domestic sizes of Invincible Renovators for which this company is sole agent in the State of Illinois. The Invincible Renovator is not a vacuum machine. It is operated on the principle of centrifugal exhaust, and is claimed by the company to have greater power for cleaning than that of a vacuum machine. The machine is built substantially of aluminum and is mounted on 6-in. ball-bearing wheels, which allow the machine to be easily moved from one room to another. During the progress of the Electrical Show the representatives of the company are giving practical demonstrations of the efficiency of this machine.

INDICATOR ELECTRIC COMPANY, Chicago, Ill., exhibits electric clock systems, time stamps and electric clocks. In addition to this it shows sign flashers, which are claimed to do the work of many of the older types of flashers with considerably less complication. In this company's apparatus the flasher is located in the sign and requires not more than four wires from the building to the sign to operate it.

INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa., are showing the text books used in several of the courses of instruction adopted for use by the schools, several volumes of books taken from the schools' technical library and a revolving globe on which are shown the many countries in which the International Correspondence Schools have students. This globe is very attractive and is made more so by a motor passenger train, in miniature, which is operated on a small track surrounding the globe. The representatives at the booth are C. C. Marson, J. E. Mellon, W. G. Jones, J. B. Hevan, V. C. Curtis and J. C. Freelove.

H. W. JOHNS-MANVILLE COMPANY, New York, N. Y., has its booth lighted throughout by the "Linolite" system of lighting, which makes its exhibit one of the attractive features of the Electrical Show. Linolite lamps, which consist of a tube enclosing a straight filament, are arranged end to end about the booth and in front of polished reflectors which distribute the

light therefrom uniformly around the space occupied by the exhibit. This company has recently placed on the market a new line of portable desk and table lamps and picture reflectors, which are especially applicable for use with the Linolite system of lighting. This system of lighting is also being recommended for show-window purposes. The lamps used are made either with carbon or with metallized filaments in any desired candle-power. The company is also showing samples of its well-known line of "Noark" enclosed fuses, samples from a new and complete line of National Electrical Code standard service switch fuse boxes which are equipped with interchangeable conduit fittings, making them suitable for any form of installation. These boxes are made in capacities up to 400 amp for service on current ranging from 250 volts to 600 volts. The J.-M. catenary line construction material is also given an important place in the booth. These materials include a complete line of porcelain strain insulators, steady braces, messenger insulators, bracket arms, anchors, pull-off clamps, studs and hangers, etc., for line constructions, intended for carrying current ranging up to 11,000 volts. Various sized J.-M. immovable guy anchors are being demonstrated. This type of anchor is so constructed that the disks of which it is made can be expanded to nearly twice their original extreme diameter, and it is claimed the anchor can be installed in much less time than is required to install other types of anchors. Other Johns-Manville materials shown at the booth are Moulded Mica overhead line material and fittings for low- and high-tension railway work, vulcabeston and other molded insulating compounds, Noark fuses, Jomanco friction tape and many samples taken from the stock of standard supplies for railway, lighting and telephone construction and maintenance work. The following representatives of the company are attending the show: T. G. Younglove, H. M. Frantz, J. C. Younglove, H. W. Frantz, F. G. Simpson, T. T. Lyman, G. A. Saylor, J. C. Cone, F. C. Frumveller, T. H. Bailey and J. W. Perry.

Kellogg Switchboard & Supply Company, Chicago, Ill., has on exhibition a train dispatchers' outfit which this company is recommending for the use of the dispatching of trains on steam railroads. The system as shown includes the dispatchers' master set and four substation sets which are arranged into a working exhibit. By the use of this outfit it is claimed the dispatcher has full control of his wires at all times and can select any one station on the line or ring any desired number of stations by one operation. The company has also provided a waiting room set to demonstrate the value of installing a telephone in the waiting room of way-stations, which enables the trainman in the absence of the operator to communicate directly with the train dispatcher. This system is intended to show the superiority of the telephone over the telegraph for the safe operation of trains. The telephone apparatus shown is of the same type as has been ordered by many of the transcontinental railroads for adoption on their lines. At the exhibit is also shown a Jennings iron pole telephone set which is designed to be placed on a pole at any desired point for the use of trainmen. A trainmen's telephone, which is intended for allowing conversation to be held between trainmen inside of a car and the dispatcher is also shown. When this type of apparatus is used it is necessary to make connection to the main telephone wires by the aid of a specially devised apparatus which hooks over the main wires and forms a loop with the telephone set at the bottom end. Other apparatus on exhibit are the new railway wall and portable composite sets, which are designed for use on telegraph wires simultaneous with the dispatching of messages by telegraph; desk and wall types of intercommunicating sets for use in warehouses, factories, etc.; test sets and other equipment especially designed for railway service. The representatives of the company in attendance at the booth are J. E. Kelsey, A. Wray and W. P. Booth.

Charles L. Kiewert Company, Milwaukee, Wis., is exhibiting "Alba" and "Aurola" flaming arc lamps. The company has three of the former on exhibit connected in series, each lamp giving 1800 mean hemispherical candle-power. The maximum candle-power of the Alba lamp is about 30 deg. from the horizontal, and the distribution of light makes it suitable for lighting large areas, such as assembly halls, machine shops, railroad shops, switching yards, and for economical yet brilliant street lighting. The Alba lamp employs vertical carbons. The Aurola lamp is of the well-known inclined carbon type, the construction and design conforming to modern types of flaming arcs. The feed employs one flat-link chain of unusual design and only one wheel. Some of its additional features are: Separated control for feed, sensitive arc distance adjustment, positive automatic cut-out, sliding guide of negative carbon of simple design. Both of these lamps are shown for the first time in Chicago, and are attracting considerable attention. The exhibit adjoins that of the Central Electric Company. The company is represented by K. A. Albrecht.

Kirkpatrick Conduit Company, Chicago, Ill., occupies the booth with the Grant Flaming Arc Lamp Company, and is showing samples of its clay conduits, which are made in multiple and single ducts. These conduits are recommended for every kind of underground installation. The company is represented by E. F. Kirkpatrick.

A. W. Kratz, Chicago, Ill., is showing the "1900" electric washer with a wringer attachment and a clothes wringer designed to be attached to a stationary washtub for use in rinsing clothes. The washing machines with the wringer attachments are operated by a single ⅛-hp motor. The exhibit is designed to show how economically this apparatus can be operated. The exhibit is in charge of A. W. Kratz.

Lindstrom, Smith Company, Chicago, Ill., is exhibiting an attractive assortment of White Cross electric vibrators and electric specialties. This exhibit includes the White Cross electric hair drier and adjustable clamps. The clamps are designed for holding the drier into position on any type of chair or table, to make the work of drying the hair less tedious. There is also shown at the booth electric vibrators which operate by dry-cell battery and others that operate either on direct or alternating current, and the company's No. 18 vibrator which can be operated by dry-cell battery or by either direct or alternating current. Other devices shown are the physicians' White Cross combined galvanic and faradic batteries; also a line of therapeutic lamps for medical purposes, bleaching, etc.

Manhattan Electrical Supply Company, Chicago, Ill., is exhibiting the Gem vibrator. It also is showing dashboard and marine spark coils and heating devices as well as dry batteries. The exhibit is in charge of A. C. Holland, Clark Methot and Dr. H. T. Bassett.

Matthias Klein & Sons, Chicago, Ill., is exhibiting a full line of Klein products for electric transmission line construction and maintenance, as well as tools of general utility for electricians and for lighting, power and traction men. This exhibit comprises a very wide variety of tools such a climbers, splicing clamps and plyers of many different types. This company claims to be the pioneer manufacturer of tools and supplies used in the construction of electric transmission lines.

McRoy Clay Works, Brazil, Ind., is showing a complete line of salt glazed vitrified clay conduits in single and multiple duct types. In addition to the standard 3¼-in. conduits, the exhibit includes a special 2½-in. duct, which is a sample of a supply made for use on the Pacific coast. This type of conduit is being recommended by the company for the use of central stations and street railways.

Mears Ear Phone Company, New York City, is showing its aurophone, which is an improved electrical device that the company is recommending for the use of people who have defective hearing. This device has quite a record as a reliable sound magnifier and is so small in size that it can be carried unnoticed in a person's pocket. The exhibit is in charge of John S. Linde and a corps of able assistants.

Mechanical Appliance Company, Milwaukee, Wis., has on exhibit an electric flour sterilizer and ager which it has built for the use of the Alsop Process Company. This sterilizer consists of an iron box containing revolving rollers which are connected to a high-pressure spark coil. Current for this coil is provided by a 500 volt generator which is located on top of the

sterilizer. A current of air is provided in this sterilizer for blowing out the arc and carrying off the gases which are formed by the arc. These gases age and sterilize the flour by passing up through it. The company is also showing several direct-current motors of both variable and constant speeds and of the horizontal and vertical types; also three-phase, alternating-current motors and self-starting single-phase motors. The motors exhibited are connected up to the feed wires leading into the Coliseum and are operated when desired. The company has just brought out an electrically operated crossing gate which has been erected at the booth as a working exhibit. This gate is operated by a small direct-current motor which is driven by 500-volt current. It is so designed that the arms of the gate can be raised or lowered from a single tower or from any desired point, simply by the opening and the closing of a switch. The company is represented at the show by J. G. Zimmerman, R. G. Kellogg and H. H. Ford.

MECHANICAL & ELECTRICAL MANUFACTURING COMPANY, Chicago, Ill., shows a line of electrical porcelain goods, including porcelain receptacles and weatherproof sockets, outlet-box covers, etc. Wm. Burmeister, H. Hargis and Albert Maier have charge of the booth.

MILWAUKEE VACUUM MACHINERY COMPANY, Milwaukee, Wis, is showing two Milwaukee portable vacuum cleaners. These machines are each composed of a triplex vacuum pump, direct-connected to a ¼-hp motor, and mounted on a small three-wheel truck. Three dust collecting cylinders are also mounted on the truck so that they are easily accessible for cleaning. The outfit can be connected by a flexible cord to any lamp socket, and is made for either alternating-current or direct-current circuits. This company also exhibits a complete line of various cleaning tools suitable for carpets, draperies, upholstery, matresses, etc. The company is represented by W. H. Cameron, A. F. Seaman and Sutherland & Carpenter, Chicago representatives.

MONARCH VIBRATOR COMPANY, Chicago, Ill., is exhibiting its complete line of Monarch electrical massage vibrators. Two of the types of vibrators manufactured by this company are operated by electricity and one of the types is operated by dry-cell batteries. The company has perfected its No. 3 vibrator so that it can be operated on either direct or alternating current without the intervention of an electric light bulb, as has heretofore been necessary. The representatives of the company are demonstrating the efficiency of the motors used in the Monarch machines. These motors are of the bi-polar type, and produce 15,000 vibrations per minute. The speed of the motor is controlled by a special adjustment device which makes it possible to produce 70 different vibratory strokes.

MURPHY ELECTRICITY RECTIFIER COMPANY, Rochester, N. Y., is exhibiting its rectifier for changing alternating into direct current. The machine consists of a rotary disk type of rectifier, driven by a small synchronous motor, and is designed to do away with inductances, resistances, vacuum tubes and chemicals. It is intended for charging storage batteries for series arc lighting for X-ray and other electro-medical appliances, for moving picture machines, for electroplating, telephone, telegraph, fire alarm and signaling systems. With this type of rectifier the losses are constant, so that the efficiency increases with the load. By the use of an entirely novel principle of control it is possible to regulate the current very closely, making this rectifier applicable to purposes hitherto believed impossible, where close regulation is necessary. The company is represented by Thomas J. Murphy, Richard Murphy and James P. B. Duffy.

NATIONAL ACME MANUFACTURING COMPANY, Cleveland, Ohio, has an exhibit consisting of one Acme automatic multiple-spindle screw machine. This machine, which is motor-driven, is shown in operation manufacturing small brass coupling joints with internal and external threads which are made by a single operation by the machine. The company has also on display a sample board showing several of the types of work which can be done economically by this machine. Photographs of the various types of Acme automatic machines that the company manufactures, together with a few of the attachments to be used on the machines when special work is required, are shown. The exhibit is in charge of E. C. Woolger and A. D. Breeze.

NATIONAL BATTERY COMPANY, Buffalo, N. Y., has on display at its booth a board containing sample grids, plates and other material used in connection with the manufacture of all types of its battery plates for ignition, propulsion, light, power, telephone, signal and fire alarm uses. The exhibit consists of a very comprehensive display of the various materials used in the manufacture of storage batteries for every purpose. The company is represented by E. B. Cottrill, Bertram Smith, A. Otto Hiester, W. F. Daner and W. W. Somes.

NATIONAL ELECTRIC LAMP ASSOCIATION, Engineering Department, Cleveland, Ohio, has its booth decorated with all of its latest and standard styles of Gem, tantalum and tungsten incandescent lamps. The booth is surrounded by arches in which are set tungsten lamps in high-efficiency holophane reflectors. The arches were designed to conform in general appearance with the other decorations in the Coliseum. The special feature of the exhibit is a display of materials of which the tungsten lamp is made. A glass case is provided in which the minerals and chemicals which are used in the making of the finished lamp are shown, and an exhibition table is provided upon which are located meters designed to show the increased efficiency of the tungsten over carbon and tantalum lamps. At another table in the booth demonstrations of the better regulation of the voltage candle-power of tungsten lamps are given. Practical demonstrations of the use of tungsten lamps for show-window illumination are made, as well as demonstrations showing the superiority and the efficiency of tungsten lamps over carbon-filament lamps. The exhibit is in charge of P. F. Bauder, R. B. Clark and R. F. Strickland.

NATIONAL CARBON COMPANY, Cleveland, Ohio, is showing samples of its carbon products for flaming, open and enclosed arc lamps, carbon electrodes for electric telephone work, carbon crucibles and carbons for motion-picture machines. The company is also showing a general line of motor and generator carbon brushes, and is displaying panels of carbon specialties for telephone apparatus and many of its other well-known products. The company is represented by N. C. Cotabish, A. J. Summerell, Wallace O'Connor and A. V. Ward.

THE U. S. NAVY EXHIBIT, which occupies the entire Coliseum Annex, is one of the attractive and instructive exhibits of the show. The exhibit is in charge of Chief Gunner Andrew Olsson, U. S. N., who is also assistant in charge of the U. S. Navy Electrical School, Navy Yard, New York. He is assisted by chief electrician, J. Munroe; electrician, first class, A. M. Minoot; electrician, second class, B. H. Goldsboro, and electrician, third class, W. D. Wickney, all of which are graduates or students of the Navy Electrical School. The walls of the Annex are very artistically decorated with large United States flags and emblems, and red, white and blue bunting. The ceiling is draped with bunting and lighted so as to give an appearance of height to the room. The main part of the exhibit consists of a model of a battleship which has an extreme length of 58 ft. and a beam of 24 ft. The deck of this model is equipped with many of the fixtures found on the main deck of a battleship. It has two 6-lb. Hotchkiss guns, two 1-lb. Hotchkiss guns, two Colt automatic firing guns, two gatling guns and one 3-in. fieldpiece. The bridge, which has been constructed so that the visitors can pass over it, is equipped with searchlights, night signal keyboards, truck light controllers and other electric devices which are usually found on a model battleship, such as helm anchor indicators, revolution telegraphs, steering telegraph apparatus, compass, binnacle wheel, etc. The model battleship is equipped with electric semaphore lights and a complete wireless telegraph [illegible] practical demonstrations of the sending and receiving of messages by wireless are given. The auxiliary [illegible] is located at the far end of the main room of the Coliseum. The canopy covering the decks of the model ship is surrounded by 500 8-cp electric lamps, which

add very materially to the attractiveness of the exhibit. At one side of the Annex the navy has on display the wiring diagrams of all of the principal electrical installations used on the United States battleship *Connecticut*, as well as literature and diagrams of the following wireless telegraph systems: Shumaker, Telefunken, De Forrest, Mossie, Fessenden, Stone and Pickard; also diagrams of navy standard switch and distribution boards for all purposes. At the west side of the Annex several glass showcases filled with relics of the Spanish-American War are exhibited. These were furnished for the occasion by Mrs. Stickney. On the south side are shown moving pictures taken of the Atlantic fleet on its cruise around the world, also many biographical views on land and sea as taken from several of the United States battleships. A very complete exhibit of the U. S. Hydrographic Office, showing charts, maps, etc., also occupies a portion of this part of the building. During the progress of the Electrical Show, Mr. Olsson and his assistants are explaining in detail the various courses taught at the U. S. Navy Electrical School and are explaining the attractive features of service in the U. S. Navy.

Henry Newgard & Company, Chicago, Ill., is showing the Newgard waterproof receptacle mounted on a fountain with running water spraying over it. The company is also showing the Wizard medical battery and several of its electrical specialties, such as panel boards and steel cut-out boxes which it manufactures. This company had complete charge of the wiring of the Coliseum for the Electrical Show and aided in designing the electrical effects of the main show room. The company is represented by Henry Newgard, Martin Newgard and Dr. A. S. Goss.

Chris. S. Neville Company, Chicago, is exhibiting three Neville illuminating signs, two of which are circular in shape, illuminated by one cluster, and the third, oblong in shape, is 12 ft. x 5 ft. and is illuminated by two clusters. Each of the clusters consists of three concealed lamps in connected diffusers, so that the illumination is evenly distributed over the surface of the sign. The company is represented by Chris. S. Neville, J. C. Sternburger and Joseph B. Tinker.

Northern Electrical Manufacturing Company, Madison, Wis., is showing a number of samples of equipments of the company's manufacture, among which is a Northern Electric rock drill which is shown in actual operation. This drill is operated by electric power which is transmitted from the motor to a revolving helve in which are mounted two hammers which are so placed that they are thrown by centrifugal force outside of the diameter of the helve. The hammers impinge on a simple steel device which serves both as a piston and a chuck for the drill. The hammers are cushioned on air. There is also shown at the booth a Northern, type S motor which has a laminated field. These laminations are of horseshoe shape, and are assembled in such a way that each end of the horseshoe forms an internal pole tip as well as one-half of the pole piece. This is said to be the most effective method of controlling the lines of force and is said to be successful with the motor running under heavy overloads as well as under wide ranges of speed and reversal. These motors are constructed for enclosed operation, and are so arranged that the commutator and brush rigging are easily accessible at all times. They are especially designed for driving machine tools. Other devices shown at the company's booth is an Atwood vacuum cleaning outfit, driven by a Northern type B motor, Northern type S grinders and a type S buffer.

The North Shore Electric Company, which gives central-station service in the suburban towns surrounding Chicago, made as the great feature of its exhibit an array of Pacific electric irons of the kind which it is loaning free to customers. Another important feature of the exhibit was the meter-testing board, which contained a Fort Wayne wattmeter of the kind used by the North Shore Electric Company with different candle-powers of lamps which could be easily connected and show how the speed of the meter varied according to the load. Along with this was an ammeter which was calibrated to read in cents per hour instead of kilowatt-hours. Mr. John G. Learned, contract agent of the North Shore Electric Company, and his various assistants, were in charge.

Oral & Motion Advertising Company, Chicago, Ill., is exhibiting a machine for advertising purposes which consists of moving advertising panels and a phonograph which operate in conjunction from current supplied by one motor. L. S. Treat is in charge of the exhibit.

Pacific Electric Heating Company, Ontario, Cal., is exhibiting its various types of electric flatirons and toasters. The principal feature of this exhibit is the company's new automatic cut-out attachment which it has recently placed on the market. This attachment is entirely mechanical, and may be attached to any of the company's well-known "hot point" irons. It consists of a small conical-shaped well which is filled with a metal which softens with excessive heat. In this well is placed a spiral-shaped metal spindle. This spindle is held rigidly in one position between the heating units until the iron is subjected to excessive heat, when it is allowed to turn. The spindle upon turning releases a spring which is attached to the upper portion of the iron and the spring in turn engages with the lower portion of the connecting switch plug and throws the plug entirely out of the socket, thus eliminating the danger of the iron burning out. It is attracting a great deal of the attention of visitors at the company's booth. All of the Pacific Electric Heating Company's 1909 irons will be provided with these automatic cut-out attachments. This company's large pressing and tailor irons, in which the heat may be adjusted to three distinct temperatures, are also being shown. Several of the automatic cut-out irons on exhibition have been in constant operation under very severe conditions for the past six months, and have shown no deterioration whatever. The Eltosto, which was one of the first electric toasters to be placed on the market, has been given a conspicuous space in the booth. This toaster is built with an open coil which prevents it from reaching a temperature high enough to cause oxidation. The electric curling tong heater manufactured by this company has a cord attachment which screws into an ordinary electric light socket. It consumes less than 1 amp of current in heating. Other devices shown are electric air heaters, foot warmers, chafing dishes and percolators. This company has recently opened up a new factory in Chicago, where all of the electric devices sold in the Central and Eastern States will be manufactured. The company is represented at the show by H. F. Holland, J. R. Richardson, W. L. Gender, Miss Lucy Black and Miss Gladys Lee.

Palm Engineering Company, Detroit, Mich., is exhibiting its various types of vacuum cleaning machinery. The vacuum pumps with which this company's machinery is equipped is especially designed to handle dust-laden air. It is claimed the pumps are so constructed that dust strainers in the form of buckets, water separators, etc., are eliminated without reducing the efficiency of the pumps, and thereby prevent the friction which is often caused by tight-fitting piston rings in some forms of vacuum pumps. The packing for the Palm Engineering Company's vacuum cleaning machinery is of the constant flowing water type which is designed to obviate the necessity of constant lubrication and care. The company claims that ½ hp is sufficient to operate its vacuum pumps efficiently.

Peerless Light Company, Chicago, Ill., has on exhibition samples of its complete line of gas and electric lamps and art glass shades. The company is also showing a new type of Peerless gas lamp and a new electric sign. The exhibit is in charge of William Herskovitz, Robert Witz, L. Landesman, Abraham Herskovitz, Max Herskovitz, J. G. Shonfarber, Arthur Davidson, Ben. F. Henshel and Milton Zucker.

Pelouze Electric Heater Company, Chicago, Ill., has a working exhibit of the Universal electric sadirons. The irons made by this company are in 4-lb., 6½-lb. and 8½-lb. sizes. The Universal iron is a new product that has just been placed on the market. The iron is made of three separate units, consisting of a handle and frame, a heater unit and an ironing face, all of which are held together by a single bolt. The heater unit is composed of a flat ribbon wound on edge and

embedded in a special heat-resisting insulating compound of extreme rigidity. By employing this method of winding, all parts of the heater unit are brought in close proximity to the ironing face and increased heat radiating surface is given at the point of the iron where the greatest heat is required. The main parts of these three different sized irons are interchangeable. At the beginning of the show this company turned the current on one of its irons and has determined to leave the iron connected up until the show closes. This is done to show the practical indestructibility of the irons and to show the distribution of heat at the bottom of the main casting. The exhibit is under the charge of Wm. Nelson Pelouze and Chas. P. Madsen.

PERFECTION VACUUM CLEANER COMPANY, Chicago, Ill., is making daily practical demonstrations of its portable and stationary types of alternating-current vacuum cleaners. The portable type of cleaner is mounted on a three-wheeled rubber-tired truck and is encased in a neat oak-paneled case which is provided with a handle to aid the user in moving it from place to place. The stationary type of cleaner is very compact in form. These machines are capable of producing from 15 in. to 20 in. of vacuum and are each operated with a 1-hp motor. The members of the firm in attendance at the show are O. E. Becker, J. L. Wallace and Harvey Wallace.

PHOENIX GLASS COMPANY, Pittsburgh, Pa., and New York, is showing Phoenix inner and outer globes and shades for incandescent lamps. Also new tungsten, colonial and cut-glass reflectors, and many other attractive lighting reflectors.

RED CROSS ANTISEPTIC COMPANY, Chicago, Ill., is exhibiting the Red Cross antiseptic telephone mouthpiece, which is made of vulcanite with an inner lining of perforated aluminum. The interior periphery of this lining is turned backward so as to form a hollow rim, which is filled with absorbent material saturated with Red Cross antiseptic fluid. The mouthpiece has been indorsed by many medical authorities. The booth is in charge of Aaron Levitt and Lester D. Fried.

ROBBINS & MEYERS COMPANY, Springfield, Ohio, is showing motors ranging in capacity from 1/50th to 15 hp, which are designed to drive most any type of machine. One application of this motor is shown by it driving a press made by the Buffum Tool Company, of Louisiana, Mo. This exhibit is made for the dual purpose of showing the efficiency of the motor and of demonstrating the value of the press. The Standard motor is also shown in connection with a Thomas & Smith pump. The motor is shown in operation at the bottom of a tank filled with water. The Ilg Electric Ventilating Company is demonstrating at this booth the value of its ventilating shutters when used in connection with an exhaust fan operated by Standard motors. Another unusual exhibit is a motor driving a sewing machine, the current for which is controlled by the foot treadle of the machine. This device can be applied to any type of sewing machine without the aid of an electrician. The company is also showing the Robbins & Meyers electric hoist, which is intended for the use of manufacturers and dealers whose places of business are not provided with freight elevators for conveying goods between the different floors of the building. Other devices shown at the booth are various types of grinders and buffers and a complete line of fans. The company is represented by H. A. Porter, J. F. Kadic, F. P. Luedtke, E. C. Starr, R. A. Ilg, F. W. Batterman, A. C. Durdin, M. R. Weil, R. C. Burmood, C. F. McGilvray, H. E. Myers and W. W. Mumma.

ROTH BROTHERS, Chicago, Ill., show a full line of direct-current motors, air compressors and blowers, as well as one of their vertical direct-current motors and some buffing and grinding motors. They also exhibit a motor and controller for printing presses. In this booth also is shown the Economy automatic water system, which furnishes water without the use of a roof tank for buildings where the city pressure is inadequate. The Economy submergible lake pump is also shown here. These pumps discharge into the sewer from basements which are below the sewer level. The motor is claimed to operate under most adverse conditions, even that of being 10 ft. to 15 ft. under water.

SHELTON ELECTRIC COMPANY, Chicago, Ill., is exhibiting at its booth a complete line of the Shelton vibrators and vibrator accessories. The Shelton devices include several notable improvements over what has ever before been shown. Among the most recent vibrator attachments which this company has placed on the market is the Shelton electrical razor, which is designed to be used in connection with the Twentieth Century vibrator. This razor has a weight of about 3½ oz. Inside of the handle of the razor is located a rotary eccentric which gives the blade a vibratory movement sufficient to cut the hair as the blade is drawn down across the beard. The razor is similar in design to the ordinary safety razor. Other new devices shown are the Shelton vibro hand massage instrument, which is designed especially for the use of osteopathic physicians, and the Shelton Marcel vibrator, which is manufactured expressly for manicurists and for use in hairdressing parlors. The company is giving continuous demonstrations of the various vibrator instruments which it manufactures.

SIMPLEX ELECTRIC HEATING COMPANY, Cambridge, Mass., is showing a complete line of electric-heating appliances, including a number not heretofore shown. Among these are a circulation water heater, which may be attached to any kitchen or range tank; a special glue pot for use by cabinet makers; special designs of food warmers and a complete line of chafing dishes, percolators, teakettles and various sizes of range and cooking combinations. During the progress of the show Mrs. Gans, a domestic science expert, gave practical demonstrations of cooking by electricity. Practical demonstrations of ironing by electricity were also made. The company was represented by H. R. Hixson, J. N. Macalister, J. G. Brobeck, W. F. Hruby, George Plachek, James De Han and E. R. Jacobs.

STANDARD VACUUM CLEANER COMPANY, Chicago, Ill., is exhibiting a line of portable vacuum cleaning apparatus of convenient type which may be carried about in the hand. The entire outfit is enclosed in a cylindrical metal case measuring 10 in. x 18 in. It is operated by a universal motor of 1/6 hp, which is enclosed in the case. The booth is in charge of A. H. Lanphear, assisted by George Clements and C. W. Hayes.

STOLTZ ELECTROPHONE COMPANY, Chicago, Ill., is showing the Stoltz electrophone, which is a sensitive portable telephone which enables deaf people to hear ordinary conversation. The Stoltz opera and church electrophones and the Stoltz stenographone are also exhibited. This latter type of apparatus is used in letter dictation and for communication between rooms. It is designed for the use of busy men, who by its aid can sit at their own desk and dictate letters to a stenographer in another room.

STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., has an exhibit of the telephone apparatus manufactured by the company, which includes the various types of generator call and central-energy instruments for different kinds of service. Two prominent displays of this exhibit are mounted on panels, which form the background of the booth. One of the panels, completely wired and ready for operation, is devoted to the company's new line of central-station intercommunicating telephone systems. The other panel is arranged to display a complete equipment of the company's selective alarm railway telephone dispatching system, and includes the dispatcher's office equipment and several local station equipments with telephone instruments and semaphore signals connected. This exhibit is completely wired and shown in operation for demonstrating purposes. Two hexagonal revolving display turrets are located in the booth upon which are mounted various types of telephones. One set of these turrets are located generator call telephones and the other are located central energy telephones. These displays are such as are used for rural telephone operation and for general office and house installations. In addition to these the company is showing several [illegible] switchboards, of the smaller [illegible] gravity drop magneto switchboard and a lamp line private branch switchboard. All of these [illegible] are wired and connected up so that they may be rung [illegible] to attract the attention of visitors passing the booth. The representatives of the company in attendance are A. M. Haubrich, H. C. Slemin and Ben C. Hyde.

Swedish Electric Vibrator Company, Chicago, Ill., is showing a complete line of electric massage vibrators of both the current and battery types. Special attention is being called to the motor vibrator, which weighs but 24 oz. This vibrator will operate equally well on direct or alternating 110 or 120-volt, 60-cycle current, with practically no vibration in the handle. It has a brush-shifting device for regulating from high to low speed. The vibrator is sold in a portable case containing six different applications, with a complete equipment of accessory apparatus. The company's booth is in charge of professional lady attendants, giving practical demonstrations of the devices.

Swedish-American Telephone Company, Chicago, Ill., has on display at its booth samples of its exchange telephones, switchboards, telephone tables and many samples of the parts which are used in the manufacture of its telephone apparatus. Among the new apparatus brought out by this company is a desk telephone rigidly mounted on the top of a small mission table, with a small mission stool to match. The auxiliary apparatus for this telephone is mounted on the under side of the hinged top of the table, so as to be readily accessible. When the stool is not in use it can be pushed in underneath the table, and in this position is held clear of the floor by guides. The representatives at the booth are calling attention to the fact that the company is building a new telephone-manufacturing plant at Waterford, Ont., where telephone apparatus sold in Canada will hereafter be manufactured. This building, which is to be 60 ft. x 250 ft. in size and two stories high, will be ready for operation about March 1. The representatives of the company at the Electrical Show are E. B. Overshiner, O. V. Overshiner, W. O. Rhode and Fred Seeley.

Taussig & Babcock, Chicago, Ill., are showing a small Kerr turbine direct-connected to a 5-kw Burke generator, as well as a switchboard on which is mounted a number of American intruments. They are also showing a special generator designed for furnishing electric light and spark-ignition for automobiles. This generator is designed to be geared to an automobile engine in the same way that a magneto is usually attached and delivers constant current within limiting speeds. Other devices shown by the company are a Warner friction clutch of the constrictor type, Condit circuit-breakers and samples of the Automatic Switch Company's motor-controlling apparatus. F. R. Babcock, Mr. Taussig and P. R. Fisher are in attendance.

Thomas & Smith, Chicago, Ill., is exhibiting in a part of the booth occupied by Roth Brothers an automatic electric water system. This system consists of a two-stage centrifugal pump direct-connected to a Roth electric motor, a steel compression tank and an automatic controlling switch. The system is devised for furnishing water automatically to buildings without the ordinary roof tank. M. I. Weil represents the company.

Thordarson Electric Manufacturing Company is exhibiting electric laboratory appliances, bell-ringing transformers and small transformers for operating electric signs; also induction coils and automobile and stationary gas and gasoline engine coils. A full line of electrical toys is also exhibited. These toys are operated by small transformers. The booth is in charge of C. H. Thordarson, assisted by John Beenan and A. J. Johnson.

United Pump & Power Company, Chicago, Ill., is showing two complete installations of the Perry pneumatic water system. One of these installations consists of a No. 14 Perry pneumatic pump, installed in an open tank, which is meant to represent a well. In connection with this installation is a 300-gal. air storage tank. The air for this tank is supplied by a single-acting 6-in. x 6-in. "Granite" compressor, driven with a 3-hp Wagner electric motor. This motor is started and stopped automatically by a Perry automatic controller, patents on which have but recently been granted. The controller is connected with a starting box which throws the motor in circuit and leaves it so until a desired pressure is secured in the tank, when the motor is automatically stopped. The other exhibit shown is a No. 6 Perry pneumatic pump. This pump is installed in a glass tank in such a way that its operation can be plainly seen from the outside. The air tank has a capacity of 100 gal., the air being supplied by a double-cylinder Perry air compressor which is driven by a ½-hp Wagner motor. The company is represented at the show by Mr. Thomas O. Perry, Mr. George C. Huppertz and Mr. L. S. Landis.

Vulcan Electric Heating Company, Chicago, Ill., is exhibiting its full line of soldering and branding irons and curling irons. The object of this company has been constant perfection of its present line of apparatus. F. J. Holmes, W. J. Miskella and W. M. Williams are in charge of the exhibit.

Wagner Electric Manufacturing Company, St. Louis, Mo., is exhibiting for the first time its latest model of a single-phase alternating-current motor, and also one of its latest models of polyphase alternating-current motors. The company also is showing samples from its complete line of various types of alternating- and direct-current instruments, including its ammeters, voltmeters, power-factor meters and wattmeters in direct and alternating current. The instruments manufactured by this company are made in almost any desired type. There is also on exhibition a flaming arc-lamp transformer which is designed for installations of single flaming-arc lamps on 110-volt direct-current circuits. The booth is in charge of F. N. Jewett, C. B. Richardson and C. C. Warner. W. Robbins and W. A. Layman, of the company, are occasional visitors to the exhibit.

Western Insulation Company, Chicago, Ill., is exhibiting at its booth, mica manufactured into commutator rings, commutator bars and segments, mica tubes, and a general supply of mica for insulation purposes as manufactured by the Chicago Mica Company, of Valparaiso, Ind. The company will also show the raw mica products of Watson Brothers, Boston, Mass., and the insulating cloths, papers, tapes, etc., of the Irvington Varnish & Insulation Company, of Irvington, N. J., and samples of the fibro products of the Wilmington Fiber Specialty Company, of Wilmington, Del. The company is represented by F. T. Finney, E. M. King and A. R. McNally.

Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has an exhibit which includes several of its new line of shell type distributing transformers. These transformers are of approved design and are manufactured from a high grade of alloy steel. The line shown includes transformers of from 1- to 50-kw capacity, and are designed to be used on current having a frequency of from 50 to 133 cycles. Demonstrations are made on a small transformer which shows the assembled coils. The company also has on exhibition samples from its line of electric flatirons, which are designed for every class of work. Samples of small fans for telephone booths and fans designed for most every other desired purpose are being shown. Special attention is called to the company's new line of luminous and non-luminous electric-heating coils, and to its electric glue pots and chocolate warmers, the latter being intended for the use of confectioners. In addition to this, the company is showing a line of small horse-power motors for use on direct and alternating current. These motors are for use on sewing machines and jewelers' buffing machines and for many other similar purposes. The company is also showing small power motors, ranging in capacity from 1/20th to ¼ hp each; also a new type of single-phase motor which is built in capacities up to 5 hp, and several types of polyphase induction motors which in stock range from one up to any horse-power desired. Other devices shown are a number of direct-current motors, motor-starting devices, battery-charging outfits and metallic flame and other types of arc lamps. The company is represented at the show by T. P. Gaylord, E. M. Bischoff, J. W. Busch, H. H. Caughlin, Stephen Gardner, Ivan Hennings, W. D. McDonald, Malcolm McNeil, A. L. Millard, A. M. Miller, R. H. Moore, S. G. Peticolas, W. R. Pinckard, C. W. Regester, R. F. Schaulin, J. M. Schilling, Charles Talbott, J. W. Lewis, C. B. Humphrey, G. B. Griffin, S. L. Nicholson, C. S. Cook, J. C. McQuiston, C. C. Chappelle.

Weinsheimer Company, Chicago, is showing two 10-watt flaming-arc lamps connected in series and operating on 110 volts; also one alternating-current and one direct-current lamp exposed to show the mechanism. This company is also exhibiting the Roller Smith Company's air-brake circuit-breaker and a Hartman three-pole oil circuit-breaker. The company is represented by W. E. Weinsheimer, Edgar Switzer and A. P. O'Hara.

WESTERN ELECTRIC COMPANY, Chicago and New York, is showing a representative line of common battery and magneto telephone apparatus, including desk and wall instruments, coin collecting boxes, bells, howlers, condensers, telephone protectors, etc. Several different styles of intercommunicating telephones suitable for interior systems and isolated plants are exhibited; also a number of special telephone sets, including railway composite sets, linemen's test sets, U. S. Navy battleship telephones and also iron box telephone stations, as furnished for the City of New York High Pressure Fire Service Telephone System, and the U. S. Life Saving Service. On one side of the booth telephone systems suitable for railway train dispatching are shown, including Gill and Wray and Cummings selectors and station machines, train dispatcher's telephone sets and instruments for station agents and tower men's use. The company is represented by C. H. Starkweather, Jr., W. H. Tompkins, J. H. Finley and C. L. Howk.

Automatic Thermal Cut-Out for Electric Flatirons.

The Pacific Electric Heating Company, Ontario, Cal., is exhibiting at the Chicago Electrical Show for the first time its improved automatic cut-out electric flatiron. The iron is substantially the same as that the company has been manufacturing for the last five years, with the exception of an automatic cut-out device, which can be applied to any of the irons that have been made by the company. The automatic feature is entirely mechanical. In the space between the heating units at the back part of the iron there is located a small perforation containing a metal which softens with excessive heat and also a spiral-shaped metal spindle. When the iron overheats the metal in the well softens, allowing the spindle to revolve, thereby releasing a spring, attached to the upper portion of the iron



AUTOMATIC THERMAL CUT-OUT FOR ELECTRIC FLATIRONS.

just under the handle, which disconnects the current from the iron by throwing the switch plug entirely out of the socket. The spring is thoroughly insulated with asbestos from the lower portion of the iron, so that it cannot, it is claimed, get hot enough ever to cause it to lose its tension. To replace the switch plug it is necessary to use considerable pressure. The spring re-engages with the spindle as soon as the metal in the well has hardened sufficiently to keep the spindle from turning, and the plug is then allowed to take its normal position in the socket, thereby again throwing the iron in circuit.

These irons have been in practical service in many laundries for several months and it is stated that without exception the users have furnished reports which indicate that the mechanism is sure to work in every instance and is in no way affected by constant heating. The company claims that there is no deterioration shown in the irons that have been equipped with the automatic cut-out mechanism and that this device will absolutely protect the iron against the usual burnouts.

Making the Smoke Record Its Own Misdoings

Careless firing is of course chiefly responsible for objectionable smoke from steam-boiler plants, but in combating this nuisance trouble has been experienced from the fact that the fireman does not know, from actual observation, whether his chimney is smoking. He has no time to go out and look at the stack frequently, and unless some other person notifies him he may permit the chimney to smoke for some time, entailing a fine from the smoke inspector, perhaps, and at any rate indicating uneconomical firing.

To bring to an end this state of affairs, Messrs. W. R. Bonham and William L. Weber, of Chicago, have invented an automatic smoke indicator and recorder which is novel and of some interest. In the breeching, just before it enters the stack, is introduced a perforated ring of piping or other means of taking out a small amount of the gases and other products of combustion which shall be a fair sample of the contents of the breeching throughout all its area. This ring is connected to a small pipe, to which is attached a small blower. The pipe is led around to the boiler front and terminates in a miniature smokestack on the firing floor, literally at the fireman's elbow. The draft in the pipe is carefully regulated in comparison with that of the stack, so that the smoke, if any, escaping from the little pipe in the boiler room is exactly the same, proportionally, as that discharged into the atmosphere perhaps 200 ft. above.

Obviously, the fireman has but to glance at his own little stack to see what is "doing" in the smoke line at the top of the big chimney for which he is responsible. He will perceive the smoke issuing from his pipe about a minute or a minute and a half before it reaches the top of the outside stack and can at once adjust his dampers or otherwise stop the smoke.

Further, the pipe from the breeching can be conducted to the office of the manager or chief engineer, on its way to the fireman's floor, and in these offices a glass bowl can be connected in the pipe, so that the man in charge can see at any moment whether smoke is passing into the chimney by simply looking at the glass tell-tale, without leaving his desk.

A valuable feature of the invention is the making by its aid an actual record of the smoke escaping from the stack for each 24 hours, by night, when it would be invisible, as well as by day. A jet is taken off from the little pipe in the boiler room, and this impinges on a tape or appropriately marked sheet revolved by clockwork. This record may be chemically prepared or merely covered with some sticky substance to hold mechanically the particles of carbon forced upon it by the jet from the miniature smokestack. By this means there will be an actual, visual record of the smoke issuing from the chimney for 24 hours, a black line on the tape showing the time and also indicating, by its heaviness or faintness, the amount of smoke escaping.

Chicago is said to have 17,000 steam-boiler plants, and as nearly all of them burn soft coal, its smoke problem is a serious one. Recently Mr. Bird, the chief smoke inspector for the city, addressed the Electric Club on the subject. He said that a smoke indicator or gage would be a great boon. Comparatively few inspectors would then be needed, for all that would be necessary would be to visit the plant occasionally, see that the apparatus was working properly and inspect the records. Mr Bonham, who was present, explained the principle of the new device. Mr. Bird had never heard of it, but he was pleased with the plan, although somewhat surprised with the unexpectedly prompt response to his appeal for an invention.

All the details for the apparatus have not been worked out, but [illegible] and simple as the idea is, there seems to be no anticipation, and it is believed that [illegible]

[illegible] will appeal to the plant owner as well as to the city authorities. The device will enable him to judge the work of his firemen and to protect himself against wrongful accusation of producing smoke. Moreover, the plant that does not smoke is the economical plant.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

General business conditions during the past week appeared to be considerably better than at any time since the beginning of the year. The prevalence of cold weather, together with the extensive post-holiday reduction sales, has done much to move a considerable amount of retail stock. The effect of this is felt among the wholesalers and jobbers by rather liberal re-orders. Spring orders have also been coming in with greater freedom and, while there is a tendency to conservatism on the part of the buyers, there is no doubt that a great deal more business is being actually done than has been transacted at any time within the past two months. The agitation of the tariff is doing something to restrict trade in many lines, and in some instances orders are being placed with provisional attachments that prices shall be regulated according to the tariff after the new bill is agreed upon. This class of business is not popular with jobbers because it leaves them uncertain as to the actual volume of their trade. It is only sanctioned where buyers of considerable quantities insist upon it. While the present severe weather, which has prevailed all over the West, has stimulated trade, it has also retarded shipments to a considerable extent and has blocked business in many rural sections. This may have some effect upon railroad earnings for the immediate weeks that it has prevailed, but as a rule the reports that are now coming in from the roads are the most favorable since the period of depression began in October, 1907. Reports for the latter part of December and for the first week of January show substantial gains, not only over the similar weeks of the year previous, but also over the average of the fall of 1908. Collections are very satisfactory all over the country, except in the heavy cotton growing portions of the South. In these localities the fact that the planters have not yet parted with their 1908 crops, owing to dissatisfaction over the prevailing price, has done much to limit the ability of the country merchants to meet their obligations. In the iron and steel trade all lines continue to be very dull. The tariff agitation seems to have a more serious effect upon this branch of industry than upon any other. Very few sales of pig iron are being made, and orders for finished material are coming in very slowly. The railroads, which are usually the heaviest buyers in January, are laggards this year. Rail orders which were anticipated for the early part of 1909 have not materialized. During the past week the New York Central sent out inquiries for 80,000 tons of steel rails and the Hill lines announced that specifications were ready for about 30,000 tons. So far as reported, neither of these orders has been placed as yet. It appears to be the policy of our conservative railroad managers to await full assurance of returning business before incurring additional liability. Reports from the building industry for 1908 as gathered by *Bradstreet's* for 83 of the principal cities of the United States, show a decrease of 10 per cent from 1907 and of 17 per cent from 1906. The monthly and quartely returns show that while the year began badly, there was a steady growth of building in the fall. The amount of building done in December, 1908, was considerably greater than in December, 1907, indicating that conditions in this line are gettting back to normal. Business failures for the week ended Jan. 14, as reported by *Bradstreet's*, were 319, against 329 the previous week, 431 in the like week of 1908, 234 in 1907, 279 in 1906 and 304 in 1905.

THE COPPER MARKET.

The copper market during the past week has been inactive and prices have shown an inclination to recede. In fact, quotations at the end of the week averaged about ¼ of a cent less than at the beginning of it. This is due to the fact that the heavy holdings of the European speculators have been to some extent liquidated. It is estimated that there is carried, on the speculative account in Europe, between 80,000,000 and 100,000,000 lb. With the tightening of the money market in financial centers abroad the burden of carrying this vast amount of metal becomes onerous. Added to this condition is the growing belief that the figures heretofore published concerning the stocks on hand in this country are practically correct. At the beginning of the year the best statisticians calculated that there was on hand, in this country, about 213,000,000 lb. These figures were vigorously denied by both the producers and the selling agencies, but as the returns from the smelters continued to come in, it seemed evident that they were not very far wrong. From government reports and from other data it is apparent that there came into the market in America, during 1908, from mine production and imports, something like 1,130,000,000 lb. The exports were 650,000,000 lb. The consumption was certainly less than 400,000,000 lb.—the government figures are 372,000,000 lb. This added to the known stock at the beginning of the year which the government statistics say was 126,000,000 lb. put the present surplus at something like the figures first named. While it is a recognized fact that the copper market is controlled by strong interests for the benefit of the copper stock market, speculators are timid about taking hold. The very uncertainty which has heretofore surrounded all copper statistics has been an advantage to the speculative element. With definite information as to production, such as it is now planned to furnish, the speculator will have little chance to do more than follow the natural trend of the market. At the meeting of the Association of Copper Producers, which was held last week, it was decided that Mr. L. C. Graton, of the United States Geological Survey, should be given charge of the collection and tabulation of copper statistics. Mr. Graton will not resign his position with the government unless the Department considers that his new work is inconsistent with public duties. If that is the case, he will resign and take up the statistical work for the copper producers. It will certainly be a satisfaction to have weekly and monthly statistics of production that are known to be fairly accurate. During the past week there has been little copper bought by the consumers. There is not a great deal of work being done by the electrical companies, and all of the larger concerns are fairly well stocked with metal. Speaking of the future, Mr. John Stanton, who is recognized as an authority among Lake Superior producers, declared that while he considered the present market unusually flat he was still anticipating large orders from equipment companies and for the electrification of railroads. Admitting that these orders were somewhat problematical, he still said that the copper producers were not despondent, but expected an early reawakening of the trade. Exports for the month of January, including Jan. 18, have been 12,600 tons. Quotations on the Metal Exchange on the date mentioned were:

Lake	14¼ @ 14⅜
Electrolytic	13⅞ @ 14
Castings	13¾ @ 13⅞

The London market was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	60 7 6	60 5 0
Standard copper, futures	61 7 6	61 3 9
Market	Weak.	Weak.
Sales of spot		1,200 tons
Sales of futures		1,900 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.55	14.45
Electrolytic	14.25	14.05
Casting	14.12½	13.95
London, spot	£64 2 6	£60 5 0
London, futures	64 17 6	61 3 9
London, best selected	67 15 0	65 6 0

HOTEL FIXTURES.—An American Consul in the Far East reports that a company in that region will shortly be ordering furniture and equipment for two hotels which it expects to finish in a few months, and he suggests that the company be furnished with catalogs and net price lists of hotel equipment and furniture, especially in bath-room and sanitary equipment, heating plants, electric-light fixtures, etc. The company also proposes to furnish quite elaborately the president's office and a room for meetings of the board of directors. Address to which catalogs and correspondence should be sent can be obtained from the Bureau of Manufactures, Washington, D. C.

FAN AND BLOWER CONSOLIDATION.—The American Blower Company, of Detroit, Mich., announces its consolidation with the Sirocco Engineering Company, of New York, through negotiations carried out by President James Inglis of the former concern. Mr. S. C. Davidson of the parent "Sirocco" fan works, Belfast, Ireland, is financially interested in the deal. The factory of the Sirocco Engineering Company at Troy, N. Y., and the plants of the American Blower Company, Detroit, will continue in full operation under one management, and the home office will be at Detroit. In anticipation of a general improvement in business, also the necessity for increased foundry facilities, and the consummation of the "ABC"-"Sirocco" consolidation, the American Blower Company purchased outright during 1908 the complete foundry and plant formerly operated by the Northwestern Foundry & Supply Company, Detroit. The large triangular-shaped property owned and occupied by the American Blower Company since about 1881, being entirely covered by buildings by the completion in '07 and '08 of a large steel plate fan shop and office addition, the company purchased recently a large tract of land across the street, upon which it is expected new buildings, covering approximately 175 x 300 ft. will be erected. All business will hereafter be transacted under the style and name of American Blower Company at Detroit. Mr. James Inglis, the president of the new company, has been at the head of the American Blower Company; Mr. William C. Redfield, the vice-president, was president of the Sirocco Engineering Company; Mr. Charles H. Gifford, the treasurer, was until about a year ago general manager of the B. F. Sturtevant Company, and has had perhaps the longest experience of any official at present engaged in this line; Mr. Still, the secretary, is well known among engineers as chief engineer of the American Blower Company.

PRODUCER-GAS POWER EXTENSIONS.—The Compania Azucarera del Panuco, Tampico, Mexico, has placed an order with the Westinghouse Machine Company for a complete producer gas-electric power plant. This initial installation will consist of a vertical three-cylinder, single-acting engine and a 150-hp suction producer, to operate on small anthracite coal. Even larger sizes of producers of the suction type are contemplated by the builders. The New York Standard Watch Company, of Jersey City, N. J., also operates a suction producer plant of considerable size, and recently added another unit. A number of contracts have been let for gas engines operating temporarily on natural or illuminating gas, with the intention of later changing over to producer-gas operation. A 200-hp plant has been ordered by Seaver & Company, Chelsea, Mass., and by the Cambridge Gas Company, Cambridge, Md. The Shelbourne Falls (Mass.) Electric Light Company has adopted the power-gas system and has ordered a 175-hp Westinghouse suction producer for anthracite coal.

MOTION PICTURE COMBINE FORMED.—Plans for the combination of the two competing concerns manufacturing films for motion pictures have been completed and the consolidation, called the Motion Picture Patents Company, will begin business with a capital stock of $15,000,000. The two competing companies which have been invited were the Edison Company, called the "association," and the Biograph Company, which had been known as the "independent." Litigation over minor inventions has been going on between these two companies for years without any definite result. The new company takes over all the patent rights controlled by the Edison, Biograph, Jenkins, Pross, Vitagraph and Campbell companies. All the pictures of the new company, it is said, will be controlled by the Film Service Association. Under the proposed plans it is said that films will no longer be sold outright to show managers, but only rented. It is expected that the new arrangement will affect at least 50 per cent of the moving-picture shows in New York City.

WESTINGHOUSE ENGINE ORDERS.—The steam engine business of the Westinghouse Machine Company has been fairly active. Some of the contracts recorded in the last few months are as follows: Byron Jackson Iron Works, San Francisco, Cal., three compound engines for centrifugal pump drive; Kentucky State Hospital, Frankfort, Ky., three compound engines for central light, heat and power plant; Central Islip Hospital, Central Islip, L. I., two engines, and the Johns Hopkins Hospital, Baltimore, Md., three engines, both for isolated plants; Chicago, Minneapolis & St. Paul Railroad, one engine for railroad shop plant; T. A. Gillespie Company, contractors, one engine for construction work; Black Hills Traction Company, Deadwood, S. D., one engine for railway power plant.

UNITED FRUIT COMPANY INSTALLING WIRELESS.—Mr. M. Musgrave, chief of the wireless department of the United Fruit Company, announces that within the next six months practically every ship running out of New York, Boston, New Orleans and Mobile will be equipped with both wireless telegraph and telephone apparatus. Mr. Musgrave says that the big high-power wireless station at San Antonio, Cuba, will be ready for operation the latter part of February. It is guaranteed to have a radius of 600 miles in any kind of weather and of 1000 miles in favorable conditions. This is the most extensive of the United Fruit Company's stations. The others, located at Swan Island, Bluefields, Rama, Port Limon, Bocas del Toro and New Orleans, have maximum radii of about 250 miles.

FOREIGN TRADE.—The total merchandise imports for the year 1908 reached the sum of $1,116,402,243, and the exports $1,753,307,931, leaving an excess of exports of not less than $636,905,688, which is by far the largest in the history of the country, exceeding 1907 by more than $136,000,000. At the same time the contraction of international trade is shown by the fact that the total of imports and exports was $2,809,710,174 in 1908, whereas in 1907 it was $3,346,596,025. The excess of exports in December was $76,857,586.

UTILIZING SPARE POWER.—Mr. R. D. Kehrer, general manager of the Eagles Mere Light Company, Eagles Mere, Pa., writes us that the corporation has a water power plant of 490 ft. head, and has about 200 kw to dispose of, which it could furnish continuously. The water supply is practically constant, as there is a large lake for storage. The company is looking around for a consumer of its surplus and is investigating electrochemical industries as to nature of business, supply of raw materials, etc.

ELECTRIC SIGNS.—The U. S. Consular Reports note as follows: "A special inquiry has been received at the office of an American Consul from a British firm, requesting the names of American houses making a specialty of electric signs, either for inside or outside use. The electric work must be suitable for high voltage, and if satisfactory arrangements can be made the firm is of the opinion that good business will result."

CATALOGS WANTED.—The technical department of Bryant & Stratton College, Buffalo, is establishing a library and reading room for its students and requests to be placed on the mailing list of electrical manufacturing companies and supply dealers. All catalogs, etc., received will be kept on file for reference.

NEW WOOD ARC LAMP.—The Fort Wayne Electric Works are developing a new type of arc lamp, the latest invention of John J. Wood, factory manager of the works, and the inventor of the well-known line of Wood dynamos, motors and lamps. The new lamp will use metallic oxide electrodes.

Financial Intelligence.

THE WEEK IN WALL STREET

When you come to consider the stock market during the past week you must consider the money market. As far as prices are concerned the money market has not counted very much, but it is really the only thing which the people in Wall Street are now talking about. The present money market at home is very little changed and therefore there is no practical reason [illegible] market abroad is a serious proposition. It is already understood that the Russian loan will amount to $278,000,000. While [illegible] and apparently plentiful. The only effect of the European [illegible] then down, with no material changes in any issue. The general tendency has been toward lower levels, but some stocks have shown strength and some have been weak without any apparent explanation in the technical conditions of the market. The entire week indicates that the professionals are still in charge,

and while it may be that they have permitted temporary recessions, a permanent break is hardly probable. The reports from the railroad companies show that during the last three months of 1908 there was a material increase in the volume of business. Doubts concerning the ability of the Erie Railroad to push through its reorganization program had a bearish effect upon the market, but the fact that Erie stock at best was dealt in to a limited extent restricted this influence. There has been very little improvement in the business world and on that account the minor fluctuations in the stock market do not mean much except the desire to buy or to sell which is indulged in by the speculators. Commercial business has not as yet returned to normal conditions, by at least 40 per cent. The iron and steel business has been conspicuously dull, and while the stock of the United States Steel Corporation has shown little weakness it is not because there has been a great amount of new business booked. These stocks while they represent actual money invested, are, as a matter of fact, the most speculative stocks on the market. They can be handled, and they are handled, by the professionals. The market, it may be said, is in a condition of abeyance. It is waiting for the next thing to turn up. It may be that a great increase in business, cheap money and a great desire on the part of outsiders to invest would bring about a large boom. It might be, on the other hand, that the absolute retirement of outsiders and the withdrawal of the professional support which large financial interests in Wall Street have undoubtedly afforded would mean a market decline. Taken altogether the Wall Street proposition is a problem and the fellow who guesses it right may be rich and the fellow who guesses it wrong will be broke. Stocks on Jan. 18 were inactive and prices were inclined to sag. There was an unaccountable activity in New York Central, but at the close the price was lower than at the opening. The money market was not active and rates were very cheap. Call loans were quoted at 1½ @ 2 per cent and 90-day paper at 2¾ @ 3 per cent. The quotations in the table are those of the close Jan. 18.

NEW YORK.

	Jan. 11.	Jan. 18.	Shares sold.		Jan. 11.	Jan. 18.	Shares sold
All.-Ch.	15	14⅞	1,400	Int.-Met., pfd.	43¼	45½	118,800
All.-Ch., pfd.	47¼	47¾	1,970	Mackay Cos.	75*	75	100
Amal. Cop.	81½	78	135,945	Mackay Cos., pfd.	69½	70*	100
Am. D. T.	35*	35*	———	Manhattan Elev.	150	151*	783
Am. Loc.	55⅜	56	8,115	Met. St. Ry.	34¼	24	600
Am. Loc., pfd.	111	111*	400	N.Y. & N.J. Tel.	113	113*	90
Am. Tel. & Cbl.	78*	76½	150	Steel, com.	51¾	52¼	251,627
Am. T. & T.	126⅝	126	8,470	Steel, pfd.	112⅞	113¾	12,000
B. R. T.	68⅜	70¼	141,145	W. U. T.	68¼*	68¾*	750
Gen. Elec.	155½	155½*	4,380	West'h., com.	84	81	6,670
Int.-Met., com.	15⅜	16⅛	38,760	West'h., pfd.	120*	115	———

PHILADELPHIA.

	Jan. 11.	Jan. 18.	Shares sold.		Jan. 11.	Jan. 18.	Shares sold.
Am. Rys.	45½	45	———	Phila. Elec.	11¾	11⅝	———
Elec. Co. of A.	11⅛*	11⅛*	———	Phila. R. T.	26	26	———
Elec. Stor. B'ty.	44	44	———	Phila. Traction.	91¼	91	———
E. S. B'ty, pfd.	49*	49*	———	Union Traction.	52⅛	52¼	———

CHICAGO.

	Jan. 11.	Jan. 18.	Shares sold.		Jan. 11.	Jan. 18.	Shares sold.
Chi. City Ry.	180*	180*	———	Chi. Tel. Co.	128	127⅛	———
Chi. Rys., Ser. 1.	116*	116*	———	Met. El., com.	17*	17*	———
Chi. Rys., Ser. 2.	45½*	45½*	———	Nat'nal Carbon.	84½	84	———
Com. Edison.	108	108	———	Nat. Carb., pfd.	112*	110	———
Chi. Subway	27⅛	26⅞	———				

BOSTON.

	Jan. 11.	Jan. 18.	Shares sold.		Jan. 11.	Jan. 18.	Shares sold
Am. Tel. & Tel.	126½	126¼	———	Mex. Tel.	2½*	2½*	———
Cum. Tel.	126*	128	———	Mex. Tel., pfd	5½*	5½*	———
Edison El. Ill.	247¾	246	———	N. E. Tel.	131	130	———
Gen. Elec.	156	156*	———	W. Tel. & Tel.	8*	8*	———
Mass. Elec. Ry.	11¾	12	———	W. T. & T., pfd.	81*	82	———
Mas. E. R., pfd.	59	59½	———				

*Last price quoted.
Shares sold are for week Jan. 11 to Jan. 16.

DIVIDENDS.

Big Bend Light & Power Company, Spokane, Wash., quarterly, 2 per cent.

Butte Electric & Power Company, Butte, Mont., quarterly, preferred, 1¼ per cent., payable Feb. 1.

Commonwealth Edison Company, Chicago, Ill., quarterly, common, 1½ per cent, payable Feb. 1.

East St. Louis & Suburban Railway, East St. Louis, Ill., quarterly, preferred, 1¼ per cent, payable Feb. 1.

Electric Company of America, Philadelphia, Pa., semi-annual, common, 3½ per cent, payable Feb. 3.

Electric Bond & Share Company, New York, N. Y., quarterly, preferred, 1¼ per cent, payable Feb. 1.

Grand Rapids (Mich.) Railway, quarterly, preferred, 1¼ per cent, payable Feb. 1.

Havana (Cuba) Electric Railway, quarterly, common, 1 per cent, payable Feb. 15.

Havana (Cuba) Electric Railway, quarterly, preferred, 1½ per cent, payable Feb. 15.

Jacksonville (Fla.) Electric Company, semi-annual, common, 3 per cent, payable Feb. 1.

Jacksonville (Fla.) Electric Company, semi-annual, preferred, 3 per cent, payable Feb. 1.

Manhattan Electrical Supply Company, New York, N. Y., semi-annual, common, 3 per cent, payable Feb. 2.

Manhattan Electrical Supply Company, New York, N. Y., semi-annual, preferred, 3 per cent, payable Feb. 2.

Mexican Telegraph Company, New York, N. Y., quarterly, common, 2½ per cent, payable Jan. 15.

Michigan State Telephone Company, Detroit, Mich., quarterly, common, 1½ per cent, payable March 1.

Michigan State Telephone Company, Detroit, Mich., quarterly, preferred, 1½ per cent, payable May 1.

Milwaukee Electric Railway & Light Company, Milwaukee, Wis., quarterly, preferred, 1½ per cent, payable Jan. 31.

Minneapolis (Minn.) General Electric Company, quarterly, common, 2 per cent, payable Feb. 1.

Minneapolis (Minn.) General Electric Company, quarterly, preferred, 3 per cent, payable Feb. 1.

Montana Independent Telephone Company, Helena, Mont., quarterly, common, 1 per cent, payable Feb. 1.

New Hampshire Electric Railways, Haverhill, Mass., semi-annual, preferred, 1 per cent, payable Jan. 30.

Philadelphia Company, Pittsburgh, Pa., quarterly, common, 1½ per cent, payable Feb. 1.

Railway & Light Securities Company, Boston, Mass., semi-annual, preferred, $3 per share, payable Feb. 1.

St. Regis Light & Power Compay, St. Regis Falls, N. Y., quarterly, 1 per cent, payable Jan. 15.

Shawinigan Water & Power Company, Montreal, Can., quarterly, common, 1 per cent, payable Jan. 20.

STANISLAUS ELECTRIC POWER COMPANY.—A dispatch dated San Francisco, Jan. 17, states that news was received from New York of the closing of a deal whereby the United Railways of San Francisco obtained control of the Stanislaus Electric Power Company for $5,000,000. Mr. Patrick Calhoun, president of the United Railways of San Francisco, confirmed this purchase over a month ago, a note to that effect appearing in this column in the issue of Dec. 19. The dispatch states that the United Railways will effect a saving of half a million yearly by the purchase in addition to controlling one of the largest power plants in the West. Messrs. Sanderson & Porter, of New York, are the engineers for the Stanislaus power project.

GREAT WESTERN POWER COMPANY.—The vast hydro-electric power plant of this company on the Feather River, in California, is near enough to completion to offer assurances of its ultimate success. The company, through its tunnel on the big bend of the Feather River, will ultimately, so it is claimed, develop 430,000 hp. The company has already built a power house and installed a plant capable of developing 40,000 kw, of which 10,000 is now being transmitted to Oakland, Cal., 165 miles distant. The financing of this company, which involved $10,000,000, has been satisfactorily accomplished and there is nothing now remaining except to complete the installation and find a market for the power. The market, it is said, has been found and all the power the company can furnish will be easily disposed of.

BIG BEND LIGHT & POWER COMPANY.—Mr. W. C. Stivyer, president of the Big Bend Light & Power Company, of Spokane, Wash., in his annual report to the stockholders says with regard to the extension of the work: "We are now completing plans for the development of our power site on the Spokane River, 12 miles below Little Falls, where we will first develop 15,000 hp and later increase to 20,000 hp. Work will be pushed rapidly in the spring."

NEW YORK & ONTARIO POWER COMPANY.—The Public Service Commission of the Second District of New York has authorized the New York & Ontario Power Company, Waddington, N. Y., to issue $600,000 stock and $1,850,000 of 30-year 5 per cent gold bonds. The company is developing an important water-power project on the St. Lawrence River at Waddington, St. Lawrence County.

UNITED WIRELESS TELEGRAPH COMPANY.—The United Wireless Telegraph Company, New York, N. Y., has made public the following balance sheet, dated Nov. 30, 1908:

ASSETS.

	1908.	1907.
Good will and patent rights	$5,005,100	$500,000
Treasury stock, preferred and common	5,310,420	6,659,110
Stocks and bonds, other wireless companies	14,128,610	12,459,263
Factory and equipment	25,997	23,405
Stations, boats and equipment	502,942	229,988
Furniture and fixtures	3,975	4,085
Cash accounts, receipts, inventories, etc.	294,183	241,612
Total	$25,272,219	$20,117,463

LIABILITIES.

Capital stock	$20,000,000	$20,000,000
Bills and accounts payable	15,556	117,463
Surplus	5,256,662	.....
Total	$25,272,219	$20,117,463

The items of patents and patent rights include patents and patent rights in wireless telegraphy, wireless telephony and the fog-phone. The item of stocks and bonds includes stock that gives the company control of the International Telegraph Construction Company and its factory, patents, etc. The item of factories and equipments includes the factories at Jersey City and Seattle.

ONTARIO POWER COMPANY.—E. M. Farnsworth & Company, Boston, Mass., offer for subscription at 97½ and interest a limited amount of first mortgage 5 per cent gold bonds of the Ontario Power Company, Niagara Falls, Ont., dated Feb. 2, 1903, and due Feb. 1, 1943. The interest on the bonds is payable February and August in New York and Toronto. The bonds are callable as a whole during the first 10 years at 110. They are secured by a first mortgage covering the entire property of the company. The bonds so far issued on the 66,000 hp now installed amount to $70.60 per horsepower, and a sinking fund of $1 per horsepower sold will be established, beginning July 1, 1909, to buy the bonds in the open market up to 110. The Ontario Power Company numbers among its customers the New York Central & Hudson River Railroad and the Province of Ontario. The net earnings of the company for 1909, based on contracts already closed, are estimated at $658,275, an amount more than twice the interest on the bonds outstanding.

MICHIGAN STATE TELEPHONE COMPANY.—The establishment of a 6 per cent annual dividend rate for the common stock of the Michigan State Telephone Company, Detroit, Mich., has attracted attention to the securities of that company. The Michigan State Telephone Company is the successor of the Michigan Telephone Company, which defaulted on the interest on its $5,000,000 of bonds in 1902 and whose property was sold in July of that year to the bondholders for $4,000,000. The company is now estimated to be earning from 13 per cent to 15 per cent on its outstanding common stock and shows an annual increase of more than 12 per cent in new stations, with property assets approximating $18,000,000. On Nov. 1, 1909, $1,250,000 of the company's 6 per cent bonds will mature, and it is reported that arrangements will be made to retire them by issuing $1,500,000 of the $2,500,000 stock still remaining in the treasury of the company.

KEYSTONE TELEPHONE COMPANY.—At the annual meeting of stockholders of the Keystone Telephone Company, Philadelphia, Pa., at Camden, on Jan. 12, a statement of earnings was presented, supplementing the report of the company for the fiscal year ended June 30, 1908. The report for the year ended June 30, 1908, showed gross earnings of $1,051,071, net earnings of $511,948 and a surplus of $98,836 after all charges. The supplementary statement presented on Jan. 12 was for the six months ended Dec. 31, 1908, and showed gross earnings of $528,237, net earnings of $266,459 and a surplus of $59,480 after all charges. Mr. Nathan Folwell, president of the company, explained that the earnings were all being used for extensions and improvements, and presented a statement showing that for the calendar year $183,963 had been spent in improving the plant and equipment, and that $30,000 of the 6 per cent collateral trust bonds had been retired.

MASSACHUSETTS LIGHTING COMPANIES.—Mr. Arthur E. Childs, president of the Massachusetts Lighting Companies, Boston, has sent out to the stockholders a statement showing the earnings of the companies during the past year. The returns for 1908 were satisfactory both for the gas and electric properties in spite of the general depression of business. The figures as furnished by Mr. Childs show a total income of $725,000, and a net income of $247,000. After paying fixed charges there was $165,000 left for dividends on the stocks. The trustees felt warranted in declaring an extra dividend of ¼ per cent which is payable with the regular quarterly dividend Jan. 15.

SAN FRANCISCO GAS & ELECTRIC COMPANY.—An injunction, to remain in force during the pendency of the suit brought by the San Francisco Gas & Electric Company against the city, has been granted by Judge Van Cleek, of the United States Circuit Court, at San Francisco, to restrain the city authorities from enforcing the 85-cent rate fixed by the ordinance passed last year. The order provides that all money in excess of the ordinance rate paid by consumers shall be placed in a depositary approved by the court, to draw interest and to be distributed to the consumers or the gas company, according to the finding of the court.

CHICAGO RAILWAYS COMPANY.—The Chicago Railways Company announces that, as successor through the Chicago Union Traction Company to the West Chicago Street Railroad and the North Chicago Street Railroad, it will redeem at 102 and interest on Feb. 1, 1909, the following equipment trust obligations issued by the West Chicago Street Railroad and the North Chicago Street Railroad: West Chicago Street Railroad—All of series C, Nos. 1 to 70; series B, Nos. 1 to 73, inclusive. North Chicago Street Railroad—All of series C, Nos. 1 to 38; series D, Nos. 1 to 40, both inclusive.

BARTLETTSVILLE (OKLA.) ELECTRIC LIGHT & POWER COMPANY.—This company at its last meeting voted to add to its equipment, as soon as possible, two twin tandem gas engines, direct-connected to 500-kw generators and to erect about five miles of new transmission lines covering the entire town. The total capacity of the plant will then be 1360 kw with two steam and two gas engines all in parallel. The financial report for the year 1908 shows gross earnings of more than $17,000 and net earnings of $9,362.

MANISTEE LIGHT & TRACTION COMPANY.—Mr. John P. Reynolds, Jr., has been appointed receiver of the Manistee Light & Traction Company, Manistee, Mich., by Judge Knappan, of the Federal Court, on application of the New England Trust Company, Boston, Mass., trustee of the first mortgage bonds. The company is alleged to have defaulted in the payment of taxes and interest and otherwise to have violated the provisions of the mortgage.

REPORT OF EARNINGS.

American Light & Traction Company, New York, N. Y.					
Year ended Dec. 31, 1908					
Year ended Dec. 31, 1907					
American Railways, Philadelphia, Pa.					
December, 1908					
December, 1907					
Chicago (Ill.) City Railway					
Eleven months ended Dec.					
Eleven months ended Dec.					
Detroit (Mich.) Edison Company					
Year ended Oct. 31, 1908					
Year ended Dec. 31, 1907					
Economy Light & Power Company, Joliet, Ill.					
Year ended April 30, 1908					
Year ended April 30, 1907					
Northwestern Elevated Railroad Company, Chicago, Ill.					
December, 1908					
December, 1907					
Sao Paulo Tramway, Light & Power Company, Ltd.					
November, 1908					
November, 1907					
United Railways, St. Louis, Mo.					
December, 1908					
December, 1907					

*Dividends and reconstruction reserve fund.

GENERAL NEWS

Construction News.

EUFALA, ALA.—The committee authorized to investigate the question of constructing a municipal electric light plant has been instructed to secure the services of an engineer to prepare plans and specifications for the same. Mayor McDowell is a member of the committee.

LEEDS, ALA.—A movement is on foot in this town to secure electrical service from the electric plant of the Standard Portland Cement Company and also to make connections with the telephone nad water works systems of the company.

HOT SPRINGS, ARK.—Plans are being considered by the Hot Springs Water Company for the installation of a 1500-kw water turbine. H. E. Martin is vice-president and manager.

LITTLE ROCK, ARK.—The Western Construction Company, of Minneapolis, Minn., has been awarded the contract for the construction of the proposed electric interurban railway of the Missouri-Arkansas Interurban Railway Company. The railway will extend from Joplin, Mo., to Bentonville, Ark., thence to Gentry, Tontitown and Springdale. A branch line will be built to Huntsville, Montene or Saloam Springs.

STUTTGART, ARK.—The Stuttgart Water & Light Company is making improvements to its plant necessary to provide for a 24-hour service, which will require the installation of additional machinery.

YELLVILLE, ARK.—Plans are being considered for the construction of an electric railway between Yellville and Rush Creek, electricity for which will be furnished by waterpower from Buffalo River, conveyed through a tunnel from Horseshoe Bend.

BERKELEY, CAL.—The Bay Counties Power Company is making arrangements to construct a new auxiliary power station in North Berkeley, which will practically be a duplicate of the substation just completed at end of Rose Street in the Berkeley Hills. The new station will do away with all the high-tension wires in Berkeley. The cost of the plant is estimated at $100,000.

CORONA, CAL.—The Corona Gas & Electric Light Company contemplates extending its transmission lines to the pumping plants to supply 1000 hp.

LOS ANGELES, CAL.—H. F. Vollmer has petitioned the City Council for a franchise to construct an electric railway on Fifty-fourth Street from Hoover to Dalton.

MODESTO, CAL.—The La Grange Light & Power Company has been granted a franchise by the Board of Trustees, for which it recently applied, it being the only bidder. The amount paid for the franchise was $225.

MODESTO, CAL.—Application has been made by the South San Joaquin Improvement Company to the Board of City Trustees for a franchise to construct and operate an electric railway in this city. It is proposed to grant the franchise, bids for which will be received until Feb. 17.

OAKLAND, CAL.—Plans have been completed by the Great Western Power Company for the erection of an electric power plant in Oakland, at an expenditure of about $1,000,000. Contracts for machinery have been placed. The proposed plant is to be used as an auxiliary to the Big Bend power station. It will be located on Sessions Basin. Contracts for piling and other preliminary work have been awarded to Healy, Tibbitts & Company, of Oakland, Cal. The first installation will provide for an output of 15,000 kw, with an ultimate expansion of 40,000 hp. Oil will be used for fuel. It is expected to have the plant in operation in about seven months.

PLACERVILLE, CAL.—Notice of appropriation of 2000 cu. in. of water in the North Fork of Cosumnes River to be diverted at Nashville for power and other purposes has been filed by W. P. Hyatt.

SACRAMENTO, CAL.—The City Board of Trustees has granted the Western Power Company a franchise to furnish electricity in Sacramento, Cal.

ST. HELENA, CAL.—Henry Brown and associates have been granted a fifty-year franchise to erect and maintain transmission lines for the distribution of electricity for lamps, heat and motors in St. Helena, Cal.

BOULDER, COL.—The Eastern Colorado Power Company has awarded a contract to MacArthur Brothers, of New York, N. Y., for the construction of the Barker reservoir dam, near Boulder. The dam is located on Middle Boulder Creek, about 17 miles from Boulder. It is to be of cyclopean concrete masonry and will be about 625 ft. in length and 180 ft. above bed rock. Construction work will begin about Feb. 1.

DENVER, COL.—Plans have been completed by the Skagit River Power Company for the construction of a 100,000-hp plant. E. M. Riggs is president of the company.

FORT MORGAN, COL.—Plans are being considered to install a 100-kw turbo generator set and a 150-hp boiler in the municipal electric light plant. George Cox is superintendent.

MONTROSE, COL.—It is reported that arrangements are being made to construct an electric railway covering the entire Uncompagre Valley, as well as the valley of the North Fork of the Gunnison. The railway will extend south from Montrose to Ouray and north to Delta, continuing up the North Fork of the Gunnison to Paonia and Hotchkiss, a distance of about 90 miles. The promoters are said to be also considering extending the railway into Norwood, Naturita and Paradox districts in the west end of the county. I. N. Pepper is the Montrose representative.

NORWALK, CONN.—The City Council has awarded the contract for street lighting to the Connecticut Company for a term of three years. The company is to furnish an all-night service for four months in the year, the remaining eight months until 3 a. m. It is also to furnish the extra service without additional cost to the city. Under the old contract the lamps burned until 3 a. m. the year around.

NORWICH, CONN.—Plans are being considered by the Board of Gas and Electric Commissioners for changes in the municipal electric light plant, which include discontinuing the use of the rotary converter and changing all 500-volt, direct-current motors for alternating-current motors. William F. Bogue is manager.

ROCKVILLE, CONN.—The Rockville Gas & Electric Company will apply to the Legislature for an amendment to its charter allowing it to include in its territory the towns of Willington and Mansfield, as it is planning to extend its service to these towns. The company also wants the right to take land necessary to extend its transmision lines to both places.

WILMINGTON, DEL.—Plans are being perfected by the Smyrna, Kent County & Delaware Bay Traction Company for the construction of its proposed electric suspension railway in the Delaware Peninsula. J. W. Endean is president and chief engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 2 for furnishing at the various navy and naval stations the following supplies: Philadelphia, Pa.: Schedule 811—Electric motor, drill press, engine lathes, etc. Also until Feb. 9: Mare Island, Cal.: Schedule 797—Three electrically driven bench drills, a motor-driven lathe, screw-cutting lathe, alternating-current buffing lathe, motor-driven tool grinder, universal tool and cutter grinder, a No. 4 high-power universal milling machine, two motor-driven tool grinders, drill press, electric tool post grinder, etc. E. B. Rogers is paymaster general, U. S. N.

MIAMI, FLA.—The East Coast Hotel Company has decided to install tungsten lamps for stret lighting. The change will necessitate the rebuilding of the entire system. Orders for material have already been placed. W. D. Avery will have charge of the work.

QUINCY, FLA.—The installation of a new dynamo and engine in the municipal electric light plant this year is contemplated. B. A. Puckett is manager.

ATLANTA, GA.—The Southern Power Company has secured options on about 40,000 acres of land on the Wateree River, extending from Wateree Creek to Getty's Shoals, for future development.

JESUP, GA.—The City Council is considering the question of issuing $25,000 in bonds, the proceeds to be used to purchase the present electric light system or install a new plant, and also for the construction of a water works systems.

LA GRANGE, GA.—Plans are being made to extend the arc and incandescent lamp circuits of the municipal electric light plant to a new section of the town.

THOMASTON, GA.—Plans are being considered for extensive improvements and additions to the municipal electric light plant, including the installation of a 140-hp boiler, one 140-hp engine, one 100-kw and one 175-kw alternating-current generator. H. H. Wheless is superintendent.

BOISE, IDAHO.—Specifications have been completed for extensions to the system of the Boise Valley Railway Company, calling for an expenditure of $140,000. It is proposed to extend the railway from Nampa to the Deer Flat irrigation reservoir, a distance of five miles, and to complete what is known as the South Boise loop at Morris Hill Cemetery. It is also proposed to construct and equip a substation at Meridian and purchase several interurban cars.

BOISE, IDAHO.—Arrangements are being made by the Boise & Interurban Railway Company for improvements and extensions to its system, which will involve an expenditure of about $200,000, and include double tracking the Pierce Park line, at a cost of about $100,000, and improvements to the park, at a cost of $10,000. The company also contemplates increasing the output of the substation at Pierce Park and erecting heavier feed wires nearly to the Caldwell end of the line. W. E. Pierce is president.

SANDPOINT, IDAHO.—The City Council has granted a 50-year franchise to A. Filson, F. M. Molyneaux, J. F. McBride, J. M. Prater, J. B. Southmayd and H. C. Olney to construct and operate a street railway in Sandpoint.

SANDPOINT, IDAHO.—It is reported that negotiations are under way for the purchase by Chicago capitalists of the plant of the Pend d'Oreille Electric Company, the controlling interest in which is owned by Jerome L. Drumheller, of Spokane, Wash. It is said the new owners propose to dismantle the steam plant in Sandpoint and electricity for operating the system will be transmitted from the water-power plants of the company.

Plans are being made for an expenditure of about $2,500,000 in the development of power sites and to furnish electricity to the whole panhandle of Idaho as well as Sandpoint.

CARROLLTON, ILL.—We are informed that the Carrollton Heat, Light & Power Company is planning to change its system to 60 cycles and install a 150-kw, three-phase, revolving field generator if the change is made. F. M. Sinsabaugh is secretary and treasurer.

CHAMPAIGN, ILL.—The Illinois Traction System is planning to extend its system from Seneca to Morris, a distance of 12 miles, material for which will be purchased at once. The new railway will be operated by the company under the name of the Chicago, Ottawa & Peoria Railway. The company is also making arrangements to change 100 miles of its system from alternating to direct current and will build eight substations. It is also proposed to construct a three-mile belt line in Decatur.

CHICAGO, ILL.—The City Council has granted the Calumet & South Chicago Railway Company a franchise to construct an extension in South Chicago Avenue between Vincennes Avenue and South Park Avenue; also permitting the company to build a single-track railway on 115th Street from Michigan Avenue to Halsted Street.

CHICAGO, ILL.—The drainage board of the Sanitary District of Chicago has awarded contracts for machinery and apparatus to increase the output of the water power plant at Lockport as follows: To the Western Electric Compnay, of Chicago, Ill., for generator, for $25,748; for furnishing transformers, to J. Jackson, for $18,500.

GALESBURG, ILL.—Plans are being considered by the People's Traction Company for the construction of an electric interurban railway between Galesburg and Galva, a distance of 24 miles, work on which will soon commence. Charles S. Harris is secretary and treasurer.

LA SALLE, ILL.—Arrangements are being made by the Central Union Telephone Company for extensive improvements to its system in La Salle and Peru during the coming year. The work will involve an expenditure of about $40,000.

LINCOLN, ILL.—The Lincoln Railway & Light Company is considering the question of installing a steam heating plant, using exhaust steam. C. F. Richardson is superintendent.

MONMOUTH, ILL.—The Rock Island-Southern Railroad Company has presented a proposition to W. D. Brereton, president of the Commercial Club, offering to construct an electric railway from Monmouth to Alexis if the sum of $200,000 is raised jointly between Monmouth and Alexis, the $126,300 already pledged in Monmouth to apply on the fund.

PAXTON, ILL.—The Chicago, Kankakee & Champaign Railway Company has been granted a franchise by the City Council to construct and operate an electric railway on Railroad Avenue. The proposed railway will extend from Kankakee to Champaign, a distance of 75 miles.

BLUFFTON, IND.—The County Commissioners of Wells and Adams Counties have ordered elections to be held in four townships Feb. 9 to vote on the proposition to give subsidies amounting to $34,000, asked by the Bluffton, Berne & Celina Traction Company. Franchises have been granted to the company in Celina, Ohio, the eastern terminal, and at Berne. Surveys have been completed and the right of way secured for three-fourths of the distance.

DECATUR, IND.—The question of installing a new street lighting system in connection with the municipal electric light plant is under consideration. Magnetite arc lamps will probably be installed. M. J. Mylott is manager.

EVANSVILLE, IND.—The American Bell Telephone Company will build a new substation in this city, work to commence early in the spring. The company will expend about $50,000 in improvements to its system in this city during the coming year.

GREENCASTLE, IND.—The board of trustees of the De Pauw University has decided to construct a new electric light plant during the coming spring and summer, the cost of which is estimated between $4,000 and $5,000. It has not been decided whether to erect a new building or build an addition to the present heating plant. R. L. O'Hara is president of the board of trustees.

TERRE HAUTE, IND.—The Terre Haute, Indianapolis & Eastern Traction Company is planning to increase the output of its plant. A 300-kw steam turbine, four additional boilers, two large brick stacks, with coal and ash-handling apparatus for the entire plant, will be installed.

TERRE HAUTE, IND.—Plans are being considered for the construction of the large electric plant near the Fauvre mine to supply electricity for lamps, heat and motors to points within a radius of 100 miles. The cost of the plant is estimated at $1,000,000. F. M. Fauvre, president of the Citizens' Lighting & Heating Company, of Indianpolis, Ind., and the Fauvre Coal Company, of Terre Haute, Ind., is interested in the project.

TERRE HAUTE, IND.—The Graves & Wiles Company, with offices in Indianapolis, has secured the contract for street lighting in West Terre Haute, Ind., at $66 per lamp; also a franchise to furnish electricity for commercial lighting. The company is building an electric generating plant at the mouth of the Fauvre coal mine in Vigo County, from which point electricity will be transmitted to a number of cities in Indiana. The Terre Haute, Indianapolis & Eastern Traction Company holds the present contract for public lighting, which expires June 1, 1909.

COUNCIL BLUFFS, IA.—It is reported that the Independent Transportation Company is planning to construct a street railway system in Council Bluffs. The company will soon apply to the City Council for a franchise for the same. A. T. Flickinger is vice-president.

MAQUOKETA, IA.—Arrangements are being made by the Davenport, Maquoketa & Dubuque Railway Company to commence work on the construction of its proposed interurban electric railway this spring. The railway will be 90 miles in length and will connect Davenport, Maquoketa, Dubuque and intervening cities. The power station will be located in Maquoketa. The company will furnish electricity for lamps and motors to towns along the route.

PRIMGHAR, IA.—The Sioux City & Spirit Lake Railway Company has been granted a franchise to construct and operate a street and interurban electric railway in this town. The franhcise also provides for furnishing electricity for lamps and motors in Primghar.

SIOUX CITY, IA.—The Sioux City Telephone Company is contemplating extensive improvements to its system in this city, which will require an expenditure of about $75,000. The work will include the installation of a new switchboard at Morningside and four branch automatic exchanges. Howard S. Baker is president and general manager.

ARKANSAS CITY, KAN.—Contracts have been awarded by the Land & Power Company, of this city, for the construction of a power plant to cost $40,000, as follows: For construction of power house, to the Freeborn Engineering & Construction Company, of Kansas City, and the Allis-Chalmers Company, of Milwaukee, Wis., for furnishing the machinery. It is to be a hydro-electric plant with steam auxiliary plant.

ELLIS, KAN.—The contract for the construction of the municipal electric light plant and water works sytem has been awarded to Henry Bowman, of Belleville, Kan. The cost of the plants is estimated at $40,000.

HIGHLAND, KAN.—The Home Telephone & Electric Company is planning to install additional storage battery in its plant and establish a 24-hour service. L. B. Bender is president and manager.

MANHATTAN, KAN.—The Manhattan Ice, Light & Power Company is installing a 350-kw direct-connected unit in its plant. B. F. Eyer is vice-president.

TOPEKA, KAN.—The State Charter Board has granted the Kansas City & Kansas Southwestern Railroad Company an amendment to its charter, increasing its capital stock from $10,000,000, to $12,000,000. The company proposes to construct an electric railway from Kansas City to Independence, Kan., and from Kansas City to Topeka, Kan.

TOPEKA, KAN.—The Kansas City, Olathe, Ottawa & Iola Railway Company has applied for a charter to construct an electric railway from Kansas City, Kan., to Iola, a distance of 115 miles. The company will be capitalized at $5,000,000. D. Bowerstock, of Lawrence, Kan.; Robert A. Barr, of Kansas City, Mo.; Hugh A. Holmes, of Kansas City, Kan., and others are interested in the enterprise.

LEXINGTON, KY.—The Lexington & Interurban Railways Company is building an extension to Nicholsville, a distance of 12 miles. John B. Crawford is manager.

MANCHESTER, KY.—The Manchester Traction Company is making arrangements for the construction of an electric railway to connect London or Barboursville, Ky., with Manchester, Ky. The railway will consist of 25 miles of single track. Louis des Cognets, of Lexington, Ky., is president, and Hugh R. Manning, secretary and treasurer.

RICHMOND, KY.—Bids will be received by the Board of Regents of the Eastern State Normal School, Richmond, Ky., at the office of Anderson & Frankel, Lexington, Ky., architects, until Feb. 17, for constructing a heating and lighting plant and manual training building and distributing system and heating appliances for University Hall, at Richmond, Ky. Plans and specifications may be seen at the offices of the above architects or at the office of the Normal School, at Richmond, Ky. All bids should be addressed to the Board of Regents, Eastern Kentucky State Normal School, care of Anderson & Frankel, architects, Lexington, Ky.

THIBODEAUX, LA.—George U. Porde, Hibernia Building, New Orleans, La., consulting engineer, has been engaged by the Board of Aldermen to prepare plans and specifications for the construction of an electric light plant and waterworks system.

WINNFIELD, LA.—The North Louisiana Telephone Company has been consolidated with the Southwestern Telephone Company, which operates a telephone line from Shreveport to Beaumont. The headquarters of the company will be in Winnfield

CORINNA, MAINE.—[illegible] with John R. Graham [illegible] Bangor, Maine, in relation to transmitting electrical power from Charleston or Corinth to Corinna. It is understood that Ireland Brothers, who [illegible] with Mr. Graham should he decide to extend the transmission lines of the company to this place, as they are unable to meet the demands for electrical service

LEWISTON, MAINE.—Plans are being considered to increase the output of the municipal electric light plant to furnish electricity to light the city hall, Carnegie Library, fire houses and other buildings. The work will include the installation of another generator, switchboard and [illegible]. The cost is estimated at about $25,000.

OAKLAND, MD.—The Oakland, Swallow Falls & Uniontown Electric Railway Company has completed surveys for its proposed electric railway from Oakland, Md., to Uniontown, Pa., with a branch from Swallows Falls down the river, about two miles to its hydro-electric plant; also a

branch from Gracesville to Kingwood, W. Va. The railway will be about 50 miles in length. A hydro-electric plant will be erected about six miles north of Oakland. The plant will have an output of about 10,000 hp and will furnish electricity for lamps and motors as well as for operating the proposed railway. The company is capitalized at $150,000. A. G. Sturgess is president and H. P. Tasker, general manager.

AVON, MASS.—The Edison Electric Illuminating Company, of Boston, has applied to the Selectmen for a franchise to erect poles and wires on East Main and High Streets. The company proposes to furnish electricity for lamps and motors for the shoe shop and offers to place lamps on both East Main and High Streets free of charge until the annual meeting in March, when the town will take action in regard to street lighting.

FITCHBURG, MASS.—Negotiations are under way by which the controlling interests of the Fitchburg Gas & Electric Light Company will pass into the hands of the Tenney-Royce Companies, which control other gas and electric plants in Massachusetts, including the Springfield Gas Light Company. The syndicate was represented by Charles H. Tenney, of Hartford, Conn.; Albert B. Tenney, of Everett, Mass., and Frederick H. Royce, of Dedham, Mass.

GLOUCESTER, MASS.—The Gloucester Electric Company contemplates the installation of a 500-kw, alternating-current generator direct connected. E. L. Munger is manager.

HUBBARDSTON, MASS.—H. S. Harriman, of the Connecticut River Power & Transmission Company, has notified James E. WcWilliams, of the Hygienic Blanket Mills and the Chemical Fire Extinguisher Company, of Hubbardston, Mass., that if suitable franchises can be secured in Hubbardston and Barre and the manufacturers of the two towns can contract for 200 hp the company might arrange to extend its transmission lines to both towns.

LYNNFIELD CENTER, MASS.—The question of establishing an electric light system in Lynnfield Center is under consideration. It is proposed to secure electrical energy from the municipal electric light plant in Reading, Mass.

SPRINGFIELD, MASS.—Colonel Stanhope E. Blunt, commandant at the United States Armory, at Springfield, Mass., has asked an appropriation from Congress, the proceeds to be used for the construction of an electric railway for freight purposes.

SPRINGFIELD, MASS.—The United Electric Light Company has petitioned the State Legislature for a change in the act which requires that not less than three nor more than five miles of its wires be placed underground each year, so that the act will require but one mile each year. The company has placed its wires underground on most of the important streets and now has its wires underground in about 48 miles of streets and is three miles ahead of the city's requirement. The streets which still have wires above ground are where there will be little business coming to the company, and it means an investment of between $8,000 and $10,000 a mile, upon which no return will be made. As the main thoroughfares and many of the less important ones are free from overhead wires, the company feels that it should be given a little relief from an annual expenditure of between $25,000 and $50,000 for underground work, upon which it gets but a small return.

STERLING, MASS.—The question of lighting the town by electricity is under consideration. It is proposed to purchase electricity from the Massachusetts Power & Transmission Company's plant of the Connecticut River Power & Transmission Company at Vernon, Vt.

DETROIT, MICH.—It is reported that the Michigan Central Railway Company has decided to equip its terminals in Detroit to be operated by electricity and the main line as far west as Ypsilanti, Mich., a distance of 30 miles. It is proposed to abolish local trains and use electric cars for local business, having the steam trains stop only at large cities. Electricity for operating the system will be furnished by a hydro-electric plant to be constructed on the Huron River at Chelsea, Mich.

ALBERT LEA, MINN.—The Albert Lea Light & Power Company has decided to make extensions and improvements to its plant, for which plans and specifications have been prepared. The work will include the installation of a 200 or 300-kw unit, a 200-hp boiler, 100-kw motor generator, transformers, three miles of pole line and five miles of gas mains Ludwig Kemper is treasurer and manager.

FERTILE, MINN.—The electric light plant of the Fertile Brick & Tile Company has been closed, the company declaring that the plant is an unprofitable investment after five years' operation. It is said that the Council will compel the company to resume the service or it will cancel the franchise and order the poles and wires removed from the streets.

GRACEVILLE, MINN.—Plans are being considered to form a local company to establish a telephone exchange in Graceville. M. S. Stevens is interested in the project.

KASOTA, MINN.—It is reported that plans are being considered to extend the transmission lines of the municipal electric light plant at St. Peter to Kasota to furnish electricity for lamps.

HOUSTON, MISS.—Plans are being considered to install a new 125-kw generator in the municipal electric light plant. J. C. Arnold is manager.

MOUNT OLIVE, MISS.—Messrs. Houston & Cunnigham, 705 Maison Blanche Building, New Orleans, La., have been engaged to prepare plans for the construction of an electric light plant at Mount Olive, to cost $7,000. Bids for construction of the plant will be called for in about [illegible]

CLINTON, MO.—The Western Missouri Interurban Railway Company has applied to the City Council for a franchise to construct an electric railway through Clinton. The proposed railway will extend from Odessa through Warrensburg and Greenfield to Clinton, a distance of 75 miles. George S. Halliday, of Clinton, is president.

EAST ST. LOUIS, MO.—The City Council has granted a franchise to the Citizens' Electric Light & Power Company to construct and operate an electric light plant in this city. The company will furnish electricity for lamps for the fire engine house, police station and city hall, free of charge. Dr. A. A. McBrien is one of the promoters.

MAYSVILLE, MO.—A franchise has been granted to W. T. Wingate to operate an electric light system in Maysville.

GREAT FALLS, MONT.—It is reported that the Mackay Wall Plaster Company contemplates the construction of a dam on Belt Creek, the water power to be utilized to generate electricity to operate its mines.

ARAPAHOE, NEB.—The City Council has called a special election for Feb. 9 to vote on the proposition to construct a municipal electric light plant and water works system, to cost $6,000 and $24,000, respectively. E. C. Wagner is City Clerk.

FORT ROBINSON, NEB.—The contract for constructing an electric light system at Fort Robinson has been awarded to Samuel A. Oliver, of Crawford, Neb., for $32,000. Captain F. T. Arnold is quartermaster.

McCOOK, NEB.—The McCook Electric Light Company is planning to entirely rebuild its plant. A. R. Scott is manager.

OAKLAND, NEB.—It is reported that M. A. Drager, of Emerson, and R. H. Burton Smith, of Sioux City, propose to remodel the city power plant.

BUFFALO, N. Y.—Bids will be received until Feb. 3 by the State Commission in Lunacy, Albany, N. Y., for furnishing engine, dynamo, switchboard and feed-water heater and making changes to exhaust mains at the Buffalo State Hospital, Buffalo, N. Y. Plans and specifications may be seen and blank form of proposal obtained at the Buffalo State Hospital, or at the office of Franklin B. Ware, state architect, Albany, N. Y. T. E. McGarr is secretary of commission.

CARTHAGE, N. Y.—The Carthage Electric Light & Power Company is planning to install an additional 400-kw generator in its plant and to erect a new transmission line from Carthage to the plant. S. M. Strickland is secretary and manager.

NEWPORT, N. Y.—The Newport Electric Light & Power Company is planning to extend its transmission lines to Poland this year. George T. Woodin is president and manager.

NEW YORK, N. Y.—The Public Service Commission, Second District, has dismissed the application of the New York, New Haven & Hartford Railroad Company and the Harlem & Port Chester Railroad Company for consent to change its motive power upon the Harlem & Port Chester Railroad from steam to electricity, upon the ground that the companies are authorized to make such a change without the consent or approval of the commission.

OXBOW, N. Y.—Arrangements are being made to establish an electric lighting system in Oxbow.

WADDINGTON, N. Y.—The New York & Ontario Power Company has been granted permission by the Public Service Commission to issue capital stock to the amount of $600,000 and $1,500,000 in bonds. The company is developing a water power on the St. Lawrence River at Waddington. The present plans call for a development of about 17,000 hp.

ASHEVILLE, N. C.—Plans are being considered by the Asheville Electric Company for improvements and extensions to its plant, including the construction of a new power station. The cost of the work is estimated at $130,000. Frank K. Wade is electrical engineer.

GREENSBORO, N. C.—We are informed that the Randolph Power Company, recently incorporated, contemplates the installation of a small steam plant at first. C. W. Petty is interested in the project.

BUCYRUS, OHIO.—The City Council has passed a resolution authorizing the Board of Public Service to advertise again for bids for lighting the city, the contract to take effect June 1, 1909.

CAMBRIDGE, OHIO.—Mayor W. N. Bradford in his annual message recommends the construction of a municipal electric light plant for Cambridge.

COLUMBUS BARRACKS, OHIO.—Bids will be received until Feb. 8 for furnishing and installing transformer, etc., and making underground electric service connections to new post hospital, new bakery, disinfecting plant and new hospital corps sergeants' quarters at this post. Information, blank form for proposals, etc., furnished on application. Captain H. J. Hirsch is constructing quartermaster.

NAVARRE, OHIO.—The Mayor has advised the Council to take necessary steps to secure rights from the State to construct a dam in the Tuscarawas River, where it is said that 200 hp could be developed.

WOOSTER, OHIO.—The capital stock of the Wayne County Telephone Company has been increased from $10,000 to $100,000.

YUKON, OKLA.—The Yukon Mill & Grain Company, of Yukon, Okla., will receive bids until Feb. 15 for the following machinery and equipment: One 18 x 42 girder type Corliss engine; two 175-hp water tube boilers; 175-lb. pressure, with separator, etc.; two simplex pumps, and a 350-hp heater. Copies of blueprints and specifications will be furnished for $5.

COQUILLE, ORE.—Seymour H. Bell has applied to the Council for a franchise to erect transmission lines for the distribution of electricity in Coquille, Ore. It is said that Mr. Bell will make application for a franchise in Myrtle Point.

THE DALLES, ORE.—The Interior Development Company has appropriated 500,000 cu. in. of water from the Des Chutes River and proposes to reclaim thousands of acres of semi-arid lands in Wasco County. It is proposed to construct a dam 60 ft. high, with canal having screens and intakes, flumes, pipe lines; also the erection of a power house and installation of hydro-electric machinery. Work will begin in the spring. A. Welch is president.

BRADFORD, PA.—B. J. Gaffney, of Bradford, Pa., contemplates developing the water power of Beaver River to be utilized to generate electricity.

HONESDALE, PA.—The Lackawaxen Valley Railway Company, which is successor to the Honesdale & Hawley Railway Company, has been granted a 75-year franchise by the City Council to construct and operate a street railway in Honesdale. The company proposes to build an electric railway from Seeleyville to Hawley, a distance of 11½ miles.

LANSDOWNE, PA.—The Sharon Hill & Upper Darby Street Railway Company, which is controlled by the Interstate Railways Company, has applied to the Borough Councils of Aldan and Lansdowne for a franchise for a right of way from Chester Pike and Clifton Avenue, Sharon Hill, through the boroughs of Sharon Hill, Collingdale, Aldan, Lansdowne and the township of Upper Darby to a terminus at Sixty-ninth Street, Philadelphia, Pa.

MEYERSDALE, PA.—The Pennsylvania & Maryland Street Railway Company has been granted a franchise by the Borough Council of Garrett, allowing the company to operate its railway on three streets in the borough. The company proposes to extend its system to Berlin. The company now has in operation a railway from Salisbury through Meyersdale to Garrett.

NEW BRIGHTON, PA.—The Valley Electric Company is considering plans for the installation of a 500-kw turbine unit in its plant. C. A. White is manager.

ST. MARYS, PA.—The St. Marys Electric Company contemplates changing its generating system from 133 to 60 cycles. Edward Heath is secretary.

WEST NEWTON, PA.—The Pittsburg, McKeesport & Westmoreland Street Railway Company has decided to construct a street railway from Herminie to West Newton, contract for the construction of which will be let in the near future. The company has also decided to take over the property of the railway extending between McKeesport to Irwin, which is now in the hands of a receiver.

FLORENCE, S. C.—The Southern Public Service Corporation, of which P. A. Willcox is receiver, is contemplating the general rebuilding of its plant. F. G. Godfroy, of Florence, is general superintendent for the receiver. H. N. Cassell is local manager.

MARION, S. C.—The Carolina Water, Light & Power Company, which is in the hands of P. A. Willcox as receiver, is planning for a general rebuilding of its plant. F. G. Godfroy, of Florence, S. C., is general superintendent for the receiver. W. L. Black is local manager.

ROCK HILL, S. C.—The Rock Hill Water, Light & Power Company contemplates the general rebuilding of its plant. P. A. Willcox, receiver, and F. G. Godfrey, of Florence, S. C., is general manager.

NEW HOLLAND, S. D.—Bids will be received by Peter Jongeward, secretary of the Farmers' Co-operative Telephone Company, of New Holland, until Feb. 6 for the construction of 15 miles of telephone line.

SCOTLAND, S. D.—The Dakota Gas & Electric Power Company has been granted a 25-year franchise to operate an electric light plant in Scotland.

WOLSEY, S. D.—J. Fletcher, owner of the local electric light plant, contemplates the installation of a larger engine and generator in his electric plant.

ATHENS, TENN.—The Long Manufacturing Company, owners of the Athens Light & Power Company, has been awarded a contract for lighting the streeets of the city with 81 incandescent lamps. The streets have been in darkness since the expiration of the last contract, over a year ago. T. J. Long is president of the company.

JEFFERSON CITY, TENN.—The Jefferson City Electric Company contemplates erecting about one mile of transmission line. I. M. Coler is manager.

MEMPHIS, TENN.—The special committee appointed to investigate the question of installing an electric light plant at the poor and insane and the county workhouse estimates the cost of such a plant at $6,500. No action has yet been taken by the county court.

BRUNNER (P. O. HOUSTON), TEX.—It is reported that the Brunner Water & Light Company will [illegible] in the construction of an electric light plant and water works system to supply both services in Brunner and Corbet[illegible]. The cost is said to be about $25,000. L. N. Yarborough, J. W. Pruett and others are interested.

BROWNWOOD, TEX.—The West Texas Telephone Company is planning to build a new system in this city at an expenditure of about $30,000.

ENNIS, TEX.—The Ennis Ice, Light & Power Company contemplates the installation of a 200-hp boiler and a [illegible] engine in its plant this year. A. D. Brown is manager.

GREENVILLE, TEX.—The Greenville Power & Manufacturing Company has increased its capital stock from $15,000 to $25,000.

HOUSTON, TEX.—The Houston Electric Company is planning to enlarge its power house and install additional equipment. David Daly is manager.

MART, TEX.—The City Council has granted a franchise to James Nichols for the construction of an electric light plant in Mart.

PLANO, TEX.—Arrangements are being made by the City Council to establish a municipal electric light plant. For further information address J. C. Skinner.

SAN MARCOS, TEX.—F. F. Beck, of Buffalo, N. Y., representing an Eastern syndicate, which proposes to construct an interurban railway from Austin to San Antonio, has applied to the City Council for a franchise to and through this city. The company proposes to construct a belt railway in the city if a satisfactory franchise is given; also to erect its power house in San Marcos if a suitable site is donated.

TAYLOR, TEX.—The capital stock of the Citizens' Light & Power Company has been increased from $10,000 to $20,000.

WAXAHACHIE, TEX.—Plans are being considered to install an electric light plant in connection with the water works system. Estimates of the cost are now being secured.

WICHITA FALLS, TEX.—Application has been made to the City Council for a franchise to construct and operate an electric street railway in Wichita Falls by Edgar Scurry, Henry Sayles and N. Henderson.

GOLD SPRINGS, UTAH.—C. A. Short and H. R. Elliott are interested in a project to furnish electrical energy for the mines of Gold Springs and neighboring camps.

SALT LAKE CITY, UTAH.—The Salt Lake & Los Angeles Railway Company is contemplating equipping its railroad to be operated by electricity at a cost estimated at $300,000.

SALT LAKE CITY, UTAH.—The Salt Lake & Ogden Railroad Company is planning to equip its railway to be operated by electricity between Salt Lake City and Ogden. It is said contracts will soon be placed. Simon Bamberger is president.

VERNAL, UTAH.—The Vernal Milling & Light Company is making preparations to double the output of its electric plant in the near future and to extend its transmission lines. S. R. Bennion is president.

BRATTLEBORO, VT.—Negotiations are said to be under way between the Connecticut River Power Company and the Twin State Gas & Electric Company whereby the latter company will eventually abandon its Brattleboro plant and take electrical energy from the plant of the Connecticut River Power Company at Vernon, Vt. If the deal is carried through, the Connecticut company will purchase the pole rights of the Twin State Gas & Electric Company and erect a new high-tension transmission line.

RUTLAND, VT.—The Rutland Railway, Light & Power Company is planning to raise its dam at Chittendon, Vt., 10 ft., thus doubling the capacity of the reservoir. The company has secured contracts during the last year to furnish electricity for lamps and motors in the towns of Castleton, West Rutland and Wallingford and along its transmission line to Wallingford, and will require more power.

ABINGTON, VA.—Application has been made to the Town Council for a franchise to operate an electric light and power system in Abington by Mr. Palmer, who proposes to construct a plant on the river about six miles south of town.

BURKEVILLE, VA.—The J. L. Bradshaw Cooperage Company, of Burkeville, contemplates the installation of a motor and generator in its plant to furnish electricity for lamps in Burkeville. The company wants to secure an engineer to prepare plans for the plant.

FORT MONROE, VA.—Captain Ernest R. Tilton, quartermaster, U. S. A., writes that contracts for furnishing machinery for electric system, etc., at Fort Monroe, bids for which were opened Jan. 4, have been recommended to be awarded as follows: For boilers, to the Heine Safety Boiler Company; to M. W. Hill, for engines, and to the Crook-Reis Company for construction of underground conduit, and to the McKay Engineering Company, Baltimore, Md., for dynamos, for $7,925.

CHEHALIS, WASH.—The Spirit Lake Power & Mining Company is making arrangements to connect the St. Helens mining district with [illegible] miles of line.

CHEHALIS, WASH.—The City Council has granted the Chehalis Electric Light & Power Company a 25-year franchise. It is understood that plans are being considered whereby the control of the lighting and [illegible] management.

GRANITE FALLS, WASH.—Plans are being considered by the Granite Falls Electric Company to change its system from single-phase, 133 cycles. [illegible] C. H. Cleaver is secretary and manager.

HUSUM, WASH.—H. A. Ingram is installing an electric light and power plant at Luzon, in Klickitat County. The plant will also furnish electricity to pump water to irrigate about 6500 acres of land.

MILAN, WASH.—It is said that the Little Spokane Power Company contemplates greatly increasing the output of its plant in the near future.

It is proposed to construct a dam across the waterway to furnish power to generate electricity for this section of Spokane County.

MT. VERNON, WASH.—The Mount Vernon Electric Light Company contemplates the installation of a 150-kw, three-phase, 60-cycle, alternating-current generator in its plant. W. H. Franklin is manager.

NORTH YAKIMA, WASH.—The North Yakima & East Selah Irrigation Company contemplates installing a water pumping plant, with a rating of about 3,000 hp, to furnish power to pump water for irrigation purposes. T. A. Noble, of North Yakima, is chief engineer.

OTHELLO, WASH.—R. S. Chapman, electrical engineer, who had charge of the electrical equipment of the Bitter Root Tunnel for the Chicago, Milwaukee & St. Paul Railway, is investigating the possibilities for furnishing electricity for lamps and motors in Othello and Beverly.

PROSSER, WASH.—The Prosser Falls Land & Power Company contemplates installing an entire new generating plant at a cost of $50,000. John Chisholm is superintendent.

SPOKANE, WASH.—Plans are being considered by the Spokane & Inland Empire Railroad Company to extend its railway from Colfax to Pullman, a distance of about 12 miles.

SPOKANE, WASH.—The Big Bend Light & Power Company is preparing plans for the development of its power site on the Spokane River, 12 miles below Little Falls. It is proposed to develop 15,000 hp and later increase it to 20,000 hp. The company holds franchises in Reardon, Davenport, Harrington, Ritzville, Springdale and Lind, Wash., and Whitefish, Mont. It purchases electrical energy from the Washington Power Company for operating its system in the Big Bend towns and has a steam plant in Whitefish, Mont. W. C. Sivyer is president.

TACOMA, WASH.—The City Council has authorized the Commissioner of Public Works to advertise for bids for furnishing Station C with two compressors, one air receiver and two electric motors with complete fittings.

TOPPENISH, WASH.—The Council has granted a franchise to the Northwest Light & Water Company to erect transmission lines and conduits for the distribution of electricity for lamps and motors in Toppenish.

CEDAR GROVE, WIS.—It is reported that the Wisconsin Foundry & Steel Works has been awarded a contract to furnish electricity for lighting in Cedar Grove.

CHIPPEWA FALLS, WIS.—Plans are being considered by the Dells Paper & Pulp Company to construct a large dam at Jim Falls, near Chippewa Falls. The company proposes to utilize the power to operate a large paper and pulp mill. It has not yet been decided whether the mill will be located in this town or at Eau Claire. In case the plant is located in the last-named place the power will be transmitted by wire.

OSHKOSH, WIS.—The Northern Hydro-Electric Company has awarded the contract for the construction of a dam and power plant on the Peshtigo River, 14 miles below Crivitz, to the Bates-Rogers Construction Company, of Chicago, Ill. The company proposes to erect transmission lines to Green Bay, a distance of 50 miles, where, it is said, it has a contract with the electric light and power company of that city for the entire output of the plant.

WAUSAU, WIS.—The Wausau Telephone Company is planning to make extensive improvements to its system and has placed an order for 220,000 ft. of 50 and 100 pair lead cable. The telephone line from Wausau to Merrill on the west side of the river will be rebuilt; it is also planned to extend the telephone line from Brokaw to Granite Heights. The cost of the work is estimated at from $10,000 to $12,000.

MEETEETSE, WYO.—We are informed that Fred. C. Schaub, of Cody, Wyo., is planning to erect an electric light plant in Meeteetse, Wyo., in the near future, and also has a contract to pump the water for the water system of the town. The plant will be operated by water power from Greybull River.

SHERIDAN, WYO.—Plans are being made by the Sheridan Electric Light & Power Company for the installation of a 500-kw, 60-cycle, 2300-volt unit in its plant. Judson Bibb is manager.

EDMONTON, ALB., CAN.—The managers of the municipal electric light plant contemplate installing an additional 1000-kw generator and engine in the municipal electric light plant. A. W. Ormsby is superintendent.

McLEOD, ALB., CAN.—Bids are now being asked for two new boilers and a 260-kw direct-connected generator for the municipal electric light plant. G. H. Altham is superintendent.

WINNIPEG, MAN., CAN.—The City Council has decided to consider the proposition of allowing the Winnipeg Street Railway Company to sell its interests in this city. The company operates the street railway, light and power systems in Winnipeg, which are estimated to be worth from $15,000,000 to $20,000,000.

MONCTON, N. B., CAN.—The municipality of Moncton will make application to the incoming Legislature for power to construct and operate an electric street railway in the city of Moncton and the parishes of Moncton and Shediac, to lease such railway and to grant the right to construct and operate such railway to any other person or persons upon such terms as shall be approved by the City Council from time to time, and to generate, use, sell or supply electricity for such street railway. John S. McGee is city clerk.

FORT WILLIAM, ONT., CAN.—Plans are being considered by the Board of Water, Light and Telephone Commissioners for general extensions to the municipal electric light plant, for which $10,000 has been voted. Charles J. Moors is superintendent.

MORRISBURG, ONT., CAN.—The Morrisburg Electric Railway Company has applied to the Legislature for permission to extend its railway from Ormond to a point near Ottawa.

TORONTO, ONT., CAN.—The following towns are reported to have voted in favor of purchasing electricity from the Hydro-Electric Commission of Ontario: Amherstburg, Bothwell, Chatham, Comber, Dundas, Elmira, Essex, Glencoe, Leamington, Norwich, Port Stanley, Ridgetown, Simcoe, Sandwich, Stratford, Tilbury, Tilsonburg, West Lorne. Adam Beck is chairman of commission.

TWEED, ONT., CAN.—The Tweed Electric Light & Power Company contemplates increasing the output of its plant and will install a 100-kw, two or three-phase generator. J. T. Kissack is secretary and manager.

MONTREAL, QUE., CAN.—The Saraguay Electric & Water Company contemplates the erection of about 20 miles of transmission lines during this year. E. Champagne is manager.

MONTREAL, QUE., CAN.—The City Council has made temporary arrangements with the Montreal Light, Heat & Power Company to continue the stret lighting service under what the Council calls an open contract. No terms have yet been made for time or price for the service.

SASKATOON, SASK., CAN.—Bids will be received by J. H. Trusdale, City Clerk, until Feb. 3 for furnishing 500-hp boilers in two or threee units. Plans and specifications, also form of tender, may be seen at the office of the electrical superintendent. E. L. White is electrical engineer.

Company Elections.

SKOWHEGAN, MAINE.—At the annual meeting of the Skowhegan Electric Light Company the following named officers were elected: F. G. Danforth, president; A. H. Wyman, auditor, and M. B. Heselton, clerk; directors, Blin W. Page, A. H. Wyman, C. J. Abbey and C. P. Merrill.

FALL RIVER, MASS.—At the annual meeting of the Fall River Electric Light Company the following named directors were elected: Edward L. Anthony, George A. Ballard, Rufus W. Bassett, Jerome C. Borden, Albert F. Dow, Robert S. Goff, Oliver S. Hawes and James E. Osborn. The directors elected the following officers: Jerome C. Borden, president; Albert F. Dow, treasurer, and Owen Durfee, clerk.

DISPATCH, N. Y.—At the annual meeting of the Dispatch Heat, Light & Power Company the following directors were elected: Horace E. Andrews, John Carstensen, E. B. W. Rossiter, W. K. Vanderbilt, Jr., Daniel M. Beach, Walter N. Kernan and Albert W. Harris.

ROCHESTER, N. Y.—At the annual meeting of the Eastern Monroe Electric Light & Gas Company the following named directors were elected: Horace E. Andrews, W. K. Vanderbilt, Jr., E. B. W. Rossiter and Walter N. Kernan.

COLUMBUS, OHIO.—At the annual meeting of the stockholders of the Columbus Light, Heat & Power Company, a subsidiary of the Columbus Railway & Light Company, the following directors were elected: Butler Sheldon, Frank T. Stewart, George Hardy, Harford T. Stewart and William K. Lanman. The board was organized as follows: Butler Sheldon, president; Frank T. Stewart, vice-president; Herbert M. Burrington, secretary and auditor.

MECHANICSBURG, OHIO.—At the annual meeting of the Long Manufacturing Company, owners of the Mechanicsburg Light & Power Company, of Mechanicsburg, Ohio, and the Athens Light & Power Company, of Athens, Tenn., the old board of directors was re-elected.

PITTSBURGH, PA.—At the annual meeting of the Pittsburgh, McKeesport & Westmoreland Railway Company the followng named officers were elected: Manning Stiers, of New York, N. Y., president; J. J. Robertson, of West Newton, Pa., vice-president; R. W. Harvey, of Monongahela, Pa., secretary, and H. D. Lyon, of Pittsburgh, Pa., treasurer.

New Industrial Companies.

THE YOUNGSTOWN DRY CELL COMPANY, of Youngstown, Ohio, has been incorporated, with a capital stock of $5,000, by Irvine Strouther, C. A. Pettiford, F. B. Leece, G. L. Tarver and Robert Stewart.

THE ELECTRIC CHEMICAL PERMANENT BETTERMENT COMPANY, of Newark, N. J., has been incorporated, with a capital stock of $120,000, by George Stern, Charles Lefkourtz and Charles Henry Williams.

THE FISHER MANUFACTURING COMPANY, of South Bend, Ind., has been incorporated, with a capital of $25,000, to manufacture electrical machinery, electric supplies, batteries, coils, lamps ,etc. A. W., E. H. and F. W. Fisher are directors.

THE NEW JERSEY GAS & ELECTRIC FIXTURE COMPANY, of Passaic, N. J., has been chartered, with a capital stock of $10,000, by Jacob Wisner, Max Madow and William Madow. The company proposes to manufacture gas and electric fixtures.

NAYLOR & NEWTON, of Long Branch, N. J., has been chartered, with a capital stock of $25,000, by H. M. Browne, F. W. Mills and E. Forhan, of New York, N. Y. The company proposes to do an electrical contracting, construction and repair business.

THE PATTERSON SIGN ELECTRICAL COMPANY, of Buffalo, N. Y., has been chartered, with a capital stock of $10,000, to manufacture signs for display advertising. The incorporators are Frederick J. Sauer, Charles B. Graves and John Reitz, of Buffalo, N. Y.

THE STRAUSE BOILERINE COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $10,000, by Salo D. Straus, Sara Straus and Louis Straus, all of New York, N. Y. The company proposes to manufacture boiler compounds, engineers' specialties.

THE UNITED TUNGSTEN LAMP COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $10,000, to manufacture lamps and appliances. The incorporators are Thomas F. Farrell, Joseph J. Schmidt and Harry G. Anderson, all of New York, N. Y.

THE ACME METAL MANUFACTURING COMPANY, of New York, N. Y., has been chartered, with a capital stock of $5,000, by H. Betts Hengerer, James H. Betts and Charles D. Winters, of New York, N. Y. The company proposes to manufacture electrical and other advertising signs.

THE SECRET PARTY LINE TELEPHONE COMPANY, of Brooklyn, N. Y., has been chartered, with a capital stock of $50,000, to manufacture a patented article to secure privacy in use of telephone. The incorporators are R. Hamilton, E. F. Linton and J. R. Clark, all of Brooklyn, N. Y.

THE CAR LIGHTING & POWER COMPANY, of Augusta, Maine, has been incorporated, with a capital stock of $8,000,000, for the purpose of dealing in machinery and apparatus for lighting, heating and propelling railway cars and locomotives. J. Berry, of Augusta, Maine, is president and treasurer.

THE ECONOMICAL GENERAL REPAIR & SUPPLY COMPANY, of New York, N. Y., has been chartered, with a capital stock of $2,000, by A. Adler, Adolph Mendel and Emanual Klein, all of New York, N. Y. The company proposes to do electrical work, deal in gas and electrical fixtures, plumbing, etc.

THE INDICATOR SALES COMPANY, of New York, N. Y., has been chartered, with a capital stock of $10,000, to manufacture pressure indicators and regulators, etc. The incorporators are: Robert Farles and John Luppert, of Williamsport, Pa.; L. W. Lissberger and Jacobs Wellington, both of New York, N. Y.

THE RELIABLE NOVELTY & ELECTRIC COMPANY, of Binghamton, N. Y., has been chartered, with a capital stock of $5,000, to manufacture electrical motors, machinery, etc. The incorporators are Frederick W. Newman, Gustavus Millard, Robert T. Hullar, Louis Z. Green and Frank D. Croft, all of Binghamton, N. Y.

THE SAN PEDRO ELECTRIC LIGHT & POWER COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $100,000. The incorporators are Willard Hein, Harry Hein and Enrique Naltes, all of New York, N. Y. The company proposes to carry on the business of contractors and engineers.

THE PLANET ENGINEERING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, by E. M. Sawtelle, of Englewood, N. J.; J. H. Wallace, L. E. Gunderson and M. Gintzler, of New York, N. Y. The company proposes to carry on a business of engineers, architects, chemists and industrial experts.

THE TELEPHONE OPERATING & CONSTRUCTION COMPANY, of Middletown, N. Y., has been incorporated, with a capital stock of $2,500, for the purpose of constructing and operating telephone and telegraph lines. The incorporators are: Edwin Fanchier, Sayer Fanchier and Edmund Millen, of Middletown, N. Y., and others.

THE MECCA MACHINERY COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $50,000, to manufacture and deal in machinery, mechanical devices, etc. The incorporators are John W. Danielson, Horace L. Roberts, John E. Dahlgren, Carl B. Larson and Charles B. McKeever, of Brooklyn, N. Y.

THE SCHENIC ELECTRIC MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $5,000, to carry on a business of electrical contracting. The incorporators are: Harvey V. Finch, of Jersey City, N. J.; Charles F. De Sona, of New York, N. Y., and Clinton Stark, of East Orange, N. J.

THE ELIZABETH AUXILIARY FIRE ALARM COMPANY, of Elizabeth, N. J., has filed articles of incorporation, with a capital stock of $30,000, for the purpose of constructing fire alarms and fire alarm systems and to carry on an electrical business. The incorporators are: Dennis F. Collins and Robert L. Patterson, of Elizabeth, N. J., and Oliver M. Schafer, of Trenton, N. J.

THE RICHARDSON ELECTRIC COMPANY, of Duluth, Minn., has filed articles of incorporation, with a capital stock of $50,000, for the purpose of manufacturing and dealing in electrical apparatus and appliances, and machinery of every [illegible] electrical engineering and construction work in connection with light and power plants; and also to purchase, generate and distribute electricity for all purposes. The incorporators are [illegible] blade, Axel W. Lindgren and Walter L. Seaton, all of Duluth, Minn.

New Incorporations.

PELL CITY, ALA.—The St. Clair County Telephone Company has been incorporated, with a capital stock of $10,000, by L. Cooke, J. F. Cooke, E. E. Cooke and W. P. Cooke.

AMITY, ARK.—The Cedar Point & Amity Telephone Company has been organized by J. F. Sheets, A. L. and T. A. Hawkins, S. R. Harrison and M. L. C. Small.

PASADENA, CAL.—The Pasadena Rapid Transit Company has been incorporated, with a capital stock of $3,000,000, to operate a third-rail electric railway, connecting Los Angeles and Pasadena. The incorporators are Horace M. Dobbins, George H. Hayes, W. H. Smith, Edward J. Sheehan and Don C. Porter. Ernest H. May, president of the Pasadena National Bank, has been elected treasurer of the company.

COVENTRY, COL.—The Naturita Telephone Company has been chartered, with a capital stock of $50,000, by G. A. Akers, H. H. Ross, Henry Pamm, George M. Hook and Arthur Priestly. The company proposes to construct telephone lines through Montrose and San Miguel Counties.

CHICAGO, ILL.—The Chicago, Joliet & Pacific Railway Company has been incorporated with a capital stock of $50,000 to construct an electric railway from Chicago to Keithsburg, Ill. The incorporators are: George Fuller, Isaac B. Fuller, William H. Richardson and Charles F. Blue, all of Chicago, Ill.

MOLINE, ILL.—Articles of incorporation have been filed for the Tri-City & Northeastern Interurban Street Railway Company by C. E. Peck, J. W. Simonson and G. W. Turner. The company proposes to operate a street railway from Watertown, Ill., to Albany, Ill.

RILEY, IND.—Articles of incorporation have been filed for the Farmers' Independent Telephone Company, with a capital stock of $1,000, by Harley Brill, William Clingerman, Everett Fox, Charles Adkins and others.

KEOKUK, IA.—The Keokuk Gas & Electric Company has been incorporated, with a capital stock of $300,000, by Frederick Sargent and others.

TOLEDO, IA.—The Commercial Telephone Company has been incorporated, with a capital stock of $5,000, by C. E. Fleming, president, and W. A. Dexter, secretary.

FRANKFORT, KY.—Articles of incorporation have been filed with the Secretary of State for the Midland Electric Company, of Fayette County, with a capital stock of $100,000 by Warren O. Griffith, Pendelton Beckley, Arthur Lipper, J. E. Cope Morton and Walter M. Griffith.

PAINTSVILLE, KY.—The Johnson County Telephone Company has been incorporated with a capital stock of $5,000 by B. K. Given, D. J. Wheeler and others.

BARRYTON, MICH.—Articles of incorporation have been filed for the Barryton Rural Telephone Company, with a capital stock of $10,000. The directors are Henry Walroth, D. Wait and Charles Gawner.

DEXTER, MICH.—Articles of incorporation have been filed for the Dexter Telephone Company, with a capital stock of $10,000.

FLINT, MICH.—Articles of incorporation have been filed for the Flint Electric Company with a capital stock of $10,000 by E. F. Loud, of Au Sable, Mich.; N. S. Potter, of Jackson, Mich., and H. Kimball Loud, of Au Sable, Mich. The company proposes to construct 13 dams in the Au Sable River, at a cost of about $8,000,000. It has been granted a franchise in Flint and expects to have its plant in operation by February, 1910, and will furnish electricity in several counties.

RIGA, MICH.—The Riga Telephone Company has filed articles of incorporation, with a capital stock of $3,000.

PIPESTONE, MINN.—The Moody County Telephone Company has been incorporated, with a capital stock of $36,000.

PLATTSBURG, MISS.—Articles of incorporation have been filed for the Plattsburg Telephone Company, with a capital stock of $10,000, by H. B. Watkins, H. M. Woodall and others.

TUTWILER, MISS.—The Tutwiler Water & Light Company has been chartered, with a capital stock of $10,000, by D. W. Harrison, A. J. Rylee, O. E. Bradford and others.

BUTLER, MO.—A certificate of incorporation has been issued to the Butler, Peru & Pleasant Gap Telephone Company. The company is capitalized at $5,000, and the incorporators are J. I. Bartlett, N. Blough, C. M. Thomas, U. S. Isom and R. R. Eason.

COLUMBIA, MO.—A charter has been granted to the Mexico & Jefferson City Electric Railway Company, with a capital stock of $600,000, to construct an electric railway from Mexico to Jefferson City, via Ashland and Columbia, 60 miles in length. The incorporators are: T. F. Whiteside, C. F. Spaerta, Turner S. Gordon, A. J. Estes, John Williams, E. F. McCallister and C. A. Marshall, of Columbia, Mo., and [illegible]

BUTTE, MONT.—The Independent Messenger & Telephone Company [illegible] and the [illegible]

[illegible]—The Bay State Telephone Company has been incorporated [illegible] and others.

PAVILION, N. Y.—The Pavilion Telephone Company has been incorporated with a capital stock of $10,000 by B. J. Bernd, G. D. Hudson and [illegible]

TUSCARORA, N. Y.—Articles of incorporation have been filed for the Tuscarora Telephone Company with a capital stock of $5,000 by J. W. Slaught, T. L. Carney and T. H. Rowan.

GOLDSBORO, N. C.—The Goldsboro Traction Company has been granted a charter to construct and maintain a street railway. The incorporators are E. T. Oliver and J. H. Trent, of Raleigh, N. C.; S. L. Blackburn, of Richmond, Va., and J. S. Oliver, of Goldsboro, N. C. The company is capitalized at $150,000.

NORTHWOOD, N. D.—The Avon Pleasant View Telephone Company has been incorporated, with a capital stock of $25,000, by T. O. Mandt, E. Corkins, John Pletron and others, all of Northwood, N. D.

HOPEDALE, OHIO.—The Hopedale Telephone Company has been chartered, with a capital stock of $5,000, by W. V. Scott, J. K. Skeely, J. B. Beadle and others.

TULSA, OKLA.—The Citizens' Telephone Company has been organized by J. I. Gillespie, C. W. Avery, J. W. Sloan and others to establish a telephone system in Tulsa.

PORTLAND, ORE.—Articles of incorporation have been filed for the Citizens' Independent Telephone Company by Everett D. Adamson, Roscoe R. Giltner and William D. Quinn. The company is capitalized at $6,000.

BLUE RIDGE SUMMIT, PA.—The Blue Ridge Mountain Telephone Company has been incorporated, with a capital stock of $5,000, to erect a telephone line from Blue Ridge to Liberty.

PITTSBURGH, PA.—The Woodlawn Light & Power Company has been chartered with a capital stock of $5,000. The directors are: J. B. Laughlin, treasurer; B. F. Jones, William Larimer Jones, Willis L. King, W. C. Moreland, all of Pittsburgh, Pa.

SLATEDALE, PA.—The Slatedale Electric Light, Heat & Power Company has been chartered with a capital stock of $10,000. Wilson Rex is president and Henry W. Bloss, secretary and treasurer.

DALLAS, S. D.—Articles of incorporation have been filed for the Tripp-Myer Telephone Company, with a capital stock of $10,000.

JONESBORO, TENN.—The Weaver Electric Company has been incorporated with a capital stock of $1,500 by Marvin Weaver, Hugh A. Bowers, Charles A. Weaver and others.

Legal.

MANISTEE LIGHT & TRACTION COMPANY IN RECEIVER'S HANDS.—The United States Court of Grand Rapids, Mich., has appointed John P. Reynolds receiver of the Manistee Light & Traction Company, of Manistee, Mich., on petition of the New England Trust Company, of Boston, Mass. The company operates electric lighting, gas and street railway systems in Manistee, Mich., and has defaulted interest on $1,500,000 in bonds outstanding.

Obituary.

MR. W. E. LOCKWOOD.—We regret to note the death on Dec. 28, at Auburn, Cal., of Mr. William Elisha Rockwood, the president and founder of the Rockwood Manufacturing Company, of Indianapolis, Ind.

MR. A. I. BRECKENRIDGE, purchasing agent and general storekeeper of the Waterloo, Cedar Falls & Northern Railway, Waterloo, Iowa, is dead. Mr. Breckenridge was born in Meriden, Conn., Aug. 12, 1845, and was graduated from Trinity College, Hartford, in 1870.

MR. G. C. T. ABOILARD.—We regret to be advised of the death of Mr. G. C. T. Aboilard, head of the firm of Aboilard & Company, Avenue de Breteuil, Paris, France, where he died suddenly Dec. 30, 1908, at the age of 58, his home being situated within the yard of the great factory with which he was so long connected. The firm was virtually a branch of the Western Electric Company, and a large amount of insulated wire and cable was made by it annually for French and other telephonic purposes. Mr. Aboilard, who was thus an intimate associate of Mr. F. R. Welles, vice-president of the Western Electric Company, resident in Paris, was prominent in industrial circles in that city and was well known to many American visitors. Some years ago he received the decoration of an officer of the Legion of Honor. The funeral exercises occurred on Jan. 2 and the remains were interred in the cemetery of Pere Lachaise.

Personal.

MR. A. R. BREWER, for many years secretary of the Western Union Telegraph Company, has been elected treasurer of the same company.

MR. J. C. WILLEVER, executive clerk for the Western Union Tele[illegible] to fill the position of secretary of the [illegible]

MR. FRED. C. SCHRAUB will in the near future install a hydro-electric plant in Meeteetse, Wyom., utilizing a water power on the Grey-[illegible]

[illegible] of the Bay [illegible] of the Hygrade [illegible]

SIR HIRAM MAXIM has studied the subject of aerial flight these 50 years, and Macmillans are now bringing out a book by him on the subject which will be of universal interest.

MR. F. R. BRYANT, who for some time past has been general salesman of the Central Electric Company, Chicago, Ill., has severed his connection with the concern and is now associated with the Crescent Company.

MR. JOHN G. ROBERTS has resigned his position as head of the patent department of the Western Electric Company, Chicago, and is now engaged as a consulting electrical engineer and expert in patent cases.

MR. C. A. CHAPMAN, consulting engineer, Marquette Building, Chicago, has incorporated his business under the name "C. A. Chapman, Inc." Mr. Chapman is president of the new corporation and Mr. W. D. Chapman is secretary-treasurer.

MR. L. A. FERGUSON, president of the American Institute of Electrical Engineers, was the guest of the Urbana section of the institute at a meeting held in the physics lecture room, Engineering Hall, University of Illinois, on Jan. 15 at 4 p. m.

PROF. L. A. HERDT, of McGill University, has been retained by the City of Winnipeg, Man., to report on the electric lighting situation in Winnipeg and also to make a survey and report on the subject of electrolysis from electric railway current.

MAJOR E. L. ZALINSKI, president of the Bureau of Illuminating Engineering, New York City, has been seriously ill and is now in the New York Hospital, on West Fifteenth Street. He is suffering from an attack of pneumonia and his condition causes anxiety to his numerous friends.

MR. F. K. BRECKENRIDGE has been appointed superintendent of purchases and stores of the Waterloo, Cedar Falls & Northern Railway to succeed Mr. A. I. Breckenridge, deceased. Mr. F. K. Breckenridge's duties will include those of purchasing agent and general storekeeper, which positions have been abolished.

MR. W. C. BROWN, recently elected president of the New York Central lines, started his business career as a telegraph operator on a Western railroad at a salary of $35 per month. He has always been a hard worker, and his lifelong experience in railroading makes him eminently fitted to fill the high office to which he has been elected.

MR. HOMER HONEYWELL has resigned as general manager of the Lincoln (Neb.) Gas & Electric Light Company to take charge of the Freemont (Neb.) Gas Company, in which he is largely interested. His successor as manager of the Lincoln company is Mr. Ben. C. Adams, who formerly occupied the position of superintendent.

MRS. FRANCES A. W. McINTOSH, formerly advertising manager of the Buffalo Forge Company and its associate enterprises, has resigned, and has opened an office on her own account, where her services can be secured in the preparation of advertising literature of all kinds. Her new office is at 103 Anderson Place, Buffalo, N. Y.

MR. R. M. SEARLE has been appointed third vice-president of the Rochester Railway & Light Company, of Rochester, N. Y. Mr. Jas. T. Hutchings has been made general manager. Both promotions are well deserved. The other officers of this progressive company are H. E. Andrews, president; W. K. Vanderbilt, Jr., first vice-president, and G. A. Hollister, second vice-president.

MR. EDWARD C. BROWN, manager of the Honolulu office of the Dearborn Drug & Chemical Works, is making an extensive Oriental trip of three or four months, during which he will visit Japan, the important coast cities of China, Australia, the Philippines, Java and other important islands in the Pacific Ocean. Mr. Brown has succesfully handled the Dearborn company's business in the Hawaiian Islands since that department opened, some 10 years ago.

MR. AVERY P. ECKERT has issued an announcement to the electrical community that he has embarked in the railroad and electrical supply business at the Hudson Terminal Building, 50 Church Street, New York City. He is well known in the industry, with which he has now been connected a great many years, and, with his ripe experience and wide circle of friends and acquaintances, he has every prospect of building up a large and prosperous business.

MR. GEORGE N. TIDD, formerly general manager of the Scranton (Pa.) Electric Company, has resigned to become general manager of the American Gas & Electric Company, with offices at 30 Church Street, New York City. In this position he succeeds Mr. H. T. Hartman, who has been vice-president and general manager. Mr. Tidd is succeeded as manager of the Scranton company by Mr. L. H. Conklin, formerly general superintendent of the West Penn Electric Company, of Connellsville, Pa.

MR. F. A. WILLARD has resigned as commercial agent of the Rochester Railway & Light Company and will become general manager of the Red Wing Gas Light & Power Company, of Red Wing, Minn. Mr. Willard entered the employ of the Rochester company in January, 1906, organizing the commercial department which has done so much toward molding public opinion and popularizing electricity in that city. His resignation takes effect Feb. 1, and, following the policy of the company, some one in the commercial department will be promoted to the position made vacant.

MRS. G. WESTINGHOUSE.—Advices from Pittsburgh make the following announcement, which we understand to be correct as far as it goes: "The humanitarian instincts of Mrs. George Westinghouse and her great love for horses have resulted in her husband interesting himself

in the manufacture of an overshoe for horses which, it is hoped, will result in lessening the percentage of lame animals through preventing horses slipping on wet or icy streets. Arrangements have been completed here by A. G. Uptegraf, of Pittsfield, Mass., and the Westinghouse interests for the formation of a company to erect a large manufactory for horse overshoes. Mr. Westinghouse, it is said, has agreed to finance the concern one-third. George N. Kinnell, a veterinary surgeon of Pittsfield, Mass., inventor of the overshoe, will be president of the concern, while Mr. Uptegraf, who is here at present, will act as vice-president and treasurer."

Trade Publications.

D'OLIER ENGINEERING COMPANY, 119 South Eleventh Street, Philadelphia, has issued recently bulletins or leaflets devoted to steam turbines for direct and belted services, and horizontal centrifugal pumps. Both of these are illustrated.

M. B. AUSTIN & COMPANY, West Jackson Boulevard, Chicago, issued recently by the General Electric Company, illustrates and describes specialties, including Safety wire and cable, T. & B. conduit fittings, condulets, steel wall cabinets and other items and details of construction.

STROMBERG-CARLSON.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has just issued pamphlet No. 9 illustrative and descriptive of a number of rubber and composition parts for use with its standard telephone apparatus. Its object is to assist the purchaser of equipments of this make in ordering perishable parts. The cuts are actual size.

Business Notes.

THE C. H. GEIST COMPANY has removed its main offices from the Commercial Bank Building, Chicago, to the Land Title Building, Philadelphia.

SOUTHERN ILLINOIS ELECTRIC COMPANY, East St. Louis, Ill., has taken over the business of the American Vibrator Company, in addition to its lines of electrical supplies and electric railway, lighting and mining material.

REMOVAL.—The Economical Electric Lamp Company, manufacturer of turn-down lamps of that name, has removed from 96 Warren Street to 25 West Broadway, New York.

AMERICAN STEAM GAUGE.—The Southern branch of the American Steam Gauge & Valve Manufacturing Company, for several years located in the Equitable Building, Atlanta, Ga., has removed its office to 524-525 Candler Building, of that city.

BATTERY MAKING.—Mr. H. Chris Hansen, 19 Ransom Street, Muskegon, Mich., states that he is starting in the electrical manufacturing business and will make dry and storage batteries. He is in the market for brass parts, zins cans and other details.

WARREN WEBSTER.—Notice is issued that the business heretofore carried on by the American Engineering Specialty Company, in the West, will now be conducted in the name of Warren Webster & Company, with main offices and works at Camden, N. J.

NORTHERN APPARATUS.—The Northern Electrical Manufacturing Company, Madison, Wis., announces the enlargement and removal of its St. Paul district office to 1046 Security Bank Building, Minneapolis, continuing under the charge of Mr. T. E. Drohan as district sales manager.

FAN MOTORS.—The Independent Electric Machinery Company, Sheidley Building, Kansas City, Mo., will be glad to receive bulletins and prices on fan motors for both currents, of the ceiling, wall and desk types. It would also like prices on forge blower and other electrical specialties that can be handled to advantage in the territory. It is in the market for used electrical machinery.

GREEN FUEL ECONOMIZER COMPANY, Matteawan, N. Y., gives out the following list of recent sales of fans, blowers and exhausters: St. Joseph Railway, Light, Heat & Power Company, St. Joseph, Mo.; S. S. White Dental Manufacturing Company, Princes Bay, S. I.; New Bijou Theater Company, Atlanta, Ga.; American Manufacturing Company, Brooklyn, N. Y.; Masonic Building, Somerville, Mass.; People's Gas & Electric Company, Burlington, Ia.; U. S. Navy Yard, Mare Island, Cal.; General Storage Battery Company, New York, and scores of others in miscellaneous industries.

WAGNER POLYPHASE WATTMETER.—The Wagner Electric Manufacturing Company has placed on the market a portable polyphase wattmeter, which gives in a single indication the total power consumed in two-phase or three-phase circuits, as well as in single-phase circuits. Moreover, the instrument has the same accuracy on an unbalanced as on a balanced circuit. The Wagner line of switchboard and portable instruments now includes ammeters, voltmeters, power-factor indicators, frequency meters, wattmeters, ground detectors and synchronism indicators, together with current and potential transformers for all capacities, voltages and frequencies and any character of service.

HARVARD ELECTRIC COMPANY, Chicago, reports that the new Harvard patent galvanized channel steel bracket has met with deserved success since it was placed on the market a few months ago. The firm has sent out a number of brackets on approval and has received orders and testimonials relative to its serviceable qualities. This line includes steel construction material for telephone, telegraph, electric light and power transmission work in the way of brackets, foot and corner straps, pole fixtures, construction tools, etc. Mr. Allen L. Haase, for years actively identified with the steel bracket industry, is now sales manager of the company, 66 West Van Buren Street, Chicago, and 136 Liberty Street, New York City, and is paying particular attention to the bracket end of the Harvard business.

A NEW HEATING ELEMENT.—Mr. Walter G. Clark, president of the Parker-Clark Electric Company, states that its open-air burning filament described in *Electrical World* of June 27, has proved of great value as a "heater" for use in electric flat-irons, cookers, grills and all sorts of heating utensils; also for melting pots, for tin, lead, zinc, etc., and for heating varnish and other inflammable compounds, and for luminous electric radiators and electric heating devices of every description. This filament possesses many remarkable qualities. It can be plunged, while burning, in ice water or placed in contact with ice without in any way affecting it other than reducing its temperature. It will withstand a temperature up to 1500 deg. C.; its resistance is 50 times that of carbon of equal cross-section, and it can be made up in any size and in any shape required. On account of its high resistance, a number of these filaments or heaters may be used in parallel. In the laboratory the filament has burned in the open air at a bright heat for upward of 1000 hours, it is stated, with no apparent deterioration. This filament operates equally well on either direct or alternating current and it can be made for any voltage. [illegible] as a heater, it absorbs approximately [illegible] much at [illegible] than [illegible]

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. ... 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

909,136. DYNAMO-ELECTRIC MACHINE. [illegible] Norwood, Ohio. App. filed Nov. [illegible] alternators with air cooling of the [illegible] to the field.

909,140. RELAY. [illegible] Cleveland, Ohio. App. filed July [illegible] which the [illegible] the armature of the track relay [illegible] controlled by the relay, the [illegible] trolled by movement of the armature of the relay.

909,156. BLOCK-SIGNAL SYSTEM. [illegible] App. filed March [illegible] signal near in the rear, and [illegible] tive when the motor is [illegible]

909,179. ELECTRIC ALARM BELL. [illegible] Dayton, Ky. App. filed May [illegible] spring arms which [illegible] arm release the ball [illegible] the bell in connection [illegible]

909,193. ALTERNATING-CURRENT MOTOR. [illegible] Lenox. App. filed [illegible] shift the current [illegible] balanced by a [illegible] the motor [illegible]

909,198. DYNAMO-ELECTRIC MACHINE. [illegible] Mayfield, Manchester, and Walter [illegible] Mayfield, Lancashire, England. App. filed [illegible]

909,199. COMBINED TELEGRAPH RELAY AND SIGNAL. [illegible] Mayfield, Manchester, and Walter [illegible] Mayfield, Lancashire, England. App. filed [illegible]

909,200. ELECTRIC CONTROLLING [illegible] Lenox. App. filed [illegible] 1908. Serial No. [illegible] [illegible] and [illegible] [illegible] [illegible]

909,326. ELECTRIC LAMP RECEPTACLE; G. L. Patterson and J. B. Farrell, New York, N. Y. App. filed Aug. 10, 1907. Avoids short circuiting when the lamp is used in outdoor work by providing drainage canals in the porcelain base.

909,335. THIRD-RAIL ANCHORAGE; W. B. Potter, Schenectady, N. Y. App. filed Sept. 7, 1907. Prevents creeping of the rail, by means of clamps secured to the rail bolts located beneath the rail and extending from the clamps to the roadbed and an insulator in each bolt.

909,356. TELEPHONE-TRANSMITTER ATTACHMENT; J. S. Wincrantz, Pittsburg, Pa. App. filed Aug. 12, 1908. In order to temporarily stop the transmitter from working, instead of placing the hand over the mouth, a brake is forced into engagement with the diaphragm to prevent its vibrating.

909,367. POTENTIAL STARTER ATTACHMENT; W. W. Cheney, Norwood, Ohio. App. filed Sept. 29, 1906. For induction motors.



909,448—Cable Hanger.

Comprises a controller with a handle and a latch thereon and a fixed plate coacting with the latch to prevent backward movement of the handle.

909,382. ELECTRICAL-IMPULSE-TRANSMITTING DEVICE; J. Erickson, Chicago, Ill. App. filed Aug. 20, 1906. Make-and-break device for calling, provided with a rotatable dial and a retarding device for resisting the backward rotation of the dial when an attempt is made to manually force the dial to its normal position.

909,383. ELECTRICAL-IMPULSE-TRANSMITTING DEVICE; J. Erickson, Chicago, Ill. App. filed Aug. 20, 1906. Positively locks the rotatable dial against backward rotation as soon as the stop which limits the forward rotation of the dial is engaged by the calling subscriber's finger.

909,403. SWITCHING DEVICE FOR PARTY-LINE EXCHANGES; W. Hagstrom, Lindsborg, Kan. App. filed June 11, 1906. A mechanism which performs all the useful functions of the ordinary switching mechanism and its associated magnet, at the same time disposing of that magnet and its circuit.

909,414. TELEGRAPHONE APPARATUS; E. A. Hytten, Copenhagen, Denmark. App. filed Dec. 31, 1907. By means of the apparatus, the person dictating can control the advancement, reversal and stopping of the telegraphones at different points on the line and can hear the parts which have been dictated. The telegraphone comprises a wire passing between spools, a power shaft and clutches with suitable magnets.

909,417. ELECTRIC SELF-WINDING CLOCK; H. O. Jackson and H. C. Vizents, Chicago, Ill. App. filed April 24, 1908. The spring driving the clock train is automatically wound by an electromagnet. Details.

909,418. ELECTRIC SECONDARY CLOCK; H. O. Jackson and H. C. Vizents, Chicago, Ill. App. filed June 10, 1908. Relates to secondary clocks driven by a master clock, in which a worm gear guides the minute hand, thus locking it against accidental movement.

909,428. ELECTRODE OR PENCIL FOR ARC LIGHTS; I. Ladoff, Cleveland, Ohio. App. filed May 27, 1908. The upper electrode of carbon has a central core of iron and the negative electrode comprises ferric and titantic material.

909,433. APPLIANCE FOR ELEVATORS AND OTHER MOVABLE OBJECTS AND BODIES; Adam Lungen, New York, N. Y. App. filed Jan. 30, 1908. Indicates the failure to close the door before the car has left the landing, by means magnetically displaced by the movement of the car.

909,438. INCANDESCENT LAMP; M. M. Merritt, Middleton, Mass. App. filed Feb. 24, 1906. Prevents repairing old lamps and selling them as new by providing means independent of the filament fastening, such as a guard to hinder access to the end of a leading in wire.

909,448. CABLE HANGER; C. L. Peirce, Jr., Chicago, Ill. App. filed May 31, 1905. The hanger includes a hook which does not require manipulation to render it non-detachable from the supporting wire.

909,481. TERMINAL CONNECTOR; W. C. Tregoning, Hackensack, N. J. App. filed Oct. 22, 1906. The connector comprises two members joined together and resiliently movable away from each other, the free ends of the members having suitable openings to engage the terminal post.

909,485. SELF-WINDING CLOCK; C. W. Wagner, Danville, Pa. App. filed April 30, 1908. When the motor spring runs down it closes the circuit which automatically causes the rewinding of the spring. Details.

909,503. CLOCK SYSTEM; E. E. Yaxley, Chicago, Ill. App. filed Oct. 26, 1908. A clock system in which a master clock controls secondary clocks designed to improve the synchronizing of the clocks by suitable circuits and switching mechanism.

909,511. QUADRUPLEX TELEGRAPH SYSTEM; E. J. App, Lynchburg, Va. App. filed Sept. 23, 1907. Reduces sparking at the pole changer by means of an artificial line. Details.

909,551. SIGNAL APPARATUS; C. J. Coleman, Rockaway, N. J. App. filed July 8, 1901. Operates a normal safety system by means of a local storage tank of liquified carbonic acid gas.

909,564. ELECTRIC FUSE; Louis W. Downes, Providence, R. I. App. filed Dec. 15, 1903. A plug fuse with a cup-like casing and a main fuse wire enclosed within the casing, together with indicating means for indicating the condition of the fuse.

909,566. TELEPHONE TRANSMITTER; J. B. Edwards, Chicago, Ill. App. filed May 5, 1905. Omits the usual large flexible diaphragm and provides a granule-containing chamber with suitable means for preventing packing.

909,569. TROLLEY-WIRE SUPPORT OR HANGER; C. G. Ette, St. Louis, Mo. App. filed May 4, 1908. A trolley-wire support in which the jaws that carry the wire are perfectly insulated from that portion of the support which is connected to the guide wire which sustains the support. Details.

909,572. SECONDARY BATTERY; L. H. Flanders, Wilkinsburg, Pa. App. filed April 15, 1905. A separator for battery plates which prevents bridging of the active material, comprising a perforated sheet, having a plurality of integrally formed spacing strips.

909,584. TROLLEY; E. H. Green, Emeryville, Cal. App. filed Sept. 13, 1907. A yoke having arms provided with bearings, whose extremities are returned to overlie the bearings, together with a roller journaled in the bearings and guards connected with the return portion of the arms.

909,594. SPARK COIL; J. O. Heinze, Jr., Lowell, Mass. App. filed June 3, 1908. A tension device for the armature spring which prevents the tension exceeding a predetermined amount, thus limiting the amount of current passing through the primary of the coil.

909,627. THERAPEUTIC LAMP; E. W. Locke, Chicago, Ill. App. filed Sept. 16, 1908. Avoids overheating of the lamp by interposing a non-conductor of heat between the two bodies which form the attaching medium for the lamp.

909,651. SELECTIVE ELECTRIC SIGNALING; A. H. Nicholson, Wendover, England. App. filed Feb. 20, 1908. A polarized relay which fulfils the function of a non-polarized relay by providing two relay contacts in series with each other, which are normally closed. If either contact is interrupted, the circuit is broken.

909,666. PROCESS OF OBTAINING NICKEL FROM SILICIOUS ORES; E. F. Price, Niagara Falls, N. Y. App. filed July 29, 1907. Makes ferro-nickel, by smelting a silicious ore, by means of an electric arc and protecting the electrode by a large body of the charge.

909,667. PROCESS OF OBTAINING NICKEL FROM SILICIOUS ORES; E. F. Price, Niagara Falls, N. Y. App. filed July 29, 1907. Makes ferro-nickel by heating a suitable charge by means of an electrically heated resistance conductor.

909,673. BATTERY PLATE; G. B. Rinehart, Ashland, Wis. App. filed Feb. 4, 1908. The grid includes a rim with an integral tongue. The front and back bars of the grid are staggered with relation to each other.

909,691. HANGER FOR TROLLEY WIRES; H. Schutte, Wheeling, W. Va. App. filed Sept. 12, 1907. The hanger comprises a central socket portion with elastic shanks and longitudinal jaws extending from the shanks.

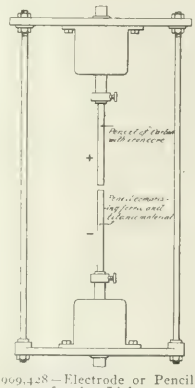
909,702. TELEPHONE TRANSMITTER; S. A. Steinbarger and R. L. Steinbarger, Augusta, Ill. App. filed July 16, 1907. A main diaphragm with an auxiliary diaphragm originally secured thereto, the latter movable bodily and a rear electrode carrying a multiplicity of cells with granular material therewithin.

909,732. ELECTRIC SECONDARY CLOCK; H. C. Vizents, Chicago, Ill. App. filed Sept. 21, 1908. A noiseless electric secondary clock, in which the hands are turned by means of a worm gear. Details.

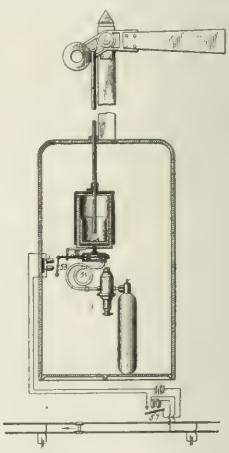
909,742. SWITCH; R. W. Borchert, St. Louis, Mo. App. filed Dec. 16, 1907. A switch in a lamp socket which is actuated by a revoluble ring encircling the switch. Details.

909,811. PROCESS FOR EXHAUSTING LAMPS; M. M. Merritt, Middleton, Mass. App. filed Jan. 27, 1905. Places a volatile chemical agent within the bulb, then exhausts, then incandesces the filament, then seals the bulb and completes the volitalization in the presence of the incandescent filament

909,812. INCANDESCENT LAMP; M. M. Merritt, Middleton, Mass. App. filed Feb. 24, 1906. Avoids repairing lamps by irresponsible persons and selling them as new by making one of the leading-in



909,428—Electrode or Pencil for Arc Lights.



909,551—Signal Apparatus.

wires relatively weak near the stem, so that the latter will break off close to the stem in attempting to repair the parts.

909,813. BATTERY-DISCHARGE REGULATOR; E. J. Murphy, Brooklyn, N. Y. App. filed June 9, 1908. Protects primary batteries from abnormal rates of discharge by introducing a circuit breaker control from the working circuit, with mechanical means whereby the time limit of the action of the retardation may be adjusted.

909,818. THERMO-ELECTRIC ALARM; J. E. Paul and J. M. Stewart, Denver, Col. App. filed Nov. 30, 1906. A closed container containing air on one side of which is a flexible diaphragm that operates a circuit closer. Details.

909,834. BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES; Miles Walker, Hale, England. App. filed March 23, 1908. For machines with grooved commutators, comprising a frame with guide projections that produce a lateral recess near one extremity and brush blocks moving in the recess and pressed on by a spring.



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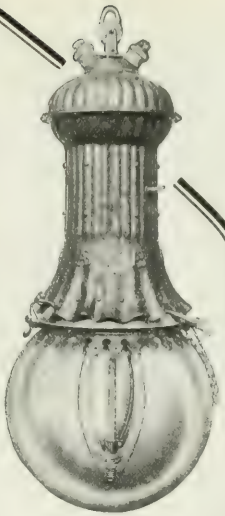
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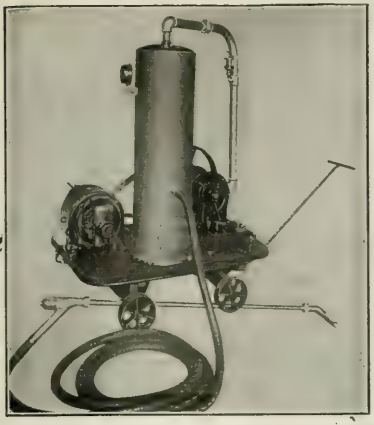
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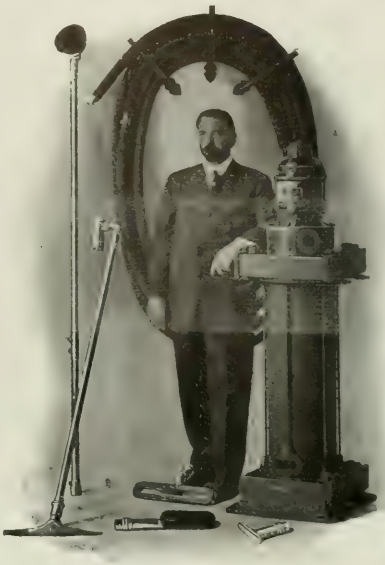
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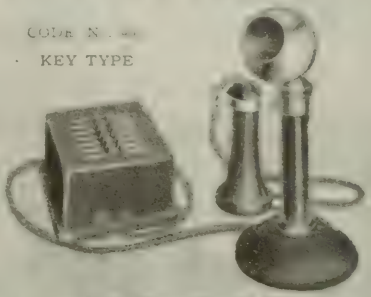
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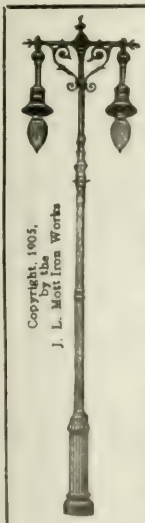
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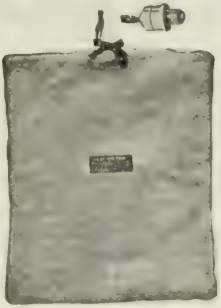
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THE NORTHWESTERN ELECTRICAL CONVENTION.

The Northwestern Electrical Association convention in Milwaukee last week confined most of its attention to the two subjects uppermost in the minds of Wisconsin central-station men these days, one of these being the tungsten-lamp situation and the other the Wisconsin Public Service Commission. The consensus of opinion was that Wisconsin is to be congratulated on the personnel of its commission and expert staff, and that the records so far show that the commission has gone thoroughly and impartially into every case brought up and with an understanding of the facts which would be impossible to city councils or local governing bodies not versed in the business of electric light and power production. In an address before the convention Professor Meyer, of the commission, although expressing, as he said, only his personal views, presented strong arguments in favor of a plan involving both rates and dividends similar to what is known in gas circles as the London sliding scale. This is a kind of profit-sharing arrangement whereby the company which has enterprise enough to improve its plant and methods so as to increase its net earnings may increase its dividends, if along with this increase the profit is shared with the public by a reduction of rates. The Wisconsin law permits such a plan to be put into operation in connection with the control of public utilities, although this clause is rather indefinite in its provisions, and the working out of the scheme is evidently to be left with the companies, municipalities and the commission.

The tungsten lamp situation was gone over at length in discussion. The interesting announcement was made that American manufacturers are now ready to supply a 4-cp, 5-watt sign lamp intended to operate on a 10-volt circuit supplied from a small 10-volt transformer mounted on or near the sign. There are in existence to-day a large number of signs operated on flat rate and turned on and off by the company. The introduction of the 5-watt sign lamp in place of one taking about 20 watts means a considerable reduction in the capacity required to handle a given amount of sign business, and also some reduction in fuel costs. The series tungsten lamp for street lighting, to judge from the discussion, has come into very general use in place of the carbon-filament series street lamps, about four fifths of the present series incandescent sales now being, it was stated, of the tungsten type. As regards the economy of the tungsten lamp in the case of small plants, it was pointed out by some of the members who had taken occasion to investigate costs of production closely, that the fixed losses and expenses connected with the operation of a small plant are so great that a reduction of the load by the use of the more efficient lamps is not likely to be noticeable on the ledger at the end of the year, or at least it would be so small as to be hardly worth while. The reverse of this proposition is well known to those familiar with costs in small plants—namely, that the addition of considerable load to a lightly loaded plant adds but a small figure to the total cost of producing power

The greatest value of the series tungsten lamp in a small central station now operating series carbon lamps is shown to be, first, the better service obtained from the tungsten lamp because of less blackening; and, second, the station capacity set free by its use, which can be sold for other purposes. Thus the substitution of the tungsten lamp for street lighting means virtually an increase in station capacity at a low cost per kilowatt of capacity, and it is the interest and depreciation on station investment per kilowatt of capacity that form a very important percentage of the total cost of supplying electrical energy. As practically all central stations are growing, this station capacity usually has a very tangible value to the company, even though the reduction in fuel bills would not be enough to justify the change to high-efficiency lamps.

C. Q. D.

It was certain that sooner or later the wireless telegraph would have the opportunity to demonstrate its value as a means of saving life at sea. The full extent of its capacity in that direction is hardly indicated by the rescue of the passengers and crews of the collided *Republic* and *Florida*, but the illustration will suffice merely as an illustration. If this dramatic incident does not serve to convince the last doubter as to the immense utility of the wireless, nothing else will. The navies of the world are not telling all they know, and the story of what the wireless really did for Japan in her sea victories in the late war may possibly never be published; but such an event as that of last Saturday, with its sequel, proves beyond any controversy that in the wireless telegraph, and in the watertight compartment, two devices have been found reducing the perils of sea travel to a minimum. Even the submarine bell, with which the *Republic* was equipped, was also shown to have its incidental uses.

It was an Italian who gave to mankind this beautiful, practical system of etheric communication that was of such vital value in the emergency; and yet the big Italian steamer *Florida*, laden with hundreds of Italians, was without such an equipment! We can readily imagine conditions like those of the *Bourgogne* disaster whereby, the wireless not being available, lives are needlessly lost. After this experience, the maritime nations of the world will hardly allow their passenger steamers to go to sea without a duplicate wireless equipment, telegraphic or telephonic, or both. The expense is very small, and an operator will not always be necessary, if the junior officers are made to add to their study of navigation a little elementary knowledge of electricity. We hope and certainly expect to see immediate legislation or marine insurance rules aimed in this direction. In the meantime we may be permitted to congratulate Mr. Marconi heartily on furnishing this new exemplification of the service of the electrical arts to mankind.

The Relative Proportions of Copper and Iron in Alternating and Continuous-Current Generators.

A recent article by Mr. A. G. Ellis in London *Electrical Engineering* compares the relative weights and costs of copper and of iron in standard British alternating-current and direct-current generators as their speeds of rotation are increased. The results arrived at in the article go to show that in alternators the amount of copper and of iron both diminish for a given kilovolt-ampere capacity up to a certain speed of rotation, and beyond that speed they commence to increase again; whereas in direct-current machines of similar capacity, the amount of copper and iron tend downward to certain limits as the speeds increase, but do not reach their minimum within practicable speed limits. Nevertheless, the alternators can be produced under normal speed conditions at lower cost than direct-current generators, mainly on account of the commutation difference.

Equivalent Circuits of Transmission Lines.

The advantage of substituting simple equivalent circuits for the complex true circuits when dealing with alternating-current problems is so great that the equivalent-circuit method is now employed in computations connected with all types of alternating-current machinery. One of the most complicated true circuit interconnections is found in the transmission line, which consists of uniformly distributed resistance and inductance, in series relation, shunted by uniformly distributed capacity. When one attempts to determine the performance of such a line under certain assumed operating conditions, the calculations become so involved when he uses the true interconnections that he is content to resort to approximate methods involving the substitution of simplified equivalent circuits. An article by Dr. A. E. Kennelly in our issue for Jan. 21 draws attention to the use of a concentrated equivalent for the true distributed capacity of a transmission line, and discusses the magnitude of the error thereby involved. Dr. Kennelly finds that, so far as concerns the capacity, each wire of a transmission system may be treated as an independent element having capacity merely between itself and the neutral zero potential point of the system. This relation exists also with reference to the resistance and inductance of each wire, so that, even on the true basis of distributed series resistance, series inductance and shunted capacity, the calculations are greatly simplified by dealing with each wire singly. Moreover, the error occasioned by considering the capacity as concentrated at the central point, or as placed in equal halves at the two ends of the line, is negligible in practical transmission systems operated at commercial frequencies. However, at greatly increased frequencies the error may be large, and, therefore, more refined methods are necessary when determining the effects of the higher harmonics in the e.m.f. wave. The latter methods are outlined by Dr. Kennelly in the article referred to above. It is worthy of note that even in the unusual case of a large value for an e.m.f. component having a frequency as high as the seventh harmonic, the approximate methods are sufficiently accurate for engineering calculation.

The Hunting of Alternators.

An instructive analysis of the interactions of two alternators in parallel is given in an article by Prof. George H. Shepard on page 271 of this issue. Having determined the value of the force which tends to keep the two machines in step, and found that it varies with the sine of the angle of displacement from the neutral position, Prof. Shepard shows that in their oscillation about a mean position the alternators are equivalent to a simple pendulum. The analogy is one that has served a useful purpose in fixing ideas as to the behavior of alternators when hunting, and in the present case it allows the author to express the exact value of the oscillating period in terms of the electrical and mechanical constants of the machines. However, as is true with all analogies, the present analogy should not be carried beyond certain limits. For instance, the period of swing of a pendulum is independent of the mass of the

pendulum, while the oscillation period of an alternator varies with the mass. A more complete analogy for alternators in oscillation is found in considering that the alternators are held in step by a flexible spring coupling—the synchronizing current; the vibrating period in this case will vary with the quotient of the mass divided by the elongational force of the spring.

By assuming the alternators to be of the two-pole type, the effect of various extreme displacements, such as 90 deg., 180 deg. and 270 deg., can easily be represented in the spring-mass analogue. Furthermore, the effect of the change in excitation of the two alternators can be shown by representing the spring as connected at each end to a crank-pin on a smooth disk mounted on the shaft of each armature, the distance from the center of the disk to each crank-pin varying directly with the field excitation of the corresponding generator. The circulating current varies directly with the elongation of the spring, but the synchronizing force depends not only on the value of the circulating current, but also on the angular displacement between the alternators, and is always exerted in a direction to bring the two machines into the position of zero displacement. It is particularly worthy of note in this connection that while the circulating current produced by a change in the excitation of two machines in parallel is "wattless," being "leading" in time with respect to the "e.m.f." of one machine, and "lagging" with respect to the other, the circulating current caused by angular displacement is a true power component, being a "motor" current with reference to the e.m.f. of the machine lagging in space and a generator current with reference to that of the other. Thus the circulating current tends to cause the field excitations to remain equal and to prevent an angular displacement between the two machines. In the mechanical analogue the spring tends to pull the two pins to similar positions on the disks, and to minimize the angular displacement between the disks.

The Opportunity in Engineering.

The two large hydro-electric stations of the Rochester Railway & Light Company, described elsewhere, are altogether remarkable in their situations. Falls of 90 ft. or 100 ft. in a straight plunge are scarce in the East, and the opportunity of utilizing them fairly within urban territory is in the highest degree extraordinary. Rochester, however, is thus favored and Stations Nos. 4 and 5 on the Upper and Lower Falls of the Genesee respectively, are noteworthy examples of the fortunate. The latter station, now developed up to nearly 5000 kw, has the very comfortable head of 96 ft. The power house itself is on rock foundation at the base of the great rock escarpment, and the penstocks plunge downward into it. An interesting feature of the head works above is their adroit location at an angle to the flow of the stream so that the swift current may carry everything that floats on the surface by the racks and over the falls. The forebay is naturally swept clear by this means so that a little attention at the racks to rid them of slush-ice keeps the plant free of trouble. At the station itself an inclined railway is installed leading to the top of the cliff, so that material is very readily brought down to a situation otherwise almost inaccessible. The engineers seem to have taken full advantage of the situation as respects topography and to have had an eye out for every chance. The equipment of the station is singularly eclectic, but again well suited to the local situation. It includes three makes of waterwheels and the same variety in the generators.

Such departures from uniformity are very offensive to catalog engineers, but as a matter of common sense why should one not buy goods of several makes if they are desirable in quality and price, assuming, of course, that none of the machines is made at the ends of the earth or chargeable with extreme specialization in construction? Most modern generators are nearly enough alike to be quite free from idiosyncrasies that demand special care, and work together quite in harmony. The same is true of waterwheels if properly governed. The long and short of the matter is that while uniformity is in itself a good enough thing, it is not worth a stiff price. One of the noticeable features of the plant is the frequency changer used to work over the power transmitted from Niagara. The number of these devices scattered around the Niagara region is quite sufficient comment on the unwisdom of deliberately installing a great plant at a frequency impracticable for incandescent lighting. At the present time the development of thoroughly good 60-cycle synchronous converters leaves little cause for repeating the mistake elsewhere, although it has already been perpetuated in a few big central stations at heavy cost.

The No. 4 station on the Upper Falls is in the very midst of things. It works on a head of 94 ft. and is only slightly smaller in capacity than Station No. 5, although not used to so great extent save when water is plenty. It then carries some 3000 kw in railway load, besides lighting load on the three-wire network. If the catalog engineer is shocked at No. 5, he will fall in convulsions at a sight of No. 4 with its long array of stalwart old bipolar Edison generators, which—horrors of horrors!—are actually belt driven. One always likes to see prettily designed, direct-driven units, but there is no denying that a well-fitted and well-kept belt is one of the most efficient and reliable power transmitting devices known, and that peripheral velocity is the cheapest way of getting e.m.f. The use of such machines in the station in question, driven as they are by four different makes of turbines, queer as it seems, is quite justified by the facts. The station was so located that at the time of its construction belt driving was more economical than making room for direct-coupled units, and, moreover, it is used mainly at times when there is an excess of water and the slight loss in efficiency is a matter of no consequence in view of the great utilized volume going over the falls. The design was a piece of opportunism for which no apologies need be offered. It is like the case of an emergency steam station in which low first cost may be essential. Few elaborate systems of plants could not now be rebuilt with a substantial gain in efficiency, but fixed charges would often more than eat up the possible gain. Change in equipment has in the history of electrical work been responsible for a very large burden of debt, only worth incurring for the sake of clearly proved economies. Necessary changes are quite serious enough without going into still more for the sake of appearances. Opportunism has therefore reason for being if coupled with promptness in realizing genuine need for re-equipment. Any network of allied stations offers great opportunity [illegible] and [illegible] opportunism, and [illegible] As such networks become more common, there will grow up a new and broad type of engineering that looks to economy and efficiency of the whole and lays stress on results independent of conventionalities.

Independent Telephone Meeting in Boston.

The presidents and executive officers of the leading Independent telephone companies of the United States, representing an invested capital of about $400,000,000, held a conference in Boston on Jan. 23 at the Hotel Bellevue. Mr. B. G. Hubbell, of Buffalo, president of the conference committee, was in the chair. The first question taken up was the organization of a comprehensive system for handling the long-distance traffic of the Independent companies. For this purpose a company was organized to issue interchangeable long-distance coupons which are accepted by all the Independent companies of the country. For the purpose of clearing the business, a company was incorporated in Ohio with C. Y. McVey, general manager of the Cuyahoga and the United States companies of Cleveland, as president. The corporation is called the International Independent Telephone Accounting Company, and issues a coupon book on the plan of a railroad mileage, which is guaranteed by companies in Pennsylvania, Michigan, New York, Kansas, West Virginia, Minnesota and Ohio. The companies represent about 360,000 miles of wire.

It was the sense of the conference that the present time is very favorable for the entire telephone industry, both Bell and Independent; that there is ample room for both organizations in the field, and that while no affiliation between the two is desirable or probable, the separate organizations can do their work without the industrial warfare that exists, according to opinions in some quarters. The conference went on record in favor of competition, believing that by competition a satisfactory service is alone made possible. It was unanimously agreed that there is a greater demand for telephone service than both organizations can now supply, and that the plan to be pursued by the Independents will be that of offering a good service at fair rates and letting the competition take care of itself.

Statistics were presented at the meeting to the effect that there are now about 4,000,000 Independents against 3,200,000 Bell instruments. In the Middle West the ratio was stated to be 2 to 1 in favor of the Independents, and in some sections of Ohio, Indiana and Iowa the ratio is as high as 6 to 1. Other figures presented at the meeting showed the same development in toll lines. Mr. Hubbell stated that there should be little talk about the displacement of Independent companies in the face of the growth now evident. The trouble of the latter is not to find a market for their service, but to keep up with the demands that are made on the companies by their subscribers. The natural development of the business is from 25 to 50 per cent a year, and this without the necessity of keeping in the field an expensive selling organization such as is incumbent upon every other industry. A large item of expense is thus saved. There has been little time to devote to considering the business of competitors. Mr. Hubbell stated in conclusion that the Independents now have only the friendliest feelings for those with whom they happen to be in competition. The Independent lines form an unbroken chain reaching from Albany, N. Y., to the State of Nebraska on the West.

Among those present at the conference, representing the larger companies, were: B. G. Hubbell, Buffalo, chairman; E. L. Barber, Wauseon, O.; A. E. Barker, Detroit, Mich.; F. L. Beam, Mt. Vernon, O.; J. S. Bradley, Jr., Toledo, O.; C. C. Cockerill, Jefferson, Ia.; H. D. Critchfield, Chicago; A. C. Davis, Parkersburg, W. Va.; E. B. Fisher, Grand Rapids, Mich.; G. R. Fuller, Rochester, N. Y.; I. H. Griswold, Albany, N. Y.; W. C. Hanlan, Wheeling, W. Va.; J. B. Hoge, Cleveland, O.; F. D Houck, Harrisburg, Pa.; W. R. McCanne, Rochester, N. Y.; W. J. Melchers, Alma, Mich.; M. Koehler, St. Louis, Mo.; G. R. Johnstown, Columbus, O.; C. Y. McVey, Cleveland, O.; E. H. Moulton, Minneapolis, Minn.; L. G. Parker, Louisville, Ky.; H. L. Reber, St. Louis; J. C. Reber, Dayton, O.; O. C. Snider, Kansas City, Mo.; J. G. Splane, Pittsburg, Pa.; H. C. Stifel, St. Louis; C. E. Tarte, Grand Rapids, Mich.; Charles West, Allentown, Pa.; Charles Wilson, Philadelphia; F. H. Woods, Lincoln, Neb. The conference was arranged by Bernard M. Wolf and Alfred S. Hayes, of the Metropolitan Home Telephone Company, Boston.

In the evening a banquet was held at the Parker House. The principal speakers were Messrs. Moulton, Critchfield, Hubbell, Fisher and Snider, and of local speakers, H. T. Hubbard, Boyd Jones, Mayor W. C. Wardwell, of Cambridge; B. M. Wolf, Geo. H. Tinkham, Col. S. O. Bigney, and Col Albert Clarke. Mr. A. G. Bean, president of the Metropolitan Home Company, Boston, presided, and the toastmaster was Mr. Alfred Hayes. Most of the speakers voiced the need of Independent telephone service in the East, especially in Boston, and pointed out the success of competition in the West. Mr. Critchfield stated that three principal elements in the telephone business are largely due to competition: First, the improvement of the apparatus mechanically; second, the more efficient and comprehensive service; and third, lower rates. In 14 years, he said that the Independents have put 33 per cent more telephones into service than the Bell company. More than 80 per cent of the Bell growth has come under the stimulus of competition, according to the speaker. The Independent companies comprise over 12,000 organizations, with 400,000 stockholders, and in almost every case at competitive points they operate more telephones than their rivals. Mr. Critchfield said that two telephone systems do not constitute wasteful competition because both interests, financing themselves in different fields, have been unable to raise the money to meet the public demand for telephone service. There is practically no telephone company in the country to-day which has not waiting lists of applicants for its service. It is also true in most cases that the aggregate of the highest rates charged by both companies is but slightly in excess of the rates charged by one company before the advent of competition, while the number of possible connections has been multiplied sevenfold, the service vastly improved, the treatment accorded to patrons much more considerate and courteous, and the service in every way much more efficient. The telephone properties were the only public utilities which showed increased earnings during the panic period of 1908; and second, that there have been fewer failures of Independent telephone companies in proportion to the number, within the past 12 years, than there have been failures of national banks. The future is thoroughly assured. President Moulton then pointed out the value of telephone companies as a field of investment. The next meeting will be held in Rochester, N. Y.

Lockport Patent Fraud Case.

Mr. C. E. Acker has made the following statement relating to the case of alleged patent frauds in connection with a process for detinning tin scrap, details of which appeared in these columns last week:

"This prosecution grows out of a litigation concerning certain patents or applications owned by the Tin Products Company of New York relating to a process of detinning, the parties to which were Goldschmidt and Weber, of Germany, upon the one side, and myself on the other.

"The witnesses whom it is claimed I induced to testify falsely in that litigation were examined at great length and in the minutest detail in a public hearing in which both parties were represented by attorneys, Mr. Dane, of New York, representing Goldschmidt and Weber, and Dr. Byrnes, of Washington, representing myself, and some time after their testimony had been given they were induced, by some means, to go again upon the stand and testify that they had sworn falsely in some particulars and had been induced to do so by me.

"It developed that the attorneys for Goldschmidt and Weber had pressed the District Attorney of Niagara County into their service, and that he had required the presence of these witnesses at his office and had obtained from them statements to the effect that their testimony was false, and had then immediately turned over these affidavits to the attorneys for Goldschmidt and Weber for use in the litigation. This occurred about seven months ago. Many grand juries have convened,

in Niagara County, during these seven months and these charges have not been presented by the District Attorney until now. The fact that the District Attorney first procured these witnesses to say that they falsely testified, that he turned over their statements to the attorneys for Goldschmidt and Weber for use in the litigation, that he has permitted seven months to elapse without making any move toward a judicial investigation of the charge against me and that he now acts only upon the request of the attorneys for Goldschmidt and Weber, and that he refused to permit my side of the case to be heard before the Grand Jury, are circumstances which seem to call for an explanation and characterize this prosecution as an effort to advance the interests of one of the parties to a civil litigation rather than as a performance of a public duty.

"I can only say that I am guiltless of the charge made against me, and I feel sure that when I am accorded a fair hearing that I will be vindicated."

Statement of Consolidated Gas Company on Supreme Court Decision.

At the annual meeting of stockholders of the Consolidated Gas Company of New York, on Jan. 25, a statement was made by Walter R. Addicks, vice-president, concerning the effect of the decision of the United States Supreme Court in the 80-cent gas case. Mr. Addicks said in part:

"Notwithstanding the sweeping character of its decision in declaring the pressure and penalty provisions unconstitutional and void and in holding that, on the findings of the lower court (as to which no error was found) the company did not receive a fair and constitutional return, the United States Supreme Court not only did not affirm that portion of the decree which permanently enjoined the enforcement of the pressure and penalty provisions, but it dismissed the suit absolutely; and although it did this 'without prejudice'—that is, without prejudice to the right of the company to commence a new suit to make a further test—the effect of the decree, as it now stands, will be to deprive the company (if it should ultimately be successful in having the act declared void) of the sum of about $5,000,000 heretofore deposited with the United States Circuit Court, the further sum of nearly $2,000,000, which has accrued since the final judgment of the United States Circuit Court was entered in favor of the company and to a further sum of at least $2,500,000 for each year which may elapse before the new suit can be decided, thus involving a loss of millions of dollars, if the fund is not meantime preserved; and this amount will be nearly duplicated, in the case of the allied companies, which have been depositing the 20 cents in court, in the suits brought by or against them at about the time the act went into effect.

"Although the Supreme Court thus held that the company was entitled to a 6 per cent return upon the present value of its gas properties and franchises, and that it did not actually receive 5½ per cent on the valuation found by the Circuit Court, as reduced in the case of the special franchises, by the Supreme Court, yet it refrained from holding the act to be unconstitutional and void, because (1) it thought it possible that the reduction in price 'might' cause such an increase in the consumption, without any corresponding increase in expense, as would make up the difference, and also (2) because it was of the opinion that a 'slight' reduction in the valuation of the tangible property might bridge over the difference.

"In assuming that there might be an increase in sales from the reduction in the rate, no allusion is made in the opinion of the court to the fact that Judge Hough, in the Circuit Court, had already assumed an increase in sales for the year 1909, as the result of the 80-cent rate, of more than 1,100,000,000 cu. ft. for that year alone, and that, too, without any allowance for additional distributing expenses. The increase thus assumed was more than double the average annual increase during the period from 1885 to 1905, although, during the greatest portion of that period, there was no competition from electric lighting, while the candle-power has been largely increased and the price of gas has been reduced from $1.70 to $1, and although, in 1906, the most profitable part of the lighting business in connection with the large hotels, department stores, theaters and office buildings had passed into the exclusive control of the electric lighting companies.

"All the profits derived from this extreme estimated increase in sales was included in the $3,024,492.14 of income found by Judge Hough, and accepted by the Supreme Court, without allowing for any distributing and general expenses which in the last three years have actually increased over $600,000. Increased consumption in the gas business comes largely from small consumers, where the cost of installing and inspecting meters, and the additional force required for collection and bookkeeping purposes, is very large in proportion to the new business.

"The second assumption made by the Supreme Court was that a slight reduction made in the tangible property of the company might bring about a 6 per cent return. The actual reduction, however, would amount to the large total of about $5,200,000, or more than 11 per cent of the valuation of the company's entire tangible property as found by the Circuit Court.

"It may be interesting to present, at this time, a comparative statement of the values of the property, as found and adopted by the several authorities which have considered the subject within the past four years:

VALUE OF PROPERTY OF THE CONSOLIDATED GAS COMPANY USED IN ITS GAS BUSINESS.

As found by	Intangible property.	Tangible property.	Total.	Astoria investment (additional).	Grand total.
Legislative Comm. (of 1905)	.....	.....	$30,000,000	.....	.....
N. Y. Gas. Com.	.....	.....	30,000,000	.....	.....
Special master	$20,000,000	$51,357,000	71,357,000	$12,000,000	$83,357,000
U. S. Cir. Court.	12,000,000	47,831,435	59,831,435	12,000,000	71,831,435
U. S. Sup. Court.	7,781,000	47,831,435	55,612,435	12,000,000	67,612,435

NOTE.—The State Board of Tax Assessors valued the intangible property for 1908 at approximately $25,000,000.

"The New York Gas Commission stated that the company was entitled to 8 per cent as a rate of return on its property used in the gas business.

"It will be noted that the value of the property of the Consolidated company used in its gas business, as adopted by the United States Supreme Court, is $37,612,435 more than the Gas Commission stated was the value of that property. The Legislature, in passing the 80-cent act, admittedly relied upon the report of the Gas Commission, as to the accuracy of the value of such property. Eight per cent on this difference of $37,612,435 amounts to $3,008,994 per annum. This amount, divided by the gas sales for the year examined by the Gas Commission, would represent 22.61 cents per thousand, which, added to the 80-cent rate which the commission ordered, would produce a selling price of 102.61 cents upon the commission's own theory, and accepting all its other figures.

"From figures now available, the earnings from the company's gas business for the year 1908, with gas figured at 80 cents, and without any allowance for contingencies and reserve, would amount approximately to 4 per cent per annum on the value of the property as assumed by the United States Supreme Court."

New England Water Powers.

The Boston Merchants' Association has issued a circular urging action to prevent the destruction of forests on the high watersheds of the White Mountains. It is stated that there is over $400,000,000 invested in manufacturing interests on streams which flow from the White Mountains, that these interests employ about 200,000 operators, pay wages of $60,000,000 a year and have a yearly output of about $300,000,000. On the Connecticut River alone there are 3000 mills. It is pointed out that the government has already spent $3,000,000 in aiding navigation on the several rivers tributary to the White Mountains, all of which will be injured, if not destroyed, by the river channels silting up through erosion among the mountains.

Public Utilities Commission Recommended for Connecticut.

Mention has been made in the *Electrical World* of the draft of a bill providing for the creation of a public utilities commission in Connecticut. This bill was prepared by a commission appointed by the last General Assembly of the State to consider the existing laws and to recommend remedial legislation or any legislation on the subject which it might deem desirable for the public interest. This commission has presented its formal report to the new Legislature, together with the draft of a bill, whose passage it recommends.

The commission reports that it reached the conclusion that it would be desirable to vest in a permanent public utilities commission the following powers and duties:

1. To grant franchises to public service corporations.

2. To supervise the condemnation of land and construction of fixtures by these corporations in so far as the same affect the public safety or interest.

3. To supervise the capitalization of these corporations.

4. To ascertain the facts relating to the financial conditions of these corporations; the physical conditions of their plants and equipments, and the cause of accidents resulting from their operation.

5. To supervise their operation in so far as the same substantially affects the public safety.

6. To fix the rates chargeable when existing rates are unreasonable.

The commission expresses the opinion that "the duties of a public utilities commission should be purely supervisory and not managerial." The commission believes that the public is justified in supervising the operation of public service corporations so far as it is necessary to enforce compliance with the obligations "to render to the public adequate service at reasonable rates" and "to furnish service to all members of the public upon equal terms and without discrimination against or in favor of any." While the powers of a permanent commission "ought to be adequate for that purpose, beyond this point the management of the affairs of these corporations ought, in the opinion of the commission, to be left to the persons investing their money therein."

The commission then takes up in order its recommendations as given in the foregoing.

By the term "public service corporations" is meant all private railroad, street railway, gas, electric light, electric power, water, express, telephone and telegraph corporations. Corporations organized for the sole purpose of developing water power are not included.

The commission believes that a small permanent commission would be better adapted to the exercise of the power to grant special rights than the General Assembly, which exercises this power by the present system of special charters.

In discussing the second recommendation, the commission says: "Construction on private property should be supervised, as the safety of the public may be affected by such construction. While it is for the real interest of a corporation to render its construction safe, yet this has not always been the case; there is much construction in the State which is unsafe. Many instances might be cited. High-power electric wires cross and are crossed by telephone wires at various points throughout the State with no protection from contact of the wires if the higher wire should fall."

Supporting its recommendation that a permanent commission be given authority to supervise capitalization, the commission says that many of the public service corporations in Connecticut have been largely over-capitalized. After comparing figures of capitalization in Massachusetts and Connecticut, the commission says:

"These figures show that the Massachusetts capitalization per mile of street railway is about two-fifths that in Connecticut. This is not due to better construction or to a larger proportion of double-track lines in this State, as the percentage of double-track street railway mileage in Massachusetts is slightly larger than in this State, and it is believed that the construction of the street railways in Massachusetts compares favorably with that in this State.

"There is no apparent reason why a similar supervision in this State should not effect similar results in so far as the construction of lines in the future are concerned. Such supervision would not be detrimental to the legitimate interests of the corporations, but would add to the value of their securities by the practical guarantee that the proceeds of such securities would be used in building up and developing their properties for the benefit of their stockholders and of the investing public instead of for the benefit of the professional promoter.

"If such corporations were properly capitalized the saving would enable managers to maintain their properties in a much higher state of efficiency, and hence of safety; would provide means and credit for extending new lines into unoccupied territory, with a view to future rather than immediate profits; would give a longer ride and better transfers for a single fare; and would provide for a larger fund for wages, thus securing better help, greater safety for passengers, and avoidance of labor troubles, with attendant strikes."

The power to examine the financial condition of the corporations, the commission argues, is only extending the present policy of the State, while "the power to examine and ascertain the physical condition of the plants and equipments of these companies is necessary for the safety of the public and of the employees of the company."

The commission believes that a disinterested tribunal should have the power to determine "if and when an unreasonable rate is charged." The commission "does not attempt to state or intend to intimate that the rates charged by public service corporations in this State are reasonable or unreasonable. What constitutes a reasonable rate in any instance can only be determined by a careful investigation and consideration of all the circumstances and conditions which bear upon the question."

Besides the new legislation recommended by the commission, it suggests a recodification of existing legislation relating to public service corporations.

The commission which made the report consists of Messrs. Marcus H. Holcomb, Thomas D. Bradstreet, Charles Phelps, P. H. Woodward and Washington F. Willcox. Ralph O. Wells was clerk of the commission.

United States Water-Power Regulation.

In a report transmitted to Congress by President Roosevelt, accompanied by a message, the National Conservation Commission gives an estimate of the water power of the United States. It is stated that the water power now in use aggregates 5,250,000 hp, that the amount running over government dams and not used is about 1,400,000 hp, and that the amount reasonably available not only equals the entire mechanical power now in use, but is enough to operate every mill, drive every spindle, propel every train and boat, light every city, town and village in the country. The fuel production for 1907 is stated to be 395,000,000 tons of bituminous and 85,000,000 tons of anthracite coal. The production of petroleum was 166,000,000 bbl. It is predicted that the coal deposits will be exhausted by the middle of the next century.

The report states that the permanent welfare of the nation demands that its natural resources be conserved by proper use of them, and that to this end the State and Nation can do much by legislative example; that private ownership in natural resources is a public trust, and should be administered in the interest of the people as a whole; and that the present need is that every citizen, the State and Nation unite in an effort toward the conservation of natural resources. An organization is recommended to which all agencies, State, national and municipal, associate and individual, may unite in a common effort to this end, but the immediate creation of a national agency is essential. President Roosevelt in his message asked for an appropriation of $50,000 to carry out the recommendations of the commission.

Massachusetts Railroad Commission Reports Against Steam and Trolley Mergers.

The Massachusetts Railroad Commission made public on Jan. 18 an important report on the question of steam and electric railway relations in the State, addressed to the Legislature in response to a resolution of the Senate asking for the board's opinion upon these relations, upon the expediency of permitting the Berkshire Street Railway to purchase the franchise and property of the Bennington & North Adams Street Railway Company, and upon the expediency of permitting any railroad corporation chartered under the laws of Massachusetts to become or continue a stockholder in the Berkshire Company.

After an exhaustive review of steam and electric railway development in Massachusetts, and a survey of legislation bearing upon mutual relations of steam and electric railway companies, and the merger of steam roads, the board concludes that "the established policy of the State with respect to keeping separate and distinct the railroads and street railways of the commonwealth is a system of efficient administration entirely consistent with the public interest. The board is therefore of the opinion that no general legislation is now necessary to change or modify the existing laws as to the relations between these two classes of public servants." Regarding the permitting of any railroad to become a stockholder or to continue as one in the Berkshire line, the board is of the opinion "that the enactment of legislation permitting this company to be acquired in any form of holding by a steam railroad would not be an exception but a violation of the general policy of the commonwealth. Private capital can be secured for the construction of additions to and extensions of street railway or other lines in Massachusetts when sound and reasonable public demands exist. The past experience of Berkshire County has confirmed this view. A policy that would legalize the control by a steam railroad of this street railway, solely upon the ground that it would make available superior financial resources, would also, if carried to its logical conclusion, result in the control of all street railway mileage in the commonwealth."

The board sees no valid reason why the Berkshire should not purchase the Bennington, with suitable safeguards. A chapter in the report deals at length with future possibilities in electric transportation in Berkshire County, and points out several routes of travel which might be logically developed to afford better facilities than now obtain.

The board finally notes a progressive street railway development in Massachusetts, and points out that the two systems of transportation, steam and electric, are each fulfilling their functions as public servants. "Each within its distinct field of service should receive the most favorable consideration of the General Court. Neither, however, should absorb the other, in whole or in part, until experience has completely demonstrated that only by the adoption of such a policy can Massachusetts continue to secure the full benefits of two great public utilities."

The Navy at the Chicago Electrical Show.

The noon-day meeting of the Chicago Electrical Club was held on Wednesday, Jan. 20, in the café of the Coliseum. This day was known as the "Electrical Club Day" of the Chicago Electrical Show which is being held at the Coliseum, Chicago, from Jan. 16 to Jan. 30.

The meeting was one of unusual interest, and was well attended by the members of the club. The principal speaker was Lieut.-Commander E. T. Witherspoon, U. S. N., in charge of the Chicago and the Milwaukee recruiting stations. Mr. Witherspoon in a general way gave a synopsis of the uses to which electricity is put on a modern battleship. He said electricity has become as important in the performing of necessary duties in the operation of battleships and the firing of guns etc., as any other element that has ever added to the efficiency of these ships. This applied not alone to the apparatus found on the upper decks, but also to the ship's equipment on each of the lower decks, and even down into the coal bunkers and firing rooms. Without the use of electric motors forced draft, such as is needed on a modern battleship, would, he said, be impossible, and the efficiency of the ship in time of war would be correspondingly decreased. He asked the representatives of electrical manufacturers present to visit the model battleship which had been installed at great expense in the Coliseum Annex, and to become better acquainted with the apparatus shown. He said one of the objects of his appearing before the club was to interest the electrical men of the West and Middle West in the methods employed by the government in placing contracts for furnishing electrical equipment for the U. S. Navy. During the balance of the Electrical Show he would have on exhibit several sets of specifications for electrical apparatus as sent out by the U. S. Government, and would gladly furnish information to make manufacturers of electrical machinery better acquainted with the best methods to follow in making bids for electrical apparatus for modern battleships. Heretofore, he said, a large percentage of electrical contracts have been placed in the Eastern States, but he thought the only reason for this was that the manufacturers of the Central West are not well enough acquainted with the naval electrical equipment to bid successfully for the business.

Meeting of the Metropolitan Electrical Trade Association.

At the annual meeting of the Metropolitan Electrical Trade Association, held on Thursday, Jan. 21, at the rooms of the Modern Science Club, Brooklyn, Mr. John P. Bonney, of Thompson-Bonney Company, was unanimously chosen president of the association for the current year, and the following were elected members of the board of directors, viz.: Messrs. John P Bonney, Louis L. Brown, George M. Wheeler, John F. Jordan, W. C. Bloomer, Charles A. Borne and George Weiderman.

James F. Hughes, of Charles A. Borne Company, the retiring president, congratulated the members on the spirit of concord and co-operation shown during the first year of the association's existence and gave emphatic expression to his firm confidence that the association will thrive under the leadership of the new president.

The annual dinner of the association will be held at Edgett's on Thursday, Feb. 18. Mr. Leopold F. Luedecke, 45 York Street, Brooklyn, was unanimously re-elected secretary and treasurer.

Edison Returns to Quadruplex Invention.

A patent was issued Jan. 19 to Thomas A. Edison on an improvement to the quadruplex telegraph system. It is stated that one of the defects which has always existed in the quadruplex system is that when the armature of a neutral relay employed in that system is drawn by the full current strength, and a reversal of the current takes place, the armature momentarily falls away from the front stop with a likelihood of producing a "kick" or false signal in the local sounder. While numerous suggestions have been proposed for overcoming this defect, none, it is stated, has in practice and on lines of considerable length been entirely satisfactory. The invention of the patent consists in combining with the neutral relay a rectifier, such as the aluminum rectifier, by means of which, although the current in the line may be reversed the polarity of the current [illegible] the neutral relay will remain unchanged. It is pointed out that the aluminum rectifier presents a practically perfect insulation of one polarity without appreciably resisting currents of the opposite polarity, and therefore it becomes possible to arrange a number of cells of such rectifier in such a manner that a current of reverse polarity will be so commutated as to pass through the neutral relay always in the same direction.

French Letter-Telegrams.

Recently a note appeared in these columns on the subject of French letter-telegrams, and also a letter from Mr. Patrick B. Delany commenting on this telegraphic innovation. In a consular report, Consul-General Washington states that the service was inaugurated on Dec. 7, when from certain offices in France and Corsica, letter-telegrams paid in advance were transmitted by wire during the night at the rate of 1 centime (⅕ of a cent) the word. No messages are forwarded at a charge of less than 50 centimes (10 cents). The messages are sent out as mail matter by the early deliveries.

Although messages are only forwarded during the night after 9 o'clock, they may be deposited after 7 o'clock in the evening, and at designated offices, which are open until midnight, until 11 o'clock. The following cities are provided with the service until midnight: Paris, Bordeaux, Boulogne-sur-Mer, Brest, Calais, Cherbourg, Le Havre, Lille, Lyon, Marseilles, Montpellier, Nancy, Nice, Roubiax, Toulouse and Tourcoing, the principal offices of which are open until midnight, and the minor offices until 11 o'clock.

The following cities will have the service until 11 o'clock: Agen, Aix-en-Provence, Ajaccio, Amiens, Angers, Arras, Avignon, Bastia, Bayonne, Besançon, Béziers, Biarritz, Boulogne-sur-Seine, Caen, Cambrai, Cannes, Carcassonne, Cette, Châlons-sur-Marne, Clermont-Ferand, Dijon, Dieppe, Douai, Dunkerque, Elbeuf, Grenoble, Laval, Levallois-Perrett, Limoges, Lorient, Mâcon, Le Mans, Montauban, Montecarlo, Nantes, Narbonne, Neuilly-sur-Seine, Nimes, Orléans, Pau, Perpignan, Rheims, Rennes, Rochefort, Rouen, Saint-Etienne, Saint-Nazaire, Saint-Quentin, Toulon, Tours, Troyes, Valence, Valenciennes and Versailles.

It is added that the letter telegram is an experiment, and its continuation will depend upon the extent the public avails itself of this opportunity. Considering the low rate provided, and the immense convenience to business interests that admit of lengthy messages being sent at the close of a business day and received early the morning following at points two or more days distant perhaps by ordinary mail facilities, as is the case when letters are sent from Corsica to Paris, and 20 hours when sent from the northeastern section to the capital.

Between cities not on a main line connection much practical convenience will result, since the length of time required by ordinary postal service across even comparatively small distances in France not directly connected is often too great to admit of a letter mailed at night reaching its destination on the morning of the following day. It is estimated that an appreciable portion of the patronage will come in this way. The interest demonstrated generally by business men indicates that there is every prospect of financial return that will warrant this method being decreed a permanent service.

Meeting of the Empire State Association.

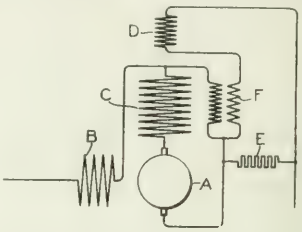
The adjourned annual meeting of the Empire State Gas & Electric Association of New York State was held on Jan. 15. At this meeting a revised constitution and by-laws were adopted and officers for the coming year were elected. The officers and members of the executive committee are as follows: President, William T. Morris, Associated Gas & Electric Company; first vice-president, M. J. Brayton, Utica Gas & Electric Company; second vice-president, R. M. Searle, Rochester Railway & Light Company; treasurer, T. O. Horton, New York & Richmond Gas Company; executive committee, class 1909: Walter R. Addicks, Westchester Lighting Company; P. T. Glidden, Binghamton Light, Heat & Power Company; G. W. Curran, Syracuse Lighting Company; executive committee, class 1910: T. O. Horton, New York & Richmond Gas Company; J. J. Humphreys, Jr., Brooklyn Borough Gas Company; F. L. Dame, Geneva-Seneca Electric Company. The present secretary was re-elected.

No papers were presented. The association has taken offices in the United Engineering Societies Building and will occupy them about Feb. 1.

Non-Sparking Single-Phase Commutator Motor.

In order to provide a proper value of voltage for impressing upon the commutating-pole winding of a single-phase series motor, Mr. Marius C. A. Latour, according to a patent issued Jan. 12, subjects this winding to two e.m.fs. in the proper time-phase position, oppositely directed. One e.m.f. varies directly with the current taken by the machine, while the other varies with the product of the current and the speed of rotation. The latter e.m.f. is smaller than the former and is opposed to it in direction, so that the resultant e.m.f. decreases with increase of speed.

The arrangement proposed by Mr. Latour is shown in the accompanying illustration, where *A* is the armature winding, *B*



NON-SPARKING SINGLE-PHASE COMMUTATOR MOTOR.

is the main field coil, *C* is the stationary compensating winding for opposing the armature m.m.f., *D* is the commutating pole winding, *E* is a resistance in series in the armature circuit, and *F* is a transformer in parallel with the armature and compensating coils. The e.m.f. across *E* is approximately in time-phase with the motor current, as is also the e.m.f. at the secondary of the transformer *F;* the resultant (difference) of these two e.m.fs. is impressed upon the coil *D*, so that the flux in the commutating pole is approximately in time-quadrature with the armature current and the main field flux, and it decreases automatically with increase of speed.

The Humming Telephone.

The *Proceedings* of the American Philosophical Society for 1908 contains a paper by Dr. A. E. Kennelly and Mr. Walter L. Upson, entitled "The Humming Telephone: A Contribution to the Theoretical and Practical Analysis of Its Behavior." It is stated that the fact that the telephone receiver held either in contact with or close to the face of the transmitter may cause the production of a hum or singing tone appears to have been observed by Mr. A. S. Hibbard, and first published in a paper read in 1901 by Mr. F. Gill before a meeting of the Dublin Section of the (British) Institution of Electrical Engineers.

In many cases it is only necessary to lift a receiver from the hook and hold it face to face to the transmitter in order to produce a hum which may be so loud as to be heard in a distant room through several partitions. The present paper gives the result of a large number of experiments made with a view of establishing a theory of the phenomenon. Among the conclusions are that the mean frequency of the humming telephone note is determined solely by the receiver diaphragm and its natural free rate of vibration. On the other hand, the range of pitch vibration and the breaking conditions are determined by the transmitter. For systems that are weak, however, either electrically or acoustically, the range of pitch above or below the mean would be rather small. The primary current is ordinarily a minimum at the mean frequency and a maximum at the break. The paper includes a mathematical discussion of the various elements entering into the phenomenon from which conclusions are deduced as to the relations between it and the frequency and the circuit capacity and conductance.

Convention of the Northwestern Electrical Association.

THE seventeenth annual convention of the Northwestern Electrical Association was held at Hotel Pfister, Milwaukee, Wis., Jan. 20 and 21, 1909. The meetings were presided over by President P. H. Korst, of Janesville, who was directly responsible for the program this year and to whom much of the success scored by the convention is due. After the meeting was called to order Mr. Korst delivered his presidential address.

President Korst reviewed briefly the history of the association, which was organized in February, 1893, at a meeting at which there were present half-a-dozen central-station men and one supply man. Until 1901 two meetings were held each year. Referring to the business situation he said that each month the field grows larger and that the advent of the tungsten lamp has placed electric lighting on such an economical basis as to cost to users that many new fields are now opened up that formerly were barred on account of cost. Power work is of growing importance and Mr. Korst said that he is familiar with a plant which by its means has attained an average low factor of 50 per cent. There are many industries that can regulate their working hours so that no power and not much light will be used during the peak-load hours during the winter months, providing sufficient inducements can be offered to make it an object for them to organize their operations accordingly. A few such industries in the territory of the association are creameries, canning factories, cold-storage warehouses, refrigerating plants, some of the wood-working industries and pumping city water. Electric laundry irons, toasters, chafing dishes and coffee percolators are also very helpful. Electric cooking on a practical scale has not in the past been very successful owing to the high cost of utensils and electrical energy, but he said that we can soon expect a combination of a fireless cooker with an electric heating element that will be so economical in current as to justify its use even at the lighting rate. This cooker will boil, bake, broil, roast and, in fact, do almost any manner of cooking and with the ordinary cooking utensils.

Referring to the Railroad Commission of Wisconsin he said that the association should feel proud of its personnel and its employees, and render them all possible assistance in carrying on the work. Any company desiring to deal justly with its customers need fear no injury from the commission, but, on the other hand, will be benefited since customers, through it, will be assured that good service is being rendered at reasonable rates, that the meters are accurate, and that the company is required to improve any part of the service or equipment found deficient. While small companies will be inclined to object to the refinement of accounting required by the commission in order to obtain the necessary information for it to act intelligently when complaints are filed, the benefit to the company itself from this additional information will more than offset the extra cost and trouble. The information, moreover, will enable citizens in towns having municipal plants to judge as to the economical operation of these plants by comparison with the reports of privately-owned plants. Uniform accounts will also enable central-station men to compare costs of operation, receipts per head of population, etc., thus aiding in forming rational plans for lowering cost of operation and getting new business.

Mr. J. S. Allen, of Lake Geneva, chairman of the committee appointed last year to consider consolidation with the Wisconsin Electric & Interurban Railway Association, reported, contrary to the apparent drift of events at the last convention, against such consolidation on the ground that the work of the two associations does not to any extent overlap or interfere. After some discussion on the report no action was taken.

Formal invitations were received from the Chicago section of the Illuminating Engineering Society to attend its meeting in Chicago, Jan. 22, and from the Electrical Trades Exposition Company to attend the Electrical Show in Chicago. An invitation was also extended to visit the Allis-Chalmers Company shops the following morning. All these invitations were accepted with thanks. The president called upon Mr. C. H. Williams, now general manager of the Northern Colorado Power Company at Denver, Col., and an ex-president of the association, for a few remarks.

Mr. George B. Wheeler, general manager of the Chippewa Valley Railway, Light & Power Company, of Eau Claire, Wis., brought to the attention of the association a circular advertising an automatic cut-out which was being addressed to central-station consumers and which is so worded as to create an altogether false impression as to the dangers of electric light wiring to life and property. The convention expressed its disapproval of such literature by appointing Messrs. Wheeler and Gonzenbach a committee to consider the matter and draw up resolutions of censure.

The convention then drifted into an informal discussion of matters pertaining to legislation and public utility regulation in Wisconsin. The commission in whose hands this regulation has been placed is apparently admitted by everyone to be men of a high order of intelligence and integrity. Its rulings have always been very fair and conservative, both from the public and corporation standpoint. The remarkable fact was brought out, however, that there is a movement on foot originating with the city officials of Manitowoc, Wis., to get the present commission law repealed or modified, the present arrangement evidently not suiting some politicians. The commission law takes regulation out of the hands of local city councils and places it with the commission which has in its employ a large number of experts. The public utilities are therefore being regulated by a body of men who understand the business thoroughly, rather than by local councilmen who do not understand it. This is not at all to the liking of some of the city officials, and attempts are being made to have the law changed at this session of the Legislature. As was brought out by the discussion at this session, the electric lighting companies are in a peculiar position as regards their attitude toward the present law. While they believe that the present commission is of benefit both for the companies and the public, and while the acts of the commission so far have been unquestionably fair and conservative, it was seriously argued that too enthusiastic support of the present commission law by the public service companies might in itself be considered sufficient ground for opposition to it by some legislators.

Wednesday afternoon a paper was read by Mr. Henry Schroeder, of the General Electric Company, on "Series Tungsten Lighting." This brought out a discussion on the actual and theoretical economies to be obtained by the use of tungsten lamps in replacing series carbon lamps on street-lighting circuits.

Mr. S. E. Doane, chief engineer of the National Electric Lamp Association, read a paper on "The Commercial Development of the Tungsten Lamp." In connection with the extended discussion on the tungsten lamp situation which this paper elicited, an announcement was made of a tungsten sign lamp of 4 cp, taking 5 watts at 10 volts, and having a life of about 2000 hours. It is intended to be operated from a small transformer located at the sign, and having a 10-volt secondary.

Mr. F. W. Willcox, of the General Electric lamp factory, also called attention to the new 40-watt tungsten lamp which is now being made in small bulbs so that it can be placed in regular 16-cp lamp sockets. This lamp lists at 10 cents less than the large-bulb, 40-watt lamp.

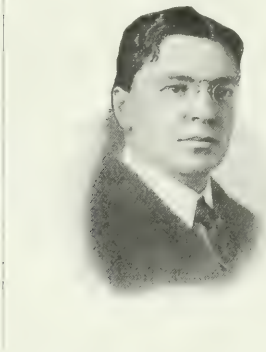
The discussion on tungsten lamps was followed by a paper by Mr. Ludwig Koeppel, manager of the Albert Lea (Minn.) Light & Power Company, on "Cost Keeping in the Contracting Department," an abstract of which is printed elsewhere. He described a system of keeping records of supplies and labor used in wiring and piping contracting in a central-station company doing $10,000 worth of contracting business annually. By the employment of a storekeeper his company had stopped so many leaks that the contracting business, instead of showing an annual loss, was showing a good annual profit.

with about the same gross business. He therefore fully indorsed the idea of having a storekeeper and a proper system, even in a small company, with that volume of contracting business. The storekeeper does other work, such as testing and repairing meters and arc lamps which are brought in to him.

On Thursday morning the Allis-Chalmers Company provided a special car from the hotel to West Allis, where an hour was spent by the members in going through the great shops of that company. This trip took up practically all the morning.

The afternoon session was given over to matters pertaining to the regulation of electric service by the Wisconsin Railroad Commission. A paper on "The Control of the Adequacy of Electric Service" was read by Mr. F. A. Vaughn, of the Milwaukee Electric Railway & Light Company, of which an abstract appears elsewhere. He took up in detail various rules regarding the adequacy of electric service, formulated by the Wisconsin State Commission, and gave the methods which his company is pursuing in testing and keeping records of meters, voltage regulation and other matters having directly to do with consumers' service.

The convention was then fortunate in listening to an address by Prof. B. H. Meyer, chairman of the Wisconsin Railway and Public Service Commission, whose remarks were very reassuring to the members as to the fairness of the treatment they would receive at the hands of the commission. He came out strongly in favor of developing the profit-sharing idea suggested in the public-service law, which makes it possible to increase dividends when there is also a reduction of rates. Both these papers were discussed at length, and many questions asked regarding the attitude of the commission on various matters.



PRESIDENT ERNEST GONZENBACH.

The officers elected for the ensuing year were as follows: President, Mr. Ernest Gonzenbach, general manager of the Sheboygan Light, Power & Railway Company; first vice-president, Mr. George B. Wheeler, secretary and general manager of the Chippewa Valley Railway, Light & Power Company, Eau Claire; second vice-president, Mr. Roger N. Kimball, Kenosha Gas & Electric Company; secretary and treasurer, Mr. John S. Allen, manager Equitable Electric Light Company, Lake Geneva, Wis. Executive committee: Messrs. P. H. Korst, of Janesville; Clement C. Smith, of Milwaukee, and J. H. Harding, of La Porte, Ind.

Mr. Ernest Gonzenbach, who was elected president of the Northwestern Electrical Association, is vice-president and general manager of the Sheboygan Light, Power & Railway Company, Sheboygan, Wis. Although Mr. Gonzenbach's reputation has been largely made in the electric railway field, he has demonstrated since taking hold of the Sheboygan property his ability also to handle electric lighting problems in a broad way, and is one of the few managers who combine well the ability and willingness to give attention to details of both railway and lighting work. For the past three years he has taken a prominent part in the proceedings of the Northwestern Electrical Association. Mr. Gonzenbach is Swiss by birth and education, but came to this country immediately after leaving school. After an electrical experience in power-house work in Chicago he passed through the Thomson-Houston expert course at Lynn, Mass. In 1895, as electrical engineer in St. Johnsbury, Vt., he constructed several electric light and transmission plants in that vicinity. In 1898 he went with the Westinghouse Company, and in 1900 became electrical engineer of the Albany & Hudson Electric Railway, from which he went to Chicago to take a similar position with the Aurora, Elgin & Chicago Railroad, then being constructed. He has been at Sheboygan as general manager since Jan. 1, 1905.

Artificial Electric Lines.

In a paper published in the *Proceedings* of the American Academy of Arts and Sciences for 1908, Dr. A. E. Kennelly treats mathematically the subject of "Artificial Lines for Continuous Currents in the Steady State." The subject is developed under the heads of types of artificial lines; fundamental relations and notations; artificial line free at far end; line grounded at far end; best resistance of receiving instruments; imitative accuracy of artificial lines; equivalence between single-section artificial line and uniform smooth line.

The conclusions are that every artificial line composed of similar mid-leak sections, carrying either continuous or alternating currents, may be reduced trigometrically to its equivalent smooth line, and reciprocally. The resistance, current and voltage at the various junctions and leaks along the lines are simple hyperbolic sections of the analysis. Every smooth line in the steady state carrying either continuous or alternating current may be externally completely replaced by one, and only one, single-section mid-leak artificial line; or by one, and only one, single conductor with equal terminal leaks, and reciprocally. This proposition is stated to have numerous applications in telegraphy, telephony, power transmission and distribution.

Electrical Attachments to Gasoline and Oil Engines.

Five joint patents were granted Jan. 19 to Harry Hertzberg, of New York City, and A. A. Low, of Horseshoe, N. Y., on the application of electrical heat to the vaporizer of gasoline and oil engines. The specifications state that such an engine cannot be started quickly when a combustible mixture of air and oil is first supplied to the cylinder owing to the fact that the oil has a tendency to condense by contact with the cold surfaces of the cylinder and its head. Ordinarily the cylinder is heated by some external appliance or flame, which is stated to be objectionable for a number of reasons. The object of the invention patented is to overcome these objections and to vaporize quickly the liquid combustible when starting and while operating a vapor engine, thus requiring only one kind of grade of fuel to be used in the operation of the engine. Two kinds of devices are described for this purpose, one being used internally and the other externally. In both cases the vaporizing surface is heated electrically to the required temperature in a very brief time. It has been found that in a few minutes the engine by this means may become sufficiently heated up to vaporize the successive charges of fuel, after which the preliminary electric starting device is discontinued from service. Another patent on a vaporizer of the same type was also on the same date granted to A. A. Low individually.

On the same date a patent was granted to F. S. Perrin, of New York, on a speed-limiting device for electrically ignited explosive engines. This consists of a centrifugal arrangement like a speed indicator, by means of which when the speed of an automobile exceeds a predetermined amount the primary of the sparking coil is cut out.

Appointments to Harvard Engineering Faculty.

The appointments of Prof. George F. Swain and of Prof. H. E. Clifford, both of the Massachusetts Institute of Technology, to the Graduate School of Applied Science at Harvard University, has been just announced. The appointments will be effected next September. Professor Swain is at present in charge of the department of Civil Engineering at the Institute of Technology and has carried on much teaching and notable engineering work at that institution for a number of years. Professor Clifford was born in Lowell in 1866, and was graduated from the Institute of Technology with the degree of bachelor of science in electrical engineering in 1886. He immediately joined the teaching staff and has since been continuously connected with the institute. He was appointed assistant professor of electrical engineering in 1895, professor in 1904, and was acting head of the department from 1904 to the accession of Prof. Dugald C. Jackson in 1907. Professor Clifford is one of the board of directors of the American Institute of Electrical Engineers and is a past-chairman of the Boston section. He is a fellow of the American Academy of Arts and Sciences and of the Circolo Mathematico di Palermo.

Both of these appointments have been made in view of the approach of the first payment of $1,000,000 to Harvard University from the great McKay bequest for applied science. It is stated that other appointments to the engineering departments are to follow. Inasmuch as engineering has occupied a prominent department of Harvard University for some time past, it is expected that, with the impetus given by the McKay bequest as it comes into operation, a graduate school of applied science will be built up at Harvard second to none in engineering, mining and metallurgy, architecture, forestry, chemistry and physics.

Cost of Installing Small Central Stations.

The Massachusetts Gas and Electric Light Commission has approved the issue of stock by the Lawrence Gas Company to the amount of $600,000 par value at a market value of $160 per share to cover the payment of promissory notes and the cost of additions to the gas and electric plants. The company has expended $385,133 on construction work in its electrical department in the period between July 1, 1906, and Oct. 31, 1908, and estimates that the cost of completing the work will be $39,355.

The recent electrical improvements comprise the following items:

EDISON ELECTRIC PLANT.

The inside dimensions were 91 ft. long, 36.5 ft. wide, height 17 ft. 8 in.; front bay, 36 ft. x 10 ft. The work existed of building new walls on three sides of the station, erection of bay across full width of building at front for feeders; lining of walls inside with face brick; laying concrete foundation; excavating for basement; building air chambers for basement; construction of subway for ducts, and erection of steel frame, floor and roof.

[illegible]

Wire, supplies and incidentals work..... $96
Company's labor..... 313
$2,592
Sundry labor, supplies and engineering..... 1,817
$4,409

Labor, setting up blower plant..... $19.56
Labor, wiring blower plant..... 32.72
Labor on new busbar..... 38.40
Fittings, insulators, etc..... 30.47
$123.15
Total Edison electric plant..... $35,565

SOUTH SIDE ELECTRIC PLANT EXTENSION.

Balance of cost of completing work (building)..... $9,122
Machinery..... 20,583
Including the following items of interest:
Damper regulator..... $[illegible]
7-10" valves for circulating water system..... [illegible]
2-6", 5-8", 2-12" valves for main steam system..... 667
1000 ft. 500,000 c. m. cable..... 543
Total, South Side plant extension..... $29,706

ELECTRIC LINES.

Total cost..... $37,38[illegible]
Items of interest:

No. B & S.	Wire, length.	Cost.
[illegible]	33,700 ft.	$3,697
[illegible]	40,074 ft.	5,081
2	10,650 ft.	1,083
4	39,030 ft.	3,414
[illegible]	[illegible]	4,286
8	34,617 ft.	931

Poles (kind not stated)			Cross arms		Mast arms.	
Size.	Number	Cost	Size.	Number.	Cost	Number.	Cost.
30 ft.	153	$613	6 pin	981	$833	31	$310
35 ft.	125	690	8 pin	434	434		
40 ft.	16	112	10 pin	79	95		
45 ft.	5	43					
50 ft.	7	84					
55 ft.	2	30					

Hangers			Switches	
Hooks				
[illegible]	$8	30. [illegible]	$2.	278. [illegible] $14

UNDERGROUND CONDUIT.

Conduit.
Total length of street covered, feet..... 2,140
Total duct, feet..... 20,119
Size of duct, 3¼ in. inside, vitrified clay, ducts laid in concrete:
14,619 duct feet for mains..... $375.99
[illegible] duct feet for services..... [illegible]
264 duct feet for bends for services..... 58.50
Conduit wrappers..... 24.35
Total..... $1,240.82
Laying ducts (cement, $270; sand, $98; broken stone, $192; lumber, $241)..... 801.35
Labor and teaming..... [illegible]
Total..... $4,578.29
Conduit cost, laid:
Cables, 49,859 ft., cost..... $11,805.00
Cables drawing in 49,859 ft., cost..... 1,710.00
[illegible]
Enlargement of South Side plant. Original size of boiler house, 48 x 51 ft., enlarged to 95 x 81 ft.; foundations, steel beams and concrete; walls, brick and steel; roof, steel and tiles; floor, concrete and brick. Height, 33 ft. 4 in.
Dynamo house: Brick, steel and concrete. Original size extended by 28 x 47 ft. addition. Height, 42 ft.
Economizer house: Length, 91 ft. 7 in. x 26 ft. 6 in. Height, 32 ft., with addition for mechanical draft, 15 ft. 6 in. x 12 ft. 3 in. Brick, steel and concrete.

BOILER HOUSE.

Total building cost, boiler house..... $12,561
Total machinery cost, boiler house..... 36,431
Machinery includes following items of interest:
3 604-hp B. & W. boilers, with superheaters, erected..... $25,717
[illegible]
1 Cochrane feed-water heater, erected..... 1,250

GENERATOR HOUSE.

[illegible]
Total machinery cost..... 82,151
Machinery includes following items of interest:
1 2250 Curtis turbine, $58,000.
1 2250 Curtis turbine foundation, $1,188.
1 2250 Curtis turbine foundation (excavating and back filling), $[illegible].
1 2250 Curtis turbine: Freight, $375.00; teaming and labor, $184; sundries, $43.54.
[illegible]
Condenser and auxiliary foundations, $401.
75-kw turbo exciter set and foundation: Turbo exciter, $158; foundation, $2,887.
[illegible]

Winnipeg Municipal Plant.

On June 19 the Winnipeg City Council [illegible] to purchase [illegible] the Winnipeg Street Railway Company to sell the municipality its entire railway and lighting plant for $16,000,000, authorized the immediate execution of contracts for the completion of the new power plant, which will ultimately cost [illegible]. The City Railway Company had offered to reduce the present rate for light and power 20 per cent below the [illegible] and to sell all the power the city might require

for retail purposes at $24.60 per annual horse-power. The city plant will generate 60,000 hp. That the feeling between the Winnipeg Street Railway Company and the municipality is tense is indicated by the refusal of the latter to allow the streets to be opened for carrying out a recent ordinance requiring circuits to be placed underground.

Transformers and Secondary Distribution.

At a meeting of the Lewis Institute branch of the A. I. E. E., held at Lewis Institute, Chicago, on Jan. 20, at which about 425 members and visitors were present, Mr. Harry B. Gear, general inspector of the Commonwealth Edison Company, gave an interesting talk on the topic "Transformers and Secondary Distribution." In the first alternating-current lighting systems, he said, the transformers usually had 50-volt secondaries. On account of the heavy line loss with this low voltage, the transformers had to be located close to the consumer, and for this reason it was customary to hang a transformer near each building, which made a very expensive and inefficient installation. Later came the three-wire, 110-220-volt secondary, which made it possible to supply a number of consumers from one transformer, and by taking advantage of the "diversity factor" it became possible to supply a given district with a very much smaller amount of transformer capacity. In this way a few large transformers take the place of many small ones, and the first cost and installation cost are much reduced, and the efficiency is better.

It does not pay, however, to cover too large a territory from one transformer. In illustrating this the speaker assumed the case of two adjoining city blocks (600 ft.) and worked out a comparison of cost, first with one transformer for both blocks, and, second, with a transformer in each block. In the first case the transformer was cheaper and the copper more expensive than in the second case. The practice of the Commonwealth Edison Company is to locate one transformer in the center of each block, and run a three-wire circuit 300 ft. in each direction. No attempt is made to figure the line losses in such systems. The company makes a practice of putting up certain standard lines, more than large enough to take care of the existing loads, and as the load grows on these lines simply increases the transformer size from time to time.

Three-wire circuits are not used unless more than 40 lights are to be supplied. If any service calls for a larger capacity than 50 kw, two or more transformers are put in parallel to supply it. It is not the rule to operate motors on lighting circuits on account of the disturbing effects of the motor currents. Only motors smaller than ½ hp are put on lighting circuits. For motors larger than ½ hp and up to 15 hp the open delta is used with two transformers. For still larger sizes, three transformers are used.

In the discussion following the lecture, Mr. Gear explained the method of splitting off single-phase lighting feeders from a trunk three-phase four-wire feeder. He showed how four voltmeter compensators are used and how they are set, so that the station voltmeters read the voltages existing at the distant ends of the feeders. He stated that in some recent installations the voltage of each feeder is regulated automatically by means of a contact-making voltmeter.

Effect of Dirt on Globes and Reflectors.

Mr. A. L. Eustice presented a paper before the Chicago section of the Illuminating Engineering Society, Jan. 22, the subject being "Lamp Efficiencies or the Efficiency of the System—Which?" This paper took up the results of some of a large number of tests made by Mr. Eustice on the loss of light due to dirt on globes and reflectors. The results given included one laboratory test on a 60-watt tungsten lamp and clear prismatic bowl reflector; 13 tests on actual installations of Nernst lamps before and after cleaning and two tests on an installation of 4-amp arc lamps.

The test on the tungsten lamp and reflector, which was made after they had been hanging for one year in the Nernst factory laboratory so that a large amount of dirt had collected, showed 35 per cent loss in lower hemispherical candle-power. Cleaning the reflector by wiping and dusting reduced this to 19 per cent. The lamp and reflector were then scrubbed in soap and water. The results of measurements then taken were made the basis for the percentage losses given before.

The five Nernst lamp installations tested showed losses ranging from 1.5 per cent to 20.4 per cent. In some of these cases the loss was partially due to depreciation of the lamp by the falling off in candle-power of the glower and the blackening of the reflecting surface above the glower. The lamps when tested dirty were in ordinary maintenance condition.

The arc-lamp installation showed a loss of 20 per cent, largely because of the dirty condition of the inner globes. In presenting the figures, Mr. Eustice called special attention to the danger of taking laboratory figures as representing commercial conditions of actual installations. He said that the data obtained with prismatic glassware, as has already been quoted, were so astonishing as to lead to a change of plans for the tests which originally contemplated laboratory tests only. He said that these results would be supplemented later by others which he did not have time to tabulate and draw conclusions from. Most of the installations tested and reported were from the older types of Nernst lamp. An installation of Westinghouse Nernst lamps, however, was tested—that in the Siegel-Cooper Company store in Chicago. In this case the watts per lumen (that is, the watts per square foot required to produce 1 ft.-candle average illumination) were 0.240 with clean, new lamps; 0.276 with clean lamps depreciated by use, and 0.295 with glassware dirty and lamps depreciated with use, as under ordinary maintenance conditions. The conditions in this case were that of a general merchandise store with white ceilings, white walls and maple floor. The lamps were of the three-glower type.

Chairman Cravath announced that the membership of the Chicago section had reached 183 at the first of the year, 73 new members having been accepted during the year. The present section officers continue until June, 1909, in order to bring the election of new officers in accordance with a recent amendment to the constitution.

Kalamazoo River Water Power.

The Commonwealth Power Company, of Jackson, Mich., is developing 23,000 hp at five various points of the Kalamazoo River and at one point on the Grand River. The largest power is at Webber, where 6000 hp is generated; 3000 hp is generated at Otsego, and 2000 each at Plainwell and Ceresco. The company has also steam plants at Jackson, Battle Creek and Kalamazoo; the first mentioned is now being practically doubled in size, to have a capacity of 4000 hp, while the two last mentioned each generates 1000 hp. The transmission lines of the company cover a territory of 140 square miles, including Allegan, Otsego, Kalamazoo, Galesburg, Augusta, Battle Creek, Marshall, Albion, Parma, Jackson and Lansing. Grand Ledge is abandoning a municipal plant and has contracted with the company for the operation of its pumping plant and to light its streets. The company supplies 10,227 hp to motors in manufacturing plants.

New Telephone Receiver.

Among the early experimental shapes of telephone receiver was the "spoon" type, in which the permanent magnet was set at right angles to its extension pole piece. However, the hand type, which is the form of receiver in common use to-day, soon superseded all others. On the other hand, the spoon type seems to lend itself well to certain adjustments, as evidenced by a recent patent granted to J. T. Curtis, of Bement, Ill. In the receiver therein described, the U-type magnet carries two pole extensions and a spacer between them; each extension has its own coil. The pole faces of the extension parallel the length of the magnet, which latter is held about midway of its length in the wall of a hall like casing, the pole-end being within the

ball. A hand piece screws onto the ball so as to cover the projecting end of the magnet. The diaphragm is carried by a formed-up annulus, against which it is held by the ear cap. The seat for the diaphragm is tapered and the clamping face of the cap is cut to match, in a manner such that forcing the cap home puts the diaphragm under radial tension. The annulus screws down on a neck opening from the ball casing, in a manner to confront the pole faces with the diaphragm. A proper adjustment is effected by adjusting the annulus upon the threaded neck, and then a ring lock-nut carried by threads upon the outside of the annulus serves to jam the parts, thereby locking them in position.

CURRENT NEWS AND NOTES.

WATER-POWER CONTROL IN OKLAHOMA.—A bill will be introduced in the Oklahoma Legislature for State control of streams having water powers.

ILLINOIS WATER POWERS.—Governor Deneen, of Illinois, in his inaugural message discusses at length the subject of water powers, and recommended action whereby the State should invest itself with title to such powers now undeveloped.

MUNICIPAL OWNERSHIP IN WASHINGTON, D. C.—A bill has been introduced in Congress authorizing the Commissioners of the District of Columbia to acquire all the present electric lighting and gas-light plants for operation by the District government.

PHILADELPHIA PLAN TO TAX PUBLIC UTILITY POWER PLANTS.—A bill has been introduced in the Pennsylvania Legislature to tax the power plants of public utility companies in Philadelphia, which under present law are exempt from taxation. The assessed value of these plants in the city is $1,933,600.

WORCESTER POLYTECHNIC A. I. E. E. BRANCH.—The next meeting of the Worcester Polytechnic Institute branch of the A. I. E. E. will be held in the Electrical Engineering Building of the Institute at 8 p. m. Friday, Jan. 29. Mr. Leon I. Thomas will deliver a lecture on "Wireless Telephony and Its Recent Developments."

N. E. L. A. CONVENTION.—It has been decided to hold the annual convention of the National Electric Light Association during the first week in June at Atlantic City, and President Eglin has made the necessary arrangements with the hotel managers' association for that period, including the use of the Pier, where the meetings will be held and the exhibit made.

MASSACHUSETTS MUNICIPAL PLANT LEGISLATION.—A bill has been introduced into the Massachusetts Legislature to authorize cities and towns having gas or electric lighting plants to purchase gas or electricity from an adjoining city or town, or from any corporation manufacturing it. Another bill authorizes the town of South Framingham to purchase electricity for municipal purposes for use in its water supply and sewage disposal departments.

NIAGARA POWER.—According to a report just issued, the shutting down of the two American Niagara water-power plants on several occasions last year showed that these plants in diverting 8000 cu. ft. of water per second lowered the water level on the American side only 2/5 in., the normal flow level of the American Falls being about 19 in. On the other hand, the level of the river at Grass Island was lowered 3⅛ in., and near the Ontario intake on the Canadian side about 1¼ in.

I. E. S., BOSTON BRANCH.—The annual meeting of the Boston section of the Illuminating Engineering Society was held at the Edison Building, Boston, on the evening of Jan. 19. The following officers were elected for the ensuing year: Chairman, Mr. Theo. H. Piser, Welsbach Company, Boston; secretary, L. D. Gibbs, Edison Electric Illuminating Company, Boston. The paper on "Street Lighting" presented at the New York section by Mr. Walter C. Allen, electrical engineer of the District of Columbia, was read.

ELECTRICAL TRADES SOCIETY.—At the January meeting of the board of directors of the Electrical Trades Society, of New York, the Wire & Telephone Company, of Rome, N. Y., was admitted as a new member. A membership committee was named with Mr. John H. Dale, president of the Dale Company, New York City, as chairman. Every manufacturer and every dealer in electrical supplies is eligible to membership in this society and an active campaign for new members is to be inaugurated. The headquarters of the organization is at 80 Wall Street.

MUSEUM OF SAFETY AND SANITATION.—Announcement has just been made of the acceptance of the treasurership of the Museum of Safety and Sanitation by Mr. Frank A. Vanderlip. An executive office for the administrative and promotive work of the museum has been opened at the United Engineering Societies Building, 29 West Thirty-ninth Street, New York City. Plans are being pushed forward along practicable lines to prevent the loss of life and limb through the Museum of Safety and Sanitation, where safety devices for dangerous machines and preventable methods of combating dread diseases may be demonstrated.

WIRELESS AND WRECK OF THE REPUBLIC.—Wireless telegraphy scored a triumph at the wreck last week of the White Star liner *Republic,* which was rammed and sunk off Nantucket. Immediately following the disaster the wireless operator on the vessel signaled the news and immediately almost a dozen vessels equipped with wireless which were within signaling distance, including several ocean liners, left their courses and speeded to the scene of the wreck, which was indicated in the message intercepted. With the assistance thus afforded, all hands—numbering almost 2000—were safely transferred from the sinking vessel, some of the aiding vessels playing their searchlights on the boats going to and from the vessel.

CANADIAN PACIFIC ELECTRIFICATION.—It is announced that the Canadian Pacific Railway has decided to electrify its system through the mountains of the West. Plans were begun a year ago, when experts were sent to examine the mountain streams and the available water supply between the eastern Rockies and the Pacific Coast range. They reported that there were enough waterfalls immediately adjacent to the Canadian Pacific's main line to "develop energy sufficient to run all the railways in the world." Many water sites have been purchased and throughout British Columbia options on others have been obtained. The advances made by the Canadian Northern and the Grand Trunk lines in the West are said to have been responsible for this action by the Canadian Pacific.

THE ELECTRIC PIANO PLAYER.—At a meeting of the New York Electrical Society, held in the Engineering Societies Building, New York, on Jan. 20, Dr. John F. Kelly, president of the Telelectric Company, delivered an interesting and instructive lecture on "The Development of the Electric Piano Player." After reviewing historically the inventions relating to automatic piano players Dr. Kelly outlined the problem of producing the required electromagnetic devices for the so-called electric player and explained the schemes used for controlling the speed, touch, expression and accentuation. As now constructed the electric piano player affords control of the individual notes to such an extent that the melody is properly accentuated in distinction to the accompaniment, while the time is under perfect control, and the harmony is mathematically exact. That the electric player has reached a high state of development was demonstrated by means of machines in actual operation in piano solo work and in accompanying the human voice both while under manual control and while performing automatically.

OXFORD ELECTRICAL LABORATORY.—Work has commenced on the laboratory given to the University of Oxford for electrical work by the Drapers' Company of London.

FORT WAYNE ELECTROTECHNIC CLUB.—The Electrotechnic Club, of Fort Wayne, Ind., held its annual social meeting on Jan. 19. The attendance was large and the entertainment and social function were heartily enjoyed.

SIXTY-CENT GAS FOR EVANSVILLE, IND.—A bill has been introduced in the Senate by Senator Durre providing for 60-cent gas in Evansville. At present the rate charged by the Evansville Gas & Electric Light Company is $1.10 per 1000 ft. for gas for fuel and light.

WIRELESS BETWEEN COLLEGES.—Princeton and Columbia Universities and the University of Pennsylvania have students' wireless clubs, which propose to establish regular wireless communication between New York and Princeton and Princeton and Philadelphia.

BROOKLYN ELECTRIC LIGHTING RATES.—A bill has been introduced in the New York State Legislature reducing the maximum rate in Brooklyn, N. Y., for electrical energy from 12 cents per kw-hour to 10 cents. The change would make the rate uniform with that of Manhattan Borough..

ELECTRIC HEADLIGHTS.—Senator Kistler has presented a bill to the Indiana Senate which, if it becomes a law, will require electric headlights on all locomotives operated by railroads in Indiana. The bill provides that the light shall be of not less than 2000 cp. The railroads are given until Sept. 1, 1909, to equip all passenger engines, and Jan. 1, 1910, for freight engines.

GRAND RAPIDS-MUSKEGON WATER-POWER FRANCHISE.—The supervisors of Mecosta County, Michigan, contend that a franchise for the use of water power on the Muskegon River granted to the Grand Rapids-Muskegon Power Company will expire April 1, because of non-compliance with its provisions. It is stated that the Muskegon River is capable of developing 26,000 hp within the county. One proposition is to require a payment of 7 per cent of the gross earnings arising from the use of the power developed on the river.

INDIANA PUBLIC SERVICE BILLS.—Senator Beal and Representative Garrard will each introduce a public utilities bill before the Indiana Legislature. Each bill provides for a State commission of carefully selected men to have charge of public utilities questions in cities of Indiana, much as the Indiana Railroad Commission now has control over questions relating to railway rates, safety measures and other railroad questions. The Indiana gas men are said to be in favor of an equitable public utilities law because of the belief that such a law would make more secure the standing of reputable companies in the stock and bond market and would place such companies out of the realm of interference by politicians.

EFFICACY OF TROLLEY WIRES.—In a paper presented before the Division of Industrial Chemists and Chemical Engineers of the American Chemical Society on Dec. 31, 1908, Mr. F. Woods called attention to the desirability of purchasing trolley wire with restrictions on the quality of material. He showed that two wires having equal diameter and equal conductivity may differ greatly as to torsional and tensile strength. Wires should possess high tensile strength in order to withstand abnormal loads, while high torsional strength indicates homogeniety and toughness—two desirable characteristics. In order to obtain the best results it is necessary to use high-grade copper, and to prevent an excess of cuprous oxide entering at any stage of the manufacture.

MICHIGAN WATER-POWER INVESTIGATION.—The Michigan Legislature has appointed a special waterways committee with a view to investigating charges made that the waterways of the State are now being acquired by large corporations without adequate compensation, and for purposes which threaten the commercial development of the State. The cause of the investigation has been the publication of charges that the Grand Rapids-Muskegon, Commonwealth and West Michigan companies on the western side of the State, and the Detroit Edison Company on the eastern slope, had formed a merger for the purpose of gaining absolute control of all water-power flowage rights, and that the Edison Company had purchased practically all the rights on the power-producing streams of eastern Michigan, all of which power that company could not use for 50 years.

ELECTRIC RAILWAY ELECTROLYSIS IN NEW BEDFORD, MASS.—Mr. William E. Foss, consulting engineer, of Boston, has made a report to the city of New Bedford, Mass., giving the results of investigations as to electrolytic corrosion in that city from electric railway ground returns. It would be necessary, he said, for the electric railway company to insulate its return circuit completely to stop all electrolytic corrosion, but the amount of damage which has been discovered does not seem to warrant the outlay, provided a satisfactory arrangement can be made between the interested parties covering the expense for damages that are discovered and for carrying out means for reducing electrolytic corrosion to a minimum. He recommended all defective rail bonding to be repaired, the installation of test wires and boxes, the separation of submarine pipes and cables under drawbridges as far as possible, and the reduction of present excessive fall of potential on non-insulated railway return conductors.

TELEPHONE COUPON BOOKS.—Mr. J. B. Hoge, of Cleveland, Ohio, the well-known independent telephone manager, has designed an interchangeable coupon book for the use of the long-distance telephone companies of the country, patterned to some extent after the books used by the electric railways which are members of the Central Electric Railway Mileage Bureau. The coupons are for five cents each, and as many may be taken out as are required to pay for a message at the office of any of the companies that enter into the arrangements. A clearing office will be established at Cleveland, and all coupons will be sent there, where settlements with the companies will be made. It is understood that all the independent long-distance companies will become members of this bureau. In fact, many of them have been working for some time to secure a uniform plan of some kind along these lines. The books will insure a reduction in the rates, because of the fact that the purchaser pays in advance for many calls. The companies can thus afford to do this.

OHIO TELEPHONIC LEGISLATION.—Representative A. B. Canfield has introduced a bill in the Ohio House of Representatives having for its purpose to compel the interchange of long-distance business between the Bell companies and the independents wherever it is necessary to do so in order to get a message through to destination. It provides for forfeiture of the charter of any company that refuses to connect its lines with those of any other company whenever it is necessary to transmit a message in that way. In the past efforts have been made to secure such a law, but not enough members could see the necessity of putting requirements upon the companies that might destroy competition and make it impossible for the further development of territory by the independents. This bill also contains a provision limiting the rate that local exchanges shall charge to $24 a year in cities of 100,000 population or less, with an increase of $6 for each 100,000. For long-distance business the rate is to be not more than half a cent a mile for five minutes' conversation. The difference in the length of conversation is the greatest change over present rates for long-distance service.

Large Water-Power Stations of the Rochester Railway & Light Company.

THE largest and most important water-power station of the Rochester Railway & Light Company is known as Station No. 5. It is located on the Lower Falls of the Genesee River, where there is a head of 96 ft. and where there is at present being developed about 4550 kw. An excellent view of the station and of the falls at slack-water period is shown in Fig. 1. A plan view and sectional elevation of the complete generating station is shown in Fig. 2, and Fig. 4 gives a view of the power-house interior. The lower level of the river is about 124 ft. below the general level at the top of the high bank, so that the upper level of the river is more than midway between the street level and the base of the falls.

Station No. 5 is on the opposite bank of the river from Station No. 15, described in our issue of Jan. 14, and is not much more than a stone's throw below it. The power house, which is



FIG. 1.—VIEW OF STATION NO. 5 OF THE ROCHESTER RAILWAY & LIGHT COMPANY ON THE LOWER FALLS OF THE GENESEE RIVER.

47 ft. x 90 ft. x 47 ft. high, is built of masonry on concrete foundations placed in the rock at the river bottom. The construction and layout are such that the station can be extended eastward toward the high bank of the river, and its present proportions duplicated. At the outset the equipment was faced with concrete and the forebay used for an old plant located at this point enlarged to give a rock length of 80 ft. To the westward or river edge the depth of water at the intake is 17 ft.

From the forebay two 11-ft. and three 6-ft. penstocks are run, as shown in Fig. 2. Only one of the 11-ft. penstocks is in use. The penstocks have a vertical descent to the floor of the station. The large penstock has a height of 94½ ft. and extends under the floor of the turbine room a distance of 75 ft. It is made of ⅝-in. steel, and to it are connected three 2100-hp turbines; two built by the Trump Manufacturing Company and one by the I. P. Morris Company. To the smaller penstocks are connected, respectively, a 900-hp Morris turbine, a 450-hp Leffel turbine driving a railway generator, and another of the same size and make driving an alternator. The large water-wheels are 42 in. in diameter with 96-in. openings from the penstock. The tail race is 14 ft. deep and has a concrete floor. The 11-ft. penstock is fitted with a Sturgess relief valve and the 6-ft. penstocks are equipped with Lombard relief valves. Each of the 2100-hp turbines has an 84-in. valve for shutting off the water in case of repairs, and the penstock supplying the 900-hp turbine is fitted with a hydraulic valve for this purpose, the other valves being motor-operated. All the turbines are equipped with Sturgess oil-pressure governors so interconnected that in case of failure of the pump on one unit, the pressure can be supplied by the rest. A 25-ton crane spans the generator room so that repairs can be readily made. An inclined railway runs from the cliff overhead to the power house below, as shown on the left of Fig. 1, and on this inclined railway all supplies, etc., are brought to the station.

The head-gate house is built at an angle to the flow of the river so that the swift exterior surface flow sweeping the full length of the gate-house screens carries all refuse and floating cake-ice over the falls beyond. The forebay is thus kept free of refuse and cake-ice, so that in winter mush-ice, also known as anchor ice, frazil or slush ice, is all that has to be contended with at the racks leading to the penstocks. Extending over the racks and gates leading to the penstocks is a corrugated iron shed which also hangs over a portion of the spillway. The front of the shed is brought down close to the water so that in winter the men who rake the slush-ice from the racks are well protected from the weather. Back of the racks and connecting with the spillway is an ample ice run. These simple provisions, combined with the strategic position of the power plant, have left it comparatively free from serious ice troubles.

The electrical equipment installed comprises three 1200-kw. three-phase, 25-cycle General Electric generators, each of

which is direct-connected to one of the 2100-hp turbines; one 500-kw, 550-volt generator, one 300-kw, 550-volt generator, and one 350-kw, 4150-volt, three-phase generator; the last three machines being of General Electric, Westinghouse and Bullock make, respectively. In addition to the generating equipment there is the following transforming apparatus: nine 71-kw constant-current transformers for alternating-current series circuits and a 500-kw frequency changer. The latter set has a 4150-volt, three-phase, 60-cycle motor and a 11,000-volt, three-phase, 25-cycle generator and is used for supplying energy to a 40-mile suburban line formerly fed from a steam-driven station located about six miles outside the city. Each of the large alternators receives exciting current from a 20-kw multipolar generator fitted to the extreme end of the shaft. The frequency changer has a 25-kw exciter set belted to it as has also the Bullock set. In addition there is a 50-kw motor-generator set available for boosting railway feeders.

The switchboard is situated on a gallery or pulpit on the falls with static and lightning arresters mounted in brick compartments. The feeders pass from the panels on the first gallery to switches on the second gallery and thence out through the roof of the station into ducts built in the wall overhead. On the top gallery are the constant-current transformers for the series arc-lamp circuits. Each transformer has its own panel mounted in front of it and the lightning arresters are placed on the wall back of the transformers. In all of the stations having such apparatus no attempt is made to have a board for transferring circuits, each transformer being equipped with a separate panel.

Two high-tension lines carrying energy from Niagara Falls are brought underground to Station No. 5. One of these passes direct from Station No. 6 and the other also comes from Station No. 6, but reaches Station No. 5 by way of Station No. 1. The 11,000-volt lines radiate from Station No. 5, one line being used to supply energy to Sodus Point, 40 miles away, and the other supplying energy to the railway at Charlotte

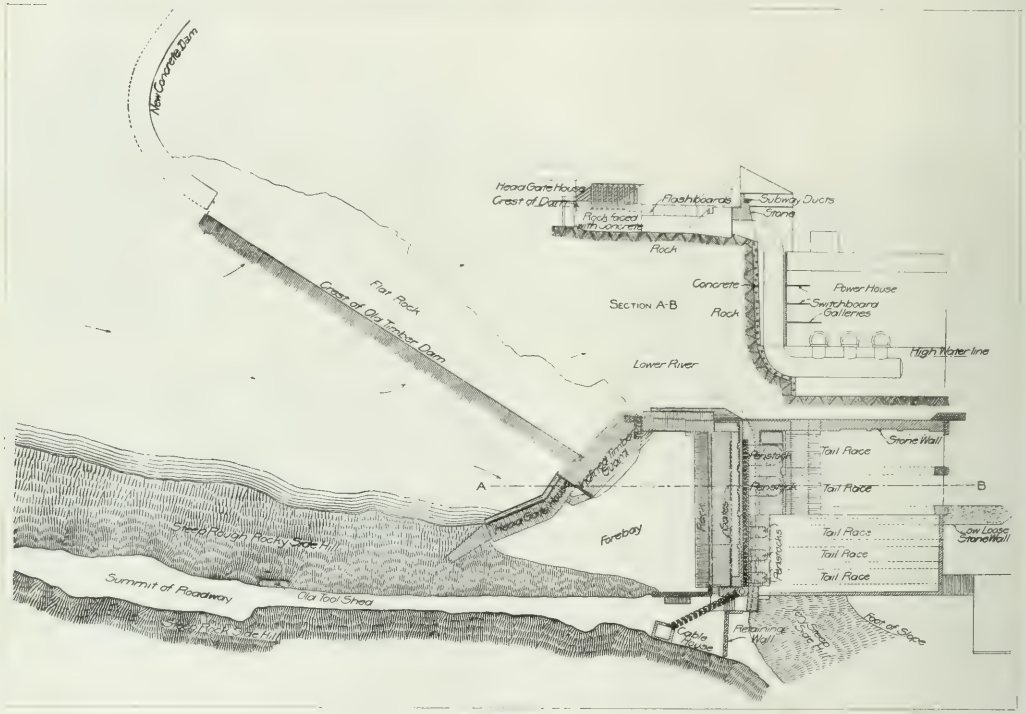


FIG. 2.—PLAN AND SECTIONAL ELEVATION OF WATER-POWER DEVELOPMENT.

side of the power house. The equipment is for a four-wire, three-phase system. As shown in Fig. 4, there are three galleries. On the first gallery the general arrangement consists of three generator panels in the center of the board with two interlocking oil switches and duplicate busbars. To the left are tie-feeder panels with oil switches and time-limit relays and farther on are three-phase distributing panels, arc-feeder panels and at the end a tie-line panel for an incoming circuit from Station No. 15. To the right of the generator panels are the panels for the frequency changer, the panels for the smaller alternator, exciter panels and panels for starting the frequency changer. On the left beyond the tie-line panel are panels for two incoming and two outgoing feeders for controlling energy received from Niagara Falls from this point. Beyond these panels are the panels for controlling the railway generators and feeders.

The second gallery contains the line disconnecting switches and vicinity. The Niagara lines are run underground from the Rochester Railway & Light Company's transformer station at Elmwood Avenue to Station No. 6. The transformer station is supplied from the Ontario Power Company's switching station, four miles outside the city. All the feed wires from Station No. 5 are carried up the face of the power house next to the falls, where they enter conduits forming part of the race wall and are carried up the high bank, where they enter the underground conduit system.

STATION NO. 4.

Station No. 4 is on the Upper Falls on the west side of the Genesee River alongside the tracks of the New York Central Railroad. The station is reached from the intersection of Central Avenue and North Water Street and is shown in Fig. 3. In the valley across the river is also shown Station No. 2, which is a combined steam- and water-power plant, the water

being taken from Brown's Race. Station No. 4 has many features of interest, chief among which are the number of old Edison machines in use and the switchboard for lighting circuits



FIG. 3.—GENERAL VIEW OF UPPER FALLS SHOWING STATIONS NO. 4 AND NO. 2

recently installed. When water is plentiful this station carries a railway load of about 3000 kw.

The head available at Station No. 4 is 94 ft., and the water power developed is 4200 kw. The equipment comprises two

the American system of rope drive to a countershaft, to which are belted two 150-kw, 125-volt Edison machines; one Poole & Hunt wheel belted direct to two 150-kw, 125-volt Edison machines; one 500-hp Leffel turbine belted to two 150-kw, 125-volt Edison machines; one 1200-hp Trump wheel belted to countershaft to which are belted two 150-kw and two 200-kw Edison bipolar machines; one 1200-hp Trump wheel direct-

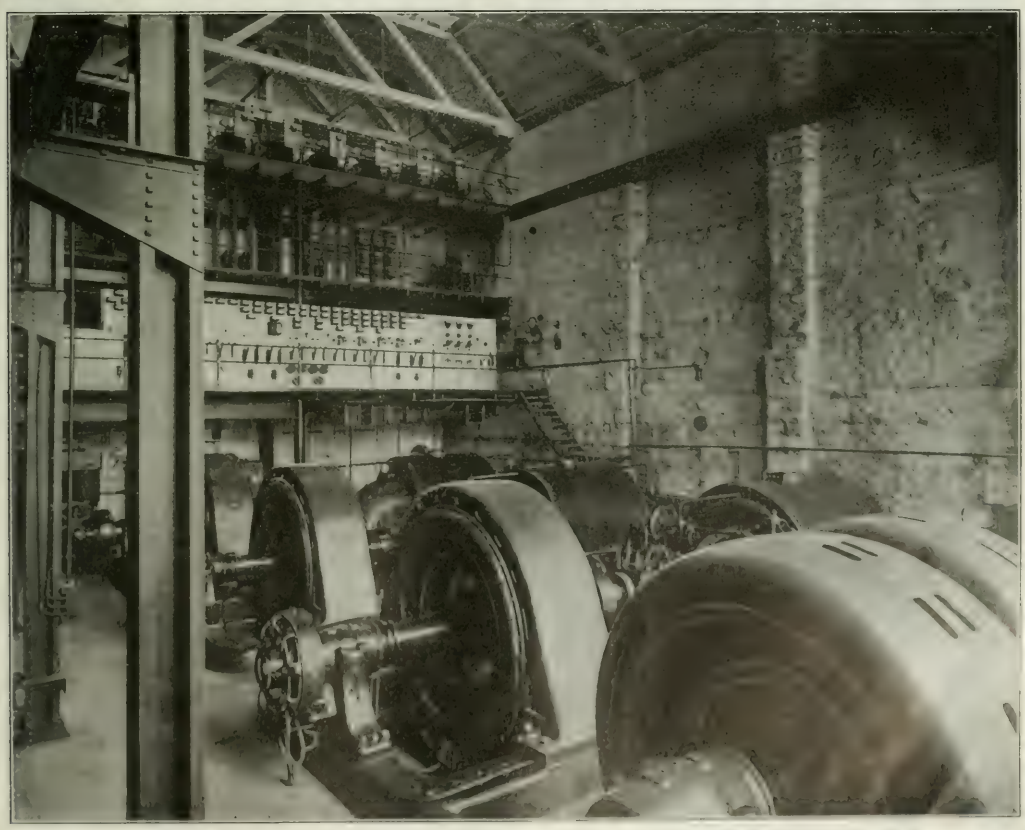


FIG. 4.—INTERIOR OF STATION NO. 5 OF THE [illegible] RAILWAY & LIGHT COMPANY

twin Leffel turbines rated at 500 hp and belted to four 150-kw, 250-volt Edison bipolar machines, two single Leffel wheels rated at 500 hp, belted to four 150-kw, 500-volt Edison machines, one Poole & Hunt wheel rated at 600 hp, connected by [illegible] to a 800-kw, 250-volt generator feeding the outside wires of the Edison system, and one 1200-hp Allis-Chalmers wheel direct-connected to a 800-kw, 250-volt generator, also feeding into the outside wires of the Edison system. The 250-

volt Edison generators are, as occasion demands, thrown in series and connected to the street railway network. In order to take advantage of the copper distribution available from this station two 500-kw motor-generator sets and one 350-kw motor-generator set are installed. These receive energy from the steam-driven stations and feed into the network focused here.

are 80 ft. high from center to center, and there is just enough room in the bottom of the station building for the direct-connected sets. The latter are shown in Fig. 5, and a view of the upper floor is given in Fig. 6. The Edison machines are a sort of survival of the fittest. They withstand rough usage

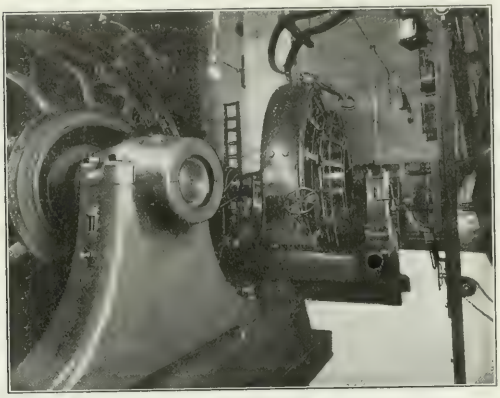


FIG. 5.—DIRECT CONNECTED GENERATORS IN STATION NO. 4.

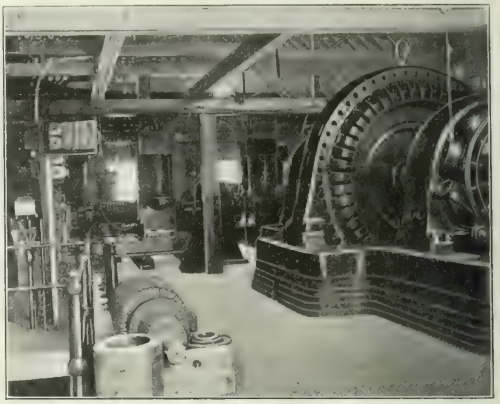


FIG. 6.—UPPER FLOOR OF STATION NO. 4.

In this way a great saving is effected in the amount of copper necessary to feed this district from the other stations at periods of very low water. The 300-kw motor-generator set is made up of a 350-kw induction motor and two 150-kw, 125-volt compound-wound generators. In the summer it is used principally as a 125-volt or 250-volt booster for the railway feeders and

better than later machines, and their momentary overload capacity is enormous. The Rochester company purchased them when the fever for direct-connected sets started, at about $8 per kilowatt, so that the actual investment is small. A number of them are also installed in other stations, and for peak-load conditions it is doubtful if cheaper and more reliable apparatus can be had. The machines are used chiefly for overloads on water power, and when water is plentiful they carry the load of the steam units, which may then be shut down. When the water is low the company has sufficient other more economical units to carry the load; but since at high water and flood conditions the water runs to waste anyway, the Edison machines are brought into use. For peak-load conditions the machines are used about 70 hours a year.

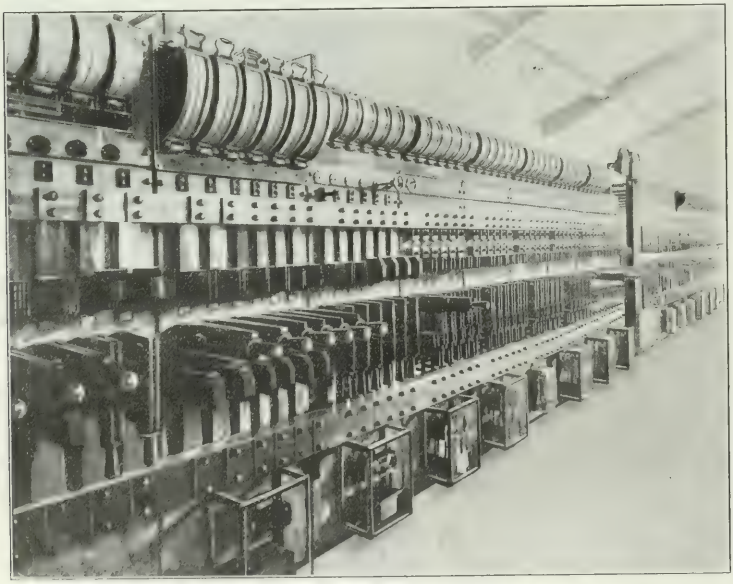


FIG. 7.—FRONT OF SWITCHBOARD FOR LIGHTING CIRCUITS IN STATION NO. 4.

The switchboard for the lighting circuits in Station No. 4 is shown in Fig. 7. This board controls Edison three-wire circuits with a total capacity of 60,000 amp in generators and 75,000 amp in feeders at 125 volts. The board controls 16 generators and 30 two-wire feeders. The generator panels are equipped with watt-hour meters and the feeder panels have double-throw switches with fusible cut-outs and ammeters. The board is arranged for carrying two pressures on any portion of the feeder and generator panels. Each generator and each feeder panel occupies a space 4½ in. wide, which is very small, indeed, considering the circuits controlled. The busbars are carried on the front of the board and the generator panels are equipped with edgewise ammeters at the top, below which are receptacles for voltmeters for balancing and cutting generators in on the system. In the same vertical plane are the rheostat

the tail and winter it is used chiefly as a plain shunt wound machine feeding into the Edison system. The machines are capable of taking full load without the series winding. The other motor generator sets have synchronous motors.

As might be inferred from the exterior view, the station is [illegible] appearance. The vertical drives

handle and switch so that the operator has the whole cycle of operations so arranged that mistakes liable to occur are reduced to a minimum. All positive and all negative polarities are grouped together, the neutral panel standing by itself. This enables any repair work or extensions to be made with the board alive and with absolutely no liability of short-circuit. The generator leads are brought to the board from below and the feeders pass out overhead to a room in the back of the board, whence they continue out in conduit to the underground system. The railway circuits are controlled from a board on



FIG. 8.—POLE LINE CROSSING RIVER.

the river side of the station. The latter board has 12 feeder panels and seven tie panels. There are four tie circuits running to Station No. 6 and three tie circuits running to Station No. 3. Some of the Edison three-wire circuits and the railway circuits are carried on a pole line across the river, as shown in Fig. 8. The lines are supported on cross-arms, which in turn are held by I-beams fastened to concrete piers built on the river bed. The feeders are made up of 500,000 circ.-mil cables.

Fluctuations in the Speed of the Rotors of Alternators Operating in Parallel.

By George H. Shepard.

In designing an engine for use with alternators, the designer usually draws a curve of crank-effort, of which Fig. 1 is an example from a two-stroke-cycle double-acting engine, and from it calculates the necessary moment of inertia of the flywheel to limit the angular velocity of the rotating parts within certain desired extremes. He then constructs the familiar curve of displacement to show the maximum amount that two similar



FIG. 1.—CRANK EFFORT OF A TWO-STROKE CYCLE DOUBLE-ACTING ENGINE.

engine-driven alternators can get out of step under the action of the crank efforts alone, the counter torque being assumed to be uniform. If this amount is less than that allowed by the specification of the electrical manufacturer, it is supposed that satisfactory parallel operation will be obtained; it is sometimes found, however, that excessive pumping of the alternators will take place in spite of such precautions.

The pumping is due to the fact that the counter torque is not uniform because, in addition to the crank efforts, the rotating parts of the engine-alternators are acted on by the electric cross-current, which exists whenever the machines in parallel get out of step.

Two alternators connected in parallel act as a unit on the external circuit, but oppose one another on the internal circuit, so long as they are exactly in step.

When one of the alternators lags behind the other in step its e.m.f. E (see Fig. 2) changes from a time-phase position in direct opposition to that of the other machine, to some later position. Immediately there is a resultant e.m.f., E', which produces a current i, which, in armatures as usually constructed, lags nearly 90 time-degrees behind E' and thus comes very nearly into time-phase agreement with the e.m.f. of the leading machine and time-phase opposition to that of the lagging machine. The current i is, therefore, a generator current for the leading machine and a motor current for the lagging machine. It evidently involves the taking of power from the leading machine and giving of it to the lagging machine, thus tending to slow the leader and speed the laggard.

The purpose of the present article is to explain the means that may be employed for stopping the enlargement of the angle of phase displacement (α in Fig. 2), while it is still very small.

Since, in good practice, a phase displacement of five or six electrical degrees is the maximum, α may be treated as a very

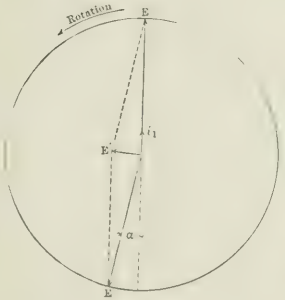


FIG. 2.—VOLTAGE RELATIONS.

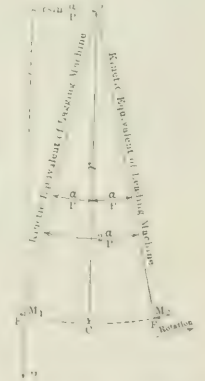


FIG. 3.—PENDULUM ACTION OF PARALLELED ALTERNATORS.

small angle. Hence, $E' = E \sin \alpha$ as a very close approximation. If i' is the short-circuit current at normal e.m.f. E, the cross-current i has the value $i = i'E \sin \alpha \div E$. The synchronizing power expressed in watts will be $Ei = Ei' \sin \alpha$; expressed in horse-power it will have a value of $Ei' \sin \alpha \div 746$.

Let r be the radius of gyration about the axis of the shaft, of the rotating parts of the machine, in feet, and let F be the synchronizing force in pounds acting at this radius. Then the synchronizing horse-power will be [illegible] where N is the rotative speed in r.p.m. Hence, one may write,

$$Fr = \frac{33{,}000\, Ei' \sin \alpha}{2\pi N \cdot 2\pi} = K \sin \alpha \qquad (1)$$

where K is a constant having the value indicated.

Let ϕ be the angular displacement of the lagging machine from any fixed axial plane, expressed in mechanical degrees. Then

$$\phi' = \frac{F'r'}{W_1 r^2} = \frac{K \sin \alpha}{W_1 r^2} \qquad (2)$$

where W_1 is the moment of inertia about the axis of the shaft of the rotating member of the lagging machine.

With the exception of the quantity $\sin \alpha$ the right-hand side

of equation (2) contains only quantities that are dependent on the lagging machine alone; that is to say, the angular acceleration of the lagging machine under any phase displacement is independent of the other machines with which it is in parallel, the other machines being, of course, of the same frequency and terminal e.m.f. The lagging machine may, therefore, be considered as running in parallel with an identical machine, with which its angle of phase displacement is α.

In order to determine the period of fluctuation of the rotating parts of the machine, due to the cross-current, consider the crank effort as absolutely uniform, so that the machine fluctuates from the effect of the cross-current alone.

Suppose that the two machines have suffered a phase displacement α. Since the leading machine experiences always the same synchronizing force as the other, but in the opposite direction, its acceleration is always equal to that of the other, but opposite in direction. The two rotors, therefore, are always swinging either toward or away from each other, with equal, but opposite, relative angular movements. They, therefore, swing equally about their relative mid-position; that is to say, a wheel running uniformly at the mean speed would always be half way between them.

ALTERNATORS IN PARALLEL.

The angular acceleration of the lagging wheel with reference to a fixed axial plane is the same in amount as its angular acceleration with reference to a wheel running uniformly at the mean velocity.

In an alternator having P poles, the angular acceleration of the lagging rotor with reference to a rotor running uniformly at the mean velocity, both being considered as if they were rotating about the same axis, is $\frac{d^2\left(\frac{\alpha}{P}\right)}{dt^2}$. (See Fig. 3.)

But

$$\frac{d^2\left(\frac{\alpha}{P}\right)}{dt^2} = \frac{d^2\beta}{dt^2}$$

$$\therefore = \frac{d^2(\alpha \div P)}{dt^2} = \frac{K \sin \alpha}{M_1 r^2}$$

$$= \frac{PK \sin (\alpha \div P)}{M_1 r^2} \text{ (approximately)} \qquad (3)$$

For the moment $PK \sin (\alpha \div P)$ there may be substituted an equal moment $Hr \sin (\alpha \div P)$, (see Fig. 3), where $H = PK \div r$. The force H is constant and acts always parallel to the kinetic equivalent (OC of Fig. 3) of the wheel running uniformly at the mean velocity.

It is evident, therefore, that the rotating parts of an engine-driven alternator, as far as their oscillation about their mean position under the cross-current alone is concerned, are the kinetic equivalent of a simple pendulum suspended at O, the axis of the shaft, and swinging on either side of the vertical line OC, but having the force of gravity replaced by the force

$$PK \div r$$

The period of oscillation of the rotating parts from M_1 to M_2, Fig. 3—that is, from farthest behind to farthest ahead is, then,

$$T = \pi \sqrt{\frac{M_1 r^2}{PK}} \qquad (4)$$

Another fact shown by this analogy is that the cross-current will not bring the rotating parts up to the mean position and stop them there; but, neglecting friction, will swing them to a relative displacement ahead as great as they formerly had behind. Therefore, if an alternator operating in parallel with other machines suffers a phase displacement, the cross-current will tend to keep it continually surging back and forth through that phase displacement.

If the natural period of oscillation of the rotor pendulum under the cross-current is such that during alternate pendulum periods it may regularly receive from the engine greater energy than the rotor gives up, and during intermediate periods may regularly give up greater energy than the rotor receives, then enlargement of the oscillations will occur, the limit being set by the frictional resistances.

If the amount of energy periodically gained and lost by the rotor in synchronism with its pendulum period is small enough in comparison to the total energy transmitted from the engine to the generator during the same period, the frictional resistances will stop the enlargement before the oscillations become objectionably large. Hence, an engine-driven alternator whose rotor has a large moment of inertia and a long pendulum period can, without objectionable fluctuations, alternately gain and lose, in synchronism with its pendulum period, an absolute amount of energy sufficient to cause objectionable pumping in a machine having a rotor of smaller moment of inertia.

The above considerations are of special importance in connection with gas engines on account of the irregularity of their crank efforts. In them combinations of cylinders and cranks equivalent to one two-stroke-cycle, double-acting cylinder are common for driving alternators. In such a case it is apparent that during a regularly recurring period about equal to the time of one half stroke, there will be a time when the crank effort exceeds the mean counter-torque, and another time of about equal length when the crank effort is less than the mean counter torque. For such engines it may, therefore be assumed at the outset that the value of T, as calculated from equation (4), should not approximate the time of a quarter revolution. A value of the moment of inertia may be calculated on this assumption, as well as on the common one of limiting the fluctuations of speed.

It is desirable to construct the flywheel of the engine-drive alternator, so that its rotating parts will have, about the axis of the shaft, the larger of the two moments of inertia thus found; and its suitability should be further tested by constructing the displacement curve.

The effort will usually be made to increase T of equation (4) above the period of fluctuation of the crank effort, in order to decrease the displacements of the rotor of the alternator from its mean position, under the action of the varying crank efforts, and to keep the variations of speed within small limits. However, this method may lead to a flywheel impracticably large. In such a case resonance may be avoided by making T small, and the fluctuations may be dampened by a short-circuited winding on the rotor of the alternator.

It may easily happen that there will be sufficient lag in the energy-regulating mechanism, so that the governor will increase the delivery of energy to the engine during the periods of large crank effort, and diminish it during the periods of small crank effort, thus increasing the fluctuations. To avoid this action, the governor should be as little affected as possible by fluctuations of speed within the revolution, but it should respond to changes of the mean speed.

Practical success in this respect is facilitated by the fact that considerable change of speed from full-load to no-load may be allowed. In driving induction motors, a drop of 12.5 per cent from no-load to full-load may be allowed in the voltage at the busbars in the station. Under such conditions the speed of the engine may be allowed to decrease 3 or 4 per cent. Under lighting load the voltage should be kept more nearly constant, but the station attendant can handle a much larger gradual change of the engine speed by means of the field rheostats.

With a drop in speed of 3 or 4 per cent from no-load to full-load, shaft governors may be made very stable; such governors would be very little affected by variations of speed of a fraction of a per cent during the revolution, but would respond steadily to the mean speed.

It goes without saying that, if the alternators in parallel are to divide the load between them in proportion to their ratings, the governors on the engines should have the same speed-load characteristics; that is, they should all give the same speed at the same fractions of rated load.

Revoking American Letters-Patent.

BY AN ENGLISH BARRISTER-AT-LAW.

There appeared in the *Electrical World* of Jan. 7, page 97, a note of a case in which the Comptroller-General in England revoked a patent held by a person foreign to England. The Comptroller-General did this on the ground that the patent was not worked in England. He exercised the powers which were conferred upon him by a recent act of the English Parliament. In that case the victims were a Belgian firm; we have now to record a case which is of greater interest to American inventors, because it has involved the revocation of a patent held by an American firm.

The invention in question is a sewing-machine for producing a lockstitch, which is capable of operating at a high rate of speed upon either thick or thin work. Up to the present time the machine, which is the subject of a patent granted in 1896, has been wholly manufactured in the United States, but before selling it in England it was the practice of the patentees to remove a few parts and substitute others manufactured in England. It is not patented in Germany; and it was alleged before the Comptroller that the applicants for revocation were about to become agents for certain manufacturing firms in Germany and elsewhere, for whom they desire to sell sewing-machines which are made by such firms in accordance with the patent, and, if sold in the United Kingdom, would be an infringement of the patent.

In resisting the application for revocation, and in order to explain why the patent was not manufactured in England, the managing director of the American firm stated "that it would scarcely be possible to manufacture the machine entirely in the United Kingdom, by reason of the fact that neither the necessary tools nor the high-class skilled labor required could be procured here; that every part of the machine required the utmost skill and precision in manufacture; that the sewing-machines, so far as they were manufactured in America, were manufactured by a firm at Providence, R. I., who were the best tool manufacturers in the world, and that no other firm, to his knowledge, was capable of turning out such refined work as was required in the course of the manufacture. Mr. Smith, the mechanical expert of the company, stated that there were about 75 patented parts in the machine, and that in his opinion there were some 10 of these parts that could not be manufactured in this country by any plant at present in use here."

It is very instructive to examine the way in which the Comptroller dealt with the points raised. In the first place, he said, the English demands for the patented article could not be met by the manufacture of a comparatively small number of the component parts in England. He also came to the conclusion that the patentees had not given an adequate reason for not manufacturing in Great Britain. He said: "An attempt has been made to show that it is impossible to make the machine in England. It is very natural that the patentees and their employees should believe that their machine is a better one than anyone else can produce, and that the American firm which has done their work well for 40 years is the best tool manufacturer in the world. But it is manifest that opinions of this kind must be received with considerable hesitation, having regard to the high-class machinery turned out in England and on the Continent; that, even if they can be substantiated, they would not, of themselves, afford a satisfactory reason for not manufacturing in the United Kingdom. . . . I doubt very much whether the protection which, it is suggested, the users of these machines would derive from the continuance of the patent (i.e., protection from imitation machines) is quite the kind of protection which they themselves desire or require, and whether they would not prefer that the trade should be freed; that they should have the opportunity of testing the qualities of some of these much-maligned German sewing machines, which cannot be brought into this country so long as the patent remains in force. The patent has rather less than two years more to run in the ordinary course, and, according to the evidence of the managing director of the company, it would be between 5 and 10 years from the present time before the company could be in a position to make the machine completely in this country." Eventually, because he found that the patentees had taken no steps whatever to work the patent in England, he ordered revocation, subject to an appeal to the law.

There is one point about this case which deserves special notice. The object of the recent act, which enables the English courts to revoke patents not worked in England, was, primarily, to cause those patents to be so worked in order to give employment to the British artisan. In the case under review it was not even suggested by those who sought to deprive the American patentees of their property that a revocation order would have this effect. On the contrary, the avowed object of the move was to assist a German manufacturer who has been longing to find a market for his sewing-machines in England. Arguing by analogy, it will be competent for any person in the world to "queer the pitch" for an American inventor who is importing manufactured patented goods into England. His motives will not be inquired into.

It may be that this state of the English law will press hardly upon the American inventor; but signs are not wanting that the enthusiasm which was at first shown for the act in English political and commercial circles is gradually abating. This was the first step toward fostering British industry; the foundation of Protection for the United Kingdom! But to every piece of legislation there are objections which only become apparent when the readjustment of the law has taken place. Further, experience has shown that, in England and elsewhere, the most skilful draughtsman of a statute is unable to perform his task in such a way as to prevent the law being evaded.

In the first place, it has been found that the new act has adversely affected the number of inventors foreign to England applying for patents in that country. America heads the list, while Germany, France and Switzerland follow in the order named. Altogether, the foreign applications show a reduction of 8½ per cent. This means a serious diminution of the revenues of the English Patent Office.

There are divers courses open to the inventor foreign to England which will enable him to avoid having to set up a factory on British soil. In the first place, he may manufacture the parts of a complicated machine, and have them assembled in England. The point has not yet been decided, but the English courts may hold that this constitutes manufacture.

With regard to other methods of evading the stringency of this measure, it is impossible to do better than quote the following passage from a letter from an English patent agent, which appeared in the London *Times* of Jan. 6:

"It is now open to the foreign patentee to follow one of two courses. In the first place, where he knows that he can manufacture his improved article abroad and import it into England at a price slightly lower than that at which it could be sold if manufactured in England, he will refrain from making application for a British patent. There will similarly be no object in obtaining a British patent in the case of a complicated machine which the patentee knows well is not likely to be made by anyone who does not hold the monopoly. The other course open to the foreign patentee is to apply for and obtain a British patent, but allow it to lapse at the end of the fourth year before any question of proceedings under section 27 can arise. During these four years the patentee has had the monopoly and will have been able to obtain such an advantage on the English market with his imported goods that he can in a large majority of cases disregard the competition resulting from [illegible] can easily be prevented by obtaining patents covering the likely countries, the patentee himself naturally manufacturing where the work can be done cheaply, and thus complying with the [illegible] as to working.

"I shall be glad to have it pointed out where the country is going to benefit in either of these cases, which I may say are [illegible]. So far from being a gainer, England will actually be the loser by the amount of the fees on the patents which will not be applied for or kept up."

Effect of Physical Differences of Red Lead on Storage Battery Plates.

By Henry C. Frey.

Red lead as sold in the markets is made by two processes—namely, the old process in which the litharge obtained by oxidizing metallic lead in the open oxidizing furnaces is calcined further until the mass shows a desired shade of red. The other process, known as the "Nitrite" process, is an indirect method of manufacture. There is a marked physical difference in the resulting product of these two processes. The red lead made by the "Nitrite" process is much more bulky and also lighter in color than red lead made by the old method. Of course, the lightness of color in the "Nitrite" process is explained by the product being perfectly amorphous, while the red lead of the old method is crystalline and much denser.

There are some makers of storage batteries who prefer for positive plates the red lead made by the old method, but seemingly without any particular reason. To overcome the density of the paste plates such inert matter as powdered pumice stone, coke, carbon, lampblack, etc., have been used. The addition of such material has been found deleterious to the life of the plate, as well as to the proper chemical action. As I have stated, the red lead of the old method is crystalline, and at the same time these minute crystals are vitreous. It will be found that this objectionable property affects the final finished plate, inasmuch as it does not allow of charging at the rate that ordinarily would be expected. Now, in the case of red lead by the "Nitrite" process the product is absolutely amorphous, and bulky, which imparts to the plate a proper porosity and at the same time results in a lighter plate, while, being amorphous, rapid reaction of the electrochemical change in the plate is facilitated.

Plates made with "Nitrite" process red lead have given longer life than plates made with red lead by the old method. Then again, the latter material contains in some instances as high as 40 per cent of free litharge. This large amount of free litharge is undesirable for positive plates, although an average of 10 per cent of free litharge has been found advantageous. "Nitrite" process red lead will contain very often much less than 10 per cent, and even as low as one-fourth of 1 per cent of free litharge has been found. The most reliable method for determining the amount of free litharge in red lead, in the absence of adulterants, is the one used by Dunlap (*Jour.* Amer. Chem. Soc., XXX (4), 611). I have used this method and find no room for improvement, as results have always been very accurate.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Flaming Arcs on Flat-Rate Contracts in Chicago.

The Commonwealth Edison Company in Chicago now makes the following flat rates on flaming arc lamps, the lamps to be maintained and turned on and off by the company's regular patrolmen. The company maintains a large force of patrolmen on its flat-rate electric signs and tungsten clusters, turning them on and off at stated hours, and noting necessary lamp renewals. The rate on the regular flaming arc from dusk to midnight is 51 cents per night; from dusk to 1 a. m., 56 cents, and from dusk to dawn, 81 cents. This is subject to a discount of 25 cents per week per lamp for payment within 10 days from the issuance of bill. These prices are based on the assumption that the consumer owns the lamps and the company simply maintains, trims and switches on and off. If the company owns the lamps, a rental charge of $1 per week is made.

Electric Heating and Cooking at Grinnell, Iowa.

Mention has been made from time to time in the *Electrical World* of the unusually extensive introduction of electric heating and cooking devices by the Grinnell Electric & Heating Company, under the management of Mr. O. K. Cole. This company operates in a town of 5000 inhabitants where there is no gas competition. It is the aim as far as possible to make electric heating and cooking take the place which would otherwise be filled by gas.

The company gives a rate of five cents per kw-hour for cooking and heating appliances when placed on a separate meter. It had connected at the first of the year 18 of these special heating meters. These were on complete cooking outfits and other heating and cooking installations large enough to justify a separate meter. It is not to be understood that all of these 18 were complete cooking outfits, as many consumers have purchased certain appliances which appeal to them most on account of their convenience. Besides these 18 special heating circuits, there are a large number of miscellaneous appliances operated from the lighting circuit at the regular rate of 10 cents per kw-hour. These appliances in the order of their numerical importance are as follows: (1) Flatirons, (2) disk stoves, (3) coffee percolators, (4) frying pans, and (5) toasters. There are about 400 flatirons connected. Assuming that most of these irons take 0.5 kw, the interesting fact is deducted that the company has connected half a kilowatt in electric irons for every kilowatt of station capacity, as the station capacity in kilowatts is 400. On other devices than electric irons we have no accurate record, but it is interesting to know the relative popularity of the different devices. The disk stove appeals to many because it can be used for so many different purposes. The coffee percolator comes third on the list, the frying pan fourth and the toaster fifth. Toasters have begun to take rapidly, however, with the introduction of the new General Electric toaster, and nine of these were sold as soon as this toaster was exhibited before the holidays. This device may, therefore, pass some of the others in numbers before long.

It would be interesting to know whether any other central station has exceeded this record in the introduction of heating devices, station capacity and population served being considered.

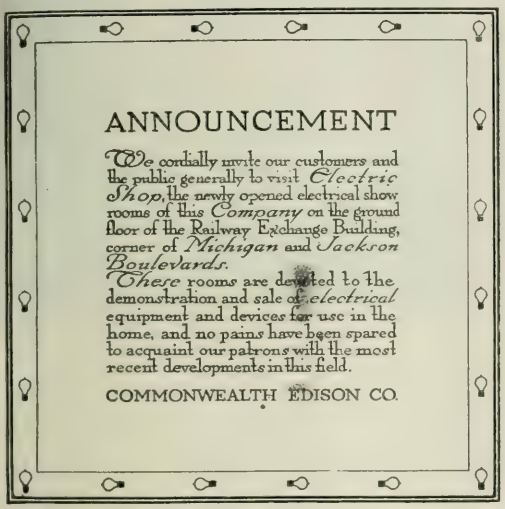
Meter Testing in Sioux City, Ia.

The Sioux City Gas & Electric Company has adopted the plan of testing consumers' meters by a combination of the methods of testing on consumers' premises and testing at the meter department. As a start, the 1200 electric meters which this company has out are to be brought in and tested at the meter department.

It is estimated that two men, one for bringing in and replacing meters and the other for testing at the department, can go over these 1200 meters in about 40 working days, or at the rate of 30 per day. A board has been fitted up for rapid testing at the department. After this complete test of all the meters has been made at the department, a plan will be inaugurated of testing meters on consumers' premises once a year and bringing them in for test once a year, thus making six months between tests. This plan to a certain extent will combine the advantages of the two methods.

A New Display Room for the Commonwealth Edison Company of Chicago.

The Commonwealth Edison Company, of Chicago, opened its magnificent new display room Jan. 16, coincident with the opening of the Electrical Show. This display room, which is called the "Electric Shop," is located on one of the finest down-town corners in Chicago, on the main floor of the Railway Exchange Building, Michigan and Jackson Boulevards. In this display room everything pertaining to application of electricity



NEWSPAPER ANNOUNCEMENT OF OPENING OF ELECTRIC SHOP.

in the household is to be shown. No expense has been spared in the equipment of this room. In the basement of the same building a display of electric motor applications of the more common and popular types is to be made. The accompanying illustration is a reproduction, considerably reduced, of the announcement in the Chicago newspapers of the opening of the "Electric Shop."

Central-Station Improvements at Columbus, Neb.

The electric light plant at Columbus, Neb., was purchased last year by gentlemen who formed the Columbus Light, Heat & Power Company. The old power plant is being entirely abandoned and a new plant has been built in another location. Much of the distributing system has also been rebuilt. The new plant is an unusually fine one for a town of this size. The population of Columbus in 1900 was 3522, and is probably now between 4000 and 5000. The old plant gave 133 cycles single-phase alternating-current night service only and had some direct-current arc machines for street lighting. The new plant gives 60-cycle, 2300-volt, three-phase all-day service.

FIRE PROOF BUILDING.

The station building is absolutely fireproof, being of brick with concrete floors and reinforced concrete roof. The building dimensions are 50 x 70 ft. over all and the walls rise 18 ft. above the ground level. Of this space 25 x 30 ft. is occupied by the engine room. This engine room is 16 ft. high and has a basement 7 ft. high for condensing apparatus under its concrete floor. The engines are direct-connected, medium speed, cross-compound, four-valve condensing. One is connected to a 200-kw Allis-Chalmers alternator and the other to a 125-kw alternator. The 200 kw unit runs 200 r.p.m. and the 125 kw unit 225 r.p.m. The cost of this station is stated to be about $100 per kw, exclusive of the building, which latter cost about $28 per kw.

As steam coal is high in Nebraska, costing about $4 per ton at Columbus, condensing in small plants is more common than in adjoining Eastern States. Condensing water is obtained from wells on the property, from which there is a suction lift of about 10 ft. to the condensers. Condensing is doubly attractive in this case because the company has succeeded in making a contract with the Union Pacific Railroad, which will take most of its condensing water.

The engines are equipped with new type so-called Corliss valves. The makers' guarantee is 14.75 lb. steam per hp-hour. In the basement of the engine room is one Platt Iron Works condenser. There are two boilers, 72 in. x 18 ft., of the horizontal return-flue type. A peculiar feature of this plant is the forced draft whereby heated air is supplied from the ash pits by means of a fan blower. This blower, which is direct-connected to a 5-hp engine, forces air into the ashpits through three 10-in. wrought iron air pipes, which pass from the rear of the boilers forward through the combustion chamber, so that the air becomes heated during its passage to the ashpits. The boilers were manufactured and supplied by the Murray Iron Works.

The company has a contract to pump water for the city for five years. The city pumping plant is near the electric light plant. In this plant the city installs two 2300-volt 20-hp induction motors. The city owns the pumps and motors, but the company has to keep them in order. The city pays 7 cents per 1000 gal. pumped. The pumps operate against 100-ft. head. The city requirements are from 100,000 gal. per day in the winter to 300,000 in the summer. There are two 500,000-gal. per day pumps, each driven by a 20-hp induction motor. Previous to the starting of the new plant there was no day service in the town. As an evidence of how quickly day service will come when the public is convinced that the company has a plant which is capable of giving continuous service, it may be mentioned that this company had 200 hp in motors awaiting it when it began day service.

A TRADE FOR TUNGSTEN STREET LAMPS

In view of the advent of the tungsten lamp for street lighting, it is interesting to note that this company has made a trade with the city whereby tungsten lamps are to be substituted for arc lamps. The city contract called for 5-amp series alternating-current enclosed arcs at $70 per lamp per year on a moonlight all-night schedule. The city agreed to exchange one arc lamp for two 60-cp tungsten lamps. The tungsten lamps are to be placed on every corner. The price of the 60-cp tungstens is therefore to be $35 per year on a moonlight all-night schedule. There are to be 40 of these 60-cp tungstens and also 40 32-cp tungstens, the latter to be paid for at $15 per lamp per year.

The officers of the company are: President, W. C. Ross, of Omaha; vice-president, John T. Burke, of Columbus, and secretary, John W. Parish, of Omaha. The company's new plant has been erected under the management and supervision of Mr. Burke.

Central-Station Exhibits at the Chicago Electrical Show.

The exhibit of the Commonwealth Edison Company at the Chicago Electrical Show was, of course, one of the largest single features of the show, as the object of the show is to appeal specially to the possible electric consumers of Chicago and therefore give the company an excellent opportunity to get before its public. Last year this company had for its exhibit the "House Electrical." This year an industrial power exhibit was decided upon. This exhibit (of which some idea can be obtained from the accompanying engravings) covered a large range of power applications. Along with this exhibit the company issued a 24 page pamphlet, describing the different

applications of electric power shown in the exhibit. The exhibit in reality consisted of several small factories of different kinds, most of which were conducted by large manufacturing concerns of Chicago which are users of Commonwealth Edison power. For example, J. T. Ryerson & Son, large iron and steel workers of Chicago, occupied one section with some very powerful metal-working machines. Among them were included the

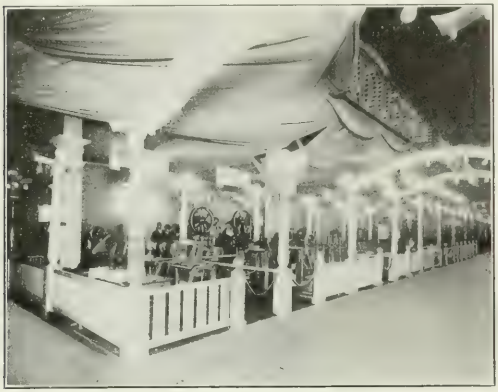


FIG. 1.—COMMONWEALTH EDISON EXHIBIT.

Ryerson friction saw, a Lennox rotary bevel shear and a vertical punch.

A moving-picture machine, so located as to be easily inspected, was kept in operation by the Viascope Manufacturing Company, of Chicago, thus illustrating an application of electricity which has found its way into the smallest villages of the country and has helped to swell the revenues both of large and small central-station companies. In the line of wood-working machinery, the Lochman carving machine showed some of the wonderful work done in the wood-working industry. The Haffner Furniture Company, of Chicago, also showed in operation a wood-embossing machine.

Bakers' machinery of various kinds, including a dough and cake mixer and a Morten beater, were operated in a section

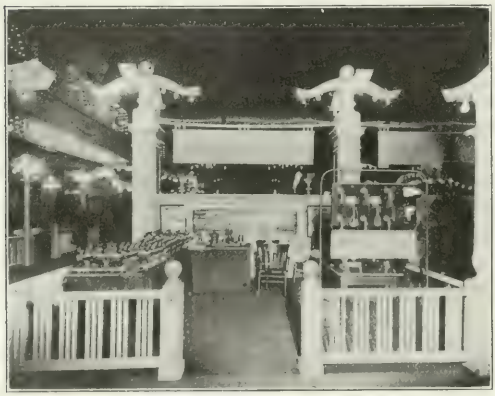


FIG. 2.—COMMONWEALTH EDISON EXHIBIT.

under the control of H. H. Kohlsaat & Company, Chicago, bakers. For the baking four electric ovens were employed of General Electric and Simplex manufacture. The Strauss Underwear & Stocking Company operated a number of knitting machines. *The Electric City*, the Commonwealth Edison publication, occupied one end of the exhibit with a linotype machine and printing press. Another branch of the printer's industry was represented by embossing presses of two different makes.

In connection with central-station advertising of the Electrical Show in Chicago, one of the notable things this year has been the extensive use made of cartoons. Nearly every day cartoons about the show of one kind or another appeared in the Commonwealth Edison advertisements in the daily papers, and in



FIG. 3.—COMMONWEALTH EDISON EXHIBIT.

advance of the show a number of the daily papers had cartoons of their own relative to it, most of them being about household applications of electricity of various impossible and ridiculous kinds, which nevertheless tended to bring to mind the numerous uses to which electricity is being put in the home.

THE NORTH SHORE ELECTRIC COMPANY EXHIBIT.

The exhibit of the North Shore Electric Company, which operates in suburban districts, and may be termed a suburban cousin of the Commonwealth Edison Company, made a very simple display this year, but one which was good advertising because of this simplicity. Along one side was an enormous display of Pacific electric irons. In common with the Commonwealth Edison Company, the North Shore Electric Company



FIG. 4.—COMMONWEALTH EDISON EXHIBIT.

recently started out to loan free to its consumers a large number of electric flatirons. On the other side of the booth was a board containing a recording wattmeter and an indicating wattmeter, calibrated to read in cents. Thus the rate of consumption in cents per hour with a different number of lamps burning could be seen at a glance. The speed of the meter could also be easily shown.

Cost Keeping in the Central-Station Contracting Department.*

Among the papers presented at the recent meeting of the Northwestern Electrical Association is one by Mr. Ludwig Kemper, manager of the Albert Lea (Minn.) Light & Power Company, entitled "Cost Keeping in the Contracting Department." The writer said that in the case of his company, whose contracting work amounts to about $10,000 annually, it is found each year that instead of having actually made a profit of 8 or 10 per cent, as shown by the books, an actual loss of 8 to 10 per cent was incurred, and it was therefore decided to install a stores department.

The storekeeper is a man with experience in wiring and meter testing; he is also timekeeper, and, in addition, he repairs everything that comes in the shop, as fans, irons, arc lamps, motors, etc.; he also tests and repairs meters brought in from the line. He reports direct to the superintendent.

On establishing the department the cost of running it was estimated by taking 75 per cent of the storekeeper's wages, allowing 25 per cent for repair and meter work, estimating freight and drawing expenses, and charging for rent, light, heat, insurance and taxes. Having the total estimated business and total estimated expenses, a percentage is added to invoice prices to cover the cost of doing business. On top of this is the percentage for profit. This method discriminates in favor of certain material, but it saves a good deal of work and thus far it has worked out satisfactorily.

All material bought for use in more than one department is charged to the material in stock accounts. Material, such as coal, oil, packing, etc., which is used in one specific department only, is charged to specific accounts direct, and does not enter the storeroom at all, but is accounted for to the manager through the superintendent by the men in charge of these departments.

All material wanted is ordered on a requisition in duplicate, the original going to the manager, the duplicate being retained by the signer of the requisition. The storekeeper makes the requisitions for the material in stock articles, the superintendent for all supplies not entering the storeroom. All requisitions are numbered, those of the superintendent having the letter "A" affixed to the number. The manager then makes out orders in triplicate for the material, if it meets with his approval. The original order (white) goes to the jobber, the duplicate (blue), with the requisition attached, is filed in the office; the triplicate (pink) goes back to whoever made the requisition.

On the pink slip, the quantities of material ordered are not entered, so that the storekeeper or the superintendent does not know how much of each item is ordered, and on arrival of the goods he has actually to count and check them. When the material arrives it is checked and the quantities are entered on the back of the triplicate, and when the order is filled completely it is signed and returned to the office. There the pink slip is attached to the blue one and the requisition, and later on to the invoice, when it arrives. After the prices are O. K.'d, this file goes to the bookkeeper, who audits a voucher to which the bill is attached, which is entered on the voucher register. When the bill is paid, the check number is entered on the voucher and the voucher with its attachments is filed when receipted and returned by the jobber. In this file there is then a complete history of every order, and if occasion arises to look up an order, the entire transaction is found with the voucher.

All material going into the storeroom is entered in a stock book, which is made up of loose leaves. These stock sheets are made up once a month, when material on hand must be checked with that actually in the storeroom.

When an employee wants material for a job, he signs a receipt and he is held responsible for this material. When the job is completed, the returned material is credited on the receipt. On a charge ticket is then entered the material and labor, with its price. From these charge tickets are made out the bills which are sent to the office for entering on the customer's ledger and for distribution.

The cost price of the jobs at the bottom of the charge tickets is footed up at the end of the month and credited to "Material" in the stock account. If the work is done for some department, the procedure is the same, this department being billed at the end of the month, the same as a customer, with the exception that it is billed at cost price, instead of cost price and profit. From the charge tickets the different items are credited on the stock sheets in the column "Charged out during." This completes the record of the material from the requisition until the charging out.

Everybody on entering the employ of the company receives a number and time card, which he has to punch on a recording time clock every time he enters and leaves the building. Whenever he goes out on a job for material in stock account he punches out; when he returns, he punches in again, and his time is taken from this time card and entered on the charge ticket. At the end of the day his total material in stock time is entered on the back of the time card. When he works for some other account, which is always company's work, his time is not entered on a charge ticket, but on the back of the time card in the column designating the account for which the work was done. At the end of each day his working hours as printed by the recorder have to check with the time charged out on the back of the card.

Semi-monthly on payday these cards are sent to the office for approval by the manager, after which they are entered on a payroll sheet, distributing the amounts to the various accounts. When the man is paid, he has to receipt and date his time card and the complete record of his work and earnings during this period is on the card.

This system of keeping track of material and labor is more simple in actual practice than it appears from the description. It makes clear what every job costs and enables the costs of the work to be checked with the estimated costs. The prices to the public have been uniform and lower than when there was no system, but the net profits have been larger.

The system is flexible when started with a good man at the head instead of a cheap one. During the summer it was decided to test all electric meters; this was more than the storekeeper could do in a short time besides his other duties, so a cheaper man was hired as his assistant, and the two of them tested all meters and did the other regular work. When the meters were tested, the assistant was laid off. If the storekeeper had not been a man with meter experience this could not have been done.

*A paper read at the Northwestern Electrical Association convention, Milwaukee, Jan. 26 and 27, 1909. Mr. Kemper is manager of the Albert Lea (Minn.) Light & Power Company.

Testing Electric Meters.

In a paper presented at the recent annual Northwestern Electrical Convention entitled "Control of the Adequacy of Electric Service," Mr. Frank A. Vaughn, electrical engineer of the lighting department of the Milwaukee Electric Railway & Light Company, gave an account of the measures adopted by his company to meet the requirements laid down by the Wisconsin public service commission (Railroad Commission of Wisconsin), in regard to the testing and maintenance of customers' meters.

The provisions of the Wisconsin public utility law require that the commission shall "ascertain and fix adequate and serviceable standards for the measurement of quality, pressure, initial voltage or other condition pertaining to the supply of the product or service rendered by any public utility, and prescribe reasonable regulations for examination and testing of such product or service and for the measurement thereof. It shall establish reasonable rules, regulations, specifications and standards to secure the accuracy of all meters and appliances for measurements, and every public utility is required to carry into effect all orders issued by the commission relative thereto." In one of its reports the commissioners state that "adequate

service is not necessarily the best service which it is possible to give, but rather the best service which can be given with due regard to economy to the consumer and to the company. The kind of service prescribed should not be materially different from that furnished by companies operated under the best management and giving the best service. In formulating definitions of adequate service and rules for securing the same, recognition must be made of the rapidly changing conditions to which the electrical energy supply industry is subjected. It is also obviously desirable that rules should not be adopted which shall interfere with the natural growth or progress of the industry."

The commission has formulated the rule that adequacy of electrical service may be considered according to the following

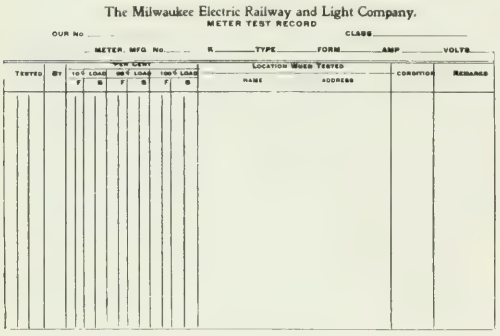

The Milwaukee Electric Railway and Light Company.
METER TEST RECORD
OUR No. ____ CLASS ____
METER, MFG. No. ____ R. ____ TYPE ____ FORM ____ AMP ____ VOLTS ____
TESTED | BY | PER CENT LOAD | LOCATION WHERE TESTED | CONDITION | REMARKS
100% LOAD 50% LOAD 100% LOAD
F | S | F | S | F | S
NAME ADDRESS

FIG. 1.—METER TEST RECORD.

classification: Accuracy of meters, regulation of pressure, and efficiency of devices for utilizing electrical energy.

Mr. Vaughn states that for best average accuracy a meter of a full-load rated capacity of not more than two-thirds of the connected installation should be used. On this basis the meter will carry a load somewhere near its full-rate capacity with occasional maximum overloads which will be well within the limits of heating and correct registration, and the light-load consumption will be such a percentage of the full load as to insure just registration, light load being defined in the neighborhood of 10 per cent or 20 per cent of the full-load capacity. The paper then takes up the discussion of various rules established by the commission. In regard to the rule that "no electric meter shall be placed or allowed to remain in service which has an error of registration in excess of 4 per cent on light load, half-load or full load," he says it ought to be a comparatively easy matter to obtain the accuracy called for immediately after adjustment, but that the error of 4 per cent will probably be exceeded after a meter has remained in service for some time and it will therefore be necessary to inspect and adjust all meters periodically. It is pointed out that the error of registration allows a range of 4 per cent fast to 4 per cent slow. Another rule allows a consumer to request a meter test as frequently as once in six months.

The accompanying illustration shows the record adopted by the Milwaukee Company to meet the requirements of a rule which specifies that a complete record shall be kept of all tests made on electric meters.

The records called for by Rule 18 are, it is believed, very well covered by Form 815 (Fig. 1).

As to the equipment for testing meters to any particular type or method, the commission says:

"It is impossible to specify in detail the methods and instruments which should be employed in testing electric meters. There are various standard instruments which give satisfactory results and manufacturers are continually making improvements in testing equipments. It is the purpose of the Railroad Commission, through its engineering staff, to keep informed regarding the improvements which are being made and of the various approved methods of testing, and from time to time such information will be placed at the disposal of the electric companies operating in this State."

Following are the details given of the meter-testing system of the Milwaukee Company in order to meet the requirements of the commission:

Before a meter is installed, after receipt from the factory, or after having been returned from a cut-off, it should be thoroughly tested and inspected in the Electrical Testing Bureau.

Alternating-Current Meters.

Test meters on light load (10 per cent or 20 per cent), half load (50 per cent) and full load (100 per cent), based on rated capacity of meters. Use a master wattmeter with 1 amp, 10 amp and 20 amp coils, comparing revolutions made in approximately 30 seconds by calibrator and by meter being tested. For the larger capacities use current transformers with 5 amp secondary winding in conjunction with calibrator. Time to be measured by a standard stop watch, graduated in fifths of seconds. The ratio of the revolutions of meter being tested to the revolutions of calibrator is the accuracy of the meter in per cent.

Adjust meter so as to register at least within the limits of 99 per cent to 101 per cent accuracy—that is, with not more than 1 per cent error, either fast or slow. For testing load use suitable rheostats or lamp banks for all loads, except for starting load a low candle-power incandescent lamp. All meters up to and including 25-amp rated capacity should start on a 2-cp incandescent lamp; beyond this and up to and including 100-amp capacity on a 6-cp lamp.

Direct-Current Meters.

Test meters on light load (10 per cent or 20 per cent), half load (50 per cent) and full load (100 per cent). For measuring volts use a voltmeter with triple scale, reading 0 volt to 150 volts, 0 volt to 300 volts and 0 volt to 750 volts, and for measuring amperes a millivoltmeter with scale of 150 divisions and the necessary shunts to read the required load for comparing seconds required by meter being tested to make $\frac{\text{ampere} \times \text{volts}}{\text{meter constant}}$ revolutions, with number of seconds required for 100 per cent accuracy, using "per cent error curve" (Fig. 2). Time to be measured by a standard stop-watch graduated in fifths of seconds. Adjust the meter so as to register at least within the limits of 99 per cent to 101 per cent accuracy—that is, with not more than 1 per cent error, either

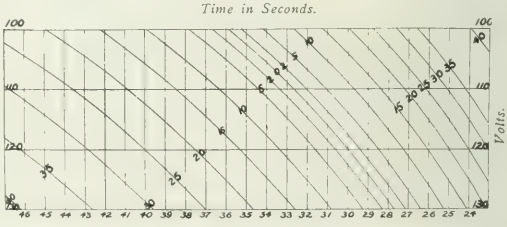


FIG. 2.—PER CENT ERROR CURVES.

fast or slow. For testing load use suitable rheostat or lamp banks for ordinary loads, and a low candle-power incandescent lamp for starting load. All meters up to and including 10-amp rated capacity should start on a 6-cp incandescent lamp, balanced to start on 2 per cent of rated capacity.

Tagging Meters.

When a meter is adjusted to required accuracy and inspected, an aluminum name-plate is attached to the outside of the cover, giving the information covered by Fig. 3. The hand on the smallest reading dial is then set on 9, and the others at zero, which indicates that the meter has been adjusted, and allows a small amount of current to be used when installing and trying out at customer's premises, without affecting customer's bill. The meter disk and moving parts are then securely blocked and

the meter is placed in stock of meters ready for installation, whence it is subsequently taken out to be installed.

Recording Tests and Inspections.

The record of all tests and inspections is kept on a form and the results are transferred to that shown in Fig. 1, which is a continuous history of the individual meter and is kept on file and up to date as long as the meter exists, as explained below. The original record should be kept on file for two years. When, according to the rulings of the Railroad Commission of Wisconsin, special or request tests are made in the laboratory after "cut-off" or for other reasons, the data on such tests are entered on the original record form, which is filed with the customer's records, and the results transferred to the form of Fig. 1, as a part of the history of the individual meter.

The meter being now properly calibrated and installed, its periodical tests and inspections proceed in this company as follows:

Testing at Customer's Premises.

After a meter is installed it must, within three months from that date, be tested and inspected at customer's premises, and periodical, special or request tests and inspections must be made thereafter to conform with the ruling of the commission.

Adjust the meter so as to register at least within the limits of 98 per cent to 102 per cent accuracy—that is, with not more than 2 per cent error, either fast or slow. For testing load use

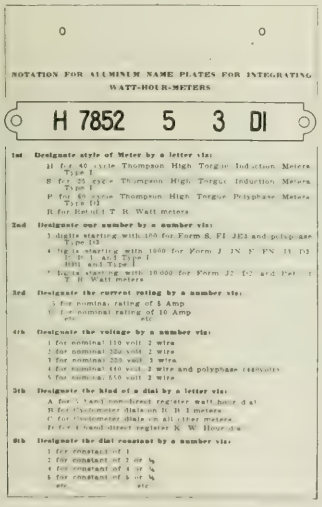


FIG. 3.—REPRODUCTION OF ALUMINUM NAME PLATE

the customer's installation and a lamp bank, of 20-amp maximum capacity in conjunction for regulation, or for larger capacities, a fiber waterpail rheostat with large carbon electrodes.

The rule requires a test no oftener than once a year, but some meters in very important installations involving a large amount of income will be watched more closely than this in justice to both contracting parties, and the exact time which any meter should remain in service before being inspected is dependent on local as well as general conditions.

The above routine methods do not take up specifically the testing of very large meters, as for apparent reasons these will require more or less special and specific treatment along well known lines. Their use should also be discouraged for a customer's installation.

The question of the policy of testing a meter on the customer's premises is also one which has been very thoroughly gone over, and it is assumed that the request of the commission to test "the meter while connected in its place of service" will willingly be complied with, by any company, where there is more than one man to operate the plant and test the meters. The commission also requires: "In addition to the installation test and the yearly test made upon each meter, it is desirable that provision be made on the part of the company for testing meters at other times upon request of any consumer who believes his meter to be registering inaccurately. It is a common practice among electric companies to make these tests free of charge. The following seems to be, therefore, a desirable provision: Each company supplying electrical energy shall make a test of the accuracy of a meter upon request of a consumer, provided such consumer does not make request for tests more frequently than once in six months. A report giving the results of such tests shall be made to the consumer, and a complete record of the same shall be kept on file in the office of the company."

Another rule is that: "Upon formal application of any consumer to the Railroad Commission, a test shall be made upon the consumer's meter by an inspector employed by the commission, such test to be made as soon as practicable after the receipt of the application. For such test a fee of two dollars ($2) shall be paid by the consumer making application for the test if the meter is found to be slow or correct within the allowable limit, and by the company owning the meter if the meter is found to be fast beyond the allowable limit."

This rule should not interfere with the very laudable practice, followed by most companies, of encouraging the consumer to bring his troubles and complaints to the notice of the proper official of the company, when, if reasonable, a meter test or entire change of meter is willingly allowed for the satisfaction of the customers.

INTERIOR WIRING AND ILLUMINATION

Christmas-tree Street Decorations.

At Des Moines, Ia., before the holidays, the merchants along one of the streets purchased enough evergreen trees to place one approximately every 20 ft. along each curb. These were supported in large sewer tiles filled with sand, the tree trunk being braced inside of the tile, and were lighted day and night by various colored electric lamps. This move was carried out entirely by the merchants along the street. At Grinnell, Ia., a similar scheme was inaugurated, 27 trees being placed in a block and a half. The relative effects of these two installations brought out the importance of selecting the right kind of trees for this work in the future. At Des Moines the trees had the branches thoroughly open. At Grinnell trees in which there was little space between branches were used. The trees in which the branches were open presented by far the better appearance, as they allowed the lamps to shine through the leaves and between the branches. On the trees with branches close set and with thick leaves, many of the lamps were hidden and the effect was disappointing. Energy in both cases was purchased by the merchants at the regular rates. The business in both these cities was looked upon as desirable, purely on account of the possibility that it would lead to some permanent special down-town street lighting.

Trees High and Low.

In many towns and cities experienced with tree trimming forced the pole lines into the alleys as much as possible, which is the best place for them. But frequently it happens that in towns in which the street conditions are most difficult for pole lines there are no alleys. Conditions as regards height of trees vary so much as to suggest three general methods of procedure. In some cities the size and height of trees are limited by ordinances or by natural conditions which have

prevented the growth of trees to great height. In such cases there is the possibility of running the lines above the trees on very high poles. After this is done the trees are kept trimmed to a uniform height of, say, 35 ft. In another class of towns where the soil is very fertile, so that trees grow rapidly, and where the trees are of considerable age, they have exceeded any possibility of trimming to a uniform height to permit running of wires above. In fact, the rapidly-growing soft maple trees in the fertile soil of Iowa and some other Central States have attained such size as to suggest the feasibility in the future of using on the older streets very low pole lines, keeping all lines entirely beneath the trees and trimming accordingly. Where one can go above or below the trees conditions are easy to meet, although high pole-line construction is expensive. The main trouble comes where the trees are too small for lines to go below and too high for them to go above. It is, of course, true that with rapidly-growing trees, lines which are now among the boughs, where frequent trimming is necessary, will in a few years be below them. In the meantime, the conditions are trying. As the trees in a town get older and larger, the tendency will probably be more and more to go below rather than among or above the trees.

Special Street Lighting in Poughkeepsie, N. Y.

The city authorities at Poughkeepsie, N. Y., have recently adopted ornamental double-bracket arc lamps for the principal business streets of the city and the merchants along these streets have also manifested an interest in outside illumination, with the result that many of them have installed extra circuits for outline and other forms of display lighting. What has heretofore been a dimly-lighted thoroughfare as a consequence has been suddenly transformed into a well-illuminated avenue, and



POUGHKEEPSIE STREET LIGHTING.

the sudden awakening is beginning to have its effect on the electric light company's load curve. The accompanying illustration shows Main Street at 10 p. m.

The city is also arranging for a grand blaze of light for the coming New York State Convention of Firemen and for the Hudson-Fulton Celebration which is to follow. Plans are now being made for arching Main Street for over half a mile with incandescent lamps. The supervisors recently passed a resolution to outline the County Court House with nearly 1000 incandescent lamps for the Firemen's Convention and other prominent buildings in the city are also to be decorated. The convention lasts four days and the new business department of the Poughkeepsie Light, Heat & Power Company will make an effort to have much of the lighting continued. In its modest way the company has been adding steadily to its circuits and the main streets of the city are becoming as well lighted at night as some of the larger cities in the country.

Concealed Knob and Tube Work Versus Conduit.

By Arthur L. Abbott.

The short article with the title "Concealed Knob and Tube Wiring" in the *Electrical World* for Jan. 14 leads the writer to believe that some discussion of this question might be of some benefit to those interested in methods of interior wiring. The fact that knob and tube work is allowed under the Underwriters' rules cannot be taken as conclusive evidence of the safety of such installations. The code is notoriously behind the times, as witness rule No. 54A on cut-out cabinets, in which is the following:

"When wood is used the inside of the cabinet must be completely lined with a non-combustible insulating material." And further on, "With metal conduit systems, the lining of either the box or the gutter must be of 1-16th in. galvanized, painted or enameled steel, or preferably ¼-in. slate or marble." Here is found, first, a direct contradiction; second, a statement that slate or marble is preferable to steel for the lining of wood cabinets for conduit systems, a statement with which very few construction men or inspectors will agree; third, there is no specification covering cabinets made entirely of steel, such cabinets not even being mentioned. This is the type of cabinet which is used almost exclusively on up-to-date conduit installations.

As a set of engineering specifications, the code is, in many ways, a shining example of what to avoid. It is not logically arranged, and it is very far from being clear and specific on many points. The writer recently asked the electrical inspector of a large city, a man whose competence is unquestioned, the meaning of a certain rule in the code. The inspector replied that he did not know, but had always wondered what the meaning was.

It is true that concealed knob and tube wiring, if installed strictly in accordance with the rules, is perfectly safe, provided it is never disturbed. But who can state positively that this condition is fulfilled in any case? The contractor knows to his sorrow how little respect the plumber, the gas fitter, the steam fitter and the carpenter have for the electric wires in a building. After the roughing-in has been completed, some of the injuries to the wiring are found by the inspector and reported to the contractor, who is usually compelled to repair his work without compensation. Many more such defects are undoubtedly never discovered and are, therefore, a permanent part of the installation. Even if, by good fortune, the wiring happens to be in good condition when the building is completed, there is absolutely no safeguard against subsequent injury while repairs or alterations are being made to the building or its equipment. The infrequent occurrence of fires caused by defective wiring cannot be used as any argument for the continuance of the poorer methods of wiring, for every one in the business knows of numberless cases where the most antiquated forms of wiring and the most flagrant violations of the rules have existed for many years without causing trouble.

It must be admitted that the matter of cost is an open question, though the writer does not believe that the additional cost of conduit work will deter many owners from wiring their buildings. An ordinance was passed in the City of Minneapolis a few years ago requiring conduit work for all concealed wiring except in residences outside the fire limits, and time has demonstrated that this rule has no appreciable effect in impeding the progress of electric lighting. It may be that the class of buildings exempt from the conduit requirement is the one which would be most affected by a universal rule; but the cost of wiring is such a small part of the whole cost of any building that it hardly seems that any owner of a residence would forego the use of electricity on account of the comparatively small sum representing the difference between knob and tube work, and conduit work. Even where it is not required by city ordinances, many owners of the better class of residences prefer to pay the additional cost of a conduit system

for the sake of the greater safety and reliability thereby insured.

A comparison of the costs of the two classes of work is given below for four residences of the better class in the City of St. Paul. Bids were taken on both conduit work and knob and tube work in each case, and the figures represent actual cost to the customer.

COMPARATIVE COSTS PER OUTLET.

		Knob and Tube		Conduit	
	No. outlets.	Total cost.	Cost per outlet.	Total cost,	Cost per outlet.
No. 1.....	120	$247.00	$2.06	$423.00	$3.53
No. 2.....	80	147.00	1.84	251.00	3.14
No. 3.....	72	158.00	2.19	248.00	3.44
No. 4.....	66	136.00	2.06	213.00	3.23
Average		.....	2.04	.....	3.36

Average excess cost of conduit work over knob and tube work. 65 per cent

A large number of the best-informed construction men and consulting engineers agree in the opinion that the only safe method of installing concealed wiring is to draw the wires into iron conduits, and it is believed that the day is surely coming when no other method will be recognized where any pretense is made of installing high-grade work.

Street Illumination at Newark, N. J.

BY WILLIAM H. STUART.

When the flaming arc lamps blazed out on South Broad Street, Newark, N. J., on Jan. 16, 1909, Newark stepped one pace ahead of every other city in the country in the point of street illumination. South Broad Street ranks now as the most brilliantly lighted thoroughfare in the country from street lamps alone. This street is also one of the widest thoroughfares in the country, being over 100 ft. from one sidewalk to the other.

The primary object was some advertising scheme to divert



FLAMING ARC LAMP STREET ILLUMINATION, NEWARK, N. J.

trade from the shopping district on Broad Street, north of Market Street, to that portion of the street south of Market Street. After considerable talk the merchants of the district organized an association known as the South Broad Street Improvement Association. A committee conferred with the officials of the Public Service Corporation of New Jersey, which concern operates the lighting business in Newark, as to means and costs of doing the advertising by electric light, and they also offered to place as many electric lights in their windows and store fronts as was possible. For this lighting they asked for a reduction in rates, expecting to use it from dusk until midnight every evening in the week. The Public Service Corporation could not see its way clear to granting the merchants any special rates, but on the other hand submitted a general street lighting proposition which was readily accepted.

A system was laid out composed of flaming arc lamps to remain as a permanent installation and a system composed of incandescent lamps to be used temporarily for two weeks only—the idea being to open the electric display in a blaze at a given time and have as attractive and brilliant a one as possible. The affair was widely advertised in the newspapers and by means of special posters, etc., throughout the entire city. The main point brought out in the advertising was the fact that nowhere else on earth was there to be found such a display of permanent electric street illumination. As the hour approached when the current was to be thrown on, an immense throng of people jammed the streets, who came out in a raging snowstorm to witness the scene.

The permanent installation is composed of 35 flaming arc lamps, made by the Scott Electric Company, of Newark, with a rating of 10,000 cp for each lamp. These lamps were erected on poles along three blocks of South Broad Street at a distance of every 60 ft., and replaced 21 of the regular enclosed alternating-current, arc-type of street lamp. The new installation has been erected on a three-year contract. The lamps are lighted at dusk and burn till dawn. The charge which the Public Service Corporation makes the merchants for this installation is a very favorable one. The city makes an allowance to the merchants amounting to that which was paid to the Public Service Corporation for the use of the old enclosed street lamps.

To add further to this installation, thousands of incandescent lamps were strung across the street and along the streets from the top of the lamp poles. These lamps were furnished free, together with the current for lighting them by the Public Service Corporation. The buildings facing South Broad Street were festooned with varied colored lamps and draped with flags and bunting. This incandescent lighting will be left up for two weeks, the flaming arcs remaining as street lamps.

The merchants when they first learned of the flaming arc proposition immediately started a subscription list to pay for the installation and all were invited to contribute. Not only did those benefiting directly respond with enthusiasm, but business houses in other sections of the city and private citizens who believe in civic pride also joined. The sums so contributed ranged from $5 to $500.

That the whole scheme has been a big success is already proved by the results. Already plans have been made to extend the lighting two more blocks with an additional equipment of 15 flaming arc lamps, making 50 lamps in all. The success of the affair has so impressed the merchants from whose territory the scheme was intended to divert business, that they are making plans to counteract the effect.

The Public Service Corporation believes that it has struck a very good proposition and is receiving numerous calls for installations of flaming arcs all over its territory. The free advertising that was derived from the affair exceeded everything obtained by any and all other methods employed by the company, and the central-station service in Newark received a great boom from the display.

New Telephone Patents.

NEW APPARATUS.

A combined drop and jack forms the subject of a patent granted to Mr. T. Lidberg, of Chicago, and assigned by him to the Swedish-American Telephone Company. The novelty lies in the removable coil of the drop part. The magnetic coil casing is closed at the rear by the drop armature. It is open at the front. The coil and core are assembled integrally with the drop face and shutter and the whole may be slipped into place from the front, the coil terminals automatically engaging spring clamps.

Mr. E. S. McLarn, of New York City, has patented a new short-arm type bracket for transmitters for the small type wall set. A hole is made in the cover of the box and from a face escutcheon plate mounted upon this there projects inwardly two triangular stiffened sheet-metal wings. The ordinary transmitter lug is thrust between the wings, being engaged by flat bosses raised on the opposing faces of the wings, and being centered by small bosses which fit the drilling of the lug. The whole is then adjusted for tension by a bolt through the rear point of the wings. This patent has been assigned to the Western Electric Company.

PARTY LINE SETS.

One type of multi-party line now becoming prevalent is the despatch circuit of railroads, either electrical or steam. With such a circuit there is distributed at more or less equal inter-

vals a number of talking stations, any two of which, or any combination of which, may be used simultaneously. When a large number of stations is used, the line resistance differs to such an extent that there is an uneven distribution of the telephone currents; the near stations get more than their share and some of the far stations do not receive enough.

Mr. H. D. Currier, of Chicago, has devised a means for overcoming this difficulty in the shape of an adjustable inductance coil wired in the telephone set at the station. All stations are bridged, and when many are to be used together the inductance at those receiving insufficient current is decreased by withdrawing the sliding core. Each station, of course, is adjusted for maximum practicable inductance. Mr. Currier has patented the use of such an adjustable inductance for this purpose. In his specification he also suggests a detachable shunt about the receiver circuit which can be controlled by the manipulation of a key. This shunt, of course, removes from the transmitting station the inductance of its own receiver.

A four-party line, selective-ringing circuit forms the subject of a patent granted to Mr. H. G. Webster, of Chicago, and assigned to Mr. M. G. Kellogg. Two of the stations are provided with ordinary biased selective bells, both wired to the same limb of the line. One of these responds to negative impulses and the other to positive impulses. At the other two stations alternating-current bells are used, these being wired to the second limb of the line at both stations, but the circuits of both are carried through the contacts of polarized direct-current relays located at the respective stations. The coils of these polarized relays are both wired to the first limb of the line, and they, together with the bells, at both stations are connected to ground on their free sides.

The operation of the system is as follows: The pulsating currents of proper polarity applied to one side only affect the correspondingly poled pulsating bells. At this time, of course, the alternating-current bells fail as no current is applied to their side of the line. When current is, however, applied for the alternating-current bells, the differentiation between these two is effected by applying properly poled steady current to the other side of the line simultaneously. The pulsating bells fail on this steady current. The polarized relay, on the other hand, at the desired station closes the circuit of the alternating-current bell, under the influence of the particular sign of steady current applied, while the second polarized relay opens its bell contact under the influence of this same current.

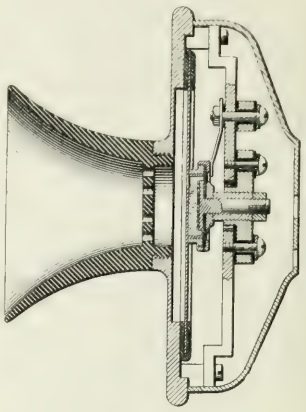
A third four-party line system has been patented by Mr. W. W. Dean, the patent being assigned to the Kellogg Switchboard & Supply Company. This system contemplates the use of the ordinary biased polarized bell responding to either positive or negative impulses and two stations legged off each side of the line to ground. With the common-battery system, it becomes necessary to maintain this grounded bell leg open to steady current in order to prevent the display of the line signals. Mr. Dean's system provides for maintaining this condition by the introduction in the bell circuit at each station of the proper number of electrolytic cells. The electrolytic cells are poled to oppose the flow of current from the exchange storage battery, yet they freely permit the passage of intermittent direct currents.

SWITCHBOARD CIRCUIT SYSTEMS.

An improvement in automatic switchboard circuits has been invented jointly by Messrs. A. H. Dyson and F. W. Dunbar. The improvement consists in the substitution of a differential repeating-coil relay for the usual knock-down relay. Hence this repeating-coil relay serves not only as the means of current supply to the two branches of a connection built up through the automatic switchboard, and as the repeating connection between the two branches of this circuit, but it also serves, through its contacts, to control the restoration of the apparatus upon the completion of the connection. This restoration follows the simultaneous grounding of the two limbs at either end of the connection. The repeating relay is balanced differentially until such a ground is applied, when its windings become unbalanced to effect the desired disconnection.

TRANSMITTER

Below is shown an improved transmitter, the invention of Mr. W. W. Dean, of Elyria, Ohio. This instrument is primarily of the inverted, solid-back type, the usual auxiliary mica diaphragm being provided, with the carbon cup clamped to its periphery and the stationary electrode clamped to its center. One end of the carbon cup is, however, omitted, this end being closed directly by the diaphragm. The rear of the diaphragm is properly plated to serve as an electrode. The tension springs,



DEAN TRANSMITTER.

one of which is shown, hold the carbon cup sufficiently tight against the rear of the diaphragm to seal it, there being no other connection between the cup and the diaphragm. One of the chief improvements claimed lies in the symmetrical application of the pressure of the damping (and clamping) springs to the diaphragm through the cylindrical carbon cup. Mr. Dean's patent has been assigned to the Dean Electric Company.

LETTER TO THE EDITORS.

The United States Patent System.

To the Editors of Electrical World:

SIRS:—The account in your issue of last week of the discussion of the U. S. patent system at the Chemists' Club and associated societies, as well as the notice concerning the Court of Patent Appeals measure now before Congress, indicate clearly the error of the proposed methods to correct patent abuses, and the effort expended in their advocacy are misdirected and cannot lead to the desired results.

The remedies suggested by these writers are presented too early in the game. Who is there to listen to them; who to execute their ideas? The Commissioner of Patents is not empowered to make any of the proposed changes and Congress can act only on bills brought before the House, such as the bill of the American Bar Association. Congressional committees cannot or *should* not take cognizance of individual suggestions, because in most instances they are one-sided. They should not even pass a measure of a single class of men such as form the American Bar Association without hearing inventors and manufacturers and others of standing interested in the cause, because that association cannot judge for these.

What is needed by the commerce of the United States and by the manufacturing interests is a standing representative committee, perhaps attached to the Department of Commerce and Labor. It should consist of independent inventors and others interested in the industries concerned, who should be able to discuss and urge the passage of proper measures before Con-

gress in a less round-about way than is possible at present. Any other way will merely be a case of from the frying pan into the fire.

The laws at present are not up to date and competency of the courts does not exist when any of the sciences are involved in a suit. The American Bar Association wishes to give the inventor a final chance to get justice if he cannot obtain this in the lower courts, by creating the Court of Patent Appeals. Will it help? Let us see. There are to be chosen five justices on their legal qualifications, and our present system of court procedure is to be retained. But perhaps 95 per cent of the inventors and 80 per cent of the manufacturers are unable to uphold their present rights through the lower courts against commercial aggression, and, therefore, could not reach this tribunal of final resort if it existed. Concerns with large capital that can take their suits through the lower courts and could make such an appeal, compromise out of court if possible, buy out the competitor or pool patent interests, to avoid additional legal expenses. However, if this were not so, could these five judges be more just than those of the lower courts? Can they cover the field of knowledge necessary for rendering proper judgment? No, they cannot. There would be created a titled judiciary with plenty of dignity, drawing large salaries but incapable of performing the work required.

What the industries need is action by national and other engineering and industrial societies, which will unite in suggesting the enactment of proper laws and authorization of proper tribunals, and have at Washington a representative committee to advocate the measures proposed.

What is actually needed to meet the present situation is a single court of original jurisdiction which may convene in different sections of the country, and a single Court of Appeals. A government grant of privileges of national scope, such as a patent, should be heard before a Court of National Jurisdiction. Instead of a Court of Appeals, as planned by the American Bar Association, where the people would pay a tribute to titled men instead of for services rendered, the judges should include men not only versed in law but also in the state of the art, who have worked in the Patent Office Division in which a patent has been examined. Every industry should have the same right to a competent judiciary.

This change from the present mode cannot be accomplished at once; the solution for the intermediate steps is, however, not difficult to find or to accomplish.

The irony of leaving to others what you yourself should attend to is plainly apparent. The people are exasperated by "too much court," "too little justice," "too great expense." They want competency in the courts and adequate laws. The generous American Bar Association (always ready and willing to help the poor inventor) answers: What you need are courts and more courts.

ST. LOUIS, MO. LUDWIG GUTMANN.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Reluctance of Air-Gap.—F. C. BAILLIE.—The author quotes some experiments verifying the formula of Carter for the effect of armature slots on the reluctance of the air-gap of a dynamo (see *Electrical World*, Vol. 38, page 884). Carter's formula is, however, not convenient for quick applications, but the present author has employed it to plot a diagram from which the correction coefficient can be read off directly. This is reproduced in Fig. 1. In constructing this diagram from Carter's formula, the scales of ordinates and abscissas have been gradated so as to make all of the curves come out straight lines. This arrangement has the advantage of lending itself to accurate construction and of being readily copied on tracing paper.—Lond. *Electrician*, Jan. 8.

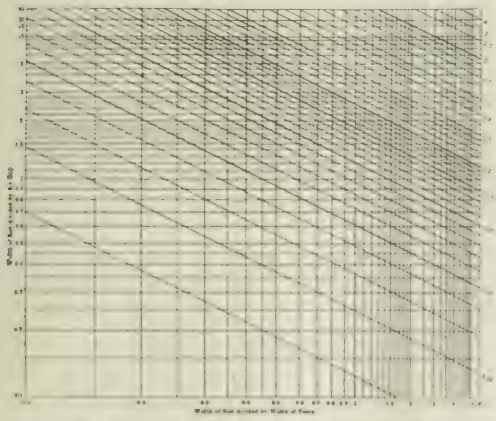


FIG. 1.—DIAGRAM OF CORRECTION COEFFICIENTS.

Copper and Iron in Generators.—A. G. DAVIS.—An article illustrated by diagrams in which the relative costs of copper and iron in alternating current and continuous current generators are considered. It is shown that, whereas the copper costs constitute some 55 per cent of the total cost of effective material in the case of continuous-current designs, this figure falls to less than 35 per cent in the case of alternating-current designs. The preponderance of copper in the former case is explained as being due to commutation restrictions. The effect of these considerations on the relative weights and costs of alternating-current and continuous-current generators for various ranges of speed and output is then shown by a number of curves, and finally there are given some curves which show that at high speeds continuous-current machines weigh less but cost more per kilowatt than alternating-current machines.—Lond. *Elec. Eng'ing*, Jan. 7.

Automatic Voltage Regulation of Direct-Current Generators.—A note on a recent British patent (4372, 1908) of the Felten & Guilleaume Lahmeyerwerke A. G. Compounded continuous-current generators, when working in parallel, have the disadvantage that fluctuations of the e.m.f. in the circuit produce considerable variations in the currents through the machines. According to the present invention, this unstable state is utilized to obtain an automatic voltage regulation, in that the equalizing currents between a machine to be regulated and a compounded machine in parallel with it are caused to influence the magnetic circuits of both machines. An over-compounded machine is put in parallel with the shunt-wound generator, the voltage of which is to be regulated, and auxiliary exciting windings on the magnet-poles of the shunt generator are connected in series with the compounded machine. The circulating current will thus raise the e.m.fs. of both machines, and by suitably adjusting the number of turns in the two series windings, the pressure of the shunt dynamo can be made to keep constant over wide variations in load. The main generator may be excited separately by a compounded machine which is in parallel with the main machine. If the latter is an alternator, a suitable converter must be interposed between the two machines.—Lond. *Elec. Eng'ing*, Jan. 7.

[illegible] E. G. LAMME.—An article [illegible] the characteristics of the single-phase commutator motor and the special features characteristic of its design and operation. The author deals especially with the necessity of reducing the excessive current handled by the brushes and

with the question of power factor. The explanations are given in a simple, clear way without mathematics.—*Elec. Jour.*, January.

Flux Density in Teeth.—F. Blanc.—A mathematical paper illustrated by diagrams, in which a graphical method is described for determining the real flux densities in the teeth of dynamo armatures. This method permits one in general to avoid the use of the so-called "apparent teeth induction." A numerical example is added in which the application of his method is shown to the calculation of the total magnetizing amp-turns and the losses due to reversal of magnetism.—*Elek. Zeit.*, Jan. 7.

Lamps and Lighting.

Street Lighting of Berlin.—L. Bloch.—The conclusion of his long illustrated article on recent developments in street lighting of Berlin and a comparison with former methods of illumination. The results are summarized as follows: Gas lighting by the adoption of inverted high-pressure lamps has made a considerable step toward obtaining a greater, and at the same time a more economical, illumination in the streets. In the same

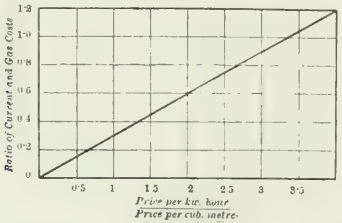


FIG. 2.—RELATION OF CURRENT AND GAS COSTS TO ILLUMINATION.

way, also, electric light by the practical use of flame arc lamps for street lighting, especially when "Alba" electrodes are employed, makes a very suitable and economical light for this purpose. It is as impossible to-day as heretofore to state which one of these two very different methods of lighting is the cheapest, but the balance lies with one or the other, according to the cost of gas, electricity and maintenance. Formerly the ordinary arc lamp was more efficient and gave a better distribution of light than the upturned gas lamp under ordinary or high pressure, and to-day the flame arc lamp, with "Alba" or other electrodes, holds the same position as regards inverted high-pressure gas lamps. In conclusion, the inverted high-pressure gas lamp and the flame arc lamp fitted with "Alba" or with inclined electrodes are compared. The comparison is not made with any particular prices for energy or gas, but is considered in a general manner, so that the prices for energy and gas can be inserted in any particular case. For lighting by inverted high-pressure gas lamps an average consumption of 20 liters per lux of mean horizontal illumination and 100 sq. m of street surface can be taken. The corresponding value for the lamp fitted with "Alba" electrodes or with inclined flame electrodes is about 6 watts. This value is obtained when the arc lamps are suspended at the usual height of 8 m or 9 m (26 ft. or 29 ft.). A comparison of these two values is shown in Fig. 2, from which it will be seen that with equal prices per kw-hour and per cubic meter of gas the cost of energy for the flame arc lamp is only 30 per cent of the cost of gas with inverted high-pressure gas lamps. The costs for energy and gas becomes equal when the price of energy per kw-hour is 3.3 times that of gas per cubic meter—for example, when gas costs 3 cents per cubic meter, or 84 cents per 1000 cu. ft., and a kw-hour costs 10 cents. It was formerly shown that using upturned high-pressure gas burners and ordinary direct-current arc lamps the cost of energy was 36 per cent of the cost of gas, so that the total costs were equal when the price of energy was 2.75 times that of gas. In spite of the great decrease in the consumption of gas lighting, that is, from 50 to 20 liters per lux and 100 sq. m, the advantages of electric lighting by flame arc lamps as compared with inverted high-pressure gas lamps are greater than they were with ordinary arc lamps and upturned high-pressure gas lamps.—Lond. *Electrician.* Jan. 8.

Tungsten Lamp.—A note on a recent British patent (19,311, 1908) of the Siemens & Halske Company for the manufacture of tungsten filaments. Nickel tungstate is mixed with tungstic acid or some plastic tungsten compound, so that after reduction by heating to a temperature of about 1650 deg. C. in an atmosphere of hydrogen, the final alloy contains about 12 per cent of nickel and 88 per cent of tungsten. This alloy of nickel and tungsten is ductile, and can be drawn or rolled. After the drawing the nickel is expelled by heating the filament electrically in a vacuum.—Lond. *Elec. Eng'ing*, Jan. 7.

Generation, Transmission and Distribution.

Power Companies in England.—An anonymous article in which the writer reviews the conditions under which British power companies are working. He points out that the companies have scattered districts owing to their not being allowed to enter the large municipal areas, and that there have been other causes to make the capital expenditure high. Taking an imaginary case of a company that has spent $3,000,000, and has 8000 kw installed in its power house, and generates 21,024,000 kw-hours per annum at a plant load factor of 40 per cent, he calculates that the capital cost and establishment charges per kw-hour sold will be 1.054 cents, and the works costs 0.5 cent, making a total of 1.554 cents per kw-hour, and in order to pay 5 per cent dividend the kw-hour must be sold at 2.408 cents, a price which would be prohibitive. In an editorial comment on this article it is not denied that British power companies have to earn dividends upon a capital that has been much inflated by the cost of parliamentary procedure and the difficulty of raising money at the outset; that they are prohibited from developing their business within the boundaries of the largest towns and cities in which municipal electricity works are in existence; and, lastly, that the exclusion of these areas increases the cost of the transmission and distributing lines, which have to be extended to the less populous parts of the companies' districts, so that a greater length of main is required per consumer. But the above specific figures are considered to be too pessimistic.—Lond. *Elec. Eng'ing*, Jan. 7.

Energy Supply from Central Stations.—A table of electric energy supply in which statistical data are given on the progress made by electricity departments of the principal industrial towns in England in the encouragement of the owners to employ electric motors for driving their machinery. Seventy British stations are covered in this list. With respect to the total brake horse-power connected, the Glasgow municipal station heads the list with a total of over 27,000 hp.—Supplement to Lond. *Electrician*, Jan. 8.

Swedish Power Company.—P. Frenell.—The first part of a long illustrated description of the Hemsjo Power Company, distributing energy in the southeastern part of Sweden, the principal towns being Kristianstad, Solvesborg, Karlshamm and Karlskrona. The amount of power which the Hemsjo company now has at its command is about 20,000 hp. Water power is utilized. A description is begun of the upper Hemsjo power station, which contains three three-phase generators, each giving 900 kva. The article is to be continued.—Lond. *Electrician*, Jan. 8.

High-Tension Energy Transmission in Europe.—A list of the 20 transmission systems in Europe on which the transmission e.m.f. is 30,000 volts or above. The highest voltage is to be used by the Sociedad Hydroelectrica Espanola Molinar, the system being in course of erection in Spain. The e.m.f. will be 66,000 volts, the rating 25,000 kw. Energy will be transmitted over a line 150 miles in length to Madrid.—Lond. *Electrician*, Jan. 8.

Sicily.—A note on recent hydro-electric developments in Sicily, taken from a paper of E. Vismara before the Italian Electrical Society. The Societa Elettrica della Sicilia Orientale were recently building two stations, one to have an 8000-hp equipment and the other 7500 hp, the transmisison line of 137 miles following the coast from Messina to Syracuse. Iron

poles were used, being placed about 200 yd. apart where the line is straight; each pole is 60 ft. high and weighs about ¾ ton. The line is made up of three wires each 0.24 in. in diameter, and the transmission e.m.f. is 40,000 volts. A 50,000-hp, 40,000-volt distribution system had been designed encircling the island. To build it, it will be necessary to use 790 tons of copper, the mean diameter of the wires being 0.28 in.—Lond. *Electrician*, Jan. 8.

Electric Cranes.—H. H. BROUGHTON.—A continuation of his long illustrated serial on electric cranes. In the present installment the author deals with the design and construction of the structural steel framework of cranes. The first sections of the article are devoted to the consideration of the most suitable materials and working stresses. It is suggested that the (Brit.) Engineering Standard Committee's specifications for structural steelwork should be adhered to by crane makers; also that the working stresses allowed be based on the nature of the forces acting and not upon some arbitrary "factor of safety." Then follows a note on the determination of the stresses in the several members of frames of complicated shape. To assist designers curves connecting weight and rating of English and German cranes are given. A number of typical examples of girder construction are also described.—Lond. *Electrician*, Jan. 8.

Winding in Mines.—A note on an electric winding plant in a German mine. There is installed in the power station a steam turbine provided with an automatic valve for by-passing live steam to the expansion stages. It drives two machines coupled in tandem. The first of these is a continuous-current generator, which provides the energy for the winding motor, and the second machine is a three-phase alternator supplying energy for auxiliary motors about the mine and surface works. The control of the winding motor, as in other winding systems, is accomplished by variations in the strength and direction of the generator field after the Ward Leonard principle. The peaks of the load are met by supplying high-pressure steam to the expansion stages of the turbine. No flywheel set is used.—Lond. *Elec. Eng'ing*, Jan. 7.

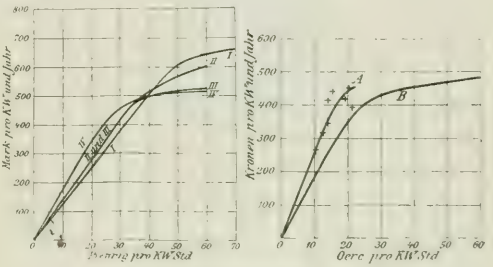
Traction.

One-Thousand-Two-Hundred-Volt Direct-Current Railway.—J. R. HEWETT.—An illustrated description of the Pittsburgh, Harmony, Butler & New Castle 1200-volt direct-current railway, which is 65 miles long and is constructed throughout for high-speed service. Energy is generated at Harmony Junction at 13,200 volts, 60 cycles, and fed to substations. Synchronous motor-generator sets in the substations transform the high-potential alternating current to 1200 volts direct current, which is supplied to the trolley.—*Elec. Railway Jour.*, Jan. 16.

Electric Motors in Railroad Shops.—J. LISTON.—The author discusses the advantages of the electric drive in railroad shops, especially the increased output, the saving in fuel and labor, the reduction in the size of the power plant, the unhampered location of machinery, the reduction of maintenance cost and of cost of building, and the ability to economically operate a single machine overtime. While formerly direct current has been preferred in the electrification of railroad shops, this is hardly the proper policy. Three-fourths of the total power is used for constant-speed machinery and for this purpose the induction motor is most suitable. The author recommends alternating-current generators, together with motor-generator sets to supply direct current for the variable-speed motors in the boiler shop, etc.—*Gen. Elec. Rev.*, January.

Installations, Systems and Appliances.

Effect of Tariff on Financial Results of Central Stations.—NORBERG-SCHULZ.—A paper illustrated by diagrams, in which, on the basis of the reports of various central stations, an investigation is made as to the manner in which the yearly receipts per kilowatt of maximum load depend on the average receipts per kw-hour sold. It is shown that the kind of tariff, and especially the absolute value of the average price of the kw-hour, has a considerable effect on the receipts per kilowatt of maximum load. If in a central station the price per kw-hour sold is gradually reduced in the course of years, the receipts per kilowatt of maximum load also change, and this variation may be plotted in form of a curve. This curve has a similar form for stations working under similar conditions. It is called by the author the "characteristic curve" of the station. The characteristic curves for four different stations are shown in Fig. 3. Curve I refers to Breslau in Germany, curve II to Hanover in Germany, curve III to Copenhagen in Denmark, and curve IV to Kristiania in Norway. The abscissas represent pfennig per kw-hour (4 pfennig equal about 1 cent). The ordinates represent marks per kilowatt of maximum load per year (one mark equals 25 cents). The tangent of the angle, which the curve at any point forms with the axis of abscissas, is the load factor. When the rate of charging for electrical energy is reduced the load factor is increased so long as one deals with the upper range of the characteristic curve. When the rate of charging is further reduced, the load factor tends to remain constant = tan α, in Fig. 3. Electric stations must endeavor to have such rates of charging that they are on a lower branch of their characteristic curves. By changing the nature of



FIGS. 3 AND 4.—STATION CURVES.

supply, for instance, by adding a tramway load, the characteristic curve is changed. This result is shown in Fig. 4, in which *B* is the characteristic curve for lamp and motor supply alone, while *A* is the characteristic curve after a tramway load had been added. The abscissas are in this case oere per kw-hour sold, the ordinates are kronen per kilowatt of maximum load per year ($1 = 3.73 kronen = 4.0 oere).—*Elek. Zeit.*, Jan. 7.

Control of Motors.—D. E. CARPENTER.—An illustrated article on the automatic control of direct-current motors in industrial service. The lag in the operation of the switches, which governs the rate of acceleration of the motor, is controlled by either of two methods: partly by the varying drop of voltage in the starting rheostat, and, secondly, by means of a series accelerating relay switch. The method of controlling the rate of acceleration by drop in resistance is simple, effective and perfectly satisfactory where the voltage of the supply circuit is fairly steady. Acceleration by time element of the switches alone is useful where very quick starting is required, as in some operations in steel mills and rolling mills. Acceleration by series relay is essential where the line voltage fluctuates; by this method very close results can be obtained. The author also discusses safety devices, magnet switches and protective relay switches.—*Elec. Jour.*, January.

Brussels.—A. OSCHINSKY.—[illegible] description of a new electric station in the city of Brussels. There were formerly various generating stations in the city itself, but recently one generating plant has been erected outside of the city at a place favorably located [illegible] supply. This plant contains three 4000-hp steam-driven generators and a fourth generator rated at 2000 hp. This station generates high-tension energy, which is transmitted to five substations in the city, which distribute it by means of [illegible] volt, three-wire, direct-current network. In the present installment the steam plant of the generating station is described. —*Elek. Tech.*, Jan. 1.

The Earth as Conductor.—F. BEVLINSKI.—His report in full to the International Electric Congress at Marseilles on the possibility of using the earth as conductor, as part of a commer-

cial electric transmission system. The report is distinctly favorable. The same issue contains also an editorial note by J. Blondin on this subject.—*La Revue Elec.*, Dec. 15.

Electrophysics and Magnetism.

Dielectric Losses.—C. Kinsley.—An abstract of an American Physical Society paper on the dielectric losses in alternating-current circuits. The equations showing the distribution of energy in simple alternating-current circuits must contain terms giving the copper, eddy-current, iron-core and dielectric losses. The importance of the iron-core loss has been recognized and its amount carefully determined for the conditions usually met in practice. The dielectric loss, however, although recognized, has generally been found to be either negligible or assumed to be so without any actual determination. The present author found that frequently the dielectric loss is very large and it may be even larger than all of the other losses in the circuit. The dielectric loss is a function of the temperature, and the paper gives determinations for temperatures between —140 deg. C. and +50 deg. C. Various dielectrics have been examined; whenever they show absorption the energy losses are considerable.—*Phys. Rev.*, January.

Magnetic Properties of Electrolytic Iron.—E. M. Terry.—An abstract of an American Physical Society paper, giving an account of an experimental investigation of the effect of temperature on the magnetic properties of electrolytic iron. The iron for this work was furnished by Professor C. F. Burgess, and was 99.97 per cent pure. Rings were tested magnetically by a modification of the Rowland ring method. Hysteresis and magnetization curves were taken at temperatures ranging from —190 deg. C. to +780 deg. C. at intervals of from 20 deg. C. to 100 deg. C., for both freshly deposited and annealed samples. The energy loss per cycle and coercive force were found to decrease uniformly with increasing temperature, while the retentivity has a maximum at about room temperature. The permeability for low values of magnetizing force increases with the temperature, reaching a maximum of 9500 for $H = 0.5$, $T = 740$ deg. C. For larger values of H the permeability decreases with increasing temperature. One sample, after annealing, was found to have a coercive force of only 1.2.—*Phys. Rev.*, January.

Mechanical Strength and Conductivity.—N. F. Smith.—An abstract of an American Physical Society paper. The author has formerly given a preliminary report on the changes in the thermal and electrical conductivities of metal bars due to the influence of a stretching force. He has now completed these measurements with the following results. In all cases the thermal conductivity of the bars increases when a moderate tension is applied. As the limit of elasticity is approached the increase reaches a maximum. When the tension exceeds this limit, the conductivity remains practically constant in the case of steel and brass or begins to diminish in the case of iron and copper. The total change in thermal conductivity due to tension amounts to from 2 to 8 per cent. The corresponding changes in electrical conductivity are much smaller, and in each case the electrical conductivity is diminished under tension. The same experimental method has been applied to investigate the effects produced by torsion. These measurements are still incomplete, but have been carried far enough to show that the thermal conductivity, like the electrical, is diminished by torsion and that the changes in thermal conductivity are much greater in magnitude.—*Phys. Rev.*, January.

Electric Oscillations.—E. T. Jones.—A highly mathematical paper on electric oscillations in coupled circuits. In a system consisting of two circuits containing capacity, self-inductance and sufficiently great mutual inductance, each circuit has two natural periods of electrical oscillation. The problem of determining the constants of the two oscillations has been considered by Overbeck, M. Wien and Drude. Drude showed that in addition to having different periods, the two oscillations also have, in general, different damping coefficients, and calculated their values; he further showed how to calculate the potential at the terminals of the secondary circuit at any time after the application of a given potential-difference to the primary terminals. The present paper deals mainly with the case in which the oscillations are started by breaking a circuit in the primary. The expression for the secondary potential is deduced for this case by Drude's method, and compared with measurements of photographs obtained by means of the short-period electrometer (or "electrostatic oscillograph," as it has been called), described by the present author. The instrument shows that the course of the variation of the secondary potential is much simpler when the oscillations are started in this way, owing to the absence of disturbance by the auxiliary sparking apparatus. Some photographs and their measurements are also given for electrical oscillations in coupled circuits produced by the "musical-arc" method.—*Phil. Mag.*, January.

Impulsive Motion of an Electric Sphere.—G. F. C. Searle.—The author has formerly calculated the energy and momentum radiated when the velocity of a charged sphere is impulsively changed by an infinitesimal amount, the change of velocity making any angle with the initial velocity. In the present paper he completes the investigation by calculating the energy and momentum which are radiated when the velocity of the sphere is impulsively changed in any manner, the only restrictions being that both the initial and the final velocities are less than that of light and that the sphere has no angular velocity about any axis through its center.—*Phil. Mag.*, January.

Aging of Steel.—An abstract of a report of C. E Stromeyer, chief engineer of the Manchester Steam Users' Association. The best Lowmoor furnace plates have, after years of work, acquired a brittleness which cannot be removed by annealing. The cause of this brittleness may be either a molecular change due to age alone, or a chemical change due to absorption of gases. A very small percentage of hydrogen makes mild steel not only brittle, but so hard that it will scratch glass, and very small traces of nitrogen also impart brittleness to mild steel. Stromeyer's conclusions with regard to the aging of steel are that the effect of an injury, such as a chisel nick, or a serious deforming pressure, is not an immediate one, except as regards local alteration of shape, but that after a lapse of many weeks the neighborhood of the injured region gets somewhat brittle. Nevertheless, this decrease of ductility is not serious, and has only been detected by very sensitive tests. In regard to steam-pipe explosions, it is shown that steam pipes made of mild steel are infinitely safer than cast-iron ones.—Lond. *Electrician*, Jan. 1.

Beta Rays.—V. E. Pound, W. Makower and N. Campbell.—Three papers on experimental investigations with respect to beta rays. The paper of Pound deals with the absorption of the different types of beta rays, together with a study of the secondary rays excited by them. The paper of Makower deals with the number and absorption by matter of the beta particles emitted by radium. His results indicate that the beta rays are stopped and not merely scattered when they pass through matter. The number of beta particles emitted per second by the radium C in radioactive equilibrium with 1 gram of radium is 5.0×10^{10}. The paper by Campbell deals with the absorption of the beta rays of uranium in liquids, especially in solutions. He finds that it is doubtful whether liquids possess a true absorption coefficient defined as a quantity occurring in an exponential equation.—*Phil. Mag.*, January.

Photoactive Cells.—P. Hodge.—A paper giving an account of an experimental investigation of photoactive cells with fluorescent electrolytes. No effect is produced by light upon the conductivity of a fluorescent solution unless a region very near the electrodes is illuminated and, further, this effect at the electrodes is produced only in a very thin film of the liquid immediately in contact with the surface of the plates. The author then studied the effects at the anode and especially at the cathode. While no conclusive results have yet been obtained he thinks he will be able to prove a definite connection between the photoelectric effects in fluorescent liquids and the phenomenon of fluorescence itself.—*Phys. Rev.*, January.

Gravitation.—C. V. Burton.—A highly theoretical paper in which the author endeavors to find a new dynamical basis for the theory of gravitation. His theory is a development of that

of Hicks. Reference to electric phenomena is also made.—*Phil. Mag.*, January.

Units, Measurements and Instruments.

Ampere-Hour Meters.—A. SCHWARTZ.—With revolving ampere-hour meters the difficulty has been experienced that the meter changes its constant after a short time of service and that considerable errors result, especially at low loads. This phenomenon is due to a transition resistance between brush and commutator. Stronger currents are able to break this transition resistance down, while at low load the resistance makes itself manifest. One method to compensate the errors is illustrated in Fig. 5. S is the shunt in the main-current circuit, W_1 is a resistance inserted in the circuit containing the brushes B_1 and B_1. A second set of brushes, B_2 and B_2, is short-circuited by means of the resistance W_2. If a transition resistance develops at the commutator, it affects not only the brushes B_1, but also the brushes B_2. By proper choice of the various resistances it is possible to obtain almost perfect compensation. The disadvantage of this arrangement is a high watt consumption. It has been found that the troubles due to this transition resistance can be overcome by providing systematic vibrations of the brushes. A device of this kind was recently described in the Digest. It has also been found that meters in which the

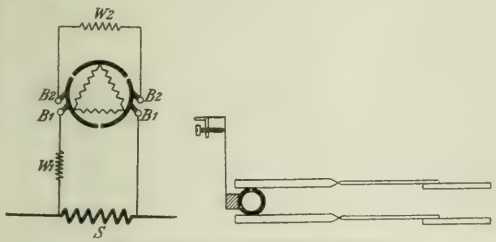


FIG. 5 AND 6.—AMPERE-HOUR METERS

pressure of the brushes upon the commutator is sufficiently strong and in which gold is used in the commutator or in the brushes are subject to errors only after a long time. The gold prevents the occurrence of a transition resistance due to chemical action. Any transition resistance due to dust deposited, etc., can best be avoided by an automatic cleaning device. The author uses a third brush of hard graphite, which does not carry any current, but is intended simply to polish the surface of the commutator. An arrangement of this kind is shown in Fig. 6.—*Elek. Zeit.*, Jan. 7.

Measuring Alternating Currents.—C. KINSLEY AND E. J. MOORE.—An abstract of an American Physical Society paper, describing a method for determining small variations in an alternating current in a circuit. A short heating wire of iron, manganin or other material is used to carry the current, and about this is wrapped an insulated No. 40 copper wire. The wires are mounted in a glass tube, from which the air is exhausted. The short wire carrying the current heats the wire which is wrapped around it, and this wire is made one of the arms of a Wheatstone bridge. Either the galvanometer can be arranged to read the current directly upon a properly divided scale or else a direct current can be sent through the wire of such a value that the heating effect is the same as that due to the alternating current. The direct current can then be read with any of the usual direct-current instruments.—*Phys. Rev.*, January.

Telegraphy, Telephony and Signals.

Morse Key.—An illustrated description of some recent improvements in the well-known signaling key for submarine cable working and in the Morse key. The new design (Fig. 7)

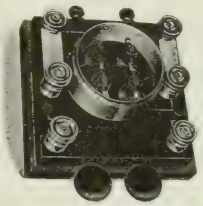


FIG. 7.—IMPROVED MORSE KEY

was exhibited at the recent exhibition of the Physical Society in London. The levers are L-shaped, with the result that the contacts become horizontal instead of vertical, as in the standard forms. In this way they are always in view, so that there is greater likelihood of their being kept clean and in good working order, while, when cleaning is necessary, it can be performed with greater ease.—Lond. *Elec.*, Jan. 8.

Continuous Oscillations.—F. KIEBITZ.—A paper read before the Berlin Electrical Society describing a number of lecture experiments made with the aid of high-frequency continuous oscillations, and showing especially the characteristic resonance phenomena.—*Elek. Zeit.*, Jan. 7.

Miscellaneous.

Germany.—W. KOCH.—A review of the electrical industry in Germany, and especially of the large electrical manufacturing companies. The German electrical industry employed, in 1906, about 140,000 persons, who produced goods worth nearly $175,000,000, while $500,000,000 is invested in central stations and electric railways. The exports amount to $33,000,000 strictly electrical products, which is about 25 per cent of the whole production. The imports were $1,800,000, or 6 per cent of the export.—*Elec. Jour.*, January

NEW APPARATUS AND APPLIANCES

Remote Control of Lamps and Motors.

BY G. F. PALMER.

A convenient method of control for lamps and motors, particularly when the latter are operated by alternating current, almost invariably results in an increase in the economy and safety of their operation. Now that the development of the art of remote control has produced a magnetically operated switch that meets all of the requirements of severe service conditions many modern buildings and residences are being equipped with such a system.

In a modern type of remote-control switch the contacts are made by means of laminated copper brushes; years of experience with circuit-breakers having shown that the knife-blade and carbon-block contacts were entirely unsuited for this class of work. This switch is closed and locked securely home by means of an armature-controlled toggle mechanism, this armature being in common relation with two solenoids, one of which [illegible] and the other opens the switch. As the switch is held at both closed and open position by mechanical means, it is not necessary that the solenoids be energized except at the moment of operation, so means are provided automatically to break the operating circuit the instant the switch is fully closed or open.

The switch itself is controlled by a momentary-contact switch having the standard dimensions for flush push-button switches,

and is arranged so that by pressing one button the closing solenoid of the remote-control switch is energized, and by pushing the other button the opening coil is caused to operate. Each button operates an independent member in the switch, which makes a snap contact when the button is released. The buttons interlock so that they cannot both be pressed together, making a switch that not only performs its service admirably, but

Fig. 4 indicates a house-wiring plan in which the remote-control switch is controlled by the push button located at *B*. This arrangement permits control of any or all lamps in a building, making it possible to disconnect entirely the electric service in time of storms, while at the same time giving complete control of all lamps in the building. This arrangement can, if desired, be connected with the regular burglar alarm system so that a

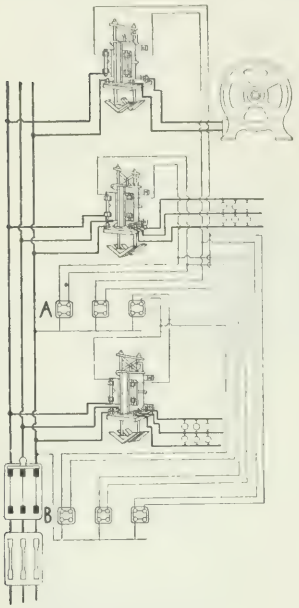
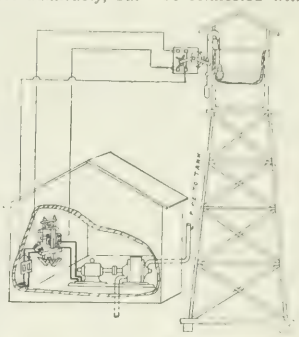


FIG. 1.—DIAGRAM OF REMOTE CONTROL CONNECTIONS.



REMOTE CONTROL FOR WATER AND HEATER

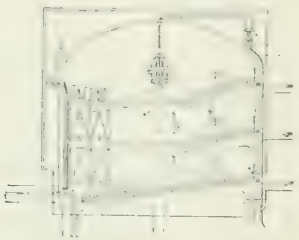


FIG. 3.—CONTROL OF THEATRE LAMPS.



FIG. 4. HOUSE WIRING PLAN



FIG. 5.—CHURCH CIRCUITS CONTROLLED REMOTELY.

meets the full approval of all inspection departments, a statement that also applies to the remote-control switch.

It will be observed by tracing the connections in Fig. 1 that either the group of lamps or motors may be controlled from either of the points *A-B*, it being further noted that the heavy mains are carried direct to the distributing points.

Fig. 2 shows the remote-control switch arranged for the control of motors driving pumps that supply elevated or compression tanks. The former is controlled by means of a float switch, and the latter by a pressure gage. Both of these control circuits are further controlled by means of standard three- or four-way switches, making the system at once comprehensive and complete. Fig. 3 shows a theater section. The complicated wiring systems in the modern theater may be greatly simplified by the use of remote-control switches.

The above is an illustration of a method of control from both stage and head usher's stand or box office of the principal means of illumination. It is one of the many adaptations possible in applying the use of remote-control switches to the wiring of buildings of this character. It is possible so to arrange a system of theater wiring as greatly to simplify the cumbersome stage switchboard, giving a better control of lamps and frequently making a very considerable saving in the cost of wiring.

Fig. 5 is a sectional view of a church. The panel board indicated at *D* is equipped with a remote-control switch, supplying chandelier circuits, and is controlled by flush push buttons located at *A* and *B*. This arrangement obviates the necessity of running heavy mains to convenient switching points, which are frequently very difficult to obtain in buildings of this character. It will be noted that the heavy mains are carried in a direct line from the service entrance *C* to the panel board *D*, the latter being located with the reference only to its accessibility and the natural center of distribution.

certain group of lamps can be switched on in event of the burglar alarm operating.

In fact, the use of remote-control switches imparts flexibility to the use of electricity not possible by direct methods of control.

Annual Show of the Association of Licensed Automobile Manufacturers.

The annual show of the Association of Licensed Automobile Manufacturers was held in Madison Square Garden, New York, Jan. 16 to 23, and the following statistics may give some idea of the size of the exhibition:

Complete gasoline cars	117
Complete gasoline car chassis	28
Complete electric cars	37
Complete electric chassis	5
Complete commercial cars	19
Complete commercial chassis	5
Taxicabs	3

The gasoline vehicles occupied the arena of the Garden, the overflow being placed on the galleries; while the electric pleasure vehicles, with one exception, occupied the space usually allotted to the restaurant near the main entrance. The electric commercial vehicles were located in the basement. Over 85 per cent of the gasoline vehicles on exhibition employ the jump spark for ignition; less than 15 per cent of the cars using the make-and-break. For the jump spark most of the machines use a high-tension magneto in connection with a storage battery for reserve, although there are very many cars using dry cells for this purpose.

Although the number of companies manufacturing electric vehicles does not seem to have increased, the vehicle itself is

evidently growing in popularity. The distance a vehicle will travel on a single charge under most favorable conditions is claimed to be over 100 miles; but with the increase in the number of charging stations the question of mileage decreases in importance. The features of the various designs of electric vehicles shown are contained in the brief descriptions which follow:

The Anderson Carriage Company, of Detroit, Mich., exhibited a roadster, a victoria and two coupés. An Elwell-Parker motor, rated at from 2 hp to 3 hp, is used and the power transmitted to a countershaft through a chain drive running in oil. The countershaft on which is fitted the differential gearing is fitted with ball bearings. The battery consists of 24 cells divided into two units of 12 cells placed in the front and in the rear under detachable hoods. Double chain drive is used on the Detroit electrics.

S. R. Bailey & Company, Amesbury, Mass., showed two victoria phætons. The vehicles were equipped with 30 cells of Gould battery and a 60-volt motor. The battery is hung, by a three-point suspension, under the floor and is easily accessible. A silent chain connects the motor to a countershaft and double roller chain is used on the rear wheels. A D-shaped steering wheel is used and the steering column swings either way. The speed control lever is mounted on top of the wheel in much the same manner that the spark lever is mounted in most gasoline cars. The car has forward speeds from 5 to 20 miles per hour and two reverse speeds.

Baker Motor Vehicle Company, Cleveland, Ohio, had five cars and two chassis on exhibition. These included a roadster, a runabout, a victoria, two coupés and a commercial and lighter chassis. Exide battery and General Electric motor and controller are used on this company's cars. The motor is suspended near the center of the car and a single chain drive is employed. The latter feature embodies the advantages of quiet running, and remaining in alignment, the chain being in the center of the rear axles. The battery is always connected in series and is divided; part being placed in front and part in the rear so as to distribute the weight. The number of cells used varies from 24 to 30, depending on the car. A steering wheel is used on all vehicles except the victoria and coupé, which are equipped with levers. Ball bearings are used on all revolving parts of the Baker vehicles.

Babcock Electric Carriage Company, Buffalo, N. Y., displayed a new runabout, a roadster, a coupé, a victoria, a town car and a chassis. The runabout is built on the lines of a gasoline car and has a battery of 42 cells. Half of these are placed in the front end of the car. Double chain drive is used on all but the town car, which has a worm drive. The batteries are built by the company, as is also the controller. All the cars have wheel steering gear. Friction is reduced to a minimum by ball and roller bearings, and lightness and graceful outlines are features of this company's output.

The Champion Wagon Company, of Owego, N. Y., exhibited a 1000-lb. wagon for general express service. This has a single General Electric motor equipment driving a countershaft by silent chain and from these double roller chains connect with the rear wheels.

Electric Vehicle Company, of Hartford, Conn., builder of the Columbia electric cars, displayed a victoria-phæton and a brougham. General Electric motors and Exide batteries are used. The model for this year preserves the original outward design, but embodies four changes in the mechanism—an emergency brake, two extra cells of battery, ball bearings on all wheels and the rear axle construction is now of the floating type. The motor and all mechanical parts are attached direct to the body and the reduction gear and enclosed chain connect the motor to the differential gear on the driving axle, which runs in a tubular casing, with all working parts housed to exclude dirt. A steel helical pinion and bronze helical gear connects the motor to the countershaft and thence sprocket and chain gear connects to the live rear axle. Steering is accomplished by means of a hinged lever. The vehicles are provided with every approved device for steering control.

General Vehicle Company, of New York, exhibited five of the seven sizes of commercial wagons built by it, in the basement; the smallest being a light delivery runabout with closed body, having a capacity of 350 lb. load, a speed of 14 miles per hour and a mileage of 50 on one charge of the battery. Standard models of electric delivery wagons of 1000 lb. and 2000 lb. capacity were shown complete and ready for work. These have a radius of 40 miles on a single charge and a speed of from 10 to 11 miles per hour. A heavy trucking wagon of 3½ tons capacity with a stake body was also shown. This model has a mileage of 35 and a speed of 7 miles per hour. A representative chassis of 2 tons capacity was featured. This type illustrated the general design of all models of the power-plant construction; the wagon having a radius of action of 40 miles at 8½ miles an hour. The battery which furnishes the electricity for the 85-volt motor is suspended below the main frame in a cradle. It is placed in sectional crates. The controller is of the continuous torque type, speed changes being effected without interrupting the supply of energy to the motor. The latter has its armature revolving in ball bearings. The motor is suspended on a cross-bar pivoted to the side frames in front of the rear axle. Double chain drive is used from a countershaft. The latter consists of two short shafts connected by a differential of the spur gear type; each shaft being connected to a rear wheel through sprockets and roller chain.

Rauch & Lang Carriage Company, of Cleveland, Ohio, featured a runabout, stanhope, coupé, extension coupé, gentleman's runabout and chassis. In these cars the battery is located at both ends. Ball bearings are used on the motor and on the countershaft, and transmission from the former to the latter is by means of a silent chain. The motor used is of the Herter Electric Company make and the batteries are of the General Storage Battery Company's Exide type. The controller is of the flat radial type, giving two starting and four running speeds.

Studebaker Automobile Company, of South Bend, Ind., exhibited an ambulance equipped with an Exide battery of 36 cells and Westinghouse motor and controller; an 11-passenger drag, equipped with 44 cells and two motors with chain drive; a stanhope fitted with divided battery of 24 cells, one-third in front, and a centrally-located motor with single chain drive; one runabout similar in equipment to the stanhope; a high-speed stanhope with single chain drive from motor in center and equipped with 12 cells in front and 24 cells in the rear. In the basement were shown four commercial vehicles consisting of one 5-ton, one 2500-lb., one 1500-lb. and one 800-lb. wagon. In these the batteries are always connected in series, the small delivery wagon having 26 cells and the others 44 cells. Although a manufacturer of gasoline cars, the company only builds commercial vehicles of the electric type, feeling that within the convenient radius of action of the electric it is the more economical of the two.

The Waverley Company, Indianapolis, Ind., showed five models, two coupés, a stanhope, a victoria and a runabout. The new driving system employed was shown in operation. The motor is attached to the body with rubber cushions to overcome vibration. The power is transmitted to the floating rear axle by a silent chain running in oil, a shaft parallel with the axle fitted with universal joints and a small herring-bone gear on the rear axle. The battery is located over the front and rear axles. The motors are of Waverley design and Exide, National or Waverley batteries are used.

Woods Motor Vehicle Company, Chicago, Ill., had two coupés, a victoria and a stanhope on exhibition in the gallery overlooking the main hall. In these cars the motor, transmission gears and driving sprockets are mounted on a bronze frame. On one end of the motor shaft is fastened a pinion meshing with a gear mounted on the differential housing. From each end of this differential power is transmitted through universal-joint shafts to the driving sprockets. From the sprockets chains run to the rear wheels. The main transmission gears are of the herring-bone-tooth type and the differential is of the beveled gear type. A four pole series wound

motor is used and a drum controller. No less than 16 annular ball bearings are used throughout the car. Exide batteries are employed and the weight of these is distributed over the front and rear wheels.

Dinner to Electric Vehicle and Carriage Manufacturers.

Mr. Herbert Lloyd, president of the Electric Storage Battery Company; Mr. J. R. Williams, second vice-president; Mr. Charles Blizzard, third vice-president, and the sales managers of the company from all over the country gave a dinner to the visiting electric vehicle and carriage manufacturers at Sherry's, New York, on Wednesday evening, Jan. 20.

The dinner, while purely social, was notable for the prominence of the guests and in that it gathered together for the first time nearly all the representative vehicle manufacturers.

Among the guests were: Messrs. Haydon Eames, president, and Hanson Robinson, W. P. Kennedy, E. C. Witwer and A. R. Davis, of the Studebaker Company; Messrs. E. Greenfeldt, R. C. Norton and O. B. Henderson, of the Baker Electric Vehicle Company; Messrs. C. J. Metzger and Louis E. Burr, of the Woods Motor Vehicle Company; Messrs. Robt. McA. Lloyd and J. A. Smith, of the General Vehicle Company; Messrs. C. E. Firestone and R. A. Feul, of the Columbus Buggy Company; Mr. Chas. E. J. Lang, of Rauch & Lang; Messrs. W. B. Cooley, H. H. Rice, general manager, and W. C. Johnson, of the Waverly Electric Vehicle Company; Col. E. W. M. Bailey, of the Bailey Carriage Company; Mr. Geo. M. Bacon, of the Anderson Carriage Company, and Mr. J. E. Michel.

In addition to the general good fellowship the guests were regaled with an artistic and entertaining vaudeville show, interspersed with hits on the guests, their products and current auto topics.

Motor-Driven Lumber Mill.

A most progressive example of the new era in lumber-mill construction is that of the Dare Lumber Company, of Elizabeth City, N. C. This mill is located near the Norfolk & Southern Railroad, on the banks of the Pasquotank River. There is deep-water communication from its docks and mill pond to the Albemarle Sound, and the extensive system of inland waterways, of which the sound is a part. For its lumber supply the company draws upon all the timber of this celebrated yellow-pine district. The supply in sight is such that even with the old-time destructive methods of deforestation the mill could run for a long period of years, but the plans of the owners are to lumber their holdings scientifically and in this way maintain a perpetual supply of first-class timber for their mill.

The mill itself is constructed of reinforced concrete throughout. All the machinery is operated by means of electric drive. In the power house is installed a 500-kw, three-phase, 60-cycle, 150-r.p.m. Western Electric alternator direct-connected to a Clark Brothers semi-Corliss engine. This unit furnishes electricity not only for the lumber mill, but has sufficient reserve to take care of a lathe mill, planing mill and shook mill.

The mill itself is equipped with two 8-in. band-saws, each driven by a 100-hp, 440-r.p.m. induction motor. An 8-in. resaw is also installed, which is direct-coupled to a 150-hp, 385-r.p.m. induction motor. It has been found that these machines are of ample capacity to do their work and are most of the time running with less than normal load; while with the old system, where a steam engine was employed to drive these saws, it required more than 300 hp continuously to do the same work.

From the band-saws the lumber goes to two edgers. The shafts of these edgers run at 1730 r.p.m., and a 50-hp motor of this speed is mounted directly on the shaft of each. From the edgers the boards are carried to the automatic trimmer, to the shaft of which is coupled a 35-hp, 870-r.p.m. motor. The waste is carried to the slashers. The main shaft of this machine also is coupled directly to a 35-hp, 870-r.p.m. motor.

The lathe mill and shook mill get their supply from this point and the boards which cannot possibly be used will be carried to the Diamond hog, which is operated by an 85-hp, 1200 r.p.m. motor belted to the shaft of the hog. All the refuse emerges in the form of small chips, which are carried to the fuel house. All the conveyors, elevators, log hauls, loaders and unloaders throughout the mill are driven by 24 back-geared induction motors ranging in size from 7½ to 20 hp. All these

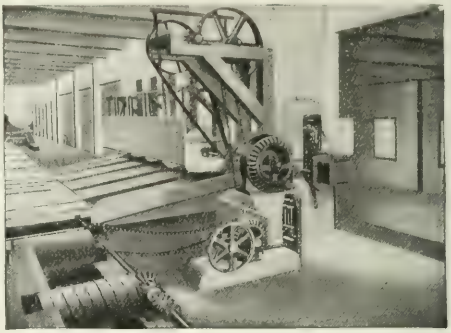


FIG. 1.—SLASHER DRIVEN BY INDUCTION MOTOR AND TABLE CONVEYOR DRIVEN BY BACK GEAR MOTOR.

smaller machines are started by merely throwing in the line switch. The larger motors, however, are equipped with oil-immersed auto-starters.

The operation of this mill has, it is said, more than fulfilled its owners' expectations. But 300 ihp is required for the operation of the complete mill with the exception of the resaw, a test not having been made since this new saw was installed. For the operation of the same equipment driven by means of belts and shafting with two engines 450 hp would be required under

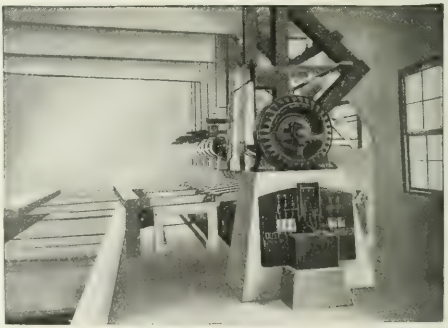


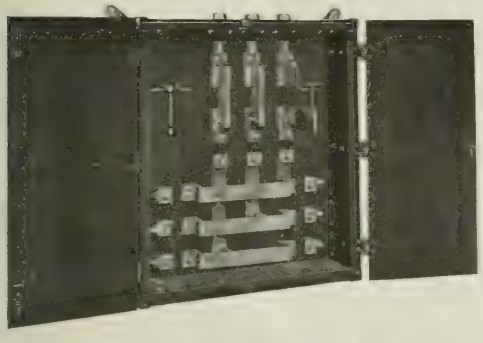
FIG. 2. EDGER DRIVEN BY A 35-HP INDUCTION MOTOR

the most favorable circumstances. Under average conditions of alignment, the power required would be considerably more; from 550 to 600 hp being a reasonable figure. It used to be considered that fuel cost was a negligible item, but this is no longer true, for the refuse which is consumed has a ready market, besides this there is so little refuse left in a modern mill that none remains to be disposed of even with the efficient electrically driven plant. The entire electrical equipment for this mill was furnished by the Western Electric Company.

Divided Service Box.

The divided service box brought out by the Ricker Manufacturing Company, of Rochester, N. Y., is made of heavy steel, lined with slate. The metal parts are made of cast copper free from all blowholes. The branch is cast solid to the through connections, eliminating the joints at this point, and the switch

on the service branch is of 1200-amp capacity. The box is designed to split a lighting main through a large consumer's building, the main being fused on each side of the service to insure the consumer uninterrupted service. This box is used in

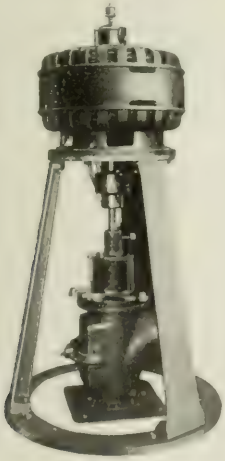


DIVIDED SERVICE BOX

theaters, hotels and department stores using large quantities of electricity, where it is of very great importance that the service should not be interrupted by a burn-out or fuse blowing in the main at some other point.

Impeller Pump Installed for Condensing Service.

The development of impeller pumps was made primarily for pumping water for irrigation purposes from deep wells, because of the simplicity of the parts in the well and the ability of this type of pump to handle all the water such a well will produce. The field of application has widened considerably since these pumps came into use until now there are installations in many classes



IMPELLER PUMP

of service. Shown herewith is a view of one of the four Columbus impeller pumps installed by Kingan & Company at their plant at Indianapolis, Ind. There are three pumps, all alike, installed here; two pump water from deep wells into the reservoir, from which it is used for condensing purposes for a Westinghouse steam turbine, rated at 500 kw. A third of these pumps is installed to raise the water from the well to a higher storage reservoir from which it flows by gravity throughout the plant. In each case the pump is equipped with a vertical Westinghouse induction motor of 75 hp, and takes energy from the two-phase alternating-current system at 440 volts, supplied for the entire plant from the turbo-generator set and from several engine-driven generators. The principle on which the pump works suggests that of the centrifugal pump, but the "impellers," as they are called, are placed horizontally within the casing and are spaced about 4 ft. apart along the shaft, to which the motor is direct-connected. The number of impellers depends upon the depth of the well. The lower two or three must be submerged at all times; that is, they must be below the lowest water level in the well. The water is whirled upward by the first impeller to a stationary vane located just beneath the second impeller. This vane, or "retarder" as it is called, stops the whirling motion of the water just before it enters the next impeller, but does not impede the upward progress. The second impeller then repeats the performance of the first, and so on, till the water is discharged at the top. The only wearing parts in the pump are the guide and thrust bearings, both of which are located at the top of the well, where they may be readily inspected and repaired when necessary. The thrust bearing is specially constructed with rollers, so that the friction is reduced, as it is rolling and not sliding friction. The vertical motor is thus not called upon to carry any weight but its own, but is coupled to the pump by a flexible coupling. In a test recently made on the pump installed for pumping into the reservoir at the Kingan plant, the pump handled 1121 gal. of water per minute, with an average power consumption of 43.2 kw, which means that the motor was running with an output of approximately 50 hp, or at two-thirds load. The pump was manufactured by the Roth Manufacturing Company, of Columbus, Ind.

Chicago Show Exhibits.

In addition to exhibits at the Chicago Electrical Show noted last week are the following:

THE ATTRACTOGRAPH COMPANY, Chicago, Ill., has an interesting exhibit of its moving and stationary illuminated signs. These are made in many styles.

THE CAMPBELL ELECTRIC COMPANY, Lynn, Mass., has an exhibit in which are shown samples of the company's one-day and eight-day time switches. These switches, which are of especial interest to central-station men, are designed for turning on and off the current of electric illuminated signs by the aid of a clock mechanism. The exhibit is in charge of C. P. Cook.

PYRO ONE-LIGHT ELECTRIC SIGN COMPANY, Chicago, Ill., is showing in a practical way the one-light Pyro electric sign in four different styles. These signs differ from the ordinary one-light sign in that the lamp is located in front of the sign and is covered with a reflector which throws the rays of the light directly onto the face of the sign. The representatives in attendance are: S. Samson, C. Mueller, C. M. Henderson, V. White, V. F. Hickerson, J. C. Maloney, Mr. Timlin, F. C. Mueller and M. C. Conley.

THE AMERICAN IRONING MACHINE COMPANY, Chicago, Ill., is showing its line of electrically heated and motor-driven ironing machines. The exhibit consists of a 48-in. gas-heated Simplex ironer with ¼-hp motor attached; a 37-in. Simplex ironer with a 220-volt heating coil and ⅛-hp attached motor; a 24-in. Simplex hand-operated machine with a 110-volt heating coil, and a new shirt-waist and electrically heated and operated puffing machine. The machines are so constructed that they may be operated in connection with any of the well-known electrically operated washing machines. The exhibit was in charge of H. G. Gross, G. A. Renner, B. G. Barker and Miss Blair.

Proposed Louisville Electrical Show.

A [illegible] of the Louisville Commercial Club and officials of the Southern Electrical & Industrial Exposition Company, of Louisville, Ky., visited the [illegible] Show in Chicago Ill., on Jan. 21, 22 and 23. The party left Louisville on the evening of Jan. 20 and went to Chicago to get pointers on ways and means of successfully holding an electrical show, as well as to get ideas on decoration,

illumination and the methods employed by the Trades Exposition Company, which has so successfully brought off four Chicago electrical shows.

The Louisville Electrical Show will be held in the armory at Louisville, Ky., from April 12 to April 24, 1909. The representatives in the party assured the manufacturers of electrical apparatus who are exhibiting at the Chicago show that the Louisville attraction will surpass anything heretofore held. It will correspond in many respects to the Greater Louisville Exposition which was held in March, 1907, and is to be held for the purpose of educating electrically the people of the South, and to give them an opportunity of studying the improvements that have been made during the last few years in the manufacture and distribution of electricity, and the uses to which it can be put. The exhibits made at the last show, held under the auspices of the Commercial Club, were confined entirely to home-made products, but the club has decided to let down the bars this year and invite manufacturers from all parts of the United States to make exhibits. The building in which the show will be held has a floor area of 54,000 sq. ft. Among the officials who comprised the delegation that visited the Chicago Electrical Show were the following: Messrs Fred. W. Keisker, Julius V. Beckman, A. T. McDonald, Brinton B. Davis, Henry Besten, Lewis S. Streng, W. W. Stouffer, Andrew Broaddus and Robert E. Hughes.

Hand Type Lifting Magnet.

The device shown in the accompanying illustrations is a hand magnet weighing only about 7 lb., but capable of lifting castings weighing from 70 lb. to 100 lb. The magnet is designed for operation on 110-volt, direct-current circuits and is furnished with drop cord and attachment plug so that it may be readily attached to any ordinary lamp socket. The push-button mounted on top of the magnet and operated by the thumb closes the circuit to the coils and makes the magnet operative. On releasing the button the poles become demagnetized and the load is released.

The magnet should prove useful in machine shops for clearing chips and borings out of the machinery or removing them from parts of the work not easily accessible, as for instance from the bottom of a deep cylindrical casting. Dropped tools, bolts, boring bars, etc., are easily recovered with the aid of the



HAND TYPE LIFTING MAGNET.

magnet from places from which it would be difficult to fish them by ordinary means.

In shops where large quantities of brass and iron filings accumulate and which it is desirable to separate them before selling them as waste material, the magnet is especially useful, since the two metals can be separated by merely passing the magnet through the mixture. In the same manner tacks or nails can be separated instantly from brass screws with which they may have become accidentally mixed.

In foundries this magnet may be used to pick up hot or awkwardly shaped castings; smooth plates, which are sometimes difficult to handle when lying on a flat surface, or for cleansing the molding sand of minute particles of metal.

Suspended with its two poles immersed in the liquid the magnet will attract to itself any particles of iron or steel which it may be desired to remove from the tubs in which paints, glazes, chemicals, etc., are mixed.

One purchaser, who uses several automobile trucks in his business, has put this magnet to a novel use. He is paving an alley in the rear of his store with ashes, and finding that many nails from packing boxes, burned under the boilers, were mixed with the ashes, he is guarding against punctured tires by employing a magnet to remove nails from the ashes before strewing them in the alley.

The above-described hand magnet has been placed on the market by the Cutler-Hammer Clutch Company, Milwaukee, Wis.

Pocket Meter for Incandescent Lamps.

The increasing use of tungsten incandescent lamps has developed the demand for a device which will enable purchasers, salesmen or others interested in the use or sale of incandescent lamps readily to compare the relative efficiencies of the various types. To the ordinary user of lamps, who is invariably averse to paying the first high cost of tungsten lamps, there is no more effective method of showing the economy of tungsten lamps than a practical demonstration of the comparative watt consumption of the tungsten and ordinary carbon-filament lamps. With the view of meeting this new demand for a special type of meter to fulfil the conditions imposed, the pocket type of tungstometer, illustrated herewith, has been developed.

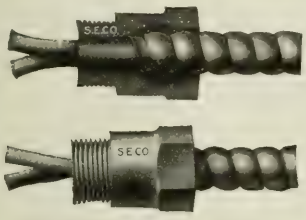


LAMP METER

The latter instrument consists of three elements: a measuring system; a connection system, consisting of an insulating tube, on the upper end of which is secured a swivel-type Edison screw plug and on the lower end an Edison-type lamp receptacle; and a special computing scale located just below the meter, by the use of which the observer can measure the watt consumption of any lamp within the full scale of the range of the meter and at any voltage up to and including 250. As will be seen, the entire arrangement is symmetrical, the measuring elements being mounted at the center of the insulating tube and the computing scale so located that it can be readily used when reading the meter. The meter windings are so proportioned that currents up to and including 1.5 amp can be measured, and, as previously stated, the windings are likewise adapted up to and including 250 volts, a decided advantage to those having occasion to measure lamps widely varying in voltage range. By the use of the swivel-screw block the meter can always be used with the scale in full view of the operator, and the diameter and length of the supporting tube are such that it can be readily employed in connection with lamps using comparatively deep or heavy shades. The tungstometer will also be found useful in measuring the ampere consumption of tungsten lamps, especially when it is desired to run them in series. The scale is so proportioned that it can be read directly in mil-amperes, thus giving a combination of watt and mil-ampere readings which permits of an extremely wide application. The dimensions of the instrument are: Length, 7 in.; width, 2½ in., and depth, 1½ in. The total weight is 9 oz. This instrument is being put on the market by the Central Electric Company, Chicago, Ill.

Galvanized Watertight Stuffing Bushing.

A galvanized watertight stuffing bushing for Greenfield lead-covered, steel-armored conductors was recently put on the market by the Sprague Electric Company. The bushing is made of two parts, as shown in the accompanying cross-sectional view. One part consists of a male nipple having one end drilled out in a cup shape, while the other part is a hexagonal female cap. The cable is inserted in the bushing and the female cap pushed back over the armor; steam packing is then wrapped around the lead covering and steel armor of the conductors, and the female cap screwed to the male nipple. This forces the steam packing into the cup-shaped space formed in the nipple,



WATERTIGHT STUFFING BUSHING.

thus making an absolutely watertight joint in the bushing. The coupling is made for Nos. 10, 12 and 14 conductors.

Detachable Wireless Cluster.

The Dale Company, of New City, has brought out a wireless cluster comprising a detachable base and cluster body; the former being screwed directly to the outlet box if used for close ceiling work. No insulating joint is needed and if the cluster is to be attached to a pendant, the base can be screwed



DETACHABLE WIRELESS CLUSTER.

to the pendant stem. The cluster body is attached by a simple push which securely locks it in position. There is no chance for the cluster to unscrew from the stem. It may, however, be readily detached by a pull without disturbing the wiring connections in case the shade is to be removed. All parts of the cluster are completely insulated with porcelain, no fiber insulation being needed. The cluster is made for from two to seven lamps and, all parts being interchangeable the number of lamps may be increased within the limits specified by simply detaching the cluster body from the base and attaching one carrying the desired number of lamp sockets. The wiring, of course, remains the same. An advantage possessed by this type of cluster is that the detachable base can be installed and after the mechanics are out of the building, the bodies, shades, etc., may be quickly attached.

Water-Flow Indicator.

The device shown in the accompanying illustration has been developed for indicating the flow of liquid in pipe lines. It consists of a valve body, with inlet and outlet connections for piping. In the valve body is a pivot plate carrying an indicator or flap, with a red arrow in the casting. This pivot plate can



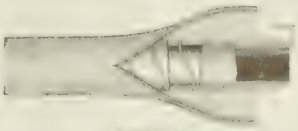
WATER-FLOW INDICATOR.

be moved into any position, which allows the device to operate in horizontal, vertical or angular connections. A glass disk held by a ring-nut allows free sight of the pivot at all times, so that one may be certain at a glance whether water is flowing. If water or fluid is not flowing through the pipe line the pivot will fall to a right angle with the axis of the indicator, thereby acting as a check valve, and showing the operator that the fluid is not moving.

The indicator is made for pressures not exceeding 250 lb. per square inch. It is particularly useful in connection with boiler feed lines, water-cooled transformers, jacket water lines for air compressors and internal combustion engines. It is being placed on the market by Mr. C. W. Bergen, 39 Cortlandt Street, New York.

Wireduct.

The American Conduit Manufacturing Company, Pittsburgh, Pa., is placing on the market "Wireduct," a new non-metallic flexible conduit, which is claimed to be distinctly different and superior to any flexible conduit heretofore invented. The inner tube of this conduit cannot be pulled out, it will not collapse under any circumstances, and extreme torsion and severe abuse have no effect upon the tube. It is stated that the bond between the middle tube and the fiber center of the conduit is so perfect that the two are literally one. The fiber comprising the body of



Wireduct is a special [illegible] great elasticity and tensile strength and at the same time of such a character as to readily blend with the rubber elements of the tube. The tube is covered in an envelope of material which resembles the skin of the alligator in toughness and pliability and which, it is claimed, will not deteriorate, but retain its toughness and pliability for years. The manufacturers claim that they have discovered the missing link in conduits and found the long sought elements which will render flexible tubing always pliable and ready for use after long storage.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

There has been little improvement in trade during the past week although conditions are gradually growing somewhat better. Some orders are coming to the wholesalers and the jobbers for immediate delivery and a few of moderate size are being placed for the spring. The general rule, however, is conservatism, and many retail merchants are only ordering to fill their actual needs. Good reports come from the leading dry goods centers of the East, where there is a considerable demand for cotton goods. The big manufacturers of fertilizers are beginning to feel the near approach of spring by the number of inquiries coming from the agricultural sections. In the retail trade the best reports are those which are received from the North and West, where post-election cut-rate sales are still actively in progress. In the South trade is still dragging owing to the lack of money in the hands of the planters. Cotton holding continues to be in evidence, and this, of course, makes collections slow in that section of the country. It furthermore has a direct bearing upon the orders from retail merchants who are not willing to stock up anew when they have not received payment for the goods they sold during 1908. In the leading industries there is still a gradual tendency toward resumption of activity, but it is coming much slower than had been hoped for during the fall. Very few manufacturers are running up to normal, and many of them are but little improved from the conditions which prevailed before the election. The uncertainty as to tariff changes has much to do with this tardiness in the return to ordinary business conditions. Neither the manufacturer nor the wholesaler is willing to commit himself very extensively while the tariff rates are a matter of so much doubt. In the electrical and kindred industries the condition is about the same as in other manufacturing lines. The Western Electric Company, for instance, announces through one of its five important officials that while some orders are being booked and there is an increase in the volume of inquiries, conditions are really very little improved from what they were four months ago. So far the January sales have been better than those for December, but the improvement is so slight that it is not worth boasting about. The Allis-Chalmers Company reports that it is operating between 65 and 70 per cent of its full capacity. It announces that the business booked during the first week of January amounted to 60 per cent of the business taken during the entire month of December, but frankly admits that this spurt cannot be taken as an average. The Otis Elevator Company reports an increase in orders, but says that none of them has been very large. The best business is coming from the Central West. The New York Air Brake Company says that its plants, both here and in Russia, are working full time and that the prospects for good earnings during the coming year were very bright. Taken as a whole, the iron and steel markets continue to be very dull and the sales of pig iron are unusually light. The demand for steel rails has not yet begun. Failures for the week ended Jan. 21, as reported by *Bradstreet's*, were 307 as against 319 for the previous week, 408 in 1908, 252 in 1907, 276 in 1906 and 228 in 1905.

THE COPPER MARKET.

The market for copper metal is beginning to show the effects of the long strain under which it has been to support prices. During the past week prices have receded a half cent in this market and still the purchases of consumers have not developed. It is not out of the way to say that the market is distinctly weak. There is still the same persistent effort on the part of the large interests producing copper to sustain prices, but there is in evidence more pressure to sell than at any time within the past three months. It is also worth noting that speculators appear to have suddenly grown timid and are not taking hold of future warrants. As is always the case, the lower the market goes the less anxious the consumers seem to buy. When copper, a few years ago, was quoted at 25 cents a pound the consumers were clamoring for metals. With copper down near 13 cents there seems to be no anxiety to stock up. In this respect the American consumer is unique. In Europe a recession in price, as a rule, stimulates buying. It is probable that at the present time there is a more general belief that the accumulation of copper is heavy than there has been at any time during recent months. The protests of the producers and selling agencies that the surplus is exaggerated are having less effect. The known figures of production and the estimates of consumption leave such a wide margin of surplus that even some of the sanguine copper boomers are beginning to be doubtful. In the meantime the market is awaiting with much interest the result of the new organization for collecting copper statistics. There is much uncertainty about what will be the program of this new association of copper producers. It is not even known whether the statistics that are collected and compiled by Mr. Graton will be made public or not. There is one thing upon which the market is pretty thoroughly agreed and that is that the figures will not be tampered with in order to sustain prices. Whether they are to be given to the public or whether they are to be used for the private information of the members of the association has not yet been announced. During the past week there has been very little demand from consumers either in this country or Europe and no large sales have been reported in this market. The exports have been running at about the rate of 20,000 tons per month; the imports have been fairly large and it is safe to calculate that the production of the American mines is over 100,000,000 lb. per month. This combination of figures, of course, must leave at the end of each month a considerable surplus. One of the leading interests in the wire industry estimates that at the present time about 25 per cent of the entire copper production is being taken by the wire manufacturers. In ordinary times more than 50 per cent is thus employed. Other branches of industry are even less active than the wire drawers. The exports for the month up to and including Jan. 25, were 17,394 tons. Prices quoted on the Metal Exchange Jan. 25 were:

Lake	14 @ 14⅛
Electrolyte	13⅝ @ 13¾
Castings	13½ @ 13⅝

London prices were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	59 12 6	59 12 6
Standard copper, futures	60 10 0	60 11 3
Market	Easy.	Steady.
Sales of spot		600 tons
Sales of futures		800 tons

Extreme fluctuations for this year:

	Highest	Lowest.
Standard		
Lake	14.55	14.12½
Electrolytic	14.25	13.70
Casting	14.12½	13.57½
London, spot	£64 2 6	£59 12 6
London, futures	64 17 6	60 10 0
London, best selected	67 15 0	64 10 0

REPORTED LARGE WIRE PURCHASE DENIED.—The announcement made from Boston last week in copper and financial circles that the Bell Telephone Companies had entered into a contract with a Connecticut wire-drawing concern for very large tonnages of copper wire at about 14½ cents per pound for electrolytic seems to have been to a large extent mythical. Such reports are not entirely unusual in the present copper market and Boston soil seems to be particularly fertile for their growth. A high official in the American Telephone & Telegraph Company, with headquarters in this city, said to a representative of this journal when he was informed of the published report: "There is nothing to it. Some of the small subsidiary companies may have bought wire for their immediate needs, but there have been no purchases of heavy tonnages such as this publication declares. I am in a position to know positively concerning any important copper contract and I tell you that none has been made. Just at present we do not need any great amount of wire and we certainly are not going to buy it and store it with the copper market in its present uncertain state."

THE COMMONWEALTH EDISON COMPANY OF CHICAGO has acquired another large piece of land adjoining its present plant, consisting of a tract of about 6 acres fronting 1100 ft. on Center Avenue, and with a depth of 248 ft. to the Allens Canal.

REPORT OF JAPANESE ELECTRIFICATION.—The report, which was generally published in the New York daily papers, that an order had been signed for $7,000,000 worth of electrical apparatus and equipment to be used in the electrification of an Imperial Japanese Railway system appears to have been exaggerated and premature. While it is well known that the government of Japan is considering the electrification of its railways it is practically a certainty that no contract of this magnitude has been signed as yet. A Japanese engineer, who is now in New York, said in reference to the electrification plans of the country: "The Imperial Engineering Corps has recently completed a most exhaustive report upon the practicability and economy of electrifying all the railways of the Empire. The work settled to be done in eliminating steam railway traction in the zone of Tokio is to be begun at once; other sections will be electrified as soon as the money can be found. Japan is well conditioned for generating hydro-electric power. The country is for the most part mountainous and has many rivers and streams that can be made to yield energy for hydro-electric power at very low cost. Such power plants in Japan will never lack abundant water supply. For large units of electrical power and for many kinds of power machinery and apparatus Japan is a good market. The country is not yet supplied with manufactories for the construction of heavy machinery of this kind. Many establishments are making small motors, but we must go outside for our large installations." Speaking of the report that an order for $7,000,000 worth of apparatus has been placed, an official of the General Electric Company said: "I have no doubt that this story refers to some recent sales which the General Electric Company has made in Japan. Our Mr. M. A. Oudin, who has recently returned from an extended stay in Japan, made sales to the Imperial Government of considerable large apparatus. It amounted, however, to nothing like the figure mentioned in the published statement. I take it that this story is but an exaggeration of our sales. It is true that extensive electrification is planned and Japan may be ready to order a considerable amount of apparatus in the near future, but I am positive that no such contract has been let because the General Electric Company is certainly in a position to have known all about it. We have paid particular attention to the Japanese trade."

THE L. S. MONTGOMERY COMPANY, Atlanta, Ga., has succeeded to the business of L. S. Montgomery of the same place, and filed application for a charter with a capital of $5,000 and the privilege of increase to $50,000. The firm will conduct a manufacturers' sales and distributing agency, and do an electrical specialty jobbing business in the Southern territory. Offices are being established in the Empire Building, Atlanta, and stock will be carried in a warehouse. We are requested to say that catalogs and trade literature will be appreciated.

TO SUPPLEMENT WATER POWER PLANTS.—The General Electric Company has sold to the Albany & Hudson Railroad Company, at Hudson, N. Y., a 1500-kw steam-turbine installation. This railroad, which has been largely dependent on hydro-electric plants for its power, has been seriously handicapped by the severe drought of the past season. It is the present purpose to install a capable steam plant as an auxiliary.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market for the past week has been as near featureless as it is possible to imagine. Trading has been unusually light and almost exclusively professional in character. The changes for the week have been in most instances fractional and the causes for such changes have had little to do with conditions of trade or the ordinary news which is expected to affect markets. The slight advances which occurred about the middle of the month can most reasonably be attributed to the determination on the part of those interests which are sustaining prices to frighten, if not to punish, certain bear elements which had begun to grow too bold. This unruly element having been chastised, the market settled into a condition of apathy. The condition of the copper market had something to do with the movement of Amalgamated and other copper stocks, but the very substantial support which has been constantly under these issues was sufficient to prevent any serious break. The report of the Amalgamated Copper Company was not considered encouraging, although it more than earned the dividend that was paid and piled up a surplus of at least $3,000,000. The most discouraging feature in the report is the indication that it costs at least 11 cents for the Amalgamated company to produce and market a pound of copper. This means that even with a production of 200,000,000 lb. a year the company must be able to sell its product at something like 15 cents in order to be able to pay reasonable dividends on its capitalization. The uncertainty of the tariff schedule on iron and steel products is considered a disturbing element to these issues. There is no doubt about there having been an organized movement on foot to advance United States Steel common to a higher point than that at which it is now quoted. This movement has been seriously hampered by the talk of free trade on steel products. While it is not anywhere believed that Congress will take off the tariff entirely, it is the almost universal opinion that the present rates will be materially lowered. The question then comes whether or not the Steel Corporation can earn its present dividends upon its vast capitalization. Upon these subjects there are almost as many opinions as there are traders in the Street. In almost every market the allotment of these bonds was immediately oversubscribed. There still seems to be plenty of money in Europe, as there is in America, for investment in any good interest bearing bonds. That there is still a great abundance of money in the New York banks is indicated by the daily rates, which are as low as they were during the dull season of 1908. Neither the withdrawals of the United States Treasury nor the floating of new bond issues seems to have any effect upon the amount of cash on hand or upon the rates of interest. Call money on Jan. 25 was quoted at 1½ @ 1¾ per cent and 90-day loans were made at 2½ @ 2¾ per cent. The quotations in the table are those of the close on Jan. 25.

NEW YORK

	Jan. 18.	Jan. 25.	Shares sold.		Jan. 18.	Jan. 25.	Shares sold.
Allis-Ch.	11⅞	11⅞	3,100	Int. Met.	15⅛	14⅝	53,450
Allis-Ch., pfd.	37½	40¼	3,085	Mackay Cos.	75	71⅞	2,000
Amal. Cop.	78	79	163,700	Mackay Cos., pfd.	70	70½	150
Am. D. T.	35	35	— —	Manhattan Elev.	143	143½	820
Am. Loc.	56	57	7,080	Met. St. Ry.	34	34	100
Am. Loc., pfd.	111	112	— —	N.Y. & N.J. Tel.	113	113	91
Am. Tel. & Cbl.	75⅝	75⅝	20	Steel, com.	53⅛	54	440,025
Am. T. & T.	126	126	5,750	Steel, pfd.	118⅜	118⅜	16,850
B. R. T.	70¾	70¼	58,250	W. U. T.	68½	69⅛	3,700
Gen. Elec.	155½	156	2,300	West'h., com.	81	82½	4,700
Int. Met., com.	16⅞	15¾	17,695	West'h., pfd.	113	113	100

PHILADELPHIA.

	Jan. 18.	Jan. 25.	Shares sold.		Jan. 18.	Jan. 25.	Shares sold.
Am. Rys.	45	44½	— —	Phila. Elec.	11⅝	12	
Elec. Co. of A.	11⅛	11	— —	Phila. R. T.	29	28½	
Elec. Stor. Bty.	44	45	— —	Phila. Traction	95	95⅝	
E. S. Bty., pfd.	49	49	— —	Union Traction	50½	51⅜	

CHICAGO

	Jan. 18.	Jan. 25.	Shares sold.		Jan. 18.	Jan. 25.	Shares sold.
Chi. City Ry.	180	180	— —	Chi. Tel. Co.	127½	128	— —
Chi. Rys., Ser. 1	116	116	— —	Met. El., com.	17	17	
Chi. Rys., Ser. 2	45½	45	— —	Nat'nal Carbon.	84	84	
Com. Edison	138	138	— —	Nat. Carbon, pfd.	116	116	
Chi. Subway.	26⅞	26	— —				

BOSTON

	Jan. 18.	Jan. 25.	Shares sold.		Jan. 18.	Jan. 25.	Shares sold.
Am. Tel. & Tel.	126¼	126	— —	Mex. Tel.	20	20	
Cum. Tel.	120	120	— —	Mex. Tel., pfd.	40	40	
Edison El. Ill.	246	251½	— —	N. E. Tel.	98	98	
Gen. Elec.	156	156	— —	W. Tel. & Tel.,	8	8	
Mass. Elec. Ry.	13	13	— —	W. T. & T., pfd.	80	80	
Mass. E. R., pfd.	58	58½	— —				

*Last price quoted.
Shares sold are for week Jan. 18 to Jan. 23.

Albany (N. Y.) Home Telephone Company, quarterly, common, 1 per cent, paid Jan. 20.

American District Telegraph Company, of New Jersey, quarterly, common, 1 per cent.

American Gas & Electric Company, of Philadelphia, Pa., quarterly, preferred, 1½ per cent, payable Feb. 1.

Beaumont (Tex.) Ice, Light & Refrigerating Company, [illegible]

Connecticut Railway & Light Company, Bridgeport, Conn., quarterly, common, 1 per cent, payable Feb. 15.

Connecticut Railway & Light Company, Bridgeport, Conn., quarterly, preferred, 1 per cent, payable Feb. 15.

Edison Electric Illuminating Company, Boston, Mass., quarterly, common, 2½ per cent, payable Feb. 1.

Harrisburg (Pa.) Traction Company, semi-annual, common, 3 per cent, payable Feb. 1.

Helena Light & Railway Company, Helena, Mont., quarterly, preferred, 1½ per cent, payable Feb. 1.

Houston (Tex.) Electric Company, semi-annual, preferred, 3 per cent, payable Feb. 1

International Steam Pump Company, New York, N. Y., quarterly, preferred, 1½ per cent. payable Feb. 1.

Montreal Light, Heat & Power Company, Montreal, Que., quarterly, common, payable Feb. 15.

Municipal Gas Company, Albany, N. Y., quarterly, common, 2½ per cent, payable Feb. 1.

New York & Queens County Electric Light & Power Company, Long Island City, N. Y., semi-annual, preferred, 2½ per cent, payable Feb. 10.

Twin City Rapid Transit Company, Minneapolis, Minn., quarterly, common, 1¾ per cent, payable Feb. 15.

Washington (D. C.) Gas Light Company, quarterly, common, 2½ per cent, payable Feb. 1.

Western Telephone & Telegraph Company, Boston, Mass., semi-annual, preferred, 2½ per cent, payable Feb. 1.

ROBERT MATHER HEADS WESTINGHOUSE BOARD.—The selection of Mr. Robert Mather as chairman of the board of directors of the Westinghouse Electric & Manufacturing Company has been announced. It is regarded as a very satisfactory move. Mr. Mather, while he is a lawyer by profession, is best known as an able financier and man of affairs. As chairman of the board of directors he will have full charge of the financial affairs of the Westinghouse company. His selection is due to those financial and banking interests which have united to make the rehabilitation of the company possible. He is known as an active organizer, a shrewd student of current conditions, and a man of conservative tendencies. But there are other reasons which seem to make the selection of Mr. Mather a particularly sagacious one at this time. It should be remembered, that he is president of the Rock Island Company, vice-president of the St. Louis & San Francisco Railroad Company and head of the law department of all the Rock Island and Frisco lines. In addition to this Mr. Mather has a wide and intimate acquaintance with the officials of all the great roads centering in Chicago and in that section of the country. Just at this time when Chicago and almost all of the other large cities of the West are beginning to clamor for the electrification of all urban and suburban lines, the advantage to the Westinghouse of having at the head of its board a man in close touch with railroad officials is apparent. Mr. Mather thoroughly understands the railroad situation in the West, and he will be able to render valuable services to the company in the new field of activity. With the return of prosperous or even normal business times, it is probable that the electrification of steam road terminals will be rapidly pushed forward, and this branch of the industry will certainly rival the development of new lighting and traction schemes. Already a bill has been passed by the Illinois Legislature requiring the railroads centering in Chicago to change from steam to electricity within the city limits. Many of the larger roads are also considering the policy of operating their suburban lines by electricity. All of this means large business for the manufacturers of heavy electrical apparatus, and the Westinghouse will lose nothing by having "a friend at court" when the consideration of contracts comes. At the same meeting of stockholders at which Mr. Mather was chosen chairman of the board of directors, Mr. Charles A. Terry, for many years the efficient and devoted secretary of the company, was advanced to the position of vice-president. The practical direction of the company's affairs will remain entirely in the hands of Mr. George Westinghouse, the president.

MEXICAN LIGHT & POWER COMPANY PROSPEROUS.—The report of earnings for the Mexican Light & Power Company for the full year 1908 shows gross earnings of $5,876,947, which is an increase of $946,577 over the previous year; total expenses, $2,161,140, an increase of $210,997; net earnings, $3,715,807, an increase of $735,580. A dividend of 3½ per cent was paid out of the earnings and after charging off large sums to construction and depreciation accounts a balance of $910,823 was credited to surplus. Sir Edward Clouston, president of the company, outlined the future plans of the company as follows in his report to the stockholders: "Owing to the great and unexpected demand for service it has been decided to double the capacity of the hydro-electric plant at Necaxa and to develop other water rights granted to the company by the government of Mexico which it was not believed until recently would be needed for many years to come. The usual dry season in Mexico during the first six months of the year will be a critical period for the operation of the plant, and this year there will be a considerable consumption of coal which will hereafter be saved when the three new reservoirs, for which plans have been made, have been put in commission."

AMALGAMATED COPPER COMPANY DIVIDEND.—The Amalgamated Copper Company has declared the usual quarterly dividend of ½ of one per cent, thus keeping the stock on a 2 per cent basis. It is clearly the policy of the company to limit the disbursements until prosperity has undoubtedly returned, although the figures of the company indicate that it is earning considerably more than the amount of dividend declared. During the year 1908 the company produced 156,430,700 lb. of copper and at the December rate will produce 208,000,000 lb. in 1909. It is stated that it costs from 11 to 11½ cents to produce and market this copper. As the average selling price in 1908 was about 14¼ cents the company ought to show $1,000,000 surplus and in 1909 should earn at least 4 per cent on its capital.

OHIO TRACTION DEAL RUMOR.—The report that New York capitalists, headed by S. J. Dill, of the Elmira Light & Railway Company, are negotiating a deal involving $10,000,000 for the properties of the Mahoning & Shenango Railway & Light Company, of Youngstown, Ohio, seems to be premature. It is true that Mr. Dill was in Ohio and made some investigations of the property, which it is known is for sale, but further than that nothing has been done. A member of the engineering firm of Sanderson & Porter—which firm was instrumental in merging the properties into the present company—said that there was absolutely nothing in the shape of a deal on hand. Engineers for prospective purchasers had looked at the property, but so far there had been no negotiations involving prices.

MICHIGAN STATE TELEPHONE COMPANY.—The establishment of a 6 per cent annual dividend rate for the common stock of the Michigan State Telephone Company, Detroit, Mich., was mentioned in the *Electrical World* of Jan. 21, 1909. The report of the company for the 11 months ended Nov. 30, 1908, is now available, and shows as follows: Gross earnings, $3,113,697; general expenses, rentals, taxes, maintenance, reconstruction, $2,268,105; net earnings, $845,592; interest, $382,163; balance for dividends, $463,163; preferred dividends, $125,569; surplus, $337,859; common dividends, $69,184; net surplus, $268,675.

AMERICAN DISTRICT TELEGRAPH COMPANY.—The American District Telegraph Company, New York, has just made public its report for the year ended Dec. 31, 1908. Compared with the previous year it shows gross revenues of $492,896, as compared with $586,066 in 1907; expenses, $424,790, compared with $506,037. The deficit after paying dividends for the year was $8,782. The year previous there had been a surplus of $2,143. The report says that the capital stock remained during the year at $3,844,700. The number of miles of wire in operation on Dec. 31 was 1596; number of offices, 79; number of instruments in circuit, 34,990; total number of messages delivered 4,168,247; total number of messages collected, 2,451,394.

RAILWAY MERGER IN CENTRAL NEW YORK.—The stockholders of the Rochester Railway, the Rochester & Sodus Bay Railway and the Rochester & Eastern Rapid Railway have voted in favor of the proposed merger of the three companies into the New York State Railways, which is designed to take over as a holding corporation all the electric railways in New York State controlled by the Central Railway Syndicate.

TRACTION CONSOLIDATION IN PENNSYLVANIA.—The Susquehanna Railway & Light Company, of Lancaster, Pa., has purchased the property and franchise of the Philadelphia, Coatesville & Lancaster Railroad Company, paying $137,500 for it. The purchasing company, which is largely controlled by New York capitalists, will now have a trolley system which through connecting lines will reach into Philadelphia.

EDISON ELECTRIC ILLUMINATING COMPANY.—Of the 9,725 shares of new stock of the Edison Electric Illuminating Company, Boston, Mass., offered stockholders as of record on Dec. 18, less than 150 shares remained unsubscribed at the close of subscriptions on Jan. 22. Subscriptions are payable $100 on Feb. 1 and $115 on March 3. The stock not subscribed for by the stockholders will be sold at public auction.

STORAGE BATTERIES FOR BALTIMORE & OHIO.—The Westinghouse Machine Company has sold recently to the Baltimore & Ohio Railroad Company a large order of storage batteries for use in the tunnel service of that railroad in the city of Baltimore.

HUDSON RIVER ELECTRIC POWER COMPANY.—The report made by Stone & Webster to James R. Hooper, chairman of the bondholders' committee of the Hudson River Electric Power Committee, deals with the physical condition of the property and its facilities for successful operation. There are two groups of properties, those in the Hudson Valley, and those at or near Utica. The Hudson Valley properties are largely operated by water power, but are supplemented by a small steam installation of their own and by larger ones of their customers. The Utica system is entirely steam operated. The total value of all the property of the companies is estimated to be $6,234,000, of which the Spier Falls plant is estimated to be worth $2,250,000. For the first seven months of 1908—the period for which the report was prepared—almost every one of the subsidiary companies lost money. The report is taken to mean the necessity of a radical reorganization. Steps have been taken by the bondholders' committee of the Hudson River Water Power Company to have the Trust Company of America foreclose the mortgage securing the first mortgage bonds.

RHODE ISLAND COMPANY, PROVIDENCE, R. I.—The Rhode Island Company has been added as a defendant to the suit brought by United States District Attorney French on behalf of the government in which he cites the New York, New Haven & Hartford Railroad, the Boston & Maine Railroad, the Providence Securities Company and the Consolidated Railway of Connecticut as defendants, and charges them with violation of the Sherman anti-trust law in the merging of railroad and railway interests. The Rhode Island Company was not mentioned at first, but the amendment alleges that this company, which operates and owns practically all the urban and interurban railways in Rhode Island, in June, 1907, transferred to the Providence Securities Company all its holdings in the Providence & Burrillville Street Railway, in the Columbian Street Railway, and the Woonsocket Street Railway. The Providence Securities Company transferred control of these properties to the New York, New Haven & Hartford Railroad on Jan. 1, 1908, it is alleged.

SAN DIEGO CONSOLIDATED GAS & ELECTRIC COMPANY.—W. P. Bonbright & Company, New York, offer for subscription at 98½ and interest $250,000 of 5 per cent first and refunding mortgage gold bonds of the San Diego Consolidated Gas & Electric Company, San Diego, Cal. At present there are outstanding $1,250,000 of the company's authorized issue of $1,500,000. They are dated April 20, 1905, and are due April 20, 1935, and are subject to call on or after April 20, 1910, at 102 and interest. The proceeds from the sale of part of the bonds of this offering have been used to retire $193,000 outstanding prior lien first mortgage 6 per cent bonds, which makes this issue a first and only lien upon the entire property of the company.

INTERBOROUGH-METROPOLITAN COMPANY.—At the annual meeting of the stockholders of the Interborough-Metropolitan Company the retiring directors were re-elected. Theodore P. Shonts, president of the company, said that conditions affecting the property have improved since the last meeting. Mr. Shonts is quoted as saying in an informal conversation with some of the shareholders after the meeting that the company had not yet decided whether or not it would retain its interest in the Metropolitan Street Railway, about $43,000,000 of whose stock it holds. Receipts and disbursements will not be made public by the company at this time.

CONSOLIDATED GAS, ELECTRIC LIGHT & POWER COMPANY.—E. H. Rollins & Sons, Boston, Mass., offer for subscription at 86½ $2,500,000 of 4½ per cent general mortgage bonds of the Consolidated Gas, Electric Light & Power Company, Baltimore, Md., dated Feb. 14, 1905, and due Feb. 14, 1935. The bonds are a first lien on the main electric generating station of the company, which controls the entire gas and electric light and power business of Boston, and are part of a total authorized issue of $15,000,000, of which $9,832,000 are outstanding.

LAKE SUPERIOR CORPORATION.—In the *Electrical World*, issue of Jan. 7, 1909, mention was made of the purchase by Robert Fleming, London and New York, of the holdings of a syndicate of Philadelphians in the Lake Superior Corporation, Sault Ste. Marie, Mich., for English and Canadian interests. In accordance with the plans of Mr. Fleming and his associates W. K. Whigham, London, Eng., and Walter Gow, Toronto, were elected directors of the Lake Superior Corporation on Jan. 21, to succeed James Hay, Philadelphia, and Thomas Gibson, Toronto.

SYRACUSE & SUBURBAN RAILROAD, SYRACUSE, N. Y.—A syndicate headed by Mr. John J. Stanley, vice-president of the Syracuse (N. Y.) Rapid Transit Railway, as syndicate manager has purchased the capital stock of the Syracuse & Suburban Railroad. Syracuse, N. Y.

AMERICAN GAS & ELECTRIC COMPANY.—Mr. W. T. Hanson has been elected a director of the American Gas & Electric Company, New York City, to succeed Mr. R. T. Paine, 2d.

REPORT OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings	Charges	Surplus.
Cape Breton Electric Company, Ltd., Sydney, C. B.:					
November, 1908	$21,780	$11,312	$10,476	$4,896	$5,579
November, 1907	23,384	12,496	10,887	4,842	6,044
Dallas (Tex.) Electric Corporation:					
November, 1908	105,194	66,355	38,839	28,394	10,444
November, 1907	103,206	62,246	40,960	29,479	11,480
Edison Electric Illuminating Company, Brockton, Mass.:					
November, 1908	22,027	9,785	12,841	3,267	9,574
November, 1907	20,722	10,067	10,655	1,416	9,238
El Paso (Tex.) Electric Company:					
November, 1908	42,597	34,684	12,913	7,508	5,405
November, 1907	40,431	30,673	15,758	6,158	9,599
Galveston-Houston Electric Company:					
November, 1908	104,446	59,593	44,853	20,941	23,912
November, 1907	80,740	53,674	26,066	19,907	6,158
Houghton County Traction Company, Houghton, Mich.:					
November, 1908	21,591	12,063	9,529	5,836	3,693
November, 1907	19,816	12,360	7,456	4,776	2,680
Houghton County Electric Light Company, Houghton, Mich.:					
November, 1908	27,560	10,506	17,059	5,388	11,670
November, 1907	25,803	10,673	15,130	3,780	11,350
Lowell (Mass.) Electric Light Corporation:					
November, 1908	24,828	17,231	7,597	3,571	12,525
November, 1907	23,074	16,809	13,265	4,225	9,040
Milwaukee Electric Railway & Light Company, Milwaukee, Wis.:					
December, 1908	208,112	177,327	230,784	101,915	128,868
December, 1907	196,284	176,156	186,598	102,150	84,448
Year ended December, 1908	2,938,284	938,804	2,007,290	107,201	81,720
Year ended December, 1907	2,607,290	1,000,788	1,606,502	181,604	1,424,898
Milwaukee Light, Heat & Traction Company, Milwaukee, Wis.:					
December, 1908	191,116	97,411	161,048	69,945	91,203
December, 1907	178,111	73,411	104,510	57,065	47,444
Year ended December, 1908	2,251,000	1,150,000	1,100,405	600,000	500,405
Year ended December, 1907	2,000,000	1,000,000	1,000,000	500,000	500,000
Minneapolis (Minn.) General Electric Company:					
November, 1908	144,000	80,000	63,637	38,000	25,637
November, 1907	140,220	100,000	40,220	15,000	25,010
Northern Texas Electric Company, Ft. Worth, Tex.:					
November, 1908	35,000	21,000	14,000	14,000	22,081
November, 1907	31,000	16,898	14,102		
Puget Sound Electric Railway, Tacoma, Wash.:					
November, 1908	96,000	54,261	42,470	34,000	8,470
November, 1907	85,000	50,000	35,000	27,835	7,165
Seattle (Wash.) Electric Company:					
November, 1908	140,000	85,000	55,000	25,000	30,000
November, 1907	122,000	45,000	81,000	25,000	56,000

*Deficit.

GENERAL NEWS

Construction News.

BIRMINGHAM, ALA.—A movement is on foot among the merchants of Birmingham looking toward the construction of an electric light plant in the near future. A company is being formed to carry out the project. Louis Pizitz and S. Capen are interested in the enterprise.

FLORENCE, ALA.—The Sheffield Company is considering the question of extending its electric railway to the Florence University, two miles north of the town, and also to establish a more direct line to East Florence. J. W. Worthington is vice-president.

LINEVILLE, ALA.—Arrangements are being made to install an electric light plant at Lineville, for which contracts for machinery, it is said, have been placed. Dr. B. M. Smith is interested in the enterprise.

SAMSON, ALA.—The citizens have voted to issue $25,000 in bonds, the proceeds to be used for the construction of an electric light plant and water works system. W. J. Gresham is Mayor.

DOUGLASS, ARIZ.—The Treadwell Company, it is said, is planning to construct a large power plant to operate its stamp mill. The plant is to be located on the Taku River and will cost about $800,000. Robert McKenzie is general superintendent.

MESA, ARIZ.—Dr. A. J. Chandler has applied for a franchise to construct and operate a street car line on Main and McDonald Streets.

EL DORADO, ARK.—The El Dorado Light & Water Company, recently incorporated with a capital stock of $50,000, has purchased the local electric light plant. It is said that the company will not make any additions to the plant before September. J. P. Holmes is president.

MAMMOTH SPRINGS, ARK.—It is reported that the plant of the Mammoth Springs Electric Light & Power Company has been destroyed by fire, causing a loss of about $8,000. The plant furnished electricity in Mammoth Springs, Ark., and Thayer, Mo.

PRAIRIE GROVE, ARK.—The question of establishing an electric light plant in this city is under consideration. For further information address Dr. W. H. Mack, secretary of Board of Trade.

EUREKA, CAL.—The Humboldt Traction Company contemplates the installation of a 400-kw unit, consisting of an engine and generator, in its plant. A boiler will also be installed.

FRESNO, CAL.—Plans are being considered by the Fresno Light & Power Company to increase the output of its plant in the near future and extend its transmission lines to the towns of Clovis, Sanger and Lomoore, to furnish electricity for lamps and motors. A. G. Wishon is manager.

GREENVILLE, CAL.—The Round Valley Land & Power Company, which is installing an electric plant west of Greenville, has placed contracts with many of the farmers in Plumas County to furnish electricity to operate pumps to irrigate their farms. It is also stated that the company will furnish electrical energy to six towns in this vicinity, which have been using petroleum for lighting, as soon as the company can erect its transmission lines from the central plant. C. K. Reid is interested in the project.

HOLTVILLE, CAL.—Work has commenced on the construction of the new power plant of the Holton Power Company, on the Alamo River, below the present power House in Holtville. James Stratton has charge of the work.

OROVILLE, CAL.—J. H. Richardson has been granted a franchise to construct and operate a telephone line from Richardson Springs to Chico.

OROVILLE, CAL.—The Oro Water, Light & Power Company is extending its transmission lines through the Central House and Honout sections to supply electricity to operate several pumping plants.

SAN ANDREAS, CAL.—The Mokelumne River Power & Water Company has filed notice of appropriation of 5000 cu. in. of water of the south branch of the middle fork of the Mokelumne River, to be diverted at Cadish Dish.

SAN FRANCISCO, CAL.—Plans are being prepared by the Great Western Power Company to construct a large dam in Plumas, for which options on lands have been secured and steps taken for the construction of the dam. Work will begin upon the completion of its projected dam at Big Meadows. The company proposes to erect a large generating plant at the dam.

YREKA, CAL.—The Siskiyou Electric Light & Power Company, it is said, has decided to extend its transmission line at once from Montague to Dunsmuir, for which poles, wire and transformers have been ordered for the entire installation. The company will install another 1125-kw generator in its plant at Fall Creek, and is also extending its transmission lines down the Klamath River seven miles, to furnish electrical service to the mines in that vicinity. The new extension will serve Gazelle, Edgewood, Weed, Sison and Shasta Springs. J. Rosborough, Oakland, Cal., is [illegible].

MERIDEN, CONN.—The Meriden Electric Light Company has been awarded the contract to install tungsten lamps on the streets and sections of the city now lighted by Welsbach lamps. The contract calls for at least 184 lamps by May 1.

WILMINGTON, DEL.—Mayor Wilson has returned without his approval the resolutions adopted recently by the Street and Sewer Commissioners, granting the Commercial Light, Heat & Power Company and the Delaware Electric Transmission Company, affiliated concerns, an extension of two years in time allowed for fulfilling the obligations contained in the franchises, one of which was to make certain payments to the city.

WASHINGTON, D. C.—Bids will be received by the Bureau of Engraving and Printing, Treasury Department, Washington, D. C., until March 22 to furnish electrical supplies, etc., during the fiscal year beginning July 1, 1909. Blank forms with specifications for proposals will be furnished on application to Joseph E. Ralph, director of bureau.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 2 for furnishing at the various naval stations and navy yards the following supplies: Mare Island, Cal.: Schedule 794—A 3-hp motor and two 5-hp motors. Annapolis, Md.: Schedule 827—100 ft. twin conductor lighting wire and 3000 ft. single conductor lighting wire. Washington, D. C.: Schedule 832—Two duplex horizontal boiler feed pumps, cold rolled copper, hard sheet brass and 1000 lb. flexible G. I. wire hoisting rope, etc. Brooklyn, N. Y., and Camden, N. J.: Schedule 766—Ammunition hoists and electrical equipments. E. B. Rogers is paymaster general, U. S. N.

ATLANTA, GA.—The newly organized Piedmont Power Company has elected the following named directors: William L. Pell, David Woodward, William Nixon, J. S. B. Thompson, S. F. Parrott, Frederick J. Paxon, S. D. Jones, Albert Howell, Jr., and Louis B. Magie. The company proposes to transmit electricity to Atlanta for manufacturing purposes from hydro-electric plants to be constructed at outlying power sites.

EAST POINT, GA.—Contracts for the construction and equipment of the municipal electric light plant have been awarded as follows: For generator and other electrical equipment to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.; for engine, to Hoover, Ewens & Rentschler Company, and to Sullivan & Long, of Bessemer, Ala., for construction of power house. Contract for pole line not yet awarded.

ELBERTON, GA.—An election will be held Feb. 16 to vote on the proposition to issue $5,000 in bonds, the proceeds to be used to increase the output of the municipal electric light plant.

HAWKINSVILLE, GA.—The Hawkinsville Cotton Mills have been purchased by J. C. Cooper for $65,000. The mill has an electric plant which furnishes electricity for lighting the streets of the town.

JACKSON, GA.—It is reported that surveys are being made some miles below the development of the Central Georgia Power Company, with a view to establishing another electric plant on the Ocmulgee River.

WILLACOOCHEE, GA.—It is reported that plans are being prepared for the construction of a municipal electric light plant in Willacoochee. J. B. McCrary & Company, of Atlanta, Ga., will have charge of construction of the plant.

LEWISTON, IDAHO.—A proposition has been submitted to the City Council by M. A. Keans, of Lewiston, to construct and operate a street railway system by local capital. The cost of the system is estimated at about $100,000. A company will be oroganized at once.

ANNA, ILL.—The Bell Telephone Company has secured control of the Ohio & Mississippi Telephone Company, through the purchase of the stock owned by Dr. F. W. Willard, of Anna.

CHICAGO, ILL.—The Federal Electric Company has increased its capital stock from $50,000 to $250,000.

DEKALB, ILL.—The Woodstock & Sycamore Traction Company has filed in the recorder's office in Dekalb, a deed of trust in favor of the Metropolitan Trust and Savings Bank, of Chicago, Ill., to secure a bond issue of $700,000, the proceeds to be used to complete the construction of the railway. The company is building an electric railway from Woodstock to Sycamore.

ELGIN, ILL.—The question of installing an ornamental street lighting system on Riverside Avenue in this city is under consideration.

HILLSBORO, ILL.—The capital stock of the Hillsboro Electric Light & Power Company has been increased from $50,000 to $100,000.

JOSLIN, ILL.—The Crescent Telephone Company has increased its capital stock from $2,000 to $20,000.

JASONVILLE, IND.—T. J. McGrew and others, of Coalmont, Ind., have been granted a franchise to build and operate a telephone plant in this city.

NORTH MANCHESTER, IND.—We are informed that the Browne-Mills Electric Company will install a 250-kw, three-phase alternator, direct connected to an Allis-Chalmers Corliss engine, in its plant next May. The company also proposes to establish a day service for power.

PETERSBURG, IND.—The Pike County Telephone Company has increased its capital stock from $40,000 to $50,000.

SHOALS, IND.—The Board of Trustees has granted a franchise to James F. Lynch, of Danville, to construct and operate an electric light plant in Shoals. The streets will be lighted by both arc and tungsten lamps. A meter will be system for residence and commercial lighting.

BELLEVUE, IA.—W. J. Fay, city clerk, writes that it is proposed to rebuild the municipal electric light plant at a cost of about $7,000. O. C. Hintz, of Bellevue, Ia., is engineer in charge.

COUNCIL BLUFFS, IA.—The Citizens' Gas & Electric Company has increased its capital stock from $250,000 to $350,000.

FORT MADISON, IA.—Arrangements have been completed by H. H. Masden, of this city, for the sale of the Northwestern and Salem lines of the telephone system to John Saunders, of Houghton, the consideration being $16,000 and $7,500, respectively. These lines will be consolidated with the German-American lines owned by Mr. Saunders.

GRUNDY CENTER, IA.—The Iowa Construction Company has been granted a franchise to construct and operate street railway, electric light and power plant, gas and telegraph system in Grundy Center.

MASON CITY, IA.—The People's Gas & Electric Company is installing a 200-hp Skinner engine in its power plant.

OELWEIN, IA.—Plans are being considered by the Oelwein Light, Heat & Power Company for improvements to its plant during the coming year, which will involve an expenditure of about $25,000.

CHEROKEE, KAN.—The Joplin & Pittsburg Electric Railway Company has been granted a franchise by the City Council to construct and operate its railway in this city.

FOWLER, KAN.—Application has been made to the City Council for a franchise to install an electric light and ice plant in Fowler by R. B. Flesch & Company. The company proposes to erect a plant in the town to cost from $10,000 to $25,000.

LARNED, KAN.—The C. W. Smith Electric & Ice Company is planning to extend its transmission lines to small towns, which will require the erection of about 20 miles of lines.

McPHERSON, KAN.—The city has taken over the local water and electric light plants to be operated by the municipality. The price paid for the plant was $51,594. Eugene D. Meyers, of Wichita, Kan., has been engaged as superintendent. D. R. Maltby is chairman of the city commission.

PITTSBURG, KAN.—Negotiations are under way between the Girard Coal Belt Electric Railway Company, of Girard, Kan., and the Joplin and Pittsburg Electric Railway Company, by which the later will purchase the Coal Belt system. J. J. Heim is president of the Joplin & Pittsburg Electric Company.

BELLEVUE, KY.—The City Council has adopted plans submitted by City Engineer Hornung for the construction of a municipal electric light plant. The plans submitted call for a plant with sufficient output to supply electricity for 74 arc lamps and the necessary commercial lighting, the cost of which is estimated at $33,286. The cost of operating the plant would be about $11,000 per year.

PINEVILLE, KY.—The plant and holdings of the Pineville Light & Ice Company have been purchased by Frank Gibson and D. B. Logan, of Pineville, and Mr. Hale, of Knoxville, Tenn. The new owners will rebuild the plant, which was recently destroyed by fire.

LAFAYETTE, LA.—Charles J. Muller, superintendent of the municipal electric light plant, has submitted a recommendation to the City Council that the electric light system be changed from direct to alternating current.

BALTIMORE, MD.—Plans are being considered by the Park Board for making improvements at Patterson Park at a cost of about $20,000, which will include the installation of a lighting system at the bathing pool and on the athletic field, to cost about $4,500; the paving of the mall at a cost of $9,000; also lighting the mall and providing permanent seats, for which $5,000 of the annual appropriation will be used. Ferdinand C. Latrobe is president of the board.

BALTIMORE, MD.—Bids will be received at the office of the City Register, City Hall, Baltimore, Md., until Feb. 3 for the installation of an underground electric lighting system at Patterson Park. Plans and specifications can be seen and obtained at the office of the Park Board, Madison Avenue entrance to Druid Hill Park, Baltimore, Md. Copies of plans and specifications can be had for the lighting system by placing a deposit of $5. William S. Manning is general superintendent.

CAMBRIDGE, MD.—The Cambridge Light & Power Company, recently incorporated, has awarded contract for installation of plant to Wehr, Walden & Dukehart, of Baltimore, Md. The plant will have an output of about 200 kw. R. B. Fentress, of Norfolk, Va., and W. H. Medford, of Cambridge, Md., are interested in the project.

DENTON, MD.—Application has been made to the Town Council for a franchise by a company which contemplates the construction of an electric light plant in Denton.

BALDWINVILLE, MASS.—[illegible] electric light plant at Templeton, and the Municipal Electric Light Board has re-elected Herbert C. Lowell superintendent and manager of the plant for another year.

BARRE, MASS.—A movement has been started toward the establishment of an electric lighting system for this town.

FRANKLIN, MASS.—The new substation has been completed and connected with the plant of the Woonsocket Electric Machine & Power Company, of Woonsocket, R. I., which will furnish electricity for operating the local system. The new system will soon be placed in operation when a 24-hour service will be given. The two arc lamp circuits will be operated by a motor in the old plant until the new lamps are installed.

SALEM, MASS.—Bids will be received until Feb. 1 by the County Commissioners for furnishing and putting in place electric fixtures for the registry of deeds and probate court house at Salem, Mass. Drawings and specifications are on file at the office of County Commissioners, Court House, Salem, Mass., and at the office of the architect, C. H. Blackall, 20 Beacon Street, Boston, Mass. Moody Kimball, James C. Poor and J. M. Grosvenor, Jr., are county commissioners.

UPTON, MASS.—J. Russell Robinson, president of the Upton Electric Company, is negotiating with the Selectmen for a franchise to furnish electricity in the town; also for a contract for street lighting. The town now pays about $800 per year for lighting the streets with oil lamps, and it is estimated that an incandescent electric lamp system can be installed to cost about $1,000 per year.

WELLESLEY, MASS.—The municipal light commissioners have announced a reduction in the price of electricity from lamps in Wellesley from 16 to 13 cents per kw-hour, the new rate to take effect immediately.

WORCESTER, MASS.—Plans have been completed by the local wire commission, consisting of Henry A. Knight, superintendent of wires, F. H. McClure, city engineer, and George C. Moss, street commissioner, of the section of the city in which the wires are to be placed underground this year.

ALMA, MICH.—The Union Telephone Company contemplates a reorganization so as to provide for an increase in capitalization to $1,837,000.

BIG RAPIDS, MICH.—The Board of Supervisors has passed a resolution appropriating $100 and for the appointment of two members to make investigations in regard to developing water power in the Muskegon River, to be used to generate electricity. The board is securing this information so as to be able to act intelligently when, in the near future, the Grand Rapids-Muskegon Power Company will ask for new franchises, the present franchise becoming void on April 1 because of non-compliance with its provisions.

DETROIT, MICH.—Announcement has been made that the Home Telephone Company is planning to extend its telephone lines in the outlying districts. The work will involve an expenditure of about $600,000.

KALAMAZOO, MICH.—The City Council has instructed the city engineer to prepare plans and estimates of the cost of a subway for electric light, telegraph and telephone lines to be constructed on each street to be paved this year.

MADISON LAKE, MINN.—The Commercial Club is considering the question of building an electric railway from Mankato to Madison Lake, later to be extended to Northfield. H. E. Nance, general manager of the Mankato Electric Traction Company, has submitted a proposition proposing that the railway be built by the way of St. Peter, Lakes Emily and Washington, with an estimate of the cost.

OWATONNA, MINN.—The Pratt Rural Telephone Company is planning to make extensions east and south during the coming year.

PINE CITY, MINN.—We are informed that J. M. Allen and R. P. Allen are interested in the construction of a 600-hp hydro-electric plant, with an eight-mile transmission line having a potential of 10,000 volts. Bids for the construction of the plant will be received about March 10. It is proposed to form a company under the name of the Pine City Power Company with a capital stock of $50,000 to operate the plant. J. M. Allen is engineer. The cost of the plant is estimated at $25,000.

THIEF RIVER, MINN.—Plans are being considered to construct a rural telephone line to Rainer, a distance of thirty miles.

CARTHAGE, MO.—Arrangements are being made by the Empire Electric Power & Supply Company to enlarge its power house; also the installation of additional equipment, including a motor generator and transformer.

ELDORADO SPRINGS, MO.—It is reported that the Eldorado Springs, Tiffin, Monegaw Springs and Lowry City Railroad Company will locate [illegible] president.

KANSAS CITY, MO.—[illegible] posed electric railway between Kansas City and Lone Jack by the Kansas City Southeastern Traction Company. The main railway will extend from [illegible] City, a distance of 125 miles. A branch line will be built from Lees [illegible] length. Another branch will extend to Clinton. Charles A. S. Sims is president and J. C. Herring chief engineer. Electricity for operating the [illegible] $5,000,000. It is proposed ultimately to extend the railway to St. Louis, Mo.

[illegible] house and water tower at the Insane Asylum, to cost about $70,000, including machinery.

ST. LOUIS, MO.—It is reported that the Laclede Gas Light Com[illegible] contemplates extensive improvements and additions to its system.

which will involve an expenditure of about $10,000,000. Among the improvements contemplated is the construction of a new plant at Broadway and River des Peres.

ST. LOUIS, MO.—The Board of Public Improvements has granted the West End Light & Power Company permission to construct a conduit on Grand Avenue from Manchester Avenue to Lucky Street, to cost $80,000. The company is to operate under the old Browning-King franchise. It is said that the first power plant will be located in Mill Creek Valley, near Grand Avenue. Plans for the main underground conduit have been completed and plans for the power house will be ready within a short time.

MISSOULA, MONT.—The Misoula Light & Water Company contemplates enlarging its substation and the construction of a street railway system.

STEVENSVILLE, MONT.—The City Council has granted a franchise to C. D. McCarthy to construct an electric light plant in Stevensville.

ANTRIM, N. H.—The Goodell Company, owner of the local electric light plant, has decided to develop a water power at North Branch, about four miles from this village. A 500-kw generator will be installed. The company writes that about 500 hp will be developed, which will be more than the company requires at present, and it will probably have several hundred horse-power to sell. It is stated that the town is ready to vote liberal terms to industries that could be induced to locate in Antrim and utilize part of the surplus power. It is expected to install the plant during the coming summer. David H. Goodell is president.

CONWAY, N. H.—The citizens are considering the question of improving the present electric lighting system for both street and residential lighting, as the present service is inadequate and unsatisfactory. A committee has been appointed to make investigations with a view to improving conditions.

KEENE, N. H.—The Keene Electric Railway Company has made arrangements with the Keene Gas & Electric Company to furnish electricity to operate its railway to West Keene, Marlboro, Swansey and South Keene.

CEDARVILLE, N. J.—Arrangements are being made to light this town by electricity. The street lighting system will consist of 25 lamps.

ELIZABETH, N. J.—Plans are being considered for the construction of an electric railway from Elizabeth to Perth Amboy. The company will be known as the Elizabeth & Perth Amboy Traction Company. Charles A. Trimble, of Elizabeth, N. J., is one of the incorporators. J. A. McClary, of Rahway, N. J., has charge of the engineering work.

NEWARK, N. J.—The Board of Education is planning to install an independent lighting plant in the new Morton Street School at a cost of about $14,000. G. W. Knight is engineer of Board of Education.

PLAINFIELD, N. J.—Arrangements have been completed whereby electricity for consumers in Plainfield and South Plainfield will be furnished from the Cranford plant of the Public Service Corporation. The local generating station of the company will be held for use in emergencies. The equipment of the Cranford plant, which has recently been rebuilt, includes a turbine generator with a rating of 2000 hp, three new boilers, condensing apparatus, new switchboard and transformers.

SOUTH AMBOY, N. J.—Owing to the unsatisfactory electric lighting service given at present the Board of Trade is considering the advisability of securing electrical service from a large manufacturing plant in Sayreville, which is now furnishing electricity in South River, N. J.

BATH, N. Y.—The Citizens' Electric Service Company has been reorganized and Horace Jones elected president to succeed E. J. G. Towner, resigned. M. J. Burke, of Buffalo, N. Y., is the contractor to finish the plant. The land upon which the power house is being built has been paid for and operations will be resumed. The Village Trustees have given Mr. Burke until May 16 to finish the plant and assume the contract with the village for street lighting.

CLYDE, N. Y.—The Wayne County Electric Company has suspended its street lighting service in Clyde, for which various reasons have been given.

DANSVILLE, N. Y.—The Village Trustees are considering the question of improving the street lighting system in the village. The Dansville Gas & Electric Light Company has submitted a proposition offering to furnish an all-night service at $80 per lamp per year for arc lamps of 2000 cp and $18 each per year for incandescent lamps. The Akron Brass Company, of Akron, Ohio, offers to light the streets with gasoline or kerosene arc lamps, furnishing 60 lamps at $50 per lamp per year, with the understanding that at the end of five years the village would own the lamps.

GREECE (P. O. BARNARD), N. Y.—The Rochester Railway & Light Compayn, of Rochester, N. Y., has been granted permission by the Public Service Commission, Second District, to extend its electric light and gas service to this town.

KENMORE, N. Y.—The Village Board of Trustees has voted to revoke the franchise of the Frontier Telephone Company, and instructed the village attorney to institute proceedings against the company to compel it to remove its wires and poles from the village streets.

NEW YORK, N. Y.—Bids will be received by John F. Ahearn, president of the Borough of Manhattan, City Hall, New York, N. Y., until Feb. 3 for the completion of the electric wiring system at the City Hall. [illegible] for the whole work described

Blank forms and information may be obtained at the office of the architect, Charles L. Eidlitz, 1128 Broadway, New York City.

NEW YORK, N. Y.—Bids will be received by John W. Brannan, president of the Board of Trustees of Bellevue and Allied Hospitals, Twenty sixth Street and First Avenue, New York, N. Y., for furnishing and setting electric lighting fixtures in training school for women nurses Blank forms may be obtained at the office of the contract clerk, 419 East Twenty-sixth Street, New York, N. Y., where bids and deposits are to be delivered.

OLEAN, N. Y.—One of the proposed amendments of the city charter will empower the city to compel all telegraph, telephone and electric power companies to place their wires in underground conduits in Olean.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has entered into a contract with the Bausch & Lomb Optical Company to furnish electricity for lamps and motors and also steam heat for its large plant on St. Paul Street, in this city. The optical company will require 1500 hp when the new addition to its plant is completed. Plans are now under consideration by the Rochester Railway & Light Company for the construction of a substation to be erected at Vincent and Gas Streets to furnish service to the optical plant and other interests in that vicinity.

ASHEVILLE, N. C.—The electric lines and equipment of the Biltmore estate of George W. Vanderbilt have been sold to the Asheville Electric Company. C. E. Waddell will remain in charge of the Biltmore interests supplying electricity for lamps and motors to the Biltmore House, the village, Kenilworth Inn, etc. Extensions and improvements are contemplated which will involve an expenditure of more than $100,000 during the present year.

CHARLOTTE, N. C.—What looks like a rate war has been instituted in Charlotte by the Southern Power Company, which a few days ago offered electricity to new patrons free for six months and a 25 per cent reduction to old patrons for the first four months of 1909. The Charlotte Electric Railway, Light & Power Company shortly afterward followed suit, and users of electricity for lamps are reveling in low rates.

CHARLOTTE, N. C.—The Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., has secured the contract to furnish the electrical equipment of the Springstein and Eureka Mills, of Chester, S. C., and the Lancaster Mills, Nos. 1 and 2, controlled by Col. Leroy Springs. The equipment will include a large number of electric motors consisting of about 3000 hp in various sizes. The General Electric Company has secured the contract for the equipment of the substation to be established in Lancaster. Contracts have been placed with the Southern Power Company, of Charlotte, N. C., to furnish electricity to operate the mills.

GREENSBORO, N. C.—The Southern Power Company contemplates extending its transmission lines to High Point, to furnish electricity for numerous woodworking plants located in that town, and will extend the lines to Greensboro.

HURDLE MILLS, N. C.—Dr. J. I. Coleman, of Hurdle Mills, is considering the purchase of a dynamo to furnish electricity for 100 lamps.

SALISBURY, N. C.—The Piedmont Carolina Power Company is building a new transmission line in Salisbury, and will later extend the lines into suburban sections, using electricity supplied by the Southern Power Company.

DICKINSON, N. D.—Plans are being considered by A. H. Deiters and B. Davis, owners of the local electric light plant, for the construction of an addition to their power plant and the installation of two more boilers.

BUCYRUS, OHIO.—The United States Circuit Court has reinstated the injunction, which the Common Pleas Court dismissed recently, restraining the city from issuing $90,000 in bonds for the construction of a municipal electric light plant. The City Council is advertising for bids for furnishing electricity for lamps and motors for both city and commercial purposes. It is said that if a satisfactory bid is received a contract will be made and the propositon to construct a municipal plant abandoned.

CAMBRIDGE, OHIO.—The special committee appointed to investigate the question of constructing a municipal electric light plant, in its report submitted to the City Council estimates that the cost of installing the plant will be about $30,000 and the cost of maintaining the same about $6,000 per year.

CINCINNATI, OHIO.—The Park Commission and Superintendent Rodgers are considering the question of installing a new system for lighting the parks in this city.

CINCINNATI, OHIO.—It is reported that the Cincinnati Gas & Electric Company has secured the control of the Union Gas & Electric Company, of Cincinnati. The Cincinnati Gas & Electric Company is said to have had large holdings in the Union company since its organization, but did not have control.

COLUMBUS, OHIO.—Arrangements are being made to extend the municipal arc lighting system. It is proposed to install arches on Broad Street to Memorial Hall.

COLUMBUS, OHIO.—Plans are being considered to have the municipal electric light plant furnish electricity to light the arches on High Street. At present the business men are paying a private corporation $40 per month for the service. In the annual report to be submitted by H. Gamper, superintendent of the municipal electric light plant, to the

City Council he will recommend that electricity to light the City Hall. Board of Education Building, public library, city prison and arches in the business district be furnished from the municipal plant. If it is decided to do this it will be necessary to erect a new transmission line from the plant, the cost of which is estimated at $3,000. At present the city pays a private corporation to light the City Hall and other buildings.

SANDUSKY, OHIO.—It is reported that the power house of the Lake Shore Electric Railway Company, located in this city, is to be converted into a car building and repair shop.

STOCKPORT, OHIO.—The capital stock of the Morgan County Farmers' Telephone Company has been increased from $5,000 to $30,000.

TIPPECANOE CITY, OHIO.—The capital stock of the Tipp Interurban Telephone Company has been increased from $30,000 to $40,000.

WARREN, OHIO.—The Warren Water & Light Company contemplates changing its system to three-phase, 60 cycles and increasing the output of its plant. C. E. Inman is superintendent.

SULPHUR, OKLA.—It is reported that the Sulphur Light Company has purchased the local lighting plant and will make improvements to same. The company is said to be considering the construction of a hydro-electric plant. C. I. Paterson, of Magnum, Okla., is president; E. E. Preston, vice-president, and J. F. McKeal, of Ada, Okla., secretary and treasurer.

BEND, ORE.—It is reported that A. M. Drake, who recently filed an appropriation of the waters of the Deschutes River, contemplates the construction of a dam and power house on the river just north of the site of the old bunkhouse in Bend.

EUGENE, ORE.—Application has been made to the County Commissioners by J. Rodman, F. E. Dunn, Alton Hampton, George Melvin Miller and others for a franchise to construct an electric railway from Eugene to Florence at the mouth of Siuslaw River.

EUGENE, ORE.—Contracts have been awarded by the City Council for electrical equipment for the municipal electric power plant as follows: To the Portland Machinery Company, for electric machinery, for $11,512; for turbine water wheels, to the Pelton Water Wheel Company, of San Francisco, Cal., for $19,800. The contracts call for machinery capable of generating 1200 hp.

MARSHFIELD, ORE.—John Marsden, of Marshfield, Ore., has filed a notice of appropriation of 9600 cu. in. of water from Loon Lake and Mill Creek, to be utilized for hydro-electric power purposes.

ROSEBURG, ORE.—Plans are being considered by S. A. Kendall, of Pittsburg, Pa., one of the owners of the local electric light plant, for improving the water and light systems in this city. It is proposed to install a new plant about half a mile below the present plant at Winchester, four miles from Roseburg. The power house now in use will be used as a pumping station. The new plant will have an output sufficient to supply 20,000 lamps, about double the output of the present plant. Both the light and water service will be extended to Edenbower.

UNION, ORE.—The citizens are considering the question of establishing a municipal electric light plant in Union.

PANAMA.—Bids will be received at the office of the general purchasing officer of the Isthmian Canal Commission, Washington, D. C., until Feb. 8 for furnishing condenser tubes, switchboard and electrical attachments, wire, wire rope clips, etc. Blanks and general information relating to this circular (No. 490) may be obtained from the above office and the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officer.

HARRISBURG, PA.—Charters have been granted by the State Department to five electric companies for townships in Huntingdon County, to be located in the following named towns: Wayne, Granville, Union, Brady and Henderson. Each company is capitalized at $5,000, and the incorporators are: Harry F. Ambler, J. C. Moorehead and Daniel McAlnin. Electricity for operating the systems is to be supplied from some of the large hydro-electric plants.

LANCASTER, PA.—Negotiations have been completed by the Susquehanna Railway & Light Company whereby the company acquires the property and franchise of the Philadelphia, Coatesville & Lancaster Railroad Company. The price paid is said to be $137,500.

PHILADELPHIA, PA.—The Spreckles Sugar Refining Company has been granted a permit to erect a power house at the corner of Dickinson and Meadow Streets, to cost $5,000.

PITTSBURGH, PA.—The Westinghouse Electric & Manufacturing Company has been awarded a contract by the city of Pittsburgh for [illegible] at a cost of $[illegible]. The lamps will be used on the north side in connection with the municipal electric light plant.

SUNBURY, PA.—Contracts have been placed by the Middle Creek Electric Company for machinery for its new plant, which will be located on the old nail mill site in Sunbury. The electrical machinery and dynamos will be furnished by the Fort Wayne Electric Works, Fort Wayne, Ind. The plant will furnish electricity to operate the Sunbury & Selinsgrove Street Railway [illegible] the commercial business.

PROVIDENCE, R. I.—The [illegible] & Power Company has been [illegible] to operate several manufacturing plants in Scituate, also for the Clayville Mills.

PROVIDENCE, R. I.—Plans have been completed for the construction of a new power plant to be [illegible] on the property of the Atlantic Mills in Olneyville to furnish electricity to operate the mills. A contract has been awarded for a 1500-kw Westinghouse-Parsons steam turbine. The plant will have an output of 8000 hp.

CHESTER, S. C.—Arrangements are being made by the Chester Telephone Company to begin work on the construction of an underground cable system in the business section of the city. It also proposes to extend its overhead cable system.

CHESTER, S. C.—This town will shortly be lighted by electricity transmitted from the plant of the Southern Power Company at Great Falls, 23 miles distant. The company will also furnish electricity to operate a number of cotton mills in Chester.

LAURENS, S. C.—A new power plant on Reedy River, owned by N. B. Dial, eight miles distant, has been put in operation and is now supplying electricity for lamps and motors in Laurens. The plant has an output of 2000 hp.

RAMONA, S. D.—The question of establishing an electric light plant in Ramona is under consideration.

BINGHAMTON, TENN.—An election will be held Feb. 11 to vote on the proposition to issue $25,000 in bonds for the construction of an electric light plant, sewer system and water works. The equipment for electric plant will include a steam electric generating unit, to cost $4,000; material and erection of transmission lines, at a cost of $1,600; arc lamps, $300, and power station, $1,000.

KNOXVILLE, TENN.—Estimates are being made by John W. Flenniken, chairman of board of public works, of the cost of installing a generator in the Commerce Avenue fire station to furnish electricity to light the fire station, police headquarters and market house.

MEMPHIS, TENN.—A permit has been issued to the Merchants' Power Company to erect an addition to its plant, located on Keel avenue, to cost $20,000.

MONTEREY, TENN.—Plans are being considered to establish a municipal lighting plant in Monterey. For further information address the city clerk.

BEAUMONT, TEX.—At the annual meeting of the Beaumont Ice, Light & Refrigerating Company a committee was appointed to investigate its plant and system and report to the directors what improvements and additions are necessary. Kyle Ward is secretary.

BRADY, TEX.—The Brady Water & Light Company contemplates the complete rewiring and reconstruction of its system. J. H. White is president and manager.

BRYAN, TEX.—An election will be held to vote on the proposition to issue $75,000 in bonds, the proceeds to be used for the construction of an electric light plant, sewer system and water works. J. T. Maloney is Mayor.

DALLAS, TEX.—An association has been organized by the citizens of East Dallas to secure improvements to that section of the city, which will include the installation of electric street lamps, extension of water system, etc. W. A. Russell is chairman.

DENTON, TEX.—Application has been made to the Town Commissioners by Thomas F. Garey, 1004 McCulloh Street, Baltimore, Md., for a franchise to operate an electric light system in Denton. It is proposed to develop water power at Spring Mills and transmit electricity to Denton, a distance of about two miles.

GALVESTON, TEX.—The Galveston Electric Company has applied to the City Council for permission to double track its railway to the city limits on Broadway and on Avenue R.

TERRELL, TEX.—Bids will be received until about Feb. 10 for the construction of a municipal electric light plant, which will include the erection of a power house at a cost of $2,000 and installation of steam and electrical machinery to cost $15,000. Specifications furnished on application. W. C. Drake is engineer in charge of the work. The plant is to be operated in connection with the water works system.

VAN VLECK, TEX.—Plans are being considered to erect an electric and refrigerating plant, with sufficient output to supply a town of 5000 inhabitants. L. W. Trumbull is promoter of the project.

EPHRAIM, UTAH.—The City Council is considering the question of discarding flat rates in connection with the municipal electric light plant and installing meters.

[illegible] C. Kelsey, city engineer, for changing the street lighting system on Main Street between South Temple and Fourth South Streets.

VERGENNES, VT.—The city of Vergennes, Vt., has applied to the State Legislature for permission to amend its charter authorizing the city to issue bonds to the amount of $15,000 for the construction of a [illegible]

[illegible] VT. [illegible] into a contract with the Rutland Railway, Light & Power Company to furnish electricity to light the streets of the village. The company is to furnish [illegible]

BOWLING GREEN, VA.—The capital stock of the Carolina County [illegible] $[illegible].

[illegible] Va. Plans [illegible] for the construction of a large hydro-electric power plant on Staunton River at Puckett's Falls, [illegible] transmission to Lynchburg, Va. The cost of the plant is estimated at $650,000.

MEHERRIN, VA.—The Lunenburg Telephone Company has decided to make several extensions to its telephone lines and also improvements to its exchanges.

RICHMOND, VA.—The Carolina County Telephone Company has been granted permission by the State Corporation Commission to increase its capital stock from $10,000 to $15,000.

RICHMOND, VA.—The City Council has directed the committee on electricity to secure the services of an expert electrical and hydraulic engineer to review the plans and estimates of Edward W. Trafford, engineer for the municipal electric light plant, for which an appropriation of $1,000 was made.

SOUTH HILL, VA.—The City Council has granted a franchise to the South Hill Manufacturing Company to operate an electric light system in South Hill. A franchise was also granted to Norbourne G. Smith to install a local telephone exchange. Both plants are expected to be in operation in March.

BELLINGHAM, WASH.—The City Council has granted the Bellingham Bay & British Columbia Railway Company a franchise over streets leading around the water front, with provision that the company must make application within thirty days to the War Department for permission to cross Whatcom and Squalicum Creeks.

CASHMERE, WASH.—The Valley Power Company is planing to increase the output of its plant from 300 hp to 1000 hp. The cost of the work is estimated at $125,000.

CONCULLY, WASH.—Plans are being made by the Concully Copper Mining Company to install an electric plant to furnish electricity to operate its mining machinery. The company will also furnish electricity to the public for lamps and motors.

FAIRFIELD, WASH.—The City Council has granted a franchise to the Nixon-Kimmel Company to construct and maintain transmission lines for the distribution of electricity in Fairfield for lamps, heat, motor and other purposes.

NEWPORT, WASH.—Plans are being made by the Newport Telephone Company to construct a telephone line from Newport to the Metaline country. It is proposed to connect all construction camps along the Idaho & Washington Northern extension with the local office and the Pacific States and the Interstate telephone lines at Spokane.

SEATLE, WASH.—The Capitol Hill Improvement Club is endeavoring to secure electric lighting service in the Capitol Hill district.

SPOKANE, WASH.—Application has been made to the County Commissioners by Denton M. Crow for a franchise to erect a transmission line for a distance of about twenty-three miles for light, heat, power and telephone service. Electricity for the line will be taken from the Evergreen station of the Inland system.

SPOKANE, WASH.—Plans are being made by the Washington Water Power Company for extensive improvements and extensions to its system during the coming year, which will involve an expenditure of about $3,000,000 and will include the purchase of equipment, enlargement of distributing stations, underground work and the erection of new substations on the interurban railways. The company proposes to erect a power plant at Little Falls at a cost of $750,000. Two 1500-kw motor-generator sets will be installed at the steam power plant at Cheney, where a substation and motor-generator station will also be erected; some additions are to be made to the substation at Post Falls. Additions will be made to the Twenty-ninth Avenue substation and two 3000-kw transformers installed and additional tie-lines will be erected between the power stations. The equipment will also include the purchase of 30 new cars.

TACOMA, WASH.—The City Council is considering the proposition to construct a 3000-hp steam plant, to be used as an auxiliary for the overload until the new hydro-electric plant on the upper Nisqually River is completed. The Seattle-Tacoma Company has notified the Commissioner of Public Works that the company will not be able to furnish the city any electricity above the 6000 hp contracted for after April, 1909. The Council is also considering the question of securing the services of a competent engineer to supervise the construction of the power plant on the upper Nisqually River.

WILLIAMSON, W. VA.—Arrangements are being made by the Norfolk & Western Railway Company to construct a power house at Williamson. C. S. Churchill, of Roanoke, Va., is chief engineer.

DODGEVILLE, WIS.—The City Council is considering the question of installing a municipal electric light plant to furnish electricity for street lighting and commercial service.

GLENWOOD, WIS.—The Western Wisconsin Telephone Company has increased its capital stock from $12,000 to $20,000.

KENOSHA, WIS.—A committee has been appointed by the City Council to secure estimates on the cost of constructing a municipal electric light plant.

LA CROSSE, WIS.—Plans for the construction of a municipal electric light plant are being prepared by Jacob Cloos, engineer.

MELLEN, WIS.—The capital stock of the Mellen Water & Light Company has been increased from $15,000 to $50,000.

MILWAUKEE, WIS.—The State Railway Commission has granted the Milwaukee Electric Railway & Light Company a certificate of necessity and convenience, authorizing the proposed extension of its railway from Wauwatosa to Oconomowoc, via Elm Grove and the northern shores of Oconomowoc Lakes. Work will be commenced on the proposed railway next summer. John I. Beggs is president of the company.

MILTON JUNCTION, WIS.—It is reported that the Janesville Electric Company contemplates furnishing electrical service in Milton Junction.

OCONOMOWOC, WIS.—The City Council has decided to enlarge and improve the municipal electric light plant, for which an appropriation of $11,000 has been made.

OSHKOSH, WIS.—Contracts amounting to more than $1,000,000 have been awarded by the Northern Hydo-Electric Company for the construction of its hydro-electric plant at High Falls, on the Peshtigo River. The contract for construction of power house and dam was given to the Bates-Rogers Construction Company, of Chicago, Ill.; for steel towers, to the Aermotor Company, of Chicago, Ill.; to the John A. Roebling Sons' Company, of Trenton, N. J., for copper wire; for turbines and generators, to the Allis-Chalmers Company, of Milwaukee, Wis., and to the Sandusky Portland Cement Company, for cement.

WEST ALLIS, WIS.—The West Allis Light & Power Company has applied to the City Council for a franchise to construct electric light and gas plants in this city.

MEETEESE, WYO.—A franchise has been granted to Fred C. Schaub, of Cody, Wyo., to construct and operate an electric light and power plant in Meeteese. The plant will be operated by water power from the Greybull River. Mr. Schaub is in the market for machinery and electrical equipment.

WINNIPEG, MAN., CAN.—The Provincial Department of Telephone has been abolished by the Manitoba government. In future the management of the government telephone system will be undertaken by the Manitoba Government Telephone Commission.

WINNIPEG, MAN., CAN.—The City Council has ignored the proposition of the Winnipeg Street Railway Company to sell its entire plant to the city for $16,000,000, and, to avoid possible injunction proceedings, has signed contracts for the completion of the city power plant, which will involve an expenditure of $6,000,000. The street railway company as an ultimatum offered to reduce the price of electricity for lamps and motors to local consumers 20 per cent below the present schedule and to sell all the power the city might require for retail purposes at $24.60 per hp-year.

TORONTO, ONT., CAN.—Plans for the distribution system in connection with the municipal lighting plant are well under way, and it is expected that bids will be advertised for underground cables within 30 days. The cost of the first installation is estimated at $50,000. The Hydro-Electric Power Commission is expected to be in a position to furnish electricity to the city by next December. K. L. Aitken, city electrician, has been instructed to take charge of the electric light plant in East Toronto, which will become the property of the city under the terms of the annexation agreement. The plant has an output of about 200 hp and serves about 100 customers.

EMARD, QUE., CAN.—The St. Paul Electric Light & Power Company has purchased the plant and holdings owned by L. J. Marchaud, which gives the company the privilege of supplying electricity for lamps and motors all over the Island of Montreal. The franchise also gives the company an exclusive franchise in the town of Emard for a term of 30 years. The St. Paul Electric Light & Power Company also contemplates extensive extensions to its system. F. Sevinny is superintendent.

MELVILLE, SASK., CAN.—A company is being organized here to construct an electric lighting plant; also to build a telephone system. For further information address Leon Benoit.

SWIFT CURRENT, SASK., CAN.—A franchise to construct an electric light and power plant has been granted to F. W. Laidley, of this city.

MEXICO CITY, MEX.—The Mexican Light & Power Company in a report submitted to its stockholders by Edward Clouston, president of the company, states that owing to the great and unexpected demand for electrical service that it has been decided to double the output of the hydro-electric plant at Necaxa, and to develop other water rights granted to the company by the Federal Government.

Company Elections.

WASHINGTON, D. C.—At the annual meeting of the Washington Railway & Electric Company the following named directors were elected: Milton E. Ailes, Charles J. Bell, Woodbury Blair, George H. Harries, W. P. Hibbs, William Loeb, Jr., Clarence F. Norment, Ward Thoron and George Treisdell. The same board of directors was chosen for the Potomac Electric Light Company.

CLINTON, IA.—At the annual meeting of the Clinton Gas Light & Coke Company the following officers were elected: G. E. Lamb, president; W. J. Young, Jr., vice-president; F. W. Ellis, secretary; C. B. Mills, treasurer, and Thomas Crawford, general manager.

TRAVERSE CITY, MICH.—At the annual meeting of the Manistee River Power Company the following officers were elected: Lavern S. Haskins, president; Lieut. P. Haskins and Stephen Lautner, vice-presidents; William Umler, secretary, and Anton W. Bartak, treasurer.

ST. LOUIS, MO.—At the annual meeting of the Laclede Gas Light Company the following named directors were elected: John I. Beggs, of Milwaukee, Wis.; C. W. Wetmore, of New York, N. Y.; James Campbell, Murray Carleton, August Gehner, Charles H. Huttig, Thomas H. West, David R. Calhoun and James E. Smith, all of St. Louis, Mo.

ANTRIM, N. H.—At the annual meeting of the Goodell Company, owner of the Antrim electric light plant, the following named officers were elected: David H. Goodell, president and treasurer; R. C. Goodell, vice-president; Henry A. Hurlin, clerk.

DERRY, N. H.—At the annual meeting of the Derry Electric Light Company the following named directors were elected: Greenleaf K. Barlett, Frederick J. Shepard, Joseph K. Barlett, Frank A. Hardy, Charles Barlett, Warren P. Horne and Benjamin T. Barlett. The directors elected G. K. Barlett, president; F. J. Shepard, treasurer, and J. B. Barlett, manager.

ROCHESTER, N. Y.—At the annual meeting of the American Telephone Company the following named officers were elected: James S. Brailey, of Urbana, Ohio, president; Charles H. Marvin, of Urbana, Ohio, vice-president, and C. D. Juvenal, of Urbana, Ohio, secretary.

ROCHESTER, N. Y.—At a meeting of the board of directors of the Rochester Railway & Light Company, held recently, Robert M. Searle, general manager, was elected vice-president, and Assistant General Manager. J. T. Hutchings was appointed general manager to succeed Mr. Searle.

SCHENECTADY, N. Y.—At the annual meeting of the Edison General Electric Company the old board of directors was re-elected as follows: Gordon Abbott, Oliver Ames, C. A. Coffin, W. M. Crane, T. Jefferson Coolidge, Jr., Frederick P. Fish, George P. Gardner, Henry L. Higginson, J. Pierpont Morgan, J. P. Ord, Robert Treat Paine, 2d., Marsden J. Perry, E. W. Rice, Jr., Charles Steele and S. L. Schoonmaker.

BRADFORD, PA.—At the annual meeting of the Bradford Electric Light & Power Company, held recently, the following named officers were elected: George H. Potter, president; D. W. Robertson, vice-president, and J. Harvey Rose, secretary and general manager.

HANOVER, PA.—At the annual meeting of the Hanover Light, Heat & Power Company the following named directors were elected: W. H. Lanius, J. W. Steacy, George P. Smyser, George S. Bilmeyer, T. J. O'Neill, W. D. Himes and Ellis S. Lewis.

BEAUMONT, TEX.—At the annual meeting of the Beaumont Ice, Light & Refrigerating Company the following named officers were elected: Joseph E. Carroll, president; M. K. Fletcher, vice-president; Kyle Ward, secretary, and W. S. Davidson, treasurer.

SHERBROOKE, QUE., CAN.—The following officers were elected at the annual meeting of the Sherbrooke Electric Street Railway Company: P. W. Clement, of Rutland, Vt., vice-president; R. Denio, of Windsor, Vt., manager; H. R. Barney, of Rutland, Vt., secretary and treasurer.

New Industrial Companies.

THE ELECTRIC HOME SPECIALTY COMPANY, of Oklahoma City, Okla., has been chartered, with a capital stock of $5,000, by Otto W. Hauck, E. Nix and C. P. Walker.

THE RAILWAY TELEPHONE & ELECTRICAL COMPANY, of Chicago, Ill., has been incorporated by Max W. Zabel to manufacture and sell railway, electrical and telephone supplies.

ESSER & ROTH have been incorporated, with a capital stock of $2,000, by John F. Esser, F. E. Roth and G. Q. Dean, all of New York, N. Y. The company proposes to do electrical work of all kinds.

THE STORRS BROTHERS ELECTRIC COMPANY, of Enid, Okla., has been incorporated, with a capital stock of $5,000, to carry on electrical contracting business, by William J. Krieder, Henry B. and George Storrs.

THE FALZER ELECTRIC COMPANY, of Chicago, Ill., has filed articles of incorporation, with a capital stock of $2,500, and proposes to deal in electrical goods. The incorporators are Clarence J. Silber and M. Filbrandt.

THE STANDARD GAS & ELECTRIC FIXTURE COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $5,000, to manufacture gas and electric fixtures by David Broutman, Louis Vogelhut and Samuel Solomon.

THE FORT WAYNE ENGINE COMPANY, of Fort Wayne, Ind., has been incorporated to establish a plant to manufacture engines and machinery, with a capital stock of $[illegible], by I. M. Gruse, E. F. Potts and J. Y. Shoaff.

THE SIEMAN'S MAGNETO COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $[illegible], by Frank Nebel, Joseph Butler and Sidney S. Meyer, all of New York, N. Y. The company proposes to manufacture electrical machinery.

NEILSON BROTHERS, of New York, N. Y., have been incorporated, with a capital stock of $5,000, to manufacture electrical fixtures and apparatus. The incorporators are Robert Neilson, David Murray and Benjamin Klinger, all of New York, N. Y.

THE U. S. COAL SAVER & SMOKE CONSUMER COMPANY, of Augusta, Maine, has filed articles of incorporation, with a capital stock of $1,000,000, to manufacture and sell smoke-saving devices. J. Berry, of Augusta, Maine, is president and treasurer.

THE B & H SPECIALTY COMPANY, of New York, N. Y., has been chartered, with a capital stock of $[illegible], by Vincent C. Betts, L. Betts Hengerer, James H. Betts, all of New York, N. Y., to manufacture electrical and other advertising signs.

THE ARNOLD WEATHERBEE ELECTRICAL COMPANY, of Oklahoma City, Okla., has been incorporated, with a capital stock of $50,000, by W. H. Weatherbee, G. S. Moore and S. W. Van Hess. The company proposes to manufacture gas and electrical supplies.

THE LIVINGSTON & VAN EPPS COMPANY, of Syracuse, N. Y., has been chartered, with a capital stock of $5,000, to manufacture engines, machinery, motor cars, etc. The incorporators are Thomas E. Laubach, Burton B. Parsons and Emery P. Van Epps, all of Syracuse, N. Y.

THE COMMERCIAL TRUCK COMPANY, of New York, N. Y., has been chartered, with a capital stock of $10,000, by C. Q. Dean, Fred Knowlton and F. R. Marks, all of New York, N. Y. The company proposes to manufacture motors, engines, machinery, cars, vehicles, etc.

THE INTERCONTINENTAL ENGINEERING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $10,000, by John R. Putnam, Charlotte R. Putnam and Reginald Traulschold, all of New York, N. Y., to carry on an engineering and contracting business.

THE I. M. AUSTIN COMPANY, of Portchester, N. Y., has filed articles of incorporation, with a capital stock of $5,000, by Irving M. Austin, David T. Studwell, Katherine E. Austin and Ada L. Studwell, all of Portchester, N. Y. The company proposes to do general electrical work.

THE NATIONAL MACHINE RECORDER COMPANY, of Augusta, Maine, has been chartered, with a capital stock of $2,000,000, to manufacture mechanical and electrical appliances. The officers are: J. Berry, president and treasurer, and L. A. Burleigh, clerk, both of Augusta, Maine.

THE R. H. HOWES CONSTRUCTION COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, by R. H. Howes, H. C. Howes and W. J. Coon, of New York, N. Y. The company proposes to do a general contracting, engineering and construction business.

THE RELIANCE ELECTRIC INSPECTION COMPANY, of New York, N. Y., has been chartered, with a capital stock of $5,000, by George L. Fairchild, M. G. Fairfield, Charles Wertheim and B. M. Wertheim, all of Brooklyn, N. Y. The company proposes to manufacture mechanical devices.

THE WINSUNPAC MANUFACTURING COMPANY, of New York, N. Y., has been chartered, with a capital stock of $25,000, to manufacture automatic, magnetic and electric signs and devices for advertising, etc. The incorporators are G. Q. Dean, F. Knowlton and P. K. Stauff, all of New York, N. Y.

THE WELCH-FORRESTER COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $25,000, to manufacture motors, engines, machinery, vehicles, etc. The incorporators are: A. R. Welch, of Pontiac, Mich.; Allen P. Hallett and Mark M. Solomon, of New York, N. Y.

DUCAS & COMPANY, of New York, N. Y., have been incorporated by Herbert L. Schlesinger, Charles Ducas, Barnet and L. Hollander, all of New York, N. Y. The company is capitalized at $20,000, and proposes to import and export machinery and mechanical apparatus and deal in machinery and hardware.

THE COMBINATION SWITCH LOCK COMPANY, of Buffalo, N. Y., has been incorporated, with a capital stock of $500, by Oliver B. Thompson, George L. Kingston, Harry O. Kingston, of Buffalo, N. Y., and Henry G. White, of Lockport, N. Y. The company proposes to take contracts for electrical work.

THE ST. LOUIS STORAGE BATTERY COMPANY, of St. Louis, Mo., has been incorporated, with a capital stock of $200,000, to manufacture a patented storage battery and other electrical devices. George S. Tourville is president and treasurer; Oscar A. Morgner, secretary, and John Stirlen, general manager.

THE INTERVALE ELECTRIC COMPANY, of Yonkers, N. Y., has been incorporated, with a capital stock of $5,000, by Edward R. Plummer, George A. Waterman, of Yonkers, N. Y., and H. Du Bois Plummer, of New York, N. Y. The company proposes to do a general contracting and electrical engineering business.

THE W. H. STAVENHAGEN COMPANY, of Union, N. J., has filed articles of incorporation, with a capital stock of $10,000, by Wilhelm H. Stavenhagen, of Weehawken, N. J.; Byron L. Strasburger and Albert Pretzfelder, both of New York, N. Y. The company proposes to manufacture lamps, gas and electric light fixtures.

THE MOTOR APPLIANCE COMPANY, of [illegible], Amboy, N. J., has been chartered, with a capital stock of $25,000, to manufacture machinery, mechanical devices and engineering appliances. The incorporators are: Joseph P. Hall, of New York, N. Y.; Albert S. DeVean, of Brooklyn, N. Y., and Clarence C. Sibley, of Perth Amboy, N. J.

[illegible] for the purpose of carrying on a civil, mechanical, gas and electrical [illegible] and W. W. Randolph, of East Orange, N. J.

[illegible] SPECIALTY COMPANY, of Rochester, N. Y., has filed articles of incorporation with the Secretary of State. The com[illegible] and engineering busi[illegible]

[illegible] the incorporators are E. E. Clark, Robert H. Parks and John J. McInerney, of Rochester, N. Y.

THE AMERICAN BLOWER COMPANY of Green Island, N. Y., has been incorporated, with a capital stock of $1,500,000, to manufacture fans, blowers, pumps, ventilating apparatus, engines, motors and machinery. The incorporators are: Norman A. Robertson, of Brooklyn, N. Y.; Charles H. Gifford, of Dedham, Mass.; Clayton W. Old, Thomas F. Wallace, of New York, N. Y., and Eugene V. Myers, of East Orange, N. J.

New Incorporations.

JACKSONVILLE, ALA.—Articles of incorporation have been filed for the Calhoun Light & Power Company with a capital stock of $5,000 by O. H. Herring, H. R. Rice and John P. Burk.

HELENA, ARK.—Articles of incorporation have been filed for the Helena Street & Interurban Railroad Company with a capital stock of $25,000. The officers of the company are: J. W. Burke, Jr., president; J. M. Vineyard, secretary and treasurer.

CHICAGO, ILL.—The Mount Hope Traction Company has been incorporated with a capital stock of $1,000 for the purpose of operating street railways. The incorporators are: Samuel P. Parmly, Jr., T. Hood Little and Victor E. Lind.

STERLING, ILL.—The Rock River Power Company has been incorporated with a capital stock of $78,000 by John H. Lawrence, Elmer Crawford and Harry H. Wood. The company proposes to develop and sell water power and electricity.

JAMESTOWN, IND.—The People's Co-operative Telephone Company has been incorporated to construct and operate a telephone system in Jamestown. George W. Pearson is president.

HARMONY, IND.—The Harmony Telephone Company has been incorporated with a capital stock of $150 to operate a mutual telephone system in Clay and Putnam Counties. The directors are: Martin J. Stroble, Charles Rabb, William H. Nagle, Lewis Englehart, David W. Longshore and John E. Riddle.

SALEM, IND.—The Kansas Telephone Company has been incorporated to build and equip a telephone exchange in Howard Township. The directors are: Frank P. Martindale, O. M. Mitchell and A. O. Marshall, R. F. D. No. 7.

LONE TREE, IA.—The Palestine Mutual Telephone Company has been incorporated with a capital stock of $2,000 and the following officers: Charles Shellady, president; James N. Duff, secretary, and E. Miller, treasurer, all of Lone Tree.

ST. FRANCIS, KAN.—The St. Francis Telephone Company has been incorporated with a capital stock of $20,000.

BOSTON, MASS.—The Onaway Telephone Company has been chartered with a capital stock of $50,000. The officers are: A. B. Grover, of Winchester, Mass., president, and C. E. Lock, of Pawtucket, R. I., treasurer.

CADILLAC, MICH.—Articles of incorporation have been filed for the Western Michigan Power Company by C. E. Russell, of Cadillac, Mich.; S. W. Cramer, of Cadillac, Mich., and F. H. Mills, of Boston, Mass. The company proposes to develop water power on the Manistee River at the High Bridge dam site, where it is claimed that 18,000 hp can be developed.

RENSSELAER, N. Y.—The Rensselaer Home Telephone Company has filed articles of incorporation with the Secretary of State, with a capital stock of $50,000. The incorporators are: J. J. Hartigan, of Troy, N. Y.; M. A. Heeran, of Rensselaer, N. Y., and W. J. Roche, of Troy, N. Y.

FARGO, N. D.—Articles of incorporation have been filed for the Reed & Raymond Telephone Company with a capital stock of $11,500 by Hans Hoglund, N. B. Pinkham, of Fargo, and others.

BUFFALO, OKLA.—The Harper County Mutual Telephone Company has been chartered, with a capital stock of $3,000, by Oscar S. Hammerstein, W. H. Richardson and John Etherton, all of Harper, Okla.

SHEFFIELD, PA.—Articles of incorporation have been filed for the Sheffield Telephone Company, with a capital stock of $15,000.

LEXINGTON, S. C.—The Hollow Creek Telephone Company has been organized to construct rural telephone lines to connect with the main line. Haskell Shull is president. Address R. F. D. No. 3, Gilbert, S. C.

CHATTANOOGA, TENN.—The Chattanooga Lighting Company has been incorporated with a capital stock of $10,000 by A. O. Lane, T. B. Murray and others.

NASHVILLE, TENN.—The Nashville Ice, Coal & Light Company has been chartered with a capital stock of $25,000 and the following named officers: C. W. Dodson, president; O. O. Moore, vice-president, and W. J. Peppard, secretary and treasurer.

TRIMBLE, TENN.—The Trimble Telephone Company has been incorporated by B. V. Thomas, J. M. McKennon, T. A. Pierce and others.

BRUNNER (P. O. HOUSTON), TEX.—Articles of incorporation have been filed for the Brunner Water & Light Company, with a capital stock of $50,000, by George L. Linck, J. W. Pruett, D. F. Rowe, of Houston, and L. N. Yarbrough, of Brunner, Tex.

[illegible] articles of incorporation have been filed for the Marathon Telephone Company, with the following named officers: J. G. Reininger, president; G. C. Miller, vice-president; W. J. Newsome, secretary, and L. L. Hess, treasurer.

PROVO, UTAH.—Articles of incorporation have been filed for the Snake Creek Power Company with a capital stock of $100,000. The company is to take over the water rights in Snake Creek, in Wasatch County, owned by James Murdock and the Wasatch Development Company. The officers of the company are: Jesse Knight, president; Joseph R. Murdock, vice-president; R. E. Allen, secretary, and James C. Jensen, treasurer.

FARMINGTON, UTAH.—Article[illegible] of incorporation have been filed with the Secretary of State for the Davis County Independent Telephone Company, with a capital stock of $40,000. Samuel Gibson is president and N. B. Stahle secretary and manager.

TOOELE, UTAH.—The Tooele Valley Railway Company has been chartered to construct an electric railway from Black Rock into Pine Canyon through Tooele, to a connection with the San Pedro, Los Angeles & Salt Lake Railway west of Tooele, a distance of 25 miles. The general offices will be located in Salt Lake City, Utah. C. F. Kelly, of Butte, Mont., and J. B. Risque, of Salt Lake City, are interested in the enterprise.

FRONT ROYAL, VA.—The Liberty Corner Mutual Telephone Company has been incorporated with a capital stock of $5,000. The officers are: R. J. Stokes, president; John Derflinger, vice-president, and C. E. Brown, secretary and treasurer.

LEXINGTON, VA.—The Rockbridge Power Corporation has been chartered, with a capital stock of $25,000, to operate a light, heat and power plant. The president of the company is W. G. Matthews, Clifton Forge, Va. W. T. Paxton, of Beuna Vista, Va., is secretary and treasurer.

SOUTH RYEGATE, VT.—Articles of incorporation have been filed for the Blue Mountain Telephone Company, with a capital stock of $30,000, by M. F. Sargent, Albert Wright, Alex. T. Beaton, Carl Brown, George B. Robin, G. B. Steele, A. J. Witcher, C. M. Libby and Robert Earquharson. The company proposes to erect telephone lines in Groton, Ryegate, Newbury and Topsham.

WEST TOWNSEND, VT.—The West Townsend Telephone Company has filed articles of incorporation for the purpose of erecting a telephone line between West Townsend and Windham. The incorporators are G. T. Gale, L. F. Lensson and others.

ABERDEEN, WASH.—The Greyport Electric Company has been incorporated, with a capital stock of $6,000, by H. A. Bottomley and others.

BAKER, WASH.—The Skagit River Telegraph & Telephone Company has been chartered, with a capital stock of $10,000, by J. C. Eden and R. J. Kellogg.

GOLDENDALE, WASH.—The Farmers' Union Telephone Company has been formed by residents of Klickitat County. The company proposes to unite all farmers' lines and operate them upon an actual cost basis.

FAIRMONT, W. VA.—The National Telephone Company has been incorporated, with a capital stock of $50,000, by C. E. Manley, J. W. Barnes and E. F. Hardy.

BERLIN, WIS.—The Berlin Telephone Company has been incorporated, with a capital stock of $6,000, by C. S. Morris, L. C. Peck and Charles L. Bryden.

ST. JOSEPH, WIS.—The Houlton Rural Telephone Company has been chartered, with a capital stock of $3,600, by C. M. Steindorff, J. E. Frawley and E. B. Nehder.

STURGEON BAY, WIS.—The Sawyer & Western Telephone Company has been incorporated, with a capital stock of $600, to construct and maintain a telephone line in the town of Nasewaupee. Chris Hanson is president and Melvin Haines vice-president.

WAUTOMA, WIS.—The White River Farmers' Telephone Company has been incorporated, with a capital stock of $1,500, by Julius Groskreutz and others.

GROVER, WYO.—The Grover Telephone Company has been organized, with a capital stock of $10,000. The company proposes to construct a telephone line from Greeley to Cheyenne. The incorporators are E. E. Lewis, A. B. Hilton, G. E. Morris, all of Grover, Wyo.

HANNON, ONT., CAN.—The Barton & Binbrook Telephone Company has been incorporated with a capital of $10,000 by T. E. Tidey, of Barton; H. Johnson and N. Laidman, of Binbrook.

Personal.

MR. JAMES K. WILSON has been appointed superintendent of the Middle Creek Electric Company, Sunbury, Pa.

MR. ALEXANDER C. MIDDLETON, an electrical engineer of Bridgeport, Conn., and for a number of years connected with the steam-turbine department of the General Electric Company, was married last week to Miss Margaret C. Haman, of New York.

MR. J. ROBERT McFARLIN has been transferred from the Engineering Department of the Electric Service Supplies Company, of Keokuk, Iowa, to the Sales Department of the same company at Philadelphia, where he will engage in work as special engineering representative.

MR. E. W. GOLDSCHMIDT, New York manager of the Wagner Electric Manufacturing Company, sailed from Antwerp Jan. 16 on his return to this country after a four months' vacation. Mr. Goldschmidt has been

touring the Continent by automobile, after spending a couple of months rusticating in Southern Italy, which he fortunately left before the recent earthquake.

MR. JOSEPH CACCAVAJO, formerly consulting engineer for the Fulton Street Merchants' Association, of Brooklyn, N. Y., has, it is stated, been retained by a syndicate of capitalists to make a study of city traffic conditions in Japan with a view to laying out plans for the construction and operation of comprehensive systems of electric railways in Japanese cities.

MR. GEORGE A. NELLIS, who was with the Westinghouse lamp interests for 12 years, mostly as senior salesman and lamp expert, has become associated with the Liberty Electric Manufacturing Company, 543 Fourth Avenue, Pittsburgh, in the manufacture and sale of Liberty lamps. This new product is being put on the market in the form of tungsten, tantalum and metallized filament lamps.

MR. GEORGE HEARN is now president and treasurer of the Ricker Manufacturing Company, but for the present remains manager also, giving most of his attention to the electrical end of the business. He was formerly with the Rochester Railway & Light Company, being in its employ for over 15 years, becoming assistant superintendent after experience in every branch. The knowledge thus obtained is useful to him in the new surroundings, and in the production of articles to meet the varied needs of the industry.

MR. F. R. BRYANT is now in charge of the Chicago office of the Crescent Company, of Valparaiso, Ind. He was for five years connected with the sales department of the Central Electric Company, Chicago. At first he handled only the advertising part of the business, but later, while still retaining supervision of that, devoted a great deal of time to sales work. In his new sphere of activity he is outlining vigorous campaigns for business along the lines with which the company is already associated, and also with the idea of broadening the scope of its enterprise.

MR. L. A. FERGUSON, president of the American Institute of Electrical Engineers, was the guest of the University of Illinois, A. I. E. E. Section, on Friday afternoon, Jan. 15, at which he gave an interesting talk on "Training the Electrical Engineer." One of the points brought up by Mr. Ferguson was that among electrical engineers there is a tendency to shun the commercial side of the profession, and he pointed out the mistake in this idea. He also pointed out the great desirability of a broad general education, and emphasized the importance of a knowledge of foreign languages, law and business. The audience consisted of 250 students and members of the faculty.

MR. ALBERT H. STANLEY, general manager of the Underground System of London, is in New York. Mr. Stanley, who was formerly general manager of The Public Service Corporation of New Jersey and also of the United Railways System of Detroit, will inspect New York's rapid transit facilities. Speaking of the London service, Mr. Stanley said: "The London tubes are located much deeper than the Subway. The tubes, of which there are altogether about 100 miles in London, vary from a depth of 80 to 180 ft., while the District and Metropolitan Railways, of which there are altogether 80 miles, are shallow and built similar to the Subway. All passengers are required to use elevators to reach the railway, which makes it necessary to build the stations on private property."

MR. GEORGE WILLIAMS, of H. L. Doherty & Company, gave a stereopticon talk before the Lincoln Ad Club, Lincoln, Neb., on Jan. 14, on "Display Lighting in American Cities." It was accompanied by a talk on "General Advertising," by Senator G. W. Wiltse.

MR. T. N. VAIL, president of the American Telephone & Telegraph Company, has recently returned from his trip to London and Paris and says: "There is a very considerable interest in American Telephone securities abroad, particularly in London, which has shared by syndicate participation in the last two lots of convertible bonds issued by the company. The French interest is on the increase and several millions of our securities are now in hands of French investors. It goes without saying that the Frenchman puts his money only into investments which he has first carefully investigated, so that the French indorsement of American Telephone is a distinct compliment to the intrinsic worth of our securities. The English telephone system is steadily improving and is undoubtedly more efficient and in better physical condition than any of the continental systems. The stock of the International Telephone Company, which controls the telephone system of the country, is now selling above par. The property of the company is shortly to be taken over by the government and will be operated by the post office department. It is, I think, an interesting commentary upon the confidence the English investor has in the integrity and fair-mindedness of his government that the stock of this company should be selling above par, although the basis of the appraisement of the property is not yet known."

MR. G. REJNERS [illegible] company, of Rochester, N. Y., on Feb. 1 and has accepted the position of factory manager and engineer with the Rochester Coil Company. He was the superintendent of the electrical department of the Signal Company for the past eight years, prior to which time he was with the Siemens-Halske Company, of Chicago, for three years as assistant foreman in the winding department. The [illegible] Coil Company is now in a new patented armature coil adaptable to any size or type of [illegible]. Mr. Rejners is [illegible] of armature and field [illegible] interest to be had [illegible]

MR. B. G. ADAMS has [illegible] Gas & Electric Light Company. He had been general superintendent for two years, when he had charge of the rebuilding of the gas and electric light plants and the general supervision of the company's work. Mr. Adams is a graduate of the University of Wisconsin, class of 1899. Shortly after he completed his course he entered the employ of the Madison (Wis.) Gas & Electric Light Company. He received rapid promotion until he became the head of the accounting, distribution and service departments. While in the employ of the Madison company he was consulting engineer of a number of public utility organizations in Wisconsin. Besides being prominently connected with the Northwestern Electrical Association, he has served on a number of committees of the National Electric Light Association, the American Institute of Electrical Engineers and the American Gas Institute. Mr. Adams is the son of the late Congressman H. C. Adams, of Wisconsin. He was married a little more than a year ago to Miss Rachel Nicholson, the eldest daughter of Professor Nicholson, who was at the head of the chemical department of the Nebraska University.

MR. L. H. CONKLIN, of Connellsville, Pa., who was recently elected the first president of the new Pennsylvania Electric Association, graduated from Pratt Institute, Brooklyn, in 1891, having completed the full technical course of that institute. From 1891 to 1894, working in various factories, etc., he acquired experience in the practical side of the business. From 1894 to 1896 he was expert on the arc apparatus for the Excelsior Electric Company, manufacturing the arc machines designed by the late Wm. Hockhousen, to whom he afterward became chief assistant, being closely associated with him in his own private work and having the title of Assistant Superintendent of the factory. From 1896 to 1900 he was superintendent of the electric plant operated by the Flatbush Gas Company, of Brooklyn, N. Y. This plant took in the extensive suburban districts of New York known as Flatbush, Flatlands and Coney Island. During his connection with this plant he remodeled the entire system and put the company on a paying basis for the first time. He then engaged in an engineering and contracting business in New York City under the firm name of Weiderman & Conklin. This business was very successful and is still being carried on, but for family reasons, however, he was obliged to go South in the spring of 1904 and there operated a hosiery mill of which he was principal owner. In the spring of 1905 Mr. Conklin returned North and entered the employ of Mr. A. M. Young, the so-called "trolley king" of Connecticut and a director of the American Gas & Electric Company and several other electrical enterprises. During his employment by Mr. Young he worked as his engineer in the New England territory, rebuilding and modernizing several electric light plants and then building a trolley road. In the spring of 1907 Mr. Conklin went with the West Penn Electric Company, of Pittsburgh, as superintendent of lighting and in August of the same year he was made general superintendent of the West Penn Railways Company; the West Penn Electric Company; Pittsburgh, McKeesport & Greensburg Railway Company; Westmoreland Light, Heat & Power Company and the Latrobe Street Railway Company, constituting what is known as the West Penn system, operating the railways and lighting most of the towns in the four counties of Fayette, Westmoreland, Allegheny and Washington, which position he is now resigning to become general manager of the Scranton Electric Company. Mr. Conklin is a member of the American Institute of Electrical Engineers and, as already noted, the president of the Pennsylvania Electric Association, of which he was the organizer. This association is now composed of over fifty operating companies in Pennsylvania, including the four largest, and it is also the first State association to become a State branch of the National Electric Light Association.



MR. L. H. CONKLIN

Trade Publications.

CONCRETE MIXERS [illegible] booklet issued by the Chain Belt Company, Milwaukee, Wis.

[illegible] phia, Pa.

[illegible] booklet [illegible] West Street [illegible] York.

[illegible] Company, Matteawan, N. Y.

ELECTRIC CLOCKS [illegible]

...ously executed catalog is issued as Bulletin No. ... of the Standard Electric Time Company, Waterbury, Conn.

EXPANSION JOINTS, for use with superheated and high-pressure steam, are well discussed in Catalog No. 11 of the Alberger Condenser Company, 95 Liberty Street, New York City.

LAMP SOCKETS.—The James Clark, Jr., Electric Company, 313 West Main Street, Louisville, Ky., has issued a folder devoted to swivel-less cap fixture sockets and push snap sockets.

STEAM TRAPS of the tilting tank type and return traps are illustrated, described and listed in a neat publication, designated Bul. No. ... of the American Blower Company, Detroit, Mich.

BALL BEARINGS.—The International Engineering Co., 1779 Broadway, New York City, has issued a catalog dealing with ball bearings for automobiles, motor boats, electrical machinery, etc.

GATE VALVE.—Walch & Wyeth, 87 Lake Street, Chicago, have issued a bulletin devoted exclusively to the Erwood swing-gate valve, which serves simultaneously as a gate valve and as check valve.

NERNST LAMPS.—Vol. VI, No. ... of the ... published by the Nernst Lamp Company, Pittsburgh, Pa., contains an excellent outline of the numerous Nernst lamp installations in Cleveland, Ohio.

TUNGSTEN LAMPS for series street circuits are discussed in a convincing manner in a publication dealing with costs, designated as Bulletin No. 3728, issued by the General Electric Company, Harrison, N. J.

ELECTRIC TRUCKS.—Full details of electrically propelled trucks for loads varying from 1000 lbs. to 5 tons are given in an illustrated bulletin issued by the Commercial Truck Company of America, Philadelphia, Pa.

MACHINE TOOLS of the automatic and semi-automatic screw-cutting types are well described and effectively illustrated in a neatly executed catalogue of the National Acme Manufacturing Company, Cleveland, Ohio.

MOTOR-DRIVEN TOOLS, including drills, grinders, saws, notching presses and winding machines, are illustrated, listed and described in a catalog issued by the James Clark, Jr., Electric Company, 313 West Main Street, Louisville, Ky.

REFLECTORS producing an opalescent effect with the minimum of light absorption are listed and described with photometric curves in a bulletin issued by the Pettingell-Andrews Company, Pearl Street and Atlantic Avenue, Boston, Mass.

FANS.—Catalog No. 5020 of the Emerson Electric Manufacturing Company, St. Louis, Mo., gives much information concerning its 1909 line of alternating current fans. The motors for all of these fans are of the single-phase self-starting induction type.

STEAM CONDENSING APPARATUS.—An elaborately colored folder issued by the Dean Brothers' Steam Pump Works, Indianapolis, Ind., relates to a vertical air pump and jet condenser, which is claimed to produce the highest vacuum practically attainable.

CENTRAL-STATION EQUIPMENTS.—Bulletin No. 5910-G of the Western Electric Company, Chicago, Ill., is devoted to brief technical descriptions of apparatus for central stations, including alternating-current and direct-current generators, arc lamps and switchboards.

SECOND-HAND STEAM AND ELECTRICAL MACHINES, including engines, boilers, compressors, generators, motors, converters, arc lamps and switchboards, are covered in the January price list of MacGovern, Archer & Company, 114 Liberty Street, New York City.

ELECTRIC WAGONS in which use is made of the new Edison batteries are outlined and listed in a folder issued by the Lansden Company, Newark, N. J. These vehicles are competitors of horse-drawn wagons and trucks; they are built for loads ranging from 350 lb. to 3 tons.

THERMAL INSULATION.—The H. W. Johns-Manville Company, 100 William Street, New York City, has issued a clearly illustrated catalog describing thermal insulating materials for covering pipes and boilers. The coverings are made from asbestos fiber and carbonate of magnesia.

POLYPHASE INDUCTION MOTORS.—Bulletin No. 82 of the Wagner Electric Manufacturing Company, St. Louis, Mo., gives a well-arranged outline of the constructive features and operating characteristics of polyphase induction motors of the wound-rotor and squirrel-cage types.

SEAL OF APPROVAL.—The General Incandescent Lamp Company, of Cleveland, Ohio, has utilized a shaped cardboard folder, showing an old-fashioned wax seal, to illustrate the idea of the public setting its seal of approval on its G.-I. tungsten lamps, details in regard to which are given.

KNIFE SWITCHES.—Bulletin No. 19 of the H. Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, N. Y., contains price lists and illustrations of knife switches, fuse blocks and wire connectors for currents up to 1000 amp. Panel board units are shown in leaflets of the same company.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, Chicago, Ill., is sending out circulars describing the electric flatirons which the company has recently placed on the market. This iron is claimed to have several interesting features not included in the manufacture of other electric irons.

MOTORS.—The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has issued an interesting booklet devoted to a discussion of display window advertising. The keynote of the publication is education of the public concerning the application of electric motors especially

TELEPHONES.—The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has issued pamphlet No. ... dealing with two-piece desk telephones and both series and bridging dry-battery wall telephones. The pamphlet contains a complete tabulation of prices for magneto instruments.

ELECTRIC TRUCKS.—Bulletin No. 4 of the Pittsburg Motor Vehicle Company, Pittsburg, Pa., gives many convincing statements of the advantageous features of electric trucks in competition with horse-drawn trucks. Illustrations are given of a 3000-lb. truck that does the work of two horse-drawn trucks.

VARIABLE SPEED STEAM ENGINES, designed for driving paper making machinery, are briefly described in bulletin No. 244 of the American Blower Company, Detroit, Mich. These engines are equipped with a variable speed ratio mechanism for connecting the engine shaft to the governor. A speed variation of 5 to 1 is thereby obtained.

DISTRIBUTION OF ELECTRICAL ENERGY.—A neatly illustrated bulletin, entitled "Distribution of Electrical Energy," has been issued by Mr. G. M. Gest, 227 Broadway, New York, for showing the advantages of underground conduit construction. Typical examples of conduit systems in the process of installation are illustrated in a striking manner.

ELECTRIC PYROMETERS.—The Bristol Company, Waterbury, Conn., has issued Bulletin No. 100, giving an outline description of recording electric pyrometers, which are elaborately illustrated. These pyrometers are especially valuable for use with annealing furnaces, case-hardening furnaces, water-gas machines, blast furnaces, galvanizing plants, gas producers and open-hearth furnaces.

MOTOR-GENERATORS of the direct, alternating and combined types, rated at from 0.075 kw to 12.0 kw, are illustrated, listed and described in Bulletin No. 47 of the Eck Dynamo & Motor Company, Belleville, N. J. Direct-current generators rated at from 0.035 kw to 15.0 kw are treated in Bulletin No. 39, while Bulletin No. 40 deals with direct-current motors rated at from 0.033 hp to 20 hp.

BLAKE SIGNAL & MANUFACTURING COMPANY, 246 Summer Street, Boston, Mass., has sent out an envelope-size four-page folder illustrative and descriptive of its Blake tube flux. This is shown in the process of being applied on armature coil ends. The spout of the tube is aluminum, allowing the paste to be applied directly at the joint at the same time as the heat, without soldering up the vent.

THE LAGONDA MANUFACTURING COMPANY is distributing a booklet of 24 pages on "The Scale Question." It gives numerous facts about steam power plant economy and protection. Among the new Lagonda products described therein is the Weinland air-driven wing-head cleaner. This machine is a miniature rotary engine which goes into the tube and rotates the cleaning head in much the same manner as a turbine does, but is more powerful. The pamphlet will be sent to all who write to the Lagonda Manufacturing Company, Springfield, Ohio.

VACUUM DRYING AND IMPREGNATING DEVICES are described and illustrated in a folder issued by the J. P. Devine Company, 428 Brisbane Building, Maryland and Seventh Streets, Buffalo, N. Y. These devices are built under Emil Passburg patents. They are employed in the preparation of chemicals, the manufacture of electrical apparatus, the vulcanizing of rubber and in numerous other industries. It is claimed that more than 2000 installations are now in successful operation. A list of the users of Passburg apparatus is published by the company in booklet form.

VALUE OF THE TUNGSTEN.—Pamphlet No. 3728, just issued by the General Electric Company, gives, by means of tables and curves, a brief exhibit of the value and economy of tungsten series street lamps, showing the saving and possible gain in income. It shows the rate at which the tungsten lamp is able to compete with Welsbach gas street lamps, the economical life of the tungsten lamp, the relative cost of producing a candle-hour of light with the tungsten as compared with the carbon and Gem, and the candle-power and life performance of the tungsten series lamp.

MERCURY ARC RECTIFIERS.—In Pamphlet No. 3715, just issued by the General Electric Company, are described mercury arc rectifiers for telephone battery charging. The advantage which this outfit is claimed to have over the general motor-generator sets, rotary converters and electrolytic rectifiers for charging central telephone batteries, is reliability, freedom from line disturbances, high efficiency, low first cost, low cost of maintenance, simplicity of operation, noiseless operation and economy of floor space. The pamphlet contains a detailed description of the outfit with connection diagrams and dimensions.

TUNGSTEN LAMPS FOR BATTERY SERVICE.—Bulletin No. 4637, issued recently by the General Electric Company, illustrates and describes various styles and sizes of tungsten lamps for battery service. The high efficiency of the tungsten filament renders it especially suited to the production of an ideal battery lamp where high efficiency is necessarily a prime requisite. The bulletin illustrates and describes battery, novelty and surgical lamps, lamps for limousine automobile lighting and various other styles with miniature bases and bases adapted for use in standard sockets. The bulletin contains also prices of the various types.

TRANSFORMER FOR MOVING PICTURE MACHINES.—In a folder just issued by the General Electric Company is described its transformer for use in connection with moving picture machine arc lamps. It is known as the G. E. Economy Arc, and the advantages claimed for it are reduction of light bills, simplicity of operation and

safety. The saving in energy insured by the use of a transformer instead of a rheostat varies, it is said, from 65 to 90 per cent, depending upon the voltage of the circuit. The construction of this transformer is very substantial and embodies all of the distinctive features of the transformers manufactured by this company.

DAYTON GLOBE IRON WORKS.—There has just been issued from the press of the Caxton Company, Cleveland, Ohio, a 7000-edition, 80-page catalog for the Dayton Globe Iron Works Company, of Dayton, Ohio, describing and illustrating the New American turbine. It is printed on high-grade coated paper. The cover is of dark gray stock with a light gray flyleaf and is highly embossed with the company's name and the name of the product. A pleasing effect is obtained by the use of a tint block in a delicate shade which overcomes the high gloss of the paper stock and makes the illustrations more attractive by having the high lights cut away and bringing them out in white. Not only the tables of power of the various types of New American turbines, but other tables of value to those interested in water-power development are contained in this book.

Business Notes.

SCHUCHARDT & SCHUTTE have removed their New York offices and warerooms from 136 Liberty Street to the West Street Building, 90 West Street, where they are now installed.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, of Chicago, asks us to state that it has no connection with a company in New York of the same name, thereby correcting a misunderstanding recently brought to its attention on this point.

THE WAGNER ELECTRIC MANUFACTURING COMPANY has opened a sales office in the Trust Building, Charlotte, N. C., to assist in the care of its rapidly growing Southern business. The Wagner Company's other office in the South is in Atlanta, Ga., and the factory and the main office, as is well known, are in St. Louis.

SOLDERLESS CONNECTORS.—Dossert & Company, of New York, have received an order from the National Electrical Supply Company, of Washington, D. C., for a large number of solderless connectors, cable taps and terminal lugs specified by the Isthmian Canal Commission; also an order from the San Francisco Gas & Electric Company for 300 cable taps and from the Fairbanks-Morse Electrical Manufacturing Company, of Indianapolis, Ind., for 100 Dossert insulating joints.

STANDARD ROLLER BEARING.—Supplementing its established testing department, the Standard Roller Bearing Company, of Philadelphia, has secured Henry Souther, the well-known engineer of Hartford, Conn., to devote a large part of his time to its interests as consulting engineer. Mr. Souther's services have recently been employed to some extent by this company in this direction, and the above arrangement is the outcome of the satisfactory results obtained in the betterment of its product.

THE BLAKE SIGNAL & MANUFACTURING COMPANY, Boston, Mass., is receiving flattering commendations of its wares, of which the following extracts from recent letters are examples: "In regard to the sample of Blake tube flux received from you, will say that I have never used anything for soldering that equals it." From a telephone company: "We find the Blake insulated staples, compressed cleats and tube flux the best for their respective purposes that we have ever used and are buying them regularly from our dealers."

THE STAVE ELECTRICAL COMPANY, 27 West Twenty-seventh Street, New York City, has now established branches in Chicago, Detroit, Davenport, Pittsburgh, Philadelphia and Cleveland. The rapid extension of the business has made this necessary, and it answers the convenience of the districts thus covered. Each of the branches carries a large stock of the well-known "Stave" flaming arc lamps and the "Stavelco" lamp. Mr. J. J. Batterman, general sales manager of the company, has just returned from an extended trip through the Central and Western States and to the various branch offices. He reports a very brisk business in the lamps, especially in Illinois and Pennsylvania.

THE SUNBEAM INCANDESCENT LAMP COMPANY, Chicago, has moved its sales office and warehouse from 32 West Polk Street to the Western Electric Company Building, at 259 South Clinton Street, Chicago. This change was made as larger quarters were needed to properly take care of the increased volume of business being handled by both the Sunbeam Company and the Western Electric Company since the adoption of the Sunbeam tungsten lamp. The Sunbeam product is well and favorably known, having been on the market continuously for 20 years. The company manufactures a complete line consisting of, in addition to regular lamps, Gem, tantalum and tungsten filament lamps of all styles, candlepowers and voltage. The entire output of the Sunbeam Incandescent Lamp Company is distributed through the Western Electric Company.

THE DEARBORN DRUG & CHEMICAL WORKS, Chicago, report that the general business of the company for the last six months of 1908 was larger than for any other six months in its history, indicating the quick return of prosperous business conditions. The percentage of increase the past few months, and especially for January, in the Eastern department of the company is particularly gratifying. Mr. Grant W. Spear, vice-president and Eastern manager, at the general Eastern offices, 299 Broadway, New York, who has been for years vice-president of the Dearborn company at Chicago, assisted by Mr. Herbert E. Stone as general sales manager, Mr. P. H. Hogan, manager of the Boston office, and Mr. Paul T. Payne, manager of the Philadelphia office, with Mr. P. G. Jones as special representative in the Philadelphia district, together with such popular and able representatives out of the New York office as Messrs. McConnaughy, Mitchell, etc., constitute a most effective organization.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 19, 1909

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

909,872. ELECTRIC ELEVATOR; William M. Cummiskey, Honesdale, Pa. App. filed June 5, 1908. Increases the safety of electric elevators, by insuring the proper order of steps in the operation of the controller and by preventing overload. The motor is provided with a retarding element and electro-magnetic means for removing the element. A resistance is included in circuit with said means and a brake for the motor is arranged to cut the resistance out of circuit.

909,877. TELEGRAPHY; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed June 20, 1907. Improvement in quadruplex relays in which the neutral relay is so designed as to be unaffected by reversals of current. A series of rectifiers is disposed between the relay and the circuit so as to cause all of the currents to pass through the relay in the same direction.

909,889. ELECTRIC ELEVATOR; H. F. Gurney, Jersey City, N. J., and William Cummiskey, Honesdale, Pa. App. filed Feb. 26, 1908. (See Patent 909,872.)

909,896. ELECTRIC VAPORIZER FOR INTERNAL-COMBUSTION ENGINES; H. Hertzberg, New York, and A. A. Low, Horseshoe, N. Y. App. filed Feb. 11, 1907. An electrical heater for heating the plate against which the petroleum is sprayed. Two thin plates of metal contain between them an electrical resistance which is made of a fine metallic wire or ribbon coiled in a coil.

909,897. EXTERNAL ELECTRICAL VAPORIZER FOR COMBUSTION-ENGINES; H. Hertzberg, New York. App. filed March 2, 1907. An electrical heater like that of Patent 909,896 is arranged at the end of a vaporizing chamber into which the petroleum is sprayed. The entire metallic mass of the walls of the chamber and of the heater is made hot.

909,898. INTERNAL ELECTRIC STARTING-VAPORIZER FOR COMBUSTION-ENGINES; H. Hertzberg, New York; A. A. Low, Horseshoe, and A. Wassmann, Astoria, N. Y. App. filed April 16, 1907. A hollow vaporizer is located internally of the engine cylinder, and an electrically heated starting vaporizer is arranged within the hollow vaporizer.

909,899. ELECTRICAL VAPORIZER FOR INTERNAL COMBUSTION ENGINES, Harry Hertzberg, New York, and A. A. Low, Horseshoe, N. Y. App. filed Feb. 11, 1907. An electrically heated vaporizer is located internally of the combustion chamber or piston cylinder of the engine, and is provided with means for conducting a cooling medium in the vaporizer.

909,900. ELECTRICALLY HEATED STARTING-VAPORIZER FOR INTERNAL-COMBUSTION ENGINES. Harry Hertzberg, New York, and A. A. Low, Horseshoe, N. Y. App. filed Feb. 11, 1907. The heater consists of a plurality of units, each having a mass of heat-absorbing metal, and an electrically-operated heater within the mass of metal. The liquid combustible strikes the hot metallic surfaces.

909,917. ELECTRICALLY OPERATED STARTING-VAPORIZER FOR COMBUSTION ENGINES; A. A. Low, Horseshoe, N. Y. App. filed June 8, 1907. The vaporizer consists of a metal having its two surfaces at an angle to each other with one of the surfaces corrugated to increase its surface area and an electrical means for heating the element.

909,935. PROTECTED INSULATOR; John H. B. Rea, La Fayette, Ga. App. filed May 7, 1908. A glass insulator with a non-breakable protective covering of metal which surrounds the external surface of the insulator, and which is cemented thereto.

909,943. WIRE-CONNECTOR; J. M. Sahlin, Chicago, Ill. App. filed Feb. 11, 1907. Duplicate members formed of tapering sleeves with semi-circular openings and tongues are adapted to interlock with each other.

909,987. PROCESS OF TREATING SUGAR-CANE AND SIMILAR SUBSTANCES; G. D. Burton, Boston, Mass. App. filed Oct. 17, 1906. Bleaches and softens the fibers of sugar-cane and the like so that they may be used in the arts by immersing the fibers, after removing the juices, in a bath containing animal grease and a quantity of electrolytic chemical salts. The bath is then heated and an electric current passed there through.

909,993. TROLLEY-WIRE SUPPORT; C. G. Etee, St. Louis, Mo. App. filed May 4, 1908. The device has a cast metal shank with lugs at its upper end which grip the supporting wire. The trolley wire is [illegible]

910,040. TRAIN LINE COUPLING; W. L. Bliss, Brooklyn, N. Y. App. filed Nov. 28, 1904. The coupling members of the air-pipe line are used to connect the sections of the electric line.

910,042. MOTOR-CONTROLLING DEVICE; C. E. Carpenter, New York, N. Y. App. filed May 9, 1907. Permits the motor to start with all the armature resistance in circuit which is cut out at speed. A field resistance is used for controlling the speed of the motor.

910,058. ELECTRICAL CONTROLLING MECHANISM; W. O. Haymond and J. O. Potter, Muncie, Ind. App. filed July 20, 1907. Particularly for actuating dampers to supply hot air to a room. Two electro magnets are used to attract a solenoid core in opposite directions. The magnets are controlled by a thermostat.

910,092. CONTROLLER FOR RADIATOR-VALVES; F. A. Simonds, Grand Rapids, Mich. App. filed March 24, 1906. Controls the radiator valve of a steam radiator by an electro-magnetic controlling device operated by a thermostat. Details.

910,118. FIRE-ALARM SIGNALING DEVICE; F. C. Crutchfield, Washington, D. C. App. filed May 3, 1907. A switch controlled by a fusible plug which normally holds a circuit closing spring in inoperative position which, when the plug fuses, closes the circuit and gives an alarm. When the alarm has been sounded the circuit is reopened.

910,161. TROLLEY; W. J. Baker, Washington, D. C. App. filed Jan. 29, 1907. Prevents the trolley wheel from leaving the wire, by means of weighted fingers attached to the wheel support and projecting over the wire.

910,165. TURBO-GENERATOR; E. J. Berg, Schenectady, N. Y. App. filed Sept. 7, 1907. A bucket-wheel turbine divided into two stages, each containing independently rotating wheels. A shaft is driven at high speed by one of the wheels and carries an induction alternator. A second shaft is driven at a lower speed by the other wheel and carries a synchronous alternator.

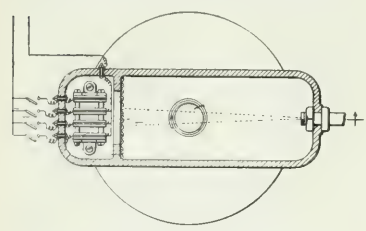
910,176. ANTI-INDUCTION METHOD FOR TELEPHONE SYSTEMS; William Condon and Albert Barrett, Kansas City, Mo. App. filed May 27, 1907. Avoids disturbances due to induction in systems in which the transmitters and a battery are located in a primary line circuit and the receivers in a secondary circuit inductively connected therewith. The disturbing currents are caused to induce in the secondary circuit currents contrary in direction, but equal in strength to the talking currents so as to nullify each other.

910,177. ANTI-INDUCTION TELEPHONE SYSTEM; William Condon and Albert Barrett, Kansas City, Mo. Anti-inductive device along the lines of 910,176, in which an ordinary condenser is connected in series with half of the primary circuit. The direct telephone current and the alternating disturbing current divide at the center of the primary winding, the disturbing current passing through the condenser. Two opposite and balancing fields of induction are formed.

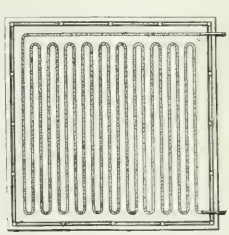
910,184. RAILWAY SIGNAL SYSTEM; C. E. Duffie, Omaha, Neb. App. filed Aug. 19, 1907. The signal circuits are not grounded, thus permitting the use of high-voltage currents, and they are not electrically connected with the track circuit. A plurality of normally closed overlapping independent signal circuits are used together with a normally closed track circuit, with means in the track circuit for opening and closing all of the signal circuits.

910,185. ELECTRIC LAMP SOCKET; V. E. Extrom and C. H. Grundy, Tomahawk, Wis. App. filed Oct. 9, 1907. A lamp socket which, by means of a single key, will light two lamps or either one, and put them out. Details.

910,189. TELEPHONE ATTACHMENT; J. C. Fox, Seattle, Wash. App. filed June 18, 1907. Avoids holding the telephone by hand and makes use of a support consisting of two sections slidable one on the other, one secured to the standard and the other having a clip to receive the telephone receiver.



909,900—Electrically Heated Starting Vaporizer for Internal Combustion Engines.



910,191—Electric Heater.

910,191. ELECTRIC HEATER; G. V. K. Greene, New York, N. Y. App. filed Feb. 19, 1908. The heater consists of two plates of non-conducting material, one of the plates being formed with a continuous channel, the ends of which open to an edge of the plate. The channel is filled with a heating element of current resisting material.

910,197. OVERHEAD TROLLEY; J. H. Howard, Kansas City, Kan. App. filed Sept. 11, 1907. The trolley wheel presses against the trolley wire with the same force irrespective of the distance of the latter above the car. At the base of the pole on the car roof a drum is mounted containing a plurality of spring-actuated plungers coacting with a cam so as to exert a variable pressure upwardly on the trolley pole according to the inclination of the pole.

910,214. COMMUTATOR BRUSH; C. B. Mills, Wilmerding, Pa. App. filed Jan. 3, 1906. A carbon commutator brush with a slotted outer edge and a conducting strip within the slot having a portion projecting therefrom which engages a conductor in its fold.

910,222. LONCOMOTIVE ELECTRIC ALARM SYSTEM; G. Noreau, Quebec, Canada. App. filed Jan. 14, 1908. Part of the signalling apparatus is located in the locomotive, and is provided with a plunger carrying a contact wheel to close the circuits at the proper time. Details.

910,241. ROSETTE; J. S. Stewart, New York, N. Y. App. filed Dec. 23, 1907. Does away with forming a knot in the extension core by providing a partition or barrier in the rosette, together with a cover plate recessed to form two pairs of gripping surfaces in conjunction with the partition so as to engage the conductors.

910,243. MEANS FOR CONNECTING CONDUCTORS TO COMMUTATOR BRUSHES; N. W. Storer, Pittsburgh, Pa. App. filed April 4, 1906. The brush has a cavity and a recess and is provided with a plate which covers the cavity and that has a portion entering the recess. An expanded stud projects from the plate and is located in the cavity. The flexible conductor is connected to the plate.

910,244. TELEPHONE RECEIVER; Harve R. Stuart, Wheeling, W. Va. App. filed Jan. 10, 1907. The telephone receiver comprises separate magnet circuits with an armature for each of said circuits, the movement of the armature produced by the received voice current being multiplied to move the diaphragm, which in turn produces the sound.

910,261. FLOOR-BOX FOR ELECTRIC-CONDUCTOR TERMINALS; M. E. Ames and J. H. Goehst, Chicago, Ill. App. filed June 8, 1908. The box is provided with a rim and a detachable cover, together with an adjusting ring between the cover and the rim. The cover may be accurately fitted to the floor without accurately fitting the body to the floor.

910,269. TEMPERATURE-REGULATING APPARATUS; A. M. Butz, Oak Park, Ill. App. filed July 12, 1904. For steam heaters in which the control is effected by an electric motor, whose current is controlled by a thermostat.

910,314. THREE-WIRE TELEPHONE SYSTEM; William Reid, Chicago, Ill. App. filed Feb. 26, 1906. A common battery system provided with one or more supervisory relays with means associated with the third conductor for disconnecting the signaling apparatus from the line and closing the circuit of the supervisory relay, the latter relay controlling another signal circuit.

910,328. KNIFE SWITCH; G. B. Thomas, Bridgeport, Conn. App. filed May 26, 1908. The blade and the post are of flat metal, one having two leaves to embrace the end of the other. Details.

910,333. ELECTRIC SWITCH; E. B. Wedmore, Rugby, England. App. filed Nov. 20, 1905. Oil-brake switch provided with a detachable oil can for enclosing the switch contacts, together with a lever for shifting the can into and out of position.

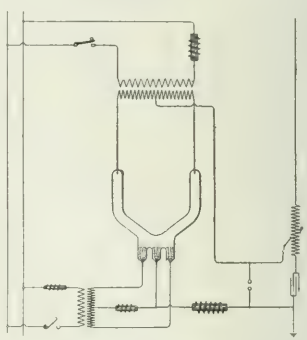
910,343. MOTOR-CONTROLLING RHEOSTAT; W. C. Yates, Schenectady, N. Y. App. filed July 3, 1907. A pair of resistances each provided with an independent controlling arm and means connected to one of said arms and inoperative until the arm stops at a predetermined position for moving the second arm to vary the resistance.

910,362. REMEDIAL HEAD-BAND; C. C. Dieudonne, Washington, D. C. App. filed Oct. 15, 1908. A copper plate which carries two zinc plates and is adapted to contact with the forehead.

910,381. BATH CABINET; John Hermann, Saginaw, Mich. App. filed March 25, 1907. The switches for controlling the bath may be operated from within the cabinet. The bath has a false bottom with openings, and electric lamps are arranged in the space between the false bottom and the base.

910,383. SANITARY SHIELD FOR TELEPHONES; O. H. Hudgen, Los Angeles, Cal. App. filed June 10, 1907. A rubber disk with an annular rib. The disk can be turned so as to use either side as an outer face. It is placed over the mouthpiece of the telephone.

910,387. RAILWAY SIGNAL; W. H. Jordan, Brooklyn, N. Y., and G. T. Hanchett, Hackensack, N. J. App. filed June 14, 1905. Particularly adapted for trolley lines. Attempts to eliminate the residual magnetism of the cores of the solenoid magnets employed in the system by means of a separate demagnetizing coil.



910,430—Wireless Telegraph Transmitter.

910,412. ELECTRIC BELL; G. L. Patterson, New York, N. Y. App. filed Oct. 17, 1907. May be mounted in place before plastering. A hollow receptacle contains the parts with a plate adapted to close the open side of the receptacle. Details.

910,417. SPEED-LIMITING DEVICE FOR ELECTRICALLY-IGNITED EXPLOSIVE ENGINES; F. S. Perrin, New York, N. Y. Orig. app. filed Jan. 9, 1907. The speed is controlled by a governor which closes the contact at the desired speed. A scale and pointer permit setting the parts.

910,430. WIRELESS TELEGRAPH TRANSMITTER; C. P. Steinmetz, Schenectady, N. Y. App. filed April 20, 1907. Converts alternating current into direct current, which latter is used for discharging at the spark gap by means of a rectifier. The rectifier discharges are leveled by a reaction coil.

910,433. TROLLEY WHEEL; L. J. Tetlow, Holyoke, Mass. App. filed June 5, 1908. Relates to the bearings of a trolley wheel which consist of a series of disks enclosed within the shell of the wheel.

910,434. METHOD OF ELECTRIC WELDING; C. E. Thompson, Cleveland, O. App. filed June 11, 1907. For welding a brass head to a steel body by first reducing the cross-sectional area of the brass-head, which has the higher conductivity, then placing the reduced portion in contact with the face of the other part and passing a welding current between them.

910,454. RAILWAY SIGNALING; L. M. Bracewell, Sewal, Ia. App. filed April 29, 1907. Provides a service wire which runs along the track and a series of return wires with electric signaling lamps arranged between the wires. The lamps may be selectively operated by means of a switch at the station.

910,478. RHEOSTAT; W. C. Yates, Schenectady, N. Y. App. filed July 29, 1907. A plurality of automatically-operated rheostats with suitable connections whereby one of said rheostats starts another after a pre-determined movement.

910,479. ELECTRIC HEATER; W. S. Andrews, Schenectady, N. Y. App. filed Jan. 15, 1908. An electrical heater for heating a water receptacle or the like provided with a detachable cup which may be locked to the base of the heater so as to force it into the contact therewith.

910,481. ARC LAMP; R. Fleming, Lynn, Mass. App. filed Dec. 28, 1905. A flaming arc lamp provided with a suitable hood for the non-consuming positive electrode which serves as a conduit for carrying away the gaseous arc products. The positive electrode consists of a rod of metal with a number of supporting wings of metal extending away from the rod, said wings having large heat-radiating surfaces.

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Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to July, 1907, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Thursday of the same week.

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THE TELEPHONE INDUSTRY.

This week we are able to give the U. S. Census Bureau gross figures for the American telephone industry, thus completing the series of three reports on the great branches of electrical development—lighting and traction being the other two. A very impressive showing is made by these public utilities, whose gross income for the year 1907 is reported in these statistics to reach the enormous sum of $790,000,000. Our estimate made in Jan. 2 issue, for 1908, was at least $775,000,000 for that year, but allowing an increase of 5 per cent over the whole field—it was probably thereabouts—the actual amount was not less than $825,000,000, a total very near our assumption, but little suspected, we fancy, by most of our readers. If telegraphy be added, the higher total of $900,000,000 for 1908 is reached, without the inclusion of $250,000,000 for electrical manufacturing, and over $100,000,000 for miscellaneous service and isolated plant output. Truly our electrical industries are broad-based and all pervasive in their service and beneficence!

Looked at from the standpoint of capital and of employment to labor, these three great industries again loom up respectably. The central-station industry gives a livelihood to 47,500 people, telephony to 144,000, and traction to 220,000, making a total of 411,500 persons. The cost of the central-station plants in 1907 was just $1,000,000,000; the capitalization of telephony was $1,100,000,000 and the capitalization of street railways was just upon $4,000,000,000, making a grand aggregate of $6,100,000,000, or for 1908 about $7,000,000,000. These are large figures, but will soon be eclipsed by the very process of growth which in normal years is well over 10 per cent all around.

Coming specifically to the growth of telephony, it will be seen by the table given elsewhere that the percentages show an average annual gain of 20 per cent and upward for the last five years—1902 to 1907—so that the total income shows a gain of 112 per cent; capitalization 134 per cent; employees about 80 per cent; stations 158 per cent; and messages 124 per cent. These are striking advances, due, of course, in large measure, to the competition in the field, but also to the natural expansion of a highly useful art. The [illegible] was 6,118,578 and the average income per station was $30, as compared with [illegible] stations at [illegible] per station was $40. We [illegible] to estimate both stations and income very closely—in fact, the [illegible] The [illegible] tion. It is not at all unlikely that the income per station may rise slowly, for it is universally felt that competitive rates have been too low and strenuous efforts are being made to raise them.

Incidentally, the Bell system is shown to be still decidedly "on top" with about 3,000,000 of the stations, and probably a disproportionate slice of the income, for the Bell telephone

report of last year gave the earnings of the system in 1907 as $120,753,200 out of the total shown in the table of $184,461,747—two-thirds. As a matter of fact, if we are to accept the figures of the Bell report, the telephones connected into the system of all companies at the end of 1907 were 3,839,000, making again two-thirds of the apparent 6,000,000. This discrepancy is due to the fact that so many "independent" telephones are Bell connections. Another interesting point that comes out is that, on the surface, the gross telephone income was more than that of the central stations, viz., $184,461,747 as compared with $175,642,338. But it is to be borne in mind that several hundred trolley companies are also doing a lighting and power business, directly or through subsidiary corporations, and this would bring the gross lighting income well above that of telephony. The two great industries are, however, running pretty closely, neck and neck, and it will be extremely interesting to watch their relative growth.

Transformer Performance.

An article in this issue by Prof. A. C. Scott gives an instructive comparison of the performances of one-kilowatt units of certain commercial lines of transformers. Both the dimensional data and the operating characteristics serve to show that each of the five designers represented has made an independent selection of the proportions considered by him as best suited for his purposes. Thus, the weights of the core of one of the transformers is 2.5 times that of another, while the core losses vary by 25 per cent, and the copper losses by 15 per cent. In spite of these large differences, the full-load efficiencies vary by only 3 per cent, the "all-day" efficiencies by only 9 per cent. The transformer exhibiting the highest core loss has a core weighing less than one-half as much as the core of another transformer, the loss per pound in the former being nearly three times that in the latter, and yet the maximum temperature rises in the two cases differ by less than 16 per cent. The transformer having the lightest core and that having the heaviest core experience almost identical maximum temperature rises. Although the transformers tested are of relatively very recent construction, it is safe to say that, since they were built, several of the lines to which these transformers belong have been greatly improved by the substitution for older core material of the new alloy-steel, to which a considerable portion of the superior performance of one of the transformers is attributable.

All of the units are conservatively rated so far as initial temperature rise is concerned. In fact, the transformers having non-aging cores could well be rated much above 1 kw. Quite independently of the lower specific energy loss in the alloy-steel cores, the substitution of this material for cores that "age" in service should permit the builder to base the transformer rating on a higher maximum temperature rise without altering in the least the temperature to which the insulation will be subjected before destruction. For example, in a transformer rated by the manufacturer on a 50 deg. C. rise, the actual rise will reach 60 deg. C. after the transformer has been in service for some time, if the core "ages" by 40 per cent. Since a 40 per cent increase in the core loss was not uncommon at the time when an initial rise of 50 deg. C. was considered safe for the insulation, equal safety to even the old, unimproved insulation would be insured by permitting an initial 60 deg. C. rise when non-aging cores are employed. Owing to the fact that the customer is the one who in the end pays for any excess of conservatism in rating, it would seem that the permissible temperature rise of oil-insulated transformers having non-aging cores could well be increased over the value selected when the older magnetic material was employed.

Earnings Per Kilowatt of Capacity.

It has been so much the custom for those engaged in the production and sale of electric light and power to talk in terms of kilowatt-hours and the revenue per kilowatt-hour that an equally important item has been lost sight of too frequently. The item to which we refer is the gross yearly income per kilowatt of station capacity, and closely related to this is the item of gross yearly income per kilowatt of maximum demand by a consumer. Other things being equal, the cost of power plant and distributing system varies in proportion to the kilowatt capacity of the station, which factor thus governs the amount of money invested in a central-station enterprise. It is, therefore, of first importance to consider the gross revenue which is being obtained for each kilowatt of station capacity, because this item indicates the degree to which the company is utilizing its apparatus and investment. Of course, the investment represented by bonds and stock may be dependent on the condition of the company's plant, and also is dependent on the wisdom and honesty with which past investments have been made. The investment per kilowatt of capacity should be higher for a plant which is thoroughly up to date and in first-class physical condition than in a plant which is practically worn out. In the case of the worn-out plant, greater investment will soon be necessary, while in that of the plant in good physical condition, the investment is in condition to earn money for a number of years to come. Along with gross earnings per kilowatt the investment per kilowatt of equipment should also be considered.

As a common unit which every company should consider in analyzing its own operations and in comparing them with other companies the yearly revenue per kilowatt of station capacity is a most useful and instructive item. High earnings per unit of capacity almost invariably indicate good net earnings on the investment. The reason for this is that so large a portion of the actual cost of supplying electric light and power consists of certain fixed charges, such as interest on investment, depreciation and fixed losses connected with the plant which go on 12 or 24 hours per day without much regard to whether the plant is carrying full load or very light load. It is, of course, conceivable that a plant might be earning a high gross revenue per kilowatt of capacity, and yet have operating expenses in so large a proportion of the gross revenue as to yield but little net revenue. While such conditions are conceivable, in practice they are rarely found in central-station work. As with every other item entering into central-station operation, this figure of gross yearly income per kilowatt of station capacity varies greatly, the limits varying between $40 and $140.

It would benefit a great many central-station companies to go over a number of their consumers' accounts and figure out the gross yearly revenue which each consumer yields per kilowatt of capacity demanded at the time of the yearly peak load. It would open the eyes of a great many as to which are the most desirable customers. We have in mind the manager of a small company who recently applied this test to a number

of installations, with the result that he discovered that some of his supposedly insignificant lighting customers were paying over $100 per kilowatt of capacity demanded, whereas others with much more pretentious installations were yielding only about $30. The raising of the gross earnings per kilowatt of station capacity is one of the principal problems before the commercial men of the central-station business. If the service is good and the rates anywhere within reason, the connected load and peak load will grow rapidly from year to year. This does not necessarily mean, however, that for each kilowatt of station capacity installed greater revenue is being received. The real struggle comes in improving this condition by making each unit of capacity do more work. This compels the securing of some load which does not come on during the yearly peak period, or at least can be shut down during that period at the option of the company. In the smaller towns city water pumping and operation of refrigerating and ice-making machinery are the most common possibilities along this line. Electric irons and heating appliances also help to fill in the valleys of the load curve. It goes without saying that before power contracts of relative magnitude in a community can be secured, the rates must be such as to encourage power users who operate many hours per day. The only logical way to do this is to make a rate which becomes lower as the number of hours the consumer uses his installation per month increases, or else make a fixed readiness-to-serve charge plus a very low kw-hour charge.

Limitations of the Gas Decision.

Since the United States Supreme Court decision in the Consolidated Gas Company case will probably stimulate legislation for regulation of rates, it is important to emphasize the cautionary statements of the court, which should limit the effect of its conclusions on vital questions to the city and corporation directly involved. These questions relate in part to franchise value and the rate of return on an investment. Concerning the sum allowed for franchises in the computation determining the value of the property, the court states that "what has been said regarding the value of the franchises in this case has been necessarily founded upon its own peculiar facts, and the decision thereon can form no precedent in regard to the valuation of franchises generally, where the facts are not similar to those in the case before us. We simply accept the sum named as the value under the circumstances stated." Preceding its conclusion that the corporation is "entitled to 6 per cent on the fair value of its property devoted to the public use," the Supreme Court says: "There is no particular rate of compensation which must in all cases and in all parts of the country be regarded as sufficient for capital invested in business enterprises. Such compensation must depend greatly upon circumstances and locality." Continuing, the court discusses the influence of the element of risk and states that there are other matters which may properly be taken into account in determining the rate which an investor might expect or to which he would be entitled without legislative interference. It is plain, however, that the court regards the Consolidated Gas Company as the possessor of a monopoly of the gas service in the largest city in America, a fact which [illegible] applicable to no other company.

The Supreme Court decision is now a matter of history, but the demonstration of its inapplicability to every other public utility corporation whose rates become a subject of regulation or controversy will be a task that may try the minds of many representatives of corporate interests for several years. It is right, however, that the gravity of the task should be recognized and that public education upon the serious aspects of the situation should be undertaken. If more publicity had been given to corporate affairs in the past, the distress of the last few years would have been lessened; and now that publicity is a national policy, it would be unfortunate if companies did not prepare to present their points of view on all questions affecting the integrity of the investment and the cost of operation. No franchise definitely limited to a period of years fixed in advance was concerned in the case under consideration, and no conclusion was required, therefore, as to the necessity for provision for amortization if a company is to make proper provision for its shareholders and creditors before its rights of operation cease. If companies will accept limited franchises, they should do so with a full understanding on the part of their security-holders and the public served as to the rights, if any, which are to have recognition at the expiration of the term. In the fundamental respect that the franchise of the Consolidated Gas Company is not limited, this case is different from many that may be brought before the highest court eventually for final decision.

No fault can be found with the statement of principle applying to the rate of return on the investment, made by the court, that "the less risk, the less right to any unusual returns upon the investment." The element of risk necessarily exists in every investment, although to an inappreciable extent in the safest securities in this country, the bonds of the Government of the United States. From that security there are many grades of investment and speculation, with the interest return increasing, generally, as the risk becomes larger. What constitutes risk in investment is, however, difficult to determine in advance, even when good business judgment and knowledge of values direct the disposal of the funds and skilful management and undoubted integrity prevail in the corporation whose securities may be purchased. The urban railway, in its progress from horse to cable power and then to electricity, is an example of the revolutionary changes in types of equipment and the consequent destruction of property which time and service have effected in one class of public utilities. No one can predict with absolute assurance that the future will not develop a necessity for alterations equally radical in the equipment of other public utilities. From changes of this nature, adding, perhaps largely, to capitalization, the public receives better service; and the expenditures required to provide the improvements, whether large or small in extent, are met necessarily either by the issue of capital securities or through operating expenses. In either event, the cost should be considered as an element in the fixing of rates. Inseparable from the consideration of this aspect of the situation is the danger of loss from casualty, such as that experienced in San Francisco and Baltimore, which can never be guaranteed against [illegible] degree. No fixed rule can guide all communities in their relations with public service corporations affecting the rate of return. The interest allowed should be fair to those whose capital is invested, but it should be large enough to attract new capital when needed for extensions. No single arbitrary rate can be applied successfully to all cases.

Practice of Massachusetts Commission on Questions of Capitalization.

Extracts from the report of the New York Public Service Commission, Second District, were published in a recent issue. This report discussed the questions of discounts on bonds, working capital and allowance for promotion services and the differences in the practice of the New York commission and that of the Massachusetts commission. An article from Boston states on this subject:

The Massachusetts laws place considerable discretion with the commission in these questions affecting issues of capital securities. A street railway or lighting company may increase its capital stock or issue bonds to such an amount as the Railroad Commission or the Gas & Electric Light Commission, respectively, shall determine will realize the amount which has been properly expended or will be properly required, and as the commission in either case shall approve for the purposes set forth by the company's petition.

The Gas & Electric Light Commission is understood to view these matters as follows:

Discount on bonds.—The commission requires bonds to be issued at par.

Working capital.—The commission permits an issue of stock or bonds to provide working capital in the original capitalization of a company.

Allowance for promotion services.—The commission has never approved promotion expenses and it is understood that the question of so doing has never come before the board.

A Public Utilities Commission for Vermont.

The agitation in Vermont for a public utilities commission has been given definite shape by the passage of an "Administration" bill, which has now been approved by the Governor. Two or three measures of the kind, more or less favored by the corporations, have been before the Legislature, but this one enlarging the powers of the railroad commission has been carried through because of the administrative support given to it.

The Board of Railroad Commissioners of the State is now to be known as the Public Service Commission, and in addition to the control of all railways it has been given "general supervision of all companies engaged in the manufacture, distribution and sale of gas or electricity for lighting or heating, of all express companies, and of all companies owning or operating telegraph or telephone lines, stations or exchanges * * * and shall have supervision of companies engaged in the manufacture, sale and distribution of power, so far as relates to their use or occupancy of the public highways and so far as relates to furnishing power for public use."

Under Section 9 the commission is given jurisdiction over the purity, quantity or quality of any product, including the measurement, pressure or initial voltage, as well as the provision of standard commercial units. It can also direct "the manner of operating and conducting any business * * * so as to be reasonable and expedient, and to promote the safety, convenience and accommodation of the public." Under the same section the commission has supervision over the price, toll, rate or rental charged. It can forbid any discrimination and can interpose to prevent overcapitalization in the issue of stocks, bonds or mortgages.

All rate schedules are to be filed and to be open to public inspection, and no changes are to be made except on 10 days' notice to the commission. If rates are found unfair, and if service is not adequate, the commission can order changes; but this does not imply that like conditions can be enforced in different parts of the State. All the companies are to keep their books, etc., open for inspection or production, but apparently this does not include any provision for a uniform system of accounts. Fines and penalties are set down for refusal or neglect, up to $5,000 for a final offence and not less than $500.

Any person or corporation aggrieved by municipal authorities as to grant of a license or location can appeal to the commission; and any company desiring right of way can secure it through the commission, after compensation is paid, which judgment is final except on appeal to the Supreme Court. Complaints as to any alleged unlawful corporate act, or otherwise, affecting any plant or line subject to this law can be taken up by the attorney-general or the State's attorney of the county or by 10 or more freeholders. All accidents resulting in loss of life or incapacity must be reported.

Section 23 is important in providing that "nothing in this act or previous statutes shall be construed as giving the Public Service Commission power to prevent or restrict competition or limit the number of persons or companies who may engage in the business of furnishing light, heat, power or any other business subject to supervision under the provisions of this act in any town." This clause is understood to owe its insertion to the independent telephone companies, but is not welcomed by any of the other public utilities, which believe that if supervised they should also be guarded against "strikes" and unbridled competition.

Petition for Rehearing of Consolidated Gas Company Case.

Counsel for the Consolidated Gas Company, of New York, filed a petition with the United States Supreme Court, at Washington, on Jan. 26 for a rehearing of the 80-cent gas case. The petition asks specifically for "a rehearing upon such points as the court may specially designate," or "if such rehearing be denied, a modification of the decree so as to make it conform to the conclusions reached by the court and to protect the rights of your petitioner."

The petition states that the decree is inconsistent with the conclusions of the court, saying: "The fundamental proposition of petitioner, that it could not furnish gas to the consumer (including pressure requirements) under the provisions prescribed by the 80-cent act, at the 80-cent rate, was sustained by this court, which, therefore, declared the pressure and penalty provisions to be unconstitutional; but the court has inadvertently failed to grant the petitioner any relief in these respects. * * * No precedent has been found in the decisions of this court, where a complainant has sustained a substantial portion of his bill, and yet has been denied all relief and the entire costs of the litigation have been imposed upon him."

Taking up another point, the petition says that "controlling facts were overlooked or misapprehended by the court. The court has found that petitioner is entitled to a return of 6 per cent upon the fair value of its property devoted to the public use. * * * This court accepted the net income, as found by the Circuit Court, as $3,024,492.14, representing less than 5½ per cent return on the said total valuation of $55,612,435. Upon that finding, therefore, the conclusion was inevitable that the act complained of was unconstitutional and void. The court, however, refrained from drawing that conclusion, because 'increased consumption at the lower rate might result in increased earnings, and the cost of furnishing the gas would not increase in proportion to the increased amount of gas furnished'; and because 'a slight reduction in the estimated value would give a 6 per cent return upon the total value of the property.'"

This point is discussed in detail in the petition, which says in part: "The court overlooked the fact that profits from an abnormal increase in sales had already been assumed and included by the Circuit Court. As the income of $3,024,000 found by the Circuit Court thus already includes an impossible increase in consumption due to the reduction of the rate to 80 cents, it is obvious that there can be no further increase from that cause. But even that unwarranted increase assumed by the Circuit Court falls far short of bringing the return up to a 6 per cent basis. For the income, at 6 per cent on the value of the tangible property ($47,831,435), plus the value of special franchises ($7,781,000), aggregating $55,612,435, would be $3,336,000; and the difference between that sum and the income found by the

Circuit Court ($3,024,000) is $312,000, to produce which would require the sale of an additional 1,040,000,000 ft., on the basis of 30 cents profit per 1000 ft. as found by that court (80 cents, less 50 cents to cover material, labor and return on manufacturing plant only), with no allowance whatever for distributing expenses. In other words, in order to bring the rate of return up to 6 per cent, there would have to be a total aggregate increase in sales for the year 1906 over those of 1905 of 2,176,000,000 ft., without allowing anything for increased distribution expense or for any return on increased distribution capital. Such an increase would be 20 times the increase in the sales of 1905 over those of 1904, and is quite inconceivable; and it far exceeds any increase in petitioner's experience due to increase in population and reduction in price combined.

"The court erroneously assumed that only a 'slight' reduction in the valuation of the tangible property would be necessary to produce a 6 per cent return.

"The second reason given by this court for declining to hold the rate confiscatory, namely, that a 'slight' reduction in the estimated value of the tangible property ($55,612,435) would yield a 6 per cent return, overlooks the fact that the reduction would not be 'slight.' The accepted income of $3,024,492.14 represents, at 6 per cent, a total valuation of only $50,409,867, or a reduction of the very large sum of $5,202,568.

"The only possible method available to your petitioner of proving the value of its tangible property was by expert evidence. This court has uniformly accepted the findings of the lower court where they were supported by the evidence."

It is asserted in the petition that an actual test of the 80-cent rate would involve inevitable confiscation. The petition says on this point:

"This court has uniformly held that a public service corporation complaining of a rate should not be required to make an actual test of the rate before bringing suit. If such a requirement should be imposed, then, in all cases where there is any conflict in the evidence and where the result is in doubt, it must necessarily follow that no one can successfully contest such a rate without submitting to the confiscation of a portion of his property, while the test is being made. In other words, irreparable injury is inevitable, unless the new rate is enjoined at the outset, security being furnished to the public by a bond or by deposit in court, as was done in the present instance.

"The order of the Circuit Court, requiring such a deposit, took effect on May 1, 1906, the date when the new rate became operative; and as 20 per cent of the receipts were, by the original order, required to be deposited in court, it is evident that the fund would now amount, on the basis of annual sales equal only to those of 1905, to more than $7,000,000. (As a matter of fact, the fund deposited does not exceed $5,000,000, because the Circuit Court did not require the deposit of the fund subsequent to the date of its final decree, being satisfied with the responsibility of your petitioner to return the excess since that date if its decree should be reversed). An actual test, at the 80-cent rate, could probably not be made satisfactorily on less than a year's experience, owing to the varying nature of petitioner's business, due to the changes of season. To compel your petitioner to wait until after a year's test had been made at the 80-cent rate would add at least $2,600,000 more to the sum involved in a final decision; and the trial and disposition of a new suit, commenced in January, 1910, might require two years further time during which the 80-cent rate would be in force, representing a further loss of at least $5,200,000. If, at the end of that period, your petitioner should demonstrate to the satisfaction of this court that the act did not permit a return of 6 per cent upon the reasonable value of its property, it would thus have been deprived of earnings to which it was legally entitled, amounting to the enormous aggregate of nearly $15,000,000, or nearly one-third of the entire value of all its tangible property as assumed by this court."

The petition then takes up recent decisions of the Supreme Court bearing on the subject of rates, and refers to the Knoxville water case as follows:

"The Knoxville water case, which has just been decided, was entirely different in its facts from the present case. The company there was dealing in an article which was not manufactured and for which there was no substitute, and the business was small and free from the complications which exist in the extensive business of your petitioner. No injunctive relief was apparently asked for, as the suit was not commenced until nearly a year after the new rate had been established; and there were no excessive penalties and no impossible pressure provisions, such as those complained of in the present case. Moreover, not only was the suit not commenced promptly, but no diligence was shown in its prosecution, as it was allowed to drag along for years, not reaching this court until 1908, although it was commenced in 1901. While the evidence of the actual business done by that company subsequent to the establishment of the rate was available, such evidence was excluded by the lower court, upon the objection of the complainant, and the proof was confined to the business done by the company for the year prior to the taking effect of the rate complained of. The case was thus entirely devoid of the conclusive evidence which was available, and the complainant deliberately threw away its opportunity to prove the alleged invalidity of the rate; and this court properly held that, having failed to give any competent proof when it had the full opportunity to do so, it was not entitled to any further indulgence."

The petition states that the Consolidated Gas "suit was commenced to enjoin the rate complained of on the very day it took effect; it was prosecuted with unexampled diligence, considering its magnitude, and the very best evidence available was produced.

"It was absolutely essential that the present suit should be commenced before making a practical test of the new rate, in order to obtain relief against the oppressive pressure and penalty provisions of the act, and to preserve the fund which was the subject of the controversy.

"The net earnings of petitioner for the year 1908, on a basis of 80-cent gas, after deducting all items of expense of the character disallowed by the Circuit Court for 1905, are at least $600,000 below the $3,024,000 estimated by the court for 1906 and show a return of only about 4 per cent upon the property valuation of $55,612,435 employed by this court, which does not include expenditures since 1905 of $1,442,897 for additional (chiefly distributing) plant. The result is a deficit in 1908 below earnings required to pay a 6 per cent return upon even $55,612,435, of about $1,000,000, representing at 6 per cent over $16,000,000 of assets which would receive no return under the 80-cent rate."

Single-Phase Equipment for the Spiez-Frutigen Railway.

The Berner Alpenbahn-Gesellschaft has decided on the electrification of the full-gage line from Spiez to Frutigen and has ordered three motor-cars and one locomotive for the service. The system will be the same as used on the Seebach-Wettingen line and is also similar to that to be used for the Wiesental Railway, an order for the electrical equipment of which has recently been placed by the State Railways of Baden.

The Spiez-Frutigen line will be worked by single-phase current at a frequency of 15 cycles per second and a line e.m.f. of 15,000 volts. Energy will be supplied by the Vereinigten [illegible]

The trolley wire will be supported by a catenary in the center [illegible]

The motor-cars will be provided with two bogies. They will [illegible] and provide seating capacity for 64 passengers, third class.

[illegible] on the Spiez-Frutigen line is 1.55 per

cent, but the maximum gradient on the Loetschberg Railway, which forms the continuation of the former line, ranges up to 2.7 per cent. The motor-cars will, therefore, be designed for four single-phase motors having an aggregate output of 880 hp. As long, however, as electric operation is confined to the Spiez-Frutigen section only two motors will be provided. The weight of the fully equipped motor-car will be 55 tons, and the motors are sufficient to haul a train having a total weight of 160 tons up a gradient of 2.7 per cent at a speed of 28 miles per hour, or a train weighing 240 tons up a gradient of 1.5 per cent at the same speed.

The locomotive will have a total motor rating of 2000 hp and will be capable of hauling trains of 310 and 500 tons up the gradients of 2.7 and 1.55 per cent respectively, at a speed of 25 miles per hour.

Each of the two bogies is provided with a 1000-hp, single-phase motor which drives the three axles by means of gearing and coupling rods. These motors will be the largest single-phase commutator motors yet built. The whole weight of the locomotive—approximately 86 tons—will be utilized for adhesion. The motor-cars and locomotive will be equipped with transformers for reducing the line e.m.f. of 15,000 volts to the variable voltage required for the motors when running at different speeds. The maximum speed for the motor-cars and the locomotive has been fixed at 43½ miles per hour. The motor-cars are intended for regular service on the Spiez-Frutigen section, while the locomotives are primarily intended for experimental purposes looking to the adaptation of electric traction on the main line later.

The work in connection with the electrification is being directed by Consulting Engineer Herr Thormann, in Bern. The motor-cars, locomotive and the overhead equipment will be supplied by the Oerlikon and Siemens-Schuckert companies.

Employees as Stockholders in Spokane Trolleys.

The example set by the U. S. Steel Corporation and other companies in giving employees the opportunity to become stockholders is being followed on the Pacific Coast. Jay P. Graves, president of the Spokane & Inland Empire Electric Railroad Company, operating interurban lines in Washington and Idaho and power plants in and near Spokane, has addressed the following letter to the officers and employees of the entire system, setting forth a plan by which they may become stockholders:

"A number of corporations in the United States have during the last few years adopted plans whereby their employees were afforded opportunities for acquiring their stock or securities on safe and easy terms, believing that thereby employer and employee were brought closer together to their mutual benefit.

"Believing thoroughly in the principle, and desiring to bring about and maintain between this company and its employees a community of interest and consequent good feeling, the company has arranged with the Union Trust Company of Spokane to supply to any officer or employee of the company shares of its preferred rights or preferred stock at the going market price, plus an interest which may have accrued on the purchase price between the time of purchase by the trust company and its sale, and a commission of 5 per cent on the amount purchased. No profit is made by the trust company except the commission, it purchasing the stock in the market and selling it to the purchaser at cost.

"Easy terms will be made, the purchaser paying not less than 15 per cent of the purchase price in cash, and the deferred payments being arranged to suit the purchaser, provided that not longer than five years' time will be allowed, the deferred payments bearing interest at 5 per cent per annum.

"In case the purchaser becomes sick or disabled, leaves the service of the company, is discharged or dies before the stock is paid for, the Union Trust Company will, if requested to do so, cancel the contract and repay to the purchaser, or in case of death, to his heirs, all sums paid on account of the purchase price. After the purchase is completed the company will, in any of the events above stated, take the stock off the hands of the purchaser, or his heirs, at the price paid for same, plus 5 per cent per annum interest and less any dividends on the shares that may have been paid.

"The par value of the shares is $100, the selling price by the trust company to be the cost plus commission and interest. Holders are entitled to dividends at the rate of 5 per cent per annum before dividends are payable to holders of the common stock. Above 5 per cent, up to 7 per cent, the two stocks share equally in dividends. The shares are redeemable at any time by the company upon payment of $135 a share and accrued dividends. Owing to the recent financial depression it is believed that the shares can now be purchased for less than par."

Relation of Quasi-Public Corporations to the Public.

Mr. Henry L. Doherty in an address made at the special convention of the Indiana Electric Light Association at Indianapolis, Jan. 26, discussed the subject of the relations of public utility corporations to the public. For the past few years, he said, there has been in this country a movement against all corporations and against public utility corporations in particular. This, he thinks, has in some degree been the fault of the managers of these corporations themselves. These officers have felt that education of the public involved reaching so many people as to be very difficult, if not impossible. Therefore, they had generally waited until harmful measures were brought up before legislative bodies and then had brought forth their arguments. It was easier to present the company side of a case to a few in this way than to reach the mass of the people. If the presentation of the company's side of the case was not successful before legislative bodies and unjust legislation was passed, the officers had always felt that there were the courts to fall back upon and that justice could be obtained there even if nowhere else.

Attempts at public utility legislation had taken on different forms from year to year, and he reviewed these one by one. The first movement was to limit franchises to short terms. This plan proved to be more dangerous to public service companies than central-station men had at first thought. The expiration of a franchise was formerly looked upon by the majority of such companies as merely the time for the renewal and revision of the terms under which the company should continue to do business. However, as has been recently demonstrated in the Cleveland street railway franchise case, the company may in some cases be considered as having no rights on the streets whatever after the expiration of the franchise, and therefore it must figure on establishing a sinking fund which will return to the investors all that they have put into the property by the time the franchise expires. This feature in itself necessarily makes the cost of service to the consumer higher than it should be because of the large amount that must go into the sinking fund. For this reason it has become recognized by thinking men that the short-term franchise is not desirable, and that in some form or other franchises must be perpetual if the best and cheapest service for the public is to be obtained.

The second movement to regulate these companies was to tax their franchises. A third method that had been tried in many communities is that of allowing competing companies to come in. This idea of regulation of public services by competition is now generally looked upon unfavorably by thinking business men. It involves an economic waste in duplication of lines and apparatus, unnecessarily encumbers the streets and does not in practice give the results that have been expected of it where it has been tried. The fourth movement was to regulate the quality of service rendered. In this the thing most to be feared is unintelligent regulation, which makes the company conform to unnecessary and expensive requirements which bring no commensurate advantages to the consumer.

The fifth and most recent movement which he enumerated

was that of rate regulation. In defense of this kind of regulation it is sometimes argued that if a City Council in its ignorance establishes rates that are not fair to the company there can be a resort to the courts and the necessary relief obtained. In this connection it must be remembered, however, that credit is a very delicate thing and that the necessity for litigation alone may be enough to force a company into bankruptcy. Its case in court may be just, but the fact that it has to be in court at all tends to destroy or impair its credit. For this reason many companies are to-day saying that if State regulation by commission is to be intelligent regulation, by all means let us have it in preference to what we have had.

One of the principal points urged in favor of public utility rate regulation by some has been the prevention of stock watering thereby. The agitation about stock watering had been all out of proportion to the amount of real injury that has been worked to individuals by such practice. For example, the agitation about stock watering has been heard much more than that pertaining to our pure food laws, and yet the injury to individuals in the case of adulterated foods had been much greater than in the case of stock watering.

To sum up, we have 20 years of anti-corporation agitation to overcome. After all, public opinion is what we must reach. There is a common theory that the corporation does not have as high a moral standard as the individual. As a rule, he thinks the corporation is more honest than the individual. Its acts are necessarily more public and it has to be fairly honest to do business at all. It is commonly thought that the corporation is something primarily for the benefit of the men of large capital. The fundamental theory of corporations is to make it possible for men of small capital to conduct large enterprises.

Mr. Doherty defended overcapitalization as a perfectly legitimate operation. In the starting of a new enterprise where there is risk he considers it perfectly proper to capitalize the concern for the amount which it would be worth if fully developed to the extent expected by the promoters. He could not understand why an investor in a public utility company should be denied the profits which investors taking similar risks in other kinds of enterprises are allowed without question. For example, he cited the case of two Western men who went into a small Western town in its early days. A put his money into building a street railway. B put his money into real estate. A had to nurse his investment along constantly from year to year. All the risks of a small street railway in a new town were his and it took constant attention to its operation to pull it through. B did not have to watch his investment. He could leave it whenever he pleased. The street railway which A had built was at work constantly increasing the value of B's land. Others were building around B's property and making it more valuable. At the end of 20 years all property in the city had increased enormously in value. It is now contended that A is not entitled to a profit on his investment above current rates of interest, and he is in general looked on as a robber for expecting more. On the other hand, his real-estate friend who has realized great profits out of the efforts of others is looked upon with approbation by all and no one questions his right to his profit.

If public utilities are to be extended to the smaller communities the public must not only deal fairly, but liberally with the companies. The public, on the other hand, is entitled to three things: First, complete service from a geographical standpoint, so that the territory is covered; second, good service; third, low rates.

Two States, New York and Wisconsin, are trying the experiment with regulation by public service commissions, but they have been established such a short time that these workings can be considered as yet experimental. Mr. Doherty commended very highly the work being done by the Wisconsin commission, and said that it is at present composed of high-grade men with competent corps of experts. He expressed the opinion that regulation by commission will be the solution of some of our present problems. To accomplish the desired purposes, however, the commission must have power not held by any other body, and powers therefore clashing with other bodies must be revoked.

As regards the present situation in Indiana, where public utility commission laws are likely to be presented to the Legislature this session, he advised delay until the results of the trials of the plan in Wisconsin and New York could be seen and the experience of these States profited by. The companies with which he is connected have purchased from time to time many electric lighting properties in different States, but are not at present investing in any such properties in States where there are commissions. They want to see how the commission idea works and what chance there is for profit under such a form of government. He expressed the opinion that the passage of a commission law in Indiana at this time might possibly have the effect of preventing the investment of the necessary capital in much-needed extensions and improvements of central-station properties for a time. In view of the large amount of capital from outside the State needed for this purpose during the next two years, he advised letting things remain as they are for the present.

Following Mr. Doherty's address, Mr. C. C. Perry, president of the Indianapolis Light & Heat Company, said he did not oppose the idea of having a suitable commission. He was not sure, however, that we have had enough experience with State commissions to draft a suitable bill which will be the best for all concerned. The Indiana Manufacturers' Association had appointed a committee to draw up a bill for presentation to the Legislature. This committee had heard all interests involved and he had no doubt that when they got through that whatever bill they might recommend it would be a fair one.

Development of Public Utilities Under the Wisconsin Law.

A reference was made in the issue of Jan. 28 to the address of Professor B. H. Meyer, chairman of the Railroad Commission of Wisconsin, before the Northwestern Electrical Association on the subject "Future Development Under the Wisconsin Utilities Law." The commission of which Professor Meyer is chairman has jurisdiction over the public utilities of the State.

Professor Meyer said in his address that the success of the law would have to be measured by the quality of the service rendered by the utilities, the price charged for the service and the development of the business which provides the service. No provision of the law is more important that the section which provides for profit-sharing and sliding-scale arrangements. In expressing his firm conviction that "the sliding-scale arrangement is full of promise for the future," and that in it is found "the solution of one of the most important factors, if not the most important factor, affecting the development of utility enterprise in Wisconsin," Professor Meyer said:

"The profit-sharing provisions go chiefly to the scale of wages to be paid by the utility, while the sliding-scale provisions go primarily to the rate of return upon the investment as the reciprocal of the rate of charge paid by the consumer.

"When the individual promoter or manager or investor feels that with greater and keener application, with increased efficiency and economy, the rate of return upon his investment will be increased, he is much more likely to aim toward efficiency and economy than he would if no such inducements were held out to him. Under a sliding-scale arrangement the hope of greater profit combines the interest of producer and consumer. Leaving out of consideration other factors, it may be said that the consumer desires service at the lowest possible price and the utility desires to furnish this service at the highest possible rate of profit. The nucleus of the sliding-scale idea is to permit a utility to earn a higher rate of profit in proportion as the price charged by it to the consumer is lessened.

"For illustration, we may assume an electric light plant which is at present charging 16 cents per kw-hour. We will assume, further, that this is a fair and reasonable rate under the conditions under which the plant operates to-day. As time goes on this plant, due to efficiency and enterprise in management, extends the list of its consumers, it thoroughly saturates the territory

which it serves, it introduces greater economy, it employs more efficient men, and as a result of all these and other improvements it is put into a position to furnish light at 14 cents per kw-hour. If, while the price was at 16 cents, it was earning only 4 per cent on the investment, it is quite possible that with the improvements indicated and the growth of its business it may now be making 6 per cent when the price to the consumer is only 14 cents. We will still further assume that this same progress in production and management continues until the plant can furnish current at 10 cents per kw-hour, and that then its rate of profit is 8 per cent on the investment. It is apparent that if the management of a plant of this kind operating to-day under the conditions specified can have before it constantly the incentive of an increase in the rate of profit in proportion as the price to the consumers goes down, no efforts will be spared to bring about this reduction in the price to the consumer in order that a higher rate may be secured for the investor.

"As a second illustration we may consider a plant which is now charging, say, 12 cents per kw-hour, and which is earning 6 per cent on its investment. If the management knows that with every cent or fraction of a cent of reduction in the price the rate of permissible profits will go up, it is extremely probable that the best which science and ingenuity, diligence and persistence can accomplish will be done in order to earn this higher rate of profit under a sliding-scale arrangement.

"A third and still different case may be assumed, namely, that of a plant which has been poorly managed, which represents an investment far in excess of what would be reasonably necessary under normal conditions, and which in consequence has been earning only a very low rate of return, say, 2 per cent. If, under a sliding-scale arrangement, the management of this plant is told that if it will organize its labor force more efficiently, if it will employ more skilful engineers, exercise greater economy and use more intelligent effort in extending its business, it will be allowed to earn as high as 8 or 10 or 12 per cent, it is quite probable that a marked change in the management of this business will occur. If the investor once realizes that his failure to earn a higher rate of return is due to wasteful methods, incompetency and similar avoidable causes, he will turn to the management of the plant and demand improvements along these lines in order that this higher rate of return may be achieved. The present abnormally low rate of return is, under the conditions assumed, merely an index of inefficiency, extravagance or wastefulness. From no point of view would it be justifiable, under the assumed state of facts, to demand of the public that it pay a rate for the service sufficiently high to yield the legal rate of interest on the investment. .

"It is probable that sliding-scale arrangements of this kind must be brought about entirely through the voluntary and cooperative efforts of utilities. It is doubtful whether the commission can entirely on its own initiative prescribe and enforce them. The law says: 'Nothing in this act shall be taken to prohibit a public utility from entering into any reasonable arrangement with its customers or consumers or with its employees for the division or distribution of its surplus profits, or providing for a sliding scale of charges, or other financial device that may be practicable and advantageous to the parties interested." * * *

"The sliding scale arrangement will prevent lapse and stagnation and tend to keep in places of greatest responsibility the most competent men, the adoption of the best known and most approved methods, and the installation of the best types of machinery and appliances.

"While the utilities law fully protects the investor in his claim to a reasonable return, this provision of the law, it appears to me, intends to equally insure the wage earner his fair share in the profits. A plant which can meet the highest technical requirements, which can earn a high rate of return, and still charge a low price to the consumer must necessarily employ the best of men, which generally means also that it must pay the best wages. A profit-sharing scheme by which premiums are paid to all the men employed in a given plant is likely to work for efficiency and economy, as the higher rate of return on the investment which the manager sees for himself and his stockholders in the achievement of the same ends. In other words, the sliding-scale and the profit-sharing schemes combine the interests of the investor with those of the consumer and of the wage earner connected with the utility plant.

"The law provides that all such arrangements shall be subjected to the supervision of the commission; and it is needless to add that if sliding scales or profit-sharing schemes should be adopted which are on their face unfair to any one or more of the parties in interest, such schemes would be promptly ordered to be modified. An arrangement under which, for instance, nearly all the increased net earnings resulting from greater economy and efficiency and progress were to go to the investor without a corresponding reduction in the price to the consumer, should not be permitted to stand because of the obvious inequalities and inequity involved. Similarly, if the management of the plant were to enter into an agreement with its employees that an unduly large part of the whole of the increased net earnings were to be paid in the form of a bonus to labor, such arrangement should be set aside with equal promptness, and the consumer given his fair share of the surplus in the form of a reduced rate.

"The time will soon come, if it is not already here, for the commission to call a general conference of representatives of utilities for the purpose of discussing the sliding scale and profit sharing in their relation to the consumer, wage earner, investor and the development of the business. A statement of the history of these things would afford a starting point for the deliberations of the conference, and Wisconsin experience would give the discussion direction and shape."

Professor Meyer then discussed, as closely allied with these arrangements, the introduction of new methods, machinery, appliances and fixtures. He said on this subject:

"Progress depends very largely upon these, and whatever the interpretation of the law may be in any particular respect, this interpretation should always and inevitably spell progress.

"In very recent times there has been a marked development of water power in the State of Wisconsin. This development has scarcely begun. No one can foretell what the future has in store for us along those lines. It seems reasonably certain that many different communities will soon have offered to them electric current generated by water power many miles away. We will assume the communities to which such offers are made have in operation within their borders electric light and power plants operating under an indeterminate franchise. Under the public utilities law neither the municipality nor a private company can construct and operate a competing plant without first securing from the commission a certificate of public convenience and necessity. What is the duty of the existing utility and of the commission to the public under this assumed state of facts?

"To keep out the cheaper current generated by water power would be to compel people within the limits of that municipality to pay much more for current than it would be possible to purchase it from the water-power producer knocking at the city gates. To prevent the newcomer from entering the municipal limits without any restrictions or conditions would, in most cases, probably result in the annihilation of the existing plant. In the one case the whole consuming public would be compelled to pay much more than is necessary, and in the other the investment in the existing plant would be practically destroyed. Neither of these extremes is necessary nor desirable.

"If the management of the existing plant realizes its duty toward the public, and if the newcomer likewise realizes that its new opportunities and privileges are associated with equally certain duties, the two parties will get together upon a fair and equitable basis by which the existing plant will be utilized to the fullest extent possible consistent with the full utilization of the cheaper current brought in from without. Voluntary action upon a fair basis by which investors in the existing enterprise and consumers receive equal and fair consideration appears to be the solution. If it should come to a question of hold-up on the part of one party or the other, it appears to me inevitable that the commission will be compelled to issue a certificate of public

convenience and necessity, which under the assumed state of facts will mean ruinous warfare and all the losses and wounds attendant upon this method of conflict."

Professor Meyer then referred to a suggestion made by the manager of an electric plant in a small community, saying: "In a proceeding before the commission he stated that it was the desire of his company to reach the greatest possible number of consumers at the lowest possible price with the smallest possible investment on the part of the company, and that with this end in view his company was urging consumers to purchase high-efficiency lamps of a small candle-power. He stated it as his desire that consumers in that community use 4-, 8-, 10- and 12-cp lamps, thereby enabling the poorest people to enjoy the benefits of electric light at an expense easily within the capacity of their family budget.

"This suggests one of the most promising lines of development. I believe that the philosophy underlying the action of this manager of a small plant in a community composed chiefly of people of small means is exactly right. He is apparently actuated by the praiseworthy motive of spreading the use of electricity among the widest possible circles at a price which will enable even the poorest to enjoy its advantages and at the same time afford the company a reasonable return upon its investment."

Professor Meyer said he regretted "in the light of all the provisions of the utilities law, and from the viewpoint of good service and of reasonable rates, that not all the utilities have surrendered their franchises and taken in lieu thereof an indeterminate permit.

"If there is one thing above all others which the history of the utility business has established, it is that competition as a guarantor of good service and a regulator of rates has failed. The verification of this simple truth has cost the people of this and other commonwealths untold millions of dollars. The spirit of the utilities law is that wasteful competition and useless duplication of plants shall cease. It is conceivable that public convenience and necessity may in certain cases, due to obstinacy, bad management or other causes, require the construction of a competing plant, but such cases should be very rare, indeed, or, better still, they should never be permitted to occur. It would be nothing less than an economic crime to attempt to reopen the door to competition in the utility business with a mistaken notion that through such action the public will secure better service at lower rates.

"I must confess that personally it was a matter of disappointment to me that relatively so few utility plants availed themselves of the opportunity to surrender their respective charters on or before July 1, 1908. The commission has recommended the extension of time during which charters can be surrendered and I hope that in the event that the Legislature should see fit to amend the law in this respect every utility plant in the State which has not already done so will surrender its franchise."

The question of the relation of the value of the property of utility plants devoted to public use for rate-making purposes, as compared with the value of the same plants for purposes of taxation was discussed by Professor Meyer. "I am free to admit," he said, "that the identity of what for the sake of brevity I shall designate as the 'tax value,' on the one hand, and the 'rate value,' on the other is an ideal condition toward which we should move with the greatest possible speed. I hope the time will come in Wisconsin when the value placed upon a utility plant for rate-making purposes will be exactly the value upon which it is taxed, and vice versa. It is impossible of accomplishment to-day. To make the two values identical to-day would be a gross injustice and inequality in many, if not in most, cases.

"As I understand it, the taxing authorities endeavor to see to it that all property is made to stand upon a footing of equality in the payment of taxes. The constitutional requirements of equality apply to all dollars irrespective of their source and a dollar in a utility plant should bear the same burden of taxation borne by a dollar in a farm or city lot or in any and all other forms of property, ignoring for the present controversial questions which publicists in taxation have raised regarding the doctrine of equality. This means that the tax value is a commercial value. Commercial value depends primarily upon earning capacity. A utility plant is worth what it can earn. What it can earn and does earn is dependent upon the rate which it charges. To use the earning value of a plant as a basis for determining the rate which creates that value is to attempt to measure a thing by itself. Commercial value, and therefore tax value, being a mere reflex of the rate, can be no guide whatsoever in determining the reasonableness of a rate. As long as the tax value is the commercial value under existing conditions, it is obvious that such tax value cannot be the value for rates, or at least that it is not necessarily the value for rates. It follows that any discrepancy under these conditions between tax value and rate value is not necessarily injustice. In fact, justice may require just this discrepancy. If the taxing authorities, because of their inability to ascertain the exact commercial value of all forms of property, should, for instance, assess farms or city property at 80 per cent of their respective values, the property of public utility plants should stand upon the assessment roll at 80 per cent of their value. Because of the publicity and other features attendant upon the conduct of the utility business, it is generally true that the value of utility property can be more readily ascertained and more generally known than the value of numerous other forms of private property. To assess a utility property at 100 cents on the dollar and industrial or farming property, at 70 or 80 cents on the dollar would be unjust and unlawful. A commission charged with the duty of prescribing just and reasonable rates could, therefore, not take the tax value as a basis for determining rates.

"In the case last assumed the tax value was only 80 per cent of the commercial value, and if we assume further that this commercial value is identical with the investment, it follows that the rates must be based upon the 100 per cent and not upon the 80 per cent value. It may also occur that the rate value is very much less than the tax value. This would be true in all those cases of assessment at full commercial value where this value is the result of unusually high rates of return on the investment, due to extraordinarily high rates of charge. In a word, under present conditions, the rate value may be identical with the tax value, it may be lower or it may be higher than this value, and all in accord with principles of exact justice and equality.

"It might be still further assumed that for the present year, for instance, a company pays taxes upon $500,000, while the commission in determining its rates figures upon a return of only $400,000. Nor is there any injustice in a situation of this kind as such. It is assumed, of course, in this illustration, that the commission has fixed $400,000 as the fair value of the property used and useful for the convenience of the public. The rates prescribed insure the company a reasonable rate of return upon this $400,000 in addition to its operating expenses and depreciation. The taxes which this assumed company pays are paid upon $500,000, because during the past year that company charged a rate of return which made its property worth $500,000 as a commercial proposition. The taxes which it pays are paid for a period of time during which it earned this high rate, namely, during the past year before the commission had reduced its rates. One year from now the situation in our hypothetical case will have [illegible] value. If the taxing authorities are assessing all property at [illegible] rate value, it being readjusted to successive reductions in the rate. I am assuming, further, in this illustration that there will be no transgression of the constitutional [illegible] that, furthermore, a sliding scale is in effect."

The Latest American Telephone Statistics.

Below is given a preliminary report from the Bureau of the Census for the telephone industry for the continental United States, exclusive of Alaska, Hawaii, Philippine Islands and Porto Rico.

The statistics relate to the years ending Dec 31, 1907, and 1902.

In these totals are included reports of all commercial and mutual systems and farmer or rural lines, but excluding reports of telephone lines operated by steam and electric railways, nor do they include reports of isolated systems operated exclusively for the benefit of commercial and manufacturing enterprises, federal, state and municipal governments.

	1907.	1902.	Per cent of increase.
Number of systems and lines*	22,971	9,136	151.4
Miles of single wire	12,999,369	4,900,451	165.3
Number of stations or telephones, total.	6,118,578	2,371,044	158.1
Bell (American T. & T. Company)	†3,132,063	1,317,178	137.8
Independent (non-Bell)	2,986,515	1,053,866	183.4
Number of public exchanges	15,527	10,361	49.9
Number of switchboards, total	16,065	10,896	47.4
Common battery system	2,146	837	156.4
Magneto system	13,801	10,005	37.9
Automatic	118	54	118.5
Estimated messages or talks during year, total	11,372,605,063	5,070,554,553	124.3
Local exchange messages	11,119,867,172	4,949,849,709	124.7
Long distance and toll messages	252,737,891	120,704,844	109.4
Total income‡	$184,461,747	$86,825,536	112.5
Total expenses (including taxes, interest and fixed charges)	$140,802,305	$65,164,771	116.1
Total cost of construction and equipment (including real estate and telephones)	$819,667,008	$389,278,232	110.6
Capitalization:			
Capital stock authorized, par value	$1,121,931,023	$384,534,066	191.8
Capital stock outstanding, par value	$512,685,265	$274,049,697	87.1
Dividends on stock	$23,733,670	$14,982,719	58.4
Bonds authorized, par value	$556,537,932	$158,099,094	252.0
Bonds outstanding, par value	$301,930,739	$73,981,361	308.1
Interest on bonds	$12,316,109	$3,511,948	250.7
Total par value stock and bonds outstanding	$814,616,004	$348,031,058	134.1
Employees and wages:			
Salaried employees, number	25,298	14,124	79.1
Salaries	$19,298,423	$9,885,886	95.2
Wage-earners, average number	118,871	64,628	83.9
Wages	$18,986,704	$26,369,735	85.7

*The statistics of farmer or rural lines included in this report are confined to number of lines, miles of wire and number of telephones: 1907, 17,702 lines, 486,294 miles of wire, 565,649 telephones; 1902, 4,985 lines, 49,965 miles of wire, 55,747 telephones. It is probable that a more thorough canvass was made of these lines in 1907 than in 1902, which accounts in part for the large increase.

†Exclusive of 85,287 farmer or rural stations receiving exchange service through switchboards of "Bell" companies. A large proportion of these stations were reported as and included in total stations for independent (non-Bell) systems.

‡Includes assessments of mutual systems.

The final report for 1907 will contain an analysis of the above totals and present detail statistics for other phases of the industry.

In this connection it is of interest to work out the averages derivable from the above data, and below are submitted some of the most important figures of that nature:

	1907.	1902.
Average miles of wire per system and lines	565.9	536.4
Average miles of wire per system (exclusive of rural lines)	2,375.0	1,168.5
Average miles of wire per station, total	2.1	2.1
Bell	2.9	2.6
Independent	1.4	1.4
Number of exchanges per system (exclusive of rural lines)	2.9	2.5
Messages or talks per station per year	1,859	2,139
Messages or talks per station per day (325 days)	5.7	6.6
Long distance and toll messages, per cent of total	2.2	2.4
Income per station	$30.15	$36.62
Expenses per station	$23.01	$27.48
Per cent of expenses to income	76.3	75.0
Average cost of construction and equipment per mile of wire	$63.05	$79.44
Average cost of construction and equipment per station.	$134.00	$164.22
Outstanding stock and bonds per station	$133.14	$146.78
Average rate of dividends on stock outstanding	4.6	5.5
Average rate of interest on bonds outstanding	4.1	4.7
Average yearly salaries of salaried employees	$763.00	$700.00
Average yearly wages of wage-earners	$412.00	$408.00
Average miles of wire per farmer or rural line	27.5	10.0
Average stations per farmer or rural line	32	11
Average miles of wire per farmer or rural stations	.86	.90

Naturally, some of the "averages" are to be accepted with caution, but it is to be noted that the income per station is much less than five years ago, that expenses per station are less, cost of plant is less, and average capitalization is less. This is all obviously due to the creation of so many rural lines. The Bell system is still predominant.

A Gas View of High-Efficiency Electric Lamps.

The program of the annual meeting of the Indiana Gas Association, held last week in Indianapolis, is typical of the programs of gas associations in that all the papers related specifically to problems of management and operation. The following titles of the papers read at the meeting illustrate this characteristic: Commercialism in the Gas Business; High-Pressure Boosting; Handling of Complaints; Distribution Methods; Gas Chemistry; High Candle-Power Illuminants; Handling and Collecting Delinquent Accounts; The Marketing of Coke Locally; Meters and Meter Reading. All the papers were submitted by employees of gas companies with one exception. This latter is a paper by Mr. J. Earl King, of the Welsbach Company, of Chicago, on "High Candle-Power Illuminants—Gas vs. Electricity," of which an abstract is given below.

The object of the paper, Mr. King stated, was to outline the competition of electric companies through the recent introduction of high candle-power lamps for interior illumination. Before turning attention to these lamps he referred briefly to the flaming arc, which, though an out-door illuminant, is sometimes employed in interior illumination. This lamp, he said, probably produces the highest candle-power of any single unit known, but is not suitable for ordinary interior lighting on account of the peculiar quality of the light, its harmful effect upon the eye and obnoxious odors. Its rated candle-power is 1500. The cost of operation is about 5 cents per hour, figuring current at 10 cents per kw-hour. The indoor flaming arc is a form of competition which has given gas men more or less to think about, but has been met successfully by the upright gas arc and various types of upright gas clusters and single gas lamps, the difference in cost and value of illumination having been so largely in favor of gas installations.

The candle-power of the 4½-amp, 500-watt, indoor electric arc is rated at 500, but the actual candle-power is nearer 400. The cost of operating this lamp per hour is 5 cents (current at 10 cents per kw-hour). A four-mantle upright gas has a nominal candle-power of 400 and for a large unit has been the standard of gas illumination for about four years. The cost of operating this type of gas arc is about 2 cents per hour (gas at $1 per thousand).

After referring briefly to the Nernst and tantalum lamps, the tungsten lamp is taken up. This lamp, producing one candle for each 1¼ watt of current consumed and having a life rated at 800 hours, has, Mr. King stated, given the electric companies an opportunity to advance the idea that electricity, as consumed through a tungsten lamp, is as economical as gas for lighting. This theory has been advanced during the past summer months, which have been exceptionally warm, by the electric companies and its representatives, and a great many consumers have been secured who believed they were going to obtain electric light of a superior quality at the price of gas light. The electric companies, he said, generally use many technical terms not fully understood by customers and this has resulted in many instances in a confusion in the mind of the latter with reference to the service and the cost of service he was to receive, owing to which many gas users have been influenced into changing to electric service. As the electric bills for the longer lighting periods are being rendered, some dissatisfaction is being expressed by these former gas users. The actual comparisons are as follows:

For comparative purposes, we selected the four-light, 60-watt tungsten cluster, which is the most popular form of installation. The fixture most generally used is one containing four lamps and equipped with a 20-in. porcelain reflector. This is the fixture that has given the tungsten lamp its reputation in Chicago. The fact that the lamps are of higher candle-power than the old carbon filament generally used, and that the light is of such quality as to confuse and deceive the sense of sight, has made it generally believed that the tungsten is a great light producer. The same lamps equipped with Holophane distribut-

ing reflectors give us a unit of entirely different appearance and one which for comparative purposes, using the naked eye, is more suitable.

To successfully compete with the tungsten cluster a new inverted gas cluster fixture has been placed on the market. This consists of two, three or four inverted gas lamps arranged on a scientifically designed pendant fixture and is operated by a chain pull which gives it all of the convenience of electricity. While in appearance it is equally as attractive as the tungsten cluster equipped with Holophane reflectors it is much more pleasing in appearance than that type when equipped with a 20-in. porcelain reflector. As a light producer, the inverted gas cluster fixture has never been equaled. The gas consumed in a four-light inverted gas cluster is 13 1/3 cu. ft. per hour. Practical tests have proved the above figures correct. The cost of operating the four-light inverted gas cluster for one hour is 1 1/3 cents with gas at $1 a thousand.

While it is true great improvements in electric lighting have been made, it is also true great strides have been made in incandescent gas lighting and to-day the gas man is just as far ahead of the electric man in the lighting proposition as he was when the comparison was made between the gas arc and the electric arc, or between the single upright mantle lights and the carbon-filament lamps. It is obvious that to underestimate the strength of a competitor is a serious error. It is also obvious that to overestimate this strength shows poor judgment.

The competition to gas lighting offered by the tungsten lamp has caused much uneasiness, and many a gas manager has seen that serious inroads might possibly be made upon his illuminating output if he were obliged to compete with the new electric proposition along the old lines. In fact, the electric companies have, in some localities, secured a considerable increase in output at the expense of the output of the gas companies. The electric cry being increased light at less cost, and the gas companies with the old lighting systems having nothing new to offer their customers either in style or fixture or increased efficiency or illumination, it has not been particularly hard to convince a consumer to change over to electricity. A new lighting device always finds a following. If it is of special merit it soon has a large patronage, and almost any gas-lighting system favored and prompted by a gas company will be taken up readily by the public, the public's experience being that the gas company wishes to give the most light for the least cost.

As the electric proposition is new it naturally follows that unless something new is offered in competition, it will secure a considerable following which it would not be able to obtain if the gas lighting offered in its stead is of the up-to-date order and gives increased illumination at a decreased cost. Gas men realizing this, have always adopted new devices of merit even if the new appliance reduced the output of their product temporarily.

Dr. Steinmetz Lectures in Boston.

Dr. Charles Proteus Steinmetz, of Schenectady, N. Y., gave a lecture on "The Future of Electricity" before the Society of Arts of the Massachusetts Institute of Technology, in Boston, on the evening of Jan. 28. A large audience was present. Dr. Steinmetz pointed out that within two centuries the coal supply of the country would be exhausted, and emphasized the probable dependence of future generations upon water powers now being wasted. These will be electrically utilized for heat, light and power, and for fertilizing the soil, which is already showing signs of exhaustion. Dr. Steinmetz pointed out that there are only a few rivers in the world which normally overflow their banks, as does the Nile, and said that, although Nature does her best, she is being subjected to constantly greater burdens. He urged that water power is the only natural source of energy required to operate mills, factories, transportation systems and central stations, and through the agency of electricity alone can the nitrates now being wasted be collected and distributed upon the fields and prairies to give forth the vegetation by fertilization that is needed. Electricity has accomplished great things in bringing the cities and country into closer touch, but it will be needed far more in the future.

Meeting of Ithaca A. I. E. E. Section.

The regular meeting of the Ithaca Section of the American Institute of Electrical Engineers was held on Jan. 25, at which Mr. M. M. Goldberg, a graduate student in the university and an alumnus of the University of Munich, read a paper on "Variable Speed Induction Motors." This paper was based partly upon the convention paper of Mr. H. C. Specht, on "Induction Motors for Multispeed Service, with Particular Reference to Cascade Operation." Mr. Goldberg outlined clearly the principles of induction motor operation, giving a simple mathematical treatment of the induction motor based upon the rotating field. By this means he showed what would be necessary to change the speed of such a motor, explaining why an increase of secondary resistance is not a practical means of reducing speed. He then outlined the various methods used for obtaining several speeds from the same motor, pointing out the objections to each. An animated discussion followed the paper. In the course of this Prof. V. Karapetoff gave a clear exposition of the application of the circular diagram to induction motors operated in cascade. From the circular diagram Prof. Karapetoff was led to differ from some of Mr. Specht's conclusions. He also enlarged upon the use of the synchronous motor, rotary converter and Heyland motor in combination with the induction motor, for the production of variable speed at high power factor. The paper and discussion brought out numerous questions, the answers to which were of interest. The meeting was one of the best from the technical standpoint that has been recently held by the local section. It illustrated an important principle in the conducting of university branch meetings, namely, that a preliminary discussion of the general subject should prepare the way for a more specific study of engineering practice.

Indiana Electric Light Convention.

The Indiana Electric Light Association, which was organized Nov. 24 of last year, held a special meeting at the Claypool Hotel, Indianapolis, on Jan. 26. The attendance was most gratifying, about 75 central-station men being present. It, therefore, appears that Indiana at last has a successful central-station organization. Only one session was held, lasting from 1:50 to 5 p. m. The meeting was presided over by President T. C. McReynolds, of Kokomo. The secretary announced that the association started with 49 charter members. Ten new applicants were then voted in, making the total membership 59.

President McReynolds in his address reviewed the advantages of such an organization and pointed out how necessary it was for electric light men to get together in view of the rapid changes which are continually taking place as regards equipment and business methods. He announced that for this special meeting only two subjects would be considered, tungsten lamps and public utility commissions, both being very live subjects at the present time. As to the tungsten lamp, he thought that it brings an opportunity never before presented to invade the field of cheap illuminants. As to the proposed public utility commis-

ter of fact, it was needed much more, he said, to protect the companies from unjust and ill-advised local legislation by those who do not understand the business.

An address was then given by Mr. Henry L. Doherty, of New York, on the "Relation of Quasi-Public Corporations to the Public." This was discussed at length by Mr. C. C. Perry, president of the Indianapolis Light & Heat Company, and a number of others. An abstract of this address and discussion is given elsewhere.

A paper on "Tungsten Lamps" was read by Mr. R. M. Cass, of the Indianapolis Light & Heat Company, which drew out considerable discussion on the methods of introducing tungsten lamps in different towns. Discussion on this will be given in a later issue. The meeting adjourned to hold its regular convention in August.

Thomson-Houston Reunion.

A reunion of the men formerly associated with the Thomson-Houston Electric Company was held at Chicago Thursday, Jan. 28. While the attendance was not as large as was anticipated, the enthusiasm shown by those who were present more than made up for the depleted representation of the "old gang." A reunion of Thomson-Houston employees was first suggested last May at the annual meeting of the National Electric Light Association, when many of the old Thomson-Houston men were in evidence. The suggestion met with hearty approval, and Mr. George Cutter, of South Bend, Ind., took charge of the direction of affairs for the reunion, and his efforts were rewarded by the attendance at the reunion of 30 of the men formerly employed by the Lynn (Mass.) Company. Many of those in attendance are now very well known in the electrical field. During the day the men met at the Coliseum, where the fourth annual Electrical Show was being held. In the evening a banquet was given at the Great Northern Hotel, after which an experience meeting was held.

Judge Cummins, of Chicago, was called upon to act as toastmaster. He is familiar with the biography of many of those present and made many interesting allusions to the past in his introductory address. Mr. Bernard E. Sunny, president of the Chicago Telephone Company, told some interesting occurrences of the days when he was associated with the Thomson-Houston Company. He said he thought the success of the old company was not alone due to the excellence of its electrical apparatus, but also to a great extent to the energy of the representatives of the company. In closing his talk, Mr. Sunny paid a tribute to Mr. C. A. Coffin, and referred briefly to the development in the manufacture of electrical apparatus.

Mr. Bion J. Arnold told of his experience in the early days when he went to Chicago determined to get into the employ of the Thomson-Houston Company. He applied for a position to Mr. Sunny, and after making many efforts was finally given employment. He had his first lesson in selling dynamos at the Chicago stockyards, and was later sent to Lake Geneva to make a sale of electric apparatus, and finally went to St. Louis, where his company was having some trouble in supplying current on a 2-0 trolley wire for the operation of 40 street cars. Mr. C. A. S. Howlett made a few allusions to the early days, and called attention to the evolution of the electrical industry as is shown by the fact that the Chicago Electric Club now has a membership of more than 450 members, mostly engaged in the commercial side of that industry. Mr. Ernest Gonzenbach said he was one of the early members of the $5.90 per week brigade at Lynn. He recalled the date of manufacture of the first 200-kw generator, which was then considered a high engineering achievement. He urged that the Thomson-Houston reunion be made a national affair and that steps be taken to make it a permanent organization. Mr. George Cutter said he went with the Thomson-Houston people in 1883, and since then has followed the interesting development of the electrical business. He urged that another reunion be held at the annual meeting of the National Electric Light Association this summer, and said he would select a committee to make arrangements for the holding of the second reunion. Several other old Thomson-Houston men gave pleasing reminiscences of the early days of the company. Letters of regret at being unable to attend were read from Professor Thomson, Messrs. E. W. Rice, James W. Johnson and William Upman.

Meeting of Boston A. I. E. E. Section.

The regular meeting of the Boston Section of the American Institute of Electrical Engineers was held at the Edison Building, Boston, on Jan. 20, Chairman Kennelly presiding. The subject discussed was "Some Electrical Operating Features of the Boston Elevated Railway Company's System," the speaker being Mr. John W. Corning, electrical engineer of the company. Before the address the chairman introduced Mr. Ralph W. Pope, of New York, secretary of the institute, who spoke of the growth of the organization and gave an account of the Engineering Societies Building in New York.

Mr. Corning described the growth of the Boston system since the consolidation of companies and electrical equipment of the lines, which took place about 20 years ago. These lines were supplied from a power plant at Allston having a capacity of about 900 kw and equipped with Edison bipolar generators belted to high-speed engines. As routes were extended and horse-car lines electrified, additional stations were built until at the present time the company has 10 power plants of its own, with a total capacity of about 52,563 kw, and is buying power at three other points. The sizes of the present stations are as follows: Central, 12,900 kw; central auxiliary, belted, 800 kw; Lincoln, 13,500 kw; Charlestown, 7000 kw; Dorchester, 3600 kw; Harvard, 6300 kw; East Cambridge, 2800 kw; Medford, 975 kw; Allston, 888 kw; Somerville, 700 kw; East Boston, 600 kw; purchased power, 2500 kw.

The stations are operated in multiple through the feeder system and sections, of which latter there are 75, of which 68 are surface feeder sections and the balance for the elevated division. Of 75 feeder sections 38 are fed by two or more stations, and it is through these tie sections that the company is able to work in multiple and secure an equalization of load at times of low steam pressure, etc., resulting in loss of capacity. The load of the system has a characteristic curve through the 24 hours, with a morning peak between 8 and 9 o'clock and an afternoon peak between 5 and 6 due to a wave of traffic radiating in all directions from Boston to the suburbs. The peak on the different stations, therefore, does not occur at the same time. There is nearly an hour of difference between the peak on the Lincoln power station and the peak on the Hyde Park station of the Old Colony Street Railway Company, which furnishes about 200 kw to the Boston Elevated. In this way the stations that are tied together through the sections of the feeder system can help each other out, because at the time the peak load occurs at the outlying stations it is receding from the stations nearer the center of the city.

Of the different sections of feeders on the surface lines the lightest section in point of average load during the peak hour is one of about 60 amp. That section is on a street seldom traversed by surface cars, but on which there is a considerable traffic by the company's own service cars. The maximum section has an average demand during the peak hour of 2400 amp. On the elevated section the maximum is about 4000 amp. In order to carry this total load the company has 441 miles of trolley wire, about 500 miles of overhead feeder, about 200 miles of underground feeder and about 17 miles of third rail on the elevated division. The cars vary in length from 20 ft. to 46 ft., the typical cars and weights being as follows, without passengers:

Length, feet	20	25	26	32.5	34.3	44.6
Weight, tons	9	12	15	24	28	33

The average demands on the power stations are 18 kw for the 20-ft. car, 22 kw for the 25-ft. car, 26 kw for the 26.5-ft. car; for the lighter type of semi-convertible, 42 kw; for the heavier type, 56 kw, and for the elevated car about 65 kw. The equipment on the ordinary 25-ft. cars of the closed type con-

sists of two motors with series-parallel control; on the semi-convertibles, the Sprague G. E. multiple-unit and Westinghouse multiple-unit, although these cars are not run in trains. On the elevated cars the Sprague G. E. multiple-unit control is used. An elevated train of six cars will take about 2500 amp in full multiple. The company uses many interpole motors. These, besides the usual main poles, have four interpoles, the windings of which are arranged in series with the armature and are reversed with the armature to neutralize the demagnetizing effect of the armature current and improve the commutation.

About two years ago the company came to realize that its cars were not making as smooth accelerations as desirable, and an investigation was made into the arrangement of the resistances in connection with the controllers. It was found by taking automatic curves of the acceleration that the current throughout the series portion of the acceleration would be rather low and in the multiple portion extremely high, tending to creep up considerably beyond the maximum commutating ability of the motor. The result was that, as this heavy peak was encountered during every acceleration, the commutator became roughened until the motor began to flash and buck, with resulting service interruptions and high cost of maintenance. The different equipments were studied with an automatic ammeter and the resistance steps readjusted, so that in most instances a much smoother curve of acceleration was obtained. The net results were beneficial in all directions. In one case a certain type of car was being brought in every two or three days for commutator turning and brush cleaning, but after the resistance steps were changed the cars would often run months without coming in for such a purpose.

Mr. Corning then described the circuits and operation of the electric track switch. In the earlier types of track switch the company was troubled with frequent burnouts when cars became stalled on the overhead pan of the switch apparatus. In that case there was a steady current flowing which burned out some of the insulation through a resulting short circuit. The manufacturing company overcame the difficulty by inserting in the circuit an additional coil working with a plunger in a sort of dash pot, so that if a car became stalled the current in this coil gradually brought about a movement of the plunger and operation of contacts that broke the circuit of the apparatus.

The feeder system of the Washington Street tunnel was then taken up by the speaker. The third rail in the tunnel on the north-bound side constitutes one feeder section and that on the south-bound track another. In case of trouble with one section the traffic may then be continued on the other. This rail on both tracks is divided into sections corresponding to the signal block, so that power may be cut off from any one of these sections in case of trouble. The sections are arranged so that they may be connected all the way through by jumper switches, and each section has a supply from a feeder paralleling the third rail in the conduits alongside the track. If the distribution cable which feeds that rail becomes disabled from a burnout, the cable may be disconnected, the jumper switches at the ends of the sections closed in and the rail made continuous, feeding the trains while the regular feeder is out of service. There is a ventilating equipment in the tunnel consisting of four fan chambers, in which there are two fans each. The fans are each designed for 25,000 cu. ft. of air per minute, and the fans are operated by 6.5-hp motors. These fan motors have therefore been provided with automatic motor-starters so connected that upon the failure of the power the rheostat arm of the starter will fall back to the initial point ready for the resumption of power. If the power is interrupted and restored in a shorter space of time than it takes the arm to fall down to the initial position the motor does not start, due to an interlocking connection. It is impossible to catch the motor with the resistance all cut out when the motor is at rest. There are two of these equipments in each fan chamber, and besides the regular feed source for these fans there is an additional source so connected that upon the failure of the first source the second source of supply is automatically cut in, and upon the return of the first source the second is cut off. The first source of current for the tunnel fans is the third rail and the second is from a wire which comes in from a feeder section outside the tunnel, so that any interruption of the power in the tunnel itself will not affect the fans. There are three pump chambers equipped in the same way, and the lighting service is similarly equipped, with also an arrangement for automatic formation with the Edison Electric Illuminating Company.

Pittsburgh Section, A. I. E. E.

The regular monthly meeting of the Pittsburgh section, A. I. E. E., was held in the Carnegie Institute on Jan. 12, being preceded by a very enjoyable little social dinner held at the University Club.

The subject of the evening was presented by Mr. William Hoopes, of the Aluminum Company of America, in an original paper entitled "Electric Furnaces," and was illustrated by means of lantern slides. The iron and steel companies and kindred interests were well represented by prominent members, who took a great interest in the paper. The discussion was participated in by Prof. Fred. Crabtree, of the Carnegie Technical Schools; Mr. W. S. Hadaway, of the Westinghouse Electric & Manufacturing Company; Mr. H. W. Fisher, of the Standard Underground Cable Company; Mr. Ernest H. Brown, of the Arizona-Idaho Copper Extraction Company; Mr. E. C. Edwards, of the Firth Sterling Steel Company, and Mr. H. W. Muller, of the Allegheny County Light Company.

CURRENT NEWS AND NOTES.

REGULATION OF UTILITIES IN MONTANA.—A bill has been introduced in the Montana Legislature empowering the corporate authorities of any city in that State to regulate rates and charges for water, gas and electricity to residents.

LIGHTING OF AMERICAN STREETS.—The next meeting of the New York Electrical Society will be held in the United Engineering Societies Building, 33 West Thirty-ninth Street, at which Dr. Louis Bell will lecture on the subject "Lighting of American Streets."

A. I. E. E. MEETING.—At the meeting of the American Institute of Electrical Engineers to be held in New York on Feb. 17, Dr. C. P. Steinmetz will present a paper entitled "Prime Movers." It will discuss economic features and operating characteristics of all available types of prime movers.

COMPULSORY MARINE WIRELESS.—A third bill has been introduced into Congress providing that any ship carrying passengers from or to ports in the United States, or between them, shall have a wireless outfit if any stage in the ship's itinerary is 100 miles or more. The French government is also considering a measure to require all French ship owners to install wireless on vessels above a certain tonnage.

NEW YORK INDEPENDENT TELEPHONE ORGANIZATION.—At a meeting held in Rochester, N. Y., Jan. 28, the New York State Independent Telephone Conference Committee was formed with the following officers: President, Mr. George R. Fuller, Rochester; secretary, Mr. Max Eaton, Niagara Falls; treasurer, Mr. W. Roy McCanne, Rochester. One of the first acts of the association was to provide for toll coupon books for the [illegible] in the State.

TEXAS STATE-AIDED TROLLEY LINES.—A bill before the Texas Legislature provides for submitting to voters an amendment to the constitution which may vote the levying of taxes and issue of bonds to build or aid in the building of interurban electric railways. It is stated that the construction of several such lines will be undertaken immediately upon the adoption of such an amendment, as people in the counties through which the proposed lines are to pass are willing to aid the several enterprises.

WEST AUSTRALIA UNIVERSITY.—It is proposed to establish a university in West Australia patterned after Cornell University.

C. Q. D.—Following is the significance of the initials which the newspapers have recently made well known in connection with the recent wreck of the *Republic*: C (come) Q (quick) D (danger).

ENGINEERING ENGLISH.—A book recently issued with the title "The Changing Values of English Speech," written by Dr. Ralcy Husted Bell, charges that technical and engineering societies are "unconscious corruptors of speech."

RADIUM INSTITUTE.—The Royal British Radium Institute is to be established by charter under the auspices of King Edward, and in virtue of a large fund donated for the purpose by Sir Ernest Cassel and Lord Iveagh. The Council will include Sir J. J. Thomson and Sir William Ramsey.

PENNSYLVANIA TIE-TREATING PLANT.—The Pennsylvania Railroad Company has arranged to erect at Mt. Union, Pa., a preservative plant capable of treating from 1500 to 2000 ties per 24-hour day. The plant will be equipped for any process of recognized value, but it will operate mainly with creosote and zinc-chloride.

TUNGSTEN PATENT FRAUD CASE.—Henry E. Everding has been sentenced to two years in penitentiary for participation in fraud incident to the issue of a tungsten lamp patent to John A. Heany, of York, Pa. As previously noted, Barton, ex-Patent Office examiner, received a sentence of three years on similar charges. The court acquitted the inventor.

INSTITUTE BILLS INTRODUCED.—A bill has been introduced, appropriating $10,000 for the Worcester Polytechnic Institute, in accordance with the Acts of 1905, and in like manner, according to the Acts of 1896 and Resolves of 1901, a bill appropriating $29.000 has been introduced in behalf of the Massachusetts Institute of Technology.

SUIT TO COMPEL USE OF TELEPHONES.—The Merchants' Association, of Raleigh, N. C., has instituted proceedings before the North Carolina Corporation Commission to compel the Southern Express Company to install the telephones of the Raleigh Telephone Company in its offices. The merchants claim that it is to their interest to have this system in use by the express company.

SONS OF JOVE.—On Wednesday evening, Jan. 27, the Sons of Jove held a "Rejuvenation" at the Coliseum Annex, Chicago. It was largely attended. Twelve members were added, the work of initiation being done in costume. The membership of the order has now reached approximately 2000. After the initiation ceremonies, a light supper was served, at which Mr. Frank Perry acted as toastmaster, and 30 men gave two-minute talks. The Electrical Show afforded the opportunity for the Rejuvenation, which was carefully worked up and a great success.

FEDERAL WATER-POWER SUIT. — Attorney-General Bonaparte has authorized the United States district attorney at San Francisco, Cal., to bring suit against the Truckee River General Electric Company and the California-Nevada Electric Power Company and other parties interested to acquire possession of a certain tract of land at the outlet of Lake Tahoe, which is claimed to be necessary to the Truckee-Carson project of the United States Reclamation Service. The government has, it is stated, been negotiating for the property for the past six years, but has been unable to reach an agreement.

LEGAL STATUS OF TELEPHONE MESSAGES.—Recently a court in this country has held that a notice by telephone demanding payment of a note is a legal demand, and in another case it was held that a conversation over a telephone is, if corroborated by a third party who "listened in," legal evidence in an action. On the other hand, an English judge has decided that he "would hesitate long before he held that a man was necessarily bound by words that came over a telephone. Every contract made in that way ought to be confirmed in writing, if it were liable to doubt, before it was upheld by a court of law."

GOVERNMENT 3000-MILE WIRELESS STATION.—On Jan. 28 bids were opened in Washington for the long-distance wireless plant previously noted in these columns. The Telefunken Wireless Telegraph Company, of Philadelphia, offered to construct and equip the Washington station for $168,850. The National Electric Signaling Company, of Pittsburgh, proposed to build the tower for $108,900 and to build and equip it for $182,600. The bids of the Marconi Wireless Telegraph Company ranged from $249,295 to $361,094. The Massie Wireless Telegraph Company, of Providence, proposed to build and equip the wireless station for $300,000. The Radio-Telephone Company, of New York, bid only on the construction of the tower, which they offered to build for $52,950. Four bids submitted by the Stone Telephone & Telegraph Company, of Boston, ranged from $100,000 to $275,000.

FENDER TESTS.—Mr. A. W. McLimont, as electrical engineer of the Commission, has submitted to the Public Service Commission of New York a report showing the result of the street-car fender tests conducted at Schenectady and Pittsburgh and recommending that all cars throughout Greater New York be equipped with automatic wheel guards, and that in the Boroughs of Queens, Richmond and the Bronx and in a large section of Brooklyn the cars should be equipped with projecting fenders also. The cost of holding the tests was about $8,000, 1800 tests having been made. Thirty-eight fenders and 29 wheel guards were tested. No particular fender or wheel guard showed such efficacy as to warrant its preference over all the others, but the tests showed that many are far superior to those now in use and are less expensive to maintain. It is estimated that the cost of equipping the surface cars of Greater New York with the best type of life-saving devices will not exceed $300,000, while the companies operating such cars incurred expenditures for injuries, damages and legal expenses in the year 1906-07 amounting to more than $3,500,000, much of which could have been saved by proper fenders and wheel guards.

MUNICIPAL SOCIALISM.—It is announced from London that the organ of those opposed to the present paternalistic tendencies in British governmental and municipal affairs has just made its appearance. It is called the *Anti-Socialist*. Among the contributors are Lord Avebury, Yves Guyot, Sir Arthur Clay and Canon Hensley Henson. Lord Avebury thus summarizes the objections to Socialism: "It has been clearly shown that governments and municipalities cannot give the same care, thought and attention to details as private firms or companies. Services and products must be more expensive and the nation's output will be less. Wages, however, in the long run, are governed and determined by international competition. Government and municipal cotton mills and ironworks could not raise their wages or they would ruin their markets. Moreover, as governments and municipalities would not increase their works or adopt improvements so rapidly as private firms, the companies' demand for labor would be less, with the same, therefore, or probably lower, wages. The workingmen would have to pay a higher price for the necessaries of life. But this is not all. At present working men are free. They can choose employer and employment. Under the new system this would not be possible. The result to the working classes will be less employment, lower wages, dearer necessaries of life, and, direst misfortune of all, the loss to a great extent of the personal freedom they now enjoy."

Electric Motors in a Brewery.

By William Keily.

IN breweries, both large and small, there are numerous opportunities for the economical application of electric motors. But in a brewing establishment of the first rank, where the brewing of the beer is simply the largest of a number of manufacturing and shop processes connected with the business, it is astonishing to note the varied and often ingenious applications of electricity generated in a central plant and transmitted to the various points of application. The great plant of the Pabst Brewing Company, in Milwaukee, for instance, covers several city blocks, and is one of the show-places of the city. It offers an ideal opportunity for industrial power transmission by electricity, and it is something of a surprise to learn that the electric power plant is only now, in these opening weeks of the new year, barely finished. Electric lighting has been employed for some years, of course.

Before the installation of the electric motors there were several steam plants in the extensive works, with lines of steam piping, in some cases 500 ft. long, and with various forms of mechanical transmission. Some of the belt and other transmission systems in use displayed great [illegible] but the whole combination was [illegible] with one central power plant and electrical transmission. In one case an engine was employed to drive [illegible] well pump. Three men, in eight-hour shifts, were constantly employed to run this one engine, which was supplied with steam through a pipe several hundred feet long. This whole outfit was supplanted by the 50-hp vertical motor illustrated in Fig. 6. Now all the attention required is from the oiler, who, in making his rounds, examines the motor twice a day to see that the oil cups are full. The saving effected by this one change can be imagined. Applications of motor drive in the new Pabst Brewery power plant cover almost every form of connection, for there is a great variety of machinery driven, including machine tools, wood-working tools, galvanizing plant, deep-well pumps, air compressors, centrifugal pumping machinery, milling machinery, malt-house machinery, grain-elevator machinery, etc.

Steam is produced in a boiler plant house in a building 121 ft. long x 50 ft. wide. This building is of fireproof construction throughout, the exterior conforming to the general architectural design of the group of buildings. It contains six Munoz water-tube boilers, but ultimately it will be extended and two more boilers added. Each boiler is provided with 4011 sq. ft. of heating surface and is rated at 401 hp. The boilers are set singly and without brickwork, but are encased in a steel shell lined with tile and asbestos. Each is equipped with a Murphy automatic smokeless furnace. The products of combustion [illegible] a breeching constructed of steel casing lined with asbestos, fire-felt sheets, coated on the inside with Vitrox retort cement, into a brick chimney 225 ft. high and with a flue 11 ft. 6 in. in diameter. Installed in the breeching are Green fuel economizers, and all boiler-feed water, before passing through the economizers, is treated by the Sorge-Cochrane system, the apparatus being

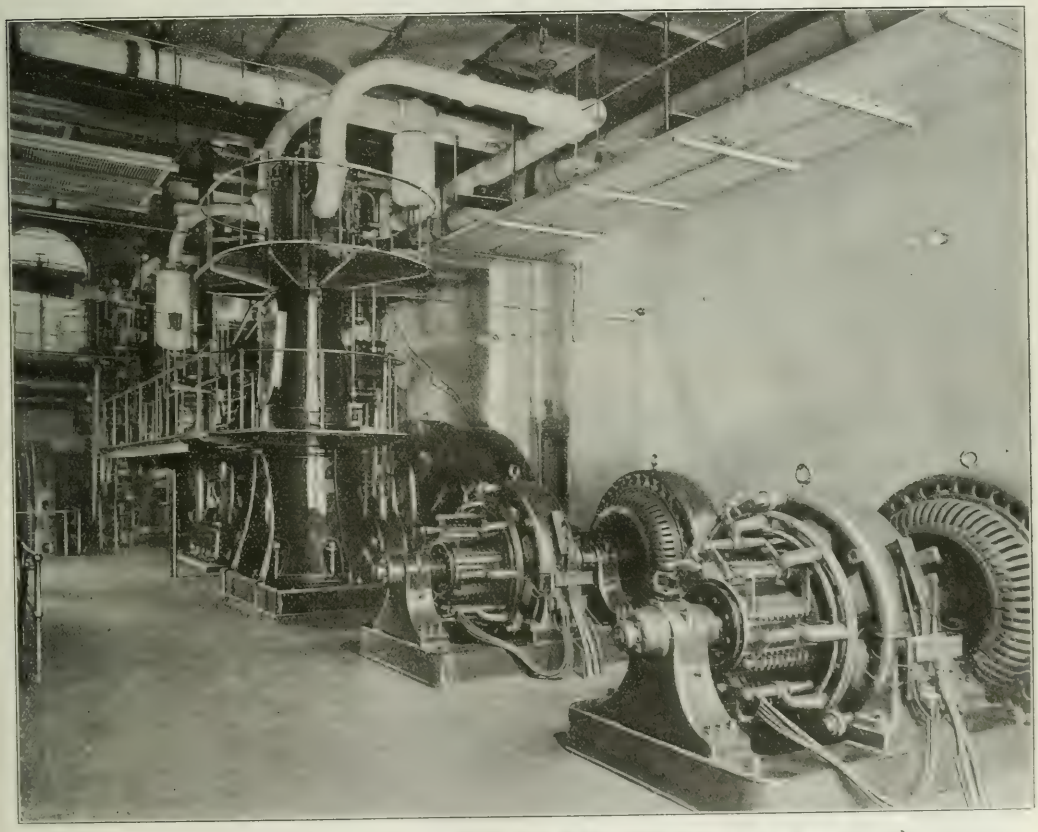


FIG. 1. GENERAL VIEW OF THE ENGINE ROOM OF THE PABST BREWERY POWER PLANT.

installed on an elevated floor immediately in front of the chimney. Beneath this floor are the boiler-feed pumps.

Coal and ashes are handled by a Link-belt bucket conveyor system. By this means the coal is deposited in bunkers, from which, through scale hoppers, it is delivered to the mechanical

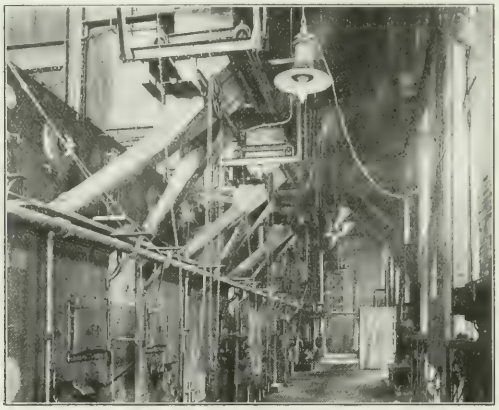


FIG. 2.—BOILER ROOM.

furnaces. Similarly, the ashes are lifted and deposited in ash hoppers for delivery to wagons. Hoppers have been provided also for receiving shavings, chips and small pieces of wood from the cooper shop, wagon shop and other wood-working departments. This refuse fuel is spouted directly into the fur-

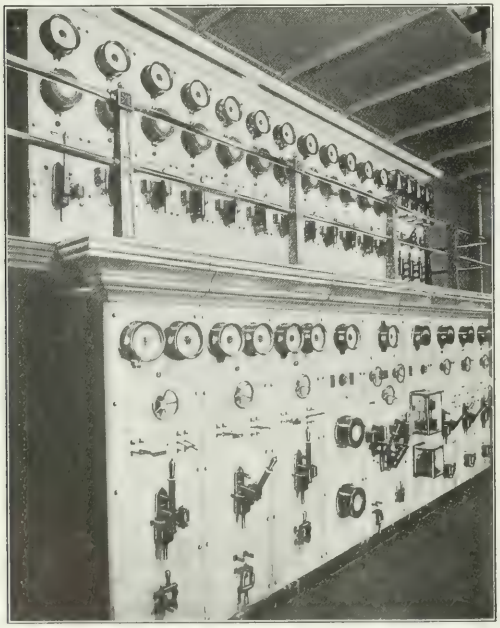


FIG. 3.—SWITCHBOARD IN POWER PLANT.

naces through special openings provided in the furnace construction.

The steam pressure carried in the boilers is 160 lb., necessitating the installation of a high-pressure piping system. The main header is placed beneath the breeching and at the rear of the boilers. It is divided into two sections connected by expansion loops around the chimney. From the boiler house the steam is conducted to the main engine room, 130 ft. away, through steam headers leading from each end of the main steam header. One of these connecting headers passes through

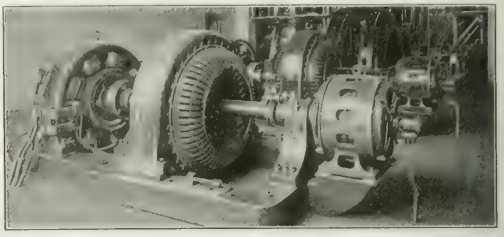


FIG. 4.—MOTOR-GENERATOR LIGHTING SETS, WITH STARTING MOTORS IN ENGINE ROOM.

a tunnel, the other is conducted overhead through the intervening buildings. The distance between boiler and engine rooms is explained by the fact that while the boiler plant is new, the generating units of the new electric installation are placed in the old engine room, which also contains all of the refrigerating machinery.

There are four generating units. Two of these are vertical engines direct-connected to 400-kw alternators. The engines are cross-compound and operate non-condensing. They drive, at 125 r.p.m., 440-volt, 25-cycle, three-phase, revolving-field generators. A third unit consists of a vertical, single-cylinder, non-condensing engine direct-connected to a 300-kw alternator of the type described, while the fourth embraces a Buckeye vertical, simple, automatic engine direct-connected to a 100-kw, 125-volt, direct-current generator. The total rating of the four units is 1200 kw. In addition there are two 125-kw, 125-volt, 500-r.p.m., direct-current generators, each mounted on a common base with and directly connected to a synchronous motor which drives it, and each having an induction motor with wire-wound secondary direct-coupled to the generator shaft for starting purposes. In Fig. 1 a view in the engine room, these motor-generator sets, used to supply energy for lighting, are shown prominently in the foreground. All engines, except the Buckeye engine, and all generators and elec-

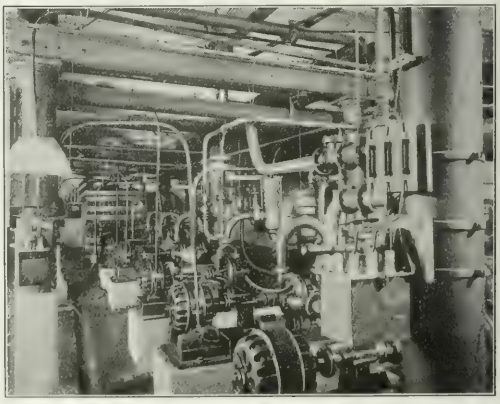


FIG. 5.—DIRECT-CONNECTED CENTRIFUGAL BRONZE BEER PUMPS IN PUMP CELLAR.

trical apparatus in the engine room were made by the Allis-Chalmers Company.

The connections for supplying steam to the engines consist of a main header, attached at each end to pipes leading from

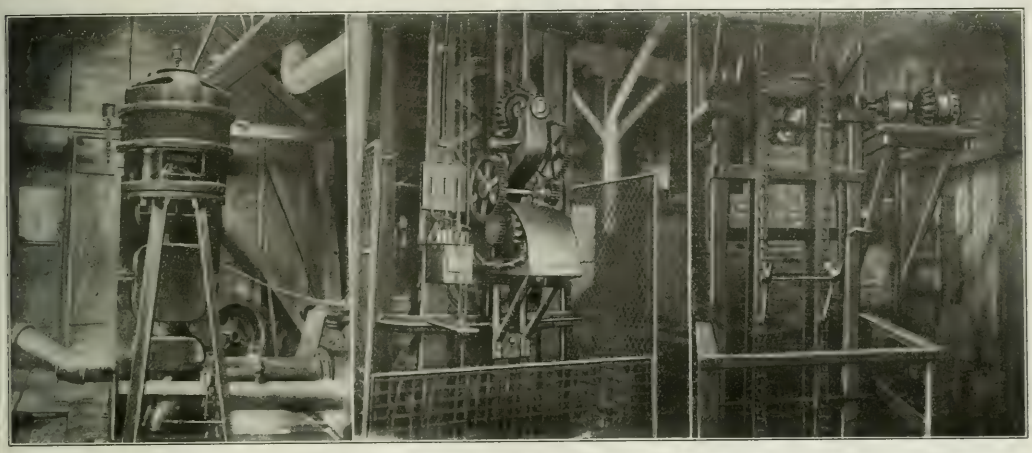
the boiler room. From this header service pipes lead to the units. The exhaust from all high-pressure cylinders is delivered into one common receiver connection or header, from which steam at a pressure varying from 35 lb. to 42 lb. is delivered to various parts of the brewery plant, where it is used for brew-house and other purposes, as well as to the low-pressure cylinders of the compound engines.

That the varying demands for steam by the various departments may be met, arrangement has been made on both high-pressure and low-pressure cylinders of the compound engines for altering at will the ratio of steam consumption and the transfer of the load from one side to the other of the cross-compound units. Heavy demands for steam at from 35 lb. to 42 lb. pressure are met by extending the point of cut-off on the high-pressure cylinder and shortening the point of cut-off on the low-pressure cylinder, thereby transferring the greater part of the load on the unit to the high-pressure cylinder. Reduced demand for steam from the various departments is met by a reversal of the proceeding described. All exhaust steam from the low pressure cylinders of the engines is consumed in the heating of water for general brewery purposes, the warming of the various departments when necessary, or in the drying coils in various departments.

The three phase, 25 cycle alternating current is transmitted to the various department... George F. Kelly & Co., Milwaukee, installed the transmission system. The control of all generating units, as well as of all feeders, is centralized in the main switchboard, which is constructed of English-vein white Italian marble, having a main board for the control of the generators and a balcony board above it for the feeder service. All circuits are controlled by automatic, overload, no-voltage release, oil-type General Electric switches. The equipment of instruments on the switchboard is very complete, indicating wattmeters, as well as watt-hour meters, being used in a manner to permit of obtaining an accurate record of the power generated or the energy consumed by each unit in the engine room and each department of the plant. The instruments are all of Westinghouse make, except the direct-current watt-hour meters, which are of the General Electric pattern. Kohler Brothers, of Chicago, built the switchboard.

Direct current at 125 volts, supplied by the synchronous motor-driven generator and the engine-driven direct-current generator, is used for lighting the entire premises. These direct-current machines also supply the exciting current for the alternators. The system of lighting used was adopted primarily to avoid the necessity of altering the existing illuminating system, to which many arc lamps are connected, and also to secure the assistance effect of the synchronous motors. Control of the induction starting motors on the synchronous motor-generator sets is accomplished from the switchboard by the use of rheostats.

Indicating lamps with bull's-eyes have been provided on all generator and feeder circuits, so connected as to direct the at-



FIGS. 6, 7 AND 8.—INDUCTION MOTORS DRIVING DEEP-WELL PUMP, BOX ELEVATOR AND BARREL ELEVATOR.

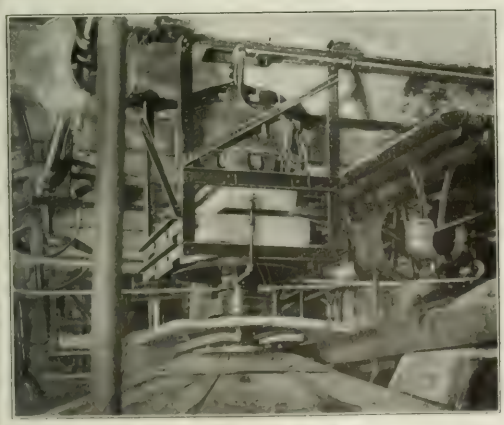


FIG. 9.—INDIVIDUAL MASH TUB DRIVE.



FIG. 10.—INDUCTION MOTOR DIRECT-CONNECTED TO BARLEY WASHING AND STEEPING MACHINE.

tention of the attendants in case of the opening of an automatic switch. All feeder circuits are installed underground and incased in iron-armored conduit mounted in tunnels. Distributing centers have steel cabinets with slate panels, and all fuses are of the enclosed type.

A count of the electric motors connected with the new power plant in this big brewery shows that there are no less than 151

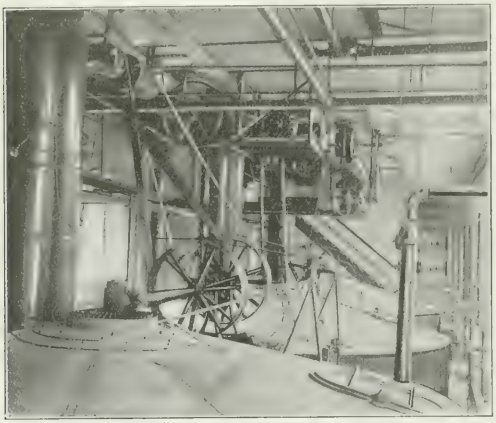


FIG. 11.—MOTOR DRIVEN AGITATORS ON BEER TANKS.

of them, varying in size from ½ to 100 hp. In all they aggregate about 2600 hp. They are distributed among the various departments and are put to the most diverse uses, only a few of which can be referred to here. Induction motors are used exclusively, with one exception in the case of the motor-generators. Reference has been made already to the 50-hp vertical induction motor mounted on a deep-well pump, as shown in Fig. 6. The motor runs at 750 r.p.m. and is coupled through an O'Kelley speed-reducing coupling to the pump, which is of the Byron Jackson make. The speed reduction is in the ratio



FIG. 12.—BARREL ELEVATOR, SHOWING APPLICATION OF SPEED REDUCING DEVICE.

of 1½ to 1. There are four additional equipments of this type except that the motors are rated at 40 hp.

Fig. 8 shows a 1-hp, 1500-revolution motor direct-coupled through an O'Kelley speed-reducing coupling having a ratio of speed of 44 to 1 to a shaft of a barrel elevator, and Fig. 7 shows a 1-hp motor mounted directly on and geared to what was formerly a belt-driven box elevator. There are several drives of this kind. A 15-hp, 750-r.p.m. vertical motor is mounted above and direct-coupled to the driving shaft of a mash tub through an O'Kelley speed-reducing coupling having a ratio of speeds of 50 to 1. This interesting combination is illustrated by Fig. 9. There are six equipments of this type. Another illustration (Fig. 12) shows a motor mounted upon a wall bracket, driving, through a speed-reducing coupling, a barrel elevator. The ratio of speed reduction in the coupling is 3 to 1, and there is a pulley mounted on a shaft extension with belt transmission to the shaft of the barrel elevator. The total reduction in speed is from 1400 to 110 r.p.m. This unusual arrangement was devised to meet existing conditions in the driving machine. This is the case with several other motor applications, and much ingenuity has been shown by the engineers in meeting difficult power requirements.

Fig. 5 is a view in the pump cellar. Here are installed a number of direct-connected, specially-designed two-stage and three-stage centrifugal beer-pumping units. The motors all operate at a synchronous speed of 1500 r.p.m., the capacities of the pumps varying from 52 gal. to 186 gal. per minute against static heads varying from 60 ft. to 120 ft. An interesting fact is that these pumps are entirely of bronze, as iron or steel would have an unfavorable effect on the beer.

Other applications with noiseless chain drives, direct-connection or single-reduction gears are numerous throughout the various departments. All freight and passenger elevators are operated by motors equipped with wire-wound rotors and are controlled by Westinghouse cable-operated elevator controllers. All motor equipments were furnished by the Westinghouse Electric & Manufacturing Company.

As a whole the plant is not only of unusual size for an industrial installation, but it is exceptionally interesting and instructive, with many ingenious "wrinkles." It does credit to Mr. C. A. Chapman, of Chicago, the consulting engineer, who designed it.

Comparative Tests of Transformers.

By A. C. Scott.

In view of the recent developments in the manufacture of sheet iron which have made possible lower core loss in transformers, it is presumed that comparative data and tests of commercial transformers as manufactured by the various companies are of sufficient interest to warrant the publication of the results.

Standard commercial types of 60-cycle, 1-kw, oil-cooled transformers were obtained from five manufacturing companies. Each transformer is presumed to be representative apparatus as manufactured by the company, and in no way specially constructed. These transformers are designated herein by the letters A, B, C, D and E. Transformers A, B and C are of the core type, while transformers D and E are of the shell type. Each of the transformers is provided with 10 times as many turns in each of its primary coils as in each of its two secondary coils. With the exception of transformer A, which is intended for a primary e.m.f. of 2080 volts per coil, the transformers have been designed for a primary e.m.f. of 2200 or 1100 volts and a secondary e.m.f. of 220 or 110 volts.

Tables I and II give the dimensions of the magnetic circuits of the transformers, explanation of the reference letters being shown in Figs. 1 and 2; the dimensions are given in inches.

TABLE I.—CONSTRUCTIVE DETAILS OF CORE-TYPE TRANSFORMERS.

Core type.	A.	B.	C.	D.	E.	F.	G.
A	9	5 0/16	2½	2 13/16	1⅜	1 7/16	6⅜
B	10½	5¼	3	2¼	1½	1½	7½
C	10	6¾	1⅞	3	1⅞	1⅞	6¼

TABLE II.—CONSTRUCTIVE DETAILS OF SHELL-TYPE TRANSFORMERS.

Shell type.	A.	B.	C.	D.	E.	F	G.	H.
D	10¼	3 5/16	6⅞	1.89	3¼	1⅝	3.78	1 9/16
E	8½	4⅜	5 7/16	2⅝	2⅛	1 1/16	3 7/16	1

Tests were made of the core loss, the copper loss, and the efficiency under normal conditions as to voltage and frequency (Figs. 3, 4, 5, 6 and 7); the temperature rise at full load and at 50 per cent overload (Figs. 8, 9, 10, 11 and 12); the variation of the core loss with change in frequency at normal voltage

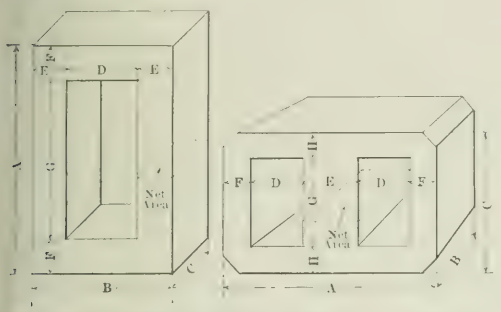
(Figs. 13, 15, 17, 19 and 21), and with change in voltage at normal frequency (Figs. 14, 16, 18, 20 and 22); the all-day efficiency and the regulation (Table III), and the insulation resistance.

LOSSES AND EFFICIENCY.

The core loss was determined, after the transformers had been brought up to their normal working temperature, by connecting the secondaries of the transformers across a supply having the proper voltage and frequency. The reading of a wattmeter in the circuit, with the primary coils open circuited, showed the loss due to hysteresis and eddy currents in the core.

The variation of core loss with a change of voltage, the frequency remaining constant, and with a change of frequency, the voltage remaining constant, was also determined.

The copper loss was determined by observing the resistance of the primary and secondary windings when they were at their normal working temperature, the resistance of the primary winding being reduced to the equivalent resistance of the secondary winding. Use was made of the formulas $W = I^2R$ where W = watts copper loss, I = current in secondary, R = equivalent total resistance of primary and secondary windings. The loss commonly termed "load loss" in transformers was found to be so small in these transformers that it has been neglected in the plotting of the curves.



FIGS. 1 AND 2.—MAGNETIC CIRCUITS OF CORE-TYPE AND SHELL-TYPE TRANSFORMERS.

The efficiency of the transformer was calculated by using the formula, $\text{Efficiency} = \frac{\text{Input Losses}}{\text{Input}}$. All of the losses having previously been determined it was decided to use this method in preference to running the transformer under load and determining the efficiency by the wattmeter readings.

A transformer which is connected in a lighting system has a load on it for only a part of the 24 hours, but the core loss takes place throughout the whole time. The "all-day efficiency," or the ratio of the energy output to the energy input during the 24 hours, is, therefore, of interest. In order to determine this efficiency, the usual conditions of practice will be met if the calculation is based on the assumption of five hours at full load and 19 hours at no-load in transformers operating on ordinary lighting circuits. The "all-day efficiency" for these transformers has been calculated on the above basis, using the following formula:

All day efficiency, in per cent,

$$\frac{\text{Rated output} \times 5}{\text{Rated output} \times 5 + \text{copper loss} \times 5 + \text{core loss} \times 24} \times 100$$

The regulation is of importance in connection with the operation of transformers, because the life of the ordinary incandescent or Nernst lamp depends largely upon the voltage impressed upon it. The regulation of a transformer is usually expressed in per cent of full load voltage, or the per cent

$$\text{regulation} = \frac{\text{No-Load Voltage} - \text{Full-Load Voltage}}{\text{Full Load Voltage}} \times 100$$

when the primary impressed pressure remains constant. The losses, efficiency and regulation of the five transformers are recorded in Table III.

TABLE III.—LOSSES, EFFICIENCY AND REGULATION.

Transformer.	Total resistance.	Copper loss.	Core loss.	Full-load efficiency.	All-day efficiency.	Per cent regulation.
A	1.340	31.0	33.2	94.0	84.0	2.79
B	1.126	23.2	18.7	95.9	89.8	2.04
C	1.440	29.7	46.8	92.9	79.7	2.72
D	1.007	20.8	39.7	94.2	82.5	2.27
E	1.230	25.4	32.7	94.6	84.5	2.27

TEMPERATURE RISE.

In order to determine the temperature rise the transformers were run under full load until a practically constant temperature was reached and readings were taken of the room and oil temperatures; resistance measurements were taken, by the drop of potential method, of the primary and secondary windings in order that the rise of temperature of the individual coils might be calculated.

The following formula was used for this calculation:

$$\Theta = (238.1 + t)\left(\frac{R_{(t+\theta)}}{R_t} - 1\right)$$

where

Θ = Degrees centigrade rise above the room temperature.

t = Initial temperature in degrees centigrade.

$R_{(t+\theta)}$ = Resistance at temperature elevation $\Theta°$ centigrade.

R_t = Resistance at room temperature $t°$ centigrade.

The above value of rise in temperature must be corrected for a standard room temperature of 25 deg. C. This is done by allowing 0.5 per cent correction for each degree centigrade the room temperature is above or below the normal. Thus, with a room temperature of 35 deg. C. the observed rise of temperature has to be decreased by 5 per cent, and with a room temperature of 15 deg. C. the observed rise of temperature has to be increased by 5 per cent.

Immediately after the full-load run was finished a run of 2.5 hours was made at 50 per cent overload in order to determine the heating under this extreme condition. The curves plotted in Figs. 8, 9, 10, 11 and 12 show the results after corrections have been made for a standard room temperature of 25 deg. C.

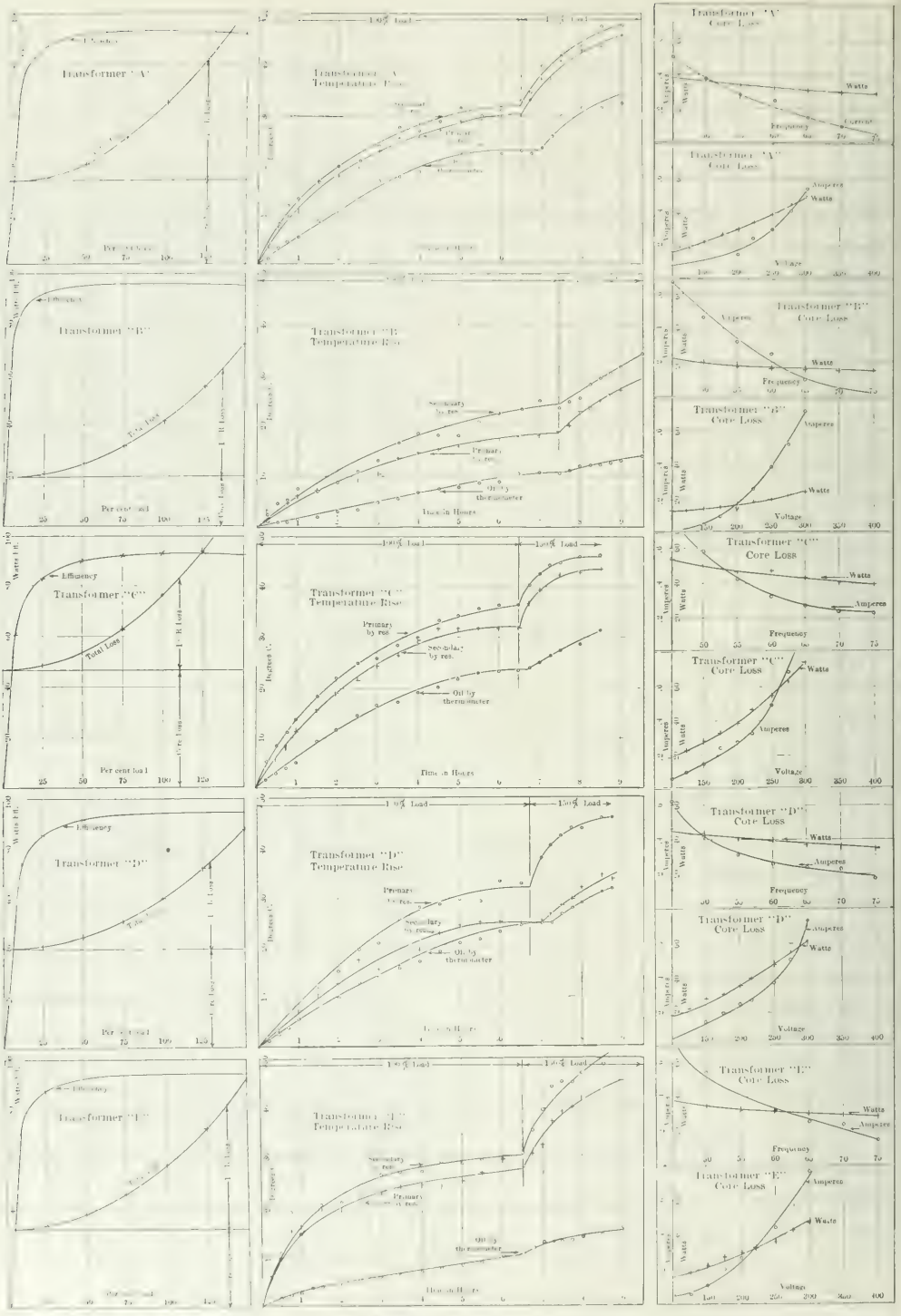
INSULATION.

The character of the insulation in a transformer should be of the best, especially between the primary and secondary windings, because poor insulation endangers the life of the consumer every time a lamp is switched on or off the circuit.

The insulation in transformers other than the single-cotton or double-cotton covering of the circuits themselves usually consists of either sheet fiber or mica over which is wound a number of layers of cotton tape, oiled linen or duck, and red rope paper, between the core and windings; in some transformers all of the above materials are used, while in other makes use is made of only part of them. Between the layers of the secondary windings one layer of thin oiled linen, varnished cloth, or parchment paper is commonly used in addition to the single-cotton or double-cotton insulation on the wire. The secondary winding is insulated from the primary winding by a thickness of either horn fiber or sheet mica over which is wound a number of layers of cotton tape, oiled linen or duck, and paper.

Different combinations of these materials are used by the various manufacturers. In the primary winding the individual layers are insulated from one another with one thickness of heavy oiled linen or varnished paper in addition to the single-cotton or double-cotton insulation on the wire. Around the finished winding there is wound one thickness of heavy oiled linen, varnished paper, or duck, which is held in place by one or two layers of cotton tape.

After the winding has been completed it is dried at a high temperature, usually in a vacuum so as to drive off any moisture that might be present. After the coils have been dried completely they are then treated with one of the many insulating



FIGS. 1 TO 7.—EFFICIENCIES.

FIGS. 8 TO 12.—TEMPERATURE RISE.

FIG. 13 TO 22.—CORE LOSS.

compounds. This is applied under a pressure of from 50 lb. to 100 lb. pressure per square inch so as to make sure that it will penetrate the whole winding. This pressure is maintained for a definite time, after which the coils are taken out and dried. Windings which have undergone the treatment before mentioned are impervious to moisture and the insulation is one solid mass.

A transformer rated at 2200 volts primary should withstand a pressure of 10,000 volts alternating e.m.f. for one minute between the primary and the secondary windings, and between the primary winding and the core. A special high-voltage transformer was used to obtain the required test voltage on these transformers and the voltage was determined as closely as possible by adjusting needle points for a 0.5-in. air-gap, which has been experimentally determined to be practically correct for a pressure of 10,000 volts. Each of the transformers was subjected to the above voltage between the primary and the secondary windings, and between the primary winding and the core for one minute, and the insulation was found to be in every way satisfactory.

CONCLUSION.

It will be seen from the curves showing the rise in temperature that all of the transformers come well within the allowable value of 50 deg. C., according to the Standardization Rules of the A. I. E. E. when operating at full load. When operating at 50 per cent overload the rise of temperature is found to be within the limit with the exception of one transformer, and in this case the slight excess would not be injurious to the insulation of the transformer.

The core loss was found to vary greatly in the different transformers, as will be seen from the curves. The variation was found to be between a maximum of 46.8 watts and a minimum of 18.7 watts. This variation can be accounted for only by a difference in the quality of iron used in the construction of the cores. It will be seen that there is a considerable variation of core loss with change in voltage; the variation with change in frequency is less remarkable.

The copper losses do not exhibit so great variation throughout the transformers.

The commercial efficiencies are satisfactory; the variations between the maximum and the minimum of only 3 per cent is small when the difference in the individual losses is taken into consideration; this fact indicates that the losses in the different types of transformers are proportioned so that the final efficiencies are practically the same for each. This is not true, however, for the "all-day efficiency," in which case the individual losses affect the final results. As will be seen by inspection of Table III, there is a variation of 10.1 per cent in the "all-day efficiency." It will also be noticed that the transformer which has the largest core loss has the smallest "all-day efficiency" and vice versa.

The regulation is shown to vary between 2.79 per cent as a maximum and 2.04 per cent as a minimum, indicating that the regulation for each is about what might be expected for this size of transformer.

In presenting the above results the fact is recognized that the rating of the individual transformers is small, but this fact does not show the tests to be irrelevant or unimportant in connection with installations in the smaller towns where many transformers of similar rating are in use. If the rating of each of the transformers were 5 kw or 10 kw, it would doubtless be possible to determine "load loss" accurately, and also to make a satisfactory separation of hysteresis and eddy current losses in connection with the core loss determinations. The latter appear to be very important in showing accurately the per cent of total core loss due to hysteresis loss, and the per cent due to insufficient attention to the insulation of the laminæ of the core.

The data and significant results embodied in this article were obtained in the Electrical Engineering Laboratory of the University of Texas, by Messrs. B. L. Evans and L. V. Correll, instructors in electrical engineering.

Cost of Energy in Nine Central Stations Operating Mixed Equipment.

One of the chief reasons why the cost of energy production and distribution in small central stations is of special interest at this time is the tendency noticeable in many quarters to break away from the traditional methods of generation by steam engines. The use of oil engines in connection with steam-driven machinery and the combination of waterwheel generation with energy production by steam turbines offer many opportunities for the introduction of efficient methods of machinery handling, and enable different types of apparatus to be tested by the severe requirements of commercial service. In a general way one must look to the small station for data showing what can be done with a wide variety of equipment under definite conditions. The larger plants are generally required to co-ordinate their equipment more closely, on account of the advantages of standardization where considerable investments are at stake. Symmetry of design has its attractive features in the small station, but the cost of trying out different apparatus combinations is less influential from the investment side. Another point worth considering is that with the improved types of motive power now available for practical application in central-station service, it is not necessary to install units of great size and correspondingly high cost in order to obtain very respectable figures of production economy.

In the following paragraphs the cost of energy production is given for nine different central stations in Massachusetts having mixed equipment, or departing from the usual steam-plant standards of operation through the use of oil engines and waterwheels. No plant of any notable size in Massachusetts is able to generate energy exclusively by water power. Whether this will always be the case is open to question, since the growing interest in the co-ordination of small water powers and their operation in a single system of hydro-electric plants and distribution lines is likely to spread more generally through Massachusetts with the extension of such plans as those of the Connecticut River transmission interests in the Worcester County section. The majority of the larger stations of the State depend upon coal alone, and figures of operating cost for the principal plants of this type have already been published in these columns. The plants using other than the orthodox steam equipment are mainly small stations, with the exception of that of the United Electric Light Company of Springfield. The thoroughness with which these are required to report annually to the Massachusetts Gas and Electric Light Commission enables the following figures to be presented for the year ending June 30, 1908:

Taking up the plants in alphabetical order, the first considered is the Cape Light, Heat & Power Company of Provincetown. This plant is a Diesel oil-engine station, and has practically no motor business except a small pumping load. The equipment of the station consists of two 120-hp American Diesel engines with 12-in. x 18-in. cylinders, the normal speed being 220 r.p.m. The plant was operated by two men, with the services half the time of an extra helper on the repairs of the engine and line. There is also a superintendent. There are a Fort Wayne three-phase, 2300-volt, 85-kw alternator and a 90-kw Stanley alternator, both running at 900 r.p.m., belted to the engine equipment. The equipment is housed in a station building 45 ft. long by 35 ft. wide, and one of the engines and generators was added during the past fiscal year. The total energy generated and delivered at the switchboard was 94,244 kw-hours, and of this 85,643 kw-hours were sold, making a transmission and distribution efficiency of 91 per cent. The generating cost was $4,952, the items of special interest being: Fuel (oil and coal), $2,035; lubricating oil and waste, $227; water, $30; wages at station, $1,844; engine repairs, $573; electric plant repairs, $175. The total cost of production per kw-hour generated was 5.3 cents; the engines consumed 27,810 gal. of oil, costing an average of 4 cents per gallon. For pumping purposes, 24,900 kw-[illegible] consumed. [illegible] delivered 3.4 kw-hours per gallon

of oil. The average load on the plant switchboard figured on a 24-hour basis was only 10.8 kw, or 14.3 kw on an 18-hour day. These figures show that the plant is at present unable to realize the full efficiency of the engines on account of the small output. Provincetown is not provided with manufacturing facilities of any magnitude, and the motor market is restricted. In view of the economy shown by oil engines in other plants to be covered below, the above figures cannot be called representative. The operating conditions are adverse, and the costs are necessarily high.

The distribution cost at Provincetown for the year was $1,213, or 1.42 cents per kw-hour sold. This cost was made up of wages for the care of lamps and meters, clerical labor and cost of collection, $284; line repairs, $119; meter and lamp repairs, $443; lamps, $366. The use of 2300 volts for distribution over the short distances necessary in this community enabled a relatively better economy of distribution to be secured than was possible in the station itself.

The Gardner Electric Light Company was operated by an oil engine equipment, consisting of three 225-hp, 16-in. x 24-in. Diesel engines running at 172 r.p.m. The company also operated to some extent two Fitchburg engines of the simple type, one being a 15-in. x 30-in. and the other a 28-in. x 30-in. machine, of 150 hp and 100 hp respectively. Four generators of Stanley make are in service, the total rating being 415 kw. The station building is a 73-ft. x 53-ft. structure, with a 26-ft. x 47-ft. boiler house, containing one Dillon boiler of 150-hp rating. The total energy generated was 654,690 kw-hours. The energy sold was 468,593 kw-hours, giving a distribution efficiency of 72 per cent. There were 157,462 kw-hours sold for motor service, and 13,293 units for electric heating. The company burned 465 tons of coal at a cost of $4.61 per ton, and 75,195 gal. of fuel oil at a cost of 4.1 cents per gallon. The output per gallon was 8.7 kw-hours. The operating force consisted of four engineers, one fireman, one helper, or six station attendants. Five linemen and one meter man were also employed. The total cost of manufacture was $13,953, or 2.14 cents per kw-hour. The principal items were: Fuel, $5,484; oil and waste, $507; water, $90; station wages, $5,352; engine plant repairs, $1,080; station repairs, $404; electric plant repairs, $740. The fuel and wages cost per kw-hour were each about 0.8 cent, making up about 75 per cent of the cost of production. Engine plant repairs were about 0.17 cent per kw-hour. There has been considerable interest expressed from time to time lately in different quarters as to the repairs necessary with the oil engine. These figures show that the total repairs for the year apportioned over the three engines cost not much over $2 per kilowatt of normal rating. If one engine had been taken out of this reckoning, the apportioned repairs would still have been only approximately $3 per kilowatt, which is far from an excessive figure in a type of prime mover of as recent development as is the oil engine.

The cost of distribution at Gardner was $6,737, or 1.44 cents per kw-hour sold. The main items were: Line repairs, $2,722; maintenance wages for lamps and motors, $1,646; and lamps, $1,536.

The Great Barrington Electric Light Company operates a combined steam and water-power installation. The use of the latter portion of the installation as far as practicable produced a saving of 1.52 cents per kw-hour generated. The equipment of the company consists of a 150-hp, 15-in. x 14-in. engine; a 150-hp Dillon boiler, and three 113-hp vertical Hercules waterwheels 45 in. in diameter and operated on a 10-ft. head. The power house equipment was operated by two men, and the total energy generated and delivered at the switchboard was 650,640 kw-hours. The total energy sold was 484,359 kw-hours, and the efficiency of distribution was 74.5 per cent. The principal items of the production cost were: Fuel, $355; purchased water power, $3,095; wages, $2,757; electric plant repairs, $798; total, $9,887. The distribution cost was $3,581, or 0.74 cent per kw-hour sold, of which the main item was line repairs and renewals, $1,474.

The Greenfield Electric Light & Power Company operates a combined engine and waterwheel plant containing the following principal equipment: Three 250-hp Hazelton boilers, and one 600-hp Stirling boiler; one 500-hp compound Russell 31½-in. x 20-in. x 27-in. engine; one Buckeye 265-hp engine; one Harris 600-hp engine; and one McIntosh & Seymour 750-hp engine. The waterwheel installation consists of two 600-hp Stilwell-Bierce & Smith-Vaile turbines, 30-in. diameter, running on 35-ft. head, driving two General Electric 40-kw generators. The total electric generating equipment in the plant is rated at 2100 kw. This equipment is disposed in two stations, one being a water-power plant located in the town of Buckland, at Gardners Falls, and the other a steam station located in Greenfield. The steam plant was operated by four engineers and three firemen, and the water-power station by three engineers and four helpers. At the steam plant the company burned 2117 tons of coal, costing on the average $4.26 each. The total energy manufactured was 3,961,470 kw-hours. The Greenfield company sold 3,354,169 kw-hours, and its maximum load was 1160 kw.

The generating cost was: Fuel, $9,012.50; wages, $11,440.66; total, including miscellaneous, $25,336.90; purchased energy from the Turners Falls Electric Company, at 0.5 cent per kw-hour, $3,588.60. The station cost per kw-hour manufactured was 0.64 cent, and the distribution cost, 0.36 cent per kw-hour sold. The company's output included a motor sale of 585,087 kw-hours, and a railway load of 2,329,676 kw-hours. These conditions produced an unusually good load factor for a plant of this rating, and tended to reduce the cost of manufacture. The utilization of water power was also a decided aid in securing good station economy.

The Orange Electric Light Company generated 196,250 kw-hours, and sold 171,626 kw-hours. There was a motor output of 15,759 kw-hours. This company operated a combined steam and water-power station, the bulk of the load being carried on the waterwheels. The station equipment consisted of one 220-hp Stirling boiler; one 300-hp McIntosh & Seymour engine; two 115-hp Rodney Hunt turbines 36 in. in diameter, and one 154-hp Rodney Hunt turbine, 42-in. diameter, all operating under 16-ft. head. The generators consisted of two 250-kw General Electric alternators of a combined rating. The company burned 34 tons of coal costing $4.44 per ton, and the station was operated by two engineers, with one electrician also on the company's payroll. The total cost of manufacture was $3,844.42, or 1.96 cents per kw-hour, and the distribution cost of the company was $2,898.17, or 1.69 cents per kw-hour sold. This plant with increased power output would undoubtedly be able to realize improved efficiency of production, in view of the possibility of carrying so much of the load on the waterwheels for a considerable period.

One of the larger mixed systems of the State is that of the Pittsfield Electric Company. This central-station organization had a total generated energy during the fiscal year of 2,389,479 kw-hours. It sold a total output of 1,920,495 kw-hours, of which 416,774 kw-hours were for motors. The maximum load on the system was 847 kw. The company operated two plants, one a steam station in Pittsfield on Renne Avenue, and the other a Diesel oil engine station at Silver Lake, in the suburbs of the city. The total station attendance included ten engineers, four firemen, one wiper and one repairman. The company burned 3452 tons of coal at an average cost of $2.85 (hard coal) and 3681 tons of bituminous coal at an average cost of $4.98. The equipment of the steam station was as follows: One 150-hp Russell boiler, and six 150-hp Bigelow boilers; two 175-hp Harris engines; two 500-hp Providence engines; one 200-hp Westinghouse engine, and one 150-hp Westinghouse engine. The total cost of energy manufacture was $41,386, or 1.73 cents per kw-hour. The total distribution cost was $24,791, or 1.29 cents per kw-hour. The company purchased 36,539 kw hours at a total cost of $543, or 1.49 cents per kw-hour.

The cost of operation at the oil engine plant, containing two 225-hp American Diesel engines, directly connected to generators, was as follows: Total energy generated at station and delivered at switchboard, 817,000 kw-hours; fuel oil consumed, 87,058 gal.; average cost per gallon, 3.9 cents. Cost of manufacture

per kw-hour: Wages, $3,612.87; fuel oil, $3,400.76; water, $87.70; oil and waste, $347.22; repairs oil engine equipment, $662.91; station repairs, $4.73; electric plant repairs, $12.51; total, $8,128.70. These figures show that the oil engine plant is producing energy at a net cost of about 1 cent per kw-hour, with a labor cost of 0.44 cent, and a fuel cost of 0.41 cent per kw-hour. The repairs came to 0.081 cent per kw-hour; as far as this station's operation at this period of its life is concerned, maintenance is far less than what many engineers have been disposed to attribute to the oil engine station. Subsequent figures from this station will be awaited with interest. The returns of this company do not enable one to separate the steam plant costs, but these seem to be kept well in hand, considering the relatively high cost of coal and the moderate size of the reciprocating engines operated, otherwise their influence on the total cost per unit would have been more adverse.

One of the smaller stations in the State is that of the Shelburne Falls Electric Light Company. The returns of this plant for the year ending June 30, 1908, cover the operation of a plant containing a single generating unit, driven by a 45-hp Westinghouse gasoline engine, and an 85-hp Rodney Hunt 18-in waterwheel operating under 32-ft. head. The generator was a 60-kw Westinghouse unit. The plant was operated by one dynamo tender and one helper. It consumed 1630 gal. of gasoline at a cost on the average of 12.5 cents per gallon. The detailed cost of operation was: Gasoline, $203.75; water-power rental, $500; wages at station, $1,150.50; total, $2,412.44, giving a cost of manufacture per kw-hour of 3.17 cents. The plant turned out 76,150 kw-hours, and sold 73,808 kw-hours, all for lighting service, with no motor load. The total distribution cost was $1,357.28, or 1.84 cents per kw-hour sold. The use of the belt drive and the absence of a motor load, together with the small size of the plant, were predisposing factors tending toward high cost per kw-hour generated.

Probably the largest plant in Massachusetts at the present time that depends upon both steam and water power is that of the United Electric Light Company of Springfield. This company manufactured during the year a total of 16,230,797 kw-hours, and sold 10,421,309 kw-hours. There are several water-power units supplying energy to this company's territory, and there is a combined steam engine and turbine plant in the neighborhood of the business center of the city of Springfield. The steam-boiler equipment consists of three 300-hp and 11 400-hp Hazelton & Williamson boilers. The steam generating units are one 800-hp Corliss-Providence compound condensing engine; three 1000-kw Westinghouse-Parsons steam turbines, and one 2500-kw turbine of the same make. The waterwheel equipment totals 2835 hp. The maximum load was 6701 hp. The operating force included eight steam engineers, three firemen, one chief electrician, and fourteen dynamo men. The total cost of manufacture was $116,884, the principal items being: Fuel, $40,108; wages, $29,753; and water power, $34,560. The generating cost per kw-hour was 0.72 cent, and the distribution cost per kw-hour sold, 0.685 cent. The influence of the water-power generation and the skilful operation of the steam plant as an auxiliary is clearly evident in the excellent generating efficiency obtained. The different plants operated by this company are closely tied together by a thoroughly organized telephone system and carefully trained organization, with a liberal application of labor-saving equipment in the stations.

The Weymouth Light & Power Company operated a plant consisting of 450 hp of Hodge & Roberts boilers, one 500-hp McEwen engine, one Harrisburg 250-hp engine, and one 250-hp Slatter engine. The company also has two Rodney Hunt turbines 21 in. in diameter. The operating force consisted of two engineers, one fireman and one engineer at the water-power plant, and the maximum load was 150 kw. The company burned 1626 tons of coal at an average cost of $4.59 per ton, and 740 tons of screenings, costing an average of $2.52 per ton. The total cost of operation was $10,013, of which fuel was $9.289 and wages $5,718. The cost of manufacture was 5.45 cents per kw-hour. The distribution cost per kw-hour sold was 0.03 cent.

Series Tungsten Lighting.

In a paper read before the Northwestern Electrical Association convention at Milwaukee, Jan. 20 and 21, Mr. Henry Schroeder discussed the subject of series tungsten lighting. Street lighting as a whole has not, he said, received proper attention in the past, and being most prominent in the eyes of the public, careful consideration should be given to it by the central station. In the opinion of the author, incandescent lighting for suburban and residential streets is the ideal system. It was stated that five large arc-lamp installations in New England in outlying districts are now being replaced by clusters of tungsten series lamps. In sparsely settled districts, in order to obtain a reasonable illumination between lamps, the greater cost of arcs does not warrant their proper spacing. Moderately low candle-power units, spaced at frequent intervals, will much more economically light a street. Over a year ago the series tungsten lamp was developed, having an economy of 1.25 watts per candle, and reports from many sources covering many thousands of lamps show an average life of over 1500 hours.

These lamps are now made in 25-, 32-, 40-, 60- and 80-cp sizes for currents of 3.5, 4.0, 5.5, 6.6 and 7.5 amp, and also in candle-powers of 25 to 60 for 1.75 amp. The greater life of the series over the multiple tungsten lamp is largely due to the greater cross-section of the filament, and from reports received vibration caused by linemen climbing poles and driving bolts, passing traffic, wind storms, etc., do not affect the lamp. One advantage of the tungsten over the carbon series lamp is that the tungsten gives equally good results on all amperages, not requiring one circuit for incandescents and another for arc lamps, as has been the practice with carbon lamps used for this purpose.

The economy of the tungsten series lamp is twofold: First, in the kw-hour saving per year, and, second, in the capacity of transformers and station apparatus. As an example of the former advantage, in the case of the 32-cp lamp burning 4000 hours, all night, every night for a year, the carbon lamp consumes 112 watts, or 448 kw-hours, for a year, while the tungsten lamp consumes 40 watts, or 160 kw-hours, per year, giving a saving of 288 kw-hours. At 2 cents per kw-hour this saving is $5.76 annually. Assuming four renewals of the carbon lamp and three of the tungsten lamp per year, the extra cost of tungsten renewals for central stations which use 1000 to 5000 lamps of all kinds per year will be $1.45 annually, making a net saving, including power and lamp renewals, of $4.31 annually. At an energy cost of 1.5 cents per kw-hour the annual net saving due to the substitution of the tungsten lamp will be $2.87.

In competition with gas or gasoline mantle lamps the tungsten lamp can easily give better service at profitable rates. From tests made in several cities on the mantle lamp, while operating under actual conditions, the following data were obtained: Maximum candle-power found anywhere, 55.1; highest average candle-power found in any city, 36.7; lowest average candle-power found in any city, 16.8; minimum candle-power found anywhere, 6.5. Thus a 40-cp tungsten series lamp which maintains its candle-power practically constant throughout life will certainly give better results than the mantle lamp, even though the Welsbach [illegible]

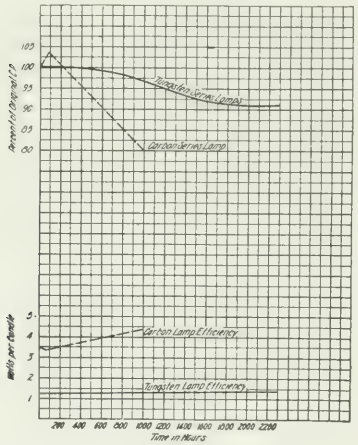
The illustration shows the life and candle-power curves of the carbon and tungsten series lamps. The tungsten lamp maintains its candle-power better throughout its life. The new "radial-wave" reflectors increase the candle-power of the lamp from 8 to 25 [illegible]

[illegible] series socket with a film cut-out is used. The receptacle is so constructed that the lamp and socket can be removed at any time without opening the circuit. A new brass disk film cut-out has been made that will readily puncture on 200 volts, which effectually overcomes the troubles previously encountered with [illegible]

puncture when the lamp burns out. This cut-out consists of two round brass plates about ¼ in. in diameter, which are held together and insulated from each other by a piece of veiling and some varnish. On account of the high efficiency of the tungsten lamp, the series lamp business has increased enormously in the last six months. The customary practice for central stations in changing over from carbon to tungsten lamps has been to give the town some of the benefits by changing from 25-cp carbon to 32-cp tungsten, etc.

DISCUSSION.

Mr. Ludwig Kemper, of Albert Lea, Minn., objected to the method of figuring saving in power at the rate of 1.5 or 2 cents per kw-hour. Assuming a small central station were to reduce its kilowatt output by the substitution of tungsten for carbon street lamps, the actual saving would not amount to 1.5 or 2 cents per kw-hour of energy reduction. The station labor and other maintenance charges would remain fixed. The only place where it could make a difference would be in the coal consumption, and the reduction in kw-hour output would not reduce the coal consumption to the amount named per kw-hour, because of the large fixed losses in the boiler and engine plant, which would remain unchanged. He said that he had actually tried some experiments along this line to determine the possible saving by reduction of load corresponding to that



LIFE AND CANDLE-POWER CURVES OF CARBON AND TUNGSTEN LAMPS.

caused by the adoption of tungsten street lighting, and the actual amount of coal saved owing to the reduction in load was so small it could hardly be noticed.

Mr. J. R. Cravath, of Chicago, said that Mr. Kemper was probably right as regards reduction in power cost. In his opinion the greatest value of the series tungsten lamp in such a case would be the station capacity set free to be sold to other consumers. In a growing station such capacity soon finds a market.

President Korst, of Janesville, said that he was operating a water-power plant where the reduction in power would cause no saving, but he had been replacing series carbon with series tungsten lamps for two reasons. One was that he could get more revenue out of a given station capacity, and the other was that the series carbon lamp blackens, so that it is not very satisfactory; on the ground of satisfying the public he thought it wise to substitute the tungsten series lamp for the regular carbon series lamp.

Mr. G. E. Newman, of Ladysmith, Wis., said that arc lamps caused more trouble than any other one thing in the operation of a small plant. He was interested in this paper as showing the possibility of substituting tungsten clusters which would not be so subject to outage and consequent strenuous objection of the alderman living on that corner.

Employer's Liability—The Fellow-Servant Rule or the Doctrine of Common Employment.

By John E. Brady.

While, generally, one person cannot be held responsible legally for the wrongful acts of others, there is a time-honored exception to the rule to the effect that an employer is liable for the negligence of his employee, when the latter is acting in pursuit of his master's business and within the scope of his employment. This modification of the general rule is subject to a further, also time-honered, exception, known as the fellow-servant rule or the doctrine of common employment, and which may be stated as follows: Where an employer uses due care to select competent servants and provides them with suitable means of accomplishing the work for which they are employed, he is not liable to one servant for the consequences of the negligence of another, while both are engaged in the same service. It may be mentioned in passing that the fellow-servant rule is not law in Mexico nor in the Province of Quebec. Consequently, in those jurisdictions an employer is not exonerated from liability for injuries to one in his service by reason of the fact that the injuries were caused by the negligence of a fellow servant of the employee.

The case of Priestly v. Fowler, 3 M. & W. 1, an English decision of the year 1837, is sometimes accredited with being the first to apply the fellow-servant rule. This contention, however, is not borne out by an examination of the facts. The plaintiff was in the employ of the defendant, who was a butcher by trade, and was injured by reason of the breaking down of the wagon on which he was riding and which was being driven at the time by another of the defendant's servants.

The history of the fellow-servant rule in the United States is said to have begun with the case of Murray v. South Carolina R. Co., 1 McMull. L. (S. Car.) 385, 36 Amer. Dec. 268, decided in South Carolina in 1837. It was here held that a railroad company was not liable to a fireman in its employ for injuries resulting from the negligence of a competent engineer. The ground most generally assigned for the fellow-servant rule is that when one enters the employ of another he assumes the risk of being injured by the negligence of others engaged in the same employment. In a leading American decision it was said: "We are not aware of any principle which should except the perils arising from the carelessness and negligence of those who are in the same employment. There are perils which the servant is as likely to know, and against which he can as effectually guard, as the master. They are perils incident to the service, and which can be as distinctly foreseen and provided for in the rate of compensation as any others." Farwell v. Boston, 4 Metc. (Mass.) 49.

So, public policy is frequently asserted as the true basis of the fellow-servant rule. It may be said to be founded upon the theory that it is calculated to make servants in a common employment watchful of each other, and thereby to promote carefulness in the performance of their duties, Burke v. Norwich, etc., R. Co., 34 Conn. 474, 480, where, however, it is said: "It is by no means certain that the public interest would not be best subserved by holding the superior, with his higher intelligence, directing and discharging subordinates, to the strictest accountability for their misconduct in his service, whoever may be the sufferer from it."

It would seem that the safety and welfare of the public would demand the establishment of the non-liability principle on the part of the employer in such cases, for when established it can work no injury to the servant, because his entering upon the service is voluntary, is with a knowledge of the hazards of the work, and with a right to demand such wages as he shall deem compensatory. If this be taken as the true ground of the rule it would follow that the rule should be confined to those servants whose duties bring them into such juxtaposition that one would be able to observe the negligence of his fellows, and this limitation is recognized in some cases. IV Cyc. 1280.

Since its first adoption the fellow-servant rule has been applied in thousands of cases, arising in every jurisdiction of the United States. In Rosa v. Volkening, 72 N. Y. Supp. 236, the plaintiff was employed by a contractor engaged in the construction of a building, his work being to wheel cement from a dock near at hand to the building, and to perform such other services in connection with the construction as he was directed to do by those in charge. In the course of the work it was found necessary to use a derrick to hoist timbers into position, and in raising them it was necessary to give them a forward movement while they were being lifted. On the day of the accident, the laborers operating the derrick, which was a crude three-legged affair, with a drum worked by levers, made a hitch upon a piece of timber, fastening the rope farther from the end than usual, and in such a manner that the dragging of the timber forward threw an excess weight upon the derrick, and it toppled over, falling upon the plaintiff and causing the injuries for which he brought suit. On the ground that the place furnished for the plaintiff to work in was made dangerous, not by the presence of the derrick, but by the negligence of the plaintiff's fellow servants in operating it, it was held that the contractor was not liable.

In a Missouri case, Strottman v. St. Louis, I. M. & S. Ry. Co., 109 S. W. 769, a station telegraph operator and a locomotive engineer, both working for the same company, under the control of and subject to the orders of the company's train dispatcher, and with no control of either one over the other, were held to be fellow servants, both at common law and within the fellow-servant law (Laws 1897, p 97, Sec. 3), providing that persons, engaged in the common service of a railroad, working together at the same time and place, to a common purpose of same grade, neither of such persons being intrusted with any superintendence over his fellow employees, are fellow servants with each other, provided that no agent or servant shall be a fellow servant with an agent or servant of the common master engaged in another department or service of the master.

The plaintiff and a co-worker, in another instance, were employed at the defendant's railroad station in transferring baggage on trucks from the trains to the baggage room. The baggage was lowered by an elevator from the train platform to a subway some 16 ft. below, and then taken to the baggage room. When the elevator was down a cage protected the aperture at the surface, and as the elevator ascended the cage descended, and when it descended the cage ascended, passing the elevator both ways. The elevators were almost a foot longer than the baggage trucks and somewhat wider, so that, if the baggage was not loaded to protrude more than that distance beyond the elevator, it would not strike the cage in ascending and descending. In lowering baggage it was customary for the head man at the truck to see that the baggage was in a proper position to be elevated; the plaintiff and another loaded a truck, the other being at the head of the truck, and after it was loaded the other employee called to plaintiff to go ahead, and he started the elevator, which came into contact with the descending cage on account of the baggage having protruded too far from the elevator, and plaintiff was compelled to jump from the elevator and was injured. It was held that plaintiff's fellow employee was negligent in not seeing that the baggage was properly loaded, and that the defendant was, therefore, not liable. Turner v. Terminal R. Ass'n of St. Louis, 111 S. W. 841.

The question as to who may be considered fellow servants is one which frequently arises. A hydraulic elevator in a steel works not being a machine whose condition as to safety is constantly changing with its use so as to require from the persons tending it, as part of the ordinary use of it, reconstruction or readjustment of parts as they become worn out or displaced, for materials or new parts supplied by the master for that purpose, the operator of the lever of the elevator and the millwrights were held not to be, respecting the performance of duties of inspection and repair, fellow servants of one employed to operate an electrical locomotive in pulling ladle cars onto the elevator. Byers v. Carnegie Steel Co., 159 Fed. 347.

It is generally recognized that the master is exempted from liability for injuries to an employee by the negligence of a fellow servant only where the injured servant was at the time of the injury engaged in the performance of his duty under his employment. In a case which involved this rule, it appeared that the plaintiff was employed by the day as brakeman on a work train. Twelve hours was a day's work, and the train had no regular run. As a rule the crew worked from 6:30 a. m. to 6:30 p. m., and did not work at night. On the morning of the injury plaintiff started out to find the train. Not finding it in the yards, he walked down the track to a roundhouse, where he ascertained that the train had gone, and that he was therefore not subject to call for duty that day. He decided to quit defendant's employ, and started back up the track to see an acquaintance when he was struck by an engine and tender while crossing a bridge. It was held that he was not in the service of defendant when injured, and that the fellow-servant rule did not apply so as to exonerate the defendant. It was further held that even if plaintiff at the time of the injury were on his way to defendant's agent to obtain a pass with a view of overtaking the work train, he would not have been in defendant's employ, since it was optional with defendant whether it should give him a pass, and, as the employment was by the day, neither party was bound except for the day's employment, but if the contract were to continue longer than the day it would seem to be under a new implied contract each day of service. Missouri, K. & T. Ry. Co. v. Hendricks, Texas Civil Appeals, 108 S. W. 745.

Splicing Lead-Covered Cables.

In telephone work it is usual when making a splice to pour hot paraffin where the lead is removed, to prevent moisture getting into the cable. A scheme which has been tried successfully to accomplish the same result in distribution boxes is to use a blower like that employed to force air into a manhole and to connect an ordinary stove-pipe elbow in the intake. Under the pipe a gasoline stove is placed, and the heated air pumped through a pipe and against the exposed conductors. Moisture is thereby excluded.

Turning and Grinding Commutators.

By W. Burns.

On a well-designed machine, and where some little attention is given to the running condition of the commutator and brushes, the commutator will run for years and not require any truing up operations beyond an occasional polish with carborundum cloth, or, should a tendency to form ridges be shown, it should be touched up with a fine file, then polished with carborundum cloth, before the ridge develops to any extent. This will keep it trued up and avoid heating and sparking.

Nearly all dynamos and motors are allowed some end play on the shaft, varying from ⅛ in. to ¼ in. in different machines, to permit the armature core to run in the center of the magnetic field, and to prevent the commutator from being grooved. The slight movement to and fro which usually occurs when the machine is running keeps it from grooving, and tends to wear it smoothly all over.

The brushes should be so spaced that there is the same rubbing surface at all parts of the commutator, and that no part is left untouched. If the brushes are thus set, and a little attention given to cleaning, with occasional slight lubrication, the commutator will run for a long time and give no trouble.

It is not every motor that is well looked after; the carelessness in this respect with some of the more common sizes of machines being very great, especially if the motor is in charge of an unskilled person whose ideas as the subject may be very vague, or, if the machine should chance to be placed in a position where it is not easy to get at, it is often neglected till it is absolutely necessary that some attention be given to it. As the bearings require no attention for oiling, and the brushes very little, just so long as the shaft continues to turn the

motor is never looked at, and running under these conditions it is little wonder that the commutator soon requires turning up.

In the smaller sizes, where the armature can be easily removed from the machine, the turning up is best done in the lathe. Centers for this purpose are usually made in the armature shaft, when the machine is being built. After the key has been drawn from the pulley or gear which is on the end of the shaft, the bolts which hold the end bearing in place are unscrewed and the bearing drawn off. Packing should first be placed between the two bottom pole faces and the armature core, to prevent injury to the windings, thin pieces of wood or cardboard being very suitable. The armature may then be withdrawn by hand, if light enough, or by rigging up a chain block if it is too heavy to handle, great care being taken to avoid knocking it in any way. It is then placed on the lathe centers.

If the shaft has been in use for some time and the journals show signs of wear, it will be necessary to apply an indicator to the journals to make sure that they run true. Should they be slightly out of true, the center must be scraped with a center scraper till both journals run properly. If no attention is paid to this point and the commutator is turned up without shifting the center, when the armature is replaced in the machine, the commutator will probably run hot and spark at the brushes, necessitating re-turning in a very short time.

A narrow, pointed tool, somewhat like a thread-cutting tool, is the most suitable for turning the commutator, the turning speed being as fast as the tool will stand, and the feed very fine. A broad-nosed tool ought not to be used, as it is liable to burr over the segments. The sharp-pointed tool does not produce a finished surface, but this is easily attained by filing lightly with a very fine file, then polishing with coarse and fine carborundum or sandpaper. If a little oil is used when finishing with the fine carborundum cloth, it will produce a nice, smooth polish; or, should the electrician think that this will harm the insulation, a little paraffin or a piece of a paraffin candle may be used. A covering of some sort should be placed over the windings and tied in position to keep any particles of metal from getting in during the turning operation. At the points where the windings are soldered to the commutator lugs, a brush should be used to remove any dust or particles of copper. The insulation between the segments should be examined after turning to see that the commutator is not short-circuited by a chip or burr of copper.

Before removing the armature from the lathe, any rough parts on the bearings should be filed and polished with emery cloth. The armature is sometimes given a coat or two of shellac varnish before replacing, but during this operation great care should be exercised, as a knock against the commutator or armature windings may undo all the work.

When the armature is too large to be conveniently taken out, a portable turning rig may be used to true the commutator in place, this rig being fixed to the end bearing or the frame of the machine. The same tools are used as when the turning is done in the lathe; all parts where chips may lodge and harm the insulation being carefully covered. The engine usually requires to be run slowly or disconnected during the turning operation, the armature sometimes being rotated by hand or by means of some portable motor, depending entirely on the material that is accessible. This turning rig is usually a slide rest of some description fitted with a traversing screw and means for feeding in the tool. Sometimes an ordinary lathe slide rest is used, being suitably mounted and clamped in place. A portable grinding machine is often used for truing up some of the larger-sized commutators.

In this connection the truing up of the commutator on the dynamo which supplied the electrical energy for a large works may be of interest. The commutator was giving trouble by undue heating, and, as a flat had formed, it was decided to true it up and see if that would improve matters. To avoid stoppage of the work, it was arranged to be trued up at night after work had stopped. To attach the grinder to the machine, the four cap bolts on the bearing were removed and four longer bolts were inserted to allow for the thickness of the bars which formed the base of the grinding fixture. The grinding wheel was driven from the commutator by means of a rubber-tired wheel held in contact by a spring which could be adjusted to any desired tension. A coarse and a fine wheel were used in turn. The machine automatically traversed back and forward, the feeding in of the wheel being done by hand. A coarse-grained wheel was used to remove most of the material, the engine being run at nearly full speed, as this was when the wheel seemed to cut most freely. After the flat had been ground out, the fine-grade wheel was put on, and soon brought the surface to a fine finish. A final smooth-up with fine carborundum cloth finished the job. The top part of the brush carrier ring had to be removed to make clearance for the grinding rig; the bottom half was left in place and pressure taken off the brushes. This allowed them to slide back in their holders, after which a cloth was passed underneath to catch the copper dust, of which there was a large amount. The armature was also completely covered. When the brushes had been replaced and the machine run for some time, there was no further trouble from heating.

Renewing Incandescent Lamps.

In a recent patent having for its object to prevent the renewal of incandescent lamp filaments, the following description is given of the various manipulations in removing an old filament and substituting a new one:

In the ordinary lamp the platinum ends of the leading-in wires have each a free or interior portion projecting beyond the stem, which is ordinarily equal to or greater in length than the remaining sealed-in portion of the wire. When the filament is initially installed, the filament is placed with its ends in overlapping relation to these projecting leading-in wire ends and cemented thereto by joints of graphite paste.

After the lamp has been perforated at its tip the pasted joints are easily broken and the old filament ends pulled free by any suitable tool inserted in the bulb and the filament broken up and withdrawn through the small opening in the bulb end. The platinum ends are then scraped or raked free of the old paste, this being ordinarily performed by a tool having a claw foot with a V-shaped opening, which is drawn lengthwise the wires and simultaneously turned to scrape them clean. The new filament having been inserted, also through the small perforation in the end of the bulb, and its ends held in juxtaposition to the platinum ends by one tool, a second paste-carrying tool is inserted and paste wiped around the adjoining ends of the filament and leading-in wires, to secure the new filament in place.

Minor Power House Economies.

There are very few power houses where strict vigilance on the part of the operators will not oftentimes result in startling economies. So many joints are susceptible to leakage, and this leakage so hard to detect by observation, that the manager is not aware of the constant losses taking place, unless a systematic search for these is instituted. Mr. R. M. Jennings, in a paper recently read before the Alabama Light & Traction Association, pointed out many sources of losses which might be avoided. As the greatest possibility of wasting or saving fuel lies in the boiler room, he says it is there that the practice of economy should begin. The boiler setting should be carefully examined for cracks or leaks which permit cold air to enter, since these not only reduce the draft, but the air cools the boiler as well. Leaks are more likely to be found around the breeching where it enters the stack, if it be a brick one, or if an iron one, around the bottom where it is set on the base or foundation; there may sometimes be found an opening an inch or more clear around where the mortar, cracked by the heat, has fallen out. Broken or warped grate bars are a source

of waste, because every time the fire is stirred a quantity of good coal drops into the ash pit and the loss in this manner would soon pay for new bars. Inasmuch as soot and scale are poor conductors of heat, their presence in the boiler should be carefully guarded against.

Steam traps and blow-off valves are apt to leak and are frequently neglected. If the steam from several boilers is blown into the same line an extra valve should be put on to use only when some of the others begin to leak. As this valve is used only occasionally it will remain tight for a long time. It is difficult to say which is responsible for the greatest amount of waste, a poor fireman or the poor condition of the boiler settings and accessories. A very efficient check on the firemen is a recording steam gage. This registers the steam pressure and is a silent and reliable witness and a ready reference, at any time. It is not only a check on the fireman, but on the engineer as well. In small plants where the fireman has duties other than firing to perform, a good damper regulator is an excellent adjunct, as it will keep the steam pressure with 2 or 3 lb. of constant. These devices are worth more to a small plant than to a large one, as in the latter the firemen are obliged to remain at the boilers all the time and so can regulate the draft by hand.

No positive rules for firing are given on account of differences in fuel, draft and methods of firing. Where the coal is hand-fired, the fires should be kept from 4 in. to 6 in. thick, the grates evenly covered and no holes or dead spots whatever allowed to exist. If run-of-mine is used, the large lumps should be broken to about 3 in. or under in size, as the fires can be run more evenly with small lumps. If the large lumps are used it is hardly possible to avoid having holes in the fires. Most of the coal should be stirred very little from the bottom, no matter if it does not look bright under the grates, if the fires are not kept too heavy there will be only a thin layer of ash on the grate, and this is not sufficient to retard the draft to any great extent. When a slice bar is used, it should be run on top of the grate, and the fire lifted a little but not pulled up clear through, because by doing so the clinkers are mixed through the coal, and in a short time it is so dirty that the fire cannot be cleaned without pulling it all out. When it is necessary to break up the fire on top a "devil's claw" should be used, and when doing this, oftentimes, clinkers can be pulled out.

Mr. Jennings emphasizes the fact that the fires must not be run too heavy, as with a light fire it can be cleaned as is necessary. Firemen coming on their watch, on the peak of the load, oftentimes pull out about half of the coal that the man on the previous watch had left in, and have a comparatively easy time keeping up steam. This was done in a plant where there were seven different firemen, and only two out of the seven could keep up steam on the peak of the load. The coal, if very fine and dry, should be sprinkled with water, as this prevents the fine particles from being carried up the chimney and helps it to coke. Water should be kept in the ash pit at all times. This not only keeps the grates cool, but burns the coal cleaner.

In looking for places to increase economy in the engine room one finds that while the engines are apparently running economically there are numerous leaks. The piston rings may be broken or badly worn, so that great quantities of steam leak by; the steam and exhaust valves improperly set, or worn and leaking badly. The matter of setting the valves is a mystery to some people. They think, as did the manager of a small plant for whom the author did some work, who, when told that the valves required setting, said that he could not see what difference that made, as all the steam that went into the engine had to come out again. That it did make a very decided difference this man found out after the changes were made.

Mr. Jennings told of being called upon to inspect a small lighting plant that had a 150-hp. high-speed engine and a 50-kw generator. The engine was built to run at 300 r.p.m. and was being run at about 210 r.p.m. After experimenting with the engine and not being able to improve the conditions without considerable expense, the owners were advised to buy a 150-hp. second-hand Corliss engine which was being replaced by a larger one. This they did, with the result that the coal consumption was cut nearly 40 per cent.

Oil filters should be properly looked after and cleaned and new filtering matter put in at frequent intervals. The pipes that are used for drawing off the water should never be connected directly with the sewer, as the person attending the filter is apt to start it running, leave it to do something else and forget it until considerable oil is lost. It is better to draw the water into a pail; this requires a little more time, but under average conditions is safer. A very successful device for saving oil and reclaiming waste or rags is the oil and waste saving machine. It is operated by steam on the same principle as the steam turbine, and one in use in Mobile, Ala., reclaims about 60 per cent of the wiping rags, and together with the oil, the saving amounts to about 60 cents a day, or $219 a year, so that the machine paid for itself in less than a year.

To obtain best results in a power house frequent tests are necessary. In making these a watermeter, draft gages and thermometer and a good platform scale should be available. The thermometer should be left in the boiler-feed line all the time and the draft gage used often. The coal must be analyzed and if the plant is a large one it would pay to buy a set of instruments for this purpose. It is assumed that watt-hour meters are used so that the total output of the stations can be obtained. In making these tests it is not necessary to employ a high-priced engineer. The regular station force can do the testing.

If the city water is used for the boilers, the water meter already on the line can be used to measure the water. If there is no meter a piece of pipe and valve should be placed in the bottom of an oil barrel, a 1-in. hole bored 2 in. or 3 in. from the top, the barrel placed on the scales and filled with water until it runs out this 1-in. hole at the top, then all that is necessary is to keep track of the number of barrels used and an accurate record of the amount of water evaporated may be thus obtained. Of course, this barrel must be placed over another connected to the pump. The coal and ashes must be weighed, and the superintendent or manager should watch the scales very closely, as it is quite easy to weigh a barrow full occasionally and guess at the rest.

By making a test occasionally a record to go by is secured and the engineer and firemen called to account. The best time and method for cutting in and out the engines and boilers can also be determined. It is undoubtedly cheaper to operate engines and boilers at an overload of 25 per cent or more for a short period than to cut in more units. Care must be taken, however, that these periods are not too long. It is the practice of some plants, where two or more boilers are fired during part of the day when the extra boilers are cut out of use, to have the valve open between the idle boiler and the steam main. This should not be done. If a condensing plant, using a closed heater, has a steam-driven vacuum pump it will pay to buy another heater, perhaps of a smaller size, and connect it in series with the main heater. By passing the feed water first through the main heater and then through the second or auxiliary heater, and using the exhaust from the steam pumps through this second heater, the temperature of the feed water will be raised very materially.

If city water is used on a meter, the meter should be read every day when the station meters are read. Then if the water consumption increases leaks should be looked for, and a place where a leak will sometimes occur is in the closed water heater. This can go on for a long time undiscovered unless checked by daily readings of the meter.

Coal and ash conveyors may perhaps be too expensive for the smaller plants, but oftentimes a light rail, narrow track [illegible] may be installed cheaply and be a labor saver.

One does not hear much talk [illegible] in the office because the [illegible] [illegible] [illegible] [illegible] trained for their positions, and yet it is not uncommon for a manager to pick up the most ignorant man he can find for a fireman, turn over to him 200 or 300 tons of coal at a time, and virtually say to him, "Here, take this and fire it up the chimney as fast as you can, and when it is gone, tell me and I will get you more."

Investigation of the Heat Losses in an Electric Generating Station.

An inquiry originating from Blackburn, in 1903, showed that the average coal consumption of 34 principal generating stations of the United Kingdom was about 7.7 lb. per unit generated. The figures ranged from 3.6 to 15 lb., Blackburn standing at 10 lb. Rough tests on the various sections of the plant resulted in considerable rearrangement. The steam-pipe system was overhauled and more effectively drained, and steam separators and driers were in consequence dispensed with. Engine stop-valves were, where possible, attached directly to the main steam pipe. The steam ring was discarded, and generally the effective heat-radiating surface was greatly diminished. Better fitting boiler dampers were provided, the condition of the brickwork was improved, and the whole process of combustion was more thoroughly controlled by the institution of flue gas analysis. These and similar alterations occupied about three years, and the fuel consumption fell during that time to about 6 lb. of the same coal per average unit generated, a reduction of 40 per cent. Further progress being imperative, it was decided to conduct tests covering the whole operation of the works, viewing the losses peculiar to each part of the plant in their relationship to each other and to the whole, and arrangements were made, and apparatus devised, for their prosecution.

After isolated trials of the various types of apparatus had proved their reliability, simultaneous tests were arranged, of a duration long enough to embrace all conditions of operation met with in routine work. A very complete description of the tests was given in a paper by Mr. F. H. Carson, presented recently before the Institution of Civil Engineers, from which these notes have been taken, as showing the methods followed in a large British station to detect the various losses likely to occur in such a plant.

The Blackburn understanding comprises two adjoining stations of 2300 kw capacity each, containing 12 mechanically-fired Lancashire boilers, six fitted with superheaters; 15 high-speed engines driving generators from 60 to 775 kw in size, controlled from three switchboards; steam piping 3 in. to 13 in. in diameter; ejector and jet condensers fed from an overhead water tank above the boiler house; low-speed, steam-driven feed pumps; four batteries of economizers, totaling 1504 tubes; two chimneys, 150 ft. and 250 ft. high, respectively. The tests covered during 168 consecutive hours the combustion of about 230 tons of coal, the evaporation of 3.376 million pounds of water, and the generation of 99,295 kw-hours. The net results show a consumption of 5.15 lb. of coal, and a total evaporation of 33.9 lb. of water per average unit.

Observations have been taken half-hourly of the rate of evaporation, and of the temperature of the feed water at the feed tank and the economizer inlets and outlets; of the chemical composition and temperature of the gases in boiler and economizer flues; of the temperature and pressure of steam supplied to and discharged from the engines; of the temperature and quantity of the injection and discharge water of the condensers, and of the kw-hours generated. Some of these data have also been obtained by using recording apparatus.

The principal subdivisions into which the trials have fallen are: Fuel selection; estimation of moisture in coal; determination of calorific value; flue-gas analysis and measurement; evaporation of water and distribution of steam; steam consumption of auxiliaries; steam consumption of main engines, and measurement of output.

Fuel selection has been effected after comprehensive trials, involving calorimetric determinations and actual working test of various fuels. The calorimeter indication has been used only as a preliminary guide, supplemented by practical trial under working conditions. As a means also of ensuring uniformity of supply of fuel, the employment of the calorimeter has been largely discarded, more reliance being placed on observation of the coal in actual use. To exhibit the results quantitatively, the calorimetric determination of the heat value of the coal has been adopted.

Every load of coal entering the works is sampled at the weighbridge. All samples, roughly 1 lb. weight each, are mixed at the end of the day, and dried, the loss of weight being approximately a true statement of the moisture contained. Periodical tests have been applied to check the accuracy of the method, and have shown that some water, about 1 per cent of the weight of the sample, still remains. With this correction, the moisture can be estimated by these means with close approximation, and uncertainty as to the efficacy of the process is overshadowed by the doubt accompanying any calculation of the qualities of the whole from those of a smaller part.

In the determination of calorific value, the Thompson calorimeter has been modified for the removal of certain liabilities to inaccuracy existent in its original form. Oxygen supply from a gas cylinder has replaced that from potassium chlorate and nitrate, rendering combustion more controllable and securing better transference of heat to the water. Electric ignition has ensured thoroughness of combustion, and external silvering of the outer vessel has reduced radiation error. The mean calorific value from 73 tests of the dried fuel is 13,180 lb.-Fahr. units per pound, or, allowing for moisture, 12,310 lb.-Fahr. units per pound of the coal as fired.

The chemical constitution of the flue gases has been estimated by a Krell CO_2 recorder and by the Orsat apparatus. Considerable difficulty has been encountered in the selection of truly average sample gas, and a large number of tests have been made to ensure certainty of its representative character at all times. Numerous test holes have been drilled in the flues and samples from one point compared with those derived simultaneously from another. Other difficulties have arisen from the type of analyzer employed. After trial of varied arrangements, all such troubles appear to have been surmounted, and the correctness of results has been proved by confirmation of the Orsat apparatus.

Some doubt is suggested of the validity of computing the specific heat of the gases from that of their several constituents, and also of assuming the quantity to be independent of change in temperature and pressure. In the inquiry this course has been followed, any error resulting therefrom being probably exceeded by possible uncertainty of the chemical analysis. Four certified mercury pyrometers, one of the recording type, have been used for observations of temperature.

The fed water has been registered by a Siemens watermeter in the pump suction-pipe, the instrument being tested daily on the pumping, at various rates, of a measured quantity of about 2000 gal. Errors of the meter, due to the presence of air vessels, were encountered, but were obviated, and the half-hourly record of the meter, corrected by the error curves, may be accepted with confidence. The water lost by leakage and by blowing-down of boilers has been determinable by direct test, and the radiation loss by shutting off all engine valves and applying still tests of 10 hours' duration for the measurement of condensation. This may be inaccurate, for in practice the steam is superheated, but it has been preferred to results obtained from attempts to derive the figure from the fall in temperature accompanying the flow of a known weight of superheated steam.

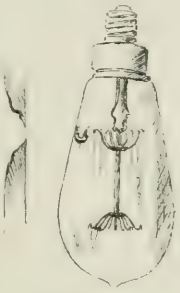
The tests for steam consumption of auxiliaries cover the steam used by furnace grate-jets, by feed pumps and by apparatus of domestic character. The first of these has been arrived at by feeding all jets from one boiler and noting the rate of evaporation; the second, by condensation of the exhaust into a known weight of water at various speeds of pumping, and the third, by frequent direct tests.

The steam consumed by the main engines is deduced from the increase in temperature of the condensing water, the quantity of which has been measured. The accuracy of this method rests upon dryness of the exhaust steam, which appears to be indicated by thermometers and mercury gages fitted to the engine exhaust. All electrical energy used for whatever purpose has passed through meters calibrated to 2 per cent accuracy.

LETTERS ON PRACTICAL SUBJECTS

PECULIAR ACCIDENT TO A TANTALUM LAMP.

The following account of a peculiar accident to an 80-watt tantalum lamp may be of interest to your readers. Coincident with a stroke of lightning, which blew the primary fuses, there was a loud explosion at the lamp and when service was restored the lamp failed to light. Upon examination, a crescent-shaped hole was found in the glass, which was evidently made from a force acting from the inside outward, as the hole was broken (not burned), while the sharp edges were broken away on the outside as shown in the sketch. The glass stem was broken away on each side at the parts where the platinum connecting wires are located. In the bulb were about enough pieces of glass to replace one of these broken portions, and the inference is that the piece of glass from the other side was shot away from the stem with such force that it passed through the bulb, making a clean hole with only a small crack on either side of it, as shown in the sketch.



DAMAGED LAMP.

NEW YORK. S. W. BORDEN.

DISMANTLING A LARGE STEAM ENGINE.

The task of tearing out a large steam engine is never an enviable one, but when the engine must be handled so that it may be erected again, the work becomes much more exacting. Care must be taken to remove each nut without straining the threads or springing the bolts. Every pin and key must be carefully removed and replaced either in its proper place or in some convenient packing box in such a manner that the article may be readily produced when the engine is to be reassembled. Sometimes everything goes well until the workmen arrive at the engine pulley. If this part is of the solid variety, and well keyed at that, the job sometimes gets the better of the man and the pulley goes out with the shaft and stays on the shaft until the engine is again set up. If the engine is a very large one, with a built-up pulley, it is impossible to leave the pulley on the shaft. In fact, the pulley itself must be taken to pieces, and here is where many a mechanic meets his Waterloo.

The several segments of which the pulley is composed are fastened together by means of links, dovetail anchors or similar articles. These links or anchors, whichever may have been used, have been put in place while hot and the contraction of the steel of which they are made has drawn the pulley segments very closely together, indeed. Likewise the bolts which clamp together the pulley hub have been screwed tight while hot, and the tightening which took place during the cooling of the steel bolts can only be understood by a man who has tried to remove these links or bolts. The bolts are comparatively easy to loosen, but not so the links. There is no way of getting under the links for they fill the cavities in the rim, in which they are imbedded. This, together with the fact that each link is pulling the rim sections together with a force of 15,000 lb. to 20,000 lb., gives an idea of what must be overcome in order to loosen each link or anchor from its hold upon the pulley-rim segments. Sometimes the mechanic drills some holes in each link and drives wedges in the holes until the links break. This removes the links, but new links must be made before the pulley can be reassembled. Frequently this is the quickest and cheapest way of getting the pulley segments apart, but when a man has taken a contract to dismantle the engine and reassemble it in its new position, he hates to break good, well-fitting links for the privilege of making and fitting new ones.

The writer has twice succeeded in loosening the links by building a charcoal fire against them as they remained in position in the pulley-rim. A plate-iron ledge was clamped to the pulley just below each link, and some loose bricks formed the semblance of a fire-pot around each link. Charcoal was piled into each fire-pot and ignited. When compressed air was available, some of it was piped into each pile of charcoal and the intense heat soon made the steel link hot enough to permit of its removal from its seat in the pulley-segments. When no compressed air was available, a smith's portable forge was placed convenient to the pulley and air was supplied to the fire-pots through lengths of garden hose which were in turn connected to the forge blower through steam pipes and fittings. When it is desirable to get along without even the portable forge, the charcoal may be made incandescent by means of a common blow-torch, such as is used by plumbers for heating coppers and by painters for removing old paint. One of these torches, blowing at full force into a pile of charcoal confined between fire-bricks or by some other adequate arrangement, soon stirs up a most intense fire and will bring quite large pieces of steel to white heat. But one link at a time can be heated with a gasoline blow-torch, while with an ordinary portable forge blower, three or four links can be heated at the same time by using 1-in. pipes for supplying air to each charcoal fire.

Once the links have been heated so they are loose it is an easy matter to pry them out with cold-chisels or pinch-bars; but this must be done very quickly, as also must the heating, for the efficiency of the method lies in heating the link before the segment gets hot. If the metal in the segment is allowed to expand as fast as does the metal in the link, then the latter can never be loosened by the method described. When links removed in this manner are to be replaced, it is well to upset them a little—heating them, of course, for that purpose, before they are again put in place.

Rim-segment links are not the only things which give trouble when dismantling an engine. Stud-bolts are the bane of the mechanic who follows that business. It should be the motto of every machinery designer never to put in a stud or a tap-bolt when a through-bolt can be used. That motto squarely lived up to will save a great deal of trouble to the erector, and to the operator of engines as well. It is a rule which the writer has conscientiously followed for many years, and it always works well.

To remove broken stud-bolts is hard; to break stud-bolts is easy. One will never believe a stud-bolt will break so very easily until he has tried it; and no one will believe that it is so hard to remove a broken stud-bolt until he has tried that also. It is so easy to believe both after one has worked all night at it. If a broken stud-bolt will not come out after a little work with a narrow cold-chisel and a hammer, then it is better to waste no more time on that object, except with a drill. It frequently happens that if a small hole is drilled axially into the stud that a square drift may be driven into the hole with sufficient force to allow the stud being backed out with a wrench applied to the square drift. Sometimes, however, this will not work; then it is better to follow with a larger drill and remove so much of the bolt or stud as will enable its being loosened and broken away without damage to the thread in the hole.

A left-handed drill will often be found of great value for removing broken studs. Soon a drill may exist in the twist variety, but I have never seen one. When a left-handed drill is required, it is usual to forge one of the old-fashioned flat kind, which can be ground either left-handed or right-handed at will. Drilling a hole down into a stud with a drill of this kind is almost sure to loosen the stud, whereupon the left-handed action of the drill causes the stud to unscrew and back out of the hole. One should not try to loosen a broken stud-bolt by heating it. Such action only results in tightening the bolt in its hole. The conditions are exactly opposite to what they were when the anchor links were to be removed.

WILLOUGHBY, OHIO. JAMES F. HOBART.

LOCATING GROUNDS ON UNDERGROUND LINES.

The following methods of locating grounds using only a telephone receiver, exploring coil and source of electricity have been used very successfully in practice by the writer on an underground transmission line where other methods failed. In Fig. 1 the source of electricity, which may be either alternating current or a direct current interrupted by a buzzer, is connected between one end of the line and ground, the other end of the line being left open. No good wire is required, and in this respect the method possesses an advantage over the loop tests, as a good wire is not always available.

The exploring coil is composed of a number of insulated copper wires, the ends being brought out to the terminals of the head telephone receiver. When the exploring coil is brought near a wire carrying alternating current or an interrupted current, a noise is heard in the telephone receiver caused by currents that are set up in the exploring coil by electromagnetic induction. To locate a ground, the exploring coil is passed along as close as possible to the faulty line, starting from where the line is connected to the source of electricity until a spot is reached where the sound in the telephone receiver starts to decrease, and perhaps 10 ft. or 15 ft. further on ceases altogether. The ground will be at the point where the sound starts to decrease. The writer located a number of grounds all within 3 ft. of the actual spot by this method on an underground transmission line about a mile long, the faulty wire being about 5 ft. underground. The exploring coil used was 2 ft. in diameter of circular shape and consisted of about 500 turns of No. 18 insulated copper wire. The wire was kept in place by insulating tape; the ends being brought out to the terminals of an ordinary telephone receiver of 100 ohms resistance. This receiver had a head-gear attachment and could have been fitted with two receivers, one for each ear for use in noisy places.

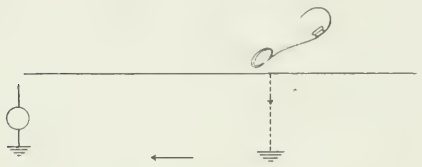


FIG. 1.—TESTING FOR FAULTS.

With this combination a 60-cycle alternating current as small as 1/10 amp in the faulty wire gave a sound in the telephone receiver when the exploring coil is 5 ft. away from the faulty wire. The sensitiveness could have been increased by using more turns on the exploring coil, but it was not necessay as the coil was amply sensitive. The maximum sensitiveness for a given weight of coil would, of course, be obtained when the impedance of the exploring coil equals the impedance of the telephone receiver.

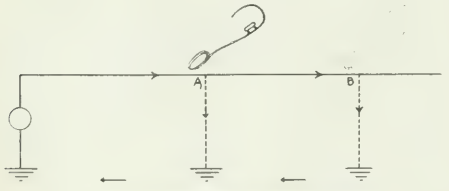


FIG. 2.—TEST FOR DOUBLE GROUND.

This method can be used when there is more than one ground on the line and the loop tests are useless. Fig. 2 shows a line with two grounds on it. In this case, when moving away from the source of electricity, the sound will decrease at the first ground *A* and will cease altogether at the second ground *B*, thus locating both. It is frequently impossible to locate a ground accurately by the Murray or Varley loop tests because of the low insulation resistance of the rest of the line caused by numerous high-resistance leaks to ground. This condition is met perfectly by the induction method of locating grounds as the currents due to these leaks are so small that they do not interfere with the accurate location of a serious ground. In Fig. 3 it is seen that there will still be a small current on the line after the ground is passed, if alternating current is used. This is caused by distributed capacity between the line and ground. These currents gradually get smaller as the end of the line farthest from the generator is reached. This phenomenon does not interfere with the location of the ground, as these currents are too small to be detected by the telephone receiver unless the line is very long and the voltage used is high. In case a high-resistance ground is encountered it may be broken down by applying a high voltage between the line and ground.

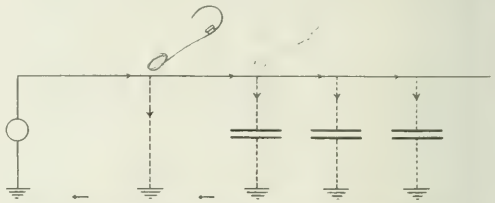


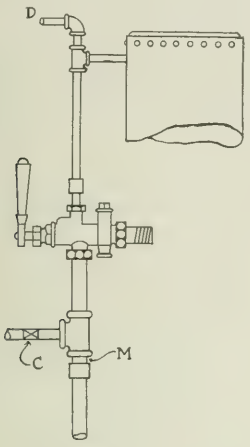
FIG. 3.—DISTRIBUTED CAPACITY BETWEEN LINE AND GROUND.

PHILADELPHIA, PA. FELIX WUNSCH.

CARE OF INJECTORS.

Injectors, like all other devices depending upon the same principles, must have the piping on the suction side air-tight or otherwise they will fail to work. Even when the piping is in good condition the injector may fail, due primarily to the way in which it is connected up or to its location. For instance, the writer has known an injector to fail to start because of the fact that it was placed too close to the side of the boiler. This condition is very likely to exist when injectors are placed alongside boilers of the locomotive type, the injector becoming hot. If the device is removed to some other point where the heat is not so intense it may be made to work. Many cases of failure on the part of the injector to lift is attributable to the fact that the pressure is not in proportion to the lift. The writer recently saw in a power house an injector with a 20-ft. lift which the engineer was trying to start with a steam pressure of 50 lb., without avail. When the steam pressure was increased to 85 lb. the injector operated. The majority of injectors will work about as follows: With water below 100 deg. Fahr. for a 2-ft. lift, a pressure of 25 lb. is required; for an 8-ft. lift, 30 lb. pressure; for a 14-ft. lift, 42 lb., and for a 20-ft. lift, 55 lb. For water having a temperature of 100 deg. Fahr. a pressure of 26 lb. would be required for the 2-ft. lift and 55 lb. for the 14-ft. lift. Injectors are like pumps in this respect, and do not lift hot water as readily as cold water. By having an inlet pipe in the suction and a regulating valve as shown at *C*, hot water may be handled by the injector. In this case just sufficient cold water is permitted to flow to the injector to cool it by the aid of this valve. When working an injector from city water mains or from other water mains under pressure, a regulating valve should be placed in the supply pipe so that the flow of water may be controlled. Injector troubles may be due to too much head or again by too small a supply pipe. In the latter case the injectors will kick back. Another cause for an injector losing its suction is due to a steam pipe connection leading to the pipe that supplies the injector as shown at *D*. When the latter valve is open the vacuum will be lost, and unless the supply pipe is quite large it is best not to have any pipes leading from it since the opening will cause trouble. Steam should always be taken from the dome or from the highest point in the boiler so as to insure dryness. Very frequently small leaks in the suction pipe, as shown at *M*, cause trouble, and these can

be tested by pouring on a little oil while the injector is working or trying to start. Oftentimes failures are due to the strainer being stopped up. Small particles will accumulate until not sufficient water can pass through. Wet steam also causes trouble at times in the working of injectors. If it is possible to raise the water and yet not force it into the boiler, this is a good indication of a leak in the suction pipe, wet steam, or insufficient steam pressure, or the drive tube on the interior of the injector may be stopped up. When steam and hot water issue from the overflow it is an indication that the steam pressure is too high for the lift, or the water too hot, and in



INJECTOR CONNECTIONS.

some instances it may indicate that the suction pipe is clogged. Water that carries much lime in solution will coat the injector so that it will be necessary to clean it frequently. This can be done by taking the parts out and and immersing them in a liquid consisting of 12 parts water to 1 of muriatic acid until the lime is removed. A leaky check valve letting hot water back upon the injector will sometimes prevent the latter from working. The working conditions of the injector will vary, and an injector to suit exact conditions can be had by specifying these to the manufacturer.

LYNCHBURG, VA. C. R. MCGAHEY.

LINE WORK FOR A SMALL LIGHT AND POWER PLANT.

The engineer in a small light and power plant is very often called upon to perform various duties, and generally is required to be the meter man, arc-lamp trimmer, the running engineer for a few hours each day and to look after the inside wiring, as well as to keep his machinery in running order. In fact, he has the supervision of the plant under his control, and all new construction comes under his care and he is required to see that it is properly executed. For the engineer who is called upon to do outside construction and who is not familiar with this class of construction, the following may be of service. Most generally in small plants the direct-current system is used, the best reason being that there is very little territory to cover and the fact that direct current will answer the purpose just as well as the alternating current system in a small town of a few hundred people.

The outside work generally receives the least amount of attention, while, in fact, it should get the same attention that any other part gets and in some cases it should receive the most, for the failure of several plants can be traced directly to bad construction of lines which, of course, prevents good service, besides the cost of keeping them up. Any one that ever did a job of line work will know that unless poles are properly set and guyed they are not going to give much satisfaction. As an example, the writer will consider one mile of No. 0000 solid and insulated wire to be strung on a straight lead by the engineer with the necessary help. The poles selected for this class of work should be about 30 ft. high, with tops about 6 in. or 7 in., and if the poles are bought from some reliable firm they will come very near to specifications and they will be the right taper, which will give them the right size at butts. The poles should be as straight as possible and none of them should have more than two "bellies," that is, sweeps, and should be free from rotten places such as in the tops and butts. They should also be as free from knots as possible and no poles should be accepted that are split at the top. The latter might be used as guy stubs and anchors, but they will not be the right height, for a pole after the split end is sawed off and while there may be a few places that short poles can be used it is not advisable to figure on very many of the short ones.

The cross-arms are next selected and the requirements are for two wires, but there may be in the future demands for another pair of wires and as the cost of using a four-pin arm is not very much more than the two-pin arm it would be advisable to buy the four-pin arm as the cost of taking off the two-pin arm and putting on the four-pin arm would amount to quite a little sum. The arms should be of yellow pine and standard, which would be about 4 ft. long, bored for one ⅝-in. through bolt and for two ⅜-in. carriage bolts and for four 1½-in. pins. The arms are generally painted with one coat of red paint and are ready for use as soon as they arrive on the ground. The pins should be of split locust, and before being used they should be dipped in paint, or gas tar, which prevents moisture from getting in the cross-arms and lengthens the life of the pin and arm.

When the work of digging the holes is begun, the engineer will have to use his judgment to a certain extent, as he will meet with obstacles that would not be met with elsewhere. The holes should be dug large enough to accommodate the butt of the pole without any cutting of the pole and besides it will save time in the long run. The poles should be delivered to the holes and framed, and the arms should be placed in the gaines on the pole before the pole is raised. It is better to put the arms on at the holes than at the yard because the arm will be dragged off as the poles are delivered to the holes.

The best practice in raising poles is to let the men dig one-half the day and raise poles the other half, as the change of work rests the men. Besides, there will be no holes open over night for someone to fall into and bring suit against the company for damages. Should it happen to rain during the night the holes would fill up with water and this would require bailing out, as the poles could never be tamped in with mud and water, and this, of course, would mean an additional expense. The holes should be at least 5 ft. deep on a straight lead, but on the two dead-end poles, the holes should be 6 ft. deep, the poles well guyed, as all the strain is on these two poles, and they should also be the heaviest.

The poles should be well tamped, as here is where the important part of setting poles comes in. The usual way to tamp a pole is for one to shovel and three to tamp, the dirt being thrown in very slowly in order to let the tampers do the proper work. After the pole is tamped to the level of the ground, the dirt should be piled up around the pole to allow for settling. When the poles are set, the arms on one pole should be [illegible] this being that if the wire should break, the strain on the arm would be against the pole instead of the bolt and washer.

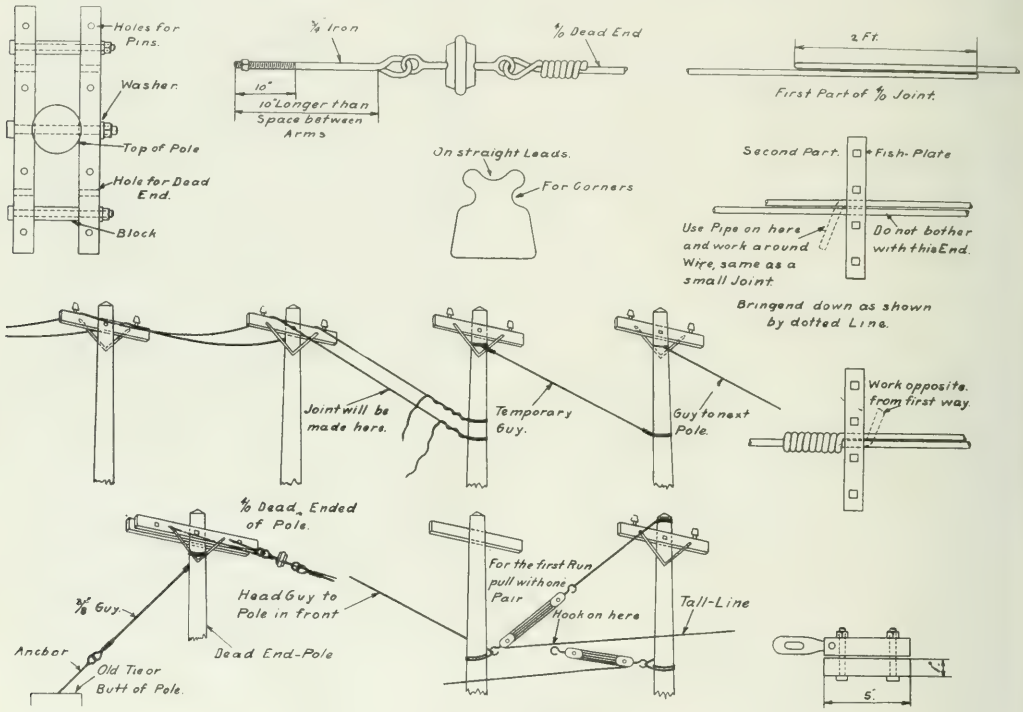
The poles on a straight lead can be set plumb, but on corners and for dead-end poles, the pole should be given a small amount of rake or, as it is better known, slant, and when the wire is pulled up the pole will just about straighten up and be plum. As these are two dead-end poles on this lead it will be necessary to guy them, poles as well as to guy them with ⅜ in. seven-strand guy wire. The two dead end poles should be double-armed, as shown, and two holes bored about 6 in. from the end of each arm to accommodate a dead-end bolt for each wire. These are shown in the drawing and can be made at a blacksmith shop. The line-strain insulator can be bought

from any supply house and four of them will be required for this job. They should be the ones with the large eyes so as to accommodate No. 0000 wire.

After the poles are all up, the wire is now ready to be strung and a running line of about 500 ft. of ½-in. rope will be required, together with two pairs of blocks and tackle, some rope slings and a clamp for holding the wire when it is pulled up. This can be made at the shop, and the illustration shows a clamp as it would look and the method of fastening it to the wire. The reel is first put on horses or blocks so as to allow it to turn freely and a few feet of wire run off. The running line is fastened to this end and the wire is started toward the other end of the line, or the other dead-end pole, as the reel is at one dead-end pole when the stringing is begun. The wire is placed on the cross-arm and the line is taken to the next pole and passed over the arm as in the first place, and this is kept up until the rope is all played out. The wire is then ready for the first pull, which is accomplished by hitching a horse or mule as tight as is necessary. The end of the wire is taken to one of the poles that was guyed and dead-ended around the pole, and after this one is secured the other wire is pulled up and dead-ended in the same manner.

This part may then be tied in with about No. 2 wire if a deep-groove, double-petticoat glass is used and if the mule-ear type of insulator is used a No. 12 wire can be used. The latter type of glass is really the best, as the wire lies in grooves and is held more rigidly than with the other glass.

The other reels are now placed and the wire is run out as in the first case, but before the wire is pulled up two joints have to be made. The method of doing this is shown at the right of the engraving, and all the tools necessary for this are two fishplates, a piece of 1-in. pipe about 4 ft. long, a blow torch and the soldering tools. The neck of the joint should be made to come up closely so as to make a neat as well as a mechanical joint, and after the joint is made it should be soldered and taped and the tape painted with a coat of weather-proof paint



DETAILS OF LINE WORK.

onto the end of the rope and pulling the wire up to where the rope leaves the last pole or where it comes from the last arm to the ground. The rope is then pulled back for another run and the wire is pulled up as in the first case. This method is repeated until the line is completed, and the other wire strung on the opposite side of the arm as the first.

After the second wire is run out the slack is ready to be pulled up and this is accomplished by means of the blocks and tackle. Before the wire is pulled, the two poles where the wires run out must be head guyed as there will be some strain on them, and ¼-in. guy wire is used for this purpose. The method of guying the poles is shown in the lower left-hand part of the illustration.

The ends of the wire should first be dead-ended in the eye-bolts as shown, and then the wire is pulled up as tight as possible on the first pull with one pair of blocks. After the wire is as tight as one pair will pull, the second pair of blocks can be hooked into the fall line of the first pair and the wire pulled The other joint is made in the same maner as the first and the wire is ready to be pulled up from the other end of the line. This is accomplished in the same manner as in the first case, and the wire is deadened around the dead-end pole and tied in just as the other wire was. The wire is now ready to be made up in the dead-end bolts and this is not as easy a job as the first was because these have to be made upon the pole while the others were made up on the ground. Before the wire is loosened from the dead-end pole, a sling should be tied on the top of the pole in front of the dead-end pole and fastened to the wires to hold them from putting all the strain on the ties. This sling can be taken off as soon as the wire is made up on the pole. The method of deadending is shown as well as the use of the blocks on the pole and the method of guying. The two end pins should be used on the cross-arms, as it will throw equal strain on each end of the arm, besides permitting the lineman to get up between the wires more easily.

CHARLESTON, W. VA. C. R. STROTHER

QUESTIONS AND ANSWERS

How can leather belts be freed from oil?

Immerse the belt in naphtha for about 24 hours and then treat it when dry with a tanner's dressing.

How should the neutral of high-potential alternators be grounded? E. N.

The proper method of grounding the neutral of high-potential alternators is through a low ground resistance of possibly not more than 2 ohms. In this manner the maximum potential that can be obtained between the system and ground is fixed at the normal potential that will exist between the neutral of the generator and its phase terminal. Grounding in this manner has met with success in practice in a number of large cities.

Will you please inform me how the enamel used by the makers of electric heating apparatus is made? W. B. M.

The ingredients used by the various manufacturers of electrical heating apparatus for enamel are necessarily secret. A simple mixture suitable for the purpose may be made up, however, of the following: 30 parts natural borate of calcium, 20 parts fluoride of sodium and aluminum and 50 parts feldspar. The coefficient of dilation of this mixture is stated to be 0.00001055, and as the coefficients of expansion of platinum, iron and nickel fall within the limits of this figure, these metals may be used in connection with this enamel.

We are operating an alternating-current, three-phase system having both lamps and motors on the same circuits. Until recently no trouble was experienced with the lamps; but lately the regulation has been very poor. Would balancing the phases remedy the defect? R. A.

The practice common among small stations operating under somewhat similar conditions, is to control the voltage on the single phase to which the lamps are attached by an automatic potential regulator and pay no attention whatever to the potential of the other phases. The motors operating on the circuit will draw the most of their load from the other phases and although the voltage of the three motor legs varies, no bad effects are encountered.

In changing over from natural to artificial gas, and vice versa, what provisions are necessary in order to use either under a boiler? E. P. E.

Natural gas being almost entirely composed of methane or marsh gas, requires much more air to effect its complete combustion than artificial gas. Methane requires two times its volume of oxygen, whereas hydrogen and carbon monoxide, the chief constituents of artificial gas, require only half their volume of oxygen to effect complete combustion. The orifices of appliances burning natural gas are smaller than those burning artificial gas because natural gas is ordinarily carried at a higher pressure. Roughly, about four times as much air is necessary to effect the complete combustion of natural gas as is necessary completely to consume artificial gas.

We have a 50-hp direct-current motor connected to a line shaft from which are run a number of emery wheels. The motor is built for 220 volts and takes 180 amp. at the controller on the first notch. This suffices to start the emery wheels but when full speed is reached only 60 amp. is required. What type of inductor motor is best suited for this work, the supply being 220 volt, three-phase? Can a large motor of the squirrel-cage type rated at 50 hp, even if it were not connected to a line shaft, be started without an auto-starter? E. N. N.

In order to duplicate the work of the 50-hp, direct-current motor driving emery wheels, it would be well to install a 40-hp induction motor, preferably of the wound-rotor type, although a machine of the squirrel-cage type could be used. In starting up a 40-hp, squirrel-cage induction motor from rest, it is very desirable to employ either an auto-transformer or a resistance type starter. With almost no exception [illegible] started from rest by being connected directly across the supply circuit.

Can you suggest some quick means for determining whether lamps returned by customers are still suitable for service? H. H. C.

The proper and best way to judge returned lamps is to install a photometer and to test each lamp, classifying it according to its candle-power. For all practical purposes, however, good results may be obtained by mounting a series of lamps with different degrees of blackening on a white background. Under the series may be placed the measured candle-power of each lamp. The blackening of any lamp may then be quickly determined by locating it in this series which serves as a standard. It has been found that the degree of blackening constitutes a reliable criterion for the depreciation of the lamp. By this means one can readily determine whether the lamps have been returned too early or too late in their lives, and also whether the lamps are much below rating.

We have a 30-kw, 250-volt, 725 r.p.m. direct-current generator, belt-driven by a four-valve, center-crank, automatic engine running at 220 r.p.m. on 115 lb. steam pressure. The dynamo is about 15 ft. from the engine and is driven by a good double belt. The trouble is that there is a decided flickering in the light from this dynamo which seems to be in synchronism with the speed of the engine. We have driven the generator by motor and it then gives a steady light. We have also disconnected the engine and belted the dynamo to one of the fly-wheels so as to run the engine crank shaft and drive the dynamo by its regular drive belt. Under this condition the lamps show no flickering. What could you suggest as to remedying the trouble? A. E. Co.

From the information given there can be no doubt that the flickering of the light is caused by a variation in the rotative speed of the engine. The only method of overcoming the flickering is that which will prevent fluctuation in the speed of the engine. It is probable that the use of a heavy flywheel in connection with the set will minimize the flickering to a satisfactory extent.

What precautions are taken by companies connected to transmission lines to keep down the peaks, where the practice is to penalize on peaks? B. C.

Most of the transmission companies sell electrical energy in blocks of so many horse-power per year, the customer agreeing to pay for energy taken above the maximum at a certain increased rate based upon the highest peak. It is possible to have a motor-generator set with an automatic slip regulator of such a nature as to keep the load taken by the set from the transmission line a constant. Some companies employ steam-driven apparatus, which is cut-in on peak loads. Others feeding railway loads employ rotary converters with a special arrangement of potential regulator and contact-making ammeter so adjusted that a constant load is kept on the machine, other machinery taking the peaks so as to get rid of the peak charge. The device used consists of an ammeter with relays on either side, which control the regulator circuit. A large motor is placed on the regulator so that quick operation of the latter will result.

We are contemplating the installation of a storage battery and wish to know how best to insulate this from the floor. T. A. L.

There are various methods of installing storage batteries, any one of which answers the purpose well. A good job can be made with a double tier of porcelain insulators. The first tier may be mounted on brick piers which are capped with a hard-pressed tile thoroughly impregnated by boiling in paraffin. Triple-petticoat porcelain insulators are then placed on the tile. Longitudinally with the cell and resting on the four insulators are placed two hard-pine sticks, 4 in. x 4 in. x 34 in., well painted with an acid-proof paint. On each of these hard-pine sticks are placed three tiles boiled in paraffin, and resting on these tiles is a second tier of porcelain insulators, which in turn supports the battery tanks. The distance from the floor to the bottom of the tank in a case such as cited will be about 20¾ in. The floor under each cell should be pitched away from the cells at an angle of about 20 deg. This will allow any surface water or dripping from the tank to drain off rapidly. Frequent washing of the floor [illegible] cleaning of the insulators will prevent leakage. The floor should be of glazed tile or vitrified brick with asphalt joints. Cement is attacked by sulphuric acid.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

The Moonlight Schedule in Old Paris.

The first attempt at street lighting in Paris at municipal expense was made in 1667 when the Parliament authorized the installation of 3000 lanterns in streets most notorious for night hold-ups, the source of light being the tallow candles. This introduction of systematic street lighting was commemorated by the issue of a medal stamped with the legend in Latin, "Security and Light." In 1745 the candles in lanterns began to be displaced by oil-burners, with which tin reflectors were used, but this improvement was for some years confined to the more prominent streets. In order to reduce the cost of this more expensive service, the contractors for oil lighting were later given the privilege of a moonlight schedule, which proceeding became the subject of much ridicule and was so lampooned from the stage and by writers of satirical verse that finally, about 1774, all-night lighting was restored. It is scarcely in accord with up-to-date American methods that the moonlight schedule should be largely used in this country after being laughed out of Paris more than a century ago, in a period of the most primitive ideas with respect to street lighting.

Discussion on Tungsten Lamps at Northwestern Electrical Convention.

Following the reading of a paper on "The Commercial Development of the Tungsten Lamp," by Mr. S. E. Doane, chief engineer of the National Electric Lamp Association, at the Northwestern Electrical Association convention, at Milwaukee, Jan. 20 and 21, Mr. H. C. Sterling, of New London, Wis., inquired as to the changes which had been made in manufacture to permit the lamp to be used in other than a vertical position, as specified for the early lamp. Mr. Doane replied that there was no reason why any tungsten lamp should not be burned in a horizontal or angular position if it was properly made. In the early lamps considerable allowance had to be made for shrinkage of the filament, with the result that the filament was hung loose from the upper support. The difficulty with the shrinkage having been overcome, the filaments are now mounted without slack, and are stretched between the supports. In answer to a question, he told of a new 4-cp, 5-watt sign lamp which had just been brought out to operate on 10-volt circuits, in connection with a small 10-volt transformer mounted on or near each sign.

Mr. F. W. Willcox called attention to a 40-watt tungsten lamp in a small bulb which has recently been brought out. This is intended to go in the regular sockets and reflectors used with 16-cp lamps.

Mr. J. H. Harding, of La Porte, Ind., reported having made a number of tungsten installations. He had been very careful as to how these were put in, seeing that they were placed on proper fixtures with efficient glassware. His experience thus far had not been satisfactory with lamps installed in other than a vertical position. On the whole, the result of these tungsten installations had been an increase in revenue. He sells tungsten renewals to consumers at the price they cost the company.

Mr. Ludwig Kemper, of Albert Lea, Minn., said that at first he made a few installations in which the consumers paid a fixed rental and maintenance charge. This was before the lamps were understood, and when the consumers were suspicious of the lamp. Now he sells these lamps at a profit. He does not sell the 25-watt size, as he is afraid of excessive breakages due to the fact that in so many cases they will be used where there is no wall switch.

Mr. O. M. Rau reported that at Milwaukee the practice had been adopted of furnishing tungsten lamps to consumers who would otherwise receive free renewals of carbon lamps, on the basis of 15 cents less than the list price of the tungsten lamp. This 15 cents credit is allowed the consumer because he does not require a carbon lamp renewal where he is using a tungsten lamp.

Mr. Doane expressed the opinion that the carbon lamp would be with us for some time. The output of carbon lamps during the past year, in spite of the tungsten output, was equal to that of the boom year 1906. The carbon lamp would doubtless continue to be used in the numerous sockets where lamps were infrequently used, and where economy was no great object, as well as in cases where breakage would be likely.

Mr. Rau spoke of a large tungsten installation in Milwaukee in which a great reduction in revenue to the company had resulted. He, therefore, felt it necessary to make a vigorous new-business campaign to get tungsten lamps in the places heretofore using gasoline or gas in order to make up for the loss of revenue on some of these existing installations.

Mr. J. G. Boyd expressed the opinion that it was a reflection on the selling ability of a central-station man if consumers were quietly being allowed to substitute lower wattage tungsten lamps for carbon lamps heretofore used. If the central-station man exercised proper diplomacy and salesmanship the light would be increased and the wattage would not be reduced.

Mr. Doane cited the case of a progressive combination gas and electric company which recently found that by the introduction of tungsten lamps its revenue from store lighting installations and the like had been reduced, but the total gross revenue had been increased because of the sign and window lighting which had been taken on as the result of reduction in store-lighting expense.

Mr. C. H. Williams, of Denver, reported that his company (Northern Colorado Power Company) was putting out tungstens on a flat rental basis, plus the regular kw-hour charge. This schedule of rental and maintenance per lamp is as follows: 40-watt, 20 cents per month; 60-watt, 30 cents; 100-watt, 60 cents; 250-watt, $1.50. He did not believe in waiting for the contractor to put in tungsten lamps and cut the company's revenue by reducing the wattage. He further expressed the opinion that the tungsten was the best tool that the central-station company ever had in replacing gasoline plants.

Mr. George Loring talked to the effect that the central station could, if it wished, keep the friendship of the dealers and contractors and get them to talk increased illumination rather than reduced bills.

Central-Station Power Loads in Great Britain.

The current issue of the London *Electrician* contains an elaborate table giving statistics of the power load of 70 British central stations. The data are given under the heads of the trades to which power is supplied, voltage, horse-power connected, total number of motors, largest motor on circuit, maximum demand in kilowatts, method of driving, rates horse-power of steam and gas engines displaced, and the number of isolated power plants at present operating. Glasgow heads the list with a total of 27,000 hp of moters. The Clyde-Valley Power Company makes a return of 14,200 hp on motors connected, and the New Castle & District Company has a total of nearly 9000 hp. The Cork central station has already displaced 1000 hp of a total of 3000 hp of isolated power plant in its territory, and the North Wales Power Company, with a total of 5000 hp connected, has displaced over 3000 hp in engines. The Bradford Corporation has 1478 motors connected, largely in textile and dye works. The Birmingham Corporation supplies 1740 motors employed in the metal, cycle and jewelry trades. Among the

London central stations that of St. Marylebone supplies 474 motors in printing offices, small workshops, etc., displacing 3374 kw of other power, and the Metropolitan Electrical Supply Company supplies 897 motors in ordinary workshops. The enterprising West Ham station has 500 motors connected, which have displaced 4500 kw of other power.

The motor rates vary considerably, ranging from 6 cents per kw-hour to 2 cents per kw-hour, and even less in a few cases. In Glasgow the rate varies from 3 cents to 1½ cents per kw-hour, with a flat rate of 2 cents for restricted hours. In Dublin, where 2000 hp has been displaced by motors, the rate is 2.75 cents per kw-hour. The data relating to the number of isolated power plants at present operating is interesting. In the territory of the Luton corporation, for example, there are 300 gas engines and 250 steam engines. In this territory there are 268 electric motors now supplied. In Reading there are 175 gas engines and here 256 electric motors have been installed.

It is interesting to note that the best showings are made by municipal plants, many of which have vigorously conducted "new-business" departments.

Non-Peak Load at Lincoln, Neb.

Various statements have been published from time to time regarding a remarkable improvement in load factor by the Lincoln (Neb.) Gas & Electric Light Company, due to the securing of load for non-peak periods. The sign and outline



FIG. 1.—OUTLINE LIGHTING AT LINCOLN, NEB.

lighting which this company supplies was one of the principal causes of improvement. It will be interesting to note some of the recent business which this company has secured which will have a tendency to smooth out the load factor still fur-

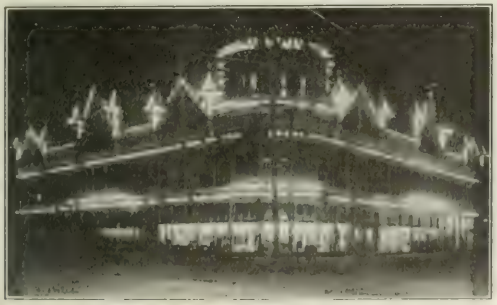


FIG. 2.—OUTLINE LIGHTING AT LINCOLN, NEB.

ther and improve the earning capacity per kilowatt of station apparatus installed.

One large contract for outlining the department store of Rudge & Gunzel, amounting to 30 kw, was recently closed with the agreement that lamps are to be turned on after 6 p. m. only. This brings them off the company's December peak. The com-

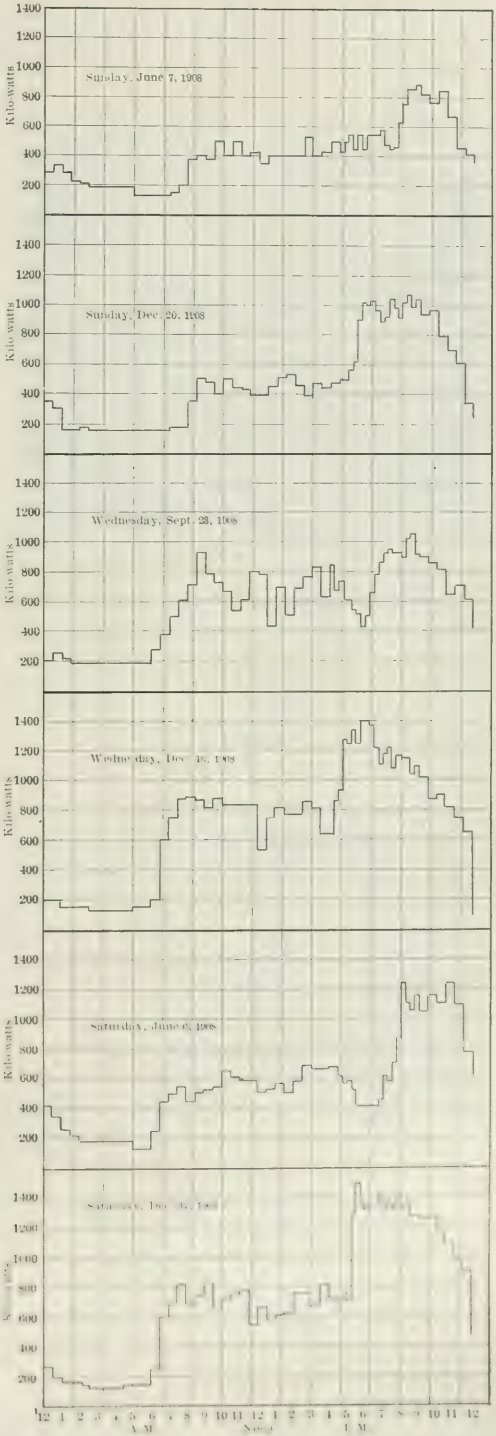


FIG. 3.—TYPICAL DAILY LOAD CURVES.

pany also has an 85 hp load in a factory which it has taken under a contract whereby it can ask the factory to shut down at 5 p. m. Another excellent non-peak contract is with an ice cream manufacturing company which uses 30 hp, 24 hours per day, in the summer. In the winter it will shut down during the peak load.

The principal hotel in town, which has its own isolated plant, uses central-station service from midnight until dusk the following day, paying $100 minimum bill for this service. This is cheaper than operating its isolated plant for such light load. The city hall has been taken on a similar contract, as the municipal street lighting plant which supplies the city hall does not operate during the daytime. In the case of the city hall, however, there is no minimum guarantee, as the ordinary daylight consumption is sufficient to reimburse the company for its outlay.

The output of the station in September, 1908, was as follows:

Power sold to street railway, 90,000 kw-hours.

Direct-current commercial power, 62,000 kw-hours.

Alternating-current commercial power, 30,000 kw-hours.

Alternating-current lighting, 126,000 kw-hours.

Fig. 3 shows the typical daily load curves for different days of the week at different seasons, and indicates the considerable amount of non-peak business the company carries.

The station capacity is 1400 kw alternating-current, and 500 kw direct-current. The latest unit is a 500-kw Westinghouse-Parsons turbine. This turbine is run condensing with power obtained from a cooling tower. The cost of this cooling tower was about $3 per kilowatt. It is 30 ft. high by 10 ft. x 30 ft. It is found that the make-up water required for cooling purposes to compensate for evaporation is about equal to the steam condensed. The performance of this turbine before the condenser was in operation was about 5.7 lb. of coal per kw-hour.

Commercial Department of the Rochester Railway & Light Company.

By William H Stuart

With the consolidation of all the lighting interests in 1905, the Rochester Railway & Light Company started a new business department, employing one solicitor on lighting and one solicitor on motor installations. In October, 1906, the company organized a commercial department to secure, in addition to new business, the good-will and interest of the public. This department is in charge of Mr. F. A. Willard, commercial agent, who has under him seven solicitors. One looks after special heating appliances, two solicit lighting business, three devote their time to motor installations, and one seeks to introduce electric signs. The men are not limited as to territory and make a report of each day's work. In order to secure as much business as possible among the farmers in the district north of the city, one solicitor devotes all his time to them introducing motor-driven pumps for irrigation purposes. Within two years work in this territory has resulted in the installation of about 400 hp in motors. These have replaced windmills and gasoline and steam engines. The company expects shortly to install three separate model pumping installations for this work, each rated at 20 hp. A motor installation which has given very satisfactory service consists of a 150-hp, direct-current motor direct-connected to a turbine pump. The installation is used for pumping water from the Genesee to a large reservoir 120 ft. above the river. The water is used by a local brewery and the motor is controlled by an automatic switch. The greater part of the lighting load comes from residences, stores, signs and outline lighting work. Since its formation, the commercial department has increased the load on the company's system 45 per cent.

One important feature of the commercial department is the method of handling complaints. From the start the company abolished the idea of having the word "complaint" appear in the office, as it felt that the word in itself was a misnomer, in that persons who came to have any matters adjusted were led to believe that the company was going to be harsh and strict. Such a sign also deterred customers from making any suggestions for betterments because they did not care to go to a complaint desk. So the company established an "Information Bureau," where one can tell of his trouble and go away feeling that matters will be satisfactorily adjusted. The men at this desk are supplied with a pad on which are noted the name and

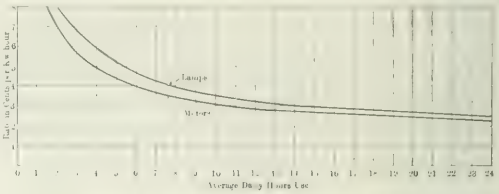


FIG. 1.—ENERGY RATE CURVES FOR LAMPS AND MOTORS.

address of the customer and the nature of the trouble. If the matter necessitates attention from an employee of the company, an order is issued in duplicate and an investigation made. When the difficulty has been adjusted the order is returned to the man who issued it, where it is checked with the original slip and a letter is sent to the original party stating that on such and such a date the company issued an order to investigate the trouble and that the matter had been reported as being adjusted satisfactorily. This letter is sent out by the commercial agent, but no reply card or envelope is sent with it. If the trouble has not been adjusted it will naturally bring forth a letter addressed to the commercial agent. The company is thus certain that every complaint is properly and satisfactorily attended to, and by this means has accumulated a great number of unsolicited replies of which it is quite proud.

The offices of the company are located at 44 Clinton Avenue, North, in a building three stories high, faced with terra-cotta brick. On the main floor is located the bookkeeping, cashier, information, commercial, canvassers and sales departments. On the upper floors are located the executive and engineering offices of the company. The show windows on the street floor are very large and contain an exhibit of either gas

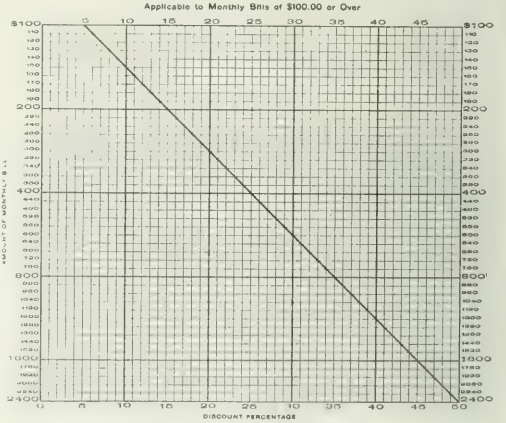


FIG. 2.—DISCOUNT SCHEDULE.

or electric appliances. Sometimes a set display is placed in one of them showing how a storekeeper could dress a window and have it illuminated by electricity. The principal use of the windows is to show the shopkeepers how best to arrange window illumination and what the result of good methods will be. Back of the windows within the office space there is considerable show space allotted to heavy gas and electric appliances. To

the rear are the bookkeeping, information and commercial department offices. On the left-hand side of the office is a stairway leading to the basement, where there is an exhibit of a model apartment. In the four rooms are placed numerous domestic appliances operated by electricity. All the various devices are connected so that a demonstration of them can be quickly and easily made. The apparatus range from an electric piano in the parlor to a washing machine in the laundry. On the main floor is a large sign calling attention to the exhibit. The sign reads, "Do not fail to visit the House Electrical before you go." The company contemplates rearranging this basement space so as to show motors and appliances in operation. At present the various advantages of electric service are pointed out from catalogs and photographs. This general electrical exhibit is looked after by a saleswoman and a salesman, who are in constant attendance. The "House Electrical" has created considerable talk and favorable comment throughout the city. The company believes it has been a great help in the work of introducing electric service.

The company has put out a great many flatirons and a number of the consumers have two or three irons in use. The company found, at first, that a great many irons were returned because their working was not thoroughly understood, and now a solicitor delivers the iron and explains its use. The solicitor also examines the circuits to which the iron is to be connected to see if they are large enough. In this way irons sent out on trial have been retained by the consumer, and the introduction of this home appliance has been greatly facilitated.

The company confines its advertising to newspapers and church and club periodicals. This is done as a matter of policy and also because the results obtained justify it. The advertisements are keyed so that the value of the publication as an advertisement medium may be checked. Advertisements in religious publications have redounded to the benefit of the company and secured an entrée for its solicitors into homes for the purpose of obtaining a new consumer or of selling some new appliance. This same is true of club periodicals. Most of these publications are got out by trade organizations and by advertising in them and extending every offer to help the organizations in their business, the company has gained their good-will and holds it. A man is employed to write these advertisements and to watch the results.

Electric automobiles are very popular in Rochester and as a



FIG. 3.—ELECTRIC HEATING APPLIANCES IN ROCHESTER OFFICE.

consequence the company does a large automobile charging business. Every one of the 670 electric automobiles in use in the city is charged with energy from the company's mains. The company is supplying energy to operate 141 private charging stations.

The company has gone very extensively into the matter of rates and has published a schedule which it believes is the best that it can give its consumers under existing conditions. The company has not only considered its side of the rate question, but has had the consumer's side in view also when drawing up the schedule. The booklet, which gives the rates offered by the company, was drawn up and published on March 1, 1908. The company states that the reason for issuing the pamphlet is to enable any person within reach of the distribution system of the company to determine for himself when and how the com-



FIG. 4.—ROOM OF "HOUSE ELECTRICAL."

pany's product can be used to his advantage. The rates are, of course, subject to supervision of the Public Service Commission of the Second District of New York, with whom the company is in perfect accord.

The base rate is 8 cents net per kw-hour, subject to the following minimum charges:

Up to and including 50 16-cp lamps or equivalent	$1.00 per month
From 50 to 100 16-cp lamps or equivalent	2.00 per month
Over 100 16-cp lamps or equivalent	3.00 per month

A minimum charge of $1 per month is made for each enclosed arc lamp supplied with electrical energy and maintained by the company. When a rate of 8 cents per kw-hour is charged for energy for motors or arc lamps, the minimum charge is determined upon the same basis as the lighting schedule. On the lighting schedule consumers may, at their option, contract upon the guarantee of $10 per month when used for lighting; and in cases where it will work to the consumer's advantage, motors rated at 1 hp or less may (in addition to lighting installation) be placed on the lighting circuits. The lighting schedule may also be used for consumers having a connected motor load of from ½ hp to 10 hp, the consumer guaranteeing a minimum of $5 per month and $1 per month additional for each horse-power or fraction thereof above 5 hp connected to the circuits.

The lighting schedule may also be used on elevator motors, which are rated at one-half the connected load where the minimum charge at the one-half rating does not amount to $10 per month. Motors of 5 hp and under are [illegible] connected load.

[illegible]

may also be used on elevator motors of 10 hp or over, where the guaranteed minimum is $10 per month. Elevator motors of larger size than 10 hp are rated at one-half normal, the rating in no case being less than 10 hp.

ENERGY SCHEDULE FOR MOTORS BASED ON DAILY USE OF CONNECTED LOAD.

Hours' use.	Cents.	Hours' use.	Cents.
1	8	13	2.77
2	7	14	2.71
3	5.7	15	2.65
4	4.95	16	2.6
5	4.35	17	2.55
6	3.93	18	2.51
7	3.62	19	2.47
8	3.39	20	2.44
9	3.22	21	2.41
10	3.08	22	2.38
11	2.96	23	2.35
12	2.86	24	2.33

The rate for charging storage batteries for electric automobiles is 6.3 cents per kw-hour, with a minimum charge of $2 per month. In addition to this the following rates are given to consumers who guarantee a minimum of $12 per month:

For electrical energy used between the hours of 9 p. m. and 6:30 a. m., 4 cents per kw-hour; for energy used between the hours of 6:30 a. m. and 9 p. m., 3 cents per kw-hour additional. From this rate of 4 and 7 cents per kw-hour a special discount is allowed to consumers whose bills are paid on or before the fifteenth of the month succeeding that during which energy was used or for which bills were rendered, as follows:

SCHEDULE OF DISCOUNTS.

$12.00	to $14.99	10	per cent
15.00	to 19.99	12½	per cent
20.00	to 29.99	15	per cent
30.00	to 49.99	17½	per cent
50.00	to 74.99	20	per cent
75.00	to 99.99	22½	per cent
100.00	to 124.99	25	per cent
125.00	to 149.99	27½	per cent
150.00	to 174.99	30	per cent
175.00	to 199.99	32½	per cent
200.00	to 224.99	35	per cent
225.00	to 249.99	37½	per cent
250.00	to 274.99	40	per cent
275.00	to 299.99	42½	per cent
300.00	to 324.99	45	per cent
325.00	to 349.99	47½	per cent
350.00	and over	50	per cent

In places where it is impossible or impracticable to place arc lamps upon meters and consumers wish to operate lamps upon the same schedule as public street lamps, the price for energy is 25 cents per lamp per night when the lamps are located upon private property. If, however, the lamps are located upon public streets and operated in the same way as street lamps, the charge is the same as that for public street lamps to the city.

In computing accounts under the lighting schedule the following figures are taken as the basis in determining the connected load:

4-cp lamp	20 watts
8-cp lamp	32 watts
16-cp lamp	50 watts
32-cp lamp	100 watts
Enclosed arc lamp	550 watts
1 hp motor	746 watts

After the consumer has contracted for energy on the lighting schedule, a careful inspection of the installation is made and a record kept of the connected load, care being taken to note the number and rated candle-power of the various lamps connected. The connected load multiplied by 26 gives the rating of the installation, if the connected load is used one hour per day for 26 working days per month. The meter gives the kw-hour consumption of the consumer for the month and this divided by the rating of the installation gives the hours' use of the connected load from which the rate is determined.

The energy schedule for motors is worked out in the same manner as the energy schedule for lamps, with the exception that in case there is a number of individual motors installed, instead of taking the total horse-power connected, observations are taken from time to time to determine the maximum demand of the consumer, regardless of the number of motors connected. This is used as the demand load which, multiplied by 26, gives the rating of the installation and the rate is determined as before. A varying rate of discount has been established to apply on bills amounting to $100 per month and over, as shown in Fig. 2.

Consumers who obtain their supply of electrical energy only during the months from March to October, inclusive, in any year, upon the guarantee of $100 gross per month, or over, receive a reduction in rate during these months of one-tenth of a cent per kw-hour from the regular rates; but should the consumer decide to use energy during the four remaining months he is charged two-tenths of a cent per kw-hour in addition to the regular rates.

Consumers who purchase their entire lighting equipment, renew their lamps and trim their arc lamps may consolidate both their lighting and motor load upon one meter and operate under the schedule for energy for motors and have the discount apply to their total consumption.

In explanation of the lighting rate attention is called to the fact that after the fifth hour the consumer pays but 1.8 cents per kw-hour for each additional unit of energy. The following table shows how the rate is worked out and applied:

Hour's use.	Actual rate in cents per hour.	Average rate in cents per hour.	Total amount in cents per hour.
1	8	8	8
2	8	8	16
3	4.4	6.8	20.4
4	3.2	5.9	23.6
5	2.5	5.22	26.1
6	1.8	4.65	27.9
7	1.8	4.24	29.68
8	1.8	3.94	31.52
9	1.8	3.7	33.3
10	1.8	3.51	35.1
11	1.8	3.36	36.9
12	1.8	3.22	38.7
13	1.8	3.12	40.5
14	1.8	3.02	42.3
15	1.8	2.94	44.1
16	1.8	2.87	45.9
17	1.8	2.81	47.7
18	1.8	2.75	49.5
19	1.8	2.70	51.3
20	1.8	2.62	54.9
21	1.8	2.58	56.7
22	1.8	2.55	58.5
23	1.8	2.52	60.3
24	1.8		

A study of this table shows that a consumer can obtain such additional energy as he may desire (over and above that required for his regular and necessary lighting) for electric signs and other forms of display lighting at a low rate, provided that this additional consumption does not increase his maximum demand, and that the energy so used for electric signs or other special lighting is not consumed during the regular and ordinary lighting hours.

The low rates provided for long-hour burning are made possible by reason of the fact that in determining the cost of the production of electrical energy, the charge for investment and depreciation is based entirely upon the maximum demand, or amount of generating and distributing apparatus necessary to furnish such demand. The only costs which enter into the expense of long-hour lighting are the actual generating costs.

The rates for three-phase, 25-cycle, 11,000-volt service, which is only sold in blocks of 100 hp and over, are as follows:

For 100 firm horse-power	$41 per horse-power per annum
150 " "	40 " " "
200 " "	39 " " "
300 " "	38 " " "
400 " "	37 " " "
500 " "	36 " " "
700 " "	35 " " "
1,000 " "	34 " " "
2,000 " " and over	33 " " "

In order to take care of varying loads, the consumer agrees to pay for the excess demand above the "firm" horse-power contracted for on the basis of the average maximum five-minute peaks, as shown in excess of the firm power purchased each month. The consumer may increase the amount of his firm power purchased at his option. The consumer purchases energy at approximately 11,000 volts, delivered at his premises, and supplies the necessary switchboard and transformers and arranges for sufficient space to accommodate the company's meter.

The sole duty of the commercial engineering department is to assist consumers in obtaining the most economical and satisfactory system of lighting and motor service in their stores and factories and operating the necessary machinery at the lowest possible cost, as well as to obtain the most efficient type of apparatus. In other words, the situation as outlined makes it primarily the duty of the department to give the consumer the most it can for his money.

INTERIOR WIRING AND ILLUMINATION

Wiring of Modern Mills Without Regard to Code.

It is not uncommon for mill owners who have erected modern mills with every facility for fighting fire to carry their own insurance. In the wiring of many of these structures, therefore, the Code is sometimes disregarded in order to obtain an installation free from hazard at considerably reduced cost. A case of this kind recently came to our attention. The owners of a large lumber mill in the South decided that in view of its fireproof construction, the building being built of reinforced concrete, it would be economical for the company to carry its own insurance. This freed it from the necessity of observing the strict regulations of the fire underwriters which are designed to give absolute safety under average conditions. Under the ideal conditions existing, obviously a safe job could be installed at less cost. The size of wire was, therefore, determined purely by considerations of drop and safe carrying capacity, and without reference to the capacity of the fuses necessary to give best protection under starting conditions of the motors installed, which are of the induction type. All wires are run in conduit, but no cut-out boxes are installed. Wherever it was necessary to make a tap, a solderless connector was used. By this means a very reliable, efficient and at the same time convenient system of wiring for a mill of this kind was obtained and a considerable saving effected owing to the elimination of numerous junction boxes and excessive lengths of wire, which would otherwise have been required if the Code were followed.

Lighting the Facade of the Denver (Col.) Electric Offices.

Among the many excellent appropriate lighting displays during the recent Christmas holidays in Denver was the roof sign of the Denver Gas & Electric Company, erected especially for the occasion. The letters were brought out in red and green effect, and were richly artistic. The four corners were com-



CHRISTMAS AND NEW YEAR'S GREETING, DENVER, COL.

posed of holly leaves, which the night picture herewith fails to show adequately. The various arches over the windows were also in the green and red effect and gave much strength to the general display. Probably some curiosity may be felt about the ornament on the corner of the building on the roof. This is an Egyptian vase of correct design. Steam is introduced at night, giving the appearance of incense clouds ascending from it

Difficulties of Electrical Contractors in Small Towns.

An unfortunate condition exists with regard to electrical contracting in a great many towns of 20,000 inhabitants and under. In fact, this condition sometimes extends to much larger cities. This is indicated by the statements which frequently are made by central-station managers at State conventions, to the effect that they have been forced into the electrical contracting business because of the lack of a reliable electrical contractor in the town. It cannot be denied that there is a large number of irresponsible wiremen in the electrical contracting business in a small way, and that the electrical contracting business is in many cases not on the sound and permanent basis that it should be. There is certainly a demand, and a steady one, for electric wiring and supplies in every town where there is reasonably good electric-light service.

Why should the electrical contracting business in many cases be in such an unsatisfactory condition as to the permanency and responsibility of those engaged in it? The condition is probably due to a number of things. One of these is the lack of proper inspection of electrical work in many cities and towns.

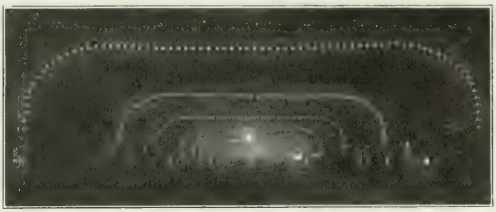
For example, a responsible, conscientious contractor will bid on a piece of work on the basis of installing it in a thorough, workmanlike manner, according to National Electrical Code requirements, but there are usually enough irresponsible wiremen in the neighborhood to offer to do the work for a considerably less sum. They will seldom count on doing the job according to Code requirements, and, not being very good business men, frequently figure too low even if they count on doing their work properly. Such men seldom continue in business long, but there are enough of them to have a demoralizing influence on the whole trade, because after one man has made a failure, there are always more to take his place. These conditions have driven many of the smaller central-station companies to do their own work. Better inspection would help to eliminate this condition. Nevertheless, there are always enough people who appreciate good work to support concerns who do it, and the possibilities of the contracting and supply business in the smaller towns have probably been overlooked by some capable electrical men who are at present engaged in less profitable work. Conditions have been rapidly changing as regards the public demand for electric wiring and supplies the past three years. The awakening of the central-station industry and of the manufacturing interests connected therewith to the importance of more active efforts to push for business would have a stimulating effect all along the line. Electrical conveniences are now much more thought of and used by the general public than three years ago, and conditions are constantly improving.

Arch Lighting at Appleton, Wis.

The city of Appleton, Wis., one of the first to enjoy electric lighting by incandescent lamps, has lately become an exponent of the arch method as applied to the streets, and as illustrated in the accompanying view of a main thoroughfare, College Avenue. There are 25 of these arches built of gas pipe. The supports on each side of the streets consist of 2½-in. pipe, set 3 ft. in the ground, grouted with cement. The 2½-in. pipe extends a distance of 10 ft. above the sidewalk. From the top of the [illegible] that the center of the span is 23 ft. above the street grade, the street being 90 ft. in width from curb to curb. As a special factor of safety a 5/12-in. steel strand is used as a support, fastened to the building on each side of the street with a turnbuckle, placed on one side near the building so that the sag is easily taken up at any time. To this cross span the arches are made fast in six places, and are constructed of galvanized iron wire.

The arches are placed 75 ft. apart. Each arch has 75 8-cp incandescent lamps, with a hard-rubber socket. All the connections are soldered and taped, the work being permanent in every particular, the cost being $35 per arch erected.

The designing of this installation was done by the Langstedt & Meyer Construction & Supply Company in conjunction with the Wisconsin Traction, Light, Heat & Power Company. That this style of construction and erection is perfectly secure and durable was demonstrated before the arches were in place a week. Two wind storms of unusual violence made no impression on any of the arches, although numerous signs and chimneys were demoralized by the high winds.



ARCH STREET LIGHTING AT APPLETON, WIS.

The cost of this installation was paid by subscription, each merchant paying a pro rata in accordance with the number of feet of frontage owned. The current consumption is paid for by the Merchants' Association at the following rates: Twelve cents for the first 100 kw, 10 cents for the next 100 kw, 8 cents for the next 100 kw, 6 cents for the next 300 kw; all over this amount at a rate of 4 cents per kilowatt, with a 5 per cent cash discount. These arches have been used since Dec. 1 four hours each evening, the intention being thereafter to burn them only two or three or four nights a week as may be decided later.

One of the interesting developments of this work was the illumination of a large tree alongside the arches, giving the effect of a huge Christmas tree. This tree is a very large elm that has cast its grateful shade over the thoroughfare many a summer, covering a large area. The ball branches were now festooned with incandescent lamps, to the top of the branches. The result obtained was very pretty and effective.

Indirect Lighting in a Stationery Store.

A system of indirect lighting known as "Eye Comfort," the reflectors and fixtures for which are made by the National X-Ray Reflector Company, of Chicago, has been installed in a number of prominent places in Chicago with notable results. The new offices of the North Shore Electric Company, in the Home Insurance Building, have been equipped throughout with this system of indirect lighting, in which the light is obtained by reflection from any light-colored ceiling. The fixtures are equipped with tungsten lamps. An ordinary lamp with a special shape of "X-Ray" reflector giving the proper light distribution without streaks and shadows on the ceiling is employed. In the accompanying cut is illustrated the interior of the Hartzell, Lord Company's stationery store, on La Salle Street, in Chicago. This store is 30 ft. x 30 ft., and contains four two-light fixtures, each fixture having two 100-watt tungsten lamps. The total wattage is, therefore, 800 and the total square feet area 900. The store was lighted before with exposed clusters of lamps which produced such a glare as to annoy clerks and customers and make the illumination on the goods seem much less than it actually was because of the blinding effect of the exposed lamps.

Wiring Residences at Small Cost.

By Thomas W. Poppe.

In the average town of 5000 inhabitants where the profitable increase of business is a problem to the central-station manager, the wiring of finished residences is a cause of considerable worry. The wiring must be acceptable to the Board of Fire Underwriters and suitable to the owner of the building. Hence care should be taken to conform with the rules as formulated by the underwriters and to avoid damaging any part of the decorations. Should any damage be necessary to the successful termination of the work, care should be so taken that it can be covered by the fittings to be used, as fixture blocks, canopies, switch plates, etc.

While employed by a central station in a town of the above size, the writer had occasion to wire quite a number of residences, some of which were extensively decorated. The prevailing type of building in this town was frame, and the following is a description of the general method of wiring which necessarily had to be done at a low cost to obtain the business.



INDIRECT LIGHTING IN A STATIONERY STORE.

As a typical example, the writer will consider the wiring of a two-story and cellar building containing 12 rooms on the first and second floors and three divisions in the cellar. The owner of the building desired the lamps placed as follows: One lamp in each of the three divisions comprising the cellar; on the first floor a three-lamp electrolier in the parlor, library and dining-room, a two-lamp electrolier in the kitchen, and a drop lamp in the pantry. In the pantry a switch was to be placed to control the three lamps in the cellar. In the hall on the first floor an electrolier containing one lamp was to be placed on the ceiling over the newell post. This lamp was to be controlled by a switch placed in the corner of the hall near the door leading into the parlor and the one leading from the street, so as to be within convenient reach of each doorway. On the second floor a bracket containing one lamp was to be placed in each of the five bedrooms and in the bathroom. At the angle of the hallway a drop lamp consisting of flexible cord and socket was to be placed so as to fairly illuminate the entire hallway.

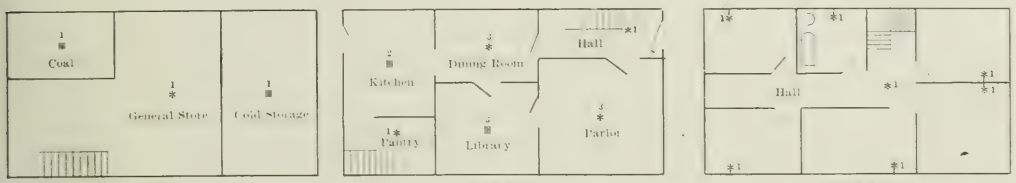


FIG. 1.—PLAN VIEWS OF THE VARIOUS FLOORS.

Fig. 1 will give a general idea of how the rooms and electrical outlets were located. The number of lamps to be installed was 24. As the rules of the underwriters allow only 660 watts on one circuit, it was necessary so to divide the outlets as to allow each circuit to carry its full allowable load of 660 watts, or 12 16-cp lamps. It was decided that the cheapest way, time and material considered, was to place the outlets in the parlor, library, dining-room, hall and the two brackets in the front bedrooms on the second floor on one circuit and the balance of the outlets throughout the house on the second circuit.

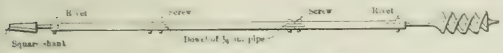


FIG. 2.—EXTENSION AUGER.

As the overhead alternating-current system supplied the town, the service mains were brought into the attic, where the service switch, fuses and meter were placed. The location of the brackets in the front bedroom were then determined, and a board removed from the attic flooring. This board was directly over the partition upon which the brackets were to be placed. Through the ceiling plate, which is generally a joist 2 in. x 4 in. (Fig. 4), four holes ¾ in. in diameter were bored. Through two of these holes a long bit (Fig. 2) was placed and two ¾ in. holes bored through the floor plate (Fig. 4) and flooring of the second floor. In doing this care was taken to avoid boring through the lath and plaster of the partition. This brought the auger bit into a cavity formed by the beams supporting the second floor, the lath and plaster of the first floor ceiling and the flooring of the second floor. Below the brackets on the second floor a pocket was removed from the flooring. This allowed access to the auger bit. As it was necessary to draw wire and flexible tubing through the holes made by the auger bit and upward through the hollow space of the partition to the attic floor a piece of strong cord was attached to the auger bit by tying it to the shank and winding it around, following the spiral formation of the bit until the screw part, generally termed the worm of the bit, was reached, where it was again fastened by tying two half hitches around the worm. This was done as each hole was finished. When the bit was withdrawn from the hole the cord naturally followed it. In this way fishing or mousing for the holes, two methods which require patience and often too much time, were avoided and a good drawing-in arrangement obtained. To each of the cords mentioned a wire long enough to reach from the nearest outlet in the attic floor to the nearest outlet on the second floor was attached. The wire was then drawn upward, and flexible tubing long enough to reach from the nearest support in the attic flooring to the nearest support under the second floor was pushed upward, enclosing each wire. The underwriters' rules are very strict regarding flexible tubing, requiring it to be placed in position in one continuous piece from support to support, or from support to outlet, or from outlet to outlet. Through the wall at the height and place where the brackets were to be placed a hole 2 x 2 in. was cut through the partition. Through these holes and through the remaining holes in the partition plate above a piece of reed or rattan ¼ in. diameter, with a hook attached (Fig. 3) was pushed, it being necessary to fish the hook at the opening in the partition. This was done by means of a piece of stiff wire, with a small hook on one end. This hook easily engaged the hook on the reed, or rattan, and the latter pulled outward.

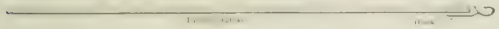


FIG. 3.—RATTAN FOR FISHING.

To the hook on the rattan a wire sufficiently long to reach the nearest support overhead was attached and drawn upward. Over each of these wires was placed flexible tubing to reach from the nearest support to a point 3 in. from the wall, where the brackets were to be placed. Fig. 4 shows how the wires were arranged to comply with the rules of the underwriters.

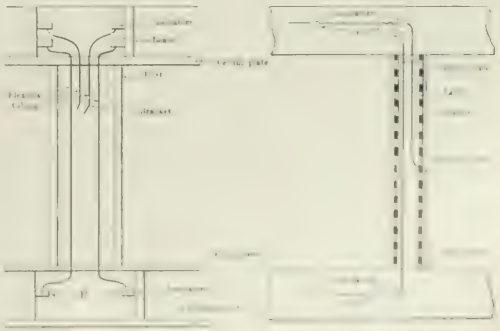


FIG. 4.—WIRING DETAILS.

From the porcelain split knob, which constituted the wire support in this case, two wires were drawn between the beams to the center hall electrolier outlet. One of these wires was taken to the switch outlet and from the switch outlet to the electrolier. This constituted a single-pole switch loop to control the electrolier lamp. The means of wiring from the floor to the

switch outlet in the hall were identical to those used in wiring for the brackets.

When drawing wires between beams, as in this case, it is necessary to fasten the wires on porcelain insulators, so as to support them rigidly or as nearly so as possible. The wires should be drawn tight so as to have no slack wire, which might come in contact with any part of the construction of the building. To attain this condition it is necessary to space the insulators at not more than 4½ ft., and the nearer the insulators are spaced the more easily the conditions are maintained.

To wire to the center of the parlor below it was necessary to remove pockets from the flooring until a board which ran directly over the center of the parlor was reached. Two wires were connected to the wires coming from the attic at the point *B*, Fig. 4, and drawn between the beams and supported as explained. To get to the center of the room it was necessary

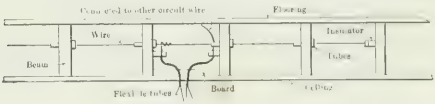


FIG. 5.—CONNECTION FOR CEILING OUTLET.

to bore through the beams and draw the wires through the holes made. In every case when this was done the holes were bushed by a porcelain tube having an internal diameter sufficiently large to allow the entrance of the wire without abraising the insulation. The holes, made in the beams, were of sufficient size to allow the porcelain tube to be placed therein by hand without the use of any force. The tubes for this purpose have a shoulder on one end and project through the beam at least ½ in. The holes containing tubes were given a slight pitch downward so that when the wires were drawn in tightly the tendency was to wedge the tubes, thus insuring their remaining in the one position, Fig. 5.

Fig. 5 also shows how the wires were arranged when connections were made for a ceiling outlet. The wires going through the ceiling were connected to the circuit wires and fastened by means of a porcelain insulator on each wire. On these wires flexible tubing was placed. The tubing in every similar case should reach from the insulating support to a point 3 in. below the ceiling. Before boring the holes in the ceiling to allow placing the tubing and wire through the lath and plaster a piece of board was fastened between the beams to carry the weight of the electrolier. The rest of the rooms were wired in a like manner, except the cellar, where the ceiling was bare of lath or plaster. The holes in the beams here were bored from below, making it unnecessary to remove any of the flooring.

When placing the brackets in position it was necessary to fasten a round block of wood ⅞ in. thick to the wall over the holes made for the exit of the wires to carry the weight of the brackets. Before fastening the blocks, holes large enough to admit the flexible tubing were bored through them. The brackets were then placed in position, using a crowfoot to sustain them. It was not necessary to place a block between the crowfoot and ceiling plaster when hanging the center electroliers, as the boards placed between the beams carried the weight. Care should be taken, however, in cases of this kind to use screws long enough to engage about ¾ in. of the board. To avoid any possibility of the electrolier working loose, owing to the toes of the crowfoot working into the plaster, holes were drilled into a sheet-iron disk of sufficient diameter to cover all three toes of the crowfoot. The holes drilled into the disk were so placed that the same screw fastening the crowfoot would also support this disk between the crowfoot and plaster. This gave a larger pressing area and lessened the possibility of the electrolier working loose. This system of wiring is absolutely safe and admits of a good job being done at reasonable cost.

LETTER TO THE EDITORS.

Chart for the Calculation of the Size of Copper Conductors in Transmission Lines.

To the Editors of Electrical World:

SIRS:—In the article written by the undersigned, entitled "Chart for the Calculation of the Size of Copper Conductors in Transmission Lines," one of the examples employed for illustrating the use of the transmission line chart, which was printed as a supplement to the first issue in January, 1909, contains a numerical error occasioned by the use of 0.70 as the power factor in one case and 1.00 in another. In example 3, page 38, the value of 0.70 should have been used throughout for the power factor. Thus the resistance volts loss should be 2100 instead of 3000, giving the value of 0.76 for the resistance volts loss per mile per ampere and, therefore, requiring a wire between No. 2-0 and No. 3-0 instead of No. 0 wire. The regulation volts for a No. 2-0 wire would be 0.95 volt per mile per ampere, or 2630 volts total, which is 8.8 per cent of the delivered e.m.f. of 30,000.

In example 4 the calculation of total line loss, the value 2275 volts represent the true volt loss—that is, the resistance voltage drop. If this value is multiplied by the current in the line—namely, 102.4 amp, and if this is expressed as a per cent of the power delivered—namely, 4300 kw, the loss in power is found to be 5.43 per cent of the delivered watts.

On page 37 there appears an error where the word "larger" in the sentence reading "the regulation volts or line drop determined from the chart will be somewhat larger than the true value" should read "somewhat smaller than the true value."

MONTREAL, CANADA. L. A. HERDT.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Interpoles.—E. O. TURNER.—A paper read before the Glasgow Students' Section of the (British) Inst. Elec. Eng. on commutation-pole design. The author gives the formulas used in their calculation. A method of finding the flux density in the interpole gap is first outlined, the necessary ampere-turns are found and the dimensions of the pole-shoe are fixed. The leakage coefficient is then worked out by means of the quantities already obtained. From this, lastly, the size of the pole core is determined. Lond. *Electrician*, Jan. 15.

Predetermination of Dynamo-Electric Machinery.—R. V. PICOU.—The first part of a paper on the predetermination of the behavior of a machine of given design. There are many graphical methods available for this purpose and the author endeavors to develop from them a method of calculation, which shows the degree of exactness of the calculation. In the present installment the author discusses the problem in a general way and gives with the aid of diagrams all of the elements which are necessary for such a predetermination.—*La Lumière Elec.*, Jan. 9.

Armature Reaction.—E. SIEDEK.—An illustrated translation in abstract of his recent German paper on distortion of pressure curves due to load in alternating-current generators. The author gives results of an oscillographic investigation of the effect of armature reaction in alternators, whereby the now generally accepted theory is experimentally confirmed. He deals with the distortion of pressure wave in a single-phase alternator and in a polyphase alternator with balanced and unbal-

anced load, and discusses the effect of loading one phase on the pressure curves of the other phases in a polyphase alternator.—Lond. *Electrician*, Jan. 15.

Leakage Fluxes in Induction Motors.—R. E. HELLMUND.—An illustrated article in which the author shows that the graphical method which he has formerly used for studying the rotary field of an induction motor is also very suitable for investigating the leakage fluxes. On the basis of his vector diagrams, he develops some simple formulas.—*Elek. Zeit.*, Jan. 14.

Rheostats for Induction Motors.—L. SOLOMON.—The author gives graphical solutions of the problem of determining the resistance to be inserted in the rotor circuit of a polyphase induction motor for starting and controlling purposes. The graphical method is based on some simple additions to the familiar Heyland circular diagram.—Lond. *Electrician*, Jan. 15.

Lamps and Lighting.

Tungsten Lamp.—A note on a British patent of the Allgem. Elk. Ges. (28,138, 1907; Jan. 7, 1909). The fusing point of a tungsten filament is reached when the specific consumption is reduced to 0.33 watt per candle. If the filament is heated to a temperature corresponding to a consumption of from 0.7 to 0.8 watt per candle, the resistance of the filament gradually increases, as it softens and sinters together, becoming thicker and shorter. This allows the current to increase, and the filament is soon burned out; serious blackening of the lamp does not occur, however. According to the present invention, it is proposed to insert a resistor with a positive resistance-temperature coefficient, such as an iron coil in a bulb filled with hydrogen, as used as a ballast resistor for Nernst lamps, in series with the tungsten filament to enable it to be run at a specific consumption of 0.7 to 0.8 watt per candle, without unreasonably shortening the life of the lamp. Thus a filament taking 0.6 amp at 140 volts at this specific consumption could be operated on a 150-volt circuit, the iron resistor absorbing 10 volts. Variations in the supply pressure will be compensated for, and the reduction in the resistance of the filament will be retarded. The resistor could be placed in the lamp itself. By running the filaments at such a low specific consumption, the length of filament for a given e.m.f. is considerably shortened, and the lamps can, therefore, be constructed for comparatively high voltages.—Lond. *Elec. Eng'ing*, Jan. 14.

Tungsten Lamp.—A note on a British patent of F. J. Planchon (4956, 1908; Jan. 7, 1909) for an improved process for preparing a homogeneous plastic compound of tungsten for squirting into lamp filaments. A carbo-hydrate, such as gum arabic, starch and cellulose, is dissolved, and the "aqueous or alkaline solution obtained" is mixed with an alkaline solution of tungstic acid. The mixture is then poured into dilute hydrochloric acid, and a precipitate, which is a chemical compound of tungstic acid and carbo-hydrate, is obtained. The precipitate is washed and made into a paste with water, after which it is ready for the usual squirting process.—Lond. *Elec. Eng'ing*, Jan. 14.

Generation, Transmission and Distribution.

Friction Brakes.—H. D. JAMES.—An article on the design of friction brakes to be used in connection with electrically driven hoisting machinery. The author emphasizes the fact that a friction brake should be designed and applied as carefully as a motor. The work that the brake is to do should be clearly outlined and the characteristics of the machinery to which it is attached should be stated. A brake suitable for a crane is not suitable for a passenger elevator. If the load is to be lowered a considerable distance, some method of artificial cooling may be necessary, such as the use of water. Wherever possible brakes should be mounted on the motor shafts, as their size is determined by the torque only, and if a brake is run at a speed lower than the motor, it must be correspondingly larger.—*Elec. Jour.*, January.

Explosion in Suction-Gas Plant.—H. WEGNER.—In a Berlin electric generating station an explosion recently occurred in a suction-gas plant. Since such plants are considered generally free from danger so that not even a license is required, the causes of the explosion were carefully investigated. It was found that the gas mixture had been such as to have a maximum of explosive effect. This effect was attributable to an excess of air, and three possibilities are discussed by which the excess of air had been sucked in. The explosion itself could only have been started by back ignition from the gas engine. Remedies to prevent such occurrences are described, and it is stated that this accident was due to the joint action of several incidental circumstances all tending in the same direction.—*Elek. Zeit.*, Jan. 14.

Pulverized Fuel.—R. K. MEADE.—A paper read before the Amer. Inst. Chem. Eng. While practically all of the Portland cement is now burned in this country with pulverized coal, this method of using fuel in powdered form is hardly used in other industries. The author summarizes the advantages of pulverized coal over solid coal and producer gas, and describes methods for burning pulverized coal for certain purposes, especially open-hearth furnaces. With special designs, he claims, it could also be used for boilers.—*Electrochem. and Met. Ind.*, February.

Losses in Steam-Power Plants.—W. M. BOOTH.—A paper read before the Amer. Inst. Chem. Eng. on steam-power plant economics. The author discusses the different losses in a steam-power plant from the standpoint of the chemical engineer.—*Electrochem. and Met. Ind.*, February.

Traction.

English Traction Statistics.—Statistical tables of the electric traction systems of the United Kingdom. There are three tables: the first covers tramways which obtain electricity from a combined lighting and traction station; there are 136 systems of this kind. The second table refers to tramway systems which have generating stations for traction only, there being 47 systems of this kind. The third table relates to electric railways under construction; there are 16. The total length of tramway track now recorded in the tables is 3843 miles, compared with 3651 miles last year. The tables contain 28 different columns, giving an immense amount of information concerning history, equipment, etc. A new column gives the method of bonding employed on the various undertakings. A point which is thereby brought into prominence is the number of tramways on which thermit welding is in use, though in some cases it is for experimental purposes only. There are many tramway systems on which a gradient of 1 to 9 exists, while in three instances the figure approaches 1 to 8. In the course of a few months the total length of railroad track in England on which electrical working is in operation will be 411 miles, this including the London Bridge-Victoria route of the London, Brighton & South Coast Railway.—Lond. *Electrician*, Jan. 15.

Rolling Stock.—M. STAHL.—His report before the International Tramway and Light Railway Association, giving a summary of answers received in reply to different questions concerning the life and wear of rolling stock. In dealing with the answers sent out to the different companies, the author has divided his report into a number of sections. Under these he reports on axles, wheels and tires, axle boxes, car frames and gearing. These sections are again subdivided into appropriate headings which summarize the answers on the particular points; at the end of each section the author puts forward his own conclusions on the subject. In this way the general design of axles, journals, wheels, tires and axle boxes, with the methods of lubrication and the cost of upkeep of the various parts, which are obtained from figures provided by the members, are given. Moreover, the lay-out of the car frames, details of the springs, sand boxes, and of various types of axles with their advantages and disadvantages are outlined. The question of the proper design of gearing with the upkeep costs of various types is also dealt with.—Lond. *Electrician*, Jan. 15.

Surface Contact System.—S. CLESS.—An illustrated paper read before the (British) Institution Elec. Eng. on the "G. B." surface-contact system from a tramway manager's point of view. The author describes the "G. B." system as installed at Lincoln, and then proceeds to relate his experience with it under working conditions. Particulars of the number of live studs are

given, together with their causes, and it is shown what alterations have been found necessary to render faults unlikely to occur again. A comparison is finally made between the "G. B." and the overhead systems, the former comparing very favorably as regards reliability, sightliness, safety to the public, silent running and maintenance cost, sufficient in many cases to offset the additional 10 per cent in capital outlay.—Lond. *Elec.*, Jan. 15.

Single-Phase Traction.—H. Studer.—The conclusion of his illustrated article on the single-phase traction system on the Seebach-Wettingen line. The author discusses the troubles which were experienced on account of the inductive effect on telephone lines in the neighborhood. He finally summarizes briefly the results obtained with electric traction. During the first four months steam locomotives had to be used in three cases; the reasons are stated.—*La Lumière Elec.*, Jan. 9.

Single-Phase Traction.—Henry.—An illustrated article on single-phase traction on European railways in 1908. Concise descriptions of the different systems used are given.—*L'Industrie Elec.*, Jan. 10.

Simplon.—F. De Weldon.—The first part of an illustrated description of the electric installations of the Simplon Tunnel.—*La Lumière Elec.*, Jan. 2.

Installations, Systems and Appliances.

Auto-Transformer Switch.—A description of a new switch of British make for auto-transformer installations, shown in Fig. 1. *A* is a laminated core, having pole-pieces *B*, *C* and *D*; *E*

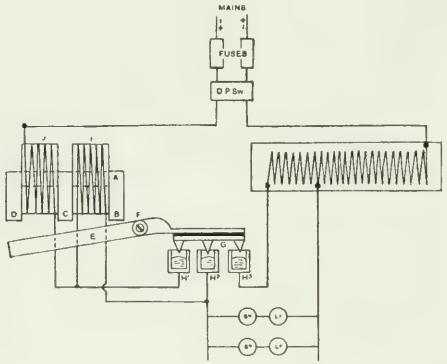


FIG. 1.—DIAGRAM OF CONNECTIONS.

is a laminated armature, pivoted at *F*. *G* is a contact plate with three conical dippers, arranged to enter the mercury cups H^1, H^2 and H^3. *I* and *J* are the actuating coils, *I* being wound with a large number of turns of fine wire, and *J* with a small number of turns of wire of a gage suitable for carrying the maximum primary current required by the transformers. The coils *I* and *J* are in series with each other, and with the lamps and transformer *T*. The high-resistance coil *I* is also connected across the mercury cups H^1 and H^2, while the lamps and secondary of transformer are across the cups H^2 and H^3. The action is as follows: When the first lamp is switched on, a circuit is formed through coils *I* and *J*, lamp and transformer. The small resulting current, owing to a large number of turns in coil *I*, and the proximity of the armature to pole-pieces *B* and *C*, is sufficient to raise the armature *E*, and place the dippers in the mercury cups. The lamps are thus placed in the secondary circuit of transformer, and the high-resistance coil *I* is shorted, but the armature having been raised against the pole-pieces *C* and *D*, the coil *J* is able to hold it in that position. The switching on of additional lamps increases the attraction, but when the last lamp is switched off, the armature drops by its own weight, and the transformer is cut out. The switch will cut in and hold it with a 15-watt lamp in circuit, and the voltage loss due to the coil *J* is only 1 per cent.—Lond. *Elec. Rev.*, Jan. 8.

Balancing a Three-Wire Network.—B. Sankey.—An article emphasizing the importance of carefully balancing the two sides of a three-wire, direct-current network, especially in small towns. It is recommended to divide the consumers into not less than three distinct classes and to balance each class separately. These three classes are: first, the early-hour consumers; second, evening consumers; thirdly, late-hour consumers and miscellaneous. A card-index system is recommended.—Lond. *Elec. Rev.*, Jan. 8.

Brussels.—A. Oschinsky.—A continuation of his illustrated description of the new generating station of the city of Brussels. It contains four steam-driven, three-phase generators, the voltage being 5000 and the frequency 50. Three of the generators have a capacity of 3500 kv-amp, the fourth of 2050 kv-amp.—*Elek. Zeit.*, Jan. 14.

Switchboard.—P. Frenell.—A continuation of his illustrated article on the Hemsjö Power Company, in Sweden. In the present instalment the author describes the switchboard. The principle followed in the design is that each integral part of it can be disconnected and repaired, whenever necessary, without causing the least interruption to the normal service.—Lond. *Electrician*, Jan. 15.

Wires, Wiring and Conduits.

Insulators.—F. S. Denneen.—An abstract of an illustrated paper, read before the Central Electric Railway Association, on insulators for high-tension transmission lines. The author discusses the action of an insulator under stress, the chief features of insulator design and the construction of insulator pins, and makes suggestions for insulator specifications.—Lond. *Electrician*, Jan. 15.

Electrochemistry and Batteries.

Detinning.—K. Goldschmidt.—An illustrated article giving a review of the detinning industry. Electrolytic detinning is first described. The tin scrap is used as anode in hot caustic soda solution. The tin is precipitated in spongy form on the cathodes. More recently detinning with chlorine is found more profitable, the products being steel and tin tetrachloride. Old, used tin cans are also now treated, but require a preliminary purification process.—*Electrochem. and Met. Ind.*, February.

Nitric Acid from Air.—W. Cramp and B. Hoyle.—An abstract of their recent paper before the (British) Inst. Elec. Eng. on the production of nitric acid from air by electric discharges. The different forms of electric discharges through air and their chemical effects are analyzed.—*Electrochem and Met. Ind.*, February.

Units, Measurements and Instruments.

Photometer.—An illustrated description of the latest form of the Harrison universal photometer. The instrument is intended for the measurement of illumination on a screen making an angle of 45 deg. with the vertical, and for the measurement of the candle-power of various sources of light. It is provided with a flicker disk rotated by a blast of air under the control of the operator. By fixing the flicker disk to half cover the field of view of the eye-piece, the instrument may be used as a direct-comparison photometer, the illumination of the source of light being compared directly with that of the adjustable screen inside the instrument, illuminated by a small standard lamp connected to a self-contained accumulator battery. The latest addition to the instrument consists of a horizontal screen, which is covered by a cap when the flicker disk is used. This cap has a hole through the center, and forms the eye-piece of the instrument. When the cap is removed the horizontal screen is exposed, and by fixing the flicker disk out of the field of view of the eye-piece, by means a small milled-headed screw, the photometer can be used to measure horizontal illumination by direct comparison. Fig. 2 gives a general diagram of the instrument, together with an enlarged view of the eye-piece. *S* is the adjustable screen, attached to the pointer; *P* the pointer on outside of case; S_2 the revolving sector screen for general illumination; S_3 the screen for horizontal illumination; *M* the reflecting mirror; L_1 and L_2 are standard lamps; *C* is the cover cap, to be removed when observing horizontal illumination, and *G* the glass in the eye-piece. The following tests can be made with the instrument: Candle-power by means of the flicker disk; candle-power by the direct-comparison method; illumina-

tion on the screen at an angle of 45 deg. by the flicker disk; illumination on the screen at an angle of 45 deg. by the direct-comparison method; horizontal illumination by direct comparison. The advantages of the instrument are light weight and portability and a long range due to the use of two standard lamps of different candle-powers. Permanent connections are

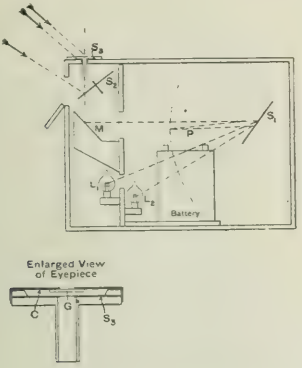


FIG. 2.—UNIVERSAL PHOTOMETER

made between the battery and the rest of the circuit, which need never be disconnected for charging purposes, and the battery, standard lamps and flicker disk may be readily removed from the instrument for inspection without disconnecting or altering any adjustments.—Lond. *Elec. Eng'ing*, Jan. 14, and Lond *Electrician*, Jan. 15.

Resistance Pyrometry.—E. F. NORTHRUP.—A paper read before the Amer. Inst. of Chem. Eng. on modern electric resistance pyrometry. Of the different parts of a resistance pyrometer, the indicator and the resistance thermometer bulb have been worked out by the manufacturer until they are now no longer unreliable. However, to avoid disappointments it is important to take good care in the wiring system. Up to about 1200 deg. C. the resistance thermometer is the most suitable, above 1200 deg. and below 1600 deg. C. the platinum-platinum rhodium thermocouple must be used. Above 1600 deg. C. radiation or optical pyrometers must be employed. Applications of resistance thermometers in various industries are sketched.—*Electrochem. and Met. Ind.*, February.

Induction Ammeter.—P. MACGAHAN.—The first part of an illustrated serial on alternating-current instruments. In this instalment the author deals with the disk-type induction ammeter and voltmeters. While this form of indicating instrument is at present superseded by other forms, it has been manufactured and installed in large numbers.—*Elec. Jour.*, January.

Meter Connections.—H. W. BROWN.—A continuation of his illustrated serial on meter and relay connections. The author deals with the use of single-phase meters on three-phase, three-wire circuits.—*Elec. Jour.*, January.

Direct-Current Meter.—An official communication of the Reichsanstalt, by which a direct-current motor-meter of a German company for two- or three-wire systems is admitted for calibration.—*Elek. Zeit.*, Jan. 14.

Meters.—An article pointing out that the watt consumption and the first cost of electricity meters are economically important. For small installations it is thought that electricity meters should be recommended only when the consumer pays a rent for the meter or a high rate for the energy consumed.—*Elek. Anz.*, Jan. 10.

Water Rheostat.—G. KRIBS.—An account of several cases in which a water rheostat could be employed in emergency. One case was the test of a high-voltage generator at constant power factor, while in the other cases the water rheostat was used as a substitute for a missing controller and for a motor starter.—*Elec. Jour.*, January.

Telegraphy, Telephony and Signals.

Loaded Telephone Lines.—R. NOWOTNY.—An illustrated article on two new types of loaded telephone line construction on the Pupin system, used in Austria. In the older lines, in that country, troubles had been experienced in two directions. Firstly, the self-inductance of the coils was found to change with time; while in some cases the changes were small, they became as high as 30 per cent in others, being sometimes an increase and sometimes a decrease of inductance. Since coils were inserted alternately in the two conductors of the two-conductor line, the result was an unsymmetrically loaded line. To remedy this, double coils are now used in order to assure that both conductors of the line remain equally loaded. The two conductors are now wound over a common iron coil (as in American practice) and it has been found that the symmetry of the loaded line was thereby preserved. The second trouble experienced was due to small boys throwing stones at the coils. For this reason the coils are now surrounded by metal cases.—*Elek. u. Masch.* (Vienna), Jan. 3.

Induction from Single-Phase Railways on Telephone Lines.—R. DAHLANDER.—An account of an investigation with respect to the proposed use of single-phase current on the Swedish railways. The author first investigates the case of a telephone line insulated at both ends and running parallel to the traction system along its whole length. He determines separately the induced static tension, the induced electromagnetic tension, and the tension due to the voltage drop in the traction line. For short lines the induced voltage is chiefly of static nature. He then takes up the case of a telegraph line earthed at both ends and parallel with a line. Finally, the case of a double-conductor telephone line is considered. The article gives chiefly the mathematical formulas of these different cases.—*Elek. Zeit.*, Jan. 14.

Two-Tone Vibrating Transmitter.—E. RAYMOND-BARKER.—An article on the use of his two-tone vibrating transmitter for inductive signaling. The author discusses separately the application of the transmitter in an inductive-signal system for maintaining telegraphic communication between ship and shore—within certain *KR* limits—during a ship's final operations on a cable repair, when the cable conductor is no longer accessible for electrical signaling by ordinary methods.—Lond. *Electrician*, Jan. 15.

Directive System of Wireless Telegraphy.—E. BELLINI AND A. TOSI.—An illustrated abstract of a (British) Physical Society paper. The authors' bilateral directive wireless telegraph system is first briefly described, after which particulars of a new unilateral directive method are given, depending on the simultaneous use of closed oscillatory aerial circuits and vertical antenna.—Lond. *Electrician*, Jan. 15.

Telegraphone.—C. F. FRANKHAUSER.—A Franklin Institute paper on the principles embodied in the telegraphone, its accomplishments in actual experience, and its influence on commercial and social life.—*Jour. Franklin Institute*, January.

Miscellaneous.

Electric Light for Therapeutic Purposes.—O. VOGEL.—An article on the Finsen method for treating certain skin diseases by means of electric light. To kill bacteria, the blue and violet rays are most suitable, since they kill all bacteria with certainty within five minutes and pass deeply into the tissues. On the other hand, ultraviolet rays have an etching effect and do not go too deeply into the tissues; while it formerly was thought that the ultraviolet rays were of special therapeutic value, this has now been found to be an error, and the endeavor is now to use blue light. This has naturally had an effect on the construction of lamps for therapeutic purposes. The author emphasizes that the endeavor should be to further simplify and cheapen the apparatus and to increase the intensity of the rays which have a therapeutic value, so as to reduce the time of application.—*Elek. Zeit.*, Jan. 14.

Slide Rule.—A description of a new slide rule which is intended especially for the use of electrical engineers. One of the problems for which it is specially intended is the calculation of

electric wiring. It is also possible for one to be able to read off directly squares, cubes and fourth powers and also the square-roots, cube roots and fourth roots of figures.—*Elek. Anz.*, Jan. 7.

Electric Welding.—The first part of an illustrated article on the different methods of electric welding, especially in British practice.—*Lond, Eng'ing*, Jan. 15.

Electric Piano Player.—J. F. KELLY.—An illustrated sketch of the development of the electric piano-player.—*Jour. Franklin Inst.*, January.

NEW APPARATUS AND APPLIANCES

The 110,000-Volt Transmission Line of the Grand Rapids-Muskegon Power Company.

Considerable interest has been aroused by the 110,000-volt transmission line of the Grand Rapids Power Company which, now that it has been operating satisfactorily for six months, has proved the entire practicability of this voltage for long-distance electric transmission of power.

The line, which runs between Grand Rapids and the Croton Dam, Mich., a distance of 50 miles, is carried on triangular steel towers approximately 53 ft. in height over all and 43 ft. 8 in. from the ground to the lowest cross-arm, and designed to give a 40-ft. clearance between the line wire and ground. The towers weigh approximately 1700 lb. each, and provide a minimum spacing between the insulator hangers of 8 ft.; they are placed on large concrete anchors buried in the ground, and are spaced 528 ft. apart on tangents (Figs. 1 and 2). The anchors consist of 3-in. angle steel, 7 ft. 10 in. long, encased in concrete. The anchors each extend about 10 in. below the bottom of the concrete in which they are encased, thus securing a ground for the transmission line.

In view of the many troubles experienced by the large majority of companies when first starting a high-tension transmission line using pin insulators, a report made on the operation of this line is of special interest. This report states that "this line has been in operation since July 18 last, and we have experienced no trouble whatever. Nothing of an unusual nature has occurred and we consider its operation as very satisfactory and successful."

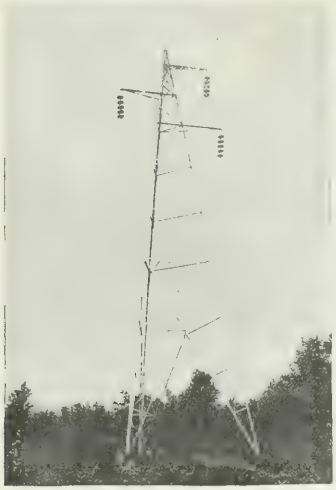


FIG. 1.—STEEL TOWER.

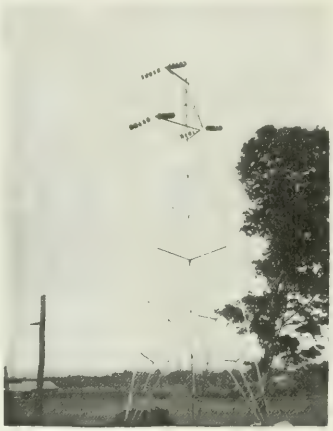


FIG. 2.—STEEL TOWER.

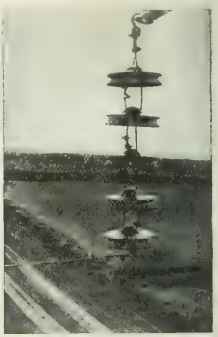


FIG. 3.—DISK INSULATOR.

The majority of the right of way is located along the highways, and only a tower right was taken. Where the line passes through forests or makes short cuts across country, a strip of land was purchased, varying in width from 33 ft. to 66 ft., according to circumstances. This land is usually fenced off. No protection whatever is used where the lines cross highways or traffic routes.

The insulators are of the standard General Electric disk pattern, the suspension type being used for a straight support and the strain type for pull-off curves. Five of these 10-in. disks



FIG. 4.—DISK INSULATOR.



FIG. 5.—CROTON DAM POWER STATION

are used in series, the arrangement being very clearly shown in Figs. 3 and 4. Each disk is rated at 25,000 volts.

The line transmits 10,000 kw, the conductors consisting of No. 2 stranded, hard-drawn copper wire with hemp center. The lines are spaced 8 ft. apart and are entirely without transposition throughout the whole length. No guard wire is used. The lines are brought into the stations through porcelain insulators and are connected directly to the high-tension transformers, which are delta-connected on both sides. There are no switches of any kind in the lines, the control being by means of generator field switches.



FIG. 6.—CROTON DAM POWER STATION.

The pressure was first applied to the transmission line on July 18, 1908, and it was noticed that the line was a little noisy at the working pressure of 110,000 volts, while at night the atmospheric discharge was distinctly visible. Wattmeter ratings on the empty line, after deducting the core losses of the step-up transformers, seemed to indicate a constant loss on the 50 miles of line of from 20 to 25 kw.



FIG. 7.—STATIC DISCHARGE FROM THE LINE.

Other interesting features of the line are shown in Figs. 5 to 7, inclusive.

Chicago Show Exhibit.

An attractive exhibit at the Chicago Electrical Show was that of the Stave Electrical Company, of 27 West Twenty-seventh Street, New York, in which was shown the "Stave" flaming-arc lamps in several types. These lamps are designed for alternating current or direct current circuits of from 110 to 550 volts, and have recently been adopted for the exterior illumination of a number of prominent theaters. The company's booth was one of the brightest spots of the show.

Conkling Reversing Mechanism for Machine Tools.

A mechanical device which is of interest to electrical men because of its application to motor-driven tools and other mechanisms where quick reversing is required, is the Conkling reversing mechanism, made by the Conkling Company, Ninety-sixth Street and Erie Avenue, Chicago. Fig. 1 shows the application of this mechanism between a motor and a planer which it is driving. The mechanism with the top casing removed is shown in Fig. 2. As can be seen from Fig. 2, the driven shaft operates from a bevel gear, being driven from one side or the other, according to the direction of rotation. These bevel gears are in turn operated by a clutch-driven mechanism inside the casing. The great advantage claimed for this reversing mechanism is that the action of the clutch is so easy that there is no jerk which disturbs the load on the motor to any great extent. For example, with a motor driving a machine with 8-amp load, the increase in current when the reversing takes place is stated to be only 1.5 amp, or about 18 per cent. The clutch in this mechanism which accomplishes the reversing consists essentially of three parts. A two-piece nut closes down on a continuously revolving belt whenever the cam operated by the machine tool trips the reversing mechanism. The two-piece nut closely grasps a surface on which a worm acts to force a friction clutch into engagement. The mechanism as shown is arranged for driving at full speed through the set of gears on the left and at partial speed through the gears on the right, thus acomplishing a quick reverse. The clutch is steel to steel. It releases instantaneously by the opening of the two-piece nut which engages the threads on the shaft. The mechanism is completely encased and runs in oil.

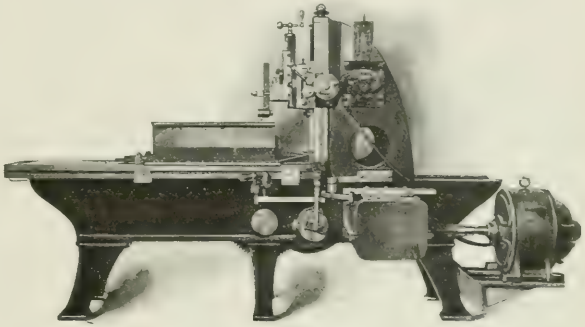


FIG. 1.—MOTOR-DRIVEN PLANER WITH REVERSING MECHANISM.

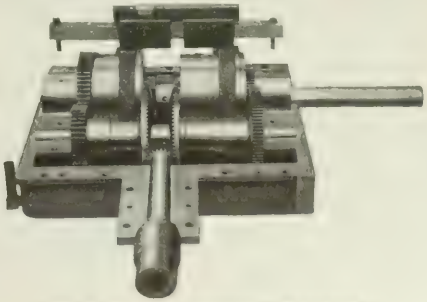
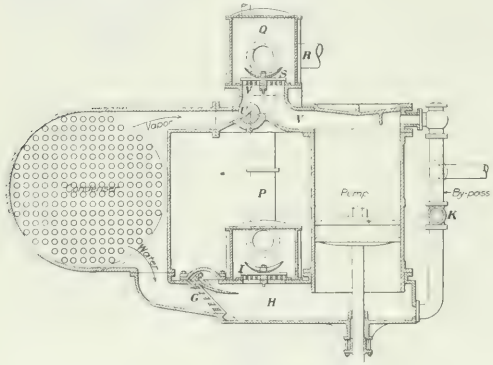


FIG. 2. VIEW OF REVERSING MECHANISM.

High Vacuum Pump for Condenser Use.

The accompanying illustration shows a new type of combined hot-well and vacuum pump which is being built for a 20,000,000-gal. vertical triple-expansion pumping unit now under construction for the water works of an Eastern city. It was designed by Mr. Charles A. Hague, of New York City. The arrangement of pump cylinder, valves, discharge pipe and the connections to the condenser are clearly shown. The upper passage from the condenser is a suction for drawing off vapor and air from the upper part, and the lower passage is for water. The valves at *G*, *I* and *S* are simple rubber flap valves, as shown, or may be of the ordinary rubber disk form, while that at *U* is mechanically operated. A by-pass runs from one end of the pump cylinder to the other, and is controlled by the valve *K*. *P* is the discharge pipe for water, connecting with the line *R*. The chief feature of the pump is the method of securing a perfect vacuum at the upper end of the pump cylinder, in order to increase the quantity of vapor and air withdrawn from the condenser and secure a higher vacuum in the latter. If the pump piston is assumed to be at the upper end of its stroke, the lower end of the cylinder and passage *H* are partly filled with water, which is expelled through the valve *I* on the downward stroke, some of the water at the same time being forced through the by-pass and into the upper part of the cylinder. As soon as the down-stroke commences the mechanically operated valve *U*



VACUUM PUMP.

opens, drawing vapor from the condenser. When the piston starts to return, the valve *U* closes and the vapor, together with some of the water, is forced out through the valve *S*, while the lower part of the cylinder draws water from the condenser through valve *G*. The water forced through the by-pass to the upper part of the cylinder plays its part on the up-stroke, for a sufficient quantity is allowed to pass over, by properly regulating valve *K*, to fill the vapor passages *V* completely and cause some to be expelled through valve *S* so that when the piston starts downward and the valve *U* opens the passages are completely filled with flat condenser water, and a perfect vacuum would result if *U* did not operate. The net power required to run the pump is about the same as would be required for other pumps doing the same service, but it is expected that it will increase the vacuum about 3 in. over the ordinary condenser in every-day practice, with a minimum use of condenser water. There is thought to be no danger of the high vacuum running down, since the only regulation required is the setting of the valve *K*, for controlling the amount of water going through the by-pass to the upper part of the cylinder, and this can be properly determined after a few trials. The pump can be used either vertically or horizontally, and for surface, spray and barometric condensers. For use in steam-turbine plants, drives have been devised for operation directly from the turbine shaft, by means of a worm; and for individual motor drive, in the latter case the pump and motor bases being cast as one.

All-Metal Telephones.

The telephone shown in the accompanying illustration is of the automatic switchless type. It consists of a telephone in an all-metal stamped-steel case that is composed of a base with knock-out rings at the top and bottom for the insertion of

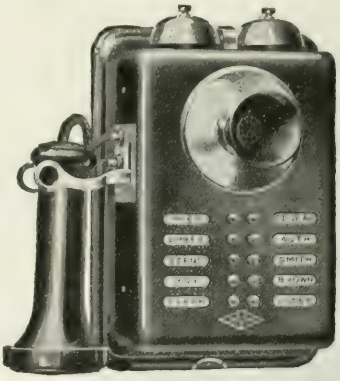
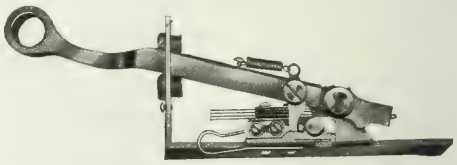


FIG. 1.—ALL-METAL TELEPHONE.

cable; the cover clips on to the base without the use of any screws, hinges, lock, etc.

The instrument can be used for metallic circuit or common return and has the self-contained hook, ball-bearing mechanism; all movable parts in the telephone are interchangeable. All of the connections are made by means of screws and are completed



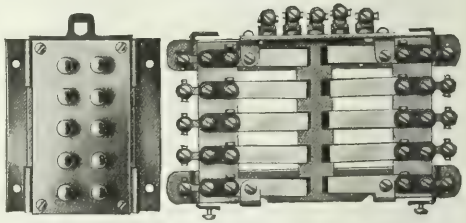


FIG. 2.—ALL METAL TELEPHONE.

inside of the telephone. The line wires are led into the rear of the telephone through fiber bushings. No wood is used in the telephone, and it is claimed to be practically indestructible. The all-metal telephone is made by the De Veau Telephone Manufacturing Company, 427 Eighteenth Street, Brooklyn, N. Y.

Lamp-Cord Adjuster.

The Gem Manufacturing Company, Milwaukee, Wis., has recently placed on the market a new lamp-cord adjuster. The essential parts of this adjuster are a U-shaped hanger, a 3-in. grooved wheel, which is provided with a coiled expansion spring, and a cord which winds around the drum of the wheel and attaches at one end to the drop wires. The wheel is also provided with a catch and trip of the rolling-curtain type.

Auto-Starter with Circuit-Breaker Protection.

The Hartman Circuit Breaker Company, of Mansfield, Ohio, has recently brought out an improved auto-starter for two-phase and three-phase induction motors. The unique feature of this starter is that it affords automatic protection, both overload and low-voltage, and thus dispenses with the usual circuit-breaker. The overload protection is usually provided only for the running side, but if desired, the starting side can also be connected in such manner so that about one-fourth of the turns

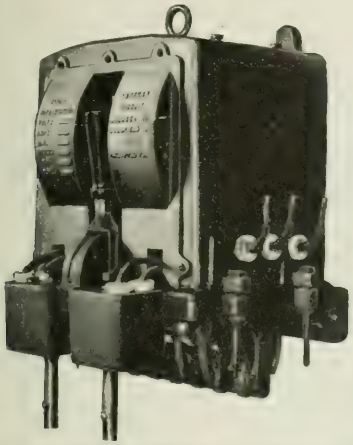


FIG. 1.—WALL MOUNTING, THREE-PHASE AUTO STARTER WITH OIL TANK REMOVED.

of the overload coil are in series. This gives complete protection against overload and short circuit. The starter is made six-pole, with six contact points on both starting and running sides. By using this number of contacts the auto-transformers are cut out when the switch is thrown to the running side, thus relieving the transformer coils of all potential strains except during the period of starting the motor. In starting the motor the operating handle is brought down midway and must be held at this point. Should the operator let go of the handle the switch will immediately return to the off position. This

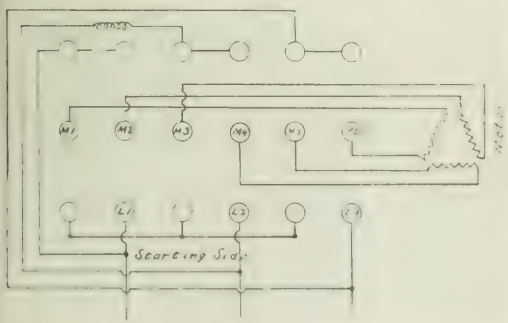
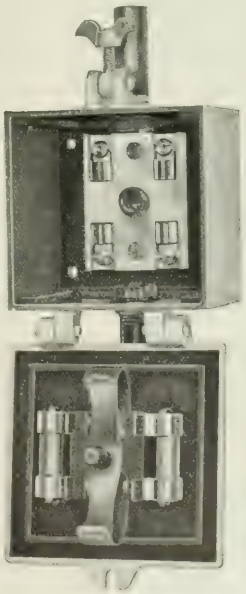


FIG. 2.—DIAGRAM OF CONNECTIONS FOR STARTING VOLTAGE WITHOUT USE OF AUTO-TRANSFORMER, FOR COMPENSATOR.

feature renders it impossible for a careless or inexperienced operator to go out and leave the switch in the starting position. When the motor has picked up sufficiently the trip lever is raised, allowing the handle to be thrown on to the running position where it is securely locked. Laminated contacts are used on the running side, which are protected by heavy arcing contact. Both laminated and arcing contacts are made easily removable without disturbing the leads. The starters are frequently furnished for star- and delta-connection, in which case the transformer case and coils are omitted, and the cost of the installation can be reduced over one-half by this method. In the case of a three-phase motor, whenever six leads can be carried from the motor to the starter, a starting voltage the equivalent of 57.8 per cent of the running e.m.f. can be obtained by making the connections shown in Fig. 2. The phase windings of the motor are not permanently joined together, but are brought to the starter and three of the leads are arranged in star-connection for starting and in delta-connection for normal running. For motors of from 5 hp to 30 hp a smaller starter has been developed especially for the star- and delta-connection. This starter is provided with either overload or low-voltage protection, or both.

Fused Switches

The Detroit Fuse & Manufacturing Company, of Detroit, Mich., has brought out a line of ironclad fused switches which embody an entirely new knife-switch mechanism. This mechanism is controlled by a plunger from the outside of the box, making it possible to open and close the circuit without opening the box. Many advantages are claimed by the manufacturer. The box may be sealed, thus preventing the theft of electricity or tampering with fuses, while at the same time the switch can be thrown on and off as desired. The new mechanism provides a quick make and an equally quick break, there being no intermediate position of the switch. The spring is sufficiently strong to throw the switch either on or off independent of other pressure. It is impossible to make contact by closing the cover, since an extension on the plunger engages a lug in the base, thus preventing the knife blades from approaching the terminals in the box. It is also impossible to break the circuit by opening the cover, since when the switch is in the "on" position the plunger projection extends into the lug in the base and can only be removed from this position by means of the quick-action spring mechanism. A blown fuse is readily replaceable without danger of shock or without the operator touching or coming into close proximity with any live part of the circuit; but it is impossible to replace a fuse without first actuating the switch to its "off" position. It will be noticed from the accompanying illustration that the fuses are mounted between the knife



FUSED SWITCHES.

blades of the switch and [illegible] plunger. The mechanism consists of [illegible] spring in which a smaller spring is inserted. The latter is either [illegible] position. [illegible] Should the [illegible] the switch to its "off" position [illegible] to the [illegible]

A portion of the [illegible] extends through the [illegible] plunger projection [illegible] opened or closed when the switch is in the "on" position. The [illegible] and for [illegible] entrance work, where a switch will be subjected to severe [illegible]

Torque Characteristics of Alternating-Current Motors.

The greatest difficulty attending the use of alternating current motors upon lighting circuits is in the disturbance produced at the moment of starting. Polyphase motors of the squirrel-cage type usually take from three to eight times normal current at the instant of starting, when full normal torque is required, and since this current is at low power factor considerable disturbance will result unless the feeder and transformers are both of ample capacity. In the accompanying diagrams Fig. 1 shows the relation of starting current to starting torque for various types

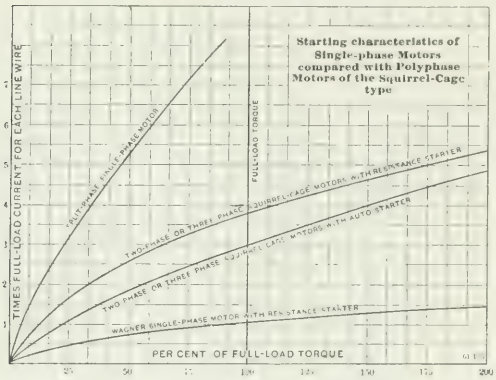


FIG. 1.—STARTING CHARACTERISTICS OF VARIOUS TYPES OF MOTOR.

of alternating-current motors. It will be noted that the best results in the matter of starting and line disturbance are claimed for the Wagner single-phase type, and that full normal starting torque may be obtained at approximately full-load current. The curves relate to actual starting condition, and give no clue as to the variation of torque with the change in rotor speed. The change in torque of the Wagner single-phase motor, with and without a starting box, is shown in Fig. 2. It will be noted that a current 2.5 times normal is obtained at the instant of starting, but the current decreases rapidly to normal at full-load speed. The time required under the usual conditions for the motor to attain full speed is said to be from 8 seconds to 12 seconds, so that the circuits can be fused for full protection without danger of blowing the fuses at the instant of starting.

The Wagner motor is so constructed that it can be used without any form of starting device, a switch being used for opening and closing the circuit when desired. When no starter is employed the current at the first instant of starting, as well as the torque, will be approximately 2.5 times the normal. Under these conditions the circuits can safely be fused for 1.25 times normal current, the motor attaining speed before the fuse becomes overheated.

The actual currents per line wire for full-load starting torque in certain motors wound for 220 volts is shown in the following tabulation:

	5 hp.	7½ hp.	10 hp.	15 hp.
Three-phase squirrel-cage with auto-starter, amp.	51	80	105	140
Two-phase squirrel-cage with auto-starter, amp.	50	75	98	132
Wagner single-phase without starting box, amp.	45	68	90	125
Wagner single-phase with starting box, amp....	33	50	65	90

It is interesting to note in this tabulation that the starting currents required for single-phase motors, without starter, are favorable as compared with polyphase motors giving equal starting torque, and that when a starter is employed the advantage in the matter of line disturbance is much in favor of the single-phase type for the same starting torque.

It will be recalled that the Wagner single-phase motor is an induction machine having a commutator mounted on the rotor shaft and connected to the rotor winding. Starting with the machine at rest, brushes in pairs, cross-connected through a low-resistance conductor, bear upon the commutator, temporarily short-circuiting the rotor winding and developing a large starting torque on the "repulsion" principle. On attaining full-load speed, by the operation of an automatic centrifugal governor the individual segments of the commutator are all positively connected together, thereby transforming the rotor winding to the squirrel-cage form; the motor then continues to operate as an induction type machine. The governor at the same time removes the brushes from contact with the commutator, thereby saving wear.

A view of a 20-hp Wagner single-phase motor, showing the radial commutator with the brushes in the starting position, is given in Fig. 3.

It is said that no harm can be done to the Wagner single-

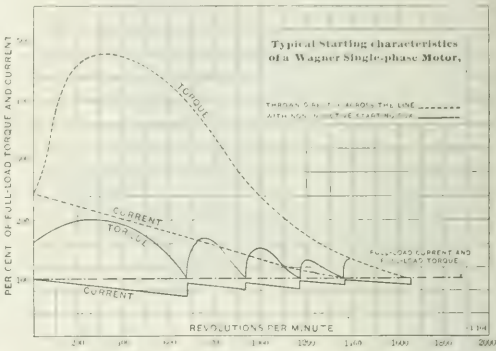


FIG. 2.—CURVES SHOWING CHANGE IN TORQUE OF THE REPULSION MOTOR.

phase motor by suddenly interrupting, or without the intermediary of resistance suddenly re-establish the circuit at any stage of the cycle of its operation from rest to full speed, irrespective of load conditions. If the supply should fail for any reason, the motor returns to the starting condition, and picks up its load when the service is returned, without the assistance or attention of anyone.

The single-phase motor just described is built by the Wagner

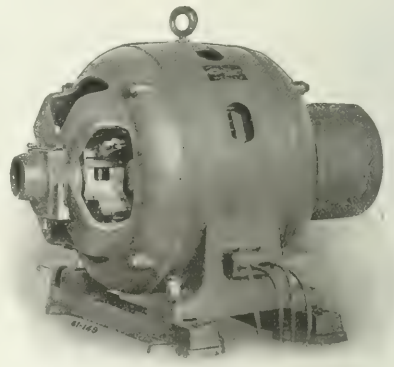


FIG. 3.—SELF STARTING SINGLE PHASE MOTOR.

Electric Manufacturing Company, St. Louis, Mo. This company also builds a similar motor for variable-speed work. This machine differs from the constant-speed motor in that its commutator remains in service at all times. Wide speed variation is obtained by varying the voltage applied at the stator terminals, the torque at any speed varying with the square of the applied e.m.f.

Meter and Service Box.

The Rochester meter and service box, illustrations of which are shown below, is so designed as to combine a service-entrance box and meter board having many advantages. The box, being sealed and therefore inaccessible to any other than authorized inspectors of the lighting company, the underwriters will allow the use therein of link fuses, which are very much cheaper than enclosed fuses, and as the fuses in service boxes are generally furnished and maintained by the company this feature alone means a considerable saving each year. As the box is sealed the underwriters will require the consumer to install a switch and cut-out on the house side of the meter and if the service box is fused a little higher than the consumer's main-cut, the company will be troubled very little with the link fuses in the service box blowing. On the other hand, if the consumer places copper wire in his cut-out, the house lines are still protected by the fuses in the company's service box. The service box is so designed that in case the company's inspector wishes to test or change the meter, after breaking the seal, he has merely to insert two common plugs and open two copper links when the meter is disconnected and can be tested or replaced with a new meter without interrupting the service of the consumer. The plugs which are used to bridge or by-pass the meter are provided with handles of such length that the door of the service box cannot be shut until the plugs are removed, thus making it impossible for an inspector to close and seal the box and leave the meter bridged. With the use of this box it is absolutely impossible to obtain access to a wire on the service side of the meter without breaking the seal, thus effectually preventing the theft of electricity.

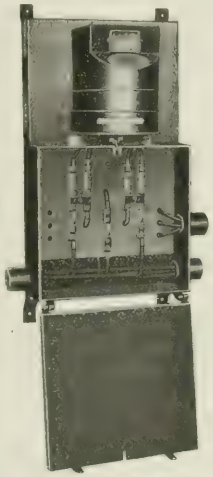


FIG. 1.—METER AND SERVICE BOX.

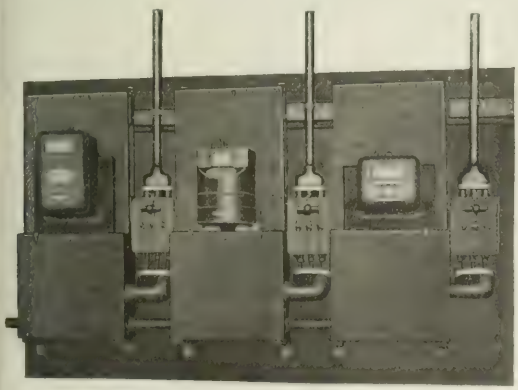


FIG. 2.—METER AND SERVICE BOX.

The meter and service box is standard for all makes of meters, as a special gutter is furnished for any make or type of meter, these gutters being interchangeable. In case a consumer's service is discontinued, the meter may be removed and the service box sealed, thus leaving the service box and meter board ready for the installation of a new meter if at some later date the consumer calls for a reintroduction of service, at the same time preventing theft of electricity while the meter is out. Owing to the simple method of bridging the meter and connecting instruments and artificial load without interrupting the consumer's service, a tester, it is claimed, can test at least 25 per cent more meters per day than is possible where meters are installed in any other manner. The meter and service box is manufactured by the Ricker Manufacturing Company, of Rochester, N. Y.

A German Roentgen-Ray Outfit.

The Emperor of Germany, who is always interested in new technical apparatus of every kind, has ordered from the Siemens & Halske Company, Berlin, a 25-in. X-ray coil and complete Roentgen outfit for a hospital in Szittkehmen, near his Castle Rominten. A gasoline motor of 4½ hp is used for driving a dynamo generating 20 amp at 65 volts. With this dynamo a storage battery of about 30 amp is charged, from which the current for actuating the induction coil is taken. The battery also serves to furnish energy for about 20 tantalum lamps. The motor can also be used for driving a Siemens-Schuckert rotary pump for pumping water into a tank at the top of the house. The Emperor and the Empress witnessed the operation of the plant a few weeks ago and expressed themselves as much pleased with its excellent working.

New Cartridge Enclosed Fuse.

The Trio Manufacturing Company, Rock Island, Ill., has placed on the market, through the Crescent Company, Chicago, Ill., a new enclosed fuse of the cartridge type which can be made in any desired capacity and may be used wherever other types of cartridge fuses are employed. It consists of two contact metal end pieces and a "filler." The contact pieces, which do not vary in appearance from the caps ordinarily used on enclosed fuses, fit over the ends of the filler and are provided on the inside with copper jaws which engage with the ends of the fuse. The filler is composed of a paper cartridge in which is located a hard-metal fuse. The fuse wire extends through into the caps, and there engages with copper jaws provided in the contact ends. When the fuse wire is blown another filler may be inserted in the original contact caps at small expense.

Tungsten Shade Holder.

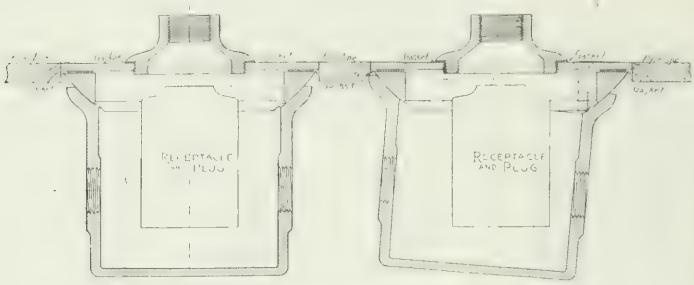
The Dale Company, of New York City, has brought out an exceptionally simple tungsten shade holder. The device, which is shown herewith, is practically made of one piece, no screws whatever being used. It is quickly and readily attached to both



the socket and the shade, being securely held to the former by means of a catch and to the latter by means of a spring clamp. The method for attaching the shade will be readily apparent by reference to the illustration, the base being clamped around the shade by means of the wire ring.

Floor Box and Receptacle.

The new floor box shown in the accompanying illustration, made by the Federal Electric Company, Chicago, is a simple and compact device, being only 4 in. deep and 4 in. in diameter. The principal feature of its design is a perfect vertical and angular adjustment which permits the floor plate to be set exactly level and flush with the floor and assures it remaining that way permanently. The vertical adjustment permits of raising or lowering of the floor plate and maintaining it at any desired level. The angular adjustment is made and maintained by three screws, permitting the plate to be set level in case the box is installed at an angle. No extra parts are needed for installing, thus making this operation very simple. Gaskets under the flange of the nozzle, between it and the floor plate, and also between the floor plate proper and plate giving the angular adjustment, insure water-tight joints. The box itself is a one-piece casting. The floor plate is of brass, highly polished on the upper surface.



FLOOR BOX AND RECEPTACLE.

Stationary Tachometer.

A new line of stationary tachometers has just been put on the market by Schuchardt & Schutte, of New York. The line comprises stationary tachometers of both the vertical and horizontal types, for belt connection as well as for direct connection to the shafts of steam turbines, launch engines, centrifugal engines, etc., and also tachographs for continuously recording the revolutions, rates and running time of machinery of all kinds. They are based on the action of centrifugal force on weights pivoted on a rotating spindle. The movement of the weights when rotating is controlled by gravity or by springs, and is indicated by a pointer mechanically connected to them. The pointer at any moment indicates the exact position of the rotating weights. Both the tachometers and tachographs are made in a number of different sizes to meet all conditions, and are furnished for any desired ratio of speed. They are, when required, supplied with gear boxes, so that the spindles can be directly connected to driving shafts of other revolution rates than those furnished as standard for the different types. Another feature that renders these instruments universally applicable is the arrangement of electric alarm contacts for sounding warning bells, or for automatic speed regulation, such as is frequently essential in the operation of gas engines, when the speed rises or falls beyond any predetermined value. Auxiliary pointers are also furnished which indicate the maximum speed at which the shaft has been running at any time. The tachographs are composed of a tachometer and a recording mechanism, with clockwork drive and a recording strip. The curve is drawn in ink by a recording pen on a paper strip wound from one roll to another automatically. These instruments can also be supplied with clockwork drive, arranged to traverse the paper at various speeds per minute. The recording strips are ruled with horizontal lines for speeds and upright lines for time. The lines are marked with the corresponding revolution or time rating.

Flexible Strap Toggle.

The accompanying illustrations show two flexible strap toggles and their applications; the one for securing moldings and the other for fastening conduit to walls. The devices are manufactured by the Conlan Electric Company, New York City, and possess the advantage of greatly reducing the labor cost of fastening molding to hollow ceilings and walls, where nails or screws cannot be used. All that is necessary is to bore ¼-in. holes, insert the strap toggle through the molding and the ceiling, or other surface, to which it is to be attached in one movement, bend over the strap and drive the necessary nails. The strap being very thin, countersinking is eliminated, the cap of the molding fitting over the strap without gouging. The wire toggle support, shown in Fig. 2, possesses the strength and rigidity of a toggle bolt, at the same time reducing the necessary operations to drilling, inserting the toggle and twisting the wire around the pipe as indicated.

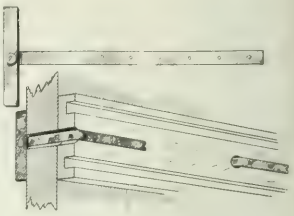


FIG. 1.—STRAP TOGGLE.

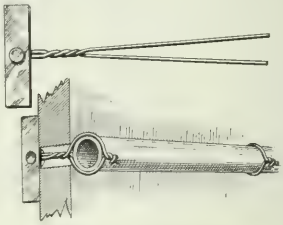


FIG. 2.—WIRE TOGGLE.

Weatherproof Fuse and Disconnecting Switch.

The accompanying illustration shows a high-tension weatherproof fuse and disconnecting switch, consisting of a fuse chamber, arc chute, fuse holder and disconnecting switch, all the elements being self-contained and so designed as to be directly mounted on an ordinary cross-arm without alignment. The disconnecting switch is mounted on a heavy porcelain insulator and the other elements are contained in a heavy, specially designed, petticoated weatherproof porcelain chamber attached to a galvanized-iron support adapted for mounting on standard cross-arms.

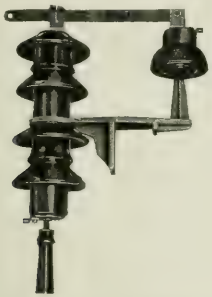
The fuse holder proper is provided with an insulating handle in the end of which is located a pin which engages a bayonet lock in the fuse holder, in turn provided with a secondary locking device which, after the fuse holder is forced into the fixed contacts, holds the fuse in position. The handle is then removed, leaving the fuse in series with the line and preventing unauthorized persons from tampering with it.

The fuse is of the expulsion type, being so designed that its lowest melting point is within a metallic expulsion chamber

which receives the shock and at the same time collects the gas, the explosive action of which expels the heated gases through properly located port holes.

By the use of the disconnecting switch a lineman can safely replace a blown fuse, although the disconnecting switch is not intended for opening a circuit under load.

It is said that a long series of tests on a transmission system



WEATHERPROOF FUSE AND DISCONNECTING SWITCH.

were made before the final design was adopted, and that while the present limitations are 13,200 volts at 15 amp, experiments under way indicate that the limits can be carried considerably higher.

The above fuse is being placed on the market by the Central Electric Company, Chicago, Ill.

Multiple Tungsten Fixture.

While the special office of the tungsten lamp is to afford a high-efficiency unit of low candle-power for frequent spacing over large areas to give a better light distribution, many lighting problems involve large spaces with high ceilings, where fixtures containing single lamps would appear insignificant. In many other places, too, such as large department stores, halls, etc., at present illuminated with arc lamps, tungsten lamps can be used with economy and the present wiring need not be disturbed or the number of outlets increased. It is for these purposes that the Wheeler Reflector Company, of Boston, Mass., has designed three special fixtures, one of which is shown herewith. The slightly concave porcelain enameled steel reflector and the convex deflector inside the globe form a concave channel around the inside of the fixture immediately above the lamps which intercepts the upward radiated light and directs it toward the tip, while the horizontal light is radiated directly outward without interference, giving practically a uniform candle-power in all directions in the lower hemisphere. Especial attention is drawn to the diffusing globe, which follows the outline of the bulbs of the lamps enclosed. The bottom is concaved at the center, at which point the globe is supported by a holder placed so high above the bottom of the globe that no shadows are cast.



MULTIPLE TUNGSTEN FIXTURE.

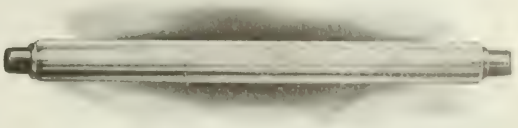
This fixture has a waterproof housing for the sockets and connections, and is also arranged so that it may be fitted to a gooseneck or crook on an ornamental iron post, or fitted for use with series sockets, either with or without the diffusing globe, and provided with cross-arms, insulating joints, etc., essential to street series constructions.

Incandescent Electric Desk and Table Lamps.

Proper illumination of desks is a problem which has never been satisfactorily solved. Most of the lamps used for this purpose consist of an ordinary incandescent lamp-bulb placed in a small reflector, which throws nearly all of the light on one section of the desk and leaves the balance of the desk insufficiently lighted. As an improvement over this system, the H. W. Johns-Manville Company, New York, has brought out a line of desk lamps known as "Linolite" desk lamps. While the design of these lamps is somewhat different from others now on the market, their novel feature is in the lamp. Instead of the ordinary bulb lamp generally used, the tubular Linolite lamp, here shown, is employed. This tubular lamp is 12 in. long between centers and, therefore, distributes the light more evenly and over a larger area of the desk than bulb lamps. Its filament is stretched out straight from end to end and has throughout



FIG. 1.—LINOLITE DESK LAMP STANDARD.



[illegible] LINOLITE LAMP.

its whole length a uniform cross-section. Where the filament of a lamp throws its greatest light at right angles to its axis, the lamp naturally gives more useful light than bulb lamps, where filament cannot be in the focus of a reflector on account of being coiled. The lamps are made in various [illegible]

Contact Coupling for Arc Lamps.

Fox Brothers & Company, New York City, are placing on the market the contact coupling shown herewith. This is made of a special pulley fitting at the top, a fixed clutch part in the center and a lower contact part. The main body is made of vitrified porcelain in which the clutch mechanism is securely mounted. The coupling permits of raising and lowering arc lamps without the necessity of any flexible conductors. The lamps can be installed at considerable heights and lowered for trimming, the circuit wires only going to the main body portion,



CONTACT COUPLING FOR ARC LAMPS.

which can be securely fastened to the ceiling or any other suitable place. A number of special pulleys are provided for fastening on poles, I-beams and ceilings. The clutch is strong and simple, and the contacts are made of non-corrosive spring metal. The contact portion is so made that the polarity of the wires cannot become reversed, and needless to state ample metal is provided for carrying the necessary current. When the lamp is pulled up in position the clutch catches and the lamp is secured without any strain on the lowering cable. To lower the lamp a slight pull is first given to the cable which suffices to release the clutch, when the lamp may be lowered by paying out the cable in the usual manner.

Tank and Sump Switch.

In the first issue of January there appeared in these columns an illustrated description of a tank and sump switch manufactured by the Sundh Electric Company of New York City. Owing to a typographical error the name of the manufacturer of this interesting piece of apparatus was given as the Smith Electric Company. No such company exists in New York City, and since any inquiries addressed to it will necessarily be returned to the sender, these should be re-addressed to the Sundh Electric Company.

Electrical Exhibits at the Boston Motor Boat Show.

Electricity played a most prominent part at the recently held Boston Motor and Power Boat Show. The gasoline motor naturally occupied the center of the stage, but in the field of auxiliary equipment and in the operation of exhibits, the advertising of displays, and in facilitating communication electricity was the most extensively employed agent. The show was under the management of Chester I. Campbell, of Boston, and was located in the Mechanic's Building on Huntington Avenue, in the Back Bay district.

The Gordon Auto Supply Company, represented by H. Disner, exhibited the Remy magneto, the Eisner timer and distributor, switch and coil, and spark plugs. The magneto shown was of the inductor type, with no moving contacts or wire. A single coil of No. 18 wire is imbedded in the pole pieces of the magneto, and the rotor consists of a simple forging mounted on a steel shaft. This company also showed the Geiszler non sulphating storage battery, specially used for motor boat ignition. This battery is provided with perforated hard rubber and wooden separators; the compartments of the cells are sealed by an inner hard-rubber cover and sealing compound; and vents are provided to allow the free escape of gases, and by an indirect opening, to prevent both evaporation and the spilling of acid. Corrosion has been eliminated by the use of heavy silver-plated screws in the binding terminal posts. A small hand-book of ignition troubles was distributed at the booth.

The A. S. Morss Company, Boston, showed a large variety of fittings, including a waterproof battery set, the Morss control lever for leading spark and throttle controls to any part of the boat, and coils. The cells in the company's waterproof boxes are connected and flooded with waterproof composition of insulating character. The spark coils are similarly imbedded. The company also showed the Hermetic battery case for dry cells of the removable type. A water-tight gasket is provided for the cover, and the spaces between the cells are filled with waterproof composition, the cells being held in place by spring blocks. The company also showed the Morss lighting outfit to facilitate engine adjustments at night. The outfit consisted of a waterproof battery set and 4-cp reflector lamp protected by a wire cage and provided with a pull chain for current control. The Stayfast connector was shown, with provision for turning the edge of the metallic contact leaf against the face of a binding post nut, preventing the backing off of the nut until the edge is again turned down flat. The company was represented by G. S. Campbell.

The Fore River Shipbuilding Company, of Quincy, Mass., made a display of parts of Curtis turbines for marine service, crank shafts, forgings, water-tight electrical connections with glass tube fuses for marine work, photographs of the company's yards and shops, and miscellaneous marine equipment turned out in the execution of government contracts. Messrs. Browning and Simons represented the company.

Howe & French, Boston, exhibited the Duro dry storage battery, provided with a copper case, Duro plate and electrolyte, steel bottom and lead lining.

The Fairbanks Company, New York, exhibited a direct connected gas engine set running on city gas and furnishing current for the lighting of a large electric sign. The exhibit was in charge of M. W. Carsley.

The K-W Ignition Company, Cleveland, displayed a magneto and spark coil, the magneto being run continually under water without injury. This machine is of the inductor type, without brushes, commutator or moving wires, and requiring no mechanical governor. Ball bearings, waterproof housing and quadruple magnets capable of lifting all told 25 lb. are the special features. The company was represented by J. A. Williams and W. J. Forbes.

The Acme Wireless Construction Company, of Cambridge, Mass., exhibited two wireless telegraph stations in operation in the hall, and displayed a variety of commercial apparatus for sale, from amateur equipment upward. C. E. Russell represented the company.

The Richardson Engineering Company, of Hartford, Conn., exhibited storage batteries, independent gasoline electric generating sets for yacht and factory lighting, engine telegraph apparatus, and arc searchlights, with switchboards for marine service. The generating sets were rated at from 5 hp to 20 hp

110 volts. The smaller switchboards are built with slate of enamel finish, which is non-absorptive of oil and more readily cleaned than marble. Meters, an automatic storage battery charging switch, electric yacht lamps, and miniature lamp outfits were shown. A special exhibit was a new automatic storage battery charging box. This apparatus resembles an ordinary spark coil, being a wooden case of about the same size. Inside, sealed in, are a voltmeter and ammeter, a charging switch and a control switch with controlling lever on the outside. A fuse is provided with terminals for taking readings of the current and voltage. The engine telegraph exhibited is electrically operated, with dials resembling the standard mechanical telegraph, but when the apparatus is worked the instrument rings a bell in the engine room, turns on a light in a sector wanted, and indicates at the sending station that the signal has been received. When the handle is released the light is extinguished, but the drop remains down in the proper sector until a new signal is given. The company was represented by D. A. Richardson and A. C. D. Loucks.

The Percy Ford Company, Boston, exhibited the Reliance spark plug, operating under water. The insulated sparking point in this device is a fine platinum wire baked in and brought flush with the surface of a porcelain insulator. Under the cap is a small pellet of high resistance material which serves the purpose of an air-gap in series with the spark-gap. The company was represented by A. H. McIntyre.

The Charles J. Jager Company, Boston, exhibited direct-connected gasoline engine generator sets of from 3 kw to 6 kw, for lighting and power service generally, with Holtzer-Cabot generators and Apple ignition dynamos. Representatives present were C. J. Jager, R. N. Stewart and C. O. Rogers.

The Westchester Appliance Company, represented by J. H. Cooper, showed the dry battery made by the company. The initial voltage of this cell is stated as 1.6, with claims of long life and recuperative powers.

The Oswell Igniter Company, Boston, displayed a moisture, heat and waterproof igniter, with a vibrator and condenser in separate equipment.

The Motsinger Device Manufacturing Company, of Pendleton, Ind., exhibited a plug switch without a swinging arm, encased in a moisture-proof box. This apparatus consists essentially of phosphor-bronze springs and the plug, the number of parts being a minimum. An automobile and motor-boat sparker and charging board of pocket size were also shown, equipped with a plug switch, and combination volt and ammeter. The company was represented by P. J. Dasey.

The American Electric Fuse Company, of Muskegon, Mich., showed a compact form of igniter, combined with a coil, timer and distributor in a single structure. This igniter consists of a case containing a hollow coil, within which is a shaft carrying a timing device and a distributor. The case is made of vulcanized fiber that is heat and dustproof, with an aluminum base. The secondary coil is made up of fiber spool wound in 12 sections, separated from each other by 1/16-in. partitions. The secondary coil can easily be removed. The igniter operates on 0.5 amp to 0.7 amp at 6 volts. The platinum point of the timer is carried on a spring plunger, to make it impossible to ruin the contact points by careless adjustment. The igniter runs on a double set of ball bearings. The company was represented by R. W. Augustine.

The Chicago Coil Company exhibited spark coils of the cartridge type for jump spark and make-and-break service. Non-absorbent enameled wire is used in these coils, with interchangeable parts. The company also showed an iron-clad igniter of waterproof type. "National" batteries of the storage type were also handled by this company.

Byrne-Kingston & Company, of Kokomo, Ind., represented by Geo. Kingston, showed an automatic cut-out.

F. D. Lawley, representing the F. A. Brownell Motor Company, of Rochester, N. Y., showed a Brownell electric generating outfit of 5 kw, consisting of a Rochester dynamo direct-driven by a Brownell four-cycle, four-cylinder gasoline motor, for general marine and isolated lighting service.

The National Carbon Company, of Cleveland, exhibited a full line of dry batteries for all kinds of service, various styles of high-efficiency lamps for automobile and motor-boat service, and an apparatus for analyzing the operations of ignition circuits. This equipment showed the current consumption from a battery by coil and timers, the length of contact of various kinds of timers, the actual number of sparks given in a given time, the synchronism of the timing, speed of the vibrator, regularity of action of the vibrator, and the reliability of contacts on timers. The company was represented by J. C. Irvine and A. L. Haskell.

The Kingston coil was exhibited by the Kokomo Electric Company in various types. Special switches were also displayed, with magneto coils and vibrators.

C. F. Splitdorf, New York, showed a large variety of spark coils, magnets and spark plugs. This house was represented by Rohde Brothers, who have just opened a branch in Boston at the Motor Mart.

The Stuart-Howland Company, Boston, exhibited spark plugs, detachable terminals, spring terminals, copper gaskets, flexible cable, connectors, switches, marine switchboards, testing instruments, timers, distributors, coils, igniters, magnetos, charging dynamos, batteries, fan outfits, electric whistles, lamps, tools and other electrical supplies useful in motor boating. The company was represented by R. M. Merritt.

The Hoyt Electrical Instrument Works, of Penacook, N. H., showed a full line of accurate ammeters, voltmeters and volt-ammeters for ignition testing. The company was represented by Dr. A. H. Hoyt and Mr. W. C. Hoyt. The moving systems of these instruments operate in jeweled bearings, and the coils are located in a strong permanent field. They indicate the conditions in the ignition system during the whole time that the circuit is closed.

The Eastern Carbon Works, of Jersey City, N. J., exhibited dry batteries and connectors, in varied sizes, from 1½ in. to 8 in. in diameter, and also the "Eastern" gas engine battery in a square carton, for improved compactness when in operation on motor vehicles. The company was represented by Oliver L. Turgeon.

The Burn-Boston Liquid Battery Company showed three sizes of ignition cells, and the Klaxton horn, electrically operated. Mr. M. H. Stearns represented the company.

The Waterman Marine Motor Company, of Detroit, Mich., exhibited a 0.5-kw marine lighting set with a generator direct driven by a two-cycle Waterman gasoline engine. Messrs Miller and Homer represented the house.

The American Storage Battery Company, of Boston, showed the Harvard igniter and low-voltage batteries for sparking service. These were shown in both single and twin sets for convenient operation, with a submarine boat. Metallic and wooden cases were provided. The company was represented by Arthur P. Homer, of Boston.

Stanley & Patterson, New York, exhibited wireless battery holders, making it possible to carry in one solid molded-rubber composition plate as many battery units as the conditions require. The cells are fitted at their terminal ends with a screw thread just the same as an incandescent lamp. No binding posts are required. The cells are connected-up by being screwed into the rubber plate. The company was represented by Mr Clifton F. Draper.

A. Hall Berry, of New York, also showed a wireless battery box.

George Lawley & Son Corporation, Boston, showed a marine electric generating set. The company was represented by Fred Lawley.

The Murray & Tregurtha Company, South Boston, showed a Baxter switchboard made by W. H. Baxter, Somerville, Mass., battery charging rheostat yacht lighting equipment, and Chlorine accumulators. It was represented by J. W. Card.

The Electric Goods Manufacturing Company, of Boston, showed the apparatus of the Apple Electric Company. The company showed yacht and motor-boat switches, water-tight switches, Apple dynamos and coils. The company was represented by Messrs Snell, Ross, Lovell and Mr Apple.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The general condition of trade during the past week was a trifle quieter than during the one immediately preceding. Taken as a whole, the business for January does not seem to have come up to the expectations of either the wholesalers or the manufacturers. While it is true that there has been a steady improvement all through the month the growth has been so gradual as to amount to a disappointment in the majority of cases. Buying is still extremely conservative and there seems to be absolutely no disposition on the part of retailers to lay in complete stocks. The retail trade throughout the Western country continues to be fair, but it is not of such proportion as to form any basis of encouragement. The unseasonably mild weather during January is held responsible, in a large measure, for the quiet conditions prevailing among the retailers. The lack of money for purchasing in the South is also another drawback, and it has made collections in that section of the country unusually slow. So far there seems to be no disposition on the part of the planters to market their cotton crops. They are dissatisfied with the present prices, and so long as they are not in absolute need of money they will refrain from selling. In the West and Northwest there has been some activity in fertilizers and farm implements due, of course, to the approach of the crop making season. In that portion of the country, too, there is some disposition on the part of the farmers to hold their crops, there being a prevailing impression that grain prices will be higher in the future. In the iron and steel industries there has been practically no development. Pig iron is still very dull and few sales are made. Prices are about at the basis that has prevailed for the last two months. There are a few orders being received for structural material and the steel wire business is fairly active. In equipment lines which were expected to develop into life during January there is very little being done. The rail orders are still held up and not many purchases are being made of cars or other material. The best transaction reported during the week is the placing of an order by the Pennsylvania Railroad Company for 2200 steel cars. It is believed that other companies will be compelled to buy in the near future if there is any general resumption of business. So far the railroad earnings are still disappointing, although they show, of course, heavy increases over the comparative months of 1908 when the period of depression was at its worst. There has been some betterment in the cotton goods trade and exports in this line are becoming more liberal. The foreign trade report, however, for the month of December was disappointing. It shows a decrease in exports of $18,000,000, and an increase in imports of $19,000,000 as compared with December last year. This indicates that while there is a better buying demand from American importers, the decrease in exports is not encouraging for business generally. The balance of trade, however, is still in our favor to a large extent, and as long as this is true there will be no serious feeling of discouragement. Business failures of the week ended Jan. 28 as reported by *Bradstreet's* were 311, against 307 of the previous week, 359 in 1908, 211 in 1907, 228 in 1906 and 319 in 1905.

THE COPPER MARKET.

The downward tendency of copper became more pronounced during the past week; prices broke lower and the demand from consumers was even less positive than heretofore. There begins to be an understanding among those interested in copper that a false position has been maintained for months. This market review has insisted for many months that the quoted prices for copper were inconsistent with the statistical position as far as it was definitely known. It has been insisted that prices were being maintained by the absolute strength of the holders and in open violation of the laws of supply and demand which are presumed to control trade. The only answer to this reasoning which the producers and selling agencies could make has been to boldly assert that the statistics were untruthful. While practically admitting the accuracy of the figures showing an enormous production and while unable to disprove the figures showing a light consumption and export, they insistently declared that the subtraction of the two does not leave the heavy accumulation that seems apparent. This game of bluff has served for months to prevent any break in prices, but it is beginning to fail now. Speculators and consumers are beginning to realize that figures cannot be made to lie by simple assertion. There is a better understanding to-day of the true condition of the market than there has been for months. The exports for January have been 19,000 tons or in round numbers 38,000,000 lb. Estimating the domestic consumption at the highest, say, 60 per cent of normal, the takings for January will be but little more than 45,000,000 lb. Under such circumstances it is evident that the takings of copper both at home and abroad for the month could not be in excess of 85,000,000 lb. The domestic mine production for the month, together with the imports, will hardly be less than 110,000,000 lb. Thus we see added to an accumulation, which must already be well above 200,000,000 lb., another 25,000,000 lb. At this rate of growth there will soon be a load of copper on hand that even the great money interests back of the producing industry cannot carry. Consumers, not being particularly rushed for metal, appear to be calmly awaiting such a condition. During the past week the demand from actual consumers has been very light. Such has been the case all through January, in spite of the fact that the price of copper has been lowered 1 cent a pound in this market, and there has been an even greater reduction abroad. Standard warrants in London are weak and are really not salable at more than ½ cent below quoted prices for metal. What buying this market has developed is mostly in small lots, and as far as can be discovered there are no inquiries for round quantities. Whether there are any concessions being offered, below quoted prices, it is hard to determine. The sellers strenuously deny any such report in spite of the evident weakness of the condition. Imports for January were heavy, being in the neighborhood of 12,000 tons. The total imports for 1908 were 97,700 tons compared with 121,000 tons in 1907. Quotations on the Metal Exchange Feb. 1 were as follows:

Lake	13¾ @ 14
Electrolytic	13¼ @ 13½
Castings	13⅛ @ 13⅜

London quotations were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	57 12 6	57 7 6
Standard copper, futures	58 12 6	58 7 6
Market	Weak.	Weak.
Sales of spot		1,700 tons.
Sales of futures		1,900 tons.

Extreme fluctuations for this year:

	Highest	Lowest.
Standard	.....	.....
Lake	14.55	13 8½
Electrolytic	14.25	13.37½
Casting	14.12½	13.25
London, spot	£64 2 6	£57 7 6
London, futures	64 17 6	58 7 6
London, best selected	67 15 0	61 15 0

DEMANDS FOR A WIRELESS AGREEMENT.

Since the accident to the steamship *Republic*, and the part played by wireless telegraphy in the rescue of her crew and passengers, the importance of this means of communication has taken fresh hold on the public mind. Shippers and travelers alike are coming forward with demands that every steamship that carries passengers and freight not only shall be equipped with wireless outfit, but that there shall be some standardization of systems and codes and that there shall be some sort of an understanding between the various companies in the wireless business through the means of which messages will be freely interchanged. It is pointed out that if the *Florida*, the Italian emigrant ship which rammed the *Republic*, had been equipped with wireless the accident would probably have been averted, and the danger to life and the tremendous loss of property would have been avoided. That the *Florida* was not fitted with wireless was due entirely to the fact that under the present arrangements for installing the service the boat would not have paid a profit to the telegraph company. To compel the

installation of wireless on all passenger-carrying ships several movements have already been started. A bill has been introduced in Congress providing that every ocean steamer certified to carry 50 passengers or more must be equipped with wireless, and a Congressional movement, it is said, will soon be started looking toward an international agreement compelling installation of wireless and fixing a basis for interchange of service. The board of managers of the Produce Exchange has already adopted resolutions declaring "heartily in favor of such international legislation as will compel the equipment of all ocean-going passenger steamers with systems of wireless telegraphy."

Speaking of the demand for a free interchange of messages with other companies using different systems Mr. John Bottomley, vice-president and general manager of the Marconi Company, said: "There is not the slightest danger of our system being taken off of any steamship because of the question of terms, and the ship owners are beginning to see more and more clearly the necessity of having the wireless aboard. As to the movement to compel us to freely interchange messages with other companies, our position is this: We look upon all companies and systems other than the Marconi as imitators and interlopers. Why should we be expected to divide our tolls with them? We would simply be giving them added advantages and facilities for increasing their business. But this restriction on the interchange of business is only placed on ordinary commercial affairs. Every one of our operators and employees is instructed to immediately respond to any signal of distress and to any messages from United States Government ships and stations no matter what systems they come from. We do not believe we should be compelled to throw open our service to our rivals, and that is the reason we opposed the ratification of the Berlin wireless convention which practically compels us to do the very thing which we have persistently refused to do. We do not think we should be forced to recognize people that we feel have no right in the business."

Upon the same subject—a community of interest of wireless telegraph companies—Mr. W. A. Diboll, treasurer of the United Wireless Telegraph Company said: "We are strongly in favor of government regulation of the wireless telegraph business. Not government control of the companies, but regulation of the business. That is why we advocated the ratification of the Berlin treaty which was signed Nov. 3, 1906. When ships of any nation, equipped with any of the many kinds of wireless apparatus, can start from any port and keep in touch with the shore or with other ships regardless of the make of instruments that may be used, then only will wireless telegraphy be fully as useful as it should be. We think that now is the time for international action when the business is in its formative period and when the necessary standardization can be done at much less expense than later on. The United Wireless Company is by far the largest manufacturer of apparatus, controls a number of the most important patents, and is the most extensive operator of wireless telegraphy. We claim that with our present system we can guarantee service twice as far as the Marconi people and that we have done more to perfect and advance wireless apparatus than all the other concerns combined. We are doing a legitimate commercial business, are making money and our contracts with steamships are not such that we lose money on them. The Marconi company claims that it will always take a distress signal or other messages involving the safety of a ship or any of its passengers. I could name you dozens of instances where their operators have refused to accept messages of the greatest value to shipping and sometimes involving the safety of vessels. The truth of the whole matter is the Marconi company is pursuing a 'dog in the manger' policy, and will continue to do so until government control forces a change."

GAS ENGINE BUSINESS ACTIVE FOR ALLIS CHALMERS.—The Allis-Chalmers Company reports that its gas engine shops at West Allis, Wis., are very busy at the present time, having a large number of blower contracts to be shipped out and a number of good gas engine contracts upon which to begin work. Among the more notable contracts recently made is one with the Pittsburg Plate Glass Company to furnish additional equipment for its plant at Crystal City, Mo., which already contains the famous "Big Reliable" unit of 3500-kw capacity, exhibited by Allis-Chalmers Company at the Louisiana Purchase Exposition. The new apparatus consists of two Allis Chalmers alternating current generators of 3000-kw combined capacity, each driven by a 34 in. x 48 in. horizontal twin-tandem Allis-Chalmers gas engine. The rotative speed is 107 r.p.m. and the total weight of each unit is about 1,000,000 lb., the flywheel alone weighing 120,000 lb. These units have been designed to carry full load at 85 per cent power factor and are guaranteed to operate in parallel, delivering 25-cycle, three-phase current at a terminal pressure of 2300 volts. Producers will furnish the gas required for the engines. For the Kokomo (Ind.) plant of the same company there are being built three Allis-Chalmers gas engines and generators of the same characteristics as the units named above, but each of half the capacity, or an aggregate of 2250 kw. For the Kansas Buff Brick & Manufacturing Company there are being built two horizontal tandem gas engines, one of 500 hp and the other of 250 hp, to operate on natural gas. They will be installed in one power plant and are to be connected, through friction clutch couplings on the outboard ends of the crankshaft, to a common transmission shaft, on which will be mounted a belt wheel carrying a belt to drive a 150-kw Allis-Chalmers generator. The 500-hp engine will also have a belt wheel from which power is to be transmitted to line shafting in the brick factory. Additional contracts for gas engines and electric generators, at present pending, involve no less than 30,000 hp.

WESTERN ELECTRIC MAKES MACHINERY RECORD FOR 1908.—Reports given out by the Western Electric Company indicate that in the machinery end of the business quite a satisfactory record was made in 1908. The sales ran far ahead of those for the previous year and there is no indication at the present time that they are falling off. The machinery shops are now operating overtime and many departments are adding additional employees. One of the largest installations recently was a 4000-kw generator for the Chicago Drainage Canal. There is no doubt that the expansion and development work among the big telephone and electrical companies has been disappointing during the month of January. The business which it was thought would materialize has not come, but there are a fair number of inquiries and there is no discouragement felt over the future prospects. Quite a considerable business has been done in supplying intercommunicating telephones for use in office buildings and large manufacturing plants. In speaking of the company's business one of the officials said: "Reports of our business for December show that it exceeded that of the same month in 1907 by about 25 per cent. The number of our customers has largely increased in the past year although the average of their purchases has been less. We do not want such a boom in business as we had in 1906, when our sales went up to nearly $70,000,000, because that necessitates too violent an expansion of our plants, but we expect a gradual expansion of our sales during the year and the total for 1909 to be far better than for 1908."

WESTINGHOUSE WAGES RESTORED.—Without making any previous announcement of the fact, the Westinghouse Electric & Manufacturing Company has increased the wages of its 3000 employees to the figures that prevailed before they were cut last March, when the policy of rigid retrenchment was enforced. This increase will amount in the total to more than $500,000 annually. This return to the old wages was brought about by Mr. George Westinghouse, personally, and was one of the first matters taken up when he resumed control of the property. The business of the company is showing steady improvement, and it is given out that the increase in January orders was $250,000 over those of December. In addition to the recent Third Avenue Railroad orders sales have recently been made to the Cincinnati Traction Company, the Washington Railway & Light Company, and the Capital Railway Company of Washington, D. C., the Oil City Railway Company and the Spokane & Inland Empire Railroad Company.

DECISION IN FAVOR OF ECONOMIC POWER & CONSTRUCTION COMPANY.—A decision of the Appellate Division of the New York Supreme Court, the Economic Power & Construction Company, of Buffalo, [illegible] therefore beyond the jurisdiction of the Public Service Commission. The company claims that its charter empowers the [illegible]

BARTLESVILLE (OKLA.) INDUSTRIAL BOOM.—The Bartlesville Oklahoma Commercial Club is making a vigorous campaign [illegible] electrical manufacturing to the town and vicinity. A tungsten lamp factory is particularly desired. The price of natural gas ranges from 7½ to 8 cents, according to quantity, and electric power is sold at the rate of 3 cents per kw-hour in quantities of 50 hp and over.

ALASKA HYDRO-ELECTRIC PLANT.—It is proposed to develop a $750,000 hydro-electric plant on the Taku run, Alaska, to supply electric power to the Treadwell group of mines in Southeastern Alaska, about 30 miles distant.

WESTINGHOUSE MACHINE COMPANY ORDERS.—That there has been a considerable improvement in the general machinery business since the beginning of the year is shown by the recent orders of the Westinghouse Machine Company, of East Pittsburgh. Quite a number of important orders for steam turbines and gas engines has been booked recently. Among these orders is one from the Mohican Oil & Gas Company, of Mohican, Ind., for a 500-hp horizontal gas engine, which is to be used for pumping gas. There has been quite a demand for power apparatus from cement manufacturing companies, which indicates a strong revival in the building trades. The Westinghouse Machine Company has received an order from the Iola Portland Cement Company, of Iola, Kan., for two 600-hp horizontal gas engines, from the Cape Girardeau Portland Cement Company, of Cape Girardeau, Mo., for a 750-hp steam turbine, and from the Standard Portland Cement Company, of Leeds, Ala., for a 1000-hp steam turbine. The company is also constructing a 600-hp low pressure steam turbine for the Potlatch Lumber Company, of Potlatch, Idaho, in which Mr. Weyershauser, the owner of lumber land, is interested. The Atlantic Mills, of Providence, R. I., one of the largest textile concerns in New England, has decided to add to its operating facilities by contracting for a 1275-hp Westinghouse steam turbine. The East Pittsburgh machine works are now working on an interesting order from the New York, New Haven & Hartford Railroad, which calls for two steam turbines of 150 hp each, the smallest of that type ever made. These turbines will be used to operate the electric signal service on the lines of that railroad. They will be installed at the Coscob (Conn.) power station. One of the largest machines of the Westinghouse steam turbine type, which is now being turned out at the East Pittsburgh shops, is a 2000-hp apparatus for the Merchants' Power Company, of Memphis, Tenn.

EUGENE MUNSELL & COMPANY OPERATING INDIAN MICA MINE.—Consul-General W. H. Michael has recently reported that an American company is operating a mica mine near Kodarma, on the East India Railway, 250 miles from Calcutta. Seven hundred hands are employed, and all of its output is sent to the United States. The firm referred to in the consular report is that of Eugene Munsell & Company, 68 Church Street, New York. This firm is one of the largest in the country and has branch offices in Chicago, Ottawa and Calcutta. It both mines and manufactures mica products and does an especially large business with the electrical companies, this branch of the industry being cared for by the Mica Insulating Company, which is closely identified with the Munsell concern. An official of this latter company said, in connection with the growth of the industry, that the constant demand from the manufacturers of electrical apparatus made the importation of large quantities necessary and was compelling the advanced American manufacturers to invest in Canadian and Indian mines in order to be assured of a constant supply. The Munsell company controls mines in both countries. Owing to this increase in demand and the fact that mica mined in the United States is unsuitable for insulation, the question of tariff is interesting all dealers. At the hearing before the ways and means committee last fall it developed that there was a wide difference of opinion as to what the proper tariff should be. Many conflicting opinions were expressed. All agreed that the present rate of 6 cents per pound and 20 per cent ad valorem on uncut mica was unjust. As this kind of mica varies from 5 cents to $3 per pound the duty varied from more than 100 per cent to about 20 per cent. This is an especial hardship on the manufacturers of mica insulation as in this industry the small sizes can be utilized by the building-up process. The use of the large sheets, it is claimed, makes the product too expensive.

SCHOTT ENGINEERING COMPANY.—The Schott Engineering Company, Chicago, Ill., has been organized to succeed W. H. Schott in the contracting and engineering business formerly conducted by him and will handle the Schott system of heating. The company is incorporated under the laws of Maine with headquarters at the American Trust Building, Chicago. The company is incorporated with $500,000 6 per cent preferred stock and $500,000 common stock to engage in every class of business known to the industrial field except the banking business. The officers of the company are: W. H. Schott, president; M. O. Payne, vice-president; C. R. Scott, secretary and treasurer. The officers, together with John D. Hibbard, A. J. Goodhue, W. A. Brown and John T. Shay, constitute the board of directors. Mr. Schott will guide the company in all of its dealings and will also carry on a general consulting engineering business. The stockholders of the new company are made up of individuals and jobbers well known to the engineering field. Among the contracts which the company has in hand at present is the construction of the government naval training station at North Chicago, which was turned over by Mr. Schott when the organization was perfected.

YORK MANUFACTURING COMPANY, YORK, PA.—There has been good business during the past few months in the line of ice-making machinery. The York Manufacturing Company, of York, Pa., reports quite a number of important sales, among which some of the larger are: 100-ton ice-making plant for Webster Citizens' Ice Company, Buffalo, N. Y.; 125-ton refrigerating machine, condensers, etc., for Alex. Manning Estate, Toronto, Can.; 150-ton ice-making plant for Beehive Hygiene Ice Company, Brooklyn, N. Y.; 20-ton refrigerating plant sold to Westerburg & Williams, New York City, for the Hudson Chocolate Company, and a 75-ton freezing and distilling system for H. Koehler & Company, New York City.

FOUNTAIN-SHAW ENGINEERING COMPANY was formed Jan. 1 with offices in the Binz Building, Houston, Tex. Mr. Fountain was until recently assistant engineer to Mr. Alex. Potter, consulting civil and sanitary engineer, in New York City; Mr. Shaw recently served as assistant engineer to the chief engineer of the Pittsburgh Railways Company, Pittsburgh, and to the Alleghany County Light Company.

NEW MICHIGAN HYRDO-ELECTRIC PLANT.—The Chippewa River Power Company has just been organized at Port Huron, Mich., for the purpose of developing the water power on Chippewa River. The plan contemplates the development of 10,000 hp which it is expected to market in the principal towns in Midland, Osceola and Saginaw Counties. The president of the new company is J. L. Hudson, of Detroit.

ELECTRICALLY EQUIPPED COAL MINES IN AUSTRALIA.—Messrs, Splatt, Wall & Company, electrical engineers of Perth, Western Australia, number among their extensive properties two electric light and power plants and a tract of coal land having an area of 10,500 acres. A mine has recently been opened on the latter with the colliery plant equipped electrically throughout.

MR. VICTOR M. ARANA, consulting and contracting engineer, Lima, Peru, writes that he will be glad to receive the trade literature of steam, hydraulic and electrical manufacturers and exporters who have not agencies in that region.

Financial Intelligence.

THE WEEK IN WALL STREET

There is little to say of the stock market during the past week that has not been said previously during the month of January. The same apathetic condition that has existed since the beginning of the year continues to be in evidence. The trading is very light, the price fluctuations are small and there seems to be little interest in favor either of advances or decline. Even the market manipulators appear to be indifferent and to be taking a rest. For this condition of affairs very many explanations are offered by the regular purveyors of news and rumors in the Street. The admitted dullness in all lines of industry and commercial business; the agitation of the tariff adding uncertainty to the future conditions of trade; the rather unfavorable start which the winter wheat crop has made; the possible disagreement between the anthracite miners and the mine owners when the present wage schedule expires in April; the continued unsettled condition of political affairs in the Balkan States and a dozen other such reasons are assigned for the moribund condition of the market. All of these may, and probably do, to some extent affect the present condition. The basic reason, however, for the continued dullness of the market, for the light trading and fractional price changes, lies in the fact that there is no public participation in Wall Street business. When there is nothing doing except the few professional traders swapping dollars there cannot be either a great or an active market. The public must either be buying or selling, or doing both, in order to create business. This the public has failed to do for many months. Immediately after the election there were a few days in which it seemed as if the outsiders intended to come in and trade. It was for only a few days, however, and since that time any considerable order received by a

commission house from a bona fide outside customer had almost been sufficient to create a sensation in the market. Just at present the speculative element is anxiously awaiting a decision by the Public Service Commission, Second District, upon the application of the Erie Railroad to issue bonds. Not only will it fix the future condition of this railroad, but it is believed it will act as a precedent for many other bond issues which are expected to be proposed as soon as general business gives any indication of resuming normal conditions. Bond issues mean the circulation of money and the construction of improvements. These are supposed to mean business. One of the features which was discouraging to the market Feb. 1 was the adverse decision of the United States Supreme Court in the Consolidated Gas case. It was not so much the fact that a rehearing was denied, this has been anticipated, but the extreme promptness with which the court acted rather indicated that there would be allowed no trifling or delay. Gas stock broke 5 or 6 points as soon as the decision was announced, but at the lower price buying orders appeared from some quarter which caused the recovery of at least one-half the loss. One stock that always seems to be a matter of interest and an uncertain quanity is Brooklyn Rapid Transit. No one ever appears to know exactly what this road is going to do, but every one more than half suspects that it is going to do something. There are fresh crops of rumors about it every day. The fact that no action favoring a dividend was taken at the annual meeting depressed the stock and then the fact that no action adverse to a dividend had been taken again advanced it. The copper shares remain remarkably steady in the face of the declining market for copper metal and a practical acknowledgement by copper producers that the stocks in this country are larger than they have been reported to be. The money market continues to be easy and rates are unusually cheap. The banks are accumulating further cash reserves and the borrowers are not insistent, even with money at the present reasonable prices. Call loans Feb. 1 were made at 1¾ @ 2 per cent and 90-day loans were made at 2½ @ 2¾ per cent. The quotations in the table are those of the close Feb. 1.

NEW YORK.

	Jan. 25.	Feb. 1.	Shares sold.		Jan. 25.	Feb. 1.	Shares sold.
Ali-Ch.	14*	14½	3,300	Int.-Met., pfd.	43⅜	41	20,030
Ali-Ch., pfd.	46½	46½	5,811	Mackay Cos.	74	75⅛	1,200
Amal. Cop.	70	73⅝	166,350	Mackay Cos., pfd.	70*	70½*	95
Am. D. T.	35*	35*	——	Manhattan Elev.	140*	140*	391
Am. Loc.	37	36	3,900	Met. St. Ry.	34*	34*	50
Am. Loc., pfd.	112*	112½*	400	N. Y. & N. J. Tel.	115	114	33
Am. Tel. & Cbl.	95*	95*	——	Steel, com.	54	52⅝	270,700
Am. T. & T.	128*	128*	3,300	Steel, pfd.	114*	114*	1,000
B. R. T.	70½	69⅝	90,500	W. U. Tel.	60	59⅝	4,000
Gen. Elec.	150	152	5,200	West'h., com.	82	79*	3,600
Int.-Met., com.	15¾	14⅞	8,100	West'h., pfd.	115*	120*	200

PHILADELPHIA.

	Jan. 25.	Feb. 1.	Shares sold.		Jan. 25.	Feb. 1.	Shares sold.
Am. Rys.	44*	45*	——	Phila. Elec.	10⅝	11⅛	——
Elec. Co. of A.	11	——	——	Phila. R. T.	28¼	27⅞	——
Elec. Stor. Bty.	45	44	——	Phila. Traction	92⅝	92*	——
F. S. Bty., pfd.	49*	49*	——	Union Traction	54	54	——

CHICAGO.

	Jan. 25.	Feb. 1.	Shares sold.		Jan. 25.	Feb. 1.	Shares sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	128	128	——
Chi. Rys., Ser. 1	106*	106*	——	Met. El., com.	17*	17*	——
Chi. Rys., Ser. 2	15	15	——	National Carbon	85*	85*	——
Com. Edison	150*	148	——	Nat. Carb., pfd.	110*	110*	——
Chi. Subways	26*	26*	——				

BOSTON.

	Jan. 25.	Feb. 1.	Shares sold.		Jan. 25.	Feb. 1.	Shares sold.
Am. Tel. & Tel.	126*	126*	——	Mex. Tel.	1*	2*	——
Com. Tel.	12*	12*	——	Mex. Tel., pfd.	4*	4*	——
Edison El. Ill.	230*	230*	——	N. E. Tel.	113*	113*	——
Gen. Elec.	150*	150*	——	W. Tel. & T.	80*	80*	——
Mass. Elec. Ry.	13*	13*	——	W. T. & T., pfd.	70*	70*	——
Mass. E. R., pfd.	64*	64*	——				

*Last price quoted.
Shares sold are for week Jan. 25 to Jan. 30.

DIVIDENDS.

Boston Elevated Railroad Company, semi-annual, 3 per cent, payable Feb. 15.

Cambridge Electric Light Company, Boston, Mass., quarterly, 2½ per cent, payable Feb. 1.

Chicago City Railway Company, quarterly, 1½ per cent, extra 3 per cent, payable Feb. 10.

Consolidated Gas Company, New York City, quarterly, 1 per cent, payable March 15.

North American Company, New York, quarterly, 1¼ per cent, payable April 1.

Susquehanna Railway, Light & Power Company, semi-annual preferred, 2½ per cent, payable March 1.

United States Steel Corporation, quarterly, preferred, 1¾ per cent, payable March 1; common, ½ of 1 per cent, payable March 30.

Whatcom County Railway & Light Company, Bellingham, Wash., semi-annual, 3 per cent, payable March 1.

INTERNATIONAL STEAM PUMP COMPANY.—Mr. Benjamin Guggenheim, who for a number of years has been chairman of its executive committee, has been elected president of the International Steam Pump Company, succeeding Mr. John W. Dunn. Mr. Dunn resigned the presidency on account of ill-health. Mr. Guggenheim is president of the Power & Mining Machinery Company with a plant at Cudahy, Wis., which in 1906 was taken over by the International Steam Pump Company through the purchase of stock control. Speaking of the future, Mr. Guggenheim said: "The International company's plants are now running about 86 per cent of capacity. The floating debt now stands at $1,250,000 as against $4,000,000 two years ago. The most recent order of any consequence came two weeks ago from an Ohio natural gas concern—$120,000 worth of gas machinery. The directors are considering plans for raising funds for the erection of new plants in which to manufacture mining and hydraulic machinery and machinery other than steam pumps."

METROPOLITAN ELECTRIC COMPANY SELLS BONDS.—Edward B. Smith & Company have purchased the $2,000,000 first mortgage 5 per cent 30-year sinking fund bonds of the Metropolitan Electric Company, of Reading, Pa. Out of the proceeds of this sale $1,750,000 will be used to construct an entirely new power house with a modern transmission and distribution system. The demand for current in the territory which the company serves has entirely outgrown the capacity of the station which the company is now operating. The balance of the issue will be used to retire bonds which mature Oct. 1, 1909. The Metropolitan Electric Company is one of the subsidiary companies of the United Power & Transportation Company, and for 15 years has been the only company in Reading engaged in the electric light and power business. It furnishes the current used by the United Traction Company, of Reading, which company guarantees the new issue of bonds.

KOKOMO, MARION & WESTERN TRACTION COMPANY, KOKOMO, IND.—This company held its annual meeting on Jan. 25, at which time Mr. George J. Mariott, of Indianapolis, was chosen president, and Thomas C. McReynolds, of Kokomo, general manager. The report of the company shows a handsome increase in every department except the steel railway. The following is the increase in the connected load of the electric light department: Incandescent lights, 4346; commercial arcs, 37; street arcs, 28; motor capacity, horse-power, 146; new consumers, 241; heating devices, kilowatts, 73; increase in connected load, 466 kw. The increase in current consumption in 1908 for lighting purposes was about 17 per cent.

MORE TELEPHONE STOCK LISTED.—The New York & New Jersey Telephone Company has made an application to the New York Stock Exchange for the listing of $5,047,000 additional stock. It is announced in the application for this listing that the proceeds of the new stock will be used to take up outstanding obligations of $2,300,000 which were incurred in general construction work and that the balance of the money will be expended in further construction and equipment. The growth of the company's business has been steady and very satisfactory and the construction of new lines is a necessity.

CHICAGO CITY RAILWAY CONTINUES TO PROSPER.—The Chicago City Railway Company declared an extra dividend of 3 per cent last week, thus keeping up the company's record of paying 9 per cent, which has been done every year since 1901, when the rate was reduced from 12 per cent. The rate was reduced from 12 per cent when the company retired $4,619,500 4½ per cent bonds which matured July 1, 1901. About 95 per cent of the stock is still held by the Morgan-Mitchell syndicate which took control of the stock a couple of years ago at $200 per share.

SALE OF JENKINTOWN (PA.) LIGHTING PLANT.—The Gas & Electric Development Company of Philadelphia has just completed a deal for the Jenkintown Light Company to a Philadelphia syndicate. The Jenkintown company supplies light and power to Jenkintown, Wyncote, Glenside, Willow Grove, Hatboro, Bethayres and other towns suburban to Philadelphia. The new board of directors include William West, Harry C. Thayer, Edward E. Mandeville, Mathew F. Maury and W. W. Levering, all of Philadelphia.

NORTH AMERICAN COMPANY RESUMES DIVIDENDS.—After passing its dividends for 18 months the North American Company of Philadelphia, a holding company for numerous traction and lighting properties, has returned to its former basis of 5 per cent. The directors at a meeting last week declared a 1¼ per cent quarterly dividend, which is payable April 1. There is outstanding $29,793,300 in common stock, and while, according to the statement of Charles W. Wetmore, the president of the company, there has not been earned an amount quite sufficient to pay the dividends, it is expected that more than enough will be earned before the end of the year. The withholding of dividends for a year and a half has placed the company in a very strong financial condition. The total amount carried forward at the beginning of 1909 to the profit and loss account was $3,445,776.

MEXICO TRAMWAYS COMPANY'S PLANS.—Having acquired a controlling interest in the Mexican Light & Power Company and having on hand large plans for future development, the Mexico Tramways Company will probably elect the following directors at the coming stockholders' meeting: F. S. Pearson, president of the Rio de Janeiro Tramway, Light & Power Company, Ltd.; Sir William C. Van Horne, chairman of the board of directors, Canadian Pacific Railway; E. R. Wood, vice-president, Central Canada Loan & Savings Company, Toronto; George Flett, managing director, Dick, Kerr & Company, Ltd., London; Julio Limantour, director, National Lines of Mexico; Robert C. Brown, managing director, Mexico Tramways Company, and Walter Gow, director, the Rio de Janiero Tramway, Light & Power Company, Ltd.

FIXING OF FRANCHISE VALUES IN BOSTON.—The State of Massachusetts has fixed for taxation purposes a value of $7,000,000 on the franchise of the Boston Elevated and a value of $9,500,000 on the franchise of the Massachusetts Electric Companies. As the cash investment in the former has been $18,144,000, and the market value of its stock is now $17,157,000, it is evident that the franchise is worth $1,000,000 less than nothing. In the case of the Electric Companies the investment has been $21,192,900, and the selling price of the stock is $18,309,065, showing that the franchise is worth $2,880,000 less than nothing. These figures are published by the two companies to show the injustice of heavy franchise valuations.

UNITED ELECTRIC SECURITIES COMPANY, BOSTON.—This company is offering through Perry, Coffin & Burr and Parkinson & Burr, of Boston, a new issue of collateral trust 5 per cent bonds due Aug. 1, 1938. These bonds are offered at par and interest. The company pays 7 per cent dividends on $1,000,000 preferred stock, and showed a surplus on Aug. 1, 1908, of $1,256,677 over all liabilities. Out of a total of $16,500,000 bonds issued by the company, it has redeemed and cancelled $11,926,000, leaving outstanding $4,574,000, including the present series.

EDISON ELECTRIC COMPANY, LOS ANGELES, CAL.—A special meeting of the stockholders of the Edison Electric Company, which is incorporated in Wyoming, but operates in California, will be held at Evanston, Wyo., Feb. 27 to vote on the proposition to increase the bonded indebtedness of the company, which is now $10,000,000, to $30,000,000. The company operates in California. R. H. Ballard, of Los Angeles, Cal., is secretary and general manager.

WESTERN NEW YORK & PENNSYLVANIA TRACTION COMPANY.—The Public Service Commission of the Second District of New York has granted permission to the Western New York & Pennsylvania Traction Company to issue additional mortgage bonds to the extent of $5,000,000. The mortgage is to be issued to the Trust Company of America and the proceeds are to be devoted to extensions and improvements.

LONDON ELECTRIC COMPANY.—The report of the London Electric Company, of Toronto, for the year ended Nov. 30, 1908, shows a net profit on operating account of $37,137, out of which were paid two semi-annual dividends of 3 per cent each. The surplus fund was increased by the addition of $15,000 and now amounts to $105,000.

KIAWATHA (KAN.) ELECTRIC LIGHT COMPANY.—The annual report of the Kiawatha (Kan.) Electric Light Company shows that the total receipts for the year ended Dec. 31, 1908, were $20,108, and the total expeditures, including improvements, $15,389. This also included a 6 per cent dividend on the $23,500 capital stock.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses	Net earnings.	Charges.	Surplus.
American District Telegraph Company					
Year 1908	$3,192,000	$2,407,000	$785,000	$398,088	$386,912
Year 1907	3,017,174	2,304,214	712,960	396,899	316,061
Bell Telephone Company of Pennsylvania, Philadelphia:					
Year 1908	11,434,520	7,980,439	3,454,081	278,761	3,175,319
Year 1907	10,982,038	7,712,938	3,269,699	679,771	2,589,927
Birmingham (Ala.) Light & Power Company:					
Year 1908	2,167,546	1,433,850	733,696	527,386	206,310
Year 1907	2,220,999	1,521,479	699,520	379,506	229,014
Capital Traction Company, Washington, D. C.:					
Year 1908	1,841,170	793,141	1,048,029	209,047	771,886
Year 1907	1,764,345	903,481	860,864	91,560	791,527
Chicago Railways Company:					
Year ended Jan. 31, 1908	10,745,253	7,696,364	3,298,441	1,740,073	1,558,367
Year ended Jan. 31, 1907	10,367,551	7,392,400	3,168,171	1,556,158	1,602,012
Fairmount Park Transportation Company, Philadelphia:					
Year ended Oct. 31, 1908	145,543	69,681	75,862	47,541	28,321
Year ended Oct. 31, 1907	133,823	67,028	66,795	51,219	15,576
Keystone Telephone Company, Philadelphia:					
December, 1908	88,854	44,323	44,531	.....	.....
December, 1907	87,356	45,523	41,833	.....	.....
Knoxville (Tenn.) Railway & Light Company:					
Year 1908	572,571	292,784	279,487	137,952	141,535
Year 1907	605,776	342,453	283,323	129,009	153,314
Little Rock (Ark.) Light & Power Company:					
Year 1908	670,897	339,234	331,663	121,677	209,986
Year 1907	642,010	330,169	311,841	101,367	210,474
Massachusetts Electric Companies:					
Quarter ended Dec. 31, 1908	1,772,533	1,297,428	475,327	436,894	38,433
Quarter ended Dec. 31, 1907	1,780,074	1,320,663	459,411	436,436	22,975
Memphis (Tenn.) Street Railway Company:					
Year 1908	1,027,648	1,031,652	595,996	424,437	171,559
Year 1907	1,061,384	1,057,384	597,233	404,822	192,411
Mexican Light & Power Company (Mexican currency).					
Year 1908	5,876,947	3,061,140	3,715,807	.....	.....
Year 1907	4,939,370	1,950,143	2,989,227	.....	.....
New York & Queens County Railway Company:					
Year ended June 30, 1908	937,800	863,815	73,985	206,148	110,097
Year ended June 30, 1907	913,242	782,907	130,305	102,573	132,268
North American Company:					
Year 1908	1,723,186	274,024	1,449,162	.....	1,449,162
Year 1907	1,611,965	206,322	1,405,643	.....	287,432
Portland (Me.) Electric Company:					
Year 1908	311,514	191,078	.....	.....	.....
Year 1907	297,783	153,785	.....	.....	.....
South Side Elevated Railway, Chicago:					
Year 1908	2,241,689	1,571,065	670,624	513,342	157,281
Year 1907	2,105,192	1,459,745	645,447	615,126	30,321
Toledo (Ohio) Railway & Light Company:					
Year 1908	2,742,111	1,673,380	1,068,731	755,425	313,306
Year 1907	2,685,200	1,591,433	1,022,867	708,166	314,701

GENERAL NEWS

Construction News.

DOTHAN, ALA.—The Morris Lumber Company has purchased a controlling interest in the Choctawhatchee River Light & Power Company. Work will soon commence on the construction of the dam which will develop about 4000 hp. The officers of the company are: A. C. Ackley, president; G. S. Kelly, vice-president and general manager, and A. L. Kelly, secretary and treasurer. Present post office address is Slocomb, Ala.

FAUNSDALE, ALA.—The city would like to communicate with contractors or manufacturers in regard to the construction of a proposed electric light plant and waterworks system in Faunsdale. Siddons Stollenwerck is town clerk.

MONTGOMERY, ALA.—The Montgomery Light & Power Company has offered to put up and operate free a large electric sign in some central point in the town to advertise the city, requiring only that the citizens shall agree upon some catch phrase or appropriate words to be flashed out on the sign by night.

SAMSON, ALA.—Howard Butt, 121 Sayre Street, Montgomery, Ala., has been appointed as engineer to take charge of the construction of the proposed electric light plant and water works system. W. J. Gresham, Mayor, would like to correspond with a bonding company for the purchase of $25,000 in bonds, the proceeds to be used for the construction of the above plants. Mr. Butt would like to communicate with manufacturers of machinery and equipment for the same.

PARKER, ARIZ.—It is reported that an electric light plant will be erected in Parker to furnish electricity for lamps and motors in this town, and possibly to mines in this vicinity. It is also proposed to install a 25-ton ice plant.

BATESVILLE, ARK.—H. H. Bule, of Buffalo, Ark., is said to be interested in the construction of a dam across Buffalo River, which will furnish power to generate electricity to operate an electric railway.

BENTONVILLE, ARK.—The city has awarded the Western Surety & Investment Company, of Minneapolis, Minn., a contract to construct an electric railway from Joplin, Mo., to Bentonville, and thence to Gentry, Tarrytown, Springdale and back to Bentonville. Work will begin on the construction of the railway as soon as the contract is signed. The Western Surety & Investment Company is guaranteed an appropriation of $55,000 by the citizens in this city as soon as the road is completed. A. W. Morris is mayor.

DERMOTT, ARK.—The city has taken over the local electric light plant and will operate it as a municipal enterprise. It is proposed to enlarge the plant.

LITTLE ROCK, ARK.—The City Council has under discussion the advisability of a bond issue for the purpose of building a municipal electric light and power plant.

MAGNOLIA, ARK.—The Magnolia Canning Company, it is reported, would like to receive prices on a 120-kw generator.

LOS ANGELES, CAL.—The city of Los Angeles is operating an electric plant in connection with the construction of the Los Angeles aqueduct, the equipment of which consists of four 2500 kw, 3 phase, 60 cycle, 2200-volt generators, boilers of 2250 hp, steam turbines of 1550 hp and water turbines with a total rating of 5000 hp. It is proposed ultimately to install power plants along the line of the aqueduct from Owen's Valley to the city, a distance of 240 miles. R. H. Manahan is city electrician.

PASADENA, CAL.—The City Council has rejected the offer of the Edison Electric Company, of Los Angeles, to purchase the municipal electric light plant, and is making preparations to call an election to submit the proposition to issue $150,000 in bonds to complete the plant. The company offered to take over the real estate, buildings, machinery and transmission lines of the municipal electric lighting plant, for which it would pay the city $[illegible], and also agreed to furnish electricity for street lamps at a greatly reduced rate. The company also agreed to reduce the rate for electricity for commercial purposes from [illegible] cents per kw-hour to 9 cent per kw-hour, with additional reductions as low as 3 cents per kw-hour for amount ranging from 600 kw-hr to [illegible] kw-hr used monthly. As an alternative proposition, the company offered to take over the municipal electric light plant and all other property appertaining thereto, with the exception of the street lighting system, for $[illegible], the latter the system to the city, and to furnish electricity for the municipal street lighting system at the flat rate of 1.5 cents per kw-hour.

RED BLUFF, CAL.—It is said that the Sierra Power Company [illegible] templates establishing a power station at Red Bluff. R. L. Dowdell is interested in the enterprise.

GREELEY, COL.—The plant and holdings of the Home Electric Light & Power Company have been acquired by the Home Gas & Electric Company, recently incorporated with a capital stock of $[illegible]. The new company proposes to enlarge the electric plant. It will also furnish gas for illuminating and other purposes. Robert M. T. Dolge, Mack Building, Denver, Col., is consulting engineer.

MERIDEN, CONN.—A new schedule of rates for electricity for lamps has been adopted by the Meriden Electric Lighting Company. Under the old schedule the company charged 12½ cents per kw-hour with a discount of 10 per cent for cash within 10 days. The new rates provide for the old discount for cash and give several additional discounts according to the quantity used.

WASHINGTON, D. C.—Plans are being considered for extensions and improvements to the street-lighting system in Washington. It is proposed to make changes in the lighting system on Pennsylvania Avenue, Seventh, F, Fifteenth, Sixteenth Streets and Massachusetts Avenue.

WASHINGTON, D. C.—Bids will be received until Feb. 9 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various naval stations and navy yards the following supplies: Washington, D. C.—Schedule 821, furnishing and erecting two steel sectional boilers; schedule 822, one cross-compound air compressor; three model engine lathes; Boston, Mass.—Schedule 864, 1900-lb. sheet brass and 2000-lb. sheet copper. Also, until Feb. 16, as follows: Puget, Sound, Wash.—Schedule 824, 2500 ft. conductor cable, 1000 ft. brass enamel conduit, 750 lb. hard sheet brass, etc. Brooklyn, N. Y.—Schedule 856, five motors, etc. Also, until March 2, at Mare Island, Cal.—Schedule 873, seven automatic motor hoists. E. B. Rogers is Paymaster-General, U. S. N.

ALBANY, GA.—The earnings of the municipal electric light plant in 1908 were the greatest in its history. The electric light department paid into the city treasury the net amount of $12,644 over and above operating expenses. In addition to this no charge was made against the city for lighting the streets, public places or public buildings.

ASHBURN, GA.—The citizens have voted to issue $55,000 in bonds, the proceeds to be used for the construction of an electric light plant, waterworks system and other improvements.

ATLANTA, GA.—It is reported that the Georgian Company would like to receive prices on new and second machinery as follows: One 100-hp engine, Ideal, Atlas, H. S. & G., or any other standard make; must have room for two pulleys; two 60 to 70 hp boilers, with Hartford tests to 100 lb.; 60 ft. heavy iron stack; duplex feed pump; water heater. Prices from second dealers must cover full description, how long in use and price net f. o. b. Will consider communication by mail only.

HAGANSVILLE, GA.—The local electric light plant, owned by M. K. Word, has been leased to Messrs. Lee, Newton and Rosser.

HAWKINSVILLE, GA.—The town has authorized an issue of $15,000 in bonds, the proceeds to be used to establish a municipal electric light plant.

LYONS, GA.—Work has begun on the construction work of a water system, upon the completion of which immediate steps will be taken toward the installation of an electric lighting plant. For further information, address S. I. Hussey.

MEIGS, GA.—Plans are being considered to install a municipal electric light plant in Meigs in the near future. It is proposed to erect a plant with sufficient output to supply 1000 lamps. D. Isreal is chairman of the light committee.

ROME, GA.—The Rome Railway & Light Company contemplates an issue of $250,000 in bonds, the proceeds to be used for extending and improving its plant.

WEISER, IDAHO.—The Idaho-Oregon Light & Power Company expects to have its transmission line completed to this city and furnish electrical service by March 1. The company offers to furnish electricity at the following rates: For residences: For 20 kw consumed in one month, 15 cents per kw-hour; for 40 kw, 10 cents per kw-hour; for 80 kw, 8 cents per kw-hour. For commercial use: For the first 50 kw consumed in one month, 10 cents per kw-hour; for 100 kw, 8 cents per kw-hour; for 200 kw, 6 cents per kw-hour; for 500 kw, 5 cents per kw-hour; for 1000 kw, [illegible] cents per kw-hour; for [illegible] kw, [illegible] cents per kw-hour, and [illegible] kw [illegible] per kw-hour.

ALEXIS, ILL.—The plant and [illegible] Company have been purchased by John Donley, of Alexis, Ill. Mr. Donley will take possession on the [illegible] and will operate the [illegible] power purposes to [illegible] users.

BLOOMINGTON, ILL.—The [illegible] Company has applied to the City Council of Bloomington for a franchise [illegible] electric power [illegible].

ANNAWAN, ILL.—A [illegible] Electric Light, Power & Heating Company has been [illegible] to furnish electric power for [illegible] purposes to Annawan, [illegible] Mr. [illegible] the [illegible] for the completion of the [illegible].

LEROY, ILL.—The LeRoy Electric Light, Power & Heating Company [illegible] a new heating and [illegible] Henry Pelham is manager.

MONMOUTH, ILL.—The stockholders of the Monmouth Telephone Company have authorized an issue of $125,000 in bonds, the proceeds to be used to improve and enlarge its system in this city.

NAPERVILLE, ILL.—It is reported that the Du Page Railroad Company is planning to construct an electric railway from Wheaton to Naperville and Plainfield during this year. Asa M. Royce, of Naperville Ill., is president.

ROCK ISLAND, ILL.—Sealed proposals will be received by M. T. Rudgren, city clerk, for furnishing electricity for 300 lamps, more or less, for lighting the streets of the city.

WATAGA, ILL.—The Village Trustees have granted a franchise to H. J. Kunkle to construct and operate an electric light plant.

WORDEN, ILL.—The City Council has abandoned the proposition to erect a municipal electric light plant in Worden, and has voted to grant a 49-year franchise to the McKinley syndicate to furnish electricity in the town. The Council will also enter into a contract with the company to furnish street-lighting service for a term of 10 years. The town had already voted to issue $12,000 in bonds for the construction of a municipal electric plant.

YORKVILLE, ILL.—The city has decided to install a new street lighting system. It is proposed to place lamps on both hills on either side of the town.

ANDERSON, IND.—The Central Union Telephone Company has decided to enlarge and improve its system in Anderson within the next few months. The cost of the work is estimated at $20,000.

LAFAYETTE, IND.—The directors of the Fort Wayne & Wabash Valley Traction Company have decided to remodel and enlarge the power plant in this city. The company proposes to sell electricity for lamps and motors, as well as to operate the interurban cars.

MEDARYVILLE, IND.—The Town Board is considering the question of establishing an electric light and power plant and will soon ask for bids for the construction and equipment of the same.

SOUTH BEND, IND.—N. M. Snyder, 518 East Bronson Street, South Bend, Ind., is reported to be in the market for 3-phase motors, variable speed and direct-current motors; also prices on complete electrical equipment and electrical supplies for a 1500-hp plant manufacturing electrical supplies.

VINCENNES, IND.—The Vincennes Light & Power Company has leased and taken possession of the local plant of the Blackhawk Gas Company. The Vincennes company will continue to buy natural gas from the Blackhawk company as long as it lasts.

CEDAR RAPIDS, IA.—The Cedar Rapids & Marion City Railway Company has presented three ordinances to the City Council asking for franchises for the construction of several new street car lines in Cedar Rapids; also for authority to make several extensions and improvements to existing lines.

COUNCIL BLUFFS, IA.—Plans are being considered by the Omaha & Council Bluffs Street Railway Company for enlarging its power house to furnish electricity, which will be required upon the completion of the number of extensions to its railway system.

DES MOINES, IA.—We are informed that the Des Moines, Winterset & Creston Electric Railway Company is making plans to commence work during the year on the construction of its proposed electric railway between Des Moines and Winterset, Macksburg and Creston, Ia. The railway will be 60 miles in length. The company expects to furnish electricity for lighting. L. H. Hixson, of Des Moines, Ia., is general manager.

UNION, IA.—The citizens have voted to grant a franchise to the Union Electric Light Company.

PARSONS, KAN.—The plant and holdings of the Parsons Electric Light & Power Company is reported to have been purchased by the Parsons Street Railway & Electrical Company for $90,000. The last named company holds a street railway franchise in Parsons and will commence work at once on the construction of a street railway system. The company also proposes to rebuild the electric light plant at a cost of about $50,000. The company is capitalized at $400,000.

TOPEKA, KAN.—Estimates are being made for the cost of equipping the Atchison, Topeka & Santa Fe Railroad, to be operated by electricity, from Trinidad to Raton, a distance of 30 miles. Electricity for operating the system will be available upon the completion of the power plant of the Southern Colorado Power Company in Trinidad. The cost of the work is estimated at not less than $2,000,000.

TURON, KAN.—We are informed that Charles McMurry, of Turon, Kan., contemplates installing an electric light plant in Turon during the coming summer and would like to communicate with manufacturers for equipment and machinery for the plant.

LONDON, KY.—The London Electric Light & Power Company contemplates purchasing a 150-hp engine during this year. W. F. Raymer is manager.

PINEVILLE, KY.—The City Council has prepared an ordinance and will soon call for bids for a 30-year franchise to construct an electric light and power plant, with an output of at least 180 kw, the equipment to include two or more generators direct-connected, both to have a rating of not less than 80 kw. B. H. Broughton is city clerk.

ALGIERS, LA.—The Algiers Railway & Lighting Company contemplates making extensive improvements and extensions to its system. It is proposed to extend the railway to the naval station, over the new viaduct and on Patterson Street, and also quite a distance in Jefferson Parish, in the near future.

BATON ROUGE, LA.—The Board of Administration of the Louisiana School for Deaf and Dumb has decided to appoint a committee to investigate the question of establishing a central power plant to supply electricity for lamps and motors to the State Capitol, Institute for Deaf and Dumb, Institute for Blind, and State University. A. S. Vreedenburg is secretary.

HOUMA, LA.—The Board of Aldermen has accepted the plans and specifications prepared by Anderson Offut, of New Orleans, La., civil engineer, for a municipal electric light plant, bids for which will be received until Feb. 9. Plans and specifications can be obtained at the office of Dreaux Angers, clerk of the board. Mr. Offut will have charge of the construction of the plant.

OPELOUSAS, LA.—Arrangements are being made by the City Council for improvements to the municipal electric light plant and water works system, which will involve an expenditure of about $35,000.

THIBODAUX, LA.—The Town Council has voted in favor of making improvements and enlarging the municipal electric light plant and an election will be held in the near future to vote on the proposition to issue $40,000 in bonds to cover the cost of the work. It is proposed to install two 75-kw alternating-current generators, Corliss engines and tub transformers for 60 arc lamps for street lighting. G. N. Borde, of New Orleans, La., has been engaged to supervise the work. A. R. Staunton is superintendent.

ANDROSCOGGIN, MAINE.—Senator Osgood, of Androscoggin, has introduced a bill to the Legislature to incorporate the Androscoggin Reservoir Company for the purpose of constructing a dam on the Magalloway River anod create a new basin in order to increase and make more constant the flow of the Androscoggin River and for use for power and manufacturing purposes. The cost of the dam is estimated at $300,000. William P. Frye, Hugh J. Chisholm, Herbert Brown and others are interested in the project.

KENNEBUNKPORT, MAINE.—It is reported that the Atlantic Shore Line Railway Company is planning to extend its railway from Sanford, Maine, through Alfred, Limerick, Kezar Falls and Fryeburg to Rumford Falls, a distance of about 120 miles.

LEWISTON, MAINE.—The committee on street lighting has awarded a contract to the Fort Wayne Electric Works, Fort Wayne, Ind., including three transformers, switchboard, generator, wires, etc., to cost between $1,700 and $1,800. The city proposes to increase the output of the municipal electric plant to furnish electricity to light the city buildings.

PEMBROKE, MAINE.—The Pennamaquan Power Company has taken over the property and holdings of the Pembroke Power Company, and proposes to rebuild the plant, which was destroyed by fire in April, 1908. The head office of the company is located in Providence, R. I. Stephen A. Welch is treasurer.

BALTIMORE, MD.—Steps have been taken by Robert J. McCuen, superintendent of lamps and lighting, looking to the final acquisition of municipal ownership of the street lighting equipment by requesting bids on all kinds of street lighting equipment.

BALTIMORE, MD.—Bids will be received until Feb. 10 by the Board of Awards for furnishing cast-iron electric lampposts and sub-posts for use under water in the swimming pool at Patterson Park in accordance with plans and specifications on file at the office of the Board of Park Commissioners. William S. Manning is general superintendent.

BOONSBORO, MD.—The Antietam Electric Light & Power Company has completed its electric plant located on the Antietam River on the site of the old Delemere Mill, about six miles south of Hagerstown, Md. The company has a contract to furnish electricity for street lamps in Boonsboro, and is contemplating entering into a contract with the town of Keedysville to light the streets of the town.

DENTON, MD.—Arrangements are being made by the Peninsular Light & Power Company to install an electric light plant and transmit electricity to Denton. About 100 hp will be developed. It is said that proposals for construction and equipment of the plant will be received about April 1. Thomas F. Garey, 16 East Lexington Street, Baltimore, Md., is president.

HAGERSTOWN, MD.—The Hagerstown Railway Company is considering the question of installing a belted 150 or 200 kw, 550-volt generator in its plant. The company will consider the purchase of a good second-hand machine.

ATTLEBORO, MASS.—The Selectmen are contemplating establishing an all-night service for street lighting for 1909. The Attleboro Steam & Electric Company, which holds the street-lighting contract, offers to furnish the additional service for about one-third more than the cost of the present schedule. The company has also agreed to replace the present 32-cp incandescent lamps with new tungsten lamps of 40 cp without extra cost to the town. The company now furnishes 333 incandescent and 104 arc lamps for lighting the streets. The all-night schedule will include continuous service in Attleboro, Hebronville, Dodgeville and South Attleboro. Edgar Tregoning is manager of the Attleboro Steam & Electric Company.

BLACKSTONE, MASS.—It is reported that the New England Securities Company, the holding company for the electric railways of the New York, New Haven & Hartford Railroad Company in Massachusetts, is contemplating the erection of a 40,000-hp electric power plant in Blackstone, at a cost of $300,000. The proposed plant will furnish electricity for operating the electric railways of the company in Massachusetts. The

plants which now furnish electrical energy for the Uxbridge & Blackstone, Milford & Uxbridge, Milford, Attleboro and Woonsocket railways will be closed.

FALL RIVER, MASS.—The Fall River Electric Light Company has applied to the City Council for permission to construct and maintain underground conduits on certain streets in the city.

HOLYOKE, MASS.—The Holyoke Water Power Company is seeking to amend its charter to enable it to furnish electricity in less than 100-hp lots to tenants of buildings erected or bought after Jan. 1, 1909.

NORTH ATTLEBORO, MASS.—Owing to the increase in demand for electricity for motors, the electric department is planning to increase the output of the municipal electric plant, and is in the market for a 150-kw, 3-phase, 60-cycle, 2300-volt generator, with exciter and switch panel. During the past year the department has carried on a campaign of advertising and soliciting for new business with tungsten lamps, heating and cooking appliances which has resulted in a large increase in the day power service. William Plattner is manager and superintendent.

QUINCY, MASS.—The stockholders of the Quincy Electric Light Company have voted to increase the capital stock of the company by $50,000.

DETROIT, MICH.—The Detroit United Railway Company has recently placed an order for the installation of an additional 1500-hp Westinghouse steam turbine, to be installed before spring.

ESCANABA, MICH.—The Escanaba Power Company is planning to extend its transmission lines to Gladstone, Mich., this year. P. L. Utley is secretary and manager.

IRONWOOD, MICH.—The Twin City General Electric Company is planning to place contracts for material for the construction of a seven-mile extension from Ironwood to Bessemer, Mich. The company is also making plans to repair its transmission lines and install new machinery in its plant, and will place a contract within the next 30 days for one 150-kw, 2300-volt, 3-phase generator; also one 200-hp, alternating-current motor connected to direct-current generator.

MANISTEE, MICH.—Plans are being prepared by the Manistee County Electric Company to develop the water power of the Manistee River, about 18 miles from Manistee. It is proposed to construct a concrete dam 90 ft. high and about 1400 ft. long. The officers of the company are: E. N. Salling, president; R. W. Smith, vice-president, and Clyde J. Holmes, secretary and treasurer.

STEPHENSDEN, MICH.—The Iron Mountain Electric Light & Power Company, of Iron Mountain, Mich., has purchased the water rights on Lower Twin Falls, on the Michigan side of the Menominee River for a consideration of $15,000. The company will commence work at once on the development of the water power, which, when completed, will supersede the present steam plant. It is proposed to develop about 500 hp. The steam plant will be held in reserve for use in emergencies.

DULUTH, MINN.—Plans are being considered by the Northwestern Telephone Exchange Company to place its wires underground in this city, which will involve an expenditure of about $100,000.

GULFPORT, MISS.—Arrangements are being made by the Gulfport & Mississippi Coast Traction Company to place contracts for the construction of 5.7 miles of track, and for the necessary overhead material.

HATTIESBURG, MISS.—Preliminary arrangements are being made by the Hattiesburg Traction Company for completion of its electric railway and construction of a new power plant, the cost of which is estimated at about $100,000. It is said that instructions have been given to place contracts for the work.

KANSAS CITY, MO.—W. Laming, of Tonganoxie, Kan., president of the Kansas City & Kansas Southwestern Railroad Company, has filed a mortgage for $12,000,000 in Kansas City, Kan., in favor of the Carnegie Trust Company, of New York, N. Y., to provide funds for the construction of electric railways between Kansas City and Topeka, and from Lawrence to Independence, Kan.

ST. LOUIS, MO.—The county court has granted a 50-year franchise to the St. Louis, Creve Cœur & Western Railway Company, of Clayton, Mo., to construct an electric railway from the city limits to Creve Cœur Lake. The railway will be built on private right of way to Studt's Park.

ST. LOUIS, MO.—The City Council has granted a franchise to the Hillsboro, Krumsville & Northern Electric Railway Company to construct an electric railway in this city. Under the terms of the franchise the company is allowed to build its railway over streets at the extreme south end of the city on conditions that a bridge be constructed across the Riviere des Peres.

SPRINGFIELD, MO.—Application has been made to the City Council by the Springfield Traction Company for a franchise to extend its street car line to the State Normal School.

DEER LODGE, MONT.—Plans are being considered by the Deer Lodge Electric Company for the installation of an engine, generator and arc regulator in its plant. F. A. Moe is manager.

GREAT FALLS, MONT.—The City Council has called an election to be held Feb. 15 to vote on the proposition to grant a franchise to G. C. Bower and associates to construct and operate an electric railway in and through Great Falls.

MISSOULA, MONT.—Plans are being considered by the Montana Power Company for the construction of seven large dams during the next two years between Heron, the mill town of St. Joe in the St. Joe River. The lines will be connected with the company's system, and will furnish power to generate electricity to operate trains through the mountainous country. Plans and estimates have been completed and active work will commence as soon as the weather will permit. The total cost of the dams is estimated at from $300,000 to $400,000. The Idaho Water & Electric Power Company has been organized, with a capital stock of $500,000, to construct the plants.

ALBION, NEB.—R. T. Flotres, City Clerk, writes that it is proposed to erect a municipal heating and lighting system in Albion at a cost of about $6,000, for which plans have not been completed.

LORETTO, NEB.—The question of installing an electric light plant in Loretto is under consideration. E. J. Mills is reported to be interested in the project.

ELY, NEV.—The White Pine County Telephone Company contemplates extensions to its toll lines to cover the entire mining district. James S. Bennett is manager.

RENO, NEV.—Application has been filed with Frank Nicholas, State Engineer, by Rolla B. Clapp, of Reno, for an appropriation of 4000 cu. ft. per second of the Truckee River, located about one-half mile distant from Reno, opposite the Western Gypsum plant, the water power to be developed for electrical purposes and mining.

YERINGTON, NEV.—Several of the mines at Yerington have been compelled to close on account of lack of power. Owing to the washouts in Nevada, the Truckee Power Company has been unable to operate its hydro-electric plants, which necessitated the shutting off of electrical energy supplied to the mines in this vicinity. It will be a month or more before they will be able to resume.

ARTESIA, N. M.—The Board of Trustees has granted a franchise to Oscar S. Coates to erect and operate an electric light plant in Artesia.

BOONTON, N. J.—The Boonton Electric Company has leased the plant formerly operated by the Public Service Corporation of New Jersey in this town. R. M. Dickinson is general manager.

HOBOKEN, N. J.—The Hoboken Board of Trade has appointed a committee to make investigations in regard to installing an ornamental street lighting system in the business district of the city. Messrs. Geismar, Gonzales, Gerlight, Greer and King are members of the committee.

ROCKAWAY, N. J.—The High Standard Steel Company is installing an electric light plant in its factory. B. K. and G. W. Stickle, of Rockaway, and others are interested in the company.

BROOKLYN, N. Y.—Bids will be received until Feb. 10 by Bird S. Coler, president Borough of Brooklyn, for furnishing all labor and materials for repairs and alterations for lighting and power equipment in the Disciplinary Training School, Borough of Brooklyn, N. Y.

OLEAN, N. Y.—The Western New York & Pennsylvania Traction Company has been granted permission by the Public Service Commission, Second District, to issue an additional mortgage for $5,000,000 in favor of the Trust Company of America, of New York, N. Y.

ELMIRA, N. Y.—The Elmira, Corning & Waverly Traction Company has been granted a 60-year franchise by the Town Board of Ashland and the Wellsburg Valley Board for the construction of an electric railway through these towns.

FORESTVILLE, N. Y.—Application has been made to the Town Board by the Buffalo & Lake Erie Traction Company for a franchise to construct an electric railway in Forestville. The company is said to be preparing plans for building an extension of its railway between Silver Creek and Forestville.

FORT SLOCUM, N. Y.—Bids will be received by Captain Peter Murray, Quartermaster, U. S. A., until Feb. 11 for installing electric wiring and fixtures in drill hall and gymnasium building at this post. Plans and specifications and necessary information will be furnished on application to the above office.

MALONE, N. Y.—The Malone Light & Power Company has filed amendments to its charter giving it the right to make extensions to its system. The company proposes to extend its transmission line from Malone to the towns of Constable, Westville and Bangor, N. Y.

PATCHOGUE, N. Y.—The Patchogue Electric Light Company has been granted a franchise by the Brookhaven Highway Commissioners and the Town Board of Patchogue for the extension of its system throughout the entire south shore of the town, south of and including the Middle County road. The company has voted to increase its capital stock from $40,000 to $70,000, the proceeds to be used for extensive improvements to its plant. It is understood that the residents of Bellport, the Moriches, Bluepoint and other villages within the territory covered by the franchise will apply to the Town Board for permission to [illegible] to install street lamps.

PORT JERVIS, N. Y.—[illegible] Electric Light, Power & Railway Company [illegible] Curtis & Hazlett, attorneys for the Keystone Power Company, of New York, N. Y., [illegible] to the Keystone Company [illegible] by the company.

RENSSELAER, N. Y.—The Rensselaer Telephone Company, recently [illegible] to construct an exchange here in this city.

ROCKVILLE CENTRE, N. Y.—The question of enlarging the municipal [illegible] is under consideration.

SYRACUSE, N. Y.—The Syracuse Rapid Transit Company is reported to be making arrangements to construct a new street car line through Genesee and Richmond Streets and Stewart Avenue, for which an appropriation of $[illegible] has been made.

ASHEVILLE, N. C.—The Swannanoa Valley Company is making arrangements to finance its proposed electric railway, which is to extend between Biltmore and Montreat. J. M. Chiles, of Asheville, N. C., is secretary and treasurer.

BUTES CREEK, N. C.—The Buies Creek Improvement Company has been chartered to generate electricity and operate an automobile line.

GREENSBORO, N. C.—The North Carolina Public Service Company, capitalized at $3,500,000, has purchased the plant and holdings of the Greensboro Electric Company with rights of way for an interurban railway between Greensboro, High Point and Winston-Salem. Coler & Company, of New York, N. Y., are interested in the company.

LENOIR, N. C.—Eugene Ivey, superintendent of the Lenoir electric lighting plant, states that the plant will probably be enlarged in the near future.

MOUNT HOLLY, N. C.—The Woodlawn Manufacturing Company is making arrangements to install 5000 spindles in its new building, recently erected, and will require from 100 to 125 hp electrical equipment, for which, it is said, orders have not yet been placed.

SALISBURY, N. C.—The Piedmont-Carolina Railway Company has been granted a franchise by the Rowan County Commissioners to construct and operate an electric railway from Salisbury to China Grove and Landis, nine miles south of Salisbury, and to Spencer; also to the Yadkin Valley fair grounds, two miles north.

COLUMBUS, N. D.—Paul Ware, of Flaxton, N. D., has purchased the local telephone system and will make extensions and improvements thereto in the spring.

ENDERLIN, N. D.—Plans are being considered to install a gas producer engine in the local electric light plant at a cost of about $5,000.

GRAND FORKS, N. D.—The joint light committee of the City Council and Commercial Club has decided to adopt side lamps for the streets. It is proposed to erect 123 lampposts with one 10-watt and four 60-watt lamps on each post.

CANFIELD, OHIO.—An effort is being made to form a stock company for the purpose of establishing an electric light and heating plant in Canfield. W. J. Smith is interested in the project.

CINCINNATI, OHIO.—The Cincinnati, Wilmington & Xenia Traction Company, it is said, will let contracts this spring for the construction of its proposed railway. The railway will connect Cincinnati and Columbus, Ohio, and will be about 170 miles in length.

CINCINNATI, OHIO.—John J. Schoft, superintendent of the city infirmary, has requested the Board of Public Service to have plans prepared for a new electric light plant to cost $3,000, and for a new refrigerating plant to cost $15,000, for the city infirmary.

CLEVELAND, OHIO.—Plans are being prepared by the Cleveland Engineering Company for the new power plant for the new court house, to be erected at the corner of West Tenth Street and St. Clair Avenue. The cost of the building, including equipment, is estimated at from $150,000 to $200,000.

EDON, OHIO.—The Village Council is considering the question of lighting the streets of the town with electricity. It is proposed to make arrangements to have a transmission line extended from Edgertown to furnish electricical energy for the system. The cost of the street lighting service is estimated at $40 per month. Mr. Glock, of Edgerton, is interested in the Edgerton electric light plant.

LIMA, OHIO.—W. Kesley Schoepf, president of the Ohio Electric Railway Company, has submitted another proposition to the City Council offering to supply electricity for lighting the streets of the city at $57.50 per lamp per year, the new contract to begin June 11, 1909. The present contract has two years yet to run. The company also offers a reduction in prices for electricity for commercial lighting. It is understood that the Council will accept the proposition.

NEWBURG, OHIO.—Bids will be received by the Board of Public Service until Feb. 11 for lighting the streets, alleys and public places with electricity for a term of 10 years, in accordance with plans and specifications on file at the office of the City Clerk. E. T. Lawrence is City Clerk.

NEWTON FALLS, OHIO.—The Council has granted the Home Lighting Company a 20-year franchise to furnish electricity in Newton Falls.

PHILO, OHIO.—The contract for the construction of the power plant of the Center Valley Light & Power Company, to be erected on the site of the William Frazier mill at Philo, was awarded to A. W. McDonald, of Steubenville, Ohio, for $260,000.

PORTSMOUTH, OHIO.—The Board of Public Service has awarded the contract for lighting the streets of the city to the Portsmouth Street Railroad & Light Company for a period of ten years. The company is to furnish not less than 300 flaming arc lamps at $47.50 per lamp per year.

RIDGEWAY, OHIO.—The Early Light Company has taken over the plant formerly owned by J. A. Rumer, and proposes to improve and rebuild the plant. J. W. Early is manager.

YOUNGSTOWN, OHIO.—The Hydro-Electric & Gas Company has decided to construct a new building for its auxiliary power plant on [illegible].

EL RENO, OKLA.—The Chichasha Power Company will make application for a franchise to furnish electricity for lamps and motors in this city. The company has recently completed a hydro-electric plant on the [illegible].

ONTARIO, ORE.—The Inter-State Light & Power Company, which is erecting a transmission line from Horseshoe Bend on the Weiser River to Weiser, has completed its line to Snake River, one mile east of the town. A substation is to be erected in Ontario.

PENDLETON, ORE.—A telephone company has been organized in Pendleton to erect a telephone line from this city to Cold Springs. J. Hanscom and Hugh Bell are interested in the project.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Feb. 11 for furnishing steam pumps, electric motors, copper tubing, steel wire, etc. Blanks and general information relating to this circular (493) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officer.

BEAVER FALLS, PA.—The New Castle & Beaver Falls Street Railway Company is planning to commence work on the construction of its proposed electric railway this spring. The railway will be 22 miles in length and when completed will connect Beaver Falls, Kopple, Wampum, West Pittsburg and New Castle. C. Strochecker, of Zelienople, Pa., is general manager. Main offices of the company are in the Magee Building, Pittsburg, Pa.

BLOOMING VALLEY, PA.—Plans are being made by the Central Crawford Traction Company to begin work on the construction of its proposed electric railway connecting Meadville and Titusville, a distance of about 28 miles. J. W. Beard, of Blooming Valley, Pa., is secretary and treasurer.

ELLWOOD CITY, PA.—The contract for furnishing electricity for street lamps and for public buildings has been awarded to the Pennsylvania Power Company for a term of five years for 2 1-5 cents per kw-hour.

JENKINTOWN, PA.—The Gas & Electric Development Company, of Philadelphia, Pa., has sold the plant of the Jenkintown Light Company to a Philadelphia syndicate. The Jenkintown Light Company furnishes electricity for lamps and motors to various Philadelphia suburban towns. The directors are: William West, Harry C. Thayer, Edward E. Mandeville, Mathew F. Maury and W. W. Levering, all of Philadelphia, Pa.

LINESVILLE, PA.—J. C. Dick, of Franklin, Pa., has applied to the Town Council for a franchise to install an electric light plant in Linesville.

READING, PA.—The Metropolitan Electric Company has issued $2,000,000 in bonds, the proceeds of which are to be used to take up outstanding bonds to the amount of $150,000, and the remainder for the construction of a new power house and a modern transmission and distribution system, the cost of which is estimated at about $1,500,000. The above company is a subsidiary of the United Power & Transportation Company, of Philadelphia, Pa. Bids will soon be called for construction of the plant. Walter J. Jones, 60 Wall Street, New York, N. Y., is construction engineer.

WAYNESBURG, PA.—The Green County Telephone Company has decided to make extensive improvements to its telephone lines during the coming year, at an expenditure of about $50,000.

COLUMBIA, S. C.—A bill has been introduced in the State Legislature giving the street railway companies permission to generate and distribute electricity for lamps and motors either for their own use or for sale to municipalities or the general public, as well as to operate their electric railway systems.

LEXINGTON, S. C.—A telephone company has been organized by the farmers of the Rockywell section with the following named officers: Haskell Shull, president; Marshall Hook, vice-president; W. K. Hook, secretary, and G. A. Kaminer, treasurer.

SPENCER, S. C.—Application will be made to the Legislature by the Town of East Spencer for authority to issue $25,000 water and light bonds.

PRESHO, S. D.—The Pierre-Presho Telephone Company has purchased the telephone line from Presho to Sylvia, 15 miles in length, and will extend the telephone line to Lamro, Jordan, Little Crow and Rosebud Agency at once.

MT. PLEASANT, TENN.—The question of issuing $150,000 in bonds for the construction of an electric light plant, waterworks system and for sewer system is under consideration by the City Council.

NASHVILLE, TENN.—Contracts have been awarded for the construction of an addition to the power house of the municipal electric light plant.

ARANSAS PASS, TEX.—It is reported that J. P. Gandy, of Supply, Okla., will install an independent telephone system in Aransas Pass and vicinity.

BAY CITY, TEX.—The electric light and ice plant owned by Dr. W. M. Cave, of Bay City, Tex., has been purchased by W. G. Wilcox, of Joliet, Mo.

FLORESVILLE, TEX.—T. J. and F. Largen have been awarded a contract for the construction of an electric light plant in Floresville.

SANDERSON, TEX.—E. McGinley, of El Paso, Tex., is reported to be interested in a project to establish an electric light plant in Sanderson.

TOYAH, TEX.—Plans are being made by A. G. Vanhorn, owner of the local telephone system, to entirely rebuild the town system; also overhaul the long-distance lines extending to Kent, Balmorhea, Sargosa and Pera.

ETNA MILLS, VA.—The King William Telephone & Telegraph Company is contemplating extending its telephone line from Hanover Court House to Richmond, Va.

RICHMOND, VA.—The sub-committee on electricity has appointed Pressey & Weller, of Washington, D. C., electrical and hydraulic engineers, to review the plans and specifications for the proposed municipal electric light plant prepared by Edward W. Trafford, engineer for the plant. An appropriation of $[illegible] was made for the work.

CENTRALIA, WASH.—Theodore Hoss, of Centralia; A. Welch and W. J. Parterson, of Portland, Ore., who have secured a franchise to furnish electricity in Chehalis, are said to have purchased the contract for street lighting from C. L. McKenzie, president of the Chehalis Light & Power Company. The same parties hold a franchise to furnish electricity in Centralia, and also to operate a street railway system in both cities.

INDEX, WASH.—Application has been made to the City Council for a franchise by Nicholas Rudebach to construct and operate an electric light plant in Index.

KENNEWICK, WASH.—Application has been made to the City Council by the Yakima Valley Power Company for a franchise to erect transmission lines from its power plant through the Garden Tracts. It also proposes to furnish energy to the Northern Pacific Irrigation Company.

NORTH YAKIMA, WASH.—Preparations are being made by Norman Brothers, proprietors of the Hotel Tacoma and the Spokane and Yakima hotels, for the construction of a large power plant to furnish electricity for their hotels and also the entire business district of North Yakima. A central heating plant will also be installed in connection with the electric plant.

PASCO, WASH.—The American Power Company has filed water rights appropriating 500 cu. ft. of water from the Columbia River, to be used for irrigation purposes and to generate electricity for lamps and motors.

SEATTLE, WASH.—The Seattle Electric Company has been granted a franchise to extend its street railway system into the Rainier Valley along Rainier Boulevard.

SEATTLE, WASH.—We are informed that the contracts for installing the cluster lamp system on Second Avenue have been awarded as follows: For constructing underground conduit, to Charles F. McDonald, of Seattle, Wash., for $20,096; for furnishing transformers, cable, etc., to Meacham & Babcock, of Seattle, Wash., and for ornamental iron posts and cross-arms, to Olympic Foundry Company, of Seattle, Wash., for $3,954.

TACOMA, WASH.—The City Council has appointed Frank C. Kelsey, of Portland, Ore., as special engineer to have charge of the construction of the hydro-electric plant on the upper Nisqually River. The cost of the plant is estimated at $1,750,000.

PARKERSBURG, W. VA.—The Parkersburg, Marietta & Interurban Railway Company is making arrangements to construct a small power plant between Parkersburg and Marietta, on the Ohio side of the Ohio River, to supply electricity for its increasing business.

KENOSHA, WIS.—The City of Kenosha is open for propositions for furnishing electricity for street lighting. Franchises for furnishing electricity for commercial and residential lighting and also for motors will be granted. The city would also like to receive suggestions for the construction of a municipal electric light plant. The population of the city is about 25,000. For further information address Peter Pusch, chairman of the committee.

OCONOMOWOC, WIS.—We are informed that plans are being made to improve and enlarge the municipal electric light plant, the cost of which is estimated at $13,000. F. R. Hubbard is engineer in charge of the work.

WAUSAU, WIS.—The Marathon Paper Company has awarded the contract for the construction of its dam and power plant at Rothschild to O'Keefe & Ordson, of Appleton, Wis. It is proposed to develop about 8000 hp.

LANDER, WYO.—The Popo Agie Oil & Power Company is erecting a large electric power plant in the Dallas oil field, near Lander. The company proposes to generate electricity, using oil for fuel, to be transmitted to the South Pass mines. It will also furnish electrical energy to Lander and other towns in Fremont County for lamps and motors.

LARAMIE, WYO.—Hartley C. Taylor, of Kansas City, has been granted a franchise by the City Council to operate an electric light system in Laramie. He proposes to construct a hydro-electric power plant to be located [illegible] miles from the city.

CALGARY, ALB., CAN.—Bids will be received by the City Commissioners of the city of Calgary until Feb. 18 for furnishing the city with three water-tube boilers, with a rating of [illegible] each, one pumping and exhaust steam system for [illegible] one 60-kw generator, direct-connected to a high-speed engine for exhaust service, with condenser, switchboard, etc. Plans and specifications may be had on application to the city engineer, H. L. Gaby, C. E., city hall.

CALGARY, ALB., CAN.—Bids will be received by the Commissioners of the city of Calgary, Alb., until Feb. 18 for the [illegible] material, including track material, [illegible] poles, [illegible] and [illegible] head construction. Equipment for [illegible] construction [illegible] steel span wire poles [illegible] and [illegible] [illegible] miles of no. trolley wire [illegible] hangers, insulators and conical strain insulators, ears, cross-overs and [illegible] frogs. Bids will be received [illegible] of the same. Full particulars and specifications may be had [illegible] city engineer's office, H. L. Gaby, C. E., city engineer.

FERNIE, B. C., CAN.—Negotiations are pending with the Crow's Nest Pass Electric Light & Power Company for the installation of an electric lighting system here to replace the one destroyed last August.

MONCTON, N. B., CAN.—The City of Moncton has applied to Parliament for permission to construct and operate a municipal electric street railway. John S. McGee is city clerk.

COBOURG, ONT., CAN.—Application has been made to the Ontario Legislature, by G. H. A. Ward, for a charter for the Cobourg, Port Hope & Havelock Railway Company, which proposes to construct an electric railway to connect Port Hope and Cobourg, extending across the country to Warkworth, Campbellford and Havelock, thus connecting the lake front towns with the Canadian Pacific Railroad. A branch will also be constructed from Cobourg to Gore's Landing.

LINDSAY, ONT., CAN.—A motion has been made in the City Council to buy out the holdings of the Lindsay Electric Heat, Power & Light Company.

LINDSAY, ONT., CAN.—The City Council has appointed a committee to make investigation in regard to municipal ownership of lighting plant, with a view to purchasing the plant of the Electric Heat, Light & Power Company on the expiration of its franchise in about two years.

ST. LAMBERT, QUE., CAN.—The ratepayers voted in favor of granting a franchise to the Montreal & Southern Counties Electric Railroad Companies to operate an electric street car system here.

REGINA, SASK., CAN.—The city has protested to the Saskatchewan Legislature regarding the proposed charter to the Regina Interurban Electric Railway. The result is the company will be allowed to build only one line from the city. It is the intention of the city to construct a municipal street railway.

GUADALAJARA, MEX.—It is reported that Manuel Cuesta, of Guadalajara, who owns valuable water power rights on the Santiago River, including a concession for the installation of a large hydro-electric plant, will soon begin work on constructing of a plant. It is proposed to transmit electricity from the plant to Lake Chapala, where it will be utilized to operate electric pumps for irrigating large tracts of land.

GUANAJUATO, MEX.—The Guanajuato Light & Power Company has decided to erect another hydro-electric plant at El Duro, which will have an output of 9,000 hp. The plant, when completed, will give the company a total output of 20,000 hp. The company has recently completed a new double transmission line to points in the Guanajuato territory. Norman Rowe is general manager.

MEXICO CITY, MEX.—The Mexican Light & Power Company has let the contracts for the construction of three tunnels and canals for the purpose of diverting the water from outside of the watershed to the reservoirs of the company at Necaxa in order to add to the present water supply for the power plant at that point. One of the tunnels will be about 4500 ft. long and each of the other two about 1200 ft. long. The canal will be about two miles long.

PATZCUARO, MEX.—Francisco Contreras and Romualdo Fagoaga are planning to utilize the water of Lake Patzcuaro, in the State of Michoacan, and are preparing to install a hydro-electric plant and build transmission lines.

PUERTO, MEX.—Concessions have been granted by the State of Vera Cruz to Manuel L. De Guerara, of Puerto, Mex., for the construction of a tramway in this city.

SANTA ROSALIA, MEX.—The Compania Agricola y de Fuerza Electrica del Rio Conchos has been organized, with a caiptal stock of $10,000,000, to construct a large hydro-electric plant and transmission system in the State of Chihuahua, Mex. It is proposed to construct a large dam across the Conchos River near the town of Santa Rosalia, State of Chihuahua. Transmission lines will be erected to the cities of Chihuahua and Parral and to various mining camps, and to industrial centers within a radius of 175 miles. The plans of the company also call for the irrigating of about 100,000 acres of land which will be reclaimed from the valley of the Conchos River. The pumps will be operated by electricity. Paul Ginther is president.

URUAPAN, MEX.—A syndicate of Americans and Mexicans is preparing to install a large hydro-electric plant at the waterfalls of Cupatitzio, State of Michoacan. The concession for the enterprise has been obtained by F. Rodriguez on behalf of the syndicate. It is planned to erect transmission lines from the hydro-electric plant to the Town of Uruapan and other industrial and mining localities in that region to supply electricity [illegible].

Company Elections.

[illegible] Ala.—At the annual meeting of the [illegible] Company, the following officers were elected: [illegible] president; [illegible] vice-president; [illegible] and W. C. Bell, treasurer.

GALVESTON, TEX.—At the annual meeting of the Beach Electric Light & Power Company, the following officers were elected for the ensuing year: [illegible] Sealy, Hal Cruse, John C. Wilcox, R. W. Smith and Henry Runge.

ATLANTA, GA.—At the annual election of the Georgia Railway & Electric Company, the following officers were elected: E. S. Ackard, president; C. E. Rone, vice-president; [illegible] and general manager; and W. H. Glenn, secretary and manager of [illegible].

FITCHBURG, MASS.—At a meeting of the stockholders of the Fitchburg Gas & Electric Company, held Jan. 27, the following officers were elected: Charles H. Tenney, president; A. B. Tenney, general manager; Clifton R. Hayes, resident manager; William L. Walker, superintendent; Palmer York, treasurer. The board of directors is now composed of Herbert I. Wallace and Charles E. Ware, of Fitchburg, member of the former board; C. H. Tenney, F. P. Royce, H. P. Wood, Philip Cabot and A. B. Tenney, of Boston.

SIKESTOWN, MO.—At the annual meeting of the Sikestown Ice, Light & Power Company the following named officers were elected: C. D. Mathews, president; S. B. Hunter, vice-president; E. C. Matthews, secretary and treasurer, and C. L. Clary, general manager.

DOYLESTOWN, PA.—At the annual election of the Doylestown Electric Company the following named directors were elected: William H. Kirk, Harvey L. Scheetz, Samuel A. Hellyer, Frank L. Worthington, George W. McIntosh, John P. Stillwell, E. Wesley Keeler, Nelson K. Leatherman and George C. Hill.

POTTSTOWN, PA.—At the annual meeting of the Pottstown Light, Heat & Power Company the following named directors were elected: J. Allen Healy, Edgar S. Cook, Jacob C. Sotter, George N. Malsberger, John W. Healy, John W. Storb, J. Harry Carey. The directors elected J. Allen Healy president and Samuel H. Fridy, secretary and treasurer.

New Industrial Companies.

THE STANDARD IGNITION COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $2,500, to manufacture electrical devices by F. J. Casey, George L. Fish and A. A. McClanahan.

THE CUTTER LIGHT & STOVE COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $15,000, to manufacture lighting and heating devices, by George M. Cutter, Charles J. Puffer and William W. Kirtland.

THE ACME RAILWAY & STATIONARY REFRIGERATING COMPANY, of Camden, N. J., has filed articles of incorporation, with a capital stock of $125,000, for the purpose of manufacturing refrigerating machinery, electric motors, etc.

THE CONSTANT SUPPLY COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $100,000, for the purpose of manufacturing machinery and mechanical devices. The incorporators are Clarence D. Fuller, Ada L. Ames and Robert P. Bates.

THE CAMPBELL BELTING COMPANY, of Jersey City, N. J., has filed articles of incorporation, with a capital stock of $50,000, to manufacture machine belting. The incorporators are A. L. Campbell, J. Newberger and J. Nagengust, all of Jersey City, N. J.

BENNETT & BROWN, of Paterson, N. J., has been incorporated, with a capital stock of $10,000, by Arthur T. Bennett, of Suffern, N. Y.; Hector H. Brown and Edward R. Weiss, both of Paterson, N. J. The company proposes to do electrical construction work.

THE TRIPLE AIR LIGHT COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, by C. A. Campbell, A. W. Lurcott, of Brooklyn, N. Y., and M. May, of New York, N. Y. The company proposes to do a general electrical business.

THE CHARLOTTE MACHINE COMPANY, of Charlotte, N. C., has been granted a charter to manufacture and deal in electrical appliances, mill supplies and engines, with a capital stock of $2,000. The incorporators are F. J. Osborne, Thomas Costello and Albert M. Guillet.

THE ADRIA ARC LAMP COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $1,000, for the purpose of manufacturing gas and electric lamps. The incorporators are Leopold Wolf, Leo Altman and Bessie Altman, all of New York, N. Y.

THE MOTOR APPLIANCE COMPANY, of Perth Amboy, N. J., has been chartered, with a capital stock of $25,000, by Joseph P. Hall, Albert S. Deveau and Clarence C. Sibley. The company proposes to manufacture machinery, mechanical devices and engineering appliances, etc.

THE MORGAN ELECTROPLATING & MANUFACTURING COMPANY has filed articles of incorporation with the Secretary of State at Wilmington, Del., with a capital stock of $25,000. The incorporators are J. R. Morgan, H. O. Spangler, A. W. Kelly, all of Pittsburg, Pa.

THE AMERICAN WATER SUPPLY COMPANY, of Newark, N. J., has been chartered, with a capital stock of $400,000, to deal in machinery, tools, mechanical devices, etc., by Lawrence W. Luellen, Hugo Moore, of New York, N. Y., and Austin M. Pinkham, of Boston, Mass.

THE N. FROOKS COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $4,000. The incorporators are N. Frooks, Louis Singer and Adam Mark, all of New York, N. Y. The company proposes to deal in hot-air devices, engines and pumping machinery.

THE C. J. LITSCHER ELECTRIC COMPANY, of Grand Rapids, Mich., has been chartered, with a capital stock of $20,000, to deal in electrical machinery and appliances. The officers of the company are: C. J. Litscher, president; S. C. MacNeil, vice-president, and J. M. Loudon, secretary and treasurer.

THE H. C. GREENLAW COMPANY, of Boston, Mass., has been incorporated with a capital stock of $10,000, to manufacture plumbing, gas and electrical fittings. The officers of the company are: William C. Adams, of Dorchester, Mass., president; Harry C. Greenlaw, of Quincy, Mass., treasurer and clerk.

THE STERLING ENGINEERING COMPANY, of Newark, N. J., has been incorporated, with a capital stock of $100,000, by Roland D. Crocker, Harry H. Poole, of Newark, N. J., and William H. Daly, of Bloomfield, N. J. The company proposes to construct railways, bridges, water courses and aqueducts.

FITZPATRICK & COOMBS, of New York, N. Y., has been chartered by Jesse Arnette Fitzpatrick, Robert D. Coombs, Arthur W. Coombs, all of New York, N. Y., and John T. Fitzpatrick, of Albany, N. Y. The company is capitalized at $1,000 and proposes to carry on a business of building engineers and contractors.

THE R. W. MARSHALL COMPANY, of New York, N. Y., has been chartered by Charles C. Mann, Flatbush, N. Y.; Frank L. Quinby and Eugene C. Bogwell, of New York, N. Y. The company is capitalized at $150,000 and proposes to manufacture and deal in electrical and mechanical appliances and apparatus, etc.

THE INTERBOROUGH AUTO REPAIR & SUPPLY COMPANY, of Cold Spring, N. Y., has filed articles of incorporation, with a capital stock of $15,000. The incorporators are Frederick A. Verdon, Daniel McElroy and John McRoberts, all of Cold Spring, N. Y. The company proposes to build automobiles and electric cars.

THE INSTANTANEOUS ELECTRIC WATER HEATER MANUFACTURING COMPANY, of Newark, N. J., has been incorporated, with a capital stock of $25,000, by Joseph A. Shepperd, Thomas P. McCrane, of Newark, N. J., and James G. Alden, of Providence, N. J. The company proposes to manufacture an electric water heater.

THE ECONOMY FRICTION DRIVE & PULLEY COMPANY, of Boston, Mass., has been chartered, with a capital stock of $100,000, to deal in pulleys and machinery. The officers are: William H. Lafacile, president; John A. McDonald, vice-president; Amos M. McLean, treasurer, and Daniel E. Irwin, clerk, all of Boston, Mass.

THE INTERSTATE ENGINEERING & SUPPLY COMPANY, of Hoboken, N. J., has been chartered, with a capital stock of $100,000, as builders and contractors for construction of railroads, water, gas and electric works, tunnels, bridges, viaducts, etc. The incorporators are William F. Eidell, John A. MacPeak, of Hoboken, N. J.

New Incorporations.

JACKSONVILLE, ALA.—The Calhoun Light & Power Company has been incorporated with a capital stock of $5,000 by O. H. Herring, H. R. Rice and John P. Park.

OAKLAND, CAL.—The Oakland & Antioch Railway Company has been chartered, with a capital stock of $2,000,000, to construct an electric railway from Oakland to Bay Point, a distance of about 30 miles. The directors are: A. W. Maltby, of Concord, Cal.; S. L. Naphthaly, Allan Pollok, Walter Arnstein and F. W. Smith, all of San Francisco, Cal.; F. S. Brooks, of Alameda, Cal., and H. A. M. Mitchell, of Berkeley, Cal.

GREELEY, COL.—The Grover & Sligo Telephone Company has been incorporated with a capital stock of $10,000 to erect about 35 miles of telephone lines east and west to connect with the lines of the Colorado Telephone Company.

WILMINGTON, DEL.—The Montana Rapid Transit Company has been incorporated, with a capital stock of $5,000,000, to construct and operate electric railways.

ABBEVILLE, GA.—A charter has been granted by the Secretary of State to the Abbeville & Northwestern Railroad Company, with a capital stock of $100,000, to construct a railway connecting Abbeville with Fort Valley. The main line will be 58 miles in length, with a branch to Montezuma 17 miles long.

RUPERT, IDAHO.—The Settlers' Mutual Telephone Company has filed articles of incorporation with a capital stock of $48,000. The incorporators are L. R. Adams, R. W. Adams and Charles C. Nelson.

AUGUSTA, ILL.—The Augusta La Prairie Telephone Company has been incorporated with a capital stock of $1,000 by J. E. Pettijohn, Henry Ippensen and S. L. Miller.

AVON, ILL.—The Banner Telephone Company has been organized by B. W. and A. E. Rubart. The company proposes to construct a telephone line from Avon through the country into St. Augustine.

CHESTER, ILL.—The Chester Water & Power Company has been incorporated, with a capital stock of $7,000, by Edward P. Bronson, C. G. Randall and Don E. Detrick.

DORCHESTER, ILL.—Articles of incorporation have been filed for the Dorchester Telephone Company, with a capital stock of $1,875, by D. M. Thompson, Henry H. Bauer and F. B. Luken.

MARISSA, ILL.—The Star Telephone Company has been chartered, with a capital stock of $100, by G. F. Paul, R. J. Mearns and W. R. Lyon.

VERMILLION GROVE, ILL.—The Vermillion Grove Telephone Company ha sbeen incorporated with a capital stock of $5,000 by John M. Kendall, C. M. Hester and D. J. Pugh.

FOUNTAINTOWN, IND.—The Readywine Telephone Company has

been chartered with a capital stock of $600 by Richard W. Low, J. E. Gunn, William E. Reese, Jesse E. McRoberts and James P. Scott.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the People's Co-operative Telephone Company, of Boone and Hendricks counties, with a capital stock of $5,000.

JAMESTOWN, IND.—Articles of incorporation have been filed for the People's Co-operative Telephone Company, with a capital stock of $5,000 by George W. Pierson and others.

SEYMOUR, IND.—The Jennings & Jackson Telephone Company has been formed to construct a telephone line from Seymour to County Line. The officers are: L. Richart, president; William Kessler, vice-president; Fred Nichaus, secretary, and P. Speckner, treasurer.

GUTTENBURG, IA.—The West Union Rural Telephone Company has been organized by J. Shay, of McGregor; T. Morrison, of Decorah, and C. Curtz, of McGregor.

WILTON JUNCTION, IA.—The Moscow-Wilton Rural Telephone Company has been chartered with a capital stock of $500. H. H. Will of Moscow, will be secretary.

LYNNVILLE, KY.—The Lynnville Telephone Company has filed articles of incorporation with a capital stock of $4,000. The incorporators are: R. B. Pryor, Henry Conner and C. M. Richardson.

LOUISVILLE, KY.—Articles of incorporation have been filed for the Mutual Telephone Company, of Grayson County. The company is capitalized at $600, and the incorporators are: A. Moore, C. D. Moore and R. M. Cannon.

PILOT OAK (P. O. FULTON), KY.—Articles of incorporation have been filed for the Pilot Oak Telephone Company with a capital stock of $1,500 by J. A. Shelby, I. T. Howard and M. H. Weems.

SCIENCE HILL, KY.—The Science Hill Telephone & Exchange Company has been incorporated with a capital stock of $800 by William Lowery, T. W. Denney, A. Y. Hayes and others.

SEDALIA, KY.—The Sedalia Telephone Company has been incorporated, with a capital stock of $5,000, by A. K. Jones, R. F. Jones and G. G. Jones.

FRIENDSVILLE, MD.—The Youghiogheny Power Company has been incorporated with a capital stock of $100,000 to develop the water power of Youghiogheny River and its tributaries in Garrett County for the generation of electricity. The directors are: Clifford L. Pullin, Heber Crane, of New York, N. Y.; Carleton M. Moody, of Philadelphia, Pa., and William A. Morgart, of Cumberland, Md.

BROWERVILLE, MINN.—The Ward & Moran Telephone Company has been organized to erect and operate a rural telephone line to Long Prairie. E. T. Crist is president and Frank Haverick, secretary.

REDWOOD FALLS, MINN.—The Redwood Falls Electric Telephone Company has been incorporated with a capital stock of $50,000 by F. W. Philbrick and others.

KANSAS CITY, MO.—Articles of incorporation have been filed for the Missouri & Cameron Railway Company by William W. Lewis, Charles O. French, William A. Medill, Fred M. Titus and N. S. F. Peabody, all of Kansas City, Mo. The company is capitalized at $350,000, and proposes to construct a railway from the Missouri River in Platte County to Lathrop, a distance of 35 miles.

WEST PLAINS, MO.—The Globe Telephone Company has been organized to construct a rural telephone line to connect with the local exchange. John G. W. Richardson is president and Asa Jarrett secretary.

CAMDEN, N. J.—The American Gas & Power Company has been incorporated, with a capital stock of $1,000,000, by W. S. Darnell, M. H. Darnell and G. D. Connelly, all of Camden, N. J. The company proposes to manufacture and generate light, heat and power.

ELIZABETH, N. J.—The Traction Development Company has been chartered, with a capital stock of $100,000, for the purpose of securing franchises, rights of way and engineering plans for the Elizabeth & Amboy Traction Company, which proposes to operate an electric railway between Elizabeth and Perth Amboy. The incorporators are: Richard F. Pettigrew, Richard M. Montgomery, Dr. H. B. Hoagland, W. J. Lansley, C. A. Trimble and P. A. Peterson. Percival E. Jones, 27 Pine Street, New York, N. Y., is general counsel.

MIZPAH, N. C.—The Quaker Gapp Telephone Company has been incorporated, with a capital stock of $3,000, by W. G. Slate, J. W. Slate and W. C. Slate.

MEDINA, N. D.—The Central Telephone Company has been incorporated, with a capital stock of $100,000, by William J. Dwyer, Mary C. Dwyer and Katherine Dwyer, all of Medina, N. D.

MARYSVILLE, OHIO.—The Union County Farmers' Telephone Company has been organized at York, Ohio, with a capital stock of $[illegible]. The following officers have been elected: J. D. Coe, president; Charles Vanhining, vice-president; William Plotner, secretary and J. O. Thomas, treasurer. Post office address, R. F. D., Peoria, Ohio.

POLK, OHIO.—The Polk Rural Telephone Company has been incorporated with a capital stock of $[illegible] to operate a telephone system in Wayne and Ashland counties. The incorporators are: John E. Smith, John S. Kaufman, Harriette Riggs Hi Smith and Mae E. Smith.

YOUNGSTOWN, OHIO.—Articles of incorporation have been filed for the Buck Light Company with a capital stock of $[illegible] by Otis Kaufman and others.

COUNCIL HILL, OKLA.—The Council Hill Telephone Company has been chartered, with a capital stock of $10,000, by Trevor Faulkner, Otto E. Sump and others.

DUNCAN, OKLA.—The Washita Valley Rural Telephone Company, of Fair, Okla., has been chartered with a capital stock of $5,000 by W. G. Brymer, J. M. Brymer, of Fair; D. Brymer, of Duncan, Okla., and M. E. Harris, of McKinney, Tex.

ELGIN, OKLA.—The Elgin Farmers' Telephone Company has been incorporated with a capital stock of $3,000 by E. A. Roll, I. A. Fisher and H. E. Cline, all of Elgin, Okla.

GEARY, OKLA.—Articles of incorporation have been filed for the Atlanta County Telephone Company with a capital stock of $1,000. The directors are: A. B. Campbell, Otto Pallas and T. P. Quayle, all of Geary, Okla.

KEYSTONE, OKLA.—Articles of incorporation have been filed for the Keystone Telephone Company, with a capital stock of $400, by S. N. Alburty, C. O. Reynolds, A. J. Snow and P. E. Long.

SUMPTER, OKLA.—The Sumpter Telephone Company has been chartered, with a capital stock of $1,000, by Frank Wells, A. W. Newcomb, C. E. Geiger, William Riles and B. Esterday, all of Braman, Okla.

BURNS, ORE.—The Eastern Oregon Telephone & Telegraph Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: J. R. Jenkins, J. H. Jordan and E. T. Jenkins. The company proposes to construct a telephone line from Burns to Lawen to connect the Halley Valley line with the line from Burns to Paulina, and also plans to make connections with the vale as soon as possible.

HUNTINGDON, PA.—The Standing Stone Telephone Company has filed articles of incorporation with a capital stock of $5,000.

LEWISTON, PA.—The Juniata Valley Telephone Company has been incorporated with a capital stock of $5,000.

PLEASANT MOUNT, PA.—The Pleasant Mount Water & Light Company has been organized with the following named officers: J. D. Brennkerry, president; J. E. Tiffany, secretary, and J. W. Bunnell, treasurer.

TOWER CITY, PA.—The Porter City Township Light, Heat & Power Company has been chartered with a capital stock of $5,000.

HAYTI (P. O. HAMLIN), S. D.—The Hamlin County Farmers' Telephone Company has been incorporated with a capital stock of $25,000 by Warren Greene, A. H. Anderson, K. G. Knudtson, Edward Arzberger and P. O. Svarari.

VOLIN, S. D.—Articles of incorporation have been filed for the Volin Telephone Company with a capital stock of $25,000 by Iver Bagstad, A. O. Bagstad, Ole Peteson, Edward O. Leir and James F. Volin.

SPRING CREEK, TENN.—The Log Cabin Telephone Company has been formed to operate a telephone line from Spring Creek to Medina and proposes to extend the line through to Jackson. H. P. Utley is secretary and treasurer and G. W. Fly manager.

GILMER, TEX.—The Gilmer Ice, Light & Power Company has been incorporated with a capital stock of $40,000 by T. E. Harnwell, Lewis Monroe and J. E. Barwell, all of Gilmer, Tex.

NACHEZ, WASH.—The Nachez Irrigation & Power Company has been incorporated, with a capital stock of $8,000, by W. S. McPhee and others.

SPOKANE, WASH.—Articles of incorporation have been filed for the Spokane-Idaho Irrigation & Power Company, with a capital stock of $5,000, by O. R. Haight and others.

MANNINGTON, W. VA.—Articles of incorporation have been filed for the Consumers' Electric Light Company, with a capital stock of $100,000, by C. E. Morris, H. A. Nolk, Herman A. Hundt and others.

EAU CLAIRE, WIS.—The Chippewa Flambeau Improvement Company has been formed and will soon apply to the Legislature for a charter. The company proposes to erect a reservoir system to develop water power. Daniel Buchanan and William Irvine, of Chippewa Falls, Wis.; E. R. Sherry, of Park Falls, and W. L. Davis, of Eau Claire, are interested in the project.

SUNDANCE, WYO.—The Inyan Kara Telephone Company has been formed to extend the independent telephone line, which now terminates at Perrigoue, to Newcastle.

AYR, ONT., CAN.—The Ayr Rural Telephone Company has been incorporated with a capital stock of $[illegible].

Legal.

WESTERN UNION'S FRANCHISE IN GEORGIA.—[illegible] decree has been handed down by Judge Newman in Federal court at Atlanta, Ga., holding that the contract entered into by the Western Union Telegraph Company and the Postal Telegraph Company [illegible] is valid and does not violate the anti-trust law. A writing to be valid and [illegible] by the court will [illegible] to the Supreme Court.

TELEPHONE SWITCHBOARD LITIGATION.—Judge Kenkaid of the United States Circuit Court of [illegible] has rendered a decision in favor of the Sterling Electric Company in a suit against the Western Electric Company involving a [illegible] switchboard invention claimed by the latter company to infringe on that of R. McBerty, and by the former company on the invention of Samuel B. Fowler. Judge Kenkaid's decision held that Fowler contributed [illegible] to justify the [illegible] beyond [illegible] the trade.

ELECTRIC COMPANY NOT LIABLE FOR INJURY TO LINEMAN BECAUSE OF BREAKING OF CROSS-ARM.—It is the duty, as a matter of law, of a lineman, engaged in adjusting wires many feet above the ground, to inspect the cross-arm to which they are attached before placing his weight upon it and ascertain if it is strong enough to hold him; and where it does not appear that the lineman took the precaution of inspecting the cross-arm before climbing upon it, he is not entitled in an action against the company for damages to have the jury determine whether or not he failed in his duty. Camille B. Johnston v. Syracuse Lighting Company, N. Y. Court of Appeals, N. Y. Law Journal, Dec. 31, 1908.

FIRE CAUSED BY NEGLIGENCE IN MAINTENANCE OF TELEPHONE WIRES.—A recent decision of the Supreme Court of Appeals of Virginia holds a telephone company responsible in damages for a fire resulting from the improper manner in which the company's wires were maintained. The facts appear in the following statement by the court: "There is no question that there was a fire in the plaintiff's storehouse, and that the damages resulting to him therefrom were equal to the amount found by the jury. There was evidence that the fire started in the corner of the building where the telephone was located; that about two hours before the storehouse was discovered to be burning a fire did occur in the cable box on a telephone pole near Gibson's corner, from which point the wires ran into the plaintiff's storehouse; that the defendant's wires not far from that corner crossed under the heavily charged wires of the city's electric light system, and so near to them (1 in.) that they might come in contact with them, and had on several occasions given trouble because of such contact; that the city wires were as high as they could be placed on the poles, and that it had notified the telephone company that the latter's wires had been placed too near the electric light wires, and requested it to lower them, as could have been done, but no attention was paid to the request, though several times made; that the defendant had failed, when the telephone was installed in the storehouse, to put in a fuse block, an appliance in common use, which was intended to and did prevent the flow of electricity when unduly heavy, and the consequent damages resulting therefrom; that on the night of the fire there was trouble with the telephone, of which the defendant had notice. The conduct and admissions of the president and general manager of the defendant at and about the time of the fire tended to show that they believed that the telephone was the cause of the fire, as did the statement of the electrician of the Southeastern Tariff Association, who represented 50 or more insurance companies, and was sent to the scene of the fire to examine into its origin. There is no evidence in the cause which shows that it was reasonably probable that the fire originated in any other manner." Stauntoj Mutual Telephone Company v. Buchanan, 62 S. E. Rep. 928.

TELEPHONE AS A MEDIUM FOR PRESENTING PROMISSORY NOTE FOR PAYMENT.—That the law keeps pace with modern inventiveness is evidenced in a recent decision of the Supreme Court of New York to the effect that a promissory note may be presented to the maker for payment in a conversation had with him over the telephone. The note in the case was payable at 507 Prospect Place, Buffalo, N. Y. On the day on which the note matured a clerk in the employ of the bank which held the note called up the maker on the telephone at his residence, which was the place of payment, and asked if the note would be paid. The maker, after being informed that the note would not be renewed, stated that he was unable to pay it. In an action at law on the note, which the bank brought against the party who had endorsed it, the defense was that the endorser had been released by reason of the fact that the note had not been presented for payment at 507 Prospect Place in accordance with its terms. In answer to the question as to whether the note had been presented to the maker at the place of payment, said the court: "We think it was. At the time of the conversation between the maker and the bank official over the telephone the maker was actually at the place of payment. The talk was immediately between him and the holder of the note. For every purpose of demand and refusal it was just as effective as though the conversation had taken place between the parties when all were within the walls of the house itself. The use of the modern invention of the telephone is recognized by the courts. Commercial transactions and conversations had over the telephone have been recognized as of the same binding force as where the parties talked face to face. The telephone is simply an instrument by which two persons may talk directly to each other. Suppose the holder of a note should call to the maker from across the street, as the maker stood in his doorway, and notify him that he had his note and ask payment. Would not such a demand be deemed in law a proper presentment, although the street separated the person holding the note and the actual place of payment? Can it make any substantial difference because the person holding the note happens to be some blocks away, provided he is able to reach the maker over the telephone and talk directly to him in that way?" Gilpin vs. Savage, New York Supreme Court, Erie County Trial Term, 112 N. Y. Supp. 80.

CITY NOT BOUND BY CONTRACT WITH TELEPHONE COMPANY ALLOWING COMPANY TO MAINTAIN FIXED SCALE OF CHARGES.—A city cannot, unless it is so expressly authorized by statute, enter into a valid contract with a telephone company, authorizing the company to maintain a certain scale of charges, thereby surrendering a power of government vested in the city by its charter. This is the gist of a recent decision of the Supreme Court of the United States in which the Home Telephone & Telegraph Company brought suit against the city of Los Angeles to restrain the enforcement of municipal ordinance reducing the maximum telephone rate. The city derived its power to regulate telephone charges from section 31 of its charter, which authorized it, among other things, "by ordinance . . . to regulate telephone service and the use of telephones within the city . . . and to fix and determine the charges for telephones and telephone service and connections." A franchise for 50 years was granted by the city to the company by an ordinance, which stipulated for certain free service for the city, and the payment to it, after five years, of 2 per cent of the gross receipts, and provided that charges to the public for services should not exceed certain specified amounts. The city subsequently enacted an ordinance reducing the maximum rates allowable, which ordinance was objected to by the company on the ground that it impaired the obligation of the contract between it and the city. The question presented was whether the city had power to enter into the contract with the company fixing, unalterably, during the term of the franchise, charges for telephone service, and disabling itself from exercising the charter power of regulation. The following is quoted from the opinion of Mr. Justice Moody, who delivered the opinion of the court: "It has been settled by this court that the State may authorize one of its municipal corporations to establish, by an inviolable contract, the rates to be charged by a public service corporation (or natural person) for a definite term, not grossly unreasonable in point of time, and that the effect of such a contract is to suspend, during the life of the contract, the government power of fixing and regulating the rates. But for the very reason that such a contract has the effect of extinguishing protanto an undoubted power of government, both its existence and the authority to make it must clearly and unmistakably appear, and all doubts must be resolved in favor of the continuance of the power."

"The facts in this case which seem to us material upon the questions of the authority of the city to contract for rates to be maintained during the term of the franchise are as follows: The charter gave to the Council the power 'by ordinance . . . to regulate telephone service and the use of telephones within the city . . . and to fix and determine the charges for telephones and telephone service and connections.' This is an ample authority to exercise the governmental power of regulating charges, but it is no authority to enter into a contract to abandon the governmental power itself. It speaks in words appropriate to describe the authority to exercise the governmental power, but entirely unfitted to describe the authority to contract. It authorizes command, but not agreement. Doubtless an agreement as to rates might be authorized by the Legislature to be made by ordinance. But the ordinance here described was not an ordinance 'to fix and determine the charges.' It authorizes the exercise of the governmental power, and nothing else. We find no other provision in the charter which, by any possibility, can be held to authorize a contract upon this important and vital subject." Home Telephone & Telegraph Company v. Los Angeles, United States Supreme Court, Nov. 30, 1908.

Obituary.

MR. H. F. KELLOGG.—The death occurred at Newton, Mass., on Jan. 16 of Mr. H. F. Kellogg, well known as the New England representative of the Hoyt Electrical Instrument Company, of Pennacook, N. H. Mr. J. A. Massill, the superintendent of the company, writes us: "We feel that in his death we have lost a warm personal friend and valued business associate."

MR. LUCIUS T. GIBBS, electrical engineer of the Baltimore & Ohio Railroad, died on Jan. 22 of pneumonia after an illness of about a week. Mr. Gibbs is survived by a widow, who was Miss A. S. Duer, of Baltimore, and two children. Mr. Gibbs served as an apprentice in the machine shop of the Otis Elevator Company, and was assistant to the mechanical engineer of the Chicago, Milwaukee & St. Paul Railway. He was graduated from Cornell University in 1891 and was afterward made electrical engineer of the Milwaukee Street Railway Company. He was also vice-president and chief engineer of the Gibbs Electric Company of Milwaukee.

Personal.

MR. JAMES N. WALLACE has been elected a director of the Brooklyn Rapid Transit Company to succeed the late Mr. Anson R. Flower.

MR. FRANK AUSTIN, formerly of Mount Holly, N. J., has been appointed general manager and treasurer of the Capital Gas & Electric Company, of Frankfort, Ky.

MR. LOUIS A. FERGUSON, president of the American Institute of Electrical Engineers, has been elected one of the directors-at-large of the Chicago Association of Commerce.

MR. ETIENNE DE FODOR, general manager of the Budapest General Electric Company, has been honored by the King of Hungary with the title of Privy Councillor, in recognition of distinguished services rendered to his country.

MR. B. V. SWENSON, secretary of the American Street & Interurban Railway Association, has resigned to accept an attractive offer to engage in business in the electric railway field. Mr. Swenson will not entirely sever his connection with the association until his successor has been appointed.

MR. H. C. EDDY has resigned as district manager in Chicago for the American District Steam Company, but still remains one of the directors

of the company. Mr. Eddy began his electrical experience with the old Sprague Electric Railway & Motor Company and was for some time connected with the Western Electric Company. A number of years ago he was Western representative of the *Electrical World* and afterward of the *Street Railway Journal*. Subsequently he was associated with Mr. J. H. Cooke in the Chicago office of the Buckeye and Jandus Electric companies. After Feb. 15 Mr. Eddy will have an office at 412 Commercial National Bank Building, Chicago, for the sale of bonds, particularly of public-service corporations.

MR. C. G. YOUNG, who has been so intimately connected with the J. G. White interests for the past 16 years, is opening offices for himself at 60 Wall Street, New York, N. Y., for engineering examinations, estimates, reports, etc. Having important work of this kind to do in the Far East, he is sailing early in February for Japan, and, after visiting other countries, will return in August and take up a regular practice. His address until departure will be 43 Exchange Place, New York, N. Y. After an academic education, Mr. Young entered the old Schuyler electric factory at Middletown, Conn., in 1886, and went through all the branches of electric lighting, manufacture and construction. From 1888 until 1892 he was general superintendent of the Mount Morris Electric Lighting Company in New York, whose extensive system is now owned by the New York Edison Company. In 1892 he began his connection with the White-Crosby and J. G. White interests as construction superintendent, and in 1900 he went with J. G. White & Company, Ltd., of London, doing special expert work all over the world for it, especially in South America. Returning to this country, Mr. White since 1902 has been successively general superintendent of construction and construction manager for the American White corporations. In this manner Mr. Young has done important work in a great many cities in this country, as well as in the Philippines, Australia, Holland, Argentine Republic, Ceylon, Cuba, Canada, Uruguay, Brazil, Porto Rico, China, Chili, New Zealand and Japan. Mr. Young takes an active part in the general field of professional endeavor, and is a member of the American Institute of Electrical Engineers, associate member American Society of Civil Engineers, member of the New York Railroad Club, the New York Electrical Society, the National Electric Light Association and the Engineers' Club.



MR. C. G. YOUNG.

Trade Publications.

THE F. BISSELL COMPANY, Toledo, Ohio, is sending out a February calendar card bearing the symbolic axle.

CONCRETE FACTORY BUILDINGS.—The Turner Construction Company, 11 Broadway, New York, has issued bulletin No. 6, devoted to reinforced concrete factories and warehouses, and giving illustrations and descriptions of structures erected for J. B. King & Co., in New York City, and on Long Island.

WATT-HOUR AND AMP.-HOUR METERS are briefly noted and listed in publication No. 579 of Veritys, Ltd., 31 King Street, Covent Garden, W. C., London. It is claimed that these meters are unaffected by vibration, and may be shipped with assurance that they will be ready for immediate use upon arrival.

INSTRUMENTS.—The January, 1909, issue of the *Foxboro Recorder*, which is Vol I, No. 1, of this publication, announces the formation of the Industrial Instrument Company, with main office at Foxboro, Mass., to serve as sales company of the Standard Gauge Manufacturing Company and sales agent for the Standard Electric Time Company.

SMALL STATION SWITCHBOARDS.—A publication of considerable interest to central-station managers has been issued by the General Electric Company under the above title. The pamphlet discusses only representative cases, pointing out both the desirable and the undesirable features. The bulletin, numbered 4638, goes into details, giving the arrangements, dimensions and connections of various styles of boards.

WIRELESS TELEPHONY.—The De Forest standard navy type wireless telephone devices are described in bulletin D-1 of the Radio Telephone Company, 19 Exchange Place, New York. The Seibt wave meter is dealt with in bulletin G-1. Bulletin J-1 is devoted to variable inductance tuners, and bulletin J-2 to R. J. wave meters. A small variometer for changing the self-induction of oscillatory circuits described in bulletin L-3, while bulletin S-1 relates to school and demonstration telegraph and telephone outfits.

HARVARD SPECIALTIES.—The Harvard Electric Company, 66 West Van Buren Street, Chicago, and 136 Liberty Street, New York City, manufacturers of electrical necessities, has issued a new catalog (No. 17) which is descriptive of a part of the many electrical necessities made by the Harvard company. This publication is the forerunner of a new series of printed matter illustrating Harvard "Dependable Electrical Necessities." Catalog No. 17 describes Harvard patent steel brackets, beveled-edge self-welding wire joints, sectional switch boxes, etc.

FLASHLIGHT ENGINE INDICATOR.—A catalogue of the Dobbie-McInnes, Ltd., 5 Bothwell Street, Glasgow, Scotland, deals with an interesting form of engine indicator, in which the usual multiplying parallel motion is dispensed with and a beam of light is substituted therefor. The motion is received from the rocking of a mirror bracket positively connected by linkage to the engine; the beam reflected from the mirror traces out the indicator diagram on a glass screen for immediate observance on a photographic plate for preservation.

ROLLER BEARING TROLLEY BASE.—In Bulletin No. 4642, just issued by the General Electric Company, is described a new trolley base designed for the increased speed of interurban cars and the consequent severe conditions. The base is light, strong and so sensitive that it not only permits of sharp turns at high speed without danger of throwing the trolley off, but by eliminating the arcing, pounding and wrenching insures a minimum wear on trolley wheels. The bulletin contains a complete description, including illustrations and dimensions.

GREASE VERSUS OIL.—An attractive brochure is printed by the Keystone Lubricating Company, Philadelphia, bearing the above title and containing comparisons of the efficiency of the two great types of lubricant that are used to grease the wheels of industry. Some of the inner reasons for the extensive use of the liquid lubricant, oil, at the present day, to do the work that should properly be done by grease, are explained; and the evolution of "Keystone Grease," stated to be a pure, natural product free from the harmful ingredients and objectionable features of ordinary grease, are set forth. A feature of the argument for Keystone grease is an account of exhaustive tests made by the head chemist of Messrs. William Cramp & Sons, the Philadelphia shipbuilders, on the chemical constitution and mechanical and anti-friction qualities of the product. This booklet may be obtained gratis on application to the home office of the company, Philadelphia, or to any of its agencies.

Business Notes.

THE ECONOMICAL ELECTRIC LAMP COMPANY has removed from 96 Warren Street, New York City, to 25 West Broadway.

THE STANDARD ASPHALT & RUBBER COMPANY will remove its general offices to Suite 508-511, Home Insurance Building, 205 LaSalle Street, Chicago.

THE H. B. KIRKLAND COMPANY, 253 Broadway, New York, N. Y., has been appointed the New York sales agent for the product of the Chicago Mica Company.

THE PELTON WATER WHEEL COMPANY announces the removal of its executive and sales offices from Nineteenth and Harrison Streets to the Monadnock Building, Third and Market Streets, San Farncisco.

THE BALL ENGINE COMPANY, of Erie, Pa., in order better to serve its increasing clientage in the Southern States, has opened an office in the Empire Building, Atlanta, Ga., with Mr. B. C. Fennell, M. E., as sales manager.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, has recently got up an attractive paper weight showing on one side a picture of the "Exide" battery and on the reverse side a general view of the offices and works.

W. F. LEGGETT COMPANY, INCORPORATED, is the title of a new corporation which succeeds to the business formerly operated by W. F. Leggett, at 56 Pine Street, New York. The address of the new concern will be 39-43 Gold Street, New York.

THE CONDIT ELECTRICAL MANUFACTURING COMPANY, Boston, Mass., reports that the new year opens with a business boom for it, and that recently some very large contracts among mills of the Middle West have been closed, and others are being completed.

ALABAMA ELECTRIC COMPANY, Birmingham, Ala., is the style of a newly organized concern which will carry on a general engineering and contracting business. The company also expects to carry a complete line of pictures. The manager of the new business is Mr. J. A. Swanton.

A CLEVER CALENDAR.—The February calendar card of The F. Bissell Company, Toledo, Ohio, has attached a miniature axe which can be removed and pinned to a coat lapel, and to which point is given by the remark: "It cuts no ice with us whether the job is large or small—we'll handle it in a satisfactory manner."

NORTHERN ENGINEERING WORKS, Detroit, Mich., have recently supplied traveling cranes to the Black Hills Traction Company, of Deadwood, S. D.; one three-ton to the New Phoenix Foundry & Machine Company, of Springfield, Mo.; one 15-ton to the city of Oswego, N. Y., and two 7½-ton traveling cranes to the Western New York Construction Company, of Buffalo, N. Y.

THE SOUTHERN ENGINEERING & SUPPLY COMPANY, has opened offices at 220 Avenue D, Henry Terrell Building, San Antonio, Tex. It proposes to make a specialty of pumping and refrigerating machinery; also isolated and small light and refrigerating plants. Manufacturers interested in southwestern territory not having representatives are requested to send catalogs and descriptive literature.

THE LIBERTY MANUFACTURING COMPANY, Pittsburgh, Pa., informs us that the arrangement it had with the Advance Packing & Supply Company to handle its Chicago business has been terminated and that it has opened an office at 1001 Manhattan Building, Chicago, in

charge of its own representatives. Mr. W. M. Burns and Mr. G. M. Porter will look after its interests in the future in the Chicago territory.

THE NILES CAR & MANUFACTURING COMPANY, Niles, Ohio, held its annual meeting Jan. 26 at the works. The old board of directors and officers were re-elected and the usual dividends of 8 per cent on the preferred and 6 per cent on the common stock were declared. President Robbins' report showed that, while the output for 1908 was less than 50 per cent of that of 1907, it was all taken at a fair profit and a substantial balance was added to the surplus.

ASH HANDLING PLANTS.—The U. S. Navy Department has awarded a contract for an ash-handling and storage plant for the Navy Yard at Charleston, S. C., to the Darley Engineering Company, 149 Broadway, New York. The contract calls for an 8-in. suction conveyor with a 25-ton storage tank. This is the fourth order the Darley Engineering Company has received from the government for its suction ash conveyor since last May, the others being for the navy yards at New York and Philadelphia, and for the Soldiers' Home at Washington. Armour & Company have just awarded to the same company, through its Chicago office, a contract for an 8-in. suction ash conveyor for their South Omaha plant. This makes the fourth order for suction conveyors awarded by Armour & Company to the Darley Engineering Company, the other plants being installed at the Chicago Glue Works, East St. Louis Packing Plant and the Sioux City Packing Company. A recent order from the American Steel & Wire Company for an 8-in. suction ash conveyor for its Rankin plant makes the third order for these conveyors so far from the United States Steel Corporation and two orders from the American Steel & Wire Company. The Quincy Market Cold Storage & Warehouse Company, Boston, Mass., has just placed an order for an 8-in. suction ash conveyor for its Richmond Street plant.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Lloyd Lyon, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West 39th St., New York.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, Niagara Falls, Canada, May 6, 7 and 8, 1909.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, United Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, 559 Frick Building Annex, Pittsburg, Pa. Next meeting, October, 1908.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago. Next meeting, Detroit, June 23, 24 and 25, 1909.

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, Walter S. Mower, London, Ont.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York.

ASSOCIATION OF CAR LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Chicago & Illinois Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, S. E. Mumford, Detroit, Mich.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Indianapolis, Ind.

CHICAGO ELECTRIC CLUB. Secretary, S. M. McFedries, care J. L. Schureman & Co., Chicago.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, September, 1909.

EASTERN STATES INDEPENDENT TELEPHONE ASSOCIATION OF PENNSYLVANIA, NEW JERSEY, MARYLAND AND DELAWARE. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 500 Fifth Ave., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau St., New York.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, V. R. Lansingh, 33 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, Lewis H. Woods, Imperial Hotel, Broadway and 32d St., New York.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., 1909.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Ia. Next meeting, Cedar Rapids, Ia., April 21 and 22, 1909.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Next meeting, Des Moines, March 9, 10 and 11, 1909.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Cedar Rapids, Ia., April, 1909.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., October, 1909.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meetings, second Tuesday in October, each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-Treasurer, Ludwig Kemper, Albert Lea, Minn. Next meeting, Nicollet Hotel, Minneapolis, Minn., March 18 and 19, 1909.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss. Next meeting, Jackson, Miss., June 15, 1909.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Schweer, Windsor, Mo.

MISSOURI ELECTRIC LIGHT, GAS & STREET RAILWAY ASSOCIATION. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, April 15, 16 and 17, 1909.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, F. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, Boston, Mass., June 10, 1909.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln, Neb.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Temporary chairman, J. D. Crary, Aberdeen, Wash. Next meeting, Seattle, 1909.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio. Next meeting, Columbus, Ohio, March 18, 1909.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Canton, Ohio, May 21 and 22, 1909.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburg, Pa., 1909.

PENNSYLVANIA ELECTRIC ASSOCIATION. E. L. Smith, Towanda, Pa., secretary.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meetings, fourth Monday each month. Next annual meeting, fourth Monday in February, 1909.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, J. A. Myler, Jr., 609 Juanita Building, Dallas, Tex. Next meeting, Dallas, Tex., May, 1909.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next meeting, New York, March, 1909.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., October, 1909

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1 each year

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 26, 1909

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y.City.]

910,495. MEANS FOR THE PURIFICATION OF WATER; D. L. V. Brown, San Francisco, Cal. App. filed Oct. 21, 1907. Softens water by electrolysis. Uses a series of anodes and cathodes in the tank made of various metals, such as iron, zinc, etc., together with a series of carbon anodes and cathodes.

910,498. PROCESS OF MANUFACTURING CHEMICAL COMPOUNDS; Courtland F. Carrier, Jr., Elmira, N. Y. App. filed June 5, 1906. The process of making compounds of the alkali metals which consists in subjecting a fused bath containing a salt of the metal which will react with the metal to form the desired product, to electrolysis. A soluble anode, comprising a fused alloy of the metal, and a metallic electrode which is electro-negative to the anode form the means for introducing the current.

910,548. ELECTRIC METER; R. C. Lanphier, Springfield, Ill. App. filed Aug. 23, 1905. The rotating element is submerged in mercury. An independent metallic damping disk with a permanent magnet acts as a brake in such a way that the braking effect is much greater than the damping effect produced by the shunt coils upon the driving disk

910,549. ELECTRICAL INDICATING INSTRUMENT; R. C. Lanphier, Springfield, Ill. App. filed Sept. 21, 1907. A volt, ampere or watt meter for alternating or direct current of the mercury motor meter type. The armature is so shaped that its successive radii diminish in length as the disk rotates. This eliminates the operation of the normal law of squares on the indicating finger.

910,550. MOTOR-METER FOR ALTERNATING CURRENTS; R. C. Lanphier and J. H. Hodele, Springfield, Ill. App. filed July 6, 1908. Improvement in mercury meters in which the initial friction is overcome so as to avoid creeping on no load when the voltage rises. Makes use of a primary and secondary of a transformer, the former across the load circuit and the latter provided with a two-branch circuit having auxiliary windings which pass around the load exciting magnet in opposite directions. An adjustable resistance is interposed in the circuit of the secondary whereby the volume of current flowing through the divided circuit may be varied.

910,561. CONTROLLER; J. F. Menningen, Oakley, O. App. filed Dec 30, 1907. A spring-pressed cam is provided which co-operates with the parts moved by the handle of the controller and which biases the controller through the off position when the controller is at the starting position and in certain other positions. This throws the controller back to off position if the operator releases the handle when starting.

910,[illegible] ELECTRIC FURNACE; James Henry Reid, Newark, N. J. App. filed Aug. 22, 1908. An electric furnace having a pair of opposing electrodes and a pair of metal carrying elements with contactors and extending between the electrodes. [illegible] are led to the electrodes from a supply above the [illegible]

910,[illegible] ELECTRIC FURNACE; James Henry Reid, Newark, N. J. App. filed Nov. 9, 1908. Polyphase current is supplied to the furnace by means of a [illegible] of which different phases of the current [illegible] second into the top of the [illegible]

910,[illegible] ELECTRIC BLOCK-SIGNAL SYSTEM; Paul I. Sampsell, Los Angeles, Cal. App. filed Apr. 3, 1907. [illegible] are provided on the [illegible] and [illegible] arranged to [illegible]

910,[illegible] TROLLEY CATCHER; James M. Shaffer and Fred E. Green, Bartlett, O. App. filed Feb. [illegible] Automatic means for [illegible] the trolley wheel [illegible] the passage of a car under the [illegible] detached wire to take the [illegible]

910,[illegible] TELEPHONE RECEIVER; Alfred [illegible] Chicago, Ill. App. filed Oct. 21, 1908. The diaphragm is provided with a [illegible] edge consisting of [illegible]

910,[illegible] SYSTEM OF CONTROL; E. W. Stone, Newark, O. App. filed June 8, 1907. [illegible] Among the [illegible] and an interlocking arrangement provided between the controlling drum and reversing switch so as to prevent improper handling. The controller comprises a single drum which is arranged to vary the resistance and to connect the motors, in series, in multiple series and in full multiple.

910,622. AUDIPHONE-TRANSMITTER; Charles E. Williams, Natick, Mass. App. filed Aug. 6, 1907. The instrument is suspended in front of a sounding board. It is provided with a resilient back and the sound is intensified thereby.

910,638. ALTERNATING-CURRENT-MOTOR SYSTEM; C. S. Bradley, New York, N. Y. App. filed May 7, 1906. Controls the capacity in circuit with the secondary of a motor generator, automatically, by means of a centrifugal governor connected to the motor generator.

910,643. APPARATUS FOR MAGNETIC TREATMENT OF DISEASES; R. S. Clymer, Allentown, Pa. App. filed Dec. 27, 1907. Magnetic pole pieces convered with sponge are connected by flexible magnetic strands of magnetic material to electromagnets.

910,649. REGULATION OF DYNAMO-ELECTRIC MACHINES; W. F. Dawson, Schenectady, N. Y. App. filed July 2, 1902. Particularly for boosters which will maintain a practically constant voltage at some point on the system regardless of the load. The series wound booster is provided with an additional shunt winding connected to the main. The booster is located in a feeder extending from the mains. The shunt winding, which is in series with an adjustable resistance, is controlled by a magnet through the variation in voltage at the end of the feeder.

910,658. SYSTEM OF LIGHTING BY ARC-LAMPS; R. Fleming, Lynn, Mass. App. filed March 6, 1907. An alternating current circuit having a pair of arc-lamps in it, each having dissimilar electrodes. The rectifying action produced thereby is avoided by connecting half the total number of lamps reversely with respect to the others.

910,661. CIRCUIT-CONTROLLING DEVICE; H. Geisenhoner, Schenectady, N. Y. App. filed Jan. 14, 1907. For starting and controlling the speed of electric motors, such as fans. A device actuated by wind pressure from the motor cuts out resistance.

910,664. MAGNETIC SEPARATOR; C. M. Green, Lynn, Mass. App. filed Dec. 10, 1904. A magnetic separator consisting of two massive iron rollers journaled horizontally in a frame with peripheral teeth.

910,670. ARC-LAMP; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Jan. 16, 1907. Either one or both electrodes are consumed in burning. When the lamp is not burning a floating chimney drops down until the upper electrode rests on the lower. The chimney is lifted in striking the arc.

910,676. AUTOMATIC STARTING DEVICE FOR ELECTRIC MOTORS; Ivan Hansen, Malden, Mass. App. filed April 18, 1906. A starting switch which is entirely automatic in its action for starting single-phase motors. The switch breaks the circuit of the phase-splitting starting device and is controlled by two magnets. When the motor speed increases the switch is released.

910,682. ELECTRIC HEATER; G. H. Hill, Schenectady, N. Y. App. filed July 9, 1908. The electric heater includes a heating element, an electromagnetic circuit-closing device therefor arranged to control its own circuit and a thermostat for controlling the circuit of said device.

910,[illegible] DRIVING MECHANISM FOR RECORDING [illegible]; [illegible] Boyer, Chicago, Ill. App. filed [illegible] a magnetic clutch [illegible] the motor circuit.

910,[illegible] CARTRIDGE FOR MINING PURPOSES; E. Purcell and S. Purcell, Pontefract, England. App. filed March 30, 1908. A detonator is placed within the [illegible] high tension is provided with a light disk having an aperture for the wires of the detonator.

910,[illegible] ELECTRIC HEATING DEVICE; A. L. Rosenau, New York, N. Y. App. filed Dec. 26, 1907. An electric heater having a metallic plate with an insulating surface and a central boss and distance plate with a high resistance wound partly on the boss and partly on the distance plate

910,[illegible]. GUARD COVERING, FOR THIRD RAILS; E. M. Scholten Berger, Chicago, Ill. App. filed June 4, 1908. The guard has elastic side walls which may move freely with respect to the rail.

910,736. ELECTRIC LAMP AND METHOD OF MAKING THE SAME; C. P. Steinmetz, Schenectady, N. Y. App. filed Nov. 17, 1902. (See 910,582.) In order to be able to run a mercury vapor lamp at a high temperature which improves the quality of the light and permits the use of lithium compounds and the like, the inclosing chamber is formed of fused quartz with nickel steel inleads for the current.

910,743. VARIABLE RESISTANCE; E. Thomson, Swampscott, Mass. App. filed Sept. 28, 1905. An improved form of flake resistance of granular silicon. The compression is varied by suitable means.

910,762. AUTOMATIC MOTOR-STARTER; W. C. Yates, Schenectady, N. Y. App. filed May 9, 1908. For alternating-current circuits having a polyphase supply circuit. Uses a plurality of automatically operated switches for first connecting the motor through the supply circuit to a transformer and then connecting the motor directly to the supply circuit, together with a no-voltage magnet responsive to any phase of the circuit.

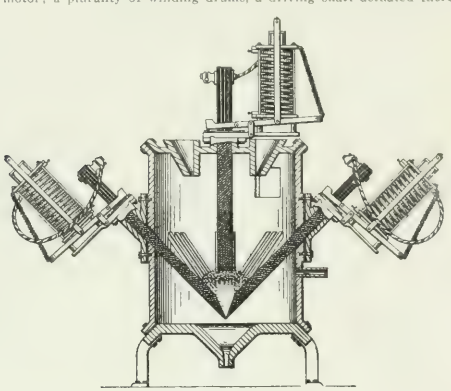
910,765. COMBINED BOX-HANGER AND GROUND-CLAMP; Sol. Adelman, Chicago, Ill. App. filed May 18, 1908. Can be easily attached to completed work without tearing away material. Makes use of a ground clamp having a split sleeve with ears secured to the outlet box.

910,770. RESILIENT FLEXIBLE CONDUIT; Ulysses S. Armstrong, New Kensington, Pa. App. filed Sept. 26, 1907. Recovers its original form after being flattened. Consists of a series of tubes one within the other and made of non-combustible fiber with woven or braided wire.

910,795. RESISTANCE; J. L. Dinsmore, New York, N. Y. App. filed Jan. 29, 1908. Resistance for arc-lamps and the like separated from the electrical structure, comprising a casing, having a perforated base member, a plurality of spools fixed to the base member, the spools overlapping but out of contact.

910,797. TROLLEY-HEAD; W. E. Donnelly and W. L. Goyette, Chicopee Falls, Mass. App. filed April 28, 1908. A detachable wheel holder having a head with a tubular end to receive one end of a pole member and provided with co-operating interlocking means and a nut to engage and draw the parts into interlocked relation.

910,798. ELECTRIC HOIST; W. O. Duntley, Chicago, Ill. App. filed July 30, 1907. Employs a plurality of motors instead of a single motor; a plurality of winding drums, a driving shaft actuated thereby,



910,582—Electric Furnace.

a plurality of motor armatures and a common field magnet for the armatures.

910,799. INSULATOR PIN; S. J. Edmiston, Greenwich, N. Y. App. filed June 26, 1908. The pin is bifurcated at its lower end to form resilient portions and the lower end has a projection to prevent withdrawal of the pin from a socket.

910,822. SECONDARY BATTERY; H. F. Joel, Forest Gate, England. App. filed Aug. 10, 1907. Cylindrical electrodes are arranged one within the other and are provided with corresponding ribs.

910,835. ELECTRIC SWITCH; P. W. Macy, Orlando, Fla. App. filed Sept. 20, 1907. To light the lights of a house singly or collectively by means of a switch having a casing with contact buttons mounted therein and a shaft operated by a hand crank to select the proper button.

910,842. ELECTRIC-TERMINAL CLIP; G. McIntyre, Jersey City, N. J. App. filed Aug. 2, 1906. One terminal of the loop forms a finger piece and the other terminal also forms a finger piece which may be pressed together to release the loop from the binding post.

910,873. TELEPHONE RINGING SYSTEM FOR PARTY-LINES; C. A. Simpson, Chicago, Ill. App. filed Nov. 30, 1907. Party line system in which the bell is connected in series with a condenser which permits a ringing current to pass for the bell. Avoids discharging all the condensers when the ringing key is released, thus giving a false clearing-out signal. The discharge current is diverted away from the clearing-out signal by a shunt about the coil of the clearing-out signal.

910,892. FIELD-MAGNET OR THE LIKE; C. P. Bary, Neuilly-sur-Seine, France. App. filed Oct. 24, 1905. The magnet has a central part with lateral prolongations, the section of the central part being twice as great as that of each of the lateral prolongations, and the distance between two poles being equal to or less than twice the width of the central part.

910,894. PROCESS OF MAKING TITANIUM ALLOYS; F. M. Becket, Niagara Falls, N. Y. App. filed June 5, 1907. Consists in reducing a titanium ore in an electric furnace by means of carbon in presence of sufficient silicon to exclude from the product carbon in excess of [illegible]

910,911. RAILWAY SIGNALING MECHANISM; L. H. Craft, Dennison, O. App. filed Sept. 23, 1907. A single-arm three-position blade driven by a gear wheel and controlled by a magnet which actuates a latch to connect the gear to the driving shaft.

910,913. MEDICAL ELECTRICAL DEVICE FOR MEDICAL AND THERAPEUTICAL PURPOSES; F. A. Litgowsky, Cincinnati, O. App. filed Feb. 24, 1908. Glass plates, induction coil batteries, etc., are provided for producing the ozone, together with a clockwork for controlling the action so as to time the generation of ozone.

910,931. ELECTRIC CARRIER SYSTEM; S. H. Libby, East Orange, N. J. App. filed Aug. 1, 1906. For raising and lowering a load at a station and transferring it to another station, where it is again raised and lowered without requiring the attendance of the operator between stations. Makes use of a trolley conductor having an insulated section at each of the stations, a carrier which travels between the stations and a motor on the carrier with suitable switches.

910,949. AUTOMATIC TENSION-REGULATOR FOR ELECTRICAL GENERATORS; A. Nicol, Berlin, Germany. App. filed Jan. 22, 1908. An auxiliary device operating intermittently increases the tension in the exciting circuit and accumulates energy, which again reduces the tension when the device ceases to operate the adjuster.

910,951. CONTROLLER FOR ELECTRIC MOTORS; W. A. Paris, Edgewood Park, Pa. App. filed March 3, 1906. Uses a rotatable contact drum having a plurality of similar groups of contacts, together with a plurality of stationary contacts comprising two electrically connected but independently yielding fingers which engage the drum at points 90 deg. apart.

910,957. BLOCK-SIGNAL; C. H. Roth and H. A. Harrington, Akron, O. App. filed Dec. 6, 1906. Incandescent lamps of different colors used for single-track roads. Controlled by means of a solenoid and plunger from the track.

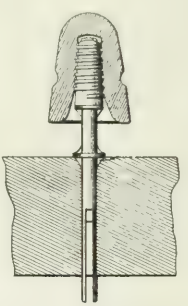
910,961. ROLLER BEARING FOR ROCKER-RINGS; R. Siegfried, Pittsburgh, Pa. App. filed May 1, 1905. Roller bearings for the rocker-rings that support the commutator brushes of dynamo electric machines. Details.

910,965. CONNECTOR ATTACHMENT FOR BATTERIES; J. F. Sims, Columbus, Neb. App. filed June 23, 1908. A draw-spring having a coil, one end of which is embedded in the battery and which affords means for inserting a connector wire between the coils of the spring. Avoids the use of screws.

910,969. ELECTRIC LAMP AND METHOD OF MAKING THE SAME; C. P. Steinmetz, Schenectady, N. Y. App. filed Nov. 17, 1902. (See 910,736.) The end portions of the enclosing chamber are formed out of fused quartz combined with potassium so as to form glass. This permits the use of the ordinary leading-in wires.

910,975. CLEAT FOR ELECTRIC WIRES; A. L. Vickers, New Sharon, Ia. App. filed Sept. 23, 1907. The cleat has a base with top members mounted on the base, the members being capable of removal independently of one another. The top member thus consists of sections.

910,989. INSULATING COMPOUND; P. J. Cannon, W. H. Young and



910,799—Insulator Pin.



910,842—Electric Terminal Clip.

C. Bateholts, Schenectady, N. Y. App. filed Dec. 26, 1903. The compound can be molded into shape. Consists of 67 parts of ground slate, 10 parts of asbestos, 6 parts of kauri, 10 parts of copal, 5 parts of gilsonite and 2 parts of rosin.

910,991. ELECTRIC STORAGE BATTERY; S. S. Cole, Sandy Hook, Conn. App. filed July 10, 1907. A unit for a storage battery cell having a plurality of apertured electrode plates. Bolts pass through the apertures and connect the plates together.

911,011. MULTIPLE-VOLTAGE SYSTEM OF CONTROL; R. P. Jackson, Wilkinsburg, Pa. App. filed March 3, 1906. May be supplied with alternating current or direct current and with alternating current of two or more voltages. A switch arranges the circuits according to the character of energy supplied. Translating devices are automatically connected to the source of alternating current when the alternating current is supplied to the system.

911,013. MOTOR-CONTROL SYSTEM; H. D. James, Pittsburg, Pa. App. filed May 6, 1907. For driving planers and the like in which the speed of the bed is high in one direction and low on the return. The electric motor has an accelerating resistance with a series of short-circuiting switches for the resistance and means governed by the load for opening the switches to reinsert resistance.

911,016. ALARM SYSTEM; W. H. Kirnan, Bayonne, N. J. App. filed July 30, 1908. A fire alarm system in which signals are received and automatically transmitted to the various engine houses over a joker line or a gong line or simultaneously over both. The apparatus on the gong line can be switched on to and actuated through the joker line and signals sent to either the joker apparatus or gong apparatus when desired when the gong line is broken.

911,018. ELECTRIC APPARATUS; B. J. Lamme, Pittsburg, Pa. App. filed May 6, 1907. For securing the magnetizing winding in the slots of laminated core structures by means of a plurality of coil-retaining blocks disposed in each slot and separated by air spaces and relatively narrow insulating spacers disposed between the blocks to maintain the air spaces.

911,020. MERCURY-MOTOR METER; R. C. Lanphier and O. White, Springfield, Ill. App. filed Aug. 20, 1908. The armature casing is composed of an upper member of insulating material having a circular recess adapted to receive an armature, a lower member composed of a thin plate of non-magnetic material, a clamping ring and means for clamping said upper member, said lower member and said clamping ring firmly together.

Rossiter, Mac Govern & Co.

ESTABLISHED 1893 (INCORPORATED)

ALTERNATING AND DIRECT-CURRENT GENERATORS AND MOTORS

Electrical Apparatus of All Kinds

WEST STREET BLDG., 90 WEST STREET, NEW YORK — **TELEPHONE, CORTLANDT 4105**

Direct Current Generators, Belted.

220-250 volts

1—400 KW. General Electric, 450 R.P.M.
1—200 KW. Crocker-Wheeler, 450 R.P.M.
1—200 KW. Triumph, 500 R.P.M.
1—200 KW. Bullock, 500 R.P.M.
1—110 KW. Card, 500 R.P.M.
1—100 KW. Fort Wayne, 550 R.P.M.
1—100 KW. Milwaukee, 600 R.P.M.
1— 75 KW. General Electric, 750 R.P.M.
1— 65 KW. General Electric, 875 R.P.M.
2— 65 KW. Eddy, 500 R.P.M.
1— 50 KW. Sprague Electric, 720 R.P.M.
2— 45 KW. Edison, 1000 R.P.M.
1— 40 KW. Eddy, 850 R.P.M.
1— 35 KW. General Electric, 1010 R.P.M.
1— 30 KW. Crocker-Wheeler, 800 R.P.M.
1— 30 KW. Fort Wayne, 1050 R.P.M.
1— 30 KW. General Electric, 1050 R.P.M.
1— 22½ KW. Westinghouse, 750 R.P.M.
1— 22½ KW. Crocker-Wheeler, 850 R.P.M.
1— 20 KW. Fort Wayne, 1200 R.P.M.
1— 15 KW. Edison, 1500 R.P.M.
1— 14½ KW. C. & C., 875 R.P.M.
2— 12 KW. Edison, 1600 R.P.M.

SEND FOR COMPLETE STOCK LIST

COMMONWEALTH EDISON CO.

REPAIR SHOPS

76 MARKET ST., CHICAGO. TELEPHONE MAIN 1280.

FIRST-CLASS EQUIPMENT THROUGHOUT

DYNAMOS, ARMATURES, MOTORS, ARC LAMPS, INSTRUMENTS, HIGH GRADE MACHINE WORK OF ALL KINDS

CORRESPONDENCE SOLICTED

SPARKING

reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All of this may be avoided if you use



The only article that will prevent sparking. Will keep the commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

It will put that high gloss on the commutator you have so long sought after

Send for Stick **50c. PER STICK** **$5.00 PER DOZ.**

For Sale by All Supply Houses or **K. McLENNAN & CO.** Sole Manufacturers

Room 411—130 Dearborn St., CHICAGO

BE INDEPENDENT

OWN AN ELECTRIC LIGHTING PLANT

We have a number of attractive opportunities to offer in different sections of the country. If you have $3,000 or more, write us.

THE GAS & ELECTRIC DEVELOPMENT CO.

1328 Chestnut Street, Philadelphia, Pa.

Electric and Hydro-Electric Properties

FINANCED

We are prepared to finance meritorious Electric Light, Railway and Power propositions in any country.

ROYAL SECURITIES CORPORATION, LIMITED

179 ST. JAMES STREET MONTREAL, CANADA

HELP WANTED

(Continued from page 86.)

WANTED—General foreman for the power apparatus shops; applicant must have good mechanical and executive ability; one with experience in the manufacture of generators and motors preferred, though this is not a necessity; apply by mail only, stating age, experience in full detail and salary expected; personal interview may be arranged for later. Address Department No. 29, Western Electric Company, Chicago.

WANTED.—Chief engineer for modern steam turbine plant of 10,000 hp; state age, experience, salary expected; give references. Address No. [illegible] care of Electrical World, New York.

WANTED—Steam engineer having first-class license to take charge shift in hydro-electric power station; must be familiar with Corliss engines and parallel operation of alternators; salary, $80 per month. Address "Chief Engineer," No. 5236, care of Electrical World, New York.

WANTED—An experienced electrical engineer, thoroughly familiar with the electrical and mechanical design of D. C. motors; must be a technical graduate; write fully, giving age, qualifications, experience and salary expected. Address No. [illegible], care of Electrical World, New York.

WANTED.—Technical writer by a large electrical manufacturing company to prepare copy for a general line of publications; should be able to write in semi-popular vein and present matters attractively to consumers, and should have good taste in display and typographical effects; moderate amount of electrical knowledge essential; the more the better; liberal salary to the right man; give full particulars and state salary desired. Address No. 5248, care of Electrical World, New York.

WANTED.—Competent and experienced man who is a hustler and can bring results to solicit business for modern electric plant in Southern city, where keen competition prevails; must be of strictly good character and thoroughly familiar with electric illuminating and power propositions; must be able to take full charge of soliciting new business and contracts department; only first-class man need apply; salary $100 a month. Address No. [illegible], care of Electrical World, New York.

WANTED.—Subinspectors (electrical). Pay from $3.04 to $4.00 per diem. A competitive examination will be held at the Navy Yard, Brooklyn, N. Y., February 23, 1909, for the purpose of establishing an eligible register of subinspectors (electrical). For application and further information address "Commandant," Navy Yard, Brooklyn, N. Y.

WANTED—An experienced foreman for a magnet wire factory in New England. Address MAGNET WIRE, No. [illegible], care of Electrical World, New York.

MISCELLANEOUS

The rate for "Miscellaneous" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

ELECTRICAL INVENTORS should employ technical patent attorney, because Patent Office examiners are technical experts; but no examiner nor other patent attorney than undersigned is member both A. I. E. E. and A. S. M. E. Mail invention for free advice, opinion, estimate and booklet. Delay dangerous. Edward P. Thompson, M. E., Reg'd. Pat. Atty., [illegible] Broadway, New York. Thompson Sq.

WANTED.—Contracting and supply business in growing town west of Missouri River; place must offer opportunities for consulting work; correspondence also invited from places where new business, requiring services of tech[illegible] Electrical World, [illegible] York.

INVENTOR has patented excellent electrical device; big demand; owing to lack of capital, desires party to manufacture and market same; fortune to be made; those in electrical manufacturing business preferred; no agents. Address No. [illegible], care of Electrical World, New York.

(Continued on page 89.)

FOR SALE

DYNAMOS

MOTORS METERS

ARC LAMPS

TRANSFORMERS

ELECTRICAL SUPPLIES

We **rent** Electrical Machinery.

We **repair all makes** of Electrical **Apparatus.**

Send for our **latest** complete **bargain book** and **net prices.**

Guarantee Electric Co.

Adams and Clinton Sts. **CHICAGO**

EDWIN R. ROCKWELL, General Manager

220-250 VOLT DIRECT CONNECTED AND BELTED UNITS.

Direct Current: **Immediate Delivery**

One 100 K.W. Walker D.C. to Watertown engine.
One 75 K.W. General Electric D.C. to Harrisburg engine.
One 50 K. W. Walker D.C. to Watertown engine.
One 35 K.W. C. & C. D.C. to Payne engine.
Two 15 K.W. Crocker-Wheeler D.C. to gas engines.
One 200 K.W. Crocker-Wheeler–3 bearing–450 RPM.
One 125 K.W. C. & C.–6 pole–450 RPM.
One 100 K.W. General Electric–4 pole–form H–650 RPM.
Two 100 K.W. Crocker-Wheeler–6 pole–650 RPM.

We buy, sell, rent and repair.

YEARSLEY, LEVENE & CO.

211 North Third Street **PHILADELPHIA, PA.**

BARGAINS

Alternating and direct current motors, dynamos; also plating dynamos at bargain prices. All makes and sizes sold, bought and repaired.

EUGENE L. RICHTER ELECTRIC CO.,

Dept. A. N. E. Cor. Uber & Columbia Ave., PHILADELPHIA, PA.

FOR SALE

The stock of a lighting plant in Northern New Jersey serving 7,500 people. Will sell on a 10 per cent. net earning basis. Plant in first-class condition and good reasons for selling.

No. 5197, Care of Electrical World, New York

NATIONAL STAMPING & ELECTRIC WKS.

We buy, sell, repair and reconstruct dynamos, motors, meters, transformers and arc lamps. Carry in stock, ready for immediate shipment, a full line of reconstructed machines.

153-159 SOUTH JEFFERSON STREET **CHICAGO, ILL.**

Vacuum Pumps

We have for sale a large stock of high-grade Packard Type Vacuum Pumps ranging in size from 4″ x 6″ to 12″ x 12″. Second hand but guaranteed to be in good operative condition. Also several new 2½ x 4¾ Chemical Vacuum Pumps.

YORK ELECTRIC & MACHINE CO.
30-34 N. Penn St. **York, Pa.**

Motors and Generators
New and Second-Hand
LARGE STOCK
If you don't know what you want, ask
"JONES"
We Buy We Sell We Rent
ARTHUR JONES COMPANY
85 VAN BUREN STREET, CHICAGO

Frank MacGovern

MacGovern, Archer & Co.

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114-118 LIBERTY STREET, 'PHONE, CORT. 5577 **NEW YORK**

Electrical and Steam Machinery

DIRECT CURRENT DIRECT CONNECTED UNITS

2—200 K.W., General Electric, 8 pole, 250 volts, 200 r.p.m., each with a 14&28x16 cross compound Ball & Wood engine.
2—150 K.W., Crocker-Wheeler, 115-125 volts, 8 pole type, speed 160 r.p.m., each with a heavy duty 4 valve type horizontal McIntosh & Seymour engine.
1—100 K.W., Bullock, 250 volts, 400 amp., direct connected to 12&19x14 tandem compound Erie Ball.

DIRECT CURRENT DYNAMOS and MOTORS (220-250 volts)

1—250 K.W., 250 volts, G. E., 8 pole type, 425 r.p.m.
2—20 H.P., G. E., 4 pole, 1025 r.p.m.
6—15 H.P., Westinghouse, 4 pole, 615 r.p.m.

500-550 VOLT MOTORS

1—85 H.P., G. E., Type C. L., 6 pole, 800 r.p.m.
1—25 H.P., G. E., Type H., 4 pole, 650 r.p.m.
2—10 H.P., G. E., Type C. E., 4 pole, 1050 r.p.m.

A. C. DIRECT CONNECTED UNITS (60-Cycle)

1—300 K.W., G. E., 3-phase, A. T. B., 150 r.p.m., 2300 volts, with 14&28x30 horizontal, C. C. McIntosh & Seymour engine.
1—145 K.W., Westinghouse, 2-phase, 257 r.p.m., 2200 volts, with 18x16 horizontal Erie Ball engine.

ALTERNATING CURRENT DYNAMOS (Belted, 3-phase)

1—300 K.W., Westinghouse, 60 cycle, 2200 volts, 300 r.p.m.
2—200 K.W., G. E., A. T. B., 60 cycle, 600 r.p.m., 2300 volts.
1—100 K.W., G. E., A. T. B., 60 cycle, 2300 volts, 900 r.p.m.
1—75 K.W., G. E., A. T. B., 60 cycle, 2300 volts, 900 r.p.m.

ARC DYNAMOS

1—No. 9½ B. Brush, 6.8 amp., oil regulator.
3—No. 10 A. Brush, 9.6 amp.

SEND FOR FULL LIST OF ELECTRICAL AND STEAM MACHINERY, ENGINES, BOILERS, ALTERNATING and DIRECT CURRENT MOTORS

DIRECT-WILL & PARTAL [illegible]
ALTERNATE

JOHN A. STEWART ELECTRIC COMPANY.

ELECTRICAL AND STEAM MACHINERY FOR IMMEDIATE SHIPMENT

A. C. DIRECT CONNECTED UNITS

1,200 K.W., 60 cy., 3 ph., 440 v., R.F. Alternator with cross comp. Horiz. H.D. Engine.
1,500 K.W., G.E., 60 cy. Monocycle revolv. field Alternator with Cross Comp. H. D. Hamilton.
800 K.W. G. E., 60 cy. Monocycle, R. A. Alternator, with Cross Comp. H. D. Hamilton.
600 K.W., Westgh. 60 cy., 2 ph. or 3 ph., R. A. Alternator with H. D. Engine.
600 K.W., Stanley 60 cy., 2 ph. or 3 ph. Alternator, with Vert. Comp. Triple Expans. Engine.

ALTERNATOR FOR BELTING OR COUPLING

1,500 K.W., 60 cy., 3 ph., 2,300 v., R. F. Alternator 100 r.p.m.
600 K.W., Stanley 60 cy., 2 ph. or 3 ph., 2,300 v., R. P. Alternator, 277 r.p.m.
300 K.W., Bullock 60 cy., 3 ph., R. F. Alternator, 600 r.p.m.
250 K.W., Ft. Wayne, 60 cy., 3 ph., R. P. Alternator, 600 r.p.m.
225 K.W., Bullock, 60 cy., 3 ph. R.F. Alternator, 600 r.p.m.

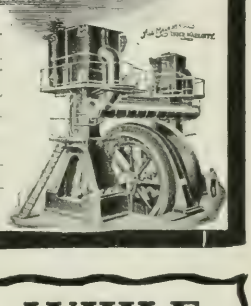
D. C. DIRECT CONNECTED UNITS

1,000 K.W., G. E. 250 v., Form L Generator with Tan. H. D. Porter-Allen.
400 K.W., G. E., 250 v., Form L Generatorwith Tan. H. D. Engine.
200 K.W., Westinghouse, 125-250 v. Generator with Vertical Ball Engine.

D. C. BELTING OR COUPLING

400 K.W. G. E., 250-320 v., Form L Generator, 450 r.p.m.
200 K.W. Triumph, 250 v., MPo Generator, 500 r.p.m.
100 K.W. Ft. Wayne, 250 v., MPo Generator, 550 r.p.m.

Correspondence solicited for requirements in every size Engines, Boilers Smaller Motors and Generators. Reference from many cities gladly furnished.



DYNAMOS, MOTORS, BARGAINS

Largest finest stock of new and second-hand machines in New York City.

Renting, Repairing

GEORGE BENDER, 82-84 Centre St. NEW YORK

FOR IMMEDIATE SHIPMENT

Railway Generators

1-525 K.W. G.E. Direct current volt
1-600 K.W. G.E. Belted
1-425 K.W. G.E. Direct current volt
2-250 K.W. G.E. Direct
Also belted and direct Generators at 125 and 250 volts

Alternators

Good Stock of Alternators of all phases

Corliss Engines

1-18 X 24 X 42 Hamilton
1-24 X 48 Nordberg Heavy duty
1-16 X 42 Allis Corliss Engine
Also other Corliss Engines and Automatic Engines

Watertube Boilers

All pressures up to 160 lbs
Write us as to your needs

STATION EQUIPMENT COMPANY, 204 Dearborn St., Chicago Ill.

WORTH WHILE

50 K.W. Ft. Wayne direct current Generator, 125v—direct connected to 12" x 12" Buffalo Forge Auto Engine—A1 condition.

50 K.W. Westinghouse direct current Generator, 250v—direct connected to 11" x 11" Harrisburg Engine with switchboard panel complete.
Has never been unpacked

100 H. P. Erie Ball high-speed Engine.

2, 3½, 7½, 10, 12½, 15, 17½, 22½, 25 and 30 K. W. direct current Generators, in good operative condition.

CORLISS ENGINES of all sizes—LOW FIGURES

GREENSBORO SUPPLY CO.

GREENSBORO, N. C.

MISCELLANEOUS

(Continued from page 87.)

FOR SALE, or trade by owner, electric plant in growing city of 5,000; desirable franchise; fine equipment; income over $21,000; operating profits over $6,500 annually; increased 20 per cent last year and growing; liberal terms, or would trade for good city real estate or Western land. Address E. R. L., 409 Temple Court, Denver, Col.

WANTED.—Partner who has had several years' experience in the electrical contracting business who will put $2,000 or $3,000 in the business; located in town of 10,000; one competitor; no supply house; must come well recommended. Address "B.," No. 5240, care of Electrical World, New York.

AGENCIES wanted by well-established electric and manufacturing company in St. Louis, Mo., for reliable electrical and mechanical specialties; will consider fan motor proposition, want good line of 40 and 60-volt D. C. fan motors for electrically lighted railway cars. Address No. 5234, care of Electrical World, New York.

PROPOSALS

NOTICE.

Applications are invited for the post of Chief Electrical Engineer to the Government of Mysore, pay Rs. 1,500 (£100) per month; passage money to and from India will be paid by Government, on condition that applicant binds himself to serve for at least 3 years, with option for renewal on either side. Copies of testimonials, &c., to be forwarded with applications; and they should reach the undersigned not later than the 15th of May, 1909.

None but those duly qualified for the place need apply. Any other terms to be stated.

W. J. W. HULSLIN,
Secretary to the Govt. of Mysore
Public Works Department.
Bangalore, 9th January, 1909.

CITY OF LETHBRIDGE, ALBERTA, CANADA.—Tenders for Municipal Power Plant.—Specifications, drawings and form of tender may be obtained from the Secretary-Treasurer, City of Lethbridge, Alberta, on and after the fifteenth day of January, 1909. The following are the sections issued: (A) Boilers and Accessories; (B) Economizers; (C) Feed Pumps. (D) Mechanical Draft. (E) Pipe Work and Valves; (F) Steam Turbine Generator; (G) Steam Engine Generator; (H) Reerection of Steam Engines; (I) Condensing Sets; (J) Crane; (K) Switchboards, etc.; (L) Motor Generators and Transformers; (M) Building Steel Work, etc. Tenders on any or all of the above sections, or any combination of the above sections, will be received. Tenders [illegible] addressed "Tenders for Electric Plant," and to be delivered to the undersigned at the City Hall, Lethbridge, on or before the 1st day of March, 1909, and to remain open for acceptance for two (2) calendar months from that date. Each tender must be accompanied by a certified check payable to the Secretary-Treasurer of the City of Lethbridge for 10% (ten per cent) of the amount of the tender, which will be returned to the tenderer unless he fail to enter into contract for the work at the rate stated in the tender. Plans and specifications may also be seen at the offices of Messrs. Sproatt, Rolph & Chave, Confederation Life Building, Toronto, and the Carnegie Public Library Building, Winnipeg, Manitoba. The lowest or any tender not necessarily accepted. A deposit of $10.00 (ten dollars) will be required for use of plans and specifications, which will be returned upon letting of contract. GEO. W. ROBINSON, Secretary-Treasurer.

CONDENSERS

4—5000 KW condensing sets complete with circulating, wet and dry air pumps, driven by direct-connected heavy-duty Corliss engines. Now being replaced by larger units in the Commonwealth Edison Co.'s Fisk Street Station.

Details as follows:

3—Alberger Combined Engines and Pumps, having 18-in. steam cylinder, two 24-in. vacuum cylinders, 24-in. diameter circulating pump, 12-in. hot-well pump cylinder, 30-in. stroke, and are arranged as follows:

The hot-well pump cylinder is just back of the steam cylinder. The two air cylinders set in a vertical position over the main shaft, from which the centrifugal circulating pump is driven.

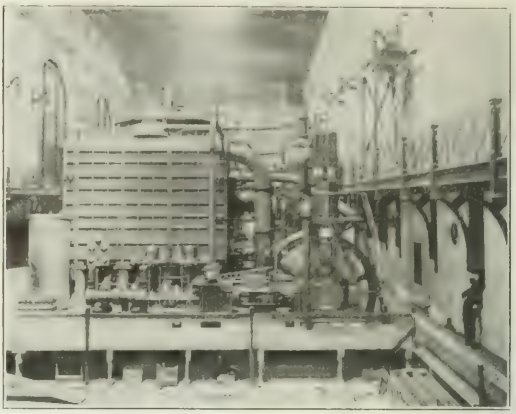
1—Alberger Combined Engine and Pump, having 14-in. steam cylinder, two 24-in. vacuum cylinders, 24-in. diameter circulating pump, 12-in. hot-well pump cylinder, 20-in. stroke, arranged same as above pumps.

8—14-in. x 10-in. x 24-in. Dean Bros. single-cylinder vertical feed pumps arranged in pairs on cast-iron base plate, with common suction.

4—20,000 sq. ft. Alberger Surface Condensers with brass tube heads, but without tubes.

4—2000 sq. ft. Alberger Feed Water Heaters with 942 brass tubes, ⅝ in. O. D. x 13 ft. 2 in. long, and with brass tube heads.

4—Cast-iron Hot Wells, 4 ft. 0 in. diameter x 10 ft. 9 in. high.



1—10 in. x 2" in. x 12 in. Dean Bros. Duplex Hydraulic Pump, 1200 lb. pressure per square inch.

2—6 x 4 x 6 Duplex Pumps, low pressure, (Stilwell-Bierce).

2—1½-in. Quimby Oil Pumps, with ½-hp Lundell motors.

4—2 in. x 8-in. Stilwell Bierce hydraulic triplex pumps with 7½-hp General Electric motors.

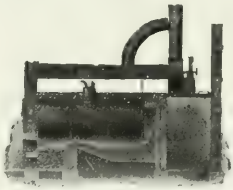
1—75-KW MARINE EXCITER SET—110 TO 125 VOLTS—DIRECT-CONNECTED TO 10½-IN. x 18-IN. x 8-IN. TANDEM-COMPOUND VERTICAL ENGINE.

POWER EQUIPMENT CO., 1407 Fisher Building, Chicago, Ill.

INDUCED DRAFT INDUCES ECONOMY

Applied to existing plants

THE "A. B. C." SYSTEM



Typical Induced Draft Plant

increases boiler efficiency and makes possible the use of cheaper fuel. In new plants it does away with need of a tall stack and gives high efficiency with low fuel cost.

In both new and old plants it increases convenience and promotes economy. Cut out and attach this "ad." Tell us your present difficulties. *It will pay you to know* what we can do there's no obligation to that

AMERICAN BLOWER COMPANY

Principal Offices: Detroit, Mich. Works: Detroit, Mich. and Troy, N. Y.

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AIR DRIVEN AND WATER DRIVEN

for Fire tube and Water tube boilers

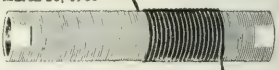
HEADS OF HIGH SPEED TOOL STEEL

The Roto Co., Hartford, Conn.

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Trade Mark **LAVITE** Patented March 26, 1906

for any insulation. Insulation equal to glass. Stands any heat. Always the same, and made exactly any shape or size. Ask for book of properties.



D. M. Steward Manufacturing Co., Chattanooga, Tenn.

WANTED IMMEDIATELY

A surface condenser for an 800-H.P. engine.

CITIZENS ELECTRIC CO.

Williamsport, Pa.

Want Advertisements Bring Results

"It may please you to know that I got the position of Superintendent of this company through an advertisement that I inserted in the ELECTRICAL WORLD."

Electrical World

The consolidation of Electrical World and Engineer and American Electrician.

Vol. LIII. NEW YORK, THURSDAY, FEBRUARY 11, 1909. No. 7.

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Dominion of Canada..... 4.50
Other Foreign Countries within the Postal Union..... 6.00
25 shillings. 25 marks. 31 francs.

Foreign subscriptions may be sent to our European office.

Requests for changes of address should be made one week in advance, giving *old* as well as new address. No copies of issues prior to July, 1907, are kept on sale, except in bound volumes. Subscription orders being renewable at the end of the month indicated on the wrapper, the sending of remittances on or before that date will be much appreciated by the publishers.

NOTICE TO ADVERTISERS

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday for the paper dated Thursday of the same week.

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NEW YORK, THURSDAY, FEBRUARY 11, 1909.

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Figures of Export Trade.

The issuance of the detailed figures of foreign trade for December completes the data for the fiscal year 1908. Our readers are already aware that while the trade balance was more than ever in favor of the United States, there was a serious decline in the grand total. The gross imports were $1,116,440,081; the gross exports were $1,752,833,247. This is a good deal of international commerce, but both items are far below those of 1907. The decline is but symptomatic of the world-wide dullness and depression that now has lasted well-nigh two years, but has been most felt during the past twelve months. We have already noted the falling off in electrical exports; and in this respect December did nothing to redeem the situation. The export of electrical instruments amounted to $611,616 as compared with $515,701 for the same month in 1907; and the export of heavy electrical machinery for the corresponding periods declined from $837,811 to $587,559. Thus the slight gain on instruments was more than offset.

The totals for the year have no element of cheerfulness about them, although it is believed that the conditions prevalent in 1908 are being left behind. The total export for 1908 of electrical instruments and appliances was $5,657,008, a falling off of not less than $2,068,537 from 1907. The total export of heavy electrical machinery was $6,956,722 as compared with $9,735,230, a falling off to the tune of $2,778,508. The two items together show $12,613,730 as compared with $17,460,775, or a net falling off of $4,847,045. This is a loss of over 25 per cent in the one year. The shrinkage has been both in bulk and in value, and electrical exporters have their work cut out to get back to the former high levels. We believe it can and will be done; but that will require courage and persistence and thoroughly scientific methods of finding out what the markets need and of filling those specific wants.

Next Meeting of the International Electrotechnical Commission.

The International Electrotechnical Commission held a council meeting in London last October, as was duly announced in our columns about that time. The German delegates intimated at the meeting the hope that if the next full meeting of the commission were scheduled for 1910 Berlin might be selected as the place of meeting. We learn that, since the adjournment of the council meeting, a formal invitation has been transmitted by the German national committee to the secretary of the commission in London, asking that Berlin be chosen as the place of meeting of the next convention, and that this invitation has been regularly accepted, although the date of the convention has not yet been assigned. The International Electrotechnical Commission was suggested at the St. Louis congress, nearly five years ago, and it was organized three years ago. Up to the present time it has accomplished nothing but "preliminary work." Of course, much has to be done in order to organize and effect the pre-

liminary arrangements for so scattered a body as an international electrotechnical commission, so that a reasonable time must be allowed for inauguration and initiation. But it is now time to expect real accomplishment. There is much to be done. The rules under which dynamo-electric machinery and apparatus are standardized and rated vary materially in different countries. By a little adjustment and compromise it should be possible to arrive at a single set of international rules, commencing with a minimum number and gradually extending them as far as may be found desirable. It is not to be expected that all of the rules affecting the standardization of all machines should at once be made international. It is, however, reasonable to expect that, commencing, say, with direct-current stationary machines, the rating in kilowatts of a given machine should be the same in all countries. It is irrational and incongruous that a machine should be rated at 25 kw under the rules of one country and at 35 kw under the rules of another country. In addition to machine rating there is before the commission the important question of international symbols and notations. At present there is a wide divergence in standard electrical engineering text-books in the matter of symbology. A great simplification would be introduced if this were rendered internationally uniform. This unification cannot be brought about suddenly throughout. It should be possible, however, to commence with a few of the most important and frequently used symbols and gradually to extend the international list. It is much to be hoped that the American Institute of Electrical Engineers will endeavor to become a factor in the situation thus presented, thereby resuming the prominence which its initiatory work gave it at the Chicago, Paris (1900) and St. Louis international electrical congresses.

The Graphical Clock Diagram.

The clock diagram of simple alternating e.m.fs. and currents is a graphic device that has been used with advantage ever since alternating-current technology began. A clock-hand, rotating uniformly over the face of a clock, makes one revolution to the cycle of the alternation considered. The length of the hand is made equal to the maximum cyclic magnitude of the alternating e.m.f. or current considered. The motion starts from the 6 o'clock position of the clock hand in a counterclockwise direction, and the projection of the rotating arm on a horizontal plane through the axis, the 9 o'clock and 3 o'clock points, gives at each instant the magnitude of the sinusoidally alternating quantity, which is proportional to the sine of the angle moved over by the rotating arm from the starting moment. If we consider the time angle as a positive angle in the trigonometrical sense, the rotation of the hand must, by convention, be opposite to that of the regular clock movement; that is, it must be counterclockwise. Some writers, however, express the motion of the arm as clockwise, which forces the angle described to become negative trigonometrically. In order to maintain uniformity in mathematical convention, it is desirable that all writers should rotate their clock-arms in the same direction, and the preferable direction is in conformity with established trigonometrical positive angular motion, or is counterclockwise.

If we place two hands on our clock-face diagram, one for the alternating e.m.f. in a circuit, the other for the alternating current, and make both hands travel counterclockwise at the same angular velocity, we can represent the relative phase of the current and e.m.f. by the fixed angle set between the two rotating arms. In any single circuit, this angular displacement cannot exceed 90 deg., and in practice is never quite 90 deg. Each rotating arm then develops its own horizontal projection, or sinusoidal motion, in the manner familiar to all who have studied such diagrams. The locus of the motion of each rotating arm extremity is clearly a circle, and the effective value of any such simply alternating quantity is well known to be its maximum value divided by 52. It is well known that the electric power developed in a simple alternating-current circuit is represented at any instant by the product of the instantaneous e.m.f. and the instantaneous current; that is, by the product of the two instantaneous clock-diagram projections. This product has been recognized as dissymmetrical with respect to zero power, but as equivalent to the joint action of a steady power and an alternating power. The steady power is the product of the effective e.m.f. and current into the cosine of their phase difference, and is the power recognized by the engineer as expended in the circuit. The accompanying alternating power is the product of the effective e.m.f. and current, acting at double frequency. Since engineers rarely take into account this alternating component of power, which, in the long run, carries no energy into or out of the circuit, no attempt seems to have been made to represent it on the clock diagram, especially as it involves a speed of rotation twice as great as that of the e.m.f. and current hands.

There can be no doubt, however, that it is desirable to include the alternating power in the clock diagram, as it conveys the essential physical facts to the mind of the engineer in a very simple and comprehensive graphic manner. This has been shown very neatly by Mr. J. Irving Brewer, in an article in our issue of Jan. 21. Taking the e.m.f. vector as of standard phase, he marks off the current vector in its proper phase relation thereto, and then extends the current vector to a distance representing the product of the two rotating vector lengths—that is, the product of maximum e.m.f. and maximum current. On this produced length as diameter he describes a circle. The projection of the center of this circle is, on the power scale adopted, the steady average power expended in the circuit. The uniformly rotating clock hands of e.m.f. and current are then geared up with the rotating power hand in a doubled angular-velocity ratio about the said center, so that as the e.m.f. and current hands rotate once, the power hand will rotate twice. The projection of the power hand on the plane of reference then gives the instantaneous power in the system. Mr. Brewer makes his hands all rotate negatively, or clockwise, but the diagram becomes conventionalized by looking at it in a mirror.

Expert Testimony.

The New York State Bar Association seems to be greatly troubled over the morals of expert witnesses, particularly those of the medical variety. It seems that the slimy touch of commercialism has too often besmirched the snow-white coat of Pure Science and that something drastic should be done about it at once. The Bar Association has, in fact, adopted a committee report looking to purification. It suggests that the Appellate Court appoint a board of consultants, any of whom may be called to testify by litigants or the court, and to keep

the board unsullied by the machinations of Mammon, its members should receive witness fees only, save as otherwise ordered by the court. Now, all thoughtful citizens fully realize that something should be done to place expert testimony, medical or other, upon a sounder and more dignified basis than at present. Every celebrated case, civil or criminal, involving technical issues emphasizes the need of reform in several particulars, not the least of which is compelling decently courteous treatment of the witness by the attorneys in the case. No insinuations are too evil or baseless to be heaped upon reputable men of science whose testimony is distasteful to pettifogging counsel, and under present conditions few judges have the courage to call a halt.

We quite agree that there is need for reform, but the lawyers have the remedy in their own hands all the time if they have the disposition to apply it. If a shady physician gives dubious evidence in a tort case, for instance, who is it that procures his services unless it be the shady "ambulance-chaser" who is working up the case on a contingent fee? If a technical expert wanders from the plain truth to an extent that would convict a fact witness of perjury, in nine cases out of ten the attorney is morally a suborner of perjury. If an expert witness for one litigant honestly differs in opinion from the other litigant's expert, as he sometimes may, it seems to be the fashion to set him down as a rascal merely on general principles, while the attorneys, unfettered by the sanctity of an oath, are under no restraint, and sometimes abuse the privilege. It is really amusing to see the lawyer weeping crocodile tears over the wickedness of the expert procured by his opponent. Let him first look after the cleanliness of his own house, and scourge out from it the rascals who try to support bad cases by worse evidence. Honesty at the bar leaves little room for dishonesty on the part of the expert. For every crooked expert there is at least one crooked lawyer who knowingly gives him employment. That there are "commercialized" experts unhappily admits of no doubt, but the way to eliminate them is for lawyers not to retain them.

As to external measures of reform, unquestionably something can be, and ought to be, done. The suggestion of an officially appointed board to be called by the court has many times been made in one form or another and in principle it is good. But it has been often, and often will be, vehemently opposed by lawyers who wish the privilege of retaining such experts as will best serve their purposes. This very opposition should give it a certain amount of prestige. But there are real objections as well, chief among which is that the highest class of men would, for the most part, decline to serve on account of pressure of private practice and the probable inadequacy of compensation. Few professional men of the knowledge and character required would care to mix up in frequent court cases at any price unless there were a radical reform of present precedure, and hence the tendency would be to gather a rather ill-assorted group of probably capable, but distinctly second-rate, men. In a medical board, every so-called "school" would insist upon representation, from the "regular" to the Indian herb doctor, and in general science the same catholicity would be in evidence. The position of an official expert to be paid a nominal figure and blackguarded in cross-examination by both sides is not one for a self respecting person to desire.

If one analyzes the failings of expert testimony under present conditions, they fall rather definitely into the three following classes: First, deliberate misstatements, comparatively rare, and to be cataloged under any "shorter and uglier" terms one may fancy. Second, errors of judgment, commonly with respect to matters about which there may be legitimate differences of opinion. Many cases popularly ascribed to ignorance or venality really belong in this class. In patent cases, for instance, expert witnesses fall naturally into two categories, rigid constructionists and loose constructionists. The former are from temperament disposed to set a high standard for "invention," and therefore hold a patent tight down to its claims of indubitable novelty; the latter take a very liberal view of invention and regard as from this viewpoint novel almost anything that is a little different from things absolutely familiar. Clash of opinion between the two is just as innocent and to be expected as difference of judgments as to politics. In the same way, certain United States judges are known as patent sustainers and others as patent breakers, without the slightest reflection on their integrity, the reputation being merely the reflection of their individual mental attitudes. Third, comes the most frequent and offensive cause of discordant expert evidence in accurately truthful replies to questions framed with intent to deceive. This is exceedingly common in jury cases and wherever the expert testimony can be introduced only through the hypothetical question. A conscientious expert, being under oath, must answer the question as asked directly and truthfully. The untechnical mind assumes that the question fairly represents the real issue, whereas it very often is in terms that compel an answer quite at variance with the facts as they appear in the evidence which the expert is not at liberty to consider. Then in cross-examination another squinting question may necessarily bring out a different opinion, and the expert gets the credit of perverting the truth. Some lawyers are exceedingly acute at this sort of thing, and the expert has no available means of protecting himself against it. If the court would take a hand in clearing matters up it might accomplish much good, but under present practice it rarely does.

What is really required in the interests of justice is some method of getting from men of the highest professional standing deliberate, unbiased judgments as to the technical points involved in any cause at issue. The big and broad representatives of the law feel this need and realize the shortcomings of the present loose methods which often pervert justice. Why would it not be practicable to treat technical matters as a proper subject for referees? In other words, when technical issues are involved, let the court appoint, say, three experts of known standing to pass deliberate judgment on these issues in the form of a written opinion for the guidance of the court and jury, after hearing the evidence and, if necessary, argument by counsel. The issues could be put in the form of definite questions to be settled on their merits, and the proceedings would follow the ordinary course of cases before a referee. Now and then something closely akin to this is actually done, and the [illegible] can be actually tried before referees selected for their technical knowledge, and [illegible] court. In short, a solution of the problem presented is to abolish the expert witness by establishing the expert board of referees with sufficient authority to command respect for its findings.

Consolidation of Electric Plants in Massachusetts.

The Edison Electric Illuminating Company of Boston has completed negotiations for the purchase of the electric plants of the Boston Consolidated Gas Company, the Waltham Gas Light Company, the Newton & Watertown Gas Light Company and the Chelsea Gas Light Company. An application will shortly be made to the Massachusetts Gas and Electric Light Commission for approval of the purchase of these properties, and the price to be paid will be contingent upon the action of the commission.

The electrical service of the Boston Consolidated Gas Company includes the suburban communities of Brookline and Brighton. It is planned to make a 10-year contract with the various electric railway lines operating in the Newton and Waltham district for energy supply from the Edison service. The Edison company can produce a kw-hour of energy more efficiently than any of the companies which will probably be taken over, with a reasonable allowance for distribution expenses, particularly in the cases of Chelsea and the Boston Consolidated Gas Company. The Newton company has for some time been affiliated with the Edison interests, and for the past two or three years all the electricity for street, residential and commercial service in the Newtons has been distributed by the Newton & Watertown Gas Light Company from a substation supplied with energy from the Edison station at South Boston. The Waltham Gas Light Company recently built a modern steam turbine plant in the central portion of Waltham, which operates on a combination railway, lighting and motor load. An older station of poorer economy is also in commission in Newtonville. The railway load, however, is in a measure incidental to its service, and the direct-current rating of the plant is comparatively small.

An interesting feature of the anticipated consolidation with the Edison company from the engineering point of view will be the methods adopted for supplying the Newton system of trolley roads connecting with the Boston elevated system at the western terminus of the latter. The influence of the railway load, if assumed by the Edison system, is liable to be in the direction of improved load factor, and the saving in expense through the consolidation will clearly be considerable.

The purchase by the Edison company of these properties involves about $2,000,000, which will later be paid for by an increased issue of Edison stock after the purchase has been approved and the stock authorized by the Massachusetts Gas & Electric Light Commission.

In the fiscal year ending June 30, 1908, the total net earnings from the operation of these electric plants were $221,000, or 11 per cent of the anticipated purchase price. The net earnings of the electrical department of the Boston Consolidated Gas Company were the largest of any of the plants purchased, $138,340.

The following table gives the valuation of the electric plants, lines and equipment of the Waltham, Newton & Watertown, Chelsea and Consolidated gas companies for the year ending June 30 last:

	Valuation.	Income.	Expenses.
Waltham	$44,662	$12,800	$7,092
Newton and Watertown	400,655	140,415	130,940
Chelsea	244,824	81,218	51,550
Boston Consolidated	892,711	255,769	117,420

Edison Companies Oppose Commission's Order.

The Edison Companies of New York, including the New York Edison Company and the United Electric Light & Power Company of Manhattan, the Edison Electric Illuminating Company of Brooklyn and the Westchester Lighting Company of the Bronx, appeared before the Public Service Commission of the First District of New York on Feb. 5 and asked for a rehearing on the general order promulgated by the commission in December regulating and prescribing the terms of all electrical energy contracts. Representatives of the four companies named stated their position to the commission and filed briefs setting forth their reasons for objecting to the order and asking for a reopening of the hearings. It is understood that the commission will decline to grant the rehearing and that the present action of the companies in making the demand is simply preliminary to carrying the matter into the courts. The New York & Queens Electric Light & Power Company, which had accepted the order of the commission, asked to have its protest joined with the others. He was assured by the chairman of the commission that if any modification of the order was made it would apply to all companies alike whether they had accepted the previous ruling or not. The commission has not yet given a decision as to whether or not it will grant a rehearing. After the briefs had been filed the New York Edison Company issued a statement outlining its position in the matter. In this it was pointed out that an important part of the company's business was concerned with large buildings for which contracts to supply energy by the wholesale or in bulk had to be provided. These contracts were largely the result of personal canvass and negotiation and if the company was not able to modify the phrasing or minor details of such contracts to suit peculiar conditions, its business would be seriously interfered with. The company stated that it does not seek to make special terms or give unusual privileges to any particular customer, but simply to be permitted to modify a contract to suit the particular conditions. It desires to extend to any customer every convenience or facility which the special conditions surrounding the service make practicable, provides that such features in the contract do not modify the cost to the consumer and provided that the company is prepared to extend the same privileges to all others who present the same conditions. The company expresses itself as quite willing to accept and obey the order insofar as it prohibits any variation in charge, preference in rates, refunds or special privileges, but it believes that special riders should be permitted to meet special conditions which do not affect the price and which do not mean in any way a discrimination in favor of one customer as against another. The demand for the rehearing is to secure more elasticity in the contract through provision for such riders and not to throw the door open to discriminations.

Wisconsin Commission Seeks Information Regarding Storm Losses.

The Railroad Commission of Wisconsin has sent a letter to public utility companies under its jurisdiction asking for information regarding the damage caused by the storm of Jan. 27 to 29. The object of the inquiry is to gather all available facts regarding these damages with a view to throw some light upon the allowance to be made for such emergencies under the provisions of the public utilities law.

The letter to telephone companies asks for figures of the total number of subscribers, both city and rural, and of the number of each class having interruptions. The companies are also asked to state the number of poles broken and the length of lines "down"; what other damage, if any, was received; the cost of repairs, divided between labor and material; allowances to regular subscribers for interruption; and losses on toll or long-distance business.

The law of Wisconsin provides that the Railroad Commission of that State "shall ascertain and determine what are the proper and adequate rates of depreciation of the several classes of property of each public utility." The rates of depreciation must be such "as will provide the amounts required over and above the expense of maintenance, to keep such property in a state of efficiency corresponding to the progress of the industry." Since the purpose of the rates for depreciation is, in its ultimate end, to make it possible to maintain the plant in a proper condition of efficiency from revenues, it follows that the

revenues must be sufficient in amount to enable the utility to provide for such depreciation.

Determination of what the rates of depreciation should be is a vital feature of the work imposed on the commission by the law, and, while it is a perplexing and serious problem, it is one which the commission has no right to ignore. Into the calculation of the permissive or prescribed rates of depreciation all elements which produce destruction of the value of the plant should enter.

The effects of the storm of Jan. 27 to Jan. 29 were felt more seriously by the telephone companies than by the other utilities under the jurisdiction of the commission. Both the losses due to damage which must be repaired if the utilities are to continue their usefulness and the losses resulting from interruption of traffic are the direct and tangible results of a storm against which no feasible protection would have availed the companies. The letter of the commission on this subject recognizes that heavy losses were sustained by many companies and indicates that the commission will gather all available data on the subject. This action will result in a compilation of statistics that will be of great value as showing the cost of one storm of the character mentioned. The information that will be obtained by this inquiry will not, of course, furnish conclusive figures as to the extent of the allowance which may properly be made for losses of this nature; but the compilation of data relating to these losses during a period of years, which is probably foreshadowed by the initial step of the Wisconsin commission in this direction, will help to show what reasonable provision should be made for such happenings in a system of accounting designed to be correct in principle.

Cutting Over New Trunking Telephone Switchboard in Boston.

The New England Telephone & Telegraph Company cut over a new common battery switchboard for trunking service at its Fort Hill exchange in Boston on Saturday evening, Jan. 30. The board represents the Western Electric Company's latest design, with the features of automatic ringing, automatic registering of calls, ancillary answering jacks, and is designed for a traffic in which about 95 per cent of the originating calls are trunks. The board is divided into the usual A and B portions, but the A board trunks every call originating within Fort Hill to the Fort Hill B board, thus saving a large quantity of multiple wiring and enabling the service to be handled more conveniently. The Fort Hill exchange is located in the same building as the Boston Main exchange, but it is separately equipped and operated, although serving the same business district.

The cut-over was one of the most successful in the history of the company, and the preparations for the change were made with special care to avoid any conditions that might give rise to complaints. About a month before the change from the old Fort Hill board occurred taps were made into all Fort Hill lines and trunks incoming and outgoing, and the connection to the new board broken by the usual toothpick installation close to the cut-off relays of the subscribers' lines. All lines were then tested from the office and found in proper shape. The toll trunks were brought in part into Fort Hill during the evening of the cut over, about 30 men being engaged on the work as a whole. The toothpicks were then pulled, throwing the old and new boards upon the lines together. All lines were then verified by calling in from the cable head, the company's men flashing three times to differentiate these calls from the subscribers' calls. This duplicate check was effected on all lines without finding errors of connection, all relay contacts were found to be working properly, the outgoing trunks were then verified and the operators were transferred to the new board with resulting disconnection of the old board.

The new board has a present capacity of 3000 lines and an ultimate capacity of 6000 lines. The average holding time is 2 seconds at present intervals. An automatic registration of calls is also provided in this board. The ancillary answering jacks provide practically six operators per line, by doubling the incoming line signals in the switchboard. The A board has 48 positions, of which 25 are in operation, and the B board has 26 positions with 9 in operation. The operating organization at full load consists of 1 chief operator, 1 assistant operator, 3 A board supervisors, 1 B supervisor, 27 A operators, 9 B operators and 2 information operators. For local business a 220-amp, 24-volt storage battery has been installed, and for toll traffic a 100-amp battery, with two charging motor generator sets, each consisting of an 800-amp, 30-volt generator direct driven by a 40-hp, 220-volt, direct-current motor run by Edison service. The service meters are operated by two 2-hp motor-generator sets with a 34-volt, 25-amp generator operated by each.

Hearing on Franchise of Connecticut River Transmission Company.

The Massachusetts Board of Gas and Electric Light Commissioners gave a hearing on Feb. 3 at the City Hall in Fitchburg, Mass., on the appeal of the Fitchburg Gas & Electric Company from the franchise granted by the Fitchburg Board of Aldermen to the Connecticut River Transmission Company in that city. The Connecticut company was represented by Mr. Jeremiah F. Smith, Jr., and Mr. David I. Walsh, of Boston, and the Fitchburg company by Mr. Charles E. Ware, of Fitchburg, and Mr. Everett W. Burdett, of Boston. The case is one of the most important that has ever arisen in Massachusetts in the field of central-station relations, since it involves the defining by the commission of the status of a local company selling electricity for lamps and motors to large and small consumers, and the expediency of allowing a hydro-electric company to enter local territory for the sale of energy in bulk in competition with the established central station.

Mr. Smith said that the Connecticut River company will depend primarily on Massachusetts and Worcester County for its market. Massachusetts laws require a power company to be incorporated under the laws of that State, if it does business in that State. The capital stock is at present small—$10,000—but it will be increased as the work of transmission and distribution progresses. The company expects to furnish 16,000 kw ultimately and will probably be in a position to deliver about 2500 hp to 5000 hp in the coming spring. Mr. Smith contended that the local electric company makes lighting its chief business and the sale of energy for motors its secondary business. "The stand is taken wisely," said he, "that it is best to have but one lighting company, rather than duplicated investment and destructive competition in this field." He claimed that selling energy for motors or in bulk is a more competitive business, and that the public interests demand the sale of energy for this purpose at the lowest practicable price. The question is one bearing upon the power business alone, it was argued, and the rates will be as follows, in a general way: Large users, 150 hp to 300 hp, will pay from 1 cent to 1.2 cents per kw-hour. Small users, whose plants are located along or adjacent to the company's transmission lines, will pay from 1.2 cents to 2 cents per kw-hour, depending upon the hours of use and the ratio which the average load used bears to the maximum demand upon the system. It is pointed out that the company could not afford to deliver energy to small consumers distant from the transmission circuits at the same rates [illegible] to the lines. These rates are quoted for continuous energy, [illegible] would probably [illegible] in the public interest. In a letter setting forth these points, President Henry L. Harrison of Boston stated that a power [illegible] a manufacturing company operating 48 hours per week equivalent to a rate of $28 per hp year.

A representative of J. G. White & Company, New York, stated in response to questions by counsel for the Fitchburg company that the power of the river had not in any sense been overestimated by the transmission company. Mr. Harriman pointed out in his letter that the company will generate about 50,000,000 kw-hours of primary energy per year, and about 20,000,000 kw-hours per year of secondary energy, compared with a total production of between 3,000,000 kw-hours and 4,000,000 kw-hours per year by the Fitchburg Gas & Electric Company. He urged that this difference will account for much greater efficiency of production in the hydro-electric plant than in the steam station.

For the Fitchburg Gas & Electric Company, Mr. Burdett said that his client had no objection to the transmission company furnishing energy in bulk, for by such a course the whole community would prosper, and the local company with it. The local company does object most earnestly, however, to the sale of energy by this new organization to small consumers. If the transmission company will decide that it does not wish to take advantage of the charter of the French King Rapids Company and sell to small consumers, a great question will be eliminated. In reply Mr. Smith stated that whether the transmission company did business with small consumers or not depended upon its franchise and the attitude of the Gas and Electric Light Commissioners. Mr. Burdett asked if the transmission company would divide the motor business by agreeing not to sell in Fitchburg less than 300 hp to any consumer; but Mr. Smith felt that in order to protect the interests of the public this could not be done under the terms of the franchise already granted to the Connecticut River Transmission Company. The French King Rapids Company is owned by the same interests as the transmission company, but the peculiar geographical situation places the enterprise really in the three States of Vermont, New Hampshire and Massachusetts, and so requires separate corporate existence. Hon. James H. McMahon, who was the Mayor of Fitchburg when the franchise was granted, expressed himself in favor of competition in the motor field. The franchise would hardly have been granted with a minimum limit of 300 hp per consumer. The hearing was continued on Feb. 9.

Supreme Court Decision in the Knoxville Water Case.

The general interest in the decision of the Supreme Court of the United States in the case of the Knoxville Water Company, already noted in these pages, is such as to warrant a general statement of the conclusions reached by the court. The decision was handed down Jan. 4 and was the result of an appeal from the Circuit Court of the United States for the Eastern District of Tennessee of a case in which the Mayor and Aldermen of the city of Knoxville were appellants and the Knoxville Water Company was the appellee. The original case in which the decree was rendered was a suit in equity brought by the company, Dec. 7, 1901, against the city to restrain the latter from the enforcement of a city ordinance fixing in detail the maximum rates to be charged by the company, which alleged that the rates fixed by the ordinance were so low as to deny to the company a reasonable return upon the property employed in the business. It thereby took such property for public use without compensation, in violation of the fourteenth amendment of the Constitution of the United States. The case was tried before a master, who reported that the net income under the new rates would be less than 6 per cent on the valuation of the company's property as found by him. In the opinion of the master, 8 per cent, which included 2 per cent to provide for depreciation, was the minimum net return which the company was entitled to earn. The judge of the Circuit Court, in his opinion, confirming the report, adopted practically the master's valuation of the whole plant and property, as well as his conclusions, and issued a permanent injunction against the enforcement of the ordinance.

In its decision, the Supreme Court first holds that the ordinance, although municipal, derived its authority from the Legislature and must be regarded as an exercise of the legislative power. In such cases, the court said, it would set aside legislation only where its constitutional invalidity was very clear. The decision then takes up the question of the valuation of the property, which, according to the master, on March 30, 1901, the date of the passage of the ordinance, was $608,000. This sum was made up by adding to the appraisement of all the tangible property the sum of $10,000 for "organization promotion, etc.," and $60,000 for "going concern." The Supreme Court declined to express an opinion as to the propriety of including these two items in the valuation of the plant for the purpose for which it was valued in this case, but left that question to be considered when it should necessarily arise. Assuming them, however, to be correct, it took up the master's valuation of the tangible property which was based upon the testimony of a witness of the company as to the cost at the date of the ordinance of reproducing the existing plant as a new plant. The company contended that the master in fixing this valuation made allowance for depreciation. The Supreme Court could see no evidence to support this claim, but declared that some substantial allowance for depreciation should have been made for that proportion of the property, such as machinery, which was subject to depreciation. A witness called upon by the city placed the reproduction value at $363,000 and placed the allowance that should be made for depreciation at $118,000, or 32 per cent. In the view which the court took it did not consider it necessary to determine how much of the master's valuation of the tangible property ought to have been diminished by the depreciation which the property had undergone, except to say that there should have been considerable diminution, sufficient at least to raise the net income found by the Circuit Court above 6 per cent upon the whole valuation thus diminished. The court brushed aside the somewhat faint claim of the company that its capitalization should have some influence in determining the valuation of the property as the evidence showed that all, or substantially all, of the preferred and common stock was issued to contractors for the construction of the plant and that the nominal amount of stock issued was greatly in excess of the trade value of the property furnished by the contractors.

It was also held by the Supreme Court that the master and Circuit Court erred in estimating the gross receipts under the new ordinance. The company had been in the habit of making a discount of 5 per cent on all bills promptly paid, and this discount for prompt payment was considered in estimating the effect of the proposed rates. The Supreme Court pointed out that the ordinance required no discount. It was admitted that the abandonment of the discount would deprive the company of an efficient aid to quick collection of these bills and would add somewhat to the cost of collection, but in the case of a prime necessity like water, it considered that there were other methods of enforcing prompt payment.

In its original case, the company claimed that in fixing the value of the plant upon which it was entitled to earn a reasonable return, the amounts of both the complete and the "incomplete" depreciation should be added to the present value of the surviving plant. By complete depreciation was understood that part of the original plant which through destruction or obsolescence had actually perished as useful property. By incomplete depreciation was meant the impairment in the value of the parts of the plant which remained in existence and that continued in use. The Circuit Court refused this contention and was upheld. Upon this point the Supreme Court says: "A water plant, with all its additions, begins to depreciate in value from the moment of its use. Before coming to the question of profit at all, the company is entitled to earn a sufficient sum annually to provide not only for current repairs, but for making good the depreciation, and replacing the parts of the property when they come to the end of their life. The company is not bound to see its property gradually waste without making provision out of earnings for its replacement. It is entitled to see that from earnings the value of the property in-

vested is kept unimpaired, so that at the end of any given term of years the original investment remains as it was at the beginning. It is not only the right of the company to make such a provision, but is its duty to its bond and stockholders, and, in the case of a public service corporation at least, its plain duty to the public. If a different course were pursued, the only method of providing for replacement of property which has ceased to be useful would be the investment of new capital and the issue of new bonds or stocks. The course would lead to a constantly increasing variance between present value and bond and stock capitalization—a tendency which would inevitably lead to disaster either to the stockholders or to the public, or both. If, however, a company fails to perform this plain duty and to exact sufficient returns to keep the investment unimpaired, whether this is the result of unwarranted dividends upon over-issues of securities, or of omission to exact prices for the output, the fault is its own. The court could not undertake to correct such past errors of management.

In another part the decision of the Circuit Court was held erroneous. Although the ordinance was passed in 1901, it had never been observed, but in the meantime the company's gross income had largely increased. The decision of the Circuit Court was based on the return of the company for the fiscal year ended 1901, so that full evidence of the results for the subsequent years was not before the Supreme Court. Hence the latter was unable to say what the effect of such evidence would be, but such evidence was really relevant and it was an error to base the judgment upon one year only.

The Supreme Court decided, therefore, that the judgment of the lower court could not stand as there was an error in the appraisement of the present value of the plant, in the deduction of the reductions made by the ordinance, and in the exclusion of evidence relating to the operations of the company after the enactment of the ordinance. The Supreme Court states that its jurisdiction in cases of this kind should be invoked only in the clearest cases. In this instance more than seven years had passed since the enactment of the ordinance and it had never been observed. "If a company of this kind chooses to decline to observe an ordinance of this nature and prefers rather to go into court with the claim that the ordinance is unconstitutional, it must be prepared to show to the satisfaction of the court that the ordinance would necessarily be so confiscatory in its effect as to violate the Constitution of the United States." This same thought has been expressed in Ex parte Young, 209 U. S., 123; San Diego Land & Town Company vs. National City, 174 U. S., 739, 754; San Diego Land & Town Company vs. Jasper, 189 U. S., 439.

On the other hand, it cannot be doubted that in a clear case of confiscation it is the right and duty of the court to annul the law. Reagan vs. Farmers' Loan & Trust Company, 154 U. S., 362; Covington, etc., Turnpike Company vs. Sandford, 164 U. S., 578; Smyth vs. Ames, 169 U. S., 466. But the court did not consider the present case as being one of this kind. It says: "Upon any aspect of the evidence the company is certain to obtain a substantial net revenue under the operation of the ordinance. The net income, in any event, would be substantially 6 per cent, or 4 per cent after an allowance of 2 per cent for depreciation. See Stanislaus County vs. San Joaquin Company, 192 U. S., 201. We cannot know clearly that the revenue would not exceed that return. We do not feel called upon to determine whether a demonstrated reduction of income to that point would or would not amount to confiscation. Where the case rests, as it does here, not upon observation of the actual operation under the ordinance, but upon speculations as to its effect, based upon the operations of a prior fiscal year, we will not guess whether the substantial return certain to be earned would lack something of the return which would save the effect of the ordinance from confiscation. It is enough that the whole case leaves us in grave doubt. The valuation of the property was an estimate and is greatly disputed. The expense account was not agreed upon. The ordinance had not actually been put into operation, the inferences were based upon the operations of the preceding year, and the conclusion of the court below rested upon that most uncertain factor, evidence, the testimony of expert witnesses employed by the parties. The city authorities acted in good faith, and they tried, without success, to obtain from the company a statement of its property, capitalization and earnings."

In conclusion the court expresses itself as follows: "The courts, in clear cases, ought not to hesitate to arrest the operation of a confiscatory law, but they ought to refrain from interfering in cases of any other kind. Regulation of public service corporations which perform their duties under conditions of necessary monopoly will occur with greater and greater frequency as time goes on. It is a delicate and dangerous function, and ought to be exercised with a keen sense of justice on the part of the regulating body, met by frank disclosure on the part of the company to be regulated. The courts ought not to bear the whole burden of saving property from confiscation, though they will not be found wanting where the proof is clear. The legislatures and subordinate bodies to whom the legislative power has been delegated ought to do their best. Our social system rests largely upon the sanctity of private property, and that State or community which seeks to invade it will soon discover the error in the disaster which follows. The slight gain to the consumer, which he would obtain from a reduction in the rates charged by public service coroporations, is as nothing compared with his share in the ruin which would be brought about by denying to private property its just reward, thus unsettling values and destroying confidence. On the other hand, the companies to be regulated will find it to their lasting interest to furnish freely the information upon which a just regulation can be based. If hereafter it shall appear, under the actual operation of the ordinance, that the returns allowed by it operate as a confiscation of property, nothing in this judgment will prevent another application to the courts of the United States or to the courts of the State of Tennessee. But as the case now stands there is no such certainty that the rates prescribed will necessarily have the effect of denying to the company such a return as would avoid confiscation."

Bakelite Insulating Material.

In a paper read before the New York section of the American Chemical Society, on Feb. 5, Dr. L. H. Baekland described a certain coal-tar product having many valuable characteristics for insulating purposes. The substance has the chemical name of oxybenzyl-methylenglycol-anhydride, but is known as Bakelite. It possesses some of the combined properties of amber, hard rubber and celluloid. It does not have the flexibility of rubber or celluloid, but it is harder and stronger than either of them, withstands heat and is not attacked by any solvents nor by most chemicals. Furthermore, it is much less expensive. It is totally insoluble and infusible and does not soften even at temperatures as high as 350 C. At the temperature of melting glass it chars without entering into fusion. It can be obtained either transparent or opaque. It can be mixed with filling materials, such as asbestos, clay, wood-pulp, etc.

It is said that generators and motors can be impregnated with the raw material, and by the simple process of heating under pressure, synthesis of Bakelite will take place in or around the fibers which cover the wires of the coils and as a result the whole will be transformed into a hard, infusible, insulated mass.

Bakelite has been used for making molded insulators, which were found to possess great mechanical strength, high insulating power and the ability to withstand high temperatures without softening. Insulating wood when impregnated with Bakelite becomes as hard as ebony, and is a good insulator. It is said to be entirely oil proof. A coating of Bakelite on wood gives a beautiful finish which is not affected by boiling in water, in solvents or chemical solutions. The material has also been used for making self-lubricating bearings which can be molded to correct shape and size. Moreover, it has proved useful for piston packing by withstanding high-pressure steam and chemical solutions.

Single-Phase Railways.

In a pamphlet issued in connection with the electrification of the St. Clair Tunnel, a description of which was given in our issue for Nov. 14, there is given the following tabulation of the single-phase railways now in service or under construction:

The first of the American equipment to be placed in commercial service was that of the Indianapolis & Cincinnati Traction Company, in December, 1904. It is noteworthy that during the past four years almost 1000 miles of road have been equipped for single-phase service, and that the total rating of single-phase railway motors in America has reached 137,000 hp. The number of cars is 246, and of locomotives 64. The total mileage of European single-phase railways is 867.5. The predominating frequency both in this country and abroad is 25 cycles. An e.m.f. of 20,000 volts is used on one of the foreign railways, while 11,000 volts is the highest e.m.f. used in this country for railway work.

SINGLE-PHASE ROADS IN AMERICA

Name of Road	Length (Miles) of Line Electrified	Equipment: Cars No.	Cars Motors	Locomotives No.	Locomotives Motors	Line Characteristics: Type of Control Used	Voltage	Cycles
Westinghouse System.								
Indianapolis & Cincinnati Traction Co.	119	25	4-125			Unit Switch	3300	25
							550	D.C.
Westmoreland County Traction Co.	7	1	1-50			Hand	1200	25
San Francisco, Vallejo, Benecia & Napa Valley Ry. Co.	34	2	4-75			Unit Switch	3300	25
		8	4-120			Hand	2200	25
Atlanta Northern Traction Co.	18	8	4-50			"	3300	25
Warren Jamestown Street Ry. Co.	22.5	6	4-50			"	2200	25
Long Island Railroad Co.	5	6	2-50			"	2200	25
Spokane & Inland Ry. Co.	113	21	4-100	6	4-150	Unit Switch	6000	25
				8	4-175		550	D.C.
Erie Railroad Co.	34	6	4-100			" "	11000	25
Fort Wayne & Springfield Street Ry. Co.	21.5	4	4-75			" "	6600	25
Pittsburg & Butler Street Ry. Co.	33	13	4-100			"	6600	25
							550	D.C.
New York, New Haven & Hartford Railroad Co.	22	4	4-150	41	4-250	" "	11000	25
							600	D.C.
Windsor, Essex & Lake Shore Rapid Railway Co.	25	5	2-100			Hand	6600	25
Grand Trunk Railroad Co. (St. Clair Tunnel)	3.5			6	3-240	Unit Control	3300	25
Visalia Electric Ry. Co.	23	4	4-75	1	4-125	" "	3300	15
Chicago, Lake Shore & South Bend Ry. Co.	78	24	4-125			Unit Switch	6600	25
		4	2-75			Hand	575	D.C.
Denver & Interurban Railway Co.	46	10	4-125			Unit Switch	11000	25
							575	D.C.
Hanover & York Street Ry. Co.	20	5	4-75			" "	6600	25
							575	D.C.
Shore Line Electric Ry. Co. (under construction).	12	4	4-75			" "	6600	25
Maryland Electric Ry. Co.	24	9	4-100			" "	6600	25
Total.	662.5	172	53700 h.p.	62	55020 h.p.			
General Electric System								
Bloomington, Pontiac & Joliet Ry. Co.	19	2	4-75			K	3300	25
Toledo & Chicago Ry. Co.	43	7	4-75			K	3300	25
							575	D.C.
Milwaukee Electric Ry. & Light Co.	59	11	4-75			M	3300	25
							575	D.C.
Central Illinois Construction Co.	85	20	4-75	1	4-150	M	3300	25
							575	D.C.
Richmond & Chesapeake Bay Ry. Co.	15	4	4-125			M	6600	25
Anderson Traction Co.	20	8	4-75			K	3300	25
							575	D.C.
Washington, Baltimore & Annapolis Ry. Co.	60	21	4-125			M	6600	25
							575	D.C.
New York, New Haven & Hartford R. R. Co.	8	4	2-125			M	11000	25
		2	4-125					
Shawinigan Railway Co. (under construction)				1	4-150	M	6600	30-15
							600	D.C.
Total	304	74	27400 h.p.	2	1200 h.p.			

American Summary

Mileage	966.5
Cars	246
Locomotives	64
Horse-power	137,320

SINGLE-PHASE ROADS IN EUROPE.

Name of Road	Length of Line (Miles)	Equipment: Cars No.	Cars Motors	Locomotives No.	Locomotives Motors	Line Characteristics: Voltage	Cycles
Westinghouse System.							
Brembana Valley Ry.	19			5	4-75	6000	25
Swedish State Ry.	7			1	2-150	3300	25
						15000	
Roma Civita Castellana Ry.	33	8	2-90	5	4-40	6000	25
Lyon, France	14	15	2-85			6000	15
Midland Ry., England	9	1	2-85			6600	25
Portsmouth District, England	5	1	1-85			6000	25
Lugano to Ponte Tresa, Switz. & Varese, Italy	13	2	2-40			6600	25
Valtellina Ry., Italy	19	4	2-75	1	4-110	6000	25
Tramway near Paris		1	1-100			6300	25
Tergnier-Aniay (Aisne-France)	11	3	2-74	3	2-150	3300	25
Total.	150						
General Electric System							
Murnau-Oberammergau.	14	1	2-100	1	150	5500	16⅔
	7			1	150	20000	25-15
Rotterdam-Haag Scheveningen	19	33	2-175			11000	
Parma Provincial Ry.		12	2-60				
		8	1-60				
Midland Ry., England	9	2	2-85			6600	25
	12			1	2-175	15000	25
	13	1	1-85			6600	25
	7	11	1-85			550	25
Hamburg-Altona Ry.	16.5	6	2-125			6600	25
	1	1	1-125			600	25
				3	150	600	

NAME OF ROAD	Length of Line (Miles)	Equipment: Cars No.	Cars Motors	Locomotives No.	Locomotives Motors	Line Characteristics: Voltage	Cycles
ALLGEMEINE ELEKTRICITÄTS GESELLSCHAFT SYSTEM.							
Royal Prussian State Ry., Blankanese-Ohlsdorf	16.5	54	2–115	..	.	6600	25
Royal Prussian Experimental Ry., Onenburg	1	1	2–175	..	. . . .	6600	25
Stubai-Thal Ry.	12	4	2–40	..	. . . .	2500	42
Borinage Ry.	13	29	2–40	..	. . . .	600	40
Swedish State Rys.		2	2–120	.	. . . .	6600	25
South London Line, London Brighton & South Coast Ry.	9	16	4–115	.	. . .	6600	25
Niederschoneweide Spindlersfeld Ry.	2.5	2	2–100	..	. .	6600	25
Prussian State Ry.	112	..	. .	..	3 350	6600	25
Berlin Stadt & Ring Ry.	306	.	. . . .	.	. . .	10000	
Total	539						
MASCHINENFABRIK OERLIKON, ZURICH SYSTEM.							
Seebach-Wettingen Ry.	12	..	. . . .	1 1	2 200 4 250	15000	25
Locarno Bignasco	17	3	4 40	.	. .	5500	20
Valle Moggia Ry.	17	.	4–40	..	. .	5000	.
Total	46						
MISCELLANEOUS.							
Compagnie Generale Parisienne de Tramway	1	1	2–50	..	. . . . .	500	25

CURRENT NEWS AND NOTES.

TARIFF ON RADIUM.—Congress has been asked to remove the tariff tax on radium, which is stated to render its importation in this country almost prohibitive.

THE MONTGOMERY ARCH.—A great electrical arch is being erected at the railway entrance to Montgomery, Ala., upon which will appear the name of the town in letters of light. It is desired to add an appropriate motto or "slogan," and suggestions as to this phrase are invited by the Montgomery Light & Water Power Company.

WIRELESS TELEPHONES.—Lieutenant Sweet, of the Navy, in testifying recently before the House Committee on Merchant Marine, said that the wireless telephones installed on the battleship fleet works satisfactorily in some instances but unsatisfactorily in others. He said that he had carried on conversation over the wireless telephones a distance of 12 miles.

DIRT ON GLOBES AND REFLECTORS.—The report of the January meeting of the Chicago section of the Illuminating Engineering Society, which appeared in our issue for Jan. 28, contained an error in the statement that certain tungsten lamps and reflectors that were tested had been in place for one year. In reality, the lighting units had been installed for only six weeks.

LIGHTING IN NEW YORK.—The New York Edison Company made 34,831 contracts last year for supply of electrical energy from its system, aggregating an equivalent of 2,765,616 lamps of 16 cp, consuming 50 watts. Of this number the net increase during the year was 882,989, bringing the connected load of the system up to 6,805,991 equivalents. The electric motors on the system aggregate 205,373 hp.

MANITOBA'S MUNICIPAL TELEPHONES.—Lieutenant-Governor McMillan, of Manitoba, has, according to a Winnipeg dispatch, declared the experiment of public ownership and operation of the telephone service to be a success. The service has been conducted by the government for 11½ months and a substantial surplus is reported. The extension of the system throughout the province has been vigorously prosecuted during the year and its further development will be continued with all possible speed.

FOREIGN LITERARY ACTIVE MATERIAL.—A patent issued Feb. 2 to Quinton Marino and F. W. Easton Wright, of London, Eng., describes a process for making active material paste for storage batteries. This consists in mixing castor oil with a small quantity of finely powdered litharge and manganese peroxide, boiling the mixture, allowing it to clarify and then decanting the liquid from the precipitate. The liquid is next dissolved in a hydrocarbon, the solution mixed with a bulk of litharge and acidulated water added to form a paste. It is claimed that with this paste less forming is required and there is increased adhesion.

COMPULSORY WIRELESS.—President Roosevelt in a message to Congress has recommended immediate legislation requiring, within reasonable limitation, that ocean-going steamers carrying considerable numbers of passengers shall carry an efficient wireless telegraph equipment. It has been urged that any legislation by Congress shall allow the substitution of the wireless telephone for the wireless telegraph on the Great Lakes. A number of amendments have been offered to one or more of the wireless measures now before Congress, and should a bill be passed at this session it will probably differ quite considerably from the terms of any of the original bills.

GUNS MADE NOISELESS.—Mr. Hiram Percy Maxim, the well-known electrical engineer, gave a very interesting demonstration of his "gun silencer," on Feb. 8, at the offices of Redding, Greeley & Austin, his patent lawyers, New York City. It was attended by a large number of technical men, rifle experts, sportsmen, etc. A shooting gallery was set up in the office with a sand bank to receive the shots, which were fired from a large variety of guns and rifles, including those of the armies of Europe. However loud the report of the discharge without the silencer, it ceased to be heard when the little appliance was screwed to the muzzle. The silencer, which varies in length from about 4 in. up to 6 in. and weighs from 7 lb. up to about 11 lb., is a steel tube with some 12 chambers through which the escaping gases of the powder are rotated so that they emerge gradually and quietly; while the bullet passes out through the central orifice with free clearance. The principle of the device is that of the "negative turbine." It is said that there is absolutely no loss of velocity, accuracy or penetration. Under the conditions, the exhibition made was most convincing.

SAFETY AND SANITATION.—The Museum of Safety and Sanitation Engineering Societies Building, New York City, is now organizing its membership subscriptions as follows: Individual, $5 per year; sustaining, $10, and commercial, $25. The individual members receive postpaid free a copy of "Social Engineering," just issuing, for which Mr. Andrew Carnegie has written a characteristic introduction. Sustaining members receive two copies, and commercial members five. The book, which [illegible] labor," for 1,500,000 employees, and is of a most helpful nature as to social and moral uplift, and the rendering safer both life and limb. The museum seeks co-operation and support in all [illegible] and [illegible] and can be assisted by precept and demonstration of safety appliances. There are 10 such museums in Europe, all aided or supported by governments; this in America depends entirely on voluntary support. Dr. W. H. [illegible] and Mr. Frank A. Vanderlip is treasurer.

NEW YORK ELECTRICAL SOCIETY MEETING.—Dr. Louis Bell will lecture on "Lighting of American Streets" before the New York Electrical Society, Wednesday evening, Feb. 17. The meeting will be held in the Engineering Societies Building, 33 West Thirty-ninth Street.

STEVENS INSTITUTE DINNER.—The alumni of the Stevens Institute of Technology will have their annual dinner on Friday, Feb. 19, at the Hotel Astor, New York. A large attendance is expected, and among the speakers will be President Alex. C. Humphreys, of Stevens Institute; Alfred Noble, past-president of the American Society of Civil Engineers, and a former member of the Panama Canal Commission, whose topic will be the "Panama Canal"; Col. H. G. Prout, vice-president of the Union Switch & Signal Company; John A. Bensel, Commissioner of the Board of Water Supply of New York City, and Col. George Harvey.

MONTHLY MEETING, A. S. M. E.—The next monthly meeting of the American Society of Mechanical Engineers in New York City will be held on Feb. 23, the fourth Tuesday of the month, instead of the second Tuesday as usual. The subject of the evening's discussion will be "Safety Valves," introduced in a brief paper by Mr. Frederic M. Whyte, general mechanical engineer of the New York Central Lines. Mr. Whyte will discuss the principles of the application of safety valves to steam boilers, with special reference to locomotive practice, including questions of design and construction, and the requirements and limitations of valves. His paper will be followed by a general discussion covering marine and stationary practice and conditions existing in connection with low-pressure heating boilers.

INSTITUTE ANNIVERSARY DINNER.—The American Institute of Electrical Engineers will celebrate the completion of its first quarter of a century with an anniversary dinner at the Hotel Astor, New York City, March 11. The annual dinners of the Institute have always been extremely successful, while the historical character of this affair promises to make the occasion more than usually interesting. President Ferguson has appointed Mr. T. C. Martin chairman of the dinner committee; the other members appointed are: Messrs. T. Beran, M. Coster, M. M. Davis, H. A. Foster, G. A. Hamilton, R. T. Lozier, W. McClellan, F. A. Muschenheim, H. W. Pope, C. W. Price, F. A. Scheffler, E. A. Sperry, A. Spies, A. Williams and G. H. Guy, secretary. The committee is already busily engaged making its plans and arrangements.

THE NEW HAVEN SYSTEM.—Under the escort of Mr. W. S. Murray, chief engineer, a party of technical journalists representing the chief engineering and mechanical papers made a trip of inspection on Feb. 5 over the New Haven Railroad system as far as Stamford, Conn., riding there and back on the Westinghouse electric locomotives hauling regular trains. The fullest opportunity was afforded to inspect every detail under conditions of actual operation, both on the locomotive and on the track, whether with direct or alternating current, and whether with the overhead catenary construction or the hooded third-rail. The observations thus made were most satisfactory as to the smoothness of operation and adhesion to schedule. A visit was also paid to the machine and repair shop at Stamford, where surprise was expressed by many at the fact that so little provision of the kind was needed.

WISCONSIN SOCIETY OF ENGINEERS.—It is proposed by 40 or more engineers in Wisconsin, representing cities, public utilities, manufacturing plants and colleges, to organize a State society along the same lines as those which are now in existence in Illinois, Indiana and other States. The purpose of this society is to get the engineers of the State better acquainted with each other, to get a better understanding of problems that are of mutual interest to all, and to discuss some of the leading municipal and other problems of the day. It is proposed to hold the first meeting in Madison in the Engineering Building at the University on Feb. 24, 25 and 26. Prof. F. E. Turneaure, dean of the College of Engineering, is chairman of the program committee, and W. G. Kirchoffer, of Madison, is secretary of this committee.

ANOTHER EPOCHAL INVENTION.—A correspondent sends an account of an invention whereby, he says, the current within a conductor may not only be maintained, but the "amperage" actually increased along the line. "The device is extremely simple and is easily applied by being placed on line poles 50 miles to 100 miles apart, when it will increase the power on the line so as to propel cars and trains and also for electric lighting, telegraphing, etc. Its principle of working is to pump the magnetism from the air and draw it on to the live conductor, thereby strengthening and maintaining the original current starter from the dynamo or battery. This idea was induced in my mind by a simple physical fact that I know but which is usually overlooked. I am imbued with the belief that electricity has its source in the aerial ocean, as water in the terrestrial ocean, and that electricity and magnetism are one and the same element, differing only in manifestation."

BIRMINGHAM ELECTRIC RAILWAY EMPLOYEES.—Consul Albert Halstead, of Birmingham, reports that the tramway committee of the City Council has decided to reduce the hours of the employees on the electric street railway system from 60 to 54 per week. It was argued that the reduction of the hours by 10 per cent would result in the employment of about 150 more men, the number under the 60-hour schedule having been 1523. The additional cost has been roughly estimated at about $19,466 per year. A new wage scale fixes lower pay for the first five years of employment, which may make the reduction of hours less costly to the city than it had been anticipated. Motormen have been paid on the following basis: First year, $7.29 per week; second year, $7.66; third year, $8.02, and the fourth year and maximum, $8.26 per week. New motormen will be paid first year, $6.68 per week; second year, $7.05; third year, $7.41; fourth year, $7.78; fifth year, $8.02, and thereafter $8.26 per week, bringing the maximum pay for new motormen with the sixth year up to what the old men get with the beginning of the fourth year. Conductors will receive for the first year, $6.08 per week; for the second year, $6.44; third year, $6.80; fourth year, $7.05; fifth year, $7.29, and thereafter $7.54 per week.

SOCIETY OF HUNGARIAN ENGINEERS.—A number of Hungarian engineers and architects pursuing their professions in the United States have organized the "American Society of Hungarian Engineers and Architects." The society has two objects. First, to bring in closer touch engineers and architects of Hungarian extraction, living in this country, and to give moral support and information to newcomers. Second, to encourage the exchange of engineering, technical and industrial information between the technical men of Hungary and of the United States and to foster technical societies, sciences and industries. The society will hold monthly meetings where papers will be read and discussed. The membership consists of mechanical, electrical and civil engineers, chemists, architects and craftsmen. Following are the officers of the new society: President, A. Henry Pikler, M.E., member of the American Institute of Electrical Engineers, engineer in charge of transformer department, Crocker-Wheeler Company, Ampere, N. J.; vice-president, Karoly Z. Horvay, architect, chief draftsman, Building Bureau of Board of Education, Brooklyn, N. Y.; secretary, Zoltan de Nemeth, M.E., New York Edison Company; treasurer, Sandor Oesterreicher, E.E., Associate Member of the American Institute of Electric Engineers and of the American Society of Mechanical Engineers, New York Edison Company; assistant secretary, Ernest L. Mandel, B.S., C.E., Bureau of Commissioner of Public Works, New York City. The society's business address is Box No. 1031, New York City.

The Urft Valley Energy Transmission Plant.

A REMARKABLE dam, the largest in Germany, has been recently completed at a cost of $2,500,000, for raising the low-water mark of the Urft River region, thereby avoiding inundations which formerly were of very frequent occurrence, and at the same time providing for a source of energy that might be able to supply a district about 25 miles in radius with electricity for lamps and motors from a central power station.

The embankment was erected from rubble and concrete, and reinforced at the foot with earthwork, according to plans by the late Dr. Otto Intze. It is 1100 ft. in length and 177 ft. in height, constituting a reservoir 187 acres in area and 60,000,000 cu. yd. in volume, the water depth on the walls being 174 ft. A penstock about 9200 ft. in length, intended for supplying the accumulated water to a hydro-electric power house, situated near Heimbach on the River Ruhr, is branched off at about 1 km to the north of the embankment, which comprises two overflow channels. The water available for conversion into electrical energy suffices to generate 4800 hp during 7200 hours per annum. However, as a yearly operation of only 4000 or 5000 hours must be taken into account, the machinery could be designed for a far larger output.

The construction of the penstock was extremely difficult, largely because clay-slate layers were encountered at certain places. It was drilled partly by hand and partly by electrically operated drills from both its ends, energy for the operation of the drills, as well as for the construction of the embankment, being supplied by a local station at 1200 volts. The penstock during construction had to be ventilated and drained artificially, the pressure-head being only 6.5 ft.

The power house is situated on the River Ruhr, 700 ft. above zero level. The engine room is 99 ft. in clear length and 75 ft. in clear width. A transportable hand-operated 8-ton traveling crane covers the engine room, close to the switchboard. The latter is arranged at the gable wall, situated close to the mountain slope, on a platform to which access is obtained from the engine house through a double staircase. Below the switchboard are situated the offices and storerooms, and behind these the transformers, while the high-tension switch-gear and fuses are arranged in the upper stories.

The power house has been designed for eight 2000-hp sets, only six of which have been installed. These are arranged symmetrically in two parallel rows of three each, care having been taken to locate the turbines close to the walls of the building, and the directly coupled generators are placed toward the middle of the room. The small exciter turbines and generators are situated in front of the switchboard.

Francis pressure turbines for a head of 110 m were adopted, the head being, however, subject to considerable fluctuations and running as low as 70 m. Each of the main turbines weighs 15 tons, inclusive of accessories, and with a maximum head of 110 m can yield an output of 2000 hp at 500 r.p.m., while giving as much as 1550 hp with a minimum head of 70 m. The normal output of 2000 hp can, however, be obtained for heads as low as 85 m, below which the head does not fall under normal conditions.

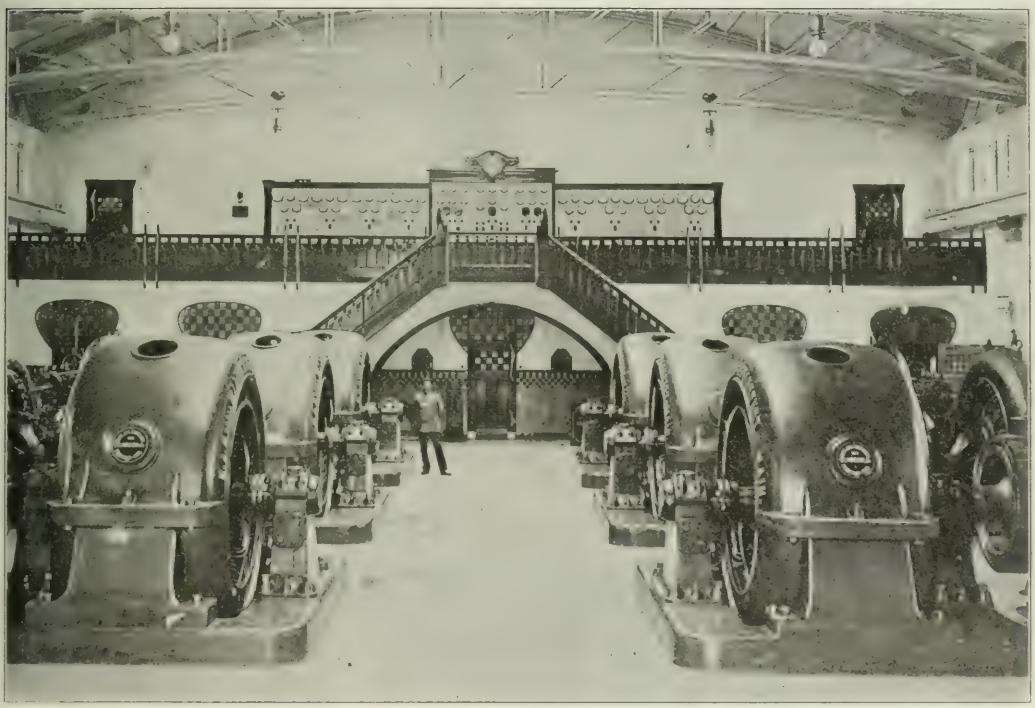


FIG. 1.—INTERIOR OF HEIMBACH GENERATING STATION.

The supply pipe of each turbine is 0.80 m, and that of each exciter turbine 0.30 m in interior diameter. All of these pipes have been tested at one and one-half working pressure. The main gates of the turbines are arranged in the horizontal portion of the supply pipe, which is situated below the floor of the engine house, while being actuated from the latter by water. Those of the exciter turbines are operated by hand.

The water after entering the turbines radially issues in an axial direction. The turbine wheels are of magnesium bronze and are 0.95 m in external diameter. The guide-vanes are made of steel, and are moved either by hand or automatically through hydraulic governors. Of the two turbine bearings, the outside one has been designed as a thrust bearing, both being pro-

vided with ring lubrication. The bearings, turbine housing and two discharging pipes rest on a common base plate; the shaft at the dynamo end is 180 mm in diameter. The two small turbines of the exciter dynamo are identical, each being designed for 200 hp at 900 r.p.m. Their wheels are 0.56 m in diameter. These turbines are provided with the same type of speed governor as the main turbines.

The arrangements for regulating the load and speed mainly comprise a motor for adjusting the guide-vanes in accordance with the turbine load. This motor is fitted directly to the tur-

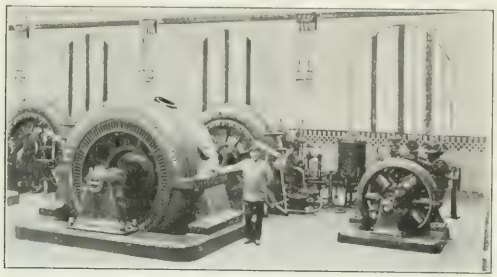


FIG. 2.—EXCITATION SET AND GOVERNOR MECHANISM.

bine housing, and the governor, operated through belt transmission from the turbine shaft, is arranged on a special jack with separate base plate, to the left of which is fixed the vertical cylinder of the self-acting regulating valves actuated from the governor through lever transmission. The position of these valves determines the position of the motor. However, the guide-vanes, if desired, can be operated by means of a hand-wheel. In order to allow the generators to be connected in parallel from the switchboard, there has been provided a special arrangement for shifting the regulating valves within certain limits, comprising a small electric motor, operated from the switchboard, which transmits its motion through a worm and worm-wheel to a spindle adjusted by hand and on which the regulating lever is mounted.

In addition to these arrangements there has been provided a regulator of excess pressure, comprising a cylinder locked by a slide valve, and which communicates with the supply pipe of the turbine, the slide valve being connected through levers to the

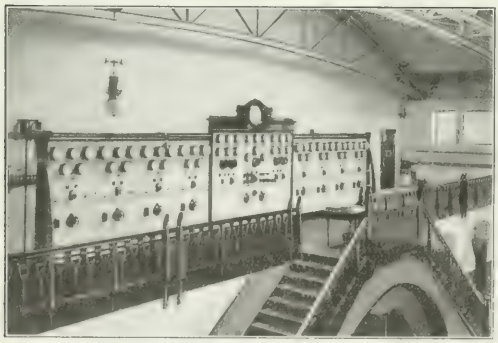


FIG. 3.—SWITCHBOARD AT POWER HOUSE.

remaining regulators. The pressure regulator is actuated automatically as soon as an excess in pressure is produced in the pipe as a consequence of a sudden locking of the guide-vanes and by allowing the water to escape immediately from the turbine supply pipe into the pond, prevents any disastrous effects of the pressure occasioned by the kinetic energy of the water. It may be mentioned that all of the pressure water required for actuating the regulators is cleaned before being used.

The following conditions were stipulated for these turbines: In case of sudden fluctuations in load of 10, 25 and 30 per cent, the corresponding variations in speed should not exceed 2, 3 and 4 per cent, respectively, and the fluctuations in e.m.f. should not exceed 1.5, 3 and 5 per cent, respectively; the time of closing the regulators, from full aperture to full closure, should not be more than two seconds.

These conditions were entirely complied with during tests made on delivery, when a maximum head of 360 ft. was available.

The main generators, producing three-phase current at 50 cycles, were designed by the Felten & Guilleaume Lahmeyer-Werke, Ltd.; they are coupled to the turbines through elastic Zodel-Voith clutches.

The rotor of each generator is designed as a flywheel, comprising 12 pole cores of oval cross-section, to which substantial pole pieces are bolted. The field coils are built of flat copper windings wound on edge. The exciting current is supplied through slip-rings and carbon brushes. The stator coils, which were made by hand, are located in half-open slots lined with

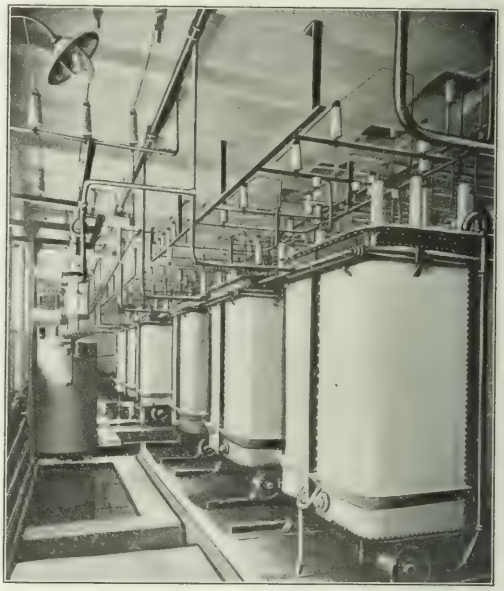


FIG. 4.—TRANSFORMERS, WATER-JET GROUNDING DEVICES AND EXCITER RESISTORS.

mica tubes. All terminal connections were carefully wound on forms. The windings are protected by perforated shields against accidental contact or damage.

The two exciter machines are four-pole, direct-current, interpole shunt machines. The main data of the two types of generators are recorded in the following table:

	Three-phase generators.	Exciter generators.
Output, kw	1,600	135
E.m.f., volts	5,000	225
Speed, r.p.m.	500	900
Armature diameter, mm	2,500	540
Armature width, mm	800	220
Armature bore, mm	1,700	226
Field bore, mm	....	550
External diameter of magnet wheel or pole housing, mm	1,662	1,500
Number of poles	12	4
Armature resistance, ohm	0.121	0.0066
Weight of rotary part, tons	7.7	0.85
Weight of machine, inclusive of shaft and base plate, tons	33.0	4.9

The e.m.f. is regulated in steps of 50 volts, the exciting current being 77 amp with full load, at 1360 kw with 5400 volts and cos $\Theta = 0.85$. The increase in tension was guaranteed not

to exceed 14 per cent in the event of the full load being cut out, the excitation and speed remaining unaltered. Alterations in speed with sudden fluctuations in load of 15 per cent are 2.5 per cent as a maximum.

The switch-gear, which was constructed by the Siemens-Schuckert Works, is arranged at the rear of the gable wall of the building. The switchboard, which is made up of marble plates mounted on substantial iron frames, is located on an elevated platform and contains all measuring instruments and accessory switches for operating the high-tension switches of the generators and transmission lines, as well as any regulators for the main generators and exciters, all these being low-tension apparatus, whereas the generator fuses and the instrument transformers for measuring the generator output are fitted on iron frames in the room situated below the switchboard. In the same room terminate the 5000-volt cables coming from the main generators, which are continued as bare copper conductors



FIG. 5.—HIGH TENSION OIL-SWITCH WITH SWITCH MOTORS AND BUSBARS FOR 35,000 VOLTS.

—through the intermediary of the apparatus just mentioned—toward the transformers arranged behind this room.

To accommodate the present number of main generators there are provisionally installed six transformers of the water-cooled oil-insulated type, located on small trucks so as to be readily removable for repair. The output of each transformer corresponds to that of a generator, transformation being effected at a ratio of 5000 to 35,000 volts. The oil, which is kept in circulation by a small centrifugal pump, reaches a maximum temperature elevation of 30 deg. C. in the case of a continuous full load. From the 35,000-volt terminals of the transformer conductors are led through the ceiling to the transformer room toward the automatic high-tension oil switches, which are installed on a platform above the floor of the switching room in masonry niches. The transformer switches are arranged in a similar manner, opposite those of the outgoing transmission lines, an operating passage being provided between the two rows. High-tension busbars, susceptible of being separated into several portions by sectional switches, are arranged alongside the two longitudinal walls so as to be inaccessible to any accidental contact. To these busbars are connected the conductors of the transformer switches of the high-tension transmission lines. Three pairs of horizontal busbars for the horn lightning arresters and choke coils belong to the earthing and



FIG. 6.—SWITCHROOM FOR 35,000-VOLT APPARATUS.

high-tension safeguards, for which water or oil resistors are used as earthing devices. The water-jet earthing devices, situated in the transformer room close to the walls of the building, are directly connected to the high-tension busbars and serve for leading any statical charge liable to result in excess e.m.f. down to the ground without causing any damage.

Of special interest among the apparatus used in connection with the switchgear are the high-tension oil switches and the arrangements provided for their operation. Cut-outs in high-tension plants should be installed at considerable distance from the switchboard, intermediary devices being used for actuating the cut-outs from the board. These devices can be designed as lever or belt transmission, but the mechanical operation, apart from being complicated, is entirely unfitted for certain cases. A more satisfactory solution of the problem is afforded by electrical long-distance operation, which has been adopted in the present case. Each of the oil switches used for the machinery as well as for the outgoing long-distance transmission lines comprises three single-pole oil switches, arranged beside



FIG. 7. [illegible]

one another and connected together by [illegible] so as to be operated in common.

In making the selection of switches it was held that oil switches are especially valuable for high-tension plants since they take up less space than open-air lever switches, while being more readily adapted to the general arrangement of the plant and giving no open arcs on being cut out. A special advantage

is that oil switches will interrupt the current without giving rise to any objectionable excess in e.m.f.

The switches are placed in entirely enclosed housings through the upper part of which enter the leads to the inside contacts through suitable porcelain fittings. All current-carrying parts are situated below the oil, which will put out immediately any arc produced in switches. Porcelain is used exclusively as the insulating material.

The switches are operated by electric motors—installed on the top of the switches—which transmit their motion to the clutch-rod through a vertical wooden rod acting on a pinion. The motor is a continuous-current series machine with two coils on the magnet core, by the alternate operation of which the rotation of the motor to the right or left is obtained. The motion of the motor is transmitted through a worm-gear to the switching shaft proper, which, owing to a conveniently arranged stop, is able to perform rotation through only 180 deg. In addition to being actuated by hand, the switch motor can be thrown into circuit automatically through a relay into which the various high-tension conductors are fitted. The relays themselves are connected in parallel to the hand controllers and are designed as overload relays with timing device.

The transmission line comprises, in addition to the 35,000-volt conductors, those for 5000 volts and low-tension distribution lines for the consumers. The aggregate length of the high-tension lines at present is 105 miles, and that of the low-tension lines 147 miles. Oil switches are used for the cutting-out of conductors and transformers of the transformer stations. The latter are equipped with devices for ascertaining whether any one of the conductors is under tension and to reduce the e.m.f. from 35,000 volts down to 5000 volts. Switching cabins are used for cutting-out some given conductors, thereby effecting any connection required in the case of local disturbances. A number of the motors installed in the industrial district are operated directly at the line e.m.f. of 5000 volts.

The insulators, which are of the brown-glazed type, constructed by the Hermsdorf Porcelain Factory, are made of two parts. Each of these was tested at the factory in a water bath at 100,000 volts. Discharges between the conductors and supports will take place at 105,000 volts in the dry air, and at from 61,000 to 78,000 volts in the case of rains of different intensity. The telephone lines are arranged on the same poles with and below the high-tension conductors.

As most of the centers of consumption are situated at a considerable distance from the power house, such a high tension had to be adopted for transmission. Notice boards fitted on the poles draw the attention of passers-by to the danger connected with touching the conductors. All other usual safety devices have also obviously been provided.

Street Lighting in Rio de Janeiro.

By A. H. Keleher.

THE principal street of the Brazilian metropolis is the Avenida Central, a most beautiful avenue. It is a well-paved and well-kept street running through the heart of the business district, which has the distinction of extending from sea to sea, although it is only one mile in length.

The accompanying illustrations of the Avenida give one a very good idea of the lighting of this important thoroughfare. Extending down the center of the avenue are arc lamps spaced about 100 ft. apart and multiple incandescent mantle gas lamps on posts similarly placed, but on both sides of the street; these lamps combined produce an illumination which allows no dark spots to be observed by the most critical eye. The arc lamps are 7.5-amp series enclosed with opal inner and clear outer globes, and the current supply is 50-cycle alternating, as is all of the city lighting current, which is supplied by the Rio de Janeiro Tramway, Light & Power Company, a Canadian corporation. Each post is of beautiful design and is equipped with three arc lamps. There are 51 of these posts along the avenue; one of these posts carries five lamps, however, making a total of 155 lamps.



FIG. 3.—WATER-FRONT LIGHTING.



FIGS. 1 AND 2.—LIGHTING AVENIDA CENTRAL, RIO DE JANEIRO.

The arcs illuminate the center of the street, while the gas lamps illuminate the sidewalks. The lamp posts for the incandescent burners are placed directly opposite each other on each side of the street and half way between two posts; the spacing then is the same as the electric lamps, 100 ft. apart. It should be noted that this spacing of the lamps provides a light source every 50 ft. which accounts for the excellent distribution of illumination. As each post supports five lamps, there are 10

gas lamps to every three arcs. On Sundays all of the arc lamps are lighted until 1 a. m., after which the two lower lamps are turned off and the top lamp used until morning—on week days the two lower lamps are used till 1 a. m., when they are extinguished and the top lamp lighted. The gas lamps burn continuously throughout the nights of the week.

Some idea of the large number of lamps on the Avenida can be had when one considers the fact that in one ordinary block there are 15 arc lamps and 50 Welsbach burners, or a total of 65. Even when compared with other examples of good street lighting this is quite extraordinary. The shop lighting contributes but little to the lighting of the Avenida, as there are only a few brilliantly lighted stores open at night, and electric signs have as yet not made their appearance in large numbers. However, there are occasional cinematograph establishments equipped with flaming arcs on the outside which afford patches of light along the street. It should be stated here that in the near future many large signs will be installed which will add to the brilliancy of the Avenida at night. The people are beginning to become interested in electric signs, so that the time is now ripe for building up a business in them.



FIG. 4.—WATER-FRONT LIGHTING.

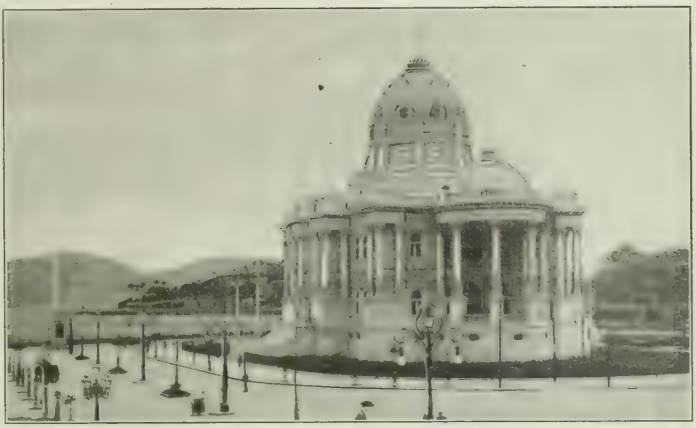


FIG. 5.—MONROE PALACE.



FIG. 6.—ORNAMENTAL LIGHTING MONUMENT.

Next in importance to the Avenida is the harbor front, which extends for five miles, beginning at the lower end of the Avenida at Monroe Palace and extending to and through the exposition grounds to the sea. Figs. 3, 4 and 5 show sections along the harbor front of this driveway, which is really a continuation of the Avenida Central, the lighting scheme of the Avenida being largely followed thereon. On Praia Botafogo, which is one of the most beautiful sections of the waterfront, there are three rows of arc lamps, making in all about 200 lamps. The park system of Praia Botafogo, for borders the bay, is paralleled by a street which is used for heavy traffic and for a line of street cars. This street is lighted by rows of single-lantern Welsbach burner posts, which line both sides of the street. Automobiles and light pleasure vehicles can use the driveways to be seen in the illustration. In the center can be seen the bridle-path, which extends through the entire length of the water-front park system from Monroe Palace to the Avenida Saudade. There are 587 arc lamps on the Avenida Central and the water-front combined, the latter extending from the end of the Avenida to the exposition grounds, a five-mile drive along the waterfront. In addition there are spaced at regular intervals along the driveway from Beira-mar to Avenida Botafogo 1400 mantle burners.

The building shown in Fig. 5 is the Monroe Palace, named in honor of President Monroe, and now used by the government for important conferences. It is considered the most striking



building in Rio outside of the new Municipal Theater, which cost in round numbers $5,000,000; its stately appearance and beauty of design are worthy of comment. On special occasions the building is lighted very simply but effectively by means of two chandeliers, each made up of 150 16-cp incan-

descent lamps, eight arc lamps at each entrance and nine in the grounds surrounding, in addition to the illumination from arcs on the street and pavements. The chandeliers are located one in the circular bay in the foreground and the other in the remaining bay in the rear of the building. It is seen that the lighting of the exterior of the building is of the simplest, but the effect is magnificent at night when the lights are burning and the white light from the arcs is shining on the pure white and cream colors of the building.

While the principal streets of the city are illuminated by electricity, the lighting of the remaining streets is confined to gas. This type of lighting is seen in the Caes Pharoux. Gas lighting is also used on the Rua Ouvidor, "the Nassau Street of Rio," and on Ruas Carioca, an important thoroughfare. On Ouvidor the Welsbach burners, suitably enclosed, are supported by brackets of graceful design, 50 ft. apart and staggered. This street is so narrow that upright lamps would interfere seriously with the traffic. On these streets, especially on Ouvidor, there are many arc lamps, including flaming arcs, hanging in front of the stores. Occasionally a tungsten cluster-body equipped with a 16-in. prismatic reflector is to be seen, and all contribute appreciably to the illumination of the street. The posts for gas lamps on these streets carry from one to three lamps, depending on the importance of the street; they are very artistic and of local manufacture.

Ornamental monuments, like the Lampadario at Largo de Lapa, are quite frequent in Rio. This particular monument is equipped with eight multiple 120-volt, 75-amp, 500-watt alternating-current arcs and 100 16-cp incandescents festooned around the top of the column and the surmounting globe. (See Fig. 6.) Only part of the arcs are lighted nightly, the whole effect being reserved for special occasions.

Fig. 7 shows the beautiful Avenida do Mangue and its lighting. Though at present gas is the illuminant, it is likely that in the near future arc lamps will be installed. The Avenida do Mangue excels the Avenida Central in its natural beauty and is rapidly becoming a popular driveway.

Automatic Electric Railway Signals.

By Wm. K. Waldron.

WITH the advent of high-speed electric trains came the demand for new safety devices, most important among which were the track signals. Previous steam railway experience had evolved the automatic block system, which, eliminating the personal equation, had dispensed with one great source of danger; the electrician, profiting by this experience, has applied the automatic block principle to the electric railways, and has brought forth the automatic electric block signals. These signals during the past few years have been developed to such a high degree of efficiency that they are rapidly being installed at all dangerous points on the electric railroads, subways and elevated lines, giving entire satisfaction as to protection of life and property, economy of time and low cost of maintenance. These three conditions being the sum total of the requirements of this branch of railroad equipment, one can readily foresee that these systems are assured of a greatly extended utilization in the near future.

This development has gone on so quietly that but few, even in the engineering profession, are familiar with the principles involved or the details of construction.

Expert signal men are scarce, and as the demand for electric signals is increasing year by year the electric signal business promises to be a very fair field for the electrician.

The writer has been engaged in the installation and maintenance of this class of signals for a considerable length of time, and can vouch for the efficiency of these machines. An accurate record of a large equipment of electric signals was kept for a period of one year, which showed the number of signal operations was over 230,000,000, while the number of failures was something over 800, less than one failure for every 250,000 trains passed.

Like all classes of equipment, there are several types or designs of automatic electric signals; one type only will be described in this article, as an attempt to include too much at one time would tend to confuse rather than instruct.

The principles involved are to a certain extent similar in all types and a thorough comprehension of one will enable the student to soon acquire an intelligent understanding of the others.

The type selected for the present article is known as the "Solenoid," which is operated on third-rail, direct-current track circuits and is built by the Union Switch & Signal Company, Swissvale, Pa.

The general appearance of these signals can be seen from the illustrations. Fig. 1 is a side and rear view showing the semaphore at "proceed" position, the spectacle casting being hidden by the cast-iron box containing the lights. Fig. 2 shows a front view of the machinery case with the door open and showing the cast-iron frame supporting the solenoid coil, circuit-breaker and dash-pot, as well as one of the resistance tubes.

The machinery operating the signal is located in a cast-iron

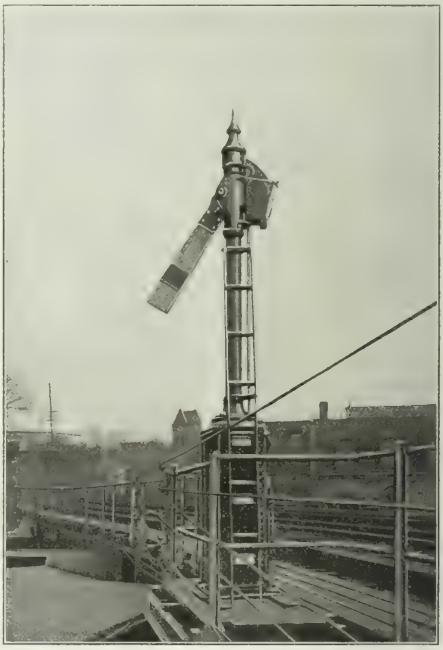


FIG. 1.—SEMAPHORE AT "PROCEED" POSITION.

case forming the base of the semaphore post. The arrangement of this machinery can be seen in Fig. 2 and the wiring is shown diagrammatically in Fig. 3, which will be described later.

The foundation principle of the block system is, of course, the "block," which is simply a section of track so protected that but one train can be in that section at any given time, no other train being allowed to enter the section until the last wheel of the previous train has passed over the release end of the block. This block section of track can be as long or as short as conditions may demand, depending on the speed of the trains, length of trains and distance required to stop a train. Fig. 3 shows a diagram of the track connections and block rail with signal indicated at *A*. The arrow indicates the direction of traffic. *A* indicates the position of the signal and entrance to block, *B* indicating release end of block; thus *A B* is the length of the block. The reader will note that one rail is marked "block rail." This is a section of track rail which is

insulated from the rest of the track by insulating joints at the entrance and release ends of the block. The other track rail is called the "common" rail and serves as return (ground) for all signals as well as motive-power current. Both of these rails must be well bonded.

At the release *B* end of the block is placed a resistance grid, which, as will be noted, is connected to the third-rail, common rail and block rail, a fuse being placed between the third-rail and the grid. This fuse is for 500 volts, 10 amp. The third-rail carries 500 volts and the block and common rails are connected to the grid so as to give a voltage of 14 volts between these two rails. This current flows back through the block rail to the entrance end of the block, where connection is made to the track relay instrument, through which it passes to the common rail as indicated in Fig. 3. A 3-amp fuse is placed in this track relay circuit as shown. Where there is no train in the block this current flows continuously, thus keeping the track relay in action. The track relay consists of a pair of small electromagnets which pick up two arms, thus completing

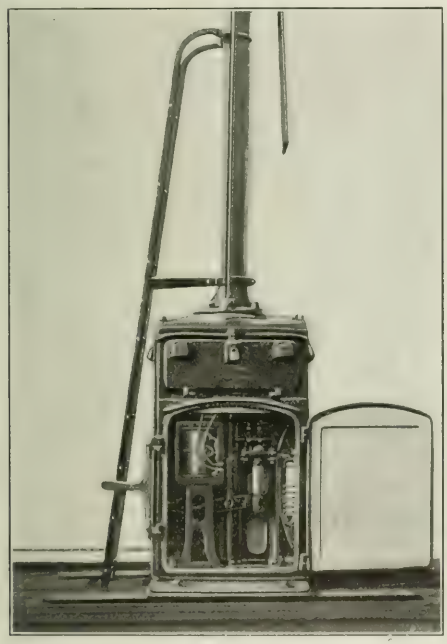


FIG. 2.—VIEW OF SIGNAL MECHANISM.

the circuit of another relay called the solenoid relay, to be mentioned later.

Referring to Fig. 3 it will be noted that a second tap is taken off of the third-rail near the entrance-end of the block and a 500-volt, 10-amp fuse is placed in this circuit near the connection to the third-rail. This circuit, after entering the machinery case, is divided into three branches, the solenoid relay circuit, solenoid circuit and light circuit, a snap switch being placed on each circuit. The solenoid circuit has a 4-amp fuse, while the other two circuits have each a 3-amp fuse inserted after the snap switch, as shown in Fig. 3. Following out the solenoid relay circuit, there is inserted a resistance tube of 1800 ohms from which the current passes through the track relay and thence to the solenoid relay, passing out to return common.

This solenoid relay is similar to the track relay, but is larger and somewhat different in construction, the principle of action being the same in both instruments. This solenoid relay completes the connection for the solenoid circuit, to be described later. As shown, the outlet of the above-mentioned 1800-ohm resistance tube is connected to another branch circuit which leads to a 1200-ohm resistance tube, after which it passes to the return common; thus when the solenoid relay circuit is broken at track relay the current returns to the common rail through the 3000-ohm resistance tubes (1800 + 1200).

Returning to the solenoid circuit, after passing through the snap switch and 4-amp fuse, the circuit leads through the solenoid relay which has been picked up by the solenoid relay circuit just described, thence through a circuit-breaker to the solenoid

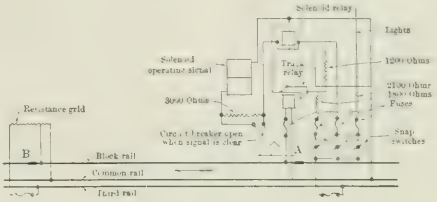


FIG. 3.—DIAGRAM OF TRACK CONNECTIONS.

coil and then to the return common. The current flowing in this circuit is 500 volts, which is required to start the lift, but not after the plunger is up. To reduce this pressure, the above-mentioned circuit-breaker is connected to the solenoid plunger, which after a given movement breaks the circuit. The current is then led off by a branch in front of the breaker and passed through a 3000-ohm resistance tube, thence to the solenoid coil and to the return common, thus reducing the current to what is required to hold up the "spectacle" casting and keep the signal "clear." The signal semaphore arm, or "spectacle" casting, is so constructed that unless balanced by the upward thrust of the solenoid plunger, the heavy or "spectacle" end will drop, thus putting the semaphore arm horizontally or to "danger."

Again turning to the light circuit, starting at the snap switch and the 3-amp fuse, the current is led through 2100 ohms resistance and up to the top of the signal post through two 6-amp fuse plugs and to two 3-cp lamps, connected in parallel.

The above description of the current flow through the track relay circuit, solenoid relay circuit and solenoid circuit is ob-

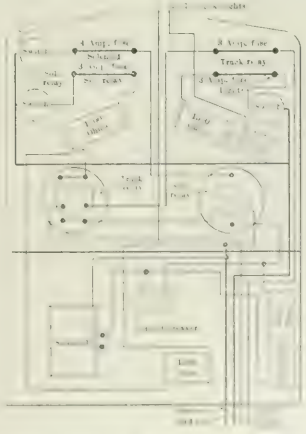


FIG. 4.—WIRING OF SOLENOID SIGNAL.

tained when the "block" is clear. When a train enters the "block" the track relay circuit is short-circuited through the wheels and axles of the train. The track relay then drops, breaking the solenoid relay circuit, which in turn breaks the solenoid circuit, allowing the solenoid plunger to fall and the signal semaphore to go to "danger."

The machines, while appearing very complicated at first glance, are, in fact, extremely simple, and require but little at-

tention after all the parts are properly adjusted and all the connections properly made.

There are many lines of electric railways where speed is the main consideration. On such roads where the track is straight and the view unobstructed, there is but little danger from rear-end collisions, but all curves and other points of obstructed view must be protected by signals. To provide this protection is the special mission of these signals, and the manner in which they have filled their mission has fully justified the highest hope of their inventors.

The four lines of the Manhattan (Elevated) Railway are equipped with the above-described type of solenoid signal, which the writer believes was the first permanent installation of this type.

An English Patent Decision of Importance to American Inventors.

BY AN ENGLISH BARRISTER.

A decision of considerable importance to American inventors who own English patents, but do not work them in the United Kingdom, has recently been pronounced by the Comptroller-General of Patents in England. As readers of this journal are aware, the English law of patents has recently been changed so as to compel every patentee to work his patent in that country (see *Electrical World*, page 348, Aug. 15, 1908). Thus it was provided by the Patents and Designs Act, 1907, that at any time not less than four years after the date of an English patent and not less than one year after the passing of the act (that is, a year after Aug. 28, 1907), *any person* may apply to the Comptroller for the revocation of the patent on the ground that the patented article or process is manufactured or carried on exclusively or mainly outside the United Kingdom. The Comptroller has power to revoke unless the patentee can prove to his satisfaction that the patent is worked in the United Kingdom, or gives satisfactory reasons why it is not so worked.

The first case arising under this statute was decided by the Comptroller-general on Dec. 9, 1908. He revoked two patents, and the reasons why he revoked them cause his judgment to be of the greatest moment to every owner or sole licensee of an English patent who for some reason has not worked the invention in England.

The material facts may be briefly stated: A man obtained two patents in 1900 for a process of manufacturing thin imitation stone slabs or tiles. For some time the patents have been in operation in Europe. In 1906 a Belgian company, the Société Anonyme Eternit, became sole licensees of the patents, and, therefore, so far as the above act is concerned, occupied the position of the patentee. This company built a factory in Belgium, where the process was carried on. The company did not work the process in the United Kingdom and refused to grant licenses for its being worked there. In these circumstances application was made for revocation; the question for the Comptroller to decide was whether the licensees could give satisfactory reasons for not working the process in the United Kingdom. Among the facts and arguments put forward by the licensees, the following appear to be material: They contended that, although their factory was erected in Belgium, they were in a position to meet all the demands of the British market; that if the patent were revoked it would not be possible to work the process so cheaply in England. It came out in evidence, however that a large part of the ingredients used for making the tiles came from Russia and Canada, and that unskilled labor was largely employed. The licensees also urged that they had, in fact, taken steps to work the patent in England by advertising for licensees in various British journals and by communicating with various British firms. They received, however, no reply to their advertisements. The fact that no answers were received was urged in support of the plea that there was no real demand for the tiles in England, and it was also argued that inasmuch as the object of the act was to bring about the establishment of new industries in Great Britain, it was for those who sought revocation to show that new industries would be established.

On behalf of the petitioner it was pointed out that the patentees had taken practically no steps to use the process in England. So long as the patented articles were simply manufactured in Belgium and imported into England on terms satisfactory to the Belgian manufacturers and patentees it was impossible to find out what the real demand was in England.

The Comptroller, in giving his decision, said that he had to decide whether the licensees had given satisfactory reasons for inaction. He pointed out that by article 2 of the code adopted by the International Union for the Protection of Industrial Property, patents may be revoked only when the patentee cannot show reasonable cause for his inaction. He then said: "While the bill for the act was passing through Parliament, many efforts were made on the part of its opponents and critics to define what might and what might not be accepted as reasonable causes for the inaction of a patentee. But Parliament decided to leave it to the tribunal dealing with each case, to determine after hearing the facts and arguments whether or not the patentee could give satisfactory reasons for his inaction. It is obvious that in determining this question, regard must be had not only to the interests of the patentee, but also to those of the public; and that the mere fact that it would be more profiable or convenient to a patentee to manufacture abroad than in this country cannot be regarded as a satisfactory reason for not taking the necessary steps for introducing the manufacture into this country. Otherwise no advantage would be gained in any state of the union by legislation under which patents can be revoked for non-working; because a patentee of his own accord and without any legislative pressure will naturally be disposed to manufacture where it is most profitable and convenient for him to do so."

On the evidence, he could not come to the conclusion that there was any reason why the article should not be manufactured in England.

The remarks of the Comptroller with regard to the attempts made by the licensees to work the process in this country are as follows:

"Dealing next with the question of the *advertisements* and *offers to sell* the patent rights, I cannot regard the fact that no answers were received by the patentees to them as a satisfactory reason for not manufacturing in this country. In the first place, they were not inserted or made until very near the expiration of the year of grace which had been allowed the patentees by the act; and, even if they had attracted the attention of persons who might otherwise have been willing to work the process, the fact that only a month of the year of grace remained unexpired would naturally make manufacturers less willing than they otherwise might have been to enter into arrangements with the patentees. *For anyone* acquiring the patent rights would be in no better position to defend the patents against applications for revocation than that which the patentees themselves *from whom he bought them possessed.* It seems to me impossible to hold that a patentee can relieve himself from the duty of manufacturing in this country by the mere insertion at any time of a few advertisements, and the sending round to manufacturers of a few circulars to which no replies are received. The advertisements and offers in this case were, I may say, of the vaguest description; they gave no intimation of the terms on which the owners of the patents were prepared to treat, beyond the statement that such terms would be reasonable."

The point had also been raised that the person applying for revocation was not going to work the patent himself. This was held by the Comptroller to be no ground for refusing to revoke. His views on the object and effect of the section were expressed in the following paragraph:

"It has further been contended by the counsel for the patentees that the object of the section being merely to bring about the establishment of new industries in this country, a patent may not be revoked under it unless it can be shown that the revocation will lead to the establishment of such new industries. In the present instance, if the patents are revoked, it

seems to me impossible to say that a new industry will not be established in this country where no royalties will be payable in respect of the carrying on of the process; but even if no such industry is started here, their revocation will undoubtedly have one beneficial result, for it will free the trade in the patented article and enable French and German manufacturers to import it freely into this country, the effect of which may very possibly be to reduce its price and, while in no way preventing its importation from the Belgian factory, give purchasers an opportunity of selecting for themselves between the articles manufactured there and at other foreign factories. Counsel for the licensees argues that this was not the intention of the section, but I can find nothing in the act to warrant me in coming to that conclusion. I have always regarded the object of the section as being to put a check on the practice, which was alleged to prevail very extensively, of taking out and maintaining patents in this country, not with any intention of working them here, but with the object of preventing the patented articles from being manufactured here, and from being imported by any other parties than the patentees. If, on the evidence which has been submitted in this case, the two patents in question may not be revoked, I find it very difficult to imagine any case in which a patent can be revoked under the section."

The Comptroller made an order for the revocation of the patents, subject to an appeal, if the licensees were advised to appeal to a higher court.

At the time of writing it is not known whether there is to be an appeal; but if the above decision stands, it is plain that the section of the patent act, 1907, which was under consideration will not by any means be a dead letter so far as persons foreign to England are concerned. It is made quite clear that the mere issue of advertisements in English technical journals inviting persons in England to take licenses on reasonable terms will not satisfy the requirements of the law. If he wants the protection of English patent law nothing short of actually working his patent on British soil will put the American owner of an English patent in an unassailable position.

Telephone Traffic as an Index to General Business Activity.

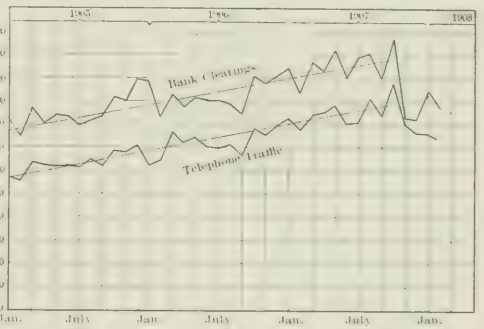
BY FRANK F. FOWLE

BUSINESS men are universally accustomed to gage the general business activity by the volume of trading in commodities which are consumed on a very large scale, such as iron, steel, foodstuffs, etc., and by the earnings of the railroads and by bank clearings. Information in this regard is spread weekly over the entire country and comparisons are made with the previous week and with the corresponding week of the previous year, in order to indicate the trend of business at the current moment. The consumption of any general commodity on a very large scale, whether it be money, transportation, building materials or manufactured products, may be regarded as showing by the weekly or monthly volume of transactions the general business activity or state of prosperity. The large public service companies now do business on so great a scale that their transactions may properly be regarded as furnishing an index to the general demand and the condition of business.

Telephone service has come to be a great public necessity and the daily use of it in messages runs into enormous figures. The total number of telephones in service now approximates 6,000,000, and the annual gross revenue is many millions of dollars. It becomes of interest, therefore, to speculate upon what the relation of telephone traffic and revenue to the general business activity may be. Telephone traffic originates in the daily course of business of almost every conceivable sort and is to the same degree cosmopolitan in its character as is the passenger traffic upon any of our great transportation systems. It originates with no particular class or community and it serves no interest exclusively. In reflecting, therefore, upon the probable sources of stimulation or depression in the telephone business, it would appear reasonable that the business must prosper in about equal measure with the sum total of other business in the community. A telephone plant is one of the greatest of modern business machines and financially its success must rest, not upon artificial stimulation or social demands, but upon the demands of commerce and its ability to serve the business man as a time-saver and a money-maker.

The writer recalls the statement of a telephone enthusiast, some eight years ago, that the telephone business had no "rainy days." This unquestionably is true with regard to such violent fluctuations as occur in some lines of manufacturing, such as steel rails, when a heavy business reaction sets in, such as that of 1907. That the telephone business, however, continues to be uniformly prosperous while general business experiences a setback seems improbable.

The writer undertook, in a small way, an investigation of this subject and made a comparison of originating toll traffic and total bank clearings in a zone having a population of approximately 2,500,000. The comparison covered a period from January, 1905, to February, 1908, and the illustration shows the relative value of toll traffic in messages and bank clearings in dollars. The general agreement between the two curves is quite remarkable; a comparison of the slopes of corresponding portions of the curves shows 30 cases of agreement and seven cases of disagreement as to direction; that is, there were 30 cases of simultaneous increase or decrease of traffic and clearings, and seven cases where one increased while the other decreased, the percentage of agreement in the total number of comparisons being 81. Aside from this detail comparison, the general similarity in growth is very noticeable, but even more remarkable is the slump in both curves with November,



RELATIVE VALUES AND FLUCTUATIONS OF BANK CLEARINGS AND TELEPHONE TRAFFIC.

1907, following the October panic. This effectually disposes, in one specific case, of the theory that the telephone business is immune from the general fluctuations of business. Local telephone traffic in the same territory fell off fully as much as the toll traffic and a considerable reduction of the operating force was possible. In the interval between February, 1908, and the present time, both clearings and traffic have been increasing slightly and are now nearly uniform with the corresponding figures for last year.

This comparison just given corroborates the theory that telephone traffic is an index to general business conditions, at least so far as bank clearings may be so regarded. This basis of reasoning would lead to the conclusion that the telephone business as a whole suffered a setback in the past year, but the reports of some companies as to earnings indicate a nearly steady growth. This fact calls forth the statement that unusually vigorous canvassing for business, the development of a large amount of new territory, important changes in rates or service, retrenchment in operating force and the deferring of maintenance or reconstruction until more prosperous times, are necessarily important factors in such a comparison when they occur in the period under consideration or a short time prior to it.

A company recently organized in a territory poorly developed, if at all, would expect a very rapid growth in normal times and during such a period as the past year would expect, not a reduction in business, but a reduced rate of increase. It is, moreover, a great testimonial to the soundness of the basic conditions throughout the country that some of these companies can show an increase in business at the present time. On the other hand, it should not be overlooked that some companies have shown increased net earnings on a reduced volume of traffic, by reason of vigorous retrenchment in the business management. Considering any territory which was fairly well developed a year ago and had not been growing at an abnormal rate, the writer believes it to be a sound theory that the telephone business has suffered the same general setback which was experienced in the demand for other public necessities.

If it be accepted as true that telephone traffic is a safe index of general business conditions, and the writer believes that the reasons for so accepting it are generally sound, the corollary to that proposition is instructive and important. It follows that with equally favorable conditions as to financing and management, the telephone business is as safe an investment as any other public service or quasi-public corporation serving the public. It follows, too, that the public demand for telephone service can be reasonably anticipated and predetermined; that it will be as stable as the demand for electric light, gas, water, transportation, etc. Much has been said and written about the value of telephone securities; a great deal of it has been in the form of attack by one of the two groups of interests engaged in the business, the Bell and the Independent companies, upon the securities of the other. The Bell companies have charged the Independents with making rates too low to provide for proper maintenance and reconstruction and give good service at a profit; the Independents have charged the Bell companies with overcapitalization and extravagance. Specific instances can without doubt be quoted to support the contentions of both sides; it would be unreasonable almost to expect that such would not be the case in any business of such vast magnitude, at the present time. The essential point to be given prominence is that with sound financing, good engineering and economical management, good service can be given at fair rates that will earn a fair return upon the investment; the demand for service is stable and, therefore, the field should have the confidence of the investor. The same careful investigation of any particular proposition before investment that is accorded to any other business is presumed here.

The Independent interests defended themselves admirably from the last attack upon their financial credit by stating that in the last five years less than 1 per cent of their companies have failed or temporarily suspended dividends. From the investor's point of view, a strong reason for withholding his confidence in the safety of telephone securities is the campaign of villification and abuse which has so long been waged between the two principal groups of interests in the business. Competition in the telephone industry has unquestionably brought about advantages to the public that could have been secured in no other way, but competition becomes harmful when it departs from honorable methods and seeks to secure business upon any basis other than merit and good service and fair rates. It is to be hoped that the day is not distant when the telephone branch of the electrical art will be dignified by business methods similar to those which now obtain in other branches, to the permanent good of telephone securities as an investment.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Cost of Electric Equipment for Outlying Communities.

In a paper by Mr. J. S. Knowlson, of the General Electric Company, read at the Northwestern Electrical Association convention at Milwaukee, Wis., Jan. 21 and 22, it was stated that of the 670 central stations in Iowa, Minnesota, Wisconsin and the Dakotas, 39 per cent are in towns of 1200 inhabitants or less. Many of the latter are receiving excellent returns from the investments.

The author presented the following data on transmission voltage, equipment, necessary outlay and margin of safety and profit which may be expected from substations in towns of various sizes at various distances from the central station.

Population served.	Rating of substation in kw.		Distance from substation to city limits, 3 miles.	6 miles.	9 miles	12 miles
500	25	Total investment.	$4,800	$5,500		
		Margin of safety and profit.....	per cent	per cent		
		Transmission	2,300 volt, three-phase	2,300 volt, three-phase		
		Total investment	$7,600	$10,000	$12,000	$14,200
		Margin of safety and profit.....	21 per cent	per cent	10 per cent	5.5 per cent
		Transmission	2,300 volt, three-phase	11,000 volt, three-phase	11,000 volt, three-phase	11,000 volt, three-phase
		Total investment	$10,000	$12,500	$14,000	$16,300
		Margin of safety and profit.....	25 per cent	18.7 per cent	13.9 per cent	10 per cent
		Transmission	2,300 volt, three-phase	11,000 volt, three-phase	11,000 volt, three-phase	11,000 volt, three-phase

The total investment includes the outlay for the transmission lines, transformers, meters, street lamps and distributing system completely installed. The estimate includes the cost of 50 poles per mile of line, at $9 per pole, with cross-arm, pins, insulators, etc., set ready to receive the wire. The power lost in transmission is assumed to be from 5 to 10 per cent. The yearly depreciation, insurance and taxes are assumed to represent 10 per cent of the total investment. The margin of safety and profit is expressed in per cent of the total investment. The gross income is estimated at $4.50 per inhabitant, the maintenance and labor cost being from 50 cents to $1 per inhabitant. The energy is assumed to cost 1.5 cents per kw-hour at the busbars, not including depreciation, insurance, etc.

The author expressed the belief that there are large possibilities for the profitable extension of electric service into outlying towns and villages, and that these possibilities merit the consideration of the small central station as well as the large.

Educational Work of the New York Edison Company.

Welfare and educational work for employees of large corporations is receiving greater attention than ever, and the winter courses of lectures and laboratory practice conducted in various cities offer excellent opportunities. The educational work of the New York Edison Company is worthy of especial notice owing to its high standard of excellence and the completeness of the courses. This work was arranged by a committee of the Association of Edison Employees.

In September a series of 12 illustrated and experimental lectures was begun by Prof. Sydney W. Ashe, entitled "From Coal Pile to Consumer." This series ended in December, and will be followed by talks given by men who are successfully designing or operating large engineering undertakings. On Wednesday evening, Jan. 20, Dr. Samuel Sheldon gave an interesting and instructive talk on the "Regulation of Electric Machinery" as a part of the latter series, in the Edison Audi-

torium, where the lectures are held. These talks will be continued on Wednesday evenings throughout the winter. A course in laboratory practice was inaugurated in November to extend over a period of 20 weeks, ending in April. Both of these courses are free to all employees of the company.

The laboratory is located in the rear portion of the company's library, at 44 West Twenty-seventh Street, on the floor below the Auditorium, and is suitably equipped with apparatus necessary to conduct the various experiments.

The laboratory will be open every Monday, Tuesday, Thursday and Friday evenings during the course. The experiments during the four evenings of each week will be similar in character in order to best accommodate the large attendance. Copies of all textbooks which may be recommended in connection with the lecture course and laboratory practice are filed in the company's library.

Tungsten Lamps in Indiana.

The experiences of several Indiana central-station men with the tungsten lamp were given in a discussion on this subject at the special meeting of the Indiana Electric Light Association at Indianapolis Jan. 26. Mr. R. M. Cass, of the Indianapolis Light & Heat Co., read a short paper on the general subject.

Mr. Cass said in regard to the complaints made by some as to the high price charged by the manufacturers for these lamps that we must consider the high development expense that the manufacturers had undergone. We must also consider the effect on the central-station industry of flooding the market with cheap lamps of such low efficiency before there is time to adjust to the new conditions. Comparing the arc with the tungsten many think that the arc will be altogether displaced by the tungsten lamp. Comparing an installation of 3-amp arcs with one of an equal number of 250-watt tungstens he figured that the tungstens would be better from the central-station standpoint if the consumer renewed the tungsten and the company had to maintain the arcs.

Comparing the 250-watt tungsten with a 4-burner gas arc under common rates he made a comparison showing that the tungsten had the best of the gas. Mr. Cass thinks the average life of the tungsten lamp in commercial installations is now over 800 hours.

Mr. S. H. Smith, of Marion, Ind., said that there was not a gas arc in the business district of Marion. They had been displaced in the past mainly by flat-rate clusters of Gem lamps and now tungsten clusters on a flat rate are being pushed. At one time the local contractors and some lamp salesmen started to reduce consumers' bills by selling tungsten lamps of the same candle-power as the carbon lamps displaced. His company therefore went after the business with a flat-rate tungsten cluster maintained by the company. The consumer, however, buys the lamps so that he will be careful not to burn the cluster when not needed. His company had over 100 installations of Gem lamp clusters in use before the tungsten lamp came in and found only two cases where the candle-power had been increased by the consumer.

Mr. P. H. Palmer, of Kokomo, thought that the tungsten lamp was most likely to affect the revenue from residences. The way to handle the situation was for the central station to control the tungsten lamp business in a town and get the higher candle-power tungsten lamps installed before people have a chance to try the lower candle-powers. Once the higher candle-power is in use, no one is willing to change to smaller lamps.

Mr. J. H. Harding, of La Porte, said that the tungsten lamp had on the whole increased his revenue. He did not favor, however, the introduction of any flat-rate scheme, as he thought it was a step backward and that flat rates were something we have been trying to get rid of for many years.

Mr. Smith, of Marion, in defence of the flat rate, explained that consumers had to purchase lamp renewals, which, with the tungsten lamp, were high enough so that it made the consumers careful about wasting current.

Mr. T. W. McNamee, of Wabash, said that he had found the tungsten lamp an excellent weapon against gas competition. It had also been the means of shutting down one isolated plant in his town. The Tremont Hotel had a load of 15 kw in its lobby dining-room before the tungsten lamp came. His company put in tungsten lamps, using 6 kw, with efficient reflectors, and the illumination was greatly improved. The load was reduced so that the isolated plant was shut down and service taken from the central station. He had thought that a flat rate might be a good thing if used with a controller which would prevent more than a certain number of lamps being turned on at once. He had written to the manufacturer of such a controller for information as to what other central stations were doing with it, and the schemes adopted for its use, as well as the results of experience with it, but about all he could get out of them was that the controller was a good thing. He suggested starting a circuit in the downtown district, to be turned on at 6 a. m. and turned off at 10 p. m. A flat-rate equivalent to three cents per kw-hour, assuming lamps would be operated the entire time the circuit was on, would yield a gross revenue of about $150 per kilowatt connected per year.

Mr. C. C. Perry, of Indianapolis, thought that a plan of this kind would be unnecessarily expensive for the consumer, and suggested that a system of rates giving a low rate to the long hour consumers would be better.

Mr. Hollingsworth, of Marion, said that in Muncie and Marion 35 gasoline lighting plants had been put out of business by flat-rate propositions with Gem lamps. With tungstens it would have been much easier. Whenever a plant was taken out the company agreed to use its best efforts to sell the plant for the new consumer and would advertise it for sale

High-efficiency Lamp Renewal.

By J. F. Musselman, Jr.

The high-efficiency, metallic-filament incandescent lamp has been reduced in cost and improved in construction within the last few years till there are now on the market, to select from, two types of incandescent lamp which differ materially in construction, life, efficiency and cost of renewal. And in making a present-day installation or a renewal of incandescent lamps, the modern tungsten unit, with a consumption rate of 1¼ watts per candle-power and a life of about 1000 hours is to be balanced against a lamp of the carbon-filament type with a consumption rate of 3.1 or 3.5 watts per candle-power and a useful life of 600 or 1200 hours, respectively. To make an estimate of this kind one may assume a cost of $85 per 100 for the tungsten lamp and less than one-third as much, or about $24 per 100, for a 32-cp carbon-filament unit of a good grade.

As to the relative merits of the two types of lamps as sources of illumination, there is much to be said, and the difference in color and intensity will in some cases determine the lamp to be used; but in this article the lamps will only be compared from a standpoint of cost of energy and renewal, and the conclusions hold good only in installations where satisfactory results can be had from the use of either kind of lamp.

The accompanying table gives the cost of energy and renewal per 1000 hours of a 32-cp, 3.5-watt carbon-filament lamp; a 32-cp 3.1-watt carbon-filament lamp and a [illegible] lamp at various cost prices of energy from $0.002 to $0.125 per kw-hour. The 32-cp unit was selected as a basis of comparison on account of its being a size which can be had in all of the three lamps. In [illegible] any ordinary installation

From the foregoing it will be seen that for any ordinary installation where either a carbon- or tungsten-filament lamp can be used the short-lived 3.1-watt carbon filament lamp is never a good investment, for however cheap or however costly the electric energy may be either a long-lived 3.5-watt carbon filament lamp or a tungsten lamp gives a lower total cost per 1000 hours. Hence a 3.1-watt lamp is no longer to be considered except in cases where the lamp breakage is very high or the vibration is

so great as to shorten the life of the tungsten filament, or where some other local condition makes the use of this filament unadvisable, and then only when energy costs more than 1.6 cents per kw-hour, for at any lower rate the 3.5 watt lamp is a better investment.

Where energy is bought at a meter rate the selection of the lamp to be used is a simple process, and for any ordinary installation where either type can be employed, it resolves itself into the use of 3.5-watt carbon-filament lamps where the rate is less than 1 cent per kw-hour and tungsten lamps wherever the rate is more than that. The above results are sometimes upset by the fact that some public service companies furnish carbon filament lamps free of cost, but charge for tungsten lamp renewals; then there is a natural tendency of all users of light to use more if they think it is cheap.

The question of lamp installation or lamp renewal in cases where the energy is generated by an isolated plant reduces itself to the net cost of generating the energy; and, if the plant is already in operation and of sufficient capacity to supply lamps

	Carbon filament.		Tungsten filament.
Candle power	32	32	32
Watts per candle-power	3.5	3.1	1.25
Total watts	112	99.2	40
Hours total life	1,200	600	1,000
Cost of lamp	.24	.24	.80
Cost of renewal per 1,000 hours	20	40	80

Cost of energy per kw-hour.	Combined cost of energy and lamp renewals per 1000 hours. Carbon filament.		Tungsten filament.
.002	.124	.597	.93
.003	.536	.695	.97
.004	.648	.794	1.01
.005	.760	.892	1.05
.006	.872	.991	1.09
.007	.984	1.090	1.13
.008	1.096	1.189	1.17
.009	1.207	1.287	1.21
.010	1.32	1.39	1.25
.012	1.54	1.59	1.33
.014	1.77	1.79	1.41
.016	1.99	1.99	1.49
.018	2.22	2.19	1.57
.020	2.44	2.38	1.65
.022	2.66	2.58	1.73
.024	2.88	2.78	1.81
.026	3.11	2.98	1.89
.028	3.34	3.18	1.97
.030	3.56	3.38	2.05
.032	3.78	3.58	2.13
.034	4.01	3.78	2.21
.036	4.23	3.98	2.29
.038	4.45	4.18	2.37
.040	4.67	4.37	2.45
.042	4.90	4.57	2.53
.045	5.21	4.87	2.65
.050	5.80	5.36	2.85
.055	6.36	5.86	3.05
.060	6.92	6.35	3.25
.065	7.48	6.85	3.45
.070	8.03	7.34	3.65
.075	8.60	6.84	3.85
.080	9.16	8.33	4.05
.085	9.72	8.83	4.25
.090	10.28	9.32	4.45
.095	10.83	9.82	4.65
.10	11.40	10.32	4.85
.105	11.96	10.81	5.05
.11	12.52	11.31	5.25
.115	13.08	11.81	5.45
.12	13.64	12.30	5.65
.125	14.20	12.80	5.85

of either type, the cost to generate the additional energy necessary for the carbon-filament lamps amounts only to the cost of the additional coal, water and ash removal, as it does not entail any additional labor in the engine or boiler room, the interest on the power-plant investment and the depreciation of the plant being already provided for.

The cost of the additional energy, figured in this way, is very low, and for a small plant, where an estimate can be made on a basis of water consumption of 51 lb. per kw-hour and an evaporation of 8.5 lb. of water per pound of coal, the coal, water and ash removal amounts to about $0.0112 per kw-hour with coal at $3.50 per ton. But for the lighting load of an office, store or factory building, or of a hotel building, where there is a considerable proportion of its contents ventilated, about one-third of the heat of the coal used throughout the year is absorbed by the heating apparatus in the form of exhaust steam, and if the exhaust steam were not available, the deficiency would have to be made up by live steam. This fact reduces the above figure for the cost per kw-hour to $0.0074, and at this rate the long-lived carbon-filament lamp makes the most economical installation, saving, as will be seen from the table, about 12 cents per 1000 lamp-hours.

For a new plant, where the size of the generating equipment can be reduced by the use of the high-efficiency lamps, it is necessary to add to the above figure the interest and depreciation charges for the increased cost of the generating plant made necessary by the use of carbon-filament lamps. These charges, where lamps are used about 1000 hours per year, amount to about 18.7 cents per 1000 lamp-hours, which includes no credit for the reduced capacity of boilers, as can sometimes be made, nor the reduction which is generally possible in the amount of copper used in the feeders. This figure would indicate a loss of 6.7 cents per 1000 lamp-hours by the use of carbon-filament lamps under the above conditions.

The above represents about an average condition for isolated plants, and from these figures it is at once evident that, at the present price of tungsten and carbon-filament lamps, it is never economical to design a plant or an installation of lighting fixtures on a basis of using low-efficiency lamps, and it is only in installations where the plant and fixtures are already in place that their use can be recommended.

Some Tungsten Lamp Lessons.

By H. H. MacPherson.

When the tungsten lamp first came on the market many articles were written and many predictions were made regarding the effect which the use of these lamps would have upon the business of the central station. It seemed then as though the output of tungsten lamps would be limited for some time to come by reason of the high cost and consequent increased risk of installing the necessary equipment for making them. This fact, together with the high price and the admitted fragility of the lamps, combined to make most central-station men believe that the use of them would of necessity be gradual in its growth.

During the year just past several causes have combined to make the growth in the sale and use of tungsten lamps surpass all expectations.

In the ordinary course of events a new invention like the tungsten lamp is manufactured by but one or two factories, and by them only on a small scale until the invention is well introduced to the commercial world, which fact therefore causes the early supply to be very limited. The tungsten lamp, however, was such a wonderful improvement in nearly every way over anything of the kind in existence that a large number of new factories in addition to all of the carbon lamp factories began to manufacture them as soon as they could install the necessary equipment. The resultant increase in the number of minds devoted to the improvement of the lamp soon showed its effect in the perfecting of many inventions looking to the betterment of the life and the strength of the tungsten filament. These improvements were rapidly followed by others and by a sweeping reduction in the price of the lamps, together with many more or less valid guarantee agreements. During all of this time the public press was full of glowing tales about the efficiency of these new lamps. The public was told the wattage and candle-power of tungsten lamps and vivid comparisons were made between the cost of operation of carbon-filament lamps and tungsten lamps, showing in most cases more and better light for something like one-third the money previously paid. As soon as the lamps began to be manufactured in commercial quantities they were shipped broadcast over the country to the electrical supply men, who took them up and pushed them with energy, always using the easy selling argument, "These will give you as much light as you have now for one-third of your present cost."

In view of these extraordinary conditions there is little wonder to be expressed at the enormous number of tungsten lamps which were made and sold during the year 1908. In

many cases the central-station men were taken quite by surprise. In some cities the situation was so completely out of their control that all a person in need of a little ready money had to do was to rent a push-cart and peddle tungsten lamps from door to door. A demonstration was all that was needed, for then the lamp sold itself. The chance for a demonstration was easy to obtain on account of the great amount of curiosity which had been aroused in the public mind by the popular articles which had appeared in the public press.

This state of affairs brought matters to a head for the companies almost at once. Problems as important as this one usually require much thought and time for their proper solution, because once a public service corporation sets out to follow a definite policy there is little chance of making vital changes in it without incurring public comment. Therefore, it is imperative that such a question should be examined with great care so that whatever policy is finally adopted will fit in with the general policy of the company and so bring the entire problem to a successful solution.

Regardless of any subsequent steps which might be taken it became plainly evident that each company must control the sale of lamps used on its circuits. In order to control absolutely the sale of such lamps it would appear necessary for the company to buy tungsten lamps in large enough lots to enable it to retail them at a price low enough to eliminate competition of local dealers. With the company in absolute control of the tungsten lamp business the problem becomes much more simple because the representative can know the exact conditions which exist in his territory and he can plan accordingly. While the local dealer may succeed in selling some of the larger sizes of lamps, most of the consumers want to spend initially as little money as possible, and therefore they buy the cheapest lamp which is, of course, the smallest in wattage.

In many companies there seems to be a very strong opinion that since the tungsten lamp produces such a big saving in cost of operation and so large an increase in the amount of light obtained that, "when the public learn of these things they will insist on getting the low-wattage lamps, and there will certainly be an enormous decrease in spite of all one can do." But if "all one can do" is done, the decrease will certainly be much less than if nothing at all is done.

Several years of hard personal work has taught people in most cities that a gas range and an electric iron are two absolutely necessary things to have in a home. In that same time thousands of families have changed from the electric lamp to the incandescent gas lamp and thousands more have complained of the poor light given by the electric lamp and have threatened to change to gas. These families appreciated the convenience and all the other advantages of the electric lamp, but they knew that they should have a stronger and whiter lamp that could be placed further away, hence they adopted the incandescent gas lamp. Now that the tungsten lamp has arrived the proper electric lamp is in the hands of the electric companies to take advantage of the situation.

In the business territories electricity has been superseded by gas in hundreds of places because the business men wanted more light for less money. Even in the smaller cities the business men have been educated to believe that the proper amount of light is comparable to a good location in business-bringing ability. Thousands of merchants who have been barred from the lavish use of light for display purposes on account of cost are now placed in a position where they can use it to advantage

It is interesting to note how the changed condition of affairs has been handled thus far by the central stations of this country. Three distinct lines of progress have been followed in working out tungsten lamp policies. The method most generally used has been to follow the path of least resistance and to allow the electrical contractors and supply men to introduce the lamps as they saw fit. When it was found that the lamps were making inroads upon the lighting revenue, the company simply took over the control of the tungsten lamp business in the city by selling lamps on terms which the small dealer could not equal.

In several large cities, of which Boston is probably the best example, the tungsten lamp has been used as a medium of uniting the interests of the architects, the electrical contractors, and the electric company by advising customers how to use electricity most efficiently. By assuming that one satisfied consumer will eventually make five new ones, the company expects to offset the decrease in gross revenue brought about by the recommendations for greater economy in the use of electricity.

The third plan is best represented by the method used by the Brooklyn Edison Company. By handling tungsten lamps in large lots, co-operating with the electrical contractors and showing them how to further their own best interests by recommending a higher standard of illumination, this company is solving the "contractor" problem and is putting itself into high public favor.

In the small and medium-sized companies the system of controlling the local sale of tungsten lamps by selling them at or near cost, either with or without a renewal arrangement, has worked well, particularly when backed up by intelligent, systematic work on the part of the company's new business department. Each representative must make himself more or less of an illuminating engineer, and investigate old or inefficient installations, seeking thereby to improve the lighting and keep up the revenue. The services of a trained illuminating engineer have been found to be invaluable in such work. Such a set of conditions means that a much larger proportion of the representative's time than ever before is taken up with adapting himself to new conditions, and in holding business.

While certain classes of lighting have shown a slight decrease temporarily, the close of 1908 saw many similar classes with the largest increase in years. The tungsten lamp brought its problems, but it has not brought the expected decreases. The central-station man should take heart and say, "I have been looking for something like the tungsten lamp for years, and am glad now that it is here."

A Study in Central-Station Finances and Operation from Marquette, Mich.

The municipally owned electric light and power plant at Marquette, Mich., offers an instructive study in central-station finances. It is one of the few municipally owned electric light and power plants of the country that has been sufficiently separated from cheap municipal politics for a term of years to be operated on a business basis in much the same way as a progressive private enterprise. The plant, in accordance with the laws of Michigan, is under the control of a commission of five members.

In considering the financial results of the Marquette plant, which are noted later, it must be remembered that the city is fortunate in having nearby a water power which has been developed at a low cost per kilowatt. This has kept both the investment and operating expenses low.

The commission issues yearly a report which contains much information on the technical and financial management of the plant. In fact, much more complete information is thus available about the plant than is usually available about a plant of its size.

Some of the general central-station facts and factors applying to the plant for the year ending [illegible] are given in Table I.

The first notable item of Table I is the low investment per kilowatt, which is only $82. In central stations of this size this item is seldom less than $150 and often runs up to $250. The low figure is attributable to the fact that by good management and by virtue of the low cost of operation at water power a large amount of construction work has been paid for out of the earnings and some of the original bonds have been retired. The bonds outstanding amount to $63,500. This amount plus $6,000 borrowed from the general fund of the city represents the total indebtedness or permanent investment for which the plant is liable. Bonds to the amount of $31,500 have been paid off.

The books show that $198,962.22 has been invested in the plant since the beginning of operations, in July, 1889. The amount not paid for by bond issues was paid out of the net earnings.

The gross yearly income is derived from a large number of consumers, as is shown by the small income per consumer. The motor load forms an important part of the business, as shown directly by the kilowatts connected and indirectly by the earnings per kw-equipment. This fact is also indicated by the yearly load factor which is higher than in any plant where there is not a considerable motor load.

TABLE I.

A.—GENERAL INFORMATION.	
Population of district served	10,000
Rating of station, kilowatt	850
B.—UTILIZATION OF INVESTMENT AND APPARATUS.	
Total investment (indebtedness) per kilowatt of station equipment.	$2.00
Gross yearly income per kilowatt of station equipment	$65.00
Gross yearly income per $100 invested	$79.00
Yearly operating expenses per kilowatt of equipment, excluding interest and depreciation	$26.50
Per cent of gross yearly income spent for operation	39
Yearly operating expenses per $100 invested	$32.00
Average income per consumer	$37.00
Total connected load in kw per kw of station equipment	2.1
Connected kw load in lamps per kw of station equipment	1.44
Connected kw load in motors per kw of station equipment	0.84
Connected kw load in heating apparatus per kw of station equipment	0.32
Kw-hours sold or accounted for per 100 kw-hours generated	74.6
Yearly load factor (average load divided by maximum)	0.30
C.—DEVELOPMENT OF TERRITORY SERVED.	
Gross yearly income per capita of population	$5.51
Investment per capita	$6.95
Watts of station equipment per capita of population	85
Number of customers per 100 of population	14.8
Residence customers per 100 of population	10.4

The gross yearly income per capita is as large as in some progressive private plants, thus indicating that the field has been well worked. Another thing showing the extent to which the plant is serving the community is the high number of consumers per 100 of population.

The number of kw-hours sold during the year, including the amount registered on the store room and plant-lighting meters, was 1,602,715. The relative percentages of energy sold or used for different purposes was as shown in Table II:

TABLE II.

	Per cent.
Registered on street lighting meters	14.6
" " store room testing and power-house meters	1.7
" " city meters for building lighting, etc	2.3
" " residence lighting meters	16.6
" " business lighting meters	37.4
" " industrial meters	27.4

The output sold for various commercial purposes for the year is shown in Table III.

TABLE III.

	City lamps and motors.	Residence lighting.	Business lighting.	Commercial motors.
March, 1907	2,550	16,627	43,447	34,147
April, 1907	2,450	16,449	38,369	43,996
May, 1907	3,660	13,940	41,114	32,497
June, 1907	1,413	13,110	35,933	29,054
July, 1907	1,642	13,730	41,547	45,142
August, 1907	1,459	15,117	42,789	47,432
September, 1907	2,616	21,384	50,454	42,054
October, 1907	2,697	25,563	63,182	34,361
November, 1907	3,475	29,352	66,433	28,970
December, 1907	3,972	30,126	70,316	31,757
January, 1908	3,356	32,123	56,848	29,999
February, 1908	2,681	27,844	45,126	37,998
	31,971	255,365	595,558	437,405

The commission does electric wiring and construction and the receipts from this source amounted to $33,316.87 for the year. This amount was not included in the gross receipts from operation, upon which the figures in Table I were based. The receipts from operation were $55,107.19.

The following figures show the relative number of consumers of the various classes:

INSTALLATIONS IN USE.

Number of residences lighted	1,040
Number of business places lighted	375
Number motors installed	70
Electric flatirons	540
Number alternating-current multiple arc lamps in service	167
Number Nernst lamps in service	89
Estimated equivalents in 16-cp lamps of all installations	41,311

The city pays the light and power commission a certain sum per year for each street lamp just as if it were a private company. It also purchases energy for lighting its buildings on the same basis as does any citizen. The rate on the 7.5-amp series enclosed arc lamps used for street lighting is $75 each. The other rates are: Residences, 7 cents per kw-hour; business places, 5 cents per kw-hour for ordinary users; long burners and large installations, 2 cents to 3 cents per kw-hour; motors, ¾ cent to 5 cents per kw-hour.

The plant at present contains one 500-kw and one 300-kw, two-phase alternators generating at 2300 volts. The past year a 6600-volt transmission, with step-up and step-down transformers, has been substituted for the 2300-volt lines formerly used between the plant and the center of the city. The water-power plant consists of a timber crib dam filled with stone, 220 ft. long, 48 ft. high, connected to the power house by a flume 6 ft. inside diameter, 2700 ft. long. The power plant has one pair of 25-in. horizontal New American turbines, working under an 85-ft. head, directly connected on one end to a 550-kw alternating-current generator and on the other end to a rope drive, to main line shaft, to which is directly connected a 300-kw alternating-current generator.

The plant has undergone the evolution and enlargement customary with similar properties and considerable loss and displacement has been paid for out of operating expenses.

The following are the disbursements for plant construction from the beginning of operation in July, 1889, to March, 1908:

For real property (water power and flowage)	$14,984.68
Power house	4,865.35
No. 1 dam and flume (original plant)	5,242.27
Dwellings (No. 1, $500; No. 2, $1,561.17; No. 3, $360)	2,421.17
No. 2 dam (new plant)	11,171.70
No. 2 flume foundation	6,957.84
No. 2 flume, wooden portion, 700 ft	3,409.86
No. 2 flume, steel part and cover, 2022 ft	17,127.84
Water wheels (No. 1, $2,654.96; No. 2, $2,963.65)	5,618.61
Machinery foundations (in power house)	2,455.47
Transmission (water wheels to dynamos)	2,716.69
Alternating-current generators (300-kw and 500-kw)	14,262.72
Pole lines (poles and fixtures in place)	9,255.87
Arc circuits, copper in place (22,836 lb. bare copper)	8,350.54
Arc circuits, station apparatus, lamps and fixtures	5,862.66
Commercial circuits, copper in place (118,157 lb. bare copper)	37,148.59
Commercial circuits, multiple arc and Nernst lamps	6,206.58
Commercial circuits, transformers and fixtures	19,687.59
Commercial circuits, meters	17,868.10
Commercial circuits, motors	659.70
General sundries	2,688.39
	$198,962 22

Of the foregoing, the following items of loss and displacement have been taken out of property account and entered as operating expenses:

1900. Losses on dam	$7,549.30
1903. One 750-lamp and one 1500-lamp alternator	8,892.91
1905. Direct-current dynamos	5,032.33
1905. Transmission machinery	2,752.38
1906. Direct-current street arc lamps	4,535.66
1907. One horse	150.00
	$28,912.58

The commission in its report estimates depreciation on the following basis:

Amounts invested.		Rate.
$14,984.68	Land	None
7,286.52	Buildings	5 per cent
51,983.59	Power plant	5 per cent
9,255.87	Poles and pole fixtures	8 per cent
2,716.69	Transmission	2 per cent
2,688.39	Team, wagon, etc	10 per cent
14,262.72	Generators	10 per cent
48,499.13	Copper conductors	3 per cent
12,069.24	Lamps	10 per cent
19,687.59	Transformers	10 per cent
17,868.10	Meters	10 per cent
659.70	Motors	10 per cent
$198,962.22		

In looking for the causes of the success of the Marquette plant and the reasons it has not drifted into the usual rut of municipal plants—in which the lack of a continuous business-like policy is likely to be plainfully evident—the first thing to be noted is the unusual personal interest taken in the plant by competent men. The chairman of the commission, Mr. J. E. Sherman, a business man used to handling large affairs, has been on the commission for years and has given to the management of the plant an amount of personal attention which is unusual among those who are burdened with public affairs in addition to important private interests. In the public spirit and pride in the enterprise which Mr. Sherman has displayed is to be found

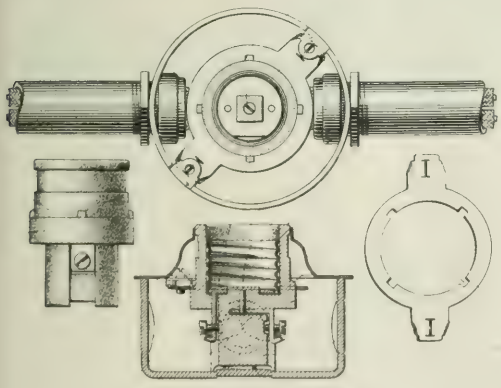
the first factor of success in the Marquette plant. Thus the plant has been for years practically under the guidance of one man acquainted by experience with its needs and interested in its success rather than under a constantly changing administration of men who have the business to learn.

The business-like management of the commission caused the employment of a competent superintendent in the person of Mr. Charles Retallic, who has been held responsible for the management of the plant just as if he were in the employ of a private company.

INTERIOR WIRING AND ILLUMINATION

Outlet Box and Receptacle for Conduit Work.

As is well known in rigid conduit work, outlet boxes must be provided for any lamps, switches, etc., connected in the system. Such a box usually comprises a cup stamped of sheet metal with openings at the side to receive the conduit sections, and a cover with a central perforation through which the lamp receptacle projects. The boxes are about 4 in. in diameter and the lamp receptacle must be anchored in place within the outlet box, usually by a fastening between the bottom or back plate of the outlet box and the receptacle, or between the cover plate and the lamp receptacle. The latter arrangement offers some difficulties in soldering, taping or compounding the wires unless the wireman leaves a long loop, because the flaring edges of the cover plate are in the way. It is also impossible to remove the cover without wholly disturbing the receptacle and the wiring. Where the receptacle is fastened by machine screws to the bottom plate of the outlet box, the holes must be registered with those of different types of receptacles and the surplus holes are apt to admit moisture. It is also necessary to have a porcelain or insulating wall between the threaded shell and the edges of the central opening through the cover, and a mere bushing ring is not satisfactory on account of its liability of becoming broken or removed and lost. The lamp receptacle usually employed has a central block which is secured to the bottom plate of the outlet box, and a projecting porcelain housing which is slipped over the central block after the connections have been made. This outer housing has a portion surrounding the threaded shell and high enough to form a partition between the threaded shell and the surrounding edge of the opening in the cover. With this arrangement and with the wiring required, it is usually necessary to have a box 4 in. in diameter and the wires are necessarily crowded against the iron back plate. To obviate the disadvantages enumerated and to provide a lamp receptacle or rosette exclusively for use in conduit wiring, Mr. James Stewart has patented the receptacle shown herewith. This has an insulating partition between the threaded shell and the edge of the opening in the cover plate which supports the wires at some distance away from the bottom plate. Means are also provided for anchoring the receptacle in place in the outlet box. The receptacle has a shoulder on which is a plurality of teats which engage with certain recesses in the holding plate. Below the shoulder is an elongated portion slightly greater in diameter than the knock-out portions of the outlet box, and the flat end face is recessed slightly so as just to fit snugly over the embossed portion of the bottom plate. The shoulder is on a line with the lugs of the outlet box. In use, a slight loop of wire is left at each box to give wire enough for the connections with the lamp receptacle or rosette. The wires are stripped and fastened to the terminals, the receptacle body being unfastened at the time. The terminal connections are made at least ½ in. away from the base of the outlet box and the cover can be removed whenever desirable without disturbing the receptacle or wiring. The receptacle is fastened against any independent movement in the box.



OUTLET BOX AND RECEPTACLE.

Illuminating Engineering vs. Common Sense.

BY ALBERT J. MARSHALL

Inasmuch as I am one of the "guilty" persons who have dared, by study, observation and experimental work, to endeavor to acquire knowledge of how to use artificial light in a more practical manner than has heretofore been the custom, and therefore have incidentally assumed the title of illuminating engineer, I feel that I am at liberty to endeavor to answer an article appearing in the issue of Jan. 21, entitled "Illuminating Engineering vs. Common Sense."

The article asks, "Suppose the illuminating engineer, previously so called, had not appeared on the scene, would we not have had the tungsten lamp, flaming-arc lamp and inverted gas burner just the same?" Perhaps we would. In all probability gold and diamonds would have been, and are oftentimes, discovered without the assistance of trained mining experts, but the mere finding of such metal and gems in the rough is one thing, while developing them so they will assume esthetic shapes and also serve utilitarian purposes, is another. Likewise with light. While there are concerns which manufacture lances, etc., for doctors to use for medical purposes, yet it is questionable if such concerns are qualified to use that which they produce. It should be understood that the illuminating engineer, while doing some experimental and research work with a view to developing illuminants, is more interested in the equipment and application of illuminating units than in their creation.

It is also asked, "Would the illuminating engineers be willing to wager their professional standing (much thanks for such recognition) on the ability of the people to pick out the installations that they have designed from those that have been laid out by the architect or electrical engineer?" There is, to my mind, but one answer to this question, and that is, yes. It is easily possible for a person of ordinary intelligence to form such judgment, for the very simple reason that it is an easy matter to see almost at a glance whether a lighting system has been designed by some one who understands its necessary requirements or by someone who thinks he does or by someone who does not think at all. There are architects, electrical engineers and others who have a very good idea of what the practice of illuminating engineering principles consists, and while their work is perhaps not absolutely perfect, yet it is far in advance of installations designed by people who ridicule the idea of the intelligent use of artificial light, which, when all is said and done, is illuminating engineering.

There are "illuminating engineers and illuminating engineers," just as there are "M.D.'s and M.D.'s," and "architects and architects," and "salesmen and salesmen." The mere fact that

there are so many so-called illuminating engineers shows in itself that a number of people at least appreciate the value of such work, even though they are not finished in the arts and sciences necessary to carry it to a successful conclusion.

An illuminating engineer, to my mind, should be qualified to handle any and all problems pertaining to his work that may be submitted to him, and must, among other things, appreciate the following necessary points: First, the giving of due consideration to the physiological and hygienic sides. Second, the esthetic, in a manner calculated to produce harmony. Third, the technical and theoretical, which exists chiefly in the laboratory. Fourth, but by no means least, practical knowledge—that knowledge which is gained by experience, such being the results of systematically directed efforts.

It is stated further that "there are, undoubtedly, a large number of specialists to-day who are entitled to take the professional degree for illuminating engineering, although in many instances they would be the last to assume it." A question in this connection is: What constitutes an illuminating engineering degree? To the statement that there are a large number of such specialists to-day, exception can easily be taken. The men in this country and abroad who have the necessary qualifications of an illuminating engineer to carry out intelligently his work are, to my mind, few. The Illuminating Engineering Society, organized in January, 1906, and having a membership of approximately 1000, has among its members representative oculists, physicists, mathematicians, artists, gas engineers, electrical engineers, civil engineers, decorators, designers, architects, oil and acetylene experts, etc.—in fact, men drawn from all professions, sciences and arts having to do with the use of artificial light or effects.

Back-yard Service Connections.

In the suburban sections of cities it becomes quite a problem to connect up various dwellings with the electric light company's mains without excessive expense or without marring the attractiveness of the streets by pole lines. Some few cities have alleys back of the houses so that the pole lines can be run along these, and the street itself kept free from any encumbrance. The majority of cities, however, have no alleys, so that either an underground conduit system is installed or a pole line is erected to carry the mains. Shade trees, however, are among the attractions of the suburbs, adding not a little to the beauty of the surroundings and incidentally adding to the worry of the electric light company. Besides, overhead wires are not particularly in public favor in such districts. In Rochester, N. Y., the electric light company has whipped the devil around the stump by erecting a pole line on the back-yard boundary line. The scheme is well illustrated in Fig. 1, and Figs. 2 and 3 show, respectively, a street and back yard on which the scheme has been carried out.

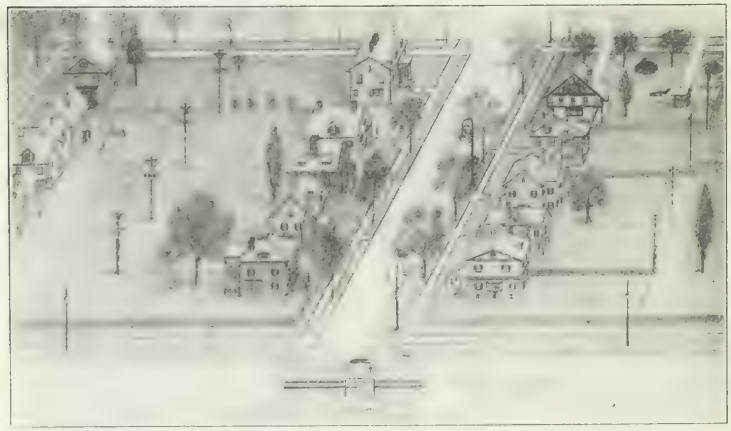


FIG. 1.—PLAN OF BACK-YARD POLE LINES AS ADOPTED IN ROCHESTER, N. Y.



FIG. 2.—STREET ON WHICH HOUSES ARE CONNECTED TO BACK YARD POLE LINE.

There are two telephone companies in Rochester and these cooperate with the Rochester Railway & Light Company in maintaining these combination pole lines. The company has deeded to it by the owner the ground on which the pole is erected, together with the right of free access at all times, and it in turn places on the streets the improved type of arc lamp post shown in Fig. 2.



FIG. 3.—LIGHT AND TELEPHONE WIRES ON BACK-YARD POLE LINE.

In running the mains to these back-yard pole lines, high-potential lines are run underground to a transformer in the manhole nearest the desired street. From here low-potential circuits run to a manhole in the street opposite the pole lines, whence they branch and run underground to the end poles on either side. The mains are then brought up through conduit to the cross-arm. The electric-light mains are carried on the top of the pole and the telephone circuits lower down. Service connections are connected to the mains and brought in overhead to the rear of the house, thus leaving the front of the house free from unsightly wires and service connections. The pole line extends from block to block, depending on the number of houses connected. No difficulty has been encountered thus far in

securing the free grant of the ground upon which the poles rest and the right of access. The property owners appreciate the value of keeping the streets free from poles and the shade trees from being killed or otherwise marred, owing to the presence of electric light or telephone wires. So far as appearances go, the plan possesses all the advantages of a conduit system and the cost of reaching suburban homes with electricity in a section where underground connections in the streets would be insisted on, is not much greater than would be entailed by a straight overhead system. Moreover, the scheme has met with public approval, at least in Rochester, and is applicable to many other cities where detached houses abound.

New Telephone Patents.

SWITCHBOARD CIRCUIT SYSTEM.

Mr. H. G. Webster has obtained four patents for various improvements and features of two-wire common-battery systems. One of these patents describes a special method of applying the heat coil protection to subscriber lines. Heretofore it has been customary to include the heat coil directly in the line circuit, but Mr. Webster has so arranged his circuits that his heat coil is included in a branch of the circuit leading to the relays only, and he is, therefore, enabled to use a high resistance heat coil without affecting the transmission. When the heat coil operates in response to sneak currents, the main line circuit is opened, the operating springs being associated in the main line circuit and the winding of the coil only being in the branch circuit.

The remainder of Mr. Webster's circuits refer to special methods of connecting the line, cut-off and supervisory relays. In one of the systems the supervisory relay is made two-stage, the first action lighting the supervisory lamp and the second step of the action, under an increased current, sufficing again to open the lamp circuit. The cut-off relay is bridged across the line, and, when it alone is in circuit, the supervisory relay is in the intermediate position. When the subscriber's set is bridged across the line in parallel with the relay, however, there is sufficient current flow to cause the complete operation of the supervisory relay.

In one of the remaining patents granted to Mr. Webster the circuits are so arranged that the line and cut-off relays are in series when the bridge is formed across the line, this giving a higher resistance to the bridge without increasing the sensitiveness of the cut-off relay, and in the other a single relay suffices for both line and cut-off purposes. When the subscriber is calling, one of the windings, acting alone, serves to light the line lamp. After the operator has inserted her plug, however, the second winding comes into action and balances the first winding, causing the extinguishing of the line lamp. All of the patents have been assigned to Mr. M. G. Kellogg.

Mr. A. H. Dyson, of Chicago, has also patented a circuit system for two-wire, common-battery switchboards. In his system the novelty lies in so associating line and cut-off relays that, in order for the cut-off relay to operate upon the insertion of the plug in response to the operator, the line relay must have previously operated.

Mr. C. S. Winston, of Chicago, has invented a three-wire common-battery switchboard circuit system, the arrangement of line and cut-off relay of which is almost the same as usually employed with these systems, the only change being that the cut-off relay, responding to current from the sleeve wire, cuts off only the ground side of the line relay and the line lamp circuit. The uncut line relay coil serves as a retardation coil battery-feed wire, the return ground side being through the ring side of the cord circuit and through the supervisory relay.

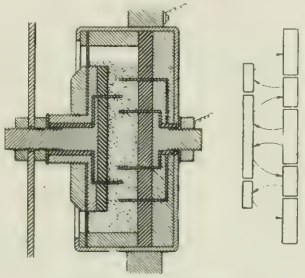
Mr. W. W. Dean has patented an improvement in his busy-test system for two-wire circuits of the Dunbar type. Heretofore he has isolated the common parts of his busy-test system from the various individual cord pairs by means of auxiliary contacts in the listening key. In the present arrangement the auxiliary contacts are associated with one of the supervisory relays of the answering cord of the pair in question. This relay is always operated at the time a busy test is desired and, therefore, the busy-test circuit is connected to the cord pair which is to be used in testing. The busy test becomes cut off as heretofore by one of the contacts of the supervisory relays associated with the calling cord just as soon as this calling cord is inserted in the jack.

PHONOGRAPH ATTACHMENT.

A patent for a phonograph attachment to telephones has been granted to G. J. Boelen, of The Hague, Netherlands. This consists of a phonograph with reproducer so associated with the telephone station that it may, through the connection of its control relays with the telephone line, be caused to repeat in the telephone line any desired message, after which it resets itself awaiting the next call.

NEW TELEPHONE INSTRUMENTS.

A multiple electrode transmitter forms the subject of a patent granted to C. D. Enochs, of La Crosse, Wis., which is illustrated in section in the accompanying diagram, which shows the course of the current back and forth through the transmitter in its



ENOCHS TRANSMITTER.

course from one terminal electrode to the other. The figures are so plain that little description is necessary. It may be well, however, to call attention to the fact that the transmitter button assembled is of a size just about equal to that usually employed for such instruments.

TELEPHONE HOOD.

A telephone hood to serve in lieu of the familiar telephone booth in special cases has been patented by H. L. Burrhus, of Hornell, N. Y. The telephone equipment is placed within the hood, which swings about a horizontal axis. In the unused condition the hood is tilted up to the vertical position, a device attached to it having performed the usual hook-switch function. During use one draws the hood down over his head and shoulders, until the transmitter is in front of his mouth. In this position the circuits are arranged for talking.

IMPROVEMENT IN AUTOMATIC SYSTEM STATION DIALS.

In automatic-exchange systems it is absolutely necessary for satisfactory results that all parts designed to work in synchronism do so. If, therefore, any part be forced to a higher speed of operation than that for which it is designed, it is readily seen that the working of the whole system may be defeated. In actual practice it has been found that at times subscribers will attempt to force the sending dial in its return movement, with the result that all parts become forced out of step or otherwise wrongly affected. To overcome this difficulty John Erickson, of Chicago, has invented a sending dial which [illegible] He has developed this in two styles, both [illegible] by patents.

In one of these the finger stop, which is movable, carries a lever, integral with it, which has a pin lock engaging apertures in the inner disks of the mechanism. In pulling up a digit, as the finger strikes the stop, the latter moves against its back stop, thereby locking the whole mechanism until such time as the finger-dial is released. In the other form the control is by means of an internal ratchet and dog device. Any attempt to

force the finger-dial backward throws the dog into a locking engagement, so that the whole device becomes locked until after the backward pressure upon the finger-dial is removed.

Letters to the Editors.

The Humming Telephone.

To the Editors of Electrical World:

Sirs:—I read with some interest the brief notice having the above caption on page 260 of your issue of Jan. 28, and referring to a paper in the *Proceedings* of the American Philosophical Society for 1908 by Dr. A. E. Kennelly and Mr. Walter L. Upson, entitled "The Humming Telephone; A Contribution to the Theoretical and Practical Analysis of Its Behavior."

I note that it is said that the fact that the telephone receiver held either in contact with or close to the face of the transmitter may cause the production of a hum or singing tone appears to have been observed by Mr. A. S. Hibbard, and first published in a paper read in 1901 by Mr. F. Gill before a meeting of the Dublin section of the (British) Institution of Electrical Engineers.

It is, however, true that the same thing, or, at any rate, something which is very nearly the same thing, was noticed by Professor D. E. Hughes in his original microphone experiments of 1878. In a paper read by Professor Hughes before the Physical Society, London, June 8, 1878, and subsequently published in the July, 1878, number of the *Philosophical Magazine*, pp. 44-50, the author remarks: "I have recently made the following curious observation: A microphone on a resonant board is placed in a battery circuit, together with two telephones. When one of these is placed on the resonant board, a continuous sound will emanate from the other. The sound is started by the vibration which is imparted to the board when the telephone is placed on it; this impulse, passing through the microphone, sets both telephone disks in motion, and the instrument on the board, reacting through the microphone, causes a continuous sound to be produced, which is permanent so long as the independent current of electricity is maintained through the microphone."

As before stated, this is either the same operation, or something so near it, that an experimenter having discovered one may without further discovery accomplish the other.

Boston, Mass. Thomas D. Lockwood.

Association of Industrial Plant Electrical Engineers.

To the Editors of Electrical World:

Sirs:—So far as I have been able to learn, there is no association or society composed of those having charge of the electrical and mechanical equipment of industrial plants, excepting, of course, the Association of Electrical Engineers of Steel Plants.

The requirements and conditions to be met in the operation of industrial plants are entirely different from any other class of equipment and there certainly should be opportunity for inestimable benefit to the manufacturer, the commercial concerns, but especially to the electrical engineers and those having charge of the operating end, from an organization of this type. Of course, there would be the necessity of preventing a society of this nature from becoming used as an advertising medium by electrical jobbing concerns, and the membership would necessarily be restricted to the chief engineers, electrical engineers and others connected with industrial plants only. It occurs that this thought may also have come to others and I should be glad to have an expression of opinion from anyone interested in the matter of such a society or association.

Providence, R. I. C. E. Fairbanks,
Chief Engineer, Gorham Manufacturing Company.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Improvement of Power Factor.—M. Walker.—A paper read before the Manchester section of the (Brit.) Inst. Elec. Eng. The author discusses the improvement of power factor by (1) using synchronous motors, (2) using capacity, and (3) improving the induction motor. In regard to the last-mentioned method he first describes Leblanc's system of special exciters

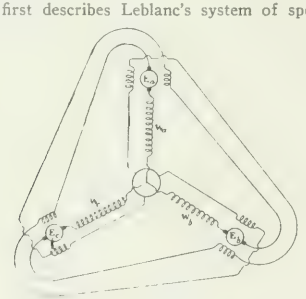


Fig. 1.—Exciters in circuit with three-phase rotors.

and Heyland's arrangement, and then describes a new type of machine, termed a "phase-advancer," which acts like the exciters proposed by Mr. Leblanc. The reason that the induction motor calls for so large a wattless current is that its magnetizing current is supplied at a high frequency. Where, however, the magnetizing current is supplied in the rotor at the low frequency of the rotor circuit, the value of the wattless volt-amperes required is reduced to 2 per cent or 3 per cent of that required at the frequency of supply. In 1895 M. Leblanc proposed to supply the magnetizing current to the rotors of induction motors and generators by means of special exciters, which consisted of commutating alternating-current generators whose magnets were excited by the rotor currents. If Leblanc's exciters be applied to a three-phase rotor, three exciters would be necessary, and these might be connected in circuit as illustrated in Fig. 1, E_a, E_b, E_c, being the armatures of the exciters—made like single-phase motors and provided with compensated windings—and W_a, W_b, W_c the phase windings of the rotor; or the arrangement might be with phase C reversed—the slip being increased—or with phase A excited from phase B reversed—the slip being decreased. The author's phase-advancer is similar in principle to the exciter proposed by Leblanc. Fig. 2 gives the diagrammatic representation of a "phase-advancer." When wound for three phases the field magnet has three poles—larger machines may have any multiple of three. The armature core resembles an ordinary direct-current armature core, and the coils are like the coils of an ordinary railway motor, except that they have in the case illustrated in Fig. 2 a span of 120 deg. instead of 90 deg. One end of each coil, which will be called the inner end, is connected to a star-point. Each outer end is connected to one bar of the commutator. The armature in this way resembles in principle Elihu Thomson's arc-lighting generator, except that in this case there are a greater number of coils. On the commutator are three brushes, which bear upon the segments, connected to coils which are for the time being passing under a pole. Each pole is provided with a compensating winding placed in slots in the pole-

face, the winding being arranged so that the ampere-turns per inch along the pole-face are equal, or slightly greater than the ampere-turns per inch of periphery of the armature. Following the armature circuits, commencing from the star-point along coil 1, 2, it passes under the pole pC, then under pole pB, and it makes as many turns in front of the poles pC and pB as are necessary to generate the required voltage. It then passes to

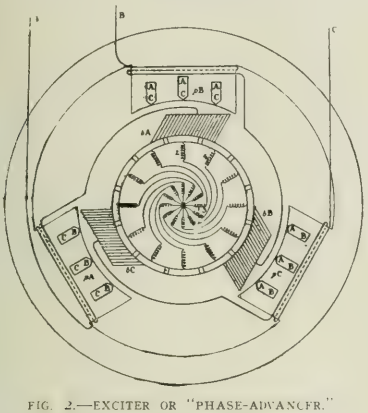


FIG. 2.—EXCITER OR "PHASE-ADVANCER."

brush bA and on to the series exciting coil on pole pA, then it passes to the compensating windings marked A in the slots in poles pC and pB, and from these to phase A of the rotor of the induction motor. The currents in the other phases pass through similar circuits, and it will be seen that the e.m.f. generated in any phase is due to a field which is produced by the current in the other two phases. By the use of an exciter in the rotor circuit it will be possible to increase greatly the output of a motor frame. But a much greater gain in output can be secured by deepening the slots of both the stator and the rotor and putting in larger conductors. At present the depth of the slots is limited because it is desirable to keep down the leakage flux and the length of saturated teeth. The limitation of an induction motor frame will then be by considerations similar to those which now obtain with synchronous motors. There is yet another use for an exciter in circuit with the rotor of an induction motor. If the e.m.f. of the exciter has a considerable component opposed to the e.m.f. generated in the rotor winding the slip is increased. The exciter, therefore, can be utilized to change the speed of an induction motor. The exciter, when its e.m.f. is opposed to the rotor e.m.f., runs as a motor and is capable of putting back into the system the power represented by the slip of the induction motor, which would otherwise be wasted in resistance. Fig. 3 shows diagrammatically a method of exciting a two-phase rotor of an induction turbo-generator by means of a "phase-advancer." The rotor and "phase-advancer" are mounted on the same shaft. *wA*

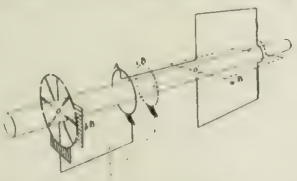


FIG. 3.—PHASE-ADVANCER DIRECT CONNECTED TO TWO PHASE ROTOR.

and *wB* show diagrammatically the two phase winding of the rotor. One end of each phase is connected to the shaft at O'. The other ends are connected to the slip rings sA and sB, and from these rings the current is collected by means of brushes and carried to the brushes of the "phase-advancer" bA and bB, which in this case would be provided with four poles, not shown in the diagram. The inner ends of all the armature coils are connected to the shaft at the point O, and the operation of the exciter is exactly the same as in the case described in Fig. 2, except that two phases are employed instead of three. It will, however, be seen that the brush capacity of the whole set is exactly the same as might be employed with ordinary direct-current excitation—in fact, no one looking at such a set would be able to say whether the excitation was by direct or by alternating current. If at any time it became necessary to run the machine as a synchronous set, all that would be necessary would be to excite the field magnets by means of coils connected as a shunt.—Slightly abstracted in Lond. *Elec.*, Jan. 22; the complete paper in Lond. *Elec. Engineer*, Jan. 22.—In the discussion which followed the reading of the paper, Mr. F. C. Raphael said that he feared there would be some difficulty in inducing consumers to adopt any device which increased the cost of their motors, and which also interfered with the extreme simplicity of the induction motor by adding a commutator arrangement. The consumer at present paid by the energy he consumed, consequently he did not concern himself with the power factor of the motors. He thought, therefore, that attention should be directed to improving the power factor at the station end. Several speakers remarked that they could not see any difficulty in charging an increased rate for consumers using motors with low power factors.—Lond. *Elec. Eng'ing*, Jan. 21.

Short-Circuits on Alternators.—E. J. BERG.—Short-circuits on alternators are serious only at low frequencies and especially with low-frequency turbo-generators. The author analyzes the electrical interactions in an alternator under short-circuit. To overcome the effects of the enormous stresses which occur during the first few fractions of a second of a short-circuit, it would seem theoretically necessary only to build the generator with high resistance or self-induction. But this is practically very difficult without increasing at the same time the armature reaction. A practicable remedy is the use of external reactance in connection with turbo-generators as built at present. The reactors are placed in the generator leads as near to the machine as possible so as to eliminate the likelihood of a short-circuit taking place between them and the generator, or they are placed at the junction of the three windings in star-connected generators. In the first case, in addition to serving as a protection against mechanical strains, they save the generator winding, to a certain extent, from high-frequency surges from the outside; they also limit the current which would flow from other machines on the same busbar in case of a short-circuit in the generator winding. In the second case they do not offer these last two advantages, but they protect the generator from its own current if the short-circuit takes place in the winding proper.—*Gen. Elec. Rev.*, February.

Transformers for Electrochemical Work.—M. H. YAZDJIAM.—An illustrated description of large transformers built by the Oerlikon Company for electrochemical purposes. The type described is a single-phase core transformer of 4450-kva rating, for a frequency of 25 cycles. The e.m.f. is reduced from 15,000 to between 115 volts and 155 volts, while the current is raised from 302 amp to 28,200 amp. The construction of the transformers is described and their characteristic curves are given, showing losses, voltage drop, short-circuit curve and efficiency.—*Elek. u. Masch.* (Vienna), Jan. 17; *Elek. Zeit.*, Jan. 21; the first part of the article also in *La Lumière Elec.*, Jan. 16.

Predetermination of Electric Machines.—R. V. PICOU.—The conclusion of his paper on the mathematical calculation of dynamo-electric machinery. The author sums up the fundamental formulas for use in such calculations and applies them to the design of a 1300-kva, three-phase turbo-alternator, for 150 amp and 1500 volts and a frequency of 50 cycles.—*La Lumière Elec.*, Jan. 16.

Brushes.—C. RICHTER.—A paper discussing the problems of theoretical mechanics involved in the sliding of brushes on the commutator and the conditions of equilibrium.—*Elek. u. Masch.*, Jan. 10 and 17.

Heating of Electrical Machinery.—G. BENISCHKE.—A mathematical article discussing the heating and cooling of electrical

machines on the basis of an exponential formula. On the basis of such considerations it is possible to determine the final temperature by making tests which are not extended until the final temperature is reached.—*Elek. u. Masch.* (Vienna), Jan. 10.

Lamps and Lighting.

Two Hundred and Twenty Volt Metallic-Filament Lamps.—H. Lux.—An account of use of commercial 220-volt metallic-filament lamps. The results are given in the following table:

	Volts.	Amp.	Watt	Hefner candles	Watt per hefner candle.
Siemens & Halske, tantalum	220	0.370	80.80	42.4	1.905
	220	0.360	79.20	45.0	1.760
Hollefreund & Co., zirkonium	220	0.270	59.40	39.0	1.525
	220	0.268	58.96	38.1	1.545
Allg. Elektr.-Ges.	220	0.280	53.90	39.0	1.410
	220	0.250	55.00	36.7	1.500
Bergmann	220	0.310	68.20	48.5	1.400
	220	0.300	66.00	48.5	1.360
Pintsch "Sirius-Colloidal"	220	0.246	54.12	42.5	1.270
	220	0.252	55.44	44.0	1.258
Felten Guilleaume Lahmeyer	220	0.265	58.30	35.5	1.640
	220	0.262	57.64	35.4	1.630
German Welsbach Co., osram	220	0.263	57.86	44.5	1.299
	220	0.262	57.75	44.5	1.296
	220	0.260	57.09	42.2	1.355
	220	0.263	57.97	45.4	1.286
"Sun lamp"	220	0.250	55.00	62.5	0.880
	220	0.345	75.90	68.2	1.110
	220	0.335	73.70	67.0	1.100

The osram lamps tested were from a former period of manufacture, so that the newer 220-volt lamps of this type would probably give better results. In most of the lamps a longer and thinner filament is used than in the corresponding 110-volt lamps. An exception is the Siemens & Halske tantalum lamp in which simply two 110-volt filaments are connected in series in one globe, so that this lamp has really two centers of light. With the exception of the last mentioned "sun lamp," all of the other lamps in the table give a more yellow light than the corresponding 110-volt lamps. The lamps are evidently used at a higher specific consumption than the corresponding 110-volt lamps.—*Zeit. f. Beleucht.*, Jan. 10.

Street Lighting from Interurban Railway Circuits.—G. N. Chamberlin.—The high-voltage transmission lines, made possible by the use of alternating current for traction, invariably render available a large surplus of railway-feeder material, a relatively large size of wire being necessary for mechanical strength. With this high voltage and ample material the variation is well within the allowable limits of both series and multiple transformation for lighting circuits. However, with the specially low frequencies used for alternating-current traction, the use of arc lamps connected directly to the railway circuit is questionable. The author describes the advantages of the series mercury rectifier with the direct-current luminous magnetite arc lamp, and describes the features of such a system.—*Gen. Elec. Rev.*, February.

Electric Lighting of Railway Cars.—E. Dick.—For train lighting the author considers the most suitable equipment to be the provision of each car with dynamo and battery so that all cars are independent of one another. He shows that the total weight of the equipment and the efficiency of the installation are very important factors which determine the economy. A minimum weight and maximum efficiency, together with greatest security of operation, are obtained with metallic-filament lamps if a single battery is used on the car and the generator is regulated for constant voltage and is self-excited.—*Elek. Zeit.*, Jan. 21.

Uniform Illumination.—E. W. Weinbeer.—An illustrated article on the construction of a reflector to give a uniform floor illumination in a room. The formulas are given for calculating the required form of the reflector which is used with incandescent lamps. A second article deals with similar arrangements to produce a uniform illumination within a room—that is, uniform illumination of floor, walls and ceiling.—*Zeit. f. Beleucht.*, Jan. 10 and 20.

Arc Lamps.—C. Heim.—An article on the regulation of arc lamps with inclined electrodes, dealing especially with the extent to which the operation of such lamps is influenced and improved by the use of a blowing magnet.—*Elek. Zeit.*, Jan. 21.

Goniometer Lamp.—F. E. Wright.—The goniometric measurement of minute crystal faces requires a source of illumination of such intensity that the author has formerly employed an electric arc lamp for the purpose. The Nernst lamp would be a very good source of light for this purpose if it were not for the unreliability of the filament. A new acetylene lamp has also been constructed; this is illustrated and described.—*Am. Jour. of Science*, February.

Generation, Transmission and Distribution.

Electric Power Supply.—G. L. Addenbrooke.—A lecture before the Society of Arts in London. The author estimates that about ¼ electric hp is used per head of population in England for all purposes. There is probably about 4,000,000 hp of engines in England which could be economically replaced by electric motors receiving energy from properly grouped stations. To prove that the larger stations have many advantages with respect to capital expenditure he gives the following table:

Available output of station, kw	Cost of power house per kw available	Allowance for distribution system per kw	Initial expenses, including working capital	Total cost per kw available	Capital cost of undertaking
2,500	$120	$100	$60	$280	$700,000
5,000	100	80	50	230	1,150,000
10,000	85	70	40	195	1,950,000
20,000	75	60	30	165	3,300,000
40,000	70	50	25	145	5,800,000

The figures in this table are stated to have been taken from actual working practice.—Lond. *Electrician*, Jan. 22.

Waste.—A. B. Gridley.—A paper read before the Cleveland and Durham Engineering Society on the application of electricity for the reduction of waste. The author discusses the advantages of buying electricity from a large plant. Electricity when purchased from an outside source at a reasonable price saves (1) waste of capital expenditure, (2) waste of labor, (3) waste of coal, oil, water and stores, (4) waste of time, (5) waste of space, (6) waste of energy in shafting and belting, (7) waste of taxes and insurance, (8) waste of "waste," and increases the output, the facilities for developing business and the industries in the neighborhood. Under waste of "waste" the author means the non-utilization of exhaust steam, waste heat, or combustible gas. The author finally discusses what is a "reasonable price." In the production of electricity for industrial purposes "the cost per unit by itself conveys nothing of any material importance, and it would be a great step gained if this fact were grasped and admitted. The price per unit conveys nothing unless accompanied by a definite statement as to load factor, and supplemented by details, such as total annual consumption, etc. It is, indeed, misleading." There are consumers deriving their supply at 1.1 cents per kw-hour who bring more profit to the producer than others paying 2.5 cents per kw-hour. It is only fair, therefore, for the purchaser to debit himself with, if he generates, or to pay, if he purchases, a definite lump sum to meet capital charges, entirely apart from the amount of energy consumed. The load factor has a very important effect upon the average price per kw-hour obtained. If a flat rate of, say, 1.5 cents per kw-hour were charged, the supplier would lose heavily in the case of a 25 per cent load-factor consumer, and the 75 per cent load-factor consumer would pay an extravagant price.—Lond. *Electrician*, Jan. 22.

Electric Motors in Paper Mill.—J. Liston.—An illustrated description of the equipment of the United Boxboard & Paper Company, in Lockport, N. Y. The sulphite and paper mills are electrically operated throughout by means of induction motors. The change from mechanical to electrical drive was made a year ago. The mechanical drive required 2250 hp and 528 hp was consumed in friction losses on shafting. At present, with a total equipment of 1700 hp in motors, the production is greater than it was with the old steam plant of 2250 hp. In addition to this, the amount of belting required has been reduced 50

per cent, in spite of the fact that most of the motors are arranged for belt operation. The motor-drive of different kinds of machines is described.—*Gen. Elec. Rev.*, February.

Coke-Oven Gas Plant.—A fully illustrated description of the Bargoed colliery installation of the Powell Duffryn Steam Coal Company. There are two coke-oven gas-driven gas engines, one of 1200 hp and the other of 2400, directly coupled to two alternators which supply the energy for the motors in the colliery.—Lond. *Elec. Rev.*, Jan. 22.

Traction.

Electric Traction on Railways.—H. E. O'BRIEN.—A paper read before the Liverpool Engineering Society on the possibilities of electric traction. The author first discusses main-line electrification, and shows that the locomotive cost per train mile for main-line service is 16 cents for steam and 16.6 cents for electric traction; the cost of fuel per mile being 4.5 cents in the former case and 9 cents in the latter. He sums up against electric traction on main lines. As regards urban and interurban service, the advantages of electric traction are more demonstrable, provided a largely increased traffic can be predicted, consequent of an improved service. The various systems of electrification are also discussed by the author.—Lond. *Electrician*, Jan. 22.

Gasoline-Electric Omnibuses.—At the (British) Society of Road Traction Engineers a discussion took place upon the relative advantages of gasoline-electric and gear transmission for omnibuses. W. A. Stevens gave figures of running costs, etc., for gasoline-electric omnibuses now being run in London, and compared these with the average of the remaining vehicles owned by the same firm, all of which are gear-driven. The total cost per mile for the gasoline-electric omnibus, including depreciation on the higher capital cost during the past year, was 17.04 cents, while the cost of the gear vehicles averaged 20.212 cents per mile. Mr. Stevens further stated that the gasoline-electric vehicle had run 28,000 miles without any trouble whatever. A. W. Windsor spoke in favor of other forms of transmission, and doubted whether the extra capital cost of the petrol-electric was justified. Col. Crompton thought Mr. Stevens had proved his case. At the same time, if the "Electrobus" had not come to stay, it would be a hard fight between steam and gasoline-electric.—Lond. *Elec. Eng'ing*, Jan. 21.

Installations, Systems and Appliances.

Brussels.—A. OSCHINSKY.—A continuation of his long illustrated article on the new electricity works of the city of Brussels. The author describes the cable network transmitting three-phase energy at 5000 volts from the generating station to the substations. The latter contain motor-generators, which provide direct current at 220 volts, supplied to a 2 × 110-volt, three-wire network.—*Elek. Zeit.*, Jan. 21.

Regulations.—Mr. James Swinburne's report on the proposed (British) Home Office regulations for the use of electricity in factories.—Lond. *Elec. Eng'ing*, Jan. 21; Lond. *Electrician, Elec. Review, Elec. Engineer*, Jan. 22.

Wires, Wiring and Conduits.

Cable Conduits.—H. BRICK.—The author recommends the systematic ventilating of conduits for telegraph, telephone and energy transmission cables. For these purposes he proposes the use of electrically driven ventilators.—*Elek. Zeit.*, Jan. 21.

Electrochemistry and Batteries.

Water Purification.—J. DON.—The first part of a fully illustrated paper read before the (British) Institute of Mechanical Engineers on the filtration and purification of water for public supply. Different kinds of filters are described and illustrated. Reference is also made to the use of ozone. The article is to be continued.—Lond. *Eng'ing*, Jan. 22.

Induction Furnace.—An illustrated description of some recent designs of induction furnaces, and also of the modified type of Roechling and Rodenhauser, in which the induction principle is combined with the use of pole-plates.—Lond. *Eng'ing*, Jan. 22.

Units, Measurements and Instruments.

Testing Outfits.—E. P. EDWARDS.—An illustrated description of testing outfits for college laboratories, especially of machines which embody in one piece of apparatus the salient characteristics of several commercial machines, together with the switchboard for controlling the machines.—*Gen. Elec. Rev.*, February.

Telegraphy, Telephony and Signals.

Transmission of Photographs.—L. DUBOIS.—An illustrated description of the apparatus of Korn for electric transmission of photographs. The system is commercially used between Paris and Berlin and between Paris and London. In general, the apparatus is worked over a double telephone line without using an earth return. Each complete apparatus of a station consists of a transmitter and a receiver, which are mounted side by side (Fig. 4). Both the transmitter and the receiver have a long box through which the light passes from the lamps *LL* at one end. The beam of light falls upon the rotating cylinders, which

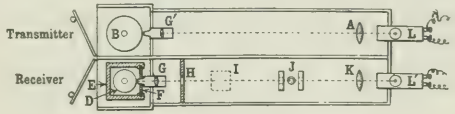


FIG. 4.—TRANSMITTER AND RECEIVER.

are mounted in a separate chamber at the other end. The principal details of the transmitter are represented in Fig. 5, which gives a vertical section of the apparatus. At the right-hand side is a Nernst lamp *L*, which is mounted within a sliding tube so that its distance can be readily adjusted. In front of it is placed the lens *A*, which serves to direct the beam of light toward the left. The beam is received in the sliding tube *G'*, which contains a lens and also a diaphragm in the smaller portion for concentrating the light and bringing it to a point upon the cylinder. The photograph, in the shape of a positive film, is placed around the glass cylinder *T*, which is mounted upon the rotating shaft *V* by means of the disk *U*, so that the cylinder can be readily removed from the shaft. The beam of light passes through the photographic film and is reflected upward within the cylinder by the totally reflecting prism *p*, so that the light is made to fall upon the selenium cell *S*, which is placed in the upper part of the chamber where it can be removed from the top. The glass cylinder is made to take a rotary movement and at the same time an upward movement by means of a revolving shaft combined with a screw, after the manner of a phonograph cylinder, so that all parts of the image on the film are made to come opposite the beam of light. The essential parts of the receiver are seen in Fig. 6, showing at the right-hand end the same arrangement of Nernst lamp, sliding tube and lens which are in the transmitter. The beam of light passes

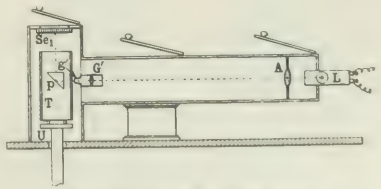


FIG. 5.—DETAILS OF TRANSMITTER.

toward the left, where it traverses the galvanometer shutter *J*. It consists of an electromagnet *d* having the pole-pieces *ee*, which project upward into the body of the instrument. These pole-pieces are perforated so as to allow the beam of light to pass through them. Between the poles is mounted a removable piece containing the moving part of the galvanometer. As seen in detail on the right, this consists of the double wire *a*—a very fine platinum wire—in tension, carrying a very small square of aluminum foil *b*. The portion composed of the wire and foil is extremely light. When current exists in the wire, the electromagnet being excited by a separate battery, the moving part is deflected to one side, the deflection depending on the current in the line. When no current exists, the aluminum square cuts off

the light beam almost entirely—that is, it throws a large shadow upon the screen *H* and lens *G* so that no light can reach the cylinder. When current exists, the shadow moves to one side and the beam can penetrate into the cylinder. The latter is shown at *D*; It is mounted upon a revolving shaft in such a way that all parts of the surface are brought successively under the beam of light from *g*. Thus it is seen that the variations of the image on the transmitter cylinder *T* will cause variable currents in the selenium cell *S*. These currents are received over

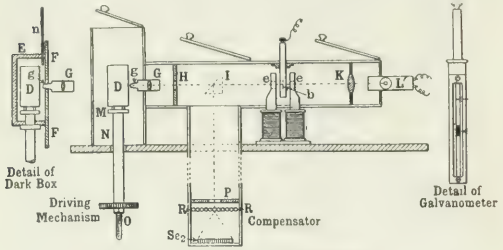


FIG. 6.—DETAILS OF RECEIVER.

the line by the galvanometer *J*. The shutter controls the amount of light according to the value of the current, so that the receiver cylinder *D* has an amount of light falling upon it at each instant corresponding with the thickness of the original film. In this way the photographic film placed upon *D* will receive the corresponding series of impressions, so as to reproduce the original image. In practice, the receiver cylinder is smaller than the one used for the transmitter, but both cylinders are rotated at the same rate by synchronous motors. A reduced image is, therefore, formed upon *D*. The compensating action for overcoming the inertia of the selenium is secured by the use of a second selenium cell connected with the cell of the transmitter so as to give a combined action of the two cells. The light is directed upon the compensating cell at practically the same time as upon the cell *S* by means of the galvanometer *d*. It is to be noted that the complete apparatus contains a transmitter and a receiver mounted side by side. In station *I* the transmitter is operated, and hence the receiver is out of use. This allows its galvanometer to be used for operating the compensator. Instead of illuminating both cells directly at the same time, as might be done, it is preferred to light the second cell by means of the galvanometer. It is accordingly placed in the vertical chamber of the receiver at station *I*, into the path of the beam, the light is reflected down upon the selenium cell. When the first cell Se_1 is illuminated, a current is produced in the neighboring galvanometer *J*, and a corresponding illumination is given to Se_2. Cell Se_1 and cell Se_2 are connected in opposition after the manner of a Wheatstone bridge, and upon the line, so that the latter receives the differential current of the two cells. This current is found to respond much better to the variations of light than that from a single cell, owing to the fact that the two cells are different in character. The light is diffused upon the compensating cell Se_2 by means of the set of glass rods *RR*. The receiver cylinder is enclosed in a dark box *E*, which can be closed by a slide *n*. This box slides upon the part *F* permanently fixed to the lens tube *G*, so that the box and cylinder can rise along with the rotating shaft, while the lens, tube and slide *F* remain fixed. When the operation is complete, the slide *n* is closed, and the box is removed from the apparatus for developing the film.—Lond. *Electrician*, Jan. 22.

NEW APPARATUS AND APPLIANCES

Non-Fragile Tungsten Lamps.

The accompanying illustrations show, respectively, a 110-volt and a 220-volt "Gral" tungsten lamp, the complete output of which is controlled by the Armorduct Manufacturing Company, Limited, of London, England. The lamps are shown one-half



"GRAL" TUNGSTEN LAMPS.

actual size, and diminution in size as compared with lamps of equal candle-power is one of the features to which the manufacturer directs attention. The method of supporting the filament has, it is claimed, much to do with decreased breakage. Platinum hooks possessing great flexibility are used for this purpose. Where rigid hooks are employed the maker claims that the fracture of the filament generally occurs on the actual support because the filament is not given the necessary freedom of movement. The lamp is proportioned to have a specific consumption of 1.1 watt per hefner candle-power when delivered; but after some 50 hours' burning the specific consumption is said to be reduced to 1 watt. A highly satisfactory life is asserted to be the result. The lamps burn in any position without appreciable sag, the manufacturer claiming that the flexible platinum hook permits of properly proportioning the filament as regards length to guard against any excess in this respect.

Regulator for Maintaining Constant Load Upon a Generating Station.

The desirability of maintaining constant load upon a generating station is generally conceded by engineers. The use of a storage battery in conjunction with an automatic regulating system forms an excellent solution of the problem. Evidently the success of such an arrangement depends largely upon the regulator. The regulator must be sensitive, yet stable in its action. It must be reliable and simple to take care of, and must be capable of permitting, quickly and easily, a wide range of adjustment of the generator load to take care of average load conditions. In other words, it is to the battery system what the governor is to a steam engine. It is claimed that all of these requirements have been met by the type of relay regulator shown in the accompanying illustration.

Fig. 1 shows the log of a battery and regulator test, with a constant rotary load and a variable external load, made at the plant of the Southern Colorado Power & Railway Company. The load is due to a railway system operated by the company

in the city of Trinidad, Col. The system comprises street railways in the city of Trinidad and an interurban railway running through mining towns for a distance of 13.5 miles.

The company operates from four to eight cars, during light traffic three city cars and one interurban, and during heavy traffic five city cars and three interurban cars. During certain parts of the day it also uses one of the interurban cars as a locomotive to haul standard 50-ton coal cars.

It will be noted that the average load runs about 100 kw, while the maximum reaches upward of 400 kw.

The generating plant consisted of one 200-kw, 550-volt, direct-current generator directly connected to a steam engine, three engine-driven, three-phase alternators rated at 105, 165 and 600 kw, respectively, and a 250-kw, two-phase rotary converter operating from a three-phase circuit.

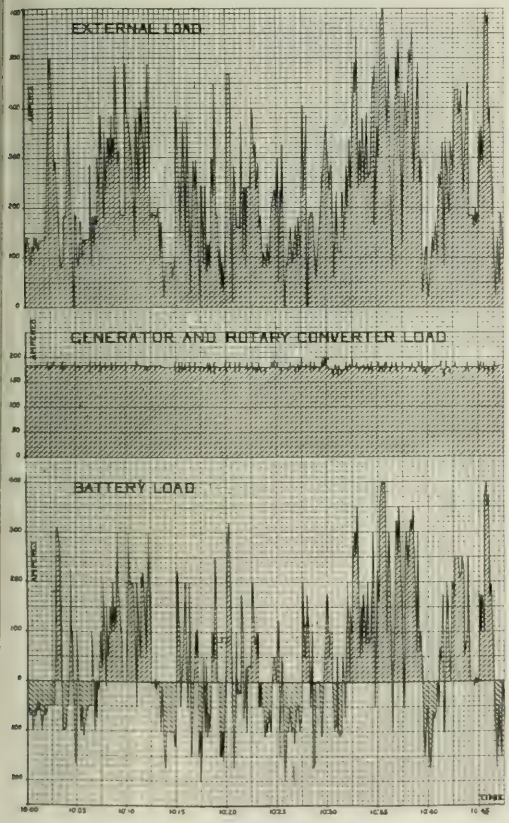


FIG. 1.—CURVES SHOWING THE EFFICIENCY OF THE LOAD REGULATOR.

Before the installation of the storage battery and regulator it was necessary for a great part of the time to keep both the 200-kw steam-driven unit and the rotary converter in operation. Since that time either one of the units is ample for the entire direct-current load.

Fig. 2 shows the switchboard with booster set at this installation, while Fig. 3 shows the regulator, which can also be seen in Fig. 2.

In this system of regulation the e.m.f. of the booster, or boosted rotary, as the case may be, is changed by changing the excitation of a single separately excited field winding. This field winding receives its energy from a small exciter which has, in addition to a self excited shunt winding, two equal and opposite pilot field windings. The current in these two windings is controlled by the making and breaking of the double relay contacts *E* in Fig. 3. These contacts are in turn controlled by the primary relay of the regulator, which consists of a series member *A* working in conjunction with the shunt member *B* to close or open the energizing circuit of the relay magnet *D*.

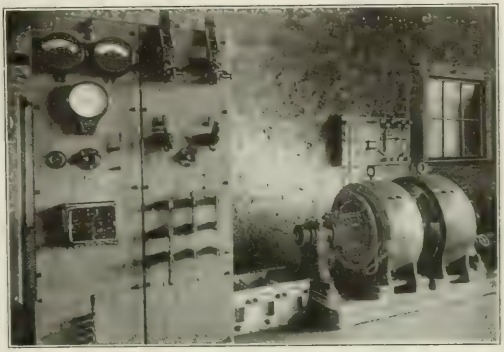


FIG. 2.—SWITCHBOARD AND BOOSTER SET FOR LOAD REGULATOR.

The series coil *A* works in a permanent magnetic field, and is balanced by an adjustable spring tension. The amount of current in the coil *A* is proportional to the current in a shunt—in the circuit to be controlled—to the ends of which the terminals of the coil are connected. This is equivalent to an ordinary ammeter movement, with the exception that the range of motion is exceedingly small.

The shunt coil *B* is exactly equivalent, excepting that its position varies according to the voltage of the booster exciter.

The primary relay contact *C* is established by the conjunction of the series and shunt-coil levers. This contact, therefore, intermittently energizes the electromagnet *D*, which operates the main relay contacts *E*. The lower contact *E* energizes one of the pilot fields, while the other contact *E* energizes the equal and opposite field. These pilot fields act in opposition so that with equal currents in the two coils there would be no voltage upon the exciter.

If one of them receives exciting current, it will tend to start up the exciter voltage in a given direction, but the shunt coil of the exciter will tend to carry the field to full saturation. This action will be checked by the shunt coil of the relay. It will thus be seen that, as the external load changes on the system, the contact is broken, the booster voltage is raised due to the exciter voltage rising, and the battery is caused to discharge.

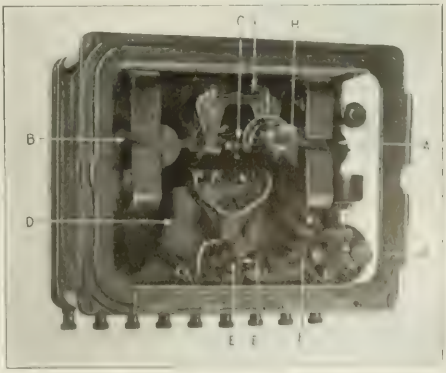


FIG. 3.—BATTERY LOAD REGULATOR.

This discharge, which will continue at an increasing rate until the operating equilibrium of the system is again restored, is entirely independent of the conditions of the battery charge, or discharge as long as there is enough booster pressure behind the

battery to give the required discharge to maintain the load constant. On the other hand, if the load decreases the opposite effect is secured, namely, the other pilot coil tends to cause the exciter to build up in the opposite direction; this action is further aided and carried to a maximum by the shunt coil, thereby causing the battery to charge.

The above-described regulator has been placed on the market by the Westinghouse Machine Company, Pittsburgh, Pa.

Inter-Communicating Telephones.

The wall and desk telephones illustrated herewith exemplify the possibility of designing types of instruments for inter-communicating systems having ultimate capacities of from 20 to 30 regular stations, respectively, and each with a trunk-line connection to a distant exchange. Installation of 10-station systems using telephones of correspondingly decreased proportions are more common than these, but systems employing telephones of these greater capacities have proved practicable for inter-communicating service in large office organizations, such as are found in banking and mercantile institutions.

Considering the operation of inter-connecting one station with any other, the important mechanical feature of these telephones is the "push-button" key provided with either 12, 22 or 32 key buttons for the three capacity instruments. The key operates when mounted in any position but, for the sake of assistance in describing its parts, consider it mounted at present in a vertical position, as shown in the illustrations. Extending outward right and left in pairs, from each row of key buttons, in a horizontal position, are the main contact springs terminating just beyond the key base in free view. Both main operating springs which engage a plunger bushing that comes down between them, and the inner pointed platinum contact springs, are mounted in sets on edge in milled hard-rubber strips paralleling the rows of key buttons and are fastened securely in this position to the metal key base-plate. The object of this construction is to provide positive action between the plunger and the contact springs and permit a direct single connection to be made between the cable conductor and the contact springs. The ends of the main contact springs extending beyond the key proper are formed in

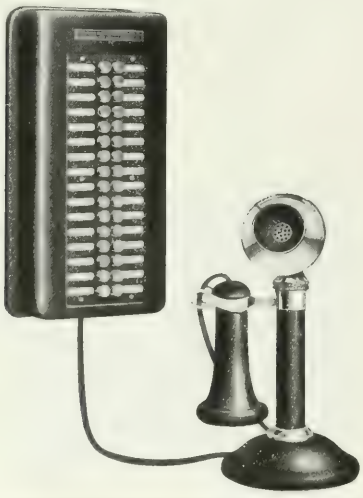


FIG. 1.—INTER-COMMUNICATING 30-STATION DESK TELEPHONE.

such a manner as to make a neat and strong screw terminal, which eliminates soldered connections and provides one contact point between the cable conductor and the key.

In the key box or wall telephone the switching device is mounted independently of all other parts in the backboard, which arrangement gives free access to a very simple design of key. There are no spiral springs or delicate parts required for operating the tumbler plate which shifts with the depressing of any key button, which is held until automatically restored upon depressing another button to call a different station. The ringing

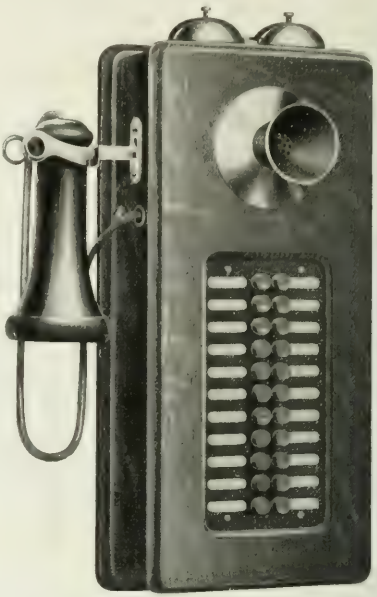


FIG. 2.—INTER-COMMUNICATING 20-STATION WALL TELEPHONE.

button, which works independently of the tumbler plate, is the last lower button of the left-hand row of keys.

Metallic circuits are employed for all of the various kinds of services for which these telephones are adapted. When the maximum distance between any two stations is 1300 ft. or less the ringing battery—of dry cells—should have a potential of about 12 volts and the talking battery about 9 volts. By operating the inter-communicating system on a slightly higher voltage employing small battery wires in the cabling, the expense for this part of the equipment is decreased and much better and more positive operation assured.

Inter-communicating telephones of the type here noted are made by the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., for common-battery systems consisting of from 2 up to 30 regular stations and one or more trunk-line connections. The same standard apparatus for the talking circuit is used in these sets as for local and long-distance service. A detachable switch-hook is furnished with the wall telephone.

Efficacy of Ventilating Ash Trays on Flaming-Arc Lamps.

In the issue of Jan. 2 there appeared a description of the Excello flaming-arc lamp fitted with an inner prismatic globe. The results of tests made by the Electric Testing Laboratories were also given in the article. Incidentally it might be mentioned that not a little of the good showing may be attributed to the use of the ventilating ash tray with which the lamp was fitted. In order that a comparison might be had between the ordinary flaming-arc lamp and one equipped with an inner globe, an ordinary Excello lamp and one fitted with the inner prismatic globe were used in the test. The lamps were fitted with the ventilating ash tray at the bottom of the clear outer globe used in both cases. The accompanying illustration shows a photograph of both lamps after the test and tells its own

story. That the type of ventilating tray employed was not of much use without the inner globe is shown by the deposit on the inside of the clear outer globe, the number shown being written with a finger on the clouded globe. In its report to the Excello Arc Lamp Company the testing company drew attention



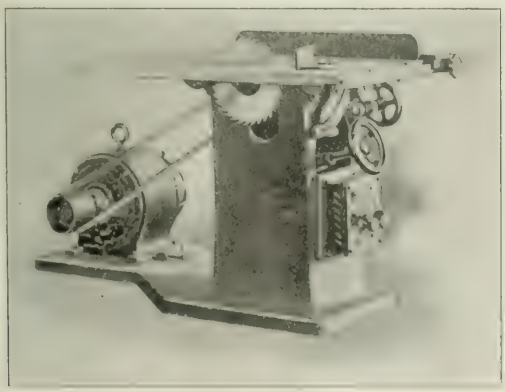
VENTILATED LAMPS WITH AND WITHOUT INNER GLOBE.

to this deposit upon the inner surface of the globe after five hours' burning, adding that the prismatic inner globe showed very little evidence of deposit.

Motor-Driven Table Saw.

A tool for woodworking establishments which is to be especially interesting on account of its convenience, efficiency and neatness, is a motor-driven table saw manufactured by the Crescent Machine Company, Leetonia, Ohio, illustrated herewith.

The saw table proper and the saw itself are supported upon a pedestal which also furnishes a frame, upon which the mechanism for adjusting the saw and table and the starting rheostat are mounted. This adjusting mechanism consists of means for tilting the table and raising or lowering the saw. The former is accomplished by means of a hand-wheel whose shaft bears a worm, with a graduated brass scale and pointer to show exactly the amount the table is tilted up to 45 deg. By means of the other hand-wheel the saw is adjustable in a vertical direction, making the machine adapted for cutting boards of different thicknesses up to 4 in. The saw itself may be as large as 14 in., but no larger.



MOTOR DRIVEN TABLE SAW.

The motor equipment consists of a 3¾-hp totally enclosed Westinghouse motor and a starting rheostat. It is a shunt-wound, direct-current motor, running at a constant speed of 1800 r.p.m. on a line voltage of 220. The rheostat is equipped with an automatic low-voltage release, and is used for starting only. The motor is mounted on the extended base of the saw table proper. It is connected to the saw mandrel by a belt which passes through an opening at the back of the pedestal.

A reference to the illustration shows the extreme ease of operation brought about by the motor equipment. The five operating handles are all within a radius of about 1 ft. The table can be tilted, the saw raised or lowered, the ripping and cut-off fences adjusted and the saw started or stopped without the operator moving a step. The motor is behind the machine out of the way, and takes up no space that would otherwise be useful, being beneath the overhanging table. The machine can be located in any position desired, being independent of line shafts. A minimum amount of power is wasted, nothing being consumed by extra belts, countershafts, etc. It should be further noted that a saw of this kind only operates intermittently, and the absence of a main shaft and countershaft is thus particularly advantageous, since power is only used when work is actually being done. Altogether this constitutes a fitting example of the advantages of the motor drive and the absence of the disadvantages of the mechanical drive.

Use of Pure Soot in Carbon Manufacture.

By H. Caird.

In the manufacture of arc-lamp carbons it is of paramount importance that the raw materials used be pure, as the least amount of impurities causes spitting, unsteadiness and heavy ash deposit. As a result of the conditions imposed the very few varieties of materials which can be used are soot, retort carbon and the carbon residues from petroleum or tar.

Soot is the best but most expensive of the materials used. It is produced by imperfect combustion of tar, pitch, naphthaline, oils or residues and if prepared with care, takes, with regard to purity, the first place among the raw materials employed, requiring only to be passed through a screen to eliminate impurities.

Retort carbon is formed during the distillation of coal in the manufacture of illuminating gas. It is deposited on the wall of the retort in the form of large steel-gray pieces of great density containing many impurities which must be removed by wire brushes or other mechanical means before it is suitable for the manufacture of carbons. Petroleum coke is obtained as a residue in the distillation of mineral oils. Petroleum contains numerous volatile constituents which have to be driven off by heat before it can be used in the manufacture of carbons. Petroleum coke, like retort carbon, presents a great resistance to combustion.

The hardness of arc-lamp carbons depends largely upon the composition and the method of baking. It affords a good criterion with respect to the material of which the carbon is composed, but gives no indications as to the probable behavior or the rate of consumption when burning. Carbons made of soot are invariably harder than those made of petroleum coke. When passing upon the quality of carbons, it is well to remember that longitudinal fissures are in no way detrimental, but on the contrary indicate that the carbons have been thoroughly baked—a most desirable feature.

The consumption of carbons not only depends upon their composition, but also upon the conditions under which they burn. In carrying out consumption tests every precaution should be taken, as test results with carbons of the same make, burning in the same lamps and under identical conditions as to

current and voltage, may vary 10 per cent or more. The subject of ash deposit is of prime importance in that a heavy deposit of ash cuts off a large percentage of light. Tests indicate that carbons made of the best quality of soot leave about 2/10 per cent of ash, while carbons consisting of a mixture of soot with less combustible material leave from 0.5 per cent to 2.5 per cent of ash, depending on the proportion of soot.

The actual commercial efficiency of an arc lamp is judged by the amount of useful light given, and an important fact has been established, namely, that the light emitted by carbons made of soot is approximately 20 per cent greater than that emitted by carbons made from petroleum coke and retort carbons. The use of pure soot carbons is a step in the right direction and should be insisted upon, as manufacturers in their mad rush for new illuminants with high efficiencies have frequently overlooked the actual needs of users of enclosed arc lamps. The Central Electric Company, of Chicago, handles a line of imported pure soot carbons suitable for flaming-arc and other types of arc lamps.

Solenoid Starters for Alternating-Current Motors.

The accompanying illustrations show several applications of single-phase plunger magnets for operating switches of alternating-current motor starters. The single solenoid, shown in Fig. 1, serves for operating a double-pole switch which may be used in the two leads of a single-phase, self-starting motor or in two of the leads of a two-phase or a three-phase self-starting motor, such as small squirrel-cage induction motors. Fig. 2 shows two of the single-phase solenoids arranged for operating double-pole switches for use with rheostatic starters for polyphase induction motors of the squirrel-cage type. One of the switches closes the main circuit to the motor, two resistors being inserted in two of the leads. The second switch short-circuits the two resistors after the rotor has reached the proper speed. The

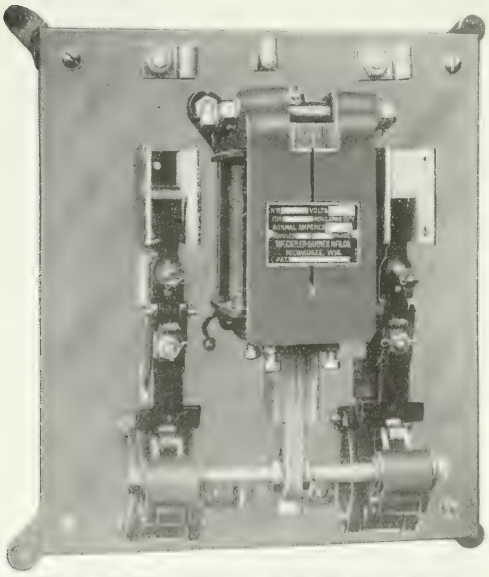


FIG. 1.—SOLENOID SWITCH FOR SELF-STARTING MOTORS.

acceleration of the motor is controlled by a series relay in the motor circuit, which will lift when the circuit is first closed and thus keep the starting resistance in circuit, but which will drop again after the motor has accelerated properly and will then permit the motor to be connected directly to the lines.

In Fig. 3 there is shown an assembly of four single-phase solenoids arranged for operating double-pole switches for starting slip-ring type induction motors for heavy service. The acceleration of the rotor is controlled by resistance in each of the three phases of the secondary circuit, which is cut out of circuit, step by step, by the two-pole solenoid switches under the

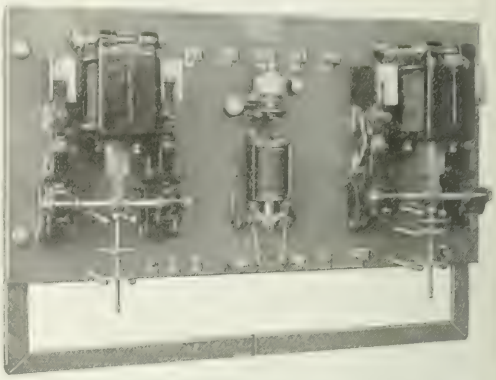


FIG. 2.—SELF-STARTER FOR USE WITH SQUIRREL CAGE MOTORS.

control of the secondary current relays. The starting switches are interconnected with each other and with the primary switch, so that they will close in succession to accelerate the rotor after the primary circuit has been closed. The rate of acceleration is controlled by three-phase current relays in the secondary circuit, each arranged so as to prevent the following step of the resistor from being cut out of circuit when it is lifted by the starting current, but which will drop again after the motor has accelerated properly, and will then permit the next step of the resistor to be cut out. The starting current is limited to a predetermined and adjustable value by the current relays, and the motor is accelerated in the shortest time consistent with this value of starting current.

The above-described motor-starting devices are made by the

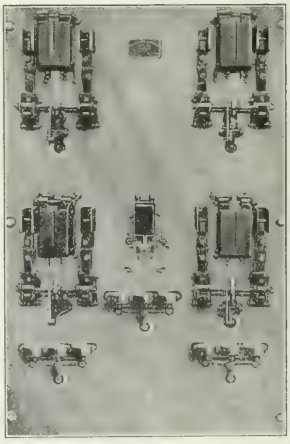


FIG. 3.—SELF-STARTER FOR SLIP-RING TYPE INDUCTION MOTORS.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., which has also developed starters involving similar single-phase solenoids for use with squirrel-cage induction motors employing auto-transformer starters and slip-ring induction motors for light service.

Carnegie Steel Company.

At the Duquesne plant of the Carnegie Steel Company a large ore-handling bridge has recently been installed by Heyl & Patterson, Inc., of Pittsburgh, Pa., which is the first bridge of its type built by this company, and possesses a number of interesting features. The bridge spans an ore yard of about 1800 ft. in length, serving six large blast furnaces. Adjacent to the furnaces are storage bins under which the lorry cars operate to



FIG. 1.—DUQUESNE ORE BRIDGE.

conduct the ore from the bins to the furnace skips. One supporting leg of the bridge rests on this bin structure, and the other is carried by a concrete wall 26 ft. high.

The bridge is of approximately 230-ft. span between trucks, and has a cantilever extension at either end of about 65 ft. The iron ore is brought within reach of the bridge by transfer cars, which operate between the car dumper 1000 ft. or more from the ore yard and run on tracks carried by the bin structure. These transfer cars discharge their load through an open track onto baffle plates, which form a temporary pile along the bin side of the storage yard. By means of the grab bucket the bridge gathers up the ore and places it in storage or removes it

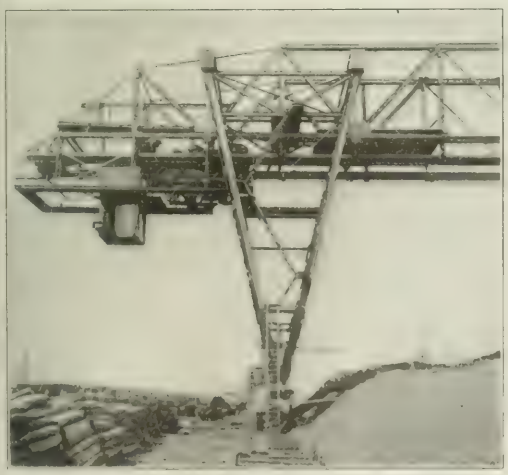


FIG. 2.—[illegible]

from the storage pile and delivers to [illegible] tion into various compartments of the bins, from which the supply for the blast furnaces is drawn as needed. At the end of the bridge farther from the furnace a V-shaped leg furnishes the support, while at the furnace end a single straight leg supports the bridge, as is shown in the accompanying illustration.

Throughout the design of this structure flexibility was sought; this provides for the inequalities in travel of the two ends of the bridge and absorbs endwise shocks and thrusts, due to the quick acceleration of the trolley, without straining the bridge.

The bridge is propelled along its track by two 52-hp Westinghouse crane motors, one on each truck, controlled from the cab. The two controllers for these motors are set adjacent and are so arranged that a single handle moves either controller separately or both simultaneously. This arrangement allows one end of the bridge to be moved without affecting the other, and on a long travel, should one end of the bridge structure get in advance of the other end, the higher-speed motor will be retarded until the slow one overtakes it.



FIG. 3.—YOUNGSTOWN ORE BRIDGE.

The bucket is a 10-ton Hulett patent excavating bucket, and is operated by two 225-hp Westinghouse crane-type motors of mill-type construction. The bucket with its load of ore weighs approximately 50,000 lb. The trolley-traversing mechanism is driven by a 225-hp Westinghouse mill-type motor, which motor is a duplicate of the two hoisting motors. The two buckets operating motors are geared together and operate by a single magnetic type controller, providing also for dynamic braking, thus removing a considerable item of wear in the shape of brake blocks from the trolley. The bridge is of very high capacity, having been constructed to handle 600 tons per hour. It has, however, within the last four months far outstripped this amount.

An equipment similar in all respects to this bridge has also been installed for the Youngstown Sheet & Tube Company, Youngstown, Ohio. This machine also is giving much satisfaction both as to speed and maintenance. The length of the Youngstown bridge is approximately 100 ft. greater than that of the Carnegie Steel Company, and the moving gear differs inasmuch as the bridge is propelled on its tracks by four motors instead of two, the trucks at all four corners being duplicate.

Cement for Pipe Joints.

As is well known, the red and white lead and the ordinary pipe-joint cements on the market are sold ready mixed with water or oil. In purchasing these, payment is made for the water and oil at the same rate as for the cement. To obviate this disadvantage the H. W. Johns-Manville Company, of New York, has placed on the market what is known as H-O pipe-joint cement. This cement is in powder form, and since it is claimed by the manufacturer that it does not dry out or deteriorate, can be kept in stock for a very long space of time. The [illegible] the water [illegible] after the joint is made up, so that a tight joint necessarily ensues. Water or linseed oil is employed for making the mixture, and it is claimed that the joint will not harden to the same degree as red or white lead, so that it can be easily broken without danger of damaging the [illegible]

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

It was almost possible to hear a note of discouragement in commercial circles during the past week. The lull in business was even more pronounced than it has been at any time since the first of the year. Up to this time manufacturers and wholesalers have been comforting themselves with the belief that the turn for the better was near at hand. The fact that things seem to be even duller than heretofore is causing much complaint and some anxiety. Orders from the retail trade are very light for this season of the year and are so evidently being made only for the purpose of filling in to supply absolute necessities that they do not portend any continuation of business. The trade in building materials, lumber, paints and other kindred wares has not begun although spring is near at hand. Dealers announce the belief that as soon as the weather settles orders for these will begin to come in, but there is a fear that their tardiness may mean a restriction of building during the coming season. All branches of the metal trade are exceptionally dull. The iron and steel markets are weak and the reductions, which have been hinted at for weeks, are now being openly admitted. Cuts have been made in almost all material of this character with the exception of steel rails, wire and tubes. Pig iron is dull and is being sold mostly in small lots. Prices are being shaded and there is no doubt that production at the present time is far in excess of the actual demand. In the electrical trade the large manufacturing plants report that orders and inquiries are abnormally low. The majority of the business that is being done is in small machinery and minor appliances. Very few large installations are being contemplated in the immediate future. There are many projects talked of, hydro-electric and steam, throughout the West and South, but all of them are being held in abeyance awaiting the revival of business. It is not a question of raising money, for that is easily done with the bond market in its present greedy condition. The point that causes the promoters of these enterprises to delay and to hesitate at the present time is the lack of market for their energy after it is generated. With the manufacturing business at its present low ebb there is little use for investing in new power producers. Railway earnings, which by many are considered a barometer of trade conditions, while in excess of the same period of a year ago, continue to be lighter than the managers anticipated. The movement of grain, coal and other bulk freight is smaller than had been expected. Collections continue to be slow but they are no worse than they have been for several months past. There were 1318 business failures reported by *Bradstreet's* for January, 1909, which is a reduction of 22 per cent from the January previous. Failures for the week ended Feb. 4 were 286, against 311 of the previous week, 272 in the like week of 1908, 198 in 1907, 204 in 1906 and 207 in 1905.

THE COPPER MARKET.

The copper market still continues to droop and the outlook is uncertain. All efforts to rally prices or to stimulate consumption are proving unavailing. There is little demand for copper in the present condition of trade, and although prices have been marked down during the past week this demand does not seem to improve. The fact that what is called the official prices, those posted at the Metal Exchange, have been above the actual selling prices for weeks is well known. During the past few days there has been a disposition to make the quotation coincide with the actual market. The London market continues to be very weak and the demand abroad shows no more improvement than the demand at home. It begins to be apparent that the large consumers in this country expect the market to go lower and a representative of one of the principal electrical concerns was quoted last week as saying that he believed that the statistical position of copper would soon warrant a 12-cent price. With this view prevailing among the consumers it is not at all surprising that purchases at present figures are made only to fill absolute requirements. The first report of the copper producers associations will soon be made public, and it is understood that it will show a surplus in this country of about 125,000,000 lb. In many quarters this figure will not be accepted as being anything like large enough. Taking the government statistics together with what is known of the consumption, it seems apparent that the surplus in this country is near 200,000,000 lb. The statistics given out by the International Copper Producers Association show that the surplus stocks in Europe are 46,567 tons. The figures given out by both of these organizations must be considered as exceedingly optimistic. In the mean time the production of copper is going on as actively as ever, the imports are still fairly large and the exports are much below the record made at this time last year. There is coming into sight every month in the American market more than 100,000,000 lb. of copper. The exports and the consumption together at the present rate are not more than 80,000,000 lb. This state of affairs has existed for a number of months, and the accumulation is obvious in spite of all denials. The exports from New York for the month of February up to and including Feb. 8 were 5,034 tons. Quotations on the Metal Exchange on that date were as follows:

Lake	13½ @ 13⅝
Electrolytic	13⅜ @ 13¼
Castings	13 @ 13½

London quotations were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	58 7 6	58 7 6
Standard copper, futures	59 7 6	59 7 6
Market	Firm.	Steady.
Sales of spot		400 tons
Sales of futures		1,000 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard		
Lake	14.55	13.75
Electrolytic	14.25	13.25
Casting	14.1.½	13.12½
London, spot	£64 2 6	£57 7 6
London, futures	64 17 6	58 7 6
London, best selected	67 15 0	61 15 0

MOTOR DRIVES FOR WOOD-WORKING FACTORY.—The John Hofman Company, a new wood-working factory located at Rochester, N. Y., has just closed a contract with the Crocker-Wheeler Company for an entire equipment of motors. The order includes 40 induction motors ranging from 1 to 30 hp, with a total capacity of about 200 hp. These motors will be used for individual drive, each machine being equipped with its own motor. The motors, with the exception of one, are of the squirrel-cage type. The generator for this plant and three lighting transformers are also included in the order.

NUMBER OF TELEPHONE STATIONS IN UNITED STATES.—According to the United States Government figures, prepared by the Department of Commerce and Labor, for 1907, there were in the country 3,132,063 Bell telephones and 2,986,515 Independent stations. These figures are probably the most accurate that can be obtained. There has been a vast increase in the number of stations since that time, but there is no method of ascertaining how great this is nor of determining the proportion between the Bell and Independent systems.

CROCKER-WHEELER CONVENTION.—The annual convention of the branch managers of the Crocker-Wheeler Company was held at Ampere, N. J., Feb. 8 and those who attended the meeting were entertained at dinner at the Machinery Club, New York, by the company on the same evening. The managers reported that they found business fairly brisk everywhere for small electrical machinery and that manufacturers everywhere were willing to consider the electrification of their plants or the installation of electric motors.

ASKS FOR GOVERNMENT PNEUMATIC TUBE.—Secretary Cortelyou, of the Treasury Department, has asked Congress for an appropriation of $175,000 for the purpose of building a pneumatic tube line from the custom house to the government bonded warehouse. It is stated that the old method of transacting business by messenger is too slow. There are 1,000,000 communications a year between the two offices.

JAPANESE PURCHASES.—The truth about the order for electrical goods placed by Japan which were exploited in daily newspapers as amounting to $7,000,000, in fact, amounted to something less than $700,000. The requirements of the Imperial government for the railroad electrification immediately at hand was divided into four contracts. The first of these consisted of equipment for a power house intended to furnish current to drive electric locomotives hauling trains outside the limits of the city. This contract was secured by the General Electric Company and consisted of three 1000-kw steam turbines, two 75-kw steam-driven exciters, switchboard and other power-house appliances. The second contract, secured by the Siemens-Halske Company, of Germany, consisted of 10 pairs of trucks, together with 10 sets of quadruple 50-hp direct-current railway motor equipments. The car bodies for these equipments were built in Japan and they are intended for suburban service in the neighborhood of Tokio. The third contract, secured by Takata & Company, of Tokio and this city, was for the equipment of a hydro-electric plant and consists of two 300-hp water turbines direct-connected to two 200-kw alternating-current generators, together with complete exciter equipments, transformer equipments, station switchboard, motor-generators, substation, etc. This plant is to furnish the power for the motor-cars used in the suburban service. The fourth contract, which is larger than any of the others, has not yet been let. It consists of 12 electric locomotives of about 50 tons each. The government is now receiving bids for these locomotives and also for rolling stock for the railroad. The line to be electrified serves not only Tokio, but seven other considerable manufacturing cities. It is understood that the government has decided to electrify all of the lines serving the more important cities of the country.

LARGEST CENTRAL STATION STORAGE BATTERY IN THE WORLD.—The New York Edison Company has recently closed a contract with the Electric Storage Battery Company for the installation of a battery at the Sixteenth Street substation which will, it is stated, be the largest single central station battery ever installed. It consists of 150 cells and has a capacity of 22,000 amp for one hour at about 120 volts. This battery is to be used for emergency service and is to be connected up to a set of the Electric Storage Battery Company's magnetically controlled, high speed, end cell switches. This makes the forty-first battery installed by the Electric Storage Battery Company for the New York Edison Company, the total capacity of all batteries now used by the latter approximating 193,000 amp at the one hour rate at about 120 volts. Two of the above batteries are used occasionally for exciter work, and added to these are two batteries which have ben installed for this exciter work exclusively, each having a capacity of 1500 amp at the one hour rate—making a total of 43 batteries in service.

ALUMINUM BUSINESS VERY DULL.—There has been practically no change in the price of aluminum for the past two or three months in spite of the fact that there is very little business being done by producers. Quoted prices are still about 24 cents a pound, but, as has been the case for months past, this figure can be shaded considerably. The best grades of aluminum can probably be bought at from 21 to 22 cents. Speaking of present conditions a representative of the Aluminum Company of America said: "We have never known, since the company was formed, business to be so stagnant as at the present time. In the line of wire and electrical aluminum we have not had a respectable inquiry for weeks. It is understood that the company has recently sold to the new municipal light and power plant of Winnipeg, Man., aluminum wire for its high-power transmission lines. The line will be operated at 66,000 volts for a distance of 75 miles. The towers will be 600 ft. apart and carry six wires. The total amount of wire sold was 450 miles. The size was 278,600 circ. mils.

THE HOSKINS MANUFACTURING COMPANY, Detroit, Mich., formerly of Chicago, Ill., moved into its new factory at the intersection of Lawton Avenue and Michigan Central Railroad, Detroit, on Feb. 1, where it will engage in the manufacture and sale of electric furnaces and pyrometers and other electric heating appliances. Later the company will develop a complete line of electric household utensils. The new factory occupies a ground floor space 85 ft. x 200 ft. in area and is equipped with the most modern machinery, which will facilitate the manufacture of electrical apparatus. Mr. H. Ralph Badger, who has been associated with the publicity department of The Arnold Company, Chicago, Ill., has been appointed manager of the publicity department for the company, and will assume his new duties on Feb. 15.

EXCELLO ARC LAMP COMPANY.—Mr. H. M. Hirschberg, of the Excello Arc Lamp Company, has just returned from a trip throughout the West where he found a great deal of interest in the flaming-arc industry. The Excello company has added to its staff Mr. R. F. Pierce, who was formerly manager of the Minerallac company, Chicago. He will be located with the company in New York as general sales manager and publicity agent. The Excello company has also secured the services of Mr. P. Caird, an arc lamp expert who was formerly connected with the Central Electric Company, Chicago. Mr. Caird will be located in the Chicago branch in the capacity of engineer and assistant manager, and will be prepared to furnish engineering data and specifications to any customer contemplating a lighting installation.

PUSHING FLAMING-ARC TRADE.—The Stave Electrical Company, 27 West Twenty-seventh Street, New York City, has recently established a number of branches throughout the West for pushing the sale of the flaming-arc lamp of which it is the importer. The Chicago branch is at Room 1101, Monadnock Building; Pittsburgh, 407 Fourth Avenue; Detroit, Washington and State Streets; Davenport, Ia., Room 506, Lane Building; Cleveland, the New England Building. Branches will also be established in Philadelphia and Indianapolis within the next two weeks. The company reports that the interest in flaming-arc lamps throughout the West is rapidly increasing and that many cities and towns have under consideration plans for using them for street lighting purposes.

BIDS ASKED FOR ELECTRICAL EQUIPMENT.—R. S. M. Mitch, engineer of the Central City Refrigerating Company, of Syracuse, N. Y., has sent out specifications asking for bids for four gas-producer units of 250-hp each, two 500-hp gas engines for direct connection to generators, two 300-kw direct-connected generators, seven freight and one passenger electric elevators, motor-driven ventilating apparatus and a large amount of cork insulation. The Secretary-Treasurer of Lethridge, Alberta, Can., has asked for bids in connection with a municipal plant for steam-turbine generator, steam-engine generator, motor generator and transformers and switchboards.

GERMAN AGREEMENT AS TO PRICES.—The statement having been made some time ago that the price agreement syndicate of German electrical manufacturers had been dissolved, an official denial is now forthcoming. The management of the syndicate announces that the agreement is still operative and that there is no change whatever in conditions. The constituents to the agreement are the Siemens-Schuckert Works, the Allgemeine Elektricitäts Gesellschaft and the Felten & Guilleaume-Lahmeyer Works Company.

AMERICAN BLOWER COMPANY.—The American Blower Company, of Detroit, and the Sorocco Engineering Company, of New York, have been consolidated under the name of the American Blower Company. The plants at Detroit and Troy will continue in full operation. The prinicpal offices are in Detroit and 141 Broadway, New York.

STEAM TURBINE FOR MINING IRON ORE.—The General Electric Company has sold to Witherbee & Sherman a 1500-kw steam turbine and generator unit to be installed at Mineville, N. Y. The current will furnish power for ore mining purposes.

BOSTON EDISON STEAM TURBINES.—An unfounded report has been printed that the Boston Edison Company has purchased two 18,000-kw Curtis steam turbines. Some of the turbine generators now installed are, however, to be rewound.

Financial Intelligence.

THE WEEK IN WALL STREET

The stock market in Wall Street during the past week has been unusually dull, but prices have been rather more firmly maintained than during the latter part of January. As a matter of fact the stock market may be said, at present, to be simply marking time. It is waiting for something to turn up. It is waiting for the tariff to be settled, for business to resume and for many of the large enterprises which are contemplated, and for which, in many instances, plans are already drawn to have the courage to begin work. In the mean time, while there is little trading, there seems to be, except a certain pressure to sell Reading, no organized movement to depress prices. The

market is so well controlled and is so entirely in the hands of big financial interests that no little fellow dares to go short. There has been but one organized bear movement within the past year—that of A. O. Brown & Company—and every one knows the distressing fate which befell that firm. While the majority of outsiders are afraid to buy, every one of them is afraid to sell. The fact that the market is well under control has been shown by a few occurrences of the past six weeks. There were rumors concerning Colorado & Southern and there was a buying movement started from somewhere, but the public never found out what was going on until the insiders had loaded up with all the stock they wanted at cheap prices. Then, the Burlington deal was announced and the reason for the upward movement was explained. Almost the same thing occurred with regard to Chesapeake & Ohio. The insiders got in at low prices while the public knew nothing of what was being done. Shortly after the first of the year Brooklyn Rapid Transit began to advance, and the Street at once was filled with rumors that a dividend would be paid. This was asserted and denied on every corner, and there was no definite knowledge that a dividend was contemplated until it was announced last week. Again the insiders had profited by the advance information. The same sort of thing may be going on to-day in regard to some of the low priced Western stocks, for there are many rumors concerning the Gould properties. The public will probably remain in ignorance of any contemplated deals until after the stocks have had all the advance which may legitimately accrue from such deals. The money market continues to be easy and rates are cheap, in spite of the fact that the deficit in the United States Treasury is now more than $80,000,000, and promises to be $125,000,000 by the end of the fiscal year. Already Secretary Cortelyou has called upon some 300 national banks to turn back into the treasury by Feb. 24 about $30,000,000. There have been times that such a condition and such a call would create a monetary stringency, but not now. The banks, not only here but all over the country, are full of cash and they promise to remain full of cash until the money is needed by a general revival of business. The rates for call money on Feb. 8 were 2½ @ 2¾ per cent, 90-day paper was quoted at 2¾ per cent; the quotations in the table are those of the close Feb. 8.

NEW YORK.

	Feb. 1.	Feb. 8.	Shares sold.		Feb. 1.	Feb. 8.	Shares sold.
All. C. L.	14½	14⅞*	100	Int. Met., pfd.	41	43	8,203
All. Chl., pfd.	46¾	47½	400	Mackay Cos.	72½	72	800
Amal. Cop.	73⅞	75¾	170,400	Mackay Cos., pfd.	70½*	71½*	875
Am. D. T.	35*	35*	——	Manhattan Elev.	146	149*	149
Am. Loc.	56	55⅞	5,770	Met. St. Ry.	31*	31*	——
Am. Loc., pfd.	112¾	111⅞	——	N.Y. & N.J. Tel.	114	114½	655
Am. Tel. & Cbl	75½	75½*	——	Steel, com.	52¼	52⅜	140,928
Am. T. & T.	125¼	128	6,700	Steel, pfd.	114⅜	113⅞	14,090
B. R. T.	69¼	71½	130,475	W. U. T.	68¼	67½	1,000
Gen. Elec.	152¼	155¼	772	West'h., com.	79½	80	2,000
Int.-Met., com.	14⅞	15⅜	5,440	West'h., pfd.	120*	118	——

PHILADELPHIA.

	Feb. 1.	Feb. 8.	Shares sold.		Feb. 1.	Feb. 8.	Shares sold.
Am. Rys.	45	45*	——	Phila. Elec.	11¾	12	——
Elec. Co. of A.	11	11¾	——	Phila. R. T.	27½	27⅜	——
Elec. Stor. Btv.	11	14*	——	Phila. Traction.	92*	93¼	——
E. S. B'tv., pfd.	19*	19*	——	Union Traction.	54	53½	——

CHICAGO.

	Feb. 1.	Feb. 8.	Shares sold.		Feb. 1.	Feb. 8.	Shares sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	128	129	——
Chi. Rys., Ser. 1	116*	116*	——	Met. El., com.	17*	17*	——
Chi. Rys., Ser. 2.	45	44	——	Nat'nal Carbon.	84*	84*	——
Com. Edison.	108	108	——	Nat. Carb., pfd.	110*	110*	——
Chi. Subway	26½	26	——				

BOSTON.

	Feb. 1.	Feb. 8.	Shares sold.		Feb. 1.	Feb. 8.	Shares sold.
Am. Tel. & Tel.	125½	128⅜	——	Mex. Tel.	21½	21½	——
Com. Tel.	125*	125*	——	Mex. Tel., pfd.	5½*	5½	——
Edison El. Ill.	250	250	——	N. E. Tel.	130⅜	131	——
Gen. Elec.	154½	154½	——	W. Tel. & Tel.	8*	8*	——
Mass. Elec. Ry.	14½	14½	——	W. T. & T., pfd.	79*	79*	——
Mass. E. R., pfd.	62	62	——				

*Last price quoted.

Sales reported to the Stock Exchange from Feb. 1 to Feb. 7.

DIVIDENDS.

Niles-Bement-Pond Company, quarterly, preferred, 1½ per cent, payable Feb. 15, common, 1½ per cent, payable March 20.

American Smelters Securities Company, quarterly, 1½ per cent on preferred "A," 1¼ per cent on preferred "B," payable March 1.

Brooklyn Union Gas Company, 3 per cent, payable April 1.

New Jersey & Hudson River Railway & Ferry Company, Edgewater, N. J., semi-annual, preferred 3 per cent, common 2 per cent, both payable Feb. 15.

Quebec Railway & Light Company, quarterly, 1 per cent, payable March 1.

Philadelphia Company, Pittsburg, Pa., semi-annual, preferred, 2½ per cent, payable March 1.

National Carbon Company, quarterly, preferred, 1¾ per cent, payable Feb. 13.

Toronto Railway Company, annual, 7 per cent, payable April 1.

American Telegraph & Cable Company, quarterly, 1¾ per cent, payable March 1.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, quarterly, common, 1½ per cent, payable March 1.

Brooklyn Rapid Transit Company, 1 per cent, payable April 1.

Galveston (Tex.) Electric Company, semi-annual, preferred, 3 per cent, payable March 1.

ELECTRIC COMPANIES JOIN FORCES.—Announcement has been made that the Fort Wayne (Ind.) Electric Works have assumed control of the Northern Electrical Manufacturing Company, of Madison, Wis. These two concerns are subsidiaries of the General Electric Company, through ownership of stock control, and their practical consolidation is for reducing expenses and simplifying the sales departments. The commercial organization of the Northern company will be merged into that of the Fort Wayne concern and both properties will be directed from the Fort Wayne office. The two concerns have been practically non-competitive, as the Fort Wayne plant has manufactured principally motors and apparatus for alternating current and the Northern plant has made machinery exclusively for direct current. Hereafter this line of distinction will be absolutely withdrawn between the two plants. In quite a number of cities each of the companies has maintained sales offices and these will in every instance be united. The New York office will be in charge of Mr. J. C. Lott at 30 Church Street. The name of the Northern Electrical Manufacturing Company will disappear and the business will be conducted under the name of the Fort Wayne Electric Works. The details of the combination are being worked out by Mr. F. S. Hunting, treasurer and sales manager of the Fort Wayne company.

ELECTRICAL CONSOLIDATION IN ARKANSAS.—The Russellville Water & Light Company, Pine Bluff, Ark., which was recently incorporated with a capital stock of $100,000, has acquired the franchise, privilege and property of the Russellville & Ozark Mountain Light & Transit Company, which was organized in June, 1907, to build a light and water plant at Russellville, Ark., and an electric road from that city to Dover. A contract has already been let for constructing a 400-ft. dam across the Illinois River, which will give a 25-ft. head of water. Power will be generated by four turbine wheels which will develop about 500 hp. A light plant was established by the company a year ago. When the present work is completed the equipment will include one 150-kw generator in addition to the 100-kw generator now in service. Within a few months contracts will be let for the equipment of a waterworks plant to be electrically operated.

BONDS OF HYDRO-ELECTRIC COMPANIES.—William P. Bonbright & Company, bankers and brokers, of New York, have issued an interesting little pamphlet entitled "Investment Value of Hydro-Electric Securities." In it are discussed the history and development of hydro-electric power, special attention being given to the value for investment purposes of the first mortgage bonds of such concerns. The economy of operation, on account of the small amount of labor required, the small depreciation, the elimination of raw-material purchases and the stable market for the product are cited as especial advantages for such properties.

WISCONSIN BELL COMPANY NOT A TRUST.—Attorney-General Gilbert, of Wisconsin, has handed down an opinion holding that the Wisconsin Telephone Company, which is a Bell property, is not a trust as had been alleged in a petition filed by the Independent Telephone Association of Chicago. He declines to allow the Independents to begin suit for the forfeiture of charter of the Wisconsin Telephone Company. With regard to the merger of the Bell and Independent companies at Beloit, Wis., he says that the customers have expressed satisfaction over the better service they are receiving since the combination.

CHICAGO RAILWAYS EARNINGS INCREASE.—The rate of increase shown by the Chicago Railways Company during December was more than maintained during January. In fact, the increase in December was about 13 per cent and that in January about 15 per cent. The management of the road is inclined to give the pay-as-you-enter cars most of the credit for these gratifying increases. The officials say that if the same

ratio is continued throughout the year, the gross earnings for 1909 will be something like $12,000,000, or $750,000 more than the estimate made by Mr. Bion J. Arnold for the City Council in 1905.

WESTERN ELECTRIC'S YEARLY REPORT.—Although the exact figures have not yet been given out, it was announced at the annual meeting of the Western Electric Company, held in Chicago Feb. 4, that the earnings for the fiscal year of the company, which ended Nov. 30, 1908, showed a serious falling off from the year 1907. At the meeting L. Schoonmaker, president of the Manhattan Trust Company, New York, and F. R. Wells, manager of the company's European business, were elected directors to succeed A. C. Bartlett and W. R. Patterson. In his address to the stockholders, H. B. Thayer said that owing to the energetic sales campaign which the company had carried on during 1908 some departments of manufacturing concerns had been kept fairly busy. The total number of orders for 1908 were about 572,000, as compared with 479,000 during the previous year. The average value of the orders in 1907 was $98 and in 1908 was less than half that amount, or about $47. The total business, therefore, in round numbers, was about $47,000,000 in 1907 and $26,800,000 in 1908. This figure is a trifle less than that already published, as a preliminary estimate, which was $30,000,000. The debts of the company, according to President Thayer, had been reduced about $6,000,000 during the year, and on Dec. 1 only amounted to $11,500,000. The cash on hand and bills receivable amounted to $5,000,000 more than the total indebtedness.

BROOKLYN RAPID TRANSIT DIVIDEND—The Brooklyn Rapid Transit Company has at last declared a dividend after years of promising and scheming. The directors met Feb. 5 and declared a quarterly dividend of 1 per cent, payable April 1, adopting at the same time a resolution setting forth that "as dividends are declared they shall be made payable on the first days of April, July, October and January." The wording of this resolution is taken in financial circles to mean that while the company hopes to continue quarterly dividends it has not committed itself to their payment. The action of the directors it is expected will enable the company to place new bonds at smaller discounts. The company earned 4.6 per cent on its capital in 1908 which is the last report that has been made.

BELL TELEPHONE COMPANY OF PENNSYLVANIA.—The report of the Bell Telephone Company of Pennsylvania for the year of 1908 shows gross earnings of $11,434,520, an increase of $451,882 over the previous year. The net earnings of the company increased $184,381, and the surplus increased $38,387. This increase in earnings was accomplished in spite of the fact that the increase in stations during the year was only 12,148, or only about 4 per cent. The territory covered by the company is about 47,000 square miles, and includes a population of something like 8,000,000. It embraces all of Pennsylvania east of the Alleghenies and south of the northern tier of counties, southern New Jersey, District of Columbia, Delaware, Maryland, parts of Virginia and West Virginia.

NEW YORK & NEW JERSEY TELEPHONE COMPANY.—The report of the New York & New Jersey Telephone Company for the calendar year 1908 shows gross earnings of $9,269,407, an increase over the previous year of $462,314. The net earnings showed an increase of $333,997. The surplus for the year was $633,763, and the total surplus at the end of the year was $5,466,359. The percentage of gain in the number of stations during the year was 5.75 per cent, while in 1907 it had been 13.41. During the year 31,159 stations were connected and 22,586 were disconnected, leaving at the end of the year a net gain of 8373 stations. There was spent during the year $2,271,000 for equipment and improvements.

TORONTO RAILWAY'S GOOD REPORT.—The Toronto Railway Company, at its annual meeting, decided to increase its dividends to 7 per cent. It is announced that 1908 was the most prosperous year in the history of the company. The net earnings amounted to over 12 per cent on the capital stock after the payment of the city's percentage and the fixed charges. The total net earnings were $1,721,226, an increase of $103,264. The road carried during the year 89,139,571 paying passengers and there were 32,700,576 passengers who rode on transfers.

NARRAGANSETT ELECTRIC LIGHT COMPANY.—The annual report of the Narragansett Electric Light Company for the year 1908 shows gross earnings of $1,088,364 and net earnings of $442,356. The company paid dividends of 8 per cent during the year and added $14,903 to its surplus. This was after making the usual deduction of $75,000 for depreciation.

NEW DIRECTORS FOR LAKE SUPERIOR CORPORATION.—The directors of the Lake Superior Corporation have accepted the resignation of Messrs. F. W. Ayer and Thomas Gibson. Messrs. Gow and Whigham were elected to fill the vacancies. The new directors represent the Scottish interests which have recently come into the company.

CAPITAL TRACTION COMPANY, WASHINGTON.—The annual report of the Capital Traction Company, of Washington, D. C., shows that the total earnings from operation were $1,841,170 and the operating expenses were $793,141. The surplus for the year was $51,886, and the total surplus at the close of the year was $180,787.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Chicago Railways Company:					
November, 1908	$926,985	$689,270	$237,684	$153,570	$124,330
November, 1907	865,333	602,813	262,520	133,235	129,284
Detroit United Railways Company:					
Year 1908	7,114,760	4,559,123	2,555,637	1,618,665	1,001,928
Year 1907	7,100,885	4,492,544	2,608,341	1,569,261	1,099,726
Illinois Traction Company, Champaign, Ill.:					
Year 1908	4,008,620	2,354,124	1,654,496	.....	.....
Year 1907	3,779,187	2,128,488	1,650,699	.....	.....
Kansas City Railway & Light Company:					
December, 1908	576,140	325,275	250,865	156,089	94,776
December, 1907	512,666	261,197	251,469	151,178	99,291
Lake Shore Electric Railway, Cleveland:					
Year 1908	867,269	490,974	376,295	326,232	75,063
Year 1907	913,161	523,559	389,602	294,073	125,529
Manufacturers' Heat & Light Company, Pittsburgh:					
Year 1908	4,709,026	1,885,914	2,823,112	972,104	1,851,008
Year 1907	4,994,803	1,730,017	3,264,786	1,249,185	2,015,601
Metropolitan West Side Elevated Railroad, Chicago:					
Year 1908	2,746,840	1,410,801	1,336,039	1,084,750	261,415
Year 1907	2,858,852	1,443,498	1,415,354	1,084,750	330,604
New York & New Jersey Telephone Company:					
Year 1908	9,269,407	6,706,460	2,562,947	142,909	2,420,038
Year 1907	8,807,093	6,473,443	2,333,650	90,209	2,243,441
Ottawa Electric Railway Company:					
Year 1908	626,129	416,789	199,440	.....	.....
Year 1907	574,078	361,743	212,535	.....	.....
Pacific Coast Railroad Company:					
December, 1908	158,035	118,035	60,000	.....	.....
December, 1907	154,869	58,869	96,046	.....	.....
Philadelphia Company, Pittsburg:					
Year 1908	8,981,455	2,118,800	6,801,555	.....	.....
Year 1907	14,153,927	12,067,808	7,024,120	4,186,693	2,837,427
Portland Mail Electric Company:					
Year 1908	221,124	120,436	101,088	.....	.....
Year 1907	214,581	64,000	150,581	.....	.....
Sacramento Gas & Electric Company:					
December, 1908	35,000	17,500	17,500	.....	17,500
December, 1907	35,000	17,810	17,190	.....	17,190
Southern New England Telephone Company:					
Year 1908	2,187,289	1,725,884	461,405	461,605	-200
Year 1907	2,187,289	.....	461,605	461,605	0
United Power & Transportation Company, Philadelphia:					
Year 1908	988,284	162,292	825,992	.....	.....
Year 1907	870,019	164,111	705,908	.....	.....
Western New York & Pennsylvania Traction Company, Olean, N. Y.					
Oct. 1 to Dec. 31, 1908	150,850	68,010	82,841	.....	.....
Oct. 1 to Dec. 31, 1907	185,282	99,435	85,847	.....	.....

GENERAL NEWS

Construction News.

DOTHAN, ALA.—The citizens of Keyton Siding, Hodgesville, Newton Springs, and Mount Enon Church have organized a company to construct a rural telephone line from Dothan to Hodgesville. C. L. Jackson is president; J. D. Holton, secretary, and C. F. Gilstrap, treasurer.

FORT PAYNE, ALA.—The Alabama Railway & Power Company is planning to begin work on construction of its proposed electric railway between Chattanooga and Birmingham this year. The company also expects to furnish electricity for lamps. J. H. Hill, of Fort Payne, is vice-president.

TREADWELL, ALASKA.—Plans are being made to construct a hydro-electric plant to furnish electricity to operate the machinery in the Alaska-Treadwell mines. It is proposed to erect a plant on the Taku River, about 30 miles distant, to be transmitted to Treadwell, Mexican, Seven Hundred, Ready Bullion and Three Hundred mills and mines of the Treadwell group of Southeastern Alaska. The cost of the plant is estimated at about $750,000. Robert A. Kenzie is general superintendent.

PARAGOULD, ARK.—The City Council has granted the Crystal Ice Company a franchise to install an electric light plant to furnish electricity for lighting the streets of the city.

BISHOP, CAL.—Negotiations are being made for water rights on the upper King's River, where a large power plant to cost about $9,000,000 is to be erected. About 250,000 hp will be developed, which will be transmitted by electricity to various parts of the San Joaquin Valley, as far south as Los Angeles and north to San Francisco. Work on the plant will begin as soon as the weather will permit. The deal was consummated through T. L. Oddie, of Tonopah, and S. G. Musser, Big Pine.

FAIRFIELD, CAL.—The Council has granted a franchise to the Nixon-Kimmel Company to construct and maintain transmission lines for the distribution of electricity for lamps and motors and other purposes in Fairfield.

FORT JONES, CAL.—Notice of appropriation of water flowing in Fog Creek has been filed by P. A. Ball, which will be utilized for mining, power, irrigation, etc.

FRESNO, CAL.—The Fresno Traction Company has been granted a franchise by the Board of Supervisors to extend its Forthcamp line to the Wilson and North Fresno tracts.

LOS ANGELES, CAL.—The Edison Electric Company of Los Angeles is planning to enlarge its plants in towns surrounding Los Angeles, for which investigations are now being made by E. C. Jones, of San Francisco, who will make a report to John B. Miller, president of the company. The cost of the work is estimated at $500,000, and will include the plants at Pomona, Redlands, Riverside, Santa Barbara, Monrovia, Santa Monica, Ocean Park, Venice, San Pedro and Long Beach, Cal.

MACDOEL, CAL.—It is reported that W. L. and Thomas Prather are contemplating installing an electric plant at the Prather ranch, to furnish electricity in Macdoel and Mount Hebron for lamps and motors.

MAGALIA, CAL.—The power house of the Steifer mine was completely destroyed by the recent floods, and part of the machinery carried away. The plant will be rebuilt immediately, it is said.

MODESTO, CAL.—The La Grange Water & Power Company is constructing a large power plant on the upper Tuolumne River. The company will furnish electricity in Modesto for lamps and motors, and also proposes to extend a branch transmission line from the Turlock Company's storage reservoir, which will be used for emergencies and supply water to the Modesto irrigation district.

PETALUMA, CAL.—Plans and specifications have been prepared for the proposed high-pressure salt-water fire-protection pumping plant and submitted by the committee to the Board of Trustees. The report submitted recommends the installation of a 2500-gal. per minute pump to work at 150 lb., pressure to be operated by an electric motor of 300 hp. The Trustees authorized the clerk to advertise for bids for installing the plant.

REDWOOD CITY, CAL.—The city is reported to be receiving bids for constructing an extension to the municipal electric light distributing system.

ST. HELENA, CAL.—The Napa Valley Electric Company, recently incorporated, is now being organized and proposes to take over the property of the St. Helena Gas & Electric Company and will commence operations about April 1, 1909. The company will purchase electricity to operate its system from the Snow Mountain Water & Power Company. The officers are: D. L. Beard, president; H. J. Lewelling, vice-president; G. S. Conner, secretary, and H. Brown, treasurer.

SACRAMENTO, CAL.—During a recent storm the steel towers of the Great Western Power Company between Sacramento and Stockton, a distance of 10 miles, were blown to the ground.

SAN FRANCISCO, CAL.—Frank D. Stringham, representing the firm of Hillyer, Stringham & O'Brien, has applied to the Board of Supervisors for a franchise for a street railway system on several streets in the city.

SANTA CRUZ, CAL.—Work has commenced on the construction of the new electric power plant to be erected by the Vicente Lumber Company at Moore's Gulch.

SONORA, CAL.—Notice of appropriation has been filed by D. A. Jones of 20,000 cu. in. of water from the Tuolumne River, to be used for irrigation and power purposes.

STOCKTON, CAL.—A bill has been submitted to the State Legislature asking for an appropriation of $35,000 for the installation of an electric light plant and telephone system at the Stockton State Hospital.

COLORADO SPRINGS, COL.—The Empire Water & Power Company has purchased 320 acres of land near its sites on Cascade and Crystal creeks on the north slope of Pike's Peak, and has also secured options of additional territory. The company already owns 1200 acres, where extensive preparations are being made for an elaborate water system, which will be utilized for power generation. G. T. Bullock, of New York, N. Y., is president.

FORT COLLINS, COL.—At a meeting of the Chamber of Commerce, held Jan. 25, a committee was appointed to confer with the City Council in regard to establishing a municipal electric light plant. It is stated that the water power of the Poudre River could easily be utilized to generate power for the plant.

GREELEY, COL.—The Home Gas & Electric Company writes that it is contemplating the installation of a new municipal street lighting system, and may install series tungsten lamps. Additional machinery will also be installed in the plant. Robert McF. Doble, Majestic Building, Denver, Col., is secretary and manager.

MIDDLETOWN, CONN.—The Middletown Electric Light Company, it is stated, has decided not to enlarge its plant. A tentative contract has been made by which the Glastonbury Light & Power Company will furnish the Middletown Electric Company with all additional electricity needed.

SAYBROOK, CONN.—The New Haven Rigging Company has been awarded a contract for driving piles in connection with laying the foundation of the large power house to be erected by the Shore Line Electric Railway Company in Saybrook. The company proposes to construct an electric railway from Stony Creek east to the Connecticut River and north to Essex.

THOMPSONVILLE, CONN.—The new mill of the Upson-Martin Carpet Company has been completed and orders placed for new looms. Each loom will be operated by an individual electric motor.

TORRINGTON, CONN.—The stockholders of the Torrington Electric Light Company have voted to increase the capital stock of the company from $300,000 to $450,000, to provide funds for enlarging the power house and increasing the equipment of the plant.

WILMINGTON, DEL.—Three bids were submitted to the levy court for furnishing electricity for lighting the court house and operating various bridges, as follows: The Wilmington Light, Power & Telephone Company offers to furnish electricity for lighting the Third street bridge over the Christiana River at a rate of $20 per year for lamps of 16 cp, and for motors for operating the gates at a flat rate of $350 per year; for operating the safety gates on the Third street bridge, at a flat rate of $70 each per year; for lighting Market street bridge over Brandywine River, at a flat rate of $78 for each arc lamp; for lighting the Eleventh street bridge over Christiana River, at $78 per lamp per year, and for lighting the Washington street bridge over Brandywine River, at $18 per year for each 16-cp lamp. For furnishing electricity for lighting the court house lawn, at a rate of $78 per arc lamp per year, and for lighting the building, five cents per kw-hour. The county is to furnish the necessary motors and other equipment for power purposes at the Third street bridge over the Christiana River. The bid of the Wilmington City Electric Company, submitted, was as follows: Contract to include electricity for lamps and motors for four years, beginning Feb. 1: For each arc lamp, per annum, $79.20; for each 16-cp incandescent lamp, $18 per year; to operate the Third street bridge, $216 per year; for operating safety gates on each bridge, $60 per year, and for electricity for lighting the county court house, five cents per kw-hour. The bid of the Wilmington Gas Company was as follows: For furnishing electricity for lighting court house and Washington street bridge, $20 per lamp per year.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Feb. 16, for furnishing at the various naval stations and navy yards the following supplies: Norfolk, Va., Schedule 880—1000 ft. lighting wire and 4500 ft. interior communication cable; Schedule 884—150 lb. copper wire and 300 sq. ft. wire cloth, etc. Applications for proposals should designate the schedule desired by number.

MIAMI, FLA.—The Miami Electric Railway Company, which is in the hands of H. C. Roomes as receiver, has decided to abandon electricity as motive power and will operate gasoline motor cars.

PANAMA CITY, FLA.—It is reported that the citizens of Panama City are asking for a charter to construct a water and light plant for the town.

ATLANTA, GA.—The Piedmont Power Company has applied to the City Council for a franchise to construct and maintain an electric light and power plant in Atlanta.

COLQUITT, GA.—An election will be held to vote on the proposition to issue bonds to the amount of $15,000 for extension to the water and electric light systems.

DOUGLASVILLE, GA.—The City Council is considering the question of granting a franchise for the installation of an electric light plant.

HOGANSVILLE, GA.—The electric light plant owned by M. E. Word has been leased to Messrs. Lee, Newton and Roser. Through error this appeared under Hagansville, Ga., in the issue of Feb. 4.

ST. JOE, IDAHO.—It is reported that the Chicago, Milwaukee & Puget Sound Railroad Company will soon award contracts for the construction of two electric power plants on the Missoula River at St. Joe, Idaho Each plant will have an output of from 20,000 to 25,000 hp. The company proposes to operate its trains between St. Regis, Mont., and St. Joe, Idaho, by electricity as soon as the plants are completed. C. B. Pride, of Spokane, Wash., is engineer.

SOLDIER, IDAHO.—Plans are being considered by the Soldier Local Telephone Company to extend its system to Hagerman, Fendell, Glenn's Ferry, Shoshone and Jerome and also east and west of Soldier, during the coming summer. The proposed extensions and improvements will involve an expenditure of about $15,000.

WALLACE, IDAHO.—Arrangements are being made by the Slate Creek Electric Company to construct a hydro-electric plant on Slate Creek as soon as the weather will permit. The plant will have an output of 15,000 hp and will cost about $200,000. H. J. Rogers is vice-president.

CHICAGO, ILL.—Bids will be received by William Carroll, city electrician, 76 Fifth Avenue, Chicago, Ill., for furnishing and installing for the Department of Electricity electric light cable in accordance with specifications on file at the above office as follows: 1520 ft. 3-conductor, paper-insulated, No. 00 lead-incased cable; 150 ft. single-conductor, cambric-insulated, No. 00 lead-incased cable. Proposals must be made out upon blanks furnished by the city electrician.

CHICAGO, ILL.—We are informed that the Chicago, Blue Island & Joliet Traction Company will award contracts during the next two months for the construction of 17 miles of new track and for equipping 2½ miles of steam railway to be operated by electricity. The company will also award contracts for a 500-kw rotary converter and construction of a substation. W. H. Conrad, First National Bank Building, of Chicago, Ill., is general manager.

CHICAGO, ILL.—Proposals will be received at the office of the business manager of the Board of Education, Room 730, Tribune Building, Chicago, Ill., for electrical work for the Schurz High School, Milwaukee Avenue and Addison Street, in accordance with plans and specifications prepared by D. H. Perkins, architect of the board, and T. Waters, chief engineer, which may be seen at the office of the architect, Room 714, Tribune Building. Proposals must be made out on printed forms to be obtained at the office of the architect.

LOVINGTON, ILL.—It is reported that the Council has purchased the electric plant owned by A. J. Lewis & Company. It is said that improvements will be made to the plant. For further information address L. G. Hostetter.

PARIS, ILL.—The Central Union Telephone Company contemplates making extensions to its rural lines, for which an appropriation of $40,000 has been made. Roscoe Wright is local manager.

SHELBYVILLE, ILL.—A movement is on foot to consolidate the local telephone systems. It is proposed to organize a stock company with a capital stock of $[illegible].

STERLING, ILL.—It is reported that A. M. Searles, of Chicago, Ill., has purchased water power rights on Rock River at Oregon, and proposes to generate electricity to be distributed in Rochelle, Amboy, Sublette and Franklin Grove for commercial and street lighting.

WAUKEGAN, ILL.—The London Investment Company, Ltd., of London, Eng., which recently purchased the system of the Kenosha Electric Railway Company, it is stated, will make extensions to the system, which will include the construction of all lines provided for under the franchises granted to A. C. Frost. The company will build street car lines to connect with the Kenosha baseball grounds and to the Northwestern depot at once. The extensions contemplated will involve an expenditure of about $125,000.

ANDERSON, IND.—At a joint meeting of the Board of Public Works and the City Council held recently it was decided to increase the output of the municipal electric light plant, at an approximate cost of $[illegible]. The plant now has an output of 1300 hp and the demand for electricity for motors is increasing rapidly.

MILLERSBURG, IND.—The Farmers' Mutual Telephone Company is planning to construct a telephone line to Topeka, and also to erect another line from Millersburg to Goshen. J. I. Zollinger is president.

WASHINGTON, IND.—The municipal electric light plant, which has been for the past year operated by the Washington Light & Water Company, has been again placed under the direct management of the city, a deed for the transfer of the property having been accepted by the City Council. A board of managers has been appointed. It is understood the city will make needed improvements in the plant this year.

WINAMAC, IND.—The Town Boards of Francesville, Medaryville and Monon have decided to construct jointly an electric power plant in one of the towns to furnish electricity for the three places, the three towns are situated about eight miles apart; each place has a population of about 1,200 and at present without electric service. The present plans provide for the erection of the plant at Medaryville, the central town, with transmission lines to Monon and Francesville.

ALBIA, IA.—We are informed that the Albia Electric Light & Power Company has been consolidated with the Hocking and Hiteman electric railways under the name of the Albia Interurban Railway Company. The company is capitalized at $250,000. The officers of the company are: L. T. Richmond, president; C. A. Ross, vice-president; Calvin Manning, secretary and treasurer; W. E. Gant, manager, and C. B. Judd, chief engineer.

CARSON, IA.—The telephone system owned by W. J. Way, of Carson, will be taken over by Musson Brothers Company, of Atlantic, Ia. It takes in the towns of Carson, Macedonia, Henderson and Treynor. It is said that the new owners will make improvements to the plant and replace the wire system with cables.

EPWORTH, IOWA.—The installation of an electric light plant in Epworth is reported to be under consideration.

GRAND JUNCTION, IA.—The local telephone company is making arrangements to erect a new telephone exchange in Grand Junction.

IOWA CITY, IA.—An election will be held Feb. 10 to vote on the proposition to grant a franchise to the Iowa City Electric Light Company.

MT. VERNON, IA.—The Cedar Rapids & Marion Telephone Company has purchased the plant of the Mt. Vernon Telephone Company. It is said the new company will improve the service by the installation of a complete metallic circuit and extend the system, work on which will begin early in the spring.

UNION, IA.—The Union Electric Light Company, which was recently granted a franchise to operate an electric light system in Union, contemplates the construction of an electric plant at a cost of $6,000. As yet no definite plans have been made. E. A. Hunt is secretary.

WILLIAMSBURG, IOWA.—We are informed that the Williamsburg & Iowa City Railway Company contemplates the construction of an electric railway between Williamsburg and Iowa City, a distance of 28 miles, contracts for which have not yet been awarded. F. O. Harrington, of Williamsburg, Iowa, is president.

LAWRENCE, KAN.—Albert Emmanuel and W. R. Sullivan, of Dayton, Ohio, have been in this city making investigations with a view of asking for a franchise from the City Council to establish a local street railway system in Lawrence.

NEW CAMBRIA, KAN.—Arrangements are being made by Charles Kirtland to erect an electric plant on Smoky River. It is said that the town is considering the question of installing electric lamps.

ROSEDALE, KAN.—The Kansas City & Olathe Electric Railway Company has applied to the City Council for a franchise to extend its railway into Rosedale. The company offers to furnish the city with five arc lamps along the route of the railway. R. W. Hocker, D. B. Johnson, J. J. Stewart and F. P. Dixson are interested in the company.

SYLVIA, KAN.—The question of establishing an electric light plant in Sylvia is under consideration.

CANE VALLEY, KY.—The village officials, it is said, have placed a contract for the installation of an electric light system in Cane Valley.

FRANKFORT, KY.—The Capitol Commission has awarded the contract for electric lighting fixtures for the entire building to the Mitchell, Vance Company, of New York, N. Y., for $25,000.

PAINTSVILLE, KY.—H. A. Loche, 547 Drexel Building, Philadelphia, Pa., has purchased a franchise for the construction of an electric light plant and water-works system in Paintsville. Work on construction of the plants will begin in about four weeks.

WINNFIELD, LA.—The plant and holdings of the Winnfield Light & Power Company have been purchased by W. P. Cooper. The new owner proposes to rebuild the plant and install new machinery, including dynamo, engine, switchboard and new line material. We are informed that this material will be purchased about Feb. 15. For further information address H. W. Wright, Winnfield, La., engineer in charge.

BRUNSWICK, MAINE.—Negotiations are practically completed for the sale of the Scribner water power privilege to the Brunswick Light & Power Company. This privilege gives the company the first rights on the lower dam of the Androscoggin River.

EASTPORT, MAINE.—Elijah Nichols has applied to the City Council for a franchise to construct and operate an electric light plant in Eastport.

FRIENDSVILLE, MD.—The Youghiogheny Power Company, recently incorporated, proposes to erect three dams, 30, 75 and 100 ft. high, respectively, on the Youghiogheny River and develop 15,000 hp. The cost of the work will be about $1,000,000. Clifford L. Pullen, of New York, N. Y., is interested in the enterprise. The Western Maryland Coal & Coke Company is said to be behind the project.

AYON, MASS.—The Ayon Electric Company, of Ayon, manufacturer of the Ayon Electric Company of Boston, as noted in these columns [illegible], has applied to the Selectmen for a franchise to erect poles and wires on East Main and High streets. The company proposes to furnish electricity for lamps and motors for the three [illegible] and erect [illegible] place lamps on both East Main and High streets free of charge until the matter comes up in March, when the town will take action in regard to [illegible] lighting.

BOSTON, MASS.—The Edison Electric Illuminating Company, of Boston, is reported to have placed a contract with the General Electric Company for two 18,000-hp steam turbines to replace the two 7500-hp turbines now in operation.

BOSTON, MASS.—Negotiations have been completed by which the Edison Electric Illuminating Company, of Boston, is to purchase the plants and holdings of the Waltham Gas Light Company, the Newton & Watertown Gas Light Company, the Brookline and Brighton plant of the Boston Consolidated Gas Company and the Chelsea Gas Light Company. Contracts have been made by which the Edison company is to furnish electricity for operating all the street railway lines of the Boston Suburban Electric Company, and will also furnish electrical power to operate the street railways running through the Newtons and to Norumbega Park and to points south of Boston.

GLOUCESTER, MASS.—The Gloucester Electric Company has applied to the State Gas and Electric Light Commissioners for permission to increase its capital stock by $60,000, the proceeds to be used to pay floating indebtedness and for additions to its plant.

HOLYOKE, MASS.—Work has commenced on the new electric plant for the Lyman Mills in this city. The plant will have an output of 10,000 hp, with provision to increase it to 15,000 hp. The Roland T. Oakes Company, of Holyoke, Mass., has the contract for the installation of electrical equipment.

NORTH ADAMS, MASS.—R. L. Gardiner, city engineer, in his annual report recommends that all overhead wires be placed in underground conduits.

WAREHAM, MASS.—Plans are being considered to have the towns of Wareham and Marion unite to secure electricity for street lighting. It is proposed to secure electric service from the New Bedford & Onset Street Railway Company's plant at Wareham Narrows dock. It is probable that the question will be brought before the voters at the annual town meeting, which will be held soon.

WEST BOYLSTON, MASS.—The Town of West Boylston has entered into a contract with the Marlboro Electric Company, of Marlboro, Mass., for a term of five years, to furnish electricity for lighting the streets of the town. The contract calls for 120 tungsten lamps of 40 cp, at $18 per lamp per year, and to furnish five 40-cp lamps free of charge. The town has the privilege of purchasing the plant at any time by giving six months' notice, the town to pay the actual cost of the plant, plus 10 per cent of the cost of material, and 15 per cent for labor for construction, less 5 per cent for depreciation from July 11, 1911. The company also agrees to furnish electricity for pumping at the rate of 5 cents per kw-hour.

WESTFIELD, MASS.—The Board of Selectmen has voted to make a change in the schedule of rates for electricity to take effect after March 1 as follows: For the first 25 kw, 16 cents per kw-hour; for the next 114 kw, 14 cents per kw-hour; for the next 250 kw, 12 cents per kw-hour, and all in excess of 289 kw, at 10 cents per kw-hour. A reduction of 10 per cent will be allowed on all bills paid on or before the 15th of the month. The new schedule gives a reduction in the rates from 10 to 15 per cent on the old prices.

BAY CITY, MICH.—The Supreme Court has handed down a decision making an injunction restraining the City Council of Bay City from building a municipal electric light plant permanent. The Bay City Traction & Electric Lighting Company sought the injunction, claiming that the Council had no right under the city charter to take action of this kind.

CHEBOYGAN, MICH.—It is reported that the plants and holdings of the Cheboygan Electric Light & Power Company and the Cheboygan Gas Light Company have been purchased by the United Equipment Company, of Chicago, Ill.

DETROIT, MICH.—The Detroit Traction Company has filed a petition with the city clerk to be presented to the Common Council for a franchise to construct several street railways in this city.

DETROIT, MICH.—The Detroit United Railway Company is reported to have placed an order for one 1500-hp steam turbine with the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa.

DETROIT, MICH.—Estimates prepared by Frank T. Mistersky, general superintendent of the municipal electric light plant, amounting to $348,248, have been approved by the Board of Estimates and will be submitted to the City Council. For operation and maintenance of the plant, which includes a recommendation for the purchase of equipment for 12-75 flame lamps and changing over the old style Brush lamp, the commission asks for $180,791, by which it will save the city about $6,000. Estimates for extensions and improvements include the erection of a new substation in the northwestern part of the city at a cost of $24,403; conduits on several streets, $21,039; new lamp locations with necessary equipment, $21,419; installation of 400 additional metallic flame arc lamps, $48,000; changing arc lamp system, $47,683; installation of new boilers with equipment, $13,066.

MANISTIQUE, MICH.—The Michigan State Telephone Company will soon commence work on the construction of a new trunk line between Manistique and Trout Lake, a distance of 45 miles.

WEST BRANCH, MICH.—Owing to a disagreement between the Village Council and the Rifle River Electric Light Company, the electric lighting service has been discontinued, leaving the streets of the village in darkness.

ALBANY, MINN.—The City Council has rejected all bids for the installation of a lighting system. Thomas Tomasek is village recorder.

BROWNS VALLEY, MINN.—Plans are being considered to organize a local telephone company and install a telephone system in Browns Valley at a cost of $4,000. The company will be capitalized at $50,000. N. J. Brown is secretary.

CHISHOLM, MINN.—Plans are being made by the local telephone company to install a new plant and also a new system of telephones.

COHASSET, MINN.—Plans are being considered by the local electric light company to increase the output of its plant.

GARNES, MINN.—The construction of a telephone line from Garnes to Malone is under consideration. Ole Riersgaard is interested in the project.

GRACEVILLE, MINN.—The citizens have decided to organize and install an independent telephone exchange at once. A. D. O'Brien was elected president; Frank Valesh, vice-president, and L. J. Keating, secretary.

MINNEAPOLIS, MINN.—The L. S. Donaldson Company has awarded the contract for boilers for the central power plant for the Donaldson buildings to the Fairbanks-Morse Company, of Chicago, Ill. The contract calls for eight boilers at a cost of $30,000.

MIZPAH, MINN.—W. A. Potter has been granted a franchise to construct and operate an electric light plant in this village.

PIPESTONE, MINN.—The Northwestern Telephone Company contemplates rebuilding the Pipestone telephone system and will establish an all-cable plant. M. E. Guinter is local manager.

RED LAKE FALLS, MINN.—The Red Lake Falls Electric Light Company has applied to the City Council for a franchise in this city.

ST. CLOUD, MINN.—Arrangements are being made by the Lunemberg Company to erect a telephone line from St. Cloud to Grand Lake via Pleasant Lake. H. C. Block is president.

STEWARTVILLE, MINN.—It is reported that a company has been formed to take over the plant of the Stewartville Electric Light Company. O. E. Hammer, E. J. Colby and James Anderson are interested in the company.

ROCKPORT, MO.—Plans are being considered to install an electric or gas motor for pumping water in the municipal electric light and water works plant. W. E. Germann is manager.

SPRINGFIELD, MO.—The county court has granted George Norman, G. W. Boyd, J. V. Sweet and others permission to erect a telephone line on the Needmore and Republic roads.

FROMBERG, MONT.—The question of erecting an electric light plant in this place is under consideration.

MISSOULA, MONT.—Arrangements are being made by the Montana Independent Telephone Company to enlarge its telephone system in Missoula.

WHITEFISH, MONT.—The installation of an electric light plant is under consideration here.

BROKEN BOW, NEB.—O. J. Shaw, superintendent of the Aurora Electric Light, Heat & Power Company, of Aurora, Neb., has been making investigations with a view of establishing an electric light plant in Broken Bow.

PAPILLION, NEB.—The question of establishing a lighting plant in Papillion is under consideration.

WYMORE, NEB.—At the next regular election the citizens will vote on the proposition to establish an electric light plant here.

HAWTHORNE, N. J.—The contract for the installation of a complete electric plant in the Wagaraw Bleachery Company, at Hawthorne, has been awarded to the Washington Company, of New York, N. Y. The equipment includes a 375-hp Hamilton Corliss engine, a 100-hp boiler and a large Sprague generator.

HOBOKEN, N. J.—It is reported that the Delaware, Lackawanna & Western Railroad Company is again considering the question of equipping its railway system from Hoboken to or beyond the Oranges, in New Jersey, to be operated by electricity. It is said that if the company can make arrangements with the municipalities of East Orange and other cities in regard to grade crossings, work will commence on equipping the entire Morris and Essex division before 1910.

PATERSON, N. J.—It is reported that the New Jersey Construction Company is making inquiries in the trade for boilers of about 1000 hp, which, it is said, is the initial purchase for a large power plant to furnish electricity for an electric railway. The company is acting for a corporation which secured a charter to build an electric railway from Suffern, N. Y., through Paterson and other towns to Hoboken, N. J., to connect with the McAdoo tunnels at that place. The equipment now called for, it is said, will be used principally in construction work. The company is considering erecting a large power plant in Hackensack, N. J., to supply electricity for operating the railway, but as yet the location has not been decided upon.

HINSDALE, N. H.—A bill has been introduced to the State Legislature by Representative E. B. Poke, of Hinsdale, N. H., asking for an amendment of the charter of the Connecticut River Power Company allowing it to build a second dam below the other, now nearly completed, across the Connecticut River at French King Rapids, near Hinsdale. The dam now under construction will develop about 15,000 hp, and the construction of the second dam would increase it to about 24,000 hp. The cost of the proposed dam is estimated at from $150,000 to $200,000.

MILFORD, N. H.—The town officials are considering the question of operating the pumps in connection with the water-works system by electricity, instead of steam power, which it is estimated would save the town several hundred dollars a year and give the town an all-night electric service.

ROSWELL, N. M.—A petition signed by the business men of the town has been presented to the City Council asking the Council to call an election to vote on the proposition to issue bonds for the construction of a municipal electric light plant.

ADDISON, N. Y.—The Tuscarora Valley Traction Company has applied to the Public Service Commission, Second District, for permission to operate an electric railway between Addison, Woodhull and Jasper, a distance of 19 miles. E. C. Smith and W. E. Barron, of Addison, are interested in the enterprise.

BATAVIA, N. Y.—Plans are being prepared by Rudolph Hering and A. L. Webster, of New York, N. Y., consulting engineers, for the construction of the proposed sewerage disposal plant and pumping station for the city of Batavia, bids for which will soon be called. The equipment of the plant will include one 150-hp engine, a boiler of 150 hp, two motor-driven pumps, one additional pump with lower rating, and manholes, castings, etc. The cost of the plant is estimated at $150,000.

BERGEN, N. Y.—Plans have been completed for the construction of the municipal electric light plant, for which bids will soon be asked.

BINGHAMTON, N. Y.—Mayor Clarence M. Slauson, in his annual message, recommends placing all overhead wires in the city undergrounnd.

HEMPSTEAD, N. Y.—The Public Service Commission, Second District, has approved of the franchise granted to the Nassau Light & Power Company by the village of Hempstead, extending the franchise of the company from Jan. 1, 1907, to Jan. 1, 1927.

HUDSON, N. Y.—The Albany & Hudson Railroad Company has placed an order with the General Electric Company, Schenectady, N. Y., for a 1500-kw steam turbine.

LONG ISLAND CITY, N. Y.—Plans are being made by the Long Island Railroad Company for extensive improvements and extensions to its system during the coming year, which will include equipping the railroad from Ozone Park to the entrance of the tunnel at Long Island City and the railway from Jamaica to Sunnyside yard to be operated by electricity. While the North Shore Division is to be equipped to be operated by electric power, eventually, it is not expected that work will commence on that part of the work before 1910. The railway to Long Beach will be changed from steam to electricity after the more important work is completed.

NEW YORK, N. Y.—It is said that plans of the New York Edison Company for the construction of a central-power station at 201st Street, New York City, will soon materialize. The proposed plant will have an output of about 20,000 hp, which will include 30 boilers of 600 hp each. It is stated that the company proposes to follow the layout of the new addition to the Waterside station, which was completed about a year ago.

NEW YORK, N. Y.—Bids will be received by John W. Brannan, president of the board of trustees, Bellevue and Allied Hospitals, Twenty-sixth Street and First Avenue, New York, N. Y., until Feb. 16, for furnishing and setting lighting fixtures in training school for women nurses of Bellevue and Allied Hospitals. Blank forms may be obtained at the office of the contract clerk, 419 East Twenty-sixth Street, New York, N. Y., where bids and deposits are to be delivered.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is said to have placed orders with the Westinghouse Electric & Manufacturing Company for three new 1000-kw, 60,000-volt, stepdown transformers to be placed in Station No. 33 in Elmwood Avenue. These transformers will be used to reduce the voltage from Niagara Falls from 66,000 to 550 to be transmitted by underground cable to operate the street car lines in the city. The station already has an output of about 6000 kw.

ROCHESTER, N. Y.—Plans and specifications for the new factory building of L. Adler Brothers Company, of Rochester, N. Y., are being prepared by Charles A. Alexander, Builders' Exchange, Rochester, N. Y., consulting engineer. The equipment of the plant will include four boiler units with a total rating of 800 hp, two 150-hp automatic engines and two 100-kw generators direct connected, boiler feed and circulating pumps, motors, blowers and other accessories. The company has awarded a contract to the Ferro-Concrete Construction Company for the construction of its factory building.

SYRACUSE, N. Y.—The Rochester, Syracuse & Eastern Railroad Company has decided upon the route for its proposed extension to Rochester, work on construction of which will begin as soon as the weather will permit. The railway will be 25 miles in length and will extend from Port Byron via Weedsport, Jordan, Memphis and Warner. C. D. Beebe is president.

SYRACUSE, N. Y.—The Central City Refrigerating Company is erecting a large cold storage and electric plant at West Fayette and West Streets, Syracuse. Bids will be received by R. S. M. Mitchell, Kirk Building, Syracuse, N. Y., consulting engineer, for the following equipment. Four gas producer units, with a rating of 250 hp each; two 150-kw generators for direct connection to generators, two 100-kw generators, direct connected type; two 200-ton direct motor driven vertical single-acting refrigerating machines; one circular or spiral conveyor; seven freight and one passenger elevators and motor driven ventilating apparatus.

VALLEY FALLS, N. Y.—The village Trustees are considering the question of replacing the present street lamps with electric lamps. It is proposed to secure electricity from the General Electric Company.

COLUMBUS, OHIO.—Plans are being made by the Findlay-Marion Railway & Light Company to commence work on its proposed electric railway in April, which is to connect Findlay, Mount Blanchard, Forest, Marseilles, Meeker and Marion, a distance of 46 miles. The company expects to purchase 12 cars and has already placed a contract for electricity for operating the railway. G. W. Meeker, of Columbus, Ohio, is secretary and treasurer.

COLUMBUS, OHIO.—The City Council now has before it an ordinance making a maximum rate of 5 cents per kw-hour for electricity for commercial lighting. The committee on gas and electric lighting has postponed action on the ordinance until officers of the local company have an opportunity to consider the matter. General Manager E. K. Stewart stated that the company would be willing to make a reduction of 20 per cent from the maximum rate of 8 cents per kw-hour if bills were paid by a certain date. This would make the rate 6.4 cents for those cases, and it is believed the company would be willing to compromise on 6 cents rather than to enter into litigation, such as resulted when the City Council endeavored to establish a 5-cent rate. The courts decided in favor of the company at that time.

CUYAHOGA FALLS, OHIO.—The installation of a new boiler and fire room outfit for the municipal electric light plant is under consideration. C. D. Crumb is city clerk.

RICHWOOD, OHIO.—The York Telephone Company, of York, Ohio, contemplates the construction of a trunk telephone line from Byhalia to York, Raymond, Liberty and West Mansfield, a distance of about 30 miles.

KENMORE, OHIO.—The Village Council has granted a franchise to the Turkeyfoot Traction Company to extend its railway into the village.

SOMERSET, OHIO.—The City Council has granted a franchise to the Independent Telephone Company to operate its system in Somerset. The Independent company has taken over the plant of the Union Telephone Company, of Glouster, and will greatly improve and extend the system during the coming summer.

TIFFIN, OHIO.—In the report of J. W. Harbaugh, receiver of the Consolidated Gas & Light Company, submitted to Judge R. W. Taylor, of the Federal Court, he recommends that the electric plant be sold and the gas plant operated separately. According to the report the electric plant is bonded for $50,000 and the gas plant for $125,000, of which $103,500 are still outstanding. Mr. Harbaugh also states that the electric plant is in bad condition and will require an expenditure of $15,000 to replace worn out equipment.

TOLEDO, OHIO.—The armature of one of the 3000-kw steam turbines in the power plant of the Toledo Railways & Light Company was recently burned out.

TOLEDO, OHIO.—Announcement has been made by the Ohio & Michigan Southern Railroad Company that it proposes to construct an electric railway from Toledo to Ann Arbor and an extension from Petersburg to Jackson. Trains are in operation from Toledo, Ohio, to Petersburg, and grading has been finished from Petersburg to Ann Arbor. The company expects to build the section from Petersburg to Jackson as soon as the weather permits. W. E. Niles, 122 Monroe Street, Chicago, Ill., is secretary.

YELLOW SPRINGS, OHIO.—The City Council is considering the question of improving the street lighting system.

ANADARKO, OKLA.—The citizens have voted to issue $14,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant.

HOBART, OKLA.—It is reported that the Hobart Water Power Company, recently incorporated, is planning to construct a hydro-electric plant with an output of 7500 hp to furnish electricity to operate the proposed Hobart Interurban Railway, and for lamps and motors along the route of the railway. Plans will be completed in about 90 days and construction work, it is said, will begin about April 15. C. T. Blake is president.

MUSKOGEE, OKLA.—Plans are being made by the Pioneer Telephone & Telegraph Company to improve and extend its local telephone system, which will involve an expenditure of about $100,000.

OKLAHOMA CITY, OKLA.—The Oklahoma Railway Company is in the market for coal and ash-handling apparatus for its power plant.

POND CREEK, OKLA.—The city has purchased the electric plant recently installed by Mathis & Company, which was recently sold at a sheriff's sale. The city will complete the system, securing power from the pumping station east of the river. The plant will be operated by the municipality.

EUGENE, ORE.—The Lane County Commissioners have granted the Lane County Asset Company a franchise to construct an electric railway over the county roads from Eugene to Florence on the Lane County coast. Vern Hamilton, P. J. Dunn, C. H. Fisher and [illegible] are interested in the project.

HOOD RIVER, ORE.—An election will be held March [illegible] to vote on the proposition to issue $[illegible] in bonds for the construction of a light plant and water works system.

NEWBERG, ORE.—The Yamhill Electric Company contemplates installing two new boilers in its plant. C. J. Edwards is president and manager.

PORTLAND, ORE.—We are informed that the Portland Water Power & Electric Company will let contracts for water wheels, generators and

all electrical equipment and steel penstock in connection with its proposed plant to be erected on Clackamas River, near Estacada. George I. Brown, Chamber of Commerce Building, Portland, Ore., is engineer.

WATERLOO, ORE.—J. B. Lothwaite has acquired water rights on the South Santiam River and will erect a power plant at Waterloo six miles from Lebanon to furnish electricity to operate the paper mill there.

JOHNSTOWN, PA.—The Johnstown & Gallitzin Railway Company is ready to receive bids for material to be used in the construction of its proposed electric interurban railway from Johnstown to Gallitzin. About 36 miles of single track will be built, and will include special track work, wooden poles, overhead construction, catenary form being considered for the stretches between incorporated towns, the road being entirely on private right of way except through small towns. Also for equipment for steam power plant to include two generating units of 750 kw each to generate electricity at 13,000 volts. One substation will be located at the power station, and an additional substation at each end of the line. Electricity will be transformed to 600 volts, direct current, as the company proposes to operate cars for a distance of 2¼ miles over the Johnstown Passenger Railway Company's tracks.

MEDIA, PA.—The Philadelphia & West Chester Traction Company has applied to the City Council for a franchise for a right of way over several streets in this city. It is said that the company intends to make Media a terminus of a railway running from State Street, across the townships of Nether Providence, Marple, Springfield and Upper Darby and make connections with the elevated road in Philadelphia. It is also stated that the company proposes to extend the railway westward through Media, Lima and Gradyville, connecting with the main line on the West Chester Pike in Edgmont.

PHILADELPHIA, PA.—The Western Union Telegraph Company has decided to place its wires underground on Samson Street from Sixth to Sixteenth Street.

PHILADELPHIA, PA.—The contract for the electrical equipment and power plant in the William Penn Theatre at Lancaster and Fairmount Avenues has been awarded to Joseph S. Miller & Company, of Philadelphia.

PITTSBURG, PA.—The Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., has been awarded the contract for furnishing a 5000-kw generator for the Brunos Island power plant of the Pittsburg Railways Company. The contract for furnishing and installing all steam and exhaust piping in connection with this generator has been awarded to the Pittsburg Valve, Foundry & Construction Company, of Pittsburg, Pa.

READING, PA.—Application has been made to the City Council by the Penn Electric Company for a franchise to construct underground conduits and erect overhead transmission lines for the distribution of electricity for lamps in the city.

READING, PA.—The Reading Edison Company has applied to the City Council for a franchise to construct and operate an electric light plant. Should the franchise be granted the company agrees to turn the entire plant over to the city at its option at any time after 1920 at a price to be agreed upon between the two parties.

WESTERLY, R. I.—The Westerly Light & Power Company will soon commence work on the erection of its transmission lines from Westerly to Potter Hill and Ashaway to furnish electricity for lamps and motors.

EASLEY, S. C.—Plans are being considered for the installation of electrical equipment in the Easley Oil Mills to supply electricity for about 1000 incandescent and 15 arc lamps. For further information, address P. Camp Johnson, superintendent.

HURON, S. D.—The City Council has granted a franchise to F. H. Kent, C. T. Koepp, William Waibel and others to construct and operate a telephone system in Huron.

ROCKFORD, TENN.—The Rockford Cotton Mills, of which Ernest Koella, 2326 Highland Avenue, Knoxville, Tenn., is manager, is making arrangements to rebuild the electric plant, recently destroyed by fire. The plant will be operated by water power and will furnish electricity to light the mill and town.

ORANGE, TEX.—The Southwestern Telegraph & Telephone Company contemplates an expenditure of from $12,000 to $15,000 for improvements to its local system. J. E. Farnsworth, of Dallas, Tex., is vice-president and general manager.

SALT LAKE CITY, UTAH.—The City Council has authorized the Board of Public Works to advertise for bids for the construction of the west side conduit, to extend from Fourth West Street to the Jordan River.

FREDERICKSBURG, VA.—The Electric Generating Company and the Fredericksburg Electric Company have applied to the City Council for a franchise to distribute electricity within the city limits. The first named company proposes to sell electrical energy in large quantities only, and the last named company to supply electricity for lamps and motors to the general public.

MEHERRIN, VA.—Arrangements are being made by the Lunenburg Telephone Company for improvements to its central offices and to construct two or three extensions to its lines.

HIGHLAND PARK (P. O. RICHMOND), VA.—The town of Highland Park is open for bids for a 25-year charter to furnish electricity for lamps. For further information address W. P. Redd, mayor.

ABERDEEN, WASH.—Plans are being made by the property owners on Market and Webster streets to install an ornamental system of electric lamps similar to the ones now in use on Huron Street.

DAYTON, WASH.—The City Council is considering the proposition to purchase the plant and holdings of the Dayton Electric Company, to be operated by the municipality at a cost of $75,000. The Dayton ice plant is to be included in the purchase.

EDMONDS, WASH.—The plant of the Edmonds Electric Light & Power Company is nearly completed and is now furnishing electricity for lighting the streets of the town. The company will soon be ready to furnish residential lighting and for motors for local industries.

NORTH YAKIMA, WASH.—The Yakima Valley Power Company is erecting a 66,000-volt transmission line between North Yakima and Kennewick, 90 miles in length, and expects to increase the output of its plant in North Yakima by 4,000-hp. The company will furnish electricity in Wapato, Granger, Sunnyside, Grandview, Mabton, Kiona and Kennewick. G. C. Arrowsmith is general superintendent.

PULLMAN, WASH.—Several parties are installing electric light plants operated by a gasoline engine. B. F. Campbell is now installing one, and several others contemplate installing plants.

TUKWILA, WASH.—The International Contract Company, of Seattle, Wash., contemplates furnishing this town with electricity for lamps.

CHARLESTOWN, W. VA.—The Winchester & Washington City Railway Company has applied to the County Court of Jefferson County for permission to erect transmission lines along the public road from Charlestown to Shenandoah Junction, thence to Bardane and Kearneysville.

FAIRMOUNT, W. VA.—The Independent Light & Power Company has applied to the City Council for a franchise to operate in Fairmount. If granted a franchise the company agrees to have the plant in operation within 17 months after the franchise is granted.

FOLLANSBEE, W. VA.—Plans are being considered by the Citizens' Water & Light Company to install a water works system, for which application will soon be made to the City Council for a franchise to operate the same. Charles Crawford, of Follansbee, is president.

APPLETON, WIS.—It is reported that the Wisconsin Telephone Company contemplates rebuilding the local exchange at a cost of $75,000.

CHIPPEWA FALLS, WIS.—The Chippewa & Flambeau Improvement Company, recently organized, has applied to the State Legislature asking for power to contract, acquire and operate a system of water reservoirs and dams on the principal streams of northwestern Wisconsin.

ELLSWORTH, WIS.—The Pierce County Telephone Company has filed an amendment to its charter increasing its capital stock from $50,000 to $100,000.

LA CROSSE, WIS.—The La Crosse Toll Line Company, it is said, contemplates the construction of a toll line from La Crosse to Viroqua. The company is capitalized at $40,000.

LA CROSSE, WIS.—Owing to the refusal of the City Council of Winona to grant a 50-year franchise, the La Crosse Water Power Company, which controls the Winona Railway & Light Company, has announced that it will not build an interurban railway from Winona to Lanesboro, Rushford and other southern Minnesota cities.

MILWAUKEE, WIS.—The Wisconsin Telephone Company has purchased the plant and holdings of the Walworth County Independent Telephone Company, which was recently placed in the hands of a receiver.

MILWAUKEE, WIS.—Extensive improvements have been outlined by the Wisconsin Telephone Company to its system in this State, which will involve an expenditure of about $1,000,000. The company has recently purchased the plants and holdings of the Northwestern Telephone Company and the Douglass County Telephone Company.

MONROE, WIS.—The Monroe Telephone Company is planning to make improvements to its system.

THERMOPOLIS, WYO.—The Hot Springs Light & Power Company is contemplating extending its transmission lines from Thermopolis to Anchor. M. W. Thompson is manager.

LETHBRIDGE, ALB., CAN.—Bids will be received until March 1 by George W. Robinson, secretary and treasurer, for the construction of a municipal electric power plant in Lethbridge, including boilers and accessories, economizer, feed pumps, mechanical draft, pipe work and valves, steam-driven generator, tubro-generator, re-erection of steam engines, condensing sets, crane, switchboards, etc., motor generators, transformers, building steel work, etc. Plans and specifications can be seen at the office of Smith, Kerry & Chace, Confederation Life Building, Toronto, Ont., consulting engineers, and at the Carnegie Public Library Building, Winnipeg, Man. A deposit of $10 will be required for use of plans and specifications, which will be returned when contracts are awarded.

NEW WESTMINSTER, B. C., CAN.—Plans are being prepared by the British Columbia Electric Railway Company to construct a tramway from Westminster Junction to Coquitlam Lake, a distance of about seven miles.

WINNIPEG, MAN., CAN.—Bids will be received by the chairman of the Board of Control, Winnipeg, Man., Can., until March 2 for the supply of insulators and material for the erection of a telephone line between Point du Bois and Winnipeg; the erection of a transmission line between Point du Bois and Winnipeg, and supply of certain repair-shop equipment. Individual bids will also be received as follows: For insulators; telephone line; erection of transmission line; repair-shop equip-

ment. As a further alternative bidders may include or group the bids for furnishing the telephone line and erection of transmission line. Copies of instruction to bidders and form of tender may be obtained at the office of the power engineer, Carnegie Library Building, Winnipeg, Man., Can. Plans and specifications may be seen at the office of Smith, Kerry & Chace, Confederation Life Building, Toronto, Ont., Can., consulting engineers. M. Peterson is secretary.

CAMPBELLFORD, ONT., CAN.—The Seymour Power & Electric Company is making arrangements for the construction of a power house at Seymour, Ont. The power plant will have an output of 4000 hp when completed. Contracts have already been placed for the more important machinery. Smith, Kerry & Chace, Toronto, Ont., are engineers in charge of the construction work of the plant.

TORONTO, ONT., CAN.—The People's Railway Company is planning to commence work on the construction of its proposed electric railway in April. The railway will be 88 miles in length and will connect Stratford, Berlin, Guelph and Woodstock. Electricity for operating the road will be purchased from the Hydro-Electric Commission. The company will be capitalized at $1,000,000. Among the provisional directors are: N. R. Bugg, Bright, Ont.; W. A. Bugg, Joseph McNeil, A. N. Warfield and J. H. Wood, of Toronto, Ont. R. T. Gough, of Toronto, chief engineer.

ACAYUCAN, MEX.—The water fall of Salto de Huasuntian, situated near the Town of Acayucan, State of Vera Cruz, is to be utilized for generating electric power. Jose Castellot is at the head of a company which is arranging to install a hydro-electric plant at that point.

AGUASCALIENTES, MEX.—The Cia. De Luz Fuerza Electricas De Aguascalientes, S. A., is contemplating the installation of two Deisel oil engines with a rating of 250 and 500 hp. C. P. Doerr is manager.

SAN ISIDRO, MEX.—Salvador Echegaray is at the head of a syndicate of Mexicans who have taken steps to erect a hydro-electric plant on the Lerma River in the State of Michoacan, near the hacienda San Isidro.

SAN JUAN DEL RIO, MEX.—The Compania de Luz y Fuerza Motriz, of San Juan del Rio, State of Queretaro, will install a hydro-electric plant on the San Juan River. The company has obtained a concession from the Federal Government for the proposed enterprise.

TECAMACHALCO, MEX.—A new electric light and power plant is being erected at Tecamachalco, State of Puebla, by Jesus G. Ruinard and associates.

TORREON, MEX.—The new electric plant of the Torreon a' Lerdo Electric Light & Power Company is nearly completed and will soon be put in operation. The company proposes to furnish electricity for lamps and motors in Lerdo, Gomez, Palacio and Torreon.

VILLA CORONA, MEX.—David John Pullinger, of Villa Corona, State of Durango, has taken steps to install a hydro-electric plant on La Presa River.

Company Elections.

SIOUX CITY, IA.—At the annual meeting of the Sioux City & Spirit Lake Interurban Company the following officers were elected: Frank Patch, president; William H. Beck, vice-president; Fred Davis, secretary; T. A. Black, treasurer, and J. D. Browning, general manager.

AUGUSTA, MAINE.—At the annual meeting of the Kennebec Light & Heat Company the following-named officers were elected: George F. West, of Portland, Maine, president; Samuel C. Manley, of Augusta, Maine, treasurer and clerk, and William H. Williams, of Augusta, Maine, superintendent.

AMHERST, MASS.—At the annual meeting of the Connecticut River Power Company the following-named officers were elected: C. Fred Deuel, president; Philip Cabot, treasurer, and C. W. Hazelton, of Turners Falls, Mass., clerk. The board of directors includes the above officers and Henry F. Thompson, of Boston, Mass.; J. D. Marsh and M. A. Dickinson, both of Amherst, Mass.

GREENFIELD, MASS.—At the annual meeting of the Greenfield Electric Light & Power Company the following directors were elected: J. W. Stevens, F. O. Wells, C. C. Dyer, W. B. Allen, Philip Cabot and Winthrop Coffin, of Boston, Mass., and J. G. MacIntosh, of Holyoke, Mass. The directors elected G. W. Lawrence, treasurer, and C. H. Keith, clerk.

WESTFIELD, MASS.—At the annual meeting of the Westfield Power Company the following-named officers were elected: M. B. Whitney, president; Sumner B. Campbell, clerk and treasurer, and George Dunbar, superintendent.

ST. LOUIS, MO.—The United Railways Company at its annual meeting re-elected the old directors with the exception of Charles D. Smithers and George R. Sheldon, whose places were filled by A. D. Brown and D. R. Francis, both of St. Louis, Mo.

SODUS, N. Y.—At the annual meeting of the Sodus Gas & Electric Light Company the following-named officers were elected: C. W. Mills, president, Thomas H. Munro, of Camillus, N. Y., vice-president, A. L. Larkin, of Syracuse, N. Y., treasurer, and G. R. Mills, secretary and general manager.

PHILADELPHIA, PA.—At the annual meeting of the American Gas & Electric Company the old board of directors was elected with the exception of R. T. Paine. W. J. Hanson was elected to succeed Mr. Paine.

SHAMOKIN, PA.—At the annual meeting of the Shamokin & Coal Township Light Company the following-named directors were elected: E. M. Leader, K. C. McWilliams, F. P. Llewellyn, M. G. Stief, J. W. Gillespie, M. C. Farrow, S. L. Sowres, Warren Unger, H. S. Zimmerman, C. C. Leader, George C. Greaber, John Mullen and W. C. McConnell. The directors elected the following officers: E. M. Leader, president; K. C. McWilliams, vice-president; F. P. Llewellyn, secretary and treasurer.

PROVIDENCE, R. I.—At the annual meeting of the Narragansett Electric Light Company the following named officers were elected: Arthur L. Kelly, president; Arthur H. Watson, vice-president; Edwin A. Barrows, secretary and treasurer; Arthur B. Lisle, general manager; William C. Woodward, electrical engineer, and Wesley T. Oviatt, general superintendent.

New Industrial Companies.

THE FAYETTE ELECTRICAL COMPANY, of Boise, Idaho, has been incorporated, with a capital stock of $50,000, by R. C. Carter, Jesse Hawley and Charles W. Mack.

THE SCENIC ELECTRIC MANUFACTURING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, by William B. Ribbett and others.

THE ELECTRICAL SALES COMPANY, of Jersey City, N. J., has been incorporated, with a capital stock of $2,000, by Harold B. Elgar, Walter Cook, Jr., and Albert C. Wall, of Jersey City, N. J.

THE STANDARD IGNITION COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $2,500, by F. J. Casey, George L. Fish and A. A. McClanahan. The company proposes to manufacture electrical devices.

THE BUTLER ELECTRIC EQUIPMENT COMPANY, of Hamilton, Ohio, has been incorporated, with a capital stock of $10,000, by Paul M. Hooven, G. G. Schoenberger, Bert Seevers, Vincent J. Bramlage and A. P. Darrow.

THE LUDWIG-KAWIN COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $2,500, by George R. Ludwig, Charles C. Kawin and Charles Goetz. The company proposes to carry on a business as chemists and engineers.

THE TRACTION DEVELOPMENT CORPORATION, of Jersey City, N. J., has filed articles of incorporation with the Secretary of State, with a capital stock of $100,000. The incorporators are H. O. Coughlan, B. S. Mantz and John R. Turner.

THE WATER POWER DEVELOPMENT COMPANY, of Boston, Mass., has been chartered, with a capital stock of $50,000, for the purpose of dealing in water power devices of all kinds. R. F. Berry, of Boston, Mass., is president and treasurer.

CRUISE & COMPANY, of Elizabeth, N. J., has filed articles with the Secretary of State, with a capital stock of $50,000, to manufacture boilers and tubes. The incorporators are Alex Cruise, Frederick Sommer and Martin F. Kennely, all of Elizabeth, N. J.

LEVETT MANUFACTURING COMPANY, of Matawan, N. J., has been chartered, with a capital stock of $300,000, to manufacture electric dynamos, motors, batteries and electric appliances, by Roderic Wellmann, J. Cotter and S. Likely, all of Matawan, N. J.

THE BAY RIDGE CHANDELIER COMPANY, of Brooklyn, N. Y., has been chartered, with a capital stock of $2,000, by Joseph and Ella Moskowitz Morris and R. Popkin, all of Brooklyn, N. Y. The company proposes to manufacture and deal in gas and electric fixtures.

THE FRUITTICHER ELECTRICAL COMPANY, of Birmingham, Ala., has been incorporated, with a capital stock of $10,000, and the following-named officers: W. H. Fruitticher, president; George A. Leath, vice-president, and E. W. Fruitticher, secretary and treasurer.

THE VALLEY BOAT & ENGINE COMPANY, of Baldwinsville, N. Y., has been incorporated, with a capital stock of $20,000, to manufacture gasoline motors, engines, electric motors, etc., by Dwight S. Simpson, Rees H. Hubbell, Josiah Tallmadge, of Baldwinsville, N. Y.

THE WATERTOWN AUXILIARY FIRE-ALARM COMPANY, of Watertown, N. Y., has been incorporated, with a capital stock of $10,000, to construct fire-alarm systems. The incorporators are John I. Mange, Warren J. Green and Sanford J. Magee, all of Watertown, N. Y.

THE LOXIT MOTOR-LOCK COMPANY, of North Tonawanda, N. Y., has been chartered, with a capital stock of $[illegible], by Samuel J. Elliott and George W. Fowler, all of North Tonawanda, N. Y.

HARRY E. GRAFF, INC., of New York, N. Y., has been chartered, with a capital stock of $[illegible], by [illegible], of New York, N. Y.

THE PEEKSKILL ENGINEERING COMPANY, of Peekskill, N. Y., has been chartered, with a capital stock of $[illegible], by Hepoch, Malcolm F. Lent and William H. Lent, all of Peekskill, N. Y.

THE WEAVER ELECTRIC COMPANY, of [illegible] City, Texas, has been chartered, with a capital stock of $[illegible], by [illegible] and John R. Weaver, of [illegible].

THE STANDARD FLORETTO COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $6,000. The incorporators are Patrick H. McNulty, Jacob M. Kraft and Charles M. Hemmway, all of New York, N. Y. The company proposes to deal in gas and electric fixtures.

THE VERNON MOTOR COMPANY, of Vernon, N. J., has filed articles of incorporation, with a capital stock of $25,000, for the purpose of manufacturing gasoline, electric and other types of motors, automobiles, etc. The incorporators are William H. Carey, Charles J. Gormley, John H. Patterson, all of Jersey City, N. J.

THE ADVERTISING MIRRORGRAPH COMPANY, of Brooklyn, N. Y., has filed articles of incorporation, with a capital stock of $28,000, for the purpose of doing general electrical work, manufacturing signs, mechanical displays, etc. The incorporators are C. K. Allen, E. L. Hopkins, C. J. Hermance, of New York, N. Y.

THE ELECTRIC-AIR DRILL COMPANY, of Camden, N. J., has filed articles of incorporation, with a capital stock of $200,000, to manufacture compressed-air tools, drills and other compressed-air machinery. The incorporators are Charles H. Haesseler, Frank W. Chattin, Joseph V. Little, William J. MacFarland and John F. Joline, of Camden, N. J.

New Incorporations.

FALLS RIVER MILLS, CAL.—Articles of incorporation have been filed for the Lava Bed Power Company, with a capital stock of $2,000,000, and the following-named directors: R. Cadwallader, Roderick McArthur and Frank McArthur. The company proposes to develop the water power on Pitt River, near Fall River Mills, utilizing water from Fall River.

OAKLAND, CAL.—Articles of incorporation have been filed for the Central Oakland Light & Power Company, with a capital stock of $1,250,000. The directors are: A. M. Hunt, of Berkeley, Cal.; James Fisher, of Berkeley, Cal.; James K. Moffitt, of Oakland, Cal.; Mountford S. Wilson, M. D. Levinson, C. N. Beal and F. G. Cartwright, all of San Francisco, Cal.

WILMINGTON, DEL.—The Beacon Lighting Company has been incorporated, with a capital stock of $200,000, by E. L. Squire, G. W. Dorsey, Jr., and Albert Biro, of Wilmington, Del.

ATLANTA, GA.—Application has been made for a charter for the Empire Electric Company, with a capital stock of $1,000, by G. G. and J. T. Rucker, H. H. Colquitt and J. T. Warner.

HONOLULU, HAWAII.—The Pearl Harbor Traction Company has applied for a charter with a capital stock of $100,000. The company is a subsidiary of the Honolulu Rapid Transit Company and has been formed to extend the railway system of the traction company to the naval station at Pauloa, Pearl Harbor. The officers of the company are: L. Tenney Peck, president; Alfred L. Castle, secretary, and Charles H. Atherton, treasurer.

BOISE, IDAHO.—Articles of incorporation have been filed for the Idaho Southern Railroad Company, with a capital stock of $2,000,000. The company proposes to take over the interests of the North Side Railroad line, which is constructing an electric railway on the Twin Falls tract. It is expected that the railway will be extended to Boise in the near future.

NEWCASTLE, IND.—The Newcastle Union Railway Company has been organized, with a capital stock of $50,000, to construct an electric railway between Newcastle, Sulphur Springs, Honey Creek and Middletown. A local system will be built in Newcastle, and at Middletown connections will be made with the Union Traction Company's system. The officers are: Thomas B. Milikan, president; Charles W. Mouch, vice-president, and Albert D. Ogborn, secretary.

FARMINGTON, KY.—The Farmington Telephone Company has been chartered, with a capital stock of $5,000, by J. C. Skelton, J. J. Trumbo and D. C. Turner.

LITTLE CYPRESS, KY.—The Little Cypress Telephone Company has been incorporated, with a capital stock of $2,000, by E. R. Goodloe, R. L. Holland and R. M. Jones.

HOUGHTON, MICH.—The Northern Michigan Power Company has been chartered with a capital stock of $50,000 by D. L. Robinson and others. The company proposes to dam the Sturgeon River, the power to be utilized to generate electricity which will be transmited to Baraga, Houghton, Ontonagon, Marquette, Dickinson, Iron and Gogebic Counties. The company also proposes to furnish water power.

MANISTEE, MICH.—The Manistee County Electric Company has been chartered to develop the water power on Manistee River, about 18 miles from Manistee. The officers are: E. N. Salling, president; R. W. Smith, vice-president; Clyde J. Holmes, secretary and treasurer.

NORTHVILLE, MICH.—The Inter-County Telephone Company has been incorporated with a capital stock of $5,000 by Clement C. Yerkes, Louis A. Babbitt, Robert C. Yerkes and Frank Thompson.

FERGUS FALLS, MINN.—The Edwards Telephone Company has been incorporated to construct a telephone system north of this city. E. W. Leeper is secretary and treasurer.

GRANGER, MINN.—A new telephone company has been organized under the name of the North Branch of the Granger Telephone System and the following named officers elected: A. N. Brant, president, and W. Henry, secretary.

[illegible] Telephone Company has been incorporated, with a capital stock of $5,000, by C. O. Anderson, A. J. Levander, W. H. Eastman, H. E. Sherracks, H. C. Kracher, John Allquist and Sanford C. Broadbent, all of Sanford.

CHARLESTON, MISS.—The Charleston Electric Light & Power Company has been organized with a capital stock of $[illegible] for the purpose of installing an electric light plant in Charleston. The cost of the plant is estimated at about $[illegible]. It is proposed to secure electricity for operating the plant from the mill

LITTLETON, N. H.—The Littleton Telephone Company has been organized and has filed a certificate of incorporation, with a capital stock of $5,000. The officers of the company are: George A. Edson, president; Frank P. Bond, vice-president, and I. N. Lunderville, secretary.

WATERTOWN, N. Y.—The Black River Power Association of Watertown has been incorporated, with a capital stock of $5,000. The directors are: David M. Anderson, Foster P. Rhines, Wooster O. Ball, Elon R. Brown, all of Watertown, N. Y.; C. H. P. Gould, of Lyon Falls, N. Y.; James P. Lewis, of Beaver Falls, N. Y., and James A. Outterson, of Carthage, N. Y.

WATERTOWN, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Deer River Power Company by Stephen R. Cleveland, L. B. Cleveland and George H. Cobb, of Watertown, N. Y. The company is capitalized at $50,000, and proposes to generate electricity for lamps, heat and motors.

COOLEEMEE, N. C.—Articles of incorporation have been filed for the Cooleemee Telephone Company, with a capital stock of $10,000, by J. M. Ledford, J. A. J. Rice and others.

GRAND FORKS, N. D.—The Grand Forks Street Railway Company has been formed, with a capital stock of $250,000, and the following-named officers: R. B. Griffith, president; J. D. Bacon, vice-president; O. A. Webster, secretary, and D. H. Beecher, treasurer, all of Grand Forks, N. D. The company, it is said, contemplates the purchase of the railway owned by the Grand Forks Transit Company, which extends from the center of the city to the State University.

INKSTER, N. D.—The Parker Telephone Company has been incorporated, with a capital stock of $50,000, by M. L. Dryburgh, Angus Johnson, of Medford, N. D., and J. R. Barry, of Inkster, N. D.

CLEVELAND, OHIO.—The Lannert Electric Company has been incorporated, with a capital stock of $3,000, by J. A. Lannert, M. Lannert, E. H. Dill, J. F. Thompson and R. V. Dill.

CACHE, OKLA.—Articles of incorporation have been filed for the Washita Valley Telephone Company, with a capital stock of $2,000. The directors are: W. K. Miller, N. E. Lake and C. E. Hankall, all of Cache.

OKLAHOMA CITY, OKLA.—The Hodge-Scott Electric Company has been incorporated, with a capital stock of $3,000, by D. L. Hodge and D. L. Scott, of Oklahoma City, and D. A. Scott, of Hobart, Okla.

RUSK, OKLA.—The Rusk Telephone Company has been chartered, with a capital stock of $10,000, by J. A. Carver, W. T. Ruby, G. W. Rankin and others.

WOODWARD, OKLA.—The Pleasant Hill Farmers' Mutual Telephone Company has been incorporated by George W. Tannahill and Flay Tibbetts, both of Curtis, Okla.

OREGON CITY, ORE.—The Clackamas Power & Irrigation Company has filed articles of incorporation, with a capital stock of $15,000. The company proposes to construct and operate water systems, reservoirs, etc., to supply water for public, agriculture, mining purposes, etc.; also to establish and operate electrical systems. The incorporators are Bruce C. Curry, H. W. Hagerman, Adrian McCalman, Joseph G. Mumpower and Louise Follansbee.

PORTLAND, ORE.—The Portland, Baker City & Butte Electric Railroad Company has filed articles of incorporation with a capital stock of $2,000,000 for the purpose of constructing an electric railway from Portland to Baker City, across Idaho and Montana to Butte.

READING, PA.—The Inter-City Electric Railway Company has been organized, with a capital stock of $500,000, to construct an electric railway from Reading to Allentown, via Lyons and Tipton, 35 miles in length. The officers are: Maxwell H. Bochow, president; Josiah Fisher, secretary, and Bateman Saddington, treasurer.

PORT LAVACA, TEX.—The Port Lavaca Telephone Company has been incorporated, with a capital stock of $20,000, by W. C. Best, H. C. Innis and Willett Wilson.

TRIMBLE, TEX.—Articles of incorporation have been filed with the Secretary of State for the Trimble Telephone Company by R. V. Thomas, J. M. McKennon, T. A. Pierce, R. O. Fisher and J. H. Green.

FREDERICKSBURG, VA.—The Electric Generating Company has been chartered, with a capital stock of $100,000, for the purpose of selling electricity at its own switchboard in large quantities only. The officers of the company are: E. J. Smith, president; Alvin T. Embrey, secretary and treasurer.

FRONT ROYAL, VA.—The Liberty Corner Mutual Telephone Company has been incorporated, with a capital stock of $5,000 and the following named officers: R. J. Stokes, president; John Derflinger, vice-president, and C. E. Brown, secretary.

CHEHALIS, WASH.—The Twin City Light & Power Company has been incorporated, with a capital stock of $400,000, for the purpose of constructing an electric railway in and between Chehalis and Centralia, also to furnish electricity for lamps and motors. The new company, it is said,

has taken over the electric lighting plants in the two cities. The directors are: H. C. Coffman, of Chehalis, Wash.; Theodore, Hess, of Centralia, Wash.; A. Welch. E. W. Hull and E. W. Harding, of Portland, Ore.

APPLETON, WIS.—Articles of incorporation have been filed for the Wolf River Improvement Company by Frank J. Sensenbrenner, of Neenah, Wis.; John M. Baer, of Appleton, Wis., and William Van Nortwick, of Appleton, Wis. The company has been organized to conserve the flood waters of the Wolf River and thus furnish the Fox and Wolf Rivers with a normal flow of water the year around. It is proposed to construct a large reservoir, dams, etc., on the upper Wolf River in Langlade County, covering about 12 miles.

BARNEVELD, WIS.—The Barneveld & Hollanddale Telephone Company has been chartered, with a capital stock of $1,250, by O. L. Theobald and others.

Personal.

MR. MORRIS W. STROUD, president of the American Gas Company, of Philadelphia, Pa., has been elected a director of the American Railways Company, of Philadelphia, Pa.

MR. ARTHUR V. WAINWRIGHT, formerly with the Mohawk Gas Company, of Schenectady, N. Y., has accepted a position with the Susquehanna Railway, Lighting & Power Company. Mr. Wainwright will have charge of extending and increasing the business of the company.

WATSON & BOYDEN.—Messrs. Robert Watson and J. Hanson Boyden have formed a partnership under the above name, at Washington, D. C., with offices in the National Union Building, for patent practice. Mr. Watson, who is well known in the electrical field, has been practicing as a solicitor and counsel for the past 15 years. Mr. Boyden was for five years a member of the U. S. Patent Office Examining Corps, and for several years has been with a leading patent law firm in Washington.

MR. DAVID S. HAWKINS has opened an office in the Rose Building, Cleveland, Ohio, and will make a specialty in co-operating with attorneys where expert engineering is required in the preparation and the prosecution of legal cases. Mr. Hawkins is a graduate of the Massachusetts Institute of Technology and has had 15 years of experience as draftsman, designer, estimator and engineer with the General Electric Company, Pennsylvania Railroad, Pope Motor Carriage Works, F. H. Richards (patent attorney), Pratt & Whitney Company, Westinghouse Electric & Manufacturing Company and the J. D. Smith Foundry Supply Company.

MR. GEORGE B. TRIPP has resigned as business manager of the Central Colorado Power Company and has been elected to the management of the following Colorado Springs properties, viz.: The Colorado Springs Electric Company, the Pike's Peak Hydro-Electric Company, the Colorado Springs Light & Power Company (gas) and the Empire Water & Power Company. The last named corporation has been formed to construct reservoirs, pipe lines and a power plant at Manitou, Col. These companies are all controlled by the Susquehanna Railway, Light & Power Company, of 40 Wall Street, New York, of which Mr. George Bullock is president. The former manager, Mr. E. P. Dillon, has resigned, to take up engineering work with companies controlled by the same interests.

Trade Publications.

IGNITION BATTERIES are described in a folder issued by the Western Electric Company, Chicago, Ill.

REAMERS.—The Cleveland Twist Drill Company, Cleveland, Ohio, has issued an attractive folder calling attention to its high-speed reamers.

CONDENSING MACHINERY.—Catalog No. 74 of the Dean Bros. Steam Pump Works, Indianapolis, Ind., gives much interesting and valuable data relating to air pumps and condensers of the jet and surface types.

REFLECTORS.—The January issue of *Holophane Illumination*, published by the Holophane Company, 227 Fulton Street, New York, contains much instructive information relating to prismatic reflectors for all purposes.

SINGLE-PHASE MOTORS.—The advantageous features of self-starting single-phase motors are well presented in Bulletin 83 of the Wagner Electric Manufacturing Company, St. Louis, Mo. The motors described are of the constant-speed and variable-speed types.

SECOND-HAND ELECTRICAL MACHINERY.—The February *Bargain Sheet* of the Gregory Electric Company, Chicago, Ill., contains a complete price list of used generators, motors, transformers, switchboards, watt-hour meters, etc. Special reductions are offered in direct-current generators.

ELECTRIC PUMP GOVERNORS for automatically controlling the operation of motor-driven air-compressors between predetermined minimum and maximum air pressures are well described and illustrated in Instruction Pamphlet T 5042 of the Westinghouse Traction Brake Company, Pittsburg, Pa.

PORCELAIN INSULATORS for high tension are well illustrated and briefly described in insulation catalog No. 2 of the Ohio Brass Company, Mansfield, Ohio. These insulators are designed for all electromotive forces up to 60,000 volts. Price lists are given of the insulators and various transmission line specialties, such as cross-arms, pins, clamps, bolts, anchors, etc.

Business Notes.

MR. C. D. WOOD, JR., has resigned as treasurer of the Electric Home Supply Company, and established offices at 136 Liberty Street, New York, to transact business as a jobber of electrical supplies.

EXCEL ELECTRIC HEATING COMPANY, which was formerly located at 54 Vesey Street, New York, has moved to extensive quarters at 237 Broadway, corner Park Place. It invites inspection of its stock of electric heating appliances at the new show rooms.

THE AMERICAN BLOWER COMPANY.—Announcement is made of the consolidation of the American Blower Company, of Detroit, and the Sirrocco Engineering Company, of New York, under the name of American Blower Company, with principal offices at Detroit, Mich.

DOSSERT & COMPANY, New York, have received an order from the Wilson-Maeulen Company, New York City, for 200 solderless connectors to be installed on electric pyrometers; also an order from the American Electrical Supply Company, of Chicago, for 450 two-ways and front lugs for use in the plant of the Buick Motor Company, Flint, Mich.

STANDARD ROLLER BEARING.—Announcement is made by the Standard Roller Bearing Company, Philadelphia, of the further expansion of its sales organization by the appointment of F. M. Germane, formerly sales manager, as assistant general manager of the company; T. J. Heller, as sales manager, and F. W. Lawrence, as Western representative, the latter with headquarters at Chicago.

THE BELDEN MANUFACTURING COMPANY, Chicago, Ill., has been appointed special agent for the Hope Webbing Company, of Providence, R. I. The company will have complete charge of the sales of electrical tapes, webbings and sleevings for the Hope Webbing Company in Illinois, Wisconsin, Iowa, Minnesota, South Dakota, North Dakota and Montana, and will carry a large stock of these goods in its Chicago warehouse, from which immediate deliveries to the Western trade can be made.

THE LORD ELECTRIC COMPANY, 213 West Fortieth Street, New York City, has appointed the Monroe Brass & Wire Company, of Cincinnati, exclusive territorial agent in the Cincinnati territory. It will handle the various products of the Lord company, including Earll retrievers and catchers, laminated soldered rail bonds, Shaw lightning arresters, auto discharge, laminar and vertical unit choke coils, together with other specialties that are now being placed on the market. T. C. White & Company have been similarly appointed for the St. Louis territory, and W. R. Garton Company for the Chicago district.

THE NELSON VALVE COMPANY, of Chestnut Hill, Philadelphia, Pa., has surrendered its New Jersey charter and will be incorporated under the laws of Pennsylvania. The works of the company are located at Wyndmoor, Pa. The new charter of the company will empower the company to manufacture and sell pipe, valves, machinery, fittings and steam specialties. The company will be capitalized at $1,000,000. The company is now manufacturing a new valve calculated to stand the pressure of superheated steam, no matter what degree of heat the steam registers. The officers of the company are: Samuel F. Houston, president, Carlisle Mason, vice-president and general manager, and Robert Borwell, secretary and treasurer.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 2, 1909.

[Conducted by William F. Rissing, Patent Law, 2 Rector St., N. Y. City.]

911,029. CONTROLLER; H. W. Cheney, Norwood, Ohio. App. filed Oct. 23, 1905. For electric motors. Avoids moving the controller too rapidly by locking it positively at each operative position until the current in the armature is below a predetermined value.

911,031. COMBINED CONTROLLER AND CIRCUIT-CLOSER; D. Witt C. Cookingham, Cleveland, Ohio. App. filed Sept. 11, 19[illegible]. The machine may be left with safety without danger of starting by an unauthorized person and the operator may throw open the circuit-closer instantly when desired. Makes use of a movable circuit-closing device carried by the handle with means for locking it against a closing movement when the controller is on.

[illegible] ELECTRIC TERMINAL CLIP; W. L. [illegible]. App. filed Oct. 5, 1907. The jaws are rigid at their inner ends and [illegible]

911,036. INTEGRATING-WATTMETER; B. E. Getchell and Oscar O. Smith, Connellsville, Pa. App. filed Feb. 26, 1908. Commutator type of meter with sectionally wound field coils and a switch by means of which the meter can be set for any of its rated capacities. Used on [illegible]

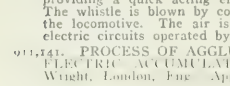
911,055. MOUNTING FOR FUSES; J. J. Lyng, New York, N. Y. App. filed May 23, 1907. A tube with a body of soft metal about the end of the tube, a terminal screw in the body and projecting therefrom, together with a fuse wire in the tube with its end in the soft metal.

911,081. COLLECTOR RING AND CLAMPING-PLATE; C. H. Smoot and H. Heitz, Chicago, Ill. App. filed Jan. 2, 1906. For rotating field magnets of high speed a. c. generators, in which the iron core is built up of disk and carries conductors formed of bars. The end disks form the terminals of the field winding.

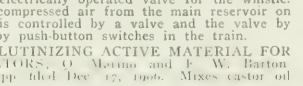
911,101. AUDIPHONE TRANSMITTER; C. E. Williams, Natick, Mass. App. filed Aug. 6, 1907. A closed reverberatory chamber is provided at the front side of the audiphone for receiving and amplifying the sound waves and conveying them to the electric transmitter.

911,118. RAILWAY SIGNAL SYSTEM; R. B. Davis, Los Angeles, Cal. App. filed Nov. 8, 1907. Takes the place of the air signal system by providing a quick acting electrically operated valve for the whistle. The whistle is blown by compressed air from the main reservoir on the locomotive. The air is controlled by a valve and the valve by electric circuits operated by push-button switches in the train.

911,141. PROCESS OF AGGLUTINIZING ACTIVE MATERIAL FOR ELECTRIC ACCUMULATORS; O. Marino and F. W. Barton Wright, London, Eng. App. filed Dec. 17, 1906. Mixes castor oil



911,083—Electric Terminal Clip.



911,[illegible]—Mounting for Fuses.

with a little powdered litharge and manganese peroxid, boils the mixture, decants the oil, dissolves the oil in a hydro-carbon solvent, mixes with litharge and adds acidulated water.

911,147. INDUCTION MOTOR AND GENERATOR; R. D. Mershon, New York, N. Y. App. filed April 29, 1905. The secondary element is provided with a winding and a plurality of condensers, resistances and impedances connected with the winding in order to reduce the effect of the stray field on the power factor at starting.

911,168. STORAGE-BATTERY PLATE; E. W. Smith, Philadelphia, Pa. App. filed April 13, 1908. The connection between the body and the sides and rim of the plate are improved by making the body of fine ribs, together with reinforcing ribs and a rim having a tapering web that extends inward.

911,178. TELEPHONE-RECEIVER; H. W. Sullivan, London, Eng. App. filed Nov. 30, 1907. A head supported telephone receiver with a multiple point spark gap in shunt with the magnets and within the casing in order to prevent injuring the windings of the magnet by high tension currents.

911,181. INTERCOMMUNICATING TELEPHONE; H. C. Thomson, Boston, Mass. App. filed March 30, 1907. A switch mechanism comprising a contact plate with a series of plungers sliding through the plate, a contact plate in front of all the plungers, a contact spring at the side of each plunger and a locking plate for each plunger.

911,188. TELEPHONE TRUNKING SYSTEM; C. S. Winston, Chicago, Ill. App. filed Jan. 3, 1905. For use between magneto and common battery offices. Provides means for positively throwing the drop in the magneto cord circuit when the common battery subscriber returns his receiver to the hook.

911,190. AUTOMATIC RAILROAD-SWITCH; Felix Wolf, New York, N. Y. App. filed Sept. 25, 1907. The switch is operated by means of two motors, the armatures of which are connected by a screw located between the rails which screw sets and locks the switch.

911,209. RAIL-BOND PROTECTOR; W. B. Cleveland, Cleveland, Ohio. App. filed Oct. 28, 1907. Relates to laminated rail bonds to be attached laterally to the rails and to avoid stripping them from the rails by the wheels of wagons. Provides a protecting armor of harder material, the bond being welded to the armor and to the rail.

911,222. TURBINE-BLADE-FIXING MACHINE; S. Ziani De Ferranti, Hampstead, London, England. App. filed Sept. 26, 1904. For electrically welding turbine blades on their drums. A movably mounted blade clamp which carries the electric current and the blade, presses the blade against the drum. The drum is rotated step by step to position it for the insertion of successive blades.

911,231. TELEPHONE-TESTING SYSTEM; H. C. Goldrick, Indianapolis, Ind. App. filed Nov. 14, 1904. The testing plug of the operator's connective circuit is provided with a tip contact which is insulated from the talking contacts thereof and is connected by a separate conductor with the apparatus by which the test is made known to the operator.

911,260. APPARATUS FOR COLLECTING ATMOSPHERIC ELECTRICITY; W. I. Pennock, Philadelphia, Pa. App. filed June 26, 1907. A balloon in a high altitude carries a bar of wood upon which collectors made of spheres of coiled wire are mounted, the latter terminating in sharp points.

911,267. CONNECTOR FOR ELECTRICAL WIRES, CABLES AND CONDUITS; R. W. Pittman, New York, N. Y. App. filed Oct. 11, 1907. For securing the ends together and for attaching them to junction boxes. A bushing which is attached to a box, has parallel walls adjacent to the box and is clamped thereto by a pair of removable clamps.

911,293. JUNCTION-BOX; W. A. Charters and E. G. Bardwell, Buffalo, N. Y. App. filed Sept. 21, 1906. The junction-box is provided with an opening and a resilient bridge lies across the opening. A supporting member extends through the bridge and has a head gripped between the bridge and the box.

911,303. ELEVATOR-INDICATOR; J. D. Griffen, New York, N. Y. App. filed March 22, 1897. A floor indicator comprising several groups of electric lamps, one group in each story of the building with an electric switch for each group and a cam on the elevator car for operating the switch.

911,338. CONNECTING-JACK FOR TELEPHONE-SWITCHBOARDS; C. H. Smith, Chicago, Ill. App. filed Dec. 30, 1904. A jack frame formed of one piece of integral metal with offset side braces, whereby the upper and lower jack contacts may be readily observed from the opposite sides of the jack. The forward part of the jack is made double to accommodate threads.

911,339. PARTY-LINE INDICATING-KEY; C. H. Smith, Chicago, Ill. App. filed Aug. 5, 1907. A key with a means for indicating to the telephone operator the last button of the key depressed and released in order to tell the operator which of the parties was last signaled.

911,364. DYNAMO-ELECTRIC MACHINE; H. A. Balcome, Boston, Mass. App. filed July 1, 1907. The field core is made of laminæ cut to form polar extremities which are clamped together between the side members of the motor frame.

911,[illegible]. KEYBOARD TELEGRAPHIC TRANSMITTER; P. B. Delany, South Orange, N. J. App. filed May 26, 1905. Provides a friction drive for causing the contact maker to travel over its contacts when the key is depressed. The drive consists of wheels whose axes are out of line and between which the traveling bar carrying the contact maker is disposed.

911,409. MOTOR HEADLIGHT; B. B. Lacy, Houston, Tex. App. filed Sept. 24, 1907. Provides a steady light, notwithstanding pitting and a means for feeding the carbon by the use of a solenoid which operates the clutch lever and whose action is opposed by the pull of a spring and a dash-pot.

911,411. CARBON HOLDER FOR ELECTRIC LAMPS; C. J. King, Olean, N. Y. App. filed April 30, 1908. The holder consists of two sections with an insulating joint between them. The section carrying the carbon is made of two jaws hinged together with a square opening. Details.

911,414. MULTIPLE-CYLINDER-MOTOR IGNITION APPARATUS; B. L. Lawton, Meriden, Conn. App. filed June 19, 1907. Avoids cross-firing in multiple cylinder cars by placing a soft iron plate between the coils, thus eliminating cross induction.

911,429. CLEAT FOR ELECTRIC WIRING; R. McLennan, Ballston Spa, N. Y. App. filed Feb. 18, 1908. A cleat for use at a bend in the wires consisting of two right-angled portions, the engaging faces of said base and cap having oppositely disposed grooves for the reception of the wire.

911,438. TELEPHONE-RECEIVER; W. E. Peters, Athens, Ohio. App. filed Dec. 24, 1907. A head telephone provided with a cap whereby pressure upon the ear will be transferred to the head so as to avoid bruising the ear.

911,439. CONTACT-PLUG FOR ELECTRIC IRONS, HEATING APPLIANCES, AND THE LIKE; R. H. Pheysey, Ontario, Col. App. filed Aug. 22, 1907. For connecting a circuit to the iron to be heated. An insulating plug carries the contact members.

911,446. THERMO-ELECTRIC PILE; Adolf Rittershaussen, Cassel, Germany. App. filed June 9, 1908. Two concentric metal rings form the metallic element of the thermo-pile. These are superimposed in groups and the product of the periphery and the height of each contact surface in the proximate rings is substantially uniform throughout the pile.

911,448. TROLLEY; P. H. Rosskamp and Ludwig Kellermann, Tarentum, Pa. App. filed Aug. 24, 1908. The trolley wheel is prevented from leaving the trolley by means of two arms which extend above the wheel and arc on opposite sides of the trolley wire. Details.

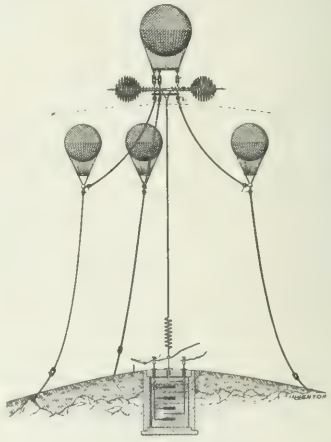
911,475. MULTIPLE LAMP-SOCKET; L. J. Castonguay, Bridgeport, Conn. App. filed Aug. 5, 1908. Reduces the manufacturing cost by utilizing strips of brass bent into ring form. The cluster has a series of units, each unit with its axis inclined, but with its insulating base piece parallel to the axis of the cluster and strip metal pieces mechanically connecting the units.

911,481. INDUCTION-MOTOR CONSTRUCTION; H. F. Elshoff, Norwood, Ohio. App. filed Feb. 7, 1906. Hollow rivets or bolts are used to connect the conductor bars and the short-circuiting rings, which hollow rivets permit a circulation of cooling air through the ends of the bars and the rings.

911,522. ELECTRIC-BATTERY HOLDER AND BATTERY; G. L. Patterson, New York, N. Y. App. filed April 18, 1908. A battery holder with electrical and mechanical connections for a plurality of batteries, avoiding the binding posts ordinarily used. May be quickly applied to a side wall.

911,527. IGNITION-TIMER; L. B. Shivers, Anglesea, N. J. App. filed June 17, 1908. A timer to be used in jump spark ignition in which the wear of the parts is reduced. A free rotatable conducting ring is interposed between the rotatable element and the exterior concentric fixed element.

911,531. TELEPHONE APPARATUS; C. H. Viggars and E. H. Stolz, Chicago, Ill. App. filed Jan. 13, 1908. For assisting the deaf to hear. One of the electrodes is provided with upwardly extending cylindrical



911,260—Apparatus for Collecting Atmospheric Electricity.

sockets in each of which there is a single row of carbon granules in an electric circuit.

911,549. ELECTRIC RELAY; Fitzhugh Townsend, New York, N. Y. App. filed Jan. 13, 1904. A relay operated by alternating current in an automatic block-signaling system for electric railways, comprising a fixed member with polar extensions and a pivoted coil mounted there between, whose plane when in equilibrium is that of the magnetic field between the polar extensions.

12,914. (Reissue.) MECHANISM FOR GONGS AND THE LIKE; H. E. Reeve, New York, N. Y. App. filed Oct. 15, 1907. A gong, a hammer and a shaft carrying the hammer, the axis of the shaft being inclined and the cam supporting the hammer, the face of which has a gradual inclination throughout its periphery.

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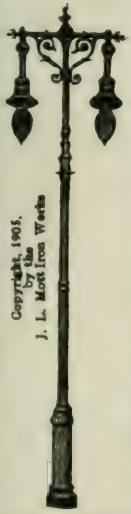
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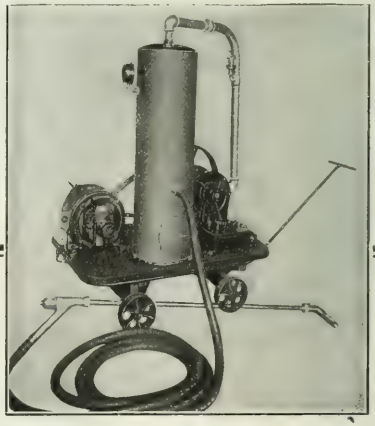
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IMPROVEMENT IN OUTLOOK.

It is probably true that no great improvement can come in industrial and business conditions until the tariff agitation is settled by the adoption of a new tariff. It is possibly true also that the expectancy of any marked change in the tariff will be disappointed, so that the tendency to delay in making new commitments is hardly justified to the full. One element that will help is the inaugural address that may be expected from President Taft, reassuring the country as to some kind of rest from the ceaseless turmoil and anxiety of the past four years. Public utilities have had about all the harassment they can stand. The newer tone of Congress is heard in the expressions of the adverse report of the Senate Committee on the Fulton bill for increasing the powers of the Interstate Commerce Commission. It says truly: "The country is now demanding repose in its industrial upbuilding. It is not a time to experiment and to change the basis upon which the former acts to regulate commerce have been predicated. The recent laws passed by Congress, so greatly enlarging the authority of the commission, should, before changes are sought, have the opportunity of at least a fair trial as to the value of their provisions of the regulations of interstate commerce." That certainly means much, reinforced by its endorsement from the "man higher up."

Meantime we are glad to note in our own pages the symptoms of coming activity and greater cheerfulness. The sap is stirring in the leafless trees. Our industrial construction news in the issues of Feb. 4 and 11 contained no fewer than 490 news items, all of which indicated the early exercise of purchasing power. Of these no fewer than 138 referred to new incorporations, of which 27 were definitely light and power, and electric railway 11. Among the other items no fewer than 237 dealt with electric lighting plans, extensions, etc., and 11 with combined lighting and railway work, while 65 were distinctively electric railway. In the aggregate this stands for a considerable volume of new work, and is in itself a notable cause for encouragement to manufacturer, engineer and supply house

NEW STATION WORK OF THE BOSTON ELEVATED

The Boston Elevated occupies a somewhat unique position in that it has steadily pursued the policy of working from a group of allied stations rather than from a single power plant to transmission lines. By [illegible] this policy has produced good results and we have [illegible] [illegible] considered, any plant of the latter class burning coal at a similar price is delivering power at the rails any more cheaply. In following this policy the Elevated plants are very generally equipped with large reciprocating engine sets. Although experiments more or less successful have been tried with direct-current turbine sets and with gas engines, there are no signs of their

adoption on any extensive scale, so that whatever the real success of these experiments, one must regard the big engine sets as the backbone of its power supply. Its latest addition to its capacity consists of four 2700-kw sets of extra large overload capacity distributed in the stations where they will do the most good—two at the Lincoln Wharf plant and one each in the Harvard plant and the Charlestown plant. The accomplishment of this installation without at all interfering with the regular service has demanded a great deal of skill, but the feat has been successfully accomplished nevertheless.

It is worth noting that the engines used follow in design the lines of rolling mill practice in which enormous overloads must be cheerfully carried on no notice at all, and which demands handling sustained 50 per cent overloads without material drop of speed. Backed by big watertube boilers, these engines are apparently capable of dealing with any emergencies likely to be encountered. The generators are somewhat interesting on account of the large adjustment possible in the compounding, ranging 10 per cent, both above and below constant potential performance, the lowering being sometimes desirable to keep them from taking an undue share of load from the other stations. The potential regulation on this system has been very thoroughly studied and is very successfully carried out. The guaranteed efficiency is high, reaching 94.8 per cent at full load and an even 94 per cent at the 50 per cent overload. In one instance the new generator is driven by a vertical cross-compound engine of special form, and is itself of the interpole form, making a unit very interesting in view of the very high efficiencies guaranteed. The engine is to do its full load at a steam consumption of 12.5 lb. per horse-power at 50 deg. superheat, and the generator is guaranteed at 95.5 per cent full load efficiency. There is a good deal to be said for interpole machines for railway work and if this one makes good, as it doubtless will, it will be invaluable from the operative standpoint, since its power of standing hard pounding without a spark is extraordinary. It would be interesting to conjecture as to what net efficiency this set would show were the engine designed for high superheat. Superheat is the one improvement that has been rather neglected on this side of the water in spite of some remarkable results obtained abroad. The installation of these new sets has involved some interesting details of construction worth studying in the description given. The Boston Elevated seems to have taken time by the forelock in this instance, and to have provided a powerful and business-like equipment that should keep it out of trouble from power supply for at least a season or two to come. From the standpoint of technical operation it is remarkably well managed, and its plants, while designed along lines now rather unusual, have shown admirable performance in a way that fully justifies them by results.

Sparking Voltage Between Commutators and Brushes.

The great complexity of the actions which occur during commutation under the brushes of a direct-current dynamo make the complete explanation of the phenomenon difficult. Designers of direct-current dynamo machinery have long been accustomed to overcome difficulties due to sparking at the commutator, by following rules arrived at experimentally, through experience with preceding machines. It is known that when sparking occurs at commutator brushes there is produced a phenomenon bearing certain resemblances to the carbon arc lamp. In order to produce a satisfactory voltaic arc between carbon points in air, it is necessary to have a certain critical voltage between them. Below this voltage no arc can be maintained. Above this voltage, an arc can be maintained, but the power of the arc will depend upon the electric power liberated in the arc. In a somewhat similar manner, in order that there shall be arcing at a dynamo commutator, there must be a certain critical voltage at rupture between the brushes and the commutator segments. Below this voltage there will be no arcing. Above this voltage there will be arcing, but the intensity of it will depend upon the amount of electric power liberated per unit of brush contact area.

As mentioned in the Digest, the *Elektrotechnische Zeitschrift* has recently published an article on this subject by Dr. J. Liska. The article contains the results of an experimental research on the behavior of a revolving commutator supplied with current from an external source. The conditions differed from those of practice in the fact that the circuit of the brushes was sensibly devoid of inductance. A storage battery supplied current to the commutator through a non-inductive resistance. By this means, however, the voltage across the break was prevented from rising inductively. It was found that if the voltage between brush and commutator was less than a certain critical value, sparking did not occur, but that above this value sparking set in. The value of this critical voltage depended upon the direction of the current. Thus, with certain carbon brushes, when the current was from brush to commutator, the critical pressure was 14.5 volts; but with the current from commutator to brush it was 22.5 volts. This phenomenon throws light on the fact sometimes observed that the negative brushes of a machine may give more trouble than the positive.

Inductance Coils Used in Wireless Telegraphy.

In order to tune wireless telegraph conductors into syntony, it is necessary to alter either their inductance or their capacity, or both. This necessity has stimulated the development of the adjustable induction coil and of the adjustable condenser. The adjustable condenser has chiefly followed the construction of the Kelvin multicellular voltmeter. The adjustable induction coil has followed different paths. The different types of construction in variable induction coils is illustrated by Mr. J. L. Hogan, Jr., in his article on page 450 of this number. They may be divided into three main classes as follows: (1) Fixed coils, with variable points of contact, including the types of Figs. 1, 2, 3, 4, and 5; (2) two fixed coils movable with relation to each other, including the Ayrton-Perry and Stone constructions of Figs. 7 and 11; (3) coils of variable winding, comprising the Fessenden double-roller of Fig. 6.

As pointed out in the article, the advantage of the first type of construction is its mechanical simplicity. Such coils are easy to construct, and are mechanically strong. The difficulty which they present is the chance of poor contact at the slider or sliders. The advantage of the second type lies in the absence of rubbing contacts and in the continuous variation of inductance which they permit. A disadvantage to which they

are liable is defect of range, because under no condition does the inductance of the device fall to zero. It merely permits of being varied between a certain minimum and the maximum. The third type has no necessary rubbing contacts, and has full range of inductance variation, from zero to the maximum, by continuous increase. The main disadvantage lies in its relative expense, as such devices have to be constructed carefully. A disadvantage mentioned in the article is that the double roller does not permit of rapid variations. In practice, however, rapid variations are readily made by means of a traveling contact, like those used in devices of the first type, held in the hand, so as to cut out any desired number of full turns. As regards the second objection mentioned in the article, of loss of energy in the short-circuited element, this seems overrated. In a complete metallic cylinder of copper, the current necessary to set up a central magnetic field is relatively small, and therefore the power expended as I^2R by this induced current, in order to cancel the inductance of the primary, is also very small. This objection would become serious in cases where the secondary resistance was great.

It is a curious fact that none of the variable inductances thus far introduced attempts to introduce equal changes of inductance with equal mechanical displacements. In devices of the first type, the inductance varies something like the square of the number of included turns. In devices of the second type, the change of inductance per unit of movement is often very complicated, and is far from being uniform. In devices of the third class, it varies again roughly as the square of the number of turns; but the deviations from the rule are considerable. An ideal device would, like a rheostat, include equal variations for equal displacements. Strictly speaking, whenever a receiving aerial is tuned to syntony by means of added inductance, reflection losses are involved by the insertion of this inductance in a single lump at the foot of the aerial. It would seem desirable to increase the efficiency of the added inductance by distributing it; and, inserting a number of small inductances at intervals in the vertical conductor, would be one way of effecting distribution. Another way would be to suspend the aerial like a long spiral spring from the top of the mast, keeping the distances uniform between successive turns by insulating cords. This plan would certainly distribute the extra inductance nearly uniformly. In both of these cases, however, the extra inductance would not be amenable to variation, and would therefore only be applicable to predetermined increase of total aerial inductance, with the opportunity for a relatively smaller adjustment in a regulator at the base of the aerial.

Wireless Motor Control.

A recent newspaper paragraph recounts the wonders of a French invention for the wireless control of submarine boats; still another exploits in a fine frenzy of imagination the awful possibilities of dynamite-laden airships directed on their terrible mission by similar means; and the Patent Office would disclose many another such scheme for similar stunts. Now, we do not at all wish to discourage the inventors or to throw cold water on their very ingenious plans for general annihilation, but in the interest of an all-too-credulous public which may be asked to invest its cash in this sort of thing it is only fair to call attention to a few of the very practical difficulties that stand in the way of success. As a mere matter of engineering it would be, and doubtless is, possible to arrange for wireless control of a submarine boat with a not inconveniently long-exposed antenna. Wireless control, however, implies, like control from a running cable, the doing of several things that demand a somewhat complex switching arrangement. At the very least a submarine torpedo of the automobile variety must be able to stop, start and turn to starboard or port. These rudimentary requirements demand that it should be kept at proper submergence by means of a float, else in addition one would have to install automatic submergence devices like those of a Whitehead, working accurately enough to keep the horizontal plane without submerging antenna or markers. In addition, one point of the control ought to fire the charge, if necessary, without depending entirely on a fair blow, in order to give a chance for cutting nets.

Now a switchboard for doing these things must either be selective by steps or by tuning. The former is easy enough if there is no interference; the latter in the present state of affairs, exceedingly difficult. And granting the possible working of either, the chief practical difficulty of the automatic submarine is not yet touched at all—to wit, the extreme difficulty of seeing what one is about in steering it. Even at the short ranges attempted by torpedos steered by a cable, the markers, unless exceedingly conspicuous, are very difficult to follow and align, and anything out of a straight course is almost impossible to follow with any respectable chance of making a hit. Even if a submarine could be directed by wireless at war-time ranges, say from three to six miles, as may be quite possible, the chance of correct steering would be almost infinitesimal and manoeuvering for a hit quite out of the question. In the case of the aeroplane or dirigible balloon, accurate location at a distance horizontal or vertical, great enough to be of any use, is nearly out of the question, especially if the speed is high enough to give a chance of escape from gun fire. A shrapnel loaded with tiny carcasses is capable of putting any balloon out of business in short order, and even a fast-moving aeroplane could be caught and disabled rather easily at any time when there might be light enough by which to steer it. This mere difficulty of location is sufficient to prevent the successful use of such devices even if they were technically well worked out. And even high explosives must be well placed to be of any destructive value. The work of the *Vesuvius* in front of Santiago is enough to attest the general inefficiency of this kind of offense. When high explosive shells are delivered from big guns and hit, the results are terrific, as in the Battle of the Sea of Japan, but one can sling around dynamite by the hundredweight and accomplish absolutely nothing unless by a chance hit. So the present purveyors of destruction will have to guess again before they make a practical weapon of the kind. One well handled [illegible] whole fleet of wireless-steered torpedoes, aerial or submarine. As to aerial weapons, it is interesting to note that Mirabeau in a work on the American Cincinnatus Society, published prior to the French Revolution, referred to the use of balloons for military purposes, adding that they might prove to be one of the agencies which, through their great potentiality of destroying life, would eventually render war too fearful to be considered by the nations of the world.

Meeting of the American Association of Electric Motor Manufacturers.

The winter meeting of the American Association of Electric Motor Manufacturers was held at Hotel Schenley, Pittsburgh, Pa., Jan. 26, 27 and 28, 1909, and was attended by 52 members and 10 guests. The papers presented at the convention were as follows: "Ratings and Guarantees of Alternating-Current Motors," by Mr. R. S. Feicht; "Temperatures on Semi-Enclosed and Enclosed Motors," by Mr. J. M. Hipple; "Methods and Cost of Testing Alternating-Current and Direct-Current Motors," by Mr. L. E. Underwood; "Starting Devices for Alternating-Current and Direct-Current Motors," by Mr. H. D James; "Standard Voltages," by Mr. P. M. Lincoln; "Relation of the Association with Central Stations," by Mr. Fred. M Kimball; "Relation of the Association with Other Manufacturing Associations," by Mr. Charles Robbins; "Unprofitable Advertising," by Mr. Rodman Gilder. Abstracts of several of these papers are printed elsewhere.

On Tuesday evening a pool and billiard tournament was held. The pool tournament was won by Mr. H. H. Smith, Chicago, manager of the Diehl Manufacturing Company, and the billiard tournament by Mr. R. C. Kellogg, of the Mechanical Appliance Company, Milwaukee, Wis. The prizes were a billiard cue in a leather case for each contest. On Wednesday afternoon, Jan. 27, the members left Hotel Schenley on special cars for the Westinghouse Electric & Manufacturing Company's works at East Pittsburgh, where luncheon was served, after which the works were inspected. On Wednesday evening the association dinner was held at Hotel Schenley and was a most enjoyable affair, music and songs being substituted for speeches. The annual convention of the association will be held at Hot Springs, Va., May 17 to 20, 1909.

Progress in Telephone Regulation in Nebraska.

Although the Nebraska Railway Commission is given, under the statute, ample power of regulation over both the rates and service of telephone companies, it has during the past year been proceeding somewhat cautiously in the exercise of its powers. It has in several cases prescribed changes in rates on its own motion, and has authorized changes on application from telephone companies. In most of the cases coming before the Commission it has been found that a raise in rates was essential and it has been put into effect with the Commission's consent. In one case the Commission has ruled that the "Burlington" Railway shall install a telephone in one of its stations, as a public necessity, and pay for it, but there will probably be no further ruling on new cases of this type until the courts have rendered a decision upon the one which has been made.

The Commission is now making plans for a broader exercise of its powers, and intends particularly to establish a general supervision and control of rates, and also of interchange of service between connecting companies.

There was held, at the time of the recent convention of the Independent Telephone men, a public session of the Commission, at which Chairman F. Clarke presided, for the discussion of a number of topics associated with accounting, rates, interchange of service, etc.

This hearing was attended by about 75 representatives of the Independent companies and by President C. E. Yost, of the Nebraska Bell Telephone Company, and F. A. Pickernell, assistant to the president of the American Telephone & Telegraph Company, who spoke for the Bell interests. Mr. Pickernell called attention to the many difficulties of putting into effect a system of accounting which will afford accurate information on the investment and cost of maintaining and operating individual telephone exchanges, and stated that the bookkeeping department of his company did not contemplate any such divisions, as they are believed to be impracticable on the score of accuracy, and unduly expensive. The Railway Commission will, however, in all probability, put into effect a system of accounting which will enable it to obtain, for each exchange district, such figures as it considers necessary for the individual determinations of equitable rates.

It was brought out at this hearing that the Independent telephone companies are opposed to anything but the most rigid classification of service under business, residence, and farmers' rates, and expect the Commission to aid them by prohibiting reduced rates which have heretofore prevailed for telephones in railway stations, lodge rooms, schools, homes of company directors, etc.

The subject of physical connection, of competing lines, although scheduled for discussion, was not taken up, and the Commission seems to feel that the general enforcement of such a measure would be dangerous.

At the present time, methods of bookkeeping which may be uniformly adopted and a corresponding form for reports to be made to the Commission, are being devised by the Railway Commission, in co-operation with representatives of the Bell and Independent telephone companies.

The Latest American Telegraph Statistics.

The Bureau of the Census, Washington, has just issued the preliminary report on the telegraphs of the country, i. e., for the continental United States, exclusive of Alaska, Hawaii, Philippine Islands and Porto Rico. The statistics relate to the years ending Dec. 31, 1907 and 1902. The totals include reports of commercial land telegraph companies owned and operated within the United States, and of domestic ocean cable companies operating from the United States, but do not include telegraph lines operated by railway companies.

	1907.	1902.	Per cent of increase.
Number of systems or companies	25	25	0.0
Miles of single wire (exclusive of ocean cable)	1,577,961	1,318,350	19.7
Nautical miles of ocean cable	46,301	16,677	177.7
Messages, total number	103,794,076	91,655,287	13.2
Total income	$51,583,868	$40,930,038	26.0
Total expenses (including taxes, interest and fixed charges)	$41,879,613	$30,948,034	35.3
Total cost of construction and equipment (including real estate)	$210,045,959	$161,679,579	29.9
Capitalization:			
Capital stock authorized, par value	$161,603,900	$123,233,075	31.1
Capital stock outstanding, par value	$155,089,575	$117,053,525	32.5
Dividends on stock	$7,477,083	$6,256,693	19.5
Bonds authorized, par value	$83,004,000	$49,893,000	66.4
Bonds outstanding, par value	$65,204,000	$45,893,000	42.1
Interest on bonds	$2,651,511	$1,949,150	36.0
Total par value stock and bonds outstanding	$220,293,575	$162,946,525	35.2
Employees and wages:			
Average number	28,034	27,627	1.5
Total salaries and wages	$17,808,249	$15,039,673	18.4

The final report for 1907 will contain an analysis of the above totals and present detail statistics for other phases of the industry.

Electrolytic Condensers for Starting Induction Motors.

In a patent issued on Feb. 2 Mr. Ralph D. Mershon proposes the use of condensers and impedance coils in the secondary circuit of an induction motor for improving the starting conditions. The devices are so adjusted that the current taken by the impedance is equal to that taken by the condenser at starting. At synchronism the currents in both devices will be zero, but at speeds slightly below synchronism the current in the impedance may be high while that in the condenser will be small. Under running conditions, therefore, the operation of the motor will closely approximate that of one with a short-circuited secondary, but at starting the machine differs from one of the usual type in that the secondary current will be practically in step with the e.m.f. The inventor suggests the use of electrolytic condensers on account of their low e.m.f., the high loss not being a disadvantage.

Annual Report of Wisconsin Commission.

The second annual report of the Railroad Commission of Wisconsin, relating to its work in connection with public utilities and railroads for the year ended June 30, 1908, has been issued.

It is shown in the report that the total amount expended under the railroad commission law was $48,169.77; the amount expended under the public utilities law was $17,513.74, making a total of $65,683.51. The total expense of maintaining the joint engineering staff of the Railroad Commission and the Wisconsin Tax Commission, including salaries and traveling expenses, but exclusive of instrumental equipment, was $31,199.09, divided as follows: Public utilities, $13,132.50; Railroad Commission, except public utilities, $9,128.82; Tax Commission, $8,937.77.

The report discusses the importance of reliable statistics in connection with the duties devolving upon the commission and describes the preparation of the uniform systems of accounts, saying in part:

"If the purpose of a uniform classification of accounts were but to secure a statement of earnings and expenses of each utility, without regard to the many varying conditions of operation and their details, together with a general balance sheet for each corporation, many of the quasi-technical considerations which arise in connection with each class of utilities might be disregarded, leaving a work of comparative simplicity. But if accounts are to be kept which will enable the management of properties to determine the efficiency of their operations and permit the commission to determine the reasonableness of rates charged for the service performed, the accounts to be prescribed must be such as show the cost of each step or process in the natural order of production, and the final cost per unit of service to the public. Whatever other elements may be considered in the making of rates, the cost of the service is of the first importance.

"With the unit cost as the object in view to be determined from the accounts, attention was directed to the second general consideration—the methods of operation.

"Among the gas companies a number of plants produce only coal gas, some produce only water gas, while others purchase a part of the gas sold or purchase the entire product. An even greater diversity of conditions exists among electric and water companies. Electric current may be generated by steam power, gas power, hydraulic power or the product may be purchased from another electric utility or a manufacturing establishment. Water plants may pump by steam power, gas power or hydraulic power. Any two or all three of these utilities may be furnished by the same corporation, in which case much apparatus and facilities of service are used for the joint benefit of several utility departments. In a large number of plants conditions are rendered still more complicated through the operation of a manufacturing or mercantile business in connection with the utility service, and in the municipally owned plants by a merging of the utility transactions with those of the city. These are some of the conditions under which the public utility business is being operated in Wisconsin and, consequently, any classification of accounts, to serve its purpose and to be a practical working scheme, must be so elastic in its provisions as to recognize these factors.

"The record of the electric plants operating by two or more methods should show the cost per kw-hour at the switchboard of current generated by steam power, as distinct from that generated by any other motive power. The management must know which method or methods of manufacture are the most economical and offer the greatest profits. This information is also essential for the work of the commission.

[illegible] unless a separate grouping of accounts were provided; for each method of production, comparisons of results could be misleading, if not impossible. Such comparisons to be of value must be made between companies operating under practically similar conditions. The switchboard cost of electric current generated at one plant by hydraulic power cannot be used to show relative efficiency by comparison with a steam power plant.

"The great variations in size of plants required many concessions to simplify the accounts. The large and completely equipped plants in the metropolis and other large cities of the State, with their technical and specialized labor, require a system wholly impossible to the many small plants which range in size downward to those utilities established and maintained by public spirited citizens, or by the municipality, largely as a matter of civic pride.

"Careful attention was paid to the accounting and operating practices of corporations or municipal plants operating two or more utility services. Since electric plants and water works, when operated by steam power, both require a large boiler capacity or other prime motive power, there is apparent a strong tendency for their combination in the interest of economy. This tendency is most pronounced in the smaller cities, and is best seen in the field of municipal ownership. In the larger cities the tendency is more toward a combination of gas and electric industries, because of the competitive nature of their service. In all such cases of joint operation, in order to determine the cost per unit of service, all joint charges should be apportioned over the different departments according to their demands upon the joint facilities or upon the basis of service received by each."

Discussing the statistical tabulations of operations for the year ended Dec. 31, 1907, the report says:

"There are some companies which have kept a systematic and detailed record of their financial transactions which reflect the most advanced thought on the subject of public utility accounting, and their reports were easily analyzed, but they represent a small minority in the aggregate. Many utilities keep practically no records worthy of the name, while in not a few cases, and even where the services performed are considerable in extent, the most detailed records are found in check-book stubs, pocket memoranda, or the memory of the manager. In some instances office records of considerable detail are maintained, but the methods followed are not always correct. Originally founded on some fundamentals, the system has since been enlarged or condensed to suit the needs of a complex business connection or the personal views of the operators. Revenues from all operating sources and non-operating revenues have frequently been merged, while operating expenses are confused with construction expenses, the accounts often being grouped more for convenience than to enable an analysis of results. The greatest difficulty was encountered in the separation of revenues and expenses by those corporations or municipalities operating two or more utilities, the general practice having been to credit all revenues to a single fund, from which all expenses were paid without regard to the department which occasioned them."

The report then takes up the subject of statistics relating to municipally owned utilities, saying:

"In the lack of separation between the public service properties and other operations, municipalities appear as the chief offenders. The greatest criticism which must be offered against the municipal methods was the merging of public service accounts with those of the city. Revenues which should be credited to the treasury of the utility were turned into the general fund of the city, while the plant's operating expenses were generally paid out of the same city fund, showing no record other than the general entries 'Cash Paid.' While the public plants often received no credit for hydrant service or water for sprinkling service or electric current for street arcs [illegible] the accounts or records of the property

"The accounts of the municipally owned utility should be [illegible] than should the accounts of the private utility reflect the activities of the shareholders. In many cities, especially the smaller [illegible] the inspection of the distribution system is a part of the

duties of the street superintendent or marshal. Meters are read and often inspected by the same city officials at times when not engaged in other municipal duties, but the public service property is not charged with any proportion of their expenses. The city clerk and his assistants generally furnish, without additional cost, much of the service which is reported by private plants under the head of administrative or general expense. Until a separation of accounts between the two departments is made, a comparison with private enterprise, to determine relative efficiency, is impossible."

On the subject of rates of utilities the report says in part:

"The rates filed by the larger companies are generally based upon scientific considerations, but those of the smaller companies partake of every conceivable form and method of determination. They vary from the simple schedule of but two or three lines to the most elaborate classification of consumers. In a majority of instances there appears to have been no particular system followed in determining the amount to be charged for a given service. The process of reasoning, which in some cities placed certain classes of consumers upon meter rates or upon flat rates, or determined the rates to be paid by certain classes of consumers, seems to have been exactly reversed in other cities. Rates for similar service often vary several hundred per cent in neighboring cities. In a number of instances schedules are in force which make some concession in rates with increasing consumption, but the rates have seldom been determined with regard to the cost of the service. Too frequently the tendency is noticed to copy the rate schedule of another community, with the result that many inconsistencies in charges are passed from city to city. The majority of schedules on file, in the effect of their application, are not calculated to secure the greatest development of service with the consequent reduction in the unit cost."

During the year there were 83 formal complaints, investigations and other formal matters affecting utilities, classified as follows: Rates, 21; application to increase, modify or equalize rates, 42; valuation of property, 13; investigations upon motion of commission, 7. There were also many informal complaints, of which 246 affected utilities.

The corporations named in the table following filed notices of surrender of franchise with the commission and obtained, in lieu thereof, an indeterminate permit.

A portion of the report referring to discrimination in rates for electric service gives the following summary reports of electric companies as to discriminatory rates:

Total number of utilities furnishing electric current	232
Total number of electrical utilities reporting no discriminatory rates	50
Total number of such utilities reporting discriminatory service of some kind	69
Total number of such utilities failing to report in time for this tabulation	113
Total	232

In discussing this subject the report says: "For the companies which reported discriminatory rates, about 3 out of every 100 consumers pay less than the schedule rate. The proportion is not so great as that for telephone companies, but it exceeds that for both water and gas utilities. Because a certain utility has more discriminations in effect than another does not mean in itself that it is following a vicious practice or is using unlawful methods. Most of the discriminations cited are remnants of a former period of unrestricted competition; others are the outgrowth of circumstances over which the utilities themselves had no control.

"No provision of any law has ever struck more directly at evils in utility enterprises than this, nor has anything ever been done in the regulation of quasi-public business in this State which more fundamentally affects the moral sense of the citizens of Wisconsin. In this respect the utilities law has brought about a quiet revolution, just as it is effecting a revolution in the business methods of many of the plants.

"A few discriminations remain, and these are complicated with more or less serious legal questions. The courts may be trusted to dispose of them fairly when the issues shall have been presented. Ample time and opportunity has been given to the respective managements to put their houses in order, and the commission shall proceed promptly against any management which may hereafter be found delinquent in its obedience to the law. We know of no such, and we hope there is none."

Suggestions for legislation are made in the report. An abstract of several of the suggestions follows:

"The administration of the public utilities law has revealed no weaknesses in its essential provisions. The only amendment to the public utilities law which may be suggested is one extending the period of time during which public utility companies, organized before the enactment of the law, can surrender their franchises and secure in lieu thereof indeterminate permits. The utilities law limited the time during which a franchise could be surrendered to July 1, 1908. Since this date a number of companies have inquired of the commission as to the manner in which they could now surrender their franchises. In our judgment it is desirable that utilities, still operating under franchises granted before the enactment of the law, should have an opportunity to surrender the same at any time in the future. Possibly it is in the interest of the public to go a step further and, under the reserve power of the constitution, by statute repeal all franchises still in existence and grant in lieu thereof indeterminate permits. The second suggestion is obviously a much larger proposition, but we are inclined to believe that it merits careful consideration.

"The public convenience and necessity law could to advantage be modified, so as to permit the commission to consider the financial ability of the applicants in passing upon the application for such certificate, as some doubt exists at present of the right of the commission to inquire into such matter. The law might be further amended to authorize the commission to permit modifications of the certificate of public convenience and necessity at any time subsequent to its first issuance.

"We think that the stock and bond law should be amended so as to include telephone companies. The securities of telephone companies can be issued with the same degree of carelessness and consequent injury to the public as the securities of other public utilities have been issued in the past. There is

LIST OF INDETERMINATE PERMITS.

Company.	Location.
Ashland Light, Power & Street Railway Company	Ashland.
Monroe Electric Light & Power Company	Monroe.
Mellen Water & Light Company	Mellen.
Burlington Electric Light & Power Company	Burlington.
Appleton Water Works Company	Appleton.
Milwaukee Central Heating Company	Milwaukee.
City Water Company	Marinette.
City Water Company	Sheboygan.
Menominee & Marinette Light & Traction Company	Marinette.
Mineral Point Electric Light Company	Mineral Point.
Wisconsin Electric Service Company	Chilton.
North Milwaukee Light & Power Company	N. Milwaukee.
Northwestern Iron Company	Mayville.
Dodgeville Electric Light & Power Company	Dodgeville.
Platteville Electric Light & Power Company	Platteville.
Falls Light & Power Company	Sheboygan Falls.
Waukesha Gas & Electric Company	Waukesha.
Equitable Electric Light Company	Lake Geneva.
Portage American Gas Company	Portage.
Cashton Light & Power Company	Cashton.
West Bend Heating & Lighting Company	West Bend.
Washburn Electric Light & Power Company	Washburn.
Darlington Electric Light & Power Company	Darlington.
Racine Water Company	Racine.
Rhinelander Lighting Company	Rhinelander.
Manitowoc Water Works Company	Manitowoc.
Manitowoc Electric Light Company	Manitowoc.
La Crosse Gas & Electric Company	La Crosse.
City Water Works	Merrill.
Medford Light & Heating Company	Medford.
Merrill Railway & Lighting Company	Merrill.
Superior Water, Light & Power Company	Superior.
Lake Geneva Water & Light Company	Lake Geneva.
Minahan Building Company	Green Bay.
Citizens' Gas Company	Burlington.
Plankinton Electric Light & Power Company	Milwaukee.
Wells Power Company	Milwaukee.
Glenwood & Downing Light & Power Company	Glenwood.
Chippewa Falls Water Works & Lighting Company	Chippewa Falls.
Kaukauna Gas, Electric Light & Power Company	Kaukauna.
Kaukauna Gas, Electric Light & Power Company	Little Chute.
Portage Electric Light Company	Portage.
Beaver Dam Fuel & Light Company	Beaver Dam.
Beloit Water, Gas & Electric Company	Beloit.
O. I. Newton's Sons Co.	Sparta.
Viroqua Electric Light Company	Viroqua.
Ripon Light & Water Company	Ripon.
Chippewa Valley Railway, Light & Power Company	Eau Claire.
Campbellsport Electric Light & Power Company	Campbellsport.

nothing in the nature of the telephone business which makes it different from the other utilities in this respect, and we therefore recommend that no telephone companies be allowed hereafter to issue securities without a certificate from this commission."

The report gives a list of public utilities properties for which tentative reports of physical valuations were submitted or upon which the engineering staff was engaged during the year ended June 30, 1908. Among these plants are the following:

Electric Plants.—Dodgeville, Eau Claire, Hudson—in progress, La Crosse—in progress, Manitowoc—in progress, Marinette.

Combined Gas and Electric Plants.—Ashland, Kenosha—in progress, Madison.

Combined Water, Gas and Electric Plants.—Beloit—in progress, Chippewa Falls, Ripon, Superior.

Combined Electric Railway and Light Properties.—Eau Claire, Menominee.

Taxation of Electrical Companies in Pennsylvania.

It has been uniformly held in Pennsylvania that the real estate of a public or quasi-public corporation, essential to the exercise of its corporate franchises, is not subject to local taxation in the absence of legislative authority imposing such taxes. The power to tax necessarily includes the power to sell for non-payment of taxes, and thus the property of a public corporation, without which it could not perform its duties to the public, could be sold piecemeal and the corporate purpose be defeated by divesting the title to certain portions of the real estate against which tax liens were filed. Again, many quasi-public corporations extend into and through different municipalities, and as a question of public policy, it has not been deemed wise to subject them to the exactions of the taxing officer at every municipal division line, but rather to authorize the Commonwealth to impose a capital stock tax upon such corporations; and, in appraising the same for the purpose of taxation, the real estate, franchises, earning power, dividends and all other matters which affect the value thereof must be taken into consideration. In this manner the real estate of a quasi-public corporation is taxed, and while the tax goes directly to the State in the first instance, cities, boroughs, townships, school districts and other municipal divisions receive the benefits of such taxation by appropriations made to the public schools, to hospitals, to eleemosynary institutions and to charities of different kinds located throughout the State. The following is quoted from the opinion of the Supreme Court of Pennsylvania accompanying a decision holding that the real estate of the York Haven Electric Power Company is exempt from local taxation:

"The only question in the present case is whether appellee is a quasi-public corporation within the meaning of the law, so as to entitle it to exemption from local taxation. The learned court below so held, and, after careful consideration, we have reached the same conclusion. If companies incorporated to supply water, electricity and light to the public are exempt from local taxation, under the rule hereinbefore mentioned, it is difficult to see why a company incorporated for the express purpose of supplying water and power should occupy a different position. So far as the power of taxation is involved, there is no difference in principle between a company incorporated to supply water or electricity to the public and one incorporated to supply both water and water power which produces electricity for the same purpose. The test in such cases is not what the corporation has done or what it may attempt to do, but what it is authorized to do and may be compelled to do under its charter in the performance of the duties imposed thereby. It does not appear in the application for the charter nor in the letters patent what particular supplemental statutes it claims the benefit of, but it is specifically stated that the corporation is formed 'for the purpose of supplying water and power to the public and to firms, individuals and corporations in the borough of York Haven, York County, Pennsylvania, and the territory adjacent thereto.'" A corporation organized for the purpose of supplying water to the public has been held to be a quasi-public corporation and it has also been decided that a corporation created for the supply, storage and transportation of water and water power for commercial and manufacturing purposes is a quasi-public corporation. It would therefore seem to necessarily follow that a corporation possessing the power to do both of these things is no less a quasi-public corporation. Conoy Township v. York Haven Electric Power Plant, Supreme Court of Pennsylvania, 71, Atl. Rep., 207.

Niagara Falls Illumination.

It may be that the illumination of the Falls of Niagara as a night spectacle will be re-established during the coming summer for the entertainment, instruction and pleasure of the thousands of people who annually visit Niagara. Mayor Anthony C. Douglass has always been a warm advocate and supporter of the electrical illumination, and recently W. D'Arcy Ryan, of the General Electric Company, was at the Falls in conference with the Mayor and other interested citizens relative to making the illumination a night feature of the summer to come. The main obstacle is the raising of a fund large enough to cover the expense, but indications are that the railroads will be disposed to assist the project. It is understood that Mr. Ryan feels he can improve greatly on the spectacle as it was presented in 1907, when the illumination amazed visitors by its beauty.

Edison, Still Inventing, Goes South.

Mr. T. A. Edison has left Orange, N. J., this week for the South, where he will spend some weeks on his plantation at Fort Myers, Fla. When seen at his laboratory just before leaving, he was found busily engaged with half a dozen workmen and experts on some details of his storage battery. Of the present form several thousand are in use, especially in Germany; but Mr. Edison has not been satisfied with it himself. With regard to the improved style now under test, he spoke very emphatically as to its capacity and endurance, and said he proposed to put it on the market at an early date. Meantime he refuses to manufacture any more of the old type, although existing customers continue to send in orders.

Mr. Edison was also found to be actively occupied with the perfection of a new form of telephone transmitter for special service on railroads. During the period of carbon transmitter invention around 1877-8, Mr. Edison made innumerable types and an exhaustive investigation; and he is now resuming some of the work that promised results at that time. After the telephone passed out of his own hands at the time of consolidation, Mr. Edison said, he lost much of his interest in it, and other cares engrossed him in the lighting field. The demand and imperative necessity in the railway field has been urged upon him so strongly of late by many of his friends in the railroad telegraph departments, he has been led to take up the subject again, with most gratifying results. The new transmitter is remarkably sensitive. Mr. Edison notes that even to-day, "Unless something is already known of the speaker or the subject, people frequently have to repeat and repeat or are asked to spell it out, or give it up. With my new transmitter, of the variable pressure type, but with very novel electrodes, I think I compass the entire alphabet with a clearness and sharpness of enunciation never before attained." Mr. Edison said the transmitter would doubtless find extensive use outside the service for which he primarily intends it. Several roads are awaiting the production of these telephones before making extensions of their dispatching systems.

Although under positive medical instruction not to do it, Mr. Edison, prior to his departure South, has been working nightly in his laboratory, finding himself simply incurable where the habit of work is concerned. Otherwise the doctors give him a clean bill.

Hydro-Electric Development in Maine.

At a meeting of the Massachusetts Street Railway Association held in Boston on Feb. 10, Mr. John R. Graham, president of the Bangor Railway & Electric Company, Bangor, Maine, read a paper entitled "The Electrification of a Part of the State of Maine." In the course of his address special consideration was paid to the recent important hydro-electric developments in Maine.

The history of the Bar Harbor & Union River Power Company is typical of the usual course of hydro-electric developments in Maine. The project of combining the water powers in use on the Union River, at Ellsworth, Maine, had been in mind for about 30 years. The originator of the plan finally succeeded in interesting a fellow townsman sufficiently to employ an engineer to investigate the feasibility of the project. The report was favorable, and plans were drawn for the installation. As the Union River is in a somewhate remote portion of the country, had never been mapped by the government and was so little known that the numerous engineers who investigated the project for various capitalists could not be convinced that sufficient power was available, it was difficult to secure the money needed to develop the work. Finally, in 1907, the Bangor Railway & Electric Company interests decided to buy the property. Although the project was condemned by many engineers, it is a fact that during the past year, when water was the lowest on record, the Ellsworth plant was about the only plant in Maine which had an abundant supply of water. With the enlistment of capital the third step was completed, but much remained to be done. Detailed plans were to be drawn, contracts for construction were to be let, property rights to be obtained, highways to be relocated, buildings were to be moved from the area to be flooded, and new bridges had to be erected. Actual construction was begun on March 1, 1907. The first three months were occupied in removing sawmills with their accompanying dams, which had occupied the site of the plant for many years, installing the contractors' plant necessary for the rapid and economical construction of the work, and in blasting out the rock required to be removed from the tailrace and canal. On June 9, 1907, the actual construction of the dam was begun, and the work proceeded so rapidly that on Jan. 1, 1908, the plant was practically completed.

The Ellsworth dam is located between two granite bluffs rising 100 ft. above the bed of the river. The dam is of the Ambursen steel and concrete construction, rising 71 ft. above the river bed, and is probably the highest dam in New England. The power house is built of concrete blocks. At one side of the building is a heavy concrete wall forming one side of a canal, the latter having been blasted out of a solid ledge and serving as a forebay from which the water is drawn through penstocks 8 ft. in diameter, which carry the water to the turbines located 60 ft. below. At intervals of 15 ft. in the interior of the dam, which is hollow, buttresses of concrete were built parallel to the flow of the stream. These buttresses were built A-shaped, being about 100 ft. wide at the base and from 60 ft. to 71 ft. high. They vary from 16 in. in thickness at the top to 36 in. at the base, and are stiffened by concrete beams reinforced by steel bars placed at right angles to the flow of the stream. These buttresses form the supports of a deck or slab of reinforced concrete extending from buttress to buttress entirely across the stream. The deck ranges from 36 in. in thickness at the bottom to 18 in. near the crest. This is the highest dam of this type that has so far been built, and is to all indications thoroughly satisfactory.

The Bar Harbor company has secured practically the control of the whole river with its water supply. The Union River drains a basin covering 525 sq. miles, included in which is a lake area of 40 sq. miles. The annual rainfall of the region is about 34 in. The average temperature is about 42 deg., and as the amount of evaporation is governed by the temperature, this low average is of great value, leaving as it does a large amount of water for the run-off. It is a fact that at no point except in North China does the isotherm of 42 deg. approach so near the equator. Within two miles of the present power station it is possible to construct another dam, thereby raising the present level of the river at that point by about 15 ft. and forming a reservoir which will impound 5,000,000,000 cu. ft. of water that can be used at the power plant at a head of 60 ft. This arrangement would insure about 10,000 hp continuously.

The present development is for 1500 kw. The power station contains two units; one consists of two S. Morgan Smith turbines rated at 1700 hp and directly connected on a horizontal shaft to a 1000-kw, 2300-volt, three-phase, 60-cycle General Electric alternator; the other consists of two turbines rated at 850 hp, driving a 500-kw generator. The e.m.f. is increased to 33,000 volts for the transmission of energy to Bar Harbor and Bangor. One of the novel features of the work is that the transformers and all of the high-tension apparatus are placed in one of the hollow compartments of the dam, in what would otherwise be wasted space.

Energy is transmitted for operating the trolley cars of Bangor, both in passenger and freight service; street lighting in Bangor, Ellsworth and Bar Harbor, industrial service and pumping water for many communities. At Ellsworth, a town of 5000 inhabitants, the company lights the streets and houses, furnishes energy to several local industries, and owns and operates the local water supply system. The energy for the local service is transmitted at the generator voltage of 2300, the e.m.f. being decreased to 500 volts for the motor service and 105 volts for lighting.

The Bar Harbor transmission line is 21 miles long. Use is made of cedar poles placed partly on the highways and partly on private right of way purchased by the company. The three conductors are placed in the form of an equilateral triangle, with the apex on top of the pole, and the two lower wires near the opposite ends of a cross-arm 7 ft. long, the spacing of the wires being 4 ft. The insulators are of brown porcelain, of the Locke type, having double petticoats; they are carried by steel pins covered with porcelain sleeves to guard against short-circuit from the conductors to the pin.

Use is made of six-strand aluminum wire which, thus far, has been very satisfactory. Aluminum as a conductor, in the company's experience, seems to have taken the place of copper perfectly and has the advantages of lower first cost and considerable decrease in the cost of erection.

It was necessary to cross an arm of the sea, called Mt. Desert Narrows, between Ellsworth and Bar Harbor. These are navigable waters and the government authorities required that the lowest wires should be at a minimum height of 125 ft. above mean tide. This action necessitated the erection of two steel towers 160 ft. high and about 900 ft. apart. These towers are erected on opposite shores, on concrete foundations, and carry three conductors of No. 2-0 hard-drawn copper, strung with a sag of 40 ft. at the center of the span. At the shore ends of the spans, and 400 ft. distant, the wires are dead-ended on steel poles 60 ft. high, these being strongly guyed with galvanized steel cables ¾ in. in diameter. At the Bar Harbor end of the line the e.m.f. is decreased to a value suitable for local lighting and industrial service, a portion of the energy, however, being sent 11 miles farther to light Northeast Harbor, the transmission potential being 10,000 volts.

From the plant at Ellsworth a line similar to that going to Bar Harbor is extended to Veazie, the company's present water-power plant, a distance of 25 miles, where the transmitted energy is used—in times of low water or when anchor ice is giving trouble—to assist in operating the trolley system of Bangor and to carry the Bangor lamp and motor load. At Veazie the company owns a 2500-hp steam plant, and at Bar Harbor one of 1200 hp. These plants are so interconnected that in case of a breakdown at Ellsworth energy can be sent to Ellsworth or Bar Harbor or to Bangor, as needed. The new dam has had no trouble from anchor ice on account of the great depth of the pond.

There are five principal lake chains in Maine connected by rivers and discharging into main channels which deliver into the ocean. These are the Umbagog-Rangeley series, with an

area of about 90 sq. miles, drained by the Androscoggin River; the Moosehead series, forming the headwaters of the Kennebec River; the Penobscot series; the Schoodic Lakes, drained by the St. Croix River, and the headwaters and stream of the St. John River. The topography of Maine tends to equalize the rainfall over the watersheds, and the effect of the heavy forests also tends to equalize the yearly flow of the streams. The lakes are most valuable at times of low river stages, tending to preserve the regularity of flow and to avoid the need of auxiliary steam plants. Though much has been done to control the storage water in the lakes of Maine and thereby increase the dry-weather flow of the streams, co-operative development is most desirable, such as has taken place on the Presumpscott and Cobbosseeconte rivers from artificial storage.

The Penobscot has the largest drainage area of all the rivers in Maine, or about 8500 sq. miles, or more than one-fourth of the State. An area of 800 sq. miles of the river basin discharges its waters into the main river below the lowest water power at Bangor.

Several hydro-electric developments have been made in the Penobscot within 14 miles of Bangor, passing upstream, the river dropping about 88 ft. in that distance. Dams are built across the main channel at five points, using an aggregate fall of from 55 ft. to 60 ft. There are also three dams on Stillwater branch, Stillwater and Orono. At Montague a 20-ft. fall is utilized. At Veazie, on the Penobscot, there are several small falls where the working head varies from 7 ft. to 11 ft. Under the larger head the wheels at present installed furnish 1650 hp, 1500 hp being used for electricity and the balance for pumps to furnish the water supply for the towns of Veazie and Brewer. There is in use a steam plant of the same rating as the turbines, for some steam power is required in the summer. The electricity developed at this station is utilized for street lighting at Brewer, for commercial arc and incandescent lighting in Bangor, and for trolley service in Bangor and to Winterport and Old Town.

The Kennebec River basin extends from the Canada line to the ocean. It is 150 miles long, varying from 50 to 80 miles in width, and embraces a total area of 6330 sq. miles. The general elevation is less than that of the Androscoggin basin. Moosehead Lake, with an area of 120 sq. miles, forms about one-third the entire lake surface in this basin. The sources of the streams forming the Kennebec are at an elevation of from 1800 ft. to 3000 ft. There is a mean descent of about 9.1 ft. per mile throughout the water-power portion of the river.

The seven waterfalls at present utilized are between Carritunk Falls and Augusta and aggregate in rating 24,000 hp; they utilize about 142 ft. of the total fall of 314 ft. between those points. The International Paper Company uses 3500 hp at Carritunk Falls under a head of 30 ft. At Madison during normal stages of the river a head of 20 ft. is utilized, the power being at present about 2250 kw. The larger consumers at Madison are paper companies, textile companies and a local pumping station. The Great Northern Paper Company uses about 1200 hp in electrical service at all times.

Only a small part of the power available at Madison is employed as yet. The Great Northern Paper Company has made plans for utilizing two falls just below the town. One is a 20-ft. fall, to be used exclusively for electrical service. A dam about 640 ft. long will be built and sufficient apparatus will be installed to generate 3000 hp. The other fall will be used mechanically for grinding wood pulp.

At Skowhegan a 17-ft. fall is utilized, giving 5100 hp. About 750 hp is used exclusively for electrical service. Energy is used by grist, saw, planing and woolen mills, sash and blind, and scythe factories. At Augusta, the head of tide water, a crib dam 17 ft. high and 950 ft. long has been constructed, impounding water 17 miles upstream to Waterville. On the east bank of the river the Cushnoc Paper Company and the Kennebec Light & Heat Company use 1400 hp, the latter company furnishing the municipal lighting for Augusta, Gardiner, Hallowell and Togus. The fall is affected somewhat by the tide.

On the Androscoggin River at Brunswick about 1000 hp is used by the Brunswick Electric Light Company for service in Brunswick and Topsham. No lack of water at this privilege has ever been experienced. At Lewiston the large cotton mills and the city employ water power extensively, the rates for the older companies being by lease, from $5 per hp-year to $12.50 for the later comers. These prices apply to the net power on the shaft, assuming the latter to be 75 per cent of the gross power of a given fall and quantity of water. The mills run 60 hours a week, and in some cases daily measurements are made of the power. Auxiliary steam power is somewhat used.

At Deer Rips a dam is being constructed to make available a fall of 28 ft. for electric power in Lewiston. At the Crooked Rips, opposite the town of Turner, there is a dam, built some years ago and giving a moderate fall, but now serving no useful purpose. At Livermore Falls 500 hp is developed for electric lighting and 2500 hp for mill work. The head realized is about 16 ft., but the rapids extending downstream indicate that an additional fall of about 25 ft. is available.

Mr. Graham stated that there are many other water powers in use for both mechanical and electrical service, and quoted others of the former type in conclusion. The electric developments cited were those with which he is in close touch.

Selective Emission of Incandescent Lamps.

A paper entitled, "Selective Emission of Incandescent Lamps As Determined by New Photometric Methods," by Messrs. E. P. Hyde, F. E. Cady and G. W. Middlekauff, was read at a meeting of the New York Section of the Illuminating Engineering Society, held on Jan. 11.

The recent development of high-efficiency metallic filament lamps has aroused new interest in the measurement of the high temperatures of glowing metals, and has raised the question as to whether the high efficiencies are due primarily to the high temperatures at which the filaments operate, or to a selective radiation, where by selective radiation is meant that the distribution of the energy in the spectrum of the radiating body at a given temperature is different from that of a black body at the same temperature.

A recent photometric study by the author of the relative properties of the newer metal, and the older carbon filament lamps has led to the establishment of two new photometric methods by which a positive qualitative criterion may be had of relative selectivity of two radiating filaments. According to the first method if one filament is maintained at some definite voltage or current—that is, at some definite temperature—and the voltage of a second filament is changed until the distribution of energy in the visible spectra of the two as determined by a spectrophotometer is the same, then if the two filaments had identical radiating properties the energy curves of the two would be identical throughout the entire spectrum, and the temperatures of the two filaments would probably be the same. If this were the case, the ratio of the energy in the visible spectrum to the total energy radiated would be the same for the two filaments. Now, the energy per second radiated in the visible spectrum can be measured by determining the lumens, and the total energy per second radiated can be determined by measuring the watts supplied to the lamp since there is no convection and very little conduction.

If the radiating properties of the two filaments were identical, the lumens per watt under the above condition would be the same for the two [illegible]. Under the above conditions the lumens per watt are different, and the filaments must be radiating selectively with respect to the other.

According to the second method the two filaments are brought to the same distribution of energy in the visible spectrum in the same way as that employed in the first method. Then a determination is made for each filament of the percentage change in candle power in a specific direction equivalent commercially to percentage change in flux corresponding to a 1 per cent change in watts supplied to the lamp; these two

coefficients of change of candle-power corresponding to 1 per cent change in watts would be the same if the radiating properties of the filaments were identical. Conversely, if the two coefficients are different, one filament must be radiating selectively with respect to the other.

In the actual use of these two methods the determination of the agreement in the visible spectrum of the energy curves of the two filaments had been made, not with a spectrophotometer as described above, but by means of a color match in an ordinary Lumner-Brodhun contrast photometer. If one lamp is maintained at some definite voltage and the voltage of a second lamp is changed until the color of the light radiated by the two lamps is the same, as observed in the photometer, it has been found that the spectrophotometric curves of the two filaments agree excellently. The color-match method is simpler and perhaps even more exact than the spectrophotometric method, provided there is no strong selectivity within the visible spectrum.

By the use of the above two methods it has been shown qualitatively that there is a decided difference in selectivity among different filaments.

It is not possible, however, to determine the exact amount of the difference in selectivity without knowing the true temperatures for the determination of which there is at present no known accurate method.

By making an assumption which has been found to be true for platinum and which, although probably correct for most metals, has not been demonstrated to be true, it is possible to form an idea of the direction in which the difference in temperature will occur and to place a lower limit on the effect of selectivity in partly accounting for the high efficiency of the metallic-filament lamps.

If we imagine a radiating body which tends to exaggerate in its emission the energy of the shorter wave-lengths—that is, a body which emits a larger proportion of its total radiant energy in the visible spectrum as compared with a black body and the same true temperature—it is probable that this property of selective emission would obtain in the visible spectrum also, so that the emission in the blue would be relatively larger than the emission in the red as compared with the emission from the black body at the same temperature. If this assumption, which would seem to be true for platinum, is true for tantalum, tungsten and osmium, then the values recorded in the last column of the tables give, in every case, the lower limit of the effect of the selectivity on the efficiency of the filaments.

TABLE I.—AVERAGE VALUES OBTAINED ON LAMPS OF EACH TYPE AT VOLTAGES CORRESPONDING TO A "COLOR MATCH" WITH THE STANDARD LAMP AT 75 VOLTS.

Types of filament.	Red black-body temperatures.	Relative change in cp for 1 per cent change in watts.	Flux per watt.
Untreated carbon	1,420 C.	1.00	1.00
Helion	1,405	1.00	0.97
Treated carbon	1,395	0.97	1.06
Gem	1,410	0.98	1.05
Tantalum	1,340	0.83	1.28
Tungsten	1,345	0.79	1.49
Osmium	1,390	0.80	1.85

TABLE II.—AVERAGE VALUES OBTAINED ON LAMPS OF EACH TYPE AT VOLTAGES CORRESPONDING TO A "COLOR MATCH" WITH THE STANDARD LAMP AT 100 VOLTS.

Types of filament.	Red black-body temperatures.	Relative change in cp for 1 per cent change in watts.	Flux per watt.
Untreated carbon	1,680 C.	0.86	3.85
Helion	1,650	0.85	3.85
Treated carbon	1,645	0.84	4.15
Gem	1,650	0.84	4.0
Tantalum	1,570	0.72	4.35
Tungsten	1,555	0.71	5.25
Osmium	1,610	0.69	5.9

TABLE III.—AVERAGE VALUES OBTAINED ON LAMPS OF EACH TYPE AT VOLTAGES CORRESPONDING TO A "COLOR MATCH" WITH THE STANDARD LAMP AT 125 VOLTS.

Types of filament.	Red black-body temperatures.	Relative change in cp for 1 per cent change in watts.	Flux per watt.
Untreated carbon	1,890 C.	0.76	9.0
Helion	1,850	0.75	9.2
Treated carbon	1,855	0.74	9.5
Gem	1,885	0.76	9.4
Tantalum	1,765	0.65	10.0
Tungsten	1,740	0.67	11.5
Osmium	1,800	0.65	12.5

It should be noted that since some of the measurements were made under conditions that were not entirely satisfactory, while the general conclusions are probably quite definitely established, yet the numerical results given in the tables are not insisted on to a high degree of accuracy.

The results of an investigation of a number of kinds of filaments using both of the methods are given in Tables I, II and III.

In Table I are given the values found for the lamps when at a color match with a 110-volt 3.5 carbon lamp consuming 3.5 watts per candle, taken as a standard, when operated at 75 volts. In Tables II and III are the corresponding data for the lamps when at a color match with the standard lamp at 100 and 125 volts respectively. The values in columns 3 and 4 are in terms of arbitrary units so taken that for the untreated carbon filament at a color match with the standard lamp at 75 volts, the value in each case is unity.

If there were no selectivity, the lumens per watt would be unity for every type and the coefficient of percentage change in candle-power for 1 per cent change in watts would be the same for each type.

The order of the filaments is that of their relative selectivity, and it is significant that this order is the same by both methods and for the three arbitrary temperatures of the standard lamp at which measurements were made.

The helion filaments which were used were old, and they may have lost the silicon deposit, which fact may account for their position in the table.

In discussing the paper, Mr. J. W. Howell stated that facts indicating the relative selectivity of treated and untreated carbon lamps were discovered many years ago. It was observed that when treated carbon lamps and untreated filaments were operated at conditions which gave equal lives to the filaments, they seemed to be operating at the same temperature as determined by optical methods, although the specific consumption of the treated filaments was much less than that of the untreated filament. That is to say, the more efficient lamp did not appear brighter to the eye, the specific brilliancy of the two being practically equal.

Discussion of Electric Motors.

At the meeting of the American Association of Electric Motor Manufacturers, held in Pittsburgh, on Jan. 26, 27 and 28, 1909, a number of papers were read on subjects of interest to electrical men as well as to makers of motors.

Mr. J. M. Hipple discussed temperature ratings for semi-enclosed and enclosed motors. He stated that a motor experiences an increase of temperature rise of from 12.5 per cent to 25 per cent when changed from the entirely open to the semi-enclosed type. He expressed the opinion that when fibrous coil insulation is used a temperture rise at full-load of 55 deg. C. on the windings and 60 deg. C. on the commutators should not be exceeded in any type of motor. When use is made of non-combustible insulation temperature rises 20 deg. C. higher may be allowed.

Mr. L. E. Underwood, in describing factory tests of direct-current and alternating-current motors, stated that the General Electric Company subjects all of its small motors, excluding fan motors, up to and including 10 hp, to an e.m.f. of 1500 volts when the normal voltage does not exceed 400, and to 2000 volts when the machine is intended for from 400 to 800 volts.

Mr. R. S. Feicht claimed that the temperature rise of semi-enclosed constant-speed induction motors for continuous duty should not exceed 40 deg. C. at full-load, while enclosed motors of the same type, and all induction motors for intermittent duty, should not experience a temperature rise exceeding 55 deg. C. at full-load.

In a paper devoted to starting devices for direct-current and alternating-current motors, Mr. H. D. James made the follow-

ing recommendations for standard starters with constant-speed motors:

Direct-current motor starters should be provided with no-voltage release and should be so arranged that the handle cannot be left in any of the starting positions. A starter for a slip-ring type of induction motor should consist only of the starting device connected in the secondary circuit, and should not be provided with a no-voltage release. The line switch and the overload protective devices should be separate from the starter. Starting devices for squirrel-cage induction motors should not be provided with either overload or no-voltage release attachments. The starting switch should be arranged for use as the line switch.

No Municipal Plant for Lima, Ohio.

After a long controversy, the City Council of Lima, Ohio, has voted to give the contract for street lighting and a franchise for 10 years to the Ohio Electric Railway Company, which already occupies the field. There was active agitation for the establishment of a municipal plant, but the Council evidently considered that with the reduction in price for arc lighting made by the company there was left no incentive for the city to go into the lighting business itself. The new price is to be $57.50 per lamp per year. The old price was $85. The ordinance specifies that within 2½ years the company shall replace its present equipment of street lamps "with metallic flame lamps which shall use electrical energy required by the flow of approximately 4 amp of current under a difference of potential which shall not vary beyond the limits of 66 and 74 volts per lamp at the lamp terminals."

The rates for commercial and domestic lighting are 8½ cents for the first 25 kw-hours consumed per month. For consumption in excess the rates decrease until all over 2400 kw-hours per month is billed at a 3-cent rate. The minimum bill is 50 cents per month. This schedule of rates, while it undoubtedly will be popular with small consumers who use current but a short time each day and who get a rate below the cost of production, is not equitable to small consumers using current many hours per day, as they have to pay the losses on the short-hour consumers. The rates on power are according to the same general plan, being from 7 to 3 cents per kw-hour.

Testing High-Tension Insulators by Means of Polarized Light.

A paper read by Prof. A. S. Richey and Dr. Frederick Bonnet before the Worcester Polytechnic Institute chapter of the Sigma Xi Society described a method of testing high-tension insulators which served to show defects in annealing that could not be detected by other methods. Experience had shown that of two types of insulators made by two different manufacturers so as to be practically identical in form and using glass of the same chemical composition, one gave excellent results in service, while the other was subject to excessive breakage. Tests by means of polarized light proved that the latter type was subjected to stresses caused by improper annealing, while in the former there was an almost entire absence of stresses.

In carrying out the tests each insulator was so mounted that when it was rotated about its principal axis the same thickness of glass skirt was always presented between the polarizer and the analyzer, which previously had been arranged so as to allow no light to pass. Stresses in the insulator were indicated by the varying intensity of light and by color changes. The insulators showing stresses had been poorly annealed. Under service conditions they became heated on account of conductive leakage and were destroyed.

The authors expressed the opinion that the polarized light method is valuable in detecting poor insulators although the tests can be considered as only qualitative.

Chicago Electric Club.

The Electric Club of Chicago held its first annual election Feb. 3 at its regular weekly noonday luncheon. Two tickets were presented, one the regular ticket of the nominating committee and the other an independent ticket. The former ticket prevailed, the officers elected being as follows: President, Mr. C. A. S. Howlett; vice-president, Mr. Frederic P. Vose; secretary, Mr. William S. Taussig, Marquette Building; treasurer, Mr. James G. Pomeroy. Board of Managers: Messrs. W. R. Pinckard, Henry F. Holland, John J. Schayer, F. S. Hickok and S. F. Dibble.

At the meeting of the club on Feb. 10, Mr. W. S. Taussig, the new secretary, announced the names of the new chairmen of committees as follows:

Speakers: Mr. F. S. Hickok, of the Ridgway Dynamo & Engine Company. Finance: Mr. S. F. Dibble, General Electric Company. Entertainment: Mr. John J. Schayer, Commonwealth Edison Company. Membership: Mr. H. F. Holland, Pacific Electric Heating Company. The House and Reception: Mr. W. R. Pinckard, Westinghouse Electric & Manufacturing Company. The membership of the club is now so large that the present weekly luncheon quarters at the Automobile Club are hardly large enough for all to attend. Therefore, it is possible that there may be a lull in the campaign for new members, which has been very successful, until arrangements are made to secure permanent quarters.

The speaker of the occasion was Mr. Frank L. Perry, who had for the sumbject of his talk, "The Wright Aeroplane and Its Possible Adaptation to Wireless Telegraphy." Mr. Perry, who witnessed the recent demonstrations of the Wright aeroplane at Ft. Myers, near Washington, is a great admirer of the beautiful mechanical means adopted to make the flying machine a success. He set up before those present a small model of the aeroplane which he had made, and explained its various parts and their operation. He then made a demonstration to show how the machine might be used in sending and receiving messages by "wireless," using two aerial wires, one to serve the usual purpose of a "ground." The whole demonstration and the informal talk accompanying it were very interesting to the members, and Mr. Perry was highly complimented.

CURRENT NEWS AND NOTES.

ELECTROLYTIC RECTIFIER PATENTS.—United States patents to the number of 45 have been issued to date on electrolytic rectifiers.

PATENT COURT.—The Judiciary Committee of the House of Representatives has reported favorably the American Bar Association bill providing a court for the trial of patent suits. The bill establishes a court of five members to sit in Washington, the chief justice to be appointed by the President and the four associate justices to be designated from among the judges of the Circuit and District Federal Courts by the Chief Justice of the Supreme Court of the United States. Two of the associate judges will sit for three years and the other two for six years, after which they may be redesignated for six years.

OHIO INDEPENDENT TELEPHONES.—According to statistics prepared by President Frank L. Beam, of the Ohio Independent Telephone Association, the number of Independent stations is now 324,063, as against 307,674 in 1907. Thirteen new exchanges have been established during the year and the number of toll lines has increased from 1,200 to 1,500. The number of stockholders has also grown from 4,158 to 5,000. In the past three years the number of subscribers to Independent exchanges has increased from 1,000 to 1,500, showing a gain of 158,000. According to this report, the Bell companies have 300 exchanges, 848 toll stations and 172,225 stations in the State.

TELEPHONES IN NEW YORK CITY BUILDINGS.—The five largest office buildings of New York City contain 2360 miles of telephone wire and almost 10,000 telephones.

CARNEGIE INSTITUTE WORK.—The current year-book of the Carnegie Institution shows that during the past year $636,300 was distributed among nearly 500 persons engaged in conducting scientific research. Plans have been completed for a specially designed ship, to be called the *Carnegie,* which will be built in Brooklyn and used for magnetic surveys in the Atlantic Ocean.

MICHIGAN ELECTRICAL ASSOCIATION.—Mr. A. C. Marshall, of Port Huron, Mich., secretary of the Michigan Electrical Association, has just issued in bound form the proceedings of the fifth annual convention of the association, held last August. The papers and discussions have been well edited, and the volume is a credit to the enterprising electric light association which issues it.

ELECTRICITY AT THE PANAMA CANAL LOCKS.—It is stated that the Board of Engineers which accompanied President-elect Taft on his recent visit of inspection to the Isthmus of Panama will recommend that some sort of electrical apparatus be employed for stopping ships before entering the canal locks and also for towing them into the locks. The object of this is to avoid damage to the lock gates by collision.

WIRELESS TELEGRAPH BILL REPORTED.—The Committee on Merchant Marine and Fisheries, which has been considering the wireless telegraph bill, reported it favorably to the House last week. The bill, as finally drawn, provides a penalty of $300 fine or one year's imprisonment, or both, for the failure of any ocean-going craft, carrying more than 50 passengers and going 200 miles, to have on board a wireless outfit and an operator. The bill does not apply to the Great Lakes, but there will be a fight in the House to include this shipping.

MAXIM SILENCERS.—The demonstration by Mr. H. P. Maxim of his gun silencer last week, in New York City, briefly noted in these pages, continues to excite great interest in the various arts and crafts affected. With regard to the weight of the device, it is so small that no appreciable burden is added to the rifle; and it is carried in any pocket until the moment of use, when it is screwed to the muzzle in a second. The weight of the smallest silencer is only 5¾ ounces, while that of the largest is 11 ounces, all made of steel. Some controversy has arisen over the humanitarian aspects of the invention, in its possible liability to abuse by vicious individuals.

GERMAN TELEPHONE RATES.—Much indignation is felt in Germany against a measure now before the Reichstag which, it is claimed, will largely increase telephone rates. The bill proposes to abolish the present system whereby Berlin subscribers got practically an unlimited service for the lump sum of $43.20 a year, substituting an annual rental charge of $24 for telephones with an additional fee of 1 cent for every connection made. The bill affects all Germany, but its provisions would be felt especially in Berlin, where it is computed that the result would be the raising of the average annual cost of business telephones to $72 or $96, or even in the case of some firms to $144.

THE CHAMBERLAIN LIBRARY.—The first section of the valuable library of the late Mr. J. Chester Chamberlain, who during his life was prominent in electrical circles, was sold by the Anderson Auction Company, 12 East Forty-sixth Street, New York City, on Feb. 16 and 17. This section comprised only first editions relating solely to 10 American authors: Longfellow, Bryant, Lowell, Whittier, Thoreau, Poe, Emerson, Hawthorne, Irving and Holmes. The total number of items was 882, including numerous dedication copies. Nearly all of the books are cased in covers (the original binding being preserved) designed by the owner and made by Bradstreet. The remaining portion of Mr. Chamberlain's library will be sold later.

INSTITUTE ANNIVERSARY DINNER.—The Dinner Committee of the American Institute of Electrical Engineers, to arrange for an anniversary banquet, celebrating the first quarter of a century of the society, which was founded in 1884, held a meeting last week at which it was decided to hold the affair at the Hotel Astor, New York City, on March 11. The price of the dinner, for which an excellent menu has been provided, is $5, including one wine, cigars and cigarettes. As usual on these occasions, ladies will participate, and an attendance of at least five or six hundred is expected. There will be only a few speeches, and these will be given by men of national prominence. Special attention is being paid to decorations, music and the souvenir menu. The following are the names and chairmen of the special committees: Speakers and Menu, T. C. Martin; Reception, M. Coster; Finance, G. A. Hamilton; Tickets and Seating, R. T. Lozier; Decorations, A. Williams; Press and Music, G. H. Guy; Old Timers, E. A. Sperry.

PARIS CONTROL OF CITY TRANSPORTATION.—The control of urban transportation is the subject of a measure now before the Paris Council which, it is stated, will be accepted by traction companies if enacted. Its main features are a division of profits between the traction companies and the city, and provision for municipal purchase of all railways at the end of specified periods. The companies will pay 4 per cent to the city on their gross earnings, after 8 per cent net profits have been distributed to the holders of stock. The remaining profits are to be divided equally between the companies and the city. Should the Council not exercise its right to purchase at the end of 10 years it may do so at any time thereafter, but at the expiration of 35 years the entire system, including conveyances, plants and everything pertaining to the ownership and operation of its lines, falls into the public's hands. None except Frenchmen shall be allowed on the administrative boards of the companies during the concession. Moreover, all materials used must be French in origin or manufacture, except in cases where especially authorized by the prefect of the Department of the Seine.

BUDAPEST NEWS-TELEPHONE.—According to a consular report, the Budapest news-telephone service, established many years ago, continues in successful operation. An annual subscription, $7.31, paid quarterly in advance, entitles the subscriber to two receivers and the full service of news, music, etc., the subscriber to pay the expenses of installation and removal, generally about $8.50. The service begins at 8:55 a. m., when a buzzing noise, loud enough to be heard across a large room and lasting 15 seconds, announces the correct time. At 9:30 the day's program of important events is announced; that is to say, the ceremonies, lectures, plays, races, etc. At 10 and 11 o'clock stock quotations and general news items are given. At noon comes a second announcement of the correct time, followed by parliamentary news and general items of interest. At 12:45 stock quotations from local, Vienna and Berlin exchanges and general news are given. At 2 o'clock more parliamentary and general news, and at 3 p. m. the closing prices of stocks, meteorological forecast, local personals and small items, and in winter the condition of the various skating places. At 4 p. m. court and miscellaneous news. From 4:30 to 6:30 military music from one of the great cafés or gardens. In the evening the subscriber may choose between the royal opera or one of the theaters, and later music by one of the tzigane orchestras. This program is sufficiently varied to satisfy the desires of all classes of subscribers, and in general the service seems to give the utmost satisfaction.

ransformer Substation for Niagara Energy at Rochester, N. Y.

ALTHOUGH the Rochester Railway & Light Company possesses a miniature Niagara in the Genesee River, the latter stream has not the Great Lakes back of it, to sure constancy of supply. For this reason steam-driven units e kept in readiness at all times, and having developed the ater power to its economical limit, the question of carrying e ever-increasing railway and lighting load was only anverable in two ways: Either the company had to install more



FIG. 1.—INCOMING LINES AT SUBSTATION.

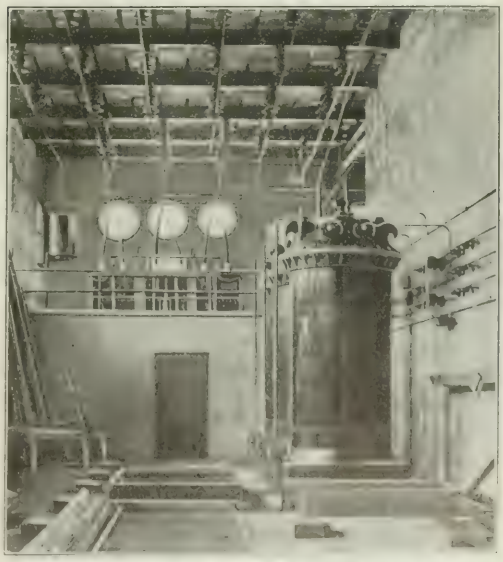
team-driven units or it would have to connect up to the Niagra transmission lines, passing outside of Rochester, on their way to Syracuse and the intervening towns. After careful consideration the company found it expedient to contract with the Niagara, Lockport & Ontario Power Company to take an initial oad of 4000 hp. In order to receive the energy and to transform t to pressures appropriate for its distribution circuits, the Rochester Railway & Light Company erected a transformer ubstation adjacent to the Lehigh Valley Railroad tracks at he corner of Elmwood Avenue. While the plant is now in complete operating condition, it has not yet been developed to ts ultimate capacity, which will probably not be reached for several years. The building and essential operative apparatus have been designed and built to accommodate an ultimate load of 24,000 hp, but at the present time working apparatus for 4000 hp only has been installed.

The energy is delivered by the Niagara, Lockport & Ontario Power Company to the Rochester Railway & Light Company at the former's switching station at Mortimer, N. Y., at which point also energy is delivered to the Erie Railroad and from which it is also sent on to Syracuse. Up to Rochester steel towers 55 ft. high carry the cables and from there to Syracuse wooden A-shaped frames are used. The insulators weigh about 75 lb. and have two petticoats and a hood, the latter having a diameter of about 14 in. The steel towers are set 550 ft. apart, and the A-frames are placed 220 ft. apart. From Mortimer the energy is brought over two separate transmission lines to the substation referred to, which is known as Station No. 33. The Niagara, Lockport & Ontario Company's switching station is located about four miles outside the city and 40 ft. to 50-ft. steel towers and aluminum cables run on a private right-of-way adjacent to the Lehigh Valley Railroad track [illegible]

The transmission line carries 60,000-volt, three-phase, 25-cycle current and before entering the transformer station the lines pass through protective apparatus carried on some 50 wooden poles, as shown in Fig. 1. These poles contain three sets of horn lightning arresters with air gaps and resistance. The shortest path consists of a carborundum resistance; the next consists of a concrete column and the longest path comprises about 15 ft. of thin copper wire acting as a fuse. The lightning arresters are of a type specially designed for use on the Niagara, Lockport & Ontario system and the theory on which these arresters are installed is that for ordinary slight static disturbances in the line, the arrester having the lower striking e.m.f. will discharge, and since it has in series with it a comparatively high resistance, the resultant disturbance due to the current which follows the discharge will be comparatively slight.

A more severe static disturbance causes the lightning arrester having the lowest gap and the arrester having the next higher gap to discharge simultaneously, thus affording two paths to earth, the combined resistance and inductance of which is much lower than that of the first path. When both arresters discharge the disturbing effect on the system, due to the generated current which follows, is much severer than that in the first instance. For a direct lightning stroke on the line, the three arresters would discharge simultaneously; the long, thin copper wire in the case of the arrester with the highest air-gap blowing and interrupting the arc upon it, the disturbance of the circuit finally ending upon the other two arresters.

The substation building is approximately 50 ft. wide, 120 ft. long and 30 ft. high. It is built of reinforced concrete, the walls being 16 in. thick and having an 8-in. space in the middle formed by the use terra-cotta tile. The roof is made of tile laid on steel rafters and purlins, which are left bare underneath the tiling. The window frames are of metal with self-closing sashes in case of fire and wire-mesh glass. In the construction of the building electricity was used for every conceivable purpose, including the mixing and hoisting of concrete, the pumping of water, the cutting of pipe and even the cooking of lunches for the foreman. The building is divided into three



[illegible] room on the east side extending from the floor to the roof, and a two-story distributing room on the left side. The latter consists of an operating room on the second floor and an entrance and bus room on the lower floor. The lower part of the inlet room is used for water circulating pumps, a storage battery, bathroom and storeroom. On the upper floor are two West-inghouse [illegible]

lines pass to these from the lightning arresters, entering the building through six bull's-eyes made of 36-in. sewer crocks, each closed with a double window of glass, through which passes a large porcelain tube. The circuit-breakers are equipped with inverse time relays.

After leaving the circuit-breakers, the conductors are carried on insulators suspended from the roof rafters over the transformer room, as shown in Fig. 2. The conductors form a loop here and are so arranged that any part of the ring bus can be isolated from any other part for repairs, alterations or additions. Practically all the conductors inside the building are bare copper or aluminum pipes. From the bus, the circuit is carried to transformers which step down the voltage from 60,000 to 11,000, the pressure at which it is delivered into the city. At present four 1000-kw, oil-and-water-cooled transformers are installed, one of which is kept in reserve for emergency use. Fig. 2 shows a view of the transformer room, which is large enough to contain ultimately 18 of these transformers In this room there is a pipe trench 3½ ft. deep and about 3 ft. wide extending down the center and normally covered with steel floor plates. On either side of the trench is a standard rail, the two forming a track for a small transfer car by means of which the transformers may be run to the north end of the room, which is partitioned off from the main room and which is provided with a 16-ton hand hoist. This arrangement was considered preferable to the use of a traveling crane as though slightly less convenient, the infrequency of use makes this inconvenience tolerable, as against the larger cost of a traveling crane and the obstruction that the latter would have introduced in suspending the conductors from the roof. In the pipe trench are four main pipes, a cold-water pipe, a warm-water pipe, a clean oil pipe and a foul oil pipe. The circulating water is pumped from the Genesee River to a well inside the station building, whence it is repumped through the transformer coils and discharged to the river or run over a riffle board of concrete, where the water is exposed in a thin sheet to the atmosphere and to slight evaporation. The use of the riffle board saves the continuous lift of water from the river, 1500 ft. away.

In the operating room on the second floor is a tank capable of holding enough oil to fill one transformer case. A similar tank is set into the ground floor of the inlet room, and in case it becomes necessary to repurify the oil in any transformer, a reserve supply carried in the foul oil tank is pumped through the oil dryer and filter to the clean oil tank on the second floor. A valve on the transformer is then opened and the foul oil

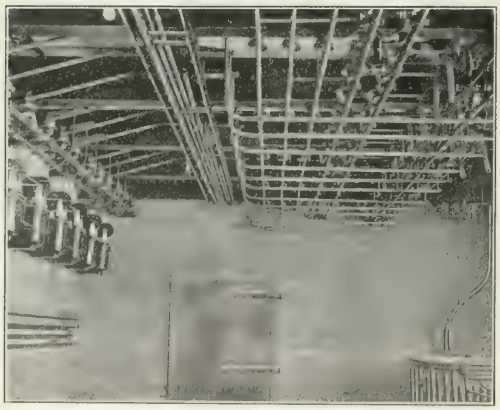


FIG. 3.—BUSBARS UNDER 11,000 VOLT SWITCHES.

flows by gravity to the submerged tank. The foul oil valve is then closed and the clean oil valve opened, whence the transformer case is rapidly filled from the elevated storage tank. The foul oil can then be dried and filtered in a leisurely manner by means of a Westinghouse outfit for dehydrating the oil.

After leaving the transformers the energy at reduced pressure is delivered to the bus room on the first floor on the west side of the building, passing upward and downward to and from oil circuit-breakers located on the operating floor above, until it is finally delivered to the underground cables connecting the transformer substation with Station No. 6. The connections in the bus room are so arranged that energy can be delivered from any set of transformers to any outgoing feeder without interfering with the general scheme of operation. Aside from the switchboard and clean oil storage tank there is nothing on the operating floor except the 11,000-volt oil switches. For operating the switches when the ordinary circuit provided for that purpose is not alive a battery of 66 cells, charged for a mercury rectifier set, is installed. The building is heated electrically and for the circuits in the station, two three-phase transformers are installed; each rated at 40 kw.

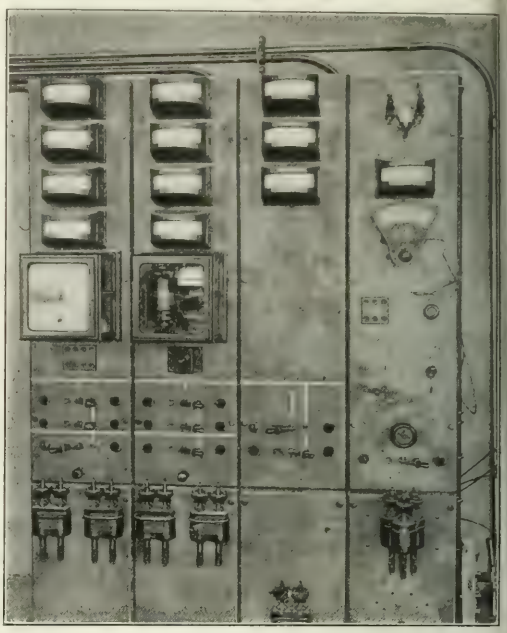


FIG. 4.—FRONT OF SWITCHBOARD.

In the entrance room a 1000-kw, three-phase, 25-cycle transformer is installed. This steps up the voltage from 11,000 to 18,000 for transmission over a wooden pole line 27 miles long to Canandaigua, where a motor-generator set is installed for carrying the railway load of the Rochester & Eastern Rapid Railway. Aluminum wire is used on this transmission circuit.

It is a significant fact that the engineers of the Rochester Railway & Light Company should regard the large investment necessary for the transformer station building with some misgivings. Located as the station is, adjacent to a public park, it was of course necessary to house the apparatus in a suitable structure; but had the station been located at some other point it is certain that the engineers would have seriously considered placing all the high-tension apparatus out of doors and making suitable provision for the switchboard and switchboard attendants only. There can be no doubt but that with a trifling expenditure, high-tension apparatus can be placed out doors without detriment to the apparatus or to its reliable operation. Although the scheme contemplated would have been slightly in advance of modern practice, the trend is in the direction indicated and away from expensive structures which serve no useful purpose, add to the fixed charges and oftentimes are inimical to reliable and continuous operation.

Power Plant Extensions of the Boston Elevated Railway Company.

AUTHORITATIVE information has been obtained concerning the enlargement of the power plants of the Boston Elevated Railway Company. This work was carried ut and completed about a year ago by the Stone & Webster Engineering Corporation, but for various reasons the details have ot been available until the present time. In December, 1906, the ngineers were called upon by the Boston Elevated Company to tudy the power situation of the elevated and surface lines of Boston. Investigation showed that 7500 kw in additional electrical equipment was needed immediately and that the shortage would in the course of another year increase to more than 0,000 kw. It was, therefore, decided to install without delay 0,800 kw of direct-current generating machinery with the necessary boilers, while an ultimate decision on recommendations for a plan of broad permanent power development was pending. On Jan 18, 1907, definite arrangements were made for the work of construction.

The emergency installation of 10,800 kw consists of four 2700-kw units distributed among three power stations. Two of the units were added to the Lincoln Wharf station, located on the harbor front in the heart of Boston proper, and one each to the Harvard station in Cambridge, and the Charlestown station, on the Mystic River, in Charlestown. It was stipulated that these new installations should be ready for service within one year, or by Feb. 1, 1908. At the same time still earlier completion was desired in order that the equipment might relieve the old stations before the next succeeding period of heavy winter traffic and the work was pushed with this end in view.

The stations were maintained in regular operation throughout the period of enlargement. Some serious physical difficulties interfered with rapid work. The construction was of a heavy and permanent character, and was at no point compromised for the urgent time requirement. Notwithstanding these various adverse circumstances the desired time was made. The work was finished within 10 months, so that the various units were ready to go under commercial load.

LINCOLN WHARF STATION.

The Lincoln Wharf power station furnishes electrical energy for the surface and subway lines in the heart of the city, as well as for a large part of the elevated system. The original station contained three 2700-kw, direct-current, vertical, cross-compound units and 6000 hp of Babcock & Wilcox boilers. The extension for the two new units is carried on a heavy concrete foundation supported on piles. The superstructure frame is of very heavy steel, particularly in the boiler room, where it is designed to carry boilers, economizers and an overhead bunker of 3000 tons capacity, or 33 tons per linear foot. Both the foundations and superstructure were designed by the constructing engineers, the architectural features being worked out by the architectural department of the Boston Elevated Company.

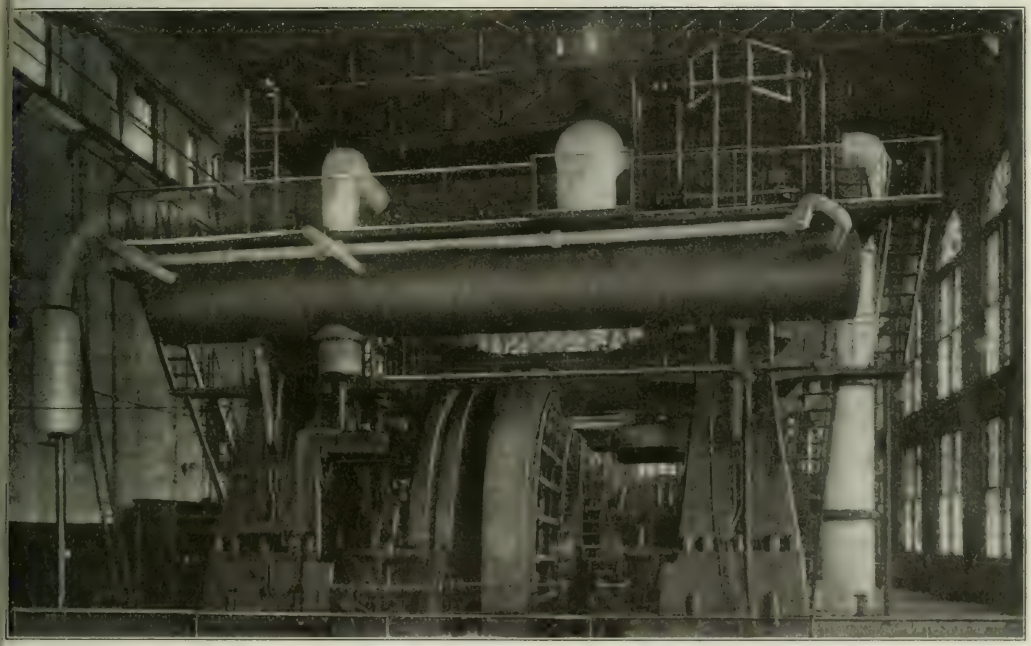


FIG. 1.—VIEW OF INTERIOR OF CHARLESTOWN STATION.

The new boiler room equipment consists of eight 600-hp Babcock & Wilcox boilers, with boiler suspensions attached directly to the building columns. The superheaters have such area that they will give 50 deg. superheat at normal boiler output and not more than 75 deg. at 50 per cent normal output. Roney mechanical stokers, each having an effective grate area of 111 sq. ft., exclusive of the dead plates and one-half the dumping grates, are provided throughout. The grates proper are of the sectional [illegible] consists of four Worthington [illegible] the basement under the boilers [illegible] sufficient capacity to supply all the boilers when running at 50 per cent overload.

The feed water passes successively through primary heaters between the engines and condensers, through open heaters fed by exhaust steam from the auxiliaries and finally through the economizers. These economizers are of the B. F. Sturtevant heavy pattern, tested to 400-lb. cold-water pressure. The primary heaters between the engines and condensers are of the

horizontal, closed type and are designed to raise the feed water from 40 deg. Fahr. to within 5 deg. of the temperature of the exhaust steam. The open heater is of the Cochrane horizontal, cylindrical type, with cast-iron trays, and raises the temperature of the feed water to within 3 deg. of the temperature of

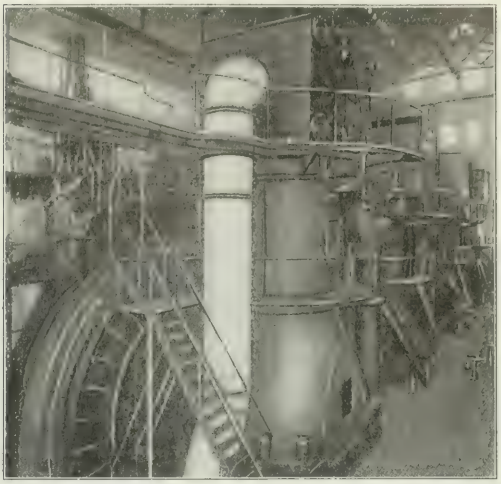


FIG. 2.—INTERIOR OF LINCOLN WHARF STATION.

the exhaust from the auxiliaries. The result is that the economizers deliver the water to the boilers at a temperature of about 250 deg. Fahr.

Squire's automatic feed-water regulators have been supplied in all the stations on old boilers, as well as new. This device controls the feed valve through pressure exerted on a diaphragm which tends to close the valve when the water in the boiler rises above a predetermined level. A pilot valve actuated by the expansion of a metal harp located in the side of the boiler regulates the pressure on the diaphragm. The harp is placed at the proper height in respect to the water level to give the maximum expansion or contraction for any change in the height of the water. The action of this automatic device is safeguarded by a water-column alarm which will attract the fireman's attention and enable him to regulate the water supply by a hand-operated valve in case of disarrangement of the automatic feed.

The new engines are of a heavy rolling-mill type, with a large factor of safety, and were built by the William Tod Com

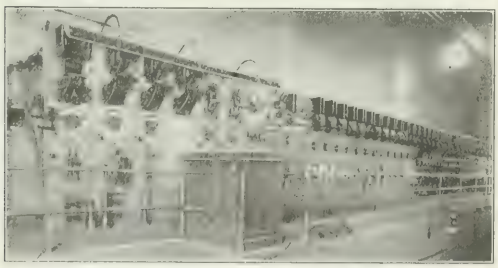


FIG. [illegible]—ENGINE ROOM, CHARLESTOWN STATION.

pany. When running at the designed initial steam pressure of 180 lb. per square inch, they have a sustained overload capacity of 50 per cent, with decrease in normal speed not exceeding 2 per cent. Each engine has a special barring arrangement consisting of a circular rack inside the rim of the flywheel and

a pinion driven by a 30 hp electric motor. Jet condensers built by the Warren Steam Pump Company, are used in connection with vertical, direct-acting, twin air pumps. The steam cylinders are 16 in. and the air cylinders 48 in. in diameter, with a common stroke of 24 in. These condensers were at the time



FIG. 4.—BOILER ROOM, CHARLESTOWN STATION.

of installation the largest of the type that had been turned out by the manufacturers.

The generators are of the direct-current railway type and were built by the Allis-Chalmers Company. The winding is compound and designed so that by the adjustment of a shunt on the series field they will operate at any characteristic between an approximate rise of 10 per cent and an approximate fall of 10 per cent, at the full-load potential of 575 volts. The falling characteristic was required to provide for proper distribution of load among the company's various stations. Commercial efficiencies guaranteed by the makers ranged from 89 per cent at one-quarter load to 94.8 per cent at full-load, decreasing to 94 per cent at 50 per cent overload. The switchboards and electrical distributing system have no particularly novel features. However, a part of the reconstruction consisted in moving the switchboard proper from a level of the engine-room floor to a gallery extending the entire length of the engine room.

In the general work of construction one of the more difficult features was a new tunnel for the supply of condensing water.



FIG. 5.—BOILER ROOM, HARVARD STATION.

Previously the plant had been supplied through a suction main, but the enlarged station required a gravity intake and limited space made tunneling necessary. The tunnel is 6 ft. in diameter and 210 ft. long, lying 19 ft. below mean high water. It was driven without the use of a shield in 56 working days and

hout the slightest accident. The workmen were safe-arded from danger of cave-in by steel roof plates.

CHARLESTOWN STATION.

The Charlestown station furnishes electricity for all the lines erating in Charlestown, Somerville, Everett and Chelsea. e old station contained 1200 hp of engines, boilers and xiliaries in a small structure, and one 2700-kw unit, with ilers, in a modern extension of the original structure, making actically 4000 kw in all. The recent work consisted in the largement of this newer portion to accommodate the new it and to provide space for a future machine of the same pacity. It included also the construction of intake and over-w tunnels for the condensing requirements of both old and w portions of the plant. The original suction intake and erflow pipes were so deteriorated as to require replacing, in y event, so they were entirely done away with and a new avity system was installed. The intake and discharge tun-ls are about 800 ft. long and 4 ft. in diameter, leading to the ystic River.

In the new building, the foundations are of concrete with wide footings resting directly on a bed of hard gravel, except under the new chimney and a portion of the north wall, where, on account of an underlying stratum of silt, it was necessary to drive piles. The superstructure is of steel frame and brick construction with a longitudinal brick wall dividing the engine room from the boiler room. The new boiler room will accommodate eight 600-hp Babcock & Wilcox boilers, though but four such boilers are included in the present installation. The new chimney and flues are of sufficient area for eight boilers. The boilers were built according to exceptionally rigid specifications, no cast iron or semi-steel being permitted in any part of the work. They were erected entirely independent of the building structure. In front they are carried on building columns, and in the rear by the standard Babcock & Wilcox type of suspension.

Superheaters are included and are of the same type and heating capacity as those installed in the Lincoln Wharf sta-tion. The new stoker equipment also is similar to that in the Lincoln Wharf station. The overhead bunker capacity is 600 tons, or 75 tons per boiler. This is three days' supply, or enough to carry over holiday periods or periods necessary in which to make repairs on coal-handling or conveying apparatus. The conveying apparatus consists of an inclined bucket conveyor from a hopper outside the building to the top of the boiler room and a horizontal fly conveyor to the several bunkers.

Economizers were not installed, because that would have entailed increasing the area of the boiler room and the saving effected by them would not have justified the extra expense. To heat the feed water, both a primary heater between engine and condenser and a Cochrane open heater are installed. The primary heater raises the temperature of the water to within 5 deg. of the temperature of the exhaust steam from the engine. The open heaters then increase the temperature of the feed water to about 210 deg. Fahr. before it enters the feed pumps.

The new engine is of the vertical cross-compound type and was built by McIntosh, Seymour & Company. The normal rated capacity at 190 r.p.m. and 160-lb. steam pressure at the throttle is 4100 hp, the maximum capacity being 7000 hp. With a superheat of 50 deg., the guaranteed steam consumption varies from 12.75 lb. at one-quarter load to 12.5 lb. at full load, increasing to 13.8 lb. at 50 per cent overload. The valve gear is the standard type of the makers, the main steam and exhaust valves being driven by fixed eccentrics, while the steam cut-off is effected by a riding valve controlled by a shaft governor. All valves are of the gridiron type. The condensing apparatus is similar to that in the Lincoln Wharf station.

The new generator in this plant is of the General Electric 600-volt railway type. It is built with commutating interpoles and was one of the first large generators thus equipped. In this case the operation has been most effective. Sudden and extreme changes of load can be effected without shifting of the brushes, and, even when running at a 50 per cent overload the circuit breaker may be tripped without sparking at

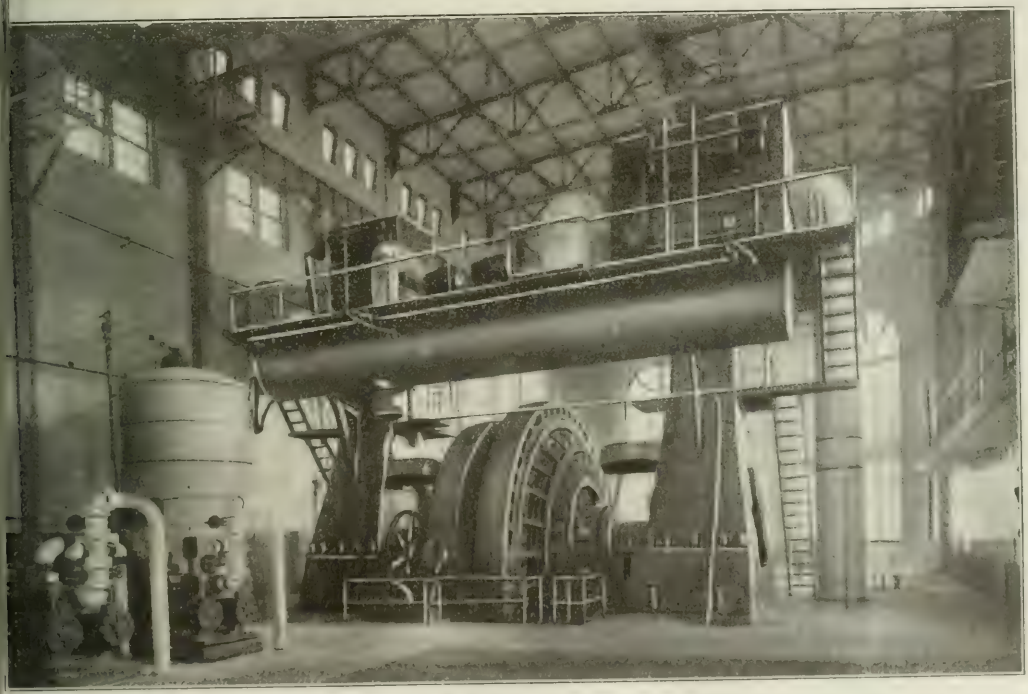


FIG. 6. VIEW OF INTERIOR OF HARVARD STATION.

the brushes. At the same time the generator has run satisfactorily in parallel with the other generators of standard non-interpole type. The guaranteed commercial efficiency of this interpole generator varies from 94 per cent at one-half load to 95½ per cent anywhere in the range from full load to 50 per cent overload.

Aside from the actual extension, a great deal of reconstruction was carried out in the old plant with a view of increasing efficiency and reducing fire risk. New stokers were placed under four of the old boilers. Old motor-driven feed pumps were replaced by duplex steam pumps. The piping system was changed over, and a Bulkley condenser was replaced by a twin vertical air pump and jet condenser, the same type as the condenser installed with the new engine. The switchboard was relocated in a steel and concrete gallery. A fireproof floor was built in the engine room, replacing a wooden floor, and various changes were made in the oil filtering and distributing system.

HARVARD STATION.

Located on the new Charles River Boulevard, near Harvard Square, this station serves Cambridge, as well as the rapidly growing districts to the north and west. In this station more than in either of the others has a revolution been worked in the external appearance. Architecturally, it has been very carefully designed so as to conform to a park-like environment. The old structure was a plain brick building containing 3600 hp of engines and boilers. The new extension fronts on the Charles River Boulevard and its pleasing façade practically effaces the older portion.

In building this station unusual measures were adopted to secure stable foundations. The ground is of a swampy nature and in the old station the horizontal engines caused marked oscillations of the structure, especially when any of them got to working in unison. To obviate this weakness a plan was used in the new structure which practically made a monolith of the entire foundation bed. The whole foundation area was first enclosed in a cofferdam of heavy yellow-pine sheet piling driven to a depth of 30 ft. below grade. Piles were then driven within this area until it was literally packed solid. Whereas the first piles driven sank into the silt almost 20 ft. under the mere weight of the hammer, the piles last driven finally encountered such friction that the travel was only about 1 ft. under the blow of a 2000-lb. hammer. This elaborate sub-base was completed and the concrete foundation laid upon it ready for the steel within two months from the time ground was broken.

The old and new portions of the foundations were bonded together by means of steel beams and rods buried in the concrete and the steadying effect of the new sub-base is transmitted to the old foundations through this bond. While the remote end of the old building still vibrates, the motion gradually diminishes to the point of junction with the new structure, beyond which point there is no perceptible movement.

Severe restrictions were encountered by the engineers in planning the discharge water system. The Park Commission of the city of Cambridge had permitted the building of the plant on the chosen site only upon the agreement of the Boston Elevated Campany to prevent the oil in the condensing water from finding its way into the Charles River. Filtration was not practicable owing to lack of room for filters large enough to handle the 800,000 gal. of water discharged per hour at peak load. The labor required to keep such filters in order presented another objection. The device finally decided upon was virtually a large separator. The discharge water flows slowly through a concrete pit of large area. The oil rises to the surface before the end of the pit is reached and is held by means of baffle boards until it can be drawn off into the oil pit. The oil pit is formed at one side of the separator by an adjustable weir. In practice, it has been found that this weir can be adjusted so the flow over its top at peak load will be just sufficient to remove the oil which has accumulated at lighter loads, thus making the separation process nearly automatic. The slight amount of water which comes over into the oil pit is drawn off by means of a drain connected to the city sewer. There has been no trouble from oil getting into the river. In this station the equipment does not differ in any noteworthy particular from that installed in the Charlestown station, and detailed description is unnecessary.

Electric Annealing Furnaces for Hardening and Tempering High-class Tools.

By John B. C. Kershaw.

THE present writer in an article which appeared in the *Electrical World* of April 25, 1908, discussed the application of the electric furnace in the iron and brass foundry and showed that although electricity at present is the most expensive heating agent, it can in many cases be applied in the iron and brass foundry with advantage. It is interesting to note that electric furnaces are now replacing crucibles, cupolas and other forms of melting furnace in many of the European steel works, and that the change from coke or gas-fired crucibles and furnaces to electric furnaces is said to be allied with improved metal and increased economy. An example of this kind is that of the Bonner Fraser Fabrik, at Bonn, Germany, where a large Stessano electric furnace has replaced a battery of crucibles for the preparation of the metal required in light castings.

The arguments for the use of electric heating for the furnaces used in the tempering and hardening of tools are even more convincing than in the case of foundry practice, for in this case the cost of the heating agent is of little importance in comparison with the value of the finished product. It is, therefore, unnecessary to repeat the cost data which were given in the earlier article. The other advantages of electric heating are, however, of much greater value in the case now presented. The cleanliness of operation and the ease with which any temperature between the limits of 500 deg. C. and 1400 deg. C. can be obtained and maintained for any length of time are two of the most important advantages of electric heating, while the possibility of excluding the air from the chamber containing the articles and of carrying on the work in some non-oxidizing gas is a minor advantage, which in some cases would alone decide the question of the relative merits of the two systems of heating. It is not contended that the method is suitable for large pieces of work—such as armor plates and gun casements, which are now face-hardened by special heat treatment—but for tempering, hardening and annealing the smaller pieces of work there is no doubt whatever that the use of electricity as the heating agent offers great advantages, and that in time electric annealing and hardening furnaces will be found in all up-to-date works, manufacturing knives, scissors, springs and similar articles.

Three types of furnace are at present in use for this particular class of work. All of them are of the resistor type, since the heat produced by the electric arc is too high and too variable to be successfully employed for this purpose. In furnaces of the first type, platinum gauze or foil is employed as the resistor medium, long strips of narrow foil or gauze being wound spirally round the tube crucible or muffle which is to contain the articles requiring heat treatment. In the second type of furnace, a patented resistor material known under the trade name of "Kryptol" is employed, capped cartridges filled with this material being used as the heating units, and arranged round or in the walls of the containing chamber or vessel. Finally, there are furnaces in which a bath of fused metallic salts is employed for heating the articles, this bath being kept in the molten state by means of electric current. It is important in this case that alternating current alone should be employed, otherwise electrolytic action may occur and the metal salt may be decomposed into its elements.

With each of the three types of furnaces it is necessary to employ some accurate form of pyrometer for measuring the temperature of the furnace. One of the recording forms of these is

most suitable, since the personal attendance required is then reduced to a minimum. The regulation of the temperature is of course, obtained by varying the strength or intensity of the current, and other conditions being the same. A reliable wire or tube resistor frame or a small water rheostat will therefore be a necessary adjunct of the electric annealing furnace for obtaining the necessary variation in the current strength.

Examples of the three types of furnace will now be described and illustrated.

1. *Platinum Resistor Furnaces.*—The electric current can be employed for temperatures up to 1500 deg. C., with platinum as the resistor material, but the earlier method of constructing these furnaces, by winding thin platinum wire upon a porcelain tube, was found unsatisfactory, and tube furnaces of this type are now made with platinum foil. The experimental work carried out by Heraeus has proved that foil 0.007 mm in thickness, weighing 1.5 grains per square decimeter, is the most suitable for this purpose. This foil is employed in long, narrow strips and is wound upon the tube so that only 2 mm or 3 mm of uncovered space remains between each coil of the spiral. The contact between the platinum spiral and the tube is thus rendered very intimate, and the temperature of the foil is only a little higher than that of the porcelain upon which it rests; whereas with platinum wire the difference in temperature is often extremely large. A further advantage is that the weight of platinum required is reduced to one-sixth. A tube furnace of this type with a tube 25 mm in diameter can be heated up to 1400 deg. C. in five minutes. This method of construction, however, can be employed only for round vessels, and for other shapes, such as muffle furnaces, Heraeus makes use of fine platinum gauze, which is firmly fixed in or upon the wall of the furnace by a glaze. The spirals of platinum gauze can in this way be embedded in the dome and back wall of a muffle, and uniform heating can be obtained without any risk of fracture. By use of a non-conducting covering, such as an enclosed air space, the radiation losses with this type of furnace can also be reduced to a minimum and electricity at 6 cents per kw-hour can be made equivalent in heating value to gas at 3 cents per cubic meter, while the temperature range is 200 deg. C. higher. Fig. 1 shows a muffle furnace of this type (made by Heraeus) with the resistor box enclosed in the base, the range of temperature of this furnace and resistance being from 700 deg. C. to 1200 deg. C. The furnace is provided with a gold wire safety device which prevents overheating of the platinum wire gauze spirals; and it can be constructed for all e.m.fs. up to 250 volts. At 110 volts a 5-amp current will produce a temperature of 800 deg. C.

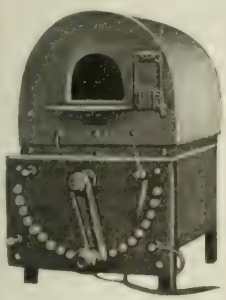


FIG. 1.—PLATINUM WIRE RESISTOR FURNACE.

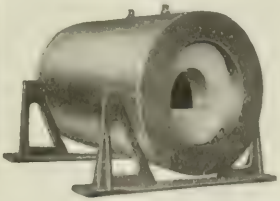


FIG. 2.—PLATINUM WIRE RESISTOR FURNACE.

and 10 amp 1200 deg. C.; while on a 220-volt circuit 2½ amp and 5 amp produce the same temperature. Fig. 2 shows a similar muffle furnace made by Cook, of Manchester. This furnace has a 4-in. flat bottom and at 1200 deg. C. consumes 1 lb. Fahr. units per hour.

2. *Kryptol Furnaces.*—"Kryptol" is a patented resistor material, of graphite, coke and carborundum, the chief feature of the mixture being that all of the grains are of uniform size, and that they possess rounded corners and edges. There are 30 varieties of the kryptol mixture manufactured, the largest having grains 7 mm in diameter; the relative proportion of the three components are varied to suit the e.m.f. of the energy supply. The addition of graphite increases the electrical conductivity of the mass, while that of coke and carborundum diminishes it. Two classes of heating apparatus are manufactured with this resistor material. In one class the kryptol is employed without enclosure, and thus comes into contact

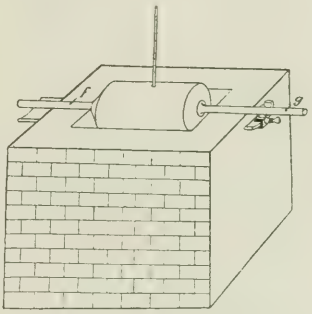


FIG. 3.—KRYPTOL RESISTOR FURNACE.

with the air and with the vessel or articles being heated; in the other class the kryptol is enclosed in air-tight glass tubes with metal caps. The latter method of employing the material has many points in its favor—the kryptol is protected from the action of the air and the temperature is more easily controlled and regulated. The tubes or cartridges of kryptol (from 15 mm to 20 mm in diameter and from 200 mm to 500 mm in length) are held by spring clamps in a specially designed frame, and are connected in parallel to the energy supply leads, such a frame holding 20 cartridges, and being suited for use with either direct or alternating current at 110 volts or 220 volts. The temperatures attainable with these cartridges are necessarily limited, however, by the glass covering (glass melting at 1200 deg. C.) and for temperatures above 800 deg. C. the kryptol must be used in the unprotected state. Fig. 3 shows a furnace of this kind designed by Schoop, and Fig. 4 a muffle furnace manufactured by the Kryptol Gesellschaft, of Berlin. In Schoop's furnace, the kryptol is placed

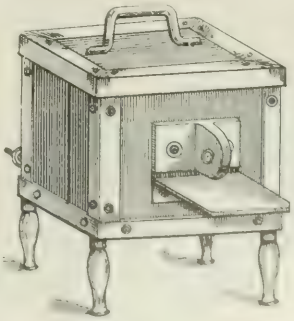


FIG. 4.—KRYPTOL [illegible] FURNACE.

closely in the cavity with [illegible] and the energy connections are made by coppered carbon electrodes, [illegible] at each end of the cavity. The cylinder which rests upon the kryptol is provided with open tubes running parallel with its axis at each end; use is made of a thermometer or pyrometer for controlling the temperature. This form of furnace was used by Schoop for experiments upon the roasting of ores in various gases, but

with the use of some device for protecting against loss of heat, and the addition of a charging opening, it could be employed for hardening and tempering work. It must be noted, however, that when kryptol is employed in this way for the production of high temperatures, slow combustion of the material with evolution of carbonic oxide gas always occurs, and this type of furnace must therefore be provided with a draft-hood for leading away the noxious gases. The muffle furnace, shown

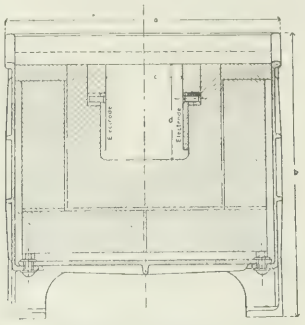


FIG. 5.—FUSED SALT RESISTOR FURNACE.

in Fig. 4, on the other hand, is free from this disadvantage, as the kryptol is here enclosed. The writer has no data showing the temperatures attainable with, or the energy consumption of, these furnaces, but for low temperature work they are no doubt convenient and economical.

3. *The Fused Metallic Salts Hardening Furnace.*—The use of baths of fused metals, such as lead or of fused metallic salts for hardening purposes, is not new in the steel-tool industry, and the only novel feature of the bath about to be described is the employment of electric current for keeping the bath in the molten condition. With gas-heated or coke-heated baths of this kind it is very difficult to keep the whole mass of molten metal or salt at one temperature, and the heating being external the containing vessel is quickly eaten through. By means of electric heating with terminal electrodes of large superficial area, the temperature of the bath can be kept uniform and all danger of unequal heating of the steel can be avoided; moreover, as a result of the method of construction, the life of the containing vessel is indefinitely prolonged. Fig. 5 shows a sectional elevation of such an

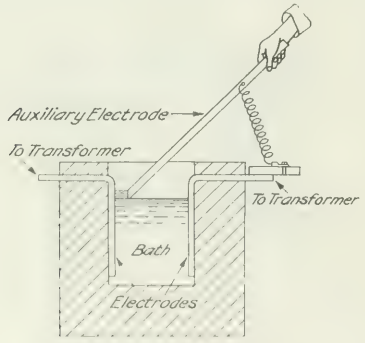


FIG. 6.—FUSED SALT RESISTOR FURNACE.

electrically heated metallic salt bath. A cast-iron containing vessel is first lined thickly with fire-clay, and is then bedded with fire-clay bricks. The cavity is next lined with asbestos, and in this is placed the vessel made without joints for holding the fused salt, the whole forming a compact mass as shown in the illustration. The choice of material for the crucible depends upon the salts used; a well-baked refractory clay is the most suitable. Two sheets of soft iron, which form the electrodes, are supported by the crucible walls, the connection with the main leads being made by transverse bars of rolled iron, placed one upon each side of the crucible cavity. Use is made of a transformer which will yield energy at e.m.fs. ranging from 5 volts up to 55 volts, the latter voltage being required when starting up the bath with all cold. For this purpose an iron rod is placed between the two electrodes, and the connection between this rod and the latter is made by small pieces of arc-lamp carbon electrodes. The secondary circuit, formed in this way, gradually melts the metallic salts lying around the carbon pieces, and in time, by manipulation of the iron rod, the whole upper surface of the bath is molten and forms a conductor. The secondary electrode is then removed and the heating effect of the current carried by the upper layer of molten salt is found to extend gradually until the whole of the bath is melted, and a uniform temperature—which varies with the current strength—is attained. To some extent, the limits of temperature are governed by the composition of the bath, and by choice of certain salt mixtures a fairly high temperature can be had. It is important in the case of this type of furnace to employ only alternating current for the reasons already named.

Fig. 6 shows a furnace of this type made by the General Electric Company, Schenectady, N. Y. In this case a mixture of potassium and barium chloride is employed as the material for the fused bath, and a range of temperature between the limits of 250 deg. C. and 1350 deg. C. is said to be obtainable.

Inductance Coils Used in Wireless Telegraphy.

By John L. Hogan, Jr.

One of the most interesting developments of wireless apparatus is that of the inductances used in both the sending and the receiving circuits. Over 11 companies build instruments which are used in the United States for radio-communication, and all of the systems depend for selective transmission upon adjusting the sending and the receiving apparatus to wave frequency by varying the constants of their oscillating circuits. The actual connections for the elements of the circuits differ considerably, but the methods of tuning are almost identical and in every case involve the use of variable capacities, self-inductances or mutual inductances. The convenient adjustable condenser is coming into wide use, but until recently it has been neglected, for very nearly all the companies utilized fixed capacities and depended upon variable inductances to change the electrical periods of their circuits. This long use of the coils has brought forth a large number of designs for inductances, and many of these are very ingenious.

The condenser used in a transmitting circuit usually has a fixed capacity, so that any change in emitted wave length must be made by changing the amount of inductance in circuit. Since, however, a commercial wireless station rarely transmits more than one length of wave—intentionally, that is—the methods of varying the contact on the coils, and the coils themselves, are rather crude. Sending helices are, in almost every case, roughly, 18 in. in diameter, and contain from 5 to 10 turns of nickeled copper tubing about ⅜ in. in diameter. Coils of this general type, with spring clips for cutting in or out parts of the tubing, have satisfied the designers of nearly all the systems now in use. The only noteworthy variations are the Shoemaker helix of metallic ribbon and the old Fessenden coils made from several strands of rather small copper wire in parallel, though the "scare" spiral of one of the commercial companies is of some interest as an indication of the condition of the wireless telegraph field. This inductance, wound in a plane spiral of about 20 in. final radius, from the usual copper tubing, was made in fear of an anticipated injunction prohibiting the use of the single-diameter coil.

Transmitting through inductive coupling is not very much

used in the United States, and this has naturally delayed the construction of novel oscillation transformers. In Europe highly ingenious methods of operation, involving mutual inductance, have been brought forward; the directive system of Bellini and Tosi is perhaps a worthy example. In America the greatest advance so far disclosed is the simultaneous use of a number of

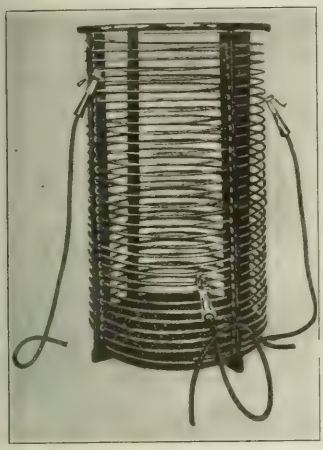


FIG. 1.—INDUCTANCE FOR HIGH-POWER SENDER

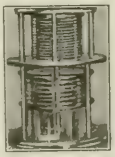


FIG. 2.—SENDING OSCILLATION TRANSFORMER.

simple air-core transformers. The neglect of loose coupling shows itself in the fact that no known home inventor has produced an exceptional oscillation transformer for wireless telegraph senders. The few couplings in use are merely pairs of simple cylindrical helices, often so mounted that their relative positions, and hence their coefficients of coupling, are fixed.

When, however, receiving apparatus is considered it is found that much originality has been shown by the designers in their efforts to devise inductances which are different from those in common use. These deviations from the standard types are often improvements, but sometimes are not. Receivers and receiving circuits have nearly everywhere been given more attention than they deserve, proportionally, and as a result there are many forms of low-voltage variable inductance coils.

Some six or seven companies use cylindrical helices of insulated copper wire, wound on wood or fiber in a single close layer, and having one or two sliding contacts which make connection at any desired points on a bare end-to-end path. These coils vary in length only from 10 in. to 14 in. or so, but the diameters run from 1.5 in. to eight times that, according to the amount of wire required on a single core. The sliding contact coils are useful because they are fairly compact and very easy to make. However, to get much inductance with low resistance, and still keep the helices of moderate length, the diameters must be increased; this means loss of close adjustment, since the turn-to-turn steps grow large rapidly. So, therefore, great disadvantages of this type are the impossibility of making small variations in the inductance—with reasonably short coils

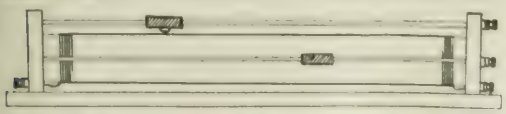


FIG. 3.—STANDARD TYPE OF SLIDING CONTACT HELIX

of considerable inductive value—and the occurrence of a sliding contact, because of its irregularly changing, and often high, resistance. The first of these points is constantly making itself felt more strongly, and a number of workers have endeavored, more or less effectively, to overcome it. Massie has made an odd form of coil, in which the wire is wound on a block of rectangular cross-section and the resulting oblong turn affair so bent that its former longitudinal axis becomes a long arc of a circle about 8 in. in diameter. The contacts are placed on levers which revolve as radii about the center of this circle. This tuner has not the nuisance of contacts running on rods, but the element of uncertain resistance is still there.

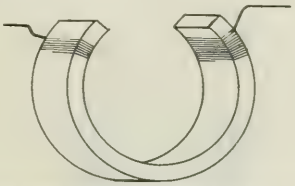


FIG. 4.—BENT RECTANGULAR-TURN HELIX FOR MASSIE'S TUNER

The necessity for close variation has been met by Dr. Fleming with a coil of bare wire, wound on a grooved wooden cylinder and so arranged that the entire winding may be rotated about its axis. A spring contact presses against it at any desired point, and so both the number of whole turns and the fraction of a turn in circuit between the spring and an end of the helix may be changed. Shoemaker, in this country, has manufactured a similar apparatus for his outfits. The coil will give a very close adjustment between two points in a circuit, but few modern methods of syntony can use a coil having only one variable contact. If a second spring is added to this rotatable helix it is clear that, while small changes in the length of wire between

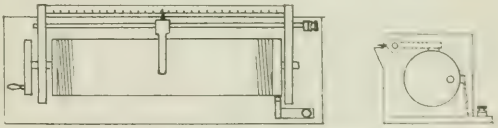
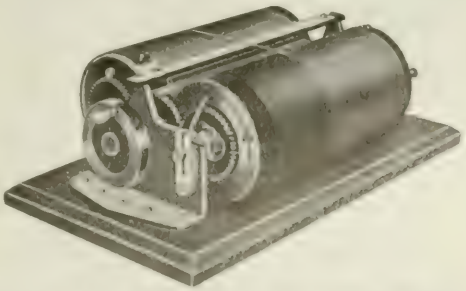


FIG. 5.—FLEMING'S INDUCTANCE STANDARD.

either contact and either terminal of the coil may be made, the length between the springs must vary in jumps of entire turns.

Fessenden used for some time standard roller inductances, in which bare wire was reeled from a metal to an insulating cylinder in any desired amounts. This gave close adjustment, since the wire on the apparatus could be divided in any ratio between the metal reel, where it was short-circuited, and the insulating carrier where it was effective inductively. The only defects seem to be that it is impossible to make large changes of inductance rapidly, and that, if either the wire or the metal cylin-



[illegible] likely to appear. This latter difficulty has been overcome very [illegible] is always insulated from both reels; this arrangement eliminates poor contacts and makes the resistance uniform. The in-[illegible]

on either spool, because one carrier is made to act as a short-circuited secondary to a primary formed by the wire it supports, while the other reel—either an insulating substance or a metal cylinder with a longitudinal slit in its surface—allows the wire coiled about it to take its normal inductance. However, even with the new type, large changes of inductance are difficult to make rapidly. Also the question of loss of energy in the short-circuited secondary arises.

A variable coil consisting of a spiral spring whose length of

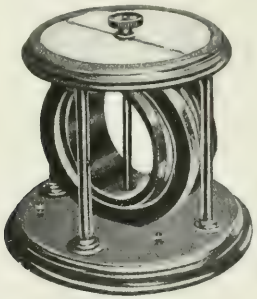


FIG. 7.—AYRTON-PERRY TYPE OF VARIABLE INDUCTANCE.

extension might be varied was suggested by the writer and used some years ago, but it was found that Dr. Fleming had tried such a helix previously. This method gives an opportunity of making very small changes of inductance, with fixed resistance, since as the turns of the spring approach each other the inductance of the coil increases. The range of a moderate-sized spring is not large, but series coils variable in larger steps make it possible to get any value.

Another form of inductance which the writer has brought forward for use in wireless telegraphy, and which has been independently adopted by a European scientist, is that involving the principle of the Ayrton-Perry standard. It is possible to construct small coils which allow a considerable variation and still have low resistance. This apparatus, which changes the sum of the effective inductances of two windings in series by varying the mutual inductance between them, would seem to be as nearly an ideal for syntonic communication as has been proposed. It may be made compact, there are no points of variable resistance and the change in inductive value is absolutely continuous, and may readily be made to cover wide limits.

In reading the criticisms regarding close and even variation it should be remembered that they are made on inductance coils simply as inductance coils, and not as elements of oscillating circuits. In these circuits there are many cases where inductance may be changed in large steps, and small differences in the

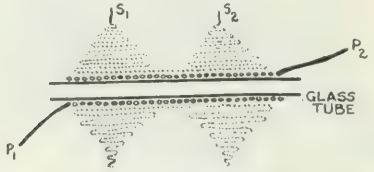


FIG. 8.—DIAGRAM OF SECTION OF MARCONI'S "JIGGER."

period of the system may be made by the use of delicately adjustable condensers; however, these instances do not prove the turn-to-turn helices to be of good design.

There now remain to be considered oscillation transformers used where inductive coupling at the receiving apparatus is preferred. These have been brought out in a number of forms, of which one of the most interesting is Marconi's "jigger." This appliance has gone through a number of changes in its development, but the one aim throughout seems to have been to build a pair of coils of high mutual inductance, yet having low electrostatic capacity between primary and secondary. Marconi wound the secondaries of his transformers in camel-back like humps, sometimes divided into two sections connected by small condensers. These "jiggers," used about 1900, are reported to have increased coherer efficiencies—when compared to direct antenna-to-ground connection—but just how much the uneven windings helped matters would be hard to determine. The problem was to apply the voltage-operated coherer at a loop of potential in



FIG. 9.—SIMPLE OSCILLATING TRANSFORMER.

the antenna system; since the foot of an aerial vibrating at its fundamental is an antinode of current and a node of voltage, some form of transformer seemed necessary. Whether Marconi's "jigger," designed after much painstaking labor, would be more effective than a properly adjusted simple two-helix air-core arrangement is not known.

The simplest inductive coupling in use at present is that consisting of two independent cylindrical coils, each of variable self-inductance, and often so mounted that their relative positions, and, therefore, their mutual inductance, may be changed. In some cases the primary and secondary are concentric, sometimes they are placed with ends abutting, again they are built side by side. In almost every instance the method of connection is that shown in Fig. 10. Tuners of this kind have found some little favor, perhaps because of the many claims of extreme selectivity made for them, and so one finds the expected number of slightly differing designs of the apparatus.

A departure from the usual transformer has a primary wound in a flat spiral on a stiff insulating plate, and a similar secondary, each being fitted with a sliding contact on a lever arm. The coils are mounted with their faces parallel and so arranged that the distance between them can be varied. Since the primary and secondary may be brought close together a very high value of mutual inductance may be had; this, together with the ease of adjustment of the coupling, is the only marked advantage the type possesses. The transformer action is somewhat veiled by a considerable condenser effect between the primary and the secondary, and sliding contacts add to the uncertainty of the device. Perhaps the worst feature of the apparatus is that the turn-to-turn variation is not constant;

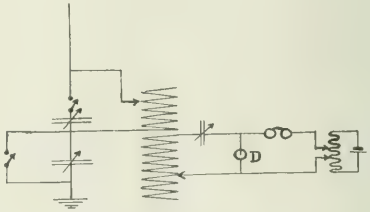


FIG. 10.—STANDARD CONNECTIONS OF LOOSE COUPLED RECEIVER.

clearly the disconnection of a single turn near the outer end of the spiral will cause a change of inductance many times that brought about by cutting out a turn near the center, since the length of the turns increases very nearly in proportion to the radius. This "pancake" coupling was probably first applied to wireless by Ducretet, in 1903 or before (United States patent application filed August, 1903). A patent on an identical apparatus, using two primaries opposing each other's effects on a secondary placed between them, was granted in 1907 to an Ameri-

can exponent of radiotelephony; in practice, however, he seldom uses the secondary primary.

The short-circuited secondary roller type of coil described above has been modeled by Fessenden into a transformer by placing two complete self-inductances end to end. This form of coupling is perhaps as nearly perfect as any so far produced since there is no opportunity for uneven resistance variation, because the self-inductance of either primary or secondary may be changed very minutely, and as the mutual inductance between

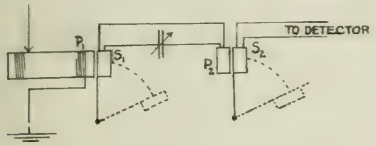


FIG. 11.—DIAGRAM OF STONE'S COUPLINGS.

the coils is adjustable; nevertheless a bad point is that it is impossible to obtain high values of this mutual action.

In all of the above couplings mutual inductance is varied by a translation of one or both coils. To get a very weak inductive effect it is sometimes necessary to separate primary and secondary quite widely. In order to save space by doing away with bulky sliding appliances, Stone has constructed his small transformers with one coil fixed and the other, which is mounted at the end of a short lever arm, arranged to swing through a 90-deg. arc. By building the windings in a semi-pancake form it is possible to get high mutual inductance when their faces are close together and parallel, yet when the fields of the coils are placed in quadrature there is no energy transferred; therefore this type gives a very complete range of coupling coefficients and still is not cumbersome.

In reviewing the designs of self-inductance coils and oscillation transformers only a few really worthy of use are found. Sliding-contact helices of the usual form are valueless for accurate work, not alone because of the uncertain and frequently excessive resistance but because the slider is always likely to be found shunting one or more turns of the coil. This is of the greatest importance, since that part of the helix adjacent to the short-circuited section will have an inductance very different from normal, and the rapid change as the contact piece touches, say, first one turn and then two, will be enough to upset the most careful calculations. Moreover, it is probable that the shunted turn absorbs a considerable amount of wave-energy and so prevents a maximum effect on the detecting apparatus.

It would seem, therefore, that the inductances of the future, or at least those used in wireless communication, will have no loose contacts. The exact type of coil to be finally adopted depends absolutely upon the method of syntonization ultimately accepted as thoroughly satisfactory.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

A Free Iron Proposition at Marion, Ind.

The Marion (Ind.) Light & Heating Company has been increasing its number of residence consumers with the aid of a special proposition which seems to be taking well. The company advertised extensively through the newspapers and by means of its talking sign in front of its office, that it would give a free electric iron to any consumer wiring his house within 30 days. This time limit was later extended. In six weeks 140 new residence consumers were secured in this way, and all but one of these were on existing lines of the company, so that no extensions were required.

Improvements in Wabash (Ind.) Central Station.

The Wabash (Ind.) Water & Light Company, under the management of Mr. T. W. McNamee, is making this year some very important changes in its electric generating and waterworks pumping plant. Heretofore the company has had steam engines operating separately three different kinds of service, namely, 125-cycle alternating-current service, 500-volt direct-current service for power purposes and independent steam-driven water pumps to supply the waterworks system. As the old plant was being outgrown and the necessity of more economical power generation in order to secure power business became evident, it was decided to replace the engine equipment entirely with steam turbine units and to generate all current at 2300 volts, 60 cycles.

The pumps in this plant will be operated by electric motors, and the old 500-volt, direct-current power circuit will be taken care of by a motor-generator set. This will put the company in a position to reach out and compete more actively for the large power business in the town, and to carry the entire pumping and electric load on one fairly well loaded turbine unit. There are to be installed two turbines, each one capable of carrying the entire present load on the station.

The Boston Edison Company and the Electric Vehicle Business.

BY L. D. GIBBS.

Pioneer or missionary work is ordinarily very edifying spiritually, but the profits are not likely to be materially large. Sometimes, however, the Biblical promise about the return of bread cast upon the waters proves true, even with a central station. This has certainly been the case with the Boston Edison Company, whose pioneer work in the automobile field is now being rewarded to a marked extent.

The advent of the electric vehicle found this company keen to its possibilities, and the management gave its thought and energy, as well as large sums of money, in the work of educating the public to a proper appreciation of these vehicles. The work was taken up on a large scale in 1903. Charging sets were installed on the company's lines at convenient points, and all lighting companies, private and municipal, in New England were asked to furnish information as to the charging facilities. A booklet was issued giving the locations of such charging sets, both upon the company's lines and elsewhere, and this information included the names of stations, individuals, livery stables and garages—all points where charging sets were available for travelers in electric machines. This very complete booklet included also the rates for electricity for charging purposes.

Signs of an especially attractive design were placed in front of all charging stations in the Boston Edison territory, and other signs were fixed at cross-roads and along the highways [illegible] charging stations. The Boston company distributed these throughout New England at its own expense.

A year later, Jan. 1, 1904, another booklet brought the in- [illegible] electric vehicles in Massachusetts. Still another booklet followed, entitled "Personally Conducted Tours," in which an interesting account was given of a trip made in an electric vehicle owned by the Edison Company from Boston to New York and return. A map was shown of the route and locations of all charging stations and the distances between them.

At that time the company was publishing its monthly bulletin, *Edison Light*, and the August, 1903, number was devoted exclusively to electric vehicles. It was finely illustrated with cuts of the company's machines, showing various practical applications; and there were many illustrations of vehicles then on the market. On the back cover page was a map of the territory from Lawrence and Lowell on the north to the Rhode Island line on the south, and west of Boston to South Framingham, showing the best routes for travel and the locations of all charging stations. That was real pioneer work.

The reward has been tangible for some time now. The electric vehicle has come into its own. These machines have been so greatly improved in efficiency and adaptability to all sorts of service, either commercial or pleasure, that those, around Boston at least, who are not "speed-mad" consider their availability seriously when making purchases. The Boston company has always been a consistent and large user of electric machines. Two trucks of 5 tons and 3 tons capacity, respectively, handle freight and transfer supplies from one station to another. The 3-ton truck is particularly adapted to the requirements of the department of maintenance of lines. Every sort of material is hauled from the company's suburban and city stations to points where improvements and line extensions are being made. A geared winch, located under the driver's seat, proves efficient for handling underground cable and for raising and lowering poles in the suburban territory.

One emergency wagon of 1000-lb. capacity is much used on the underground cable system. It is equipped with a variety of pulleys and cables, and with a crew of men, specially assigned, is ready for hurry-up calls day or night the year round. Another 1000-lb. wagon is used in the department of installations for distributing lamps and meters. It is in almost constant service six days a week throughout the year, covering an extensive territory. A third 1000-lb. wagon is fitted with pumps for removing water from manholes and junction boxes. The pumps on this wagon, as well as the winch upon the truck previously mentioned, are motor-driven from the storage batteries. The company also maintains a number of electric vehicles of the runabout type for the convenience of its officials.

At the present time the company has charging sets in the following stations: Dedham, Bingham Road; East Boston, Central Square; Natick, Mechanic Street; Somerville, 110 Willow Avenue; South Framingham, 109 Waverly Street; Woburn, Lake Street. Ignition batteries are charged at the company's exhibition rooms, 33 Boylston Street, Boston.

The company's regular rates operate very favorably for the users of electric machines. It is possible for users of large quantities to run as low as 3 or 4 cents per kw-hour. This is very satisfactory for trucks and heavy wagons. If the consumption of electricity is small, as is naturally the case with pleasure vehicles, the rate per kw-hour is, of course, not so vital, but the net results for the customer will be equally satisfactory. Direct current is available for charging purposes in the city of Boston north of Northampton Street. In the other districts of Greater Boston alternating current only is available, but that can be handled with rectifier sets.

Flat-Rate Tungsten Service at Marion, Ind.

The Marion Light & Heating Company, of Marion, Ind., is putting out tungsten lamps in the business district on flat rates. The only lamp so put out is the 100-watt size. The proposition includes a reflector of the proper type for the place in which it is installed. In cases where a cluster or chandelier is employed the company also furnishes the cluster or chandelier. The lamp proper is purchased by the consumer at $1.30. The rate is $1.60 per month per 100-watt lamp for stores which are regularly open until 11 p. m. and $1.25 per lamp for stores which are open late but one night per week. The customer is left free to turn on and off these lamps as he pleases, the fact that he has to furnish his own lamp renewals being considered sufficient incentive for him to avoid waste of current. It will be noted that this rate of $1.60 per month per 100-watt lamp yields a revenue of $192 per kilowatt connected per year, and the $1.25 per month rate gives a revenue of $150 per kilowatt connected per year. Few meter installations yield as much gross revenue as this.

Central-Station Motor Load.

At a meeting recently in Pittsburgh of the American Association of Electric Motor Manufacturers, Mr. Fred M. Kimball presented a paper in which he discussed the relation of the association with central stations. While appreciating the recognition by central stations of the value of a motor load, he advocated the co-operation of the association in educating power users to the advantages of the electric drive.

Experience indicated, he said, that the best means to be employed for promoting business with central electric power stations is through interesting the stations themselves to canvass their clientèle through the intermediary of personal visits made by competent solicitors and demonstrators. From the motor manufacturer's standpoint the central station ought to be by far his best customer. As a rule, the credit of central stations is much better than that of its customers, and, a motor having once been sold to or through a central station, the pay for it need give comparatively little concern to credit departments.

The central station should be the best salesman for motor manufacturers for the reason that it has a vital interest in extending motor sales and because, owing to its local character and the intimate knowledge and relation which its managers and officials should bear toward the public in general, it has the first knowledge of prospective customers, the best means of determining their responsibility and worth, and is in the best position to study the problems in the application of motors in any given case either by means of its own staff or in conjunction with manufacturers' experts, and thus obtain that complete data which must be the foundation of every intelligent bid.

Central-station representatives are always available at short notice not only to anticipate and set right any incipient defect which may make itself manifest in a customer's equipment or in its operation, before actual damage results, but in case of necessity can usually bring corrective measures to bear more speedily and under better conditions of expert help or equipment than anyone else in the community. When the central station itself takes the responsibility and initiative of pushing power sales, it can intelligently seek for desired classes of power users with particular reference to filling in the valleys of its power curve, thereby building up the 24-hour load on an equable and satisfactory basis. The majority of central stations now maintain 24-hour service, or they should do so. The revenue from a well-distributed day-load then proves to be very profitable in comparison with the shorter lighting load, and allows the station to distribute its charges over a wider output and thus show a much better operating cost than when run for lighting with only incidental power. Activity on the part of the central station to fill up its own lines with lucrative power users is entirely rational from a business standpoint, even when this activity includes merchandizing and instalment sales, as against the policy of producing and selling energy only, and afterward relying largely on the sometimes erratic efforts of sundry manufacturers of energy-consuming devices to scour the town for customers.

The sale of energy and the sale of motors do, or should, go hand in hand. The service and the means for utilizing it ought to be introduced concurrently by one man. There should be no divided responsibility as between the sale of apparatus and the service connected with it, and it is only by actually dealing with electric power installations from inception to completion and operation that the solicitors of a central station can be furnished with that large knowledge and that experience which together are so indispensable in interesting new prospects and crystallizing their curiosity or interest into definite orders.

INTERIOR WIRING AND ILLUMINATION

Indirect Office Lighting.

Indirect lighting is used exclusively for general illumination in the new offices of the North Shore Electric Company, in the Home Insurance Building, Chicago. Tungsten lamps of 60 and 100 watts are placed within reflecting bowls of brass, suitably lined, and suspended about 3 ft. from the ceiling by chains. All the light is directed toward the light-tinted ceiling and thence generally diffused about the room. There are no bright spots and no glare, and the light is much like daylight, being very restful to the eyes.

Admiral Evans Compliments Grand Rapids Street Lighting.

The lighting of the downtown streets of Grand Rapids, Mich., by means of arches of tungsten lamps suspended from span wires across the street received a high compliment from Admiral Robley Evans at a dinner given in his honor following one of his lectures in Grand Rapids recently. As an introduction to his remarks at this dinner Admiral Evans said: "Before making any other remarks or telling any stories I wish to say that in my opinion you have the most beautifully illuminated city which I have ever visited." The tungsten arches on this street have been illustrated in past issues of the *Electrical World* and the plan has been copied by a number of other smaller towns. In fact, it is one which is within the reach of small as well as large cities.

A "Talking" Sign at Marion, Ind.

The talking sign which the Marion (Ind) Light & Heating Company has in front of its office has been mentioned several times in these columns in the past. While a sign of this kind is expensive in first cost, it has permanent advertising possibilities which can be obtained in no other way. The sign is used partially for advertising the company's own business and partially for advertising various public affairs and enterprises. Because of the fact that it is constantly changing, the public is always looking to see what is being said. As an example of the indirect advertising obtained from this sign, it was recently used to advertise some revival services that were being held in the city, and which were largely attended. The courtesy of the company in allowing its sign to be used in this way was so much appreciated that the evangelist publicly thanked the company from the pulpit.

Wiring of the Thirteenth Regiment Armory, Brooklyn, N. Y.

With the exception of a few company rooms, the armory of the Thirteenth Regiment, at Sumner and Jefferson Avenues, Brooklyn, has always been lighted with gas. In future, however, the immense structure will be illuminated by electricity, and the actual wiring of the building is now under way. Constructed some 15 years ago, the armory it not what would be strictly termed a fireproof building; nevertheless, the wiring of it has not been found an easy task. The requirements call for rigid conduit wherever it is possible to install it, and flexible conduit or cable where rigid conduit cannot be used. In the process of the work it was discovered that flexible conduit or cable could be more quickly and easily installed; but the rigid conduit was insisted on. There were no drawings available from which the construction of the building could be seen, nor were wiring plans used, the contractor being instructed where lamps were required and left to install them as best he could. As a result, walls had to be chased, floors taken up in places, notches cut in timbers, etc.

There will be about 2000 lamps connected in circuit when the wiring is complete, and these will receive energy from the direct-current mains of the Edison Electric Illuminating Company of Brooklyn. The rooms of the 12 regimental companies, as well as those of the officers, have no set plan of illumination or of wiring; some are lighted from chandeliers, while others are lighted by bracket fixtures. Each room has a panel from which all of the lighting circuits in the room are controlled. There are three main hallways in the front of the building, from each of which two corridors lead. Each of the front halls is lighted by seven 6-lamp Benjamin clusters fitted with Holophane shades. The lamps are controlled by three gang switches placed on the wall at the head of the main stairway. If the plan under contemplation is carried out there will be a tungsten lamp on each of the clusters, and the seven tungstens will be controlled by one of the gang switches. The other lamps will be of the ordinary type and half of them will be controlled by one of the gang switches and the rest by the other gang switch. Thus three intensities of illumination can be obtained and, of course, the energy consumption can be regulated to suit conditions.

At both ends of the front hall three gang switches are installed for controlling the nine clusters in the corridors leading from that hall. In this way a person can ascend the stairs, and by means of the switches at the head of the stairs place all or only part of the hall lamps in circuit. Walking along the hall to the corridors, he can light all or part of the corridor lamps from the switches at the end of the hall, and vice versa. The lamps in the front hall are fed from a panel board located in one of the rooms; but all the corridor lamps are fed from panel boards in the corridors themselves. The latter boards are not set in the walls, and the conduit containing the feeders to them are run up from floor to floor exposed. The panel boards in the rooms are set in the walls and all wiring to them is concealed.

The feeders, which are run in 2½-in. and 3-in. conduit, supply part of the rooms and part of the halls. There are three straight risers in the building for the circuits on the upper floors. "Buzz" risers run around the basement of the building and these are fitted with branch panels serving as cut-outs. Risers run direct from these cut-outs, which are placed under each company room to the panel board in the latter rooms. The risers to all panels are made up of rigid conduit, and, in running the branch circuits from the panel, flexible conduit was installed where rigid conduit was out of the question.

In places, the walls encountered were 16 ft. thick, while the general run of walls were 12 in. to 24 in. thick. In drilling through the 16-ft. walls two men worked 3½ days each in getting two holes through. The usual pipe drill was used, the men taking turns in hammering and holding the drill. The distance between ceiling and floor varies in parts of the building from 12 in. to 3 ft., there being many vaulted or hanging ceilings. Double floors were encountered throughout the work. The rigid conduit where it was used rests on the furring strips in the ceiling. When installing the conduit on the hanging ceilings, a hole was cut in the floor and a length or half-length of conduit coaxed into the hole, depending on the depth. This was then worked back and forth between the joists until it was brought in the proper position. In this way length after length of conduit was worked into position, the whole line of conduit pushed forward until the desired length was reached. The men pushing the conduit would in when crawling along worm fashion under the floor that another man had to go in at times to pull him out. When crossing rooms to get at brackets, etc., slots were cut in the floor for the conduit. In feeding from a panel to a lamp or lamps on the ceiling below, flexible cable was employed; in some instances the distance fished was as great as 80 ft., pockets having been taken up at suitable intervals. When crossing timbers, holes were drilled in the timber by an ordinary brace

and bit, the hole being at least 3 in. below the top of the timber so as to escape nails. Where such a procedure does not obtain, it is necessary to use an iron plate over the flexible conduit, if the latter is placed in notches cut in the timbers. The wiring work is being done by the Warren Electrical Company, of Brooklyn. Tungsten lamps will be used in the memorial hall, gymnasium and reception room. These will all hang pendant and will be fitted with prismatic shades. In all other places the ordinary carbon filament lamps will be used.

Features in the Wiring of the New York Metropolitan Tower.

The tower of the Metropolitan Life Insurance Company's Building, on Madison Square, New York, is the highest office building in the world, being 50 stories high and rising 700 ft. above the sidewalk. For the lamp circuits there are 171 cut-out cabinets installed and for the low-potential bell and telephone circuits 100 interconnection boxes have been provided. Owing to the great height of the building, the problem of supporting the feeder cables was not an easy one. In its solution use was made of an excellent cable support specially designed for the purpose. This support, which is made by the H. Krantz Manufacturing Company, is shown in Fig. 1 herewith. On every third floor beneath the panel boxes are sheet-steel cable support boxes 12 in. deep with channel-iron legs. Across the center of the box are T-irons, fastened to which, in the manner shown, are wedge-shaped porcelain insulators grooved vertically the better to hold the cable. When the latter has been hauled into position the upper wedge is bolted in place and the strain and weight are carried by the support. Fig. 2 shows the cable support in actual use. There is no tearing of the insulation, and any tendency of the cable to slip would cause the wedge to tighten its grip. The scheme possesses many advantages over the older method of supporting cables. In the first place, it does not require as much room; in the second place, it is applicable where other methods recommended fail. Moreover, a 90-deg. bend is not necessary. Heretofore the Code method usually employed for supporting cables consisted in using two or more insulating supports in a junction box, the insulators being placed so that the conductors will be deflected at an angle of not less than 90 deg. and carried a distance of not less than twice the diameter of the cable from its vertical position. Cables so suspended may be additionally secured to these insulators by tie wires. To support cables of large diameter by the latter method is not an easy job.

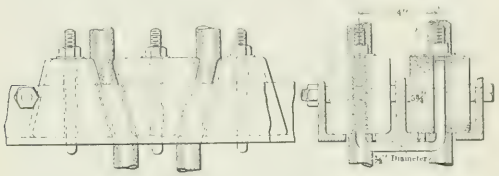


FIG. 1.—CABLE SUPPORT.

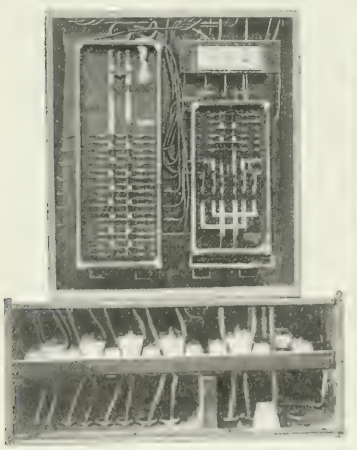




FIG. 2.—DOUBLE PANEL BOX AND CABLE SUPPORT BOX. FIG. 3.—INTERCONNECTION STRIPS FOR LOW-POTENTIAL CIRCUITS.

The type of panel box used is shown in Fig. 2. Wherever possible two panels are combined in the same sheet-steel box. The boxes are 6 in. deep and are made of ⅛-in. steel. They are fitted with marbleized-slate frames, door linings and back, the latter being blocked out ½ in. from the back of the box so as to provide an air space. The panels have two-wire branches and mains with switches and enclosed fuses to the lighting circuits. All mains and sub-mains are controlled by knife switches and open-link fuses. The copper work is designed to carry 750 amp per square inch and the switches are designed with a current-carrying capacity of 50 amp per square inch for sliding contact. Special push-button switch-frames with gang plates are installed in the boxes with the panels, the arrangement of the panels and push-button switches being such that the trim and doors will be symmetrical. The boxes were made up complete with conduit holes drilled before being used on the job. The box is stamped out of one piece of metal, the corners being reinforced with angle iron, which is also used around the face of the box. Each panel is provided with a plug lamp socket for testing circuit fuses. The base of the lamp receptacle has two prongs which are spaced so as to straddle the circuit. The other portion of the lamp receptacle is always in circuit so that by plugging in the lamp one can tell at a glance whether the feeder is alive or dead.

The interconnection strips for the low-potential circuits are placed in cabinets alongside of the letter chutes in the corridors as shown in Fig. 3. The boxes are made of steel like the panel boxes, but have no slate back, although slate is used on the sides. The base of the strip is made of composition and is supported on iron. Two-nut binding posts are provided and there are two holes in the strip for each binding post. The binding posts are staggered so as to facilitate easy connection. The lead-covered cables are held by porcelain-enameled iron clamps bolted to the back of the interconnection boxes. The boxes on every third floor are made extra deep to accommodate the clamps.

The outlet boxes used in connection with the rigid conduit system are made of stamped steel with porcelain-enameled clamp outlet. The clamp is threaded so that much time is saved in running the conduit, the joint being made by clamping the pipe to the box instead of screwing it in in the ordinary manner. The tower is fed with energy by 68 450,000-circ. mil cables from the generating plant in the basement of the Metropolitan Life Insurance Building. The feeders are connected to the studs of switches on the rear of the switchboard, the nuts and lugs used being of forged copper. A pull-box is located above the switchboard for facilitating the installation of the cables.

New Telephone Patents.

SUBSCRIBER STATION DEVICES.

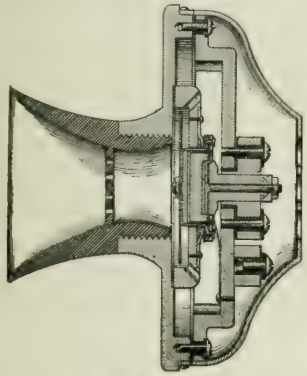
A pocket antiseptic device forms the subject of a patent granted to O. W. Hudgen, of Los Angeles, Cal. This comprises a flexible diaphragm, of some material such as rubber, stretched across an elastic ring of considerable strength. The ring is slightly smaller in diameter than the lip of the usual transmitter mouthpiece, and, in order to apply the device, the ring is stretched over the mouthpiece and allowed to take its own set upon the sloping outside wall of it. Of course, in this position the membrane becomes

stretched rather tightly over the face of the mouthpiece, shielding the user from the space within.

Mr. J. C. Fox, of Seattle, has invented an adjustable receiver supporting-arm, adapted to be clamped upon the upright of a telephone desk stand set and to support the telephone receiver at a convenient height for the ear of the user. The support comprises two similar slips of sheet metal, each carrying clips bent to include the other, so as to form a telescopic effect. One of these slips is attached to the desk-stand clamp, while the other carries an open U-clamp for holding the receiver. A spring latch is arranged to engage the hook-switch of the set whenever this is depressed. In order to release the hook-switch for conversation the latch is pushed to one side, thereby allowing the lever to rise.

NEW TRANSMITTERS.

There have been numerous advocates of the free-edge diaphragm for transmitters, the latest design of such a type being that of G. J. Edwards, which he has patented and assigned to the Kellogg Switchboard & Supply Company. This transmitter is shown in section in the accompanying illustration, from which it will readily be understood. It will be noted that the diaphragm, which is small, is carried entirely by the front of the microphone button, its edges being free. The transmitter



EDWARDS TRANSMITTER.

here shown is of the inverted solid-back type, an auxiliary diaphragm of mica serving to seal the button and at the same time to support its case upon the stationary electrode. In this particular transmitter the movable part of the button is held suspended between small, flat springs which bear on the opposing faces of its flange, and serve to hold the button in sensitive suspension without introducing initial strains in the mica diaphragm.

Another transmitter has been patented jointly by Messrs. S. A. and R. L. Stienbarger, of Augusta, Ill. In this transmitter the front electrode mounting is in the shape of a disk as large as the diaphragm and webbed to give it great rigidity. The front electrode support is screwed to the middle of the diaphragm. Upon its face is placed a thick felt pad with perforations such that it is virtually of cellular construction, the perforations being so placed that relatively thin walls of felt are left between them. Each of these cells is given a charge of granular carbon, and the rear electrode, of the same diameter as the front, is held up against the other face of the felt washer in a manner to seal all the cells. The device thus becomes a multiple-button granular transmitter without auxiliary diaphragms.

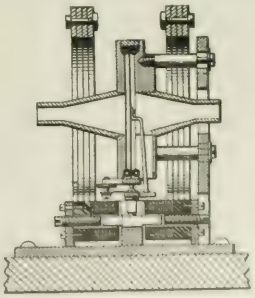
Mr. J. S. Wincrantz, of Pittsburgh, has invented a device for damping a transmitter when it is desired to speak in its neighborhood with the receiver off the hook and yet not have the voice picked up by the transmitter. Heretofore such damping has usually been done by putting the finger against the diaphragm in the older form of instruments, or covering the face of the mouthpiece with the hand in the latter form. Mr Wincrantz's arrangement consists of a short nipple to be inserted in the transmitter mouthpiece between the mouthpiece proper and its normal mounting flange in the transmitter face. This nipple carries a damping plunger, adapted to be depressed against the middle of the diaphragm by means of a small lever projecting outside in a convenient position.

NON-INDUCTIVE TRANSMISSION SYSTEM.

With grounded circuits, with only two stations, one at either end, the grounded circuits paralleling a disturbing circuit, it has been almost impossible to overcome the detrimental effects of the inductive disturbance on a telephone line. Messrs. W. Condon and A. Barrett, of Kansas City, Mo., have jointly invented and covered by two patents a system for overcoming this difficulty. The transmitter battery is included in the middle of the line wire and each end of the line wire is led to a transmitter and thence to ground through the primary of a coil. The secondary of the coil is connected to the receiver. The windings of the coil are always so arranged that the primary and secondary are differential with regard to each other, an adjustable core being provided. It has been found that such a differential arrangement may be thrown out of balance by adjusting the core, and that there is a considerable range of adjustment within which a coil so arranged will act almost perfectly differentially for induced disturbing currents, while permitting a very effective repeating of telephone voice currents. It must be seen that by this adjustable differential arrangement the telephone currents become effective in the receivers at the two stations, while the induced currents pass through the induction coils without effect upon the receivers.

RECEIVER.

Such a practicable and efficient design for the telephone receiver was devised shortly after its invention that almost all receivers have followed the same general arrangement of parts. However, Mr. H. R. Stuart, of Wheeling, W. Va., has brought forward a very different type, for which he claims greater efficiency. This receiver is well shown in the accompanying illustration. Two polarized horse-shoe magnets are arranged with their planes parallel, one pole of each confronting the cylindrical armature piece and the other pole of each carrying, respectively, pole pieces presented to the ends of this armature piece. Each pole piece carries a solenoid, the pole pieces projecting partially through them and the armature piece largely filling the remaining core space. The cylindrical armature piece is attached by means of a linkage to the center of a mica diaphragm, confronted on either side by suitable air spaces and mouthpieces. The two



STUART [illegible]

solenoids are connected [illegible] repulsions of the armature. The inventor claims that this form of receiver is more efficient than the usual one, his armature presenting sufficient [illegible] absorb properly the entire effect of the magnetic variations.

SWITCHBOARD CIRCUIT.

A three-wire common-battery switchboard circuit has been patented by W. Reid, of Chicago, the patent being assigned to the Kellogg Switchboard & Supply Company. This circuit is a sort of an adaptation of the usual Dunbar two-wire circuit to

three-wire working. To this end the cut-off relay contacts are connected to tip and ring springs of the jack, while the cut-off relay winding is joined to the jack sleeves, thereby forming the third part. Similarly, in the cord circuit, while the supervisory relays, serving as retardation coils, feed the ring side of the circuit in the usual manner, the supervisory control relays are connected to the plug sleeves to work in series with the cut-off relays. At the same time a retardation coil must be provided to feed energy from the battery to the tip side of the cord pair in lieu of the usual feed of the supervisory control relays.

LETTER TO THE EDITORS.

Wiring Mills Without Regard to Code.

To the Editors of Electrical World:

SIRS:—The article in your issue dated Feb. 4 entitled "Wiring Modern Mills Without Regard to Code" appears to imply that the insurance companies alone are responsible for the National Electrical Code, that for some ulterior motive they have increased the cost of construction to a useless degree, and that the "Code" is an entirely unnecessary thing, and aside from an insurance interest, is of no value to the public. This spirit is certainly not a healthy one in which to view the electrical fire hazard. To be sure, insurance companies have supported the "Code" to a greater degree probably than any other body, but it is also true that electrical construction, even with all the care given it, has proved none too safe as a fire hazard, as the losses show. It is further true that any manufacturer who can otherwise afford to carry his own insurance, is extremely short sighted if he does not spend extra care, and, if necessary, additional expense, in making his electrical installation the safest which the combined experience of the country has developed.

The article would seem to suggest that cabinets for cut-outs are a useless precaution, and that the use of wire smaller than the Code requirements involves no hazard. It is probable that one-third of all electrical fires are caused by the blowing out of cut-outs, and that a number of fires have occurred by the use of too small wire even when in conduit. Where the question of drop is made the basis for fixing the size of wire, there is not much danger that wiring will not be of a size equal to that called for by the Code, especially if the runs are at all long; but the writer has within two years noted two fires from conductors too small in cross-section installed in conduit, and not properly fusing these wires.

As the American public is none too addicted to careful construction under any circumstances, an article tending to put a premium on negligence is, to say the least, of doubtful value.

CHICAGO, ILL. J. K. OSWALD.

[Our correspondent views rather too seriously the case of wiring on which he comments. In special concrete construction designed to reduce fire hazard to a minimum, and where the installation is not subject to inspection under the National Code, an owner appears to be justified in departing from its requirements if he believes that the fire hazard will not thereby be increased. We should, however, regret very much if the article referred to has tended to create any impression unfavorable to the Code, which this journal has strongly favored from its inception 16 years or more ago.—EDS.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Commutation.—J. LISKA.—An account of experiments made concerning the voltage required to produce a spark between commutator and brush. The author finds that for given materials of brushes and commutator there is a minimum value of the voltage at which a spark begins to be formed. This minimum voltage is independent of the maximum voltage actually occurring, of the current, of the current density, of the mean temperature of the commutator, and of the speed of rotation, but it is in general different for different directions of the current. For instance, when the current passes from a carbon brush to a copper commutator, the minimum critical sparking e.m.f. is 14.5 volts. If the current passes in the other direction, the minimum critical sparking voltage is 22.5. For other materials of brushes, the minimum voltages are given in the following table:

Brush.	Anode. Volts.	Cathode. Volts.
Ia Carbone "Z"	14.5	22.5
Morganite "I"	14.5	16
Copper carbon Ludmanat system	14.5	21
Copper. Ludmanat system	14	14
Copper brass. Ramsdorff	15	12.5

No sparks can occur at the commutator if the actual voltage is not greater than the minimum critical voltage. There is no great difference between the minimum critical voltages for metallic and carbon brushes, but this does not contradict the fact that the metallic brushes are more liable to heavy sparking. The explanation is that when the voltage gets higher than the minimum critical voltage, the strength of the spark which occurs is determined by the energy, and with metallic brushes the current is stronger on account of the smaller transition resistance.—*Elek. Zeit.*, Jan. 28.

Single-Phase Motor.—F. ROULAUD.—An illustrated article on a single-phase commutator motor of the French Thomson-Houston Company for elevator service. It starts as a repulsion motor and becomes automatically a shunt motor when the normal speed has been reached. The motor exhibited has a rating of 2.2 kw. At starting it gives three times the normal torque and consumes 1.8 times the normal current.—*L'Industrie Elec.*, Jan. 25.

Lamps and Lighting.

Metallic-Filament Lamps.—An article pointing out the difference of the distribution of light from carbon-filament lamps and from metallic-filament lamps, especially from high-voltage metallic-filament lamps, on account of the particular design of the shape of the filament. For this reason reflectors such as used now for carbon lamps are not suitable for metallic-filament lamps. If metallic-filament lamps are to be employed chiefly for emitting light to the sides so as to illuminate the walls of a room, they hardly need any special reflector. But if the floor is to be lighted, the reflector should be so constructed as to increase the flux vertically below the lamp.—*Elek. Anz.*, Jan. 31.

Electric Lighting of Automobiles.—A. SOULIER.—An illustrated article on electric lighting systems for automobiles at the recent automobile exhibition in Paris. The author describes at length two generators which give constant voltage at varying speed. One is that of Iglesis, described before in the Digest; the other operates on the "Phi system."—*L'Industrie Elec.*, Jan. 25.

Generation, Transmission and Distribution.

Spanish Energy Transmission.—An illustrated description of the plant now being built by the Siemens-Schuckert Company—already briefly mentioned in the Digest—of the Sociedad Hidro-electrica Espanola, has been designed to transmit as much as 30,000 hp at an e.m.f. of 66,000 volts. Each of the two branch lines from the Molinar power house to Valencia and Alcoy is 50 miles in length, that leading to Cartagena is 100 miles, and the line leading to Madrid 140 miles. The weight of the copper of the Madrid line, which is to consist of six wires of 50 sq. mm cross-section, amounts to 640 tons. The Molinar central station has been designed for five 5625-kva generators, wound for 6600 volts, 50 cycles, three of which are at present

nstalled. The e.m.f. is raised by five 6750-kva, three-phase ransformers (three of which are at present installed) to 66,000 olts. Oil cooling is provided for eliminating the heat evolved, as shown in Fig. 1; the oil is propelled by an electrically driven

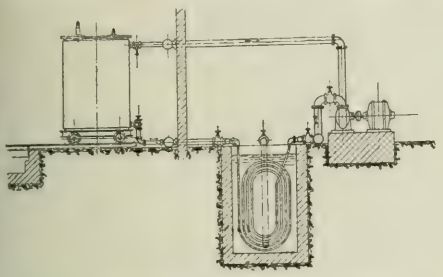


FIG. 1.—ARRANGEMENT FOR COOLING TRANSFORMER.

pump through coiled piping surrounded by flowing water. The total weight of each transformer is 38 tons, the transformer proper weighing 21 tons, the oil reservoir 6 tons, and the oil 11 tons.—Lond. *Elec. Rev.*, February.

Electricity on the Rand.—It has been officially announced in Johannesburg that the scheme prepared by Harper Bros., of London, for the supply of electric energy to 15 mines on the Rand has been accepted, and that the Victoria Falls Power Company will co-operate in putting the scheme into effect. The requirements of the mines in question amount to 300,000,000 kw-hours per year. The site selected is 14 miles from Johannesburg, and "the average cost of coal is such that it is estimated that energy will be generated at a less cost than at any other station in the world." The scheme includes the erection of a station of six 12,000-hp turbo-alternators. The contract has been adopted by the Victoria Falls Power Company, and that company has agreed to finance the new undertaking; in fact, the new company will form part of the great proposals of the Victoria Falls Company and the joint output of the two undertakings will reach almost immediately 500,000,000 kw-hours per year. The Allgem. Elek. Ges. and the Siemens & Halske Company are said to be interested in the scheme.—Lond. *Elec. Eng'ing*, Jan. 28.

Flexible Shaft Coupling.—A note on a British patent (18,221, 1908) of Siemens Bros. Dynamo Works and M. Kloss. Flexible couplings are sometimes used for turbo-generator sets in order to equalize any errors in alignment. Most couplings, however, exert a thrust parallel to the shaft axle, which interferes with satisfactory running; the present coupling is designed to overcome this objection. This coupling is similar to the Rateau pattern in that it has a number of steel pins; but in the latter type the pins are arranged parallel to the shaft, in consequence of which a force is exerted on the shaft in an axial direction. By arranging the pins radially between two concentric flanges, however, this trouble is avoided, and in the present pattern this arangement is adopted. The pins are passed through holes in the outer and inner flanges, and are kept in position by a ring screwed on to the outer flange.—Lond. *Elec. Eng'ing*, Jan. 28.

Traction.

Rolling Stock for Railways.—P. DAWSON.—A continuation of his long illustrated serial on electric traction on railways. The author first considers rolling stock as being divided into that for (1) main-line, (2) suburban-line and (3) metropolitan traffic, and then suggests a classification depending on the arrangement of the doors. After considering the conditions which influence the design of rolling stock he discusses the influence of design on the construction, and finally adopts the classification of all-wood and all-steel cars.—Lond. *Electrician*, Jan. 29.

Single-Phase Traction.—A fully illustrated description of the Seebach-Wettingen road, including a description of the power plant, substation, and line.—*La Revue Elec.*, Jan. 30

Caucasus.—T. NALDANIEN.—A note on a proposed electric road through the Caucasus. The length will be 130 miles. Trains of 176 tons weight will be hauled by 50-ton electric locomotives. The power required will be 13,500 kw. Two large hydro-electric stations will be erected and energy will be supplied along the line for lamps, motors and tramways.—*La Revue Elec.*, Jan. 30.

Installations, Systems and Appliances.

Cost of Electric Energy.—A. OSCHINSKY.—The conclusion of his long illustrated article on the new electricity works of the city of Brussels. The author first sums up the operation of the power plant and of the five substations and gives figures for the guaranteed efficiency of the machines and for the efficiency which they have in actual operation. He finally gives a detailed statement of the cost of energy generated in this plant during 1907. Bituminous coal from Belgium of about 7900 calories heat value is used. The boiler plant has an efficiency of 53 per cent. The number of kw-hours generated during the year was 9,718,000. The coal consumption was 1.38 kg per kw-hour generated. Of the total electrical energy generated they are lost in the power plant 10.2 per cent; in the high-tension cables 3 per cent, and in the substations 26 per cent, so that the efficiency of the whole electric installation is 64 per cent. The total yearly cost of the generating plant, including interest and amortization, is $146,017, or 1.5 cents per kw-hour. The total yearly cost of the cable network and of substations is $60,165, or 1.7 cents per kw-hour sold. The total yearly expense was therefore $206,182, or 3.315 cents per kw-hour, as 6,219,000 kw-hours were sold. The value 3.315 cents per kw-hour sold is the sum of the following items: Coal in station, 0.89 cent; oil in station, 0.17 cent; water in station, 0.03 cent; cleaning materials in station, 0.04 cent; oil and cleaning materials in substations, 0.045 cent; wages in station, 0.31 cent; wages in substations, 0.21 cent; repairs in station, 0.02 cent; in substations, 0.04 cent; maintenance of battery, 0.11 cent; interest and amortization of generating plant, 0.885 cent; interest and amortization of substations, 0.57 cent. The total is 3.32 cents per kw-hour sold, which is considered a rather good result for a station which is principally for lighting. In future it is thought it will be possible to reduce the coal and oil consumption, and also the amount of wages paid, although no great hopes are entertained with respect to wages since the plant is a municipal one. The comparatively good result is due chiefly to the low interest which the city has to pay. The interest on the capital invested is 2 5/6 per cent, while the amortization is based on a period of 40 years, so that on the whole 4.21 per cent are charged.—*Elek. Zeit.*, Jan. 28.

Lightning Protection.—An account of the experience gained during the season of 1908 on lightning protection on the Taylor's Falls transmission system of the Minneapolis General Electric Company. The results of two seasons' operation are summed up as follows: It is impractical to try to protect the line insulation after the more violent storm disturbances have got onto the line. Overhead ground wire, properly installed, may be relied on to shield the line from the greater part of such disturbances and will prevent interruption or damage except under extraordinary conditions. Lightning rods on the poles are an added protection to the line insulation and poles, and separate lightning-rod poles may be of sufficient value to warrant their installation at points especially exposed to direct lightning stroke. Horn arresters, particularly with two or more horns in series and selective shunting resistances, are of definite value in relieving the stations from excessive disturbances, but should be set so as to discharge only in case of unusually violent disturbances, as their discharge is at times liable to disturb unduly the line regulation or to interrupt the service momentarily. The aluminum cell type or electrolytic arrester is the most reliable and effective protection yet devised for station apparatus, but should either be disconnected from the line by the attendants in case of long-continued discharge or be automatically controlled or disconnected by fuses or other devices. With proper shielding of the trans-

mission line and the installation of proper station arresters, interruption to service and damage to the line and stations may be practically eliminated, except in rare cases, such as direct lightning stroke reaching the conductors or other abnormal disturbance.—*Stone & Webster Pub. Serv. Jour.*—February.

German Central Station.—L. MUELLER.—An article on the central station of Hildesheim in Germany. The plant contains three steam turbines driving direct-current dynamos. Two are of 200-kw rating and the third of 300-kw. The turbo-generators run at 3000 r.p.m. and generate direct current at from 450 volts to 560 volts for lamps, motors and traction. The distribution network is on the 2 x 220-volt, three-wire system. Energy is sold either on a double tariff (with certain evening hours during the winter being exempted when no energy is permitted to be consumed) or on the maximum demand system. On the latter system, about 1¼ hours of maximum energy consumed daily during the month are charged at 15 cents per kw-hour, while the balance is charged at 2.5 cents per kw-hour. Energy for motors is supplied under the same conditions. The tariffs have proved very satisfactory and have resulted in increasing the time during which the total maximum load is used per year from 1100 to 2300 hours, in spite of very little industry in the city. The receipts per kw-hour sold are about 4.75 cents.—*Jour. f. Gasbel.*, Jan. 30.

British Central Stations.—The yearly statistical tables of British electricity supply stations with no tramway load. In the whole 267 stations are analyzed, very complete data being given as to the history of the plant, the system used, equipment, connections, and rate charged.—Supplement to Lond. *Electrician*, Jan. 22. A further statistical table covers British towns which take an electricity supply "in bulk." There are 369 towns of this kind and the statistical data given are equally complete. —Supplement to Lond. *Electrician*, Jan. 29.

British Central Stations.—Diagrams showing graphically the growth of British central stations during the last year. In the provinces municipally owned stations are predominant, while in London the reverse is the case. The development of "power" companies supplying electric energy "in bulk" has been going on since 1904 in a very rapid way in extending the connections to their mains, especially during the last two years.—Lond. *Electrician*, Jan. 29.

British Lighting and Traction Stations.—A statistical table on 146 of such stations, giving data on history, equipment, connections and rate of charging.—Supplement to Lond. *Electrician*, Jan. 29.

German Central-Station Statistics.—Statistical tables on German central stations and the cost of energy generation. The data contained in the article have already been noticed from German sources.—Lond. *Electrician*, Jan. 29.

Proposed German Electricity and Lamp Tax.—G. DETTMAR. —The author, who is general secretary of the German Association of Electrical Engineers, states that the proposed tax on electricity and gas has been attacked so furiously from so many sides that it will hardly become a law. There are, however, people who think that a tax on lamps (which forms a part of the original proposal) might be acceptable. The writer tries to show that such a tax would not bring the amount which is expected from it, and he further endeavors to show that it would be unfair, because one-fourth of the money would have to be produced by users of gas lamps and three-fourths by users of electric lamps.—*Elek. Zeit.*, Jan. 28.

German Tax on Electricity and Gas.—A further protest of the German Society of Gas and Water Engineers against the proposed gas tax; an abstract of G. Dettmar's paper before the German Association of Electrical Engineers; and a protest by the Association of Manufacturers of Gas Incandescent Mantles against the proposed tax on lamps.—*Jour. f. Gasbel.*, Jan. 23.

Free Oscillations in Long Conductors.—I. DOERY.—The first part of a mathematical paper on free oscillations in long lines with special reference to the use of condensers for protecting the line against sudden dangerous rises of voltage. The paper is to be concluded.—*Elek. u. Masch.* (Vienna), Jan. 31.

Wires, Wiring and Conduits.

Conduit Wiring.—L. M. WATERHOUSE.—A paper read before the (Scotch) Electrical Contractors' Association. To protect electric conductors from mechanical, chemical and electrolytic damage, the author considers iron tubes to be most suitable. The couplings and T-pieces should be made of malleable cast iron, and their corners should be rounded off to facilitate "drawing through." The proper use of junction boxes with porcelain interiors plays a most important part in planning a satisfactory system of distribution. Continuity and earthing are not only advisable, but are in many cases specified by the inspecting authorities. These very necessary precautions do not, however, altogether guard against fire risk, unless contact with gas pipes is avoided. To prevent troubles from condensation and water from destroying the insulation, great care should be taken in handling wires during erection, and attention should also be directed to cleanliness of the rubber after the vulcanizing process. With regard to switches and ceiling rosettes, it is recommended that such fittings should not be mounted directly on the metal outlet boxes. It is better to place a small insulating disk between the two, thus greatly improving the insulation of the system. To guard against electrolytic trouble the author states that "an enamel with a linseed oil base, and containing a very efficient rubber substitute, has been discovered, and gives a very good protective to the conduits. Tests on conduits covered with this enamel show that the tubes can be bent to curves of very small radii without cracking or scaling, and that the insulation resistance is extremely high."—Lond. *Electrician*, Jan. 29.

The Earth as Conductor.—E. BRYLINSKI.—The conclusion of his long report on the possibilities of using the earth as part of an electric circuit. The report is distinctly favorable to making use of the earth in such a way under certain conditions —*L'Industrie Elec.*, Jan. 25.

Fuses.—W. KLEMENT.—The first part of a paper in which the author gives an illustrated historical review of the different forms of electric fuses.—*Elek. Zeit.*, Jan. 28.

Electrophysics and Magnetism.

Thermal and Electrical Conductivity.—N. F. SMITH.—Since the ratio of the thermal to the electric conductivity is approximately constant for all metals it is natural to expect that anything which produces a change in the one would cause a corresponding change in the other. The electric resistance of small wires increases when under tension; up to the elastic limit, the increase in resistance is nearly proportional to the stretching force; beyond this state, the change is roughly proportional to the elongation. Bismuth shows a change in the opposite direction. The author has studied whether any changes in the electric resistance are accompanied by a parallel change in thermal resistance. The author subjected metal bars to a stretching force and studied the two changes. In every case the electrical resistance increased with increasing tension; that is, the conductivity diminished. These results are in substantial agreement with those obtained by other experimenters on resistance wires. However, the conditions of this experiment were not suited to a highly accurate determination of the effect. It is, however, of interest to note that the changes in the thermal conductivity produced by moderate tensions are opposite in direction to those in the electrical and are of an order of magnitude about 10 times as great. Some rather rough experiments upon the effect of bending bars of iron and copper so that a large permanent deformation was produced seemed to show a marked decrease in thermal conductivity of from 5 per cent to 8 per cent. This is to be expected from the behavior of copper bars when stretched upon their elastic limit.—*Phys. Rev.*, February.

Theory of Oscillations.—F. EMDE.—A mathematical paper in which the author shows that Steinmetz's method of using complex quantities for the calculation of alternating-current phenomena can be employed with advantage for the treatment of certain problems of the theory of oscillations.—*Elek. u. Masch.* (Vienna), Jan. 24 and 31.

Units, Measurements and Instruments.

Electric Regulation of Temperature.—H. M. RANDALL.—An abstract of an American Physical Society paper describing a high-temperature regulator, the arrangement of which is shown in Fig. 2. The variation in the temperature of the oven is detected by a thermocouple or a platinum resistance thermometer. The coil of the galvanometer in the potentiometer or

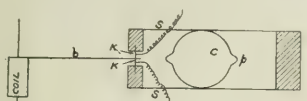


FIG. 2.—HIGH TEMPERATURE REGULATOR.

the Wheatstone-bridge circuit is provided with a light aluminum boom, *b*. With rise of temperature this boom moves between two spring jaws, *s*, which open and close upon one another regularly, the movement being caused by the rotation of the cylinder *C*, provided with the elevations *p*. The cylinder *C* is driven by a motor at low speed. The platinum contact strips *K* are insulated by hard-rubber blocks from the steel springs *s*, and just escape contact with each other when the boom is not between them. The diameter of *C* is such that the springs *s* pinch the boom with considerable force when it is between them in the position shown in the figure, thus completing a battery circuit containing an electromagnet; this latter, responding, shunts part of the heating current of the oven. As the oven cools the boom moves from between the jaws through its zero positions to a second similar pair of jaws on the opposite side, which operate to open the shunt circuit. With proper adjustment no strain is put upon the galvanometer suspensions when the jaws close upon the boom, and, therefore, light suspensions may be used. With this arrangement it has been possible to maintain for hours temperatures in the neighborhood of 1000 deg. C. in the oven employed, without any variation in temperature occurring which could be detected by a thermocouple.—*Phys. Rev.*, February.

Cadmium Cell.—P. I. WOLD.—A note on the short-circuiting of cadmium cells. The author studied the gradual recovery of a number of cells after they had been subjected to a short-circuiting for from 15 seconds to 10 minutes.—*Phys. Rev.*, February.

Telegraphy, Telephony and Signals.

Long-Distance Telegraphy from England to India.—Notes on recent progress in long-distance telegraphy, due to the completion of a new telegraph line in Persia and India. Direct telegraph connection has now been established between London and Calcutta, a distance of over 6900 miles, which is a record in long-distance telegraphy. Between London and Teheran there are 10 automatic relay stations, and direct Wheatstone automatic working between these cities, a distance of 3800 miles, has been used exclusively since 1903. In the year 1905 direct working was extended from London to Manchester and Liverpool. There are two relay stations on the new line from Teheran to Karachi, so that including the station at Teheran, direct working is accomplished between London and Karachi, a distance of 5347 miles, by means of 13 automatic relay stations. A Wheatstone receiving instrument can be put in circuit at each relay station, and by this means it is possible to ascertain the section of the line on the relay apparatus that is faulty if the messages are not being received distinctly. Up to some eight months ago, the paper-slips for passing through the transmitting apparatus were perforated by hand, but this operation is now done with the aid of a device known as the Kotyra key board perforator, which has been especially developed for use with the Wheatstone system. This apparatus consists of three electromagnets and a keyboard. The former are mounted side by side on a framework of metal designed to accommodate an ordinary Wheatstone perforator immediately underneath. Three brass pads, one fixed to each plunger, abut on the dot, space and dash keys, respectively, of the perforator, and when an electromagnet is energized, a blow is given to the respective key of the perforator, and a dot, dash or space signal is punched. A pinion driven by an electric motor runs beneath the whole of the keys. Each key has a lever connected to it, on the under side of which is a rack. When a key is depressed, the rack engages in the pinion, and is carried along a certain distance, after which it is returned to its position of rest by means of a spring. The key is then permitted to rise back to its normal position. A contact spring is fitted to each lever, and this spring passes over a series of metallic studs when the rack is in contact with the pinion. These studs are connected to the electromagnets, and as the contacts are rubbed by the spring, the corresponding electromagnets are successively energized, and the paper punched. The coils of the electromagnets, and also the motor, are wound for any e.m.f. between 80 volts and 120 volts, and the current taken by the apparatus is about 0.6 amp intermittently.—Lond. *Elec. Eng'ing*, Jan. 28.

Wireless Telephony.—A. CARLETTI.—An illustrated description of the system of Q. Majorana, who recently succeeded in obtaining wireless telephone communication over a distance of more than 300 miles. To obtain undamped electric oscillations, he formerly employed a revolving oscillator. This consisted of a motor on whose shaft was fixed a disk of ebonite carrying on its opposite faces two rings of metal. On these rings there pressed two brushes which were connected in the discharge circuit. Two steel wires 0.08 in. in diameter and 2 ft. 4 in. long were fixed to the metal rings and moved parallel to them. Their ends, across which the discharge took place, were brought up to one another. These two oscillating wires were connected to the secondary of a stationary transformer, whose primary received energy from the town mains. When the motor was running the two oscillating wires rotated, and the sparks which passed between them were blown out quickly by the air, and were, therefore, considerably subdivided. By means of the artifice he was able to produce 20,000 sparks per second. To modify these sparks to correspond with speech, Majorana designed a liquid microphone. This microphone consists essentially of a small glass tube through an opening in which a stream of slightly acidulated water flows under a known pressure. The small tube is fixed to a microphone membrane and therefore vibrates with it. This liquid jet falls between two platinum electrodes, thus establishing an electrical connection between them. When the microphone membrane is spoken into, in the same way as in an ordinary microphone, it vibrates and the small tube following its movements causes constrictions in the jet, and thus varies the resistance between the platinum electrodes. Quite measureable fluctuations are produced in the



FIG. 3.—DIAGRAM OF TRANSMITTING APPARATUS.

electric resistance, and they accord perfectly with the sounds emitted. This microphone has been tried on the ordinary telephone, and has given very satisfactory results. More recently Majorana uses Poulsen's method of producing undamped oscillations instead of his old revolving oscillator. Fig. 3 shows the arrangement adopted in the transmitting station. The arc, which is enclosed in a hydrogen atmosphere, is established be-

tween two electrodes, one of carbon and the other of copper. The oscillating circuit is made up of a condenser *c*, and the primary winding of a Tesla transformer. The secondary of this transformer is connected with the antenna, and to earth through the liquid microphone *M*. Sound waves corresponding to conversation modify the resistance of the circuit by means of the jet of water, and, therefore, also the oscillations radiated by the antenna. The arrangement adopted at the receiving end (Fig. 4) includes a new oscillatory circuit, a second antenna and a thermo-electric detector composed of two metals in contact, which under the influence of the oscillations becomes more or less heated, thus producing modifications in the current corresponding to the electric oscillations and, therefore, with the

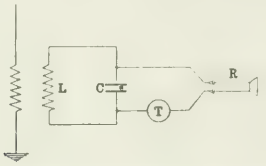


FIG. 4.—DIAGRAM OF RECEIVING ARRANGEMENT.

voice of the person speaking at the transmitting end. These variations in current are reproduced in the telephone receiver *R*.—Lond. *Electrician*, Jan. 29.

Inductance Troubles on Telegraph Lines from Traction Systems.—E. Mirabelli.—An abstract of a paper read before the first international conference of Telegraph & Telephone Engineers at Budapest. The paper deals with the experience gained on the Valtellina electric railway in Italy where a telegraph line runs along the road. The main disturbance was found to be due to induction from the two service conductors of the 3000-volt, secondary, three-phase system feeding energy to the trains. There was little disturbance due to leakage, except when heavy trains were running close to the substations. Differences of earth potential exceeding five volts between substations were noted. The total interference rendered telegraphic communication quite impossible, and the only practicable cure was to double the wires for the whole length adjacent to the railway, and insert a repeater at each end. Even then the insulation of the lines had to be very carefully maintained to avoid disturbance. Trials of closed circuits working with fairly high current were therefore made, and found to ameliorate the conditions considerably. It was, in fact, found possible to withdraw the repeaters at one end, and simply to earth the second wire at that point. The circuits are now working in this way wtih fair success. The alternatives suggested for further trial and consideration are: (1) the application of condensers and inductive resistors in the telegraph circuits in order to separate the currents of different natures; (2) doubling the aerial telegraphic wires wholly or in part; (3) laying underground cables along the railway for loop working; (4) arranging that motors shall use continuous current at low voltage in the secondary circuits or three-phase secondary currents, fed to motors by symmetrically placed conductors. The Italian administration is continuing experiments on the subject.—Lond. *Elec. Eng'ing*, Jan. 29.

Transmission of Photographs.—A description of a new process for transmitting photographs electrically by a French inventor, C. M. Senlecq. He does not use a selenium cell. The conversion of luminous shades into variations of current intensity is effected without any specially prepared plates, immediately in the photographic camera. The light rays strike, in the focus of the camera, a slide covered at its front with a glass plate and designed at its back as a microphone, connected with the transmission line in the same way as is the microphone of a telephone plate. The interval between the glass plate and the microphone, which is only about 1 in. in thickness, is filled with a mixture of hydrogen and chlorine gases, prepared in the dark under a given pressure. The glass plate inside the camera is covered with a rotary screen, in which are a series of openings arranged in spiral lines (Fig. 6), which is designed accurately like the one used in the selenium apparatus of the same inventor, but the selenium specks are replaced by perforations. In Fig. 5 *F* is the plate of an Ader microphone consisting of a very thin plate or a membrane, the vibrations of which correspond to the light shades acting on the gas mixture; *G*, in Fig. 6; is a screen 1 m or more in diameter, which, during each rotation, covers every portion of the picture in very close line. The two gases are contained in opaque receptacles, *H*, *Cl*. The glass plate, in a state of rest, is covered by the screen. The conversion of the different light shades into fluctuations of current intensity takes place as follows: A mixture of equal

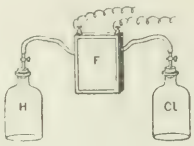


FIG. 5.—TRANSMITTER.

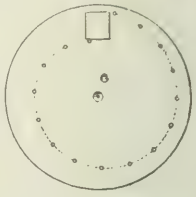


FIG. 6.—DISTRIBUTING DISK.

parts by volume of chlorine and hydrogen can be maintained only in perfect darkness. Under the action of even diffuse light a combination of the two gases to hydrochloric acid takes place at a rate corresponding to the variable luminous intensity; in fact, in bright sunlight, this combination is so violent as to result in explosion. Experiments conducted by the inventor show the combination of the two gases in the camera always to occur instantaneously, exerting on the microphone plate an action identical to that of sound vibrations. The phenomenon in question thus becomes a purely chemical effect producing a mechanical action—namely, vibrations of the microphone, which in turn are transmitted to the remote end of the line, in the shape of electric fluctuations. Owing to its strong chemical affinity for water the hydrochloric acid is absorbed immediately after production. The luminous shades of the original picture are thus converted into microphone vibrations which in turn, with fluctuations of electric current, are transmitted to the receiving station, there to be used for reproducing the picture by means of any tele-photographic receiving apparatus. The inventor uses in this connection his tele-electroscope and shade scale. It is claimed that the rapidity of transmission is quite high.—Lond. *Elec. Rev.*, Jan. 15.

Exports to Japan.—E. Schiff.—A discussion of the possibilities of exporting machines from Germany to Japan, on the basis of a communication by H. Noelke, a German engineer in Japan. The imports into Japan in 1907 are given in the following table, 1 yen being 50 cents:

	General machinery. Yen.	Locomotives, cars, etc. Yen.
Great Britain	14,674,028	907,240
United States of America	8,310,333	2,108,914
Germany	3,248,575	136,564
Total imports	26,936,865	3,280,334

Imports of general machinery into Japan, therefore, come 55 per cent from England, 31 per cent from the United States and 12 per cent from Germany. The writer gives some hints as to means for extending the export trade and he thinks that agencies are often given indiscriminately to firms in Japan, who thus become the sole agents for a great many firms who are real competitors. It is necessary to send engineers to Japan as representatives, and the representatives should be not only in the cities on the coast but in the interior. A single firm should not get the sole agency for the whole of Japan. The manufacturers in Germany should show their works to visiting engineers from Japan, since secrecy is good for nothing and only hurts the trade. In spite of the very great commercial activity in Japan since the close of the war only three or four machinery factories have been completed. Japan will therefore have to import machinery from other countries for a long time to come. The exporter should send his own engineer to Japan. The

formation of syndicates of firms exporting similar kinds of machinery is recommended. Attention is called to the Japanese World Exposition in 1912.—*Elek. Zeit.*, Jan. 28.

Increasing Self-Inductance of Telephone Lines.—M. MINOTTI.—An article on the best method of increasing the self-inductance of a telephone line uniformly all along its length, without loading it at intervals with inductance coils. There are two means of doing it. One is to use an iron core around which the copper conductor is wound. The other is to use a copper conductor around which an iron wire is spun. The author shows in detail that the second method is the preferable one, as it is more effective for the same cost.—*Elek. Zeit.*, Jan. 28.

Wireless Telegraphy.—J. BETHENOD.—A mathematical article on the calculation of the proper frequency of an antenna excited indirectly by an autotransformer arrangement.—*La Lumière Elec.*, Jan. 30.

NEW APPARATUS AND APPLIANCES

The Use of Telephones in Generating Stations.

By W. HARVEY KELLEY.

THE rapid growth of American industries within the past 25 years has made it difficult for one to keep pace with them. Large enterprises have been built up so quietly that the general public has been almost unconscious of their existence. The two Waterside stations of the New York Edison Company are a striking example of such conditions, being the scene of tremendous activity little dreamed about and seldom heard of by persons outside the electrical profession.

These central stations, through the medium of 26 substations, supply electrical energy to the Borough of Manhattan and the Borough of the Bronx. The Edison service is used by approximately 75,000 consumers. There is an equivalent of over 6,000,000 16-cp lamps in every-day use, the electric motors driven aggregating 205,373 hp. Alternating current at 6600 volts is distributed from the Waterside stations to the various substations and is there transformed by means of rotary transforming apparatus into direct current at 120 and 240 volts. This is fed into a three-wire system from which the customers are supplied. The company uses a large number of storage batteries in different sections of the city to equalize the load upon the machines.

In this connection it is interesting to note that all this vast amount of electrical energy is directed chiefly through the agency of the telephone. Through a Western Electric private telephone exchange in Waterside station No. 1 the switchboard operators there are in direct and immediate communication with Waterside station No. 2, and with each of the 26 substations. In addition to this, Waterside station No. 2 is equipped with a Western Electric private telephone exchange and an intercommunicating telephone outfit, as shown in Fig. 1.

The intercommunicating telephone system was installed by the Western Electric Company, in January, 1906. It has had a three-year test, and has proved to be one of the greatest time savers connected with the plant. The equipment has a capacity of 20 lines, 10 of which are in actual use. The others are being held in reserve for future galleries or stations as they may be added. Those in use are connected as follows: Substation, battery room, bus house, east; bus house, west; selector gallery, east; selector gallery, west; transformer gallery, automatic gallery, east; automatic gallery, west, and high-tension board.

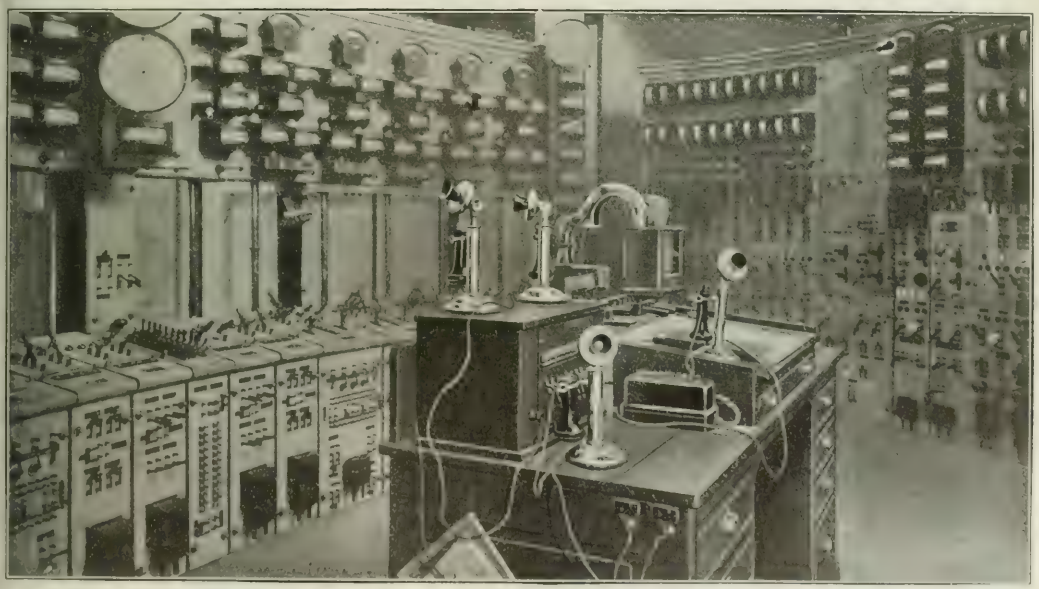


FIG. 1.—INTERCOMMUNICATING TELEPHONE EQUIPMENT IN WATERSIDE STATION NO. 2 OF THE NEW YORK EDISON COMPANY.

Fig. 2 illustrates the type of intercommunicating telephone equipment used at the Waterside stations. The efficient design of the equipment, its rigid, reliable, mechanical construction, and its pleasing appearance are worthy of note. The selective apparatus, as will be seen in the figure, is mounted in an enameled iron case. The buttons are labeled according to the telephone or station with which they are connected. The home button being labeled "Ans." To make a call it is only necessary to press the button opposite the station desired, then press the button labeled "Ring" and remove the receiver from the hook. To answer a call one has simply to

press the button labeled "Ans" and remove the receiver. All the buttons are nickel-plated with the exception of the ringing and answering buttons, which are of red fiber. Each key except the ringing key is engaged by a tumbler common to all the keys, and when depressed it is held locked down until another key is pressed, when the key previously used is automatically released and returned to normal.

In the past, and before the adoption of the intercommunicating system, it was necessary for the switchboard operator to call the gallery repair man with whistle blasts, often necessitating a wait of from 5 to 10 minutes; now the repair man is on hand within nearly as many seconds. With the intercommunicating system the switchboard operator signals the repair man, who is seldom more than 25 ft. from a local telephone station, by ringing his telephone bell. The bell is answered by the repair man over the telephone, thus establishing immediate and direct communication with the switchboard operator who tells him just what is needed. In this way the trouble is adjusted in much less time than it would take the repair man personally to report to the switchboard operator and receive instructions as he can bring the necessary tools and supplies with him.

It is estimated that this system is used in the Waterside station at least 200 times a day. By saving the time the em-

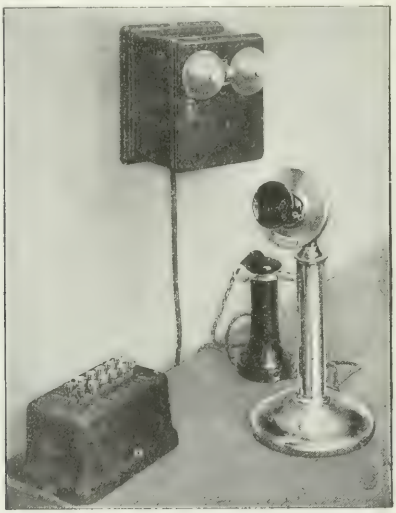
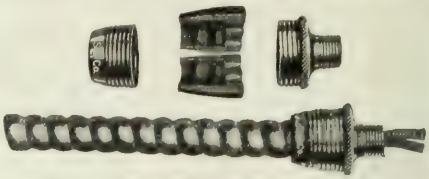


FIG. 2.—INTERCOMMUNICATING TELEPHONE EQUIPMENT.

ployees would otherwise require in traveling around the plant enables them to accomplish more and better work and safeguards the station in cases of emergency. The feature of the intercommunicating system is that it requires no special telephone operator and therefore has very low operating expense. It is available for use at all hours of day or night, as connections are made independent of a telephone operator. Aside from these advantages, it puts the manager of a plant in touch with every one of his departments at a moment's notice.

Brass Insulated Bushing.

The Sprague Electric Company, New York, has developed a new brass insulated bushing to comply with the rule of the National Board of Underwriters which requires that lamp sockets must be insulated from the armor of armored cord. The bushing consists of two brass parts and two composition insulating wedges, as shown in Fig. 1. The brass parts are insulated from the steel armor by the insulating wedges which grip the armor as the bushing is screwed into place. In Fig. 2 are shown the parts assembled. The simplicity of construction of these bushings and their ade-



FIGS. 1 AND 2.—BRASS INSULATED BUSHING.

quacy as regards the requirements of the rule, leave little to be desired in this class of devices.

Flaming Arc Lamp with Vertical Electrodes.

The accompanying engravings illustrate the features of the Alba flaming arc lamps of the Siemens-Schuckert Works, the American distributor for which is the Charles L. Kiewert Company, of Milwaukee, Wis. Fig. 1 shows the mechanism of the direct-current lamp, Fig. 2 shows the details of the alternating-current lamp, and Fig. 3 illustrates the methods of ventilating the globe by means of an ash tray. The feature of the lamp is the co-axial vertical arrangement of the electrodes. The diameter of the chemical core carbons is about double that of the inclined carbons, while the length is a little more than

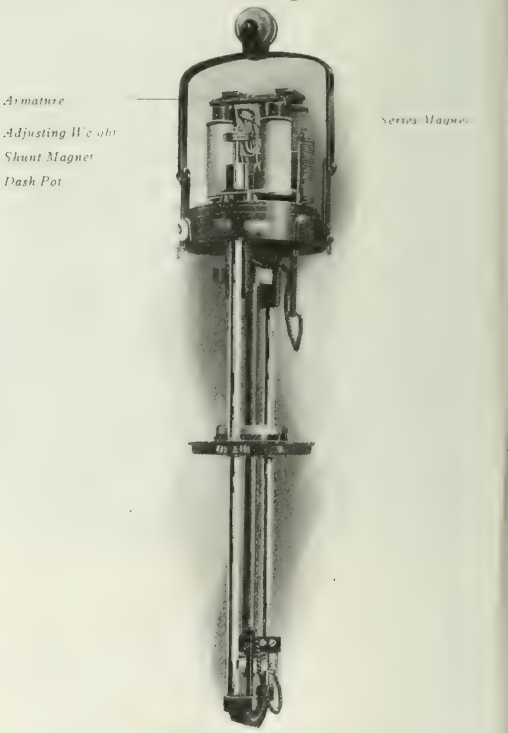


FIG. 1.—DIRECT CURRENT FLAMING ARC LAMP.

half for the same amperage and number of hours burning. The carbon shell giving mechanical strength to the electrode is 2 mm thick, while the diameter of the core is from 13 mm to 14 mm. The lamps are built for either 30 or 40 volts at the arc so that three or two may be burned in series on a 110-volt circuit. As the maximum light intensity is near the horizontal, the distribution is such as to render the lamp especially suitable for general illumination of streets, railroad sheds, machine shops, etc. The engravings show the mechanism of both lamps

n detail. On an insulated plate sealed against the ingress of fumes are mounted the series and shunt magnet between which is a clockwork mechanism. In the clockwork mechanism is a wheel over which a copper rope runs. To one end of the rope a carbon holder is attached and to the other end a counter-

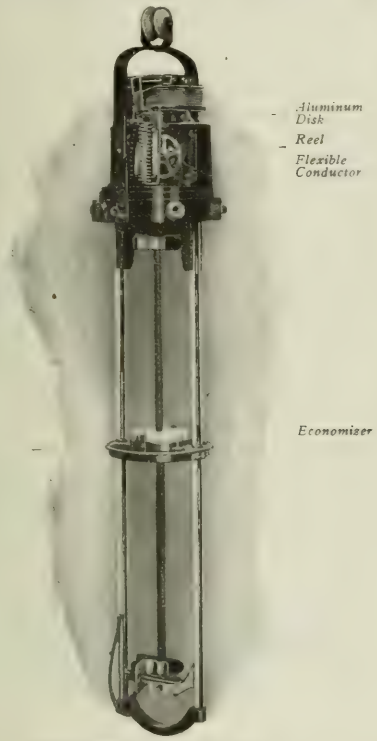


FIG. 2.—ALTERNATING-CURRENT FLAMING ARC LAMP.

weight. The carbon and holder being heavier than the counterweight, seek to turn the wheel, and by means of a ratchet arrangement the carbons are fed gradually, the movement being.

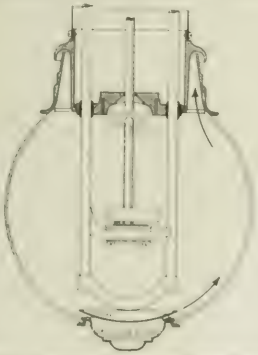


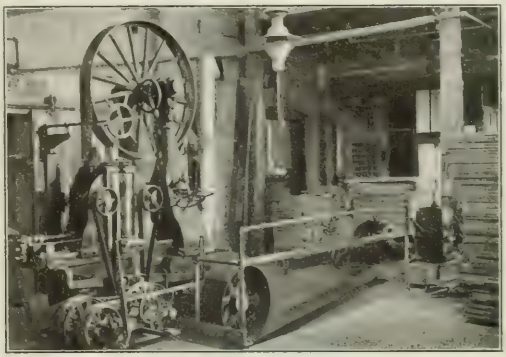
FIG. 3.—METHOD OF VENTILATING GLOBE.

of course, under control of the magnets. The economizer is fixed at about the center of the rods and the electrodes are fed so that the arc remains practically in the one spot

Motor-Driven Band Saw in Carriage Works.

In the manufacture of automobile bodies use is made of a large amount of poplar ¼ in. or less in thickness and from 12 in. to 36 in. in width. The stock from which the panels are made is usually 1 in. thick and must be resawed in the factory into ¼-in. boards. Many difficulties attend the driving of the resawing machinery by line shafting, but satisfactory results are obtained when use is made of an induction motor for driving each machine.

The accompanying illustration shows a 40-hp Westinghouse

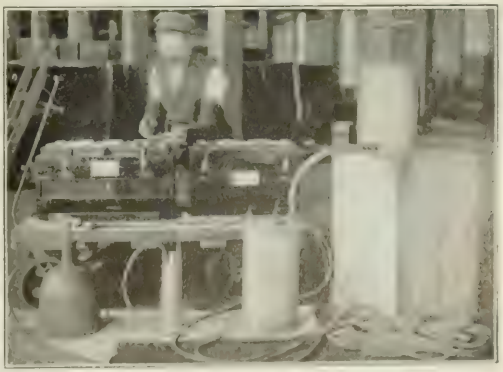


MOTOR-DRIVEN BAND RESAW IN CARRIAGE WORKS.

induction motor belted to a 60-in. American band-type resaw in the plant of the Detroit Carriage Works, at Detroit, Mich. The motor-driven equipment evidently absorbs no power when the machinery is not in use, while the induction motor maintains a constant speed in service and can withstand sudden and severe overloads.

Portable Hydrogen Generator Outfit.

The Electric Storage Battery Company has recently placed on the market a portable hydrogen generator outfit adapted for repair work on storage batteries, and especially for emergency use where lead burning is to be done away from the regular repair shop or battery depot. The complete outfit consists of four principal parts, and is so arranged that when packed for transportation, three of the parts nest inside of each other, forming a compact parcel with a bail handle for carrying, the pump being easily carried by its piston handle. The total weight of the apparatus, exclusive of the pump, is about 46 lb. When set up for use it makes a complete generator quite as serviceable for



PORTABLE HYDROGEN GENERATOR OUTFIT.

temporary use as the larger apparatus manufactured by this company. The generator furnishes gas sufficient to make a suitable flame for lead-burning work for over five hours continuously or more than sufficient time for burning on all connections in a complete set of vehicle cells in trays.

Combination Battery Volt-Ammeter.

The pocket type instrument illustrated herewith is really two instruments in one. The voltage side is used for testing storage batteries, the e.m.f. of each cell of which, during the charging period, should measure 2.5 volts when each cell is fully charged; when the e.m.f. is below 1.7 volts, the cell should be recharged. A storage cell on open circuit should have an e.m.f.

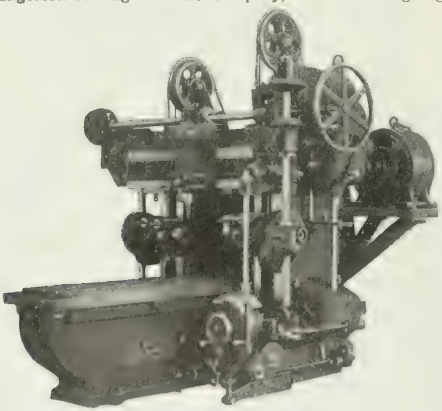


COMBINED VOLTMETER AND AMMETER

of from 2.0 to 2.2 volts when fully charged. The ampere side of the meter is used for showing the condition of dry batteries, each cell of which should be tested separately; when the current produced by any cell on short-circuit is less than 6 amp the cell should be replaced by a new one. The above combination meter has been placed on the market by the Connecticut Telephone & Electric Company, Meriden, Conn.

Motor-Driven Milling Machine.

The phenomenal growth of automobile manufacturing in recent years and the special parts to be machined have given rise to the production of the milling machine shown in the accompanying illustration. The tool is made particularly by the Ingersoll Milling Machine Company, and for milling engine

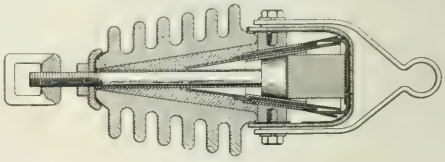


MOTOR-DRIVEN MILLING MACHINE.

bases and transmission cases of automobiles. It is, however, not only adapted for this work, but for any other work which may be machined on either a planer or milling machine. The three spindles have speeds varying from 15 r.p.m. to 120 r.p.m. The speeds are arranged for face mills up to 10 in. in diameter for steel or cast iron, but for aluminum work larger cutters may be used. The machine has a capacity of 26 in. between the ends of the horizontal spindles, and 24 in. between the table and vertical spindle. The motor equipment consists of a 15-hp, direct-current, shunt-wound, Westinghouse motor. The motor is mounted on a bracket in the rear of the machine, where it takes up little space and does not interfere with the work or the operator. The speed changes, from 875 r.p.m. to 1500 r.p.m., are effected by variations in the shunt field by means of a drum-type controller, not shown. In addition to the range of speed thus obtained there are four changes by mechanical means. This enables the cutting speed required by the work to be obtained with exactness and maintained with certainty. In the case of machine tools especially is it desirable to have a perfect control and adjustment of the speed; and undoubtedly the most satisfactory method of obtaining this is by means of the adjustable speed motor and a suitable controller

Strain Insulator.

With the rapid development of heavy electric railway work there has arisen a demand for efficient strain insulators for catenary work, where the link-type insulators are unapplicable. The existing types of strain insulators, when built for heavy strains and high voltages, become very large, heavy and expensive and some forms lack sufficient reliability. The accompanying illustration shows a new type of strain insulator, patented by J. P. Nikonow, to meet the occasion. In this insulator a mica tube is inserted between conical metal parts of comparatively small size, insuring light weight of the piece. In order to reduce the stress on the mica tubing several metal sheets are interposed between the mica and metal parts. The mica insulation is allowed to extend considerably beyond the metal parts, so as to reduce creeping leakage to a minimum. A



STRAIN INSULATOR.

sheet-metal cap covers the top of the insulator, protecting it from the atmospheric influence, and with the same purpose a removable porcelain bushing is fitted over the insulator. The patent rights of this insulator have been acquired by the Westinghouse Electric & Manufacturing Company.

Insulation for Covering Joints in High-Tension Conductors.

The requisites for a first-class insulation for covering a high-tension joint are permanently high mechanical strength, adhesiveness and dielectric strength and ease of manipulation. The material having these qualities when applied to a wire joint make a protecting covering that reliably maintains the insulation of the joint equal to that afforded by the original covering of the wire. It is claimed that all of the above qualities are possessed by "Neponset splicing compound." In the process of manufacture this compound is rolled to two standard thicknesses of 0.035 in. and 0.048 in., sheeted on glazed muslin and then cut into tape, usually ¾ in. wide. The glazed muslin, by preventing access of air to the compound, prevents surface curing of the latter, and the full adhesiveness is thus preserved. The strip of muslin also protects the turns of the tape from sticking together in the roll. It is said that the compound will withstand a tensile stress of 500 lb. per square inch, and that a single thickness of the 0.035-in. tape will withstand a puncture test of 10,000 volts. It is said that the material does not deteriorate with age, and that no heat is required in its application. This material is manufactured by the Massachusetts Chemical Company, Walpole, Mass.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Although conditions of trade during the past week were somewhat irregular the general tone is better. There is a little more buying done in all of the large wholesale centers. The first of the spring buyers' excursions began during the week and quite a large number of outside merchants have been attracted to the central markets. In both New York and Chicago the dry goods and notion jobbers are reporting a considerable number of orders, although the buying is still characterized by marked conservatism. As a rule reports from these visiting merchants are that their stocks are low but that they do not care to make extensive orders until they are assured that general business has revived. Their presence, however, and their general interest in the market have engendered a distinct feeling of optimism among the wholesalers. In the South and Southwest store trade remains rather quiet and collections are not what merchants would like to have them. In industrial lines the resumption of normal conditions seems to be practically as far off as ever. There is some little growth in almost all directions, but only in cotton goods and textiles is there really enough business to prove distinctly encouraging. Cottons are now being sold for October delivery, but outside of this line very few future orders are being placed. Heavy storms and unsettled weather conditions throughout the West have done much during the past week to retard traffic, and also have kept customers out of the retail market. In the metal line prices continue to sag and business is very dull. Sales of pig-iron are scarce and but few orders for finished material are being recorded. There is some activity in cast-iron pipe as many municipalities are extending and rebuilding their water system. The demand for steel rails continues to be very light and orders that were expected to come early in 1909 have not as yet materialized. The Baltimore & Ohio Railroad placed an order during the past week of considerable size, but it was parceled out among so many producers that it amounted to very little to any one of them. The demand for electrical goods, it is said, has declined. The trade in brass is worse than it was a few weeks ago and the sheet copper concerns are running far below their normal capacity. Business failures for the week ended Feb. 10 were 211 against 286 the previous week, 326 for the like week in 1908, 204 in 1907, 208 in 1906 and 243 in 1905.

THE COPPER MARKET.

The first report of the Copper Producers' Association, which was made public during the past week, showing a surplus in this country of "marketable copper" of 144,000,000 lb., has done much to hold the price of copper steady and to strengthen the prices of copper company stocks. While the figures were in excess of the public's guess as to what they would be, they were so much below the private estimates of copper surplus that there is a disposition to receive them with incredulity. The term "marketable copper," it is understood, includes neither pig copper—of which 30,000,000 lb. were exported last year—nor does it include any copper in process of refining. According to this report the production of copper during the month of January was 112,000,000 lb. and the amount delivered for consumption and export was 90,000,000 lb. Here there is an admission that the surplus has increased since Jan. 1 at least 22,000,000 lb. Add this to the government's estimate of the surplus on that date, 213,000,000 lb., and we would have at the time the producers' report was made 235,000,000 lb. surplus instead of 144,000,000 lb. This is quite a remarkable difference, and is all the more striking when it is remembered that both sets of figures were compiled by the same statistician—Mr. L. C. Graton. To figure it in a different way: From the producers' report it is evident that the consumption and exports of copper for January amounted to about 80 per cent of the production and imports; applying the same percentage for the year to the production, which is figured at 1,123,000,000 lb., and we have an accumulation for the year of 224,000,000 lb. These figures, however, are misleading. The exports of copper are known to have been slightly in excess of 650,000,000 lb. and the takings for domestic consumption, according to the most liberal estimates, about 400,000,000 lb. The sum of these deducted from the production for the year would leave a surplus for the year of 73,000,000 lb. to be added to the surplus of 123,000,000 lb. in January, 1908—more than the producers' figures and less than government figures. All of these figures are referred to in order to show that in spite of official and private statisticians, we are in practical ignorance of the condition of the copper industry. This condition is referred to by Mr. J. H. Dewhurst, a staff correspondent of the London *Morning Post*, who recently visited this country for the purpose of investigating copper. "It is wholly impossible at this time to publish exact figures," he says. He also has this to say concerning the New York market: "New York quotations are artificial. The large metal-selling companies and their customers are reticent as to prices of actual sales, but it is an open secret that a system of rebates quoting 2 cents a pound below published figures is in operation." During the past week in the New York market sales of actual copper have been light, but there has not been upon the surface any disposition to shade prices. The sales that are made are mostly in small quantities and have the appearance of orders to fill immediate necessities. The exports for February up to and including Feb. 15 have been 6761 tons. Prices quoted on the Metal Exchange were:

Lake	13½ @ 13⅝
Electrolytic	13 @ 13¼
Casting	12⅞ @ 13⅛

London quotations were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	58 12 6	58 7 6
Standard copper, futures	59 2 6	59 5 0
Market	Easy.	Steady.
Sales of spot		600 tons
Sales of futures		800 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.55	13.55
Electrolytic	14.25	13.12½
Casting	14.12½	13.00
London, spot	£64 2 6	£57 7 6
London, futures	64 17 6	58 7 6
London, best selected	67 15 0	61 15 0

EXTENSIVE NERNST LAMP INSTALLATION.—The Nernst Lamp Company has contracted with McFadden Brothers, proprietors of one of the largest department stores in Wheeling, W. Va., for Westinghouse Nernst lamps to light their new building. The new building, which the firm is now moving into, is a modern fireproof structure of steel, brick and stone. It consists of three floors and basement, all of which will be lighted by single glower Westinghouse Nernst lamps in special three-arm fixtures.

CANADIAN LIGHT COMPANIES FOR SALE.—Announcement is made by E. R. C. Clarkson, 33 Scott Street, Toronto, that he will receive tenders up to March 4 for the entire capital stock, save a few shares, of the Oshawa Electric Light Company, owning steam and water power plants in the town of Oshawa, Ont. This company also owns the property of the Bowmanville (Ont.) Electric Light Company, owning both a steam and water power plant and a transmission line in Bowmanville.

RUSH TO EQUIP WITH WIRELESS.—It seems likely that before the bill which has just been favorably reported in Congress can become a law a majority of the ocean-going ships will be equipped with wireless. There is at the present time a great rush in this direction. A representative of the United Wireless Telegraph Company says: "We are almost swamped with orders from steamships. Our factory is running overtime trying to keep up with its orders."

HISTORY OF COPPER PRICES.—The Wire & Telephone Company of America, manufacturer of electric wires at Rome, N. Y., has issued its regular annual leaflet "Copper History," which shows the monthly and yearly average prices of copper from 1883 to 1909. The publication makes convenient reference data for any one interested in the copper market.

SALES OF ALLIS-CHALMERS TURBINES.—Among some of the large steam-turbine generating units which have recently been contracted for from the Allis-Chalmers Company are the Memphis Consolidated Gas & Electric Company, two additional units of 1500 kw each to be added to a similar generator which was put in operation some time ago; the Pacific Mills, at Lawrence, Mass., a unit rated at 3250 kw to supplement the present plant, and the Pfister & Vogel Leather Company, of Milwaukee, two units of 1500 kw each. The Golden State Portland Cement Company, Oro Grande, Cal., and F. W. Bird & Son, paper manufacturers, East Walpole, Mass., have each purchased units of 750 kw. Among those now installing machines of 500 to 1500 kw are the city of Dunkirk, N. Y.; Cedar Rapids & Iowa City Railway & Light Company; Evansville Terminal Railways; Willamette Valley Company, Eugene, Wash.; Webster & Southbridge Gas & Electric Company, Webster, Mass.; Citizens' Electric Illuminating Company, Pittston, Pa.; Tremont & Suffolk Mills, Lowell, Mass., and United States Reclamation Service, Williston, N. D. The purchases recently made also include, in nearly every instance, auxiliary steam and electrical equipment, such as condensers, steam and motor-driven exciter sets, transformers, switchboards, motors, etc.

GENERAL ELECTRIC'S SALES IN 1908.—Unofficial figures concerning the General Electric Company's business billed in 1908 indicate it will be about $40,000,000. During the last quarter of the past year the sales of the company were about $13,000,000, and this was much the best quarter of the year. During January the company billed about $6,000,000 in orders, and if this should continue during the coming year, 1909 would be very satisfactory. It is not expected, however, that this rate can be maintained in the present condition of business. The big rush in January is explained by the fact that it is the last month of the company's fiscal year, and an especial effort is made to hurry in orders at that time. The business billed during the year which ended Jan. 31, 1908, was slightly more than $70,000,000, and for the year previous about $60,000,000, so that the past year is in the neighborhood of 60 per cent of the average for the past two years. The company is in an exceptionally strong financial condition having on hand a cash balance of $21,000,000. There is no likelihood of its dividend being curtailed even if the entire amount necessary for its payment has not been earned.

MOTORS FOR PNEUMATIC SERVICE.—The opening of the new station "H" Post-Office at Forty-fifth Street and Lexington Avenue, New York City, adds another to the numerous power stations of the Pneumatic Service Company which have recently been fitted with motors. In this station three motors have been installed: one of 75 hp, one of 40 hp and one of 30 hp. The Pneumatic Service Company has within the past year made a number of installations of motors for the purpose of driving its reciprocating and rotary compressors. They use direct current supplied by the New York Edison Company. The power installations of the company in addition to the new station are: At the General Post-Office two 75-hp and one 30-hp; at station "O," one 105-hp, one 75-hp, one 65-hp; at Times Square station, two 105-hp, one 60-hp, one 30-hp; at station "W," two 105-hp, one 80-hp; at station "J," one 70-hp, one 65-hp, one 50-hp. The plans for the new post-office building to be erected at the Pennsylvania Railroad terminal have not yet been made. The New York Pneumatic Service Company is now operating in Manhattan and Brooklyn 21 miles of double-tube line.

CHICAGO NORTH SHORE RAILWAYS TO INCREASE ITS POWER EQUIPMENT.—The North Shore Electric Company has closed a contract with the receivers of the Chicago & Milwaukee Electric Railroad Company by which it will supply 1000 kw of 25-cycle alternating current power to the railway at Waukegan, Ill. The railway is already taking a like amount from the central station company at Evanston, Ill. Owing to this order and the general expansion of the business, the North Shore company will increase the equipment of its Waukegan generating station by installing a 2500-kw Curtis 9000-volt 25-cycle turbo-generator, Babcock & Wilcox boilers, Worthington condensing apparatus and the necessary switchboard extension. Orders have been placed for this material. In the Waukegan station two turbines are now in operation, one of 500 kw and another of 1000 kw.

ELECTRICAL GOODS FOR THE FAR EAST.—The Bureau of Manufactures, of the Department of Commerce and Labor, has received information from an American consul in the Far East of opportunities for the sale of electrical machinery. Full information as to the location and names of the companies interested can be secured from the chief of the bureau. The consul says that the local branch of a house whose main offices are in France contemplates putting in an electric railway line between two cities in his district, and will soon be in the market for supplies. He also says that there is some dissatisfaction with the electric light service because of the poor material employed, and a market could be found for a superior grade of electrical fixtures, such as lamps, fans, brackets, bells and the larger parts of the electrical equipment.

WESTINGHOUSE CONDENSER INSTALLATIONS.—The Westinghouse Electric & Manufacturing Company reports that its American adaptation of the type of condenser which has been popular in Europe is meeting with marked success in this country, mostly in connection with new turbine equipments. The Narragansett Electric Light Company, of Providence, R. I., is installing two units of 7000 hp in connection with new turbines; the B. F. Goodrich Rubber Company, Akron, Ohio, has ordered one unit for its central power plant; the Coronet Phosphate Company, Plant City, Fla., three units; Portland Cement Company, Trinidad, Col., one unit, and city of Logansport, Ind., one unit.

LAYING THE GERMAN BRAZILIAN CABLE.—United States Consul Solomon Berliner, of Teneriffe, reports that the German-Brazilian Cable Company has already begun work on its line between Emden and Teneriffe. This first section will be 2163 nautical miles in length. It has not yet been decided if the cable will then be laid direct from Teneriffe to Pernambuco, Brazil, or if it will be connected with Monrovia, Liberia. The length of the second section would be 2766 miles in the first case and 3800 miles in the second, but the latter is considered more advantageous, as the cable, if connected with Monrovia, would serve the German colonies in Southwest Africa.

OPPORTUNITY TO SELL HYDRO-ELECTRIC MACHINERY.—The Bureau of Manufactures of the Department of Commerce reports that an American consul has sent to it information that two gold dredging companies in his district are preparing to construct jointly a hydro-electric plant having a capacity of 15,000 hp. The electrical energy generated in the plant will be used to operate dredges, elevators, hoists, railways, tramways, lamps and telephones. Information concerning the proposed plant can be obtained from the chief of the bureau.

ANOTHER MODEL STEEL CITY.—The United States Steel Corporation, it is said, is preparing plans to build another great plant and model city like Gary, Ind. It will be located on both sides of the St. Louis River, three miles from Superior, Wis. The plant is expected to cost $14,500,000. The blast furnaces are to be located on the Minnesota side of the river, but auxiliary plants are to be located on the Wisconsin side. The Steel Corporation has purchased and cleared 1600 acres of land on the Wisconsin side.

ELECTRICAL GOODS IN CENTRAL AMERICA.—Mr. Stephen J. Burke writes from Belize, British Honduras, announcing that he proposes opening offices in the City of Mexico to introduce and push the sale of American electrical machinery and appliances in Mexico and the Central American states. He asks that manufacturers desiring representation in these countries communicate with him.

SAN DOMINGO TELEGRAPH TOLLS REDUCED.—The French Cable & Telegraph Company, which controls the telegraph lines in the Dominican republic, has reduced its tolls to an average rate of 5 cents per word between any points on the island. Formerly some of the rates were as high as 20 cents per word.

Financial Intelligence.

THE WEEK IN WALL STREET.

The condition of trading on the New York Stock Exchange during the past week was about as near absolute stagnation as can be imagined. The average for the four days which ended with Feb. 11 was less than 400,000 shares per day. For this situation there seem to be a number of reasons, but the main one is, of course, the absolute lack of interest in business which almost all industrial and commercial lines are now showing. It is generally believed that the industries, especially the metal trades, are simply waiting for a decision in the tariff matter.

This state of uncertainty prevents new orders from being placed and establishes strict conservatism in every branch of commercial activity. It is asserted, and probably with much truth, that the steel and iron companies are only operating at the present time upon orders which were received last fall. New orders are few and far between and when they do appear are mainly for the purpose of filling in absolute necessities. Unless there is a change for the better very speedily, it is predicted that even the present limited operation of the steel mills will have to be curtailed. What trading there is on the Street is done by small professionals and floor traders. This, of course, means no business to the commission houses and indicates that the outside public is almost entirely absent from the market. One of the interesting features during the past week was the first report of the Copper Producers' Association. This report was distinctly encouraging as the figures it gave out of the surplus amount on hand were not more than 60 per cent of what had been estimated by statisticians during the past few months. The effect upon the copper stocks was a moderate advance and the strength in these issues was sufficient to hold the entire market very firm. As a matter of fact, the net changes for the week were mostly slight advances and the tone on Feb. 15 was strong and upward. The decision of the Public Service Commission, Second District, in permitting the Erie Railroad to issue $30,000,000 worth of bonds lost much of the favorable effect it would otherwise have had by the rather drastic conditions which were placed about the issue and the further fact that the favorable decision was only reached by a vote of three to two of the commissioners. The long investigation which the commission made and the rigid terms which it imposed are not considered to be encouraging to those public utilities which have the further issue of bonds in mind. It begins to look as if the good old days when such corporations could issue all the bonds they wanted to without question had forever departed. The money market continues to be more or less easy and every bond issue that is advertised is quickly oversubscribed. The Chicago Railways issue of $6,000,000 was spoken for many times over before the day that the bids were open. This greediness for bonds shows that there is plenty of money ready for investment or for business. The fact that it is lying in the banks unemployed shows to what extent the recent period of depression has educated the public in conservatism. Foreign money markets are easy and the Continental banks continue to accumulate gold. Money in New York on Feb. 15 was quoted for call loans 2 @ 2½ per cent, for 90-day paper 2¾ @ 3 per cent. The quotations in the table are those of the close Feb. 15.

NEW YORK.

	Feb. 8.	Feb. 15.	Shares sold.		Feb. 8.	Feb. 15.	Shares sold.
All.-Ch.	14⅞	15¼	2,300	Int.-Met., pfd.	43	44¾	20,725
All.-Ch., pfd.	47½	48⅞	2,725	Mackay Cos.	72	72	100
Amal. Cop.	75¼	76⅜	86,025	Mackay Cos., pfd.	71½*	72*	300
Am. D. T.	35*	35*	——	Manhattan Elev.	149*	148½*	200
Am. Loc.	55⅞	57	2,450	Met. St. Ry.	31*	30	10
Am. Loc., pfd.	111¾	112	300	N.Y. & N.J. Tel.	114½	115	320
Am. Tel. & Cbl.	75½*	78	50	Steel, com.	52⅝	53⅛	74,300
Am. T. & T.	128	129⅛	6,130	Steel, pfd.	113⅛	114⅛	6,105
B. R. T.	71½	72⅜	29,901	W. U. T.	67½	68	200
Gen. Elec.	155¼	158	5,200	West'h., com.	80	83	6,500
Int.-Met., com.	15⅜	16¼	19,385	West'h., pfd.	118	118*	100

PHILADELPHIA.

	Feb. 8.	Feb. 15.	Shares sold.		Feb. 8.	Feb. 15.	Shares sold.
Am. Rys.	45*	40½	——	Phila. Elec.	12	12	——
Elec. Co. of A.	11⅛	11½	——	Phila. R. T.	27⅛	28¼	——
Elec. Stor. B'ty.	44½	46¼	——	Phila. Traction.	93¼	93	——
E. S. B'ty. pfd.	49*	49*	——	Union Traction.	53½	53¾	——

CHICAGO.

	Feb. 8.	Feb. 15.	Shares sold.		Feb. 8.	Feb. 15.	Shares sold.
Chi. City Ry.	180*	187	——	Chi. Tel. Co.	129	130⅜	——
Chi. Rys., Ser. 1.	116*	112½	——	Met. El., com.	17*	17*	——
Chi. Rys., Ser. 2.	44	44¼	——	Nat'nal Carbon.	84*	84	——
Com. Edison.	108	108	——	Nat. Carb., pfd.	110*	110*	——
Chi. Subway.	26	26*	——				

BOSTON.

	Feb. 8.	Feb. 15.	Shares sold.		Feb. 8.	Feb. 15.	Shares sold.
Am. Tel. & Tel.	128¼	129¼	——	Mex. Tel.	2⅝	2⅝	——
Com. Tel.	125*	125*	——	Mex. Tel., pfd.	5⅝	5⅝*	——
Edison El. Ill.	250	251	——	N. E. Tel.	131	131	——
Gen. Elec.	154½	157½	——	W. Tel. & Tel.	8*	7⅛	——
Mass. Elec. Ry.	13½	14¼	——	W. T. & T., pfd.	70*	70*	——
Mass. E. R., pfd.	65¼	65¼*	——				

*Last price quoted.
Shares sold are for four days, Feb. 8 to Feb. 11.

DIVIDENDS

Columbus (Ohio) Railway Company, quarterly, 1¼ per cent, payable March 1.

People's Gas Light & Coke Company, Chicago, quarterly, 1¾ per cent, payable May 25.

Sloss-Sheffield Steel & Iron Company, quarterly, 1¼ per cent, payable March 1.

Kings County (N. Y.) Electric Light Company, quarterly, 2 per cent, payable March 1.

American Railways Company, Philadelphia, quarterly, 1½ per cent, payable March 15.

United Railroads, San Francisco, first preferred, semi-annual, 3½ per cent, payable March 15.

Northern Texas Electric Company, Fort Worth, Tex., preferred, semi-annual, 3 per cent, payable March 1.

PROFIT IN GAS AT REDUCED RATE.—The report of the People's Gas Light & Coke Company, of Chicago, shows an increase in the gross earnings of the company for 1908 of $592,600. The surplus for the year after paying all fixed charges, taxes, etc., amounts to $2,755,694, which is equivalent to 8.36 per cent. This surplus is shown after a liberal charge has been made for depreciation, reserve funds, etc. This is the third year the company has shown a comfortable surplus since the Council forced a reduction in the rate to 85 cents per thousand feet in 1906. The record of the company since the cheapening of the rate is taken as a proof that a gas company can earn an adequate dividend even when the rate is lowered. The dividend rate of the company will be advanced at once from 6 to 7 per cent.

SUMMIT COUNTY (COL.) POWER COMPANY BONDS.—Eglinton, Hammond & Andrews, New York City, are offering an issue of $500,000 20-year 6 per cent bonds of the Summit County Power Company. The company has a hydro-electric plant near Dillon, Col., with two 500-kw turbine generators. It is supplying the mining camps of Argentine, Breckenridge, Montezuma, Kokomo and French Gulch within a 20-mile radius. The plant was put in operation last October and already has contracts for power netting $40,000 a year revenue. Its rates for power range from $80 to $100 per year per horse-power. Henry L. Doherty & Company, of New York, have thoroughly examined this property and have taken extensive financial interest in the company.

HUDSON & MANHATTAN RAILROAD EXTENSION.—The Hudson & Manhattan Railroad Company, which has in operation two tubes under the Hudson from New York City to Hoboken and which is building two others to Jersey City, has applied to the Public Service Commission, First District, for permission to extend its Sixth Avenue line from the proposed terminal to the Grand Central station at Forty-second Street and Park Avenue. The plan is to build the line under Sixth Avenue to Bryant Park, diagonally under the park to a point near Fifth Avenue, thence under the present subway to the Grand Central. It is estimated that the extension will cost $5,000,000. The Public Service Commission has not as yet acted upon the application.

CHICAGO RAILWAYS BONDS OVERSUBSCRIBED.—N. W. Harris & Company and the National City Bank of New York had no trouble in disposing of the $6,000,000 worth of new bonds of the Chicago Railways Company. These bonds were 5 per cent first mortgage gold bonds and were very largely oversubscribed before the underwriters opened their bids. With this issue the Chicago Railways Company has $14,000,000 outstanding. Expenditures approximating $12,000,000 are contemplated within the coming year for rehabilitation purposes, so that it is probable that another issue of $6,000,000 will be offered to the public some time during the summer.

MEXICAN LIGHT & POWER COMPANY.—Whether the deal by which the Mexico Tramways Company takes over the Mexican Light & Power Company is finally ratified or not it is promised that the plans of the latter company for increasing its capacity will be carried through. By the construction of about 20 miles of canals and tunnels bringing into use the water from rivers now untouched it is expected that the capacity of the present plant will be [illegible]. With these improvements [illegible] the company will be able to furnish light and power for the greater part of the Federal district.

CHICAGO & OAK PARK ELEVATED.—Arrangements have been made by the Chicago & Oak Park Elevated Railroad Company through Blair & Company, New York, to secure $1,000,000 to elevate the line in Oak Park and to build an extension to Humboldt Park.

NEW YORK EDISON EARNING POWER.—The annual meeting of the New York Edison Company, which was held Feb. 9, resulted in the re-election of the old directors and a continuation of the present management. There was no financial statement given out at all, but a few shares of the $45,051,000 capital stock are owned by the Consolidated Gas Company. The only information concerning the financial operations of the Edison company are to be obtained from the figures submitted to the Public Service Commission. These go so extensively into detail that the actual earnings of the company are hard to determine. These figures show, however, that in the year 1907 the company manufactured and delivered energy for lighting and power at an average cost of 4.69 cents per kw-hour. This charge included all costs, taxes and fixed charges. The company received from the sale of this current an average price of 6.49 cents, leaving a net profit per kilowatt of 1.80 cents. As the number of kilowatt-hours sold to the public was 209,024,000 there would appear to have been a profit on the year's sale of $3,762,432. This is equal to 8.3 per cent on the entire capital stock. The earnings for 1908 are largely a matter of conjecture, but it is known that in spite of the generally depressed condition of business the New York Edison Company made large gains over the previous year. During the year 1908, as already noted on these pages, 34,831 new contracts were made for the supply of electrical energy, aggregating an equivalent of 2,765,616 incandescent lamps of 16 cp. The net increase for the year was 882,939 in such lamp units. This is an increase of 14.9 per cent over the previous year in the volume of business.

STANISLAUS HYDRO-ELECTRIC PLANT SOLD.—In spite of the protest which was made by a few of the bondholders of the Stanislaus Electric Power Company against the sale of that property to the United Railroads of San Francisco, the deal has been consummated and the contract signed. The opposition, it is said, only represented a few bondholders and is stated to have been more political than financial. The United Railways Investment Company, the holding company of the street railway property in San Francisco, is ostensibly the purchaser of the power company. On the part of the Stanislaus company it was managed by a bondholders' protective committee, at the head of which was Mr. S. Z. Mitchell, president of the Electric Bond & Share Company, of New York, which company is a subsidiary of the General Electric Company. It is proposed under the terms of the deal that the present $6,000,000 issue of first mortgage bonds of the Stanislaus company shall be surrendered in exchange for second mortgage 40-year 5 per cent bonds non-foreclosable before July 1, 1914. All of the stock of the reorganized Stanislaus company is to go to the United Railways Investment Company in exchange for $900,000 of preferred stock and $900,000 of common stock at par. It is further proposed to issue $5,500,000 of first mortgage Stanislaus bonds to complete the work of developing the hydro-electric property and to issue not more than $1,000,000 additional bonds to develop the distributing system. The contract with the traction company is that energy shall be supplied for a term of 44 years at 7.5 mills per kw-hour. The new power company will have a peak capacity of 48,000 kw under the present plans.

GERMAN ELECTRIC TRUST.—Following the denial, which has been already published, of the report that the price agreement between the principal German electrical manufacturers would be broken up there comes the following information from Mr. Richard Guenther, consul-general at Frankfort, of the formation of a large trust company for the purpose of financing electrical enterprises. The consul says: "A new financial movement of great importance and far-reaching influence has been inaugurated in Germany by the creation of an electric trust company at Berlin by the Allgemeine Elektricitats Gesellschaft, the Siemens & Halske and the Siemens-Schuckert Works. The share capital of this new finance company is to be 30,000,000 marks ($7,140,000), besides which 90,000,000 marks of bonds are to be issued by it. The aim is to supply funds to parties (private or municipal) contemplating the erection or extension of electric plants, to loan money on electric works, etc., provided ample security is rendered by the applicants. A similar trust company is announced as being projected by the Felton & Guilleaume-Lahmeyer Electrical Combination. In Vienna one of the great Austrian banks has combined with the principal electrical company for a like purpose, viz., to promote electrical manufacturing interests by financial aid without directly involving these, as was the case heretofore when the electric companies undertook huge enterprises not having any solid basis at their own risk or gave extensive credit to speculating promoters."

MACKAY COMPANIES TO MAINTAIN CABLE RATES.—At the anual meeting of the Mackay Companies, the holding corporation of the Postal Telegraph and Commercial Cable Companies, the old directors were re-elected. The corporation is also the largest stockholder in the American Telephone & Telegraph Company. The financial report shows that the total income from investments in subsidiary companies, for the year ended Jan. 31, 1909, was $3,685,761. Out of this the regular 4 per cent dividend on both the common and preferred stock was paid, leaving after the expense of the year had been deducted a balance of $5,518. While the detailed reports of the telegraph and cable companies are not made public the report shows that there was a decrease in the cable company's earnings last year owing to the damage to its lines done by steam travelers off the coast of Ireland. The report quotes the letter of General Manager Ward, of the cable company, written to the New York Board of Trade & Transporation and heretofore summarized in the *Electrical World*, protesting against any reduction in cable rates. The latter argues that 25 cents per word is necessary to give the company an adequate return. Mr. Ward says that the Commercial Cable is in no rate combine with other companies, but that it will not reduce its present tolls. The cost of the New York-Havana cable and the subscription to the new stock of the American Telephone & Telegraph Company were paid for out of the earnings of the company during the year.

UNITED ELECTRIC LIGHT & POWER COMPANY.—No financial statement of the United Electric Light & Power Company, of New York City, was made at the annual meeting of that company, but it was given out in a general way that the business of the year had been very satisfactory and the promise for the future was very encouraging. The company furnishes, exclusively, the Washington Heights section of the city, where very rapid development is in progress. At present the company has in sight new contracts, approximately 50,000-cp equivalent. There are some 35 apartment houses included in this business, the greater part of which are to be equipped with elevators of the two-phase type, and where the public halls and the individual apartments are wired throughout. It is estimated that the United company has in sight new business that represents practically 10 per cent of its present connected 16-cp equivalent.

PLANS FOR CONSOLIDATING CHICAGO ELEVATED ROADS.—A committee consisting of Messrs. Ira M. Cobe, vice-president of the Assets Realization Company, Samuel Insull, president of the Commonwealth Edison Company, and Emile K. Boisot, vice-president of the First Trust and Savings Bank, all of Chicago, have been named to work out a plan for the consolidation of the three elevated traction companies of that city. It is said that the Northwestern Elevated will probably be designated as the lessee corporation which will take over and operate the South Side and Metropolitan companies if satisfactory terms can be agreed upon. In the event that this deal is carried out the Northwestern company will absorb the Chicago & Oak Park Elevated Company.

NEW WIRELESS COMPANY ORGANIZED.—Plans are on foot for the organization of the Wireless Company of America by a number of Brooklyn financiers. Among these is Mr. P. M. Smith, a member of the firm of Clarence M. Smith & Company, of 64 Wall Street. In speaking of the plans of the new company Mr. Smith said: "Our authorized capital stock will be $10,000,000—and while we are not ready as yet to announce the personnel of the company, you may say that it will be financed by private Brooklyn capital and the stock will not be offered to the public. As soon as a proper site in Brooklyn can be secured a large tower will be erected for experimental purposes. We expect to bring new features into the wireless field."

CAPITOL TRACTION COMPANY'S PROSPEROUS YEAR.—The report of the Capitol Traction Company, of Washington, D. C., shows gross earnings of $1,841,171 for the year 1908 compared to $1,764,345 in 1907. The operating expenses, however, were largely reduced and the net earnings were $1,062,833, as against $883,027 in 1907. After paying all fixed charges, taxes and rentals there was left a surplus for the year of $771,886 applicable for dividends.

STONE & WEBSTER COMPANIES' EARNINGS.—The Stone & Webster Corporation, of Boston, has issued a combined statement of all the traction, electric light, power, gas and water power companies, under its management for the year 1908. There are 28 companies comprised in the figures which show the following: Combined capitalization: bonds and coupon notes outstanding, $57,779,900; preferred, capital and common stocks outstanding, $55,825,220; total, $113,605,120. Total earnings and expenses 1908: Gross earnings, $17,328,336; operating expenses, $10,276,654; net earnings, $7,051,682; interest charges including taxes, $4,115,895; balance, $2,935,787; dividends paid, $1,489,275; balance, $1,446,512. Total disbursements for the year 1908 for interest on bonds, coupon notes and dividends on stocks, $4,255,775; miles of equivalent single track operated, 934; passengers carried, 236,358,367; total connected electric lighting load equivalent to 1,443,914 16-cp lamps; total commercial power load, approximately, 67,187 hp; total combined power station capacity, approximately, 162,914 hp, of which 52,825 hp is generated by water power.

AMERICAN SMELTING & REFINING EARNINGS.—The American Smelting & Refining Company has issued a statement covering its operation for the six months ended Oct. 31, 1908. This is for the first six months of the company's fiscal year which ends on April 30. The net earnings from operations for the period covered were $3,917,683, and the balance which was applicable to dividends was $3,841,760. Out of this was paid the 3½ per cent semi-annual dividend on the preferred stock, and a dividend on the common stock amounting to 2 per cent. The total assets of the company are estimated at $117,802,183. The total surplus of the company now amounts to $14,499,979. The total value of the refined metals which the company sells annually is estimated to be $97,000,000.

HUDSON COMPANIES BONDS OFFERED.—Harvey Fisk & Sons, of New York City, are offering to the public at par with accrued interest $1,500,000 of the Hudson Companies 6 per cent secured convertible gold notes. These notes are secured by deposit with the Standard Trust Company, as trustee of the Hudson & Manhattan Railroad Company's first mortgage 4½ per cent convertible gold bonds, due 1957, at the rate of $1,500 per value of bonds for each $1,000 of notes outstanding. Holders of the notes have the privilege of receiving in payment of prinicpal at maturity or on redemption prior to that date either cash or an equivalent amount of Hudson & Manhattan Railroad Company first mortgage bonds, figured at 85 per cent of the par value of the bonds, with accrued interest.

UNITED RAILROADS OF SAN FRANCISCO.—The annual report of the United Railroads of San Francisco shows that the earnings of the road are increasing and that it is beginning to earn dividends on its cumulative issues of stock. The property is owned by the United Railways Investment Company, which has outstanding $19,400,000 common stock and $15,000,000 5 per cent cumulative preferred stock. The United Railroads Company has outstanding $20,000,000 common stock. $20,000,000 4 per cent cumulative preferred and $5,000,000 7 per cent cumulative first preferred stock. The dividend of 3½ per cent just declared is the initial semi-annual declaration on the last named issue, which was sold a little over a year ago.

TELEGRAPH COMPANIES INCREASE CAPITAL.—Two of the Mexican and Central American telegraph companies have recently authorized increases in their capitalization. At a special meeting of its stockholders the Central & South American Telegraph Company has authorized an increase of its capital stock from $12,000,000 to $14,000,000. The Mexican Telegraph Company also authorized an increase in its capital stock from $3,000,000 to $5,000,000. No arrangements have been made by either company to issue new stock at present and the stock will not be issued until the expenditures from net earnings justify the directors in selling the new stock.

NEW YORK, WESTCHESTER & BOSTON.—The Public Service Commission of the Second District of New York has granted full permission to the New York, Westchester & Boston Railway Company to go ahead with its construction work. The company had already received its certificate from the Public Service Commission of the First District. This step practically relieves the proposed rapid transit line—which belongs now to the New York, New Haven & Hartford Railroad Company—of all legal disabilities so far as construction is concerned and it is said that active work will begin as soon as the weather permits.

BROOKLYN UNION GAS COMPANY.—Notices have been sent out by the Brooklyn Union Gas Company that the 6 per cent convertible debentures of the company, which mature on March 1, will be exchanged at par for shares of the capital stock of the company at par, if presented for exchange on March 1, in accordance with the terms of the debentures. These debentures should be presented to the Guaranty Trust Company of New York. The stock certificates to be issued in exchange will be dated March 1, 1909, and delivered as soon after that date as possible.

CHESAPEAKE & POTOMAC TELEPHONE COMPANY.—The annual report of the Chesapeake & Potomac Telephone Company, of Washington, D. C., makes an excellent report of its 1908 business. The gross receipts for the year were $1,180,384; the total expenses, including fixed charges and dividends, were $1,056,723, leaving a net surplus of $123,661. The business during the year showed considerable expansion. More than $650,000 was spent for new construction and equipment.

COMMONWEALTH EDISON SECURITIES LISTED.—The Commonwealth Edison Company has had listed upon the Chicago Stock Exchange $30,000,000 of stock, $8,000,000 Commonwealth Electric 5 per cent bonds and $10,000,000 Commonwealth Edison 5 per cent bonds. In filing the application for this listing the company's report stated that its physical property was appraised at $52,495,749.

REPORTS OF EARNINGS

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Central District & Printing Telegraph Company, Pittsburg:					
Year 1908	$4,445,734	$3,251,234	$1,194,500	$58,992	$1,135,508
Year 1907	4,386,496	3,273,613	1,112,883	59,480	1,053,403
Chicago Telephone Company:					
Year 1908	8,741,517	6,668,176	2,073,341	...	...
Year 1907	8,718,951	6,976,868	1,742,083	...	...
Cumberland Telephone & Telegraph Company, Nashville, Tenn					
Year 1908	6,141,817	3,662,972	2,478,845	485,415	993,430
Year 1907	5,917,273	3,642,634	2,274,630	521,950	1,752,689
Dallas (Tex.) Electric Corporation:					
Year 1908	1,169,967	780,655	389,312	308,625	81,287
Year 1907	1,125,073	760,743	364,330	280,467	83,863
Massachusetts Lighting Companies:					
Year 1908	751,750	494,621	257,129	[illegible]	[illegible]
Year 1907	439,777	275,151	164,626	61,721	102,905
Minneapolis (Minn.) General Electric Company:					
Year 1908	1,008,415	432,929	575,486	[illegible]	193,486
Year 1907	920,806	428,359	492,147	[illegible]	194,467
Nashville (Tenn.) Railway & Light Company:					
Year 1908	1,269,029	944,296	642,733	[illegible]	[illegible]
Year 1907	1,185,[illegible]	960,[illegible]	[illegible]	[illegible]	[illegible]
Nebraska Telephone Company, Omaha, Neb.:					
Year 1908	1,8[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Year 1907	[illegible]	1,344,622	[illegible]	[illegible]	[illegible]
Northern Texas Electric Company, Fort Worth, Tex.:					
Year 1908	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Year 1907	[illegible]	595,072	[illegible]	[illegible]	308,878
People's Gas Light Company, Chicago, Ill.:					
Year 1908	[illegible]	8,222,625	5,516,345	[illegible]	3,632,045
Year 1907	[illegible]	7,973,626	5,172,741	[illegible]	1,362,191
Seattle Electric Company:					
Year 1908	[illegible]	2,[illegible]	1,850,236	989,374	860,862
Year 1907	[illegible]	2,421,404	1,698,320	832,941	865,380
Tarrytown, White Plains & Mamaroneck Railway Company:					
Quarter ended Dec. 31, 1908	12,880	49,222	*16,663	...	...
Quarter ended Dec. 31, 1907	11,541	38,961	*7,413	...	...

*Deficit.

GENERAL NEWS

Construction News.

BREWTON, ALA.—The installation of an additional engine and generator in the municipal electric and water-works plant is under consideration.

CAMDEN, ALA.—The citizens are considering the question of establishing a municipal electric lighting plant.

MOBILE, ALA.—The directors of the Home Telephone Company have authorized an expenditure of $75,000 for extensions and improvements to its plant in this city.

MESA, ARIZ.—The People's Independent Telephone Company is planning to install a new telephone system in Mesa.

PRESCOTT, ARIZ.—The City Council has granted a franchise to M. J. Hickey, Robert Brown and Henry T. Andrews to construct and operate an electric light and power plant, steam, hot water and cold storage systems; also telephone and telegraph systems.

RUSSELLVILLE, ARK.—Plans are being made by the Russellville Water & Light Company to establish an electric light plant and water-works system to furnish Russellville with water and electricity, and cities within a radius of 50 miles with electricity for lamps. The company has taken over the plant and franchises owned by the Russellville & Ozark Mountain Light & Transit Company, and will increase the output of the electric plant. The new equipment will include the installation of a 150-kw generator to be operated in conjunction with the 100-kw dynamo now in service. The work will include the construction of a new power house and dam on the Illinois River, near Russellville. The dam will be 400 ft. long with a 25-ft. head of water. Contracts for the water-works system will be let during the coming spring and summer. The cost of the work is estimated at $50,000.

BURBANK, CAL.—L. C. Brand has made a proposition to the city offering to build an electric street railway in Burbank, provided a bonus of $30,000 is raised and the right of way given.

EUREKA, CAL.—Plans are being made by the Pacific Telephone & Telegraph Company to construct a telephone line between Eureka and Crescent City this spring. The line will require about 80 miles of wire. E. McLaren is superintendent.

HOLLYWOOD, CAL.—Arrangements are being made by the Pacific Telephone & Telegraph Company for improvements and extensions to its local telephone system at a cost of about $45,000, of which $38,000 will be used in extension of lines.

LOS ANGELES, CAL.—The Pacific Telephone & Telegraph Company contemplates extensive improvements to its system in Los Angeles, which will involve an expenditure of about $500,000.

LOS ANGELES, CAL.—The City Council has passed an ordinance requiring all electric and telephone wires placed in underground conduits along the speedway from Hollister Avenue to the southern limits of the city at Marine Street.

SAN BERNARDINO, CAL.—The Home Telephone Company is making arrangements to rebuild its telephone system in this city, work on which will begin at once. An underground system will be installed within the fire limits. The cost of the work is estimated at $50,000.

SAN DIEGO, CAL.—The San Diego Electric Railway Company has applied to the City Council for a franchise to extend its system into the eastern section of the city.

SAN DIEGO, CAL.—The Board of County Supervisors has granted a franchise to P. J. Schaniel and A. N. Jones giving them permission to use the tidewater at the entrance of False Bay for the purpose of operating an electric power plant. The company proposes to erect an electric plant to supply the bay and surrounding settlements with electricity for lamps and motors.

VALLEJO, CAL.—The Randall, Wright & Trowbridge Company, of Oakland, Cal., has applied to the City Trustees for a franchise for right of way over 10 miles of streets in Vallejo.

WHITTIER, CAL.—Arrangements are being made by the Whittier Home Telephone Company for improvements and extensions to its plant, which will include the installation of about 7000 ft. of lead-covered cable.

BOULDER, COL.—Prof. H. S. Evans, of the State University, has submitted to the City Council an estimate placing the cost of installing a hydro-electric plant in connection with the city water system to furnish electricity for lamps and motors at about $300,000, and for the distributing system for street lighting about $50,000. The city now pays $8,160 for street lighting service. The Council will not take any action at present.

DURANGO, COL.—Arrangements are being made to reorganize the Animas Power & Water Company, now in the hands of a receiver. Under the reorganization plans it is proposed to issue $1,000,000 in capital stock and $4,000,000 in bonds. From the proceeds of the bonds it is planned to take up the present indebtedness and the remainder to be used to enlarge the plant and carry out the original plans. The company now owns a 4000-hp plant on the Animas River between Durango and Silverton. D. H. Dalton, 62 Cedar Street, New York, N. Y., is secretary of the reorganization committee.

FAIRFIELD, CONN.—Arrangements have been completed by the United Illuminating Company, of New Haven, for taking over the charter of the Fairfield Power & Lighting Company and to install an electric lighting system in Fairfield.

WILMINGTON, DEL.—Contracts for furnishing electricity for lighting the court house and bridges have been awarded by the levy court as follows: For furnishing electricity for lamps and motors on Market Street, Eleventh Street and Washington bridges, and for lamps on court house lawn to the Wilmington City Electric Company, and for lamps for the interior of the court house to the Wilmington Gas & Electric Company. Each contract is for a term of four years. The levy court is considering the application of the Wilmington City Electric Company for a franchise to erect a transmission line along the county road from Elsmere to the Ferris Industrial School to furnish electricity for lamps and motors at the Ferris School.

WHITE SPRINGS, FLA.—The date for receiving bids for the construction of the large power plant on the Suwaunee River, near White Oaks, Fla., for the Suwaunee River Railroad & Power Company has been extended from Feb. 10 until March 15. D. G. Zeigler, & Company, of Jacksonville, Fla., will have charge of the work.

COLQUITT, GA.—We are informed that J. B. McCrary & Company, of Atlanta, Ga., will have charge of the construction of the proposed municipal electric light plant. The cost of the plant is estimated at from $10,000 to $15,000.

COLUMBUS, GA.—The Town Council has voted to appropriate $3,000 for carrying to the State Corporation Commission a case now pending between business men of the town and the Columbus Railroad Company in a matter regarding the price of electricity for lamps. The question will be taken up by experts and by them laid before the commission.

MILLEDGEVILLE, GA.—It is reported that a new company has been incorporated to furnish electricity for lamps and motors. The company has purchased the old power plant and is erecting new buildings and installing new machinery with an output of 500 hp. Arrangements are being made to install equipment in the Oconee River Mills by which water power will be utilized to operate the mills. A steam plant will be held in readiness for emergencies.

LEWISTON, IDAHO.—The City Council has granted a franchise to W. H. Bourke and associates, of Spokane, Wash., to construct and operate an electric light plant in this city. The plant is to be in operation by February, 1911.

LEWISTON, IDAHO.—The Spokane & Inland Railway Company will make application to the City Council for a franchise to construct and operate a street railway in Lewiston. The company has completed its railway as far as Moscow.

SANDPOINT, IDAHO.—Arrangements are being made by the promoters of the proposed electric railway which is to connect this city with Kootenai and Ponderay to commence work on construction of the road. A committee has been appointed to prepare incorporation papers for the company, which will be capitalized at $500,000.

SANDPOINT, IDAHO.—The Pend Oreille Water & Light Company has entered into a contract with the Humbird Lumber Company to furnish electricity and water for the new town of Kootenai, about two miles distant. The electric plant of the Humbird Lumber Company will be held in reserve in case of emergencies.

WEISER, IDAHO.—The Idaho-Oregon Light & Power Company will soon commence work on construction of its large substation in Weiser. The company was recently granted a franchise to furnish electricity in this town.

CHARLESTON, ILL.—The Coles County Telephone & Telegraph Company is planning to make improvements to its system, including the installation of a new switchboard and other appliances. The improvements will involve an expenditure of about $10,000.

DANVILLE, ILL.—Surveys are being made on the Vermillion River by Frank Payne, engineer, where it is proposed to develop the water power.

HOOPESTON, ILL.—The Hoopestbn Gas & Electric Company has recently placed an order with the Minneapolis Steel & Machinery Company for a 100-hp Muenzel producer-gas engine. The company already has a 280-hp Muenzel producer plant, and the small engine will be used to run the light loads.

KANKAKEE, ILL.—Plans are being made to commence work on the construction of a large dam near Kankakee this summer to furnish power to generate electricity, which will be transmitted to cities along the Kankakee River as far as Joliet.

WATAGA, ILL.—Arrangements are being made by H. J. Kunkle to construct an electric light plant in Wataga, to cost about $40,000.

WAUKEGAN, ILL.—The North Shore Electric Company has placed orders for a third 2500-kw steam turbine for its power plant, with addi-

tional boilers and condensing apparatus to be installed at once, at a cost of about $150,000. The company has a contract to furnish electricity to operate the Milwaukee division of the Chicago & Milwaukee Electric Railroad Company, which will take effect about June 1.

BOONEVILLE, IND.—Arrangements are being made by the Chandler Telephone Company to commence work on the construction of a telephone line from Chandler to Boone, where it will install an exchange.

INDIANAPOLIS, IND.—Arrangements are being made by the Samuel H. Chute Company to install an electric light, heat and power plant on the East Side to furnish electricity for lamps and motors to all buildings on the entire square bounded by Central and First avenues, Fourth Street and University Avenue. L. P. and F. B. Chute are agents for the company.

KOKOMO, IND.—Orders have been placed by the Pittsburgh Plate Glass Company, of Kokomo, Ind., with the Allis-Chalmers Company, Milwaukee, Wis., for three units, consisting of gas engine and direct-current generator, with a total output of 2250 kw. The company has already installed a unit of 350 kw. It is reported that the Pittsburgh Plate Glass Company is to change its entire plant to electric-motor drive.

MEDARYVILLE, IND.—We are informed that it is proposed to install an electric light plant in Medaryville to furnish electricity for lamps in Medaryville and Francesville. E. O. Penry is clerk.

NORTH MANCHESTER, IND.—The Eel River Telephone Company has filed amendments to its charter increasing its capital stock from $10,000 to $40,000. Lewis Signs is secretary.

RICHMOND, IND.—The Richmond Light, Heat & Power Company contemplates extending its transmission lines to New Paris, Ind., to furnish electricity for street and commercial lighting.

WASHINGTON, IND.—The City Council has issued $20,000 in bonds, the proceeds to be used to pay off the indebtedness, to make necessary improvements and provide for running expenses of the municipal electric light plant recently taken over by the city.

BOONE, IA.—The Iowa Telephone Company contemplates extensive improvements to its local system this summer to cost about $25,000. It proposes to place a large part of its wires in cables.

CARSON, IA.—H. E. Johnson has purchased the local electric light plant and will improve the same.

CEDAR RAPIDS, IA.—The Cedar Rapids & Iowa City Railway & Light Company has selected a site for a dam near the Palisades, for which surveys have been completed. It is also proposed to construct a dam at Cedar Bluffs. William G. Dows is general manager.

DES MOINES, IA.—Bids will be received by the Board of Supervisors of Polk County at the office of the county auditor, Des Moines, Ia., until March 1, for the installation of an electric light and power plant for the Polk County Court House and jail, according to plans and specifications which may be seen at the above office and at the office of Proudfoot & Bird, architects, 625 Flynn Building, Des Moines, Ia. Harry B. Frase is county auditor.

FAIRFIELD, IA.—The City Council has decided to abandon the municipal electric light plant and to secure electricity for lighting the streets of the city and for pumping the city water from the Fairfield Gas & Electric Company, which will soon install a new plant with duplicate machinery at a cost of from $25,000 to $30,000. The company will also furnish a day electric service.

FARMINGTON, IA.—The question of installing a larger generator in the municipal electric light plant in the near future is under consideration. P. O. Petersen is superintendent.

SHANNON CITY, IA.—It is reported that plans are being considered for the construction of an electric light plant in Shannon City.

SIOUX CITY, IA.—The Sioux City & Spirit Lake Railway Company has secured franchises in the towns of LeMars, Ia.; Paullina, Primghar, Hartley and Spirit Lake for its proposed electric railway to extend from Sioux City to Spirit Lake, a distance of 108 miles. The Westinghouse, Church, Kerr & Company, New York, N. Y., are engineers and contractors. William H. Beck, of Sioux City, Ia., is president of the company.

ARKANSAS CITY, KAN.—The Arkansas City Electric Light Company, which is owned by the Land & Power Company, is constructing a new power plant, the equipment of which will include three 460-hp Leffel Sampson turbines, three 250-kw, 2200-volt, 3-phase, 60-cycle, Bullock generators; two 400-hp Corliss engines, Reynolds type, and four boilers manufactured by the Kewanee Boiler Company. The company will furnish electricity to operate the proposed electric railway of the Southwestern Interurban Railway Company, now under construction, and expects to commence operation in April. Contracts for the above equipment have been awarded. A. L. Newman is secretary.

JUNCTION CITY, KAN.—The City Council has granted a franchise to the Rocky Ford Milling & Power Company to furnish electricity in Junction City for lamps and motors. The company is constructing a large dam across the Blue River, near Manhattan, 26 miles distant, and also proposes to supply electrical energy in Manhattan and Fort Riley.

MARION, KAN.—At a special election held Feb. 9 the citizens voted to issue $60,000 in bonds, the proceeds to be used for the construction of an electric light plant and water works system.

PITTSBURG, KAN.—The Joplin & Pittsburg Railway Company has been granted a franchise by the City Council to extend its Elm Street line to the grounds of the Manual Training Normal School, and also to Cherokee, Franklin and the camps in the north part of Crawford County. After the above extensions are completed the company is planning to build a railway extending from Pittsburg to Mulberry.

TOPEKA, KAN.—Plans are being considered for a permanent electric lighting system in Garfield Park, which will be installed as soon as the municipal electric light plant has been remodeled.

FRANKFORT, KY.—The Capital Gas & Electric Light Company contemplates installing an entire new plant as soon as possible. Farnk Austin is secretary and manager.

LEXINGTON, KY.—Arrangements are being made by the Midland Electric Company to erect a new power house to cost about $25,000.

BERWICK, LA.—Plans are being made to install an electric plant in Berwick. It is also proposed to install a day service.

MANSFIELD, LA.—The municipal electric light plant was sold Feb. 3 by the City Council to J. L. Logan, of Texarkana, Tex., for $6,150. The plant was erected by the city at a cost of about $8,000 and has not proven a paying investment. It is understood that the purchaser represented the Mansfield Ice Company and that the two plants will be consolidated.

BETHEL, MAINE.—At a special village corporation meeting held recently the citizens voted to appropriate $800 for the installation of an electric lighting system. A committee consisting of Ceylon Rowe, E. C Bowler and D. S. Hastings was appointed to make further investigations in regard to the lighting and report at the next meeting of the corporation.

BERLIN, MD.—Sealed proposals will be received until March 16 by the Mayor and Council of Berlin, Md., for the construction of an electric light plant and water-works system. The work is to be divided into seven divisions, which may be bid upon separately or collectively. The work is subdivided as follows: Division A, water distribution system; Division B, poles, lines, wiring and electric street lamps; Division C, power plant building, foundations for machinery, boiler and standpipe; Division D, power plant equipment, including a 100-hp boiler, one 50-kw generating unit, one 500-gal. per minute duplex water pump, switchboard, piping and accessories; Division E, standpipe (12 ft. by 125 ft.); Division F, wells (3 in. and 8 in., and probably not more than 100 ft. deep). Plans and specifications may be seen at the office of Dodge & Day, engineers, 608 Chestnut Street, Philadelphia, Pa. Copies of plans and specifications may be had by placing a deposit of $10, which will be refunded when plans are returned.

TOWSON, MD.—The Mount Washington Electric Light & Power Company, of Mount Washington, Md., has been making investigations in the villages of Cockeysville and Texas with a view of furnishing electrical service, and has decided that if a sufficient number of patrons can be secured to warrant the expense it will extend its transmission lines to the villages. The County Commissioners have been asked to install electric lamps along the road.

ATLANTIC, MASS.—The citizens are considering the question of having a lighting system installed on the new boulevard.

CAMBRIDGE, MASS.—Preparations are being made by the Cambridge Electric Light Company to install two 300-hp boilers, which will complete the motive power equipment of the plant as originally planned. Six boilers are now in commission.

CHELSEA, MASS.—The Chelsea Gas Light Company contemplates replacing its transmission lines destroyed by the fire. Joseph M. Riley is assistant general manager.

COHASSET, MASS.—It is reported that Stone & Webster are to take over the plant and holdings of the Cohasset Electric Light Company. It is said that the Cohasset plant will be eventually discarded and electrical service will be furnished from the Brockton plant. If the change is made a 24-hour service will be established.

ENFIELD, MASS.—A. W. Mason is reported to have purchased the Blodgett box shop and electric light plant at Soapstone, near North Dana.

GREENFIELD, MASS.—The Greenfield Electric Light & Power Company is planning to extend its transmission lines up through the county farms district to furnish electricity for lamps and motors to the farmers in that vicinity.

HYDE PARK, MASS.—At a special town meeting held Feb. 10 the citizens voted to authorize the Selectmen to enter into a contract with the Hyde Park Electric Light Company for street lighting for a term of ten years. Under the terms of the contract the company is to furnish 540 tungsten incandescent lamps of 40 cp and 73 2000-cp arc lamps for $13,800 per year, with an all-night and every night service. The company has agreed to reduce the price of electricity for residential lighting from 20 cents to 15 cents per kw-hour, with a further discount of 10 per cent on all bills paid by the 15th of the month; also to furnish renewal of lamps with the exception of tungsten lamps.

LOWELL, MASS.—The Moore Spinning Company is planning to enlarge its plant and will install two 1500-hp turbine engines. The mill will be operated by electricity when the new engines are installed.

LOWELL, MASS.—The management of the Musketaquid Worsted Mills has awarded contracts for the erection of an addition to its plant. A new power plant and water wheel will be installed. F. J. Hylan is agent.

MIDDLETON, MASS.—Matthew M. Merritt has applied to the Selectmen for a franchise to supply electricity for lamps and motors in Middleton.

NORTH BROOKFIELD, MASS.—The Oxford Linen Mills Company has purchased land and water rights along Mad Brook, below the North Brookfield reservoir and pumping plant. The company proposes to develop the water power to be utilized to generate electricity to be transmitted to its plant, two miles distant. The present plans call for the consruction of a dam 60 ft. long and the installation of one or more turbine water wheels, which will develop from 150 to 250 hp.

ORANGE, MASS.—The plant and holdings of the Orange Electric Light Company have been purchased by Wallace G. Webber and associates, of Boston, Mass. It is said that the new owners will enlarge and improve the plant. The officers of the new company are: Wallace G. Webber, president; Edward C. Mason, of Boston, Mass., treasurer, and A. W. Hubbard, general manager.

BENTON HARBOR, MICH.—The Benton Harbor-St. Joe Railway & Light Company is planning to construct a 12-mile extension from Benton Harbor this spring. The company will probably ask for bids for construction of the same. H. C. Mason, of Benton Harbor, is general manager.

CHESANING, MICH.—The Chesaning Home Telephone Company, organized by local business men, has taken over the Bell telephone system in Chesaning.

HILLMAN, MICH.—The Hillman Light & Water Company contemplates extending its transmission lines to Atlanta during the coming year. L. C. Rouse is superintendent.

RAMSAY, MICH.—Plans have been completed for the installation of an electric plant at the Eureka mine at Ramsay to furnish electricity for lamps for the mines and houses and operate the surface tramway. Later when conditions will warrant the company will install electrical service underground for hauling, etc. Charles C. Jones is superintendent of the mine.

DEER RIVER, MINN.—The City Council has granted a franchise to the Itasca Telephone Company to erect a telephone system in Deer River.

KERKHOVEN, MINN.—Arrangements are being made to organize a telephone company for the purpose of erecting about 15 miles of telephone line. Joseph Holmgren and others are interested in the project.

MILLVILLE, MINN.—S. D. Pierce and E. Dickman contemplate developing the water power of the Zumbro River, which will be utilized to furnish power to operate an electric light system.

MINNEAPOLIS, MINN.—The residents of the Linden Hills district, of Minneapolis, are contemplating installing an electric light plant, for which an application for a franchise will soon be made to the City Council.

PINE RIVER, MINN.—James E. Geary has been granted a franchise to erect a telephone line in Pine River.

REDWOOD FALLS, MINN.—Work has commenced on the construction of the new power house and improvement of the water power development.

HATTIESBURG, MISS.—The Hattiesburg Traction Company is planning to increase the equipment of its power plant by the installation of two 500-kw turbo-generators and a motor generator set for railway service.

NEWTON, MISS.—The Clarke Memorial College, Newton, Miss., it is reported, contemplates installing an electric light plant.

CHILHOWEE, MO.—It is reported that the town of Chilhowee has awarded a contract for the construction of an electric light plant, to be completed and in operation within six months.

KANSAS CITY, MO.—The contract for the construction of the power house, laundry and smokestack at the poor farm has been awarded by the county court to Yetter & Kleinhoffer, for about $19,000.

KIRKSVILLE, MO.—G. W. Strubher and George E. Woodhouse, of Peoria, Ill., are interested in a project to construct an electric railway from Connelsville, through Novinger and Kirksville, to Gibbs. The proposed railway will be about 30 miles in length and will cost approximately $1,000,000. Another railway is being promoted from Hannibal to Kirksville, with a view of connecting the two systems at Gibbs.

MACON, MO.—Preparations are being made for increasing the output of the municipal electric light plant, which will include the installation of a 300-hp engine, a 125-hp tubular horizontal boiler, a three-phase alternator with a rating of from 200 to 250 kw, centrifugal pumps, etc. The proposed improvements will involve an expenditure of about $18,400. E. S. Bennett is superintendent.

MARYVILLE, MO.—It is reported that the electric plant of the Rockford Electric Light Company, recently destroyed by fire, will be rebuilt at once. James L. Clark is manager.

OZARK, MO.—The Water Power Light Company contemplates increasing the output of its plant at a cost of about $5,000. The equipment will include an additional 50-kw, alternating-current generator, another water turbine and possibly a 100-hp automatic engine. When the above improvements are completed the company may add a storage battery of about 30-kw capacity to its uptown receiving station. The company next season will probably install an ice and cold storage plant and would like to communicate with manufacturers of ice machinery, where no steam is required to make cake ice. S. E. Bronson is secretary and manager.

ST. LOUIS, MO.—The bid of the Union Electric Light & Power Company to furnish electricity for lighting the public building has been approved by the Board of Public Service. The contract is for a term of 10 years at the rate of 3¼ cents per kw-hour, which is a reduction of about 30 per cent from the price now being paid for the service. The contract takes effect Sept. 1, 1909. The board has withheld its approval of the bid for electric lighting in the downtown district to give the Downtown Lighting Association an opportunity to confer with the Union Light & Power Company in regard to furnishing new arc lamps in the downtown streets.

UNIVERSITY CITY, MO.—Plans are being considered by the City Council for extensive improvements to the city, including the installation of a lighting plant.

PHILLIPSBURG, MONT.—The Phillipsburg Granite Electric Light Company has leased its electric plant to Bowen Brothers, who will improve the plant and install a new gas engine. The new owners have secured a contract for lighting the streets of the city for a term of three years.

ARAPAHO, NEB.—At a special election held Feb. 9 the citizens voted to construct an electric light plant to cost about $6,000. E. C. Wagner is city clerk.

FAIRMONT, NEB.—The Fairmont Water Company, it is stated, has decided to install an electric light plant in connection with its water-works system.

HARVARD, NEB.—The Harvard Telephone Company is planning to add 4000 ft. of cable to its system.

HOLDREDGE, NEB.—The Holdredge Lighting Company is contemplating extending its transmission lines to nearby towns to furnish electricity for lamps.

NEBRASKA CITY, NEB.—The Nebraska City Water & Light Company has submitted a proposition to the City Council asking for a 20-year franchise.

SUTTON, NEB.—The electric plant of the Sutton Electric Light & Power Company has been purchased by the Jacob Sack Lumber Company, which has enlarged the plant. The company has over 200 hp more than it is using and is offering electricity for power purposes at a very low rate in order to induce outside parties to locate in Sutton and engage in manufacturing business.

TONOPAH, NEV.—Senator T. L. Oddie, of Tonopah, has secured an option on water rights of the Kings River, near Independence, Cal., on the west slope of the Sierras, where it is estimated that 300,000 hp can be developed.

TONOPAH, NEV.—The directors of the Round Mountain Mining Company have decided to increase the output of the mill to 110 tons a day. A compressor with 10 drills and one tubular mill will be added. The plant is being equipped to be operated by electricity, which, it is expected, will be completed by May 1.

EAST TILTON, N. H.—The East Tilton Village Improvement Society is considering the question of lighting the streets of the village. It is proposed to establish an electric light plant.

LITTLETON, N. H.—The Littleton Telephone Company, recently incorporated, is planning to commence work on the erection of its lines this spring. George A. Edson is president.

MILFORD, N. H.—The McLane Manufacturing Company is making arrangements to equip its mill, to be operated by electricity.

GREENLOCH, N. J.—Plans are being considered to install an electric light plant in Greenloch, where it is said a water power will be developed to furnish power to operate the plant.

JERSEY CITY, N. J.—The commissioners have adopted a resolution directing the Street and Water Board to take measures to have all overhead electric wires placed underground without delay.

MADISON, N. J.—The light committee has submitted a recommendation to the Borough Council to enter into a five-year contract to furnish the Borough of Florham Park with electricity, as follows: Up to 100,000 kw at 12 cents per kw-hour; 150,000 kw at 11½ cents per kw-hour, and 200,000 kw at 11 cents per kw-hour; the cost of construction and equipment to be paid by the Borough of Florham Park. The report was referred to the light committee to enter into a contract if advisable.

NEWARK, N. J.—Plans have been adopted by the Broad Street Improvement Association for improving the street lighting system on Broad Street, between Market Street and Central Avenue. It is proposed to erect 41 flaming-arc lamps at an estimated cost of $3,800. It is estimated that it will cost $21,600 per year to maintain the lamps.

VERONA, N. J.—The Borough Council has decided not to execute a contract with the Public Service Corporation for street lighting at an advance of $4 per lamp per year over the present price. The borough may install a municipal plant or use some other illuminant for street lighting.

CLOVIS, N. M.—Plans are being prepared by Burns & McDonnell, consulting engineers, Scarritt Building, Kansas City, Mo., for the installation of an electric light plant, water-works system and sewerage system for Clovis, to cost about $125,000.

ARCADE, N. Y.—The new municipal electric light plant is nearly completed and is expected to be put in operation during this month.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company has established a new system of charges for electricity for lamps to take effect from Feb. 1. The minimum charge for residential use will be $1.10 per month and the flat rate will be that amount for anything up to six lamps; for ten lamps, $1.65 per month; 15 lamps, $2.10; 20 lamps, $2.90; 30 lamps, $3.25, and $3.85 for 40 lamps. In addition to the flat

rate, a charge of 2¼ cents per kw-hour will be made. The present meter rate is 15 cents per kw-hour. A discount of 10 per cent will be made on all bills paid before the 10th of the month.

BUFFALO, N. Y.—The Buffalo & Lake Erie Traction Company has applied to the City Council for a franchise to construct a street car line out to the new dock at the foot of State Street.

DANSVILLE, N. Y.—The Dansville Gas & Electric Company has filed a petition with the Public Service Commission, Second District, for permission to issue a mortgage for $100,000 to secure an issue of bonds.

GLENS FALLS, N. Y.—Plans are being considered by the Glens Falls Gas & Electric Company for improvements to its plant, which will include the installation of a new switchboard in the local station and the erection of a duplicate high-tension transmission line from the power house at Bakers Falls to the station in Glens Falls. The cost of the work is estimated at $20,000.

LYONS, N. Y.—The Wayne County Electric Company has decided to install new machinery to increase the output of its plant in order to fulfil its contracts with the villages of Lyons and Clyde for street lighting and other purposes. The company has made arrangements to secure electricity from outside sources until the new equipment is installed.

NEW YORK, N. Y.—The Hudson & Manhattan Railroad Company has applied to the Public Service Commission for permission to extend its Sixth Avenue tunnel to the Grand Central Station.

NEW YORK, N. Y.—Judge Lacombe, of the United States Circuit Court, has signed an order authorizing Frederick W. Whitridge, receiver of the Third Avenue Railroad Company, to construct a double-track extension from Fort George, across the Harlem River, to and along Pelham Avenue and the Southern Boulevard, to the Zoological Gardens in the Bronx.

NIAGARA FALLS, N. Y.—Plans are being prepared by W. D. Robbins, city engineer, and Walter McCulloch, consulting engineer, for a new water-works system and filtration plant to be erected at Niagara Falls, at an approximate cost of $750,000. The equipment of the plant will include three 6,000,000-gal., motor-driven, low-pressure pumps; four 6,000,000-gal., motor-driven, high-pressure pumps; two 5,500,000-gal., motor-driven, high-pressure pumps, at an estimated cost of $33,000. The pumps are to be of the turbine type. About 800 hp of electrical power will be required to operate them, which will be purchased from the local power company. Bids for material and construction will be received about April 1.

ROCHESTER, N. Y.—The contract for equipping the new wood-working factory of the John Hoffman Company, Rochester, N. Y., with motor drive has been awarded to the Crocker-Wheeler Company, of Ampere, N. J. The equipment includes a generator, three lighting transformers, 40 induction motors, ranging from 1 to 30 hp. Each machine is equipped for individual motor drive.

ROME, N. Y.—It is reported that the City Council is considering the question of establishing a municipal electric light plant.

SYRACUSE, N. Y.—Bids will be received until March 1 by the building committee, consisting of Robert Dey, T. W. Meachem, C. W. Snow and DeForest Settle, at the Chamber of Commerce rooms, Syracuse, N. Y., for the construction of a 400-room hotel on Jefferson Street, Syracuse, N. Y., for the Onondaga Hotel Company. Separate proposals will be received at the same time for a complete power, lighting, heating and refrigerating plant, including boilers, pumps, stokers, grates, smoke connections, setting boilers, trimmings, engines, generators, switchboards, motors, ventilating apparatus and ice-making and refrigerating machinery.

UTICA, N. Y.—It is understood that a proposition will soon be submitted to the Board of Supervisors to install an electric light plant to furnish electricity to light the county buildings, including the court house, armory and jail. It now costs the county $10,000 per year to light the three buildings.

VICTOR, N. Y.—At a meeting of the Victor Civic League the citizens voted to install an electric lighting system in Victor. Mr. Colgate, representing the Niagara Power Company, has submitted a proposition showing that the village could be lighted with 70 incandescent lamps of 40 cp for $1,000 per year. A five-year contract for street lighting will be required with the franchise.

ASHEVILLE, N. C.—Formal decree has been signed in the state courts here for the sale of the Asheville Rapid Transit interests to R. S. Howland and associates. The bid of Mr. Howland was $25,000, and the acquired property will be utilized in connection with the Asheville-Weaverville development now under construction.

ASHEVILLE, N. C.—Announcement is made that the contract will be let within 60 days for the construction of an electric railway for the North Carolina & Tennessee Railroad Company from Weaverville, N. C., to Huntdale, from the coal fields of West Virginia to the seaboard. The line will be an extension of the Asheville-Weaverville electric road, which is now under construction, and will be equipped with high-speed cars.

CHARLOTTE, N. C.—The Charlotte Electric Railway, Light & Power Company has effected a division of the power and lighting and the street railway systems. The lighting and power interests have been incorporated, with a capital stock of $300,000, under the name of the Charlotte Gas & Electric Company. The president of both departments of the business is E. D. Latta. The company has for several years contemplated the extension of its line to the Catawba River, 12 miles distant, and to establish a pleasure park on the river. The recent action of the directors in dividing the business indicates that developments are to be expected soon. The division of the business is also accompanied by the provision for a large increase in capitalization whenever such is deemed necessary. The company is this winter expending about $100,000 in local improvements on its car line and tracks.

GREENSBORO, N. C.—Investigations are being made by John A. Hodkin, J. S. Kuykendall, secretary, Chamber of Commerce, both of Greensboro, and B. T. Thyson, civil engineer, of Roanoke, Va., for developing the water power of Deep River, to be utilized to generate electricity to be transmitted to Greensboro. The distance from Greensboro to the proposed dam site is about 44 miles. It is estimated that 4000 hp can be developed.

HIGH POINT, N. C.—Coler & Company, who have purchased certain franchises in High Point, have made a proposition to this town which has been accepted, in which it is provided that an electric street car system is to be in operation inside of 12 months and an interurban line within two years, the electric company also agreeing not to compete with the city in the sale of electricity for lamps, the town owning its own electric lighting plant. Electric railways will be built to Greensboro and to Winston, the Coler interests having purchased electric railway interests in Greensboro.

LAURINBURG, N. C.—The local electric light plant has recently doubled its output to meet the increased demand for electrical power.

MADISON, N. C.—It is reported that the Madison Grocery Company is interested in a proposed water power development about four miles from Madison to furnish power to operate electric plants at Madison and Mayodan.

NORTH WILKESBORO, N. C.—The town has purchased from J. G. and R. N. Hackett a hydro-electric power plant for $23,000. The plant includes an excellent water power from which the city now derives power to generate electricity for lighting the town.

WILMINGTON, N. C.—A proposition is being considered to build a telephone line from Wilmington to Jacksonville, N. C.

WINSTON-SALEM, N. C.—The County Commissioners have granted a franchise to John D. Williams and others to erect a telephone line from Lewisville to Clemmons.

CANAL DOVER, OHIO.—We are informed that plans and specifications for the construction of a municipal electric light plant at Canal Dover, Ohio, are on file at the office of John T. Morris, consulting engineer, 621 Columbus Savings & Trust Building, Columbus, Ohio.

CANAL DOVER, OHIO.—Franchises have been granted to S. J. Gerber and Edwin Schweitzer by the Village Councils of Sugar Creek, Shanesville, Baltic and Sugar Creek Township Trustees for the erection and maintenance of an electric light plant.

CINCINNATI, OHIO.—Bids will be received by the Board of Public Service until Feb. 18 for furnishing materials and labor for the improvement of Eden Park tower, including rewiring and furnishing with necessary sockets, bushings, wire, conduit, cut-outs, switches, etc., according to plans and specifications on file at the office of the city electrician. Bidders are required to use the printed forms. John J. Wenner is city clerk.

CLEVELAND, OHIO.—The Cleveland Salt Company has placed an order with the Lincoln Electric Company, of Cleveland, for 32 motors, aggregating about 600 hp, for driving the machinery in its salt plant.

COLUMBUS, OHIO.—The Public Service Board has filed a recommendation with the City Council for the purchase of a new 2000-kw generator for the municipal electric light plant. The new machine is needed to furnish electricity for lamps in the additional territory to be annexed. The cost of the machine is estimated at about $45,000.

LIMA, OHIO.—Bids will be received by the Board of Public Service until Feb. 20 for lighting the streets of the city.

PHILO, OHIO.—The Center Valley Light & Power Company has awarded the contract for the construction of a power plant on the site of the William Frazier mill at Philo, to A. W. McDonald, of Steubenville, Ohio, to cost $260,000. According to the present plans, two buildings will be erected, one of which will be used for the main generating plant and the other for an auxiliary plant. The plants will have an output of 2800 hp. Four double turbines will be installed; both steam and water will be used for motive power. The company proposes to furnish electricity for lamps in the villages of Philo and Duncan Falls.

SPRINGFIELD, OHIO.—Only one bid was received by the Board of Public Service for lighting the streets of the city, which was submitted by the Columbus Electric & Power Company, of Columbus, O.; [illegible] dent. The company offers to furnish 75 or more mineralized carbon arc lamps at $84 per lamp per year; for 100 or more tungsten lamps at $30 per year per lamp, and for 125 or more arc lamps at $61.92 each per year.

WESTERVILLE, OHIO.—Plans are being considered for the installation of new boilers and boiler feed pump in the municipal electric light [illegible] Council [illegible]

WEST TOLEDO, OHIO.—The Township Trustees are considering the question of lighting the streets by electricity. It is probable that an electric light plant will be installed as a private enterprise. Electricity will be furnished to private consumers also.

MINCO, OKLA.—Burns & McDonnell, consulting engineers, Scarritt Building, Kansas City, Mo., are preparing plans and specifications for an electric light plant and water-works system for this city, the cost of which is estimated at $[illegible]

MUSKOGEE, OKLA.—Plans for the construction of a large power plant on the Grand River, a few miles below Muskogee, are being revived by C. N. Haskell and D. N. Fink. The proposed plant will cost about $1,000,000 and will furnish electricity to cities within a radius of 50 miles.

TONKAWA, OKLA.—Plans and specifications are being prepared by Burns & McDonnell, consulting engineers, Scarritt Building, Kansas City, Mo., for an electric light plant, water-works and sewer systems in Tonkawa, to cost about $38,000.

BAKER CITY, ORE.—The plant and holdings of the Baker Light & Power Company have been purchased by the Elkhorn Light & Power Company, recently incorporated by J. M. Henson, I. Simmons and John Rand. The company is capitalized at $10,000 and will also manufacture and sell gas.

HOOD RIVER, ORE.—The Hood River Light & Power Company is planning to make improvements and additions to its system, which will include the purchase of equipment, as follows: One 750-kw 6600-volt alternating-current generator, a 1500-hp turbine and rewiring. A reservoir will also be built and a 60-in. valve will be placed in the main pipe near the power house. A reservoir will also be constructed in connection with the water-works system.

REDMOND, ORE.—It is reported that a company is being formed to install an electric plant at Gline Falls to furnish electricity in Redmond. J. G. Guffie is interested in the project. A notice of appropriation of water rights has been made.

ROSEBURG, ORE.—Application has been made to the Common Council by Milton Purdy for a franchise to construct and operate a street railway in Roseburg.

ALLENTOWN, PA.—It is stated that the Inter-City Electric Railway Company, recently incorporated to construct an electric railway between Allentown and Reading, proposes to ask for franchises in Allentown and Reading, and will also bid on electrical contracts in both cities and in towns along its railway between the two cities.

BEAVER, PA.—It is reported that an Eastern syndicate has secured an option on the holdings of the Beaver Falls Water Power Company on the Beaver River, at Beaver, for $100,000. It is said, should the deal go through, that it is proposed to erect a large electric power plant to furnish electricity for the Beaver Valley towns.

CARNEGIE, PA.—The Scott Iron Works, of this place, have awarded a contract to the Lincoln Electric Company, of Cleveland, Ohio, for the installation of a 75-kw generator and two motors, one 50 hp and the other 7½ hp, in its plant.

EASTON, PA.—The consolidation of the Easton Transit Company and the Easton & South Bethlehem Transit Company, under the name of the Easton Transit Company, has been approved by Governor Stuart. The consolidated company is capitalized at $2,150,000.

GASTONVILLE, PA.—Arrangements are being made to enlarge the Gastonville power plant to furnish additional power for the Cincinnati and Coal Bluff mines. The work will include the installation of a new boiler plant and a 150-kw generator.

PHILADELPHIA, PA.—An ordinance has been introduced in the Council by Chief McLaughlan, of the Electrical Bureau, to appropriate $45,000 to replace cables, poles and mastarms between City Hall and McKean Street; also for $6,000 to install dynamos to replace the old bluestone batteries at the police station.

PHILADELPHIA, PA.—Mayor Reyburn has approved the plans prepared by Chief McLaughlin, of the Electrical Bureau, for improving the electric lighting system on Market, Broad, Walnut, Chestnut and other streets in the center of the city. The proposed plan contemplates the erection of ornamental poles and arc lamps of high candle-power. The plans also provide for clearing the streets of all overhead wires excepting trolley cables.

SUSQUEHANNA, PA.—The Borough Council has awarded the contract for lighting the streets and public buildings of the borough to the Susquehanna Electric Company for a term of five years, dating from Feb. 1, 1909. The company is to furnish 10 arc lamps and 83 incandescent lamps for $2,400 per year.

WEST NEWTON, PA.—It is reported that the Borough Council is negotiating with H. D. Hershey, superintendent of the Latrobe Street Railway Company, with a view of selling the municipal electric light plant to the West Penn Railways Company. The plant has been in operation for 15 years, and the management of the plant is a burden to the Council, and there are some who are in favor of selling the plant.

SPARTANBURG, S. C.—The Spartanburg electric railway will be extended to the Saxon Cotton Mills and probably to the Whitney Mills, three and six miles distant.

RAMONA, S. D.—Arrangements are being made to form a company for the purpose of installing an electric light plant in Ramona. It is proposed to construct the plant early in the spring.

JACKSON, TENN.—Plans are under consideration for increasing the output of the municipal electric light plant.

FLATONIA, TEX.—It is reported that the electric light plant, owned by F. A. Ziegelbaur, has been destroyed by fire.

SALT LAKE CITY, UTAH.—It is reported that the Deer Creek Copper & Gold Mining Company is planning an extensive development on the American Fork River. A contract has been awarded to construct the tunnel and the company will probably install a power plant soon. W. M. Odell, of Salt Lake City, Utah, is interested in the enterprise.

WINDSOR, VT.—The Windsor Electric Light Company is contemplating extending its day power service, and, if conditions warrant, it will install a 3-phase power circuit. Richard P. Osgood is superintendent.

ALEXANDRIA, VA.—It is understood that arrangements have been completed whereby the plant of the Alexandria Electric Light Company will be transferred to local capitalists, who it is said will increase the output of the plant and make other improvements to the system. The plant is now owned by a Pennsylvania syndicate.

ONLEY, VA.—Plans are being made by H. L. East to install an electric plant to operate his laundry and also to furnish electricity for lamps in the town.

ROCKBRIDGE ALUM SPRINGS, VA.—Estimates are being received by J. W. Bell, general manager of the Rockbridge Alum Springs, on acetylene and electric lighting plants.

ROCKY MOUNT, VA.—A company is being organized in this place to establish an electric light plant. The equipment of the plant will include a 75-hp engine and a 56-kw generator. B. L. Fisher is interested in the enterprise.

BELLINGHAM, WASH.—Arrangements are being made by the residents of Austicana Colony whereby the Whatcom County Railway & Light Company will furnish electricity for lamps and motors in that district, and also to operate the water pumps. A telephone system will also be installed.

CHEHALIS, WASH.—The Chehalis & Boistfort Telephone Company contemplates extensive improvements and extensions to its system.

CHEWELAH, WASH.—The local business men are considering the question of securing electricity for lamps and motors for the United Copper mine and the Copper King mine, and also for the town, from the plant of the Stevens County Electric Light Company, located at Meyers Falls, Wash. The municipal electric plant, which was installed about 18 months ago, is inadequate to meet the demands for electricity.

FRIDAY HARBOR, WASH.—Robert Moran has applied to the Commissioners of San Juan County for a franchise to construct and maintain transmission lines for the distribution of electricity on Orcas Island.

NORTH YAKIMA, WASH.—Notice of appropriation of 10,000 cu. ft. of water per second from the Yakima River has been filed by R. B. Brown, of Seattle, Wash. The water is to be utilized to generate electricity to operate a street railway and manufacturing plants; also to supply electricity to cities and towns for lamps and motors.

SEATTLE, WASH.—The City Council has granted the Seattle, Renton & Southern Railway Company a franchise to construct an electric railway on Third Avenue and Pine Street.

SEDRO-WOOLLEY, WASH.—The Skagit Improvement Company will lease the plant of the Sedro Ice & Storage Company for a term of five years. The plant will be operated by electricity and the output increased.

STEVENS, WASH.—The Skamania Co-operative Telephone Company has been granted a franchise to extend its telephone lines along the county roads.

TAYLOR, WASH.—The capital stock of the Citizens' Light & Power Company has been increased from $20,000 to $40,000.

VANCOUVER, WASH.—The Portland Railway, Light & Power Company is making arrangements to place an electric cable under the Columbia River to transmit electricity to the substation at Vancouver, which will furnish electricity to local street railway and electric light and power systems. The local power station will be kept in readiness for emergencies. The company is planning to make improvements to its local system during the coming year, which will involve an expenditure of about $25,000, and include the installation of automatic regulators and other equipment. The new cable will transmit electricity from the power stations at Oregon City and Cazadero.

BLUEFIELD, W. VA.—The Bluestone Traction Company contemplates the installation of additional equipment in its plant, including a 450-hp engine.

TRIADELPHIA, W. VA.—The Farmers' Mutual Telephone Company has applied to the County Commissioners for a franchise to erect telephone lines along the highways of the Triadelphia district.

BLAINE (P. O. ALMOND), WIS.—The capital stock of the St. Croix Farmers' Mutual Telephone Company has been increased from $3,000 to $6,000.

COWICHAN, B. C., CAN.—The Parker Electric Company, of Nanaimo, B. C., is installing electric generating equipment in Cowichan.

EDMONTON, B. C., CAN.—Plans are being considered by the city for developing the water power of Athabasca River, at Grand Rapids, 150 miles northwest of the city, where it is estimated that 250,000 hp can be developed. The cost of the transmission line is estimated at about $1,500 per mile.

KAMLOOPS, B. C., CAN.—The City Council has engaged H. K. Dutcher, of Cleveland, Ohio, to make investigations and make a report for reorganizing the municipal electric light and pumping plant.

VANCOUVER, B. C., CAN.—It is reported that the British Columbia Electric Railway Company is planning to obtain the two large water powers of the Fraser Valley, Stave Lake Falls, near Ruskin, and the Vedder Falls, near Chilliwack, and to build a belt line railway, of which the Chilliwack line will be a part.

VANCOUVER, B. C., CAN.—Plans are being conisdered by the Canadian Industrial Company for the construction of a large paper and pulp mill on the Powell River. A 5000-hp hydro-electric plant will be built in connection with the enterprise. Alfred Carmichael, hydraulic engineer, has been making investigations for developing water power for the company.

BIRTLE, MAN., CAN.—This municipality is considering the installation of a telephone system. For further information address W. C. O'Keele, Birtle, Man.

PORTAGE LA PRAIRIE, MAN., CAN.—A local company is applying to the City Council for a franchise to erect poles on the streets and supply electricity for lamps, heat and motors. For further information address E. A. McPherson.

WINNIPEG, MAN., CAN.—Instructions have been issued by the Canadian Pacific Railroad Company for the installation of a telephone line between Winnipeg and Brandon for the operation of trains. The distance is 135 miles, and if the system proves successful, telephone wires will be installed on all the company's lines in western Canada.

BROCKVILLE, ONT., CAN.—A company has been formed and is negotiating to supply this city with electricity generated by water power of the Iroquois River.

BROCKVILLE, ONT.—M. W. Beach, of Iroquois, Ont., has submitted a proposition to the Council offering to transmit electricity from Iroquois to Brockville. If sufficient business is guaranteed, he proposes to erect transmission line and furnish electrical service in this town. He offers to sell to the town outright the distributing system, or will operate the system, provided sufficient business is guaranteed. He also proposes to supply the water department with electricity. The transmission line would pass through Prescott and Cardinal, and Mr. Beach is negotiating with these municipalities to furnish electrical service.

LONDON, ONT.—The London & Northwestern Railway Company has applied to the Ontario Legislature for a charter to construct an electric railway from London to Sarnia, and from London to a point on Lake Huron.

PETERBORO, ONT.—Preliminary plans have been prepared for the proposed municipal power plant, including the construction of a dam, power house and pumping plant. S. R. Armstrong is City Clerk.

PETERBORO, ONT., CAN.—The Water Commissioners have asked the Council to hold an election to vote on a by-law to issue $120,000 in bonds, the proceeds to be used for the construction of a new dam, power house and pumping plant. It is proposed to install an electric plant with an output of 1200 hp, of which 500 hp will be used by the water department, leaving 700 hp available for the city.

ST. THOMAS, ONT., CAN.—The Southwestern Traction Company has offered to take over the municipal street railway system in St. Thomas and make certain improvements, providing concessions are granted by the town.

TILBURY, ONT., CAN.—The Council has granted the Tilbury Telephone Company a franchise to erect telephone system in Tilbury.

IBERVILLE, QUE., CAN.—The citizens have voted in favor of establishing a municipal electric light plant in Iberville. It is proposed to install an electric plant in connection with the water-works system at a cost of about $15,000.

AGUASCALIENTES, MEX.—The stockholders of the Aguascalientes Electric Light & Power Company have decided to make extensive improvements to its plant, involving an expenditure of about $100,000. The new equipment will include two Diesel oil engines direct connected to alternating-current generators. The present power plant will be held in reserve after the installation of the new engines.

Company Elections.

HARTFORD, CONN.—At the annual meeting of the Hartford Electric Light Company the following named officers were elected: Austin C. Dunham, president; Samuel G. Dunham, vice-president; John E. Lynch, secretary; D. Newton Barney, treasurer; Frank A. Isleib, assistant secretary and treasurer; S. Nathan, assistant treasurer.

LOUISVILLE, KY.—At the annual meeting of the Kentucky Electric Company the following named officers were elected: R. E. Hughes, president; Lawrence Jones, first vice-president; Charles J. Doherty, second vice-president; Bryan H. Allen, secretary and treasurer, and Lewis S. Streng, chief engineer.

ROCKVILLE, MD.—At the meeting of the Washington & Rockville Electric Railway Company the following-named directors were elected: Charles J. Bell, Woodbury Blair, George H. Harries, W. B. Hibbs, William Loeb, Jr., Clarence F. Norment, Ward Thoren, George Truesdell and E. S. Marlow.

MARINE CITY, MICH.—At the annual meeting of the Marine City Roller Mill Company the following-named officers were elected: Alonzo Arnold, president; Andrew Manion, vice-president, and Eber Arnold, secretary, treasurer and manager.

PACIFIC, MO.—At the anual meeting of the Pacific Electric Company the officers were re-elected as follows: A. Koppitz, president; L. P. Gross, vice-president; A. R. Leber, secretary, and L. M. Roemer, treasurer.

SEA ISLE CITY, N. J.—At the annual meeting of the New Jersey Rapid Transit Company the following-named officers were elected: Walker W. Brooks, president; Marshall A. Brooks, vice-president, and M. S. Brooks, secretary and treasurer.

SEA ISLE CITY, N. J.—At the annual meeting of the Sea Isle City Electric Light, Power & Water Company the following-named officers were elected: Walker W. Brooks, president; John W. H. Brooks, vice-president, and M. S. Brooks, secretary and treasurer.

WAUPACA, WIS.—At the annual meeting of the Waupaca Electric Light & Railway Company the following-named officers were elected: Irving B. Lord, president and general manager; C. B. Lord, vice-president; W. H. Lord, secretary, and E. A. Wheeler, treasurer and assistant secretary.

WINNIPEG, MAN., CAN.—At the annual meeting of the Winnipeg Electric Railway Company, William Mackenzie was re-elected president; William Whyte, vice-president; F. Morton Morse, secretary and treasurer, and Wilford Phillips, manager.

YORKTON, SASK., CAN.—At the annual meeting of the Yorkton Northwest Electric Company, J. M. Clark was elected president; T. A. Waterfield, vice-president, and E. N. Dunsford, manager.

New Industrial Companies.

THE DUNBAR ELECTRIC SUPPLY COMPANY, of Oklahoma City, Okla., has been chartered, with a capital stock of $15,000, by G. B. Stone, George Sayles and E. S. Dunbar.

THE L. A. WHITNEY ELECTRIC COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $5,000, by Leon A. Whitney, Harry M. Hawes and Edward F. Green, all of New York, N. Y. The company proposes to do general electrical work.

THE POWERS RAILWAY SAFETY APPLIANCE COMPANY, of New York, N. Y., has been chartered, with a capital stock of $30,000, to manufacture railway appliances and mill supplies. The incorporators are: Vance S. Manson, Edward A. Sprong and Samuel S. Ryckman, all of New York, N. Y.

THE COOKE & WILSON COMPANY, of Charleston, W. Va., has been incorporated, with a capital stock of $50,000, to deal in electrical supplies and will operate as manufacturers' agents. The officers of the company are: A. S. Cooke, president; W. J. Wilson, treasurer, and O. F. Scholz, manager.

W. B. GARDINER & COMPANY, of Brooklyn, N. Y., has been incorporated, with a capital stock of $5,000, to manufacture gas and electric fixtures, toys, etc., by William B. Gardiner, Alexander A. Murphy, Jr., and Wright Molineaux, all of Brooklyn, N. Y., and Cornelius J. Haggerty, of New York, N. Y.

THE SCHOONMAKER MECHANICAL MOTOR POWER COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $200,000, by Elmer Schoonmaker, Charles H. Bausher and Stephen G. Stil, all of New York, N. Y. The company proposes to do a general manufacturing business.

THE DRUMMOND-LUDLOW COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $150,000, by B. D. Whedon, Fred R. Bagg, of New York, N. Y., and Mabel V. Warner, of Elizabeth, N. J. The company proposes to engage in the business of mechanical and electrical engineers, tool makers, founders and cutters.

THE MAXIM SPECIALTY COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, to manufacture antiseptic telephone mouth-piece, mechanical contrivances, specialties and devices. The incorporators are: James F. Doran and John C. Doran, of Danbury, Conn.; Max Rosenwald, of New York, N. Y., and David Rosenwald, of Albany, N. Y.

THE POWER ENGINEERING & CONTRACTING COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $10,000, for the purpose doing a general engineering and contracting business, including the installation of heating, ventilating and electrical apparatus. The incorporators are: Albert Altman, Augustus M. Dreherand and Emil Herzfeld, all of New York, N. Y.

THE RADIO ELECTRIC TREATMENT COMPANY has filed articles of incorporation, with a capital stock of $300,000, to construct machinery, apparatus and plants whereby "atmsopheric air is automatically incorporated with flowing water and carried into rays of quintescent light." The incorporators are: Samuel Vance, Jr., of Philadelphia, Pa.; William M. Pyle and Edmund S. Hellings, of Wilmington, Del.

New Incorporations.

WILMINGTON, DEL.—Articles of incorporation have been filed for the Northern Idaho & Montana Power Company, with a capital stock of $1,500,000, by I. Milkeurtch, J. S. Cummins, I. J. O'Brien, R. A. Wortman, of Chicago, Ill., and H. W. Davis, of Wilmington, Del.

DES MOINES, IA.—Articles of incorporation have been filed for the Des Moines, Council Bluffs & Western Railway Company for the purpose of constructing a railway from Des Moines to Council Bluffs to be operated by steam, electric or gasoline power. The company is capitalized at $100,000, and the directors are: Robert Pilmer, of Norwalk; A. P. Sawyer, of Pierre, S. D.; W. N. Hansen, H. A. Smith, E. C. Wallace, J. S Garbock and R. B. Bannister, all of Des Moines, Ia.

POLO, ILL.—The Polo Electric Light & Power Company has been incorporated, with a capital stock of $[illegible], by Byron L. Snow, Lewis D. Beckler and William Beaver.

WELLINGTON, ILL.—The Wellington Farmers' Telephone Company has been incorporated, with a capital stock of $1,200, by Monroe Garrison, Daniel Stewart and John C. Benbow.

SHELBURN, IND.—The Central Mutual Telephone Company has incorporated. P. T. Lloyd, H. V. Starke, Elias Moore and W. H. Bennett are directors.

TERRE HAUTE, IND.—The Terre Haute & Southwestern Railway Company has filed articles of incorporation with the Secretary of State, with a capital stock of $50,000. The directors are: H. P. Taussig, H. C. Pugh, R. G. Watson, Robert Herkimer, S. C. McKean, H. B. Bement and Charles Minshall. The company proposes to construct a railway from Terre Haute, through Vigo and Sullivan counties, to the Wabash River, where it forms the boundary line between Indiana and Illinois.

BOLES, KY.—Articles of incorporation have been filed for Boles Home Telephone Company by Otto Maxey, N. S. Renaeu and J. F. Marr.

COLUMBUS, KY.—The Columbus Telephone Company has been incorporated by Charles W. Dupree, Henry Gaylee and J. H. Fisher.

SMITHLAND, KY.—The Union Telephone Company has been incorporated by George W. Jolly, S. S. Miller, J. M. Moore and others.

ERHARD, MINN.—The Edwards Telephone Company has been organized to construct a telephone line to Edwards. E. M. Nelson, of Frieberg, is president.

PERKHAM, MINN.—Articles of incorporation have been filed for the Perkham Rural Telephone Company by Albert Benke and others to construct telephone lines in the vicinity of Perham.

Legal.

RECEIVER FOR THE NEWPORT NEWS & OLD POINT RAILWAY & ELECTRIC COMPANY.—The Maryland Trust Company, of Baltimore, Md., has filed a bill in the Federal Court at Norfolk, Va., for a receiver for the Newport News & Old Point Railway & Electric Company, and for an injunction against the road and its officers. The trust company is trustee of a $4,000,000 general mortgage of the Newport News & Old Point Railway & Electric Company. The petition is asked for the preservation of the assets of the company, which operates an electric railway between Newport News and Old Point.

GEORGIA MANUFACTURING & PUBLIC SERVICE CORPORATION BANKRUPT.—Judge Newman in the Federal Court at Atlanta, Ga., has approved the report of the special master, George D. Anderson, in the case of the Georgia Manufacturing & Public Service Corporation, of Marietta, Ga., and has adjudged the same bankrupt. A petition for a receiver was filed in August, 1908. The company based its objection to the receivership on the alleged grounds that it was principally engaged in furnishing light to the Town of Marietta, whereas the special master found in effect that the manufacture of paper was the principal business of the company.

RULE OF TELEPHONE COMPANY REQUIRING RENTALS TO BE PAID SIX MONTHS IN ADVANCE IS REASONABLE.—In an action brought by a telephone company against one of its subscribers to enjoin him from meddling with the appliances and equipment of the company, one phase was the legality of a telephone company requiring advance payment for service. On this point the court held that the rule followed by the company requiring rentals to be paid six months in advance was reasonable and binding, though it had never been formally adopted. Buffalo County Telephone Company v. Turner, Supreme Court of Nebraska, 118 N. W. Rep. 1064.

CONTRIBUTORY NEGLIGENCE IN TAKING HOLD OF BROKEN ELECTRIC LIGHT WIRE.—The plaintiff in an action against an electric light company was a man about 25 years of age. On July 4, 1905, while sitting in a public park, he saw some boys playing with a broken electric light wire by placing sticks on the exposed end of the copper wire where the latter was stripped of its insulation covering. He walked over to where they were, saw that the wire was emitting sparks, and that it burned the sticks pressed against it. It was very apparent, and the plaintiff knew, that this was a broken electric light wire, and at the time charged with a heavy current of electricity. Without saying anything to the boys who were playing with the wire, and after waiting and apparently watching their antics for about half a minute, he stooped down and took hold of this wire with his left hand at a place where it was coated with insulating material and some two feet from the exposed and sparking end, for the purpose of throwing it over the branch of a nearby tree and thus saving the surrounding youngsters from possible injury by contact with the wire. He thought he could safely do this, but he was severely shocked and also had his left hand badly burned. "The distinctive feature of this case," said the court, "is that the plaintiff knew he was taking hold of a live wire heavily charged, had before him actual demonstration of its condition, and yet intentionally and unnecessarily, but from good motives, grasped the wire, assuming, without any real knowledge, to know that he would be protected by the insulating cover upon the wire." The plaintiff was found guilty of contributory negligence in taking hold of the wire, and was, therefore, not allowed to recover damages. Billington v. Eastern Wisconsin Railway & Light Company, Supreme Court of Wisconsin, 117 N. W. Rep. 147.

Personal.

MR. J. R. MCCLARY, of Niagara Falls, N. Y., formerly with the Ontario Power Company, has been appointed manager of the Falls Power Company at Watertown, Ont.

MR. CLIFTON R. HAYES, formerly superintendent of the Fitchburg Gas & Electric Light Company, Fitchburg, Mass., has been appointed to the position of general manager of the company.

MR. FRANCIS S. THAYER, superintendent of the Clinton and Leominster plants, owned by the Massachusetts Lighting Companies, of Boston, Mass., has resigned his position. Mr. Thayer will be succeeded by George B. Spring, superintendent of the Ayer Electric Company, Ayer, Mass.

MR. CURTIS C. COOK has resigned his position as secretary and assistant treasurer of the Hartford Electric Light Company, of Hartford, Conn. Mr. Cook has been with the company about 16 years and for nine years has been an officer. Mr. John E. Lynch has been appointed secretary to succeed Mr. Cook.

SIR CLIFTON ROBINSON, well known in traction work on both sides of the Atlantic, and head of the London United Electric Tramways, is the subject of a biographical sketch in London *Vanity Fair* of Feb. 3, accompanied by one of the colored full-page, full-length portraits by "Spy," for which that journal is famous.

MR. H. E. LAVELLE, who for the past four years has been associated with the Electric Service Supplies Company, and was previously with the Mayer & Englund Company; also in the past with the Western Electric Company and Machado & Roller, will sever his present connection about March 1. Mr. Lavelle has as yet made no plans for the future.

DR. E. G. ACHESON.—At a convocation of the University of Pittsburgh, held in Carnegie Music Hall in that city on Lincoln's birthday, Feb. 12, several degrees commemorating the occasion were conferred by Chancellor McCormick. Mr. E. G. Acheson, the well-known engineer and inventor of carborundum, etc., was made a doctor of science. Mr. Acheson, now president of the American Electrochemical Society, was long a resident in Pittsburgh and did much of his original work there in electrochemistry, etc.

MR. HAROLD E. YOUNG has been appointed chairman of the Electric Light Commission, which was authorized by the Board of Aldermen of Manila, P. I., as the result of the agitation of the lighting question in that city. Mr. Young, who is a graduate of the Massachusetts Institute of Technology, was until recently connected with the engineering department of the American Telephone & Telegraph Company. He is at present occupying the position of electrical engineer of the city of Manila.

MR. ROBERT TODD LINCOLN, surviving son of Abraham Lincoln, whose centenary was so widely celebrated last week, is the first vice-president of the Commonwealth Edison Company, of Chicago. He is also a director and a member of the executive committee. Mr. Lincoln is a lawyer by profession and a man of large interests, being president of the Pullman Company. He has an impressive personality, with courtly manners and a retiring disposition. He is said seldom to mention his father, whose death appears to have made a profound impression on his life. He is not active in the administration of the Commonwealth Company, but he is nevertheless thoroughly conversant with its affairs and a regular attendant at board meetings. His interest is shown by the fact that a number of years ago, when minister to Great Britain, he retained his directorate in the Chicago Edison Company (predecessor of the Commonwealth Company), although he resigned nearly all the other offices which he held.

Obituary.

MR. T. LOWRY.—We regret to note the death of Mr. Thomas Lowry, president of the Twin City Rapid Transit Company, of Minneapolis, in that city, on Feb. 4. Spending the early part of his manhood in the practice of the law, he became identified with street railway development in 1873, and then was one of the first to recognize the merits of electric traction. In 1890 he served as president of the American Street Railway Association, in which he took a deep interest. He was one of the public utility managers who was deservedly popular and esteemed in the community in which he lived. His age was 66.

Trade Publications.

PORCELAIN.—Porcelain for all electrical purposes is covered in the 1908 catalogs of the G. F. Brunt Company, East Liverpool, Ohio.

FAN MOTORS.—The General Electric Company, Schenectady, N. Y., has issued a booklet giving prices and data relating to its fan motors of all types.

GRAPHITE for motor lubrication is discussed in an instructive manner in a booklet issued by the Joseph Dixon Crucible Company, Jersey City, N. J.

ELECTRIC IRONS are attractively presented in the January issue of *Hot Points*, published by the Pacific Electric Heating Company, Ontario, Cal.

LIGHTING SPECIALTIES.—The February issue of "Juice," the nthly publication of the Pettingell-Andrews Company, Pearl Street and lantic Avenue, Boston, describes many lighting specialties that have n produced so recently that they have not been covered in trade alogs.

DIRECT-CURRENT MOTORS, rated at from 0.125 hp to 7.5 hp, are strated, described and listed in a booklet issued by the U. S. Electal Manufacturing Company and Dynamo Electric Machine Company, South San Pedro Street, Los Angeles, Cal. An interesting device o described is a fan which can produce either a cooling or a warm breeze.

HIGH-VOLTAGE SWITCHES.—Bulletin No. 4 of the Kelman Electric Manufacturing Company, 612 North Main Street, Los Angeles, Cal., ntains descriptions with numerous dimensional illustrations of high-ltage oil switches and oil circuit-breakers. The devices are of the autotic and non-automatic, electrically operated and manually operated types r e.m.f. up to 110 volts.

SPRAY PUMPS.—The Deming Company, Salem, Ohio, has issued a ndsome catalog giving full details of its spray pumps, nozzles and appli-ces. These pumps are designed for such work as whitewashing in mills, tories and warehouses. The catalog contains a 12-page spraying chart; gives sectional and detailed views of several of the pumps, and illus-tes many of them in action.

MACHINE TOOLS.—Edition D of the illustrated catalog of the rvin Machine Company, Spring and Varick streets, New York, is voted to Lincoln and duplex milling machinery, profiling machinery, rtical spindle milling machinery, Universal cutter and tool grinder, rtical, horizontal and automatic tapping machines, duplex drill lathes d gang drills. The catalog is printed in English, German and French.

GAS PRODUCERS.—A 160-page publication dealing with producer-gas wer plants, producers for metallurgical use, and applications of producer s has been issued by R. D. Wood & Company, Philadelphia. The book of a character somewhat different from the usual trade publication in at it contains much valuable technical data presented in text-book form. he book should prove of much value for reference by engineers and ers of gas producers.

Business Notes.

THE JOHNS-MANVILLE FACTORY at Milwaukee was destroyed by e on Feb. 13. One employee and four firemen lost their lives.

THE HOYT ELECTRICAL INSTRUMENT WORKS, Penacook, H., has opened an office at 1931 Broadway, which will be in charge of Ir. R. V. Sutliffe as branch manager.

THE PACIFIC ELECTRIC & MANUFACTURING COMPANY has changed its address to 80 Tehama Street, San Francisco, where hereafter will be located both its factory and office.

INDIRECT ILLUMINATION.—The National X-Ray Reflector Company, of Chicago, has equipped the new offices of the North Shore Electric Company with its indirect (I-Comfort) system of lighting.

THE METROPOLITAN ELECTRICAL SUPPLY COMPANY, of Chicago, has a special bulletin giving the new prices on Crescent insulated wire and lamp cord, for which they are the Western agents. They will be glad to send these to any who are interested.

THE HESS-BRIGHT MANUFACTURING COMPANY has removed its New York office from 90 West Street to 1974 Broadway, near Sixty-sixth Street, where a store will be opened which will carry a complete stock of Hess-Bright ball bearings and magnetos.

THE MARSHALL ELECTRIC COMPANY has moved its office and factories to the new reinforced-concrete, fireproof building which it has erected and equipped at Hyde Park, Mass. Owing to the increasing business of the company, more commodious quarters became necessary, and the new building is the result.

GOVERNOR-PIN LUBRICATION.—The Keystone Lubricating Company, Philadelphia, manufacturers of Keystone grease, has recently been advised of the efficiency and economy of this product in the lubrication of governor-pins of an installation of Westinghouse high-speed engines at the plant of the Electric Storage Battery Company, Philadelphia. In this type of flywheel governor the conditions of safe and effective lubrication are severe, as the governor-pin carries a pair of heavy weights and oscillates through a short arc only for its maximum travel between light load and full load on the engine. The chief engineer, reporting on the performance of the grease, states that it gave perfect satisfaction with a consumption of 4 to 6 ounces of No. 2 density grease on each engine per week of 13 consecutive shifts.

ALLIS-CHALMERS PUBLICATIONS.—A recent list of publications issued by Allis-Chalmers Company shows 187 bulletins and instruction books which that company has prepared, or has in course of preparation, exploiting the products of its various departments, which include the manufacture of prime movers of every description, electrical apparatus for alterating and direct current, pumping machinery, mining machinery, crushing and cement making machinery, flour mill machinery, saw mill machinery, etc. Information descriptive of all of the above is indexed in a convenient manner for reference. The publications are illustrated by cuts of the most modern appliances and methods, and in addition to the descriptive matter, which can be had on application, the index of publications contains the numbers and titles of several useful instruction books.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 9, 1909.

Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

911,565. ALARM AND TELEPHONE SYSTEM; G. Babcock, Rochester, N. Y. App. filed Dec. 2, 1904. Combined fire alarm, police signal and telephone; improvement on 807,235. A police signal and telephone equipment of special type is provided so that the policeman must necessarily actuate the signaling mechanism in making his round, thus informing the office which policeman has operated a particular box.

911,578. ELECTROPLATING APPARATUS; J. T. Daniels, Newark, N. J. App. filed Aug. 27, 1907. The walls of the drum are made of celluloid instead of wood.

911,592. MULTIPLE SWITCH-STARTER; J. T. Janette, Milwaukee, Wis. App. filed May 20, 1907. Avoids burning out the starting resistance by a failure to close all of the switches by providing interlocks between the switches whereby each switch after the first holds the preceding switch in a closed position. The switches are closed by hand over hand and the last switch is retained in position by a retaining magnet. If the operator fails to close all the switches and removes his hand from the switch last closed, all the switches are opened, the starting resistance reinserted and the motor circuit opened.

911,618. AUTOMATIC ADVERTISING OR DISPLAY APPARATUS; H. M. Scutz, Milan, Italy. App. filed Feb. 11, 1905. The lamps are carried on plates which are driven by machinery so as to describe certain eccentric and concentric evolutions.

911,623. RAILWAY-CROSSING SIGNAL; H. W. Souder, Tamaqua, Pa. App. filed May 20, 1907. Protects the crossing between a steam and trolley road by a variable signal normally at danger and an insulated rail section on the main road, together with signal actuating means extending a certain distance from the crossing along the crossing road and operated by the trolley car, together with means for insuring the retention of the signal at danger while the car is in the insulated section.

911,645. COUPLING; T. W. Christian, Chicago, Ill. App. filed May 11, 1908. Makes use of hooks on one end of one conduit section and a web on the companion member entering between the hooks. Details.

911,687. HOT-AIR SYRINGE; H. E. Vogel, Chicago, Ill. App. filed Nov. 8, 1905. An electric heater located in the handle of the syringe [illegible] by [illegible] heat the [illegible]

911,696. CIRCUIT CONTROLLER FOR TROLLEY SIGNALS; A. Bevan, Providence, R. I. App. filed March 23, 1908. The circuits for the signals are controlled by a lever hanging in the path of the passing trolley wheel. Means are provided whereby the actuation of either circuit-closer by the wheel locks the other.

911,708. DYNAMO-ELECTRIC MACHINE; B. Lichtenthal, Norwood, Ohio. App. filed June 30, 1906. Means for supporting and bracing the end-turns of the stator coils by an outer bracing ring of insulating material, an inner insulating bracing ring concentric with the former, together with means for drawing the rings together to clamp the conductors between them.

911,713. METHOD OF AND MEANS FOR SECURING IN POSITION CONDUCTORS OF ELECTROMAGNETIC STRUCTURES; B. Frankenfield, Norwood, Ohio. App. filed May 3, 1906. Holds the armature coils or field coils of a machine in place by means of a laminated slotted core in which the coils are located; some of the laminæ having teeth split at the ends and spread apart over the conductors so as to secure them in position.

911,714. TELEPHONE; O. Frazier, Brazil, Ind. App. filed March 2, 1907. Amplifies the effect of the voice on the receiver diaphragm by using an additional circuit and coil which are under the control of the receiver-hook and cut in when the receiver is placed on the hook.

911,723. INTERLOCKING MACHINE; J. S. Hobson, Edgewood Park, Pa. App. filed Sept. 14, 1908. Insures that the operator closes the circuit on the electric lock before he attempts to move his lever, thus avoiding binding the latch of the electric lock. Makes use of a circuit-controller operated by the lever to close the circuit on the electric lock to release the lever.

911,730. FIRE-ALARM; Verner Kall, Rockford, Ill. App. filed July 8, 1908. The alarm is actuated by means of a circuit-closing wheel which is controlled by a bolt held by a cord. When the cord burns, the bolt is withdrawn and the wheel gives the alarm.

911,746. RELAY; Edward McClintock, St. Paul, Minn. App. filed Jan. 16, 1906. The relay consists of one or more hollow rings on a horizontal shaft between the pole pieces of an electromagnet. The rings are half full of a conducting fluid which closes the contacts at the proper time.

911,753. DISAPPEARING MANHOLE-GUARD; R. Parks, Denver, Col. App. filed Aug. 5, 1907. Particularly for the upper floor of a fire-engine house through which the pole passes upon which the men slide to the floor below when an alarm is given. Makes use of a trap-door to close the opening which is automatically removed by electrical connections and a weight when the alarm is given.

911,768. COMMUTATOR CONSTRUCTION; H. H. Ralston, Norwood, Ohio. App. filed May 31, 1907. The commutator bars are clamped in place by means of a spider and a ring of insulating material between the spider and the bars. The construction is such that a section may be removed in order to get at the bars for repairing.

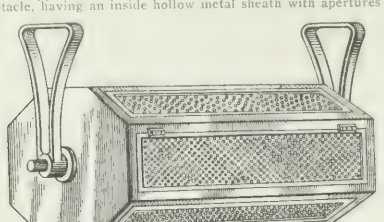
911,774. PHANTOM ELECTRIC CIRCUIT; H. B. Stone, Providence, R. I. App. filed Nov. 26, 1907. Relates to repeating coils in telephone [illegible]

The repeating coil has three windings, two of them balanced and so arranged that the third winding will induce currents in the two balancing windings of the secondaries of the circuit, which are alike in direction and intensity.

911,797. DYNAMO-ELECTRIC MACHINE; E. C. Wright, Newport, Ky. App. filed Jan. 22, 1906. Provides separable pole pieces so as to be able to get at the main and auxiliary windings without removing or disturbing the main field coils or the distributed balancing winding.

911,798. TELEPHONE-EXCHANGE SYSTEM; W. A. Wynne, Raleigh, N. C. App. filed July 29, 1908. Calling subscribers may be answered quickly by providing a special line relay for each line which is energized when the line calls. To the normally open contacts of these relays the circuit of the operator who is to answer the group is connected.

911,844. ARMORED PLUG-RECEPTACLE; R. A. Schoenberg, New York, N. Y. App. filed June 22, 1908. A detachable armored molding receptacle, having an inside hollow metal sheath with apertures adapted



911,578—Electroplating Apparatus

to be detachably secured to the molding, together with an insulating block secured to the molding and covered by the sheath.

911,847. ELECTRICAL TROLLEY-REPLACER; H. L. Sparks, Palestine, Tex. App. filed May 4, 1908. The trolley is replaced by compressed air controlled by a valve which is in turn controlled by an electromagnet.

911,850. BATTERY-CHARGING SYSTEM; W. I. Thomson, Newark, N. J. App. filed Aug. 29, 1905. Means are provided so that when a load is cut in parallel with the battery the current through the battery remains unchanged. A current-utilizing device may be put in circuit with the battery, together with means for regulating the output of the source of current, including a solenoid and a shunt about the solenoid. A single means simultaneously closes the circuit of the shunt and throws the current-utilizing device into circuit.

911,854. CONDUIT-ROD; E. L. Upson and F. J. Dole, Brooklyn, N. Y. App. filed Jan. 11, 1907. A coupling for the sections of a conduit-rod, each having a sleeve for the reception of the rod section and a cutaway portion at one side thereof and opening into the sleeve for the passage of a fastening means, together with a fastening inserted thereinto through the cutaway portion after the parts are assembled.

911,864. PORCELAIN CLEAT; Esar Haddon Ball, Cedar Rapids, Ia. App. filed Aug. 6, 1908. The base member is provided with a mortise and the cap member is composed of two sections each provided with a tenon adapted to engage the said mortise.

911,866. DESK-TELEPHONE; E. R. Corwin and C. A. Bals, Chicago, Ill. App. filed March 28, 1908. Comprises a base portion with the usual vertical standard which carries a telephone receiver-hook. Switch contact members are carried on a removable plate, which is held in place by springs. A spring-pressed rod passes from one of the switch contacts to the hook.

911,878. ELECTRIC CONTROLLING SYSTEM; D. C. Jackson, Brookline, Mass. App. filed Nov. 2, 1907. Automatic starter for electric motors. A plurality of electric switches, each controlled by an electromagnet, is provided, which successively cut out the sections of a starting rheostat. Details.

911,921. CIRCUIT-CLOSER FOR FIRE-ALARM CIRCUITS. R. D. Tiffany, Bellingham, Wash. App. filed May 29, 1908. Includes a container, for an expansible fluid, shaped like a bottle with a plunger working in the neck of the bottle. The plunger carries a contact and is actuated by the fluid to close the circuit at the desired time.

911,932. SYSTEM OF MOTOR CONTROL; G. F. Atwood, New York, N. Y. App. filed June 8, 1907. The selector arm is driven by an electric motor and means are provided whereby at each contact of the arm with a terminal the direction of rotation of the motor is reversed.

911,943. CIRCUIT-CLOSER; A. B. Culver, Aguascalientes, Mex. App. filed Aug. 24, 1908. A rotating timer for internal-combustion engines in which the shaft carries a ball and a brush at opposite sides thereof, the ball making contact and the brush dusting off and cleaning the contact surface against which the ball rolls.

911,948. ELECTRIC RAILWAY SYSTEM; W. E. Dawkins and J. W. Dawkins, O'Fallon, Ill. App. filed Feb. 21, 1908. Avoids the use of an underground system or an overhead trolley by laying the feed-wire on the surface of the ground. A blade on the car engages successive contact rollers, which, in turn, are connected to the wire. The contact roller is protected by insulated disks loosely mounted on the roller.

911,968. MULTIPLE CALL-BELL SWITCH; LeRoy I. Freas, Chalfont, Pa. App. filed May 11, 1908. A plurality of bells have their terminals connected to a plurality of contacts arranged around the periphery of a circular block of wood. A selecting arm pivoted to the center of the block can be rotated about the block to successively depress plungers into connection with the contacts so as to ring any desired bell.

911,973. INSULATING HIGH-VOLTAGE TRANSMISSION LINES; W. T. Goddard, Victor, N. Y. App. filed Aug. 22, 1908. A high resistance is interposed in series between the line wire and a support connected with the earth.

912,024. MEDICAL IMPLEMENT; W. M. Parks and B. B. Cross, Gas City, Ind. App. filed Oct. 19, 1907. A hood surrounds an incandescent lamp, the bottom of the hood being open. The walls of the hood have an air space between them. Details.

912,029. TELEGRAPHIC KEY OR TRANSMITTER; H. O. Putt, Millbury, Ohio. App. filed Feb. 17, 1908. The key lever is provided with a spring carrying a supplemental contact for the production of the dot impulses and has a weighted end, so as to be capable of rapid vibration when once set in motion in order to permit a number of closures of the circuit, thus giving a number of dots.

912,[illegible] [illegible] Providence, Saunderstown, R. I. App. filed [illegible]. The motor has a rocker armature and a permanent field magnet. The polarity of the armature is periodically reversed so as to lock it by the action of the poles on the permanent magnet.

912,055. SELF-RESTORING TROLLEY; J. T. Andrew, Montgomery, Ala. App. filed April 30, 1908. The trolley wheel is made up of a plurality of wheels side by side, which periodically raise the trolley so as to force it into the slot of the central trolley wheel, when the trolley leaves it.

912,074. MOTOR CONTROL; H. H. Clark, Schenectady, N. Y. App. filed July 26, 1906. For controlling induction motors, particularly when operating mine hoists or variable loads. A resistance or impedance is in circuit with the motor, controlled through a switch from the source of mechanical power by a slipping clutch, which, in turn, is controlled by the amount of motor current.

912,079. RELAY; F. B. Corey, Schenectady, N. Y. App. filed June 1, 1906. Means for supporting the terminal binding posts of the relay by utilizing a flange of insulating material extending beyond the magnet coil for supporting the posts.

912,128. CONTROLLING SWITCH; G. H. Hill, Schenectady, N. Y. App. filed Oct. 11, 1906. Instead of using a single switch for effecting the series-parallel control, makes use of two switches, one of which makes the series-parallel connection and the other varies the resistance in the circuit, together with suitable connections between them.

912,144. MULTIPHASE ELECTRIC INDUCTION-MOTOR; H. [illegible] Mavor, Mile End, Glasgow, Scotland. App. filed April 17, 1906. Controls the speed of these motors by surrounding the rotor with a revoluble induction element and provides a controlling multiphase induction-motor with a secondary element in connection with the first-named element, together with means for holding the former induction element stationary and releasing the same when starting the controlling motor.

912,159 SIGNAL; W. H. Parrish, Jr., Nashville, Tenn. App. filed May 2, 1908. Improvement on 847,105, for protecting a crossing between electric and steam roads so as to control the electric train. Includes a semaphore operated by one train to signal the crossing train with means for moving the semaphore to danger in the event of a defect in the first-named means.

912,199. TROLLEY-WHEEL; I. O. Stant, Dublin, Ind. App. filed March 3, 1908. The trolley-wheel has at each side thereof a conical wheel idler provided with intersecting spiral grooves running in opposite directions, so as to replace the trolley wire. Details.

912,209. RADIO-TELEGRAPHY; H. R. Von Traubenberg, Berlin, Germany. App. filed Feb. 10, 1908. The arc-lamp which produces rapid electrical oscillations has its electrodes provided with cooling ribs to dissipate the heat.

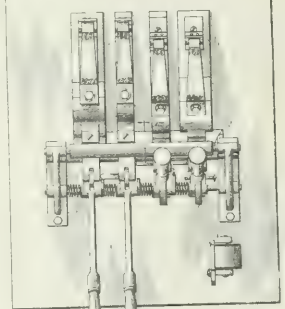
912,235. ELECTRIC CLOCK; H. H. Engelberg and C. Wagner, Danville, Pa. App. filed June 21, 1905. The making and breaking of the circuit places a coil spring under tension to wind the clock. This is accomplished by an armature controlled by a magnet. Details.

912,237. BINDING-POST; J. W. Feerrer, Boston, Mass. App. filed June 4, 1907. The binding-post has a spring-pressed jaw between which and a companion jaw operated by a lever the wire is placed.

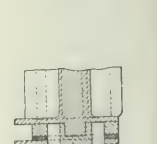
912,242. ELECTRIC STORAGE BATTERY; H. K. Hess, Philadelphia, Pa. App. filed Sept. 24, 1907. The grid consists of a rectangular open frame made of contacting lead strips secured together face to face and another series of lead strips arranged in horizontal tiers, one above the other, with their intermediate portions bent in the form of upright open loops.

912,245. SOLDER FOR INCANDESCENT-LAMP FILAMENTS; H. Kuzel, Baden, near Vienna, Austria-Hungary. App. filed Jan. 19, 1906. The solder consists of a carbide of tungsten and the carbon given off forms carbides of the metal.

912,246. MANUFACTURING ALLOYS; Hans Kuzel, Baden, near Vienna, Austria-Hungary. App. filed March 26, 1907. For the manufacture of alloys for incandescent-lamp filaments or the like. Precipitates from a mixture of a colloidal suspension and a crystalloidal solution the desired alloy and heats the mass to reconvert it into the crystalloidal state.



911,592—Multiple Switch Starter



912,209—Radio-Telegraphy.

912,247. METAL-FILAMENT ELECTRIC GLOW-LAMP; Hans Kuzel, Baden, near Vienna, Austria-Hungary. App. filed Nov. 24, 1908. Prevents contact between the filaments by connecting the tops of the filaments by substantially straight portions meeting the top at an angle.

912,267. RESISTANCE; T. Von Zweigbergk, Preston, England. App. filed Nov. 28, 1906. The resistance consists of a series of grids separated by insulation, formed with slots alternately from opposite sides and are independently supported so as to provide ventilation space between them.

912,268. SYSTEM FOR METERING SERVICE ON THE LINES OF TELEPHONE EXCHANGES; C. M. Beattie, Rochester, N. Y. App. filed Sept. 9, 1907. A meter actuated when the telephone circuit is closed to show the number of calls and a separate meter for recording the length of time the line is in use.

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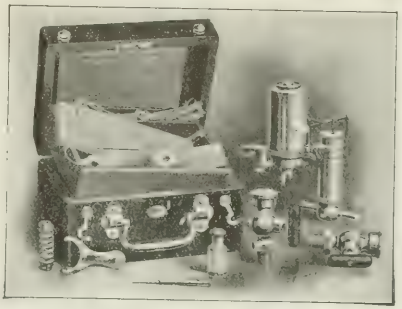
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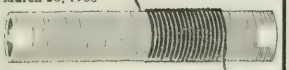
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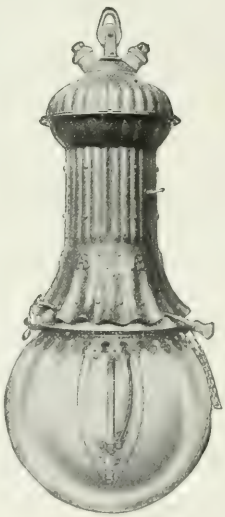


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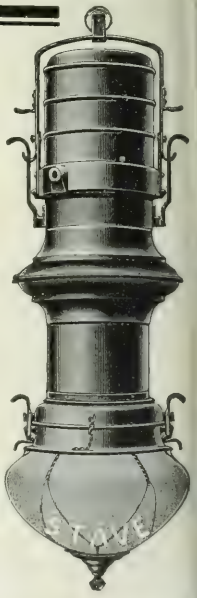
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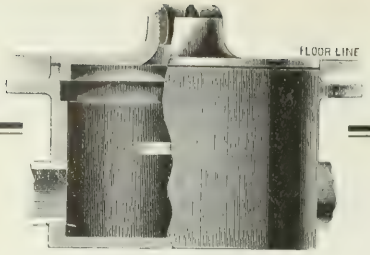
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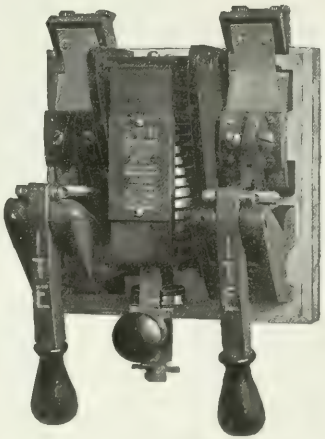
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THE METRIC SYSTEM.

A communication from Prof. M. Ch. E. Guillaume, in our correspondence columns this week, draws attention to the steady growth of the metric system throughout the civilized world, and even within the English-speaking countries that still cling to their time-honored medley of weights and measures with a persistence that the historians of the future will have difficulty in comprehending. M. Guillaume advocates legislative action to render the use of the metric system compulsory through all the States, territories and dependencies of the United States government. At the same time he points out that it is not necessary to await legislation before initiating metric reform. Individuals can do something, and associations can do much, by mutual action and agreement to inaugurate the reduction from our customary complexity to metric simplicity. At the present time, practically all of the scientific work of the United States is conducted in the metric system. Empirical work and work that, while it may be useful, does not rise to the level of being scientific, is commonly conducted in the customary system. In fact, a fairly accurate judgment ordinarily admits of being made as to the character of any quantitative work published in the United States to-day, by observing whether it is expressed in metric or in the customary measures. If it is expressed in metric measure, the work is likely to be of scientific value and of the first quality. If it is expressed in the customary local measure, the work is likely to be empirical and of the second quality. The vast majority of engineering work of all qualities is, however, carried on in the customary system.

Great Britain and the United States are the two last strongholds of old-time measures, but the situation is somewhat different between them in regard to the metric movement. Great Britain is the more conservative, and the less inclined to change of any kind; but she is surrounded at close range by a number of European countries, all devoted to the metric system, so that the constant contrast between their orderly simplicity of quantitative values and her own rambling habits of complexity is irksome and distressing. Moreover, the constantly increasing keenness of commercial competition with foreign countries using the metric system in their daily life makes the old-time measures of Great Britain a handicap in business. Here in the United States, the competitive commercial difficulty has not yet seriously arisen, while the country is so large and so far from Europe that the constant chafe of friction with metric measures is hardly felt. Consequently, the incentive to metric reform is less felt in the United States than in Great Britain. Moreover, each wishes to see the other take the medicine of metric reform first.

PHOTO-ELECTRIC CELLS.

Voltaic cells may be divided into two classes—namely, wet cells and dry cells—that is, cells which will spill out their electrolyte, when upset, and cells which will not spill out their

electrolyte which upset. The dry cell is thus, in effect, a sealed up wet cell, although the electrolyte is not identical in both. The dry cell commonly contains a porous non-conducting medium which holds the electrolyte as a sponge holds water. A new type of cell has recently come into the limelight of investigation, and may be regarded as an ultra-dry cell. It is known as a *photo-electric cell*. It seems not to be a voltaic cell in the hitherto accepted sense of that term, because its e.m.f. is not in accordance with the expected contact potential difference of its metallic plates. It is, however, a dry cell, in the sense that there is no liquid between its plates. There is a vacuous space between them, or in other words, a close approach to a vacuum takes the place of the ordinary electrolyte.

A recent paper in the *Philosophical Magazine*, by Dr. J. A. Fleming, describes a form of photo-electric cell, its construction, and some of its properties. The cell is a glass tube, supported horizontally when completed. It contains a pair of metallic plates, each connected to sealed-in platinum wires. The upper plate is a strip of platinum. The lower plate is a fluid amalgam of potassium and sodium, which resembles mercury in appearance. Such a cell is devoid of e.m.f. when unillumined, and does not conduct electricity, because the glass cell tube is exhausted to a relatively high vacuum and then sealed. The cell is, therefore, a highly exhausted vacuum tube. When, however, a powerful projection lantern has its projected beam of light concentrated upon the potassium-sodium plate, it is stated that an e.m.f. of about half a volt is produced, the amalgam forming the negative plate or positive pole, and the platinum the positive plate or negative pole, so that a current flows from platinum to amalgam through the vacuum tube or negative electricity passes from the illumined amalgam to the platinum plate. Of course, the internal resistance of a cell containing a vacuum for its electrolyte can hardly be very low. In the case reported, it was about 75,000 ohms, so that only some 5 microamperes of steady current were produced from the cell on connecting it directly to a galvanometer. Under such conditions the cell must remain a scientific study, and not a commercial rival in the dry-cell business.

The action produced in this interesting cell by the beam of powerful incident light is the liberation of negative ions from the surface of the liquid amalgam. These negative ions permeate the vacuous space, and bombard the opposed surface of platinum plate, where they deliver up their electric charge on impact. The electric current in the external circuit comes from this liberated negative electricity. It appears that, within the visible spectrum, the violet rays are the most effective in the beam of incident light stimulating the cell. On the other hand, the yellow and red rays appear to be inactive. It is, of course, needless to discuss, from an economic standpoint, the permanence and durability of a cell having so high a resistance. It would seem, however, that the energy of the cell is derived from without, rather than from within, or from the energy of the incident light rays, and not from chemical potential energy in its plates. Consequently, such cells might reasonably be expected to last a long period without replenishment or renewal. If it were possible to construct such cells with plate areas so large as to have internal resistances as low as those of ordinary voltaic cells, and if they could be stimulated to activity by ordinary sunlight, then perhaps a battery of st cells would deliver power indefinitely, taking the energy fr the electric intensity in the electromagnetic waves of the s light, and liberating this energy, or a part thereof, as a stea electric current stream. In other words, the cell appears act as a rectifier of high-frequency alternating emf. throu the intermediary of subatomic activities. While the extra-d cell is not practical at present, it is extremely interesting.

Auto-Transformer versus Rheostatic Inductio Motor Starters.

The relative advantages and disadvantages of auto-tran formers and rheostats for induction motor starters are ou lined by Mr. I. E. Hanssen in an article appearing in this issu The author finds that the rheostatic starter consumes conside able power, while the auto-transformer dissipates almost non and he therefore concludes that the latter is far preferable t the former. His observations are doubtless correct, and hi conclusions as to the relative merits of the two types of start ers are well founded if the comparative sizes, weights and cost of the two devices can be ignored. However, it is not im probable that in many cases the interest on the extra invest ment involved in the auto-transformer starter may more tha equal the cost of the extra kw-hours dissipated in the rheostati device during the starting period. The rheostatic induction motor starter is similar in operation to a direct-current starte connected in series with a motor whose armature and field coil are joined permanently in parallel. The objection that migh be urged against the latter type of starter relates rather to th poor torque than to the dissipation of power. The torque can be improved by subjecting the field coils to the full line e.m.f. at all times, the operation of the apparatus under the latter arrangement being similar to that of a slip-ring type of induction motor using extra resistance in its secondary circuit at start ing. The auto-transformer starter does not overcome the objection as to the low starting torque. Moreover, the extra volt-amperes taken by the rheostatic starter over and above the volt-amperes taken by the auto-transformer starter are directly in time-phase with the total impressed e.m.f. and hence have an inappreciable effect upon the voltage regulation. It would thus seem that the single important objection of extra power dissipation in the rheostatic starter may not always be sufficient to justify the extra cost of its older rival, the auto-transformer starter.

Effects of Light on the Eye.

Elsewhere will be found an interesting and suggestive paper by Professor Ashe on some of the relations of illumination to vision, which are just now often under discussion. The topic particularly considered is the relation of light-quality to visual acuity. There is already a large amount of literature on the subject, but, very unfortunately, it is scattered through the periodicals of several sciences, and very little of it is even adequately abstracted in English, so that Professor Ashe's article will be welcome to our readers. It is most inconvenient that the literature on so important a subject as physiological optics should be so difficult to find as it is. Since the last edi tion of Helmholtz, some 15 years ago, in which a good index up to 1804 was given, one has been compelled to grub in all

kinds of places for data. The researches have been published in physical, medical, physiological and psychological journals, and have been embalmed in the transactions of many societies often remote and unattainable. For example, the first great paper by von Kries on rod and cone vision is buried from American readers in the *Berichte* der Naturforschenden Gesellschaft zu Freiburg, 1895, and Uhthoff's splendid investigation of visual acuity reposes in Graefe's Archives, generally unknown save to ophthalmologists. For this reason there has been much repetition of work already done, and much time and labor would be saved were there an adequate index of the whole subject such as exists in some other branches of science.

Another stumbling block in the way of progress is that much of the work which has been done has neglected vital data of one sort or another. The functioning of the eye is profound, and unless this is clearly defined, the results are not properly comparable. For instance, while Professor Ashe's work was apparently done on the dark adapted eye, at least initially, other similar researches have dealt with the partially adapted or with the light adapted eye, and it is rather uncertain as to which state most fairly represents practical conditions in any given case. A still greater source of uncertainty lies in the character of the colored lights used where color vision is under investigation. To say that a light is red, green or blue means very little unless the exact color is clearly defined. To take the simplest kind of example, ordinary red such as is found in signal lanterns contains much orange and yellow, while the green contains much yellowish and bluish green. If spectral colors are employed, they must be clearly defined in order to give a basis of comparison. With some colored screens there is a good chance of shifting the effective color if the density of the screen or even the intensity of the light be changed; and in acuity measurements the extent of spectrum taken to represent any so-called color has a considerable effect, since, other things being equal, the more nearly monochromatic the light the sharper the definition. For example, a screen of "Hoffmann's violet" lets through enough red to make sharp vision very difficult, and some so-called blues have the same property. On top of all of this rest the unpleasant errors of color photometry, often big enough to hide wholly or partially the real phenomena under investigation. The moral of all this is that where investigations in physiological optics lead to discordant results when compared with similar work, one should not conclude that the work has not been thoroughly and skilfully done, but should investigate the conditions carefully to see in just what cases the results are applicable.

Perhaps the most important feature of Professor Ashe's paper is his very interesting investigation of the pupillary reaction due to the intrusion of bright light in the visual field. This is a matter of much practical moment, and its investigation requires a degree of care and patience that few readers will appreciate at its full value. The very practical observation that the intrusion of a single 16-cp lamp can decrease one's ability to read by something like 50 per cent. is one that we trust will be generally taken to heart. In spite of the competent of education in illuminating matters, nothing is more distressingly common than to find a room lighted with four lamps so placed that it is well nigh impossible to find a place to read where one or more lamps will not intrude. And it should not be forgotten that the peripheral image of the intruder on the retina may produce serious permanent injury, sometimes even involving loss of the eye. It is hard to lay too much emphasis on the care that should be taken to avoid this particular danger. The case is made all the worse by the fact, well shown in the paper before us, that the iris does not react as effectively to excentric lights as to those seen directly, and hence the eye cannot defend itself effectively against them. A comparison of considerable theoretical interest is that between excentric illumination by white and by green light on the extent of pupillary reaction. The result showed materially greater contraction from the green light than from white light of the same apparent intensity, the difference apparently being more conspicuous toward the extreme outer edge of the field. Now, Abelsdorff showed some years ago that in working with spectral colors and approximately central vision, the pupillary reaction depended on the relative luminosity of the several colors. This is, of course, a natural enough state of things, since, after all, relative luminosity merely indicates relative visual stimulation on the sensory apparatus.

The present observation shows the extension of the same principle to excentric vision in a very interesting way. For to cone vision, which more and more predominates as one gets away from the fovea, green is the most luminous color, and hence produces the stronger stimulus on the pupillamotive mechanism. The same predominance of green light in pupillary reaction was noted by Hess in the dark adapted eye of the owl, in which the retinal elements are chiefly rods. We hope that Professor Ashe may find time to extend his investigation to excentric acuity, a matter of great theoretical interest as yet rather imperfectly worked up. All the careful investigations of recent years seem to add weight to the rod-and-cone vision theory of von Kries, and therefore bear also on the much-mooted theories of color vision, particularly on the relative sufficiencies of the Young-Helmholtz and the Hering theories. From a practical standpoint, human rod vision is not extremely useful under ordinary condition. When the illumination falls so low that the cones go out of business, the seeing is altogether too poor to be worth cultivating, and it is time rather to call for more light. There is very little in the fanciful idea sometimes expressed that for street lighting a source rich in green is desirable on account of its greater value at very low illuminations. When the light is so feeble that such a change of color would be significant, more light is the only remedy of any particular use. The differences found by Professor Ashe in the acuity values of various colors are similar to those determined by previous investigations; but so far as quantitative values are concerned, the difficulties of color photometry in getting equivalent intensities are too great to permit comparisons of high precision. The practically important conclusion is that even for low intensities, variations from approximate white do no particular good and may do harm, while at any reasonable working intensity white is ordinarily to be preferred for reasons quite independent of acuity. The long and short of it is that the human eye has been developed for daylight, and while it is tolerant of the wide range that daylight really covers, it was [illegible] and is more than likely to [illegible]

Heroult Electric Steel Refining Process.

The United States Steel Corporation has, after a thorough investigation, decided to install Héroult electric furnaces at two of its plants. A 15-ton Héroult furnace is now being constructed for the South Chicago works of the Illinois Steel Company and one of the same size for the Worcester plant of the American Steel & Wire Company. A third installation will probably be made later at the Homestead plant. The capacity of each of these furnaces is about 300 tons per 24 hours. At the Chicago plant the process will be applied to the manufacture of a special steel rail of high-grade quality, and at the Worcester plant the product will be used for a special grade of wire. In the former the electric furnace will take molten steel from Bessemer converters and in the latter from open-hearth furnaces. The electric process is therefore simply a refining process in which the phosphorus and sulphur are reduced to amounts otherwise attainable only in crucible steel practice. At the same time the steel is thoroughly deoxidized and freed from all particles of slag. The largest Héroult steel furnaces formerly installed have a capacity of five tons. While the 15-ton furnaces of the U. S. Steel Corporation thus represent a trebling of capacity, the company contemplates the installation of even larger furnaces in future.

A. I. E. E. Anniversary Dinner.

Much interest is being taken by members of the American Institute of Electrical Engineers in the anniversary dinner at the Hotel Astor, March 11, celebrating the close of the first quarter of a century of its existence, and there is already evidence that there will be a record attendance. Owing to the difficulty in taking care of so many persons, members are requested that in filing their notifications they will designate with whom they would like to sit, making up complete tables of 8 or 10 persons. Table allotments will be made as rapidly as these requests are received, the location of the tables being determined by ballot. In connection with this dinner the council has made preparation for a special certificate of congratulation, which will be given to each of the charter members, of whom about 30 are now living, out of the total membership of 6200. Each of the branches and sections has been requested to have a special representative in attendance, and the various sister societies are to be officially represented on this occasion. The announcement as to speakers and other particulars of the program will be made next week.

Proposed New England Water-Power Developments.

The Connecticut River Company announces that its plans to build a dam acros the Connecticut River between Windsor Locks and Enfield call for the utilization of about 10,000 hp which are now going to waste. An additional canal will be constructed and the company states that the scheme will not interfere with any navigation projects. Electric power generated will be sold for industrial service. The Northern Connecticut Light & Power Company, which owns certain franchise privileges in the same territory, desires to have the Connecticut River Company's operations somewhat restricted, the case being in some degree parallel to the case of the Fitchburg Gas & Electric Company and the Connecticut River Transmission Company, now pending before the Massachusetts Gas and Electric Light Commission.

The Goodell Cutlery Company, of Antrim, N. H., is preparing to utilize the largest water-power privilege available on the Contoocook River by the construction of a 500-kw electric plant which will supplement the existing water power used by the company. A 500-kw generator and a set of horizontal water-wheels have been purchased, to operate under 80-ft. head.

The Oxford (Mass.) Linen Mills Company has bought land and water rights on Mad Brook, to develop water power for electrical transmission near North Brookfield. Power will be transmitted to the company's plant two miles distant. It is planned to build a dam 80 ft. high and 60 ft. long. From 150 hp to 200 hp will be installed initially.

Effect of Niagara Ice Gorge on Electric Power Plants.

It is highly probable that no single field has heard more of the great downpour of water at Niagara Falls than that associated with the electrical industry, for ever since man became interested in the development of electric power frequent reference has been made to the possibilities of Niagara, and these have served for comparison with the resources of other places in the matter of power. However, Niagara Falls has recently passed through an experience that was astonishing to the power interests, while the scenic lovers were amazed by the actual passing away, temporarily, of course, of one of the waterfalls that go to make up the world-famed Cataract.

The Falls of Niagara have several times before been in that condition termed "dry," but this does not mean actual dryness. On March 29, 1848, there was a memorable dryness, but not until March 22, 1903, were the residents again astonished by the conditions. In 1905 a similar spectacle existed, and this year the strange sight lasted over three days—Sunday, Monday and Tuesday, Feb. 14, 15 and 16. The unusual conditions are developed by a continued east wind, which has the effect of blowing the water back up Lake Erie, greatly lessening the discharge from the lake into the river channel at the foot of the lake. When this occurs in winter time, as on the dates mentioned, there is usually considerable ice in the river, and this lodges on bars and reefs at the head of Goat Island and in the upper river, as well as throughout the American channel between Goat Island and the New York mainland. With low water prevailing generally in the river, it is an easy matter for the mass of ice to divert what water might go through the American channel to the Horseshoe channel, and in this way the American channel is first to feel the changed conditions under such circumstances.

For three days the American channel was practically dry. Stretching far up the river from Goat Island was an ice field that swept by the inlet canals on the New York side. A little water trickled through here and there, finding its way toward the falls through the low dip of the channel close by the New York mainland, but beyond this toward Goat Island the river bed was high and dry, affording people every opportunity to investigate it at will and with great freedom. Men crossed from the mainland to Goat Island above the island bridges, and crossings were made from Luna Island to Prospect Park not far back from the brink of the American Fall, but this feat called for the protection of rubber boots. Others made their way up from Goat Island toward the inlets of the power companies.

While these unusual conditions prevailed, the depth of water in the surface canal of the Niagara Falls Hydraulic Power & Manufacturing Company, as well as in the inlet canal of the Niagara Falls Power Company, was materially reduced, neither company being able to carry its full power load. Practically the same trouble existed with the power plants on the Canadian side, and each one was kept very active during the days of the "dryness." Dynamite was used freely, particularly on the Canadian side, and after the water started to raise, the power companies were kept busy in opening a channel so that ice floes from Lake Erie might pass down stream freely instead of being retarded to interfere with the flow of water into the inlets.

Not until Wednesday morning, Feb. 17, was it observed that the wind had changed and Lake Erie had started to send her flood down to Niagara. The river did not quickly regain its normal condition. On the contrary, it took days, and it was only after many hours that Niagara resembled herself. During the period of time the river and falls were affected by the wind and ice, the American Fall presented a tear-dripped, shame-

laced appearance. It was indeed a ragged spectacle, as the face of the cliff was hung with huge stalactites, washed by a little stream here and there.

Considering what they passed through, the power companies feel that they came out of the battle victors. They hardly expect another such strife this season, and yet they admit there is no telling just when wind and ice will call them to a similar fight for water to keep their turbines going.

New York Public Service Commission Modifies Its Rate Regulation Order.

The New York City Public Service Commission has issued an order amending Section 4 of its order dated Dec. 18, 1908, and printed in our issue of Jan. 2, 1909, requiring that every electrical corporation shall print, post in its office and file with the commission, schedules giving all the rates charged or to be charged, forms of contract, riders modifying these forms and the general rules and regulations relating to rates, contracts and the use of electricity by the public and of apparatus furnished by the company. A clause of Section 4 of this order provided that "An exact copy of every form of contract and schedule of rates, each to be followed by an exact copy of every form of rider applicable thereto, shall be filed by the commission."

This order was accepted by all the companies within the jurisdiction of the commission except the New York Edison Company, the United Light & Power Company, and the Edison Electric Illuminating Company of Brooklyn, who objected to this particular clause, and at their request a rehearing was held on Feb. 5, a report of which appeared in our issue dated Feb. 11. As a result of this rehearing the commission has modified the clause in question so as to read as follows: "An exact copy of every form of contract and schedule of rates each to be followed by an exact copy of every form of rider applicable thereto; but any corporation may insert at its discretion in any contract a standard clause relating to any minor service condition, provided such standard clause shall first have been submitted by the said corporation and approved by the commission."

The principal objection made to the original order was that it would not allow the companies leeway upon "minor service matters." The companies stated that a consumer now and then insisted that there should be inserted in his contract an agreement upon the part of the company to read his meter weekly or on the first of every month, to render duplicate bills, to supply the most efficient type of lamps, to provide service connections at specific points, to locate the meter in a selected place, or perform some other similar service. To the suggestion that these matters be omitted entirely from contracts, the companies replied that they would gladly do so but that the consumer would not accept a verbal promise to that effect. The companies also claim that it would be impossible to grant these minor requests, it being impracticable for them to attempt to read meters for all consumers on the first day of the month, for example.

At the rehearing it was suggested by two of the corporations that they should be permitted in their discretion to insert or refuse to insert in any contract any clause relating to minor service conditions. This the commission refused to agree to, as it would open a way for an evasion of the entire order. In the amendment as adopted it will be necessary for a company to come to the commission and secure its approval before any change is made in the standard form of contract. The chief objection urged against the adoption of this amendment was that it would interfere with the freedom of the corporation. In regard to this objection, Commissioner Maltbie, in his opinion, says:

"Every corporation which performs a *public* service must, because of the nature of its business, submit to certain regulations which are not applicable to private corporations. Publicity of all rates, charges and service conditions is one of these, and equality of treatment is another. The assertion of the representative of one of the companies that the making of contracts is its 'private business' indicates that he has forgotten the generation in which he is living. If this were true, there would be no Public Service Commission."

As to the other objections raised by the three protesting companies, Commissioner Maltbie says: "The three protesting companies assert that the order limits the right of the companies to make contracts, and therefore is improper. But they are forced to admit that no public service corporation ever now has entire freedom to make any contract. If it had, it could make agreements containing discriminatory notes. Is their rights are limited to the extent that public service corporations cannot make unequal rates, why should they not also be prohibited from offering unequal service? Common carriers have been; why not electrical corporations, especially those which have virtual monopolies?

"But it should be clearly understood that the order in no way limits the right to make contracts, provided every person in a class is given the same rate and offered the same service, and provided the exact form of contract shall have been published so that every consumer may know what rates and service he may have as well as some favored consumer. The statement, therefore, that the publicity order makes it 'impossible for the company to obtain certain important classes of business and precludes the company from making any change in any form of contract' is inaccurate. The order does not prescribe directly or indirectly what a contract shall contain. Any company may make a rate as low as it pleases, give all the privileges it desires to give, and amend, extend and change in any way the forms of contract ad libitum. But it must treat every individual in a class alike, and it must publish its forms of contract so that all may see them.

"Further, the commission, in Order 823, does not undertake in any way to pass upon the propriety or impropriety of any form so established. Doubtless Order 822 against discrimination, etc., and Order 823, requiring publicity, prevent a company from offering special rates or special privileges to one prospective consumer that are not offered to all, and possibly there may be persons who will not take current from a supply company unless they are given a discriminatory contract. But this is no adequate reason why discriminatory contracts should be permitted, and the companies that make such an argument are most illogical when they say so. The same argument was and could still be urged against the law requiring common carriers to print, post and file their schedules; indeed, every objection made by the three companies applies equally to the requirements as to common carriers; but no public body would think of returning to the condition which once existed where rates and privileges were secret matters and only favored shippers knew what could be obtained. Even those who were favored one day were outside of the inner ring the next. Publicity of such matters has come to stay.

"The three corporations asking for this rehearing assert that the commission has no power to issue Order 823. The commission believes that it has this power. However, if the Legislature has not conferred the necessary authority to do such a reasonable thing as to require rates, contracts, etc., of electrical corporations to be publicly posted and filed, like those of common carriers, it is a fact that ought to be made known to the Legislature and to the public generally as well as to this commission."

In commenting upon the modification of the order of the commission, Mr. Henry J. Hemmens, counsel for the New York Edison Company, said that there is no doubt in his mind that the requirement for the publication of all contracts and every possible form of rider, condition or change of a word or phrase or sentence in a contract is, on its face, unjust, unreasonable and unwarrantable, and might even be construed as an interference with the detail of the business management of the corporation. To enforce such an order as the Public Service Commission issues would, he said, place the electric companies in the position of being arbitrary with customers, instead of trying to

meet the convenience of the public in every way where they can do so without unreasonable or improper discrimination. He said he knew of no case where any public authority or commission, with or without the necessary statutory powers, has ever undertaken to make such arbitrary, unreasonable and restrictive regulations over the conduct of a business. It is emphatically denied by the electric companies that they are discriminative or seek to discriminate, although that intimation might be inferred from a published interview with Commissioner Maltbie.

"The interstate commerce law specifically gives certain powers to the Interstate Commerce Commissioners with reference to publicity, schedules of rates, etc. We do not find that the Legislature of this State has conferred any such power on the Public Service Commissioners with relation to electric companies, nor do we believe that the Legislature ever intended that the commission should have such powers under the statute as it has assumed."

Hearing on Connecticut River Transmission Company's Franchise.

The Massachusetts Gas and Electric Light Commission gave a second hearing at Fitchburg on Feb. 9 on the petition of the Fitchburg Gas & Electric Company remonstrating against the terms of the franchise granted by the Board of Aldermen of 1908 to the Connecticut River Transmission Company. An account of the first hearing appears in the issue of Feb. 11. The full board was present. The transmission company was represented by Mr. Jeremiah F. Smith, Jr., of Boston, and Mr. David I. Walsh, of Fitchburg, and the Fitchburg company by Mr. Everett W. Burdett, of Boston, and Mr. Charles E. Ware, of Fitchburg.

Mr. N. C. Grover, of J. G. White & Company, constructing engineers for the transmission company, was first recalled by Mr. Burdett. Questioned about the records of floods occurring on the Connecticut River at Vernon, Mr. Grover stated that he had found certain flood marks of freshet water and ice formation on trees and other objects at a grade possibly a little above the level of the top of the Vernon dam. In times of high freshets the dam would probably be submerged, leaving the wheels inoperative. The wheels would probably not operate with a head of less than 12 ft. or 15 ft. between head water and tail water. With 10 ft. of water over the top of the dam and a reduction of the same amount below, the wheels would operate. If the wheels were run below normal speed their efficiency would be somewhat reduced. From French King Rapids to Vernon is a distance of about 16 miles, and the slope of the river between these points is not much over 9 in. per mile. A rise of 20 ft. in the French King gorge would carry the water above the top of the Vernon dam. There is no other way of escape for the water at the French King Rapids, in case it backs up. The height of the dam at Vernon is 30 ft. without flashboards, and 34 ft. with them. The use of flashboards might dam up the river to some extent and thus restrain the flow. A rise of 25 ft. in the river would give a rise of about 12 ft. of water above the dam. The flashboards would be used only in times of low water. Thirty miles above the Vernon dam is the dam of the Bellows Falls Canal Company. The charter of the Connecticut company forbids it to back water up over the Bellows Falls dam, but Mr. Grover did not think the Bellows Falls property would be affected within 2½ miles of the latter's tail-race.

In redirect examination by Attorney Smith Mr. Grover emphasized the fact that these freshet marks were those of floods occurring at long periods of 50 years or more, as indicated by the records of the United States Geological Survey for Sunderland, Mass. Each generator is provided with three waterwheels, one of which is utilized during flood periods, and not in low stages of the river. A diagram was presented to the commission showing the estimated amount of auxiliary steam power that would be necessary for supplementing the river power at times of low water, but not in times of flood. The estimated yearly output of the plant is 50,000,000 kw-hours, of which the steam auxiliary is expected to furnish about 6,000,000 kw-hours in an average year's flow. The flood periods would of course be of much shorter duration than those of low water. The auxiliary steam plant would naturally increase the expense, but it is necessary to give the proper service. The testimony of a number of motor users was then taken to show that they were in favor of the cheaper energy promised by the transmission company.

Mr. Charles I. Main, of Boston, who was then called by the transmission company, has been identified with the work as a consultant since its inception. He had examined the records of the Holyoke Water Power Company, and had made allowances for the difference in drainage area at Holyoke and Vernon. On this basis he felt that once in 25 or 50 years it might happen that the Vernon plant would go out of commission on account of freshets. Perhaps once in 10 years the backwater might make it possible to deliver only the primary power of the station. Nearly every year the river could provide power without the use of auxiliary steam plants more than three months of the time, the latter being not necessarily continuous. The Vernon plant would not be affected any more than many of the installations on the Merrimac River, for example. It will probably be necessary to retain part of the night flow of the river in order to carry the load on the plant the next day. This holding back of the water would occur in the times of low flow in the river. If the highest output of the Vernon plant should occur mainly in the 12 hours of each day instead of a lower output continuously, the water would flow out of the basin so rapidly that it would be necessary to utilize storage at night. The flow into the pond above the French King Rapids could be made more even by the construction of a second dam at French King, and with this done, and with the use of flashboards at the Turners Falls dam below French King, the irregularities of the flow of the river could be overcome to a large extent.

Under cross-examination Mr. Main said that the Vernon dam is now practically completed and that the company should be able to furnish electric energy early in the coming summer. The French King dam is needed mainly to back up the water toward Vernon in case 12-hour power mainly is sold by the Connecticut River company. A steam auxiliary is absolutely necessary in order to be able to deliver power to anywhere near the full capacity of the plant. The capacity of the plant on the hydraulic end at Vernon without the creation of a basin or steam plant construction is estimated at about 2775 hp for 24 hours. If the company was not obliged to supply anything but secondary energy it would not be necessary to have the storage basin, but for the operation of a well-rounded and practicable scheme auxiliary steam plant capacity and the dam at the French King Rapids are absolutely essential, while a storage reservoir above the Vernon dam is highly desirable from the business standpoint. If only secondary energy were sold, supplementary steam capacity would not be needed, but practically it is certain that both kinds of energy will be demanded. Primary energy is essential in dealing with the small consumer, who usually has no plant of his own. Mr. Main was not surprised that in the three months beginning Sept. 30, 1908, the average 24-hour hp available at Vernon was about 2786, with only 2250 hp available for a portion of that time. He admitted that a storage basin is a necessity under such conditions.

Attorney Smith stated that the estimated cost of the whole work, exclusive of the proposed dam at French King, exclusive of steam plant capacity, but including transmission lines and all the plant, with its hydraulic construction, would be about $2,500,000. It is not planned to erect a steam plant at Vernon; it may be built anywhere, or the plants of customers who will use secondary energy may be turned to account to help out the transmission company in times of low water. Mr. Main defined primary energy as that which can be delivered from water without any steam plant assistance except once or twice in 50 years. Secondary energy was defined as the excess above

the primary which can be delivered at any time. The cost of the Vernon development would be about 25 per cent more than the development at Taylors Falls, Minn., per horse-power on account of the lower head. The general result is that as the head increases the cost of development per horse-power decreases. The maximum capacity at Vernon is about 16,000 hp, the initial installation being five 2500-kw units. To fulfil the whole requirements at the full output of the plant in all seasons, it might be necessary to install a large capacity in steam plant auxiliaries. Mr. Main stated that the wheels would give 2000 kw per unit down to about 18-ft. head, against 2500 kw at full head. A 5000-hp steam plant would practically take care of the extreme high-water conditions. The dam at French King could probably be built in one season.

Mr. Kenneth B. Thornton, of J. G. White & Company, then testified for the transmission company that the estimated cost of operating the plant when finally completed would in an average year be about $153,900. This estimated a steam plant production of 6,000,000 kw-hours at 1 cent per unit. This total sum did not include depreciation. It was figured that the plant would sell 50,000,000 kw-hours per year at 1 cent, bringing in $500,000. The taxes were figured at 4 per cent of the gross earnings, or $20,300; salaries of officers, directors' allowances, and office expenses were $12,500; depreciation, 2 per cent of the cost, $50,000; and interest at 6 per cent, $150,000. The total expenses were figured at $353,000 in an average year. The labor cost at the plant was estimated at $10,260, covering the services of a superintendent, shift operator, assistant operating foreman and machinists for two daily shifts. The labor cost of operating the transmission lines from Vernon to Clinton was figured at $6,960. Mr. Thornton stated that the transmission company planned to make reciprocal energy contracts whereby it might dispose of a considerable amount of secondary energy to consumers large enough to hold in reserve steam plants of their own, which could be turned into the system to help out in the production of primary energy in times of low water. The hearing was then continued to Friday, Feb. 19.

Annual Meeting of American Electrochemical Society.

The annual meeting of the American Electrochemical Society, which is to be held at Niagara Falls on May 6, 7 and 8, promises to be one of the most important gatherings in the history of that society. During the year Mr. Acheson has been president of the society unusual efforts have been made to secure new members, and the growth has been most satisfying. Thus the old members and the new members will have opportunity, in many cases, to meet and extend greetings for the first time and realize that they have become united in what appears likely to be the greatest field of industry.

Special efforts are being made to interest electrometallurgists in the society, for it is realized that this society has more in it for workers in the electrometallurgical field than any other organization. This is particularly true at this time, when the electrical furnace is being adapted for steel making. It is worthy of note that the first day of the convention is to be devoted to papers on metallurgy of iron and steel.

A letter has been received from M. Gustave Gin, of Paris, in which he promises to send in "an important paper." M. Gin has worked on several types of electro furnaces in the manufacture of calcium carbide, ferro-alloys and steel. His principal steel furnace is installed at the Krupp Works. M. Girod has cabled that he will send a paper. The Girod steel furnace is a type of which little is known in this country, although it is being extensively exploited in Europe.

Mr. John Hay, manager of the Grondal Kjellin Company, Ltd., has written that a paper mill will be sent by Dr. Kjellin. The latter is the inventor of the Kjellin furnace, and is one of the directors of the European company which makes several different kinds of furnaces, using the induction principle. Dr. Kjellin's paper will include much interesting data on the new 8-ton Röchling-Rodenhauser steel furnace, working at Volklingen, Germany, about which nothing has yet been published. This furnace has now been working for some time, and has been giving unexpectedly good results.

A paper on the Héroult steel furnace is expected from Mr. Robert Turnbull, who for several years has acted as Dr. Héroult's chief engineer. This paper is likely to be of unusual interest because two of this type of furnaces are being built by the U. S. Steel Corporation.

In addition to these papers others are expected from the principal workers in the electrometallurgy of iron and steel, such as Keller, Stassano, etc. Dr. Haanel, who has recently returned from Sweden, has also been invited to present a paper

Dr. Bell on Street Lighting.

Dr. Louis Bell delivered an instructive illustrated lecture on "Street Lighting" at a meeting of the New York Electrical Society, held on Feb. 17. The lecture dealt largely with foreign practice, which he held to be much in advance of American practice with reference to the lighting of the principal streets of cities. It has not been uncommon in the past for foreign cities to expend five times as much electrical energy per mile of street and to use lighting units twice as efficient as found in this country. Moreover, the lamps are better arranged for effective illumination than in America. The enclosed arc lamp that has been considered standard in this country has never been adopted for general illumination abroad. It consumes about 1 watt per candle as compared to ½ watt per candle taken by the open arc lamp. Dr. Bell explained that the inability to obtain suitable carbon electrodes cheaply for the latter lamps at a reasonable price was the chief cause for the adoption of the enclosed lamps in America. At the present time the highly efficient yellow flaming-arc lamps, both with vertical and with inclined electrodes, are displacing the older open carbon arc lamps in foreign cities, while American cities have been slow to abandon the uneconomical enclosed arc lamps for street contracts.

During the lecture, an operating display was made of the various types of lamps that are in use for street lighting, including open and enclosed carbon arc lamps, the magnetite lamp, the indoor miniature white flaming-arc lamp, the yellow flaming arcs with vertical and with inclined electrodes, carbon, Gem and tungsten incandescent lamps. The operating characteristics of each type were fully explained.

By means of numerous lantern slides, Dr. Bell showed in what respect the foreign methods of placing the lamps differ from the methods used in America. The height of suspension is usually from 50 per cent to 100 per cent greater than the height employed here. In many places the lamps are hung from brackets supported from houses, while the common method is to place along the center of the street at frequent intervals artistic poles, each carrying from 2 to 12 flaming-arc lamps. One very interesting and novel view was of a four-story building with four quartz mercury-vapor type of lamps on roof fixtures, giving the tremendous volume of 12,000 cp on the street. There was an interesting discussion by Messrs. Farley Osgood, C. F. Scott and others. Mr. Theodore Beran presided.

Minnesota A. I. E. E. Section Meeting.

The Minnesota section of the American Institute of Electrical Engineers held a regular monthly meeting Monday evening, Feb. 15, at the offices of the Twin City Rapid Transit Company. The Institute paper of the evening was "Prime Movers," by Charles Proteus Steinmetz, of Schenectady, N. Y. The discussion was led by Dr. H. T. Eddy, of the University of Minnesota. Officers for the ensuing year were elected as follows: Chairman, Barry Dibble, St. Paul; secretary, J. C. Vincent, Minneapolis; executive committee, Arthur L. Abbott, of St. Paul, Edward P. Burch, of Minneapolis, Barry Dibble, of St. Paul, L. H. Seefeld, of Minneapolis, and J. C. Vincent, of Minneapolis.

Prime Movers.

At a meeting of the American Institute of Electrical Engineers, held on Feb. 19, a paper by Dr. C. P. Steinmetz entitled "Prime Movers" was read in abstract by Mr. Ernest J. Berg in the absence of the author. In addition to outlining the characteristics of the various hydraulic steam and gas turbines and steam and gas engines, Dr. Steinmetz discussed the cost of electrical energy as affected by the interest on investment, the operating expense and the so-called "reliability insurance." In connection with reliability insurance the interruptions in electric energy supply systems were arranged into four classes, distinguished according to the length of shutdowns. In Class A were placed shutdowns of less than one second; Class B, shutdowns of less than 20 minutes; Class C, less than three hours, and Class D more than three hours.

According to Dr. Steinmetz, in estimating the reliability of service the shutdown of a part of a system would be considered as a part of a shutdown in proportion to the connected load. Voltage variation beyond the limits permissible in good service —about 2 per cent in lighting and 10 per cent in industrial supply—would be considered as a partial shutdown, about in the following manner: The voltage variation of from 2 per cent to 10 per cent would be considered as one-tenth of a shutdown in a lighting system, but would not be counted in an industrial system. A voltage variation of from 10 per cent to 50 per cent would be considered as one-half of a shutdown; a voltage variation of over 50 per cent would be considered as a complete shutdown. In order for a service to be considered first-class there should be less than four Class A shutdowns, and less than one Class B shutdown per year, and there should be no Class C or Class D shutdowns. Good service would permit of as many as 12 Class A, 4 Class B and 1 Class C shutdowns per year. Second-class service would be that in which there were not over 52 Class A shutdowns, 12 Class B, 4 Class C and 1 Class D. When the shutdowns exceed the above values the service would be considered either third-class or as entirely unsatisfactory.

Dr. Steinmetz discussed thermodynamic cycles using steam and air as the working fluids. He showed that the available energy of the air cycles per kilogram of air is insignificant until high temperatures are reached and that even at a temperature of 800 deg. C. it is still much lower than that of the non-condensing steam cycle. It must be considered, however, that the volume of steam per unit weight is 58 per cent greater than that of air at the same temperature and pressure. The thermodynamic efficiency of the air cycles is less than that of the steam cycles for lower temperature, but rises far above it at higher temperatures. He stated that the gas-engine cycle shows a very much higher thermodynamic efficiency than does the steam-engine cycle; even when allowing for the lower mechanical efficiency resulting from the higher mechanical stresses the efficiency of the gas engine is still very far above that of the steam engine, especially when gaseous fuel is directly available and no producer plant is required.

In discussing Dr. Steinmetz's paper, Professor Charles E. Locke expressed his regret that the author was not present because he questioned the accuracy of certain of the demonstrations. He stated that the usual expression for the thermodynamic efficiency has no direct bearing on the actual efficiency, but represents merely a limit beyond which it is impossible to go. He said also that in the gas engine no account need be taken of the temperature changes. What one is interested in is the ratio of the energy transformed into work to the energy contained in the gas. He stated that in thermodynamics it is possible to draw almost any conclusion that one may wish, provided he makes initially those assumptions which will permit of such conclusions, and expressed his belief that the assumptions made by the author were not in accord with results practically obtainable.

Mr. D. B. Rushmore said that in comparing different installations of prime movers, it is necessary to take into account the fact that the gas engine has a very much smaller overload range than has the steam engine, while the overload range of the steam turbine is enormously greater than even that of the steam engine.

Mr. Henry E. Longwell compared the results obtained in the operation of a generating station with the product from a manufacturing establishment, and claimed that good results depend equally as much upon personal factors as upon the equipment installed.

Mr. Calvert Townley drew attention to the efforts that are now being made for placing a high tax upon water-power developments. He expressed the opinion that such action does not produce the desired result because developments should be encouraged as much as possible. Many persons have mistaken impressions concerning the profit to be derived from hydro-electric installations. When one takes into consideration the large variation in the flow of water, the necessity for providing reserve equipment and the low loading factor of the output, he will appreciate the fact that the interest on the investment represents a large proportion of the cost of producing the electrical energy. In fact, in many cases it is much cheaper to install a steam station than to depend upon hydraulic developments.

President Ferguson announced that at the next meeting of the American Institute of Electrical Engineers a paper dealing with industrial power will be presented by Mr. B. R. Shover, of the Indiana Steel Company.

Street Lighting Discussion at Chicago.

The Chicago section of the Illuminating Engineering Society at its meeting Feb. 18 discussed a paper on street lighting by Walter C. Allen, of Washington, D. C. Much of the discussion centered about the conditions actually existing in Chicago.

Mr. Wm. Caroll, city electrician, was asked many questions as to costs of various types of lighting. He brought out the interesting fact that in 13 years the total cost of lighting the streets of Chicago has decreased 7 per cent, while the candle-power has increased 300 per cent. This has been brought about by the substitution of arc lamps and gas mantle burners for the old flat flame gas burners with which a large part of the lighting was done 13 years ago. The city has a variety of methods of street lighting, including arc lamps furnished by the city, arc lamps furnished by a private company, gas-mantle burners, open-flame gas and gasoline mantle burners. The present gas mantle burners cost the city about $19 per year, each, burning all night every night, including all costs of maintenance. The flat-flame open gas, although consuming more gas, costs only about $17 per year.

Chairman Cravath called attention to the very meager lighting provided in the majority of smaller towns throughout the Central States, where arc lamps are placed only on every other corner. He showed that with tungsten lamps of 80 cp placed on each corner much better results can be secured than with a 6.6-amp, alternating-current, series enclosed arc on every other corner, although even with the tungsten lamp on each corner the illumination would leave much to be desired.

Investigation of Michigan Hydro-Electric Companies.

Following a newspaper rumor that certain Michigan hydro-electric companies have formed a combination for the purpose of gaining control of all valuable water-power rights in the State, the Michigan Legislature has appointed a committee to investigate the hydro-electric companies of the State, which will also take up the question of the power to revoke grants of water-power privileges. In the discussion of the latter question, it is stated that the Supreme Court of the State has held that a navigable stream is any which may be used to convey valuable flotage, thus making practically every stream navigable; and it is contended that in consequence all water-power companies are merely holding their rights by sufferance and that all grants are subject to revocation by the State.

Meeting of Fort Wayne A. I. E. E. Section.

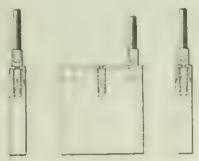
At a meeting of the Fort Wayne section of the American Institute of Electrical Engineers, held Thursday evening, Feb. 11, Mr. J. J. A. Snook opened the discussion of the subject of "Electric Heating," covering in a general way the different grounds upon which this subject has been advanced to the present time and the prospects for its future progress. In the discussion which followed attention was directed to the electric heating of cars on the railroad lines which at the present time are being electrified. Attention was also paid to the subject of electric furnaces, such as those now being developed for the treating of tool steels. The discussion then turned to the subject of electric welding, both by means of heat applied by the direct flow of current and by means of the electric arc. Several of the members detailed their experience in this line and gave interesting information for the benefit of the others present. At the next regular meeting, Mr. T. R. Cook, of the Pennsylvania Railroad, will present a paper on railroad car lighting.

February Meeting of the Pittsburg A. I. E. E. Section.

The regular February meeting of the Pittsburgh section of the American Institute of Electrical Engineers was held at Carnegie Institute on Feb. 9, 1909, Mr. W. Edgar Reed, chairman, presiding. The usual dinner preceding the meeting was held at the University Club. Mr. L. F. Howard, of the Union Switch & Signal Company, presented an original paper entitled "Railway Signaling," which was illustrated by means of lantern slides. Invitations were issued to leading representatives of the railway systems in and about Pittsburgh, as the subject of application of electric signaling to both steam and electric railway systems was considered. The discussion was participated in by Messrs. T. H. Patenall and A. G. Wilson, of the Union Switch & Signal Company; Mr. I. S. Raymer, of the Pittsburgh & Lake Erie Railroad; Messrs. H. L. Kirker and A. W. Copley, of the Westinghouse Electric & Manufacturing Company, and Mr. Wm. Hoopes, of the Aluminum Company of America. The next meeting is to be held on the second Tuesday in March and will deal with the application of electricity to steam railway systems.

Securing Conductors to Carbon Brushes.

The ordinary method for "pig-tailing" a carbon brush is to drill a hole through the brush near the upper end; fit a brass bolt snugly to this hole; solder the pig-tail to the end of the bolt and secure the latter to the brush by means of a nut and washer on the front face of the brush. If the brush holder has

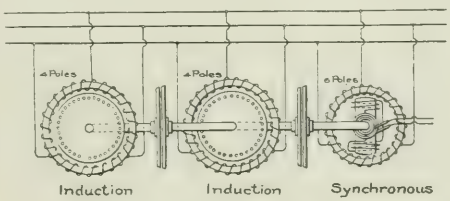


SECURING CONDUCTORS TO CARBON BRUSHES.

no slot down the front of the box to accommodate the nut, the latter is countersunk flush with the face of the brush. There are also numerous patented arrangements for securing the conductors to the brushes. In one, the outer end of the brush is provided with two or more cavities, the end of the brush being covered with a plate from which split pins project into the cavities, a flexible conductor being connected to the plate. With this arrangement it is necessary that the distances between the cavities and the pins be equal and that the pins be parallel, or else difficulty is experienced in applying the plate to the end of the brush. Mr. Norman W. Storer has patented a somewhat similar arrangement shown herewith. In this there is but a single cavity in the outer end of the brush and one or more recesses in the face of the brush in which projecting portions of the plate may be located. The arrangement has the advantage that the parts may be made interchangeable without the exercise of extraordinary care in drilling the cavity for the split pin or resilient wedge. The pin serves to retain the end plate in position while the lips or projections serve to prevent lateral displacement of the plate. The latter also serves as a wearing piece upon which the spring-pressed arm of the brush holder may rest.

Turbine-Driven Asynchronous Generator.

The accompanying illustration shows in diagram form a turbine-driven generator patented by Mr. E. J. Berg on Jan. 19. The turbine is divided into two stages, the adjacent wheels of which are mounted on the same shaft, while the two outer wheels have individual shafts. The three shafts drive three generators wound for the same e.m.f. and operated in electrical



TURBINE-DRIVEN ASYNCHRONOUS GENERATOR.

parallel. Two of the generators are of the induction (asynchronous) type arranged for high speed, while the third is a lower-speed synchronous alternator, which is excited by direct current and supplies alternating current for exciting the induction generators and assists in carrying the load. The generators deliver the same frequency, but each type operates at the speed best suited for its construction.

Quartz Tubes for Mercury-Vapor Lamps.

Two patents issued Jan. 26 to Dr. C. P. Steinmetz are of particular interest at this time by reason of the date of application being in 1902. The patents relate to mercury-vapor lamps, in which use is made of quartz tubes so that the temperature of operation can be much higher than is possible with glass tubes, and thus the efficiency can be increased and the color of the light improved. In forming the lamp tube a carbon conductor is embedded in a mass of quartz granules. Current being passed through the carbon, it becomes heated and the neighboring quartz is fused to form a shell around the conductor. The tube is allowed to cool and the carbon is burned off by means of an electric arc. The leading-in wire is made of a composition of steel with 37 per cent of nickel, which has the same temperature coefficient of expansion as the quartz.

The leading claim of one of the patents, the application for which was filed on Nov. 17, 1902, reads as follows:

"In a vapor-electric device, an inclosing chamber formed out of fused quartz and provided with means for conducting thereinto." A modification is covered by the second patent, the leading claim of which is as follows:

"As an article of manufacture, a tube having a body portion formed of fused quartz and end portions formed out of fused quartz, combined with potassium."

The object in using the potassium in the end portions is to form glass into which platinum wire can be sealed in the usual manner.

In connection with the above patents it is interesting to note that the application for the United States patent, issued to Richard Kuch, of Hanau, Germany, on April 7, 1908, was filed

on Dec. 7, 1903. As noted in our issue for May 2, 1908, this patent described the phenomena in mercury-vapor lamps operated at high temperatures. Considerable information concerning the Küch lamp was given in our issue for Oct. 19, 1907.

CURRENT NEWS AND NOTES.

TUNED WIRELESS.—According to a newspaper dispatch, the naval wireless station at Washington recently was transmitting and receiving from four separate sets of apparatus in communication with the battleship fleet, the various instruments being differently tuned.

EMPLOYEES SHAREHOLDERS IN MACKAY COMPANIES.—According to the recent annual report of the Mackay Companies the employees of the Commercial Cable and Postal Telegraph & Cable Companies hold shares in the Mackay Companies to the value of $2,000,000.

UNIVERSITY OF VIRGINIA ENGINEERING SCHOOL.—The University of Virginia has succeeded in raising the fund of $500,000 necessary to secure a similar sum from Mr. Andrew Carnegie. Part of the donation of the latter will become a permanent endowment fund of an engineering school.

SECRETARY NEWBERRY ON STATIC WIRELESS.—According to a newspaper interview with Secretary of Navy Newberry, that gentleman ascribed the failure of wireless communication with the returning battleship fleet to the atmosphere being surcharged by amateurs "with static electricity, which prevents wireless communication."

RAT SHUTS DOWN CENTRAL STATION.—The generating plant of the Fall Mountain Electric Light & Power Company, at Bellows Falls, Vt., was recently caused to suspend operations during lighting hours by a rat. The main fuse at the station blew, and after a search as to the cause it was found that a large rat in running across an oil-switch had been electrocuted; and his body becoming carbonized, had formed a short circuit on the mains.

REMOTE MOTOR CONTROL.—Mr. Charles A. Dresser, superintendent, Kohler Brothers, addressed the noonday meeting of the Chicago Electric Club on Feb. 17 on the subject of "Remote Motor Control." He spoke briefly, taking up the old hand-control methods and concluding with a statement of some of the advantages of modern remote-control methods which take the rate of acceleration entirely out of the hands of the operator and regulate it automatically.

WIRELESS TELEPHONE ON BATTLESHIP CRUISE.—Recent reports from Washington that the wireless telephones installed prior to the departure of the battleship fleet on its cruise around the world were a failure, are contradicted by the accounts of their working given by newspaper correspondents with the fleet. One of these writes the telephones more than met the expectations of the officers, though they could not be used when the wireless telegraph held the air.

COMPULSORY WIRELESS.—The Burke bill for the compulsory use of the wireless telegraph on various classes of vessels carrying passengers has passed the House of Representatives. The bill is meeting with some opposition in the Senate, and may not be reported out of committee. Mr. E. T. Chamberlain, Commissioner of Navigation, has urged its amendment by requiring all companies to exchange messages in time of distress or emergency, and a representative of coastwise steamship companies argued for a provision preventing the formation of a wireless combination.

LECTURES ON WIRELESS TELEPHONE AND TELEGRAPH SYSTEMS.—Mr. Theodore I. Jones, of the United Electric Light & Power Company of New York City, will lecture for the Department of Education in Public School No. 152, Avenue G, between East Twenty-third and East Twenty-fourth Streets, Brooklyn, on Thursday evening, Feb. 25, on wireless telephone and telegraph systems. Mr. Jones will discuss the principles underlying the wireless transmission of electromagnetic waves for the transmission of speech, telegraph signals and electrical energy. Wireless apparatus will be shown in operation and stereopticon views will illustrate the lecture.

AMERICAN INVENTION REVOKED IN GREAT BRITAIN.—The British government has revoked a patent covering an American invention for the production of a lock-stitch sewing machine "capable of operating at a very high speed with smoothness, ease, and but little noise, upon either thick or thin work." The grounds of revocation were that the machines as imported in Great Britain have hitherto been wholly manufactured in the United States, and since the new patents act came into force the patentees have taken no steps to comply with the compulsory working clause under which their patent is now revoked. The patentees have to pay the applicants for revocation 40 guineas in respect of costs.

MUNICIPAL PLANT TO BE SOLD.—The courts have sustained an ordinance providing for the sale of the municipal gas, electric and pumping plant of Fairfield, Ia. The purchase is made under stipulated prices of water and light. The machinery at the pumping station is to be turned over to the private concern completely, but the poles and wires are to be returned on demand in as good condition as they were received. The price to be paid the private company is considerably less than the present cost to the city, and it is further claimed that the city's machinery is so nearly worn out that $50,000 must be expended soon to replace part of it. The private company expects to make these improvements at once.

TELEPHONIC SECRECY.—Two bills have been introduced in the Ohio Legislature here making it unlawful for anyone to eavesdrop during a conversation over a telephone, tap telephone wires, repeat a conversation heard over a telephone wire or interfere in any other way with the service. Some crudities have been found in the bills as presented, and it is possible that a new bill will be drafted and the main features of both included in it. As they now stand no one would be able to use another's telephone without committing a crime. The principles of the bills are favored by most of the members of the Legislature, it is said, on account of the complaints that have been made from time to time regarding the interference with telephone lines.

CHAMBERLAIN LIBRARY SALE.—The library of the late Mr. J. Chester Chamberlain, to which reference was made in a previous issue, was sold last week by the Anderson Auction Company. The 882 items catalogued brought $32,000. As stated previously, the collection represented solely first editions relating to 10 American authors. A volume containing several poems by Edgar Allen Poe, which was a presentation copy from the author's sister, brought $2,900. A copy of the "New England Tragedy," in prose, by Longfellow, of which there is said to be only one other copy, was sold for $2,200. A copy of "New England's Masterkey," by Holmes, which was one of six copies printed, brought $750, and the same author's own copy of another work was sold for $745. The first edition of Hawthorne's "Fanshawe" brought $500. A collection of 500 letters and 37 postal cards written by Longfellow to an intimate friend brought the highest price of the sale—$5,100. One of the reasons for the high prices obtained at the sale was the condition of the books, most of which were handsomely bound, but in such a manner as to preserve the original covers. The collection sold was only part of the library of Mr. Chamberlain.

Combination Stations in the Rochester System.

IN THE bottom of the gorge below the Upper Falls of the Genesee River and on the left bank is located Station No. 2 of the Rochester Railway & Light Company. This station is reached by a passage leading from Brown's Race, on the street level, 75 ft. above, and much of the approach is hewn out of the solid rock. Station No. 2 is a combination generating plant, containing both steam- and water-driven units, the former being



FIG. 1.—WATER-DRIVEN BIPOLAR MACHINES IN STATION NO. 2

chiefly held in reserve. A penstock 6 ft. in diameter and about 200 ft. long leads from the race above down the rock passage referred to, the available head being 90 ft. Beside the penstock is an iron chute leading from the street to the boiler room. Through this chute the boiler room receives its supply of coal.

The station is of substantial construction, and houses the following equipment: Seven Leffel turbines, each rated at 450 hp and belted to shafting to which are connected 1800 kw in Edison bipolar machines. Three 500-hp Couty engines are belted to a line shaft, to which 800 kw in Edison bipolar machines are connected. To this same shaft are connected three of the water-wheels, so that normally the generators are turbine driven, and under low water conditions they are steam driven. Besides the three engines mentioned there are 11 other engines belted direct to 20 Edison bipolar machines. Six of the

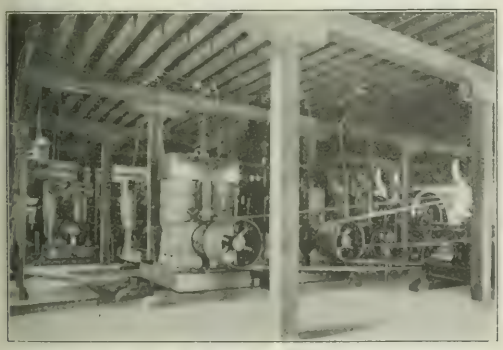


FIG. 2.—EDISON BIPOLARS USED FOR PEAK LOADS, STATION NO. 2

engines are of McIntosh & Seymour make; three are of the old Armington & Sims type, one was built by the Southwark Foundry & Machine Company and the other is a 500-hp Ball engine. Steam is supplied by 11 Hazelton boilers, each of which is rated at 500 hp. The boilers are hand-fired with bituminous slack coal. The engines operate condensing, Bulkley condensers situated outside of the station being used for the purpose. These receive their supply of condensing water from the penstock feeding the water-wheels.

Fig. 1 shows the water-driven machines on the upper floor of the station, and Fig. 2 shows the steam-driven units used for peak-load and low-water conditions. The generators are used to feed either into the three-wire system or into the railway system. In the latter case two 250-volt machines are connected in series. In this way the company is enabled to handle railway and lighting peak loads very economically. Fig 3 shows a view of the switchboard for the lighting circuits.

STATION NO. 6.

Station No. 6 of the Rochester system is located at South Water Street and Aqueduct, on the Johnson and Seymour Race adjoining the Erie Canal. It is a combination generator and substation, being equipped with water-wheels, transforming apparatus and storage battery. The Trump turbines, operating under a head of 16 ft., are belt connected to five 60-kw Edison bipolar machines, which feed directly into the three-wire network. It is possible by holding back the water from this station to pond considerable of it against peak-load conditions, and thus to relieve the steam-driven units as much as possible. Considerable saving is effected by this means. In the basement is also located a storage battery which is able to deliver 7200 amp at a one-hour rate into the Edison system. The battery consists of 182 chloride cells, with a 25-end-cell switch. The rotary transforming apparatus in the station consists of four 500-kw, 250-volt, two-unit General Electric motor-generator sets; one 500-kw, 125-volt, three-unit Stanley set, and a 90-kw, three-unit set of the same make and voltage. The stationary transforming apparatus comprises 10 71-kw constant-current transformers for the alternating-current series street-lighting circuits. As is the case with the other stations of the company containing constant-current transformers, each transformer has its own panel mounted in front of it, and the lightning arresters on the wall back of it. No attempt is made to have a board for transferring the arc circuits.

As was pointed out in a previous article, all of the energy received over the Niagara transmission lines in the transformer station is distributed in Rochester through Station No. 6; the two 11,000-volt lines to Station No. 5 pass through Station No. 6, one directly and the other by way of Station No. 1. Fig. 5 shows a view of the transforming apparatus installed for handling the high-tension circuits. Four 550-kw, single-phase, 25-

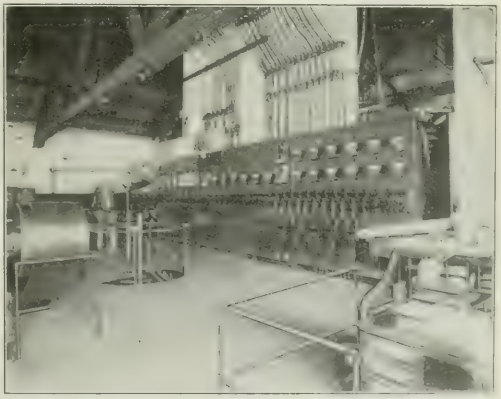


FIG. 3.—SWITCHBOARD FOR EDISON SYSTEM, STATION

cycle oil- and water-cooled transformers step down the voltage from 11,000 volts to 390 volts, at which tension the energy is fed to a six-phase rotary converter feeding into the railway system. One of the transformers is used as a spare unit. The rotary converter is provided with a special arrangement of potential regulator and [illegible] so adjusted that a constant load is kept on the unit. The ammeter has relays on either side which control the circuit of the regulator. The latter is fitted with a larger motor than is ordinarily the case, so as to insure quick and reliable operation. Although the scheme has worked well in keeping down the peaks on which the company is penalized, a different arrangement will be used

in the future. This will comprise a motor generator set having a 60-cycle generator and a 25-cycle motor, with an automatic slip regulator of such a nature as to keep the load taken by the set from the 25-cycle system a constant. In this way the power taken from the Niagara lines will be automatically regulated.

Station No. 4. There is thus available in the station 125-volt, 250-volt and 500-volt direct current, besides high-tension, medium-tension and low-tension alternating current.

Just above the station is a small concrete building housing a centrifugal pump direct-connected to a 275-hp induction motor.



FIG. 4.—MOTOR-GENERATOR SETS FOR LIGHTING AND RAILWAY SERVICE.

The company contemplates installing such a set shortly. A general view of the motor-generator sets in the station is shown in Fig. 4.

These units are wired so that all of them can be run in series on the railway circuits when the load on the lighting system is not heavy. Switches are provided on the machines for this purpose, so that current at 500 volts does not go to the lighting board. The possibility of throwing a 500-volt current on the lighting circuits by mistake is thus eliminated.

A view of the racks and some of the outgoing feeders is shown in Fig. 6. The latter pass overhead, crossing the Erie Canal aqueduct over the Genesee River to Court Street, whence they pass underground to the various cable boxes feeding the lighting circuits in the southeastern section of the city. Heavy lines run underground from the station in a northerly direction joining the network for the three-wire system coming from Stations No. 4 and No. 2. Besides the high-tension lines already

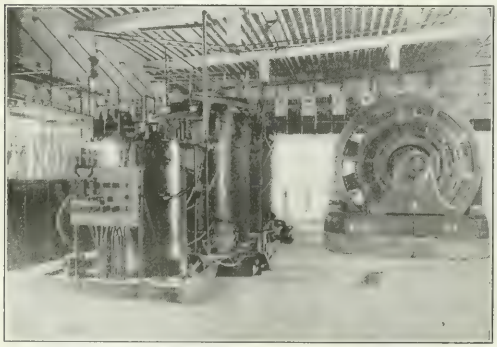


FIG. 5.—HIGH-TENSION TRANSFORMERS AND ROTARY CONVERTER.

referred to in connection with the transmitted energy from Niagara Falls, Station No. 6 is connected to Station No. 3 and Station No. 5 by alternating-current tie lines, and also with a station at Despatch, N. Y. Tie lines for railway circuits and also for the Edison three-wire circuits connect the station with

This outfit is capable of pumping 3,000,000 gal. of water daily into the Holly system, as it is called, of the Rochester waterworks. The energy for the motor is received from Station No. 6.

On the roof of the generating station is a large electric sign representing a woman cooking on a gas range. It would appear that inasmuch as the company controls the railway, electric light

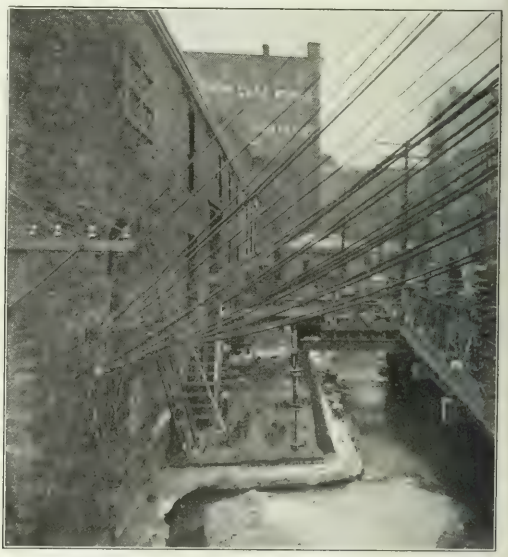


FIG. 6.—RACK AND OUTGOING FEEDERS.

and gas companies there must necessarily be friction at times between the various departments. Such, however, is not the case, and this absence of friction is the secret of the phenomenal success of the railway, the electric and the gas departments at Rochester.

Electric Suspension Railways for Handling Coal and Coke.

By F. A. Talbot.

SEVERAL important developments in the handling of coal and coke have recently been effected in Germany for securing a saving in labor, as well as economy in working cost and expedition in transporation between the various points of manufacturing plants. Hitherto mechanically driven suspension railways have been extensively adopted for such operations



FIG. 1.—ELECTRIC SUSPENSION RAILWAY FOR HAULING COAL.

owing to their simplicity, flexibility in dealing with changes of level combined with efficiency and low cost of installation and operation. It was found, however, in a complex installation covering a small area involving numerous junctions and crossovers, together with short lengths of side-tracks, that certain disadvantages exist, the greatest of which is in connection with the short sections, the cars upon which have to be pushed by hand on to the main tracks in order to avoid undue intricacy of the system. By the electric suspension railway these drawbacks are overcome.

In the accompanying illustrations are shown plants lately erected by a Leipzig engineering firm that has made a special study of this transportation problem, at the Duisburg Municipal and Hamburg-Barmbeck gas works respectively. In the first-named installation the coal is delivered to the works from a steam railroad sidetrack which runs through the shed. The coal is collected and distributed by an electric suspension railway comprising a number of parallel lines attached to the roof of the building. One of these lines runs above the surface railroad track so that the car buckets thereof can be lowered into the railroad cars by means of the electric winch attached to the carriage of the car, the lowering and hoisting of which is effected automatically by a motor-driven hoist mounted on the bucket. This motor carries two hoisting drums, one on either side at right angles to the track, the object being to secure a uniform strain on the car and the avoidance of side pressure on the overhead track rail. The hoisting motor collects energy from an overhead conductor, and its motions are automatically conducted together with steering and tipping by special devices. This system has a capacity of from 20 to 30 tons per hour, to carry out which only four cars are necessary, although extra buckets are provided so that one can be filled in the railroad car while the others are traveling. When an empty car returns it is lowered by the winch, detached, and a loaded one attached, so that the minimum of delay occurs at the loading point. All the electric suspension railway lines are connected together by switches so that coal can be discharged at any desired spot in the storage shed by the Bleichert remote-control and steering system, from a central point. The lines are even carried into the angle formed by the converging side walls of the shed, with the result that the entire space can be served mechanically. This would scarcely be practicable with any other mechanical means of conveyance without very complicated arrangements. The coal is stored to a height of some 13 ft. In addition to stacking the coal the railway serves to convey it to the crushers near the retort house, either from the railway direct, or from any point of the storage shed, as the buckets can be automatically lowered and filled at any point of the track.

The plant erected at the Hamburg-Barmbeck gas works is more extensive and in fact is one of the largest of this type that has yet been laid out. Here there are three distinct plants, two for coal and one for dealing with coke. The latter has been in operation for some time past and proved so economical and efficient that the same system was adopted for the two coal lines.

The coke line is used to carry that reduced product from the preparation plant to the main dumps, or to load it into boats moored alongside the adjacent wharves, in addition to which there is a tipping point in front of the retort house. In passing from the preparation plant the line has to negotiate several sharp curves along the canal bank to the main dump. Here, owing to the buckets being discharged from a considerably higher level than the line in front of the retort house, a section of 5 per cent grade 330 ft. in length had to be introduced. Generally speaking, a heavier grade than this is not permissible upon electric suspension railways, since driving efficiency is dependent upon friction between wheel and rail. The line runs on either side of the coke dump and the space between is spanned by a traveling bridge carrying a section of suspended track, the ends of which on either side project with planed tongues beyond the fixed side lines so that the cars can be transferred from one line to the other in any position of the bridge. A detent is fitted on the bridge by means of which the cars are tipped and as the detent is made to move across the bridge, and the latter can traverse the whole length of the dump, the coke can be emptied at any point of the whole space as desired.

Having emptied their contents, the cars reach the highest point on the line and have a gradually descending grade back to the loading station. The waterside station is connected with



FIG. 2.—COAL LOADING STATION AND TIPPING POINT.

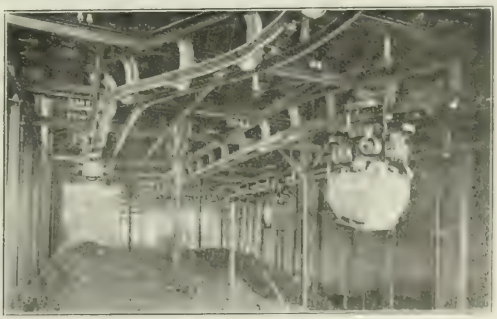


FIG. 3.—ELECTRIC SUSPENSION RAILWAY FOR HANDLING COKE.

the loading station by a special interconnecting line and at the portable chutes are placed so that the coke may be discharged from the cars direct into the boat that is being loaded. While this section of the track is in use that connecting the coke-loading station with the main dump is thrown out of action, so that there may be no unnecessary consumption of energy, and the same fact applies when the line between the preparation plant and dumps is in use.

Each of the cars has a cubical contents of 37 ft. for a load of about 780 lb. of coke, and the traveling velocity is 200 ft. per minute. The power consumption upon this basis is 0.4 kw for the empty and 0.5 kw for the loaded cars. Two workmen are sufficient for tending the installation, one at the loading hopper of the preparation plant and the other on the dump station to attend to the movements of the bridge and the release appliance for tipping the cars where required. When boats are being loaded with coke and the dump is cut out of the service this last named attendant leaves the dump station and manipulates the movements of the portable chutes on the wharf so that the loading of the vessel may be uniform.

Owing to the extremely low consumption of energy and the minimum attendance necessary to control operations the cost of working the Hamburg-Barmbeck plant is small. The following gives a representative idea of the working expenses upon the line extending between the coke preparation plant and the ship:

Consumption of energy: As one-half of the section is used for the loaded cars and the other half for the returning empty vehicles the average power consumption amounts to about 0.45 kw, and upon the basis of 500 cars per day, with a track length of 210 ft., or 650 seconds for traveling, the energy consumption approximates

$$\frac{0.45 \times 650 \times 500}{3600} = 40.6 \text{ kw-hours.}$$

As one kw-hour costs 4.5 cents the cost of energy per day is $1.827, according to which the energy consumption for 390,000 lb. (195 tons) only averages 0.9 cent per ton. To this is added the expense of two workmen at 96 cents, or $1.92, and maintenance expenses, lubricating, etc., 66 cents, making a total of $4.40, giving an inclusive working cost, less depreciation and interest on capital, of 2.25 cents per ton.

The consumption of energy on the section extending from the preparation plant to the dumps is somewhat higher, inasmuch as this track is of greater length and the gradient for a distance of about 330 ft. of 5 per cent, although the attention required is the same as already pointed out. Even in this case, however, the energy consumption cost per ton is only approximately 1.5 cents.

Each of the coal lines is loaded by three rotary cranes which lift the coal from the vessels by means of automatic grabs, discharging it into hoppers fixed within the crane frame, whence the cars of the electric suspension railway are filled. The coal line is carried at a higher level than the coke line, above which the platform is laid for the workmen engaged in loading the cars with coal. At the loading stations the cars are transferred over switches to sidetracks so as not to offer any interruption to the traffic on the main line. When the car has been filled and has started on its journey it automatically opens and runs through the switch leading on to the main track, and takes its allotted place among the train of cars on the main track. Collisions at switch points, crossovers, or junctions, or even upon the line itself, are rendered impossible by the Bleichert "block length" system which has been incorporated in such railways. In this arrangement the track is divided into a series of short lengths or blocks, only that upon which the leading car is running being alive. Consequently a regular distance is maintained between the cars, and there is no possibility of this distance being varied by succeeding cars having a lighter load. Similarly, should a car break down, all those behind are brought to a standstill upon their respective currentless blocks, so that rear collisions are impossible. This sectional working constitutes one of the greatest features of the Bleichert system. It is automatic in its action, the car coming into contact with strikers at the beginning of each block length, which opens the circuits upon the succeeding section, automatically switching it in again at the end of the length, so that the next car can follow.

After leaving the loading station the cars reach the inner track of the loop laid along the waterside, where they run on to a longitudinal section at the coal storage shed. From here they run over one of the traveling bridges on which the method of discharging the contents is the same as the coke installation, passing on to the track on the opposite end of the bridge, whence they finally return to the loading station for a fresh consignment of coal. The capacity of the whole plant is 250 tons per hour.

This installation is an excellent example of how the many transportation problems can be successfully solved by the employment of an electric suspension railway. The traffic on the coal line, for instance, could not be handled at all by any less comprehensive system. Without this electrical plant a combination of various means of transportation would have had to be adopted, which would not only have entailed a heavier initial outlay, but would have involved greater operating expenditure and considerable depreciation of the material owing to transshipment.

Auto-Transformers versus Rheostats for Induction Motor Starters.

By I. E. Hanssen.

Ever since its introduction the so-called auto-starter has generally been considered the only satisfactory device known for starting induction motors of the type having a squirrel-cage rotor winding. Of late, however, considerable attention has been given to the use of rheostatic starters, and it is the purpose of this article to discuss briefly some of the relative advantages and disadvantages of the two types.

The object of the starter is to reduce the voltage impressed upon the motor in order to prevent excessive current. The auto-starter accomplishes this result without introducing large losses, because the voltage is reduced through transformer action. When a rheostatic starter is used the case is different, because the reduction in voltage represents loss of power. As the e.m.f. across the resistance is out of phase with that of the motor terminals, the former is greater than that shown by the algebraic difference between the line e.m.f. and the motor e.m.f. and the losses are also correspondingly greater.

For large motors of the type in question, although they are seldom called upon to deliver a starting torque exceeding one-half full-load torque, the total power required in starting would nearly always be too great to be handled successfully by the prime mover if a rheostatic starter were used.

For the same reason, so far as the effect upon the regulation of the prime mover is concerned, the auto-starter is always superior to the other type.

Due to the magnetizing current and to the magnetic leakage of the auto-transformer the wattless current at the receiving end of the line will be slightly greater for the auto-starter than for the rheostatic one. The difference is very small, however, being less than 1 per cent in well-designed auto-transformers; it has a counterpart in the greater inductive drop due to the greater current when using the rheostatic starter. This remark applies particularly to large apparatus where the percentage of leakage in the auto-starter is less than for small starters. Even in small sizes it is possible to keep the magnetizing current down to from 2 per cent to 4 per cent of the motor's wattless current and, therefore, the above statements apply also for these smaller sizes. Of course, if the proper precautions are not taken, the leakage will be high and in this case the auto-starter may prove inferior to the other type. One should be careful, however, about drawing broad conclusions from a few instances which may be particularly favorable to one type or the other.

The rheostatic starter is always inferior to a well-designed auto-starter, but makes a fair showing when used:

(1) With motors having low torque and low power factor when starting.

(2) When used on circuits of relatively low resistance drop nd high inductive drop and ample reserve power.

(3) With small motors.

With poorly designed auto-starters good results can, of ourse, not be expected, and if other conditions augment this eature, it may be found that the rheostat will give better re- ults for small sizes; however, such a case is not one to be sed as a criterion for a whole class of starters.

The fact is that, in general, for machines of any considerable ize the use of rheostatic starters would be decidedly poor engi- neering, with few exceptions. For example, a modern 450-hp, 5-cycle, 2200-volt, three-phase motor delivering half full-load orque at starting, requires about 300 kw when an auto-starter s used, while fully four times this amount, or 3.5 times the ated motor output, is needed when a rheostatic starter is sed; the line loss, line drop and drop in the generator speed would also be very considerably greater for the latter.

It has been stated by others that where relatively high start- ng torque is required to be delivered by a large motor, the heostat would be nearly as good as the auto-starter. This is rue if the motor voltage is very nearly equal to the line volt- age, since in this case the effect of the starting device is small in either case. However, such a condition should, as a rule, be taken care of by installing a motor with a phase-wound secondary.

In general, the operating conditions are somewhat different from the above for small apparatus, particularly when operated from a circuit where variations of voltage are of no great im- portance. Here the extra power taken by the resistance is of no considerable moment, and it does not pay to try to keep the voltage variations very small; here is a field for rheostatic starters of low cost for sizes up to, say, 15 hp. Even here it will be necessary to use an auto-starter when a heavy start- ting torque is required and the line resistance is considerable. In order to meet all conditions in the most satisfactory manner it would, therefore, be necessary to provide auto-starters in stock in addition to rheostatic starters, if the latter were to be standardized for certain sizes; this fact to a certain extent nulli- fies the advantage of low cost.

In Table I and Table II are given the data concerning the starting conditions for two 30-hp, 25-cycle, three-phase motors Motor No. 1 has a pull-out torque of 3.75 times its full-load torque, while motor No. 2, due to greater magnetic leakage, has a pull-out torque of only 2.8 times its full-load torque. The slip at full load is 4 per cent for each motor.

TABLE I.

Starting Torque Equals Full-load Running Torque

	Motor No. 1			Motor No. 2		
	Amp. in line.	Kva. in line.	Kw. in line.	Amp. in line.	Kva. in line.	Kw. in line.
Type of starter.						
Auto-starter	101	70	33	133	92	43.5
Rheostatic starter	158	110	91.6	158		
Values: rheo ÷ auto	1.57	1.57	2.77	1.18		

TABLE II.

Starting Torque Equals One-half Full-load Running Torque

	Motor No. 1			Motor No. 2		
	Amp. in line.	Kva. in line.	Kw. in line.	Amp. in line.	Kva. in line.	Kw. in line.
Type of starter.						
Auto-starter	51	35.5	17.6	68.5	47.8	17.8
Rheostatic starter	112	77.6	71		77.6	65
Values: rheo ÷ auto	2.07	2.07	4.04	1.64		3.6

An inspection of Table No. 1, which gives the conditions when the motors deliver a starting torque equal to the normal full-load torque, shows that for motor No. 1 the line current and kva are 57 per cent greater, the kw 177 per cent greater for the rheostatic starter than for the other type; for No. 2 motor, these values are 18 per cent and 110 per cent, respectively.

When exerting one-half of full-load torque the difference is still greater, the change being in favor of the auto-starter. For motor No. 1 the current and kva are more than two times and the kilowatts more than four times as great for the rheostat as for the auto-starter, while for motor No. 2 they are 1.64 and 4 times as great, respectively.

The above values show plainly that the auto-starter is much superior to the other class in regard to kva and power con- sumption and consequently also as to the line drop and the speed regulation of prime movers. They also show that with the rheostatic starter the current and the power required at starting are greater for the good motor than for the poorer one; that is, the better the motor the more power it requires at start- ing if a rheostatic starter is used, while with an auto-starter the reverse is true.

It will also be seen that there is required about twice as much power to exert one-half full-load torque when using the rheo- static starter as is necessary to develop full-load torque with the aid of the auto-starter; for motors such as No. 1 the value of the kva is greater also, although the difference is not so great as for the kilowatts. Moreover, the tables show that the greater the difference between the line e.m.f. and the e.m.f. at the motor terminals the greater is the saving due to the use of the auto-starter.

The Bearing of Modern Illumination Upon Physiological Optics.

By Sydney W. Ashe.

Helmholtz states that, when studying the effects of illumina- tion upon the eye, one is dealing with a physiological and not a physical problem. This fact soon becomes apparent to any- one making light measurements. The writer noticed it par- ticularly when making a number of measurements performed with a view to using the pupil of the eye as a form of photom- eter, the purpose being to measure its diameter when exposed to various colored lights of different intensities. The actual size of the pupil plays a very important part in our judgment of light intensities.

In connection with the above-mentioned measurements of the pupil, a large number of measurements were made upon the variation of visual acuity for lights of different intensities and of different intrinsic brightness. Other phases of the investiga- tion have been to determine the effect upon visual acuity of foreign lights placed in the field of vision—the effect of size and shape of different letters upon one's ability to read, the effects of accommodation and of fatigue. This work is now being carried on at Columbia University by the writer in collab- oration with Mr. Rice, under the co-operation of the Depart- ments of Psychology and of Physics.

Up to the present time a large amount of work has been de- voted to the development of new apparatus for making accurate measurement, the standardization of instruments, and the elimi- nation, so far as possible, of all physical errors. All of the illuminants are supplied with energy from a storage battery, and the e.m.f. being maintained constant; a variation of e.m.f. of a few per cent, equal approximately to the width of the voltmeter needle with a 150-volt scale, introduces an error of from 3 per cent to 4 per cent—or, in other words, causes a varia- tion in the light intensity of this amount. All values of the candle-power of the various colored illuminants have been care- fully determined by means of the flicker photometer developed by the late Professor Rood.

The elimination of physiological errors has been a more difficult problem than the elimination of the physical errors; the former are eliminated only by taking a large number of readings upon various subjects and at various times. For in- stance, when measuring the visual acuity by means of a Snel- lin's chart the writer would find, after entering a dark room and beginning observations immediately, a tendency to read high; that is the ability of the observer to read a letter such as the capital R, when illuminated by an intensity of light of a given number of foot-candles, was greater at this time than when one remained in the room from 15 to 20 minutes before be- ginning to read. The percentage variation in the readings was about the same at all times, the effect previously mentioned being due probably to the accommodation or adaptation of the eye in the darkened room to the light intensity under test. When the process of taking observations had continued for about an hour, successive readings began to vary widely in ac- curacy, due to general fatigue of the eye. The fatigue is espe- cially trying when making observations with red light.

Upon looking over several series of observations the writer was able to determine the length of time necessary to stay in

the darkened room before beginning to observe, and also how long the observations could be taken before the eye became fatigued and lost its accuracy. It is found after taking all of these precautions that a variation still exists due to a change in the physical condition of the individual. This result seems natural when it is remembered that the eyes reflect the general condition of fatigue of the body, or what is termed a feeling of sleepiness comes over one when he is bodily tired, although his eyes may not have been used at all for reading.

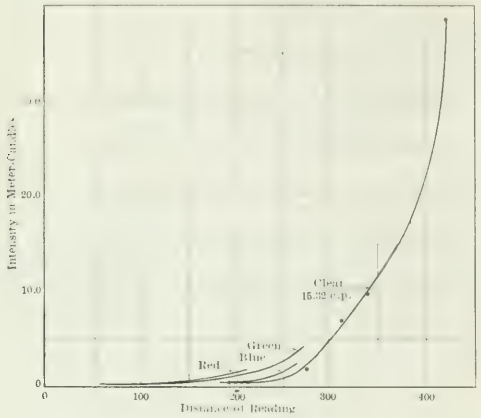


FIG. 1.—VARIATION OF VISUAL ACUITY WITH COLOR

To eliminate so far as possible errors due to changes in the physical condition of the individual, it was necessary to take observation in the morning when the eye and body were thoroughly rested, and to take the observations about the same time each day. It was also found desirable to reverse the order of taking the observation; for instance, to use the lights in the order red, green and blue for several mornings; then blue, green and red, and red, green and blue, to determine what effect the fatigue of a particular color might have upon the visual acuity when reading with another color of illumination. The results obtained thus far are interesting, as showing a wide variation from somewhat similar tests made by Messrs. Andre Broca and F. Laporte, as reported by them in the *Bulletin de la Société Internationale des Electriciens*, June, 1908. They made a study of visual acuity, rapidity of reading, contraction of the pupil and after images, their main object being to study the effect of the intrinsic brightness of light sources especially when placed in the field of vision. Their tests were performed upon modern illuminants—namely, the carbon-filament lamp, the tantalum lamp, the tungsten lamp, the mercury-vapor lamp, the Nernst lamp, open and closed arcs, and flaming arcs. Their conclusions, which have been much quoted, are given literally as follows:

1. "The question may be asked whether industrial lights of different color, compared by means of a photometer with equal intensity would be equivalent in giving to the eye acuity of vision, ease and quickness of reading.

2. "We have just seen that the incandescent carbon lamp and the mercury arc giving the same intensity measured on the most simple possible photometer give also the same practical visual acuity.

3. "The rapidity of observation is independent of the nature of the light and also the intensity of the light, if the distance of the observer from the test is in each case the same fraction of the limited distance for reading.

4. "Our measurements show the fact which has been much discussed that the photometric measures executed with industrial and utilizable intensities determined very fully the practical value of the lights.

5. "Knowing the physiological properties of the eye and the mean limits of accommodation we recommend as a suitabl intensity for work a value of from 20 lux to 40 lux.

6. "The study of the pupilary contraction shows that it i necessary to remove the luminous source from the field o peripheral vision. The contraction seems to depend more on th brightness of the luminous source than its distance. One ought therefore to recommend the use of lamps with reflectors and with globes of such dimensions that the intrinsic brightness will be relatively feeble. Indirect lighting from diffused light sources hidden from view fulfils the requirement completely.

7. "The contraction of the pupil caused by peripheral vision of the lamps is the more harmful to visual acuity as the illumination of the text is the more feeble, and this may cause in this case considerable fatigue. On the contrary it becomes less important when the intensity is from 20 lux to 40 lux. In certain cases of powerful intensity the presence of a brilliant source in the peripheral field is able to increase the visual acuity but at the cost of inadvisable fatigue.

8. "The study of the residual images on the retina leads to the recommendations already given of removing luminous sources of light as far as possible from the field of vision.

9. "The different luminous sources arrange themselves for pupilary contraction and persistence of residual images according to the order of their respective intrinsic brightness. However, the mercury arc, which had the most feeble intrinsic brightness among the lamps which we have studied, makes an important contraction of the pupil. It does not show, therefore, all of the advantages which one would have expected. When one is able to avoid the direct view of the luminous source it is absolutely indifferent from the point of view of hygiene of the eye which of the industrial lamps is chosen."

Referring to paragraph 2 of these conclusions the writer wishes to offer the curves of Fig. 1, which show the variation in the visual acuity for the writer's eyes for lights of different colors—red, blue and green. While the number of observations which have been taken are not sufficient as yet to derive the equations of the curves and establish a law for average conditions, the fact has still been apparent for all of the observations that there is a marked difference in the visual acuity or one's ability to read, depending upon the color used. All of the values of light intensity have been reduced to meter-candles by dividing the candle-power by the square of the distance of the light

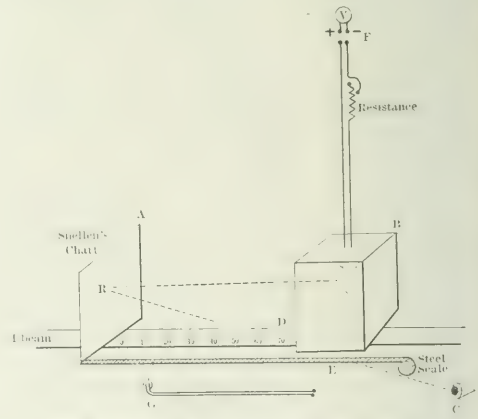


FIG. 2.—APPARATUS FOR MEASURING VISUAL ACUITY

from the chart in meters. In Fig 1, the reading distance is expressed in centimeters.

The manner of making the observations was as follows: Referring to Fig. 2, *A* is a Snellin's chart, the capital letter *R* on one of the lower lines being chosen for observation. The height of this letter divided by the distance from the chart at which it may be read is termed the visual acuity. Referring to Fig. 1, instead of dividing the reading distance by the height of

ne letter, the curve has been plotted with distance directly as bscissae. The values, however, can be readily converted to isual acuity by using the value 0.4 cm the height of the letter *R*. At 300 cm the visual acuity is $0.4/300 = 0.01332$. This letter was used in the observations because it was more difficult to distern than the other letters in the same row, such as *N*, *A*, *D*, etc. Referring to Fig. 2 again, *B* is a lamp mounted in a box, one side of which is open so as to illuminate the chart *A*. The

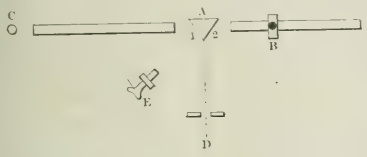


FIG. 3.—SIMPLE PHOTOMETER OF BROCA AND LAPORTE.

lamp is movable so that it may be set at a given distance along the beam *D*, which is graduated. The lamp voltage is maintained at a constant value by means of the voltmeter, adjustable resistance, and storage battery service *F*. A steel scale *E* hangs loosely, fastened at one end, at the chart, and can be brought to the eye of the observer giving the reading distance. A small lamp *G* is carried in one hand of the observer, and turned on when the observer is ready to read the steel scale. By this method one observer may make observations singly. Fig. 1 shows a series of observations taken in this manner. While the relative position of these curves seems to shift slightly from day to day—depending, as previously stated, upon the physical condition of the individual—nevertheless there is always a decided difference in the visual acuity for different colored illuminants of the same meter-candle intensity. The reason why Messrs. Broca and Laporte could not appreciate this difference in the visual acuity may possibly be explained in the manner in which their observations were made.

The simple apparatus which they used for studying visual acuity is illustrated in Fig. 3. This apparatus consists of a wedge of wood *A*, upon one side of which, 1, is pasted a small Snellin's chart, upon the other face is pasted a white card cut from the same material as the chart. On one side, *B*, is placed a standard lamp at a fixed distance, and at the end of *C* is placed a movable lamp under test. The eye of the observer is placed at the opening *D*, the eye looking at both sides of the wedge, and the movable lamp is so placed that the illuminations on both sides of the wedge are the same. The eye is then shifted to a small telescope *E*, which is moved back and forth until the letters on the face of the Snellin's chart had been read. If the authors had used a flicker photometer to determine the relative intensities of the lights of different color, no doubt this difference, due to a difference in the color effect, would have been appreciated. In other words, they have argued in a circle.

The following method has been used by the writer and his associates to study the contraction of the pupil:

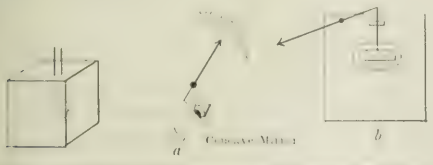


FIG. 4.—APPARATUS FOR MEASURING DIAMETER OF PUPIL.

The arrangement for illuminating the lamp and adjusting it was the one used in the previous experiments on visual acuity. For the Snellin's chart was substituted a support with an opening in it, as shown in Fig. 4; across this opening are mounted two cross-hairs, one of which is fixed and the other movable, being connected to a stirrup, as shown in Fig. 4 at *b*. The distance between the cross-hairs is magnified by means of a simple lever, as shown in *b*. The size of the pupil can thus be measured very accurately. The observer looks through the opening into a small concave mirror with a radius of curvature of 2 in., adjusts the cross-hairs and takes the reading, the eye being so placed that it almost coincides with the cross-hairs. While it is true that the size of the pupil as thus determined is slightly refracted, due to the cornea, the percentage of error is about the same with all observations and is therefore satisfactory for comparative work.

Fig. 5 shows a series of observations taken upon the pupil with two sources of light, a green lamp and an ordinary 16-cp lamp placed at such distances that their intensities on the eye were equal. The lamps were then placed at different angles in the field of vision, namely 0 deg. to 30 deg., 50 deg. to 75 deg. The readings were as follows:

Green lamp:	
30 deg.	4.03 m.m.s.
50 deg.	4.25 m.m.s.
75 deg.	4.75 m.m.s.
Carbon lamp:	
0 deg.	3.90 m.m.s.
15 deg.	4.03 m.m.s.
30 deg.	4.51 m.m.s.
50 deg.	4.85 m.m.s.
75 deg.	5.32 m.m.s.

These results were the averages of a number of readings. It will be noticed from these readings that, as a lamp is brought into the field of vision, the angle becoming shorter and shorter, the pupil of the eye contracts more and more. Although no image of the lamp is formed on the fovea of the eye except

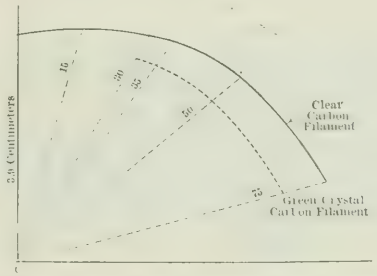


FIG. 5.—CURVE SHOWING SIZE OF PUPIL WHEN EXPOSED TO ILLUMINANT AT VARIOUS ANGLES IN VISUAL FIELD.

when the light is at zero, it will be noticed that the pupil contracts gradually as the lamp is brought into the field of vision, and that the contraction is greater for the green than for the approximately white light of the carbon filament, the light containing nearly all rays of the upper part of the spectrum. The effect of the lamp in the field of vision may be likened to a camera which is so placed that the sun shines into the lens from an angle. A photograph taken in this manner will be "light struck." There is no sharpness, only outlines more or less indistinct. The pupil of the eye contracts, however, tending thereby to lessen the amount of light which enters the eye; but even with this there is an excess of light flux impinged upon the retina to one side of the fovea. Upon the fovea is focused by the accommodation of the lens the image of the letter which one is attempting to read, but the sharpness of this image is probably affected by the excess of light flux on the retina, by the foreign lamp in the field of vision. The writer has found that the presence of a foreign lamp in the field or vision decreases one's ability to read by approximately 30 per cent for an ordinary 16-cp carbon incandescent lamp. The effect would probably be more marked if the intensity of the light were greater.

The curve sheet of Fig. 5 is interesting in view of the modern theory of color perception based upon the number and location of rods and cones over the retina. If there is practically no color perception outside of the fovea one would imagine that the size of the pupil would be the same at a given angle irrespective of the color, but experiment seems to point to the opposite effect, as indicated by the curves.

Electrical Equipment of the Bergenport Chemical Works.

By Warren H. Miller,
Electrical Engineer, Standard Oil Refineries.

THERE are two features of the Bergenport Chemical Works that may be of interest to the electrical fraternity: the size of the installation units compared to the majority of alternating-current plants, and the acid corrosive problems encountered in the atmosphere of a chemical works.

The entire plant had to be put up and operated in an atmosphere so heavily charged with sulphuric acid vapors that when a 1-in. rope is left out over night it is unsafe for use on the following morning. No metal or conduit whatever can be used anywhere, marine fittings are useless because all of them contain more or less exposed metal, and lead cable has proved, in the light of practical experience with lead about acid plants, to be the most hopeless of all.

The plant belongs to the Standard Oil Company, and is one of the largest chemical works in the world, producing nearly 300 tons of sulphuric acid per day of 24 hours. It uses the "chamber acid" process, which renders the conditions a little more severe than ordinary, but the same problems are encountered in any chemical works where acid vapors abound.

Sulphuric acid, being a most excellent conductor of electricity, and a corrosive of every known metal, including lead, makes fires from electric "grounds" an absolute certainty sooner or later unless the electric distribution is designed to obviate its effects from the start. In plants reeking with acid vapors, dangerous corrosion is only a matter of weeks, but even in plants where the effects are not very noticeable, the same corrosion to dangerous grounds is sure to occur within at most a few years' time.

As all of the soil of a large acid plant is virtually one vast acid-soaked sponge containing acid salts in all degrees of formation, an underground conduit is by no means a haven of rest from the ever-present vapors. One of the most successful conduits ever put down was a wooden trough in which the feeders and mains were laid, the whole being filled with boiling tar which hardened on cooling. The acid promptly ate away the wooden trough, but stopped at the surface of the solid block of tar which contained the wires. While the tar proved to be completely acid-proof, much difficulty was had in tapping the wires so as to make an acid-proof junction.

The cheapest and most flexible system of distribution about a chemical plant for all outside work is plain triple-braid, weatherproof wire on poles, all of the wire being throughly tarred as soon as put up. The balata gum insulation of this wire is quite resistive to acid, whereas any form of rubber covering would be entirely inadmissible because of the vulcanizing effects which quickly become manifest. Lead-covered wire, which seems at first sight to be the panacea for all acid ills, was not seriously considered for an instant. Long experience with lead work for protecting iron has taught acid men that, no matter how thick the sheet is, no permanent protection can be relied upon. All acid plants are full of iron bars, rods and plates, lead covered with all the care that experienced lead-burners could give to the work, yet these within a very few years become so badly "sulphated" as to require stripping the lead off entirely and re-covering. As soon as the bar is put up, the acid vapors condense on it and immediately find their way down to the iron through tiny pores and infinitesimal fissures caused by the stretching effect of manufacturing the sheet lead and by minute particles of impurities. Forthwith begins that insidious process known as "sulphating." A double salt of iron and lead is formed in the fissure which lifts the lead, exposing more iron to the acid, which in its turn becomes sulphated until in time the entire rod is virtually a bag of lead containing an iron core surrounded with sulphate. The entire process sometimes takes place in as short a time as six months. The mechanical strength of this sulphating action is almost inconceivable. The writer has seen steel acid towers weighing over 170 tons lifted inches above their foundations by sulphate formations between their column bearing plates and the lead work covering the foundations. The sulphate is far more bulky than the metal used to form the basic radical and it exerts as much force in finding room for this bulk as a metal rod will on expanding under heat.

When one reflects that these troubles occur within a few years with heavy sheet lead protection, he will understand how much greater is the danger from using lead-covered wires where the lead is only 1/32-in. thick and so full of pinholes from the process of drawing that the manufacturers will not guarantee it for submarine service unless armored with iron. Such a case in point was that of a twin wire cable run under 4-ft. of fresh water crossing a 70-ft. race. This cable developed a weak ground connection in the first month of service, showed a full ground on the voltmeter the second month and passed ¼ amp of current on 500 volts in the third month, whereupon it was taken up and replaced by overhead work. The grounding was due to minute pinholes inherent in the lead itself, which metal is non-ductile to a degree and apt to become granular in the process of drawing.



FIGS. 1, 2 AND 3.—ALTERNATORS, EXCITERS, SWITCHBOARD, FAN AND PUMPS.

Tar, on the other hand, is impervious to acids and a good coat of it on weatherproof wire renders a conductor proof against grounds and safe for splicing. It is best put up with poles and standard glass insulators so as to be eaily reached and always in plain sight. Junction fuse boxes are of the cast-iron, weatherproof, iron-clad type, well tarred and provided with brass thumb-screws, as iron threads quickly rust solid. All splices are covered with rubber tape which in its turn is given a single thickness of ordinary friction tape and the whole splice is well tarred.

Entrances to the buildings throughout the plant were effected by means of the usual drip loops and porcelain tubes. The entrance switches used were porcelain base combination switches and cut-outs. Slate bases are not advisable, being readily attacked by acid fumes. Many of these switches were placed outside in "Transite" asbestos board boxes on the poles. The layout of the buildings was such that many lines could be run along the parapet walls on the 4-in. x 4-in. hard yellow pine poles shown in the illustration.

In arranging the distributing circuits, the "closet" system was adopted for the lamps principally because it kept all heavy mains on the outside of the buildings where they would be in the least danger from grounds. Taps were taken off at the various locations for the lamps, spaced as nearly as possible to

balance the two sides of the closet system. The position of the building gives a good illustration of the maxim that where the lamp center is a geometrical point, the "star" system is best to use; but where it lies in a line such as a circle, the "closet" gives the better distribution.

The interior wiring problem held just one consideration, namely, that absolutely no metal must be exposed to the action of acid fumes. Such an object as the ordinary steel conduit outlet box, for instance, would simply prove a nest for the formation of sulphate. Separate lead-covered wires to be run on cleat work were considered for a time. If the wire were well tarred, pinhole troubles would be obviated, but every single tap meant a place where exposed copper and lead would be perilously near each other in the presence of a highly conductive acid condensation. The solution adopted was the use of hard yellow pine molding painted with asbestos and tarred both inside and out, with Fielding molding receptacles for outlets. The molding was first put up with neat miter joints and then painted with thick tar that filled the grooves. Weatherproofed wire was then buried in the tarred grooves and the molding was given another coat of tar. While still wet the cap was secured by twopenny copper nails spaced 2 ft. apart and the cap was then tarred. Thus there was obtained a solid tar cable impervious to acid and moisture. Wherever a lamp was wanted the cap was sawed and a porcelain molding receptacle was put on, raising the wires out of the tar with the screw-driver and baring them where they passed under the receptacle screws. With the porcelain cap screwed down and the lamp in place, there was still a narrow annular space between the lamp and the receptacle. The simplest seal for this proved to be a ring of No. 14 weatherproofed wire tarred and slipped on the lamp before screwing it in place. This wire filled the space and made an effective seal. Thus nothing was exposed to the acid fumes but glass, porcelain and tarred molding. It may be mentioned in passing that in a later installation at the acid-restoring plant of the Bay Way refinery the writer used tungsten lamps and found that the same seal could be had with insulated telephone wire, though weatherproofed wire was too thick to allow the lamp to seat because of the large brass shoulder on the tungsten lamps.

No arc lamps of any description could be used, as it is impossible to keep the metal cases from corrosion for any great length of time, but by forming clusters with bars of six receptacles spaced a few inches apart on the molding and fitted with a cut-out, more than 40 arc lamps were displaced—before the day of the tungsten lamp. For all motor leads use was made of three-wire molding led into yellow pine Transite-lined cabinets. The switches were then closed, the fuses put in place and all metal work was tarred.

The equipment contemplated electric drive for six lead acid fans, two elevators, a rotary dust burner and a machine shop and a carpenter shop. The motors had to be protected against red iron oxide dust from burnt pyrites ore in addition to the acid fumes. The oxide is another excellent electric conductor. Whenever one touches a beam a shower of it sifts downward. This dust would surely ground the commutator leads and collect on the brush contacts of a "dustproof" direct-current machine and cause sparking. However, an induction motor will run when covered deep with it without the slightest danger from grounds, which fact virtually dictated the adoption of alternating current for the entire system. It is easy to get first-class marine, water-tight, direct-current motors, but it is difficult to keep them so when the electrician has to break the joint periodically to reach the commutator. In a few months the motor cover is without a gasket, being screwed down by hand while the armature is packed with dust. Men are only human, and in a great company one must reckon with the personal element of things quite as much as with the engineering possibilities.

As the installation was to be one of mixed lamps and motors receiving energy from the same busbars, the elevator motors injected their little idiosyncrasies into the situation. The elevators were two-ton, belt-driven units and required about 7½ hp motors. As the whole generator equipment would not require more than two 50-kw machines, the effect of starting and stopping the elevators would be felt on the lamps, besides which there would be the inevitable and interminable controller troubles with which to contend. Works managers do not have to be reminded of the legion of times when "that elevator" was out of commission "because there was something the matter with the controller." The reasons therefor are simple and patent:

There are only two kinds of operators who handle shop elevators. One is the husky stock wrangler or cupola tender who lays violent hands on it and takes all the notches at one whirl; the other is that old man who inches the controller around, bit by bit, until he sees something moving. There he leaves it—with a bare contact on two fingers and the other finger just at the arcing point. The only way to circumvent these two individuals is to provide a belt-driven shop elevator which owes its risings and settings to the movement of a wire rope shifter. This can be pulled, yanked or otherwise maltreated without causing anything in particular to happen, and shop managers have long recognized it as the one form of elevator control possessing the necessary longevity and hardihood.

At the Bergenport Chemical Works the belted elevators were operated by foreigners and run by steam engines on friction load unless hoisting or lowering the elevator. The engines were replaced by simple induction motors, and to avoid any rush of current with consequent drop in voltage on throwing the elevator hoist into action, a flywheel was put on each motor. This wheel was about 27 in. in diameter, with a 3-in. x 4-in. rim and ⅞-in. web, and weighed about 300 lb. The energy stored in it at 1200 r.p.m. was great. It was quite feasible to disconnect the motor entirely when the elevator was half-way up, whereupon the flywheel would run the entire load up to the top without appreciably losing speed. It proved the best "controller" ever invented. The writer had often used the same device in motors driving air-compressors, bulldozers, bar shears and other intermittent tools, but did not expect such good results with elevators. The actual data are as follows: Hoist, 2 tons; lift, 18 ft.; motors, 7.5-hp Westinghouse, three-phase, 60-cycle, squirrel-cage induction. Full load, 5 kw; friction load, ½ kw; drop in voltage on line, 8 volts momentary fluctuation returning to normal. This on the 220-volt system caused no noticeable drop in the lamp brilliancy. A similar elevator at a Philadelphia refinery requires a 10-hp motor without a flywheel as there is no stored energy available.

On the acid fan loads the induction motors proved capable and efficient, replacing steam engines that had run for 20 years day and night with only sufficient stoppage to take up the brasses. The motors required practically no attention from the day they were set running. Where the vapor of the running room was heavily acid-laden, the fan action of the rotor caused trouble from blowing acid vapor over the stator coils, thereby "grounding" them. This trouble was remedied by making lead kidneys to fit the inlet openings in the end frames and plugging all of them up but one, into which was led a 2-in. lead pipe which connected the motor with the comparatively clean outside air. To avoid ultimate trouble from sulphating, the laminations of all the motors, the stator cores and the squirrel cages of the rotors were tarred up solid, leaving clearance merely in the air-gap. As thus installed the motors last indefinitely and give no more trouble than so much mill shafting.

The power-house installation differs from standard installations only in that the alternators were the first of their kind ever built. They were two 50-kw, engine-type, Westinghouse, 220-volt, three-phase, 60-cycle alternators directly connected to two Harrisburg simple non-condensing engines. The exciters were directly connected to the stub end of the engine shaft by a suitable shaft coupling. They were totally enclosed and "dustproof," which matter was a piece of polite fiction. These exciters gave the only operating trouble of the entire installation, running so hot at full load that the covers had to be taken off. The rest of the generating station required no attention

beyond an occasional supervision by the head fireman in charge of the works boiler plant adjoining. At regular intervals the electrician of the works visits the installation to examine the bearings and the switchboard instruments. At night the electrical plant is headquarters for the works foreman, who had been drilled previously in the operations of running the generators. About the only precaution necessary with the generators to meet acid works conditions was to tar thoroughly the rotor and stator coils and the laminations of the core.

The switchboard, built by the Walker Electric Company, was of green Vermont slate, black enameled. Any form of marble would promptly have been reduced to calcium sulphate by the ever-ready acid fumes, and Pennsylvania slate would soon have had its iron veins swollen with compound ferric sulphate salts, but the green Vermont slate stood the acid very well. The board was heavily shellacked on the back and all busbars and leads were taped and shellacked. With these precautions it was reasonably safe, though one could not touch it anywhere in damp weather without being shocked.

This plant has been running steadily since its erection, over a year ago, without any motor troubles whatsoever having been reported, and without materially increasing the conductance to ground. Not having any metal exposed to acid fumes, the sulphuric acid department should be in as good condition 20 years from now as at present, with the usual amount of upkeep and repair always going on in a large industrial establishment.

Third-Rail Circuit Break Signals.

By William K. Waldron

In the practical operation of the third-rail electric power system it is often convenient and sometimes even necessary to divide the power circuit into sections, each section being fed from a separate substation or power house.

This division of circuit allows the cutting off of power from any given section in the event of any accident in that particular section, such as wrecks or fires, as well as for making repairs, while the balance of the line may be in full operation. Whenever the power is cut off from a section there is, of course, the danger of trains running from the adjacent "live" sections into this dead section, the results of which would be disastrous, causing the ruin of probably several motors and possibly injury to some of the workmen, if not the loss of human life.

To prevent such disasters each section break is provided with "break" signals, ordinarily known as "gap" signals, which warn the motorman of danger when he is approaching a dead section of circuit.

For the benefit of beginners desirous of acquiring a good, practical knowledge of electric railway equipment, the writer submits the following detailed description of the type of gap signal used on one of the largest elevated railway systems in this country.

These signals are controlled by two circuits, one from each adjacent third-rail section, neither of which is able to control the signals independently of the other; thus, when either section is "dead" both signals go to "danger."

The accompanying diagram is a plan of a signal layout, indicating the "section break," the ends of adjacent third-rail sections, signals and relay box, the latter containing the switches, fuses, resistance tubes and relay. The signals themselves are, of course, located one on the right-hand side of each track; the relay box may be located at any convenient point in the vicinage.

Designating the third-rail sections as *N* and *S*, as shown on sketch, the *S* section controls the relay. After tapping off from the third-rail the circuit passes through a 10-amp, 500-volt fuse. This fuse box is marked "relay," indicating that it is the relay fuse. The circuit then passes to and enters the relay box, where it passes through a snap switch and a 1-amp, 500-volt fuse, from which it enters a 4000-ohm resistance tube, 500 ohm of the resistance being cut out, as shown, 3500 ohms are effective. From this tube the current is led to the relay, which it picks up, thus completing the circuit for the signals. After passing through the relay the current is led to the ground.

The *N* section controls the signals. As in the relay circuit there is a 10-amp, 500-volt fuse, the box of which is marked "signal," indicating that this is the signal fuse. This circuit after passing through a snap switch contains a 3-amp, 500-volt fuse, and is led to the relay, after leaving which it is divided into two branches, one for each signal; both signal circuits being the same, one description will suffice. After the circuit is divided each branch passes through a 100-ohm resistance tube, thence to the bottom of a 1000-ohm tube, where it joins a lead to the signal passing through a solenoid coil to

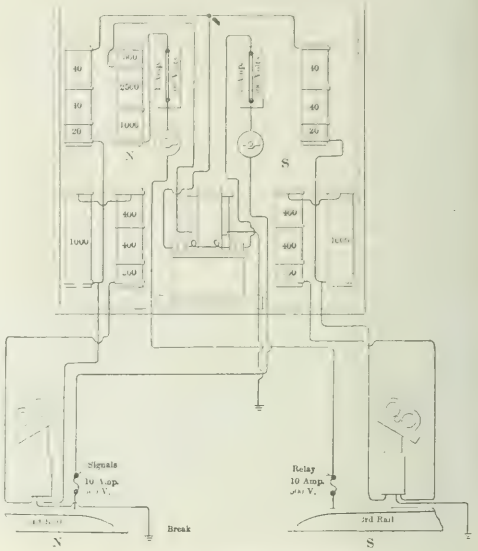


DIAGRAM OF SIGNAL CIRCUITS.

ground. This solenoid, in moving signal to "proceed" position, breaks the circuit, which then leads up through the 1000-ohm tube, across and down through another 1000-ohm tube, thence to signal as before, thereby holding the signal in "proceed" position.

Thus it will be seen that any defect in signal circuits after division of main circuit will put to "danger" the signal on the branch in which defect exists. A defect in the main circuit between the third-rail and the point of division will put both signals to "danger," as will also a defect in the relay circuit. Cutting off power in either section of the third-rail will, of course, put both signals to "danger."

These signals are provided with oil lamps, as to light by electricity would require connection with some other source of power, which is generally inconvenient.

The Construction of Ozonizers.

The production of ozone by electrical means is a development which has not received the attention in this country which the importance of the subject would seem to warrant. Comparatively few investigators are working along these lines and the degree of efficiency in the production of ozone is a matter of considerable interest. Ozone purification plants operated in conjunction with a city water-supply system are in common operation on the continent of Europe, but there is practically none in this country. With the single exception of what is

practically an experimental plant in conjunction with the water-works system in a small town in Canada, the ozone development in this particular field is undeveloped in this country. Their use, however, as a result of this development is undoubtedly apt to increase very greatly in the United States, and the use of ozone itself in a wide variety of operations, as a direct result of knowledge gained in regard to its production in this field both in the European installations and in the single one existing in this country.

Ozonizers for their operation need not be very large, and extremely high potentials are not necessary. The condition of the air before ozonization, as regards its temperature, pressure and hygrometric state, is a matter of considerable importance from an efficiency viewpoint in the operation of the ozonizers themselves, but is even of minor significance in practical developments where the preparation of the air in large quantities involves the installation of special units, such as refrigerating plants and drying devices and air compressors with heaters or coolers for its preparation.

The ozonizer in its commercial form consists of an iron box filled with a series of plates or electrodes, separated by plates of mica, somewhat like a condenser, and having the plates punched with a large number of small holes having rough edges, through which the air is drawn after passage over the plates of the electrodes. In commercial work current at a voltage of about 1040 volts is quite satisfactory, and this is carried into step-up transformers, where it is changed to give an e.m.f. of about 10,000 volts. The alternate plates in the ozonizers are connected to terminals of this voltage and the brush discharge occurs at the surface of the plates and from the irregularities in the innumerable small holes in its surface. The electrodes can be simply plates extending entirely across the iron box and insulated at the edges in each case, and may be practically air-tight as well. Alternate chambers will, therefore, be air reservoir chambers as well, and the air will enter in one chamber and be drawn out of the other, or may be required to pass through a series of such chambers and by a large number of electrodes. Its passage through each electrode is accomplished with considerable ozonizing effect on account of the close contact of the air with the brush discharge in the innumerable small holes.

The constructive details of such an ozonizer are not complete by any means, and are merely in the experimental stage. Cylindrical plates are undoubtedly capable of much more efficient installation and operation if the question of mica insulation and its production in efficient cylindrical units can be solved. Fiber has not been used to any great extent, but from the constructive standpoint the cylindrical type would undoubtedly prove its superiority with respect to air handling and minimum cost of construction if the insulation is not considered. It would then consist simply of a series of concentric metal pipes separated by the required insulation and having the air enter into the inner cylinder and leave from the exterior cylinder.

Undoubtedly the effects of preparation of the air have been over-estimated, at least from a commercial viewpoint, in the development of such ozonizers. The use of mechanical refrigeration for the drying of the air is common in most of the water purification plants in European countries, and air compressors are used as well for the transportation through the ozonizers. The fact that this air can be transported through the ozonizer by suction alone; that this suction can be obtained simply by the utilization of the aspirator principle common in many water developments, and that the immediate contact of the air with the water proves a suitable and adequate preparation of the water itself for such ozonizing effect, are points not generally understood. The effect of water in contact with the air, especially in conjunction with its commingling by means of aspirators, results in a complete purification of the air from all dust and ordinary impurities. Further, whatever air compression is gained is accomplished isothermally and the resulting compression diminishes the water content present in the air, strange as it may seem, although the water vapor present is, of course, in a saturated condition.

The construction and commercial development of ozonizers have been going on apace. Higher and higher voltages have been attempted and, as has been said, additional developments for the preparation of the air have been formerly considered indispensable. The fact of the matter is to-day that the commercial ozonizer in its development and utilization in a wide variety of applications is dependent more on constructive details and reliability of operation than upon any theoretical efficiency of the units in the production of ozone. Again, the position of the ozonizer in respect to its situation as an integral part of the plant, with its relation to other operating units, is of equal importance, and if these features received anywhere near the attention that the theoretical development has up to the present time, the commercial application of the electrostatic producing apparatus will increase remarkably in a comparatively short space of time.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Readiness-to-Serve Rate Applied to Denver Residences.

The Doherty readiness-to-serve rate, which first came into prominence through its application to lighting in the business district at Denver, Col., is also proving adaptable to residence business as well. This rate as applied in the business district consists of a readiness-to-serve charge made up as follows: $1 per month for meter and service charge, plus 15 cents per month per 16-cp lamp connected. To the readiness-to-serve charge is added 5 cents per kw-hour for all electricity consumed as measured by meter.

In applying this rate to residences, it is manifestly unjust to apply the readiness-to-serve charge to all lamps connected as in the business district, because it is seldom that all the lamps in a house will be turned on at once. It is, therefore, the custom of the Denver Gas & Electric Company in framing rates for a residence to make the readiness-to-serve charge of 15 cents per lamp on only half or a third of the connected load.

Out of the 22,000 residence consumers in Denver approximately 30 per cent are now on the readiness-to-serve rate. It is the company's custom to give consumers this rate whenever it will be to the consumer's advantage, rather than a straight 10-cent rate. The rate is mainly of advantage to consumers using considerable electricity in proportion to their connected load. For example, electric flatiron users can get a much lower rate by the readiness-to-serve plan than by the other plan. About one-third of the residences connected in Denver now have electric flatirons.

Electric Motors for Brick Plants.

In a paper recently read by Mr. E. A. Lof before the Iowa Brick and Tile Association, the advantages of electric power for operating brick and tile plants were presented, and the following data given as to the power requirements of machines in a brick plant with a yearly capacity of 25,000,000 brick

Brick machine	30
Pug mill	15
Dry [illegible] crush	35
Rotary [illegible]	25
Elevator	20
Conveyor	5
Exhaust fan	40
Drier [illegible]	30

The aggregate for such a plant is thus about 250 hp. The fans would run 24 hours. Central stations having brick plants in their vicinity should find this class of prospective business worth looking into.

America's Dark Streets.

The New York *Evening Post* of Feb. 13 contains an interview with Dr. Louis Bell on the subject of street lighting, as follows:

"The principal streets in European cities, the streets, I should say, most in use after dark, are invariably better lighted than similar streets in America. This is so because, while in this country the average amount of energy per mile of street is from 5 kw to 10 kw, in Europe it is from 15 kw to 20 kw. Then, also, the price of carbons and the excellency of the product have much to do with the matter.

"In America we have what amounts to a carbon trust, which, at the time of the last revision of the tariff, succeeded in having the duty on carbon increased to $9 a thousand sticks. Immediately after this new ruling went into effect the trust raised its price on the domestic article by $9 a thousand sticks. But the American carbon trust has not attempted to improve its product. Its carbon is inferior to that in general use abroad.

"So it is impossible for the electric lighting companies to provide as adequate a service in New York as in Berlin, perhaps the best lighted city in the world. Still another reason why we have less effective light on our main thoroughfares is the desire, prompted by the greater cost of carbons, to make them last as long as possible. Consequently, our arc lamps are designed with an eye to economy of consumption, whereas, in Europe the fullest power is applied.

"Altogether, the price of American carbon is 100 per cent greater than that of European carbons, and it should be remembered in conjunction with this, that European carbons are longer-lived, so that they are doubly cheap. In European cities, too, there has recently been put into service a new type of carbon, loaded with various chemicals, primarily calcium fluoride, which have the effect of giving a more brilliant and yellower light than the ordinary carbon. Pearl globes as well, such as indeed we have on Fifth Avenue, are common all over the Continent and England. They do much to soften the brilliancy of the light, and diffuse it gradually, with a prettier effect on nearby shrubberies and buildings.

"This particular type of arc light is known as the flaming arc. Another improved type, not suited to main thoroughfares, but which is being adopted widely for side streets, is an incandescent lamp which has electrodes made of a somewhat rare metal called tungsten. These incandescents give fully twice as much light as do any others consuming the same amount of electricity. In my opinion they must eventually wholly displace gas on side streets and in the suburbs.

"Although two years or less ago they would have been more expensive than gas, a bid which came to me the other day offered to install tungsten incandescents at $18, as against $22 quoted for gas lamps. That seems to be a pretty fair indication of the development that has been accomplished in their manufacture.

"When it comes to the side streets of European towns, I don't think they are ahead of us. Conditions of lighting are practically the same. On the main streets I have already referred to, they place their lamps closer together than is our custom—at intervals of from 100 ft. to 130 ft., I should think, in contrast with the 200 ft. which generally separates lamps on American highways.

"Most European cities own their gas plants, but whether this is more profitable than private ownership, and, if so, just how much, it is very difficult to discover. Occasionally confusion is caused, as in the case of Paris, which owns gas plants, but has for many years taken its electricity from a number of small companies. Not long ago these companies banded together, and it is hoped that the result will be beneficial to the city's lighting service.

"Summed up, I believe that the chief things which we have to learn from European systems are more frequent distribution of lights, more energy in proportion to the extent of territory covered, and more artistic effects. The lamps might be hung higher above the sidewalk, and care might be taken to get a light that, while powerful, should be easy on the eyes, without the cruel whiteness of the plain arc light. Besides, much may be done in the way of designing graceful and ornamental poles to support the lights."

New Street-Lighting System at Aurora, Ill.

By C. J. McCarty.

Aurora, Ill., was one of the first cities in the United States to use the electric arc for street lighting. In 1881 seven 150-ft. towers were erected, on each of which were placed two lamps of the early open-arc type. About 10 years later all the towers but one were taken down on account of weakness and the lamps suspended on Brady arms along the street. A visitor in the city is reminded of the early system by lamps on the high tower of one of the east side schools. In the latter part of 1906 the municipal lighting plant was entirely rebuilt. About 400 Western Electric series enclosed-arc lamps replaced the old open-arc lamps and are operated 50 in series on a 4000-volt alternating-current circuit.



FIG. 1.—AURORA POST.

Recently 25 of these lamps in the business district were replaced by a system which has attracted considerable attention for the reason that it presents a very pleasing appearance to the eye and places light in abundance where it is most effective. The idea originated among the business men of the west side, who were looking over possibilities of booming the city. Many schemes were suggested. The plan of establishing a market place where cash would be paid for farm produce, and that of a 5-cent moving-picture vaudeville theater, where free tickets would be given by each merchant for a certain value in cash purchases, were considered. Finally, the scheme of brilliantly lighting the streets was chosen as being most likely to give quick results. The city had provided ample electricity for additional lighting, but had no money with which to purchase more lamps. Organization was perfected in the West Aurora Improvement Company, a charter obtained and a board of control appointed to plan and execute the work. A committee visited other cities and with the assistance of the city engineer and the city electrician, a plan of lighting was worked out which in some respects is similar to that in service at St. Louis. Proper ordinances were passed by the City Council whereby the merchants would install and pay for the system and then turn it over to the city for maintenance and operation. Similar movements were started in other parts of the business district which have resulted in a thorough lighting of the downtown streets.

The system consists of 173 ornamental, cast-iron posts, Fig. 1, carrying three lamps each, except at the four corners of each street intersection, where five lamps are placed on each post. The posts are spaced about 50 ft. apart along each side of the street on the curb-line and have two arms, one extending toward the street and the other over the sidewalk. The arms curve downward and terminate in a 100-watt, 110-volt tungsten lamp, enclosed in a 10-in. opalescent globe. At the center of the post and extending upward is a 60-watt lamp enclosed in a 12-in. opalescent globe, this lamp serving more for decorative purposes. The tungsten lamps hang vertically. The weatherproof sockets are not rigidly attached to the framework, but hang loosely from the wires leading out of the arms. The

vibration from passing cars and heavily laden vehicles is thus less easily transmitted to the filament. The system is complete except for the Island, which will not be lighted until two concrete bridges spanning Fox River are completed.

Fig. 1 gives a good idea of the post. The lower part is 8¾ in. square, tapering to 7 in. square, 3 ft. above the base. From this point the post is fluted for 9 ft., at the top of which is a plate supporting the center lamp. The post stands 14 ft. high to the top of the globe and the side lamps are 4 ft. apart, the three globes forming a triangle. The posts were cast in a local foundry at a cost of $19.50, bids running as high as $66. Each post was painted one coat of bronze and one coat of best coach varnish at a cost of $1.40. A special curb was built outside the old curb and varied in width from 8 in. to 24 in. On this the posts are bolted. In this arrangement the sidewalk space was not diminished and it gave opportunity for concealing the conduit.

The conduit is a 2-in., second-hand, wrought-iron pipe purchased for 5 cents per foot. No. 0 stranded, double-rubber-covered, double-braided wire was drawn between junction boxes set in the curbing at each post, in each of which are placed a 5-amp or 8-amp enclosed fuse and a switch for cutting out the unit. The box is made water tight with a rubber gasket. No. 14 solid wire, double rubber covered and braided is used in reaching the lamps from the conduit box.

On the frontage basis the work was installed at a cost of $2.16 per front foot or at the rate of $103 per post. These figures cover the cost of the step-down transformers and all labor and material outside of extra power-house equipment and the line.

Energy is furnished from the city power station, located about two miles from the business district, and is carried on an existing pole line on two independent No. 6 circuits, one supplying the east side and one the west side. The city operates a combined pumping and lighting plant. The electrical equipment consists of a 300-kw Western Electric Company two-phase, 60-cycle, 2300-volt generator, direct-connected to a 450-hp, cross-compound, condensing Erie Ball engine which furnishes electricity for the street lighting system. All electricity in the city for private use is generated by a private company. The voltage from the generator is stepped up to 4000 volts through four Western Electric Company 100-light transformers for the arc lighting system, but is taken direct at 2300 volts to the center of distribution downtown and stepped down to 110 volts for the new lighting system: the lamps being wired in multiple.

From the standpoint of advertisement, the idea has succeeded



FIG. 2. AURORA STREET BY DAY.

beyond expectation. Inquiries have been received from as great a distance as San Francisco and Seattle, while neighboring cities have had many delegations to see it. The illumination is very soft and of sufficient quantity to produce abundance of light and gives a good impression to all who see it. The local companies having poles in the streets willingly moved them into line and respaced them when necessary. By day the streets do not seem unnecessarily obstructed as might be supposed. The beauty of the posts and globes add to the appearance of the streets. It has been suggested by those in charge that the posts be spaced 75 ft. apart in the business district and 100 ft. apart in the residence district.



FIG. 3. AURORA STREET BY NIGHT.

A plan for series lamps with thicker filaments would be also practical. However, a part of this system has been operating since Nov. 21 last, and but one renewal has been made. In placing these lamps in position only one filament was found broken in the first test.

Wisconsin Classification of Electric Accounts.

The Railroad Commission of Wisconsin, acting under the public utilities law of that State, has promulgated a uniform classification of accounts for electric utilities. In an explanatory communication accompanying the classification the commission says that as circulars have been issued from time to time explaining the general principles upon which the accounts to be kept were to be based, and what subdivisions were to be made, a considerable number of utilities have for some time had in operation a system which conforms substantially to that submitted. The commission adds:

"The work in its present form is the result of an examination of accounting systems of practically all electric properties in this State supplemented by numerous conferences with electric company officials and their committee on accounting. It is desired that those electric utilities which have not already conformed their accounts to this system will do so at their earliest convenience. It is possible that after an adequate trial, some alterations will be found expedient both from the standpoint of general experience and practice or because of local and individual conditions. For the present, however, this classification is adherred to and prescribed and upon it will be based the annual report to be made to the Railroad Commission.

"Owing to the great difference in sizes of the properties it was found necessary to prepare two separate schedules which would recognize these conditions, and by each following the same general principles would permit comparison of operating results between the smallest and largest plants. Class B schedule is the basis upon which Class A schedule has been founded, the latter being an unfolding and refinement of the former.

"In general, electric utilities operating in cities of substantially 10,000 population or over will keep at least the list of accounts prescribed in Class A classification, and all electric utilities operating in cities under 10,000 population will keep at least the accounts prescribed in Class B classification. Upon this basis of division the opportunity for development will determine the accounts to be kept rather than the development which has actually been made. Here again, local and individual conditions must be recognized to do full justice and in a num-

bet of instance it is possible that this arrangement must be arbitrarily varied upon sufficient cause shown to the commission.

"Any utility in Class B desiring a more detailed classification than that prescribed for such class should open the accounts prescribed for Class A, and any utility in Class A desiring a more detailed system may go into as much subdivision and refinement of each of the submitted accounts as its interest requires, but must not re-arrange or combine any two or more of the accounts in such a manner as to interfere with the integrity of the general scheme and thus destroy the possibility for comparisons. A copy of all additional accounts and the desired subdivisions of the prescribed accounts must be filed with the Railroad Commission before such accounts are opened. All records and accounts, including those which are an enlargement, subdivision or refinement of the prescribed accounts, are to be open at all times to the examination of this commission.

"In order that this system may meet in a most satisfactory manner with the needs of the electric interests, consistent with the requirements of the public utilities law, it is urged that all companies which are unable for any reason to conform to the accounts for the class in which they naturally come under the above arrangements, will communicate with this commission, stating in full their reasons or conditions why special consideration should be given and an explanation of how complete a compliance with this system can be made."

The titles of the various accounts in the system are as follows:

INCOME ACCOUNT

Class A and Class B.

Operating Revenues
- Commercial lighting earnings.....
- Municipal contract lighting earnings.....
- Commercial power earnings.....
- Municipal power earnings.....
- Sales of electric current to other public utilities.....
- Miscellaneous earnings from operation.....

Total operating revenues.....

Operating Expenses:
- Power.....
- Transmission and transformation.....
- Storage.....
- Distribution.....
- Consumption.....
- Commercial.....
- General.....
- Undistributed.....

Total of above items.....
- Depreciation.....
- Contingencies (extraordinary).....
- Taxes.....

Total operating expenses.....

Net operating revenue or deficit.....
Non-operating revenue.....

Gross income or deficit.....
Deductions from gross income.
- Interest on funded debt.....
- Interest on real estate mortgages.....
- Interest on floating debt.....
- Contractural sinking fund requirements.....
- Amortization reserve requirements.....
- Miscellaneous deductions.....

Total.....

Net income or deficit.....
Disposition of net income.
- Preferred stock dividends.....
- Common stock dividends.....
- Appropriations to municipal funds (municipal plant only).....
- Other payments from net income.....

Total.....

Surplus or deficit for year.....
Surplus or deficit at beginning of year.....
Adjustments during year (profit and loss account).....

Surplus or deficit at close of year (as per balance sheet).

SCHEDULE OF REVENUE ACCOUNTS

A Operating Revenue

Class A and Class B:
1. Commercial lighting earnings
2. Municipal contract lighting earnings.
3. Commercial power earnings.
4. Municipal power earnings.
5. Sales of electric current to other public utilities.
6. Miscellaneous earnings from operation.

B Non-Operating Revenues

Class A and Class B:
1. Profit on merchandise sales (net).
2. Wiring and installation work (net).
3. Rents from land and buildings, conduits, pole lines and apparatus (net).
4. Interest on deposits.
5. Interest and dividends from investments.
6. Appropriations from municipal funds (for municipal plants only).
7. Miscellaneous non-operating revenues.

SCHEDULE OF OPERATING EXPENSE ACCOUNTS

Class A and Class B.

Power:
- (A) Steam power generation.
- (B) Gas power generation.
- (C) Hydraulic power generation.
- (D) Electric current purchased (in lieu of electric current generated).
- (E) Steam generation (apportionment account).
- (F) Power gas production (apportionment account).
- II. Transmission and transformation.
- III. Storage.
- IV. Distribution.
- V. Consumption.
- VI Commercial.
- VII. General.
- VIII Undistributed.

1. POWER.

A. Steam Power Generation.

Class A	Class B.
Operation:	*Operation.*
1a. Superintendence 1b. Engine labor. 1c. Electrical labor 1d. Miscellaneous labor.	1. Operating labor
2. Steam generation (accounts 20-25)	2. Steam generation (accounts 20-25).
3. Steam purchased.	3. Steam purchased.
4a. Lubricants. 4b. Miscellaneous power plant supplies and expenses.	4. Miscellaneous power plant supplies and expenses.
Maintenance	*Maintenance*
5a. Maintenance of steam engines and turbines. 5b. Maintenance of power plant auxiliary equipment 5c. Maintenance of generators. 5d. Maintenance of auxiliary power plant electrical equipment.	5. Maintenance of power plant equipment.
6. Maintenance of power plant buildings, fixtures and grounds	6. Maintenance of power plant buildings, fixtures and grounds.

B. Gas Power Generation

Class A	Class B.
Operation.	*Operation*
7a. Superintendence 7b. Engine labor. 7c. Electrical labor. 7d. Miscellaneous labor.	7. Operating labor.
8. Power gas produced (accounts 26-31).	8. Power gas produced (accounts 26-31).
9. Power gas purchased.	9. Power gas purchased.
10a. Water for cooling engines. 10b. Lubricants. 10c. Miscellaneous power plant supplies and expenses.	10. Miscellaneous power plant supplies and expenses.
Maintenance	*Maintenance*
11a. Maintenance of gas engines and turbines. 11b. Maintenance of power plant auxiliary equipment 11c. Maintenance of generators. 11d. Maintenance of auxiliary power plant electrical equipment	11. Maintenance of power plant equipment.
12. Maintenance of power plant buildings, fixtures and grounds.	12. Maintenance of power plant buildings, fixtures and grounds.

C. Hydraulic Power Generation.

Class A.	Class B.
Operation.	*Operation:*
13a. Superintendence.	13. Operating labor.
13b. Hydraulic labor.	
13c. Electrical labor.	
13d. Miscellaneous labor.	
14. Hydraulic power purchased.	14. Hydraulic power purchased.
15a. Lubricants.	15. Miscellaneous power plant supplies and expenses.
15b. Miscellaneous power plant supplies and expenses.	
Maintenance.	*Maintenance.*
16a. Maintenance of dams, canals and flumes.	16. Maintenance of hydraulic power works.
16b. Maintenance of turbines and water-wheels.	
17a. Maintenance of power plant auxiliary equipment.	17. Maintenance of power plant equipment.
17b. Maintenance of generators.	
17c. Maintenance of auxiliary power plant electrical equipment.	
18. Maintenance of power plant buildings, fixtures and grounds.	18. Maintenance of power plant buildings, fixtures and grounds.

D. Electric Current Purchased.

(In lieu of electric current generated.)

Class A and Class B.

19. Commercial electric current purchased.

E. Steam Generation.

(Apportionment account.)

Class A	Class B
Operation:	*Operation.*
20. Operating labor.	20. Operating labor.
21. Fuel for steam	21. Fuel for steam
22. Water for steam.	22. Water for steam.
23. Miscellaneous steam supplies and expenses.	23. Miscellaneous steam supplies and expenses.
Maintenance	*Maintenance.*
24a. Maintenance of boilers and boiler auxiliary equipment.	24. Maintenance of boiler plant equipment.
24b. Maintenance of coal and ash-handling equipment.	
25. Maintenance of boiler plant buildings, fixtures and grounds	25. Maintenance of boiler plant buildings, fixtures and grounds

F. Power Gas Production.

(Apportionment account.)

Class A.	Class B.
Operation	*Operation:*
26. Gas producer operating labor.	26. Gas producer operating labor
27. Gas producer fuel.	27. Gas producer fuel
28. Gas producer water.	28. Gas producer water
29. Miscellaneous gas producer supplies and expenses	29. Miscellaneous gas producer supplies and expenses.
Maintenance	*Maintenance*
30a. Maintenance of gas producers and gas producer equipment.	30. Maintenance of gas producer equipment.
30b. Maintenance of coal and ash-handling equipment.	
31 Maintenance of gas producer buildings, fixtures and grounds.	31. Maintenance of gas producer buildings, fixtures and grounds.

II. TRANSMISSION AND TRANSFORMATION.

Class A and Class B.

Operation.
32. Inspecting and patroling transmission system.
33. Substation and transformer station operating labor.
34. Substation and transformer station supplies and expenses.

Maintenance
35. Maintenance of transmission system.
36. Maintenance of substation and transformer station equipment
37. Maintenance of substation and transformer station buildings, fixtures and grounds

III. STORAGE

Class A and Class B

Operation.
38 Storage battery operating labor
39 Storage battery supplies and expenses

Maintenance
40 Maintenance of storage battery equipment
41 Maintenance of storage battery buildings, fixtures and grounds

IV. DISTRIBUTION

Class A.	Class B.
Operation:	*Operation.*
42a. Labor, removing and resetting meters	
42b. Labor, inspecting, removing and resetting transformers	1. Distribution system operating labor
42c. Labor, inspecting and testing meters.	
42d Miscellaneous distribution system operating labor.	
43a Meter department supplies and expenses.	13. Distribution system supplies and expenses
43b Miscellaneous distribution system supplies and expenses	
Maintenance	*Maintenance*
44a Maintenance of overhead distribution system.	11. Maintenance of distribution system
44b Maintenance of underground distribution system	
45 Maintenance of transformers	12. Maintenance of transformers
46 Maintenance of meters	46. Maintenance of meters.

V. CONSUMERS

Class A and Class B

Operation
47 Trimming and inspecting lamps
48 Lamp supplies
49 Incandescent lamp renewals
50 Miscellaneous consumption supplies and expenses
51 Customers' premises expenses

Maintenance
52 Maintenance of lamps

Note. While the above represent the ledger accounts to be kept by all electric plants, the following items will be called for in the report to the Railroad Commission, the apportionment being made upon the lamp hours basis

Commercial

17a Trimming and inspecting commercial lamps
18a Commercial lamp supplies
19a Commercial incandescent lamp renewals
20a Miscellaneous commercial consumption supplies and expenses
21 Customers' premises expenses
52a Maintenance of commercial lamps

Municipal Contract Lighting.

48b. Financing and inspecting municipal contract lamps.
48b. Municipal contract lamp supplies.
49b. Municipal contract incandescent lamp renewals.
50b. Miscellaneous municipal contract lighting supplies and expenses.
52b. Maintenance of municipal contract lamps.

VI. COMMERCIAL

Class A

Operation

53a. Collection salaries and commissions.
53b. Reading meters and delivering bills.
53c. Collection supplies and expenses.
53d. Uncollectable accounts (reserve charge).
54a. Promotion of business salaries and commissions.
54b. Promotion of business supplies and expenses.

Class B

1. Collection expense.
1. Promotion of business expenses.

VII. GENERAL

Class A

Operation

55a. Salaries of general officers.
55b. Salaries of general office clerks.
56a. General office rent.
56b. Miscellaneous general office supplies and expenses.
57. Law expenses—general.
58. Miscellaneous general expenses.
59. Railroad Commission expenses.

Maintenance

60. Maintenance of general office equipment.
61. Maintenance of general office buildings, fixtures and grounds.

Class B

Operation

General office salaries.
56. General office supplies and expenses.
57. Law expenses—general.
58. Miscellaneous general expenses.
59. Railroad Commission expenses.

Maintenance:

60. Maintenance of general office equipment.
61. Maintenance of general office buildings, fixtures and grounds.

VIII. UNDISTRIBUTED

Class A and Class B

62. Injuries and damages.
63. Insurance.
64. Stationery and printing.
65. Operation of stores department.
66. Maintenance of stores department equipment.
67. Maintenance of stores department buildings, fixtures and grounds.
68. Operation of utility equipment.
69. Maintenance of utility equipment.
70. Maintenance of utility equipment buildings, fixtures and grounds.

DEPRECIATION.

Class A and Class B.

Depreciation reserve charge.

CONTINGENCIES (EXTRAORDINARY)

Class A and Class B.

Contingencies (extraordinary) reserve charge.

TAXES.

Class A and Class B.

Taxes

DEDUCTIONS FROM GROSS INCOME

Contractual Accounts.

Class A and Class B.

1. Interest on funded debt.
2. Interest on real estate mortgages.
3. Interest on floating debt.
4. Contractual sinking fund requirements

RESERVE ACCOUNTS

Required Permanent Reserves

Class A and Class B.

1. Depreciation reserve.
2. Sinking fund reserve.
3. Amortization reserve.

OPTIONAL RESERVES.

Class A and Class B.

1. Maintenance reserve.
2. Uncollectible accounts reserve.
3. Promotion of business reserve.
4. Injuries and damages reserve.
5. Insurance reserve.

SCHEDULE OF STOCK ACCOUNTS.

Class A and Class B.

1. Fuel.
2. Power plant supplies.
3. Electric line material.
4. Transformers.
5. Meters.
6. Lamps and lamp supplies.
7. Electric appliances.
8. Miscellaneous stock.

SCHEDULE OF CONSTRUCTION AND EQUIPMENT ACCOUNTS

Class A and Class B.

Intangible:

1. Organization.
2. Franchises.
3. Rights, licenses, etc.

Tangible:

4. Land (used in operation of property):
   a. Power plant land.
   b. Substation and transformer station land.
   c. Storage battery land.
   d. General office land.
   e. Stores department land.
   f. Utility equipment land.
5. Buildings, fixtures and grounds (used in operation of property):
   a. Steam power plant buildings, fixtures and grounds.
   b. Gas power plant buildings, fixtures and grounds.
   c. Hydraulic power plant buildings, fixtures and grounds.
   d. Boiler plant buildings, fixtures and grounds.
   e. Gas producer plant buildings, fixtures and grounds.
   f. Substation and transformer station buildings, fixtures and grounds.
   g. Storage battery buildings, fixtures and ground.
   h. General office buildings, fixtures and grounds.
   i. Stores, department buildings, fixtures and grounds.
   j. Utility equipment buildings, fixtures and grounds.
6. Power plant equipment:
   a. Steam power plant equipment.
   b. Gas power plant equipment.
   c. Hydraulic power works equipment.
   d. Hydraulic power plant equipment.
   e. Boiler plant equipment.
   f. Gas producer equipment.
7. Transmission and transformation:
   a. Transmission system.
   b. Substation and transformer station equipment.
8. Storage battery equipment.
9. Distribution:
   a. Distribution system.
   b. Transformers.
   c. Meters.
10. Commercial lamps and lamp equipment.
11. Municipal contract lighting system.
12. General office equipment.
13. Stores department equipment.
14. Utility equipment.
15. Miscellaneous equipment.
16. Miscellaneous construction and equipment expenditures:
   a. Salaries.
   b. Office supplies and expenses.
17. Stationery and printing.
   d. Law expenses.
   e. Injuries and damages.
   f. Insurance.
   g. Interest.
   h. Taxes.
   i. Discount on bonds.
   j. Miscellaneous.
17. Cost of plant purchased (in lieu of plant constructed).

BALANCE SHEET.

Assets.

Class A and Class B.

Property and Plant:
Cost beginning of year.
Construction and equipment current fiscal year.
Cost close of year.
Treasury Securities:
Treasury stock.
Treasury bonds.
Investments
Stocks and bonds of other companies.
Other investments.
Reserve, Sinking and Special Fund Assets:
Depreciation reserve fund.
Sinking fund.
Amortization reserve fund.
Special funds.
Current Assets:
Cash.
Notes and bills receivable.
Accounts receivable.
Interest and dividends receivable.
Material and supplies.
Sundry current assets.
Prepaid Accounts
Prepaid insurance.
Prepaid taxes.
Prepaid interest.
Sundry prepaid accounts.
Open accounts.
Deficit.

BALANCE SHEET.

Liabilities.

Class A and Class B.

Capital Liabilities:
Capital stock, preferred.
Capital stock, common.
Funded debt.
Mortgage Liabilities:
Real estate mortgages.
Other mortgages.
Current Liabilities;
Notes and bills payable.
Accounts payable.
Matured interest on funded debt unpaid.
Matured interest on notes and bills payable unpaid.

Dividends unpaid.
Deposits.
Sundry current liabilities.
Accrued Liabilities:
Insurance accrued.
Taxes accrued.
Unmatured interest on funded debt accrued.
Unmatured interest on notes and bills payable accrued.
Dividends accrued.
Sundry liabilities accrued.
Open accounts.
Reserve, Sinking and Special Fund Liabilities
Depreciation reserve.
Sinking fund.
Amortization reserve.
Special funds.
Surplus.

The classification was discussed at the recent meeting of the Wisconsin Electrical Association, at Milwaukee, by Mr. C. N. Duffy, comptroller of the Milwaukee Electric Railway & Light Company.

Mr. Duffy said that the association had appointed a committee a year ago to work in connection with a committee appointed by the Wisconsin Railway & Interurban Association. These committees were to confer with the commission regarding the subject of uniform classifications of accounts for the electric lighting properties and the electric railways. Mr. Duffy was the chairman of the committee of the Northwestern Electrical Association. The classification of accounts for electric lighting properties was considered by Mr. Duffy, speaking from a disinterested standpoint, as serving all the purposes of the commission. He did not understand how anybody engaged in the electric lighting business would be willing to conduct it and to know less than would be required by this classification.

Mr. Duffy spoke of the meetings with Mr. W. P. Hagenah, statistician of the committee, and the conferences with representatives of the railway association and members of the committees. He said that Mr. Hagenah had made a thorough and analytical investigation of the question of accounts. In the course of his study Mr. Hagenah visited different parts of the country and various plants and had conferences in New York with representatives of the American Gas Institute, the National Electric Light Association and the Public Service Commission of New York, First and Second districts. The classification of accounts which was finally prepared was intended primarily for the uses of the commission, which unquestionably had a right to ask for what it thought might be required. Upon the information furnished under the system of accounts, the commission must base its decisions as to the fairness of rates. Mr. Duffy thought that the electric lighting companies of Wisconsin should be willing in their own interest to co-operate with the commission in this matter. The fundamental principle laid down in the classification of accounts, Mr. Duffy said, is that the method of generating electric current, whether by steam power, gas producer power or hydraulic power, should be kept separate and distinct from the other expenses.

It was then stated by Mr. Duffy that the United Railways Company, of St. Louis; the Union Electric Light & Power Company, of St. Louis, and the Milwaukee Electric Railway & Light Company, all of which are controlled by the North American Company, had been endeavoring for three or four years to work out a uniform classification of power accounts for comparison for their own purposes. When the Wisconsin classification was issued the representatives of these companies realized that it was nearer what they had been trying to get than anything else they had seen. The engineers of the Milwaukee company and of various other companies had given assistance and criticism to Mr. Hagenah and Mr. Duffy, representing the committee, in the preparation of the accounts. As the officials of the St. Louis companies were impressed with the classification two conferences were held in St. Louis, with the result that the two companies in that city decided to adopt the classification of power accounts as of Jan. 1, 1909. The results of operation of the power plants of the St. Louis companies, the Milwaukee company and also of companies in Kenosha, Watertown, Racine and Appleton, Wis., which are controlled by the same interests, will be shown, therefore, on blanks that will be identical and will be interchanged between the various companies.

Mr. Duffy also discussed briefly the details of the classification. He thought it would be possible for any company to report its earnings in accordance with the form of the income account. His experience had been that a great many of the smaller companies reported their earnings in greater detail than was required by the classification of the commission. Mr. Duffy, however, called attention to the suggestion of the commission that companies which are unable to conform to the requirements communicate that fact to the commission, stating reasons why special consideration should be given to needs in individual instances. While no classification could be a classification of accounts, a reflector of specific conditions at each plant, an analytical cost system, and a statistical data exhibit, a classification should perform these functions in a broad and general way; and Mr. Duffy said that the Wisconsin classification accomplished that purpose.

INTERIOR WIRING AND ILLUMINATION

Central-Station Illuminating Engineering at Denver.

The Denver (Col.) Gas & Electric Company now has Mr. C. F. Oehlman, one of its new-business force, giving his entire time to illuminating engineering work, endeavoring to straighten out the installations of dissatisfied customers so as to convert them into satisfied customers and working upon those who are now using gasoline. The tungsten lamp is being introduced to give more light for the same money, this being the first active effort made by this company in pushing illuminants of higher efficiency than the common carbon-filament lamp and the enclosed alternating-current arc lamp.

Electric Sign Advertising.

The electric sign for advertising purposes is being used effectively by the Western Electric Company at its manufacturing plant in Hawthorne, Ill., and at its building in New York City. In the latter city this company has placed on the top of its 13-story structure, which faces on the North River, an electric sign over 200 ft. long, with letters 9 ft. high, made up of 1000 2-cp lamps. This sign is conspicuous even from the New Jersey shore. It is viewed by thousands of persons daily, Jersey commuters, passengers on Atlantic lines, coastwise steamers and others.

At Hawthorne this company's electric sign faces the main line of the Chicago, Burlington & Quincy Railroad out of Chicago. Over this line upward of 90,000 persons travel weekly. Of these about 75,000 are suburban passengers, while about 15,000 are through passengers. Fifty per cent of the travel is between the hours of 5 p. m. and midnight. The sign being so conspicuous on account of its size, brilliancy, etc., it is safe to say practically all of these people have become acquainted with it. Of course, the results that these signs bring are not felt directly, but they are making the name of the concern familiar to hundreds of thousands of people, and the indirect results, it is believed, greatly outweigh the expense made in erecting and maintaining these signs.

A Contractor's Canvass for Residence Lighting.

Mention was made in these columns last summer of the progressive policy of the Sanborn-Marsh Electric Company, of Indianapolis, Ind., which has been canvassing the residence districts of Indianapolis for securing house-wiring business. This canvass was conducted by women solicitors, who carried with them electric irons for sale. In houses which were already

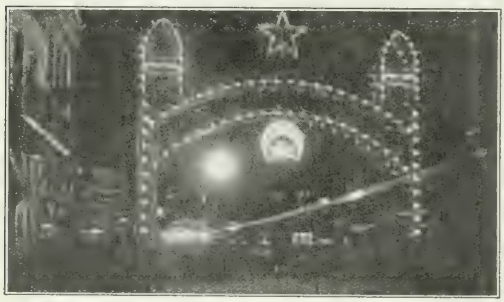
wired the attempt would be made to leave these irons on two weeks' trial. By this means the solicitors would find out which houses had electric service, which houses were wired and not connected and which were unwired. The solicitors visited every house and were required to make as complete reports as possible on the condition of the house as regards wiring and the attitude of the owner toward having the house wired. The solicitors were paid $6 per week plus a commission on the irons which they sold.

When the canvass was over the company had a complete card index record on all the houses, and in many cases the information as to the sentiment of the owner regarding wiring was exhaustive. The best prospects were sorted out and advertising literature mailed to them occasionally. The profit on the flatiron sales paid for the canvass. The Simplex iron was supplied, the lowest-priced household iron being $4.50. The circulars now being sent out are both on electrical appliances and on the advantages of having a house wired. The company is employing no solicitors, but estimators follow up all inquiries which come in reply to these circulars. It is found that this method of handling the business gets results at an expense which is not prohibitive for the contractor.

This company is endeavoring in every way to cultivate the idea that its wiremen are neat and careful, and that the wiring of an old house does not necessarily mean leaving it in a very dirty and flattered-up condition, as many suppose.

Special Street Lighting at Parkersburg.

A good example of the arch arrangement of incandescent lamps for street illumination is found at Parkersburg, W. Va. Along one of the main business thoroughfares of the city there have been placed iron lattice-work arches spanning the street from curb to curb at a sufficient height not to interfere with the



ARCH LIGHTING AT PARKERSBURG.

double line of trolley cars. These arches are equipped with incandescent lamps that are used for decorative illumination over the street on each Saturday night. The accompanying illustration shows the use made of one of these arches at the time of the K. P. C. convention in Parkersburg.

Importance of Illuminating Engineering.

By Alfred N. Wohlauer

The satirical article entitled "Illuminating Engineering vs. Common Sense," by Basil G. Kodjbanoff, printed in the issue of Jan. 21, may influence unfavorably the standing of the illuminating engineer, and the writer therefore considers it a duty to take issue with some of the statements which it contains. Although agreeing with a number of statements, especially as to the incompetence of some of those who pose as illuminating engineers, and as to the undeveloped state of the science of illuminating engineering, still the title alone of the article would reflect on illuminating engineers in general if it were not compensated by the following concession by the author: "I do not wish to be understood as maintaining there is not sufficient material and field of operation for a science and art of illumination. Not only is the subject as a whole sufficiently comprehensive to afford ample opportunities for the specialist, but it is capable of being subdivided into departments, each of which is sufficiently large to constitute a specialty." A science and art of which the above may be said can by no means be void of common sense. While thus the author counteracts the effect of the title of his article, other statements remain with which to be contended.

He says: "When all the figuring (of the illuminating engineer) has been done, are the results any better than would have been obtained by any good electrical engineer or architect who has had experience coupled with observational power?" To this the reply can be made: "Yes, many times better. Ninety-nine out of a hundred buildings erected at the present time are not satisfactory from the viewpoint of correct illuminating engineering. It is true that in numerous cases considerable deliberation and even experience are required on the side of a good and conscientious illuminating engineer who wants to do a better job than the experienced contractor or architect. But if he arrives at some definite results his work will unquestionably excel many times that of the latter. It is not only the use of up-to-date illuminants, tungsten lamps, mercury-vapor and flaming-arc lamps which make his work superior, but also his ability to apply consistently results derived from theoretical and practical study which enables him to arrive at his figures. It must be admitted that the results at the present time are not always perfect and will be better in the future, but astonishingly much has been accomplished so far which, if properly followed up, must put the work of the illuminating engineer high above that done by a layman.

Another remark tends to put the work of the illuminating engineer down to the level of goods offered at a bargain sale. An illumination well laid out is efficient, economical, efficacious, practical, artistic, hygienic, etc., and therefore less expensive than an illumination which is void of these characteristics, but it cannot be classified with cheap goods. In fact, it may involve a higher initial expense if the work and time devoted to it by the illuminating engineer are considered, but it will pay in the end.

The author claims that mathematical calculations of illumination are of no avail and just as ridiculous as "the theoretical designing of a corkscrew built on engineering principles." This is entirely incorrect; in fact, a corkscrew actually and properly built on engineering principles would represent an accomplishment worth while considering and buying if it were cheap enough.

While the author professes to consider that there is a large field of operation for the science and art of illumination, in his good intention to purge the new profession of the unscrupulous and therefore undesirable elements, he nearly comes to doing more harm than good. Much can be achieved in improving illumination, often by an application of very simple schemes and rules; and although the author is correct that "the knowledge and skill requisite to constitute an engineering profession is not something to be put on like a garment," it is more important to improve illumination than to prevent people from professing to be illuminating engineers.

New Telephone Patents.

IMPROVED RECEIVER

It has been usual for a long time to support the thin metallic diaphragm of a telephone receiver directly upon the casing or magnet mounting, relying for spacing upon the relation of the planes of the pole faces and that of the diaphragm support to provide the proper air-gap between the diaphragm and the pole-pieces. With this arrangement it has also been customary to clamp the diaphragm against its support by means of the ear-cap piece. It has been found that as this cap is screwed home its friction upon the diaphragm may at times cause initial buckling or other strains.

Mr. A. Stromberg, of Chicago, has employed a different ar-

ngement in a receiver recently patented by him. He has surunded the edge of his diaphragm with a rather substantial g-piece, which is spun over both faces to the amount of a all fraction of an inch. When the ear-cap is screwed to place twisting pressure comes directly upon the ring binding and e diaphragm itself is in this way relieved of any undue rains.

Moreover, the ring lifts the diaphragm more than normal from e supporting face and this action is used to advantage by hav- g the flange of gage thickness equal to the desired spacing tween the diaphragm and the pole-face, and the diaphragm-pporting face is so arranged that it lies exactly in the plane f the magnet pole-faces. It will thus be seen that each iaphragm carries its own adjusting spacer incident to the engthening ring.

CLEARING-OUT DROP-CONTROL CIRCUIT.

With those switchboard circuits in which a clearing-out drop ridged across a cord-pair is used to indicate the termination of conversation it has been found that, when condensers are included in the subscriber station circuits, if by chance upon calling a station the ringing key of the cord circuit is released at the top of a wave of current the back-kick from the condenser will throw the clearing-out drop. This action happens particularly often where there are many stations connected to the line being rung, the condensers at various stations acting cumulatively to make a considerable back discharge, even with a low impressed voltage.

Mr. C. A. Simpson, of Chicago, has designed drop-control circuits to overcome this annoyance, having provided the ringing keys with auxiliary contacts so arranged that whenever the ringing key is thrown an auxiliary relay is cut into circuit, its contact closing a low-resistance path across the cord-pair between the clearing-out drop and the innermost contacts of the nearest ringing key. As soon as any one of the keys is depressed in ringing, the auxiliary relay responds, thereby short-circuiting the clearing-out drop; when the ringing key is released the condenser discharge, occurring practically simultaneously therewith, takes place across the relay path instead of through the clearing-out drop, before the relay has had time to fall back.

AUDIPHONE TRANSMITTER.

As is well known, audiphone transmitting instruments are usually carried suspended about the person of the user and it most frequently happens that the clothing of the user is immediately in contact with the audiphone transmitter, the result being that the yielding substance of the clothing acts as a damper for the transmitter. Mr. C. E. Williams, of Natick, Mass., has obtained a patent for an audiphone transmitter designed to overcome this difficulty. It will, of course, be understood that such transmitters are designed to pick up the maximum of extraneous sounds; in order to increase the efficacy he has associated the transmitter with a sounding-board casing of hard rubber. The sounding board has sides like an open box and it lies against the person of the user. The front of the sounding board, to which the transmitter is directly secured, is slightly smaller than the rear part, so that sound impinging upon the instrument is effective in two ways. The sound that impinges on the front cover acts directly on the transmitter, while that which impinges on the open space between the front cover and the edges of the sides of the box strikes against the bottom of the rear and is there reflected to the transmitter.

PARTY-LINE RINGING DEVICE.

A step-by-step switching device for controlling lock-out party-line stations is the subject of a patent granted to W. Hagstrom, of Lindsborg, Kan. This is a polarized electromagnetic device which responds to impulses in one direction to drive forward a step device, thereby connecting one station after the other to the line, the desired station corresponding to the total number of impulses sent. Upon reverse currents being applied after conversation is complete, the releasing pawls are withdrawn to permit the return to zero at all the stations.

LETTERS TO THE EDITORS.

Wireless Telegraph Inductance Coils.

To the Editors of Electrical World:

SIRS:—Referring to the article by Mr. John L. Hogan, Jr., on "Inductance Coils Used in Wireless Telegraphy," in your issue for Feb. 18, we wish to state that our "variometer" type of inductance or tuning coil, based on the principle of the Ayrton and Perry standard, has formed a part of our regular receiving sets since 1905. These coils are also provided with a simple switch for cutting them entirely out of circuit when even the minimum inductance obtainable with the two coils in complete opposition is too high.

We have always advocated and used loose coupling, both sending and receiving, and with one movable coil—for varying the coupling—and with both the movable and the stationary coil variable. We employ this type particularly in connection with our receivers, but have also supplied transmitters with two independent variable coils inductively coupled and with one of the coils movable for varying the coupling.

TELEFUNKEN WIRELESS TELEGRAPH CO. OF NEW YORK.

To the Editors of Electrical World:

SIRS:—In reading the editorial "Inductance Coils Used in Wireless Telegraphy," in the issue of Feb. 18, 1909, one is struck by the statement that in fixed coils with variable points of contact the inductance varies nearly as the square of the number of included turns. The approximate expression for the inductance of a helical conductor is

$$L = (\pi dn)^2 l$$

where L represents the total inductance, d the diameter of helix, n the *number of turns per unit length* and l the length of the coil. Assuming n to be constant (as is usual), the total number of turns will be proportional to the length l. In all ordinary construction d is constant, whence it is certain that the amount of inductance in the circuit varies directly with the mechanical displacement of an axially sliding contact.

NEW HAVEN, CONN. JOHN L. HOGAN, JR.

Valuation of Public Utility Properties.

To the Editors of Electrical World:

SIRS:—I note in your article on the Supreme Court decision in the Knoxville water case (issue of Feb. 11) what appears to me a fallacy in the reasoning of the Supreme Court on the subject of depreciation. The court says:

"If, however, a company fails to perform this plain duty, and to exact sufficient returns to keep the investment unimpaired, whether this is the result of unwarranted dividends upon over-issues of securities or of omission to exact prices for the output, the fault is its own. The court could not undertake to correct such past errors of management."

Unless I misapprehend the application of this it means that returns can only be computed on the existing structural value of the plant—that is, the cost of reproduction diminished by an allowance for decreased value due to age. Or, put in another way, that the wages of a servant should be diminished as his age increases, unless he has been able to lay aside adequate provision for old age, even though age has not diminished the quality or amount of the work he performs; or, again, that of two servants performing identical duties, the younger should receive the higher pay, unless the older has accumulated property.

The fallacy consists in failing to perceive that, while purchase value is affected by age, rental value (in the absence of decreased efficiency) is not. To further illustrate: Assume that two horses are for sale, both of whom can do the same day's work, and that one of them is much older than the other. It is clear that the younger horse will bring the higher price, as the additional length of time during which he will be useful is a

vital factor. Assume, again, that these two horses are offered for hire; is there anyone who will dispute that, as long as they do equivalent work, they are entitled to the same earnings?

I believe that failure to recognize the difference between sale and rental values, in public utility cases, has been due to the false assumption that the purchaser at depreciated prices would need to consider only such prices in fixing rates of return, and that, therefore, there was no justice in allowing the owners to charge rates based on larger sums. This assumption fails to take into account the fact that the sum which must be accumulated for rebuilding is not the depreciated cost paid, but the original cost; and that, therefore, to escape loss, such a purchaser must do either one of two things: First, at once place in a depreciation fund the difference between the price paid and the cost of reproduction, new; or, second, collect each year, in addition to the current depreciation, a further sum which will make up the past depreciation during the remaining life of the plant. In either case, in order to obtain the same net earnings, the rates charged must be equal to those charged on a new plant.

It appears to me to be of immense importance to the public utilities of the country that the fact of rate of return being a function of reproductive—and not of depreciated—value, be firmly established.

SUPERIOR, WIS. W. H. WINSLOW.

The Metric System.

To the Editors of Electrical World:

SIRS:—The recent important action taken by the American Society of Civil Engineers, in favor of metric reform, has been received with much satisfaction by all in Europe who know the advantages that metric reform has there brought about, and who are desirous both of extending these advantages to other countries and of seeing the whole world adopt a uniform language in all departments accessible to measurement, for facilitating international transactions which are becoming constantly more frequent.

The great importance of the discussion announced for Jan. 20 requires that it should be elucidated as fully as possible, and that every trace of misunderstanding should be eliminated therefrom in advance. A perusal of the article published in your number of Nov. 9 has made me fear that some little hesitation still exists in the interpretation of the law of the United States relative to systems of measurement, and it is on this account that I beg to take part in the discussion of the subject.

Let us first establish a principle that experience has many times confirmed in the past. A mere *authorization* to employ a simple and rational system of measurements in commercial transactions, as a substitute for a much less perfect system long established by usage, is not sufficient to bring about a reform. In fact, in commercial affairs, the buyers and sellers are dependent one upon the other in such a manner that unless one of them completely dominates the situation, neither is able to take the initiative toward the adoption of the improved measurements. The authorization of the employment of improved measures rests, therefore, a dead letter for all the internal commerce of a country, and only the external commerce is in a position to benefit thereby. In order to bring about, not the entire application, but even a partial application, of the improved system in the purchase and sale of commodities, it is necessary to make the new measures *obligatory*.

The situation is quite different in manufacturing. Here each individual possesses a much greater degree of liberty. Each manufacturer can introduce into his factory the new system without reference to the action of neighboring factories, and only with reference to his own better advantage.

Nevertheless, it must be admitted that the introduction of metric reform into the shop of an individual manufacturer is apt to present a considerable difficulty, such as is likely to retard the enterprise for a considerable period. Here again uniformity of action, without being indispensable as in commerce, at least offers marked advantages, and it may be said that the adoption of a rational system of weights and measures, as a substitute for a less perfect system, is advantageous in proportion as the system is generally recognized and employed.

But the industrial situation is distinguished from the commercial situation by two important factors. Firstly, the number of individuals interested in the industrial reform is much more limited, and they possess a technical education considerably above the public average. Secondly, those interested in industry are more apt to recognize and adopt an innovation, and, moreover, they reach a mutual understanding with far less difficulty, an advantage which gives an impetus to reform, at least among those engaged in the same branch of industry.

The sole condition necessary for bringing about such a result is that the system of measures to be introduced shall be *authorized* by law.

In this connection the situation of the metric system in the United States is especially advantageous. The metric system is the only system which has been legalized in the entire Union. The customary measures, on the other hand, are well known to be more or less variable, having been recognized only by the laws of individual States. No general law has ever been imposed by the United States for the employment of the yard, the pound, the gallon or the bushel. Whereas, by the act of July 23, 1866, the metric system was declared legal from the Atlantic to the Pacific.[1]

Nothing would prevent, then, the manufacturing establishments of the United States from adopting the metric measures. In order that this adoption should be immediately advantageous to any, I think it would be sufficient that a considerable number among them should come to an understanding to effect the reform simultaneously, so as to constitute a co-operative union of interests, toward which the outsiders would be gradually drawn into conformity.

The possibility of such an understanding has been clearly demonstrated at various times by the experience of European manufacturers. In Switzerland, for example, where the metric system is obligatory in commerce, but where all kinds of measurements are authorized within factories, a long-established custom caused watchmakers to adhere to their old measurements, based on the Paris foot. In consequence, however, of an agreement between the large factories, and an actively prosecuted campaign, the old system of measurements, which was in very general use five years ago, has almost entirely disappeared from the watchmaking industry, which will certainly be completely freed from the last vestiges of the old system in the course of the next five years.

Another example of an understanding, international in this case, has been given by the extension of the system of metric screw-threads, which all the recent industries of continental Europe have adopted, and which the long-established manufacturies are adopting as time goes on and as the originally existing plant becomes worn out. At the present day the international metric system of threads, officially sanctioned less than 10 years ago, is certainly the most extensively used system in the mechanical industries of continental Europe.

Metric reform would be greatly facilitated in the United States by certain fortunate conditions there existing, in reference to particular groups of manufacturers, the most interested in the use of a simple and rational system of measurements, reducing computations to a minimum.

Thus the law gives to American engineers every opportunity for the adoption of metric measurements. The introduction of factory measurements is at the same time placed within their control in a very effective manner. There are certain American firms (Brown & Sharpe; Pratt & Whitney; the Lufkin Rule Company, Saginaw; W. & L. E. Gurley, Troy) who manufacture instruments on the metric system with great precision, and who export them in considerable quantity to Europe. The Bureau of Standards is also equipped to determine metric standards, in addition to those of the customary American system. In fact, it is even better equipped for this purpose, since

[1] Louis A. Fischer and Henry D. Hubbard: "Laws Concerning the Weights and Measures of the United States."

conformity with the law of April 5, 1893, the American units of measure are defined in numerical ratio to the metric units.

Finally, let us not forget that, in many instances, metric measurements are forced upon manufacturers in the United States unless they withdraw from dealings with European countries and Latin America. The facility with which metric reform can be effected in a factory for the execution of large orders has been clearly demonstrated by the recent example of the Baldwin Locomotive Works, which were equipped with great rapidity for the manufacture of a batch of locomotives ordered to metric dimensions by a French railway company, and which executed the order without any error having been observed.

I have above endeavored to show that it would be practicable for American factories to bring about metric reform in certain mechanical industries entirely by mutual voluntary action. The examples above cited show that such reform is possible by mutual understanding, and that no special legislation is necessary for the purpose. Nevertheless, it is true that if a law of the United States called for the introduction of the metric system into commerce, its introduction into manufacture would become much more simple and rapid. Manufacturers interested in such reform should, therefore, not lose sight of the advantage of legislative action, but if it seems difficult to obtain such action in the near future, it should be quite possible to take the initiative even in individual cases, or at least by mutual agreement among industrial groups.

One argument only, worthy of consideration, has been offered in opposition to metric reform in the discussion. The adoption of the new measures produces in every industrial plant a disturbance which is annoying and sometimes expensive.

The most ardent partisans of metric reform are obliged to admit the validity of this argument, but an impartial examination of the situation indicates, at the same time, that its importance has been greatly exaggerated. Mr. Byrom announced at the Cotton Congress, Manchester, in 1905, that the adoption of the metric system would cost English engineers alone a sum in excess of $500,000,000. The absurdity of such a statement is evident to all those who have followed the progress of metric reform in industrial countries, such as Germany. As for England, it is only necessary to consider that Mr. Arthur Chamberlain, president of Kynoch's, estimates that the adoption of the metric system by his important firm has cost exactly a half of one per cent of profit for a single year, balanced by a marked economy in the year following.[2]

Whatever may be the disturbance caused by the adoption of the metric system in manufacture, it must be clearly recognized that, sooner or later, metric reform must come about, owing to the inevitable law of progress and perfection; and, moreover, that the longer the reform is put off the more expensive it must be, not only because industrial production is constantly increasing, but also because the losses caused by a wasteful system are constantly increasing.

It is also necessary to take into consideration a factor of considerable importance, namely, that the longer metric reform is put off, the longer the Anglo-Saxon countries will find themselves isolated from mutual understanding with other nations in respect to measures. The report which I am forwarding herewith[3] contains a statement of the actual condition of the metric system in the world. It is there shown that the only industrial countries, outside of Anglo-Saxon countries, in which the international metric system is not obligatory by law, are Japan and Russia. In the latter countries, however, metric measurements are in rapid development. The metric units introduced into these countries in 1891 and 1900, respectively, have advanced so rapidly that, in Japan, metric units of weights are calibrated 12 times more frequently than the weights of the national system, while in Russia, 250,000 metric weights have been calibrated and delivered to commerce in two years.

Moreover, in China, a preliminary reform in weights and measures has been accomplished during the current year in the direction of the metric system by adopting as a measure of length a unit of 32 cm, the multiples and sub-multiples of which are all decimal, in such a manner that the centimeter is the basis of the new Chinese measurement, which from one end of its range to the other is referred to the centimeter by a simple equivalent in which the significant figures are constant. Thus the metric system has recently penetrated those countries which have been for the longest time connected to secular traditions, and their influence will, apparently, before long markedly affect the coalition of the metric countries. It would be, moreover, an error to suppose that, as has occasionally appeared in recent statistics, the Anglo-Saxon countries are jointly opposed to the metric system. Scientific measures, all the world over, employ to-day no other units than those of the international metric system, which is the same as that of all electric measurements. The American scientist is, without doubt, more familiar with the kilogram than with the pound, and an American engineer can hardly be unacquainted with the gram and the centimeter, which are the bases of his units the volt and ampere, as well as of the joule and the watt, in which latter units the metric connection is perfectly clear. The American exporter cannot be ignorant of the meter and of the kilogram, because he meets them constantly in his regular business. Even within the United States, the purchases by civil or military hospitals are made almost exclusively in the units of the metric system.[4]

Thus the adoption of the metric system appears as the necessary solution of a dualism which is a constantly increasing annoyance. Its future acceptance becomes irresistible before the world pressure in its favor. For commerce, as I have already endeavored to show, compulsory legislation can only bring about benefit, but that is a matter of national action whose limits are beyond the subject of the present debate. Manufacturers can, themselves, however, accomplish a large share of metric reform, which will be beneficial to all, and the time is favorable for initiating it.

CH. ED. GUILLAUME.

Bureau International des Poids et Mesures, Sèvres, France.

[2] *Nature*, March 14, 1907.
[3] "Report upon the Recent Progress of the Metric System."
[4] Laws of April 13, 1894, and of Nov. 21, 1902.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Parallel Operation of Alternators. E. ROSENBERG. A long illustrated paper read before the (Brit.) Inst. Elec. Eng. dealing with hunting troubles in the parallel operation of alternators. The author explained the magnifying effect of the electrical reaction of an alternator on the oscillations produced by those irregularities in the torque diagram which were not taken care of by the flywheel, and he gave some curves which showed the critical values of the flywheel effect for given electrical constants, as a function of the speed. The author pointed out that the dangerous conditions could be [illegible] increasing the flywheel effect or by improving the regulation of the alternator. In very slow-speed engines often the only possible way is to reduce the initial oscillations to the smallest possible value and to apply amortisseurs to the alternator. In the London discussion Stoney called attention to the part played by the governor in causing hunting of parallel alternators. Clough doubted the value of dampers. The importance of proper valve setting was emphasized by Howe, and Thompson said that one conclusion to be drawn from the paper was that no alternator

should be driven by engines running at less than 100 r.p.m.—Lond. *Electrician*, Jan. 29 and Feb. 5; Lond. *Elec. Eng'ing*, Feb. 4.

Frequency Changers.—Behrend.—To supply a traction system with energy from a lighting network, frequency changers are required. The most important practical case is the transformation from 50 cycles, three-phase, to 15 cycles or 25 cycles, single-phase. If the transformation is always in the same direction, namely, from three-phase to single-phase, the use of non-synchronous machines has certain advantages. But if occasionally transformation is also to be made from single-phase to three-phase, the fact must be taken into account that induction generators always require the simultaneous operation of synchronous generators. In general it will therefore be preferable to use synchronous motor generators. In order to facilitate their connection in parallel and the proper regulation of the distribution of load on several machines working in parallel, the Siemens-Schuckert Company makes one of the four main parts of the motor generator (that is, either one stator or one rotor) displaceable against the other stator or rotor. For most purposes the simplest method is to make one of the two stators displaceable with respect to the other.—*Elek. Zeit.*, Feb. 4.

Transforming Alternating Current into Low-Tension Direct Current.—D. Korda.—An illustrated description of a converter for special application in electrolytic works or other works requiring low-tension direct current, but connected to alternating-current systems. The special feature of the machine designed by Heyland and Korda, and described in this article, is the production of both alternating and direct currents by unipolar induction in the same machine. The principle is stated as follows: "The tension produced in each conductor of the alternating-current winding is not primarily alternating, but pulsating and of constant sign. It becomes alternating only by the method of connecting the conductors in series among themselves. However, the same conductors can be connected in such a way that the pulsations are added together always with the same sign. A pulsating direct current is then obtained. Finally, if the connections are made in such a way that the pulsations are added under a certain phase displacement, a direct current of constant intensity is obtained."—*La Lumière Elec.*, Jan. 30 and Feb. 6.

Lamps and Lighting.

High-Efficiency Incandescent Lamps vs. Carbon Lamps.—C. Leonard.—The first part of what will probably be a long article on the comparison of carbon-filament lamps and the new high-efficiency incandescent lamps. The author first discusses those practical units on which a comparison must be based. In comparing the candle-powers, the spherical candle-power must be used. The author explains the importance of the mean spherical candle-power during useful life, and the mean specific consumption during useful life in watts per mean spherical candle-power. The cost of the mean spherical cp-hour depends on the useful life, the price of the lamp, the price of the kw-hour, the mean spherical candle-power during life, and the mean specific consumption during life. The author begins with a discussion of the carbon-filament lamp. The article is illustrated by diagrams.—*La Lumière Elec.*, Feb. 6.

Tungsten Lamp.—A note on a British patent of W. C. Arsen (17,618, 1908) for a process of making tungsten filaments. It consists in first mixing very finely divided WO_3 with graphitized lampblack and a solution of ceresene, rosin and gilsonite, in benzole. To insure a uniform mixture the product is passed several times through a fine aperture under pressure, and finally squirted through a circular die. The squirted threads are baked at a temperature of about 350 deg. C. to drive off the volatile components. They are then packed in powdered silica in graphite troughs, and fired to a temperature of 1500 deg. C. to complete the reduction and to sinter them together.—Lond. *Elec. Eng'ing*, Feb. 4.

Tungsten Lamp.—An article by H. T. Owens on the progress of street lighting by tungsten lamps in the city of New York; and an article by N. Macbeth on tungsten lamps in a hat-store window.—*Illum. Engineer*, January.

Flame Arc Lamp.—An illustrated description of a double electrode flame-arc lamp made by a British company. When the lamp starts up the arc is struck between only the first pair of electrodes, for the second pair is kept further apart than the first by slightly staggering the holes in the striking cradle through which the electrodes of one pole pass, and no arc is, therefore, struck between them. The electrodes are placed in the usual slanting position, and are controlled by shunt- and series-wound solenoids, one at each end of a rocking lever. This lever releases a drum from which the cross-bar, carrying the electrode holders, is suspended by a flexible cord, this latter being automatically wound up by a coiled spring inside the drum when the cross-bar is lifted for trimming. When the first pair of electrodes is nearly consumed the cross-bar carrying them touches one end of a small lever, and, gradually pressing it down, causes a rod which is connected to the other end of the lever to be raised until the controlling gear for the second pair of electrodes comes into action. The change-over, therefore, takes place quite smoothly and is practically imperceptible. The arc is practically at the same point in the globe whichever pair of electrodes is in use. In the continuous-current lamp the electrodes are 9 mm and 8 mm in diameter, respectively, and in the alternating-current lamp they are both 9 mm. The burning hours are 11 for each pair of electrodes, or one lamp burns for 22 hours without retrimming. This lamp will burn two in series on 100 volts, or four in series on 200 volts, or any number in series on a suitable voltage on both continuous- and alternating-current circuits.—Lond. *Electrician*, Jan. 29.

Flame-Arc Lamps.—Some notes on the Jandus "regenerative" flame-arc lamp, which has been on the British market for nearly a year and is now used in about 27 British cities. The burning life varies from 70 to 90 hours, according to the type of lamp, etc., and this length of burning is obtained with one pair of electrodes, which may feed continuously without any break. The longest electrode is 18 in. and of large cross-section, namely, $\frac{5}{8}$-in. diameter, and this reduction of length results in a short lamp with an over-all length of only 36 in. The arc is completely enclosed, and no fumes can escape.—Lond. *Elec. Rev.*, Feb. 5.

Flux of Light Method.—E. L. Elliott.—A continuation of his serial, discussing simple calculations from the practice of the illuminating engineer, covering the flux of light principle. The article is illustrated by diagrams.—*Illum. Engineering*, January.

Generation, Transmission and Distribution.

Gas Power.—J. R. Bibbins.—An illustrated description of the Swissvale plant of the Union Switch & Signal Company which is of practical interest as it was one of the very earliest 60-cycle, gas-driven, alternating-current plants installed in this country, yielding eight years' experience to date. Its operation at all times has been representative of the average industrial plant on 24-hour service. The results of this long experience are summed up as follows: The modern gas engine, properly operated, is fully equal to industrial power service even with alternating-current distribution. Eight years' experience points to a normal depreciation rate on the vertical type, with every indication of an equally satisfactory future for the horizontal type of engine. The operation of either the horizontal or the vertical type presents no greater difficulties than does a good steam engine, and requires about the same extent and grade of attendance. In double-acting designs ample security is provided against careless operation by automatic oiling and duplicate igniters. The necessary uniformity of combustion is assured. Cost of energy generation, with all charges included, is relatively low; it is well below steam. Regulation is suited to demands of direct-current or alternating-current parallel operation. Speed variation is within present requirements. Angular deviation is well below that of steam engines, with sufficient factor of safety to cover ordinary contingencies. The success of solid-coupled, 60-cycle plants is practically assured for general commercial service.—*Electric Journal*, February.

Application of Motors.—H. W. Peck.—An illustrated article on the selection of electric motors for industrial purposes. The

rst thing to consider is the power requirement of each machine individually. It is important, especially in old plants which are being modernized, to examine each machine with the idea of replacing it if possible with a new machine of enough greater sufficiency to warrant the investment and with the idea of correcting mistakes in operation which may have crept into practice insidiously and remained unnoticed. Of prime importance is the matter of speed variation, as it determines the choice between the direct- and alternating-current systems, if both forms of energy are available from the central station. The author discusses briefly the special features of various types of motors for different purposes and then speaks of individual and group drive. Individual drive is correct when, 1, the cost of installation is less than for a group drive; 2, when the saving in operating cost of the individual drive is more than enough to pay the additional fixed charges of this form; 3, when the convenience of operation is worth the additional cost which may be involved. The discrepancy in cost between group and individual drive is not as great as might at first be supposed. The saving in operating cost of individual drive depends on: 1, the difference in fixed charges, usually in favor of group drive; 2, the difference in efficiency of the motors, which is in favor of the large group motor if run at high average load, otherwise in favor of the smaller motors well loaded when running at all; 3, the number of bearings, loose pulleys, belts and gears eliminated by the use of individual motors; 4, the average hours daily use of machines.—*Electric Journal,* February.

Electricity in Metallurgical Works.—E. W. LEHMANN-RICHTER.—The author gives a comparison of the losses with mechanical transmission and electrical transmission in large metallurgical works. He then describes the method used in the lead and silver works of Braubach for determining the power consumption of the various machines. He describes in detail the various systems of group driving and individual driving employed in these works. Electric motors are used for crushing, traction, elevators, blowers, exhausters and compressors.—*Elek. Zeit.,* Feb. 4.

Energy Distribution.—G. L. ADDENBROOKE.—His concluding lecture on energy supply in Great Britain. The author commences by describing the modern distributing system. In connection with the protection of mains he advocates the adoption of the balanced transformer system. With regard to future developments, he looks forward to the time when the gas engine, supplied with gas from producers consuming bituminous coal, will be able to compete successfully with the steam engine. Such a development, however, can be retarded, in his opinion, by effecting further economies in steam plant. In concluding, the lecturer dealt briefly with the legal position.—Lond. *Elec. Eng'ing,* Feb. 4.

Electric Motors in Railway Shop.—An illustrated description of the electrical equipment of a large railway workshop in India. The plant was recently electrified, the aggregate rating of the motors being 2000 hp. The present generating plant consists of two 125-kw and two 250-kw sets. Three additional sets, of 375 kw each, will shortly be in operation. Energy is supplied on the three-wire system with 440 volts across the outers, to which nearly all the motors are connected. The 220-volt supply is reserved for lighting, fans, a few small motors and some portable electric drills. Two balancers, each capable of dealing with an out-of-balance current of 50 amp, are installed. —Lond. *Elec. Rev.,* Jan. 29.

Energy Cost.—H. S. KNOWLTON.—An article on the cost of generating electrical energy during four succeeding years in a New England central station of about 5000-kw rating. The equipment consisted in 1905 of 10 generators ranging in rating from 135 to 675 kw and driven by steam engines. In 1908 a 2000-kw steam-turbo-generating set was installed. The cost of generating electrical energy during the four years is summed up from the article, as far as possible, in the accompanying table. The total operating cost given in the last column includes the cost of fuel, rentals, station, real estate, oil and waste water, wages for stations, station repairs, steam-plant repairs, electrical-plant repairs, and of the station tools and appliances. The table shows a progressive increase in the cost of coal, and, as an offset, a considerable increase of the motor load of the station from year to year. No information is given on capital investment, interest or amortization.—*Power,* Feb. 9.

Year.	Cost of coal.	Fuel consumption per kw-hour, lb.	Kw.-hour generated.	Kw.-hour sold for industrial purposes.	Fuel cost per kw hour, cent.	Wage cost per kw hour, cent.	Total operating cost per kw-hour, cent.
1905	$4.28	3.29	5,354,000	1,409,000	0.63	0.318	1.30
1906...	4.42	3.09	6,038,000	1,772,000	0.61	0.286	1.18
1907...	4.55	...	.....	2,196,000	0.635	0.247	0.975
1908...	4.75	3.35	9,426,000	3,760,000	0.71	0.262	1.06

Ventilation of Mines.—A. H. STOW.—A paper discussing the relative advantages of pressure fans and exhaust fans for mines. While the general preference is now for exhaust fans, the author endeavors to show that pressure fans have distinct advantages. —*Bull. Am. Inst. Mining Eng's,* February.

Brakes.—J. C. RENNIE.—An abstract of a paper read before the Northampton Institute Engineering Society. The stopping distance for a car is proportional to the square of the speed and is inversely proportional to the friction coefficient. With the present tendency to increase speed it is important to seek improvement in the study of friction, with a view to increasing the coefficient of friction. The author suggests a method of measuring more accurately and satisfactorily the coefficient of friction of the brakes on a tramcar. The ordinary method of loading a track brake on a truck and drawing it at various speeds, measuring the drawbar pull, is admittedly unsatisfactory, and impossible at high speeds. The proposal is to obtain a curve giving the variation of the friction coefficient with speed directly from an accelerometer. The simplest form of accelerometer is a simple pendulum which can oscillate in the plane of the car's motion. When the car is accelerating or retarding, the pendulum will be displaced proportionally to the acceleration or retardation. The car is run up to any required speed, the power shut off and the brakes applied until the car comes to rest. If a retardation curve has been taken from the instrument, for the car coming to rest under running friction alone, the difference of the curves gives the retardation due to the brakes. This retardation is the product of the load on the shoes and the coefficient of friction. If the load is constant, the curve finally obtained is a curve of the friction coefficient. The scale could readily be calibrated to give direct readings of the coefficient of friction by selecting a suitable length for the pendulum. The instrument could be made very delicate if required, for a pendulum 32 in. long will give a movement of approximately 1 in. for an acceleration of 1 ft. per second per second. The coefficients could on this scale be read directly to the second significant figure without difficulty. This instrument would also be useful for determining the comparative states of different rails for greasiness, and would probably be very convenient in the training of drivers.—Lond. *Elec. Engineer,* Feb. 5.

Definition of Acceleration.—C. O. MAILLOUX.—A paper read before the International Electrical Congress at Marseilles on the industrial definition of train acceleration. The author defends the use of the miles-per-hour-per-second unit for the calculation of train acceleration, as against the unit of feet-per-second-per-second.—*Elec. Railway Jour.,* Feb. 13.

Convention.—An account of the proceedings of the annual meeting of the Central Electric Railway Association, held in Indianapolis on Jan. 28, together with an account of the proceedings of the Central Traffic Association meeting held on Jan. 27, and reprints of two papers presented, one by W. E. Rolston on the proper installation and equipment, and the other by G. H. Kelsey on operating lamps and motors upon railway circuits.—*Elec. Railway Jour.,* Feb. 6.

Motor and Relay Connections.—H. W. BROWN.—A continua-

tion of his long illustrated serial. In the present installment the author deals with three-phase, four-wire circuits and discusses the method of grouping and the connections of the wattmeter and power-factor meter, and of the voltmeters and ammeters. The minimum number of meters and meter transformers, for a three-phase, four-wire circuit, is always as great, and sometimes greater, than is required for a three-wire circuit. One single-phase wattmeter or power-factor meter is not suitable for the entire circuit, because a four-wire circuit is usually unbalanced, and the unbalancing would affect the accuracy of these instruments. Three series transformers are required on four-wire circuits for use with wattmeters, power-factor meters or ammeters, if measurements are to be made on all the phases. Three shunt transformers must be provided if it is required to measure the e.m.f. from each line to neutral and also between any two non-neutral—main—lines. Three shunt transformers are required—whether the e.m.fs. to neutral are to be measured or not—if a wattmeter is also to be used in addition to the voltmeters measuring the e.m.fs. between all of the non-neutral lines. If the e.m.f. from only one or two lines of the neutral and the e.m.f. between only one pair of main lines is required, only two shunt transformers are necessary for both the voltmeter and the wattmeter. A grounded neutral system must be treated as a four-wire circuit, if any current returns through the ground, the currents in the other lines would be the same as if it were returning through a neutral line. Sometimes a system is grounded or has a neutral line in one part of the circuit, but has no connection to ground or neutral in another part. At all points between the connections to ground or neutral, the system must be considered as a four-wire circuit, but at other

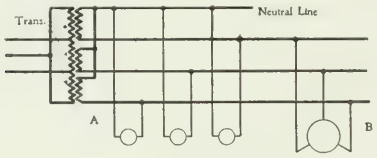


FIG. 1.—DIAGRAM OF CONNECTIONS.

points connections may be made for either a three-wire or a four-wire circuit. A common arrangement of this kind is to have one side of the transformers delta-connected and the other side Y-connected. Three lines are brought out from the delta-connection and four from the Y-connection. In Fig. 1 the middle portion is a four-wire circuit having Y-connected transformers with a neutral line brought out from the common transformer connection. This part must be treated as a four-wire circuit. The left-hand part is delta-connected, and the right-hand part has no connection to the neutral. Both the left-hand and right-hand parts may, therefore, be considered as three-wire circuits. *A* represents any single-phase or three-phase apparatus connected to the neutral, while the apparatus at *B* has no neutral connection.—*Electric Journal,* February.

Electric Installation in Mines.—A set of regulations for lamp and motor installations in mines, proposed by the German Association of Electrical Engineers.—*Elek. Zeit.,* Feb. 4.

Wires, Wiring and Conduits.

Wiring of Buildings.—D. S. Munro.—A paper read before the Glasgow section of the (British) Inst. Elec. Eng. The author reconsiders the various familiar methods of wiring, with their advantages and troubles, as a reminder that no really good and cheap method of indoor wiring has yet been invented and that the subject is worthy of persistent attention and effort. It is quite possible that there will be a return to lower consuming voltages coincident with the development of high-tension transmission. With pressures of from 25 to 100 volts the wiring precautions can be very materially reduced, and cheap methods of wiring would have a fair chance, notwithstanding the increased size of indoor cables; the increased efficiency of lamps is of assistance. Whether present pressures be changed or not, there is a demand for a cheaper system of wiring. Until the advent of good, cheap wires fit for drawing-in uncovered, like gas pipes, the choice will be limited. Iron or steel conduit has not much in its favor. If wiring must be concealed, what is wanted for branch wires is cable, with its metallic protection complete, manufactured in long lengths and delivered in coils and soft enough to unwind, bend and straighten easily. With such a cable it would be a pity not to use the continuous metal covering as the neutral wire in town work, or as, say, a negative in isolated work. With such a metal covering, enameled run in dry places and on insulating studs in damp places, the leakage risk would be small, seeing that the external metal would be so nearly at earth potential. Architects in designing buildings should provide better paths for electrical conductors.—Lond. *Electrician,* Jan. 29.

Compound Wire of High Self-Inductance.—An abstract of a British patent (13,678, 1908) of A. Wolff. Many attempts have been made to produce a conductor which shall have great self-induction, but shall not be subject to the action of the skin effect. Pupin coils inserted with this object have not always been successful owing to a reflex action and the sensitiveness with respect to magnetic influence. Compound conductors of copper and iron have also proved impracticable. According to this invention it is proposed to use a conductor comprising a magnetic steel core and a non-magnetic manganese steel outer case, or alternate layers of magnetic and non-magnetic steel.—Lond. *Elec. Eng'ing,* Feb. 4.

Fuses.—The conclusion of the first part of his long illustrated article on the historical evolution of the construction of fuses, with recommendations to standardize a certain type.—*Elek. Zeit.,* Feb. 4.

Electrophysics and Magnetism.

Photo-Electricity.—J. A. Fleming.—The author first describes a convenient method of preparing a suitable specimen of a highly photo-electric potassium-sodium alloy. This is contained in a glass tube, connections to the outside being made by means of platinum wires. In the same glass tube, but isolated from the alloy, there is a platinum strip, also connected to the outside by means of platinum wires. Various experiments with this arrangement are described. If the tube is supported in a horizontal position, an electric arc contained in a projection lantern, equipped with the ordinary condenser lens, can be so placed and tilted downward as to converge on to the brilliant mercury-like surface of the pool of alloy a very concentrated beam of light. If, then, the platinum plate and the alloy are connected by means of wires with a sensitive mirror galvanometer, it is found that the impact of the light upon the surface of the alloy not merely facilitates the escape of negative electricity from it, but actually creates an e.m.f. and current in the galvanometer circuit, which is in such a direction as to indicate that negative electricity is caused to move, by the action of the light, through the vacuum from the surface of the alloy to the platinum plate. The physical operation of this photo-electric cell is not identical with that of an ordinary voltaic cell, since the current is in opposite direction. By using two such cells in series the author finds that the separate photo-electromotive forces are additive, and that if such photo-electric cells are joined in series like voltaic cells and separately illuminated, the individual e.m.fs. are added together in an external circuit connecting the first and last plate. In the case of two tubes giving separately 0.45 and 0.6 volt e.m.f., the e.m.f. when in series was found to be 1.0 volt. The effective rays producing the photo-electric effect are the most refrangible ones of the visible spectrum. In the experiments the ultraviolet rays had been considerably filtered out from the radiation. If a very thin film of gelatine stained with a yellow dye or a sheet of ordinary yellow glass is interposed in the path of the incident light, the deflection of the galvanometer drops almost to zero. The same reduction is effected by a sheet of ruby glass or a gelatine film stained red. A green glass cuts off a good deal of the deflection, but a sheet of cobalt glass reduces it only to about two-thirds, showing that the blue glass is fairly transparent to those rays which can produce this e.m.f. The most electro-positive metals are the most highly photo-electric substances. The ionized gas over the illuminated alloy has a unilateral conduc-

vity, and will conduct the current from a voltaic cell in one direction, but not in the opposite. Negative electricity can be conveyed from the alloy to the platinum across the rarefied air space, but not in the opposite direction. Hence, an alternating current, whether of low or high frequency, can be rectified, and by interposing such a light-cell in the circuit of a galvanometer, in which circuit high-frequency oscillations are also created by the inductive action of a discharging condenser, the author has been able to rectify these oscillations. The action, however, proved to be much more feeble and irregular than the similar rectifying effect which can be produced by a glow-lamp. The effect is much influenced by temperature, being increased by heating the alloy and by exposing it to powerful radiation for some time.—*Phil. Mag.*, February.

Nature of Alpha Particles. E. Rutherford and T. Royds.—The experimental evidence collected during the last few years has strongly supported the view that the alpha particle is a charged helium atom, but it has been found exceedingly difficult to give a decisive proof of the relation. The authors have made experiments to test whether helium appears in a vessel into which the particles have been fired, the active matter itself being enclosed in a vessel sufficiently thin to allow the particles to escape, but impervious to the passage of helium or other radioactive products. The experiments give a decisive proof that the particle after losing its charge is an atom of helium. Other evidence indicates that the charge is twice the unit charge carried by the hydrogen atom set free in the electrolysis of water.—*Phil. Mag.*, February.

Secondary Radiation.—L. T. More and R. E. C. Gowdy.—An abstract of an Amer. Phys. Soc'y paper, in which they report on the continuation of their researches on the secondary radiation given off by metals, bombarded by Roentgen rays. To account for the secondary radiation, J. J. Thomson has advanced the theory that the X-rays effect a disintegration of the atomic structure of the metal and permit the expulsion of charged corpuscles. The present authors' experiments make this theory doubtful. Iron, lead and copper plates, with pure surfaces, were used, and then the plates were coated with thin films of the lower oxides of the metal and again with films of the higher oxides. The effect of this successive oxidation on the fatigue seems to show that chemical changes of the surface produced by the X-rays with the consequent changes of the surface electrified double layers will account for the phenomena observed.—*Phys. Rev.*, February.

Units, Measurements and Instruments.

Instruments and Tests.—An illustrated description of various instruments made by Siemens Brothers & Company, and arrangements for testing. A method is described for obtaining various power factors, and for testing wattmeters at all loads without waste of power. A direct-current motor is mechanically coupled to two alternating-current generators, one of which feeds energy to the pressure circuits and the other to the current circuits. The field magnets of both generators are controlled by rheostats at the testing table, and the direct-current motor is supplied with energy from a set of accumulators having a rating of 240 amp-hours at 500 volts, so that a constant speed can be maintained over a long period. The speed of the motor is controlled by field regulation, giving a range of frequency from 20 to 120 cycles per second. The stator of one of the generators is mounted so as to be capable of rotation through an angle of about 100 deg., the movement being effected by means of a small motor driving through worm gear, so that it is possible to produce any desired phase angle between current and pressure, giving a range of power factor from zero to unity with infinitesimal gradations. This operation is controlled entirely from the testing table, the motor-generator requiring no attention. Wattmeters are required not only to give correct indications at all loads within their range at usual values of the power factor, but also to read absolutely zero when supplied with the maximum current and pressure at zero power factor. Among the numerous instruments which are described in the article there is the Hopkinson-Thring torsion meter, which has special application to turbines, but can be used for measuring the power transmitted through any shaft. The principle of the instrument depends upon the observation of the relative motion between two rays of light projected upon a scale from mirrors, which revolve with the shaft, and throw a practically continuous line of light across a scale, even at moderate speeds. One mirror is fixed relatively to the shaft, while the other is deflected proportionately to the torsion between two points on the shaft at a fixed distance apart, the distance between the two lines of light being a measure of the torsion in that length of shaft. Various pyrometers are also briefly described.—Lond. *Elec. Rev.*, Jan. 29. A detailed illustrated description of the Hopkinson-Thring torsion meter is given in Lond. *Electrician*, Feb. 5.

Hysteresis Coefficient.—G. W. Meyer.—An article recommending the method of Stahl for determining the Steinmetz coefficient of hysteresis (*Electrical World* Nov. 21, 1908, Vol. LII, page 1122).—*Elek. u. Masch.* (Vienna), Jan. 24.

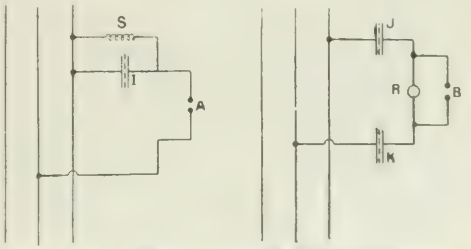
Radioactivity.—W. Wilson.—An account of experiments on the radioactive products present in the atmosphere, with an estimate of the amount of thorium present in the earth's crust.—*Phil. Mag.*, February.

High-Pressure Gage.—P. W. Bridgman.—An abstract of a paper read before the American Physical Society. An experimental investigation of the suitability of the secondary gage proposed by De Forest Palmer, making use of the variation of electrical resistance of mercury. Measurements were made by De Forest Palmer to 2000 kg per square centimeter with a probable error of about 1.6 per cent in the pressure which might be deduced from the resistance measurement. The present author has tested the mercury gage over a wider range and with greater accuracy. He finds that the gage shows no hysteresis and is capable of indicating a pressure of from 500 kg to 6800 kg per square centimeter with an accuracy of 1/10 per cent. The greatest source of error in actual use is the irregular action of the glass capillary containing the mercury. The glass must be seasoned by repeated subjection to pressure before its indications become regular. The glass must be reseasoned if subjected to large changes of temperature. It was found that an easily fusible glass in which the strains left from drawing are small gives the most regular results.—*Phys. Rev.*, February.

Induction Meter.—An official communication by the Reichsanstalt by which a single-phase induction meter of the German Westinghouse Company is admitted for calibration.—*Elek. Zeit.*, Feb. 4.

Telegraphy, Telephony and Signals.

Sending of Telegraph Signals over Energy Transmission Lines.—L. New.—A description of a system for using the wires of an energy transmission line for sending signals from the generating plant to substations, etc. The system is based on the super-position of a high-frequency current on the wire current. The transmitter is shown in Fig. 2, where *A* is a spark-gap,



FIGS. 2 AND 3.—TELEGRAPHING OVER ENERGY TRANSMISSION LINES.

I a condenser and S an inductance coil. S arrests the high-frequency current produced by the spark-gap, while the condenser *I* arrests the low-frequency current of the line. The arrangement of the receiving station is shown in Fig. 3, where R is a spark-gap, J and K are condensers, *M* a telegraph wire relay or another type of relay, which on the arrival of a high-frequency current closes an auxiliary circuit containing a

bell, etc. It is also possible to get visible signals by passing a strip of paper along the spark gap *B* so as to get impressions of the spark. In order to send signals over the line, the spark-gap *A* at the transmitting station is adjusted to get sparks and produce high-frequency oscillations. Their duration depends on the adjustment of the spark-gap, and it is possible to send signals of variable duration over the line, such as Morse signals. Fig. 4 shows the continuation of a transmitter and receiver. The switch *G* is used for changing transmitting to receiving. Instead of using two line wires, as shown in the illustrations, it is possible to employ one line wire and an earth return.—*L'Industrie Elec.*, Jan. 25

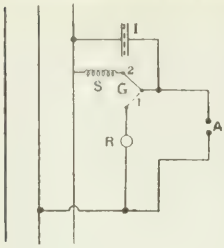


FIG. 4.—TELEGRAPHING OVER TRANSMISSION LINES.

Miscellaneous.

British Exports and Imports.—Diagrams showing the monthly imports and exports of electrical machinery in Great Britain. The curves show an increase of the exports, while the imports are shown to have remained about steady.—Lond. *Elec. Rev.*, Jan. 29.

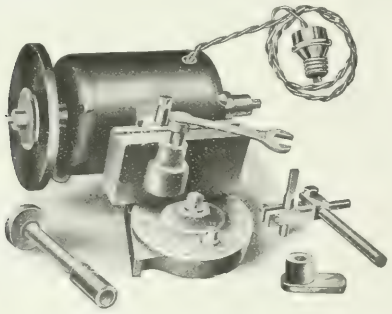
Feed Water.—J. B. C. KERSHAW.—An abstract of his paper on purification of feed water. The author deals with methods of detecting and eliminating various scale-forming and corrosive impurities and with the subject of oil separation.—Lond. *Elec. Eng'ing*, Jan. 21.

Steam.—F. R. LOW.—An article illustrated by diagrams on the amount of energy in a pound of steam. The author shows at some length why the net energy of expansion from 150 lb. down to atmospheric pressure goes to approximate the energy from atmospheric pressure down to 27½ in. of vacuum.—*Power*, Feb. 2.

NEW APPARATUS AND APPLIANCES

Electric Grinder for Machine Tools.

The Anderson Electric Machine Tool Company, 1113 Cass Avenue, St. Louis, Mo., is making a grinder for the centers of machine tools and similar applications, which is illustrated herewith. It consists of a small ½-hp motor of light weight, direct-connected to an emery wheel. It is so mounted as to be easily attached to a lathe or other machine tool. The base-plate of this device has an angle extending downward and resting against the side of the compound rest of the lathe. This



GRINDER FOR MACHINE TOOLS.

brings it square with the compound rest. When the binding post is tightened so as to hold the machine firm on the rest, any angle desired can be obtained by adjusting the graduated swivel in the base-plate. The horizontal dovetail slide has a gear rack which meshes with the pinion, the pinion being turned by a wrench. This makes a handy device for moving the grinding wheel back and forth against the work being ground. It is claimed that this machine can be attached to a lathe and a set of centers dressed in 10 minutes. The emery wheel can be removed and extension mandrels applied for internal grinding.

Enclosed Fuses.

The Crescent Company, 103 West Adams Street, Chicago, has placed on the market a type of enclosed fuse in which the cartridge containing the fuse element is separate from the end terminals, so that when a fuse has "blown" a new cartridge can be inserted without renewing the terminals. The fuse is equipped with an indicator that is claimed to be thoroughly reliable. A small German silver wire passes along the entire length of the fuse, under the label on the outside of the cartridge and coming through the label at the center of the cartridge. To this is attached a small glass bead; when the fuse blows the bead drops off, thereby showing at a glance that the fuse has blown. Each cartridge has its own indicator, so that when a burned-out cartridge is replaced with a new one, the fuse is ready for service. It is stated that in all of the tests made upon the fuses there has not been one failure to indicate.

The cartridge is a fire-proofed tube with the fuse element passing through the tube; the tube is filled with a non-conducting powder which absorbs the shock and gases, and quenches the arc. The ends are closed with metal caps, which are riveted into the tube.

Sodium for Drying Transformer Oils.

In order for the insulation of transformer oil to retain a high value it is necessary to exclude moisture. Several methods are in use for dehydrating oil, one of the latest to be developed involving the use of metallic sodium, which reacts with water to form caustic soda and hydrogen. In using the sodium process, the oil to be treated is put into an open tank or barrel, the sodium being added initially in the proportion of about one ounce per barrel. The evolution of much hydrogen will furnish conclusive proof that there is much water in the oil, and the balance of the sodium should be added carefully and in small amounts. The amount to be added depends upon the oil, but as a rule 1 lb. to the barrel is usually much more than is required. The oil is then stirred up three or four times a day for a minute at a time. After several days the oil may be removed and tested, but the longer it remains over the sodium the better the insulation of the oil becomes.

According to a second method sodium in the form of sticks is placed in a cylinder of iron wire suspended in the oil. It is said that this method may be used while the transformer is in active service. Metallic sodium is handled by the Roessler & Hasslacher Chemical Company, selling agent for the Niagara Electrochemical Company, the manufacturer.

Asbestos-Covered Magnet Wire.

The Heany Fire-Proof Wire Company has placed on the market asbestos-covered magnet wire which is claimed to possess characteristics which render it valuable for use with traction motors, crane motors, rolling-mill motors, arc lamps,

lifting magnets, blow-out coils, transformers, etc. The wire is surrounded with a wrapping of asbestos having a thickness approximately equal to that of a cotton covering, which is said to be able to withstand even a greater temperature than the wire. It is stated that use is made of pure asbestos, which does not deteriorate.

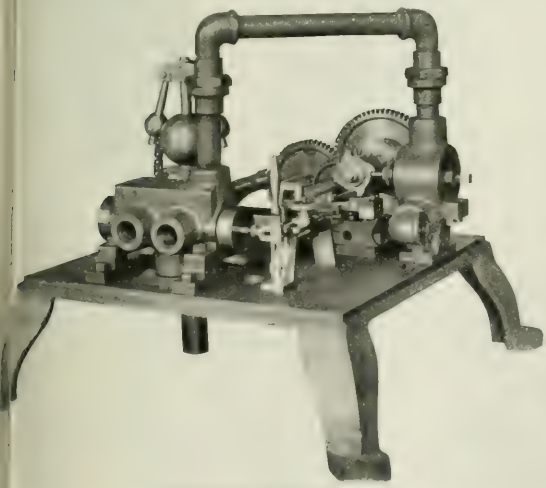
In tests made at the Bureau of Standards, in Washington, it was found that a 0.005-in. thickness of asbestos wire-covering of the non-waterproof type punctured at from 485 volts to 665 volts, while a 0.006-in. covering of moisture-proof material punctured at from 555 volts to 850 volts. The insulation resistance of a 5-in. length of the waterproof covering on a wire 0.081 in. in diameter, when immersed in water, varied from 970,000 ohms to 20,200 ohms, according to the length of immersion. The insulation resistance of a 4-ft. length of non-waterproof covering of a wire 0.091 in. in diameter was found to vary from 13,000 ohms to 40,000 ohms, according to the duration of the test.

Tests made at the New York Navy Yard showed that, when the asbestos-insulated wire was subjected to full-load current continuously for three weeks, the insulation remained intact and unaffected. Current which could be carried for one hour without any apparent effect on the asbestos covering charred the insulation of double-cotton-covered wire within 10 minutes. The asbestos insulation has been recommended by the commandant as a substitute for cotton-covered magnet wire used in the repair and manufacture of apparatus at the Navy Yard

The factory of the Heany Fire-Proof Wire Company is at York, Pa., its main office being at 25 Broad Street, New York.

Impulse Water-Wheel Governor.

There are in use two general methods for governing the speed of impulse water wheels, namely, by partial deflection of the jet from the buckets of the water wheel and by varying the cross-section of the jet. Each method varies the power applied to the wheel and each possesses both advantages and disadvantages. Jet deflection, although wasteful of water, possesses the advantage of introducing neither shock nor ram into the water column. Cross-sectional variation is highly economical in water consumption, but it subjects the hydraulic system to severe shocks.



IMPULSE WATER-WHEEL GOVERNOR.

The governor illustrated herewith uses a combination of the deflection and the variation methods of control; the former to respond instantly to changes in the load without affecting the equilibrium in the pipe line and the latter to adjust and restore conditions to the greater operating efficiency which results from the prevention of the waste of water. In its construction especial effort has been made to reduce to a minimum the time-interval in operation and to eliminate hunting. Its principle is that of a centrifugal apparatus connected with a distributing valve for operating a piston that controls the jet, this distributing valve being manipulated by a lever with an adjustable fulcrum in such a way as to give maximum acceleration to its action in successive and distinct steps which cease to advance —or recede—upon the instant when the speed of the water wheel has been restored to normal.

The above described governor has been placed on the market by the Bailey Mfg. Co., 102 Battery Street, San Francisco, Cal.

Variable-Speed Electric Drive for Paper Machines.

What is said to be the first Fourdrinier paper-making machine to be driven by individual electric motors on the various parts has just been placed in operation by the Gould Paper Company, at Lyons Falls, N. Y. The electric motors have been used to overcome the difficulties caused by the exacting speed requirements of a paper machine, and the results show that the arrangement is far superior to the complicated belt, shafting and gear systems previously used to obtain similar results.

In the process of manufacture there are numerous difficulties encountered in maintaining a continuous sheet of paper on account of the inconsistency of the stock, the irregularities of the mechanism, the elongation of the webb due to pressing and the shrinkage in the drying process, and lastly, and very important, in regulating the driving mechanism so as to allow for the contraction and expansion of the sheet of paper in passing over the machine.

It is sometimes a matter of tedious adjustment on the part of the machine operator to get the "draw" of paper between the several sections adjusted so that the webb of paper will run the longest possible time without breaking, because there is a considerable loss of time and material when a break occurs.

If constant speed were the only requirement, synchronous alternating-current motors might have been adopted to solve the problem. There is the added complication, however, that all classes of paper are not made at the same speed. At the Gould Paper Mill, for instance, newspaper is made at a high speed, and a heavy bag paper is also manufactured which requires a very low speed.

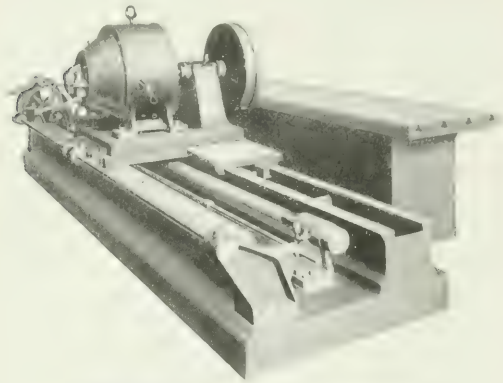
The system installed for the Gould Paper Company was designed by the Standard Engineering Corporation, of Wilmington, Del., and Philadelphia, Pa., assisted by the engineers of the Crocker-Wheeler Company, of Ampere, N. J., which handled the intricate electrical problems involved.

It is said that by means of the direct-current motors employed the system can be operated at any speed to accommodate any kind of paper. The motors, once adjusted to uniform speed, will remain in adjustment indefinitely. The generating plant and all the motors for the drive were furnished by the Crocker-Wheeler Company, of Ampere, N. J.

Motor-Driven Traveling Head Face Grinder.

The type of traveling head grinder illustrated herewith, known as a face grinder, is particularly adapted to the work of structural iron workers, bridge builders, safe makers and manufacturers in kindred lines, where it is necessary to grind to very exact figures any materials that are liable to be too hard to be machined, such as beams, columns, steel safe plates, cast-iron floor plates, iron staircases, cast-iron fences and railings. As shown in the illustration, the grinding head is direct-connected to an electric motor, which, together with a very heavy outboard bearing, is mounted on a large base moving on ways. The motor has an extended shaft to carry the grinder chuck. The work is stationary, being bolted to the large platen in front of the 22-in. emery ring, while the ring rotates and also moves slowly back and forth from end to end of the platen. The reversing is done by a hand lever when the machine is in use, but automatic stops are provided at each end of the extreme travel

to prevent over travel should the attendant neglect to reverse the feed. The maximum traverse feed of the grinder is ⅝ in., and is operated by a hand wheel and mitre gear on the splined shaft in the front of the machine. The longitudinal travel of the grinder is obtained from the powerful feed-screw shown in the illustration. The travel of 20 ft. per minute is somewhat faster than might be supposed from the thread of the screw, as



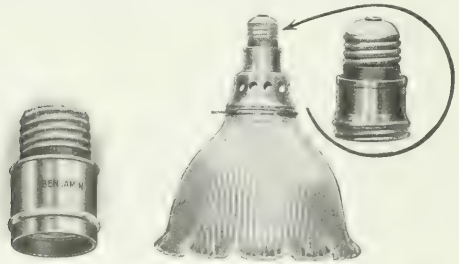
MOTOR DRIVEN TRAVELING HEAD FACE GRINDER

a triple thread is used. The lead screw is driven by a second motor, not shown in the illustration.

The grinder is driven by a standard Westinghouse type compound-wound, direct-current, 10-hp, 1100-r.p.m. totally enclosed motor. Where required, an alternating-current motor may be used in place of the direct-current motor. The size of the motor to operate the lead screw is dependent upon the nature of the work to be performed—that is, the amount of metal to be removed. This grinder is a 102-in. face grinder as manufactured by the Diamond Machine Company, of Providence, R. I.

Benjamin Extension Socket.

It frequently happens that it is desired to use reflectors over lamps which are in ceiling receptacles. Sometimes these receptacles are sunk some distance below the surface of the plastering so that it is impossible to attach a shade-holder. Even if the receptacle is not sunk flush with the plastering, the ordinary type of receptacle is not suited to taking a shade-holder. If the receptacle is of porcelain there is no way of attaching the holder to the porcelain, and if it is of the kind in which a composition ring holds on the receptacle casing, it is dangerous to attempt to attach a shade-holder, because this

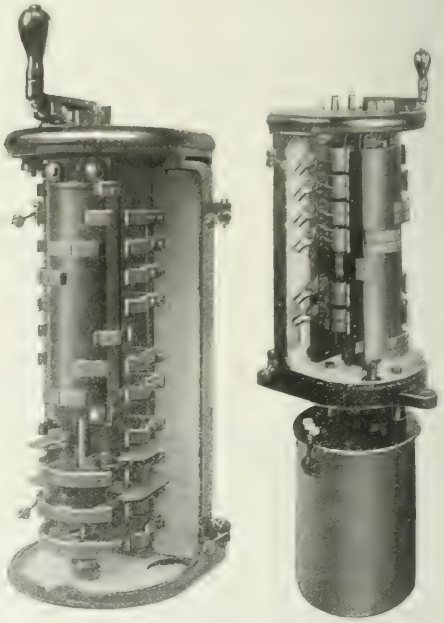


FIGS. 1 AND 2. EXTENSION LAMP SOCKET.

ring will soften with the heat of the lamp and it is likely to let the holder and reflector or globe drop on the lamp. If the lamp breaks or pulls out of its base, as it is likely to do in such an event, the whole combination drops to the floor. The Benjamin Electric Manufacturing Company, of Chicago, has brought out a new specialty called the "Benjamin Socket Extension," the construction of which is evident from Fig. 1 and 2. It is simply an extension plug carrying a receptacle. The shell is the same shape as a standard socket shell, so that it easily takes any standard shade-holder. This extension increases the length of the socket or receptacle 1.25 in.

Controllers for Slip-Ring Induction Motors.

The accompanying illustrations show two forms of reversible drum-type controllers for slip-ring induction motors. The form illustrated in Fig. 1 is intended for rotors using not over 80 amp at 280 volts, while the one shown in Fig. 2 is suitable for rotor currents up to 400 amp and e.m.fs. not exceeding 500 volts. Each controller is equipped with a three-pole primary switch, a combined line and reverse switch and a cylinder for



FIGS. 1 AND 2. CONTROLLERS FOR SLIP-RING INDUCTION MOTORS.

controlling the secondary starting and regulating resistance, all of which are operated by one lever. In the controllers of larger rating the primary switch is immersed in oil, as indicated in Fig. 2. The resistors are of the cast-metal grid type, compactly mounted for convenient installation. These controllers are made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

General Electric Wiring Supplies Building.

The General Electric Company has recently completed, at Schenectady, a large building specially designed for the manufacture of wiring supplies of all kinds. The building is four stories in height, 400 ft. long, 85 ft. wide at its narrowest part, and has a total floor space of about 150,000 sq. ft. Reinforced concrete was used throughout in the construction. All partitions are of reinforced concrete with asbestos wood trim and for double assurance the interior is equipped with a fire-extinguishing sprinkler system. Enclosed arc lamps, with large corrugated reflectors, furnish a well-diffused light during the late hours of the day, ample natural illumination being afforded by numerous windows on each floor. All machinery within the building is, of course, driven by electric motors.

which in a great many cases are directly connected to the machine.

The boxing and shipping department occupies the first floor, which has a track for freight cars. The second floor is occupied by the mechanical department. Machinery for the production of dies, tools, molds, etc., are grouped on one part of the floor, while presses for punchings, metal cases, etc., are placed elsewhere. Other machinery on this floor are automatic screw



ASSEMBLY FLOOR, WIRING SUPPLIES DEPARTMENT BUILDING.

machines, drilling, tapping, stamping, spinning machines, etc. Part of the floor is divided off for polishing, dipping and plating operations.

The third floor is occupied by the assembling department, which is devoted entirely to the building up of the numerous parts into a complete and finished article ready for boxing and shipping. There are accommodations and facilities for about 1000 operatives in this department. The assembling operations are divided into several divisions, the main sections being for sockets and receptacles, cut-outs and attaching plugs, fuse plugs, small knife and snap-push button switches, enclosed and open type fuses, distribution cabinet panels, etc. Sealing and pitching operations are also here performed and the assembled devices placed in boxes and labeled.

The fourth floor contains the offices of the managing engineer and his force of designing engineers, draughtsmen, production and costs clerks. On this floor there are also facilities for electrical and mechanical testing of the completed devices and for the production of models. A force of model makers is daily engaged in making up preliminary models, in which the molds, dies and tools are formed for the production of the finished article.

The productive capacity of the building at maximum output is about 1,500,000 complete and separate devices weekly, representing all types of sockets and receptacles, cut-outs, fuses, magnetic blow-out fuses, switches for open and concealed wiring, knife blade switches, cabinet panel boards, etc.

Feeding Device for Boiler-Tube Cleaner.

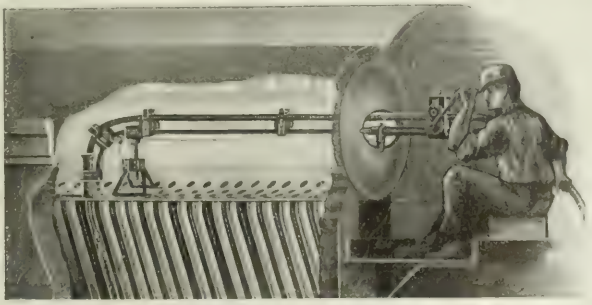
The device illustrated below has been designed for eliminating the necessity for workmen entering a boiler when cleaning the tubes. The mechanism consists of a funnel through which the cleaner is guided into the tube, a stand and shafting to support this funnel and the hose and to provide adjustment over the different tubes. The shafting is jointed and snapped together with triggers so that the sections can easily be handled and used in the limited space between boilers. On each section of shaft is a spool and rack on which the hose is rolled. The shafting is held in the center of the manhole by a tripod rigidly braced from the edge of the manhole. Extending from this tripod is the feeding device proper for feeding the hose into the tube. This feeding device consists of two capstan-shaped rolls which enclose and grip the hose and which are geared together, so that when one is turned by the crank the other turns. There is provision for squeezing these onto the hose as tightly as may be desired and the "capstan rolls" are lagged with leather which grips the hose.

The feeding device here shown has been placed on the market by the Lagonda Manufacturing Company, Springfield, Ohio.

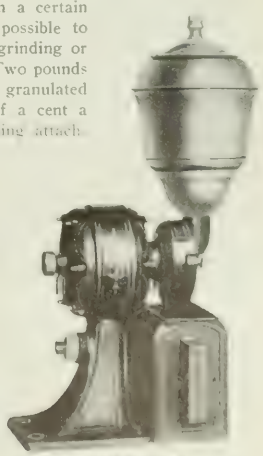
Motor-Driven Coffee Grinders.

The use of electric motors to drive coffee mills is growing rapidly because of the perfect satisfaction given by the motors and the time and annoyance saved by having a machine to grind the coffee instead of being compelled to do the work by hand. Progressive grocers everywhere appreciate the advantage of having a clerk spend his time waiting on a customer and not turning a handwheel, because it pleases the customer to be waited on promptly.

The coffee mill illustrated is manufactured by B. C. Holwick, of Canton, Ohio, and is equipped with a single-phase Westinghouse motor. The outfit is an excellent combination of strength, durability, neatness and service. The grinders are milled from steel plates, which gives them true and sharp cutting edges, causing them to cut the coffee instead of crushing it. Steel-cut coffee is far more uniform in size than crushed coffee and is free from dust, and for these reasons gives a better flavor. The mills are provided with a certain adjustment by which it is possible to change from coarse to fine grinding or the reverse while running. Two pounds of coffee per minute may be granulated at a cost of one-thirtieth of a cent a pound. A durable self cleaning attach-



FEEDING DEVICE FOR BOILER TUBE CLEANER.



ment is provided by the construction of the machine.

Several of these mills on the current at a central station and in the revenues without increasing the peak load. Progressive managers who are endeavoring to increase the sale of electrical energy among merchants say they find the motor-driven coffee mill one of the easiest propositions in which to interest the grocer.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Reports of trade during the past week were irregular. It is undeniable that in most directions very much less is being done than had been anticipated. In fact, it would hardly be improper to say that in places there is a note of absolute discouragement. The revival of business, which was expected to occur early in the year has not materialized, and individual reports from manufacturing companies, especially in electrical and machinery lines, indicate that just at the present moment orders are scarcer than they have been at any time within the past six months. The agitation of the tariff is held responsible to a large degree to this condition of affairs. There is no doubt that there is widespread conservatism being practised in very branch of retail trade and even among individual consumers. In the leading wholesale markets of the country there are quite a number of visiting buyers, and this has given some activity to dry goods, cottons and notions. The buying, however, is hardly what might be called free. There are some millinery goods and some of the cheaper grade of cotton goods being taken. Heavy orders, however, do not seem to be in evidence. During the past week there was noted improvement in farm machinery, implements, seeds and fertilizers. This was simply the seasonable demand which is to be expected at the beginning of the crop year. Collections, especially in the South, are inclined to be slow, although there has been little complaint from the wheat growing section. Cereals for the moment are higher, wheat having been advanced in Chicago to an unusual figure. The export trade, however, is small and the demand at home is the only reason for this stiffening of prices. Reports from the growing crops are negative. The ground through most of the Northwest has been recently covered with snow, and this is generally taken to be favorable to crop conditions. It, however, leaves in doubt the actual condition of winter wheat. Until the spring thaws come, it will be impossible to tell exactly how the crop that was planted last fall has weathered the winter season. The sudden throwing down of the bars by the United States Steel Corporation, in its announced abandonment of the price agreement, is expected, in a mild degree, to demoralize the steel industry. It is also expected to bring in a number of orders which have been held up a long time waiting for cheaper prices. The long-continued dullness in the metal market and the lack of business in finished steel product made such a breakdown in the price agreement almost inevitable. So far there has been no change in the price of steel rails, although there are constant rumors that any road desiring a large quantity might very easily have the rate of $28 per ton considerably shaded. It is reported that within the past week the New York Central has allotted an order for 85,000 tons of rails and that smaller roads have ordered 20,000 tons in addition. These orders were distributed among the smaller plants. The Pennsylvania Railroad has placed an order for 2,404 steel gondola cars. It is reported that extra low prices were secured for this business. The building industry is not moving forward very rapidly and very few large projects are being discussed. This is one reason for the extra quiet condition of structural material. It is hardly believed that there will be much improvement until later in the spring. By this time we will probably know what the tariff schedules will be. Business failures for the week which ended Feb. 18 were 282 against 211 the previous week, 326 in 1908, 177 in 1907, 186 in 1906 and 220 in 1905.

THE COPPER MARKET.

The copper market was practically in a state of collapse during the week which ended Feb. 20. The long strain of attempting to sustain prices in the face of evident accumulation and of very limited buying has finally proved to be too great, even for the great interests which have been behind the market. The Metal Exchange, the quoted prices of which have been notoriously above the actual selling prices in the market, has practically admitted the defeat of the effort to keep up appearances. Prices were marked down last week not in the customary ⅛ fraction of a cent, but in a ⅜ drop. The result was that at the close of the week the official quoted price of copper was 13 cents for lake, 12¾ for electrolytic and 12⅝ for castings. This is a decrease within the week of about ⅝ of a cent. It is said that offerings are made on the Street even at cheaper rates, but these things are so hard to substantiate it is unsafe to attempt to quote such prices. The best information that can be obtained is that even this radical marking down of copper has developed but little buying. The principal consumers are running their plants at not more than 60 per cent of capacity hence the demand for copper is necessarily light. In some quarters it is believed that the consumers are fairly well supplied for all their immediate needs, but whether this is true or not it is certain that they are not buying for any purpose except to fill orders already taken. In the meantime the production continues to be the largest in the history of the country, imports are above the average and exports are running very much lighter than they were the same time last year. This latter is true, of course, because Europe is well stocked with metal and there is the same stagnation in the copper consuming industries abroad as exists here. One of the most careful statisticians in the copper market estimates that there is now held at home and abroad between 450,000,000 lb. and 500,000,000 lb. of "marketable" copper. This means that there is in sight at least nine months' supply for all the ordinary takings of the consumers. With the mines producing 110,000,000 lb. a month, the reduction of such a stock as this, if it really exists, must necessarily be very slow. The present depression in the price of copper and the undoubted pressure to sell indicates that these figures have finally been accepted by both buyers and sellers. What the outcome of such a condition can be, unless an arrangement can be made to curtail prediction, it is hard to say. Copper prices cannot go very much lower and leave a margin of profit for the majority of the large copper mining corporations. Production will certainly be curtailed when this margin has been wiped out. The exports so far for the month of February have been but 7,419 tons, which would seem to indicate that the total exports for the month would be below 30,000,000 lb. The exports for last February were over 55,000,000 lb. Quotations on the Metal Exchange Feb. 20 were:

Lake	13	@ 13¼
Electrolytic	12¾	@ 12⅞
Casting	12⅝	@ 12¾

London quotations were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	56 17 6	57 0 0
Standard copper, futures	57 15 0	57 16 3
Market	Weak.	Steady.
Sales of spot		400 tons
Sales of futures		2,400 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.58	13.12½
Electrolytic	14.25	12.82½
Casting	14.12½	12.75
London, spot	£64 2 6	£56 17 6
London, futures	64 17 6	57 15 0
London, best selected	67 15 0	60 15 0

OLD-TIME WESTERN ELECTRIC EMPLOYEES.—During the recent gathering in Chicago of the sales organization of the Western Electric Company, there was a luncheon of old-timers, which brought together quite a number of the pioneer days of telephony. Many interesting reminiscences were told and many old friendships renewed. Those who attended the luncheon and the dates they entered the employ of the company were: E. W. Bennett, 1874; J. C. Cannon, 1877; F. B. Uhrig, now Western district supervisor of the company located at Kansas City, 1881; D. L. Harmon, now a banker at Indiana Harbor, Ind., 1883; C. D. Wilkinson, manager of the Minneapolis house, 1886; William Carpenter, of the Walworth & Neville Manufacturing Company, who entered the employ of the Western Electric Company in 1887; R. C. Hearsley, 1888, and E. S. Holmes, now manager of the Indianapolis house, 1890.

STEEL MAKERS FORCED TO CUT PRICES.—After valorously maintaining prices on iron and steel products during the dark days of depression, for the past 16 months, the United States Steel Corporation has finally been forced to surrender to the stress of the times. In a carefully prepared statement, made public Feb. 19, Judge Elbert H. Gary, chairman of the board of directors of the Steel Corporation and directing spirit in the steel business, announces the abandonment of the principle of price maintenance. No definite cuts in price are promulgated, but the price agreement is definitely abandoned and the door is thrown open for every steel maker to get the best prices he can. Even before Judge Gary's announcement had been formally made active price cutting had begun. Reductions of from $3 to $7 per ton were made by individual plants, and the scramble for business among the concerns, both inside and outside the big trust, was exceedingly active. There has been no reduction made as yet on steel rails—$28 per ton being still the prevailing price—but in almost every other product there has been liberal price shading. Steel bars have been offered $4 below schedule price, structural steel is down $7 a ton, sheets were off and even wire, which has been the best seller of all the steel products, was offered at lower prices where any considerable contract could be booked. In his statement, Judge Gary declares that following the panic of October, 1907, a rigid maintenance of prices was made necessary in order to protect from disaster jobbers and consumers who had purchased large stocks at prices which prevailed when conditions were favorable. These contracts having been protected, and there being little new business now coming to light, it is now deemed advisable to let every steel maker get all the business he can at the best price he can. Judge Gary, however, makes it plain that the abandonment of the price agreement was practically forced by the small concerns and that it was brought about suddenly. The statement says: "Until within the last 48 hours it has been the belief of many, if not most, of the leading manufacturers of iron and steel that no general reductions in prices were necessary or desirable. However, during the last two days many of the manufacturers have been in conference for the purpose of giving to one another all the information and facts obtainable concerning actual conditions in detail. It appears that for one reason or another, including particularly the tariff agitation, many of the smaller concerns who have not been disposed to co-operate during the last year have become more or less excited and demoralized, and have been selling their products at prices below those which were generally maintained. This feeling has been somewhat extended and has influenced unreasonable cutting of prices by some of those who were opposed to changes, but felt compelled to meet conditions in order to protect their customers. As a result of these conditions there has been a material decrease in new business during the last month for the reason, as stated by consumers, that they proposed to wait until after they were satisfied bottom prices has been reached." Speaking of the actual business done, Judge Gary says that during the month of December the average daily bookings of the subsidiary companies of the Steel Corporation were 29,685 tons. The total capacity of these plants is 36,000 tons, so that they were operated during this month at about 82.5 per cent of their full ability.

DUTY ON MICA PRONOUNCED EXCESSIVE.—The duty on mica which is now under consideration by the Ways and Means Committee of the House, together with other tariff duties, is creating a great deal of interest among the mica dealers. One of the principal mica importers and producers in this country has this to say: "The present rate of duty, which is 6 cents per lb. and 20 per cent ad valorem, is excessive. An examination of the mica statistics will show that within recent years the amount of duty paid on imported mica was more than the entire value of the domestic production. In 1906 there was produced $252,248 domestic mica. Duties on imported mica for that year were $291,033. In 1907 the domestic production was $349,311. In that same year there was paid $466,028 in duty. These figures are quoted simply to show how much more important is the importation of mica than the domestic production. The men employed in mica mining in the United States [illegible] no time more than 1000, and at the present time probably not over 500. The interests asking for an increase in the already excessive duty are the few owners of mica mines which can only be operated at a profit when mica [illegible] put are most exorbitant when compared with prices obtained abroad. It would seem that the small contingent of American mica mine owners was excessively protected under the present tariff, but these interests are now asking for a further duty of double the present rate on white mica. In other words, when the duty paid in 1907 exceeded the entire production in the United States by over $100,000, these interests are still unsatisfied and are asking for an increase that would double the present already disproportionate relation between duty paid and domestic production. Even were the efforts to increase the duty entirely successful, it would be impossible for the domestic production to replace the imported in certain usages that consume the major portions of mica, such as insulation between copper bars, etc., for the reason that domestic mica has been found entirely too hard and brittle and contains too great a quantity of iron for this purpose. The unsuitability of domestic mica in general for electrical purposes is shown by the fact that during 1905, 1906 and 1907, the years of greatest consumption and highest prices, the production of mica in the United States increased but slightly, while on the other hand, the increase in importations was 300 per cent."

CONTINUING THE PRODUCER GAS TESTS.—The United States Geological Survey has purchased a 140-hp Westinghouse, three-cylinder, vertical, single-action gas engine, with which to continue the series of tests of producer gas made from various grades of bituminous coal, which were begun at the St. Louis Exposition. This engine is of the same type as the one used at the exposition. The use of the gas engine is rapidly broadening. One important application of this engine has just been made by the Mohican Oil & Gas Company, of Ohio, a large distributor of natural gas, for service as a compressor or booster to regulate the distribution of gas over long stretches of pipe line. The initial installation which was put in at Howard, Ohio, consists of two 1000-hp, direct-acting, two-stage compressors driven by Westinghouse horizontal, double-acting, twin-tandem gas engines. These units are designed to deliver into the pipes any desired pressure up to 300 lb. per square inch. Other installations of this character have been made in both Ohio and Kansas. The engines use natural gas. Another use for the gas engine is in connection with mining operations. The Capuzaya Mining Company, of Parral, Mex., has recently installed a 300-hp Westinghouse gas engine unit, which is operating on gas generated from charcoal.

WORCESTER (MASS.) ELECTRICAL EXPOSITION.—The management of the Worcester Mechanical and Electrical Exposition, which is to be held in Worcester, Mass., from March 27 to April 3, is arranging a number of novel exhibits to attract the attention of the business men to the practicability of modern electrical devices for cheapening of the products of large corporations. For the public at large the thousand and one machines and inventions for the use of the home will be given practical demonstration by the construction of an electrical house, every room of which will be completely furnished with the latest devices for cooking, eating, lighting, etc. In the mechanical end of the exposition will be seen heavier electric machines used for various purposes, magnetic chucks, etc. One of the scientific institutions is to put in a large electrical display of delicate instruments. This exposition is more than a local affair, and has as sponsors the Worcester County Mechanics' Association, which is composed of over 1300 business men of Massachusetts. Nearly every member of the association is an officer of some large corporation. Spaces at the exposition are already well taken and its success is assured. Full information regarding this exposition can be had of H. F. Campbell, Mechanics Hall, Worcester, Mass.

THE AMERICAN BLOWER COMPANY, Detroit, Mich., has shipped seven 2.5-kw engine-generator sets to the Isthmian Canal Commission, Colon, Isthmus of Panama. The engines were arranged to comply with the requirements, which stated that they should be "built for high speed, self-oiling, and automatically governed, and be able to control and also be strong enough to withstand a change from no-load to full-load, and should be of sufficient capacity to drive the 2.5-kw generator at the proper speed when under full-load and with initial pressure of 80 lb. per square inch," etc. Each engine is equipped with a small pump, which delivers oil to each moving part. The generators are 110-volt machines, built by the Fort Wayne Electric Works, Fort Wayne, Ind.

WIRE BUSINESS SHOWS LITTLE IMPROVEMENT.—The dealers in wire for electrical purposes are practically unanimous in saying that the business is showing but little improvement. There are many projects, hydro-electric and steam, that are under contemplation, but in almost every case they are being held up until general business further improves. A representative of a large manufacturer of bare copper wire is responsible for the statement that business is hardly more than 60 per cent of normal. There is not much new business coming in and some old contracts that were made last fall are being held up. In connection with insulated wire the manager of one important company had this to say: "We are constantly hoping for business to get better, but, as a matter of fact, it is showing little improvement. Our main business, of course, is on the inside of new buildings. Now the building business, as you know, has not been very extensive during the past few months so there are not many contracts of importance coming to light. Then again, wiring a building is one of the last things done so that in many instances even those buildings which have been started are not yet ready for us. If there should be a boom in building the coming spring it would probably be midsummer before we would get to our end of the contract. We are constantly hearing of projects that are on foot, but they are slow coming to realization."

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.—The headquarters of the Empire State Gas and Electric Association has been removed from 154 Nassau Street to the United Engineering Societies Building, 29 West Thirty-ninth Street, New York City. The following is the list of the officers and members of the executive committee for the year ending Oct. 31, 1909: President, William T. Morris, Ithaca; first vice-president, M. J. Brayton, Utica; second vice-president, R. M. Searle, Rochester; secretary, Charles H. B. Chapin, 29 West Thirty-ninth Street; treasurer, T. O. Horton, Staten Island; executive committee, Walter R. Addicks, Westchester Lighting Company; F. L. Dame, Geneva-Seneca Electric Company; G. W. Curran, Syracuse Lighting Company; J. J. Humphreys, Jr., Brooklyn Borough Gas Company; P. T. Glidden, Binghamton Light, Heat & Power Company.

CHICAGO PNEUMATIC TOOL COMPANY.—At the annual meeting of the Chicago Pneumatic Tool Company, last week, the president, J. W. Duntley, reported that the year 1908 had been a particularly severe one on the company on account of the general depression in business. The total net profits for the year were only $289,525, which is less than 35 per cent of what they were in the previous year. The balance available for dividends, on the year's business, after deducting the fixed charges, was only $129,575, or about 1.85 per cent on the capital stock. At the directors' meeting the resignation of President J. W. Duntley, who expressed his intention of retiring some weeks ago, was accepted, and his brother, W. O. Duntley, former vice-president, was elected to fill his place. Charles M. Schwab retired as chairman of the board, being succeeded by J. R. McGinley. Charles Booth was elected to the vice-presidency to succeed W. O. Duntley.

STREET TRANSPORTATION ON FIVE LEVELS.—The Public Service Commission of the First District of New York has written a letter to the Board of Estimates and Apportionment calling attention to the application of the Hudson & Manhattan Railroad Company for authority to extend its subway under Sixth Avenue to the Grand Central Station. The communication says that with the various plans which the Board of Estimate has now under consideration there would be transportation in some places in the city on five levels, and that the lowest would be 100 ft. below the surface of the street. The Commission suggests that very careful consideration be given to this phase of the rapid transit problem.

GIGANTIC ELECTRICAL DISPLAY ON NEW BRIDGE.—According to present plans, real estate interests connected with the development of the Borough of Queens, New York City, propose to erect on the south side of the new Queensboro, or Blackwell's Island, bridge, when it is opened for traffic, the most gigantic electrical display ever attempted. The entire face of the bridge will be covered with an electrical map of Long Island. The map will be about 3000 ft. long and will be 69 ft. high. The island will be outlined in red, the principal towns and cities in green and separate contrivances to show the leading transmission lines. There will be a number of other electrical displays at the opening session and they will be so arranged with switches as to show alternately.

ELECTRICAL EQUIPMENT FOR ITALY.—An American consul reports that the Palace of Justice in Rome is preparing to install an electric light plant and that the same department has advertised for the delivery of wire cables amounting to $40,000.

Financial Intelligence.

THE WEEK IN WALL STREET.

Of course there was nothing in the stock market during the past week that cut any figure in comparison with the breakdown in the combination on steel prices. After having made a valorous fight for 16 months to uphold prices in the face of adverse conditions, the United States Steel Corporation was finally forced to admit its defeat. There was no general cut in prices announced by the corporation, but simply a letting down of the bars whereby every manufacturer could come in and get business at the best rates at which he could afford to take it. The effect on the stock market was immediate. Even before the surrender had been announced there was fairly complete information that it was coming and the price of United States Steel common stock, which is dependent upon the excess earnings of the company for dividends, began to crumble. The preferred shares of the Steel Corporation are practically assured of their 7 per cent dividend by the high earning capacity of the organization. Producing this dividend and the fixed charges is, however, a considerable undertaking, and the dividends on the common stock must be dependent upon extra profit. The same powers that undertook to maintain the price of steel products, in the face of business depression, undertook to put steel common above 50 and hold it there. As soon as the price combine was broken the price of steel stock necessarily fell in sympathy. There are other conditions, however, in the steel situation which are interesting and important. In the first place the immediate effect of the cut has been to vastly stimulate orders for steel products. It is said that the Carnegie Steel Company made a record in its bookings on Feb. 20. This large influx of business means the continued operation of the steel plants, but whether or not it means a reduction in wages remains to be seen. It is intimated that orders cannot be filled at the present rates, upon the existing scale of wages. The weakness in steel shares sympathetically affected all of the balance of the list. The net changes for the week which ended Feb. 20 were in almost every instance losses ranging from 1 to 6 points. The volume of trade, however, was somewhat increased, and, while there was little more outside interest displayed, there was considerable more buying by the regular traders who have practically made the market since the first of January. In the bond market there was the same eagerness displayed to take every issue that offered a

NEW YORK

	Feb. 15.	Feb. 20.	Shares sold.		Feb. 15.	Feb. 20.	Shares sold.
All.-Ch.	15¾	14¼	1,315	Int.-Met., pfd...	44¼	41	11,825
All.-Ch., pfd....	48⅞	45⅜	2,200	Mackay Cos....	72	72¼	1,455
Amal. Cop.	76⅞	49	164,310	Mackay Cos.,pfd.	72*	71¼	700
Am. D. T.....	35*	35*	——	Manhattan Elev.	148½*	145	16
Am. Loc.	57	51	23,600	Met. St. Ry....	30	30	200
Am. Loc., pfd.	112	112	825	N. Y. & N. J. Tel.	115	115	300
Am. Tel. & Cbl.	78	78*	——	Steel, com.	53⅛	46	633,320
Am. T. & T....	129¾	128¼	12,200	Steel, pfd.....	113⅛	109¾	26,895
B. R. T.....	72⅜	69⅞	99,015	W. U. T.....	68	67¼	1,100
Gen Elec.....	158	152½	5,072	West'h., com....	83	79¼	4,700
Int.-Met., com...	16¼	15	10,150	West'h., pfd....	118*	118	400

PHILADELPHIA.

	Feb. 15.	Feb. 20.	Shares sold.		Feb. 15.	Feb. 20.	Shares sold.
Am. Rys.	40½	46½*	——	Phila. Elec.	12	11⅞	——
Elec. Co. of A..	11½	11½	——	Phila. R. T....	28¼	27⅞	——
Elec. Stor. B'ty.	46¼	46*	——	Phila. Traction..	93	92½*	——
E. S. B'ty. pfd.	49*	49*	——	Union Traction .	53¾	53	——

CHICAGO.

	Feb. 15.	Feb. 20.	Shares sold.		Feb. 15.	Feb. 20.	Shares sold.
Chi. City Ry...	187	187*	——				
Chi. Rys., Ser.1.	112½	112½*	——	Chi. Tel. Co....	130⅝	131½	——
Chi. Rys., Ser.2.	44¼	44*	——	Met. El., com...	17*	16*	——
Com. Edison...	108	108½	——	Nat'nal Carbon.	84	85½*	——
Chi. Subways...	26*	26*	——	Nat. Carb., pfd..	110*	118¾	——

BOSTON.

	Feb. 15.	Feb. 20.	Shares sold.		Feb. 15.	Feb. 20.	Shares sold.
Am. Tel. & Tel.	129¾	128¼	——	Mex. Tel	2¼	2¼	——
Com. Tel.	125*	125*	——	Mex. Tel., pfd.	5½*	5½	——
Edison El. Ill..	251	——	——	N. E. Tel.	131	131½	——
Gen. Elec.	157½	——	——	W. Tel. & Tel..	7¼	7*	——
Mass. Elec. Ry..	14¾	14¼	——	W. T. & T., pfd.	79*	78*	——
Mass. E. R., pfd.	65¾*	65¼	——				

*Last price quoted.
Shares sold are for week Feb. 15 to Feb. 20

good investment. No proposition seems too large for the present market to absorb. The talk of an issue of more than $80,000,000 by the Southern Pacific in nowise disturbs conditions and every one familiar with the market is practically certain that such an issue would be absorbed without trouble. As an instance of the strength of bonds it is but necessary to point out that the $15,000,000 issue of the Burlington was subscribed 10 times over. In other words, there was $150,000,000 ready to take bonds. The actual money market was not quite so easy during the past week as it has been for several months. While there was no apparent scarcity and while rates were only slightly advanced there was in evidence less urgency to lend money. The banks and trust companies seemed to be willing to hold off until the industrial and commercial conditions had settled down from the temporary disturbance caused by the cut in steel prices. Nominal quotations for money on Feb. 20 were call loans 2 per cent and 90-day paper 2¾ @ 3 per cent. The quotations in the table are those of the close Feb. 20.

KINGS COUNTY ELECTRIC COMPANY SHOWS INCREASED EARNINGS.—The annual report of the Kings County Electric Light & Power Company, of Brooklyn, N. Y., shows that in spite of the depressed condition of general business the increase in the company's earnings has been very satisfactory. The gross earnings of the company were $3,613,470, an increase of $141,729 over 1907, while the operating expenses showed a decline of $38,637. By this system of economy the net earnings are made to show an increase of $180,367. The surplus for the year, after dividends, was $29,513. This, added to the previous surplus, makes the total surplus carried by the company $1,207,574. The annual stockholders' meeting has not yet been held, but it is not anticipated that there will be any change in the board of directors or in the management of the company. The entire capital stock of the Edison Electric Illuminating Company of Brooklyn is owned by the Kings County company and there is no separate report made of that company.

INTERSTATE RAILWAYS REORGANIZATION PLAN.—Mr. J. J. Sullivan, president of the American Railways Company, Philadelphia, has issued notices to the holders of the collateral trust 4 per cent bonds of the Interstate Railways Company, which are now in default, offering to purchase the bonds at 50 per cent of their par value, giving in exchange the 50-year 4½ per cent convertible gold bonds of the American Railways Company. In order to carry out this plan the directors of the American Railways Company have authorized a new issue of $6,000,000 4½ per cent bonds, of which $5,390,625 will be required to retire the $10,781,250 Interstate issue. The proposed plan is being generally accepted by the holders of the defaulted bonds. The new issue of the American company bears interest from Jan. 1, 1910, and is convertible into the stock of the company at any time between Jan. 1, 1911, and Jan. 1, 1915. The American Railways Company has enough unissued stock already authorized to meet the conversion.

TOLEDO RAILWAYS & LIGHT COMPANY.—The Toledo Railways & Light Company for the year 1908 shows earnings which amount to 2.26 per cent on its capital stock. The gross earnings of the company were $2,542,111, which is a decrease of $23,089 in comparison with the previous year. The net earnings, however, were the largest in the history of the company, owing to the creditable reduction made in the operating expenses. The net surplus for the year was $313,307. In spite of the fact that the company has not been in the best of financial condition the work of construction and extension has not been neglected. During the past year a transformer substation of 2000-kw capacity, a rotary converter of 400-kw capacity and a section lighting substation have been added to the equipment.

INCREASE IN TRACTION OPERATING COSTS.—The annual report made by the Northamptom Street Railway Company to the Massachusetts Railway Commission is interesting in showing how much more it costs to operate a traction line than it did a few years ago. The report shows that wages, coal and supplies cost the company 33 per cent more than they did [illegible] ago. The total cost of carrying a passenger, including taxes and interest, has advanced from 4.11 cents to 4.50 cents. Within the past 13 years the company's income per car mile has increased less than 2 per cent, while the operating cost per car mile has advanced 45 per cent.

LONDON UNDERGROUND EARNINGS INCREASE.—The financial reports of the London Underground System and the Metropolitan District Railway for the six months which ended Dec. 31, 1908, show substantial gains in earnings while for the most part there has been a decrease in the operating expenses. The Baker Street & Waterloo division has increased £17,106; the Great Northern, Piccadilly & Brompton division, £23,963; the Charing Cross, Euston & Hampstead division, £19,738, and the Metropolitan District Railway increased £37,411. The average increase in the number of passengers carried was about 25 per cent.

MEXICAN LIGHT & POWER COMPANY TAKEN OVER.—In spite of the opposition raised by interests identified with the Bank of Montreal, the Mexican Tramways Company has finally taken control of the Mexican light & Power Company, the old management has been turned out and a new board of directors headed by Dr. F. S. Pearson, of New York, has been placed in charge. The new interests state that they intend to operate the property in the interests of the minority shareholders just as much as of the majority. The capacity of the plants will be considerably increased.

NEW HUDSON & MANHATTAN BONDS.—The Hudson & Manhattan Railroad Company has just issued, through the Guaranty Trust Company of New York, $920,000 5 per cent car trust bonds. These bonds are secured by a mortgage upon $1,143,180 of new car equipment, the company paying in cash a trifle more than 20 per cent of the purchase price. The equipment offered as security consists of 90 steel motor cars which cost $12,700 each. They will be put into service in the Jersey City tubes when these are opened in July. The bonds were placed on a basis of about 6 per cent.

BOSTON CONSOLIDATED COPPER COMPANY INCREASES STOCK.—At the annual meeting of the Boston Consolidated Copper Mining Company, which was held in London Feb. 19, the shareholders were asked to authorize an issue of 50,000 shares of new stock to be offered at £2.55, or about $11.25 per share. This issue makes the total outstanding stock issue of the company 775,000 shares. The new stock has been underwritten by a joint syndicate, one-half being taken in this country and one-half abroad.

BELL TELEPHONE INTERESTS LOSE.—The Supreme Court of Illinois has finally rendered a decision denying the right of the American Telephone & Telegraph Company to acquire the majority stock of the Kellogg Switchboard Company. This suit has been in the courts for eight years and was brought by the minority stockholders. The basis of the decision is that it is against public policy to permit a foreign corporation to procure control of an Illinois corporation for the purpose of creating a monopoly.

CHESAPEAKE & POTOMAC TELEPHONE COMPANY.—The annual report of the Chesapeake & Potomac Telephone Company, Washington, D. C., for 1908 shows total receipts of $1,180,384 and total expenditures of $1,056,723, which left a revenue balance of $123,661. Receipts from sale of notes and stock amounted to $1,400,865; total expenditures on account of capital included real estate, $733,437; conduits and cables, $372,664; aerial wires, $37,068, and equipment, $256,605, a total of $1,400,865.

NEW SECRETARY FOR WESTINGHOUSE COMPANY.—At a recent meeting of the directors of the Westinghouse Electric & Manufacturing Company Mr. W. A. Esselstyn was chosen secretary to succeed Mr. Charles A. Terry, who was recently elected vice-president. Mr. Esselstyn has been connected with Westinghouse enterprises for more than 20 years, having been chiefly identified with the auditing and treasury departments. During the receivership he acted as secretary.

UNION NATURAL GAS CORPORATION, COLUMBUS, OHIO.—The report for 1908 of the Union Natural Gas Corporation, of Columbus, Ohio, shows that the company during the year has required 32,015 acres of new oil and gas leases. The net earnings for the year were $1,004,721, and the balance [illegible]

UNION SWITCH & SIGNAL COMPANY.—The annual report of the Union Switch & Signal Company for 1908, shows that the total income of the company was $2,123,542 as compared with $5,023,590 in 1907. The surplus for the year was only $77,848 as compared with $791,598 for the previous year. The annual meeting of the company will be held March 9.

CHICAGO CONSOLIDATION ABANDONED.—It is authoritatively announced in Chicago that the negotiations tending toward the consolidation of the Chicago City Railway, the Chicago Railways and the Commonwealth Edison Company have been temporarily abandoned. Dissentions have arisen as to the valuations of the two traction companies. It is said that the Railways company interests consider that the valuation placed by the City Railway owners upon their property is entirely too high and that the figures will not be accepted as a basis of negotiations. The trouble reverts back to the time when the Morgan-Mitchell paid $200 per share for the South Side Traction Company's stock on the belief that its 99-year franchise was valid. This franchise having been knocked out by the United States Supreme Court the syndicate has had a hard time trying to get out anywhere near even.

LAKE SUPERIOR COPPER CONSOLIDATION.—The reported deal between the Calumet & Hecla interests and the mining interests represented by the Bigelow-Hyams syndicate, has not been officially confirmed as yet, but is generally accepted as a fact. This is practically a consolidation of control as the ownership interests are already largely identical. It is given out that the amount involved in the deal is a little more than $8,000,000, but if all of the Bigelow properties outside the Calumet & Hecla are involved the amount represented is at least three times this sum. The total output of the combined properties when operated at full capacity is expected to be at least 150,000,000 lb. per year.

OHIO TELEPHONE COMPANY SOLD.—The National Telephone Company, of Wheeling, W. Va., which is known as one of the largest independent companies in the West, has purchased, for $540,000, the Woodsville Telephone Company, operating in Monroe County, Ohio. The new owners of the plant will commence its improvements at once, and set about the extension of its lines.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
American Telephone & Telegraph Company:					
January, 1908	$1,101,906	$180,674	$3,921,232	$774,010	$3,147,222
January, 1908	3,790,498	160,282	3,630,216	633,394	2,996,822
Birmingham (Ala.) Railway, Light & Power Company:					
January, 1908	194,343	119,635	74,707	44,783	27,924
January, 1908	177,745	125,862	51,942	43,789	8,162
Brockton & Plymouth (Mass.) Street Railway Company:					
Year, 1908	122,265	88,440	33,825	26,754	7,070
Year, 1907	119,365	82,106	37,259	26,977	10,281
Cape Breton (N. S.) Electric Company:					
Year, 1908	247,143	141,500	105,036	48,511	56,524
Year, 1907	250,064	152,627	97,438	47,284	50,154
Dominion Power & Transmission Company, Hamilton, Can.:					
Year, 1908	1,600,312	974,641	625,671	323,047	302,623
Edison Electric Illuminating Company, Brockton, Mass.:					
Year, 1908	218,927	117,283	101,644	29,213	72,431
Year, 1907	197,966	109,036	88,930	14,336	74,593
Electric Light & Power Company, Abington, Mass.:					
Year, 1908	58,811	34,445	24,366	3,824	20,541
Year, 1907	53,296	31,599	21,601	4,996	16,604
El Paso (Tex.) Electric Companies:					
Year, 1908	534,253	384,639	149,584	86,893	62,690
Year, 1907	506,664	370,120	136,574	68,845	67,728
Fall River (Mass.) Gas Works:					
Year, 1908	417,907	237,776	179,791	28,661	141,529
Year, 1907	397,634	232,338	164,296	26,354	137,942
Galveston-Houston (Tex.) Electric Company:					
Year, 1908	1,088,447	627,972	460,474	213,666	246,808
Year, 1907	1,050,892	616,946	433,946	193,276	240,669
Houghton County (Mich.) Electric Light Company:					
Year, 1908	246,407	120,328	126,072	39,988	80,869
Year, 1907	249,060	122,245	126,815	34,184	92,631
Houghton County (Mich.) Traction Company:					
Year, 1908	265,575	148,244	117,330	59,632	57,698
Year, 1907	249,956	146,317	103,601	57,049	46,552
Hudson River Telephone Company, Albany, N. Y.:					
Year, 1908	1,461,266	1,033,278	430,931	311,980	118,951
Year, 1907	1,474,328	1,103,783	370,525	255,402	115,123
Jacksonville (Fla.) Electric Company:					
Year, 1908	430,837	253,943	176,894	98,909	77,985
Year, 1907	392,363	231,161	161,202	75,315	85,887
Kings County (N. Y.) Electric Light & Power Company:					
Year, 1908	3,613,472	1,747,757	1,865,712	606,560	829,513
Year, 1907	3,471,746	1,786,395	1,685,345	606,560	785,853
Knoxville Railway & Light Company:					
January, 1908	48,217	24,668	23,549	11,483	12,065
January, 1908	38,505	26,785	11,720	11,447	272
Little Rock (Ark.) Railway & Electric Company:					
January, 1908	59,904	29,543	30,360	10,726	19,634
January, 1908	55,680	26,363	29,317	9,579	19,737
Lowell (Mass.) Electric Light Corporation:					
Year, 1908	340,279	196,822	143,857	44,366	99,491
Year, 1907	315,311	175,086	140,257	39,279	100,978
Pacific Telephone & Telegraph Company, San Francisco:					
Year, 1908	9,699,600	8,924,179	1,775,471	1,080,000	695,471
Year, 1907	9,223,874	7,828,416	1,395,148	1,080,000	315,108
Paducah (Ky.) Traction & Light Company:					
Year, 1908	226,613	133,393	93,220	81,349	11,870
Year, 1907	237,153	152,800	84,020	80,773	5,849
Pensacola (Fla.) Electric Company:					
Year, 1908	209,181	144,870	64,311	51,161	13,150
Year, 1907	228,149	145,656	82,493	47,128	35,364
Puget Sound Electric Railway & Subsidiary Company, Tacoma, Wash.:					
Year, 1908	1,694,973	1,096,747	598,226	468,445	48,694
Year, 1907	1,664,281	1,027,894	636,387	408,761	43,031
Rochester (N. Y.) Railway Company:					
Quarter ended Sept. 30, 1908	732,512	461,666	270,846	.....	.....
Quarter ended Sept. 30, 1907	741,551	464,326	276,224	.....	.....
Savannah (Ga.) Electric Company:					
Year, 1908	595,819	388,829	206,989	186,614	20,374
Year, 1907	601,400	383,717	218,682	174,626	44,056
Tampa (Fla.) Electric Company:					
Year, 1908	552,574	367,909	184,664	36,024	148,640
Year, 1907	514,181	376,639	144,341	18,021	126,520
Union Switch & Signal Company, Pittsburgh:					
Year, 1908	2,123,542	2,045,694	77,848	.....	.....
Year, 1907	5,023,598	2,998,756	1,024,842	.....	.....
United Railways, St. Louis:					
Year, 1908	559,352	274,752	284,284	235,568	48,716
January, 1908	827,398	554,359	273,039	233,454	39,585
West Penn Railways Company, Pittsburgh:					
Year, 1908	1,551,138	859,264	691,874	446,300	245,568
Year, 1907	1,603,100	841,767	761,333	416,734	344,599
Whatcom County Railway & Light Company, Bellingham, Wash.:					
Year, 1908	362,231	206,758	155,493	99,691	55,801
Year, 1907	354,469	199,375	155,094	88,583	66,510
Year, 1908	308,190	189,512	118,678	70,833	
Year, 1907	278,240	166,677	111,789	54,887	

GENERAL NEWS

Construction News.

DEMOPOLIS, ALA.—The Demopolis Telephone Company is making arrangements to construct a telephone line to Galion, Prairieville, Allenville and Lanesville.

GLOBE, ARIZ.—The Globe Electric Light & Gas Company is making arrangements to enlarge its plant. The company is also planning to extend its gas mains.

HEBER, ARK.—John M. Covey, of Earle, Ark., has been granted a franchise to install an electric light plant in Heber.

LOS ANGELES, CAL.—The flooding of the Kern River has put the large hydro-electric power plant of the Edison Electric Company at Bakersfield, Cal., out of commission. The tunnel at Lucas Creek, several miles above the plant, has been damaged for a distance of 500 ft. The plant furnishes electricity to operate the system in Los Angeles and Southern California. Energy will be supplied from the local steam plant until repairs are made.

OROVILLE, CAL.—It is stated that work of enlarging the electric plant of the Great Western Power Company at Big Bend, near Oroville, will commence as soon as the weather will permit. The output of the plant will be increased to 144,000 hp. Work will also commence on the construction of the large dam at Big Meadows. The above work will involve an expenditure of about $5,000,000. H. P. Wilson is secretary.

PASADENA, CAL.—The citizens on Feb. 11 voted in favor of the proposition to issue $150,000 in bonds, the proceeds to be used to complete the municipal electric light plant. C. W. Koiner is manager.

PASADENA, CAL.—The Edison Electric Company, of Los Angeles, it is said, is cutting its rates for electricity to keep its patrons from taking electrical service from the municipal electric plant. The company has placed orders for additional generators to be installed immediately to increase the output of its plant.

PASO ROBLES, CAL.—The Council has decided to appoint a committee of five, with power to employ experts to be paid by the city, to make investigations and estimates as to the cost of establishing an electric light plant and water works system for the city.

REDLANDS, CAL.—It is reported that the Domestic Water Company is planning to erect a transformer station at the corner of Reservoir and Crescent Avenues.

VALLEJO, CAL.—The contract for the installation of electric freight elevator in storehouse at Mare Island navy yard has been awarded to the Otis Elevator Company, of New York, N. Y., for which an appropriation of $4,000 was made.

SAYBROOK, CONN.—The Shore Line Electric Railway Company filed a petition with the State Board of Railroad Commissioners asking for approval of its proposed route in the towns of Old Saybrook, Essex and Westbrook.

WASHINGTON, D. C.—The Capital City Telephone Company is planning to make extensive improvements in its system in Washington and surrounding territory.

ATLANTA, GA.—The electric light committee of the Council is considering the question of disposing of the electric plant formerly owned by the Town of Edgewater before it was annexed to Atlanta. The Georgia Railway & Electric Company has made a bid for the distributing system, which will not be needed at the water works, with provision that it will resell it to the city in case it might be needed, which leaves only the generating equipment, lamps, pumps and meters to be disposed of.

AUGUSTA, GA.—Judge R. R. Lamar has been appointed to present the claim of the Twin City Power Company before the War Department at Washington, D. C., for permission to begin work on the proposed water power development at Price's Island, on the Savannah River, near Modoc. The Ambursen Hydraulic Construction Company has the contract for construction of the dam.

FORSYTH, GA. The Upson Manufacturing Company has decided to remove its plant from Waymanville to Forsyth. The factory will have 3000 spindles, which will be operated by steam power at first, but it is expected that it will be superseded by electricity later. The name of the company has been changed to the Newton-Harp Manufacturing Company. W. H. Newton is general manager.

HAWKINSVILLE, GA.—W. O. Jelks, of Hawkinsville, and G. E. Clower, of Auburn, both connected with the University of Alabama, have been engaged to prepare plans and specifications for a municipal electric light plant, for which $15,000 has been appropriated. C. W. Harris is city clerk.

WASHINGTON, GA.—A company is being formed with a capital stock of $65,000 to take over the property of the Pope Manufacturing Company. The new company proposes to enlarge the electric light plant to furnish electricity for a day service for commercial purposes.

SHELLEY, IDAHO.—It is stated that a company recently organized will install a power plant at Gem Falls, two miles distant, to cost about $100,000.

WALLACE, IDAHO.—We are informed that the Spokane, Wallace & Interstate Railway Company has completed its final surveys and has secured considerable right of way for its proposed electric railway between Wallace, Idaho, and Spokane, Wash., a distance of about 100 miles. It is planned to begin construction work this year, but as yet no contracts have been awarded. The overhead type of catenary construction will be used. Direct current will be transmitted at 1200 volts. No definite arrangements have yet been made for furnishing power for operating the system. The company expects to operate 24 passenger, 2 express motor and 118 freight cars, and also four 50-ton electric locomotives for freight service. F. F. Johnson, of Wallace, is president.

CORNELL, ILL.—The Cornell Telephone Company has decided to install a new switchboard in its exchange.

GALESBURG, ILL.—The Galesburg Union Telephone Company contemplates the construction of another telephone line direct to West Quincy, work on which will begin as soon as the weather permits.

GENEVA, ILL.—The City Council has granted a 50-year franchise to the Chicago, Wheaton & Western Electric Railway Company, for which it paid the city $30,000. The new road will be an extension of the third-rail system west of Wheaton, through West Chicago to Geneva, and probably to Sycamore. Henry C. Wood, of Wheaton, is president and attorney for the company.

CONNERSVILLE, IND.—Application has been made to the City Council by W. W. McFarlan for a franchise to install an electric light system in Connersville. A general franchise covering the entire city is asked, although the main object of establishing the plant is to furnish electricity for lamps for the McFarlan Hotel.

HUNTINGTON, IND.—The Majonica Telephone Company has made an assessment of $6 on each of its 700 stockholders to cover the cost of repairing the system damaged by the recent sleet storm.

INDIANAPOLIS, IND.—The Laycock Power House Company has filed notice of increase of capital from $100,000 to $150,000 for the purpose of increasing the output and improving its power plant.

INDIANAPOLIS, IND.—The Indianapolis & Western Railway Company, which, it is said, is planning to extend its railway from Danville to Amo, will also build an extension from Amo to Sullivan, a distance of 75 miles.

INDIANAPOLIS, IND.—A permit has been granted to the Rice Electrical Display Company, of Dayton, Ohio, to construct a steel framework on the roof of the Commercial Block, corner Washington and Illinois Streets and Kentucky Avenue, for an electric advertising display that will cost about $50,000. The display presents a large screen, and by the manipulation of 10,000 electric bulbs will appear to be in motion. Work will begin at once and be completed by June 1. One of the scenes to be displayed is the Hen-Hur chariot race.

JASONVILLE, IND.—The Town Council has granted a franchise to T. J. McGraw to construct and operate a telephone system in Jasonville.

LOGANSPORT, IND.—It is estimated that upward of $50,000 will be expended to repair the damages to telephone wires, poles and property in northern Indiana. Until poles can be erected, the wires are being strung on fences.

ORLAND, IND.—Robert N. Sanderson contemplates installing an electric plant in his mill and furnish electricity for lamps in this town. The village authorities have decided to install electric lamps on the streets.

THORNTOWN, IND.—Plans are now being made for the construction and equipment of a combined water, electric light and heating system in this city. A gift of $50,000 has been made to the town for the purpose of installing a water plant by General Mills, of Washington, D. C., and the city will appropriate sufficient to insure the combined system. Contracts for the work will be awarded soon.

WHITESTOWN, IND.—The Whitestown Citizens' Telephone Company has filed amendments to its charter increasing its capital stock from $1,800 to $20,625. J. Frank Laughnor is secretary and treasurer.

ANITA, IA.—We are informed that nothing definite as yet has been done toward the construction of an electric light plant. The city would like to grant a franchise to some company to install a plant. H. H. Cate is city clerk.

CLARION, IA.—Plans are being considered for installing a better [illegible] engine in the municipal electric light plant. O. P. Stockdale is mayor.

COUNCIL BLUFFS, IA.—It is reported that the contract for the construction of the section from Council Bluffs, Ia., to Traynor, 15 miles in length, of the proposed Iowa & Omaha Short Line Railway, has been awarded to George W. Adams & Company, of Walnut, Ia. J. H. Mayne, of Walnut, Ia., is chief engineer.

FARNHAM, IA.—Owing to the election held in June, at which it was voted to install an electric light plant and water works system, having been declared illegal, a special election was held Feb. 10 to vote again

on the proposition. The citizens again voted in favor of the project and the matter will now be hurried to completion. Preliminary steps have already been taken to install both systems.

OSSIAN, IA.—The Town Council contemplates holding an election to vote on the proposition to establish a municipal electric light plant in Ossian.

PITTSBURG, KAN.—The Joplin & Pittsburg Railway Company has been granted a 30-year franchise in this city. The company has also been granted a 99-year franchise in the town of Cherokee, Kan.

BRINKLEY, KY.—The Sassafrac-Ball Telephone Company, recently organized, proposes to construct telephone lines from Brinkley via Sassafrac and Ball to Quicksand, a distance of 18 miles. James Garnett, of Brinkley, is manager.

FOLSOMDALE, KY.—The Home Telephone Company has decided to install a new and larger switchboard in its local exchange.

HARLAN, KY.—The Harlan Telephone Company is planning to erect a telephone line from Harlan to Hagan, Va., a distance of about 20 miles. Material for construction of the line will soon be purchased. F. G. Green, of Harlan, is manager.

BANGOR, MAINE.—Plans are being considered by the Bangor Railway & Electric Company for replacing the wooden dam across the Penobscot River, which now furnishes power for its electric plant in Veazie, with a concrete structure during the coming summer at a cost from $75,000 to $100,000.

LEWISTON, MAINE.—A bill has been introduced in the Legislature incorporating the Androscoggin Railroad Company for the purpose of constructing a street railway in the towns of East Livermore, Livermore and Turner from the terminus of the Auburn & Turner Railroad in Turner to East Livermore. The capital stock is placed at $300,000, and the incorporators are: Hewitt M. Lowe, of Turner; John A. Jones, Albert M. Kavanaugh, of Lewiston; Harry Manser, of Auburn, and Frank W. Brigham, of Boston, Mass.

BALTIMORE, MD.—The Maryland Electric Railways Company has made application for a franchise in this city to connect with the Baltimore & Ohio Railroad and to enter the Camden station. John Wilson Brown is president and J. F. Heyward general manager, both of Baltimore.

DENTON, MD.—Thomas F. Garey, of Baltimore, Md., has filed his acceptance of the franchise granted by the Commissioners to furnish electricity in Denton, and will construct an electric light plant at his mill stream, near the town. It is planned to have the plant completed and in service in June. Mr. Garey also proposes to extend the transmission lines to Greensboro, Ridgeley, Queen Anne's and Hillboro to furnish electricity for lamps and motors.

MIDDLETON, MASS.—Matthew M. Merritt has applied to the Town of Middleton for a franchise to supply electricity to the town. Mr. Merritt, it is said, proposes to secure electricity for operating the system from the municipal plant at Danvers, if possible. If not he will erect a power station in Middleton.

PEABODY, MASS.—The Peabody Light Board has submitted its annual report to the Town Board, showing a cost of $1,418 for lighting the streets of the town with 188 arc lamps and 70 incandescent lamps. The committee recommends an increase in the equipment of the plant to meet the demands for commercial lighting, which the plant is at present unable to supply.

BATTLE CREEK, MICH.—The Battle Creek, Coldwater & Southern Railway Company is making arrangements to construct an electric railway from Battle Creek to Coldwater, Mich., and from there southward. The company has purchased 26 miles of steam railroad graded roadbed between the two cities. C. E. Flynn, of Erie, Pa., is president.

LAKE CITY, MICH.—The stockholders of the Missaukee Telephone Company have decided to increase the capital stock from $20,000 to $40,000.

MANKATO, MINN.—Bids will be received until Feb. 26 by the Board of Public Works for furnishing equipment for a sewage pumping plant, as follows: One 8-in. vertical submerged centrifugal pump, one 18-in. vertical submerged centrifugal pump, one 15-hp 3-phase motor, one 65-hp 3-phase motor. The motors may be of horizontal type, making belt connections with vertical pump shaft. Second-hand motors will be considered. Electricity will be furnished at 2300 volts, alternating current. Bids also to include the necessary transformers. The bids are to be itemized as follows: Motors, transformers, and pumps complete. All bids to be f. o. b. Mankato. The city will install the plant. J. N. Day is president of the Board of Public Works.

MINNEAPOLIS, MINN.—Senator T. T. Ewell, of Minneapolis, Minn., has introduced a bill in the State Legislature, authorizing cities with a population of 50,000 or more to exercise the power of eminent domain to acquire lighting and heating plants by condemnation if they so desire. The design of the bill is to furnish means by which lighting plants can be acquired by municipalities at a fair valuation.

VIRGINIA, MINN.—The Virginia Light & Water Company contemplates making improvements to its system during the coming year, which will involve an expenditure of about $75,000.

GRENADA, MISS.—The City Council is considering the question of issuing bonds to provide funds for improvements to the municipal electric light plant. The cost of the work is estimated at $35,000.

BENTONVILLE, MO.—Arrangements are being made by the Western Surety & Adjustable Company, of Minneapolis, Minn., to commence work on the construction of an electric interurban railway from Bentonville to Joplin. The company has established headquarters at Bentonville.

ST. LOUIS, MO.—The contract for lighting the downtown streets for a term of ten years, beginning Sept. 1, 1910, has been awarded by the Board of Public Service to the Union Electric Light & Power Company. Under the new contract the cost of arc lamps will be reduced from $90 to $55 per lamp per year, which will mean a saving to the city of more than $516,000 in ten years. The board has also approved the plan of the Downtown Lighting Association to install 470 artistic electroliers in the business district, now lighted by 136 arc lamps.

SCOTT'S BLUFF, NEB.—Plans are being considered by B. A. Lathrop for the installation of an electric light plant in Scott's Bluff.

GOLDFIELD, NEV.—Bids will be received by the Board of County Commissioners until March 6 for furnishing electricity for street lighting in the Town of Goldfield. The system will include 20 arc lamps of 1200 cp.

IRVINGTON, N. J.—The citizens are considering the question of establishing a municipal electric light plant. A committee has been appointed by the Second Ward Improvement Association to look into the matter and ascertain the probable cost and report at the March meeting. It now costs the town between $9,000 and $10,000 per year for street lighting. Warren T. Frey is a member of the committee.

LONG BRANCH, N. J.—The installation of electric lamps from Ocean Avenue to Deal, with provision for an underground conduit system, has been recommended by the special committee and Mayor McFaddin.

NEWARK, N. J.—Arrangements are being made by the New York & New Jersey Telephone Company to erect a new building in Newark, to cost about $500,000, work on which will be started this spring.

FORT BAYARD, N. M.—Bids will be received until March 16 for the construction, including heating, electric wiring and electric light fixtures for three double sets captains' quarters, one nurses' quarters, one steam laundry building and machinery and medical storehouse at this fort. Captain S. P. Vestal is constructing quartermaster.

SILVER CITY, N. M.—It is reported that the plant and holdings of the New Mexico Light, Heat & Power Company have been purchased by J. B. Downey and associates, of Colorado. It is said that the new owners plan to rebuild the plant at a cost of about $15,000.

ALBANY, N. Y.—The contract for supplying the New York State Hospital for the Insane with 25,000 incandescent lamps for the year beginning March 1, 1909, has been awarded to Fairbanks, Morse & Company, of New York, N. Y., for 13.5 cents for 16-cp lamps.

ALBANY, N. Y.—Plans are being made by the Albany Electric Illuminating Company for extensive improvements to its plant and distributing system in this city, which will involve an expenditure of about $300,000. The company is also making arrangements for an extensive exhibit of electrical cooking, heating and lighting apparatus in one of the large department stores this spring.

BERGEN, N. Y.—Plans have been completed for the municipal electric light plant in Bergen, and bids have been advertised for the construction of the plant. The equipment of the plant includes a 270-hp boiler, one 50-hp engine, one 35-kw, direct-current generator, one 100-hp feed-water heater, pump, high-pressure piping, etc. Fred Fish, of Fish & Horton Company, of Rochester, N. Y., is consulting engineer.

ITHACA, N. Y.—The Ithaca & Seneca Falls Interurban Railroad Company is making arrangements to commence the construction of its proposed electric railway this year. The railway will be about 47 miles in length. The power house and repair shops will be located in Ithaca. The company also proposes to furnish electricity for lamps. Jacob Rothschild, of Ithaca, is president.

NEW YORK, N. Y.—The municipal art commission on Feb. 16 approved the designs for the proposed lighting fixtures for the new Police Headquarters, in Centre Street, to cost $20,000.

NEW YORK, N. Y.—Bloomingdale Brothers, Fifty-ninth Street and Third Avenue, New York, have placed an order with Fairbanks, Morse & Company for motors to be used in connection with their vacuum cleaning installation.

NEW YORK, N. Y.—The Public Service Commission of the Second District has granted the New York, Westchester & Boston Railway Company permission to construct its proposed third-rail electric railway from a connection with the New York subway to Port Chester, N. Y.

ONEIDA, N. Y.—The Oneida Railway Company has applied to the Common Council for a franchise to extend its railway from Sherrill to Kenwood.

ROME, N. Y.—The Carey Construction Company, which has the contract for the construction of the water system, has proposed to the Water and Sewer Board the construction of a telephone line from the dam in Fish Creek to the reservoir at Stokes, to cost about $1,200. The board will purchase the system after the completion of the contract, providing the company will construct the plant according to the specifications of the board.

SYRACUSE, N. Y.—The Syracuse, Lake Shore & Northern Electric Railroad Company, which has recently completed its extension from Baldwinsville to Fulton, it is said, will probably extend the railway from Fulton to Oswego, a distance of about 20 miles, during 1909.

SYRACUSE, N. Y.—The Rochester, Syracuse & Eastern Railroad Company, it is reported, will award contracts in March for the construction of

an extension of its railway from Port Byron, N. Y., to Syracuse, a distance of about 35 miles. Surveys have been made, rights of way and franchises secured.

WAPPINGER FALLS, N. Y.—The contract for the construction of the extension to the municipal electric light plant has been awarded to Stehlin-Miller Company, of New York, N. Y., for $9,150.

WARWICK, N. Y.—The Warwick Valley Light & Power Company contemplates installing new dynamos in its plant. Frank Barber is secretary and manager.

GREENSBORO, N. C.—The Proximity Manufacturing Company has placed orders for equipment for its power plant, which will be used to operate the bleaching and dyehouse machinery. The mill has recently been equipped with electric motors. Electricity for operating the mill will be supplied from the power plant at the White Oak Cotton Mill, owned by the company.

LAURINSBURG, N. C.—R. C. Bibberstein, architect, has been engaged to prepare plans for a factory for the Waverly Cotton Mill, which will be operated electrically. J. P. McRae is president.

SPENCER, N. C.—The Board of Aldermen is considering the question of establishing a municipal electrical light plant. It is proposed to furnish electricity for commercial lighting, as well as for municipal purposes.

WINSTON-SALEM, N. C.—Plans are being made by the Crescent Electric Railway Company to begin work in March on the construction of its proposed electric railway, which will extend from Winston-Salem to Stuart, Va., via Rural Hall, Capella Gap, Vade Mecum, Moore Springs, Piedmont, Danbury and Sandy Ridge, N. C., a distance of 68.9 miles. Surveys have been made and right of way secured, and 20 miles are ready for track laying. E. Hillman, of Aberdeen, N. C., is president.

GRAND FORKS, N. D.—The street lighting committee of the Commercial Club, which has been making investigations in conjunction with the light committee of the City Council in regard to lighting the business streets with ornamental lamps and placing wires underground, has submitted its report. The report recommends the installation of a 100-kw turbo-generator set, a switchboard and a 150-hp boiler in the municipal electric light plant, to cost $8,500. About 202 lamp posts will probably be needed. The total cost of the work is estimated at about $30,300.

NORTON, N. D.—The capital stock of the Norton Farmers' Telephone Company has been increased to $30,000.

CANTON, OHIO.—Negotiations are said to be under way for the consolidation of the Stark County Telephone Company, of this city, and the Massillon Telephone Company, of Massillon. Both are controlled by the United States Telephone Company. It is understood that the Massillon plant is to be improved.

CANTON, OHIO.—Plans are being considered by the Stark County Commissioners for the installation of a cooling system and electric light plant at the County Infirmary. The commissioners would like to receive plans and estimates from manufacturers of such plants. M. W. Oberlin is county auditor.

CLEVELAND, OHIO.—F. C. Kingsbury, of Columbus, Ohio, has been given a franchise to construct and operate an electric light and power plant in this city and also a contract for the street lighting. Under the terms of the contract Mr. Kingsbury is to furnish arc lamps at $74.50 per lamp on an all-night schedule and $69 on a moonlight schedule. The plant is to be in operation within eight months.

COLUMBUS, OHIO.—Plans are being considered by the Public Service Board to operate the sewage disposal and garbage disposal plants by electricity, the service to be furnished by the municipal electric plant.

DEFIANCE, OHIO.—As a result of the suit of the C. M. Anderson Coal Company against the People's Gas & Electric Company, argued in common pleas court recently, an agreement has been reached to allow the sale of the property either by the Sheriff or a receiver. That point has not yet been decided, nor has a date for the sale been fixed. The coal company brought suit to collect money due for coal delivered to the local company, and this was followed by an accumulation of claims. The fact that the interest on its bonds was passed caused the Guaranty Savings & Trust Company, which holds $[illegible],000 of them, to foreclose its mortgage on the plant, and F. T. Hay of this city, was appointed receiver. The franchises of the company expire in October next. The Defiance Street Railroad Company is not affected by the action, as it only rents power from the lighting company.

LE MOYNE, OHIO.—The Le Moyne Telephone Company has increased its capital stock from $[illegible] to $10,000.

NATIONAL MILITARY HOME, OHIO.—Sealed proposals will be received at the office of the treasurer, Central Branch National Home Disabled Volunteer Soldiers, National Military Home, Ohio, until March [illegible] for additional central power house, including equipment (electrical and feed water heaters), in accordance with plans and specifications, copies of which, with blank proposals and other information, may be had on application to W. H. Ott, treasurer.

OTTAWA, OHIO.—The directors of the Putnam Telephone Company have decided to install a new plant in place of the one destroyed by the ice storm recently. Cables will replace many of the lines, and central energy system will be used. The old lines will be repaired to give service until the new system is in working order.

SPRINGFIELD, OHIO.—At a meeting of the stockholders of the Springfield Light, Heat & Power Company, held recently, the proposed issue of $450,000 bonds was approved, the proceeds to be used to pay for the Kelley plant, which was purchased some months ago. As soon as the weather will permit the Kelley plant will be closed and the machinery will be sold. All business will be taken care of from the new plant, the output of which will be increased sufficiently to do this by the coming fall.

WARREN, OHIO.—The Board of Public Service is contemplating the installation of tungsten lamps in the business portion of the city as well as on North Avenue.

ANADARKO, OKLA.—The O'Neil Engineering Company, of Dallas, Tex., has been engaged to take charge of improvements to be made to the municipal electric light plant, for which bids for electrical supplies will soon be asked. The citizens recently voted to issue $14,000 in bonds for the same.

CORDELL, OKLA.—The City Council has granted a franchise to L. L. Landry, H. H. Sherman and J. F. Amis, of Alva, Okla., to construct and operate an electric plant in Cordell.

LAWTON, OKLA.—James M. Sims, of the Federal Trust Company, of St. Louis, Mo.; W. D. Todd, president of the Cornplanters' Refining Company, of Warren, Pa., and C. L. Carson, of St. Louis, Mo., are interested in a project to construct a street railway system in Lawton, for which franchises will be asked at once. The system will include about 15 miles of trackage and will cost approximately $300,000.

NORMAN, OKLA.—Plans are being made by the Norman Telephone Company for extensive improvements to its system.

GRANT'S PASS, ORE.—The Rogue River & Oregon Southern Electric Railway Company has secured franchises from the City of Grant's Pass and the County of Josephine to construct an electric railway on the public highways and streets. The company proposes to construct an electric railway from Grant's Pass through the Rouge River Valley to Waldo, a distance of about 50 miles. A water power on the Illinois River has been located. The company is planning to commence construction work in the spring. O. S. Blanchard, of Grant's Pass, is interested in the project.

MILTON, ORE.—Plans are being considered to extend the transmission lines of the municipal electric light plant to Freewater to furnish electricity for lamps, for which a franchise has been granted by the town of Freewater.

PORTLAND, ORE.—The Columbia River Light & Power Company, recently incorporated, is constructing a hydro-electric plant at Cascade Locks, Ore., but as yet has only installed a temporary plant for use in construction of its plant. According to the present plans, the equipment will include two direct-connected units, consisting of Pelton impulse water-wheels, one with a rating of 200 hp and the other 1333 hp, and 2200-volt, 3-phase, 60-cycle generators. The transmission line will be operated at a potential of 40,000 volts. The intake of pipe line is 4800 ft. above the generating station on Herman Creek. R. W. Lang is secretary.

BEAVER FALLS, PA.—The citizens of College Hill have voted to issue $15,000 in bonds, the proceeds to be used for the construction of an electric light plant. C. S. Caughey is secretary of the Council.

FOREST CITY, PA.—The plant and holdings of the Forest City Electric Company has been purchased by the American Gas & Electric Company. The last named company has secured a franchise to furnish electricity in the Borough of Vandling, and also a contract to furnish street lamps. The plant of the Forest City Electric Company will be closed and electricity for lamps and motors will be supplied by the company's high-tension transmission lines, which will be extended to this city at once. J. Kern is local manager.

GREENVILLE, PA.—The Mercer Construction Company, which is promoting the Greenville electric railway, has purchased the charter of the New Castle-Wilmington Railway, including the franchise in New Castle and the 11-mile right of way between the two towns.

LANSDOWNE, PA.—Bids will be received by John W. Davis, secretary, for lighting the streets of the borough for a term of five years, according to plans and specifications, which can be procured from William C. Shuster, Jr., 17 South Lansdowne Avenue, Lansdowne.

WASHINGTON, PA.—The National Telephone Company has been granted a franchise by the East Washington Council to install a telephone system.

SOMERSET, PA.—The capital stock of the Somerset Telephone Company has been increased from $5,000 to $10,000.

CAMDEN, S. C.—The Wateree Power Company has applied to the Legislature for a charter. The company is to be capitalized at $100,000, with the privilege of increasing it to $3,000,000. The company proposes to construct a [illegible] on the Catawba and Wateree Rivers [illegible] McDonald, J. D. Harrison, John Boykin, L. C. Harrison, W. S. Lee, D. P. [illegible] and others, constituting the [illegible]

SENECA, S. C.—[illegible] the construction of the proposed electric [illegible] the Commercial Club of Anderson, S. C. [illegible] Seneca, where it is estimated that 1300 hp can be developed [illegible] Duke to the amount of $[illegible], and [illegible] construction of the plant.

SENECA, S. C.—A. B. Groscor, of Spartanburg, S. C., and others have acquired a water power on Chauga Creek, about ten miles from Seneca, where it is estimated that 1300 hp can be developed

SENECA, S. C.—L. A. Edwards, president of the Citizens' Bank, is reported to have purchased a water power on Conneross Creek, at High Bridge, which, it is said, he proposes to develop.

STEEDMAN, S. C.—It is reported that work has commenced on the construction of a dam on North Edisto River, where it is proposed to develop from 800 to 1000 hp, which will be utilized to generate electricity to be transmitted to Batesburg, Leesville and Wagners for lamps and motors. The plant will also furnish 250 hp to the Middleburg Mills, at Batesburg. Perry Hall is interested in the enterprise.

SUMTER, S. C.—Bids will be received until March 9 for furnishing the city of Sumter with 50 arc lamps of 2000 cp, with an all-night service, all within a radius of one mile from the center. Also prices on additional lamps as needed, above 50, not exceeding 80. The contract to run 10 years,, beginning Nov. 1, 1909. For further information address C. M. Hurst, clerk and treasurer.

CAMP COOK, S. D.—The capital stock of the Ekalaka Telephone Company has been increased from $5,000 to $25,000.

IROQUOIS, S. D.—The City Council has granted a 20-year franchise to L. W. Liddle, of Iroquois, to install and operate an electric light plant.

PIERRE, S. D.—The Great Western Telephone Company, which was recently purchased by the Gas Belt Telephone Company, is planning to install 10 exchanges and erect 500 miles of telephone lines on the west side of the Missouri River. It also contemplates rebuilding the main line between Fort Pierre and Rapid City with copper wire.

BINGHAMPTON, TENN.—The citizens on Feb. 11 voted to issue $25,000 in bonds, the proceeds to be used for the construction of an electric light plant, water-works system and sewerage system. J. A. Omberg, of Memphis, Tenn., will have charge of the construction of the electric light plant.

CHATTANOOGA, TENN.—The Chattanooga Station Company is making arrangements to install three interlocking electrical switch plants at once. The plants will be used for operation of all tracks in the company's terminal yard, and will cost about $100,000. Electricity for operating the system will be furnished by the Chattanooga Electric Company

MEMPHIS, TENN.—The Woodward Iron Company is making arrangements to install electrical equipment in its mines on Red Top Mountain.

YORKVILLE (P. O. RUTHERFORD), TENN.—The stockholders of the Yorkville Telephone Company have voted to increase the capital stock of the company from $5,000 to $10,000.

BROWNWOOD, TEX.—It is reported that the West Texas Telephone Company will construct a new telephone system in Brownwood, which will involve an expenditure of about $30,000.

MARBLE FALLS, TEX.—Arrangements are being made to establish a cotton manufacturing plant in connection with the Granite Manufacturing Company's water power development. The plant will have an output of 10,000 hp and will cost about $250,000.

SAN ANTONIO, TEX.—The San Antonio Traction Company contemplates building a 4-mile extension in the near future to Palm Garden, via the stockyards.

NORTON, VA.—Only one bid was received for a 30-year electric light franchise, which was submitted by R. A. Morrison, of Big Stone Gap, Va. It is probable that the franchise will be revised and new bids called for.

RICHMOND, VA.—The State Corporation Commission has granted the Carolina County Telephone Company permission to increase its capital stock from $10,000 to $15,000.

RICHMOND, VA.—Plans are being prepared by C. S. Wenger, Brownsville, Pa., consulting hydraulic engineer, for the power development of the Craig Water Power Company in Virginia. Two power plants are to be constructed, from which electricity will be transmitted to Richmond for lamps and motors. The Meadow Creek installation will develop about 2500 hp under an 800-ft. head, and the equipment will include two impulse water wheels driven units, direct connected, with a rating of 700 kw. The second plant will be located on John's Creek, near Meadow Creek, will be installed later, and will furnish 2500 hp under a 225-ft. head. The company is capitalized at $200,000. The main office of the company is in Richmond, Va. A. L. Sibert is president.

BREMERTON, WASH.—The Peninsula Light & Power Company has been awarded a contract to supply the navy yard at Bremerton with electricity. R. F. Chapman, of Seattle, Wash., is president.

CAMAS, WASH.—A franchise has been granted to Cottrell & Son to install an electric light plant.

MEYERS FALLS, WASH.—The Northwestern Light & Power Company and the Spokane International Railway Company, it is said, will lease the water power at the falls and will commence at once the construction of a hydro-electric plant, to cost about $100,000.

NEWPORT, WASH.—Application has been made to the City Council by H. G. Smith, of Spokane, Wash., general manager of the Panhandle Electric Railway & Power Company, for a franchise to construct and operate an electric light, heat and power plant in Newport.

PALOUSE, WASH.—The Idaho-Washington Light & Power Company is reported to have taken over the plant and holdings of the Palouse Light & Power Company. It is understood that the new owners will make improvements to the plant. M. J. Shields is president.

PASCO, WASH.—Application has been made to the City Council by J. B. Hubrich for a franchise to operate a street railway system in Pasco.

TENINO, WASH.—The Tenino Light, Water & Power Company has awarded the contract for the construction of a new power house and installation of an additional 150 kw alternator, a 200 kw, 500-volt, direct-current generator, and a 250-hp Corliss engine, to Edwin C. Amme Company, of Portland, Ore. The transmission line from Blumauers to Tenino is finished and it is expected to have the plant completed in about 60 days.

WALLA WALLA, WASH.—The Walla Walla Valley Traction Company is in the market for four 1000-hp water wheels, two 500-kw units, either steam or gas, for auxiliary plants, and one 500-kw unit for a hydro-electric plant. F. S. Drake is manager.

WHEELING, W. VA.—Bids will be received by Captain F. W. Altstaetter, U. S. Engineer Office, Wheeling, W. Va., until March 24, for furnishing and installing gas engines, compressors, special machinery, piping, etc., for operating the locks at dams Nos. 13 and 18, Ohio River.

BLAINE, WIS.—The capital stock of the St. Louis Farmers' Mutual Telephone Company has been increased from $3,000 to $6,000.

CEDARBURG, WIS.—The Milwaukee Northern Railway Company contemplates double tracking its railway, now in operation, from Milwaukee to Cedarburg, and also to construct a single-track from Cedarburg to West Bend this year.

CUMBERLAND, WIS.—The McKinley Telephone Company contemplates increasing its capital stock to $10,000, and will establish a local exchange in Cumberland.

ELLSWORTH, WIS.—The capital stock of the Pierce County Telephone Company has been increased from $50,000 to $100,000.

MERRILL, WIS.—The Western Electric Company, Chicago, Ill., is reported to have secured the contract for the installation of additional machinery at the Grandfather Falls plant. The equipment will include a 1100-kw generator, switchboard and one 140-hp exciter set in the power house, and a 1100-kw transformer at the mill. The cost of the improvements is estimated at $25,000.

SPARTA, WIS.—Jacob Cloos, of Milwaukee, Wis., consulting engineer, has been engaged by the committee on street lighting to make investigations as to the feasibility of installing a municipal electric light plant in Sparta.

WAUSAU, WIS.—The Wausau Street Railway Company is preparing plans for the construction of an electric interurban railway to connect Grand Rapids with Port Edwards and Nekoosa, for which preliminary surveys are now being made between Grand Rapids and Nekoosa.

CHEYENNE, WYO.—The United Smelters, Railway & Copper Company, capitalized at $12,500,000, has purchased the properties of the Penn-Wyoming Copper Company, which has been operating the Ferris-Haggerty and Rambler copper mines, the Battle Lake-Encampment six-mile aerial tramway, the smelters and mills at Encampment, Wyo.; water, light and power companies, banking and mercantile institutions, which recently completed the Saratoga & Grand Encampment Railway, which extends from Walcott to Encampment, a distance of 46 miles. The price paid is said to be $10,000,000.

FORT YELLOWSTONE, WYO.—Bids will be received by Lieut. G. C. Smith, constructing quartermaster, Ft. Yellowstone, Wyo., until March 13 for construction of electric power house. Also at the same place and date, separate proposals will be received for equipment for the power plant as follows: Three 280-hp Francis type water turbines, with governors, complete, 940 r.p.m., to work under a head of 280 ft.; three 150-kw, direct-connected revolving field, 3-phase, 2200 or 2300-volt, 60-cycle, 950 r.p.m. generators and three 8-kw exciters, with switchboard and all connections; approximately 2200 ft. of 26-in. spiral, ¼-in. thick, riveted steel penstock, including air chamber; the lighting equipment for an electrical power house. These items should be bid for separately, but a lump sum for the whole apparatus will be considered. Plans and specifications furnished upon application to the above office.

CHEMAINUS, B. C., CAN.—Arrangements are being made by E. J. Palmer, of Chemainus, to replace the present motive power at his lumber mills with electricity. It is proposed to install a plant adequate to furnish electricity for lighting the entire town. A 115-kw generator and switchboard will be installed. Power for operating the plant will be furnished by the present boiler plant, where refuse matter is used for fuel. Thirty-five arc lamps will be erected about the yards and the buildings will be wired throughout and electrical equipment installed for operating hoists for handling lumber. Hinton & Company, of Vancouver, have the contract for installing the apparatus.

SYDNEY, N. S., CAN.—The Sydney-East Bay Electric Tramway Company has applied to the Council of Cape Breton for a franchise to construct and operate an electric railway from Sydney to the southern end of East Bay, with branches and spurs 17 miles in length. Surveys are now being made for the railway.

TORONTO, ONT., CAN.—Arrangements are being made by the Hydro-Electric Power Commission to erect a telephone line parallel with its electric transmission lines.

MEXICO CITY, MEX.—The Mexican Northern Power Company has secured a valuable franchise from the Mexican government for water power rights on the Conchos River. The company is capitalized at $10,000,000. E. B. Greenshields, of Montreal, Que., is vice-president.

Company Elections.

SANTA ROSA, CAL.—At the annual meeting of the Petaluma & Santa Rosa Railway Company the following officers were elected: E. M. Van Frank, president; J. A. McNear, vice-president, and Thomas Archer, secretary and treasurer.

EVANSVILLE, IND.—At the annual meeting of the Evansville, Mt. Carmel & Onley Interurban Company the following named officers were elected: Aden Knoph, president; Elmer Q. Lockyear, secretary; Lewis Seitz, treasurer, and C. J. Siebert, general manager.

DOVER, MAINE.—At the annual meeting of the Dover & Foxcroft Light & Heat Company the following named officers were elected: C. C. Hall, president; E. A. Thompson, treasurer, and Eugene W. Crocker, clerk.

DETROIT, MICH.—At the annual meeting of the Eastern Michigan Edison Company the present board of directors was re-elected.

DETROIT, MICH.—At the annual meeting of the Detroit Edison Company the present board of directors was re-elected.

SHARON, PA.—At the annual meeting of the Shenango Valley Railway & Light Company the following named officers were elected: N. McD. Crawford, of New York, N. Y., president; Leighton Calkins, of New York, N. Y., secretary, and A. C. Rogers, of Youngstown, Ohio, treasurer.

New Industrial Companies.

THE C. J. LITSCHER COMPANY, of Grand Rapids, Wis., has been chartered for the purpose of dealing in electrical supplies, telephone equipment, automobiles, etc.

THE STERLING ENGINEERING COMPANY, of Newark, N. J., has been incorporated, with a capital stock of $100,000, by Roland D. Crocker, Harry H. Poole and William H. Daly.

THE HENRY H. MEYER COMPANY, of Baltimore, Md., has been chartered by John T. Donohue, Timothy J. Hooper, of Baltimore, Md. The company proposes to deal in engines and boilers.

THE OLIVER ROTO COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to do a general electrical business by G. Raymond Collins, C. A. Fry and Hugh A. Caperton.

THE FUNK MACHINE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 by T. Hill, of Quincy, Ill.; N. E. Funk and J. B. Wentworth, both of New York, N. Y.

THE ELECTRIC BANK PROTECTIVE COMPANY, of Dover, Del., has been incorporated, with a capital stock of $200,000, by R. C. Birkholm, N. M. Lynch and C. D. Voels, of New York, N. Y.

THE LEBETT MANUFACTURING COMPANY has been incorporated under the laws of New Jersey, with a capital stock of $800,000, for the purpose of manufacturing electric dynamos, motors, batteries, etc.

THE NEVILLE ILLUMINATING SIGN COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000 by C. S. Neville, C. F. Beezley and R. E. Nicholson. The company proposes to manufacture signs.

THE BABCOCK ELECTRIC GARAGE & SALES COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $25,000 by E. J. Blandin, Joseph Hidy, Albert E. Green, Frank H. Ginn and J. M. Garfield.

THE NORTHERN EQUIPMENT COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $20,000 to manufacture and sell steam power and electrical appliances. The incorporators are: Charles M. Clark, R. Blom and F. Cederberg.

THE CALUMET ELECTRICAL CONSTRUCTION COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 to carry on a general electrical manufacturing and construction business by Charles J. Carroll, James McGovern and Orie A. Keeler.

THE CONTINENTAL ELECTRIC COMPANY, of Baltimore, Md., has been incorporated with a capital stock of $2,500 by Herluf A. F. Peterson, Joseph I. McAllister and Lindon E. Richardson. The company proposes to do a general electrical contracting business.

BRUNS, KIMBALL & COMPANY, of Jersey City, N. J., have been chartered with a capital stock of $35,000 by W. Bruns, C. C. Kimball, of Jersey City, N. J., and M. C. Kimball, of New York, N. Y. The company proposes to deal in and repair motors, engines, etc.

THE FRALEY HAND VIBRATOR COMPANY, of New York, N. Y., has been chartered with a capital stock of $5,000 to manufacture electrical and mechanical instruments. The incorporators are: John T. Booth, James M. Tully, Lewis V. Hulse, all of New York, N. Y.

THE KIRKPATRICK CONDUIT COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $2,500 by Edward F. Kirkpatrick, Edwin Terwilliger, Jr., and Archibald K. Banham. The company proposes to do a general contracting and merchandise business.

THE NATIONAL LIGHT & MANUFACTURING COMPANY, of Edgewater, N. J., has been incorporated with a capital stock of $50,000 by D. M. Barrett, H. M. Brown and E. J. Gorham, all of New York, N. Y. The company proposes to manufacture gas lamps, fixtures, etc.

THE QUEENS ENGINEERING COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $6,000, to do general construction work. The incorporators are: Thorburn Reid, Frederick C. Mearns, of New York, N. Y., and Robert Brown, of Norfolk, Va.

THE NILSON, MILLER COMPANY, of Hoboken, N. J., has been incorporated by H .S. Nilson, J. E. Miller, L. G. Nilson and E. Miller, all of Hoboken, N. J. The company is capitalized at $25,000, and proposes to do a general mechanical and electrical engineering business, toolmakers, machinists, etc.

THE LIGHTER MANUFACTURING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $35,000 to manufacture electric cigar lighters and other lighting devices. The incorporators are: W. J. Setzer, of Brooklyn, N. Y.; W. A. Walling and E. W. Fuchs, of New York, N. Y.

JACOBUS & HIGGINS, of Jersey City, N. J., have filed articles of incorporation with a capital stock of $25,000, and propose to do a general engineering, surveying and developing business. The incorporators are: W. M. Jacobus, of Rutherford, N. J.; C. H. Higgins and S. Wearst, of Jersey City, N. J.

THE UNITED STATES ELECTRICAL SIGNAL COMPANY, of Boston, Mass., has been chartered with a capital stock of $15,000 to manufacture electric signals of all kinds. The officers are: George B. Bullord, of West Newton, Mass., and Roland Gammons, of Newtonville, Mass., treasurer and clerk.

THE AMERICAN THERMOSTAT COMPANY, of Elmira, N. Y., has filed articles of incorporation, with a capital stock of $25,000. The incorporators are: Burchard C. Johnson, Arthur McClellan and Byron R. Johnson, all of Elmira, N. Y. The company proposes to manufacture thermostats, electrical devices, etc.

THE A. A. AUTOMATIC MANUFACTURING COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 by A. Aderer, W. M. Lambert, Z. S. Oppenheimer and M. W. Gorge, all of New York, N. Y., and R. Markowitz, of New Jersey. The company proposes to manufacture electric cooking utensils.

THE SIRIUS COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by R. Fulton Rubens, Mitchell F. McCarthy and Ralph J. Sachers, all of New York, N. Y. The company proposes to manufacture machinery and appliances useful in electrical, mechanical, chemical and manufacturing trades.

THE CHICAGO CONTRACTING & ENGINEERING COMPANY, of Chicago, Ill., has filed articles of incorporation. The company is capitalized at $30,000, and proposes to install and operate power and heating plants and to operate machine and repair shops. The incorporators are: John M. Blakely, Arthur B. Blakely and H. H. Talcott.

THE NATIONAL ARIAL NAVIGATION COMPANY OF AMERICA, of Clinton, N. Y., has filed articles of incorporation with the Secretary of State. The company is capitalized at $25,000 and proposes to manufacture electrical devices or machines for navigation. The incorporators are: G. H. Allen, J. G. Kirby and L. M. Martin, of Clinton, N. Y.

THE TOLEDO INCANDESCENT LAMP COMPANY, of Toledo, Ohio, has been incorporated with a capital stock of $25,000 by A. Q. Thatcher, C. M. Edson, W. S. Delehanty, W. W. Hill and A. C. Tefft. Mr. Thatcher will be the president of the company, and Mr. Edson, secretary and treasurer. The business of the Toledo Refill Lamp Company, 933 Summit Street, will be taken over and the output of the plant increased from 1,000 lamps per day to 5,000.

New Incorporations.

LITTLE ROCK, ARK.—The West Memphis Belt Line & Terminal Railroad Company has been incorporated to construct an electric railway, 12.14 miles in length. The incorporators are: Edwin Boysden, of Wheatley; R. L. Mixon, H. F. Roleson, W. E. Ayers, J. B. Badgett and others, of Marion.

MERCED, CAL.—The Dos Palos Telephone Company has been incorporated by H. T. Reynolds, A. S. Woodhouse, George Christien and others.

SAN DIEGO, CAL.—The San Diego & El Cajon Valley Interurban Railway Company has been chartered to construct an electric railway from La Mesa Springs through Alta to a point near Lakeside, a distance of 15 miles. The directors are: William B. Gross, Edward Fletcher, of Pasadena, and Thomas Ballantyne, of El Cajon, Cal.

DENVER, COL.—The Denver, Colorado Springs & Pueblo Interurban Electric Railroad Company has filed articles of incorporation, with a capital stock of $1,500,000, to construct an electric railway from Denver through Colorado Springs to Pueblo. The incorporators are: L. M. Pfeiffer, William S. Binford, F. C. Lewis, Charles Lederer and A. E. Van Dusen.

DOVER, DEL.—The Paintsville Water & Light Company has filed articles of incorporation with the Secretary of State, with a capital stock of $100,000. The incorporators are Edwin D. Lamel, L. D. Brooks and Martin Garnet, all of Philadelphia, Pa.

CHICAGO, ILL.—The Independent Telephone & Telegraph Company has been incorporated, with a capital stock of $15,000, by Daniel F. Flannery, Archibald A. McKinley and William McKinley.

NAUVOO, ILL.—The Independent Telegraph & Telephone Company

has been chartered with a capital stock of $12,000 by Daniel F. Flannery, Archibald A. McKinley and William McKinley.

WELLINGTON, ILL.—The Wellington Farmers' Telephone Company has been incorporated, with a capital stock of $1,200, by Monroe Garrison, Daniel Stewart and John C. Benbow.

CROSS PLAINS, IND.—The Farmers' Mutual Telephone Company has been organized, with a capital stock of $890, to operate a mutual telephone line. Daniel Denmore is president of the company, and Martin Vanosdall, secretary and treasurer.

INDIANAPOLIS, IND.—Articles of incorporation have beeen filed for the Central Mutual Telephone Company with a capital stock of $1,000 to construct and operate a telephone system in Sullivan County. The directors are: Philip T. Lloyd, Herschel V. Stark, Charles Moore, Ira S. Anderson and William H. Bennett.

CRESTON, IA.—The Iowa & Southwestern Railway Company has been chartered, with a capital stock of $300,000, to construct an electric railway between Clarinda, College Springs and Blanchard, a distance of 18 miles. The officers are: William S. Farquar, of College Springs, president; J. N. Miller, of Clarinda, vice-president; J. H. Walkinshaw, of Blanchard, vice-president; L. H. Taggart, of College Springs, treasurer, and A. F. Galloway, of Clarinda, secretary.

RICHMOND, MAINE.—Articles of incorporation have been filed for the Richmond Electric Company, with a capital stock of $10,000, for the purpose of generating and distributing electricity and gas. The officers of the company are: C. D. Newell, president; H. E. Houdlette, treasurer, and H. C. Reed, clerk, all of Richmond, Maine.

SALISBURY, MD.—The Wicomico Electric & Power Company has been organized to construct an electric railway from Salisbury and Nanticoke Point, a distance of 24 miles. It is reported that bids have been received, but contract not yet awarded for the work. The officers are: Marion V. Brewington, president; L. W. Dorman, vice-president; Mark Cooper, secretary; William M. Cooper, treasurer, and Jesse D. Price, general manager.

CURRYVILLE, MO.—The People's Telephone Company has been organized to construct and operate a rural telephone line. E. Sparks is president of the company, and Ira Stone, secretary and treasurer.

RICH HILL, MO.—The Ray Telephone Company has been organized by the residents of the Mound Valley district to erect a telephone line to connect with the Rich Hill telephone exchange. James Baughan is president; Peter Flexner, vice-president; George J. Reik, secretary, and Frank Ford, treasurer.

HARLEMVILLE (P. O. GHENT), N. Y.—The Harlemville-Chatham Co-operative Telephone Company has been formed, with a capital stock of $600, to erect and operate a telephone line from Harlemville to Chatham. John B. Jones and William H. Angel, of Ghent, and John Freehan and Frank Wolfe, of Austerlitz, are interested in the enterprise.

OSWEGO, N. Y.—Articles of incorporation have been filed for the City Traction Company with the Secretary of State to construct and operate an electric railway from Oswego to Seneca Hill, a distance of 10 miles. The company is capitalized at $550,000. The directors are: Cadwell B. Benson, of Minetto; William Nottingham, Clifford D. Beebe, of Syracuse, and Harold C. Beatty, of Skaneateles.

RALEIGH, N. C.—The Ivanhoe Manufacturing Company has been incorporated by W. M. Sanders, J. H. B. Franklin, T. R. Hood, N. B. Grantham, T. C. Jordan, and others of Smithfield, and B. B. Adams, of Four Oaks. The company is capitalized at $300,000 and proposes to manufacture cotton warps, hosiery or underwear yarns and manufacture and distribute electricity and operate electric railways in Smithfield and Johnston Counties.

NEW HOME, N. D.—The Sykeston & New Home Telephone Company has been incorporated, with a capital stock of $10,000, by C. C. Guenther, D. Jensen, John Ran and others, of New Home, N. D.

SHERWOOD, N. D.—The Barber Telephone Company has been organized to construct telephone lines in Calquhoun, Prosperity and Grover townships. W. J. Doyle is secretary and treasurer.

Personal.

MR. HARRY D. BAYNE has resigned as Eastern manager of the Canadian Westinghouse Company.

MR. A. H. PICKLER, electrical engineer with the Crocker-Wheeler Company, has been elected president of the American Society of Hungarian Engineers and Architects, recently organized in New York City. Messrs. Zoltan de Nemeth and Sandor Oesterreicher, of the New York Edison Company, have been elected sercetary and treasurer, respectively, of the society.

MR. CHARLES H. PORTER has resigned as instructor in electrical engineering at the Massachusetts Institute of Technology to accept a position with William Filene's Sons & Company, of Boston. Mr. Porter entered the institute from Brown University with the degree of A. B. and was graduated in 1903. After spending a year with the Chase-Shawmut Company, he returned to the Tech. as instructor.

MR. EDWIN H. CHENEY.—The announcement of the appointment of Mr. Edwin H. Cheney as manager of the Chicago district of the Wagner Electric Manufacturing Company, with headquarters in the Marquette Building, Chicago, [illegible] is attributed to his wide circle of friends and acquaintances in the electrical field. Since his graduation in the electrical engineering course of the University of Michigan, in 1892, Mr. Cheney has been located in Chicago. After graduation, he entered the employ of the Chicago Edison Company as chief draftsman, and was subsequently connected with its construction department until 1899. He left that company to become treasurer and manager of the Mutual Electric Company of Chicago, an electrical construction concern, which office he filled until 1901, when he resigned, to become secretary and treasurer of the Illinois Maintenance Company. This position he held for five years, discontinuing his connection with the company to become president of the Fuel Engineering Company, resigning, in turn, to accept the appointment of the Wagner Electric Manufacturing Company as its Chicago district manager. Mr. Cheney's energy, ability and personality, as well as his thorough knowledge of electrical manufacture and installation, make him a valuable acquisition to the Wagner staff.



Obituary.

MR. EDWARD H. BOWEN, associate editor of the *Telegraph Age*, New York, died suddenly of apoplexy on Sunday, Feb. 21.

MR. JOHN STARR, of Halifax, N. S., senior member of John Starr, Son & Company, of Halifax, N. S., electrical engineering and contracting firm, died at his home in that city Feb. 15. Mr. Starr was in his 81st year and is survived by two sons and four daughters.

MR. EDWIN REYNOLDS, for many years head of the engineering department of the Allis-Chalmers Co., died at Milwaukee Feb. 18 after a long illness at the age of 77. Mr. Reynolds was one of the foremost designing steam engineers of the world and some of his types of engines have enjoyed a reputation only second to the original Corliss. One of his achievements was the adaptation of the Corliss principles to engines for electrical generation.

Trade Publications.

TELEPHONES.—The Connecticut Telephone & Electric Company, Meriden, Conn., has issued catalog No. 20-W, covering intercommunicating telephone.

LAMP GUARDS.—Guards for protecting incandescent electirc lamps are listed, described and illustrated in a booklet issued by the F. Bissell Company, Toledo, Ohio.

PANEL BOARDS for various duties are described in the February issue of "Trumbull Cheer," issued by the Trumbull Electric Manufacturing Company, Plainville, Conn.

STEAM PUMPS.—Pony Catalog No. 76 of the Dean Brothers Steam Pump Works, Indianapolis, Ind., gives brief descriptions and illustrations of standardized styles and sizes of steam pumps.

ELECTRIC WASHING MACHINES.—The Metropolitan Electrical Supply Company, of Chicago, Ill., has issued a special bulletin describing the "Thor" electric washing machine, for which it is selling agents.

MOTORS FOR SEWING MACHINES.—Bulletin No. 3907 of the Emerson Electric Manufacturing Company, St. Louis, Mo., is devoted to alternating-current and direct-current motors for driving sewing machines.

GROUNDING CLAMPS for use with Sprague flexible conduit and B-X conductors, and clamps for rigid conduit, are listed in a leaflet issued by the Novelty Electric Company, 50 North Fourth Street, Philadelphia, Pa.

STEAM ENGINES of the simple slide-valve type, rated at from 12 hp to 71 hp, traction engines for all duties and hoisting apparatus, are treated quite fully in Catalog No. 61 of the Heilman Machine Works, Evansville, Ind.

REFLECTORS.—The Pettingell-Andrews Company, Pearl Street and Atlantic Avenue, Boston, Mass., has issued an attractive catalog devoted to "Opalux" reflectors and artistic fixtures that have been designed for use with these reflectors.

WATT-HOUR METERS.—Much valuable technical information concerning all types of watt-hour meters, but especially those of the mercury-motor type, is given in a bulletin issued by the Sangamo Electric Company, Springfield, Ill.

ARC LAMPS.—The Charles L. Kiewert Company, Milwaukee, Wis., has issued illustrated folders dealing with flaming arc lamps and electrodes. The folders cover "Alba" and "Aurola" lamps, giving data, prices and performance characteristics.

MAGNET WIRE.—Rubber covered and bare copper wire are well described in an attractive catalog issued by the Electric Cable Company, Bridgeport, Conn. The catalog gives much specific information concerning the diameters, weights, resistance, etc., of the various wires discussed. Attention is called to the increasing importance of asbestos-covered wire.

LARGE TRANSFORMERS of the shell type for both single-phase and three-phase service are thoroughly discussed in Bulletin No. 4640 of the General Electric Company, Schenectady, N. Y. The bulletin contains also information intended to assist a customer in determining whether air-blast or water-cooled transformers will be more suitable for a given installation.

GAS ENGINES of the horizontal, single-cylinder, four-stroke cycle, are well discussed in an illustrated catalog issued by the Fort Wayne Foundry & Machine Company, Fort Wayne, Ind. Detailed descriptions are given of the constructive features and performance of the engines. A folder issued by the same company gives information concerning suction gas-producer plants of the Burger type.

MOTOR-GENERATORS.—The General Electric Company, Schenectady, N. Y., has issued Bulletin No. 4644, which describes a motor-generator set particularly suited for use in connection with search lanterns, welding, for motor service, or as a reversible booster for battery service. The generator is of the Rosenberg type, capable of giving constant current at variable speed or constant output with variable resistance.

ALTERNATING-CURRENT SWITCHBOARDS are described in detail in Bulletin No. 31 of the F. Bissell Company, Toledo, Ohio. The bulletin covers single-phase, two-phase and three-phase generator, feeder and totalizing panels, as well as exciter panels. Information is given concerning instruments, switchboard parts and appliances. The bulletin contains numerous line drawings of standard boards and price-lists of completed boards and accessories.

ELECTRICITY IN THE WOOD-WORKING INDUSTRY.—A description of the combined direct-current and alternating-current equipment of the plant of the Great Southern Lumber Company, Bogalusa, La., is contained in Bulletin No. 4641 of the General Electric Company, Schenectady, N. Y. An outline of the advantages to be derived from electricity in the wood-working industry is given, together with a discussion of the relative merits of alternating current and direct current.

Business Notes.

DR. ALFRED MULLER, who furnishes expert advice upon foreign patents, designs, trademarks and copyrights, has removed his office from 60 Wall Street to 2 Rector Street, New York.

THE BANNER ELECTRIC COMPANY has moved its Atlanta office from the English-American building to more commodious quarters in the Candler building. Mr. Joel Mann Martin is in charge as Southern manager.

DOSSERT & COMPANY, of New York, have received orders through the Association of Edison Purchasing Agents for 1,500 fuse-box plugs, 1,200 flat shank-lugs, 500 three-way connectors and 500 grounding caps, all of the Dossert solderless type.

THE ROBERTSON ELECTRIC COMPANY, of Buffalo, N. Y., has consolidated with the Cataract Electric Supply Company, also of Buffalo. The new company will move into the Court Inn Building, 37-39 Court Street, Buffalo, N. Y. William E. Robertson is general manager.

CROCKER-WHEELER ORDERS.—Among the recent orders taken by the Crocker-Wheeler Company, of Ampere, N. J., is one for a 250-kw motor-generator set for the Tennessee Coal, Iron & Railroad Company, at Ensley, Ala. It will consist of a 250-kw, 275-volt, direct-current, generator driven by a 6600-volt, three-phase, 25-cycle synchronous motor and will be used as an exciter. Another order is one for about 50 hp of small elevator motors from the Haughton Elevator & Machine Company, of Toledo, Ohio. Yawman & Erbe, of Rochester, N. Y., have also placed order for a number of 2/5-hp motors for use on some of their specialties.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 16, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

912,301. BLOCK-SIGNALING SYSTEM; N. P. Fraser, Carsonville, Mich. App. filed Jan. 30, 1908. In combination with an insulated block of which the rails are electrically separated, of a conductor, connecting the diagonally opposite ends of the rail, together with a source of electric current in the conductor and an electric signal so arranged that a train moving onto the rails will short-circuit the current and release the signal.

912,339. APPARATUS FOR HANDLING THE ELECTROLYTIC PRODUCTS OF BRINE IN THE TREATMENT OF FIBER; W. V. Wentworth and A. B. Larchar, Oldtown, Me. App. filed Jan. 29, 1907. The cell is provided with an evaporator for concentrating the caustic soda, together with a receiving chamber into which the concentrates are discharged without intermitting the evaporation and a filter tank for separating the caustic soda from the salt.

912,340. PROCESS OF HANDLING THE ELECTROLYTIC PRODUCTS OF BRINE IN THE TREATMENT OF FIBER; W. V. Wentworth and A. B. Larchar, Oldtown, Me. App. filed Jan. 29, 1907. Process of treating brine which consists in electrolyzing, then concentrating the caustic soda effluent of the electrolysis, then collecting the concentrate and separating the same into its caustic soda and salt constituents.

912,346. COLLISION-PREVENTING DEVICE FOR RAILROADS; F. Wolf, New York, N. Y. App. filed Oct. 30, 1907. Actuates the brake and shuts off the power of a locomotive automatically, one of the rails forming a continuous electrical conductor, the other rail being interrupted at suitable distances, the parts being connected to a suitable contact arrangement.

912,350. BRUSH-HOLDER; H. L. Zabriskie, Brooklyn, N. Y. App. filed Sept. 9, 1904. An interchangeable brush-holder of the box type in which the pressure of the carbon brush against the commutator bar is regulated by a coil spring which may be tensioned by a ratchet.

912,351. PROCESS OF CHARGING LEAD-PEROXID-ZINC STORAGE BATTERIES; R. Ziegenberg, Berlin, Germany. App. filed Aug. 8, 1907. The process of charging lead-peroxid-zinc storage batteries, consisting in placing the positive and negative plates, normally discharged in sulphuric acid, in a substantially neutral solution of zinc sulphate, and in maintaining the charging bath in a substantially neutral condition by inserting therein zinc not in electrical connection with the plates.

912,359. AUTOMATIC SIGNAL-ALARM; P. A. Brown, Denver, Col. App. filed March 22, 1905. The bell hammer is provided with a part carrying a pawl which works a ratchet carrying a make and break wheel so as to send out signals to any desired count.

912,363. ELECTROMAGNETIC ORE-SEPARATOR; T. Charlton, Chicago, Ill. App. filed Oct. 7, 1905. Two magnetic pole pieces of opposite polarity, one of which is in the form of a rotating roll. The axes of the pole pieces are arranged in an inclined plane. Details.

912,364. INSULATOR FOR ELECTRICALLY CHARGED WIRES; S. Jackson Conrad, Cedar Rapids, Iowa. App. filed July 17, 1908. A recess is formed in the outside of the insulator and a spring catch placed therein to engage the insulator and prevent its removal.

912,384. AUTOMATIC ENGINE STOP-VALVE; I. L. Kimball, Salem, Mass. App. filed May 8, 1907. A balanced poppet valve comprising two connected disks, together with a vent port controlled by an electromagnet so as to unbalance the valve or to balance it and permit the valve to fall by gravity to stop the engine.

912,385. AUTOMATIC ENGINE STOP-VALVE; I. L. Kimball, Salem, Mass. App. filed March 27, 1908. A valve with two actuators for moving the valve in opposite directions, both acted upon by pressure on the inlet side of the valve to balance it, each actuator having exhaust passage so as to permit the other actuator to operate with electrically operated means controlling one of the exhaust passages and hand-operated means controlling the other.

912,400. TROLLEY-HEAD AND GUARD; J. G. McGuffey and R. P. Dowler, Groveport, O. App. filed Jan. 2, 1908. A trolley pole with a casing and a troller wheel slidably mounted within the casing, together with guard arms pivotally mounted in the said casing and means carried by the trolley wheel for operating the arms.

912,427. TROLLEY; S. B. Sickelsmith, Newhaven, Pa. App. filed April 7, 1908. The pole is provided with a pivotal section at the end, the said section carrying a trolley wheel at the outer end and being spring-pressed by a spring pushing against the inner end.

912,432. VALVE ALARM ATTACHMENT; R. F. Spamer, Chicago, Ill. App. filed Oct. 12, 1905. A local circuit extends through the building to be protected so that whenever the valve is tampered with it rings an alarm. The valve is provided with a detachable casing and a removable head with three contacts carried by the head, two in a local circuit and the other grounded.

912,433. ALARM FOR SIGNAL LAMPS; W. K. Sparrow, South Nyack, N. Y. App. filed June 18, 1908. Gives an automatic alarm for signal lamps for automobiles and lighthouses. Provided with a thermo-couple which starts a current and gives a signal if the lamp should go out.

912,447. CIRCUIT CONTROLLER; R. W. Coffee, Richmond, Va. App. filed May 15, 1906. For explosive engines in which a plurality of contacts, mounted on spring arms, make contact with fixed contacts, together with a rotatable shaft, which normally holds the contacts out of engagement and allows them to successively operate.

912,454. ALARM CLOCK; C. Fesenbek, Philadelphia, Pa. App. filed Oct. 6, 1908. Rings an alarm when the bolt is unlocked. Details.

912,459. BRAKE APPARATUS; S. G. Freund, New York, N. Y. App. filed March 27, 1908. For the automatic application and release of brakes when the speed of the train has been reduced to a predetermined degree, the operation being repeated on a further decrease of speed. Combines the braking apparatus with a motor and a plurality of solenoids of differing voltages in circuit with the motor.

912,471. ELECTRICALLY HEATED FLATIRON; E. D. Holley, Forestville, and C. L. Root, Bristol, Conn. App. filed Feb. 29, 1908. Provides an iron base plate with a copper heat distributor having a homogeneous surface union with the plate.

912,501. HIGH-TENSION INSULATOR; J. K. Soden, Chicago, Ill. App. filed [illegible]. Prevents current leakage over the surfaces by providing a housing or jacket surrounding the insulator, the base portion of the jacket admitting air at its lower portion which circulates about the insulator.

912,504. ELECTRICAL CLUTCH AND BRAKE; A. P. [illegible], N. Y., and Francis DuP. Thomson, Wheeling, W. Va. App. filed July 15, 1907. An electrical induction brake or clutch having magnetized pole pieces and a [illegible] pole pieces. The [illegible] traction.

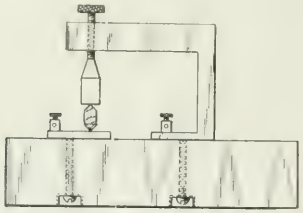
912,[illegible]. ELECTRICAL LAMP FIXTURE; N. W. [illegible], N. Y. App. filed [illegible] the insulating base. Details.

912,[illegible]. PLURAL LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed July [illegible]. Access to the binding post of the device is obtained by removing the cover or casing instead of removing a bushing from each of the threaded shells of the socket.

912,542. MULTIPLE-UNIT SWITCH; H. W. Cheney, Norwood, Ohio. App. filed Aug. 30, 1905. For operating two or more adjacent single-pole switches by means of a solenoid. Each switch has a separate operating mechanism, including a rotatable shaft, a walking-beam lever and a solenoid, and means are provided for connecting together any desired number of shafts, the solenoids being energized simultaneously to operate the switches in unison.

912,551. FIELD STRUCTURE FOR DYNAMO-ELECTRIC MACHINE; A. B. Field, Norwood, Ohio. App. filed Jan. 22, 1906. Avoids the strains produced by centrifugal force on strap-wound coils by bending portions of the coils so as to incline them to the axes of the poles so as to reduce the shearing stress due to centrifugal force.

912,555. TIME CUT-OUT; John Gardner, Fleetwood, England. App. filed Sept. 19, 1905. Time cut-out for electrical circuits provided with a continuously rotatable disk of magnetic material with two magnets arranged on opposite sides of the disks, one of variable



912,613—Oscillation Detector and Rectifier.

strength and a movable part carrying the magnets and displaceable in one direction or the other according to which magnet exerts a preponderating influence on the disk.

912,556. TROLLEY STAND OR BASE; C. J. Geterman, Canton, Ohio; App. filed June 4, 1908. A compression spring is arranged upon a rod and a trolley-pole carrier is pivoted upon rotary support and bears against the rear end of a crosshead on the rod at a point below the pivot of the carrier, whereby the spring is compressed, as the free end of the trolley is depressed.

912,557. TROLLEY STAND OR BASE; C. J. Geterman, Canton, Ohio. App. filed June 4, 1908. A trolley stand provided with a rotary support and a combined elevating and buffer spring, together with a sliding abutment adapted to compress the spring and links connecting the abutment with the trolley-pole carrier.

912,565. DYNAMO-ELECTRIC GENERATOR; J. O. Heinze, Jr., Lowell, Mass. App. filed Nov. 11, 1907. Relates to magnetos with several permanent magnets forming the field so that when one is demagnetized the magnetism from the remaining magnets passes through the armature instead of through the demagnetized maget. Makes use of iron armature sections rotatable in their respective fields each magnetically independent of the adjacent magnet.

912,573. THERMOSTATIC INSTRUMENT; C. S. Johnson, Boston, Mass. App. filed Dec. 17, 1907. A movable strip member elongates under heat and co-operates with a fixed contact. Abnormal movements are prevented by providing a backstop co-operating with the movable member to limit its contactive movement away from the fixed member.

912,594. HICKEY; Louis McCarthy, Boston, Mass. App. filed Oct. 23, 1908. For connecting the stem of an electrolier to the insulating joint which is connected to the outlet. It consists of a separable two-part member which engage the insulating joint and fixture, respectively, and are in slidable engagement with each other, the two members having registering openings for the wires and means for rigidly connecting the members.

912,612. COMMUTATOR FOR MOTORS; A. J. Pfaff, St. Louis, Mo. App. filed April 29, 1908. A commutator head is provided with rings of hard and smooth insulating cement arraged adjacent to the ends of the segments that are mounted in the head.

912,613. OSCILLATION DETECTOR AND RECTIFIER; G. Whittier Pickard, Amesbury, Mass. App. filed Sept. 3, 1907. An individual conducting crystal of low conductivity with a metallic deposition upon its edge. The crystal consists of carborundum.

912,639. ELECTRIC-LIGHTED SIGN; C. F. Ziegler and R. A. Bartling, Chicago, Ill. App. filed Sept. 25, 1907. A flashing sign. Electric lamps are rotated to illuminate the sign. A hollow rotatable shaft carries hollow arms which carry the lamps. The wires are led through the shaft and arms to the lamps.

912,701. TELEPHONE ATTACHMENT; A. W. Lyda, Pittsburg, Pa., and E. C. Robinson, Lowellville, Ohio. App. filed July 17, 1908. A mouthpiece attachment for holding a disinfectant which covers the mouthpiece of a telephone and is provided with an advertising device. Details.

912,705. BATTERY HOLDER; C. T. Mason, Sumter, S. C. App. filed Dec. 19, 1908. For holding a series of dry cells comprising a frame or support and a series of cell-connectors carried thereby, each connector including a circular spring clip adapted to engage the casing of the cell and a resilient conductor tongue integral with and extending from the clip.

912,720. ELECTRIC LIGHT SOCKET; M. Norden, New York, N. Y. App. filed July 18, 1908. Relates to supporting electric light bulb sockets from the circuit wires, each bulb adapted to receive a plurality of electric lights. Details.

912,726. OSCILLATION RECEIVER; G. W. Pickard, Amesbury, Mass. App. filed Oct. 15, 1908. A fragment of chalcopyrite in electrical contact with a substantially rough, unpolished fracture surface of the electrically conducting mineral red oxid of zinc.

912,734. COIN-CONTROLLER ELECTRICAL APPARATUS; A. W. Roovers, Brooklyn, N. Y. App. filed Oct. 1, 1906. For giving shocks. Is provided with two movable handles so connected that they move in unison, one insulated from the other, and an indicating mechanism indicating the extent of movement of the handles and, consequently, the strength of current passing through the user.

912,765. ELECTRICALLY HEATED TOOL; M. J. Wohl, New York, and A. A. Low, Horseshoe, N. Y. App. filed Feb. 10, 1908. A detachable tip for a soldering iron so coupled to the body that the heat of the body is conducted to the tip. The tip has a plurality of projections which engage the size of the body. The body is electrically heated.

912,778. TELEPHONE CORD PROTECTOR; L. J. Bates, Philadelphia, Pa. App. filed Jan. 23, 1908. A bushing of resilient material which prevents the cord from wearing, by contact with the metal part of a plug. It consists of a split sleeve of elastic material on the cord at the inner end of the plug.

912,786. ELECTRIC SIGNAL SYSTEM; V. L. Beeman, Wellington, Ohio. App. filed May 25, 1908. For indicating in the locomotive cab or at the despatcher's office the position of the train by dividing the line into blocks with track relays and circuit wires extending along the track to the relays, together with a reversible train magnet whose poles reverse according to the direction being traveled so as to energize the track relays and close the circuit.

912,801. ELECTRIC CONDUCTOR; S. G. Brown, London, England. App. filed Dec. 11, 1903. Electric cables for submarine work having an inner conductor, an outer conductor, a closed iron magnetic circuit developing the inner conductor and a dielectric between the inner conductor and the magnetic envelope and between the latter and the outer conductor.

912,822. TELEPHONE SYSTEM; W. W. Dean, Chicago, Ill. App. filed Jan. 23, 1904. A two-wire type of telephone system in which the cut-off relays are actuated by current over the talking circuit. A common battery system in which there is associated with each line a line signal and a line relay, the latter controlling normally open contacts in the local circuit of the signal. There is also provided a cut-off relay for each line to establish a path of low resistance about the line relay to render it inoperative.

912,831. DEVICE FOR INDICATING THE INTENDED MOVEMENTS OF VEHICLES; Percy Seymour Douglas-Hamilton, Queen's Gate Gardens, London, England. App. filed Dec. 31, 1907. For signaling the movement of an automobile at night by illuminating a hand which shows red and is in a horizontal position on the left-hand side of the vehicle when the driver intends to turn to the left and which illuminates two upright hands when he intends stopping.

912,859. ELECTROLYTIC CELL FOR SEPARATING CONSTITUENTS OF A MIXTURE OF METAL OR AN ALLOY; H. Lacroix, Geneva, Switzerland. App. filed July 2, 1908. The material which drops from the anode is collected separately from that which drops from the cathode. One of the electrodes is surrounded by a diaphragm, the lower end of which opens into a chamber separate from the rest of the body of the cell.

912,871. CONTROLLER FOR ELECTRIC MOTOR; R. L. Munson, Seattle, Wash. App. filed Feb. 11, 1908. A starting-box which may be used as a phase splitter which is dust proof and ventilated and so that the cores carrying the coils may be separately removed and replaced. Has a hinged cover and a parallel series of spring socket clips, one series carried by the cover, together with detachable resistance coils mounted in the clips and exposed by turning back the cover.

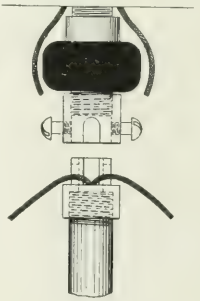
912,878. TELEPHONIC RECEIVER; A. H. Nicholson, Wendover, England. App. filed Sept. 2, 1908. Comprises a permanent horseshoe magnet, with two parallel diaphragms between the poles, a bar electromagnet between the diaphragms and a circular wedge-shaped piece carrying the bar magnet.

912,901. RAIL JOINT; H. S. Shafer, Nazareth, Pa. App. filed Aug. 13, 1908. The abutting ends of the rails are recessed and a plug mounted in the recess which connects the rails electrically. A current-conducting wire passes through the plug and extends into the recesses.

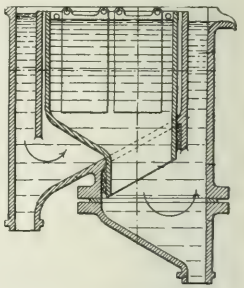
912,908. TELEPHONE REPEATING APPARATUS AND CIRCUIT; J. J. Skidmore, Boston, Mass. App. filed May 9, 1907. Adjusts the sensitiveness of the telephone apparatus in order to secure the electrical balance between the line sections so as to prevent the active disturbances without attention from the switching operator. Inserts a resistance connected to an element of a jack which bears a predetermined relation to the line to which the jack belongs.

912,916. RAIL BOND; C. R. Sturdevant, Worcester, Mass. App. filed Jan. 13, 1906. Rail bonds for electric railways having at the ends terminals, each terminal comprising a plurality of solid metal stud-bearing branches adjustable toward and from each other.

912,924. COIN-CONTROLLER ELECTRICAL DEVICE OR MACHINE; J. Weiner, Cleveland, Ohio. App. filed March 7, 1908. For giving shocks. A magneto generator has a crank member which is



912,594—Hickey.



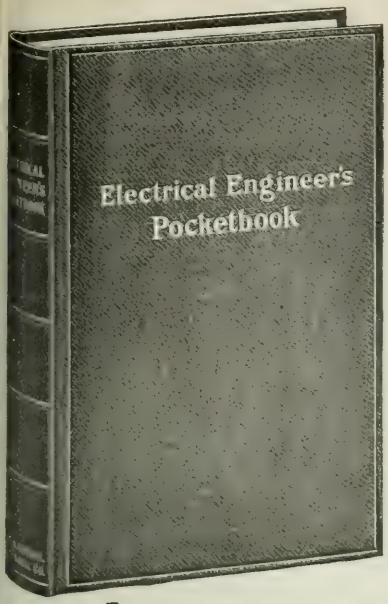
912,859—Electrolytic Cell for Separating Constituents of a Mixture of Metal or an Alloy.

turned by one hand of the user, the circuit being closed through this hand and a hand-hold which is grasped by the other hand of the user.

912,946. DRY BATTERY CELL; G. N. Eastman, Riverside, Cal. App. filed Aug. 12, 1908. Avoids leaking of the fluid by constructing the metal electrode of tubular form and incasing it in an adhesive fibrous material of sufficient rigidity to preserve the form of the electrode.

912,970. ELECTRIC ALARM WATER GAGE; G. C. Marsh, Denver, Col. App. filed April 8, 1908. The float is an electric conductor and closes the circuit between the electrodes so as to ring an alarm when the water has reached a high or low level within the boiler or other receptacle with which the gage is connected.

912,974. BRUSH HOLDER; J. F. Elroy, Albany, N. Y. App. filed Nov. 22, 1904. A brush holder having jaws which grip the brush and pivoted at its opposite end to a conducting support provided with a binding post for the leading-in wire. Details.



Renewal of Special Offer

THE special offer that we made for our Electrical Engineers' Handbook in January resulted so successfully that we have decided to renew the offer. This famous little Handbook is a Little Giant Encyclopedia of practical information about the electrical engineering profession and allied trades, compiled from the courses of the International Correspondence Schools, which are written by the best experts in the country. To enable members of the electrical trades and professions to become better acquainted with I. C. S. instruction matter we make a most unusual offer for this Handbook, as stated in the paragraph below.

This book is not only of value to men in higher positions, but can be successfully used by workers in subordinate positions in these trades on account of the fact that it is readily understood without a knowledge of higher mathematics. It contains rules, formulas, tables and diagrams of connections that are most generally used by wiremen, dynamo attendants, foremen of construction, managers, engineers, and superintendents of power stations, and superintendents of electric-lighting and electric-railway systems, and manufacturers and dealers in electrical apparatus and supplies. It provides the facts and figures needed in every-day work that are difficult to find in ordinary textbooks.

The description of dynamos and motors, their faults, method of locating faults, and remedying them is of great value. A very valuable table of the sizes of motors necessary to drive various machine tools is incorporated. Of great value are the sections on alternators, alternating-current motors; alternating-current measuring instruments; electric transmission, and diagrams of connections, data, tables, etc.; and methods of controlling speed of electric cars and multiple unit trains. The up-to-date instruction on storage batteries has been carefully edited by the engineers of the largest battery manufacturing concern in the country. A glance over the partial list of contents below will give a fair idea of the immense value of this Pocketbook.

The book is 3½ x 5⅛ x ¾ inches in size and is easily carried in the pocket. It is bound in silk cloth with gilt top and title, and printed on a high-grade book paper in clear type. It contains 420 pages and 262 illustrations. The regular selling price of this book is $1.25, **but to those who send us this coupon, we will mail the book prepaid for 50 cents.** This is undoubtedly the greatest book value you have ever received. Don't fail to take advantage of it.

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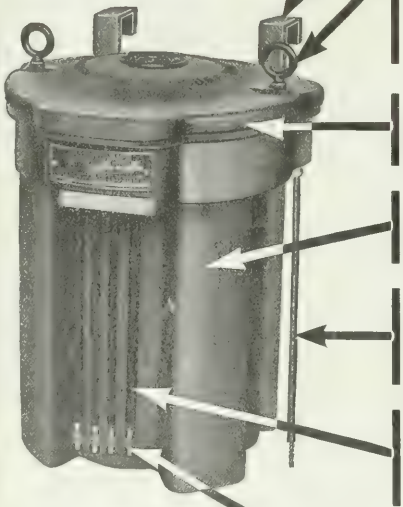
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General Electric Company

The Improved Type H Transformer

Over 45,000 in Actual Operation. Capacities: 50 K.W. and Less

ADDITIONAL POINTS OF ORIGINALITY AND SUPERIORITY



Suspension Hooks—Simple design. Rugged construction. Interlocking device permits transformer to be raised with or without hooks attached.

Eyebolts—Wrought iron. Hold cover tightly in place and provide safe means of lifting transformer. When lugs are used slings may easily slip, especially when lifting transformers through wires and over cross-arms. Eyebolts entirely eliminate this danger. It is unnecessary for linemen to carry a wrench to remove cover.

Cover—Scientifically designed to prevent cracking from static discharges during thunderstorms or grounding from terminal board to cover.

Tanks—Cast iron. Ample radiating surface. Corrugated tanks used for large sizes. Durable and neat in appearance.

Primary Leads—Heavily insulated to prevent short circuits through cross-arm braces. Rubber—not paper—covering is used. Consequently insulation does not crack at bends or absorb moisture.

Secondary Leads—All brought out through one bushing. High current conductors, with section of tank between each, increase the reactance, and also losses due to local eddy currents in the tank.

Leaf Connectors—Have been used for years on Improved Type H Transformers. Their superior advantages over other forms of connectors have been so fully appreciated that nothing additional need be said.

Visit our transformer factory and be convinced, or write regarding tests on your own premises

The original low losses have been greatly reduced recently

Write for "new data on the Improved Type H Transformer"

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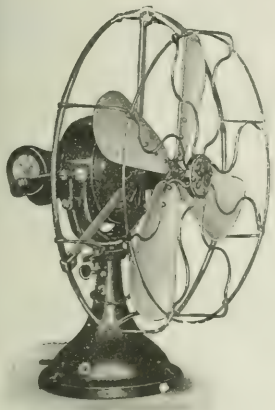
New York Office:
30 Church Street

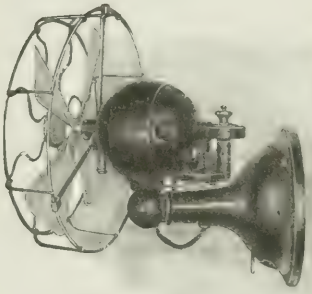
Principal Office:
Schenectady, N. Y.

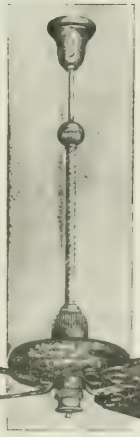
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General Electric Company

The right GE Fan adds the finishing touch to all hot weather comforts







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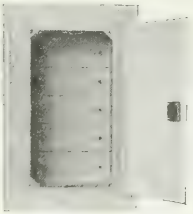
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The Evolution of Metropolitan Service.

Waterside Station No. 2 of the New York Edison Company is a very striking example of the way in which an electrical supply company needs the services of both prophet and engineer in meeting its needs. The rate of growth of load in a modern city is something that almost passes belief. In New York, as in every other metropolis, all principles of normal growth of activity and population are violated. A city nowadays does not grow like a plant, but like a magnet in a shower of iron filings. Hence, the eternal difficulty with rapid transit and other public services. It would be almost impossible to build another subway in New York so rapidly that it would not be foredoomed to overcrowding from the moment its stations should open their doors. Such, too, has been the tendency in electrical supply, and Waterside Station No. 2, huge as it is, will probably require help long before it now seems probable. When Waterside No. 1 was built there was a question as between reciprocating engines and turbines in its equipment. In the short time that has elapsed between that date and the present, that equipment matter has resolved itself into a choice between turbines, and even that doubt seems to be passing at the present time. The big turbine certainly has made good in central-station practice, and the economical results obtained from the big modern units are so excellent as to have little to be desired so far as the generation of alternating current is concerned. And within the past few years a vast proportion of all the generating plants built have been for alternating current irrespective of the final disposition of the output. Whether alternating distribution is rapidly to displace the older direct-current distribution is another matter. As the exigencies of service force the alternating-current wires underground, it will doubtless be discovered that alternating-current distribution is not such a bad thing as it was the fashion in some circles to believe it 15 years ago.

Not the least interesting part of Waterside Station No. 2 is the coal-handling and boiler plant. Here, too, is strong evidence of the evolutionary process, for part of the boilers are fired by hand and part equipped with automatic stokers. This is at least evidence that the stoking question is still unsettled, at least for the grades of coal used in New York. There is, too, evidence of a strong tendency to increase the size of the boiler units, although at present [illegible] have more than kept ahead of the game. There seems to be no good reason why automatically stoked boilers cannot be designed for double the outputs now usual, with gain in simplicity and cost. The tendency is toward increase of size, although as yet no very radical steps have been taken. Another tendency not yet very marked is toward the use of greater furnace space with a corresponding gain in cleanliness of combustion. We noted some time since a remarkable piece of research done at the University of Illinois on smokeless combus-

tion, a research that has already borne fruit in at least one great Western station. The Waterside stations are equipped with very complete coal-handling systems that should make it economically possible to use almost any grade of coal that is suited to the needs of the fire room. The greater attention recently given to boiler and furnace design is one of the things that bears very hopefully on costs of production. If one compares in any large station the known efficiency of the generating sets with the hole in the coal pile, it becomes evident that the generator room is a long way ahead of the fire room. Here is the chance for modern design and improvements in economy, and stations such as that here considered are moving along toward better conditions. Superheat and high vacuum have forced their way into practice along with the turbine, and attention must now be concentrated on the preliminary stages of the cycle that ends on the distributing system.

One of the very pleasant things about these new stations is the attention paid to finish. A modern plant is beautifully clean and bears everywhere the marks of the scientific production of energy. The old huddled dynamo room, slimy with oil and encrusted with dirt, has nearly disappeared from the face of the earth. Even the boiler room peopled by grimy firemen is on the wane and now generally presents a vista of neat furnaces with slowly moving feed shafts and a few skillful workmen seeing that the coal goes where it will do the most good. Even hand-fired furnaces present a far more orderly appearance than of old. In the new Waterside station the interior of the operating rooms proper is comparable with that of a fine office building. The net result of this case will very certainly be apparent in the upkeep and in a spirit of efficiency and *esprit-de-corps* that has a value far above dollars in promoting good service. Few people who are not intimately acquainted with central-station work have any adequate idea of the change in temperament, so to speak, that the last decade has wrought. There is vastly more effective pulling together than there used to be, and of late there has been a tendency to far better relations with the public. It is no uncommon thing to hear a central-station manager in the privacy of his own office and to his own staff speak fairly from the point of view of the publicist. Big, broad-minded men have now grown up in the business, and if they were given a fair chance by the powers in financial control, would establish public service on a far better basis than has ever yet been known. The world really moves faster than the public at times, and this is often evident in the central-station business in spite of hostile legislation and unreasonable restrictions. Electric service has passed from being a luxury to being a necessity, and these great central stations are monuments to the change. Fancy for a moment what would happen were electric service in New York to stop for even 24 hours. There would be either demoralization of commerce and industry and by another day pandemonium would break loose. The growth of such service has been so gradual that we can hardly realize its importance. Were an accidental shut-down possible it would be almost worth the while merely as a lesson on the fundamentals of modern life.

The Electric Vehicle Situation.

In the early stages of the automobile business the electric vehicle occupied the center of the stage, and it has been with considerable regret that electrical men have watched gasoline machines increase in numbers at a more rapid rate than the electric. Nevertheless, the electric vehicle has by no means been on the decline, and if the development of the electric automobile business in some of our cities is any criterion, the near future is full of encouragement. The central-station companies in various cities certainly can make no mistake in encouraging this business in every way. One trouble with the electric vehicle has been that too much was expected of it in the early stages of the art. Various companies rushed into its manufacture, but, strange to say, storage batteries did not alter any of their previously well-known characteristics and objected to neglect and mistreatment just as much when placed on an electric vehicle as when used in any other way. Almost as much improvement has been made in batteries and vehicles in 10 years as has been made in gasoline automobiles, but many of the old traditions still seem to cling to the electric vehicle. One of these is the fallacy that a large mileage on one charge is essential to ordinary business about town. The average electric vehicle, as built to-day, has considerably more available mileage on one charge of battery than the average vehicle of 10 years ago, and what is more, has a considerably greater mileage available than is actually needed in the ordinary run of business or pleasure, except where a long tour is undertaken. The best accepted practice now as to charge and discharge of vehicle batteries allows the vehicle owner more latitude than in the old days, not only by giving better mileage and greater durability of batteries, but in allowing the vehicle to remain partially discharged. The old idea was to keep the batteries as fully charged, and as far away from the point of complete discharge, as possible. In the last few years it has been learned that repeated overcharging is detrimental, and that a battery if discharged regularly down to 1.9 or 1.8 volts per cell will last longer than if only partially discharged between the rechargings. The life of the battery is somewhat dependent on the number of completed charges which it receives, and consequently the practice of fully charging every day a vehicle which has been run only a small fraction of its total available mileage is being discontinued as far as possible by owners and garage operators.

There is an immense field for the electric vehicle without it in any way attempting to perform the same feats as the gasoline machine—the field of every-day use by business men and by the fair sex. Indeed, it is especially noticeable in cities where electric automobiles are seen in greatest numbers that the electric vehicle is extensively used by the ladies. From experience in cities where a large number of electric vehicles are in use, it appears that the income per vehicle to the central-station company can be counted as about $5 per month, at a 6-cent per kw-hour rate, taking the average from one year's end to the other. An income of $60 per year for a 3-kw load which is on during the peak is not sought after by a central-station company which intends to remain out of bankruptcy. Automobile charging, however, does not, from its very nature, come on during the peak-load period, and consequently the only investment over and above that necessary for carrying the regular lighting load is in the service wires, meter and transformer. The electric automobile business can only experience its best growth in cities where proper provision is made for the care of batteries. If a central-station company wishes to encourage this business, it is essential that this matter be thoroughly looked into. In some cities the central-station companies have stood behind the bat-

tery-maintenance business, either directly or through the medium of some garage operating company. It is not always necessary to do this if there is a garage in the city which is properly equipped both as to men and materials for maintaining batteries. In a large number of garages, however, the electric is so secondary to the gasoline business that the electric vehicle does not receive proper attention. Many garage owners and operators are men who have come up through the bicycle or gasoline engine ranks, and it is not to be expected that they should either love, or be proficient in, battery maintenance. Where there are no good battery-maintenance men in a town, it is clearly up to the central-station company to bring them there if it wishes to get the electric automobile business on a good footing.

The Fan Motor and the Central Station.

With its popularity ever increasing and its design ever improving in detail, the electric fan becomes more and more a proposition for central-station encouragement and exploitation. As indicative of the attitudes of central stations toward the electric fan, the articles appearing elsewhere in this issue are suggestive. In some cities the policy of the company is to leave the matter of fans entirely in the hands of the contractors and supply houses. Others have found it profitable to sell the fans outright or to rent them for a stipulated sum per season, while a few companies install fans on a flat-rate basis. The actual number of fans in use is not ascertainable in the majority of cases nor the exact revenue from them, since they are connected to the lighting circuits and the energy is not separately metered. While the estimate given in a number of instances of the revenue received cannot in the nature of things be accurate, it nevertheless indicates that fan business is worthy of every encouragement.

As with many other electrical devices, the greatest obstacle to the introduction of fan motors is in the first cost. Many customers would gladly pay the expense of operating, but hesitate at the purchase price. The profit involved in the sale of fan motors is sufficient to make the business attractive to local contractors and dealers if such exist in a town, and the more of these the central-station company can get to handle fans, the more lively the business is likely to be. It is even advisable in some cases to get hardware or other stores to handle a few fan motors, even where they deal in no other electrical supplies, in order to stir up public interest. It is well to remember that fans are now made in smaller sizes than formerly. In many cases a 10-in. fan will suit a customer better than a 12-in. or 16-in., and the cost is lower.

When the fan season opens it should be the work of the central-station manager or solicitor to locate the places in his territory where fans are specially needed. When he finds such places, a few days' free trial will be found an aid. The possibilities as to the number of fan motors that can be sold in a town are likely to be underestimated. In a small town of 2500 inhabitants in southern Illinois, 43 fans were ordered and connected before a promised day service was even started, though usually it is considered impossible to get motor customers until after day service has been actually in existence for some months. In this case the motors were paid for in cash and were sold entirely by a contractor and dealer, no inducement in the way of installment payments being offered.

Automatic Devices for Synchronizing Alternators.

Ever since alternators have been operated in central stations their synchronization has been a matter of great practical importance. In the early days, with alternators giving frequencies of 120 cycles to 140 cycles per second, it was regarded as unsafe to attempt to synchronize them, and they were allowed to operate independent circuits only. As the art of alternating-current distribution developed, the necessity for, and capability of, synchronizing alternators became well established, and no central-station manager would now contemplate any other method of operation. At first incandescent lamps were used as synchronism indicators, but latterly rotary synchronism indicators have been widely adopted. An automatic device for synchronizing alternators is described by Herr Fritz Lux in an article in the *Electrotechnische Zeitschrift*, which is abstracted in the Digest. Electromagnetic mechanism, operated jointly by the operating and the incoming alternator, serves to throw the connecting switches at the proper moment. A machine for the same purpose has also been devised in this country. It seems doubtful whether such automatic synchronizers will come into extensive use. The amount of damage that might be effected by an accidental error on the part of the instrument is so great that most central-station operators would prefer to trust to rotary indicators and to synchronize manually.

Organization of Technical Bodies.

From a recently published account of the International Telegraphic and Telephonic Conference held at Budapest last year, it appears that this country, as in the case of several other international professional meetings held within the past few years, was not represented. It is much to be desired that America should send delegates to such conferences in the future. Whether the particular systems or devices employed in this country resemble or differ from the corresponding systems or devices employed in Europe, much is gained by international comparison and discussion. No nation can, in this century, afford to stand aloof in technical discussions. It was the absence of American representation at an international telegraph conference of government representatives half a century ago that accounts for the fact that we have a somewhat different telegraphic code from that of the rest of the civilized world. The international code of Europe was agreed upon as a mutual compromise at that conference. It is reasonable to suppose that had America been represented we should also have subscribed to the international compromise, and have adopted the international code here. As it is, wireless telegraphy is making the contrast between the international and the American code daily more burdensome and more prominent.

Another inference to be drawn from the Budapest conference is that engineers naturally subdivide themselves into groups, following the lines of industrial applications. Telegraph engineers tend to group themselves with telegraph engineers, and not with telephone engineers, or electric light and power engineers, so long as telegraphy is operated industrially separately from telephony, lighting or power. When, however, telephony is operated industrially along with telegraphy, telephone and telegraph engineers tend to meet in joint concourse exclusively of engineers in railway, light or power systems. No institute of electrical engineers, as a whole, can satisfy the needs of electrical engineers in separate industrial branches, unless

special sections are created for fostering the requirements of those branches individually. In this country, there is no reason why the American Institute of Electrical Engineers should not satisfy the technical needs of all branches of engineers engaged in electrical work. Yet we have seen electrochemists secede as a separate body and swarm by themselves. We have also more recently seen illuminating engineers, wireless telephone engineers and car-lighting engineers follow a similar divergent course. Indications point to further narrowing of the professional activities of the parent body, particularly as relates to the operating side of electrical engineering. If telegraph and telephone engineers were sufficiently numerous in this country, they would probably do likewise. The only hope of preventing such schisms, which are unnecessary, deplorable and adverse to mutual advantage, would appear to be the creation of sections within the main body, devoted to particular industrial applications. This course has already been followed to some extent by the American Society of Mechanical Engineers, as well as by the Street and Interurban Railway Association. Lacking some effective plan, to counteract present tendencies, the Institute may in time find itself narrowed to the university extension work which now appears to absorb much of the energy that formerly was expended entirely in the furtherance of its objects as a professional body.

The Tungsten Lamp and Revenue Reductions.

Some of the central-station companies which have been backward in introducing the tungsten lamp to their customers have recently been undergoing some unpleasant experiences as regards the effect of the tungsten lamp on revenue. The situation in these cases seems to have been about as follows: The central-station company has done nothing actively to make the consumer familiar with the tungsten lamp, the general theory being that it is best to let well enough alone so long as the consumer is satisfied with his existing inefficient installation. Sooner or later the local dealers and contractors have taken a hand in the game and have gone direct to some of the largest consumers offering an installation of tungsten lamps on the ground that it would make a great reduction in bills. Some large installations have been made, and the companies have lost in gross earnings because of the reduction of current effected by the tungsten lamp, and also in reputation because they did not call the attention of consumers to these lamps before they were introduced by the contractor. The wise course, and the one that has been pursued by the truly progressive companies, has been to call the attention of consumers to these lamps, explain their fragility and tell each consumer that two to three times as much light can be obtained for the same energy consumption as with the present carbon-filament lamps. The majority of consumers, if dissatisfied enough with present bills to buy tungsten lamps, are willing to pay the same bills as formerly if they can obtain the promised increase in light. The result of this is to raise the standard of illumination to which customers are accustomed, and there is no opportunity for the consumer to feel or say later that he was not given the benefit of tungsten-lamp economy.

Earnings of Lighting Plants.

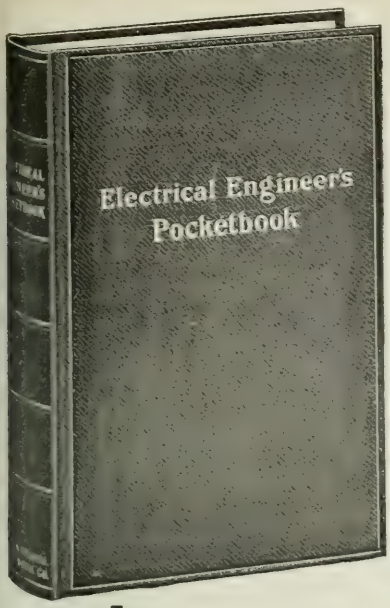
The recent census statistics of central-station plants for 1907 throw an interesting light on questions of output and income for the industry as a whole. It was shown that the total receipts of the 4714 systems or plants in this country were $175,042,338. It was also stated that the output of the stations had been 5,858,121,860 kw-hours. This works out at almost exactly 3 cents per kw-hour, which seems low. It is to be borne in mind, however, that this includes a large amount of energy transmitted from simple generating plants, where the price obtained would be far below 3 cents. It also includes a great deal of arc lighting, which is inevitably done at a low figure, often at a rate for public lighting that does not meet the cost of production and service. In many of the cities also large bulk contracts for electrical energy or "power" are being increasingly taken, where a low rate is necessary to secure and hold the business, so that, as in Chicago, 3 cents might easily be a high figure for the service given to the street railways.

In this connection as bearing on earnings in the large cities, figures have recently been available as to the output and earnings of the New York Edison system in 1907, the same year as the census figures. The number of kw-hours sold to the public is reported as 209,024,000, for which the company received an average price of 6.49 cents, with a total cost of production of 4.69 cents per unit. These are not high rates of income or profit when judged by the margins deemed safe in other industries. The figures for the country as a whole show a producing cost per unit of very nearly 2.3 cents, so that the central-station business as a whole is being conducted upon a margin of 0.7 cent profit per unit. It ought at least to be 1 cent or more per unit for most plants, if they are to be good investments and to invite new capital.

As the installed capacity of American lighting stations is given as 2,642,403 kw in 1907, the yield would appear to be slightly over $66 per kw. If the population of the country be taken as 80,000,000, the consumption would reach about 73 units per capita, and the watts installed about 33 per capita. President Mordey, of the British Institution of Electrical Engineers, in his recent inaugural address reached a careful estimate for Great Britain of somewhat less than 25 units per capita there, and watts installed as 21.8. His data were not for the whole country, however, but for 18 cities, so that the average would probably be lower if all of the 44,000,000 of people were included. On the whole, therefore, the American data show up very well, but it is to be feared that the 100 per cent increases over 1902 will not again be shown in 1914 unless the companies enjoy treatment somewhat more favorable than has of late been accorded them by legislatures, commissions and city councils.

Uniform Central-Station Rate.

Of all the kinds of rate regulation occasionally proposed for electric light and power companies, the most disastrous in its effects on the public and on the companies is the plan of requiring a uniform rate per kw-hour to all customers for all classes of service. The fundamental idea of such legislation—namely, the prevention of discrimination—is right. The prevention of this discrimination by all kinds of public service companies is being more fully insisted upon each year by the public. However, to require a uniform rate for all classes of service given by electric light and power companies is as unwise and unjust as would be the requirement of a uniform rate for all kinds of freight. There are fundamental economic reasons why it costs more to serve some classes of customers than others. In the case of railroad freight, for example, it is evident that the railroad can handle coal and grain cheaper



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THE special offer that we made for our Electrical Engineers' Handbook in January resulted so successfully that we have decided to renew the offer. This famous little Handbook is a Little Giant Encyclopedia of practical information about the electrical engineering profession and allied trades, compiled from the courses of the International Correspondence Schools, which are written by the best experts in the country. To enable members of the electrical trades and professions to become better acquainted with I. C. S. instruction matter we make a most unusual offer for this Handbook, as stated in the paragraph below.

This book is not only of value to men in higher positions, but can be successfully used by workers in subordinate positions in these trades on account of the fact that it is readily understood without a knowledge of higher mathematics. It contains rules, formulas, tables and diagrams of connections that are most generally used by wiremen, dynamo attendants, foremen of construction, managers, engineers, and superintendents of power stations, and superintendents of electric-lighting and electric-railway systems, and manufacturers and dealers in electrical apparatus and supplies. It provides the facts and figures needed in every-day work that are difficult to find in ordinary textbooks.

The description of dynamos and motors, their faults, method of locating faults, and remedying them is of great value. A very valuable table of the sizes of motors necessary to drive various machine tools is incorporated. Of great value are the sections on alternators, alternating-current motors; alternating-current measuring instruments; electric transmission, and diagrams of connections, data, tables, etc.; and methods of controlling speed of electric cars and multiple unit trains. The up-to-date instruction on storage batteries has been carefully edited by the engineers of the largest battery manufacturing concern in the country. A glance over the partial list of contents below will give a fair idea of the immense value of this Pocketbook.

The book is 3½ x 5⅛ x ¾ inches in size and is easily carried in the pocket. It is bound in silk cloth with gilt top and title, and printed on a high-grade book paper in clear type. It contains 420 pages and 262 illustrations. The regular selling price of this book is $1.25 **but to those who send us this coupon, we will mail the book prepaid for 50 cents.** This is undoubtedly the greatest book value you have ever received. Don't fail to take advantage of it

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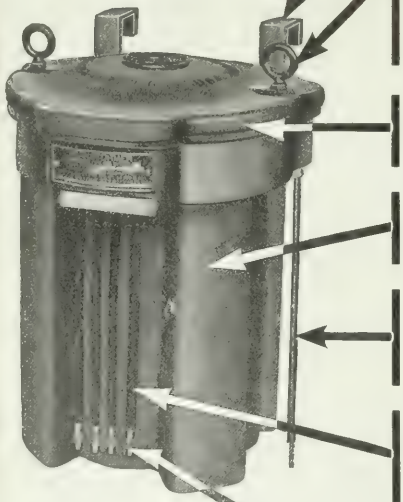
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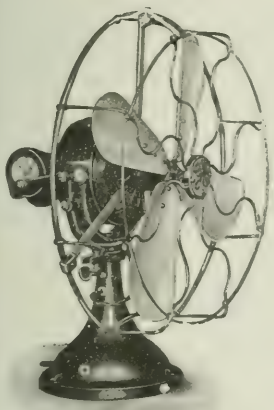
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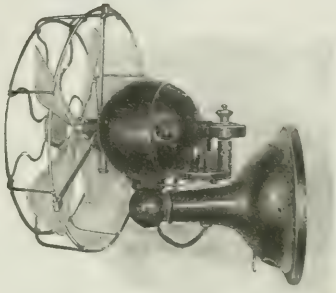
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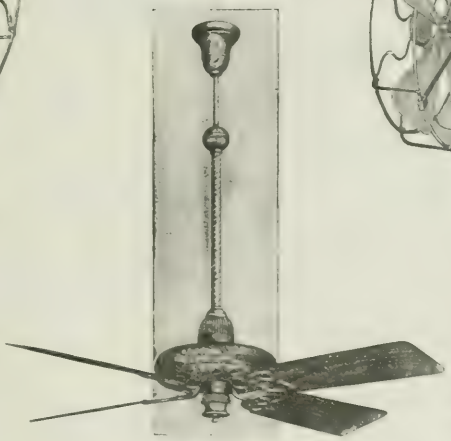
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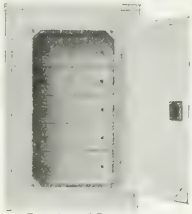
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The Evolution of Metropolitan Service.

Waterside Station No. 2 of the New York Edison Company is a very striking example of the way in which an electrical supply company needs the services of both prophet and engineer in meeting its needs. The rate of growth of load in a modern city is something that almost passes belief. In New York, as in every other metropolis, all principles of normal growth of activity and population are violated. A city nowadays does not grow like a plant, but like a magnet in a shower of iron filings. Hence, the eternal difficulty with rapid transit and other public services. It would be almost impossible to build another subway in New York so rapidly that it would not be foredoomed to overcrowding from the moment its stations should open their doors. Such, too, has been the tendency in electrical supply, and Waterside Station No. 2, huge as it is, will probably require help long before it now seems probable. When Waterside No. 1 was built there was a question as between reciprocating engines and turbines in its equipment. In the short time that has elapsed between that date and the present, that equipment matter has resolved itself into a choice between turbines, and even that doubt seems to be passing at the present time. The big turbine certainly has made good in central-station practice, and the economical results obtained from the big modern units are so excellent as to have little to be desired so far as the generation of alternating current is concerned. And within the past few years a vast proportion of all the generating plants built have been for alternating current irrespective of the final disposition of the output. Whether alternating distribution is rapidly to displace the older direct-current distribution is another matter. As the exigencies of service force the alternating-current wires underground, it will doubtless be discovered that alternating-current distribution is not such a bad thing as it was the fashion in some circles to believe it 15 years ago.

Not the least interesting part of Waterside Station No. 2 is the coal-handling and boiler plant. Here, too, is strong evidence of the evolutionary process, for part of the boilers are fired by hand and part equipped with automatic stokers. This is at least evidence that the stoking question is still unsettled, at least for the grades of coal used in New York. There is, too, evidence of a strong tendency to increase the size of the boiler units, although at present one must own that the generators have more than kept ahead of the game. There seems to be no good reason why automatically stoked boilers cannot be de[illegible] double the [illegible] with [illegible] in simplicity and cost. The tendency is toward increase of size, although as yet no very radical steps have been taken. Another tendency not yet very marked is toward the use of greater furnace space with a corresponding gain in cleanliness of combustion. We noted some time since a remarkable piece of research done at the University of Illinois on smokeless combus

tion, a research that has already borne fruit in at least one great Western station. The Waterside stations are equipped with very complete coal-handling systems that should make it economically possible to use almost any grade of coal that is suited to the needs of the fire room. The greater attention recently given to boiler and furnace design is one of the things that bears very hopefully on costs of production. If one compares in any large station the known efficiency of the generating sets with the hole in the coal pile, it becomes evident that the generator room is a long way ahead of the fire room. Here is the chance for modern design and improvements in economy, and stations such as that here considered are moving along toward better conditions. Superheat and high vacuum have forced their way into practice along with the turbine, and attention must now be concentrated on the preliminary stages of the cycle that ends on the distributing system.

One of the very pleasant things about these new stations is the attention paid to finish. A modern plant is beautifully clean and bears everywhere the marks of the scientific production of energy. The old huddled dynamo room, slimy with oil and encrusted with dirt, has nearly disappeared from the face of the earth. Even the boiler room peopled by grimy firemen is on the wane and now generally presents a vista of neat furnaces with slowly moving feed shafts and a few skillful workmen seeing that the coal goes where it will do the most good. Even hand-fired furnaces present a far more orderly appearance than of old. In the new Waterside station the interior of the operating rooms proper is comparable with that of a fine office building. The net result of this case will very certainly be apparent in the upkeep and in a spirit of efficiency and *esprit-de-corps* that has a value far above dollars in promoting good service. Few people who are not intimately acquainted with central-station work have any adequate idea of the change in temperament, so to speak, that the last decade has wrought. There is vastly more effective pulling together than there used to be, and of late there has been a tendency to far better relations with the public. It is no uncommon thing to hear a central-station manager in the privacy of his own office and to his own staff speak fairly from the point of view of the publicist. Big, broad-minded men have now grown up in the business, and if they were given a fair chance by the powers in financial control, would establish public service on a far better basis than has ever yet been known. The world really moves faster than the public at times, and this is often evident in the central-station business in spite of hostile legislation and unreasonable restrictions. Electric service has passed from being a luxury to being a necessity, and these great central stations are monuments to the change. Fancy for a moment what would happen were electric service in New York to stop for even 24 hours. There would be either demoralization of commerce and industry and by another day pandemonium would break loose. The growth of such service has been so gradual that we can hardly realize its importance. Were an accidental shut-down possible it would be almost worth the while merely as a lesson on the fundamentals of modern life.

The Electric Vehicle Situation.

In the early stages of the automobile business the electric vehicle occupied the center of the stage, and it has been with considerable regret that electrical men have watched gasoline machines increase in numbers at a more rapid rate than the electric. Nevertheless, the electric vehicle has by no means been on the decline, and if the development of the electric automobile business in some of our cities is any criterion, the near future is full of encouragement. The central-station companies in various cities certainly can make no mistake in encouraging this business in every way. One trouble with the electric vehicle has been that too much was expected of it in the early stages of the art. Various companies rushed into its manufacture, but, strange to say, storage batteries did not alter any of their previously well-known characteristics and objected to neglect and mistreatment just as much when placed on an electric vehicle as when used in any other way. Almost as much improvement has been made in batteries and vehicles in 10 years as has been made in gasoline automobiles, but many of the old traditions still seem to cling to the electric vehicle. One of these is the fallacy that a large mileage on one charge is essential to ordinary business about town. The average electric vehicle, as built to-day, has considerably more available mileage on one charge of battery than the average vehicle of 10 years ago, and what is more, has a considerably greater mileage available than is actually needed in the ordinary run of business or pleasure, except where a long tour is undertaken. The best accepted practice now as to charge and discharge of vehicle batteries allows the vehicle owner more latitude than in the old days, not only by giving better mileage and greater durability of batteries, but in allowing the vehicle to remain partially discharged. The old idea was to keep the batteries as fully charged, and as far away from the point of complete discharge, as possible. In the last few years it has been learned that repeated overcharging is detrimental, and that a battery if discharged regularly down to 1.9 or 1.8 volts per cell will last longer than if only partially discharged between the rechargings. The life of the battery is somewhat dependent on the number of completed charges which it receives, and consequently the practice of fully charging every day a vehicle which has been run only a small fraction of its total available mileage is being discontinued as far as possible by owners and garage operators.

There is an immense field for the electric vehicle without it in any way attempting to perform the same feats as the gasoline machine—the field of every-day use by business men and by the fair sex. Indeed, it is especially noticeable in cities where electric automobiles are seen in greatest numbers that the electric vehicle is extensively used by the ladies. From experience in cities where a large number of electric vehicles are in use, it appears that the income per vehicle to the central-station company can be counted as about $5 per month, at a 6-cent per kw-hour rate, taking the average from one year's end to the other. An income of $60 per year for a 3-kw load which is on during the peak is not sought after by a central-station company which intends to remain out of bankruptcy. Automobile charging, however, does not, from its very nature, come on during the peak-load period, and consequently the only investment over and above that necessary for carrying the regular lighting load is in the service wires, meter and transformer. The electric automobile business can only experience its best growth in cities where proper provision is made for the care of batteries. If a central-station company wishes to encourage this business, it is essential that this matter be thoroughly looked into. In some cities the central-station companies have stood behind the bat-

tery-maintenance business, either directly or through the medium of some garage operating company. It is not always necessary to do this if there is a garage in the city which is properly equipped both as to men and materials for maintaining batteries. In a large number of garages, however, the electric is so secondary to the gasoline business that the electric vehicle does not receive proper attention. Many garage owners and operators are men who have come up through the bicycle or gasoline engine ranks, and it is not to be expected that they should either love, or be proficient in, battery maintenance. Where there are no good battery-maintenance men in a town, it is clearly up to the central-station company to bring them there if it wishes to get the electric automobile business on a good footing.

The Fan Motor and the Central Station.

With its popularity ever increasing and its design ever improving in detail, the electric fan becomes more and more a proposition for central-station encouragement and exploitation. As indicative of the attitudes of central stations toward the electric fan, the articles appearing elsewhere in this issue are suggestive. In some cities the policy of the company is to leave the matter of fans entirely in the hands of the contractors and supply houses. Others have found it profitable to sell the fans outright or to rent them for a stipulated sum per season, while a few companies install fans on a flat-rate basis. The actual number of fans in use is not ascertainable in the majority of cases nor the exact revenue from them, since they are connected to the lighting circuits and the energy is not separately metered. While the estimate given in a number of instances of the revenue received cannot in the nature of things be accurate, it nevertheless indicates that fan business is worthy of every encouragement.

As with many other electrical devices, the greatest obstacle to the introduction of fan motors is in the first cost. Many customers would gladly pay the expense of operating, but hesitate at the purchase price. The profit involved in the sale of fan motors is sufficient to make the business attractive to local contractors and dealers if such exist in a town, and the more of these the central-station company can get to handle fans, the more lively the business is likely to be. It is even advisable in some cases to get hardware or other stores to handle a few fan motors, even where they deal in no other electrical supplies, in order to stir up public interest. It is well to remember that fans are now made in smaller sizes than formerly. In many cases a 10-in. fan will suit a customer better than a 12-in. or 16-in., and the cost is lower.

When the fan season opens it should be the work of the central-station manager or solicitor to locate the places in his territory where fans are specially needed. When he finds such places, a few days' free trial will be found an aid. The possibilities as to the number of fan motors that can be sold in a town are likely to be underestimated. In a small town of 2500 inhabitants in southern Illinois, 43 fans were ordered and connected before a promised day service was even started, though usually it is considered impossible to get motor customers until after day service has been actually in existence for some months. In this case the motors were paid for in cash and were sold entirely by a contractor and dealer, no inducement in the way of installment payments being offered.

Automatic Devices for Synchronizing Alternators.

Ever since alternators have been operated in central stations their synchronization has been a matter of great practical importance. In the early days, with alternators giving frequencies of 120 cycles to 140 cycles per second, it was regarded as unsafe to attempt to synchronize them, and they were allowed to operate independent circuits only. As the art of alternating-current distribution developed, the necessity for, and capability of, synchronizing alternators became well established, and no central-station manager would now contemplate any other method of operation. At first incandescent lamps were used as synchronism indicators, but latterly rotary synchronism indicators have been widely adopted. An automatic device for synchronizing alternators is described by Herr Fritz Lux in an article in the *Electrotechnische Zeitschrift*, which is abstracted in the Digest. Electromagnetic mechanism, operated jointly by the operating and the incoming alternator, serves to throw the connecting switches at the proper moment. A machine for the same purpose has also been devised in this country. It seems doubtful whether such automatic synchronizers will come into extensive use. The amount of damage that might be effected by an accidental error on the part of the instrument is so great that most central-station operators would prefer to trust to rotary indicators and to synchronize manually.

Organization of Technical Bodies.

From a recently published account of the International Telegraphic and Telephonic Conference held at Budapest last year, it appears that this country, as in the case of several other international professional meetings held within the past few years, was not represented. It is much to be desired that America should send delegates to such conferences in the future. Whether the particular systems or devices employed in this country resemble or differ from the corresponding systems or devices employed in Europe, much is gained by international comparison and discussion. No nation can, in this century, afford to stand aloof in technical discussions. It was the absence of American representation at an international telegraph conference of government representatives half a century ago that accounts for the fact that we have a somewhat different telegraphic code from that of the rest of the civilized world. The international code of Europe was agreed upon as a mutual compromise at that conference. It is reasonable to suppose that had America been represented we should also have subscribed to the international compromise, and have adopted the international code here. As it is, wireless telegraphy is making the contrast between the international and the American code daily more burdensome and more prominent.

Another inference to be drawn from the Budapest conference is that engineers naturally subdivide themselves into groups, following the lines of industrial applications. Telegraph engineers tend to group themselves with telegraph engineers, and not with telephone engineers, or electric light and power engineers, so long as telegraphy is operated industrially separately from telephony, lighting or power. When, however, telephony is operated industrially along with telegraphy, telephone and telegraph engineers tend to meet in joint concourse exclusively of engineers in railway, light or power systems. No institute of electrical engineers, as a whole, can satisfy the needs of electrical engineers in separate industrial branches, unless

special sections are created for fostering the requirements of those branches individually. In this country, there is no reason why the American Institute of Electrical Engineers should not satisfy the technical needs of all branches of engineers engaged in electrical work. Yet we have seen electrochemists secede as a separate body and swarm by themselves. We have also more recently seen illuminating engineers, wireless telephone engineers and car-lighting engineers follow a similar divergent course. Indications point to further narrowing of the professional activities of the parent body, particularly as relates to the operating side of electrical engineering. If telegraph and telephone engineers were sufficiently numerous in this country, they would probably do likewise. The only hope of preventing such schisms, which are unnecessary, deplorable and adverse to mutual advantage, would appear to be the creation of sections within the main body, devoted to particular industrial applications. This course has already been followed to some extent by the American Society of Mechanical Engineers, as well as by the Street and Interurban Railway Association. Lacking some effective plan, to counteract present tendencies, the Institute may in time find itself narrowed to the university extension work which now appears to absorb much of the energy that formerly was expended entirely in the furtherance of its objects as a professional body.

The Tungsten Lamp and Revenue Reductions.

Some of the central-station companies which have been backward in introducing the tungsten lamp to their customers have recently been undergoing some unpleasant experiences as regards the effect of the tungsten lamp on revenue. The situation in these cases seems to have been about as follows: The central-station company has done nothing actively to make the consumer familiar with the tungsten lamp, the general theory being that it is best to let well enough alone so long as the consumer is satisfied with his existing inefficient installation. Sooner or later the local dealers and contractors have taken a hand in the game and have gone direct to some of the largest consumers offering an installation of tungsten lamps on the ground that it would make a great reduction in bills. Some large installations have been made, and the companies have lost in gross earnings because of the reduction of current effected by the tungsten lamp, and also in reputation because they did not call the attention of consumers to these lamps before they were introduced by the contractor. The wise course, and the one that has been pursued by the truly progressive companies, has been to call the attention of consumers to these lamps, explain their fragility and tell each consumer that two to three times as much light can be obtained for the same energy consumption as with the present carbon-filament lamps. The majority of consumers, if dissatisfied enough with present bills to buy tungsten lamps, are willing to pay the same bills as formerly if they can obtain the promised increase in light. The result of this is to raise the standard of illumination to which customers are accustomed, and there is no opportunity for the consumer to feel or say later that he was not given the benefit of tungsten-lamp economy.

Earnings of Lighting Plants.

The recent census statistics of central-station plants for 1907 throw an interesting light on questions of output and income for the industry as a whole. It was shown that the total receipts of the 4714 systems or plants in this country were $175,042,338. It was also stated that the output of the stations had been 5,858,121,860 kw-hours. This works out at almost exactly 3 cents per kw-hour, which seems low. It is to be borne in mind, however, that this includes a large amount of energy transmitted from simple generating plants, where the price obtained would be far below 3 cents. It also includes a great deal of arc lighting, which is inevitably done at a low figure, often at a rate for public lighting that does not meet the cost of production and service. In many of the cities also large bulk contracts for electrical energy or "power" are being increasingly taken, where a low rate is necessary to secure and hold the business, so that, as in Chicago, 3 cents might easily be a high figure for the service given to the street railways

In this connection as bearing on earnings in the large cities, figures have recently been available as to the output and earnings of the New York Edison system in 1907, the same year as the census figures. The number of kw-hours sold to the public is reported as 209,024,000, for which the company received an average price of 6.49 cents, with a total cost of production of 4.69 cents per unit. These are not high rates of income or profit when judged by the margins deemed safe in other industries. The figures for the country as a whole show a producing cost per unit of very nearly 2.3 cents, so that the central-station business as a whole is being conducted upon a margin of 0.7 cent profit per unit. It ought at least to be 1 cent or more per unit for most plants, if they are to be good investments and to invite new capital.

As the installed capacity of American lighting stations is given as 2,642,403 kw in 1907, the yield would appear to be slightly over $66 per kw. If the population of the country be taken as 80,000,000, the consumption would reach about 73 units per capita, and the watts installed about 33 per capita. President Mordey, of the British Institution of Electrical Engineers, in his recent inaugural address reached a careful estimate for Great Britain of somewhat less than 25 units per capita there, and watts installed as 21.8. His data were not for the whole country, however, but for 18 cities, so that the average would probably be lower if all of the 44,000,000 of people were included. On the whole, therefore, the American data show up very well, but it is to be feared that the 100 per cent increases over 1902 will not again be shown in 1914 unless the companies enjoy treatment somewhat more favorable than has of late been accorded them by legislatures, commissions and city councils.

Uniform Central-Station Rate.

Of all the kinds of rate regulation occasionally proposed for electric light and power companies, the most disastrous in its effects on the public and on the companies is the plan of requiring a uniform rate per kw-hour to all customers for all classes of service. The fundamental idea of such legislation—namely, the prevention of discrimination—is right. The prevention of this discrimination by all kinds of public service companies is being more fully insisted upon each year by the public. However, to require a uniform rate for all classes of service given by electric light and power companies is as unwise and unjust as would be the requirement of a uniform rate for all kinds of freight. There are fundamental economic reasons why it costs more to serve some classes of customers than others. In the case of railroad freight, for example, it is evident that the railroad can handle coal and grain cheaper

han small, fragile packages. To insist on the same rate for ll classes of freight would simply result in restricting the hipment of bulky necessities, such as lumber, and would llow shippers of small packages service for which they did ot pay. Uniform rates per kw-hour for all classes of service y an electric light and power company would practically nean that the large consumer who uses current many hours er day could not afford to take central-station service be- ause of the high price which would be charged. The ex- enses incurred in serving the small short-hour consumers would have to be paid for in part by the revenue obtained rom the large and long-hour consumers, with the result of ractically restricting the business to the small consumers. This in itself would keep the cost of production higher than f a larger variety of business could be done by the central- station company. In the end the rates to the small short-hour consumers would be higher than if the uniform rate were not required, and the larger consumers would be forced to the inconvenience of putting in isolated plants. The whole ten- dency of central-station practice the past few years has been away from the uniform rate idea, and, in fact, one of the things which restricted central-station progress for a number of years was the failure to recognize the great difference in cost of serving different classes of consumers. Rate systems which automatically give lower rates to certain consumers because of a greater number of hours' use of electricity per day can in no sense be called discriminatory, because they are open to all and are dependent entirely on the kind of service demanded. It is safe to say that no legislation which requires a uniform rate per kw-hour for all kinds of electric light and power service will be sustained by the courts, but it is trouble- some, nevertheless, to have such legislation proposed.

Summer Central-Station Rates.

Occasional central stations, both here and abroad, make special rates to consumers during the months of light load in summer when the peak is practically absent, or rather trans- ferred—what there is left of it—to the evening hours. The result of this policy is the securing of enough extra business to compensate for the reduction of price. There are, of course, certain things like small electric cooking outfits and fan motors that belong especially to the warm months, and these are more and more freely used as the price of energy is lowered. In addition there is a certain opportunity for gaining extra use of lights. At all events, the policy has seemed to be fairly suc- cessful where tried and perhaps it deserves wider exploitation. Of course, from a practical standpoint it is more or less of a bargain sale, that does not very well fit ordinary theories of rates, but may none the less be advantageous. During the summer months the load upon a station is very moderate, and the whole investment for the winter peak confronts one. Tak- ing fixed charges into account, the station, if it bases its rate on the cost of supply, might very well find that logically it should charge more in summer than in winter. However, al- though the theory of charging each and every customer a rate proportionate to the cost of supplying him is on paper a popular one, it is more honored in the breach than the observance.

On such a basis there is no defensible ground for making any intrinsic difference between current supplied for lighting and for power; a thing which is well-nigh universal in electrical supply. The fact is that central-station supply is like any other business, and must look after the large results in profits rather than petty details. It must make its total earnings pay its dividends, and to do this must sell its product on the average at a profit while putting it as regards individual customers at a figure that is attractive. The one thing which estops it from bargain sales is its duty as a public service corporation, which compels it to treat its customers as nearly alike as may be. All existing systems of rates are therefore more or less illogi- cal compromises. From this point of view a summer rate which will get increased earnings even at modest profit is an entirely business-like proceeding, the sole question being with respect to its expediency. This depends in part on the general temper of the community and in part on the legal restrictions that commonly surround the matter of rates. If a company in virtue of an extra discernment can take on a paying load of cooking apparatus, fans and extra lights as for signs and the like, we see no good reason why it should not be allowed to do so. Electric kitchens are certainly a great convenience, and especially so during these very summer months that are in question. Their use is economical at any time below a certain price per kw-hour—for instance, at such rates as are often charged for motor service. If a general summer rate could be made on both lights and cooking devices, the increased con- sumption for both purposes ought to be able to bring in an in- creased income that would be worth while.

Another class of business that might be increased is summer specialties in signs. During the warm months, when people are much out of doors, special advertising with electric signs ought to pay, and from the central-station standpoint it would be a good kind of load to develop. Electric signs seem to form a stable part of the business. They hang on at dull times in a way that is very gratifying and are in good times steadily on the increase. How far special summer rates would increase their installation remains to be discovered. Probably some of the summer gain might be carried on through the rest of the year. A successful summer rate scheme certainly im- plies an active campaign for extra load appropriate to the sea- son, with an excellent chance for retaining part of the increase. The difficulty is to determine what the special rate should be and how it could be most tactfully made. That really is a thing which is of local significance rather than of general ap- plication. It would be a difficult step to arrange a summer rate on some systems of charging and a rather easy one upon others. The more leeway allowed in general, the easier would be special arrangements. The time has come for central stations when new business must be hunted and bagged. In spite of the huge increase in totals shown in the recent census report, the need of activity is still obvious when one comes to analyze the situation. The greatest gain has been in motor service, helped on by the establishment of great special- ized power plants. The least increase, to judge from observa- tion, is in domestic lighting, on which the gas companies have in the larger cities a very strong grip. Until by one device or another this is broken, the gas companies have a steady and reliable pot-boiler that enables them to carry on an active fight for larger work. The summer schedule, involving much residence work, is therefore a weapon of offense that the central station should not throw aside without careful investigation.

Electrical Features of the Inauguration.

As has been customary in the past, the Capital City has put on festive attire for the inauguration of the President on March 4. This year electricity plays an important part in the decorative features. Pennsylvania Avenue from the Peace Monument to the Treasury Building is festooned with electric lamps, the entire electrical display culminating in the Court of Honor in front of the White House. The lines of decoration in the Court of Honor extend from Fifteenth Street to Seventeenth Street with parallel rows of columns at the curbs at each side of the street. The columns are approximately 25 ft. high and from the top of each there is a festoon of flowers intertwined within which is a string of 8-cp lamps spaced 12 in. apart. At the top of each pole is a banner and an electric emblem. Where the streets join there are four 45-ft. columns 4 ft. in diameter at the top. Surrounding the base of each of the four large columns are six 20-ft. columns. These smaller columns are entwined with floral decorations and electric lamps and the large columns are circled with receptacles at various points. At the top of each of the four large columns is a mammoth flower basket made of wicker work with electric lamps placed in each of the apertures. There are 150 lamps in each flower basket or a total of 600 in the four baskets at each street intersection. Connecting the columns is a series of festoons forming a hollow square, together with diagonal festoons. These festoons are made of laurel and are studded with 8-cp lamps spaced 9 in. apart. At the center of the festoons are emblems consisting of trophies, shields and the American eagle, all of which are outlined with electric lamps. At the intersection of the diagonal festoons there is a 3-ft. ball studded with 200 lamps. This design is repeated at the intersection of each of the streets. The total number of lamps used in the Court of Honor is 7000, all rated at 8 cp. The energy is supplied by the Potomac Electric Power Company, the feeders being located at the intersections of the streets and the control boards being placed in each of the high columns. The work was installed by The Electric Motor & Equipment Company, of Newark, N. J., under the direction of the Inaugural Committee. The general design of the work is such as to make the Court of Honor the most elaborate ever installed in Washington. The grand ball will take place as usual in the Pension Building, the electrical decorations here being installed by the National Electrical Supply Company, of Washington. Myriad incandescent lamps are used in connection with flags, bunting, festoons, etc., adding greatly to the already dazzling effect of officers in uniform, diplomats in court attire, civilians in regulation dress and women in evening gowns.

Edison Incandescent Lamp Leading-in Wire Patent Sustained.

Another incident in the rather remarkable legal history of the Edison incandescent lamp leading-in wire patent was the reversal on Feb. 16 by a United States Court of Appeals, of the decision on May 14, 1908, of a Circuit Court declaring the patent invalid on the grounds that it merely related to a mechanical improvement. Both of these decisions were rendered subsequent to the expiration of the term of life of the patent, which occurred Jan. 13, 1908. The original patent was the subject of numerous suits of infringement instituted about 1904. On the grounds that the claims of this patent were too broad, a reissue was obtained Oct. 10, 1905, and the present suit was based on the reissued patent.

In discussing the claim of anticipations of the invention, the court held that in Heisler and Bernstein lamps exhibited, the complete sealing-in occasionally of the platinum wire was by mistake and that no such accidental and fugitive occurrence is of account. In the Lemp & Wightman patent adduced, the court held that it was by the error of a draftsman that the outer section of the leading-in wire is apparently made to extend into the glass. The patentability of the device was declared to be the real question, and the court held that Edison's successful method in dealing with the subject, and particularly the method adopted, was inobvious if not obscure, calling for inventive insight to develop and discern, and that the patent therefore should have been sustained.

The Kellogg Telephone Suit.

A decision of the Illinois Supreme Court, Friday, Feb. 19, 1909, concluded a long and bitterly contested litigation, the result of which restores to Mr. Milo G. Kellogg his stock control of the Kellogg Switchboard & Supply Company, which had been acquired by the American Telephone & Telegraph Company. In November, 1901, Mr. Milo G. Kellogg, president of the Kellogg Company and owner of nearly two-thirds of its issued stock, was forced by severe illness to resign his active management of the Kellogg Company and prior to his departure for California, he resigned his management to the vice-president of the company, Mr. Wallace L. DeWolf, and gave him a power of attorney. This power severed both personal and corporate interests of Mr. Kellogg, and acting under it Mr. DeWolf, on Jan. 4, 1902, sold to Mr. Enos M. Bartle, president of the Western Electric Company, all of Mr. Kellogg's stock as well as his own and that of others. Mr. Kellogg was not advised of this sale, or attempted sale, until six months thereafter. Upon learning of it, and as soon as his health would permit, he took active steps to recover his stock.

The original bill in this case was filed in June, 1903, by Francis W. Dunbar, Kempster B. Miller, George L. Burlingame, and other minority stockholders in the Kellogg Company. These stockholders contended that a purchase of a majority of the stock of the Kellogg Company by the American Telephone & Telegraph Company tended to suppress competition and create a monopoly and was therefore illegal and void. To this the American Telephone & Telegraph Company replied that the bill of the minority stockholders was insufficient to warrant granting the relief prayed for, and Judge Mack, in the Circuit Court of Cook County, Illinois, held the bill insufficient. An appeal was then taken to the Branch Appellate Court of the same county and there Judge Mack's decision was affirmed. The minority stockholders then appealed to the Supreme Court of Illinois and this court, in an opinion handed down Oct. 23, 1906, reversed the two lower courts and established as the law of this case that a foreign corporation, such as the American Telephone & Telegraph Company, doing business in Illinois, had no greater powers than a domestic, or Illinois, corporation and that an alleged purchase by the said American Company either in its own name or in the name of others, of a majority stockholding in a rival company for the purpose of controlling it and thus stifling competition, was illegal and absolutely void.

It remained to prove the allegations of fact contained in the bill, and accordingly the case was remanded to the Circuit Court of Cook County and the proofs produced before Judge Windes of that court. A number of months were consumed in adducing these proofs. After argument before Judge Windes he found the allegations of the minority stockholders' bill substantially proved and, under the law as determined by the Supreme Court, ordered a decree entitling the minority stockholders to all the relief prayed for. The decree of Judge Windes was entered in February, 1908, and awarded the minority stockholders a permanent injunction perpetually enjoining the American Telephone & Telegraph Company and its agents from, in any manner, interfering with the management or control of the Kellogg Company. The decree also ordered that the said American Company surrender the Kellogg certificates of stock illegally acquired by it, to their rightful owners, and that the purchase price of said certificates be returned to it. Also, that should the said American Company refuse to surrender said certificates, they would be cancelled and new certificates issued.

The American Telephone & Telegraph Company then carried the case to the Branch Appellate Court and that court, while

finding the alleged facts substantially proved, disagreed with Judge Windes on the relief to be granted to the minority stockholders. The minority stockholders then carried the case to the Supreme Court of Illinois, and on Feb. 19 that court reversed the Branch Appellate Court, sustained Judge Windes, and affirmed his decree in its entirety.

Proposed Connecticut Public Service Commission.

Governor Lilley sent a message on Feb. 25 to the General Assembly asking that it give early attention to the bill to establish a public service commission. He said that the immense complexity of modern business conditions has rendered the supervision of public utilities imperative. Such supervision is not practicable under the present system, as the Legislature meeting only every two years for a few months cannot give these matters the careful scrutiny which the people rightfully demand. He believed that the same source from which grants of special privileges flow should be in session at all times to see to it that those special privileges which are granted for the benefit of the people are exercised in the interests of the people.

Michigan Public Service Commission.

A bill before the Michigan Legislature provides for transforming the State railroad commission into a public utilities commission with jurisdiction over all companies and corporations, private or municipal, providing telephone service, heat, light, power or water to the public. Representative Garry E. Sanders, of Ingham County, is sponsor for the bill. The bill provides that the commission may prescribe a uniform system of bookkeeping, require an annual printed statement of each company's financial and physical condition and examine the books whenever it desires. The commission is to fix rates, and adequate standards of measurement and make investigations of alleged oppression or discrimination upon complaint of 10 persons. In no case shall the commission fix a substitute rate without giving the company a hearing, and the company shall have the right of appeal to the Circuit Court.

The Institute Dinner.

Everything points to a very successful anniversary dinner of the American Institute of Electrical Engineers at the Hotel Astor, New York City, on March 11. All the preparations have now been carefully made, and the number of applications for seats is very large. The dinner will be conducted by President Ferguson, who will act as toastmaster. Prof. Elihu Thomson will speak for "The Charter Members;" Mr. Frank J. Sprague for "The Past Presidents;" Dr. A. C. Humphreys, president of Stevens Institute of Technology, will speak on "Electrical Engineering and Education," and Mr. John Bogart, formerly State Engineer, and secretary in 1884 of the American Society of Civil Engineers, will bring the "Greetings and Congratulations of Sister Societies," several of which will be represented by their officials. An interesting feature of the dinner also will be the participation of a number of branches and sections. The dinner committee makes an earnest request that applications for tickets and seating will be filed at once, so that attention can be given to this important matter well in advance of the affair. The cost of the dinner is only $5, including one wine and cigars and cigarettes, music, etc. The dinner will be given in the large ballroom, using the small ballroom adjoining as an annex if necessary.

Grand Falls Power Company.

The contract for the construction work involved in the hydro-electric development of the Grand Falls Power Company on the St. John River at Grand Falls, N. B., has been placed. This plant will generate 100,000 hp in electrical energy, which will be furnished to various cities throughout New Brunswick and Maine. The work involves, among other features, the construction of a number of shafts in rock excavation 130 ft. deep, a power chamber 30 ft. x 260 ft. and 130 ft. deep, and a tail-race tunnel 28 ft. in diameter and 2400 ft. long, a power house 350 ft. long and 260 ft. wide. The intake shafts will be nine in number and 12 ft. in diameter and 130 ft. deep. The plant will be equipped with the most approved hydraulic and electrical machinery for high-potential and long-distance transmission. Actual construction will, it is stated, be begun immediately and will be pushed through to completion at an early date.

The water power of the falls on the St. John River at this point is the largest in eastern Canada and its development will result in the establishment of a large number of manufacturing enterprises. The total head developed will be 135 ft. A number of auxiliary substations and long-distance transmission lines will be erected. The St. John River at Grand Falls (which is the largest river in New Brunswick) describes a horseshoe curve at this point and has a fall of 135 ft. through a gorge of great beauty. Grand Falls is situated on the Canadian Pacific Railroad, about 200 miles north of St. John, N. B., and about two miles east of the State of Maine.

The expenditure involved will amount to over $5,000,000. The contract for construction work was awarded to the Frank B. Gilbreth Company, of New York. Mr. John B. McRae, of Ottawa, is chief engineer for the development and Mr. Ralph D. Mershon, of New York, is the electrical engineer.

Ontario 110,000-Volt Transmission System.

The Hydro-Electric Power Commission of Ontario has let contracts for the building of 300 miles of 110,000-volt transmission line. Energy will be bought from the Ontario Power Company, at Niagara Falls, and will be distributed by means of the high-voltage circuits to Toronto, Hamilton, London, St. Thomas and various intermediate points in this part of the Province of Ontario. The line will require about 500 tons of aluminum cable, and about 7500 tons of steel will be used in some 3200 towers. It is expected that the line will be ready for service before the end of 1909.

The line starts at the transforming station at Niagara Falls where the e.m.f. will be increased from 12,000 volts to 11,000 volts. The initial installation will be for 30,000 kw. From Niagara Falls the line extends about 50 miles in a northwesterly direction to Dundas, at which point it divides. One line, about 40 miles long, extends in an easterly direction to Toronto, while two others go westerly to London; the northern of the latter two branches covers about 120 miles and the southern about 75 miles. From London the line proceeds westerly to St. Thomas about 14 miles. An additional extension to Windsor, about 100 miles, will subsequently be made, probably within the present year.

The poles are to be galvanized steel angle-iron towers. The standard spacing will be 550 ft. On curves the spacing will be reduced to 100 ft., while at Humber River a distance of 1250 ft. will be spanned. The tower will be placed on framed steel anchorages 6 ft. below the ground contour. The normal height will be about 65 ft. above ground; at the Welland Canal extra high structures will be employed, because a clearance of 150 ft. is required to permit the passage of vessels.

The three-phase conductors will be of stranded aluminum, having a cross-section of No. 3-0 B. & S. gage uniformly throughout with the exception of the line from Niagara to Dundas, where a cross-section of No. 4-0 will be used. The insulators will be of the disk suspension type, five disks being employed for each conductor. A grounding cable for lightning protection will be arranged along the highest point of the towers.

The general contract for the construction of the line has been let to Mr. F. H. McGuigan, of Toronto. Sub-contracts have been let to the Canadian Bridge Company, of Walkerville,

for the steel towers, to the Northern Aluminum Company, of Shawinigan Falls for the cables, and to the Niagara & Ontario Construction Company, of Toronto, for the balance of the material and the actual erection of the line. Muralt & Company, New York, have been retained as engineers and will supervise the construction. Mr. C. L. de Muralt will personally take charge of the work.

Morse Club Dines President Brown.

The annual dinner of the Morse Electric Club, which is practically an organization made up from the Western Union executive ranks, was held at the Hotel Savoy, New York City, on Saturday evening, Feb. 27. The guest of honor was Mr. William C. Brown, who has just been elected president of the New York Central system, and who was enthusiastically greeted as one of themselves because he began life as a telegraph operator. About 200 members and guests were present and an excellent dinner was served. Among those in attendance were: J. B. Van Every, who presided; Vice-Presidents J. C. Barclay and B. Brooks; A. R. Brewer, W. H. Baker, R. D. Brixey, M. R. Cockey, Gardner Irving, M. H. Kerner, J. Kempster, W. Marshall, M. J. O'Leary, C. L. Pullen, J. B. Taltavall, C. Trippe. The *Electrical World* was represented by T. C. Martin, and the *Electric Railway Journal* by J. M. Wakeman. At the speakers' table sat the guest of honor and President Van Every, supported by President R. C. Clowry, of the Western Union Telegraph Company; Justice Morgan J. O'Brien, Hon. P. H. Dugro, H. D. Estabrook, E. T. Jeffery, C. F. Daly and W. J Dealy. Before speaking began, a number of songs were sung, which were printed on a supplement to the menu.

President Brown in acknowledging the toast in his honor made some very interesting personal allusions to the beginning of his career in the West, his father having been a missionary to Iowa 60 years ago, where the family had to undergo the privations and perils of frontier life. Mr. Brown began his work as a young railway telegraph operator, whose duties included the stacking of cordwood and handling of freight; and in a modest manner he told how he had made the successive steps which have finally brought him to a position as the foremost railway manager in the United States—but still in the electrical field. Extremely interesting reminiscences of a like nature were also given by Col. Clowry and Messrs. Estabrook and Jeffery, all of whom had been acquainted with the guest in the earlier days out West. Mr. Dealy made an eloquent address, as usual, discussing Mr. Brown's characteristics as an operator and as a man. Justice O'Brien delivered a simple, dignified speech, in which he discussed with force and earnestness the difficulties with which such men as Mr. Brown now found themselves surrounded and confronted through the unintelligent and reckless legislation which had been put into force hostile to the railroads. The same spirit had also been manifested with regard to other large corporations, such as those in charge of telegraph systems, but he believed in the sober commonsense of the American people, and felt that in time better judgment in these matters would prevail, and it would be realized that the welfare of the corporation was one with that of the public. This brought to its close an altogether enjoyable and pleasant evening, which will be long remembered by all who participated.

Control of Niagara Power.

The attempt of Congressman Burton to have the provisions of the bill regulating the Niagara power development extended for a period of 10 years met with so many objections that a compromise on a two-year extension was effected—the joint resolution on the question states that the provisions of the act for the control and regulation of the waters of Niagara River, for the preservation of Niagara Falls and for other purposes, approved on June 29, 1906, will expire by limitation on June 29, 1909; that the date for the termination of the operation of the act was provided only with a view to the more permanent settlement of the questions involved with Great Britain and by further legislation appropriate to the solution; and that as such treaty has not been negotiated, it is desirable that the provisions of said act should be continued until such permanent settlement can be made. The resolution adopted states "that the provisions of the aforesaid act be and they are hereby extended for two years from June 29, 1909, being the date of the expiration of the operation of said act, save in so far as any portion thereof may be found inapplicable or already complied with."

New York Public Service Commission Work.

The Public Service Commission of the First District of New York has issued an order requiring the Empire City Subway Company and the Consolidated Telegraph & Electrical Subway Company to file report for the six months ending Dec. 31, 1907, and for the year 1908. These companies, which control the conduits carrying various sorts of electrical wires in this city, have maintained that they were not under the jurisdiction of the Public Service Commission. It has not yet been decided whether the companies will contest in the courts the point or will accede to the order.

The commission has also sent to the Board of Estimate and Apportionment a report on the present condition of the new subway loop between bridges in Manhattan Borough. In this report it is said that the reason why no contract for the operation of the loop had been advertised was because it would be impossible to get any other bidder than the Interborough Company until after the construction at the Brooklyn end of the new Manhattan bridge had been contracted for. The Board of Estimate is censured for not having taken action on the contracts for the Brooklyn construction which were submitted to it by the commission last May. The commission says that if the Board of Estimate insists that only the first section and part of the second section be constructed at this time—as has been stated—that the commission is ready to take the matter up on that basis. It insists, however, that the city's debt is now $48,000,000 below the constitutional limit and that therefore it would be possible to begin construction on all six sections of the Brooklyn subway at once. The Board of Estimate has not, as yet, made any response to the communication.

The Public Service Commission of the Second District of New York is still trying to force Mr. Herbert P. Bissell, president of the Economic Power & Construction Company, to answer certain questions concerning the business affairs and methods of his company. It has just taken an appeal to the Appellate Division of the Supreme Court from the decision of Justice Fitts, who ruled Mr. Bissell need not answer.

The Court of Appeals of New York has sustained the decision of the Appellate Division of New York City denying the motion of the Public Service Commission of the First District to quash the writs of certiorari obtained by the receivers of the Metropolitan Street Railway Company to review the proceedings fixing a fare of 5 cents to be divided between the Metropolitan company and the Fifty-ninth Street cross-town line. The commission directed the Metropolitan company to issue transfers and divide its fares. Upon this order the railway company demanded the court review.

Engineering Society of Wisconsin.

The organization of the Engineering Society of Wisconsin was completed at the first meeting, held at the University of Wisconsin, Feb. 24, 25 and 26, at which some 150 city engineers, general managers of power and traction companies, contracting engineers, superintendents of water and light plants, mechanical and civil engineers, and superintendents of highway construction were present and became charter members. The officers elected were as follows: President, Dean F. E. Turneaure, University of Wisconsin College of Engineering;

vice-president, City Engineer McClelland Dodge of Appleton. Trustees for two years: Mr. B. F. Lyons, assistant general manager of the Beloit Gas & Electric Company, and Mr. E. P. Worden, mechanical engineer of the Prescott Steam Pump Company, Milwaukee; trustees for one year: Mr. E. Gonzenbach, of the Sheboygan Electric Light & Power Company, and City Engineer E. R. Banks, of Superior. These, as executive board, will elect the secretary later.

The new organization will hold annual meetings hereafter for the purpose of bringing together the engineers from all parts of the State interested in the solution of such problems as arise in connection with municipal plants, large construction work, bridge, forest and water power questions, and light and power production. A wide range of subjects was included in the program for the initial meeting of the society.

Prof. W. D. Pence, who is engineer for the Wisconsin Railroad Commission, opened the second day's program with a description of the organization of the commission's engineering staff. The new problem of standards of gas and electric service was discussed by Prof. C. F. Burgess, of the department of applied electrochemistry at the university, who has done important work in enabling the State Railroad Commission to prescribe a standard for fuel and illuminating gas.

The electric interurban roads of Wisconsin were the subject of a paper by Mr. F. G. Simmons, superintendent of construction and maintenance of way for the Milwaukee Electric Railway & Light Company. The day circuit for small towns was discussed by Prof. J. W. Shustor, and new forms of arc lamps by Mr. W. E. Wickenden, also of the electrical engineering department. Dean Turneaure took the members of the society through the engineering experimental laboratories, explaining the work that is being done there in many lines of research. At a late session Prof. D. W. Mead discussed the subject of hydraulic and hydro-electric power development, and gas producers and small power stations were subjects of papers by Mr. V. E. McMullen, Beloit, and Mr. C. T. Atkinson.

Convention of Pacific Coast Electric Automobile Association.

Pursuant to a call sent out by Mr. R. B. Daggett, manager of the San Francisco office of the Electric Storage Battery Company, a meeting of those interested in the development of the electric vehicle business on the Pacific Coast was held at the St. Francis Hotel, San Francisco, on Feb. 19 and 20. There were over 50 delegates in attendance, representing vehicle distributors and central-power station companies, as well as manufacturers of vehicles and their equipment. The meeting was called to order by Mr. Daggett, who made a welcoming address, stating the object of bringing together those specially interested in the electric-vehicle business.

Papers were read as follows: "The Electric Vehicle," by Mr. R. B. Daggett, Pacific Coast manager Electric Storage Battery Company; "The Mercury Arc Rectifier," by Mr. R. M. Alvord, of the supply department of the General Electric Company; "Vehicle Batteries," by Mr. Geo. R. Murphy, engineer, Electric Storage Battery Company; "Relation of Central-Station Companies to the Automobile Business," by Mr. Fred. T. Kitt, agent, Columbus Electric Vehicle Company, Sacramento, Cal.; "The Electric Vehicle Motor," by Mr. J. T. Deremer, of the Westinghouse Electric & Manufacturing Company; "The Commercial Electric Vehicle," by Mr. A. C. Downing, Pacific Coast sales engineer for the electric vehicle department of the Studebaker Automobile Company; "Electric Pleasure Vehicles," by Mr. F. W. Pfaffman, of Los Angeles, representing Rauch & Lang, of Cleveland; "The Electric Garage," by Mr. S. P. Reed, of the Reed Electric Laboratory, San José, Cal.

A lively discussion followed the presentation of the paper, much interest being taken in the present and future status of the electric vehicle in San Francisco and the other coast cities.

The social features were well taken care of by the Electric Storage Battery Company and the Studebaker Brothers Company. They included a theater party, followed by a supper one evening and a banquet at the close of the convention. An interesting hill-climbing exhibition was given by Mr. William Harvey on Friday, who drove a Babcock electric up the Powell Street Hill, one of the steepest ascents in San Francisco. A general automobile run through Golden Gate Park had been planned, but had to be omitted because of inclement weather.

At the banquet on Saturday evening permanent organization was effected by the formation of the Pacific Coast Electric Automobile Association. Officers for the ensuing year were elected as follows: President, Mr. R. B. Daggett; vice-president, Mr. A. C. Downing; secretary-treasurer, Mr. J. T. Halloran. These three officers were constituted a governing board to manage the affairs of the association, select committees, etc. Oakland was selected as the place for the next annual meeting in February, 1910.

Details of Telephone Census Statistics and Methods.

The recent publication of the telephone statistics of 1907 by the United States Bureau of the Census has given rise to criticism in some "independent" telephone quarters, where disappointment is felt because the "independent" figures shown in the returns fall so far short of the claims made by interested parties. Under these circumstances, as a means of demonstrating the accuracy of the figures given in the general preliminary report, published in these pages on Feb. 4, Mr. W. M. Steuart, chief statistician of manufactures in the Census Office, has given out the subjoined table of detailed figures, State by State, which bring out the curious fact that the Census figures in the few disputed cases exceed those put forward from "independent" sources:

NUMBER OF STATIONS OR TELEPHONES, BY STATES, DEC. 31, 1907.

	Total.	Independent (Non-Bell).	Bell (American Telegraph & Telephone Company).	Independent stations connected with Bell System.
United States	6,118,578	2,986,515	3,132,063	*835,880
Alabama	40,481	14,985	25,496	3,944
Arizona	6,203	3,148	3,055	....
Arkansas	49,570	32,150	17,426	10,265
California	237,672	65,977	171,695	9,607
Colorado	65,908	4,473	61,435	1,620
Connecticut	63,898	1,815	62,083	352
Florida	17,522	11,160	6,362	3,691
Georgia	62,260	26,204	36,056	9,072
Idaho	16,394	5,754	10,640	1,288
Illinois	558,585	285,322	273,263	109,101
Indiana	289,452	216,990	72,462	50,065
Iowa	332,545	279,773	52,772	74,866
Kansas	200,233	161,913	38,320	66,880
Kentucky	93,996	51,796	42,200	9,038
Louisiana	35,692	6,184	29,508	4,351
Maine	53,134	16,024	37,110	7,830
Maryland, District of Columbia and Delaware	110,282	19,896	90,386	217
Massachusetts	209,383	5,324	204,059	650
Michigan	209,842	106,049	103,793	30,933
Minnesota	171,479	114,618	56,861	46,547
Mississippi	37,627	13,567	24,060	5,235
Missouri	312,527	220,823	91,704	82,393
Montana	17,168	8,118	9,050	846
Nebraska	153,279	105,619	47,660	45,252
Nevada	4,601	2,081	2,520	734
New Hampshire	28,920	6,488	22,432	2,487
New Jersey	116,988	19,134	97,854	241
New Mexico	6,053	4,677	1,376	760
New York	685,512	180,750	504,762	23,092
North Carolina	37,104	20,597	16,507	1,794
North Dakota	31,087	26,615	4,472	58,312
Ohio	495,636	312,278	183,358	20,284
Oklahoma	68,125	38,009	30,116	36,570
Oregon	49,629	16,253	33,376	6,078
Pennsylvania	450,493	144,582	305,911	9,000
South Carolina	20,911	7,872	13,039	1,867
South Dakota	48,405	44,[illegible]	[illegible]	[illegible]
Tennessee	71,130	57,[illegible]	13,[illegible]	81
Texas	187,562	138,[illegible]	[illegible]	181
Utah	30,630	10,528	20,102	451
Vermont	30,833	13,[illegible]	[illegible]	7,000
Virginia	55,541	24,118	31,423	4,447
Washington	98,547	[illegible]	63,[illegible]	9,168
West Virginia	69,[illegible]	16,[illegible]	53,[illegible]	3,218
Wisconsin	168,[illegible]	[illegible]	69,820	36,166
Wyoming and Rhode Island	30,605	1,538	20,067	1,267

*Figures furnished by American Telegraph & Telephone Company. Included in total for Independent.

In this connection Director North, of the Census Bureau, has addressed a careful and exhaustive letter of explanation as to Census methods to the Nebraska Independent Telephone Asso-

station, a copy of which has been given to the press. In the course of this he says:

"The statistics contained in this preliminary statement are, of course, subject to such corrections as may be found necessary upon a further examination of the reports and comparison of the tabulations. Subject to these possible corrections the 2,986,515 independent telephone stations may be accepted as the total number of such stations that were in operation during 1907.

"At the census of 1902 the office experienced great difficulty in obtaining a satisfactory enumeration of the small independent telephone companies and the farmer, or rural, lines. Therefore great care was taken at the census of 1907 to enumerate all lines of this character. In the first instance a complete card index was prepared, giving the names and addresses of all telephone companies and independent farmer lines. The basis of this index or list was the reports made at the census of 1902. But in addition to this, the postmasters throughout the entire country were required to furnish the names and addresses of all telephone companies and individual farmer or rural lines operating in their cities or immediate vicinity. State officials were also requested to furnish lists of the telephone companies in their respective States, and fairly complete lists were received from the majority of the States; county officials were requested to furnish lists of the names and addresses of farmer or rural telephone lines. These officials in a number of the States preserved records of this character in connection with the requirements of taxation, etc., and a great deal of information was obtained from them. All of the independent telephone associations were also requested to furnish the names and addresses of their members, and of any other companies or independent lines, and fairly complete lists were received from associations in at least 11 States. The International Independent Telephone Association of Chicago furnished a fairly complete list, names and addresses of telephone companies were also obtained from the city directories for all cities having a population of 50,000 and over.

"Blank schedules were mailed to all of the companies and individual lines named on the lists prepared from the sources indicated, and in addition to soliciting the statistics required for the census, each company was requested to give the names and addresses of all connecting farmer or rural lines and of other companies or lines in the vicinity. A large number of additional names were secured from this source. The original lists prepared from these various sources contained in the neighborhood of 35,000 telephone properties, but this total included a large number of duplications. However, the Office was not satisfied that it had a complete list, and therefore in arranging for the canvass schedules were in the first instance sent to the companies, and then the entire United States was subdivided into 84 enumeration districts and one or more agents assigned to each district. These agents were given the names and addresses of all of the telephone companies and farmer or rural lines located in their respective districts, and they were instructed not only to secure census reports from each company, but to make careful inquiry for any other companies and lines that were in operation during any part of the year 1907. Each agent was held to a thorough canvass of his district. I believe that by the application of these methods the entire country has been pretty thoroughly covered and that the Office secured returns from practically all companies and lines that were in operation during any portion of the year. In all work of this character, however, there is a possibility of some omissions, but in this instance the omissions are evidently very few and unimportant."

Chemical Elements.

At the February meeting of the Pittsfield Section of the American Institute of Electrical Engineers, Dr. W. R. Whitney, director of the Research Laboratory of the General Electric Company, in Schenectady, N. Y., gave an instructive talk on chemical elements, pointing out their different characteristics, such as atomic weight, melting points, etc. He stated that the various elements bear certain definite relations to each other, and may be arranged in natural groups according to their atomic weights. So perfectly has this arrangement been worked out that there is only one place in a group into which a given element will fit and it is therefore possible to predetermine with great accuracy the character of a number of elements which are known to exist but have not as yet been discovered. This knowledge of the interrelation between elements is also of great assistance in carrying on investigations as it often points out the way to new discoveries and new uses to which various materials may be adapted. For example, tungsten, of which the filaments of incandescent lamps are now made, was known to be suitable for this class of work long before it was possible to handle it commercially.

A Ladies' Electrical Luncheon.

The Buffalo General Electric Company entertained the Buffalo Chapter of the Daughters of the American Revolution and their guests at the Twentieth Century Club, in that city, on Feb. 22. The stage was arranged with a quaint old-fashioned setting, with wide fireplace, old-time open-hearth cooking utensils and 18th century furnishings. Just below the stage, in sharp contrast, was placed the most modern electrical kitchen, where electrical appliances were used for baking, roasting, broiling and coffee making. Many other household appliances were exhibited about the room, and the official insignia of the society was shown in electrical display above the stage. The total attendance was 1864, and luncheon, every part of which was electrically cooked in the room, was served to 1250 ladies. Color was given to the entertainment by the costuming of all the waitresses and attendants in Colonial dress. The entertainment was for the purpose of impressing upon the housekeepers the convenience and economy of electrical household appliances, which the Buffalo company is especially pushing.

British Illuminating Engineering Society.

An informal dinner was held at the Criterion Restaurant, Piccadilly, London, on Feb. 9, at which the formation of an illuminating engineering society in Great Britain was the subject of discussion. Mr. Leon Gaster presided at the meeting, which included representatives of the engineering, architectural, medical and other interested professions.

At the conclusion of the dinner Mr. Gaster briefly described the development and progress of the illuminating engineering movement in Great Britain, and explained the objects of the proposed society, namely, to provide a free and impartial platform for the discussion of questions connected with illumination. He emphasized especially the fact that what he proposed was an "illuminating engineering society" and not a society of "illuminating engineers." Anyone interested in furthering the science and art of illuminating engineering would be eligible to join the society, but membership would not entitle anyone to any professional status. In this respect the society would resemble similar and flourishing institutions already existing in Great Britain.

An animated discussion followed, in which all who spoke expressed their warm approval of the suggested scheme, and their conviction that the time was ripe for starting such a society. It was proposed and carried unanimously that the *Illuminating Engineer*, published in London, be appointed the official organ of the society.

CURRENT NEWS AND NOTES.

AMERICAN-GERMAN PATENT CONVENTION.—A dispatch from Washington states that a patent convention with Germany was signed Feb. 23 by Secretary of State Bacon and Count Johann von Bernst, the new German Ambassador. The treaty is designed to prevent either government from passing laws requiring that foreign patents must be manufactured in the country in which protection is asked. The treaty must be ratified by the Senate to become operative.

NO WIRELESS REGULATION.—Toward the close of ngress it was decided to let the whole matter of compulsory ireless legislation go over until the session of next winter.

WINNIPEG MUNICIPAL PLANT.—The City Council of innipeg, Manitoba, has asked the county court to investigate ith a view to learn the reason of the excessive cost of work n the city's high-tension power plant, and ascertain why it has st the city $200,000 to acquire what two responsible firms ffered for $129,000.

EXTENSION BEYOND VILLAGE LIMITS OF MUICIPAL SERVICE.—A bill has been introduced in the New ork State Legislature authorizing the extension of the lines f village municipal electric lighting plants beyond the limits f villages. If, however, the estimated expense of such exensions exceed $500 in any year, the expenditure must be approved at an election.

WIRELESS TELEGRAPHY IN TRAIN SERVICE.—A pecial train on the Lake Shore Railroad was kept in wireless-elegraphic communication with Cleveland and Chicago while unning at full speed between these places on Feb. 27. A emporary wireless station was installed in the buffet car, a wire arranged along the roof of the car serving as the antenna. About 800 words were sent and successfully received. It is said that additional tests will soon be made of the system to determine its reliability.

GREAT AMERICANS.—The *New York Herald* has recently been conducting a "competition" in which its readers have been asked to name the men whom they consider to be the 10 leading Americans. The work has just been completed, with interesting results. The list is headed by Mr. Thomas A. Edison, to whom comes Mr. Andrew Carnegie as second. The last in the 10 is Dr. Alexander Graham Bell, and just succeeding, outside the 10, is Mr. George Westinghouse. Mark Twain is the most popular author as one of the 10.

SAULT WATER POWERS.—The U. S. Senate has adopted an amendment to the Rivers and Harbors bill which provides that any water in the river of Sault Ste. Marie in excess of the amount necessary for the use of navigation shall be leased by the Secretary of War for power upon the payment of such charges as are reasonable and best adapted to insure the development and commercial progress of the communities affected. The House adopted a provision that the government shall take over the property of all the power companies except the Michigan and Lake Superior Company.

MAYOR AGAINST MUNICIPALISM.—In opposing a plan for the purchase by the city of the Williamsburg ferries on the East River, this week, Mayor McClellan said: "For my part, I am not, as a general proposition, in favor of committing the city to the operation of ferries at a loss. I look upon municipal operation as a last desperate resort and something that should not be resorted to until all other resources have failed. For that reason, while we were obliged to take over the Staten Island and Thirty-ninth Street Ferries, I do not look favorably upon taking over other ferry properties."

BRITISH PATENT ACT.—The British Comptroller General of Patents has revoked a patent owned by the British Westinghouse Electric Manufacturing Company relating to arc lamps. It was held that while 1308 arc lamps covered by the patent were manufactured at Trafford Park up to October, 1908, a German company to which the Westinghouse granted a license exported between 1906 and 1908, 9856 lamps, and the Comptroller decided that on evidence before him he is satisfied that the patented article is not manufactured to an adequate extent in the United Kingdom. Subject to an appeal to court, he therefore revoked the patent and ordered the patentees to pay to the applicant the sum of 75 guineas in respect of his costs.

ELECTROCHEMICAL SOCIETY.—The New York section of the American Electrochemical Society held a meeting at the Chemists' Club on March 1, at which time papers were presented by Dr. F. K. Cameron, of the U. S. Department of Agriculture, and by Dr. L. H. Baekeland. Dr. Cameron described a slide-wire bridge for measuring the resistance of moist soils and thereby determining the character of the soils. Dr. Baekeland explained in detail the process of manufacture of numerous articles containing "bakelite," which he exhibited. Bakelite is a coal-tar product, claimed to possess the properties of amber, rubber and celluloid, which can be used as an impregnating material for insulating purposes.

PROPOSED CHANGE IN FRENCH PATENT LAW.—The principal provision of the bill introduced by the French government to amend its patent law provides that patent rights shall be held to lapse in the event of failure on the part of the holder either to exercise his right in France or in the French colonies for a period of three years after applying for his certificate, or to resume exercise of after a similar interval; or, secondly, in the event of only partial exercise of the patent in French territory. In the second event the patent courts will be invested with discretionary power to call upon the holder of the patent to show cause why he should not exercise his rights in French territory "in an adequate degree."

MICHIGAN WATER-POWER REQUIREMENT.—The water-power investigation committee of the Michigan Legislature, which has been looking into the granting of a franchise to the Eastern Water Power Company on the Au Sable River, has advised the supervisors of Oscoda County that they should reduce from five to two and a half years the time within which the company may begin work of development and should increase the price of the franchise, which was fixed at $100 by the board of supervisors, and should require the power company to furnish a bond that the proposed dams will be built; that a concession in rates should be made to the people of Oscoda County at distant points supplied by transmission lines, and that the entire franchise proposition should be submitted to the people at the April election.

VICTORIA FALLS POWER.—At a recent meeting of the Victoria Falls Power Company in London the name of that company was changed to the Victoria Falls & Transvaal Power Company, Ltd. It was stated that while when the company was promoted one of its objects was to generate power at Victoria Falls for transmission to Johannesburg it has not been possible up to the present time to obtain the permission of the Transvaal government to run transmission lines from the Rhodesian border to Johannesburg. Another portion of the scheme was to construct new steam stations on the Witwatersrand and also to work stations that had been purchased. One of the latter has had its capacity increased by 8000 hp and a new station of 16,000 hp is under construction. During 1907 the profits of the company were $180,000 and the profits of last year were practically the same.

MESSAGES FROM MARS.—The wireless telegraph operators at Mount Wilson, Cal., state that they have recently been receiving signals in some curious code that is neither Morse nor Continental nor anything else legible. These signals are quite strong, and the operators have been conjecturing that they may come from Mars. Mr. Nikola Tesla writes us on this surmise: "I do not believe that the operators are observing the same disturbances which I have already noted in Colorado, because I had to use a device of wonderful sensitiveness, which I have reason to believe is not yet known to the wireless people. I rather think it is likely that a plant somewhere is producing stationary waves; and I have an idea that it must be located in Japan, as the Japanese experts saw me during 1900 and adopted my system at that time. Should the reports continue, I shall make an investigation. It will not be difficult if such is the case to locate the transmitting plant very closely."

FREAK LEGISLATION.—A bill recently introduced in the New York State Legislature provides that "insulators made of glass distinctly red in color" shall, for better security to life, be used in pole-line construction.

MINNESOTA CONVENTION.—The convention of the Minnesota Electrical Association is to be held at the Nicollet Hotel, Minneapolis, March 18 and 19, in accordance with the program published in the *Electrical World* of Jan. 21. The first session is to be held at 9:30 a. m., March 18. The secretary is Mr. Ludwig Kemper, of Albert Lea, Minn. The program prepared is an attractive one for the practical central-station operator.

WIRELESS COMMUNICATION WITH AERIAL CRAFT.—According to a Boston dispatch Mr. Chas. J. Glidden is having powerful wireless apparatus installed in his apartments in that city for the purpose, it is said, of communicating with any aerial craft carrying wireless equipment that may be flying east of the Mississippi River. He proposes to use a balloon equipment as part of the system.

MASSACHUSETTS PROPOSED RATE REGULATION.—A hearing was given by the committee on public lighting of the Massachusetts Legislature on Feb. 26 on a bill to permit the Board of Gas and Electric Light Commissioners to examine the returns of electric and gas lighting companies with special reference to their bearing upon the rates in force, and to give the board power to initiate investigations as to whether the prices charged are discriminatory or excessive. Attorneys Burdett and Pillsbury for the central stations in Massachusetts opposed the bill on the ground that it is unnecessary.

NEW YORK SECTION I. E. S.—The next regular meeting of the New York section of the Illuminating Engineering Society will be held in the Engineering Societies Building, 29 West Thirty-ninth Street, New York City, on Thursday, March 18, at 8:15 p. m. The date is one week later than the usual time set apart for the meeting. Two papers will be presented—namely, "The Mathematical Theory of Finite Surface Light Sources," by Mr. Bassett Jones, Jr., and "Illuminating the Editorial Offices of the New York *World*," by Mr. Albert J. Marshall. These papers treat both the theoretical and the practical sides of illumination.

BOSTON EDUCATIONAL NOTES.—The Electrical Engineering Society of the Massachusetts Institute of Technology recently held a dinner at which the principal speaker was Mr. L. L. Elden, electrical superintendent of the Edison Electric Illuminating Company of Boston. Mr. Elden addressed the society on the work of the Edison company, with special consideration of the generating and distributing systems. The lecture was extensively illustrated by lantern slides. At a meeting of the Mechanical Engineering Society of the Massachusetts Institute of Technology, on the evening of Feb. 25, Mr. H. L. Coburn, of the Ambursen Hydraulic Construction Company, Boston, gave a lecture on hydro-electric plants. Prof. Charles E. Lucke, of Columbia University, gave a lecture in Boston on Saturday evening, Feb. 27, before the Society of Arts of the Massachusetts Institute of Technology on the history and development of the gas engine.

ELECTRIFICATION OF GERMAN RAILROADS.—In a report to the United States Bureau of Manufactures, Consul Thomas H. Norton, writing from Chemnitz, gives some data relative to the cost of equipping German railroads electrically. On the basis of calculation made by Ph. Pforr, it was estimated that steam locomotives cost about $0.1186 per pound, as compared with $0.1834 for the electric competitor. The latter is, however, relatively much lighter. A 600-hp electric freight locomotive weighs 92,593 lb. The usual types of steam locomotives of the same power weigh 125,400 lb. empty, and 167,000 lb. when charged with water, etc. On the basis of replacing 64 per cent of the present stock by electric locomotives the entire railway systems would require an outlay of $133,750,000 for electric locomotives to replace the present supply of steam locomotives, which cost $167,000,000. The opinion was expressed that in the early future electricity will displace steam entirely or in great part on all of the leading German lines.

INDIANA TELEPHONE LEGISLATION.—Indiana independent telephone interests are urging the passage of the Wells bill to enable one telephone company operating under an Indiana charter to take over by lease or purchase another company operating under similar conditions, as being the best means for successfully contesting the inroads of the Bell company and preventing the ultimate establishment of one system throughout the State. Under the present law one independent company cannot sell its stock to another, and under such limitations the Bell becomes the only logical purchaser of small companies whose managements have not been successful. It is contended that if the independents are given the right to merge the strong companies will take over the small companies and strengthen the independent system throughout the State and thus be on an equal footing with the Bell, which operates under a foreign corporation charter. Representative Weekey has introduced a bill which, it is claimed, would compel all telephone companies operating in the same territory to make physical connection of their exchanges.

EDISON ON EDUCATION.—In an article in the Yale *News*, Mr. Thomas A. Edison expresses the opinion that a college education is decidedly not essential as a preparation for a young man about to enter upon a scientific career. He believes that the purely academic training is a great waste of time, since in four years no one can learn all the essential points of science, and four years of active experimental work will be of much greater value than an equal amount of time spent in obtaining a college education, in spite of the fact that the minds of college men are better trained, and therefore obtain further learning more easily. He adds that what the country needs now are engineers, industrial men, good business managers and railroad men, though in three or four hundred years, when the country is settled and commercialism is diminished, there will be time for literary men. His greatest objection to a college education for a scientist is that academic learning is old and does not keep progress with the times; if colleges could teach their men to become first-class draftsmen, that would be a great advance, for skilful drafting implies that a man can do anything.

THE PUBLIC AND THE ELECTRIC SUPPLY COMPANIES.—In giving a report of the company's recent work, the chairman of the London Electric Supply Corporation, the Earl of Crawford, stated that the history of the treatment of the electrical industry in London is a curious episode in the attitude of popular government toward money-making. The popular agitation in England has been against the London electric companies as if they were making too much money and blocked the way. He remarked that "More business sense, as Mr. Carnegie calls it, now prevails. The idea is exploded that cheap power can be made by act of Parliament, and that if the electrical companies pay big dividends it necessarily means dear power and the consumers' loss. I hope and think that, by the act passed during the last autumn session, the policy of taking care of the consumer at the expense of the producer is abandoned in the electrical industry once for all, and that we shall henceforth be free to make fair dividends till 1931, and then hand over a group of prosperous undertakings to the London County Council without any loss of capital being inflicted on our shareholders." The report showed that the corporation had sold last year 3,000,000 kw-hours more than the year before; the extra cost for production, however, was increased by only $3,440 on account of various improvements in equipment and operating methods.

than small, fragile packages. To insist on the same rate for all classes of freight would simply result in restricting the shipment of bulky necessities, such as lumber, and would allow shippers of small packages service for which they did not pay. Uniform rates per kw-hour for all classes of service by an electric light and power company would practically mean that the large consumer who uses current many hours per day could not afford to take central-station service because of the high price which would be charged. The expenses incurred in serving the small short-hour consumers would have to be paid for in part by the revenue obtained from the large and long-hour consumers, with the result of practically restricting the business to the small consumers. This in itself would keep the cost of production higher than if a larger variety of business could be done by the central-station company. In the end the rates to the small short-hour consumers would be higher than if the uniform rate were not required, and the larger consumers would be forced to the inconvenience of putting in isolated plants. The whole tendency of central-station practice the past few years has been away from the uniform rate idea, and, in fact, one of the things which restricted central-station progress for a number of years was the failure to recognize the great difference in cost of serving different classes of consumers. Rate systems which automatically give lower rates to certain consumers because of a greater number of hours' use of electricity per day can in no sense be called discriminatory, because they are open to all and are dependent entirely on the kind of service demanded. It is safe to say that no legislation which requires a uniform rate per kw-hour for all kinds of electric light and power service will be sustained by the courts, but it is troublesome, nevertheless, to have such legislation proposed.

Summer Central-Station Rates.

Occasional central stations, both here and abroad, make special rates to consumers during the months of light load in summer when the peak is practically absent, or rather transferred—what there is left of it—to the evening hours. The result of this policy is the securing of enough extra business to compensate for the reduction of price. There are, of course, certain things like small electric cooking outfits and fan motors that belong especially to the warm months, and these are more and more freely used as the price of energy is lowered. In addition there is a certain opportunity for gaining extra use of lights. At all events, the policy has seemed to be fairly successful where tried and perhaps it deserves wider exploitation. Of course, from a practical standpoint it is more or less of a bargain sale, that does not very well fit ordinary theories of rates, but may none the less be advantageous. During the summer months the load upon a station is very moderate, and the whole investment for the winter peak confronts one. Taking fixed charges into account, the station, if it bases its rate on the cost of supply, might very well find that logically it should charge more in summer than in winter. However, although the theory of charging each and every customer a rate proportionate to the cost of supplying him is on paper a popular one, it is more honored in the breach than the observance.

On such a basis there is no defensible ground for making any intrinsic difference between current supplied for lighting and for power; a thing which is well-nigh universal in electrical supply. The fact is that central-station supply is like any other business, and must look after the large results in profits rather than petty details. It must make its total earnings pay its dividends, and to do this must sell its product on the average at a profit while putting it as regards individual customers at a figure that is attractive. The one thing which estops it from bargain sales is its duty as a public service corporation, which compels it to treat its customers as nearly alike as may be. All existing systems of rates are therefore more or less illogical compromises. From this point of view a summer rate which will get increased earnings even at modest profit is an entirely business-like proceeding, the sole question being with respect to its expediency. This depends in part on the general temper of the community and in part on the legal restrictions that commonly surround the matter of rates. If a company in virtue of an extra discernment can take on a paying load of cooking apparatus, fans and extra lights as for signs and the like, we see no good reason why it should not be allowed to do so. Electric kitchens are certainly a great convenience, and especially so during these very summer months that are in question. Their use is economical at any time below a certain price per kw-hour—for instance, at such rates as are often charged for motor service. If a general summer rate could be made on both lights and cooking devices, the increased consumption for both purposes ought to be able to bring in an increased income that would be worth while.

Another class of business that might be increased is summer specialties in signs. During the warm months, when people are much out of doors, special advertising with electric signs ought to pay, and from the central-station standpoint it would be a good kind of load to develop. Electric signs seem to form a stable part of the business. They hang on at dull times in a way that is very gratifying and are in good times steadily on the increase. How far special summer rates would increase their installation remains to be discovered. Probably some of the summer gain might be carried on through the rest of the year. A successful summer rate scheme certainly implies an active campaign for extra load appropriate to the season, with an excellent chance for retaining part of the increase. The difficulty is to determine what the special rate should be and how it could be most tactfully made. That really is a thing which is of local significance rather than of general application. It would be a difficult step to arrange a summer rate on some systems of charging and a rather easy one upon others. The more leeway allowed in general, the easier would be special arrangements. The time has come for central stations when new business must be hunted and bagged. In spite of the huge increase in totals shown in the recent census report, the need of activity is still obvious when one comes to analyze the situation. The greatest gain has been in motor service, helped on by the establishment of great specialized power plants. The least increase, to judge from observation, is in domestic lighting, on which the gas companies have in the larger cities a very strong grip. Until by one device or another this is broken, the gas companies have a steady and reliable pot-boiler that enables them to carry on an active fight for larger work. The summer schedule, involving much residence work, is therefore a weapon of offense that the central station should not throw aside without careful investigation.

Electrical Features of the Inauguration.

As has been customary in the past, the Capital City has put on festive attire for the inauguration of the President on March 4. This year electricity plays an important part in the decorative features. Pennsylvania Avenue from the Peace Monument to the Treasury Building is festooned with electric lamps, the entire electrical display culminating in the Court of Honor in front of the White House. The lines of decoration in the Court of Honor extend from Fifteenth Street to Seventeenth Street with parallel rows of columns at the curbs at each side of the street. The columns are approximately 25 ft. high and from the top of each there is a festoon of flowers intertwined within which is a string of 8-cp lamps spaced 12 in. apart. At the top of each pole is a banner and an electric emblem. Where the streets join there are four 45-ft. columns 4 ft. in diameter at the top. Surrounding the base of each of the four large columns are six 20-ft. columns. These smaller columns are entwined with floral decorations and electric lamps and the large columns are circled with receptacles at various points. At the top of each of the four large columns is a mammoth flower basket made of wicker work with electric lamps placed in each of the apertures. There are 150 lamps in each flower basket or a total of 600 in the four baskets at each street intersection. Connecting the columns is a series of festoons forming a hollow square, together with diagonal festoons. These festoons are made of laurel and are studded with 8-cp lamps spaced 9 in. apart. At the center of the festoons are emblems consisting of trophies, shields and the American eagle, all of which are outlined with electric lamps. At the intersection of the diagonal festoons there is a 3-ft. ball studded with 200 lamps. This design is repeated at the intersection of each of the streets. The total number of lamps used in the Court of Honor is 7000, all rated at 8 cp. The energy is supplied by the Potomac Electric Power Company, the feeders being located at the intersections of the streets and the control boards being placed in each of the high columns. The work was installed by The Electric Motor & Equipment Company, of Newark, N. J., under the direction of the Inaugural Committee. The general design of the work is such as to make the Court of Honor the most elaborate ever installed in Washington. The grand ball will take place as usual in the Pension Building, the electrical decorations here being installed by the National Electrical Supply Company, of Washington. Myriad incandescent lamps are used in connection with flags, bunting, festoons, etc., adding greatly to the already dazzling effect of officers in uniform, diplomats in court attire, civilians in regulation dress and women in evening gowns.

Edison Incandescent Lamp Leading-in Wire Patent Sustained.

Another incident in the rather remarkable legal history of the Edison incandescent lamp leading-in wire patent was the reversal on Feb. 16 by a United States Court of Appeals, of the decision on May 14, 1908, of a Circuit Court declaring the patent invalid on the grounds that it merely related to a mechanical improvement. Both of these decisions were rendered subsequent to the expiration of the term of life of the patent, which occurred Jan. 13, 1908. The original patent was the subject of numerous suits of infringement instituted about 1904. On the grounds that the claims of this patent were too broad, a reissue was obtained Oct. 10, 1905, and the present suit was based on the reissued patent.

In discussing the claim of anticipations of the invention, the court held that in Heisler and Bernstein lamps exhibited, the complete sealing-in occasionally of the platinum wire was by mistake and that no such accidental and fugitive occurrence is of account. In the Lemp & Wightman patent adduced, the court held that it was by the error of a draftsman that the outer section of the leading-in wire is apparently made to extend into the glass. The patentability of the device was declared to be the real question, and the court held that Edison's successful method in dealing with the subject, and particularly the method adopted, was inobvious if not obscure calling for inventive insight to develop and discern, and that the patent therefore should have been sustained.

The Kellogg Telephone Suit.

A decision of the Illinois Supreme Court, Friday, Feb. 19 1909, concluded a long and bitterly contested litigation, the result of which restores to Mr. Milo G. Kellogg his stock control of the Kellogg Switchboard & Supply Company, which had been acquired by the American Telephone & Telegraph Company. In November, 1901, Mr. Milo G. Kellogg, president of the Kellogg Company and owner of nearly two-thirds of its issued stock, was forced by severe illness to resign his active management of the Kellogg Company and prior to his departure for California, he resigned his management to the vice-president of the company, Mr. Wallace L. DeWolf, and gave him a power of attorney. This power severed both personal and corporate interests of Mr. Kellogg, and acting under it Mr. DeWolf, on Jan. 4, 1902, sold to Mr. Enos M. Bartle, president of the Western Electric Company, all of Mr. Kellogg's stock as well as his own and that of others. Mr. Kellogg was not advised of this sale, or attempted sale, until six months thereafter. Upon learning of it, and as soon as his health would permit, he took active steps to recover his stock.

The original bill in this case was filed in June, 1903, by Francis W. Dunbar, Kempster B. Miller, George L. Burlingame, and other minority stockholders in the Kellogg Company. These stockholders contended that a purchase of a majority of the stock of the Kellogg Company by the American Telephone & Telegraph Company tended to suppress competition and create a monopoly and was therefore illegal and void. To this the American Telephone & Telegraph Company replied that the bill of the minority stockholders was insufficient to warrant granting the relief prayed for, and Judge Mack, in the Circuit Court of Cook County, Illinois, held the bill insufficient. An appeal was then taken to the Branch Appellate Court of the same county and there Judge Mack's decision was affirmed. The minority stockholders then appealed to the Supreme Court of Illinois and this court, in an opinion handed down Oct. 23, 1906, reversed the two lower courts and established as the law of this case that a foreign corporation, such as the American Telephone & Telegraph Company, doing business in Illinois, had no greater powers than a domestic, or Illinois, corporation and that an alleged purchase by the said American Company either in its own name or in the name of others, of a majority stockholding in a rival company for the purpose of controlling it and thus stifling competition, was illegal and absolutely void.

It remained to prove the allegations of fact contained in the bill, and accordingly the case was remanded to the Circuit Court of Cook County and the proofs produced before Judge Windes of that court. A number of months were consumed in adducing these proofs. After argument before Judge Windes he found the allegations of the minority stockholders' bill substantially proved and, under the law as determined by the Supreme Court, ordered a decree entitling the minority stockholders to all the relief prayed for. The decree of Judge Windes was entered in February, 1908, and awarded the minority stockholders a permanent injunction perpetually enjoining the American Telephone & Telegraph Company and its agents from, in any manner, interfering with the management or control of the Kellogg Company. The decree also ordered that the said American Company surrender the Kellogg certificates of stock illegally acquired by it, to their rightful owners, and that the purchase price of said certificates be returned to it. Also, that should the said American Company refuse to surrender said certificates, they would be cancelled and new certificates issued.

The American Telephone & Telegraph Company then carried the case to the Branch Appellate Court and that court, while

finding the alleged facts substantially proved, disagreed with Judge Windes on the relief to be granted to the minority stockholders. The minority stockholders then carried the case to the Supreme Court of Illinois, and on Feb. 19 that court reversed the Branch Appellate Court, sustained Judge Windes, and affirmed his decree in its entirety.

Proposed Connecticut Public Service Commission.

Governor Lilley sent a message on Feb. 25 to the General Assembly asking that it give early attention to the bill to establish a public service commission. He said that the immense complexity of modern business conditions has rendered the supervision of public utilities imperative. Such supervision is not practicable under the present system, as the Legislature meeting only every two years for a few months cannot give these matters the careful scrutiny which the people rightfully demand. He believed that the same source from which grants of special privileges flow should be in session at all times to see to it that those special privileges which are granted for the benefit of the people are exercised in the interests of the people.

Michigan Public Service Commission.

A bill before the Michigan Legislature provides for transforming the State railroad commission into a public utilities commission with jurisdiction over all companies and corporations, private or municipal, providing telephone service, heat, light, power or water to the public. Representative Garry E. Sanders, of Ingham County, is sponsor for the bill. The bill provides that the commission may prescribe a uniform system of bookkeeping, require an annual printed statement of each company's financial and physical condition and examine the books whenever it desires. The commission is to fix rates, and adequate standards of measurement and make investigations of alleged oppression or discrimination upon complaint of 10 persons. In no case shall the commission fix a substitute rate without giving the company a hearing, and the company shall have the right of appeal to the Circuit Court.

The Institute Dinner.

Everything points to a very successful anniversary dinner of the American Institute of Electrical Engineers at the Hotel Astor, New York City, on March 11. All the preparations have now been carefully made, and the number of applications for seats is very large. The dinner will be conducted by President Ferguson, who will act as toastmaster. Prof. Elihu Thomson will speak for "The Charter Members;" Mr. Frank J. Sprague for "The Past Presidents;" Dr. A. C. Humphreys, president of Stevens Institute of Technology, will speak on "Electrical Engineering and Education," and Mr. John Bogart, formerly State Engineer, and secretary in 1884 of the American Society of Civil Engineers, will bring the "Greetings and Congratulations of Sister Societies," several of which will be represented by their officials. An interesting feature of the dinner also will be the participation of a number of branches and sections. The dinner committee makes an earnest request that applications for tickets and seating will be filed at once, so that attention can be given to this important matter well in advance of the affair. The cost of the dinner is only $5, including one wine and cigars and cigarettes, music, etc. The dinner will be given in the large ballroom, using the small ballroom adjoining as an annex if necessary.

Grand Falls Power Company.

The contract for the construction work involved in the hydro-electric development of the Grand Falls Power Company on the St. John River, at Grand Falls, N. B., has been placed. This plant will generate 100,000 hp in electrical energy, which will be furnished to various cities throughout New Brunswick and Maine. The work involves, among other features, the construction of a number of shafts in rock excavation 130 ft. deep, a power chamber 30 ft. x 260 ft. and 130 ft. deep, and a tail-race tunnel 28 ft. in diameter and 2400 ft. long, a power house 350 ft. long and 260 ft. wide. The intake shafts will be nine in number and 12 ft. in diameter and 130 ft. deep. The plant will be equipped with the most approved hydraulic and electrical machinery for high-potential and long-distance transmission. Actual construction will, it is stated, be begun immediately and will be pushed through to completion at an early date.

The water power of the falls on the St. John River at this point is the largest in eastern Canada and its development will result in the establishment of a large number of manufacturing enterprises. The total head developed will be 135 ft. A number of auxiliary substations and long-distance transmission lines will be erected. The St. John River at Grand Falls (which is the largest river in New Brunswick) describes a horseshoe curve at this point and has a fall of 135 ft. through a gorge of great beauty. Grand Falls is situated on the Canadian Pacific Railroad, about 200 miles north of St. John, N. B., and about two miles east of the State of Maine.

The expenditure involved will amount to over $5,000,000. The contract for construction work was awarded to the Frank B. Gilbreth Company, of New York. Mr. John B. McRae, of Ottawa, is chief engineer for the development and Mr. Ralph D. Mershon, of New York, is the electrical engineer.

Ontario 110,000-Volt Transmission System.

The Hydro-Electric Power Commission of Ontario has let contracts for the building of 300 miles of 110,000-volt transmission line. Energy will be bought from the Ontario Power Company, at Niagara Falls, and will be distributed by means of the high-voltage circuits to Toronto, Hamilton, London, St. Thomas and various intermediate points in this part of the Province of Ontario. The line will require about 500 tons of aluminum cable, and about 7500 tons of steel will be used in some 3200 towers. It is expected that the line will be ready for service before the end of 1909.

The line starts at the transforming station at Niagara Falls where the e.m.f. will be increased from 12,000 volts to 11,000 volts. The initial installation will be for 30,000 kw. From Niagara Falls the line extends about 50 miles in a northwesterly direction to Dundas, at which point it divides. One line, about 40 miles long, extends in an easterly direction to Toronto, while two others go westerly to London; the northern of the latter two branches covers about 120 miles and the southern about 75 miles. From London the line proceeds westerly to St. Thomas about 14 miles. An additional extension to Windsor, about 100 miles, will subsequently be made, probably within the present year.

The poles are to be galvanized steel angle-iron towers. The standard spacing will be 550 ft. On curves the spacing will be reduced to 100 ft., while at Humber River a distance of 1250 ft. will be spanned. The tower will be placed on framed steel anchorages 6 ft. below the ground contour. The normal height will be about 65 ft. above ground; at the Welland Canal extra high structures will be employed, because a clearance of 150 ft. is required to permit the passage of vessels.

The three-phase conductors will be of stranded aluminum, having a cross-section of No. 3-0 B. & S. gage uniformly throughout with the exception of the line from Niagara to Dundas, where a cross-section of No. 4-0 will be used. The insulators will be of the disk suspension type, five disks being employed for each conductor. A grounding cable for lightning protection will be arranged along the highest point of the towers.

The general contract for the construction of the line has been let to Mr. F. H. McGuigan, of Toronto. Sub-contracts have been let to the Canadian Bridge Company, at Walkerville,

for the steel towers, to the Northern Aluminum Company, of Shawinigan Falls for the cables, and to the Niagara & Ontario Construction Company, of Toronto, for the balance of the material and the actual erection of the line. Muralt & Company, New York, have been retained as engineers and will supervise the construction. Mr. C. L. de Muralt will personally take charge of the work.

Morse Club Dines President Brown.

The annual dinner of the Morse Electric Club, which is practically an organization made up from the Western Union executive ranks, was held at the Hotel Savoy, New York City, on Saturday evening, Feb. 27. The guest of honor was Mr. William C. Brown, who has just been elected president of the New York Central system, and who was enthusiastically greeted as one of themselves because he began life as a telegraph operator. About 200 members and guests were present and an excellent dinner was served. Among those in attendance were: J. B. Van Every, who presided; Vice-Presidents J. C. Barclay and B. Brooks; A. R. Brewer, W. H. Baker, R. D. Brixey, M. R. Cockey, Gardner Irving, M. H. Kerner, J. Kempster, W. Marshall, M. J. O'Leary, C. L. Pullen, J. B. Taltavall, C. Trippe. The *Electrical World* was represented by T. C. Martin, and the *Electric Railway Journal* by J. M. Wakeman. At the speakers' table sat the guest of honor and President Van Every, supported by President R. C. Clowry, of the Western Union Telegraph Company; Justice Morgan J. O'Brien, Hon. P. H. Dugro, H. D. Estabrook, E. T. Jeffery, C. F. Daly and W. J Dealy. Before speaking began, a number of songs were sung, which were printed on a supplement to the menu.

President Brown in acknowledging the toast in his honor made some very interesting personal allusions to the beginning of his career in the West, his father having been a missionary to Iowa 60 years ago, where the family had to undergo the privations and perils of frontier life. Mr. Brown began his work as a young railway telegraph operator, whose duties included the stacking of cordwood and handling of freight; and in a modest manner he told how he had made the successive steps which have finally brought him to a position as the foremost railway manager in the United States—but still in the electrical field. Extremely interesting reminiscences of a like nature were also given by Col. Clowry and Messrs. Estabrook and Jeffery, all of whom had been acquainted with the guest in the earlier days out West. Mr. Dealy made an eloquent address, as usual, discussing Mr. Brown's characteristics as an operator and as a man. Justice O'Brien delivered a simple, dignified speech, in which he discussed with force and earnestness the difficulties with which such men as Mr. Brown now found themselves surrounded and confronted through the unintelligent and reckless legislation which had been put into force hostile to the railroads. The same spirit had also been manifested with regard to other large corporations, such as those in charge of telegraph systems, but he believed in the sober commonsense of the American people, and felt that in time better judgment in these matters would prevail, and it would be realized that the welfare of the corporation was one with that of the public. This brought to its close an altogether enjoyable and pleasant evening, which will be long remembered by all who participated.

Control of Niagara Power.

The attempt of Congressman Burton to have the provisions of the bill regulating the Niagara power development extended for a period of 10 years met with so many objections that a compromise on a two-year extension was effected—the joint resolution on the question states that the provisions of the act for the control and regulation of the waters of Niagara River, for the preservation of Niagara Falls and for other purposes, approved on June 29, 1906, will expire by limitation on June 29, 1909; that the date for the termination of the operation of the act was provided only with a view to the more permanent settlement of the questions involved with Great Britain and by further legislation appropriate to the solution; and that as such treaty has not been negotiated, it is desirable that the provisions of said act should be continued until such permanent settlement can be made. The resolution adopted states "that the provisions of the aforesaid act be and they are hereby extended for two years from June 29, 1909, being the date of the expiration of the operation of said act, save in so far as any portion thereof may be found inapplicable or already complied with."

New York Public Service Commission Work.

The Public Service Commission of the First District of New York has issued an order requiring the Empire City Subway Company and the Consolidated Telegraph & Electrical Subway Company to file report for the six months ending Dec. 31, 1907, and for the year 1908. These companies, which control the conduits carrying various sorts of electrical wires in this city, have maintained that they were not under the jurisdiction of the Public Service Commission. It has not yet been decided whether the companies will contest in the courts the point or will accede to the order.

The commission has also sent to the Board of Estimate and Apportionment a report on the present condition of the new subway loop between bridges in Manhattan Borough. In this report it is said that the reason why no contract for the operation of the loop had been advertised was because it would be impossible to get any other bidder than the Interborough Company until after the construction at the Brooklyn end of the new Manhattan bridge had been contracted for. The Board of Estimate is censured for not having taken action on the contracts for the Brooklyn construction which were submitted to it by the commission last May. The commission says that if the Board of Estimate insists that only the first section and part of the second section be constructed at this time—as has been stated—that the commission is ready to take the matter up on that basis. It insists, however, that the city's debt is now $48,000,000 below the constitutional limit and that therefore it would be possible to begin construction on all six sections of the Brooklyn subway at once. The Board of Estimate has not, as yet, made any response to the communication.

The Public Service Commission of the Second District of New York is still trying to force Mr. Herbert P. Bissell, president of the Economic Power & Construction Company, to answer certain questions concerning the business affairs and methods of his company. It has just taken an appeal to the Appellate Division of the Supreme Court from the decision of Justice Fitts, who ruled Mr. Bissell need not answer.

The Court of Appeals of New York has sustained the decision of the Appellate Division of New York City denying the motion of the Public Service Commission of the First District to quash the writs of certiorari obtained by the receivers of the Metropolitan Street Railway Company to review the proceedings fixing a fare of 5 cents to be divided between the Metropolitan company and the Fifty-ninth Street cross-town line. The commission directed the Metropolitan company to issue transfers and divide its fares. Upon this order the railway company demanded the court review.

Engineering Society of Wisconsin.

The organization of the Engineering Society of Wisconsin was completed at the first meeting, held at the University of Wisconsin, Feb. 24, 25 and 26, at which some 150 city engineers, general managers of power and traction companies, contracting engineers, superintendents of water and light plants, mechanical and civil engineers, and superintendents of highway construction were present and became charter members. The officers elected were as follows: President, Dean F. E. Turneaure, University of Wisconsin College of Engineering;

vice-president, City Engineer McClelland Dodge of Appleton. Trustees for two years: Mr. B. F. Lyons, assistant general manager of the Beloit Gas & Electric Company, and Mr. E. P. Worden, mechanical engineer of the Prescott Steam Pump Company, Milwaukee; trustees for one year: Mr. E. Gonzenbach, of the Sheboygan Electric Light & Power Company, and City Engineer E. R. Banks, of Superior. These, as executive board, will elect the secretary later.

The new organization will hold annual meetings hereafter for the purpose of bringing together the engineers from all parts of the State interested in the solution of such problems as arise in connection with municipal plants, large construction work, bridge, forest and water power questions, and light and power production. A wide range of subjects was included in the program for the initial meeting of the society.

Prof. W. D. Pence, who is engineer for the Wisconsin Railroad Commission, opened the second day's program with a description of the organization of the commission's engineering staff. The new problem of standards of gas and electric service was discussed by Prof. C. F. Burgess, of the department of applied electrochemistry at the university, who has done important work in enabling the State Railroad Commission to prescribe a standard for fuel and illuminating gas.

The electric interurban roads of Wisconsin were the subject of a paper by Mr. F. G. Simmons, superintendent of construction and maintenance of way for the Milwaukee Electric Railway & Light Company. The day circuit for small towns was discussed by Prof. J. W. Shustor, and new forms of arc lamps by Mr. W. E. Wickenden, also of the electrical engineering department. Dean Turneaure took the members of the society through the engineering experimental laboratories, explaining the work that is being done there in many lines of research. At a late session Prof. D. W. Mead discussed the subject of hydraulic and hydro-electric power development, and gas producers and small power stations were subjects of papers by Mr. V. E. McMullen, Beloit, and Mr. C. T. Atkinson.

Convention of Pacific Coast Electric Automobile Association.

Pursuant to a call sent out by Mr. R. B. Daggett, manager of the San Francisco office of the Electric Storage Battery Company, a meeting of those interested in the development of the electric vehicle business on the Pacific Coast was held at the St. Francis Hotel, San Francisco, on Feb. 19 and 20. There were over 50 delegates in attendance, representing vehicle distributors and central-power station companies, as well as manufacturers of vehicles and their equipment. The meeting was called to order by Mr. Daggett, who made a welcoming address, stating the object of bringing together those specially interested in the electric-vehicle business.

Papers were read as follows: "The Electric Vehicle," by Mr. R. B. Daggett, Pacific Coast manager Electric Storage Battery Company; "The Mercury Arc Rectifier," by Mr. R. M. Alvord, of the supply department of the General Electric Company; "Vehicle Batteries," by Mr. Geo. R. Murphy, engineer, Electric Storage Battery Company; "Relation of Central-Station Companies to the Automobile Business," by Mr. Fred. T. Kitt, agent, Columbus Electric Vehicle Company, Sacramento, Cal.; "The Electric Vehicle Motor," by Mr. J. T. Deremer, of the Westinghouse Electric & Manufacturing Company; "The Commercial Electric Vehicle," by Mr. A. C. Downing, Pacific Coast sales engineer for the electric vehicle department of the Studebaker Automobile Company; "Electric Pleasure Vehicles," by Mr. F. W. Pfaffman, of Los Angeles, representing Rauch & Lang, of Cleveland; "The Electric Garage," by Mr. S. P. Reed, of the Reed Electric Laboratory, San José, Cal.

A lively discussion followed the presentation of the papers, much interest being taken in the present and future status of the electric vehicle in San Francisco and the other coast cities.

The social features were well taken care of by the Electric Storage Battery Company and the Studebaker Brothers Company. They included a theater party, followed by a supper one evening and a banquet at the close of the convention. An interesting hill-climbing exhibition was given by Mr. William Harvey on Friday, who drove a Babcock electric up the Powell Street Hill, one of the steepest ascents in San Francisco. A general automobile run through Golden Gate Park had been planned, but had to be omitted because of inclement weather.

At the banquet on Saturday evening permanent organization was effected by the formation of the Pacific Coast Electric Automobile Association. Officers for the ensuing year were elected as follows: President, Mr. R. B. Daggett; vice-president, Mr. A. C. Downing; secretary-treasurer, Mr. J. T. Halloran. These three officers were constituted a governing board to manage the affairs of the association, select committees, etc. Oakland was selected as the place for the next annual meeting in February, 1910.

Details of Telephone Census Statistics and Methods.

The recent publication of the telephone statistics of 1907 by the United States Bureau of the Census has given rise to criticism in some "independent" telephone quarters, where disappointment is felt because the "independent" figures shown in the returns fall so far short of the claims made by interested parties. Under these circumstances, as a means of demonstrating the accuracy of the figures given in the general preliminary report, published in these pages on Feb. 4, Mr. W. M. Steuart, chief statistician of manufactures in the Census Office, has given out the subjoined table of detailed figures, State by State, which bring out the curious fact that the Census figures in the few disputed cases exceed those put forward from "independent" sources:

NUMBER OF STATIONS OR TELEPHONES, BY STATES, DEC. 31, 1907.

	Total.	Independent (Non-Bell).	Bell (American Telegraph & Telephone Company).	Independent stations connected with Bell System.
United States	6,118,578	2,986,515	3,132,063	*835,880
Alabama	40,481	14,985	25,496	3,944
Arizona	6,203	3,148	3,055	....
Arkansas	49,576	32,150	17,426	10,265
California	237,672	65,977	171,695	9,607
Colorado	65,908	4,473	61,435	1,620
Connecticut	63,898	1,815	62,083	352
Florida	17,522	11,160	6,362	3,691
Georgia	62,260	26,204	36,056	9,072
Idaho	16,394	5,754	10,640	1,288
Illinois	558,585	285,322	273,263	109,101
Indiana	289,452	216,990	72,462	50,065
Iowa	332,545	279,773	52,772	74,806
Kansas	200,233	161,913	38,320	66,880
Kentucky	93,996	51,796	42,200	9,038
Louisiana	35,692	6,184	29,508	4,351
Maine	53,134	16,024	37,110	7,830
Maryland, District of Columbia and Delaware	110,282	19,896	90,386	217
Massachusetts	209,383	5,324	204,059	650
Michigan	209,842	106,049	103,793	30,033
Minnesota	171,479	114,618	56,861	46,547
Mississippi	37,627	13,567	24,060	5,235
Missouri	312,527	220,823	91,704	82,393
Montana	17,168	8,118	9,050	846
Nebraska	153,279	105,610	47,669	45,252
Nevada	3,601	2,081	2,520	734
New Hampshire	28,920	6,488	22,432	2,482
New Jersey	116,988	10,134	97,854	831
New Mexico	6,653	3,476	3,177	749
New York	685,512	180,759	504,753	23,902
North Carolina	37,104	20,597	16,507	4,714
North Dakota	34,088	26,615	7,473	20,652
Ohio	495,636	312,278	183,358	29,284
Oklahoma	68,125	38,009	30,116	30,[illegible]
Oregon	49,629	16,253	33,376	[illegible]
Pennsylvania	150,403	124,582	25,821	[illegible]
South Carolina	20,911	[illegible]	[illegible]	[illegible]
South Dakota	48,495	44,[illegible]	[illegible]	[illegible]
Tennessee	71,130	56,[illegible]	[illegible]	[illegible]
Texas	187,892	138,[illegible]	[illegible]	[illegible]
Utah	30,600	20,[illegible]	[illegible]	[illegible]
Vermont	20,831	[illegible]	[illegible]	[illegible]
Virginia	[illegible]	[illegible]	[illegible]	[illegible]
Washington	[illegible]	[illegible]	[illegible]	[illegible]
West Virginia	[illegible]	[illegible]	[illegible]	[illegible]
Wisconsin	[illegible]	[illegible]	[illegible]	[illegible]
Wyoming and Rhode Island	30,605	1,538	29,067	1,267

*Figures furnished by American Telegraph & Telephone Company. Included in total for Independent.

In this connection Director North, of the Census Bureau, has addressed a careful and exhaustive letter of explanation as to Census methods to the Nebraska Independent Telephone Asso-

cation, a copy of which has been given to the press. In the course of this he says:

"The statistics contained in this preliminary statement are, of course, subject to such corrections as may be found necessary upon a further examination of the reports and comparison of the tabulations. Subject to these possible corrections the 2,986,515 independent telephone stations may be accepted as the total number of such stations that were in operation during 1907.

"At the census of 1902 the office experienced great difficulty in obtaining a satisfactory enumeration of the small independent telephone companies and the farmer, or rural, lines. Therefore great care was taken at the census of 1907 to enumerate all lines of this character. In the first instance a complete card index was prepared, giving the names and addresses of all telephone companies and independent farmer lines. The basis of this index or list was the reports made at the census of 1902. But in addition to this, the postmasters throughout the entire country were required to furnish the names and addresses of all telephone companies and individual farmer or rural lines operating in their cities or immediate vicinity. State officials were also requested to furnish lists of the telephone companies in their respective States, and fairly complete lists were received from the majority of the States; county officials were requested to furnish lists of the names and addresses of farmer or rural telephone lines. These officials in a number of the States preserved records of this character in connection with the requirements of taxation, etc., and a great deal of information was obtained from them. All of the independent telephone associations were also requested to furnish the names and addresses of their members, and of any other companies or independent lines, and fairly complete lists were received from associations in at least 11 States. The International Independent Telephone Association of Chicago furnished a fairly complete list, names and addresses of telephone companies were also obtained from the city directories for all cities having a population of 50,000 and over.

"Blank schedules were mailed to all of the companies and individual lines named on the lists prepared from the sources indicated, and in addition to soliciting the statistics required for the census, each company was requested to give the names and addresses of all connecting farmer or rural lines and of other companies or lines in the vicinity. A large number of additional names were secured from this source. The original lists prepared from these various sources contained in the neighborhood of 35,000 telephone properties, but this total included a large number of duplications. However, the Office was not satisfied that it had a complete list, and therefore in arranging for the canvass schedules were in the first instance sent to the companies, and then the entire United States was subdivided into 84 enumeration districts and one or more agents assigned to each district. These agents were given the names and addresses of all of the telephone companies and farmer or rural lines located in their respective districts, and they were instructed not only to secure census reports from each company, but to make careful inquiry for any other companies and lines that were in operation during any part of the year 1907. Each agent was held to a thorough canvass of his district. I believe that by the application of these methods the entire country has been pretty thoroughly covered and that the Office secured returns from practically all companies and lines that were in operation during any portion of the year. In all work of this character, however, there is a possibility of some omissions, but in this instance the omissions are evidently very few and unimportant."

Chemical Elements.

At the February meeting of the Pittsfield Section of the American Institute of Electrical Engineers, Dr. W. R. Whitney, director of the Research Laboratory of the General Electric Company, in Schenectady, N. Y., gave an instructive talk on chemical elements, pointing out their different characteristics, such as atomic weight, melting points, etc. He stated that the various elements bear certain definite relations to each other, and may be arranged in natural groups according to their atomic weights. So perfectly has this arrangement been worked out that there is only one place in a group into which a given element will fit and it is therefore possible to predetermine with great accuracy the character of a number of elements which are known to exist but have not as yet been discovered. This knowledge of the interrelation between elements is also of great assistance in carrying on investigations as it often points out the way to new discoveries and new uses to which various materials may be adapted. For example, tungsten, of which the filaments of incandescent lamps are now made, was known to be suitable for this class of work long before it was possible to handle it commercially.

A Ladies' Electrical Luncheon.

The Buffalo General Electric Company entertained the Buffalo Chapter of the Daughters of the American Revolution and their guests at the Twentieth Century Club, in that city, on Feb. 22. The stage was arranged with a quaint old-fashioned setting, with wide fireplace, old-time open-hearth cooking utensils and 18th century furnishings. Just below the stage, in sharp contrast, was placed the most modern electrical kitchen, where electrical appliances were used for baking, roasting, broiling and coffee making. Many other household appliances were exhibited about the room, and the official insignia of the society was shown in electrical display above the stage. The total attendance was 1864, and luncheon, every part of which was electrically cooked in the room, was served to 1250 ladies. Color was given to the entertainment by the costuming of all the waitresses and attendants in Colonial dress. The entertainment was for the purpose of impressing upon the housekeepers the convenience and economy of electrical household appliances, which the Buffalo company is especially pushing.

British Illuminating Engineering Society.

An informal dinner was held at the Criterion Restaurant, Piccadilly, London, on Feb. 9, at which the formation of an illuminating engineering society in Great Britain was the subject of discussion. Mr. Leon Gaster presided at the meeting, which included representatives of the engineering, architectural, medical and other interested professions.

At the conclusion of the dinner Mr. Gaster briefly described the development and progress of the illuminating engineering movement in Great Britain, and explained the objects of the proposed society, namely, to provide a free and impartial platform for the discussion of questions connected with illumination. He emphasized especially the fact that what he proposed was an "illuminating engineering society" and not a society of "illuminating engineers." Anyone interested in furthering the science and art of illuminating engineering would be eligible to join the society, but membership would not entitle anyone to any professional status. In this respect the society would resemble similar and flourishing institutions already existing in Great Britain.

An animated discussion followed, in which all who spoke expressed their warm approval of the suggested scheme, and their conviction that the time was ripe for starting such a society. It was proposed and carried unanimously that the *Illuminating Engineer*, published in London, be appointed the official organ of the society.

CURRENT NEWS AND NOTES.

AMERICAN-GERMAN PATENT CONVENTION.—A dispatch from Washington states that a patent convention with Germany was signed Feb. 23 by Secretary of State Bacon and Count Johann von Bernst, the new German Ambassador. The treaty is designed to prevent either government from passing laws requiring that foreign patents must be manufactured in the country in which protection is asked. The treaty must be ratified by the Senate to become operative.

NO WIRELESS REGULATION.—Toward the close of Congress it was decided to let the whole matter of compulsory wireless legislation go over until the session of next winter.

WINNIPEG MUNICIPAL PLANT.—The City Council of Winnipeg, Manitoba, has asked the county court to investigate with a view to learn the reason of the excessive cost of work on the city's high-tension power plant, and ascertain why it has cost the city $200,000 to acquire what two responsible firms offered for $129,000.

EXTENSION BEYOND VILLAGE LIMITS OF MUNICIPAL SERVICE.—A bill has been introduced in the New York State Legislature authorizing the extension of the lines of village municipal electric lighting plants beyond the limits of villages. If, however, the estimated expense of such extensions exceed $500 in any year, the expenditure must be approved at an election.

WIRELESS TELEGRAPHY IN TRAIN SERVICE.—A special train on the Lake Shore Railroad was kept in wireless-telegraphic communication with Cleveland and Chicago while running at full speed between these places on Feb. 27. A temporary wireless station was installed in the buffet car, a wire arranged along the roof of the car serving as the antenna. About 800 words were sent and successfully received. It is said that additional tests will soon be made of the system to determine its reliability.

GREAT AMERICANS.—The *New York Herald* has recently been conducting a "competition" in which its readers have been asked to name the men whom they consider to be the 10 leading Americans. The work has just been completed, with interesting results. The list is headed by Mr. Thomas A. Edison, to whom comes Mr. Andrew Carnegie as second. The last in the 10 is Dr. Alexander Graham Bell, and just succeeding, outside the 10, is Mr. George Westinghouse. Mark Twain is the most popular author as one of the 10.

SAULT WATER POWERS.—The U. S. Senate has adopted an amendment to the Rivers and Harbors bill which provides that any water in the river of Sault Ste. Marie in excess of the amount necessary for the use of navigation shall be leased by the Secretary of War for power upon the payment of such charges as are reasonable and best adapted to insure the development and commercial progress of the communities affected. The House adopted a provision that the government shall take over the property of all the power companies except the Michigan and Lake Superior Company.

MAYOR AGAINST MUNICIPALISM.—In opposing a plan for the purchase by the city of the Williamsburg ferries on the East River, this week, Mayor McClellan said: "For my part, I am not, as a general proposition, in favor of committing the city to the operation of ferries at a loss. I look upon municipal operation as a last desperate resort and something that should not be resorted to until all other resources have failed. For that reason, while we were obliged to take over the Staten Island and Thirty-ninth Street Ferries, I do not look favorably upon taking over other ferry properties."

BRITISH PATENT ACT.—The British Comptroller General of Patents has revoked a patent owned by the British Westinghouse Electric Manufacturing Company relating to arc lamps. It was held that while 1308 arc lamps covered by the patent were manufactured at Trafford Park up to October, 1908, a German company to which the Westinghouse granted a license exported between 1906 and 1908, 9856 lamps, and the Comptroller decided that on evidence before him he is satisfied that the patented article is not manufactured to an adequate extent in the United Kingdom. Subject to an appeal to court, he therefore revoked the patent and ordered the patentees to pay to the applicant the sum of 75 guineas in respect of his costs.

ELECTROCHEMICAL SOCIETY.—The New York section of the American Electrochemical Society held a meeting at the Chemists' Club on March 1, at which time papers were presented by Dr. F. K. Cameron, of the U. S. Department of Agriculture, and by Dr. L. H. Baekeland. Dr. Cameron described a slide-wire bridge for measuring the resistance of moist soils and thereby determining the character of the soils. Dr. Baekeland explained in detail the process of manufacture of numerous articles containing "bakelite," which he exhibited. Bakelite is a coal-tar product, claimed to possess the properties of amber, rubber and celluloid, which can be used as an impregnating material for insulating purposes.

PROPOSED CHANGE IN FRENCH PATENT LAW.—The principal provision of the bill introduced by the French government to amend its patent law provides that patent rights shall be held to lapse in the event of failure on the part of the holder either to exercise his right in France or in the French colonies for a period of three years after applying for his certificate, or to resume exercise of after a similar interval; or, secondly, in the event of only partial exercise of the patent in French territory. In the second event the patent courts will be invested with discretionary power to call upon the holder of the patent to show cause why he should not exercise his rights in French territory "in an adequate degree."

MICHIGAN WATER-POWER REQUIREMENT.—The water-power investigation committee of the Michigan Legislature, which has been looking into the granting of a franchise to the Eastern Water Power Company on the Au Sable River, has advised the supervisors of Oscoda County that they should reduce from five to two and a half years the time within which the company may begin work of development and should increase the price of the franchise, which was fixed at $100 by the board of supervisors, and should require the power company to furnish a bond that the proposed dams will be built; that a concession in rates should be made to the people of Oscoda County at distant points supplied by transmission lines, and that the entire franchise proposition should be submitted to the people at the April election.

VICTORIA FALLS POWER.—At a recent meeting of the Victoria Falls Power Company in London the name of that company was changed to the Victoria Falls & Transvaal Power Company, Ltd. It was stated that while when the company was promoted one of its objects was to generate power at Victoria Falls for transmission to Johannesburg it has not been possible up to the present time to obtain the permission of the Transvaal government to run transmission lines from the Rhodesian border to Johannesburg. Another portion of the scheme was to construct new steam stations on the Witwatersrand and also to work stations that had been purchased. One of the latter has had its capacity increased by 8000 hp and a new station of 16,000 hp is under construction. During 1907 the profits of the company were $180,000 and the profits of last year were practically the same.

MESSAGES FROM MARS.—The wireless telegraph operators at Mount Wilson, Cal., state that they have recently been receiving signals in some curious code that is neither Morse nor Continental nor anything else legible. These signals are quite strong, and the operators have been conjecturing that they may come from Mars. Mr. Nikola Tesla writes us on this surmise: "I do not believe that the operators are observing the same disturbances which I have already noted in Colorado, because I had to use a device of wonderful sensitiveness, which I have reason to believe is not yet known to the wireless people. I rather think it is likely that a plant somewhere is producing stationary waves; and I have an idea that it must be located in Japan, as the Japanese experts saw me during 1900 and adopted my system at that time. Should the reports continue, I shall make an investigation. It will not be difficult if such is the case to locate the transmitting plant very closely."

ERIE LEGISLATION.—A bill recently introduced in the New York State Legislature provides that "insulators made of glass distinctly red in color" shall, for better security to life, be used in pole-line construction.

MINNESOTA CONVENTION.—The convention of the Minnesota Electrical Association is to be held at the Nicollet Hotel, Minneapolis, March 18 and 19, in accordance with the program published in the *Electrical World* of Jan. 21. The first session is to be held at 9:30 a. m., March 18. The secretary is Mr. Ludwig Kemper, of Albert Lea, Minn. The program prepared is an attractive one for the practical central-station operator.

WIRELESS COMMUNICATION WITH AERIAL CRAFT.—According to a Boston dispatch Mr. Chas. J. Glidden is having powerful wireless apparatus installed in his apartments in that city for the purpose, it is said, of communicating with any aerial craft carrying wireless equipment that may be flying east of the Mississippi River. He proposes to use a balloon equipment as part of the system.

MASSACHUSETTS PROPOSED RATE REGULATION.—A hearing was given by the committee on public lighting of the Massachusetts Legislature on Feb. 26 on a bill to permit the Board of Gas and Electric Light Commissioners to examine the returns of electric and gas lighting companies with special reference to their bearing upon the rates in force, and to give the board power to initiate investigations as to whether the prices charged are discriminatory or excessive. Attorneys Burdett and Pillsbury for the central stations in Massachusetts opposed the bill on the ground that it is unnecessary.

NEW YORK SECTION I. E. S.—The next regular meeting of the New York section of the Illuminating Engineering Society will be held in the Engineering Societies Building, 29 West Thirty-ninth Street, New York City, on Thursday, March 18, at 8:15 p. m. The date is one week later than the usual time set apart for the meeting. Two papers will be presented—namely, "The Mathematical Theory of Finite Surface Light Sources," by Mr. Bassett Jones, Jr., and "Illuminating the Editorial Offices of the New York *World*," by Mr. Albert J. Marshall. These papers treat both the theoretical and the practical sides of illumination.

BOSTON EDUCATIONAL NOTES.—The Electrical Engineering Society of the Massachusetts Institute of Technology recently held a dinner at which the principal speaker was Mr. L. L. Elden, electrical superintendent of the Edison Electric Illuminating Company of Boston. Mr. Elden addressed the society on the work of the Edison company, with special consideration of the generating and distributing systems. The lecture was extensively illustrated by lantern slides. At a meeting of the Mechanical Engineering Society of the Massachusetts Institute of Technology, on the evening of Feb. 25, Mr. H. L. Coburn, of the Ambursen Hydraulic Construction Company, Boston, gave a lecture on hydro-electric plants. Prof. Charles E. Lucke, of Columbia University, gave a lecture in Boston on Saturday evening, Feb. 27, before the Society of Arts of the Massachusetts Institute of Technology on the history and development of the gas engine.

ELECTRIFICATION OF GERMAN RAILROADS.—In a report to the United States Bureau of Manufactures, Consul Thomas H. Norton, writing from Chemnitz, gives some data relative to the cost of equipping German railroads electrically. On the basis of calculation made by Ph. Pforr, it was estimated that steam locomotives cost about $0.1186 per pound, as compared with $0.1834 for the electric competitor. The latter is, however, relatively much lighter. A 600-hp electric freight locomotive weighs 92,593 lb. The usual types of steam locomotives of the same power weigh 125,400 lb. empty, and 167,000 lb. when charged with water, etc. On the basis of replacing 64 per cent of the present stock by electric locomotives, the entire railway systems would require an outlay of $143,750,000 for electric locomotives to replace the present supply of steam locomotives, which cost $167,000,000. The opinion was expressed that in the early future electricity will displace steam entirely or in great part on all of the leading German lines.

INDIANA TELEPHONE LEGISLATION.—Indiana independent telephone interests are urging the passage of the Wells bill to enable one telephone company operating under an Indiana charter to take over by lease or purchase another company operating under similar conditions, as being the best means for successfully contesting the inroads of the Bell company and preventing the ultimate establishment of one system throughout the State. Under the present law one independent company cannot sell its stock to another, and under such limitations the Bell becomes the only logical purchaser of small companies whose managements have not been successful. It is contended that if the independents are given the right to merge the strong companies will take over the small companies and strengthen the independent system throughout the State and thus be on an equal footing with the Bell, which operates under a foreign corporation charter. Representative Weekey has introduced a bill which, it is claimed, would compel all telephone companies operating in the same territory to make physical connection of their exchanges.

EDISON ON EDUCATION.—In an article in the Yale *News*, Mr. Thomas A. Edison expresses the opinion that a college education is decidedly not essential as a preparation for a young man about to enter upon a scientific career. He believes that the purely academic training is a great waste of time, since in four years no one can learn all the essential points of science, and four years of active experimental work will be of much greater value than an equal amount of time spent in obtaining a college education, in spite of the fact that the minds of college men are better trained, and therefore obtain further learning more easily. He adds that what the country needs now are engineers, industrial men, good business managers and railroad men, though in three or four hundred years, when the country is settled and commercialism is diminished, there will be time for literary men. His greatest objection to a college education for a scientist is that academic learning is old and does not keep progress with the times; if colleges could teach their men to become first-class draftsmen, that would be a great advance, for skilful drafting implies that a man can do anything.

THE PUBLIC AND THE ELECTRIC SUPPLY COMPANIES.—In giving a report of the company's recent work, the chairman of the London Electric Supply Corporation, the Earl of Crawford, stated that the history of the treatment of the electrical industry in London is a curious episode in the attitude of popular government toward money-making. The popular agitation in England has been against the London electric companies as if they were making too much money and blocked the way. He remarked that "More business sense, as Mr. Carnegie calls it, now prevails. The idea is exploded that cheap power can be made by act of Parliament, and that if the electrical companies pay big dividends it necessarily means dear power and the consumers' loss. I hope and think that, by the act passed during the last autumn session, the policy of taking care of the consumer at the expense of the producer is abandoned in the electrical industry once for all, and that we shall henceforth be free to make fair dividends till 1931, and then hand over a group of prosperous undertakings to the London County Council without any loss of capital being inflicted on our shareholders." The report showed that the corporation had sold last year 3,000,000 kw-hours more than the year before; the extra cost for production, however, was increased by only $3,440 on account of various improvements in equipment and operating methods.

Building and Boiler Plant of Waterside Station No. 2 of the New York Edison Company.

THE utter impossibility of foretelling what advance will be made in the electrical art and how soon existing machinery will be displaced by more efficient apparatus, or of even predicting at what rate the load in a large and progressive city will increase, is well illustrated in the case of the New York Edison Company. When, in October, 1901, Wateside Station No. 1 began to feed electrical energy into the network of the Edison company, with its initial generating capacity of 32,000 kw, it was felt that after all of the apparatus was installed and the station was capable of generating over 64,000 kw, there would be an ample supply of electricity for many years to come. The thought perished, however, before the station was in operation more than three years. So rapidly did the load increase that a newer and larger Waterside had to be erected and placed in operation just as soon as the machinery could be turned out.

The advance made in the art is strikingly illustrated in the engravings showing the generator rooms of both stations. Here is a remarkable example of the evolution in power-plant practice resulting from the perfection of the steam turbine as a prime mover. When the first Waterside station was designed, the steam turbine had scarcely been considered in units of large capacity; but its development was so rapid and so successful that before all the generating apparatus in Waterside No. 1 had been installed, the advantages of the steam turbine were sufficiently apparent to warrant the installation of turbines instead of the last few engine-driven units as originally intended. Even in the design of Waterside Station No. 2 it was thought advisable to provide for either vertical reciprocating engines, or for either or both types of steam turbine units of the maximum size then developed; thus necessitating a compromise between the demands of the various designs. The operating room was laid out to contain 12 6000-kw vertical, engine-driven units or 16 5000-kw vertical turbine units, or 12 5500-kw horizontal turbine units. Further developments in the turbine field and certain operating conditions have determined the final layout.

Waterside Station No. 2 was placed in operation in November, 1906, and the last unit was installed in Waterside Station No. 1 in 1907. The difference in the design of both stations may be briefly summarized as follows: Waterside Station No. 1 was originally designed for 16 3500-kw engine-driven units. The equipment actually installed consists of 11 3500-kw vertical steam-engine-driven units, three 10,000-kw and two 5000-kw vertical turbine units. The boiler room contains 56 water-tube boilers, 19 of which are fitted with inclined-grate stokers and 8 with superheaters. Thirty-seven of the boilers are fitted with flat grates for burning buckwheat No. 3 coal. The grates are 9½ ft. deep and 12 ft. 7 in. wide. The boilers are arranged in two double-decked rows, one on each side of the boiler room, 14 in a row, or 28 on a side. Eight of the boilers are equipped with superheaters. Coal is received on a tower hoist with duplicate bucket conveyor for distributing the fuel to bunkers holding 12,000 tons. The ashes are dumped into hand-operated cars and are elevated by a skip hoist for final disposition. Reciprocating feed-water pumps are used, and closed feed-water heaters, primary heaters being inserted in the engine exhaust and secondary heaters in the boiler feed lines. The auxiliaries are all steam-driven and surface condensers are used on all the apparatus in the generator room. Waterside No. 2 at present contains six 8000-kw vertical turbo-generators, two 7500-kw horizontal turbine units, one 14,000-kw vertical unit and another 14,000-kw vertical unit is about to be installed, completing the equipment of the station. Surface condensing equipment is used on these units. The circulating pumps on eight of the condensers are centrifugal, engine-driven, and on two are turbine-driven. There are four reciprocating and six turbine-driven centrifugal hot-well pumps. Rotative dry-vacuum pumps are employed on all the condensing apparatus. Open feed-water heaters are used through out. The boiler room contains 96 water-tube boilers rated at 650 hp. The boilers are fitted with superheaters and are arranged upon the cross-fire room plan. Twenty-four of them have 10-ft. shaking grates, 13 are fitted with underfeed stokers five are not yet equipped, and the rest have 12 ft. grates.

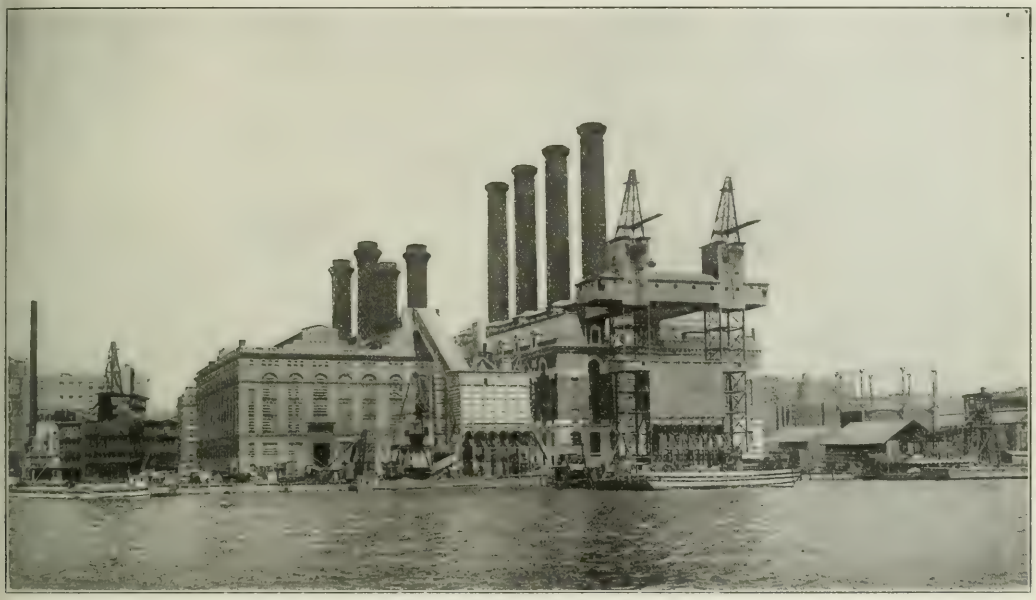


FIG. 1.—WATERSIDE STATIONS OF THE NEW YORK EDISON COMPANY HAVING AN AGGREGATE MAXIMUM RATING OF 330,000 HP.

Fifty-four of the boiler furnaces have arches and the 24 boilers fitted with 10-ft. grates have no arches. The same fuel is used as in the other station. Instead of a bucket conveyor the fuel is delivered to the bins in cable-drawn dumping cars. The ashes are removed in cars which are pulled by electric locomotives equipped with storage batteries. A bucket-conveyor is at present used to hoist the ashes to the storage bin, but a skip hoist, now in course of erection, will supersede this arrangement and the bucket conveyor will be held as a reserve.

THE BUILDING.

Waterside Station No. 2 is erected at First Avenue, Thirty-ninth and Fortieth Streets and the East River immediately adjoining Waterside Station No. 1. Fig. 1 shows both stations from the river, and Fig. 4 is a front view. The building occupies a trapezoidal plot fronting on First Avenue for a distance of 197½ ft., extending back on Fortieth Street a distance of 347 ft. 2 in., and on Thirty-ninth Street a distance of 336 ft. 1½ in. The structure is divided into two parts—an engine room 73 ft. 10 in. wide and a boiler room 119 ft. 8 in. wide, the dividing line being parallel to Thirty-ninth and Fortieth Streets. Architecturally, the building is somewhat more ornate and pleasing in appearance than the older station. A base of granite extends to the height of the second story, above which rise red brick walls surmounted by a terra-cotta cornice. All the wall and dormer window trimmings are of terra cotta, while the roof monitors have a copper finish. The roof of the boiler house is covered with Spanish roll tile on the mansard portion, while all flat sections of the turbine and boiler room roofs are of cinder concrete construction, covered by flat tiles. A feature of the exterior is the window treatment, the windows being surmounted by a terra-cotta arch which rises from the entablature of terra cotta surrounding the structure. The window in the First Avenue end of the turbine room received special treatment with a very pleasing result and is surmounted by a terra-cotta setting bearing the name of the company.

The structure is fireproof throughout. Brick and concrete have been used in connection with the steel skeleton. The boiler room and turbine room floors are of very heavy construction, designed for uniform loads up to 600 lb. per square inch. In addition the structure carries on the boiler-room side five large bins capable of holding 20,000 tons of coal. The bins are of reinforced concrete construction with vertical stiffeners of I-beams embedded at intervals. The roof structure above

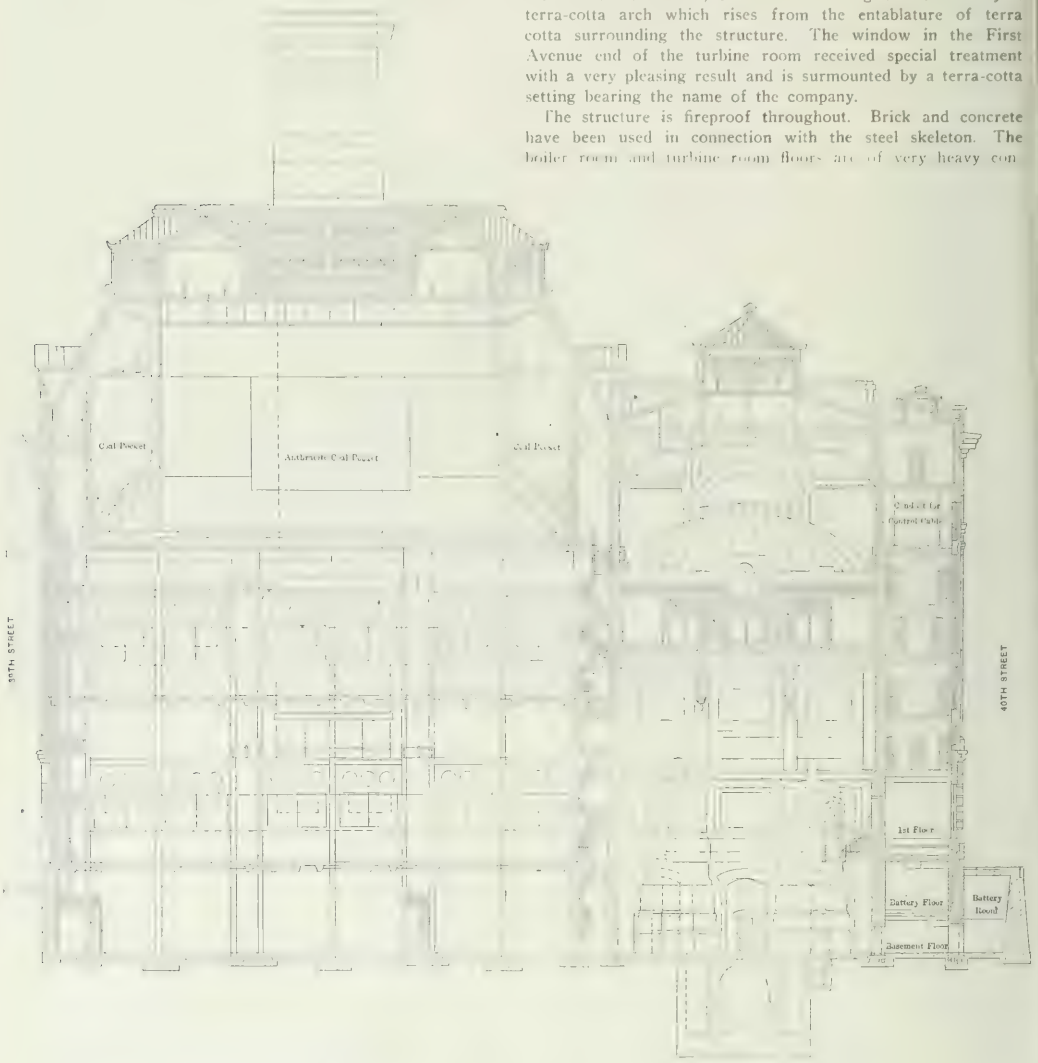


FIG. 2.—ELEVATION OF WATERSIDE STATION NO. 2 OF THE NEW YORK EDISON COMPANY.

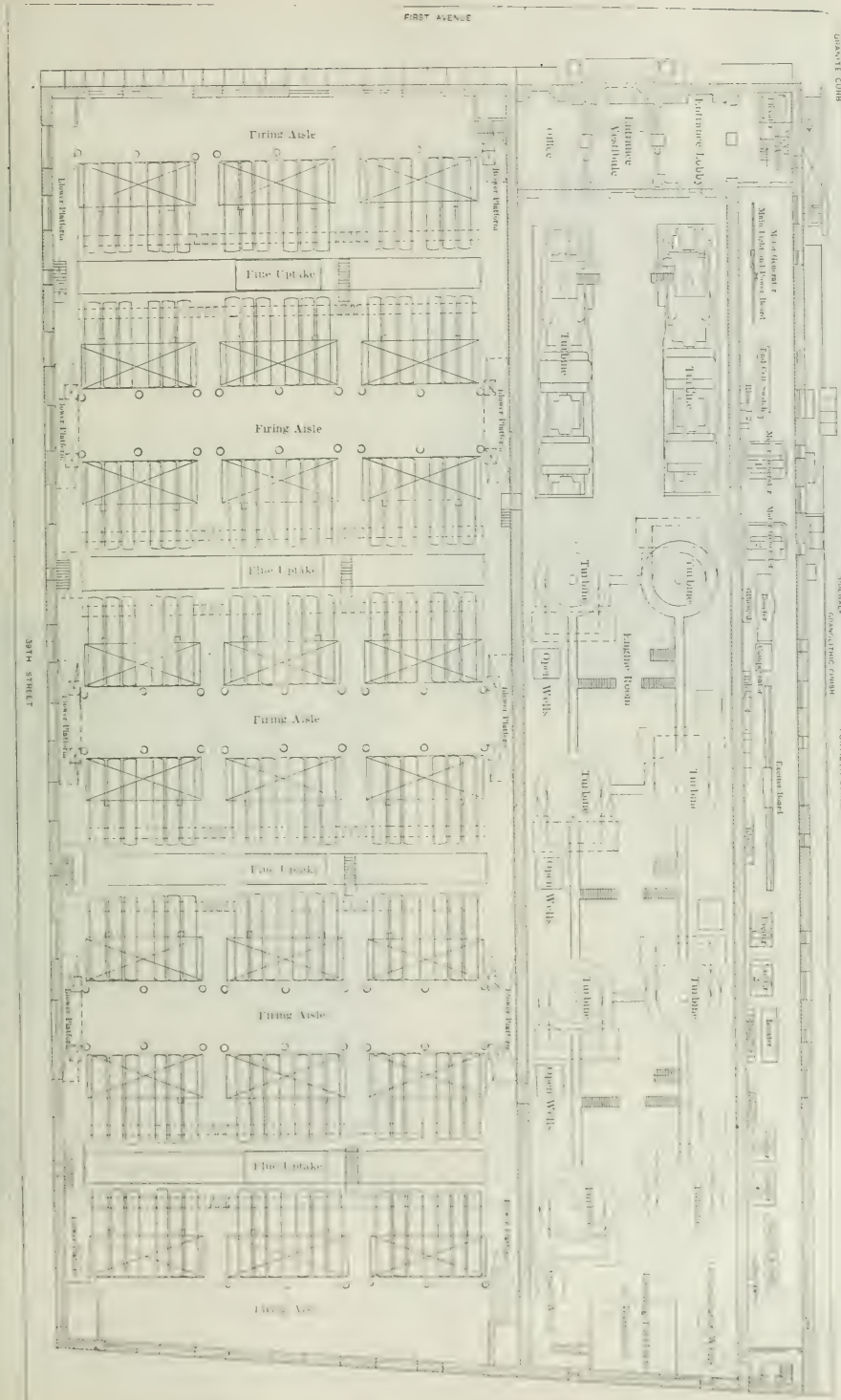


FIG. 3.—PLAN VIEW OF WATERSIDE STATION NO. 2 OF THE NEW YORK EDISON COMPANY, DESIGNED FOR AN ULTIMATE MAXIMUM EQUIPMENT OF 200,000 H.P.

the turbine room is carried by trusses having a 57½-ft. span surmounted by a 20-ft. monitor for lighting and ventilation. The boiler-room roof, monitors and coal-handling apparatus are carried by a series of 72-in. plate girders and 15-ft. Pratt trusses, all of 90-ft. span. In the turbine room are a 50-ton and a 75-ton crane, with a span between runway rails of 52½ ft. For the circulation water inlet and discharge tunnels, a trench



FIG. 4.—EXTERIOR VIEW OF WATERSIDE STATION NO. 2.

approximately 35 ft. wide and 30 ft. deep was blasted out of the rock upon which the station was built. The boiler-room basement is 20 ft. high, and the boiler-room floors are 36 ft. and 34 ft. high, respectively. Above this a space about 50 ft. high, up to the roof level, is occupied by the coal bunkers. The coal-handling system is accommodated in the roof monitors. The turbine section has a 25-ft. basement, in which the condensing apparatus is placed. The turbine room itself has a clear height of 88 ft. under roof trusses. The group of galleries at the Fortieth Street side of this room consists of six mezzanine galleries above the main floor for the switching apparatus and a basement gallery for a substation and reserve exciter storage-battery equipment. A system of galleries is provided at the First Avenue end of the turbine room for the accommodation of offices for the station operatives and the electrical and mechanical construction departments. At the top, surmounted by a glass dome, is the main station switchboard and control board. From this gallery the entire electrical equipment of the station is under supervision and control.

The interior finish of the station is worthy of mention. The entire exposed surfaces of the walls of the operating room, from the level 25 ft. above the finished basement floor up to the underside of the roof arches, and the exposed surfaces of the walls enclosing the high-tension switchboard room on the third mezzanine floor at the westerly end of the operating room, are fitted with "Grueby" glazed faience tile. The wainscoting or base from the operating-room floor up to the level of the first mezzanine floor is built out 8 in. beyond the face of the walls above and two shades of green tile are used; the ground being of a dark shade and the panels of a lighter shade of green. From the space between the top of the wainscoting up to the underside of the crane girders, the ground is of flat gray with panels of purple. The space between the top of the corni under the crane girders up to the underside of the roof arch is finished in white tile. The pilasters, pediments, architrav and the continuous ornamented cornice under the crane girde for both sides and end of the operating room are finished gray glazed faience. The walls of the high-tension switc board room, on the third mezzanine floor, have a white ti ground.

The exposed surfaces of the wall of the exciter room on t main floor at the northerly side of the operating room, the su face of the walls of the stair hall on each of the six electric mezzanine galleries, including the walls of the stair halls on t main floor and battery-room floor level at the easterly end; t surfaces of the four walls enclosing the stair and elevator hal on each of the six northerly electrical mezzanine galleri at the westerly end, and also from the mezzanine battery-floo level up to the main floor, are finished in white enamel brick The surfaces of the inside of the walls enclosing the high tension galleries on the first, second, third and fourth mez zanine floors, the control pipe runway room on the sixth mez zanine gallery and the oil-switch structure are of shale but vitrified brick.

The flooring of the main entrance vestibule, entrance lobb and the stair and elevator hall on the main floor under th westerly mezzanine galleries is finished in white marble mosai with a decorative border of colored marble mosaic of a Greek fret design. A seal or monogram of the company, about 30 in in diameter, executed in colored mosaic is placed in the cente of the floor of the lobby. The surface of the walls, columns pilasters and piers, and the door and window jambs and trim and room bases of the vestibule, entrance lobby and the stair

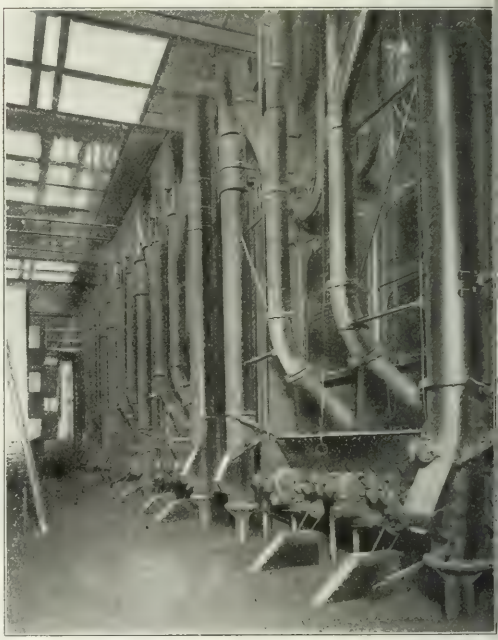


FIG. 5.—AISLE OF BOILERS EQUIPPED WITH STOKERS.

and elevator hall are finished in marble. The entire area of the floor of the high-tension switchboard room, on the third mezzanine floor, is covered with an interlocking rubber tile.

From the above it is evident that much thought has been given to make the interior of the station as finished in appearance as any high-class office building. The scheme has been well executed, with the result that the traditional power house

ith its dirty walls and oily floors is as different from Waterde No. 2 as a hut is from a palace.

COAL- AND ASH-HANDLING APPARATUS.

The 96 boilers in the station will require at period of aximum demand an average of 150 tons of hard coal per our, which is delivered to them from steel and concrete unkers over 80 ft. above the ground. Five bunkers exnd across the full width of the building and alternate ith the four smokestacks on the same horizontal center ne. The three intermediate bunkers have a single large bin olding 5000 tons of hard coal without trimming and two small de bins have a capacity of 300 tons of coal. The end bunkers ontain approximately 3200 tons of coal, giving a total storage apacity of about 20,000 tons. The bituminous coal is delivred in boat-load lots of about 800 tons each, and the small uantity for which storage is proided is used chiefly in the stokers nd for mixing with the buckwheat oal used in the hand-fired boilers.

The bunkers are filled by 3-ton utomatic dump cars traveling in a ontinuous circuit on loop tracks that rovide two lines parallel to the axis f the building and extend beyond he power house to the top of the oal tower. The tracks are near he center line of the building, are bout 120 ft. above ground and are arried from the river end of the uilding to the hoisting tower on a leck-plate girder bridge having a pan of about 90 ft. The original lan called for soft-coal tracks at a evel of about 16 ft. below the upper racks and nearer the outer walls of he building, making a complete ciruit independent of the tracks above, ut the latter tracks were not installed. Soft coal is delivered on the ame tracks as the anthracite coal nd dumped in the bins at the front nd of the building. Two handperated distributors receive the soft oal as it drops from the cars overead and direct it to various parts f the front bin so that the bunker s well trimmed. At present the emi-bituminous coal used with the nthracite coal in the hand-fired oilers is brought to the boilers in arrows and mixed in the proportion f 20 per cent bituminous with 80 per cent buckwheat by the ireman. It is proposed to effect this mixing in the bins overead by unloading soft coal and hard coal at the same time nd timing the cars so that four cars of anthracite will dump ver each car of semi-bituminous coal. Intimate mixture is not equired, so that the plan should give the desired result.

It was originally intended to unload the coal boats with lam-shell buckets hoisted about 90 ft. and discharged into a receiving hopper, from which the coal would pass through a rusher to be delivered to the horizontal arm of a continuous ucket-conveyor system connecting both sides of the tower and levating the coal to the distributing tracks, 160 ft. above low water. Here the coal would be discharged into an eight-ton opper and thence into distributing cars on a scale platform. It was deemed advisable to avoid the use of conveyors for this purpose, and the height of the towers was increased to a total f about 240 ft., enabling the coal to be hoisted by the clamhell buckets at one operation to the maximum height. The hoist of about 180 ft. is believed to be the highest of its kind that has yet been attempted, and each of the two 1½-yd. buckets is calculated to make two trips per minute, thus giving a total capacity of 360 tons per hour.

The buckets are suspended from a trolley running on a horizontal arm of the stationary jib, about 40 ft. long, and operated by a Rawson & Morrison hoisting engine with two drums, one for lifting and the other for closing. The bucket is traversed by a trolley engine on the main engine frame and is steadied by a counterweight suspended from the end of the boom. The fuel is discharged into receiving hoppers, from which the semi-bituminous coal passes by gravity through a steam-driven crusher to a second storage hopper of about 10 tons capacity, provided with a bottom cut-off valve by which the coal is loaded into W-shaped side-dump cars standing on the scale platform and hauled by an endless cable across the bridge to the power house. Anthracite coal is handled the same way except that it is not passed through a crusher. There are two duplicate independent hoists at opposite ends of the tower, and

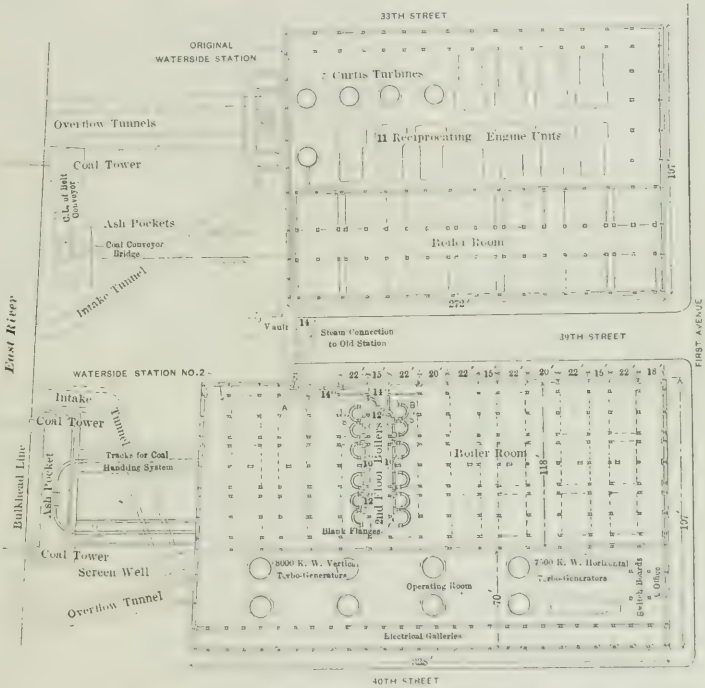


FIG. 6.—PLAN VIEW OF WATERSIDE STATIONS OF THE NEW YORK EDISON COMPANY.

in order to enable the tracks to pass under the crusher, the track floor is extended outside the tower columns and supported on heavy cantilever girders.

The tower has a steel framework about 240 ft. high, 110 ft. long and 25 ft. wide, which really consists of two 25 ft. x 25 ft. twin towers 240 ft. high and 80 ft. apart between centers, connected by an ash bin at a clear height of 40 ft. above high water and by the track platform at a height of 140 ft. above the water. Each of the twin towers is built with four vertical columns about 160 ft. high, divided into seven stories by longitudinal and transverse horizontal struts with bracing diagonals in the panels between them. Above the tops of the vertical posts, the towers have extensions with two vertical and two horizontal columns in each. The track floor is enclosed by a house about 25 ft. high and 140 ft. long, with extensions 20 ft. higher enclosing the bases of each of the pyramidal tops. The ash bin has a total height of about 60 ft., and is closed on all sides. Between the bin and the track floor the vertical space of about 45 ft. is occupied by a skeleton steel framework for an electric sign. No other portions of the structure are enclosed. The ash bin is supplied with exhaust steam to heat the wet ashes and prevent them from freezing in cold weather. The ash

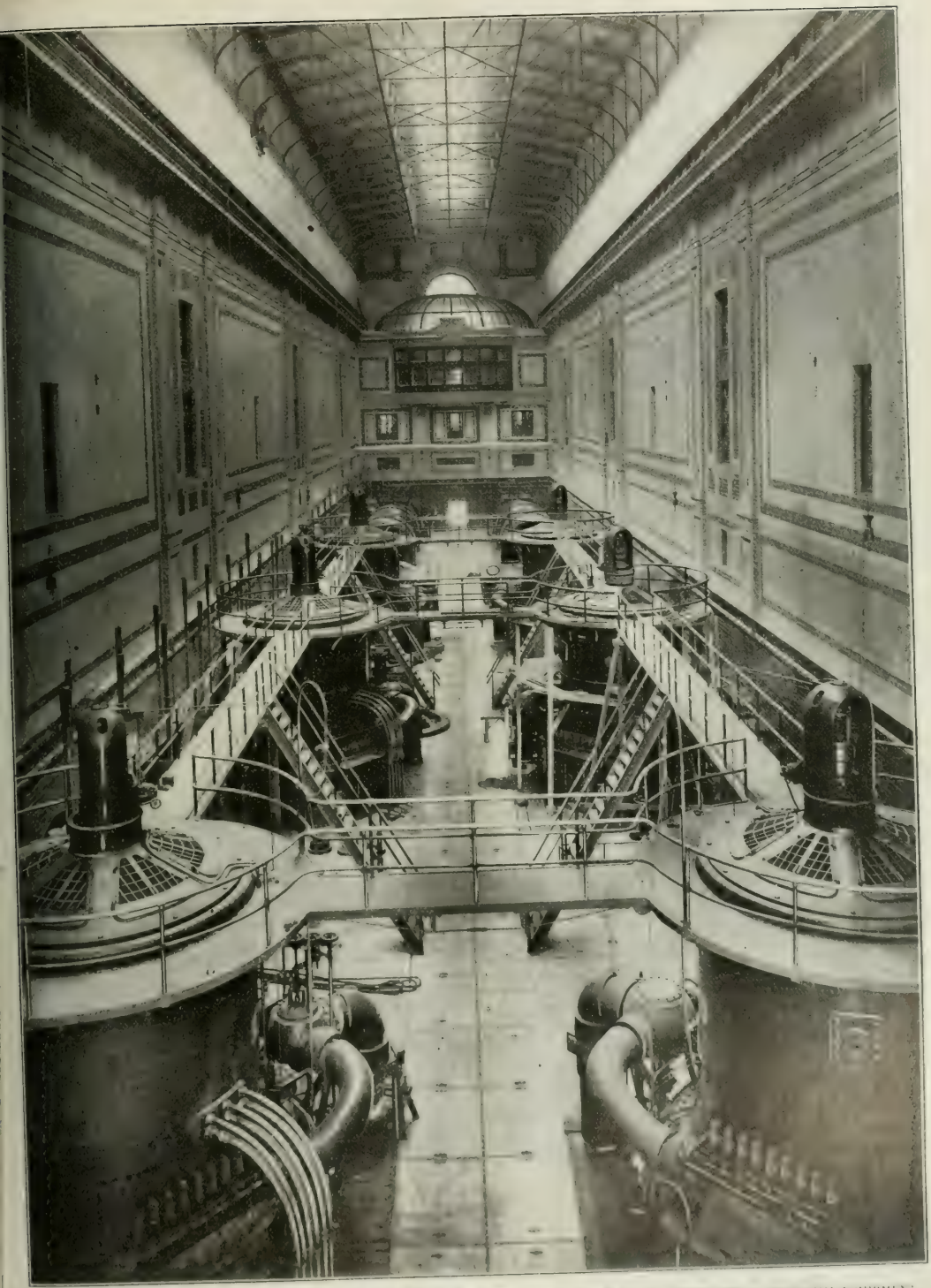


FIG. 8.—GENERATOR ROOM OF WATERSIDE STATION NO. 2, PLACED IN OPERATION IN 1906 AND DESIGNED FOR A MAXIMUM EQUIPMENT OF 200,000 HP.

bin holds approximately 1000 tons. It is fitted with a double set of very large fixed chutes commanded by vertical sliding gates that enable the ashes to be delivered to barges moored alongside the dock or to wagons on the street.

The bin is of very simple construction, with vertical end and side walls and a bottom inclined about 45 deg. downward toward the river. The walls and bottom of the bin are lined with concrete arches. In each panel of the floor a scupper nearly 3 ft. square is provided with connection to a fixed rectangular steel chute about 2 ft. square made of ¼-in. steel plate. The chutes are about 40 ft. long over all and have steep inclines so as to insure free discharge of the wet ashes. The lower end projects beyond the river face of the tower, and the bottom is bent vertical and is controlled by a cut-off valve through which the ashes are discharged into boats. Similar chutes are provided for discharging the ashes into carts under the tower. The bin has a flat concrete roof pitched toward the river. Two wooden platforms afford access to the mechanism for operating the chute valves.

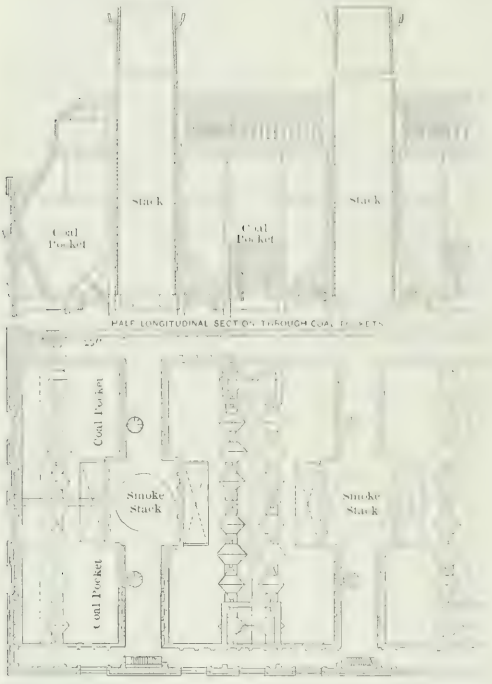


FIG. 9.—ARRANGEMENT OF COAL POCKETS.

All of the machinery in the tower is operated by steam, and the coal hoisting and conveying requires a total force of six men. The number required for handling the ashes is variable. The hoisting and lowering of each coal bucket is controlled by one man, and the traversing and dumping of it by a second man, both of whom watch the bucket continuously and do not rely upon signals. In order to provide an unimpeded view of the bucket for the hoisting operator, he is stationed in a projecting bay provided with side windows and a window in the floor through which he can view the deck of the coal boat; there are also provided at each end of the tower structure arc lamp projectors throwing a vertical beam of light for night operation.

The ashes are removed from the ash pits through chutes emptying into cars running on tracks beneath the ash hoppers. The cars are 6 ft. long and hold from 1½ cu. yd. to 2 cu. yd. They run on an industrial 2-ft. track with necessary switches, turnouts, etc., and are pulled by storage-battery locomotives operating at 80 volts. The locomotives are fitted with 44 cells of battery. Three are at present in use, one of which is kept in reserve. The ash conveyor is of the overlapping gravity-bucket type. The ashes are dumped from the cars into a hopper, as indicated in Fig. 13, and the conveyor discharges them into an ash pocket through a movable dumping block. The conveyor rises to the upper level of the ash pocket through the towers at the ends of the coal and ash structure and is provided with the necessary dumping mechanism, take-ups, drivers, guides, stops, etc. The entire coal- and ash-handling apparatus was installed by the Mead-Morrison Manufacturing Company, of New York City.

At present there is being erected a double skip hoist for disposing of the ashes. The ashes will dump from the cars inside the building into a loading hopper large enough to take two or three carloads of ashes so that it will not be necessary for the ash cars or locomotives to leave the building. The skip hoist will be operated by a 35-hp, 240-volt direct-current motor and will dump the ashes into the ash storage bin at present used. It is expected that by this means labor and maintenance costs can be reduced. The bucket conveyor will then be held in reserve.

BOILERS.

The boilers installed are all of the water-tube type, built by the Babcock & Wilcox Company. Each boiler is composed of 21 sections of 14 lap-welded charcoal-iron boiler tubes, each tube being 4 in. in diameter and 18 ft. long. The several sections are connected at each end to three 42-in. steam and water drums and at one end to a mud drum by means of 4-in. tubes. The steam and water drums are 22 ft. long and are connected to the back headers by vertical back-circulating tubes. The steel mud drums are 149 in. long and are provided with three hand-holes and two nozzles for blow-off connections. Each boiler is equipped with a superheater consisting of seamless steel U-shaped tubes expanded into forged-steel distributing and collecting headers. The superheaters are guaranteed to superheat the steam 100 deg. to 125 deg. above the temperature due to the pressure carried. Each boiler is rated at 650 hp, and is designed to deliver steam at 200-lb. pressure. The total heating surface is 6500 sq. ft.



FIG. 10.—COAL DISTRIBUTING CABLEWAY ABOVE BUNKERS.

Space is provided for 48 boilers on each boiler floor, or 96 boilers in all. There are upon each floor three main firing rooms, each having a row of three batteries of two boilers each on either side, and at either end of the building a half firing room with a single row of six boilers. This arrangement permits the use of four chimneys, each of which serves 24 boilers. Fig. 15

shows the details of the hand-fired boilers. All of the boilers are fitted with shaking grates, built by M. H. Treadwell & Company, Neemes Brothers and Washburn & Granger. The grates on 24 of the boilers are 10 ft. deep and 12 ft. 7 in. wide. The furnaces thus fitted have no arches. The other boilers, with the exception of those fitted with stokers, have



FIG. 11.—SCHEME FOR DISTRIBUTING SEMI-BITUMINOUS COAL.

grates 12 ft. deep and 12 ft. 7 in. wide. The grates are inclined toward the rear of the setting at a grade of 1½ in. to the foot, or a total of 18 in. in the deeper grates and 15 in. in the 10-ft. grates.

Because of the depth of grate experiments were conducted to determine the type and height of fire door best suited for the conditions. As a result there are two sizes of door in use and these are set at three different heights. The smaller doors are 15 in. x 24 in., and are set 36 in. and 24 in. above the floor.



FIG. 12.—VIEW OF BUNKER FILLED WITH BUCKWHEAT COAL.

The larger door is 21 in. x 24 in., and is set 31 in. above the floor. With buckwheat No. 3 fuel and the depth of grate used, the latter size and height of door has given the best satisfaction. Thirty-six of the boilers are fitted with the larger doors. Two firemen are allotted to three boilers, and each of these fires about 11 to 15 tons of coal per eight-hour watch.

It is also found that the type of shovel used in throwing the coal bears an important relation to the efficiency of the firemen. With the deep grates, the angle of the shovel makes a great difference in the ease with which the fuel can be spread over the fire. The men normally hold the handle of the shovel horizontally and the angle the blade makes at that time de-



FIG. 13.—VIEW OF ASH CONVEYING SYSTEM AT PRESENT IN USE

termines the proper spreading of coal on the fuel bed. The shovel found to give best results has a handle 27 in. long. The angle is such that with the scoop resting level with the floor the end of the handle is 19 in. above the floor. Heretofore the handle was 25 in. above the floor. With a grate not so deep, so flat an angle would not be required. It is, of course, appreciated that a grate 12 ft. deep calls for a little more skill



FIG. 14.—ASH OF HAND-FIRED BOILERS

in firing than one 9 ft. deep. With the inclination of the grates adopted, the type of shovel and the height and size of the furnace door, the firemen in the station have no difficulty in keeping good fires under the boilers with all the grate surface covered.

Twelve of the boilers, located on the First Avenue side of

the station, are fitted with underfeed stokers of the Taylor type, built by the American Ship Windlass Company, of Providence, R. I., and installed by the Lenher Engineering Company, of New York. No coking or ignition arches are used in the boilers thus equipped. The stoker consists of an inclined grate made up of air-perforated tuyeres, which are simple cast-iron plates laid up in steps. Between each row of tuyeres are two

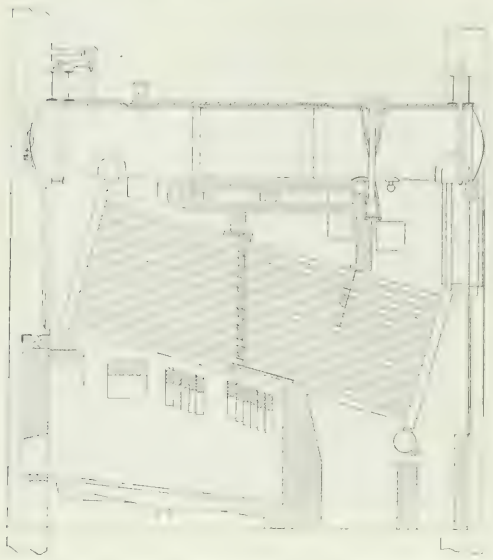


FIG. 15.—CROSS-SECTION OF BOILER WITH 12-FT. HAND-FIRED GRATE.

cylindrical rams, the upper ram receiving the coal from the hopper and the lower ram feeding only coal and partially consumed coke delivered from the upper ram. The two rams move in unison, the upper one deriving its motion from a geared crankshaft at the front of the hopper, and the lower ram from the connecting rod of the upper. The travel of the upper ram is fixed, being about 10 in., while that of the lower ram is adjustable to suit the conditions due to handling coals of varying ash

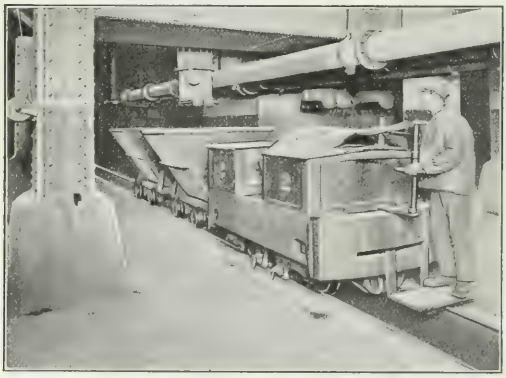


FIG. 16.—METHOD OF LOADING ASH CARS UNDER BOILER ROOM.

content. In practice the stroke of the lower ram is about 2 in. to 3 in.

The lower end of tuyeres rests on a rectangular box which acts as a support, and also as an air box, connecting all the tuyere rows to a common source of air supply. From the lower or back end of this box is hinged the segmental, sectional dump plates, operated by levers from the boiler front. This plate is unperforated, as combustion is supposed to be complete by the time that sufficient ash has accumulated to require dumping. The operation of the stoker is as follows: Coal is fed between the several rows of tuyeres from the hopper, meeting in its passage streams of heated air projected horizontally, these streams furnishing the air necessary for combustion. The

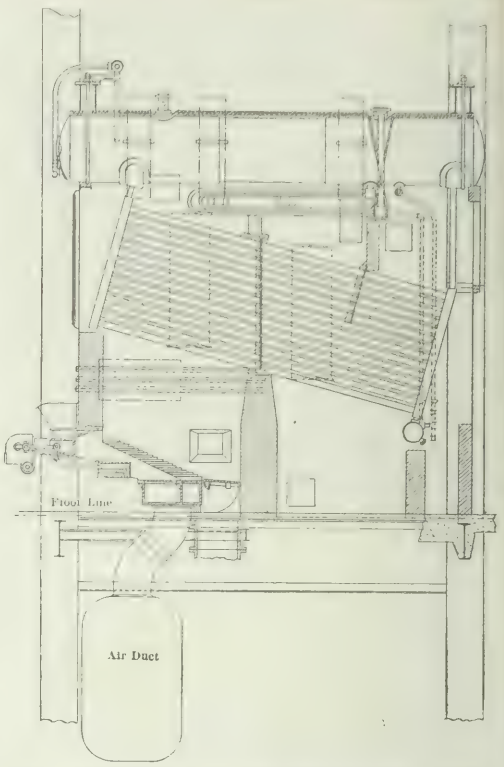


FIG. 17.—CROSS-SECTION OF BOILER EQUIPPED WITH STOKER.

resultant action of the two rams and gravity tends to break up the fuel bed continuously and move it downward toward the dump plates. The breaking action renders it unnecessary to slice or level the fire, the coal distribution being even, the only attention necessary being the periodical dumping of the ash. In practice these dumps take place in from three to five hours according to the fuel consumption. The coal feed is regulated by varying the speed of the engine driving the stoker mechanism. The air necessary for combustion is furnished by engine-driven fans of the multi-vane type, variations in thickness of fuel bed and rate of combustion requiring an air pressure equivalent to 2½ in. to 3 in. of water. In everyday practice these stoker-equipped boilers are operated at a rating giving the maximum efficiency of the combined boiler and furnace, the normal variations of load being met by the boilers equipped with hand-fired furnaces. There is, however, a large margin of capacity available in the stoker-equipped boilers to meet abnormal demand. Fig. 17 shows a sectional elevation of a boiler equipped with the stoker.

All furnaces are equipped with draft gages and all forced-blast air ducts have registering pressure gages of the Bristol type so that the proper pressure can be maintained. In the hand-fired boilers a pressure of 0.9 in. to 1.25 in. of water is maintained in the ash pits and a neutral pressure above the fire. This balance is maintained by the fireroom engineers and only requires adjustment for abnormal conditions, such as increase of load and changes in the thickness of the firebed.

Cooling-Tower Practice.

By J. H. Hart.

THE average station manager or superintendent is more or less familiar with the subject of cooling towers. While he may not have an absolutely clear understanding in regard to the theory of the operation of cooling towers, he knows the purpose for which they are created and has no doubt of their efficiency in the majority of cases in view of the large number of installations which are in existence. On the other hand, data in regard to their operation, cost of up-keep, first cost of installation and various difficulties which may be met with in their operation are matters of particular interest, as well as any minor details of construction, operation, etc., which may limit or increase the efficiency of an installation, if one has charge of the operation of such a unit, or more so if one has in contemplation its possible development.

Cooling towers are of two types, open and closed. In the former the cooling of the water is accomplished by air supplied by natural processes, and in the latter by artificial draft. The chief development of the cooling tower is in power-plant practice, especially in cases where available water for boiler supply is not at hand or is undesirable on account of its quality. While the duty in both cases is the cooling of water for re-use in condenser operation, it is esentially dissimilar in the two, since the water which has access to the cooling tower from steam-engine condensers will range in temperature from 150 deg. Fahr. to 170 deg. Fahr. and will be cooled off sometimes to 25 deg. below that of the atmosphere, whereas in refrigeration the maximum seldom exceeds 120 deg. Fahr. and very often does not approach the lower limit attained with steam practice.

Not only is the efficiency of a cooling tower dependent upon the state of the atmosphere with respect to moisture present in it, but often the performance of any duty at all is seriously threatened by these conditions if extreme, and the reliability of the tower is the first criterion by which it should be judged. All cooling towers for their cooling effect upon the water depend upon the amount of air brought in contact with the water and the intimate mixture of the two. The open type depends upon atmospheric agencies for the performance of this duty, while the closed type has its supply of air regulated by means of fans, which may be speeded up under circumstances of poor hygrometric atmospheric conditions, so that the performance of the plant may be kept fairly constant, independent of weather conditions. It is this feature which has led to its installation in the majority of power plants, although the first cost of the closed type is generally from three to four times that of the open, and its efficiency of operation is much limited by the necessary operation of a fan for the maintenance of the air supply at all times. Various outside factors enter as well in influencing this decision. The open tower with a strong wind blowing through it is a source of damage to surrounding property from the spray carried away in the atmosphere and is a serious inconvenience not only to the plant operating it, but may cause much more trouble through law suits arising from its continued maintenance. Cheapness and high efficiency under favorable conditions are the chief characteristics of the open type of tower, whereas the reliability and maintenance factors are the main features in the closed type.

Under the circumstances, there is apparently no question in regard to the relative commercial efficiency of the two types for power-plant practice. Data in regard to their absolute efficiency and the saving possible by their installation from a reduction of fuel, cut in the cost of water, if purchased from outside sources, and more efficient operation of the boiler and other units if the water is impregnated with salts or of an unsatisfactory character, are not at hand to anywhere near the extent they should be for the individual seriously contemplating the installation of one of these units. The majority of the closed type towers are operated in conjunction with steam condensers. The same pump used in operating the condenser is available for duty with the tower. The choice of a type and its efficiency is thus dependent upon the character of the condenser used, the quality of the water at hand, and the cost of same. The majority of cooling tower manufacturers have considerable data at hand in regard to the efficiency of the cooling tower and the saving to be obtained by its use, but they have almost invariably combined the results attained in a series of tests with those obtained with the use of the condenser in power-plant practice and point to the great saving attainable by the use of the condensing feature in conjunction with the cooling tower over that of the power plant without either. There is no question in the mind of the average engineer or station manager in regard to the efficiency of the steam condensing feature. The fact that the cooling tower generally operates in conjunction with the condenser to recool the water used in this and heated by steam condensation, so that it can be user over again, is one that has not been isolated by the great majority of manufacturers operating in this field. A steam condenser can operate very efficiently and increase the efficiency of the power plant as a whole and simply draw its water for cooling purposes from any source obtainable or purchase it from the city. Its efficiency is unquestioned. The cooling tower has encroached on the efficiency of the condenser in an attempt to bolster up its showing in the performance of its own duty and it should undoubtedly stand alone. The question of its installation is essentially a problem in power economics having to do only with small consumption of power if the tower is of the closed type, and of cost of water and cost of water circulatin with the inevitable loss existing in tower operation. Cost of installation and cost of maintenance enter as important factors here as in all such problems. The question of efficiency, first cost, cost of maintenance, and other details will be taken up in order.

The average cooling tower will cool water from steam condensers from 60 deg. Fahr. to 90 deg. Fahr. in one passage of water through the tower, if the tower is of such a type as to present the requisite surface and air supply per gallon of water passed in accordance with the best statistics of the manufacturers. The author has made several tests on towers of both types with respect to the performance of their duty under various hygrometric conditions. The average range in tempera ture extending over several days is generally from 140 deg. Fahr. to 170 deg. Fahr. and the fall in temperature obtainable has been such that the outflowing water ranged from 90 deg. Fahr. to 60 deg. Fahr. with atmospheric temperatures ranging between 55 deg. Fahr. and 85 deg. Fahr. and hygrometric conditions ranging from 30 per cent to 50 per cent of normal saturation conditions. It is quite possible, as has been said, so to construct the tower from a surface viewpoint and so to direct the air currents that a fall in temperature of the water of from 5 deg. to 25 deg. below the temperature of the atmosphere is attainable. This is largely a question of first cost and operation, however, so that practically any definite temperature of the outflowing water can be attained under average operating conditions of the cooling tower, and can be guaranteed by the contractors or manufacturers of the installation.

An open type of cooling tower capable of cooling from 400 gal. to 600 gal. of water per minute, as dependent upon its special construction, will be, roughly, 20 ft. x 20 ft. x 40 ft. or 45 ft. for cubical contents, and will have at least six so-called drip pans or retarding surfaces in its make-up. The square dimensions are largely eliminated in the construction of these types when the towers exceed a certain size on account of con structive details such as increased length of spans, strength to withstand wind resistance, etc. The majority are rectangular in shape, their wide surface being presented to the normal direc tion of the wind, since their efficiency is increased on this ac count because the air immediately loses its cooling property on becoming saturated and it attains this state very quickly on contact with water, especially if the latter is much warmer than itself. The cost of such a tower, with the capacity of 400 gal. per minute, would range from $1,200 to $1,500, and in general it can be said that each additional 100 gal. per minute capacity increases the cost of the open tower type by approximately $200

This figure, of course, does not hold for especially small types, but begins with about the dimensions and capacity given. The closed type of tower, on the other hand, costs from three to four times this amount for first installation with this capacity, while additional increases range at about double the price given for the open type per 100 gal. per minute additional duty. In regard to cost of operation with fans, circulating pumps, etc., it can be said that a 500-hp plant will require an expenditure in the neighborhood of $2 a day for the satisfactory maintenance and up-keep of the cooling tower alone. This is an outside figure and covers cost of fuel and water wherever used or lost. Thus it includes the power for the operation of the pump and of the air current circulation. This latter is generally accomplished by means of large fans, electrically driven, the fans having an outside reach of from 6 ft. to 8 ft. Serious difficulties often arise during the winter months in the operation of these fans on account of the presence of water in a finely divided state in close contact with the point of operation, and unless properly constructed so as to allow no countercurrents or reverse drafts the fans are apt to clog up with ice produced at these points.

For an outside figure in regard to efficient installation under normal conditions, it can be said that if water costs 6 cents per 1000 gal. or more, it pays to install the cooling tower if the total water lift does not exceed 80 ft. In some cases this figure can be raised to nearly double the amount as far as energy consumption for the circulation of the water is concerned, and any impurity in the water or non-suitability of the latter for feed purposes, or scarcity in its amount, make the possibility of efficiency attainable by an installation of a cooling tower much greater.

After installation or after a decision favorable to installation has been reached, a number of additional factors are worthy of serious consideration. Not only is the location of the cooling tower in the particular plant a matter of serious importance and very effective in its influence on efficiency on account of water and power connections and choice of site as determined by location of other units, but such intangible conditions as hygrometric effects in the atmosphere enter as well. Thus it is a recognized fact that under normal circumstances the hygrometric state of the atmosphere or percentage of moisture is much less at a distance from the ground than at points close to its surface.

A difference or variation in the height of the cooling tower of from 50 ft. to 100 ft. above the surface may affect normal hygrometric conditions to such an extent that average values obtained for this quantity leave a variation at the two points of fully 50 per cent. This phenomenon is well known and considered of great importance in installations in the tropics where moisture conditions are more pronounced. The efficiency of mining installations in the operation of the air compressors is greatly increased by drawing the air for the intake to the air compressor from a stand-pipe from 50 ft. to 100 ft. high if the compressor is located on the surface of the earth, and the efficiency of compression is much increased by the diminution of the moisture percentage present in the air. In the same way when installing cooling towers attention should be given to the sources of air current. A number of such installations have been made to the writer's knowledge in which the fans used in the operation of the cooling tower draw their air supply from the loft of the engine room, which may be especially undesirable if there is a large steam leakage going on. The heating of the air before its passage to the tower is especially desirable if this can be accomplished without affecting the moisture content present in the air.

It is admitted that air drawn from the top of the boiler room or from the vicinity of the smokestack is eminently desirable and within limits the warmer the better, although if allowed to become warm and then exposed to moist or water surfaces it loses its effective properties. The question of temperature of air advent in cooling towers is an extremely important and scientific one before the engineer of to-day. The writer is at present undertaking a series of tests to ascertain exactly the best temperatures for aid at admission, water temperature and hygrometric conditions remaining the same. The warmer the air, the greater its absorptive power for water vapor until it passes the limit where its heat conduction to the water counterbalances any cooling effect due to evaporation.

The theoretical development of this type, however, and the possible methods of increasing its absolute obtainable efficiency, are matters of interest more to the physicist than to the practicing engineer.

Employers' Liability—The Fellow-Servant Rule.

By John Edson Brady.

THE outcome of an action by an employee against his employer for damages for injuries received through the negligence of a fellow servant very often depends upon the jurisdiction in which the action is brought. A case which would warrant a verdict in favor of the employee in one State would, in many other jurisdictions, be decided against him. This condition is due to the diversity of the rules of law which govern the liability of the employer for injuries to those employed. One of the first questions to be determined in fixing the liability of the employer where one servant has been injured through the negligence of another is the question whether the servant injured and the one causing the injury are fellow servants, so as to bring the case within the general rule that the employer is not liable to a servant injured through the negligence of a fellow servant.

In regard to this question of fellow servants there is a considerable diversity of opinion among the courts of different States, although the decided weight of authority is to the effect that all who serve the same master, work under the same control, deriving authority and compensation from the same source, and are engaged in the same general business, although in different grades or departments of it, are fellow servants, each taking the risk of the other's negligence. Like other rules of law, however, this one is not without its exceptions. Its operation has been restricted in many States of the Union, sometimes by the adoption of statutes and sometimes by the decisions of the courts.

One popular exception to the above rule is known as the "superior servant rule," the doctrine under which an employee, having authority to control other employees, is held not to be legally their fellow servant, so as to relieve the employer from liability, where the negligence of the "superior" servant in the exercise of his authority is the cause of injury to one under his control.

There are statutes in some of the States, generally referred to as "Employers' Liability Acts," which have been declared constitutional, and which change the fellow-servant rule in many important particulars. For the present, however, the discussion will be confined to the law as it exists apart from statute. With more or less qualification the superior-servant rule is the settled law in the States of Illinois, Kansas, Kentucky, Louisiana, Nebraska, Ohio, Tennessee, Texas and Utah. And in these States, where this doctrine is recognized, it is said that it has received five distinct interpretations. In other States the rule has been adopted in some cases and discarded in others. For instance, in Missouri the rule was apparently rejected in the earlier cases, but was accepted subsequently, only to be repudiated in the more recent decisions.

It appears that the "superior-servant rule" received its first judicial recognition in this country in the State of Ohio. In that State the courts have gone to the extent of holding that where one employee is injured through the negligence of another who is his superior in rank, the fact that at the time of the accident the superior was performing the duties of a common workman, and not those strictly pertaining to his position as a superior, in nowise relieves the master from liability.—Berea Stone Company vs. Kroft, 31 O. St. 287. In the case of

Little Miami Railroad Company vs. Stevens—20 Ohio 415—it was held that a conductor on a train was a superior servant with regard to the engineer of the train and the company was held liable to the engineer for an injury resulting from the negligence of the conductor. The conductor had disobeyed an order to pass another train at a certain station, and, as a result of his negligent act, a collision occurred and the engineer was hurt.

Quoting from the opinion of the court: "It is said, however, that when a party contracts to perform services, he takes into account the dangers and perils incident to the employment, and receives wages accordingly. Take this for granted; and we think it falls far short of sustaining the main proposition. If the party does contract in reference to the perils incident to the business, he will be presumed to contract in reference to only such as necessarily attend it when conducted with ordinary care and prudence. So far as an implied contract in reference to the business will be presumed, it will be on the hypothesis that the business is to be properly managed. He cannot be presumed to have contracted in reference to injuries inflicted on him by negligence—by wrongful acts. An express stipulation would at least be necessary to make it a part of the contract. The employer has paid him no money for the right to break his legs, or, as in this case, to empty on him the contents of a boiler of scalding water." And in Railroad Company vs. Keary—30 Ohio St. 201—a conductor was held to be a superior servant over a brakeman, and the company was made to pay damages to the brakeman for injuries received in a collision occurring through the negligence of the conductor.

The rule was there stated in this manner: "Where an employer places one person in his employ under the direction of another also in his employ, such employer is liable for injury by the negligence of his superior to the person placed in the subordinate situation." However, in Johnson vs. Cleveland, L. & W. Railroad Company—11 Ohio Cir. Ct. Rep. 555—where a car repairer was injured while working under a car, it was held that the conductor who had ordered the moving of the car, thereby causing the injury, was not a superior servant as to the car repairer. The two were fellow servants, and, under the fellow-servant rule, the company was not legally responsible.

The superior-servant rule obtains in the State of Illinois, where it is phrased in the following terms: "Where the negligence of one servant causes injury to another as a result of the exercise by the negligent servant of authority over the injured servant, which has been conferred upon him by the master, the master is liable." In the case of Hubbard vs. Chicago Sugar Refining Company—44 Ill. App. 418—it appeared that a fire had started in one of the kilns of the sugar company, and that, after it had been extinguished, a scale or crust was left on the floor of the kiln. Two days later this crust ignited and the chemist of the company, who was also its secretary and treasurer and had full control of the works, ordered a fire extinguisher to be played upon the fire. An explosion immediately followed with disastrous results to the plaintiff.

A judgment in favor of the defendant company was reversed on appeal for the reason that the trial judge, in his instructions to the jury, had told them that if the chemist and the plaintiff were working together in the attempt to put out the fire they were fellow servants and the plaintiff could not recover notwithstanding that the chemist was the general superintendent of the plant. "The true rule," said the court, "is this: The mere fact that one of a number of servants who are in the habit of working together in the same line of employment for a common master has power to control and direct the action of the others with respect to such employment, will not of itself render the master liable for the negligence of the governing servant, resulting in an injury to one of the others without regard to other circumstances. On the other hand, the mere fact that the servant exercising such authority labors with the others as a common hand will not exonerate the master from liability for the former's negligence in the exercise of his authority over the others. Every case in this respect must depend on its own circumstances."

In Fraser vs. Hand—33 Ill. App. 153—the plaintiff was a helper working with a molder in the defendant's foundry and it was his duty to obey the molder. While they were moving a "flask" by means of a crane, the handles on one side of which had been broken off, the accident occurred. The molder, in his capacity as superior, told the helper to hook to the flange of the flask the chain by which the flask was to be raised. After the flask had been raised in this manner the chain slipped and the flask dropped on the helper's toes. The accident occurred while the plaintiff was obeying the orders of a superior and, under the rule laid down, the company was held liable.

The application of the superior-servant rule is also illustrated by the Illinois Steel Company vs. Schymanowski—162 Ill. 447. The plaintiff in that case was employed by the defendant company in its shops. On the night of the accident he was put to work loosening ore from a large pile for removal to the furnaces. It being very dark, the plaintiff sought out his foreman and asked that a better light be provided. Instead of complying with this request, the foreman told the plaintiff, in no mild language, as the record shows, to "go to work." The plaintiff returned to the pile and shortly afterward a large piece of ore fell from the top of the pile and crushed the plaintiff's leg. The company had to pay damages. The command of the foreman that the plaintiff "go to work" was within the scope of his authority, and it was therefore the command of the company itself.

When the master orders the employee to perform his work the latter has a right to assume that the former, with his superior knowledge of the facts, would not expose him to unnecessary perils; the servant has a right to rest upon the assurance that there is no danger, which is implied by such an order. Though it may seem that the law gives the advantage to the servant, it must be remembered that the master and the servant are not altogether upon an equal footing; the advantage here lies with the master and the law seeks to strike a balance. Another Illinois case, where the plaintiff was injured while carrying out the orders of his foreman, is that of Anderson Pressed Brick Company vs. Sobkowiak—148 Ill. 573. Sobkowiak was employed by the company as a shoveler. One John Keily was the foreman in charge and had complete authority over the work. He hired and discharged the men, kept their time and directed and controlled their actions. There was an overhanging bank, under which it was necessary for the men to work in getting out the clay which was being removed. Keily's attention was called to the bank and one of the men suggested that it be taken down before any further work was done.

Keily replied that the surface soil would contaminate the clay and that, in case of accident, he could find others to take the places of those injured. A cart was accordingly backed under the bank. Keily's son was the driver and Keily told him that if he got word to drive out not to waste any time doing so. There was some discussion among the men as to which of them should shovel from a position back of the cart and Keily settled the matter by ordering Sobkowiak to work at that point. The bank tumbled down and, though the driver and the men working at the sides of the cart got out safely, Sobkowiak was caught in the falling earth and seriously injured, so seriously, in fact, that the jury awarded him $8,500; the Appellate subsequently reduced the amount to $6,000. It was reasoned that Sobkowiak had a right to assume that his foreman, having wider experience and superior opportunities for knowing the condition of the bank, would not order him into a place dangerous to life and limb. It was for the jury to say whether the act of Sobkowiak in going under the bank and back of the cart, in obedience to the command of his superior, was a piece of recklessness which would defeat his right to damages, and the jury said that, under the circumstances, it was an act such as might have been done by a reasonably prudent person acting with due regard to his own personal safety.

THE ELECTRIC FAN AND THE CENTRAL STATION

The Fan Business of the Public Service Corporation of New Jersey.

By William H. Stuart.

THE fan business throughout the system of the Public Service Corporation of New Jersey is one that has been developed year by year until to-day it plays an important part in the summer business of the company. The Public Service Corporation supplies energy to a great many places throughout the State of New Jersey, from the small township of a few hundred inhabitants to the larger cities like Newark, Jersey City, Trenton and Paterson. These several places are somewhat different in character from one another, and the difference has regulated the introduction of the fan business. That is, in the different places some particular class of consumers, such as the business houses, or stores, or factories, or residences, were more readily susceptible and responsive to the soliciting for fan service than in other localities, because that class predominated. For instance, in Jersey City the fans were more readily and quickly introduced among the commercial customers, and to-day there are more fans per consumer in business places than in the residences.

For a long time in some of the cities there was operated a flat-rate ceiling-fan service for commercial customers. This service was run without meter, and the consumer paid so much per fan and guaranteed to stop using it at a specified time. The amount per fan was based on a stopping time of 7 p.m., 9 p. m. or 12 p. m. each night. There was an all-night rate also. The energy was available for the 24 hours each day, but it was left to the honor of the consumer to turn off the fans as per his contract. If a persistent breaking of the agreement was noticed, the service would be discontinued altogether or else the consumer would be charged on an all-night basis. The season lasted four months, from May 15 to Sept. 15. As the portable fans became more and more popular the flat-rate service was done away with gradually. No new consumers were accepted on the old schedule, and while it was optional with the old consumers to continue at the flat rate or to be charged on a meter basis, the consumers were advised to adopt the metered service. Considerable business is now done with ceiling fans among the commercial consumers. When the portable fan began to show its qualities the company made exceptional efforts to install as many as possible. Very fine results were obtained and the use of the fans became quite extensive.

In 1909, as in the past, the company will carry out the same methods of introducing fans throughout its territory. At about the first of April of each year considerable space in the daily newspapers is used for displaying attractive advertising cuts with short, sharp and catchy wording. In conjunction with this advertising, special illustrated folders are drawn up and placed in all of the offices for distribution to the public and for mailing. Upon the backs of the monthly bills there appear brief notices concerning the fans and their advantages. Manufacturers' advertising matter is used in the offices and show rooms, but not to a great extent. By the time that this amount of advertising has got into circulation and a little warm weather has been experienced to further impress fans upon the mind of the public, quite an amount of business will have been transacted. A reasonable amount of time is allowed for the advertising to produce effects, and then the solicitors are instructed to pay particular attention to securing and following up all leads to secure the business.

The company purchases a large number of fans each year from one of the well-known makers and has them shipped to the various offices where they are assembled, cleaned and placed in stock. They are arranged in an attractive manner about the show room and an exhibit is made of them in the show windows. In the display generally most of the fans are in operation and, to further attract an observer's attention, small ribbons and flags attached to the wire guard are allowed to flutter in the breeze. Another scheme was to blow colored balls about the window by the fans. Show-window cards, neatly printed, stating the name, size and price of the fans were also placed in the windows. The fans were sold at about cost in most of the offices, and with each fan there was included 10 ft. of flexible cord and an attachment plug. A feature which proved most successful and beneficial was the prompt delivery and the quickness with which a fan once purchased was set in operation.

There is another force at work assisting the company, namely, the wiring contractors. A great many fans have been sold and placed in operation through this agency. The company has invited a spirit of co-operation between the contractors and itself, the prices being fair to all parties, and "leads" for business are freely exchanged. Of course, in a great many places it was found to be better for the company to sell the fans. The company handled only the portable fans and allowed the contractors to sell and install all other styles.

While it has not been possible to secure any definite figures as to the number of fans in use upon the company's lines, yet it is estimated that there is one fan for every two consumers, and in the near future every consumer will have at least one fan. While the company will not deviate very much from its former methods of handling the fan business, yet with the resumption of its extensive advertising and publicity system it is expected that some attractive advertising matter will be issued. Altogether the company is preparing for and expects to do considerably more fan business this year than it has in any other year.

Electric Fans on the New York Edison Company's Service.

By Norman G. Meade.

ELECTRIC fans have become so extensively adopted in New York City that it is beyond the scope of this article to do more than outline some of the many useful applications in every-day use. The desk, bracket, ceiling and small revolving fans suspended from chandeliers have long been a familiar sight in offices and stores, circulating air for the comfort of occupants and patrons.

The one-time limited field has expanded through the ideas of ingenious people until there are many novel and useful purposes to which the electric fan is applied. It is now considered practically a necessity in private houses and apartments as well as public places, and the low operating cost brings it within reach of everyone.

So fast has the use of fan motors grown that they have become an important factor on the system of the Edison company, and indications point to a far greater business in that branch during the season of 1909 than has ever been done before. A conservative estimate places the number of electric fans operating on Edison service at about 250,000. Their particular uses are diversified in the extreme and are by no means confined to the popular conception of their function—i. e., circulating cooling breezes. Despite this fact there seems to be little effort on the part of manufacturers of fan motors to push their product for other purposes than relief from the heat. The New York Edison Company long ago realized that the fan motor had many uses in cold as well as warm weather, and has advocated persistently its adaptability to numerous novel purposes.

One quite extensive application in New York, where fans are used to advantage in winter, is to blow warm air from a steam or hot-water radiator into a room, thereby greatly increasing the heating capacity and giving a more even distribution of heat. This arrangement is found especially valuable

where the heating system is not adequate to meet the requirements. Another use which is more or less familiar to the majority of pedestrians in the business district is the blowing of warm air against show windows for the prevention of moisture condensation. Storekeepers, especially florists, find this application of the small fan very serviceable in the winter months for frustrating the accumulation of frost upon the glass which conceals the window display from passers-by.

The use of a fan for circulating pure air through a refrigerator in the winter is not only novel, but effects considerable economy, as the use of ice may be confined to the hot months of the year. There are several different arrangements that can be made, depending upon the style of the refrigerator.

One of the later developments in the use of the electric fan, where houses are heated with hot-air furnaces, is creating forced draft. This has met with such success that no electrical appliance is likely to meet with more favor. It shortens the time for heating the house in the morning, and makes it possible to maintain a comfortable temperature in rooms that on account of poor, natural circulation have been difficult to warm. The opening or casing into the cold-air inlet, through which the fan blows, is made approximately the diameter of the fan in order to create a good pressure. Various methods of installing and controlling the fans suggest themselves to meet the requirements in each case. Chains, similar to those used for raising and lowering the drafts, have been utilized for regulating the fan's speed. Arrangements are generally made to move the fan backward away from the cold-air inlet when it is not in use, and a slide is provided for covering the opening. The foregoing applications are for cold-weather use, and should dispel any ideas people may have that the electric fan is essentially a warm-weather device.

In theaters, public buildings, hotels, etc., the use of electric fans of all types is almost universal, and they are rapidly being adapted to the needs of private residences, where they are found practically invaluable in the living rooms and bedrooms, especially in cases of sickness. The rooms in a number of leading hotels are provided with ceiling fans, which add greatly to the comfort of guests in hot weather.

For ventilating kitchens, lavatories and all rooms where heat and odors are prevalent, fan motors are useful in any season of the year, and many are in constant use in New York City. Ventilation may be accomplished by circulating air directly through the room, but preferably it is done by placing the fan on a bracket adjacent to the upper pane of glass in a window, through which a circular hole, approximately the diameter of the fan, has been cut. By placing the blades close to the opening so that the fan can blow outward, a very effective exhaust is obtained.

The question of proper ventilation is one that is especially prominent in these days of careful attention to hygiene. It is being realized more and more that fresh air is one of the most important factors of healthy living. In areas too large for the small fan to ventilate effectually, a great number of larger electric fans, built especially for ventilating purposes, are in use and have been found of great benefit. In this connection it is interesting to note the frequency with which air can be changed in public buildings to insure health and comfort as prescribed by authorities on the subject. In large public rooms the air should be changed every 10 to 20 minutes; in factories and workshops, every 5 to 20 minutes, depending upon the work being done; and in shops, offices, halls and churches, every 20 minutes.

To ventilate public buildings to this extent without giving rise to complaints from numerous persons who are sensitive to drafts, has not in the past been an easy task. The electric fan offers a simple solution of all difficulties in the way of ventilation, as it can be fixed in any out-of-the-way place and controlled from any convenient point. A ventilating fan of the proper type is generally arranged in a circular aperture in the wall, and can be regulated to draw in fresh air or to expel the vitiated air.

Under the ideal conditions the room to be ventilated has only one inlet for air, which is located at the opposite side of the room from the exhaust fan. The size of the fan depends largely upon local conditions, but common practice is to use about an 18-in. fan to provide fresh air for about every 25 or 30 persons, allowing 2000 cu. ft. of air per hour for each occupant of the room.

For advertising purposes in show windows the electric fan is used by many merchants for keeping light objects, such as toy balloons or bits of paper, in constant agitation, and maintaining streamers and small flags in a horizontal position. Very novel and attractive effects can be secured that demand attention and prove to be good advertising.

Among the photographers of the city electric fans are extensively used for drying negatives and prints. Those familiar with the business will realize what an advantage quick drying by this means is, as it enables much more work to be turned out in a given time.

A novel form of electrically operated fan which has been largely used in England and on the Continent is being introduced into New York. In this type of fan, known as the "Punkah," the regulation revolving blades are replaced by swinging blades operated with a small motor. The air in the room is thus kept in a state of gentle agitation, which is preferred by some people to a strong breeze from an ordinary electric fan.

Fan Motor Experience in Boston.

The Edison Electric Illuminating Company of Boston has been paying special attention to the electric fan situation for about eight years. For many years the company has sold fans to its customers in order to encourage this character of load in every way possible. The company early recognized that the electric fan has many other uses than the cooling of relatively small interiors, and has done what it could to develop the use of small fans at all seasons of the year. Small as is the energy demand of the single fan, it provides a load of the most desirable character, for the reason that it is of the long-hour kind, generally extending far beyond and in advance of the station peak, and in many cases requiring energy continuously through the night. The multiplied effect of many hundreds of fans on the system is believed to be thoroughly beneficial, particularly as all small fans are operated under the company's regular commercial incandescent lighting rates. At these rates the cost of operating an ordinary 12-in. fan in Boston is about .06 cent per hour.

About eight years ago the company decided to introduce a rental plan in connection with the use of electric fans, in order to popularize these devices and offset to some degree the fluctuations in the regular market prices of this equipment. It was considered desirable to introduce small fans under conditions which might be taken advantage of by customers with small initial expense, and to effect this a kind of cycle was adopted by the company in its fan exploitation. In general the following plan has been pursued:

The company bought a lot of fans of the 12-in., 110-volt type, both alternating and direct current design, the number varying according to the anticipated demand for fans for the season. These fans are kept in the regular stock department of the company and drawn out for distribution on requisitions from either the sales department or the installation department. In connection with its monthly bills, the company then mails a blank in the form of an application for renting one or more fan motors at the rate of $1 per month, the minimum charge for the season being $3. These blanks constitute an announcement of the availability of fans for service through the agency of the company.

When a fan is rented the record of its number, type, location, date of sending out and date of return or purchase is recorded in a card index in the installation department, one card being used for each fan. At any time the company can, therefore, tell the exact history of all fans which it has handled, but no

record is available of fans purchased and installed by customers from other agencies than the company itself. For this reason it is most difficult to estimate with any accuracy the total number of electric fans in service on the circuits of the Boston Edison Company. The small fan has become a standard article in this territory, however, and is used most widely and in a great variety of mercantile, industrial and residential installations.

The company's practice has been to maintain rented fans under good usage by consumers. When fans need repairing they are not usually attended to by the Edison company, but are sent to an electrical repair house in Boston which makes a specialty of such work, under contract with the Edison organization. After the fans have been in use for about three months the company's canvassers look up the fans still on rental, some having been purchased in the meanwhile by the company's customers. The fans that are still on rental are offered to the customer at the regular retail price less what has been paid in rentals. In this way the customer finds it possible to buy a fan at a very reasonable rate, and the company has sold numerous fans in this way. Possibly two-thirds of the fans are returned at the end of the season.

At the beginning of the second year of the fan cycle the unsold fans are put in thorough order by the electrical repair house, if they have not been gone over at the end of the first year. These are now second-hand fans in first-class shape. In the spring the customers are notified by announcements in their bill envelopes that the company has a limited number of second-hand fans for sale, the fans being in good condition and ready for commercial service. A blank order is enclosed, and on cash payment the company delivers the fan. In all cases within its territory no charge is made by the company for delivery, the fans being carried to their destinations by the company's regular transportation department. The second-hand fans are not guaranteed, and the company does not maintain them, as in the case of rented fans. After all the second-hand fans are sold—and usually this is done very quickly—the company may find it necessary to buy more fans. In such an event a small lot is bought and sold at the regular retail rates.

In the third year the company carries a comparatively limited stock of new fans into the season and sells them at the market rates, the number on hand naturally being dependent upon the demand of the previous season. In this third year the policy of the company is to let the whole fan situation largely take care of itself, so far as the purchase of fans is concerned. Any fans handled are simply sold at the usual retail price. The demand of the previous two years tends to be prolonged somewhat, with the resulting purchase of fans from the regular dealers by consumers. At the beginning of the fourth year the company is ready to buy a lot of fans and start the rental process moving again, and thus the cycle continues. Any persons not customers of the company are required to pay cash on delivery of fans bought of the company. Regular consumers may buy on the usual terms of cash in 30 days.

The company does not loan fans free of charge and fans are rented only to customers. Deliveries can usually be made within 24 hours. The company endeavors to make enough profit in handling the fans to pay it to undertake the work, but it appreciates the value of the fan as an energy consumer, and views the whole problem from that standpoint. All fans are tested for proper running before being sent out. The company's inspectors adjust rented fans only.

In cases where special fans are required the company buys them for its customers if so requested. In the past season, for example, a large number of 16-in. alternating-current fans of the oscillating type were purchased for consumers. The company does not install large fans, but recommends this work being done by electrical contractors. When desired the company will advise its customers as to the best arrangement of fans for different services.

One of the largest recent installations of the 12-in. fan by the company was in a new publishing house, where about 40 were placed on a single order. The general situation in the fan field has been discussed frequently by the officers of the sales department at conferences with solicitors, especially in the line of pointing out the uses of fans in unusual applications or in less familiar fields. Among these are the keeping of window panes clear from frost in winter, improving the ventilation in residences in connection with furnace air inlets and registers, hair drying, photographic-plate drying, keeping fruit free from insects and the drying of clothes in seasons of inclement weather.

The company does not attempt to list fans on its circuits that have been purchased outside its own organization. All of the prominent and reliable makers of electric fans receive equal consideration by the company in purchasing. At times the company has employed newspaper advertising to a limited degree for fan exploitation. Fans are used extensively by the company in its own service, both as an object lesson and as a convenience. The fan motor is so well established in the public's favor that educational campaigns in this field are not considered necessary. Probably the chief difficulty in the commercial handling of fans is their first cost. The user does not consider the cost of operation as serious, in view of the comparison with the ordinary carbon-filament incandescent lamp. The cost of the fan in the first place is largely overcome in Boston by the policy outlined above.

Fan Motor Situation in Various Cities.

The electric fan increases in popularity year by year. Consuming ordinarily only about as much energy as the carbon-filament incandescent lamp, it would appear offhand that the revenue obtainable because of its use would be inconsiderable, excepting possibly in very large cities or in places where climatic conditions are such as to make its utilization an absolute necessity. Investigation, however, shows that the yearly income from fan motors is by no means insignificant. Time and experience have combined to widen the field of this sturdy little electrical appliance. Its usefulness is no longer limited to the warm months of the year, although it is especially serviceable during the summer season, and fan-motor peak loads naturally come at a time when the lighting load is smallest, and when some other additional load is welcome. As a piece of electrical apparatus, the fan motor is at once one of the most reliable and one of the best appreciated. It possesses the merit of advertising itself, and after having once experienced its comforting breezes the user it loath to part with it. Some idea of its value as a central-station load may be obtained from the experiences of various companies throughout the country who are cognizant of its worth. The difficulty of securing a record of the number of fans in use will be appreciated when one recalls that they are fed from the lighting circuits and are purchased usually from a supply store or from an electrical contractor. In some cities the electric light company has made a special campaign on electric fans and thus hastened their introduction, while in others fan motors are loaned to customers at very low rates. A short account of the practice in a few cities selected at random may be of interest.

The Charleston (S. C.) Consolidated Railway, Gas & Electric Company looks upon a fan-motor load as being very desirable. Its fan-motor business covers a period of six months, beginning with the month of May and ending with the month of October, during which period the lighting load is at a minimum and the fan-motor load at a maximum. During the month of August, 1908, the books of the company showed that there were 700 fans connected on a flat rate and approximately 300 fed from meters. The average receipts were approximately $2,000 per month, or $12,000 per annum. The company does not sell or handle fan motors nor does it make a fan-motor campaign. It depends upon the supply houses and the electrical contractors to increase the business, co-operating with them and lending them assistance whenever possible. At one time the company sold fans and employed solicitors for the purpose of get-

ng new business with the result that the supply houses were irtually put out of business. This campaign, which was conucted at considerable expense, did not result in any appreciable ncrease in load and another campaign was not attempted. The ompany now adds about 250 fans to its circuits yearly without xpense to itself.

The Union Electric Light & Power Company, of St. Louis, Mo., makes a canvass each year for fan-motor business. In his it depends entirely upon its soliciting force, doing very ittle advertising other than making one or two announcements ach season. In the past the company has made a flat rate for entilating service during the summer months ranging from $12 o $15 per fan per season. Where they so desire, customers nay connect their fans to the lighting circuits and thus pay for he energy used at the same rate as for energy used in lamps. Owing to the large number of fans connected to the lighting circuits, the number of fans and the actual revenue obtainable rom this source cannot be ascertained definitely. From such ecords as are available the company estimates that there are approximately 5000 ceiling fans and as many desk fans connected to its lines. The hot season at St. Louis being rather long, the revenue from 10,000 fans is by no means small.

Coming now to cities farther north, where the warm weather does not extend over so great a period as in Southern cities, it is not unusual to find the central-station company making every effort to capture a greater fan-motor load. The Philadelphia Electric Company estimates that the number of fans connected to its circuits is in the neighborhood of 10,000. From the 5580 fans of which it has a record, the approximate income for the summer season is from $20,000 to $25,000. An endeavor is made to obtain an accurate count of the fans connected by having a recount made whenever a meter test is made. Every year a short advertising campaign is carried on for the purpose of encouraging the introduction of fans. This campaign is a simple one, but the company endeavors to make it as effective as possible, bearing in mind the fact that the income from the fan business will only permit of a limited expense in the way of advertising. The method is to circularize the various mailing lists of non-consumers with folders about three times; the first about the middle of May, the second about the first of June and the third on the first very hot day in June. These folders are supplemented with a little newspaper advertising. The company has found that it does not pay to send out advertising specifically for the encouragement of the use of fans after July 1. It has been its experience that if the fan service is not introduced before that time by non-consumers it is not liable to be introduced at all. Bulletins and inserts advertising fans are sent to customers with bills. The uses to which fans are put are about the same as in other cities similarly located. In addition to the regular uses, the fans are employed in barber shops and hair-dressing establishments for hair drying; for ventilating windows; for window display work; for drying prints in drafting rooms; for drying plates and prints in photographers' galleries; for drying leather belting and for various ventilating purposes in kitchens.

On account of the climatic conditions, the use of fan motors in Rochester, N. Y., is not as general as in cities where the heat is more intense. The Rochester Railway & Light Company has, however, a large number of fans installed for use in the regular way during the summer season, and in addition the company recommends and advertises electric fans for the following purposes: In winter, to keep frost from show windows; to increase the heating capacity of radiators in rooms which on acocunt of lack of radiating surface cannot be kept warm; to force draft of air in the intake of hot-air furnaces and thus increase the circulation of heated air in the house. The company also advises the use of fan motors in stables in the summer to keep flies away and to permit horses to rest in comfort. It is impossible for the company to state the exact revenue it receives from fan motors, since these are supplied with energy from the regular house meter. There are about 200 fans in constant use during the winter alone.

The Hartford (Conn.) Electric Light Company has about 700 fans connected to its circuits. Several years ago when the fan motor was first introduced, the company had the agency for ceiling and desk fans and aggressively pushed the sale of these motors. In later years, since the fan motor has become more thoroughly established, the company has turned this end of the business over to the electrical contractors. As in other cities where the fans are fed with energy from service meters, it is impossible to obtain an accurate record of the amount of energy consumed by fan motors.

There are about 5000 fans connected to the circuits of the Narragansett Electric Lighting Company, of Providence, R. I., although the company has never kept any separate record of the number of fans connected to its system or the energy consumption, income, etc. The company has always made an effort to encourage the use of fans, but has never sold any, preferring to co-operate with the electrical contractors and supply houses. Circulars designed and written by an advertising company and printed at the expense of the electrical supply houses are mailed to the company's patrons and are also enclosed with bills. The electrical supply houses and contractors of Providence also advertise in the newspapers the advantages of the electric fan.

The Edison Electric Illuminating Company of Brooklyn, N. Y., has tried two or three fan campaigns. The most successful campaign was pursued about three years ago when the company purchased 1500 fans and sold them direct to consumers during the winter and spring. This campaign was dubbed "Midwinter Sale of Electric Fans," and it was accomplished wholly through advertising. A feature of the advertising was the announcement that the sale lasted only until May 15 and that no fans would be sold at a reduced price after that date. The company disposed of its entire stock and felt that it could have sold a great many more at the time. The sale caused some friction with contractors and local dealers, and the company's subsequent relations with the contractors has been such that it has never repeated the effort, although it was, and is, satisfied that it can dispose of more fans direct than in any other way. Last season the company attempted a fan campaign somewhat on the following lines: It purchased a stock of fans and placed them on consignment with the local contractors, sending out advertising matter on fans to its customers and referring would-be purchasers to a list of consignee contractors. This plan did not work as well as the company had hoped, and at the end of the season the company had a large stock of fan motors on hand. Hiring several wagons, the company "peddled" this stock from door to door among electricity users, but did not succeed in getting rid of all of the fans. The number of fans in use cannot be estimated with any degree of accuracy, but is quite large.

In Cincinnati, Ohio, the Union Gas & Electric Company has connected to its system 2267 direct-current fans and 376 alternating-current fans. The company has not made any special fan-motor campaign, although fans are on sale at the main office of the company and also handled by the electric contractors and jobbers. Inasmuch as the fans are connected to the meters from which the lighting load is also fed, no record of the energy consumed or of the revenue obtained from fans is obtainable.

The Edison Illuminating Company of Detroit, Mich., does not of itself push fans, as its system of charging does not include fans in the base rate. However, energy used for such purposes is charged for at a rate of 4 cents per kw-hour, and this rate has encouraged the use of fans to a considerable extent. The local supply dealers succeeded in disposing of 500 portable fans last season, and the company estimates that about 2000 fans are owned by patrons, 80 per cent of these being used by commercial customers and 20 per cent in residences. The company contemplates pushing the fan motor among its resident customers for the coming summer, but no definite plan has been outlined as yet. The probabilities are that the fans will be sent out on a rental basis.

The Commonwealth Edison Company of Chicago has always believed in pushing electric fans. It has found that the introduction of these widely recognized conveniences has proved

an entering wedge for other business. In many cases the installation of fans has been followed by orders for electric lamps or small motors. Following are some of the ideas used by this company in its fan campaign as developed in various kinds of advertising matter. Good results from newspaper advertising are reported by Mr. G. B. Johnson, of the contract department of the Commonwealth company, who is familiar with the subject. The advertising copy is prepared ahead of time and is held in reserve for the first indication of a hot wave. The striking is done while the iron is hot, and as a result, anyone entering the salesroom of the company on a warm day in summer might imagine himself in a bargain-counter rush in a department store, the demand for fans is so great. Last summer the regular solicitors of the company were given a special commission for each fan sold. Further, a prize of $10 was awarded to the solicitor in each district securing the greatest number of fan orders within a given period.



FAN ADVERTISEMENT OF COMMONWEALTH EDISON COMPANY.

Fans were also sent out on approval, with the understanding that the customer had the privilege of returning them within two days if he did not wish to keep them. But if the user did not avail himself of that right, a bill was sent for the goods. An advertisement was inserted in the daily papers containing a coupon, upon receipt of which a fan would be sent, with a demonstrator, who would connect and demonstrate it free of charge, at the same time securing the order if possible. A combination advertisement contained a picture of a lady using an electric flatiron and also an electric fan. It emphasized this declaration: "Ironing Day a Pleasure in Summer with an Electric Flatiron and Electric Fan." This announcement brought good results. It was used in theater programs as well as in the daily papers. Several samples of advertisements are reproduced herewith, one in full and two others, owing to limitations of space, with the reading matter omitted. Other mediums for fan advertising were cards in the elevated and surface cars and direct-by-mail methods. The fan situation in Chicago passed the preliminary stage several years ago. The public is now being educated by means of advertising and soliciting to consider electric fans no longer a luxury but a necessity in every modern store, office and home.

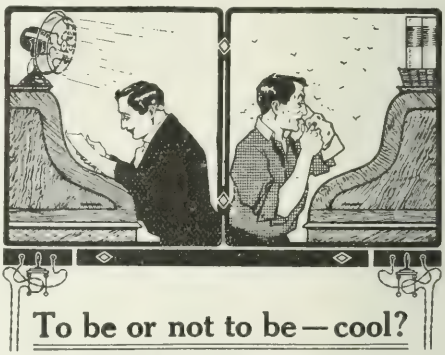
The Buffalo General Electric Company estimates that it has about 2000 fans connected to its circuits; but there are so many fan motors which, because they can be so easily attached by



ELECTRIC FAN ADVERTISEMENT

flexible cord and plug to any lamp receptacle, are not reported for inspection and of which the company has no knowledge that the exact number in use is difficult to ascertain. The fans are used on both the alternating-current and the direct-current lighting circuits and are used chiefly in stores, offices and in other business places, notably in saloons. The rate for energy varies between 3 cents and 7 cents per kw-hour. Only a few fans are used in residences where the rate for energy is 9 cents per kw-hour. The company occasionally installs fans for a few days in a sick room in residences during the summer months. A charge of $2 a month is often the rate for the small electric fan blowers used by blacksmiths, etc., but these are usually larger than the ordinary desk and ceiling fans.

In the Rocky Mountain region, the Denver Gas & Electric Company has about 1500 fans operating on its lines. This number is greatly increased during the summer months. The company receives a revenue from its fans of $3 per month, gross flat rate subject to 10 per cent discount, so that the net revenue



ELECTRIC FAN ADVERTISEMENT

per fan per month is $2.70. The standard 12-in. and 16-in. fans are used for the following purposes: Cooling a room; preventing flies from entering a room by creating a draft at the doorway; operating small washing machines in residences; operating small window displays and for operating small portable lathes for jewelers. Every fan is installed free of charge

and the energy is supplied to it free for a month. If desired, the fan can be purchased outright or rented at the rate of $1 per month.

Farther west, the Pacific Gas & Electric Company, of San Francisco, rents fans during the summer months in the interior cities where flat-rate electric systems prevail. The season lasts approximately six months, commencing with May, and the rate charged for the season is $12. This includes rental and energy used. For patrons who own fans the company makes a practice of charging for energy at the rate of $8 for the season. In the territory served by the company there are approximately 500 fans in use during the summer months and the revenue derived from these is estimated at $4,000 for the year. The company does not make a campaign with the idea of increasing the use of fans, as generally in the interior valley towns, the hot weather itself is sufficient justification for the installation of electric fans by everyone having electricity. In the cooler towns on the coast, electric fans are not used to any extent. The climate in San Francisco, Oakland, Berkeley and on the peninsulas of Marin and San Francisco is so salubrious that fans are rarely needed.

Measuring the Input and Output of a Storage Battery Automatically.

It is customary in a number of stations operating with storage batteries to measure the input and output of the battery by means of two watt-hour meters, which are thrown in and out of circuit manually or by means of an automatic throw-over arrangement of some sort depending for its operation on the reversal of polarity. The chief electrician and his assistants of the Central Pennsylvania Traction Company of Harrisburg, Pa., have devised a home-made and inexpensive appliance to accomplish the same result. In this station, a description of which appeared in these columns April 27, 1907, there is a battery of 288 chloride cells having a normal rating of 800 amp-hours and a maximum temporary output of 1400 amp-hours.

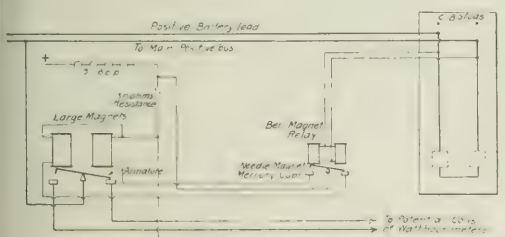


DIAGRAM OF CONNECTIONS

Deeming it advisable to measure the input and output of the battery and being unable to procure an inexpensive device in the market, the engineer and his assistants set about to devise one. It so happened that two watt-hour meters and two ammeters mounted on two unused feeder panels were available for this purpose, so no expense was incurred for measuring instruments. Since the watt-hour meters gave exactly the information required the ammeters were unnecessary.

The watt-hour meters were connected as shown in the accompanying diagram, in circuit with the positive battery leads which feed into or out of the main positive bus, through circuit-breaker studs. A relay circuit composed of a pair of ordinary bell magnets is placed across the meters in shunt with the main circuit. Owing to the low voltage, the magnets are connected in parallel, and as the current flows either to or from the battery, these magnets alternately attract and repel a permanent magnet needle carried below them. This needle is suspended on a post in circuit with the operating current which comes through five 8-cp lamps. As the needle dips into one or the other of the mercury cups shown, current is sent through a pair of large magnets which lift alternately the ends of the armature beneath them, thus causing the other end of the armature to close the circuit leading to the potential coils of either the watt-hour meter measuring the input or the one measuring the output, as the case may be. Cut-outs are supplied for all circuits, but have been omitted from the diagram for the sake of simplicity. A resistor with a resistance of 30 ohms is placed in the lamp circuit so as to reduce the sparking when the circuit is opened.

Tests on Boiler Setting by Marion Light & Heating Company.

Some interesting tests were recently made at the plant of the Marion Light & Heat Company, at Marion, Ind., on boiler setting. An Edgemoor boiler of 300-hp rated capacity was first tested with the ordinary three-pass setting, with the grates under the boilers, as in the usual construction. The setting was then changed so as to make five passes of the furnace gases in the boiler, and a Dutch oven, extending 3 ft. in front of the boiler, was installed. The results of the tests before and after making this change are given in the accompanying table.

	Before.	After.
Duration	8½ hrs.	8½ hrs.
Draft	Stack	Stack
Stack	5' x 100'	5' x 100'
Grate	7' 6" x 8' 3" 62.2 sq. ft.	62.2 sq. ft.
Air opening	40%	40%
Steam pressure, average	155	152.8
Furnace draft	.38"	.36"
Stack draft above breech	.735"	.772"
Feed water temperature, F...deg	188.5	187.
Stack temperature, deg	647	572.6
Kind coal used	⅝" ill. screenings	⅝" ill. screenings.
Amount coal burned	15,470	13,110
Moisture in coal	9%	11%
Dry coal burned	14,083	11,694
Ash	2,317	1,615
Per cent ash	14.9%	8.4%
Dry coal per hour	1656.8	1378.8
Dry coal per sq. ft. grate surface per hour	26.4	21.9
Total water evaporation	74,845	77,064
Factor of evaporation	1.0749	1.0256
Water, fire and ash, 212 deg	80,450	82,890
Water evaporated per hour	8853.3	9,000
Water evaporated per hour, fire and ash, 212 deg	9461.7	9751.7
Evaporation per pound dry coal	5.31	6.4
Evaporation per pound dry coal, fire and ash, 212 deg	5.71	7.09
Commercial horse-power developed	274.2	282.3
Builder's rating	300	300
Per cent of rating	91.4	94.
Moisture in coal	9	11
Efficiency of boiler and grate	45.22	58.4
Efficiency of boiler only	55.19	68.3
Grate used	Kelly shaking grates.	Same
Per cent of CO_2	7.8	8

for which we are indebted to Mr. S. H. Smith, superintendent of the company.

It is estimated by Mr. Smith that this change in setting under the conditions in which this boiler is operated will probably cause a saving of about 1400 tons of coal per year. As shown by the table, the evaporation in pounds of water per pound of dry coal was raised from 5.71 to 7.09. The reason for the increased efficiency is to be found, first, in the high furnace temperature permitted by the Dutch oven. The brick top of the Dutch oven, being at a high temperature, does not cool down the gases as they rise from the coal, and so combustion is thoroughly started in the oven before the gases reach the boiler. When the boiler is reached, the added number of passes which the gases must make gives the boiler tubes more opportunity to extract heat from the gases, while dead pockets in the boiler setting are eliminated.

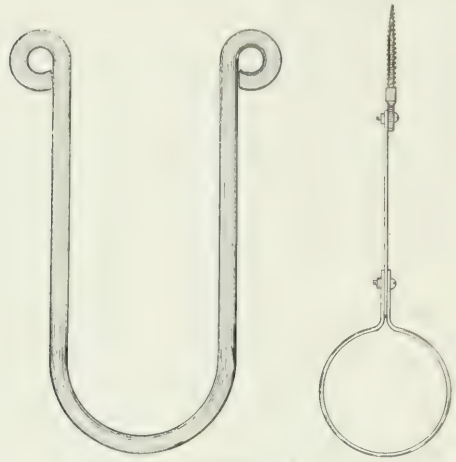
Pipe-Hangers.

By W. H. Wakeman.

Judging by the crude appliances adopted in some cases for the support of steam pipe, even in extensive plants, some engineers and owners of plants are doubtless not aware of the great variety of devices which combine convenience of application, flexibility of adjustment and strength of material that can be secured at reasonable cost in the open market. The object of this article is to describe these, showing the different styles and offering suggestions and recommendations concerning

ing their use which should prove beneficial to those who erect and operate steam plants of every kind, and for all purposes.

Fig. 1 illustrates the most simple kind of pipe-hanger that can be found. It consists of a piece of round wrought iron having a diameter suitable for the strain that is to come upon it in service, and a proper length for the pipe on which it is to be used and the "drop" adopted, or, in other words, the distance between the pipe and the ceiling above it. Each end is then bent nearly into the form of a circle, but not welded, as it has ample strength without this precaution. The rod is then bent into a semi-circle at the center, the radius depending on the diameter of pipe that it is intended to support, and the hanger is finished.



FIGS. 1 AND 2.—SIMPLE PIPE HANGERS

This kind of hanger is used almost exclusively on the sides of heavy timbers, to which it is fastened by a long screw through each eye. This form of construction seldom fails in service, partly because it does not depend directly on threads of iron holding in wood, for a plain bolt without threads would be almost as safe, provided it was a snug fit in the hole and the bolt was long enough nearly to equal the thickness of the timber. It is absolutely without means of adjustment, either when placing the pipe lines or to compensate for springing of the timber, as more weight is put upon it, or for unequal settling of the building due to insecure foundations.

The hanger shown in Fig. 2 is supported by a lag screw put into a timber which supports the floor above or directly into the floor where the popular form of "mill construction" is adopted. The latter consists of a 4-in. spruce floor laid on timbers and covered by ⅞-in. or thicker flooring of hard pine. An important point to be considered in this connection is the selection of a proper bit for boring the hole to receive the lag screw. The natural tendency of a carpenter is to select a bit that will bore a hole large enough to allow the lag screw to turn easily, thus saving himself more or less hard work; but this should be prohibited as unsafe and unprofitable. The bit should bore a hole that would allow the body of the screw to be driven easily, provided the threads were removed, thus forcing them to cut their way into the wood under actual working conditions and to secure a firm hold.

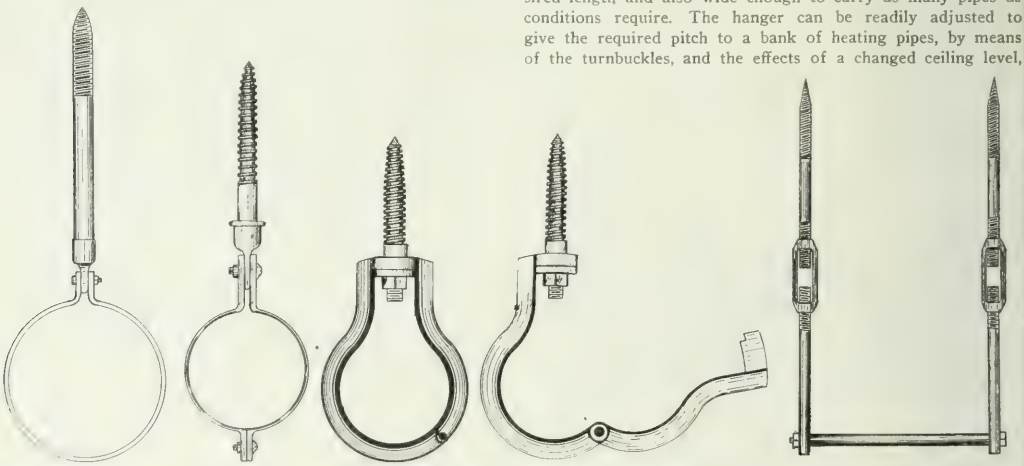
A piece of flat iron is bolted to the flattened head of the lag screw as shown, but, owing to the position of this iron several bolt-holes in it are not visible. If this iron is too long it can easily be cut off with a cold chisel, and the lower bolt may be put in another hole to secure the desired length. The lower bolt is in double shear, therefore it will hold much more than the upper bolt, which is only in single shear.

Fig. 3 illustrates another hanger, the upper part of which consists of a lag screw. All hangers of this class are adjustable to a small extent by turning this screw to the right or to the left. These lag screws have standard iron-pipe sizes, therefore they can be shortened by the use of pipe tools, or lengthened by adding a pipe coupling and a nipple of the desired length.

The two preceding illustrations show bands that are made in one piece which must be opened to clasp the pipe, but Fig. 4 shows a band made in two parts and held together by bolts. The hanger is not as symmetrical as when there is no bolt on the lower side, but it can be put on and taken off with less trouble.

Fig. 5 illustrates a malleable-iron hanger that is galvanized when so ordered. It is hinged at the lower right-hand side and may be opened, as shown in Fig. 6, to be placed on the pipe. When closed it is safe and a nut is provided for raising and lowering the pipe to secure good alignment.

Fig. 7 shows a trapeze hanger that may be made in any desired length and also wide enough to carry as many pipes as conditions require. The hanger can be readily adjusted to give the required pitch to a bank of heating pipes, by means of the turnbuckles, and the effects of a changed ceiling level, due to settling of the building, or depression due to heavy weights on the floor above, can be counteracted at pleasure by the same means.



FIGS. 3 TO 7.—VARIOUS TYPES OF PIPE HANGERS.

Fig. 8 illustrates a solid cast-iron hanger without an adjustable feature. It is strong and durable, but correct calculations must be made in advance of the erection of pipe lines that are to be supported by this style of hanger as mistakes

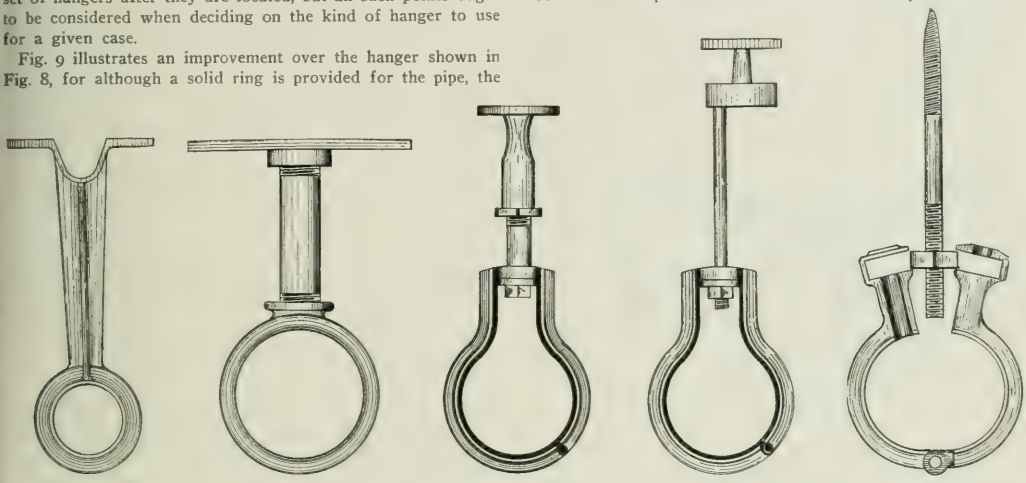
cannot be corrected by changes in lengths of the supports. It is necessary to put the required number of hangers on each length of pipe before fittings are used, and if pitch is desired, provision must be made for it on the supporting timbers. If it becomes necessary to remove the hangers after the pipes have been in use for some time, it will probably be cheaper to break them with a few blows of a hammer and substitute a kind that can be put on and taken off at pleasure than to remove the fittings to make a clear passage to the end of each length of pipe. Of course, it is seldom necessary to remove a set of hangers after they are located, but all such points ought to be considered when deciding on the kind of hanger to use for a given case.

Fig. 9 illustrates an improvement over the hanger shown in Fig. 8, for although a solid ring is provided for the pipe, the connection above is not fixed in the shop where it is made. It consists of a nipple, or short piece of pipe, therefore the owner of a steam plant may order as many rings and plates as he needs to make the required number of hangers, then he can purchase or have made the proper number of nipples, of various lengths to suit his requirements. In all cases where solid rings are used care should be taken to have them large enough to move along the pipe easily, for if they are too small to pass over rough surfaces it will take much time to file or grind them to make an easy fit, but if too large no harm will result.

The hanger can be adjusted vertically as follows: A long thread can be cut on the upper end of the nipple and the hole extends entirely through the plate, or at least it ought to in every case. If the hanger brings the pipe too high or too low with a given adjustment, the bolts or lag screws can be taken out and the plate turned in the proper direction to give the desired pitch to the pipe, and when this is secured the fastenings can be replaced. It may be necessary to bore into the timber to admit the projecting end of the nipple, but that does not represent a long job. If a right-hand thread is cut on one end of the nipple and a left-hand thread on the other end, the pipe can be raised or lowered at pleasure with a pair of pipe tongs. If the plate is fitted with a left-hand thread when manufactured, there is no good reason why it should cost more, therefore, it only requires foresight in the matter to secure a more convenient hanger. A left-hand pipe tap can be inserted in a right-hand thread and run down to a suitable depth without injury to the first thread. It is then possible to screw in either a right or left-hand nipple at pleasure, making a joint that is satisfactory for this kind of work. Of course, these adjustments can only be made to a limited extent, as calculations are supposed to be made nearly correct when the nipple is ordered.

Fig. 10 illustrates an adjustable hanger with hinged ring and a nut for raising or lowering it. The upper part of this hanger has an anchor that is intended to be built into reinforced concrete work. This popular form of fireproof construction cannot be easily used to support hangers unless provision is made for such service when the work is erected, therefore it becomes necessary to make plans in advance for every hanger to be used. While it is not impossible to locate and fasten these hangers after concrete has set or hardened, it is a thoroughly impractical job, the cost of which is much more than is actually necessary where complete plans are made in advance.

It is a very easy matter to locate hangers slightly out of their proper position, thus causing a line of pipe to assume a very unsatisfactory appearance, and it is very expensive to correct such a mistake, therefore, the hanger shown in Fig. 11 was invented to provide means for horizontal adjustment without disturbing the anchor. The lower part of this anchor consists of a hollow stationary disk within which is confined another disk that carries the rod. The inner disk can be revolved at pleasure, but will not come out of place in service. The rod that supports the pipe is tapped into this disk about 1 in. from the center, therefore when the latter is given one revolution, the former describes a circle nearly 2 in. in diameter, hence a false alignment can be corrected to the extent of this capacity, or in other words, the hanger can be made to correct an alignment that is out nearly 1 in. either side of the center line.



FIGS. 8 TO 12.—APPLIANCES FOR SUPPORTING PIPES.



FIG. 13

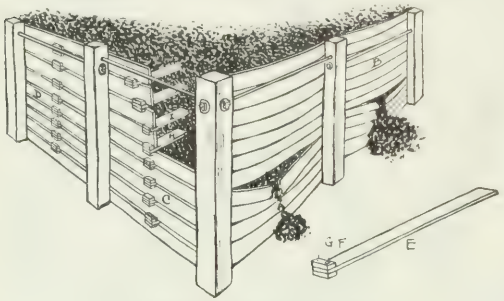
The hanger shown by Fig. 12 consists of a lag screw of suitable length to give the desired "drop" with a thread on the lower end which carries a nut by means of which vertical adjustment can be made to suit varying conditions. The lower part is a ring hinged centrally at the bottom in order that it may be put on and taken off from the pipe at pleasure. The upper part forms a clamp in two parts, which meet around and conceal the nut, as illustrated in Fig. 13, thus forming a very convenient hanger that is strong in service and symmetrical in appearance, especially as the thread is concealed. The upper part of this hanger has an anchor for use in connection with reinforced concrete work.

Hangers that are hinged centrally (see Figs. 12 and 13) make it unnecessary to raise the pipe higher than its finished position requires, whereas the hanger shown by Fig. 10 and others of the same class require the pipe to be lifted higher and lowered into place. However, hangers of the latter type will hold the pipe when the ring is open, which is not true of hangers of the former type. There are no small parts used in connection with these to be mislaid or lost in the disorder which usually attends the erection of a new mill or shop on account of masons, carpenters, machinists, iron workers, plumbers and laborers plying their vocations.

LETTERS ON PRACTICAL SUBJECTS

STORING COAL IN LIMITED SPACE.

In operating central or isolated stations, it is frequently very convenient to be able to utilize a limited floor space for the storage of considerable quantities of granulated material. If coal is to be piled to a considerable height, it becomes a serious problem to confine the material against lateral spread. It is comparatively easy to erect a few timbers, as shown by the accompanying illustration, and place planks *ss*, shown at *a*, *b*, *c* and *d*, to retain the coal or sand. But, unfortunately, the weight and pressure of a body of coal which has been piled 15 ft. or 20 ft. high is more than can be withstood by 2-in. planks 16 ft. between the retaining posts. The invariable re-



SUPPORTING COAL-BIN PLANKING.

sult of this kind of engineering is seen at *a* and at *b*, where the planks have been badly sprung outward and some of them broken by the internal coal-pressure.

A very cheap and very complete remedy for the trouble at *s*, and *b*, lies in the little arrangement shown at *e*. It is merely a piece of board, of any convenient length and width, and is found in use from 6 in. to 12 in. wide, and 4 ft. to 15 ft. long. Two short pieces of board are fastened across one end of the board, either by nails, as shown at *g*, or, which is better, by means of a couple of small bolts as shown at *f*. Ordinary carriage bolts will answer the purpose admirably.

The manner in which these supporting strips of board are applied is shown very plainly in the broken-away portion of the engraving at *h*, and *i*, where boards are shown, simply laid into the coal with the planks *c*, engaging the cleats which have been fastened at *f*, *g*, across the boards *e*. It has been found that in wall-supported or confined material, almost exactly one-half the material thus confined is supported by the walls of the bin or tank. Thus, in this case, one-half the weight of the coal is actually carried by the walls. The statement made in the preceding paragraph should be modified by stating that it refers to a storage bin where the depth of the stored material is equal at least to the diameter or width of the bin in which it is stored. The rule would not apply evidently to a bin 1 ft. deep and 100 ft. wide; but for a square or round bin of equal dimensions, the rule applies very closely. Thus, in the case in hand, the material contained in the bin may be considered as being half carried by the planking and the posts and it becomes very easy to tie the planks against being pressed outward by merely placing one of the tie-boards between each pair of planks.

Should the planks be very long between the supporting posts, or should the coal or other material be piled very high, then it may be necessary to place two or perhaps even three boards between each pair of planks. No other fastening is needed to the tie-boards, except to lay them in and pile coal on them. The pressure of the coal, vertically downward, is so great that the tie-boards cannot slip endwise, and the higher the coal is piled the greater will be the downward pressure.

When sand, ashes or other very fine material is to be piled a device must be necessary to cover the cracks or openings between the planks at *c* and at *d*, to prevent the fine material from flowing out through the cracks between the planks. Very thin boards, placed inside the bin, will answer for this purpose. These thin boards can be removed, one by one, as the bin is emptied and the tie-boards exposed to sight. The tie-boards, and also the planks are to be removed as the bin empties, and, of course, the planks and boards are to be put in place again as the filling proceeds.

No nails or other fastening should be used. Gravity must do it all, and gravity is fully equal to the occasion, provided it is given the opportunity. Care should be taken that the cleats are properly fastened to the ends of the tie-boards *e*, for should these cleats pull off under the severe outward pressure of the coal in the bin, then trouble will result. A couple of bolts should be inserted in each tie-board and then there never will be any trouble from that source.

BOSTON, MASS. JAMES FRANCIS.

TESTING METERS IN CONSUMER'S PREMISES.

When a meter is tested on a consumer's premises it is made for one of two reasons: As a check to the accuracy and operation of the meter for the central station's benefit, or due to a complaint of a customer. There are many ways of testing these meters; as with a volt and ammeter indicating wattmeter or by a standard rotating set in series with the meter under test.

The volt and ammeter are not desirable as an approximate test is reached, because the fluctuations of voltage due to motors and elevators being on the same circuit, all of which make it hard to get anything but an approximate test. Not only that, but the man making the test has four instruments to watch: A volt and ammeter, stop-watch and meter being tested; consequently he is not sure of the test, and if it is an alternating-current circuit it is not possible to get a correct test unless the exact power factor of the circuit is known. When an indicating wattmeter is used the test is made easier, reducing the number of instruments to be watched and indicating the load in watts directly. But the most modern method is to place a rotating standard portable meter in series with the meter to be tested and by using a standard load box any load can be got and the graphic condition of the meter ascertained. By starting the standard meter at zero, and counting the revolutions of the meter under test, the only instrument to be watched is the one under test, as the standard registers its own revolutions.

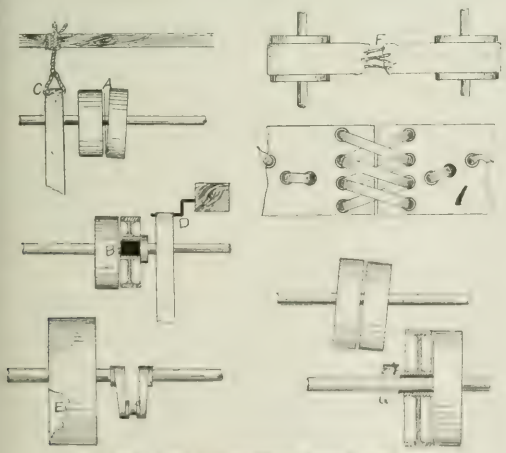
In making the test it is always advisable to place the standard ahead of the meter, because the ratio of energy passing through the standard and regular meter varies. When the standard is placed before, it receives more current by the watt losses in the regular meter; but if behind it receives less, assuming that both meters are of the same capacity. In many modern meters this loss is very low and may be neglected on full load; but as the loss decreases the error becomes greater as the I^2R loss in the field becomes less. On a load of 500 watts the standard meter will receive 4.6 watts more than the meter under test. Therefore, if the customer is watching the test it would appear more to him and make him feel satisfied when he sees his meter running slower than the standard meter. But if the standard is placed behind his meter and during the test he finds that his meter is running faster, due to the causes mentioned above, no amount of explanations will satisfy him that his meter is correct. Then again, if the customer has no technical knowledge of the subject, the graphic method of placing the two meters in series and making a direct comparison will appeal to him more than a lot of ammeters and voltmeters or indicating voltmeters showing the volts, kilowatts, etc., of which he knows nothing. If the meter should be found fast or slow it is good practice to change it and replace it by a meter from stock. Then the faulty meter can be overhauled in the test room, cleaned and recalibrated and the cause for the error located. In cases where meters are found to "creep," the house

wires should be disconnected to see whether the trouble is due to a ground on the installation or is due to the potential coil of the meter. In the above case it is advisable to stop this creeping with the meter in position, by adjusting the light load adjustment screws or by the adjustable shunt field coil. Before the meter tester leaves the premises he should show the consumer how to read his own meter and thus keep "tabs" on the indexer on his monthly round. If, when the meter is found correct and the consumer insists that there is something wrong, and that he has not been using many lamps, it is advisable in this case for the tester to inspect the installation and see whether there are any black, dim lamps on the circuit and if so, to have them renewed. The general policy of the meter department should be to give as perfect meter service as possible, and to maintain harmonious relations with the consumer and the company.

NEWBURGH, N. Y. A. P. BROADHEAD.

DEFECTIVE BELT DRIVES.

Often the best makes of electrical machines are hindered in their mechanical movements by the adverse condition of the belting. Fig. 1 shows the handicap under which a certain electrical motor was compelled to operate. The belt extended from the fly-wheel of the motor to a shafting line overhead, on which the fast and the loose pulleys for the belting were secured. The fast wheel was properly set and firm, but the loose wheel was suffering from a worn hub, with the result that the wheel inclined over at the top, leaving a gap as at *A*. The loose wheel was so arranged that it had to run all the time when not in use. Hence the premature wearing down on both the bearing of the wheel and the shaft at that point. In some places, the wheel is saved from this wear and tear by tieing up the belt, free from the wheels, by means of a rope, as at *C*, when power is not needed. This arrangement not only eases up on the wheel, but gives the belt a needed rest. One cannot get good work from a leather belt that is stretched day after day, and all night, on the wheels. The belt should be given a rest over night and Sunday. In the case of the tilting loose wheel in Fig. 1, the wheel was removed and bored. Then a sleeve was shrunk in to take up the worn part. Next the wheel was replaced as at *B*, in Fig. 2, the darkened portion showing the sleeve, and a metal



FIGS. 1 TO 6.—DEFECTIVE BELT DRIVES.

belt holding hook installed at *D* to hold the belt, instead of the rope. This arrangement proved much better for the wheels, the belt and the electric motor.

In another case, the power derived from a motor was unsteady, and various changes were made to eliminate the defect. Ultimately the balance wheel was found to have lost a certain amount of weight, due to the breaking off of a piece of the rim, as at *E*, Fig. 3. The loss of weight threw the wheel out of balance. The trouble was overcome by shaping a piece of sheet metal to conform with the plan of the rim, after which the piece was riveted in place with inner cleats. The weight being thus balanced, the wheel ran true and even.

In another case it was observed that a first-class electrical driving machine in a printing office was having quite a struggle with a belt which had been permitted to deteriorate to the condition shown at the joint at *F*, Fig. 4. Every time that the defective part of the belt contacted with the pulley rims the belt slipped a little. The loss of force created an unsteady movement. The workmen attributed the trouble to a defective motor, and complained to the makers. The belt sewing was reconstructed on the plan shown in Fig. 5. The entire torn and worn portion of the old joint was cut out. An entire new joint of belting was inserted and laced evenly and firmly like the pattern, after which the motor operated steadily.

Fig. 6 shows the worn and wabbly order in which two wheels were run for a belt connected with a motor in a flour mill. The wheels had become worn at the bores and, in order to take up the worn part some keys had been driven in. However, the keys were not evenly arranged, the result being the tipping of the wheels to one side. The belt, in seeking the high side of the combination, gave trouble by slipping and running off. To remedy the defect the wheels were removed and rebored, so as to make the holes even, and then placed back on the shafting. Four steel keys were used for each, being driven at proper distances apart around the shaft, as at *G*, in Fig. 7, thereby straightening the wheels.

NEW YORK, N. Y. ROBERT GREER.

CONSTRUCTING LAMP-ARCHES FOR STREET LIGHTING.

The lighting of streets by means of arches formed of incandescent lamps must be acknowledged to be a very pleasing, effectual and spectacular method which meets with public approbation wherever it has been tried. With the cost and the efficiency of this method the writer does not wish to deal. It is only with some of the mechanical and electrical methods which may be employed in placing and maintaining the several lamps in their respective positions that the writer desires to take issue. Fig. 1 shows a form of wire arch which answers the purpose, but which is hard to build, slow of construction and a tedious thing to adjust and to keep in shape. But for all that, this arch is frequently met with. To construct the arch, two hook-bolts, *a* and *b*, are first put in position in the buildings or in the poles which are to support the arch. Next, a heavy wire is stretched as shown at *c*, and connected with hook *b* by means of the turn-buckle *d*, through which the catenary of wire *c* is adjusted to suit. Two smaller eye-bolts are inserted at *e* and *f*, and expansion bolts may be used for these, but for the main bolts *a* and *b* through-bolts should always be used. While expansion bolts may hold, they are not to be trusted for work of this character, but they will do

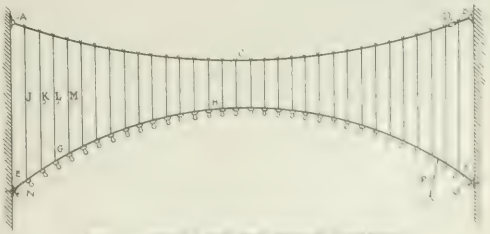


FIG. 1.—WIRE ARCH FOR STREET LIGHTING.

very well for the lesser purpose at *e* and *f*. Next, the feed wires *g*, *h*, *i* should be prepared by attaching lamps at the required distance from each other, and taping thoroughly against the action of rain and snow. If the lamps are to be spaced 1 ft. or 2 ft. apart, the chosen distances should be measured very carefully, and the feed wires and the lamps attached at the stated distance from each other. The feed wires

a, b, c must be of ample length and the excess can be cut off much easier than an extra foot can be added by splicing.

The double wires and their string of lamp sockets should then be hung and fastened temporarily in place by means of cords suspended from the wire *a, b, c*. No. 8 wire, doubled and twisted, makes an excellent support for the arch wires, which in turn support the lamps and feed wires. After the feed wires and the lamp sockets have been put temporarily, or rather approximately, in place, the plain supporting wires *j, k, l, m*, etc., are put in place and adjusted to length after having been attached to the lamp sockets as shown by the engraving, Fig. 1. Upon the manner in which these vertical supporting wires are adjusted depends the smoothness of the lamp-circle. It is possible to give the arch a very smooth and even appearance by carefully adjusting the length of each supporting wire. Indeed, it is best temporarily to fasten each wire until all are in place, then go over them all once or twice and adjust those which hold their respective lamp-sockets too high or too low. Once these wires have been satisfactorily adjusted they may be fastened permanently by

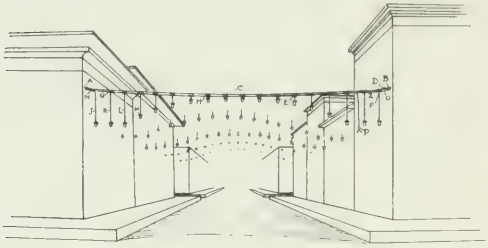


FIG. 2.—"SUSPENDED ARCH" STREET LIGHTING.

twisting them firmly together around the supporting wire as shown in the engraving (Fig. 1) above *a, b, c*.

It will be necessary to fasten the feed-wire in some manner, and this is best done by means of two pieces of No. 16 or No. 12 iron wire, the same as was used for the supporting wires. These bits of wire are shown in place at *n*, and *o*, being attached to the expansion eye-bolts *e*, and *f*, and to two porcelain insulators, one of which is placed upon each end of the feed-wire *g, h, i;* the latter wire passes through the insulator, while the iron fastening wire is twisted around the insulator in the usual way. There now only remains the attaching of the connection to the line wires from which energy is to be taken. This is effected by means of the double wire *p*, which is spliced to the feed-wires and the free ends connected to the proper lighting circuit wires, which may be hung upon poles.

The arch above described, while it may prove satisfactory for some purposes, is not convenient to install, neither is it as weatherproof as may be desired. There are so many taped connections for water to leak into, and so many supporting connections to adjust, that other forms of lighting-arches have been found more desirable. The arch represented by Fig. 2 is constructed upon an entirely different plan from that shown by the preceding engraving. Instead of four points of attachment to walls or poles, there are only two, thus lessening the construction cost considerably. The suspension wires which keep the arch in shape are also dispensed with and the number of lamps necessary has been greatly lessened by using some form of high-power lamp which is fitted into an umbrella-socket particularly adapted to outdoor use, and in which the double feed wire is introduced and specially sealed against weather and water. It is now possible to hang each lamp from a vertical wire, the length of which shall govern the position in the arch of the particular lamp to which that wire may be attached. This is very plainly shown in Fig. 2, where the 18 lamps which are spaced across the street in each arch are arranged in groups of three.

Above each sidewalk three lamps hang upon a level. The next three lamps ascend sharply in a curve approximating the quick curve of a parabola. The next three lamps reach to the center of the street and coincide with the flat reach of the parabola. The three lamps last mentioned, being adjacent to the three similarly placed lamps on the other side of the street present the flat effect which makes the appearance of this arch so much more striking than the one shown by Fig. 1. As rather

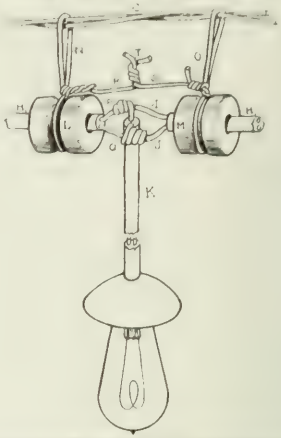


FIG. 3.—METHOD OF ATTACHING AND SUPPORTING LAMP LEADS.

crudely shown by Fig. 2, this peculiar arrangement of the arches and of the lamps gives an exceedingly pleasing effect to the perspective of the arches. There is not that exasperating sameness to this arch that there always is to the circular arch which breaks straight across the street without relief or change of curve from beginning to end.

This arch also presents very much less resistance to wind than does the arch shown by Fig. 1. As only one end of each lamp-supporting wire is fixed, the wind pressure will be relieved to a considerable extent by the swinging of each lamp in the direction of the wind. Thus, each lamp can yield independently to heavy gusts of wind, thereby placing much less strain upon the supporting wires than if the whole arrangement were fixed at four points instead of two. Another valuable feature of the arch shown by Fig. 2 is that the entire construction can be completed upon the ground, in the shop in fact, and erected in a very few minutes, with little adjustment necessary after the design has been put in place upon the supporting wire or cable. A doubled and twisted No. 8 wire answers well for this purpose and it is fastened in place exactly as described for the cable in Fig. 1. This wire is indicated by the same letter, *c*, in both engravings, the hook-bolts by *a* and *b*, the turn-buckle by *d*, etc. The feed wires, *g, h, i*, are connected with drop wires to the lamp sockets, and

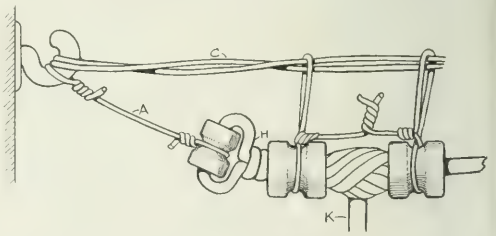


FIG. 4.—METHOD OF ANCHORING ARCH.

are shown at *j, k, l, m*, etc. To center this arrangement of wiring two pieces of lashing wire are provided as shown at *n* and *o*, and the feed wires are made fast to the hook-bolts *a* and *b*, porcelain insulators being used for this purpose.

The manner in which the wiring is connected up may better be understood by reference to Fig. 3, which represents a detail

of the wiring at *e*, upon a larger scale than can be shown by Fig. 2. In this engraving the twisted supporting wire is shown at *c*, the feed wire at *h, h*, and the double wire lamp feeder is shown at *k*. The feed wire *h* is laid bare at *i* and *j*, and the drop wire *k* (which is the same as double wire *h*) is also bared of its insulation and connected to *h*, as shown at *p* and *q*. The entire connection is then well taped to exclude the weather, after which the porcelain insulators *l* and *m* are brought close up against the taping, which is not shown by the engraving, after which, the insulators are fastened together and to the supporting wire, as shown by the lashing wires *n* and *o*. The free ends of wires *n* and *o* are twisted together so as to hug the insulators very closely, also to leave the loops which pass over the supporting wire as shown. When these are made up in quantity, a little machine may be used to advantage; just a little hand machine, jig, or tool, consisting of a piece of metal to fit inside the loop *o*. In fact, this loop, and the one at *n* may be quickly formed by putting an insulator on a pin or headless spike projecting from a bench or post, then applying the wire in a loop and using the hand jig for twisting together the free ends of the wire, leaving the loop of exactly the size required.

The ends of the loop wires, after having been twisted together, should be left with one of the wires projecting as at *r* and *s*, while the other end is cut close as shown. One of the insulators must be put in place on the double feed-wire *h* before the joint *i, j, p, q* is made and taped, after which, the other insulator should be brought as close to the joint as the taping will allow and the wire ends *r, s* twisted together as shown at *t*. This effectually prevents any sidewise movement of the insulators *l* and *m*, after the loops *n* and *o* have been slipped upon the supporting wire or cable *c*. For clearness, most of the wire-ends shown in the engravings have been left projecting into space, but the wireman will take care that none of these wire ends are left to punch holes in the insulation.

The entire assemblage of insulators, drop wires, loops and feed wire may thus be assembled and strung upon the supporting wire after the length of the latter has been determined and cut. The through eye-bolts may be located in a variety of ways. An engineer with his telescope level may be employed to give the proper height at which each bolt is drilled into the building or pole, or, if the sidewalk is on the grade, a piece of wood may be used for measuring directly the height of each hole from the sidewalk directly underneath. When the sidewalk is not to be depended upon a couple of horizontal sight-boards or targets can be arranged at distances of several streets from each other, and a pole used which will just reach from the top of the target to the bolt holes in the walls; then sight over the targets and have the pole adjusted until its lower end is exactly in line with the face of each target. The bolt holes may then be marked at the top of the pole.

After the hook-bolts are in place and screwed up, with ornamental washers to conceal the ragged drill work in the walls, the supporting cable may be stretched with its load of feed-wire and insulators, drop wires and umbrella lamp sockets. The turn buckle may then be adjusted until the catenary of the supporting cable appears about right, when the ends of the feed wire may be tied to the hook-bolts temporarily with strings and the lamp wires and sockets made hang evenly and where they are expected to appear. Each arch should be in proper alignment and level with the other arches, and the turnbuckle and the temporary lashings adjusted until the arches are straightened out to suit. The temporary cord lashings may then be replaced by permanent wire fastenings, as shown by Fig. 3, in which *o* represents the permanent wire lashing, and the manner of its application is so plainly shown that no further description is necessary.

The manner of applying the small porcelain insulator at the end of the feed wire is also plainly shown, likewise the manner in which the larger porcelain insulators are brought against the taped joint and fastened there by the free ends of the loop wires which engage the supporting cable. The wire leading to the source of electrical supply is connected in exactly the same manner as that illustrated for attaching the lamp or drop wires. Taken altogether, this arrangement of street arch lamps forms a very inexpensive as well as a very effective method of obtaining a full arch effect in the illumination, without the expense of one cent for ground work.

Occasionally it is necessary to support arches of this character upon poles or posts. This form of support should be avoided entirely, whenever possible, for the eye-bolt or hook attached to a solid wall forms a much more rigid support than is possible with pole construction. However, if absolutely necessary, pole construction can be made to answer very well, but there is often considerable expense met with in strengthening the pole line with the necessary guys.

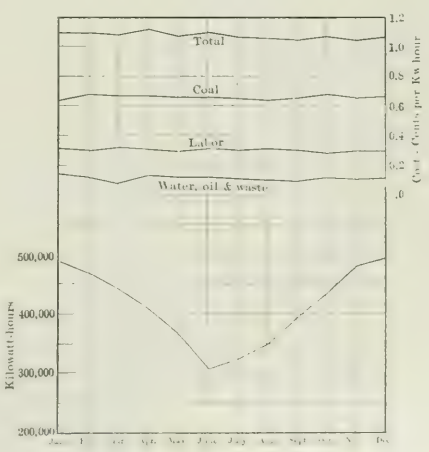
Willoughby, Ohio. James F. Hobart.

HANDY CENTRAL-STATION CHART.

In a recent issue an article by W. F. Kimball illustrates and explains a "Handy Central-Station Chart." To find the cost of any item, using Mr. Kimball's chart, it is necessary to follow up from the month to the line indicating the load for that month, thence along the horizontal line to a symbol denoting the commodity whose cost it is desired to ascertain. It is also evident that since the high or low loads may come for any month, they may have any relative position in the line of costs—that is, they are not necessarily related in any logical way to those next above or below. It may frequently happen that two or more months may have the same coal cost per kw-hour, for the same load, necessitating the superposing of symbols.

If an ordinary cross-section sheet be arranged as shown by accompanying sheet, it is possible, without going first to the load value, to find the cost per kw-hour of any item for any month by merely following the heavy vertical lines. Further, the load now takes the familiar "load-curve" shape.

A glance then serves to show whether or not the total cost per kw-hour is rising and falling with the load, or what items



CENTRAL STATION CHART.

are. For example, the curves shown indicate that the cost of coal per kw-hour is not proportional to the load factor, but for the given year is nearly independent of the output.

The values used are the same as used in Mr. Kimball's chart. For values of the different items, which differ somewhat, as shown here, no symbols need be used and where items have nearly the same values, the familiar, solid, dashed, dot-and-dashed or dashed and double-dotted lines offer a simple solution.

These curves could also be drawn with the value for each month as a horizontal line taking one full division, with vertical connecting straight lines, but this would require more time without adding any to the clearness.

New York, N. Y. R. W. Keyes.

QUESTIONS AND ANSWERS

What acid is used for cleaning the inner globes of arc lamps? M. F.

For light deposits dilute hydrofluoric acid is used; but when the deposit has been burned into the glass the hydrofluoric acid is used undiluted. Inasmuch as the acid dissolves the glass, repeated washings weaken the globe so that liability of breakage or fracture is increased.

In ordinary line work, should soft-drawn or hard-drawn copper be employed? D. I.

For ordinary work many engineers prefer the soft-drawn copper, claiming that the disadvantage due to increase of sag is more than offset by the difficulties in handling hard-drawn wire and the possibilities of damaging the latter when it is being erected.

Is there any danger attached to the use of small quantities of electricity at a potential of 10 volts? J. F. G.

No. It is doubtful if electricity at this potential can be detected by shock except by bringing both wires of the circuit to the moistened tongue. An average person under very favorable conditions does not experience any sensation whatever until the tension reaches about 35 volts.

Which is the preferable way to place cross-arms on long runs, and why? E. T. N.

On long, straight runs it is advisable to set the cross-arms in such a way that they alternately face each other on adjacent poles and are back to back on the next two poles. In this way should a stretch be cut down or a pole break, there is less danger of the cross-arms being wrenched off than if they were all set in the one direction.

How are the oscillators attached to the shafts of rotary converters operated?

An instrument which automatically closes the circuits to the electromagnet fastened to the commutator-end of the dynamo frame directly across the end of the armature shaft, is mounted upon the wall or upon a switchboard most convenient to the machine. This instrument consists of an electromagnet with a vertical plunger at the other end of which a dash-pot is attached. About the center of this plunger shaft two washers are fixed to limit the play of a lever having balance weights at one end and a carbon contact at the other end. The carbon contact piece is adjusted to strike another carbon contact piece fixed to the board. When both carbons come together the circuit is completed and the impulse in the electromagnets upon the machine attracts the armature shaft. Instantly the magnet of the oscillator instrument attracts its core and the washer lifts the carbon-tipped lever, thus opening the circuit. The core then descends again under the action of gravity, its motion being regulated by the dash-pot at the other end. The carbon-tipped lever is carried down with it until the carbons are again in contact when the movement is again repeated.

When would it be advisable to use an induction motor and when a synchronous motor? What advantage does one possess over the other? W. S. B.

Where a motor must start with full-load torque, an induction motor must be employed. Where the conditions are such that a motor starts light and receives its full load after having come up to full speed, then either the synchronous or the induction motor may be used. The synchronous motor has the advantage that its power factor is adjustable and can be made to suit the requirements of a transmission system, whereas the induction motor has a definite and lower power factor that is constant for a given load. Synchronous motors commonly start with reactances in their armature circuits sufficient to keep the starting current down to a value not greater than 50 per cent full-load current. Induction motors starting under light load and employing short-circuited secondaries, are commonly started by devices for decreasing the voltage and inserted in the main circuit for the purpose of keeping down the starting current to a little more than full-load current. (See article on rheostatic starters for induction motors by Dr. B. F. Bailey in the January number.) Either motor will come to a standstill if overloaded beyond a certain limit. In that event the only difference is that the induction motor can recover, whereas the synchronous motor will have to be started afresh.

I have been informed that in some of the hydro-electric plants in the West induction motors are attached directly to the turbines driving the exciters and perform some function automatically. This function I have been unable to ascertain and would be obliged for any information on the subject. G. M. B.

Exciters driven from main waterwheel generators are open to the objection that any drop in speed of the main generators causes the exciters to drop in voltage and thus in turn lower the voltage delivered by the generator exactly at a time when increased voltage, if anything, is required. On the other hand, when the exciters are driven by independent waterwheels, as is usually done, there is some liability that the small nozzles employed on the small waterwheels driving the exciters will be clogged. That is, there is more danger of this in the smaller wheels than in the larger wheels driving the main generators. In one of the large power houses of which we have knowledge a 50-hp exciter is driven by a 50-hp impulse wheel. Coupled directly to the other end of the waterwheel shaft is a 50-hp induction motor. This motor is connected to the 2400-volt busbars of the station. The waterwheel of the exciter is run with its valve open as for full load at all times. When less than full load is on the exciter, the induction motor acts as a generator delivering energy to the main busbars. If the water supply for any reason is interrupted on the exciter waterwheel, the induction motor drives the exciter as if nothing had happened.

In protecting against lightning, what part do choke coils play, and how often are they installed? Does barb wire protect, and, if so, what is the best way to fasten it to the poles? O. C.

Owing to the fact that any inductance in the line offers considerable resistance to the passage of a lightning discharge, choke coils are sometimes introduced in series with the line between the arrester and the central station, the combination of arresters and choke coils forming a reliable means of protecting the apparatus in the station. It is not general practice to install a choke coil in conjunction with every arrester placed on the line, owing to the high cost which would be involved. However, it is well to place such a combination to protect any large and expensive apparatus connected to the circuits. The choke coils are usually constructed of flat copper strip wound on a non-inductive core, the layers being insulated with mica or some other substance. Any self-induction in the way of coils or turns in the ground wire of an arrester should be avoided and when the arresters are being installed it is well to watch the linemen, as it is a favorite trick to take up any slack in the wire by making a little coil. Any such coils would be nothing more or less than choke coils, which would completely offset the value of the arrester. The ground wire is a very important feature in the installation of a lightning arrester. Owing to the somewhat uncertain action of lightning arresters barb wire has been used on transmission circuits as a protection against lightning and the results obtained have demonstrated that in many cases it is a most satisfactory means of protection. The barb wire is usually strung on pins on top of the poles and sometimes also at the ends of the top cross-arm. In some cases special two-pin cross-arms have been used above the line wires to carry the barb wires and in other places a single line of barb wire is strung on top of the pole. Experience has shown that it is advisable to fasten the barb wire to glass insulators on pins rather than to staple it to the pole, owing to the superior mechanical support, the insulator, of course, not being used for insulating purposes. Where the wire is simply stapled to the pole, rust sets in at the joint with the staple and the wire eventually breaks. Some engineers consider that the trouble caused by using barb wire offsets its value as a protective device and for that reason its use has been abandoned in some instances.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Electric Vehicles in Indianapolis.

There are said to be about 160 electric vehicles in operation in the city of Indianapolis, Ind., although the conditions in that city are not particularly favorable to electric vehicle development. While the city is level and has many well-paved streets, it lacks good approaches to the parks. The central-station companies have encouraged the business by giving a low rate for automobile charging, but have made no special effort to develop this class of business. The Indianapolis Light & Heat Company, which furnishes service over the entire city, gives a rate of 5 cents per kw-hour on vehicle charging. The People's Light & Heat Company, which operates a central station in the northern residence portion of the city where most of the electric automobiles are kept, offers a rate of 6 cents per kw-hour. Apparently none of the garages has made special effort to cultivate the electric vehicle business. The fact that the Waverly Electric Vehicle factory is located at Indianapolis, of course, has been conducive to greater use of the vehicle.

Development of the Electric Vehicle Business at Toledo, Ohio.

It is well recognized that in most cities the electric vehicle business is but an insignificant part of the total automobile business and, in fact, the electric automobile has too often been looked upon by garage operators as hardly worth bothering with. It has also been looked upon by some electric light and power companies as not being worth much effort to develop because of the sentiment in favor of gasoline machines.

The situation at Toledo, Ohio, as regards electric vehicles is in strong contrast to this. Here we find in a city of 160,000 inhabitants between 400 and 500 electric automobiles in use. There are nine public garages which house, charge and repair

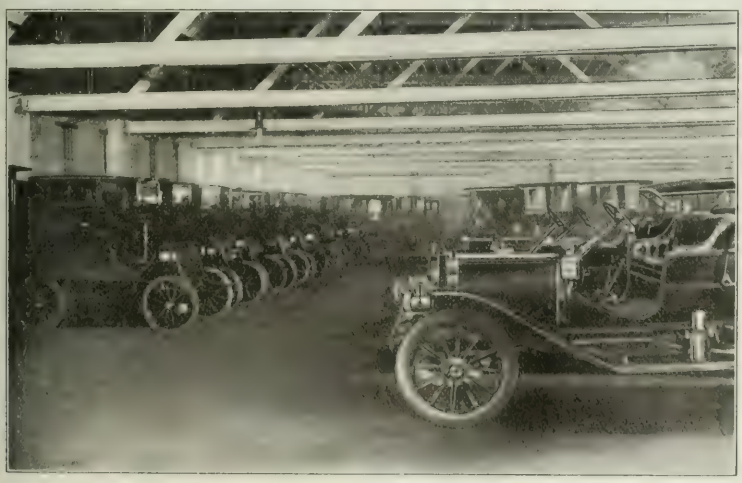


FIG. 1.—ATWOOD'S GARAGE, IN TOLEDO, OHIO.

electric vehicles, and there are 85 private garages where owners house and charge their own electric vehicles. One dealer alone has sold 25 electric vehicles since the beginning of the present winter.

There are several reasons for this unusual development of the electric vehicle in Toledo, but many of them are due to conditions which are, or can be, duplicated elsewhere. The city is level and has well-paved streets. It is also a size favorable to electric vehicle development, because an owner in driving about the city seldom would wish to exceed the available mileage offered by his storage batteries. In a larger city conditions might not be quite so favorable, although as regards

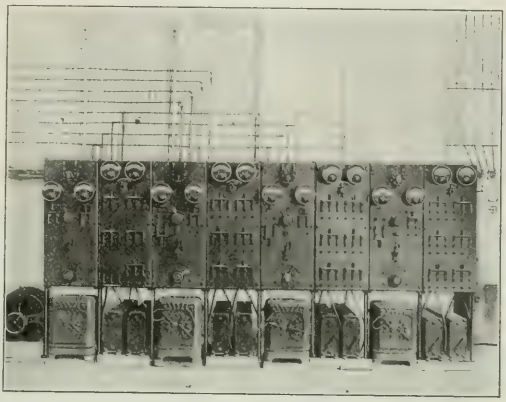


FIG. 2.—SWITCHBOARD AND MERCURY-RECTIFIER CHARGING OUTFIT, TWENTY-FIRST STREET GARAGE.

city use, the importance of large mileage upon one charge has always been considerably exaggerated in the popular mind. The other two essential elements that have built up the electric vehicle business in Toledo are low rates for vehicle charging offered by the Toledo Railways & Light Company and the excellent organization maintained by various garages for properly maintaining electric vehicles. These two essential elements have been lacking in a number of cities where conditions have otherwise been favorable. It is an important addition to central-station load, and for that reason all central-station companies should give this business every reasonable encouragement.

To the casual observer on the streets of Toledo the electric vehicle is much more in evidence than any other kind. It is used continually for running about town, and is frequently used for short trips for which a gasoline machine would not be taken from the garage. A large number of these machines are used by ladies. An afternoon reception in the best residence district will always bring a long line of electric automobiles to the neighborhood. A good show at one of the best theaters causes a line-up of 40 or 50 electric vehicles, the owners simply driving them downtown and leaving them until after the theater, no chauffeur being necessary.

RATES AND CENTRAL-STATION POLICY.

The Toledo Railways & Light Company makes a rate of 3 cents per kw-hour to all public automobile garages and repair

shops. Mr. T. D. Buckwell, contract agent of the company, considers this excellent business, even at this low price, because most of the charging is done after the lighting load goes off in the evening, but a very small part coming on the lighting peak. The rate to private garages is 5 cents per kw-hour, with a minimum bill of $3 per month. As conditions have been in the past in Toledo before recent consolidations took place, direct current was available to a large number of the residents where there were private garages. Direct current is gradually being displaced, however, and owners are putting in mercury-vapor rectifier sets for charging from single-phase alternating current.

While the expense of the rectifier is objected to at first by owners who have heretofore charged their vehicles through $25 rheostats, it is gradually coming to be recognized that the mercury-vapor outfit is worth the difference in price from the owner's standpoint alone. The changing to alternating current is, therefore, desirable from the owner's standpoint, and is not simply a gain for the company. The mercury-vapor rectifier is said to cause an average reduction in kw-hours consumed of about 40 per cent, as compared with charging through a rheostat. The rectifier does away with the necessity of wasting energy in a rheostat, and has another advantage in that it will cut itself out automatically through the extinguishing of the discharge when the battery voltage has risen to a point corresponding to full charge, provided the battery is in good condition. Should the battery not be in good condition, and the voltage thus not rise to the proper point, this, of course, would not occur. The automatic cut-out feature makes it unnecessary for the owner or his employees to watch the battery to prevent overcharge, and incidentally it probably saves considerable overcharging which will inevitably occur with a rheostat having no automatic cut-out feature.

The central-station company sells a mercury-rectifier set installed at $230 for the 20-amp rectifier and $250 for the 30-amp. A reduction of $20 from these prices is made when the owner installs the rectifier. The company, when it takes an order for a rectifier, employs a contractor or interior wireman to make the installation under company supervision, as the company does no interior wiring whatever. So far 25 rectifiers have been installed in private garages and a number in public garages. The income to the central-station company is in the neighborhood of $48 per year per vehicle in use in the city. Of course, some vehicles run far above this and others are used but little. Most of the vehicles are of the type which can be enclosed in the winter so that they are used the year around.

The rectifiers are connected across the regular 220-volt secondaries of the three-wire secondary system in the residence district. No attempt is made to specify the hours during which charging shall be done so as to keep it off the peak. This usually takes care of itself.

PUBLIC GARAGES AND BATTERY MAINTENANCE.

There are nine public garages in the city which keep, maintain and repair electric vehicles, two of which are notable on account of their size and the completeness of their equipment. The central-station income from the largest garage averages $450 per month.

The Atwood garage, at Monroe and Bancroft Streets, "boards" about 120 electric vehicles. The provisions for charging and repair are very complete, the management being in the hands of men who are storage-battery experts. This garage has facilities for charging 48 vehicles at one time. Under proper management, from 60 to 75 vehicles are charged in a night, as few of the batteries are completely discharged when the vehicles are brought in. This, however, is only a little over half the total number kept at the garage, so that there is a large percentage not charged every night. Thus the "diversity factor," which plays such an important part in central-station motor load, also figures in the electric vehicle business and makes it possible to board a much larger number of vehicles than can be charged in one night. In this garage the rate for keeping, charging batteries, washing and delivering an electric coupé is $22.50 per month. In connection with this contract there is a system in vogue whereby unnecessary charging and washing of vehicles is eliminated. It is obvious that too frequent washing of a vehicle is hard on the finish.



FIG. 3.—TWENTY-FIRST STREET GARAGE FOR ELECTRICAL VEHICLES.

It is also coming to be accepted among electric vehicle battery men that too frequent charging is not conducive to the best life of a battery, although this is exactly contrary to the teachings and practices of storage-battery men 10 years ago. Experience seems to indicate that it is better to allow a battery to be fully discharged down to a certain point each time rather than to discharge it practically each day and completely charge it every night. In ordinary garage practice where the owner gives no instructions, it is, of course, necessary to charge up the battery fully every night, because nothing is known of the plans of the owner for the following day. To obviate unnecessary washing and unnecessary charging, owners are supplied with "Don't wash" and "Don't charge" cards. Whenever the owner knows that he has run a vehicle such a short mileage in a day that he will be able to get through the following day without a charge, he can leave a "Don't charge" card on his vehicle when he sends it to the garage. This practically tends to improve the life of the battery, as the garage records show

that batteries treated this way seem to last longer than those which are fully charged every night.

Another form of maintenance contract is offered by this garage as the result of its experience with electric vehicle batteries, and it is very instructive as to the average cost of maintaining such batteries. The Atwood garage will make a contract with any electric vehicle owner whose rig is new or has been thoroughly overhauled to maintain it and renew batteries for $600 per year or $50 per month. This includes renewals of batteries when necessary and all ordinary repairs on the vehicle, but does not include the ordinary depreciation caused by age and use, or repairs necessitated by accident or collisions.

It is the practice at this garage to examine batteries with a view to the necessity of washing the loose, active material out of the bottoms of the cells after the vehicle has been run a definite number of miles. When this mileage has been made the battery is examined, and if washing out is necessary the owner is notified. The regular charge of $22.50 per month does not cover the battery washing out. By the time a second washing out is necessary the plates are usually so far gone that it does not pay to replace them after the second washing. By that time the plates are usually reduced in capacity so that only about 40 per cent of the original mileage is obtainable, so a second washing is only recommended as a means of tiding over a brief period to the end of a season, or in case the owner is about to sell.

At this garage the charging is done by direct current supplied from a motor-generator set driven by a three-phase induction motor. The rheostat and switchboard panels have two single-pole switches for each charging circuit, one of which is connected through an ammeter at the top of the panel and the other of which leaves out the ammeter. Any circuit can be connected to the ammeter at a moment's notice and then cut out so that the ammeter can be used on other circuits. Each circuit also has a push button connecting to a voltmeter on the board. This garage has a machine shop and battery room in connection. The main floor has ample width to provide for the easy movement of vehicles to and from the charging plugs, which is essential to the rapid and economical handling of vehicles.

The Twenty-first Street garage, under the management of Mr. L. L. Blood, is another large, well-equipped plant. It occupies a fireproof building, 60 ft. x 220 ft., all of which will be given over to the electric vehicle business the coming season, although at present gasoline vehicles are kept in the same space.

The charging at this garage is entirely through mercury-vapor rectifiers. There are eight rectifier panels, giving a total charging capacity of 24 vehicles at once. Two more panels are soon to be ordered. There are about 80 electric vehicles on the regular boarding list at this garage. The rates are $20 per month for cleaning, delivering and charging an open rig, and $22.50 for closed. In maintaining batteries at this garage it is the practice to examine the cells as to any necessity of cleaning out after about five months' use, and notify the owner if such cleaning is needed.

Local Option and Central-Station Revenue.

Some small central-station companies located in towns which formerly had saloons, but which have suddenly gone "dry" at a local option election, have in the past year suffered some embarrassment by a sudden reduction of revenues. This has not been due so much to the revenue obtained directly from the saloons themselves as to the fact that the saloons were operating under license, and that the city was partially dependent on these licenses with which to pay for street lighting. These things are sure to adjust themselves in time, but until such readjustment of the city's finances takes place it is rather embarrassing for some central-station companies.

A discussion by various central-station men as to whether a "wet" or "dry" town is best in which to operate a central-station would doubtless be interesting. As regards revenue traceable directly to the presence of saloons in a community, we surmise the advocate of the "wet" town would probably have the best of the argument. The saloons themselves are almost invariably liberal users of light over longer hours than any other lighting consumer, except the all-night restaurant. If considerable revenue is derived by the city from saloon licenses it helps swell the amount available for street lighting. These sound like reasonable arguments, but on the other hand it is maintained that as far as street lighting revenue is concerned the city with prosperous and steady workingmen, who own their own homes, and where there is a steady revenue from direct taxation, is a safer and sounder proposition for the central-station company than a city with a roving, irresponsible class of workmen where much revenue is obtained from saloon licenses, with the ever-present possibility that this revenue will be interfered with by legislation. The opportunities for securing large numbers of residence customers are also much better in a town where there are few or no saloons, because the working people have more money available for electric lighting and similar conveniences. As regards the revenue obtained directly from saloons for lighting this is partially counterbalanced by revenue from other places of amusement if saloons are prohibited. The saloonkeeper as a customer is generally recognized as the one who will bear the closest watching and the one who is most likely to cheat a central-station company if he gets a chance. A considerable percentage of thefts of current and attempts to tamper with meters occur in saloons. Taking it all together, therefore, the central-station company which is operating in a "dry" town has no reason to envy its neighbor which is operating in a "wet" town.

Increasing Business Among Photographers.

A small field for the sale of electricity which is worth looking up by central-station companies in all cities is that of the use of mercury-vapor lamps by photographers. This lamp has, of course, been used for some time in photograph galleries where portraits are made at night. It is only recently, however, that the advantages offered by the mercury-vapor lamp have been appreciated by photographers in general. The ordinary photographer has been inclined to argue that daylight is free and electric light costs money; therefore, why use electric light of any kind when one can get along with daylight during the best part of the business hours? This reasoning, however, overlooks the fact that it is desirable in making children's portraits, and in some of the best class of work with adults, to take instantaneous pictures. The desirability of the instantaneous feature is apparent to anyone who has ever tried to make children's portraits, and there are many adults whose natural expressions are considerably changed when required to "pose" for a picture. Instantaneous work requires more daylight than can ordinarily be obtained in a studio. A photographer in the down-town district of Chicago recently installed four mercury-vapor lamps in his studio so as to make instantaneous pictures possible. Some of the results he obtained were so fine that there seems to have been a general stampede among the more progressive photographers in Chicago to make similar installations.

From the central-station company's standpoint this is a small but very desirable class of business. It is mainly a day load. Some photographers may be induced by the possibilities of the mercury-vapor lamp to keep open evenings, but even if that should be the result, the load offered by this class of business would be better than the ordinary lighting load, because it would extend also over daylight hours.

The use of such lamps also for printing of photographs makes it possible to turn out work much more promptly in dark, cloudy weather, and, if necessary, printing can be done at night as well as by day. One advantage of printing by a mercury-vapor light and shutting out daylight altogether is that the vapor lamp is always of practically the same intensity, whereas daylight varies greatly according to the time of day and cloudiness. This being the case, it should not be necessary to watch the work so closely while printing is going on. Every

town large enough to have an electric light plant has one or more photographers, and it seems worth while for both large and small companies to look up this business.

Energy Consumption of Various Types of Incandescent Lamps.

The salesman or solicitor oftentimes experiences difficulty in explaining to the satisfaction of a prospective customer or to a patron of the electric light company the relative advantages of the various types of incandescent lamps now in use. The

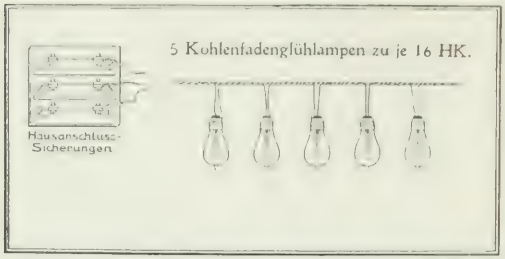


FIG. 1.—CARBON-FILAMENT LAMPS.

one advantage which appeals to the user of lamps is the energy consumption of the lamp for the light given. The accompanying illustrations, reproduced from the bulletin of the Berlin Electricity Works, are intended to convey to the mind of a prospective purchaser of electrical energy the economy of the three types of lamp now in common use in the German metropolis.

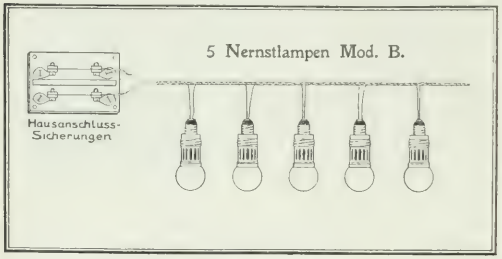


FIG. 2.—NERNST LAMPS

The carbon-filament lamp, the Nernst lamp and the tungsten lamp are chosen for comparison without regard to the cost of each. The lamps are assumed to consume a certain definite fraction of a kilowatt of power. If five carbon-filament lamps giving 16 hefner candles consume this definite amount of power, then for the same energy cost five Nernst lamps giving

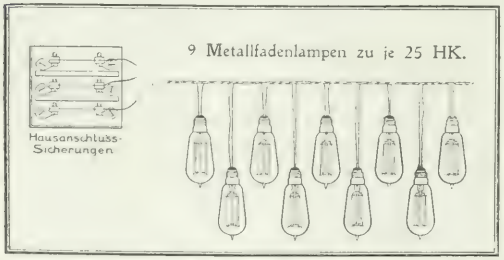


FIG. 3.—TUNGSTEN LAMPS

32 hefner candles or nine tungsten lamps rated at 25 hefner candles may be used. Six 25 or nine 16 hefner candle-power tantalum lamps could also be substituted without additional expense for electricity. By the aid of some such pictorial illustration a solicitor could make even a deaf and dumb person comprehend.

INTERIOR WIRING AND ILLUMINATION

Wiring a Church Building at Low Cost.

By T. W. Pope.

The efficient lighting of a church in a small town is always a good advertisement for the central station. To be effective the lamps must be of proper candle-power, properly placed, and the wiring must be done in a neat and substantial manner. All wires and wire-concealing devices, as molding and conduit, should be hidden from view. Should the members of the church see any fittings or appliances that would detract from the appearances of the edifice, they would be adverse to having their own residences equipped for electricity, fearing that the wiring would have to be done in a similar manner. Not knowing the difficulties experienced in wiring the church building

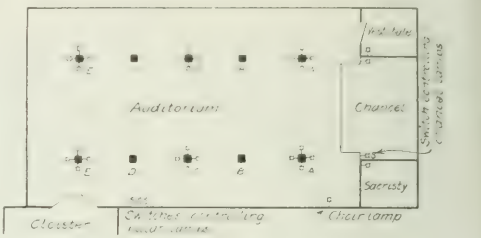


FIG. 1.—PLAN VIEW OF CHURCH BUILDING.

they would naturally take the work done there as a standard. If the job is not done neatly they would be unwilling receivers of any proposition to wire their own residences.

The church building, which was wired as explained later, was equipped at low cost by the central-station company and the general satisfaction with which the work was received resulted in the wiring of several residences, which meant more business to the central station. Fig. 1 is a floor plan of the auditorium, pulpit, chancel, sacristy and vestibule showing the entrance into the auditorium from the cloister. The pillars marked *A A'*, *C C'* and *E E'* were to be wired so as to admit of no shadow being cast by pillars *B B'* and *D D'*. It was decided to place a

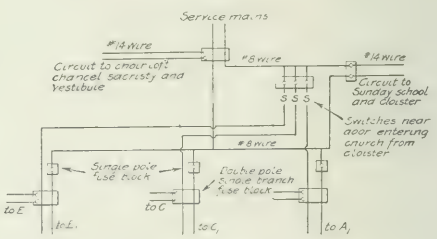


FIG. 2.—DIAGRAM OF WIRING CONNECTIONS.

bracket on each side of the pillars in such a way as to reduce whatever tendency pillars *B B'* and *D D'* might have to cast any shadows. As the church auditorium was dark, the woodwork having a black walnut finish, four 100-watt, 80-cp tungsten lamps were used to get sufficient light despite absorption. This meant 320 cp on each pillar wired. To harmonize with the woodwork and retain the severe simplicity of the auditorium, plain brackets of wrought-iron finish were procured. In the chancel one 80-cp tungsten lamp was placed on each side of the arch leading into the chancel from the pulpit. These lamps were placed as near as possible to the corner formed by the piers supporting the arch, and the partitions which divided the chancel from the vestibule and sacristy, because of a desire to

reflect the light upon the chancel; the decorative finish being white and the wall construction acting as a good reflector. In the vestibule and sacristy one lamp bracket was installed, as indicated in Fig. 1. These brackets had the same finish as the ones installed in the auditorium.

Fig. 2 shows a diagram of the wiring for the auditorium, chancel, vestibule and sacristy. This wiring was done in the cellar by means of knob-and-tube work. To wire the pillars, which were 12-in. x 12-in. beams covered by ⅞-in. finishing boards, it was necessary to remove one of the boards. This was done by driving the nails through the boards with a nail-set. A channel ⅝-in. deep and 1 in. wide was cut into the beam with a gouge. In this channel two No. 14 rubber-covered wires enclosed by flexible tubing were placed. As the rules of the underwriters require flexible tubing to be continuous from support to outlet, it was carried through the flooring to the porcelain support below and to the bracket outlet on the pillar. As it was necessary to have an outlet on each side of each pillar a 1¼-in. hole was bored into the beam through the face boards where the brackets were to be placed. These holes were made 2 in. deep. From the first outlet a 1-in. hole was bored toward one of the other holes on the side of the pillar. The 1¼-in.

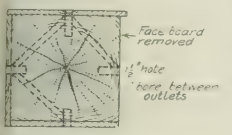


FIG. 3.—DETAIL OF PILLAR.

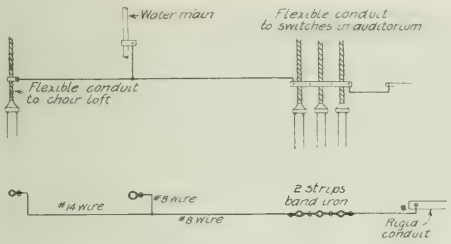


FIG. 4.—METHOD OF GROUNDING.

hole permitted this to be easily done, and in this way any danger of boring through the face boards by any miscalculation or misdirecting of the auger bit was avoided. The facing was unmarred, and a raceway for the flexible tubing containing the circuit wires was provided in this way. This method was used in every case. Fig. 3 is a diagram of a pillar thus bored.

At the choir loft a one-lamp bracket was placed high enough to reflect the light upon the books of the singers. As this bracket was fastened to a furred stone wall it was contrary to the rules of the underwriters to draw any flexible tubing be-

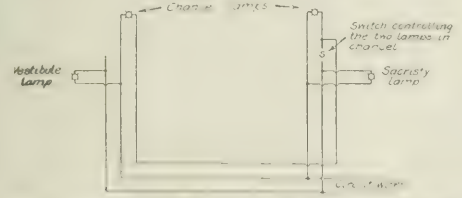


FIG. 5.—ARRANGEMENT OF LAMPS ON THREE WIRE CIRCUIT.

tween the plaster and stone. The condensation would probably affect the tubing and insulation in such a manner as eventually to render it useless. To overcome this disadvantage, a flexible steel-armored conduit containing two No. 14 wires was run into an outlet box at the brackets and a wire-separating device or conduit was fitted on the other end of the conduit in the cellar. As no switch was provided for the control of the choir lamp, and as it was out of reach, a chain-pull socket was placed on the bracket. A chain with the same finish as the bracket was used and brought low enough for a person of average height to reach it. It was necessary to ground all the conduit in the building and Fig. 4 shows how this was done. As a 6-amp fuse protected the wire in the steel-armored conduit, a No. 14 wire was connected to the conduit, with a ground clamp made of band iron ⅛ in. thick and 1 in. wide. A piece of sheet lead was placed between the band iron and the conduit to insure a good electrical connection.

The wiring in the chancel was placed in molding inasmuch as it was not visible from the body of the church. This molding was made to carry three wires, so that a single-pole switch could be installed on the molding at the point shown in Fig. 1. This switch controlled both lamps in the chancel. From these moldings wires placed in flexible tubing were drawn through the plastered partitions to the bracket outlets in the vestibule and sacristy. As it was necessary to have the wires to the lamps in the vestibule and sacristy alive at all times and the wires between the lamps and switch in the chancel partly so, the reason for installing the three-wire molding is apparent.

The door leading into the auditorium from the cloister being used most, the switches controlling the lamps on the pillars were placed on the right-hand side of the door coming in. Each switch controlled one pair of pillars lettered the same. As the same conditions regarding condensation existed here as in the case of the choir bracket wiring the conductors were run in a similar manner, using a three-gang switch box and 10-amp.

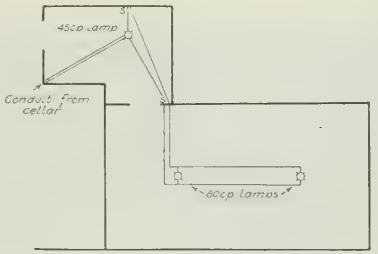


FIG. 6.—PLAN OF CLOISTER AND SCHOOL ROOM.

single-pole flush switches with wrought-iron switch plate. To make the switches less conspicuous the pearl disk generally placed on the button was removed and a disk of black composition substituted. The wires to the switches were connected to the mains as shown in Fig. 2, a three-wire, main-line, fuse-block with 10-amp fuses protecting the wire and switches. The wires from the switches were then run to the pillars; fuse blocks being placed at the first of each pair of pillars so that the circuit could be divided. Only 660 watts are allowed on a circuit and the lamps on each pair of pillars required 800 watts. By placing fuse blocks at the pillars 400 watts were run on a circuit and the No. 12 circuits made a subsidiary main. The conduit protecting the wires to and from the switches was connected to the ground wire. As this wire was apt at any time to be called upon to carry 30 amp to ground, a No. 8 grounding wire was used. As this wire was the largest ground wire in the building it was connected to the water main by means of a ground clamp, as shown in Fig. 4.

Through the wall separating the cloister from the church a ½-in. conduit was installed and carried up through the flooring of the cloister, as shown in Fig. 6, to a point 7 ft. above the floor, where a suitable wire-separating device was placed. From this point a three-wire molding was carried to a point near the door entering the Sunday-school room. From the molding point rigid conduit was run through the cloister wall, which was of wooden construction, and up the side of the Sunday-school building, which was a stone structure connected to the church building by the cloister. The wires were run to a point under the edge of the roof where the conduit was carried through the wooden framework supporting the roof to a point between the roof and ceiling of the Sunday-school room, where the wireman could work easily. Here a wire-separating device

was placed on the conduit and the knob and tube system of wiring resorted to. The conduit in the cloister was connected to a wire by drilling a ⅛-in. hole into the conduit. This hole was tapped for a screw. The wire was placed in position, using a washer to more thoroughly bind the wire, and the conductor was carried back to the other conduit, in the middle groove of the three-wire molding, where it was fastened in a similar manner. The conduit entering the cellar from the cloister was grounded in the same way to the No. 8 wire.

Sidewalk Illumination from Tungsten Lamps.

The illustration herewith shows a photographic reproduction of sidewalk illumination by tungsten lamps on the north side of Dexter Avenue, the main business block of Montgomery, Ala. The tungsten lamps burn from dusk to midnight and illuminate the sidewalk brilliantly. The Citizens' Light, Heat & Power Company of Montgomery, Ala., has recently taken hold of the tungsten-lamp proposition, and starting about Dec. 15 conducted a whirlwind campaign under the direction of Mr. E. C. Bacon, assisted by a corps of lighting experts, to introduce the lamp. As a result the company has succeeded in installing a great number of lamps in a remarkably short time. In addition to the introduction of tungsten lamps in various mercantile establishments, ranging from large department stores, clothing establishments, cafés and drug stores to sidewalk fruit stands,



TUNGSTEN LAMP SIDEWALK ILLUMINATION AT MONTGOMERY, ALA.

the company has made an exhibition of sidewalk illumination by means of tungsten units which is said to be second to none. All but four of the stores on the block shown are supplied with energy from the company's circuits. Five-lamp, 100-watt tungsten fixtures are installed in front of the stores of each customer, and all of the energy is sold on a meter basis.

The policy of the company is to put out tungsten lamps on a meter basis in place of flat-rate carbon-filament lamps and arc lamps. At the beginning of this campaign with tungstem lamps practically all of what would otherwise have been the most profitable business was on a flat rate. This rate was very low owing to the competitive conditions existing in Montgomery. The flat-rate customers were shown that by using a high-grade lamp, such as the tungsten, with the service furnished by the company, it was to their advantage to use lamps on a meter basis. The result is that the company is now not only getting a better rate for the maximum demand of the lamps installed, but has also secured the elimination of much waste of energy by causing its customers to turn off the lamps when not needed, whereas the carbon-filament and arc lamps used on the flat-rate basis would be burned sometimes 24 hours a day, depending on the conscience of the customer. The net result of the new policy is that the company has changed from a flat-rate to a meter basis, reduced the demand by substituting 60-watt tungstens for 32-cp, 3½-watt carbon-filament lamps and thereby increased the capacity of its plant, lines and transformers. By giving its patrons more and a better quality of light for the same amount of money, the latter have become so enthused that sidewalk illumination is being indulged in by many whose bills are being increased rather than decreased by tungsten installations.

The Citizens' Light, Heat & Power Company began operations June 1, 1904, with Mr. Alexander Rice as president and Mr. P. R. Whiting as manager. The company has a modern compound, condensing steam plant located on the railroad and river which enables it to receive its coal cheaply and also an abundance of water for condensing purposes.

Letter to the Editors.

Central Station Accounting.

To the Editors of Electrical World:

Sirs:—One can easily imagine the dismay of the average central-station manager when faced with the problem of conforming in his accounting methods to the requirements of the New York or Wisconsin Public Service Commission. It remains a live question if the extremely elaborate systems devised by these bodies are actually necessary to enable them to carry on their work within the scope fixed by the law, for the corresponding Massachusetts Commission has apparently been able to discharge its duties satisfactorily without subjecting central stations under its jurisdiction to the preparation of reports in such extreme detail. However, thus far the interests affected have not been able to set up any effective resistance to the accounting requirements imposed; and it is not at all evident whether this is due to lack of leadership and co-operation, or because the commissions have been able to justify their demands.

But it does not follow that the cost of keeping up a system of accounting such as that imposed by the New York and Wisconsin commissions is at all in proportion to its apparent complexity. Practically every item called for should in the past have been a matter of some record in every well-conducted central station, and consequently the greatest hardship will fall on the stations which have heretofore deregarded systematic methods in their business conduct. Even assuming that there will be considerably increased cost in the book-keeping department of some stations, this may be easily compensated for if advantage is taken of the means which the various classifications will afford for the analysis of the cost of service. In the past central stations have relied entirely too much on their monopolistic feature and have ignored the methds of minute accounting of costs which in recent years have been adopted by manufacturers in branches where competition is keen. Since

such a system is now being forced on them, the brighter and more energetic central-station men will doubtless get in line with their fellows in other fields of manufacture, and know exactly the cost of delivery of every class of their product—namely, electrical service.

Another good effect of the accounting systems with respect to the central-station industry at large will be the weeding out of the managerial type always ready with objections against anything new or any change from the old, usually on the general grounds of "local conditions," "years of experience in the business," "no profit at less than 20 cents per kw-hour," etc. The publication of accounts in comparative form will enable directors and active stockholders to locate shortcomings by checking figures with those of plants similar to their own, or at least will suggest questions difficult to evade and the answers to which will furnish some indications of managerial calibre.

Upon the whole it would seem that the elaborate accounting systems being imposed on central stations by law are not an unmitigated evil.

Milwaukee, Wis. J. S. Thornton.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Flywheel Effect in Armatures.—H. Luckin.—A table for quickly determining the stored energy or accumulated work in armatures, flywheels and other revolving bodies. The table gives the stored energy due to 1 lb. being rotated at various r.p.m., the diameter of gyration being 1 in. To use the table, multiply the figure from table—to suit revolutions per minute—by weight in pounds and diameter of gyration in inches squared.

R.P.M.	+0	+10	+20	+30	+40	+50	+60	+70	+80	+90
100	.00296	.00358	.00426	.00500	.00579	.00665	.00757	.00854	.00958	.0107
200	.0118	.0130	.0143	.0156	.0170	.0185	.0200	.0216	.0232	.0249
300	.0266	.0284	.0303	.0322	.0342	.0362	.0383	.0405	.0427	.0450
400	.0473	.0497	.0521	.0546	.0572	.0598	.0625	.0653	.0681	.0710
500	.0739	.0769	.0799	.0830	.0861	.0893	.0926	.0960	.0994	.103
600	.106	.110	.114	.117	.121	.125	.129	.133	.137	.141
700	.145	.149	.153	.158	.162	.166	.171	.175	.180	.185
800	.189	.194	.199	.204	.209	.214	.219	.224	.229	.234
900	.239	.245	.250	.255	.261	.267	.272	.278	.284	.290

For example, the stored energy due to 530 lb. being rotated at 700 r.p.m. when 25 in. is the diameter of gyration $= 0.145 \times 530 \times 25^2 = 48{,}000$ ft.-lb. For armatures up to about 20 in. diameter, the diameter of gyration is usually from 0.65 to 0.70 times the armature diameter, while for armatures from 20 in. to 40 in. in diameter it will vary from 0.7 to 0.75, while in very large machines it may be as much as 0.85 times the armature diameter—this proportion depends largely on the number of poles. The table may also be used for revolutions per minute from 1000 to 9900 (advancing by hundreds) by moving the decimal point two places to the right—i.e., for 3000 r.p.m. read 2.66.—Lond. *Electrician*, Feb. 5.

Connecting Alternators in Parallel.—F. Lutz.—An illustrated description of a device for automatically connecting two alternators in parallel. The speed regulation of the second machine, which is to be connected in parallel, is also completely automatic. *A* and *B* in Fig. 1 are two small transformers, each with three windings. The windings *a* and *b* are equal, the windings *c*, *d*, *e* and *f* are also equal. *C* is an alternating-current motor; between the poles of an electromagnet there is placed a permanent magnet of relatively small mass to the end of which two arms are attached which are able to arrest a gear wheel *h* as shown in the illustration. This wheel drives a gear wheel *i* which is suspended as a pendulum, but is removed from the wheel *h* whenever the electromagnet *l* is excited. When this action takes place the wheel *i* always assumes such a position that the heavy pin *k* is at the bottom. When the electromagnet *l* is not excited the wheel *i* is driven by the wheel *h* and the pin *k* is taken around until it presses against the lever *m* and connection in parallel takes place as follows: The first machine which has already been running may be connected to the winding *a* and the second machine which is to be joined in parallel is connected to winding *b*. If there is no phase difference the voltages of *e* and *f* are in the same direction and therefore are added together, while the voltages of *c* and *d* annihilate each other. If there is a phase difference the opposite is the case. Therefore, if there is no phase difference the motor *C* is supplied with current and the wheel *h* revolves. The electromagnet *l* is not excited and the wheel *i* is therefore driven by the wheel *h*. This condition will exist as long as there is no phase difference. Under these conditions the pin *k* gradually gets nearer and nearer the lever *m* until it reaches it and raises it. The contact *n* is thereby closed and the switch making the parallel connection is set in operation. If, however, just before this takes place a phase difference should occur again, the motor *C* loses its current and the electromagnet *l* is excited. The wheel *i* is thereby removed from the wheel *h* and the pin *k* drops to the bottom. Connection in parallel takes place, therefore, only when no phase difference has been maintained for a certain period and this period can be adjusted by adjusting the path which the pin *k* has to travel until it presses against the lever *m*. By adjusting the electromagnet *l* and the

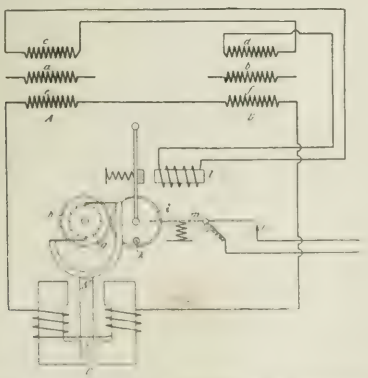


FIG. 1.—CONNECTING ALTERNATORS IN PARALLEL.

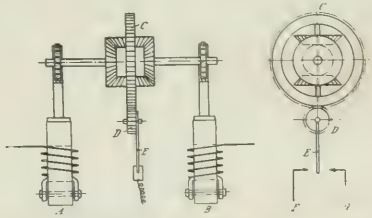


FIG. 2.—CONNECTING ALTERNATORS IN PARALLEL.

electromagnets of the motor C, the apparatus may be made independent of the voltage within wide limits. It is then influenced only according to whether there is phase difference or not. For the automatic regulation of the speed of the second machine to be connected in parallel the device of Fig. 2 is used. *A* and *B* are again two alternating-current motors acting upon gear wheels. These two wheels are connected together by the gear shown in the illustration. The arrangement is such that the two wheels have a rotation opposite to each other. If they revolve with equal speed the wheel *C* remains at rest, but if the wheels *A* and *B* revolve with different speeds the wheel *C* rotates in one or the other direction. The wheel *C* is geared to another wheel *D* to which is fixed the contact brush *E* which can make contact with either *F* or *G*. By means of these contacts there is regulated an electric motor which influences the regulator of the steam engine of the second machine. The speed of the steam engine is therefore increased or decreased—according to the rotation of wheel *C*—until complete equality of frequency of the two machines has been obtained. This condition exists when the contact brush *E* is not in contact with either *F* or *G*.—*Elek. Zeit.*, Feb. 11.

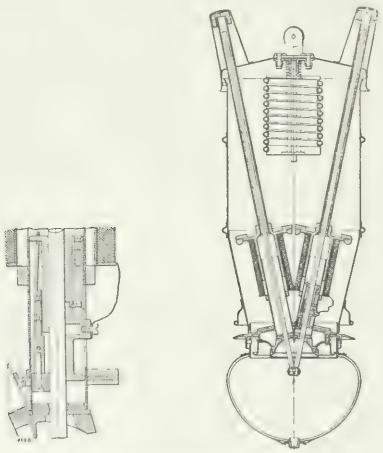
Testing Direct-Current Machines.—W. Lulofs.—An illustrated paper read before the Birmingham section of the (British) Inst. Elect. Eng. The author shows how the Kapp-Hopkinson test may be adapted for a single lap-wound, direct-current machine with four or more poles, provided it is not supplied with Mordey equalizing connections.—Lond. *Electrician*, Feb. 12.

Turbo-Alternator.—A. C. Kolben.—The first part of a detailed description with drawings of the construction of a 3200-kw, three-phase generator directly coupled to a steam turbine. The speed is 980 r.p.m. The frequency is 49 cycles per second. —*Elek. Zeit.*, Feb. 11.

Brush Holder.—An illustrated note on a new brush holder for carbon brushes made by a British company. The holder is of the box type; the spiral spring for putting the necessary pressure on the brush is arranged directly over the center of the brush, and is entirely enclosed, so that it cannot fall off or get damaged. The breakage of the spring and its subsequent entanglement in the commutator is a cause of trouble in other types of brush holder.—Lond. *Electrician*, Jan. 29.

Lamps and Lighting.

Flame Arc Lamp.—An illustrated description of the Victor flame arc lamp made by a British company. Each feed control is derived from a magnetic circuit, produced by means of a



FIGS. 3 AND 4.—VICTOR FLAME ARC LAMP.

series coil wound on an iron casting. The magnetic system operates two clutches, which feed the carbons, these latter being protected throughout the greater part of their length by brass tubing. The advantage of this construction is the absence of all shunt-coils, dash-pots, etc. These clutches are illustrated in detail by Fig. 3. Round the lower part of each of the inclined tubes a strong magnetic circuit is formed by means of a specially shaped iron frame, core, and a coil; each series coil is placed within such a frame, and provides the magnetic field for operating the clutch which slides up and down inside the core. The body of each clutch consists of a solid brass casting which has a cylindrical hole bored through it to take one of the electrodes, and is slotted at the lower end to allow of the pivoting of a soft-iron armature with a grip, shown on the left on the carbon in Fig. 3. This armature, which is in form something like a cheese-scoop, envelopes the top part of the clutch body nearly half way round. At the top end of the clutch is a soft-iron core enveloping the brass body for half of its circumference, as shown on the right of Fig. 3. As the clutch is supported in the air-gap formed between the end of the series-magnet core and the magnet frame, a magnetic force is exerted on the clutch armature when the current is switched on. This pull causes the grip to hold the electrode firmly, while at the same time the whole clutch is drawn up, thereby seeking to take a balanced position in the air-gap, and by this means the arc is struck. The manner in which these clutches feed the arc is shown in Fig. 4. To start with, the electrodes rest on a steatite striking-bar, and immediately the switch is closed, the electrodes are raised by the clutches, and are held there until the arc burns the electrodes away to such an extent that it can be no longer maintained. As soon as this happens, the clutches release the electrodes, which drop onto the striking bar, and touching one another, instantly strike the arc again; this feeding takes place approximately every 40 minutes. The flaming shape of the arc is obtained by means of a magnetic blow-out coil not shown in the illustrations. The coil produces a flat flame of great brilliancy and steadiness. The course of the current is from the positive terminal to one series coil, and from that by means of a flexible cable to the contact-screw on the clutch (Fig. 3). It then passes across the arc, through the second series coil, and thence through the blow-out coil and the central resistor (Fig. 4) to the negative terminal. The mean hemispherical candle-power of the lamp is high, being approximately 2500 cp for a 6-amp lamp, because the "extremely high voltage" employed across the arc enables a higher candle-power at a lower amperage to be efficiently maintained. The "Victor" lamps can be operated three in series on 220 volts, and under such conditions consume approximately, 0.2 watt per candle-power. The electrodes used are 23½ in. long, and have an average life of from 18 to 20 hours.—Lond. *Eng'ing*, Jan. 29.

Enclosed Flame Arc Lamp.—In flame arc lamps of the enclosed type with impregnated carbons arranged vertically, the arc is sometimes liable to burn unsteadily, as the electrodes become covered with a deposit and the arc tends to creep along this deposit up the side of the carbon. When two or more lamps are operating in series the effect is more pronounced. According to a recent British patent of A. D. Jones, of the Jandus Arc Lamp & Electric Company—5829, 1908, Feb. 4, 1909—this trouble can be overcome by the use of a "blow" magnet of annular form placed above the arc. This may be of the shape of an inverted cone, the top electrode passing through the center; generally the magnetizing effect of the current passing through the electrode in the center is found to be sufficient so that no special winding is required. As the lower electrodes in such lamps are thick and short, there is no need to arrange for the magnet to descend as the electrode burns down. The stray field from the magnet prevents the arc from rising up the electrode.—Lond. *Elec. Eng'ing*, Feb. 11.

Magazine Lamp.—An illustrated description of the "Angold" magazine flame arc lamp made by the (British) General Electric Company. It has been on the market for a year, but the mechanism has been improved from time to time. This lamp operates for over 50 hours with the nine pairs of electrodes contained in the magazines. The changing of the electrodes is effected in a few seconds. A forced feed of the electrodes is provided, and by a mechanical device the movement of the cross-bar is reversed when one pair of electrodes is nearly con-

sumed, so that the bar works up to the top again to engage with a new pair of electrodes.—Lond. *Elec. Eng'ing,* Feb. 4.

Photographic Arc Lamps.—A description of two arc lamps for photographic purposes made by a British company. The first of these is designed for operating singly or on either continuous or alternating current and with e.m.fs. from 100 volts to 250 volts. As the longest possible steady arc is very essential in photographic work, a regulating resistor—or reactor with alternating current—is recommended for use with this lamp. The lamp is switched on with a comparatively large resistance in circuit, and this is gradually cut out until the maximum steady arc length is obtained. The current consumed is from 14 amp to 15 amp or 10 amp, according as the lamp is used on 100-volt or 200-volt circuits. The second lamp, which is intended for heavier work, is made for operating singly on e.m.fs. of from 100 volts to 500 volts when continuous current is used, or from 100 volts to 250 volts when the supply is alternating. The current varies from 10 amp to 20 amp, according to the voltage used. This lamp is regulated in the same way as the other type, but is more rapid in action and illuminates a larger area; the length of arc with 10 amp on 500-volt circuits is about 6 in. It is used for portraiture, cinematograph work, and for printing.—Lond. *Electrician,* Jan. 29.

Supports for Metallic Filaments.—An abstract of a British patent—11,460, 1908; Feb. 4, 1909—of the British Thomson-Houston Company and T. E. Robertson. Metal filaments, liable to contraction, and supported rigidly at one end of the pedestal and looped over hooks at the other end, are further supported by spiral metal springs fixed either to the middle of the pedestal or to the lamp bulb. As the filaments are drawn inward or outward at the center by these springs, they will merely straighten somewhat on contracting. The lateral movement of the springs permits of unequal contraction of the two halves of the sections. Furthermore, hammering of the filaments on their supports at the tops of the loops during transit is prevented by the intermediate springs.—Lond. *Elec. Eng'ing,* Feb. 11.

Generation, Transmission and Distribution.

British Power Company.—An illustrated article on the development of the Lancashire Electric Power Company. Energy is generated at 11,000 volts, three-phase, the frequency being 50. Both overhead transmission and underground cable transmission are used. The load curve is quite satisfactory. From 6:15 in the morning to 5:30 p. m. the load does not drop below three-quarters of full load except at breakfast and at midday. There is an increased load due to lighting in the early morning and evening, but except for these variations the load is almost constant during working hours. The ratio between the maximum load on the station and the number of kilowatts representing the total connections is also a good one, the former amounting to about 3000 kw and the latter about 4200 kw.—Lond. *Elec. Eng'ing,* Jan. 28.

Italian Power Plants.—S. Q. Hayes.—An illustrated description of special features of the plants of the Societa Lombarda. This company has various hydro-electric and steam generating and transforming stations in the northern part of Italy where it supplies a large amount of energy to factories.—*Electric Journal,* February.

Low-Head Hydro-Electric Developments.—S. Rice.—An illustrated description of a plant at Milford, Maine, where 12,000 hp will be developed under a head of 20 ft.; the source of energy is the Penobscot River. The generating plant contains 12 700-kw alternating-current generators, and one 300-kw exciter. The generators produce three-phase currents at 2200 volts and 25 cycles.—*Power,* Feb. 9.

Direct-Current Motors.—R. H. Fenkhausen.—An elementary illustrated article on the installation of direct-current motors, giving directions for wiring, installing switches and connections, starting up and shutting down the motors, and hints as to what is to be done when the bearings of a motor get too warm. —*Power,* Feb. 9.

Motor Control.—D. F. Carpenter.—The first part of an illustrated article on the application of automatic and semi-automatic controllers to direct-current motors. In the present installment the author discusses elevator control and safety devices.—*Electric Journal,* February.

Traction.

Ignition on Motor Cars.—Magnetic ignition is gradually supplementing in France all other methods of igniting the charge in the gasoline engines of motor cars, the tendency being particularly marked in the direction of magnetos of the high-pressure type. Two principal forms of high-pressure magnetos are being employed. In one the current produced at low pressure in the armature is transformed by an external induction coil; in the other the armature of the magneto is provided with two windings, low and high pressure—that is to say, the transforming of the current is effected in the magneto itself,

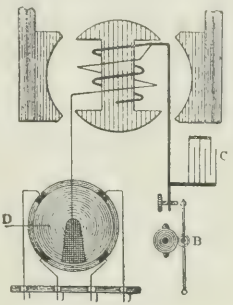


FIG. 5. IGNITION ON MOTOR CARS.

as shown in Fig. 5. *B* is the contact breaker which opens the primary circuit; *C* is a condenser, and *D* a distributor sending current to the different cylinders of the engine. In view of the reduced space occupied and the greater simplicity of the connections, it is this type of machine to which preference is being given by motor-car manufacturers.—*Le Genie Civil;* abstracted in Lond. *Elec. Rev.,* Feb. 12.

Gasoline-Electric Railway Cars.—M. Rousso.—An illustrated description of the equipment of gasoline-electric motor-cars built by the French Westinghouse Company for operation on railways. They will be used, for instance, on a German railway line of secondary importance. Such roads on which the traffic is not strong enough to justify the erection of a power station and on which the operation with steam locomotives would not pay, gasoline-electric motor-cars may be used economically. One advantage is that the cars can be run at shorter intervals than steam trains so as to attract more passengers. These conditions are especially fulfilled on railway lines of secondary importance.—*Elek. Zeit.,* Feb. 11.

Mountain Railroad.—A note on the proposed electrification of the Ofoten mountain railroad in Sweden to the Norwegian frontier. It is used especially for ore transportation. It is 80 miles long and there will be 14 stations. Energy will be obtained from the waterfalls of the Tornetrask River.—*Elek. Zeit.,* Feb. 4.

Installations, Systems and Appliances.

Electric Station in Soudan.—An illustrated description of the electric equipment of the power station of Khartum, comprising two steam-driven, 200-kw, 3000-volt, three-phase alternators, condensing plant, boilers, pipework, and switchboards.—Lond. *Elec. Eng'ing,* Feb. 11.

Wires, Wiring and Conduits.

Self-Induction of Three-Phase Cables.—F. J. O. Howe.—The author gives several formulas for calculating the self-induction of a three-phase cable, the last formula given by him is:

$$l = \left(c + 0.02 \log_{10} \frac{2a}{d}\right) 10^{-3} \text{ henry per kilometer loop,}$$

the value of the constant c being taken as 0.1; a is the distance between the centers of two conductors and d is the diameter of the conductor. However, tests on various metals show that

this "constant" varies considerably. The author gives in a table the results of systematic self-inductance tests on three-phase cables. It is shown that the value of c varies in a fairly uniform manner inversely as the conductor cross-section and inversely as the insulation thickness. There are even negative values which are quite unexpected and apparently contradictory to the fundamental equation; however, they are by no means erratic.—Lond. *Electrician,* Feb. 12.

Electrophysics and Magnetism.

Variation of Conductivity of Air.—C. S. WRIGHT.—An account of an experimental investigation the object of which was to observe the conductivity of the air confined in metallic vessels of lead, zinc, aluminum, possessing little if any radioactive impurity, and from the results to determine, if possible, what portion of the ionization was due to an intrinsic activity in the metal. The experiments were made at a number of points in the neighborhood of Toronto, both on land and over the water of Lake Ontario; and it was found that while a uniformly low and steady value was obtained for the conductivity over the water when more than a few meters in depth, values varying over a wide range were obtained for the ionization in measurements made on land at different places and on different soils. No evidence of a regular daily variation was noted. There is a penetrating secondary radiation set up by penetrating rays, such as those from radium, in the brick wall of a room. The water of Lake Ontario acts as a perfect screen both for the earth's radiation and, if a sufficient depth be taken, for the rays from radium. On this account and owing to the fact that the water of Lake Ontario contains no active impurity, it has been possible to determine what portion of the ionization in the receivers used in this investigation was due to residual active impurities and to intrinsic activity in the metals of the receivers. Based on this fact, a determination has been made of the ionization in free air due to radioactive impurities in a clay soil, and this value 9.9 ion per c.c. per sec. has been found to be in close agreement with a value deduced by Strong from Strutt's determination of the radium content of the earth. —*Phil. Mag.,* February.

Electrodynamics.—R. A. LEHFELDT.—The author criticises the method used in English books to treat magnetism before "current electricity," and to "explain" the latter by analogy with the action of magnetic shells. He suggests a new method of attacking electrodynamics for which he claims the advantage of deriving the two integral relations of electrodynamics from one, more easily comprehended, differential relation; moreover, it puts magnetism in its place as a special case of currents.—*Phil. Mag.,* February.

Inductance of Parallel Wires.—J. W. NICHOLSON.—A highly mathematical paper on calculating the inductance of two parallel wires. The author's solution includes all cases of practical importance, especially for very high frequencies.—*Phil. Mag.,* February.

Radiation Laws.—J. H. JEANS.—A highly mathematical paper on temperature radiation and the partition of energy in continuous media. The author atempts a critical examination of some of the difficulties which surround the application of the law of equipartition of energy to the energy of wave motion in the ether or other continuous media. These difficulties manifest themselves most clearly in connection with the problem of determining the law of partition of radiant energy inside a uniform-temperature enclosure. The theory of the author is especially interesting in its relation to Planck's radiation law. —*Phil. Mag.,* February.

Refraction.—T. H. HAVELOCK.—An article on the relation between the dispersion of artificial double refraction and the ordinary dispersion of the isotropic medium, with special reference to the recent investigation by Hagenow of electric double refraction in carbon bisulphide.—*Phys. Rev.,* February.

Progress of Electric Science.—E. E. FOURNIER D'ALBE.—A concise review of the progress of electrical science during 1908.—Lond. *Electrician,* Feb. 12.

Electrochemistry and Batteries.

Corrosion of Iron and Steel.—A. SANG.—A very long paper in which the author first discusses the composition and formation of rust and the various theories, especially the electrolytic theory, and then deals with the influence of structure and of stress on corrosion; with comparative corrosion of iron and steel; with corrosion in air, in fresh water, in salt water; with corrosion of ships, of rails, tubes, and wires. The author then takes up the influence of the impurities in the metal, discusses the comparative corrosion of acid and basic steel and deals finally with the corrosion of steel embedded in concrete and the attempts of inhibiting rust.—*Proc. Eng's Soc'y of Western Pa.,* January.

Electric Welding.—A continuation of the long and profusely illustrated serial on electric-welding appliances of British companies.—Lond. *Eng'ing,* Jan. 29.

Units, Measurements and Instruments.

Alternating-Current Measurements by Potentiometer Methods.—C. V. DRYSDALE.—An abstract of a paper read before the (London) Physical Society. The great difficulty in alternating-current measurements lies in the shortness of the range of the instruments available. The author suggested two methods of attempting to apply the potentiometer principle to alternating-current measurements: (a) the balancing of the alternating-current potential differences against a continuous potential difference, with the assistance of some suitable balancing device, or (b) the balancing of two alternating-current potential differences against each other. Potentiometers on the first principle seem unlikely to be successful owing to the insensitiveness of square-law instruments at low voltages; and the second method presents difficulties in that the two potential differences to be compared must be identical in magnitude, phase and frequency, and approximately so in wave-form. The author's recent experiments with a phase-shifting transformer have led him, however, to attempt to use it with a potentiometer, and the measurements are then made in the same manner as with an ordinary direct-current potentiometer, except that a vibration galvanometer or telephone is substituted for an ordinary galvanometer. By interposing an ammeter on the dynamometer principle in the main circuit of a potentiometer and deriving the current from the secondary of a phase-shifting transformer, it is possible to check the instrument with direct current against the standard cell in the ordinary way, and then to reproduce the same current in the potentiometer circuit and to bring it into coincidence of phase with the potential difference to be measured. The tests so far made seem to indicate that an alternating-current potential difference of 0.1 volt can be measured to an accuracy of 0.2 per cent or closer. The author has also designed a universal potentiometer on this principle, which serves both for direct-current and alternating-current measurements. Campbell remarked in the discussion that Drysdale's phase-turning method is interesting, but the vibration galvanometer is so very much more sensitive for its own frequency than for others, that it is not likely to give any indication of errors due to other harmonics unless they are very pronounced. Hence the method must be used with great caution. In reply, Drysdale said that for ordinary standardization of potential difference and current, this difficulty does not present itself, as there is no difficulty whatever in obtaining a sufficiently closely sinusoidal wave-form, and the wave-forms of the measured and balancing potential differences are usually similar, being derived from the same source. For inductance and capacity measurements there is, of course, a positive advantage in an instrument which disregards the harmonics.—Lond. *Elec. Eng'ing,* Feb. 11.

Deflection Potentiometer for Voltmeter Testing.—H. B. BROOKS.—In a former paper the author derived an expression for the current through the galvanometer of an unbalanced potentiometer, used in connection with a volt box, and showed how this formula could be applied to the design of a class of instruments, for current and voltage measurements, having properties intermediate between those of the balance type and of the deflection type. A description was also given of an instrument constructed on this principle, which was used for measuring voltage in photometric work, and which has now been in service for the past two years, giving satisfactory speed and accuracy. The object of the present paper is to give some

further modifications of circuits which may be used for this purpose, with their advantages and defects; to show what features should be incorporated in an instrument of this kind for such work as the testing of voltmeters, and to describe an instrument of this type recently constructed. This has been designed for voltmeter testing and other precision measurements of voltage in the laboratory and testing room.—Lond. *Electrician*, Feb. 5.

Compound Voltmeter for Measuring the Voltage at the End of a Feeder.—L. Pillier.—A description of a new method of Chauvin and Arnoux for measuring the voltage at the end of a feeder without the use of pilot wires, with the aid of a precision galvanometer, for instance, a moving-coil permanent-magnet instrument for direct current. The connections are shown in Fig. 6 where E is the voltage at the power station, R the

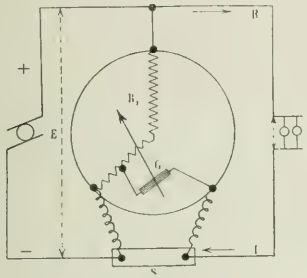


FIG. 6.—DIAGRAM OF CIRCUITS.

resistance of the transmission line to the point at the end of the feeder, where the voltage is to be measured, and I is the current in the feeder. G is the galvanometer and is connected, as shown in the illustration, in series with R_1 across the feeders, but also in parallel with the shunt S having resistance equal to G. It can then be shown that the current through the galvanometer is proportional to $E - kI$ where k depends only on the constants of the galvanometer and these may be so adjusted that k equals the resistance R of the transmission line. The current to the galvanometer is then proportional to $E - RI$ and therefore gives directly the voltage at the end of the feeder. Connections of such an instrument for a three-wire system are also shown.—*L'Industrie Elec.*, Feb. 10.

Flicker Photometer.—An abstract of a British patent—6971, 1908; Feb. 4, 1909—of W. Fennell and W. P. Perry. In the ordinary "flicker" photometer the eye sees alternately two surfaces illuminated respectively by the two sources of light to be compared, and the illuminations are equal when no flicker is observed. The general arrangement has the disadvantage that the light strikes and leaves the surfaces at an angle, and this angle must be the same for both surfaces or the reading will be inaccurate. This fact necessitates an expensive construction. The modified form described in the patent specification comprises a rotating disk consisting of two or more sectors of translucent material separated by radial opaque films. The disk is illuminated at the sides, and observed on edge. Opaque covers are fixed to one side of each sector so that each is illuminated from one side only.—Lond. *Elec. Eng'ing*, Feb. 11.

Telegraphy, Telephony and Signals.

Convention of Telegraph Engineers.—K. Strecker.—An account of the international convention of telegraph engineers in Budapest in September, 1908. There were present 25 representatives of Hungary, 12 of Austria, 12 of Germany, 4 of Roumania, 3 of Great Britain, 3 of Italy, 3 of Servia, 2 of Netherlands, 2 of Sweden, 2 of Turkey and one each of Bulgaria, Denmark and Russia. Abstracts of the papers presented are given. The full papers are contained in a printed report of 400 pages.—*Elek. Zeit.*, Feb. 11.

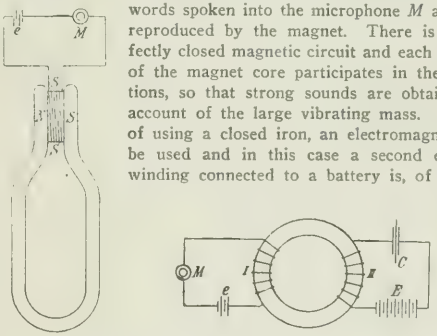
Underground Telephone Cables in Great Britain.—O'Meara.—An abstract of a paper read at the recent international conference in Budapest. Longer underground telephone cable lines have been built in Great Britain since 1895. The chief lines are from London to Birmingham and Glasgow (420 miles), from London to Bristol and Tavistock (320 miles), from Liverpool to Manchester and Leeds (72 miles), besides some smaller lines and branches. The cables are placed in iron tubes of 7.5 cm inside diameter. Some information concerning the construction of the cables and the speed of transmission is given. The cost of maintenance in the past year was 10 cents per kilometer against 83 cents—without cost of renewal—per kilometer overhead line.—*Elek. Zeit.*, Feb. 11.

Determining the Properties of Telegraph or Telephone Lines.—Gati.—An abstract of a paper presented at the recent conference of telegraph engineers in Budapest. The author uses a compensation method with two equal barreters. The alternating current to be measured (from 10^{-6} amp to 10^{-3} amp) is supplied to one barreter, thereby changing its resistance and deflecting the galvanometer needle. It is thus possible to measure telephone currents and currents in the receiver for wireless telegraphy. It is also possible to use the same method to determine the properties of a line and the damping.—*Elek. Zeit.*, Feb. 1.

Telephony.—Hill.—An abstract of a paper presented at a recent conference of telegraph engineers in Budapest. The British Telegraph office compares its telephone lines by means of the speaking tests with a standard line. A cable with 0.9 mm copper conductor and paper insulation with a lead cover is the standard—$R = 54$, $C = 0.034$, $L = 0.0067$ per kilometer loop. For any line a coefficient is determined which states what length of this line is equivalent to 1 km of standard line. Experiments have shown that it is possible to transmit speech over a distance of 735 km of standard cable with a damping factor $e^{-4.7}$. With Pupin coils it is possible to transmit speech a distance 3.7 times the distance obtainable without such coils. In the discussion Krarup pointed out the necessity of reaching an international agreement on the definition of a standard cable.—*Elek. Zeit.*, Feb. 4.

Miscellaneous.

Speaking Electromagnets.—W. Peukert.—The air-gap N S of a permanent magnet of horseshoe form is filled with a piece of soft iron provided with a winding which is connected with a battery e and the microphone M, as shown in Fig. 7. Any words spoken into the microphone M are then reproduced by the magnet. There is a perfectly closed magnetic circuit and each particle of the magnet core participates in the vibrations, so that strong sounds are obtained on account of the large vibrating mass. Instead of using a closed iron, an electromagnet may be used and in this case a second exciting winding connected to a battery is, of course,



FIGS. 7 AND 8.—SPEAKING ELECTROMAGNETS.

required. Such electromagnets are very convenient and do not exhibit any higher harmonics, as is the case with vibrating diaphragms. The author has also made experiments with the speaking condenser of Argyropoulos. The arrangement is shown in Fig. 8. M is a microphone, e and E are batteries, and C is a condenser. In this case the condenser C reproduces the sounds spoken into the microphone M.—*Elek. Zeit.*, Jan. 21.

BOOK REVIEWS.

Social Engineering. McGraw Publishing Company. New York, 1909. By Dr. William H. Tolman. Cloth. 384 pages, 61 illus. Price, $2 net.

This is one of the most interesting and original books of recent years. It is a record of various things done along the line of uplift by American industrialists, who employ 1,500,000 of people. Dr. Tolman, who is the director of the Museum of

Safety and Sanitation, was selected by the Carnegie Institution of Washington to make a series of studies in this direction, and this book is the first outcome of the work. So far as we are aware, the facts and data have never before been collected. While it was well known that a good deal of work of this helpful character was being done, and while the book does not make an attempt to cover every effort of the kind, but takes typical examples, the presentation is most impressive and effective. It is difficult to imagine anyone going through these pages without being stirred and stimulated to do what he can in turn to make the industrial world better socially than he found it. Mr. Carnegie himself has written the introduction to the book, breathing this sentiment, and making the point that it is by the efforts of individual firms that the right solution of these problems can be reached, instead of through socialism, which can only talk speculatively, while the individual works practically, curing the evils that socialists are quick and eager to point out. The various subjects taken up by Dr. Tolman are those of efficiency promotion; the social secretary; hygiene; safety and security; mutuality; thrift; profit sharing; housing; education; recreation; communal or social betterment; and finally the pertinent inquiry, "Does it pay?" Under these heads each chapter presents a mass of facts and details, instancing in each case the company or firm and the number of people employed. It is interesting to observe that in several instances the material has been drawn from electrical concerns, and we are glad to note in this connection the General Electric Company, the Westinghouse companies, the Simplex Electrical Company, New York Edison Company, Niagara Falls Power Company, Interborough Rapid Transit Company, the Edison laboratories and factories at Orange, Western Electric Company, and Weston Electrical Instrument Company. In many instances, moreover, reference is made to the adoption of electric lighting and electrical devices adding to the comfort and convenience of employees.

One of the most interesting chapters is that on profit sharing, which, we think, will attract special attention, particularly because some concerns appear to have had a rather discouraging experience, while others, like the United States Steel Corporation, have adopted it on a most extensive scale. Incidentally, the book is of great value as affording many shrewd and practical hints how to handle bodies of men as working organizations, quite aside from any efforts to improve their daily condition without lessening their independence or breaking down the democratic spirit. We should not be surprised to see this work adopted largely for text-book purposes in the schools and colleges where sociological studies are taken up.

One of the sections of the book also is that which is devoted to the Museum of Safety and Sanitation, and to the work which is being done along the same lines in this country as in the 10 similar expository institutions already established in Europe. It is not out of place to note here that copies of the book are being used in connection with securing memberships in the Museum of Safety and Sanitation, to which the author is now devoting his entire attention. It may also be added that the *Century Magazine* has bestowed on the book in its March issue the unique compliment of publishing an article about it, as an expositions of the best tendencies to be found in American industrialism.

ELECTRICAL ILLUMINATING ENGINEERING. By William Edward Barrows, Jr., B. S., E. E. New York: McGraw Publishing Company. 212 pages, illustrated. Price, $2.

The author of this book, who is assistant professor in electrical engineering at Armour Institute of Technology, Chicago, first compiled the information which it contains as a series of lecture notes for use in his classes, the material being obtained from various modern technical literature pertaining to illumination. Considerable ground is covered by the book, and hence many of the subjects are very briefly taken up. For the student of illuminating engineering, the treatment is to be considered as suggestive rather than as being thorough enough for mastery of the subject without further reference to the original sources of information. Considerable value would be added to the book were references to the various sources of information in-

[illegible] takes up the coefficient of reflection from different surfaces, and the characteristics of different lamps as to color and also the intensity of illumination necessary for various kinds of work. The second chapter considers units of illumination and photometry and is a concise statement of the units commonly used in referring to illumination and illuminants. In view of the confused state of nomenclature, this chapter is very timely at [illegible]

Under the chapter heading, "Photometry and Photometers," a brief description is given of nearly all the photometers which have been much used for the testing of lamps and illumination. In a chapter on "Spherical Photometry and Integrating Photometers," the Rousseau diagram method of obtaining the mean spherical candle-power is described, and the Kennelly graphic method is taken up at considerable length. Under the head of "Standards of Illuminating Power," a chapter is given on the various lamps which have been used as standards, and their ratios are tabulated. Extended chapters are given to the characteristics of incandescent lamps, arc lamps, flaming-arc lamps and vapor lamps. Brief consideration is given to shades and reflectors. The last chapter is devoted to illumination calculations, which will appeal to those who do not view with favor the more mathematical methods which have prevailed in connection with illuminating engineering. In practice certain elements which cannot be figured in the accurate calculations modify their results in other than skilled hands to an extent which is causing the practical illuminating engineer to rely less on such calculations and more on data now available from practical installations. The value of the book is chiefly as a ready reference work for those with some technical education, and as a series of suggestions as to matters which may be followed up with greater thoroughness elsewhere. Some parts can be employed as a text-book to advantage, while other parts would have no place in a brief course in illuminating engineering, as they involve the student in an attempt to cover, with lack of thoroughness, too much ground. There is, however, so little information in book form on illuminating engineering that every addition of this kind is valuable and welcome.

RUBBER TRADE DIRECTORY. New York: India Rubber World. 261 pages.

This volume is the first issue of an annual under the auspices of the *India Rubber World*, designed to place the rubber trade in line with other industries represented by directories. The greater part of the contents consists of a list of firms engaged in the rubber trade, the arrangement being according to States and towns, with a classification by specialties for each locality. A list is also given of the officers of all trade organizations representing the rubber industry. An appendix registers the trademarks, trade names and brands in all lines of rubber manufacture, and also gives a digest of the laws of the States relating to foreign corporations.

FOWLER'S ELECTRICAL ENGINEER'S HANDBOOK. Edited by William H. Fowler. Manchester: Scientific Publishing Company. 670 pages. Price, 1s. 6d.

The current edition of this useful publication benefits from a rearrangement of its contents to facilitate reference. While the work is intended more particularly for practical workers rather than professional engineers, the information and data have evidently been compiled with much care and thus the book is also valuable within its scope to the latter class. A section of particular interest is that in which are reprinted the rules and regulations for wiring, equipment, etc., issued to various British bodies, such as the Institution of Electrical Engineers, Board of Trade, Home Office, Lloyd's Register, etc.

HEAT ENERGY AND FUELS, By Hanns von Jüptner. Translated by Oskar Nagel. New York: McGraw Publishing Company. 306 pages, 118 illustrations. Price, $3 net.

This book is a translation of one of four volumes by Professor

Jüptner treating chemical engineering both theoretically and practically. It covers pyrometry, combustion, analysis of fuels, and the manufacture of charcoal, coke and fuel gases.

After describing the various forms of energy, as mechanical, heat electromagnetic, chemical and radiant, the author discusses in detail the chemical technology of heat and fuels. However, the treatment is more largely of an engineering nature rather than chemical. Three of the chapters are devoted to pyrometry, four to combustion, ten to solid fuels and six to liquid and gaseous fuels. The book contains much data relating to the manufacture of artificial fuels. This material is presented in the form of tables and of illustrations of practical equipments. The book is intended for use in engineering schools, but much of the information is arranged so as to be of value to practising engineers.

Electricity and Magnetism. By J. H. Jeans. New York: G. P. Putnam Sons. 536 pages, 137 illustrations. Price, $4.50.

The author, who is professor of applied mathematics at Princeton University, has given an excellent mathematical treatment of electromagnetic phenomena. After defining electrostatics, magnetostatics and electromagnetism, complete discussions are given of physical principles, the electrostatic field of force, conductors and condensers, dielectrics and inductive capacity, the state of the medium in the electrostatic field, general analytical theorems, steady currents in linear conductors and continuous media, permanent and induced magnetism, the magnetic field produced by electric currents, induction of currents in linear circuits and continuous media, dynamical theory of currents, displacement currents, and the electromagnetic theory of light.

The character of the discussion is such that the so-called "practical" man would be unable to follow the author through the numerous processes taken by his demonstrations, but the student of electricity who is familiar with the calculus can obtain much valuable information from the book. The treatment follows closely that of Maxwell, but an attempt has been made to render it more elementary. It is well suited for the student in mathematical physics, for the physicist of limited mathematical attainments, and for the mathematician who wishes to make himself familiar with electromagnetic phenomena.

Transmission Calculation. By L. W. Rosenthal, E.E. New York: McGraw Publishing Company. 91 pages. Price, $2 net.

This book, which deals with the practical calculation of transmission lines, treats of the electrical performance problems rather than the mechanical problems involved in construction. It covers direct-current distribution for lamps, stationary motors and railway circuits; alternating-current transmission by overhead wires and underground cables; interior wires for alternating-current distribution, and single-phase railway circuits.

The information contained in the book is presented in extremely compact form by means of numerous tables for ready reference, the only descriptive matter included being that necessary to explain the use of the tables. Thus the book may be considered to consist of tables giving data relating to transmission circuits, and examples for illustrating the use of the tables.

Attention is called to the errors involved in certain familiar methods for calculating alternating-current transmission lines, and more accurate methods are described. One of the most interesting methods dealt with shows how the size of wire to be used in alternating-current transmission circuits may be determined directly from the volts loss in the line. The merit in this method resides in its accuracy and simplicity. The arrangement of the tables and examples should render the book well adapted for the rapid solution of problems relating to the electrical characteristics of transmission circuits.

Induction Coils. By H. Armagnat. Translated and edited by Otis Allen Kenyon. New York: McGraw Publishing Company. 216 pages, 111 illustrations. Price, $2 net.

Of the 11 chapters of this book, four deal with the theory of mechanical and electrolytic interrupters and of induction coils, two with the construction of induction coils and interrupters, one with the uses of the coils, while the remaining four have been devoted to history, bibliography, and special devices.

Much of the haziness concerning the performance of interrupters and induction coils should be dispelled by the thorough treatment of the phenomena given by Armagnat, while the practical calculation of induction coils should no longer remain in the empirical class to which it has been assigned for many years. The treatment is characterized by clearness and accuracy, many of the conclusions being convincingly verified by means of oscillograms. A valuable feature of the book is the specific information concerning the constructive details of induction coils and interrupters. The student of induction-coil phenomena will be particularly pleased with the bibliography containing a list of a majority of the articles on this subject that have appeared in French, German and English, to which 25 pages are devoted.

The demand for a treatment such as that given by Armagnat has been created by the recent numerous applications of induction coils in medicine, radiography, wireless telegraphy and gas-engine ignition, and it would seem that this book should prove welcome at the present time.

Logarithms and Squares. By Constantine Smoley, C.E. New York: The Engineering News Publishing Company. Fifth edition, revised. 459 pages. Price, flexible morocco, $3.50 net.

The major portion of this hand-book is devoted to parallel tables of logarithms and squares of feet, inches and fractions of inches, varying by 1/32 in. from zero to 50 ft. and by 1/16 in. from 50 ft. to 100 ft. The logarithms are expressed in five significant figures. Tables are also given of angles and logarithmic functions. A five-place table of common logarithms of numbers from 1 to 10,000 is included, together with natural trigonometric functions and logarithms of these values. The book has been arranged particularly for structural engineers. That it has proved successful for this purpose is shown by the fact that the present is the fifth edition of the book.

Electrical Engineering. By Charles Proteus Steinmetz, Ph.D. Schenectady, N. Y.: Robson & Adee. 284 pages, 48 illustrations. Price, $2.

This book contains a collection of lectures by Dr. Steinmetz on electrical engineering subjects arranged and edited by Mr. J. L. R. Hayden. Among the subjects treated are the distribution of energy for lamps and motors, the cost of energy as affected by the load factor, long-distance transmission of energy, high-frequency phenomena, generator and synchronous motor characteristics, lightning protection, direct-current and alternating-current railway motors, electrochemistry, incandescent and arc lighting, while light, illumination, lighting and lightning protection are discussed in appendices.

Mathematical equations have been almost completely eliminated, the presentation being made in the simple and instructive manner for which the author is so well known. The best portion of the book is that dealing with lightning and lightning protection, which, in fact, is the clearest explanation of this most difficult subject that has ever come to the attention of the reviewer.

The lectures were intended initially for engineering students, for which they are admirably suited. They should prove of equal benefit to practising engineers, and practical men in general, who wish to acquire information concerning the generation, control, transmission, distribution and utilization of electrical energy.

NEW APPARATUS AND APPLIANCES

Flaming-Arc Lamp with Gravity Feed.

There has recently been placed on the American market a type of flaming-arc lamp in which the inclined electrodes are fed downward solely by the action of gravity. One of the electrodes rests upon a fixed support on the body of the lamp, and the rate of feeding is determined by the rapidity with which the electrodes are consumed. In this respect the action is similar to that found in the Beck flaming-arc lamp. However, the arrangement employed differs in certain details.

One of the electrodes is provided with a longitudinal air-space placed eccentrically so as to be near the circumference at one point. During operation the thin wall of the electrode rests upon a refractory knife edge. As the electrode is consumed, the thin wall disintegrates and the knife edge allows this electrode to feed downward at the proper rate.

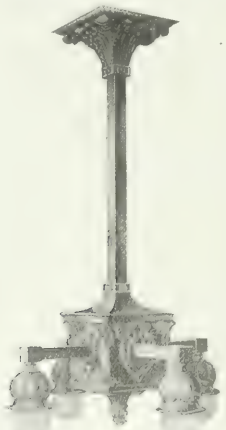
The two electrodes are interconnected mechanically by means of an insulated chain-mechanism which causes them to be lowered at the same rate, the composition of the two being such that the linear consumptions are equal. It is claimed that the arrangement employed is effective in preventing sudden movements of the electrodes and thereby eliminating flickering or unsteadiness of the light. The lamp is provided with the usual electromagnetic device for separating the electrodes in order to maintain the current at the proper value.

Tests made upon the lamp have shown that when using direct current of 8.27 amp and consuming 39.7 volts, the mean hemispherical light intensity was 1124 hefner-candles. Thus the watt per hefner candle in the lower hemisphere is 0.292. The above values refer to the lamp without globes. When globes are used the distribution is changed somewhat and there is a certain amount of absorption, but the value of mean lower hemispherical candles per watt is practically unaltered.

The lamp described above is the invention of Mr. Oskar Koenitzer, of Munich. The American rights for the lamp are held by Mr. Frank Z. Maguire, 10 Wall Street, New York City.

Chandelier for Nernst Lamps.

Since the new Westinghouse-Nernst chandeliers were put on the market several attractive variations of the original designs



CHANDELIER FOR NERNST LAMPS.

have been added to the list; one of the most pleasing is a square "art nouveau" cast chandelier, shown in the accompanying illustration. It is slightly more massive than the other designs and its ornamental treatment is somewhat more pronounced, without, however, sacrificing the simplicity characteristic of all these chandeliers. This design is made with either two or four arms and equipped with 66-, 88-, 110- or 132-watt lamps, either 110 volts or 220 volts, as desired. The four-arm 132-watt chandelier has an illuminating value equivalent to 28 16-cp carbon-filament lamps.

Mercury Type Amp-Hour Meters.

The principle underlying the action of the meter illustrated herewith is that of an ordinary electric motor, the permanent magnet providing the magnetic field in which the copper cup acts as the conductor or armature, commutation being effected

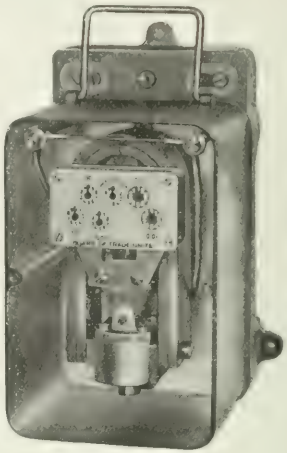


FIG. 1.—INTERIOR OF MERCURY-TYPE AMP-HOUR METER.

by mercury in which the cup is immersed. The current is led into the mercury bath at the top and out at the bottom, on the extreme edge of the cup, passing through the strongest and most condensed part of the magnetic field produced by the permanent magnet. It is stated that the error caused by the friction of the mercury has been practically eliminated by working with very high torque and strong braking forces. The mechanical friction is very small, owing to the extremely light pressure on the jeweled bearing. This result is obtained by counterbalancing the weight of the moving element by the thrust of the mercury, thus ensuring long life for the pivot and

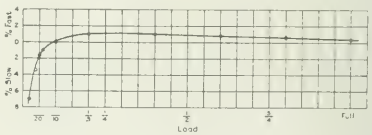


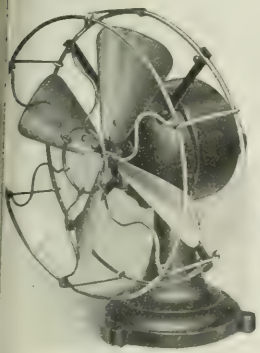
FIG. 2.—CALIBRATION CURVE OF AMP-HOUR METER.

jewel. The total losses in the meter have thus been reduced to an extremely low figure.

The characteristic error curve, shown in Fig. 2, closely approximates a straight line from the lowest load to full load, the meter starting easily with a load equal to ½ per cent of its rated full load. Friction having been reduced to a minimum, compounding is unnecessary. The meter described above is of the amp-hour type, but it is calibrated to read in kw-hours at any specified e.m.f. up to and including 600 volts. It has been placed on the market by the British Thomson-Houston Company, Rugby, England.

Dayton Fan Motors.

The line of fan motors built by the Dayton Fan & Motor Company, of Dayton, Ohio, includes 110-volt, 170-volt, 220-volt, 250-volt and 500-volt ceiling fans, electrolier fans, column fans, universal, oscillating and break-joint desk fans for direct-current circuits; alternating-current oscillating, universal and desk fans for standard frequencies, and with a 60-cycle ceiling fan. A Gramme ring armature is employed in the direct-current ceiling fan with a single bearing working continuously in oil. The brushes can be removed without taking any of the motor apart and the resistance for speed control is placed in a ventilated cover at the bottom of the fan where its heat is remote from the motor. In the oscillating fan a moving vane is employed outside the guard with stops for reversing the angle of the vane and hence the direction of fan swing. The alternating-current fans have blades whose curvature is such that an even breeze is obtained across the face of the fan, the air being projected as a solid cylinder instead of as a hollow cone. All styles of desk fans are readily convertible into the bracket type by use of a simple adapter. The low-frequency motors have two speeds, the low speed being obtained by cutting resistance



DAYTON FAN MOTOR.



MECHANICAL APPLIANCE VENTILATING FAN.

in series with the motor. Although the speed is somewhat lower than that of the 60-cycle motors, the pitch of the blades is increased. The 40-50-cycle fans have but one speed, while the 60-cycle and 133-cycle fans have two speeds. The 16-in., 133-cycle fan has but one bearing. This is of ample dimensions and is automatically and thoroughly lubricated. The shaft carries at one end the rotating secondary and at the other end the fan, the two parts balancing each other.

Mechanical Appliance Company's Fans.

A complete line of direct-connected ventilating fans for direct-current service in sizes from 18 in. to 42 in. is offered by the Mechanical Appliance Company, of Milwaukee, Wis., this season. These fans have the motor mounted direct on supporting arms attached to the wall ring; the fan itself being fastened to the motor shaft. Either open or enclosed motors are furnished with standard starters or with speed regulators. The fan blades are of the straight, Triumph, Blackman or Davidson type. In addition to the direct-current equipments the company is prepared to furnish ventilating fan outfits with single-phase motors in the 18-in. and 24-in. sizes and with polyphase motors in the 18-in., 24-in., 30-in. and 36-in. sizes. The alternating-current fans are not supplied with speed regulators, but can be furnished with either open or enclosed motors.

Dover Electric Fans.

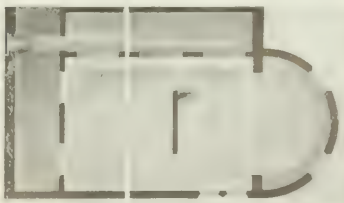
The Dover Electric Manufacturing Company, of Canal Dover, Ohio, manufactures desk fans of the swivel and trunnion type. By simply loosening a thumb-screw in the base and a T-handle the fan can be changed from one form into the other. The field coils, magnet frame, armature core and windings, as well as other electrical features, have been designed and constructed with special reference to durability and high efficiency. The body and base are of black japan finish; the guard and blades are of brass and the bearings are babbitt lined, with large oil cups. Simple cartridge brush holders are employed and a three-speed switch. The 12-in. fans for 110-volt and 220-volt circuits and the 16-in. fans have a speed of 1550 r.p.m.

American Blower Company Equipments.

As suggestive of the possible field for motor-driven ventilating fans it may be pointed out that in factories, stores and public buildings some effective system of ventilation must be used to get rid of vitiated air and cause fresh air to enter. These results cannot ordinarily be obtained by a desk, wall or ceiling fan. The placing of an electric propeller or disk ventilating fan in an outside wall or window frequently solves the problem of ventilation in the kitchen of a hotel, restaurant or apartment house. For large kitchens, a more complete system with hoods and duct leading to the exhaust ventilating fan as illustrated in Fig. 1 is generally advisable. There is probably no line of business where the disk ventilating fan is more largely used and appreciated than in a laundry. Fig. 2 illustrates a scheme for the successful ventilation of billiard and pool rooms. A plan view is shown in Fig. 3 where *A* is an "American-Sirocco" fan, *B* a galvanized iron ventilating duct, *C* ventilating screens and *D* a section through the wall on *EE*. The "American-Sirocco" propeller fans are built regularly for belt or rope drive and for direct connection to motors and steam turbines. The principal advantages claimed are, large delivery of air against resistances of from 1 in. to 2 in. water-gage pressure at very low consumption of energy. When operating freely without resistances on suction or discharge sides, the capacity in cubic feet per horse-power is very great. These results are due to the curve or dip of the blades or vanes, of which there are 10 instead of 6, as usually obtain.





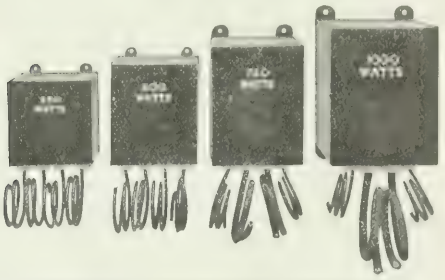


FIGS. 1, 2 AND 3. AMERICAN BLOWER COMPANY'S [illegible]

The fans are built by the American Blower Company, of New York, a consolidation of the American Blower Company and the Sirocco Engineering Company, of New York.

Transformers for Tungsten Lamps.

The Thordarson Electric Manufacturing Company, of Chicago, has designed and has ready for the market a line of transformers for low-voltage tungsten lamps, ranging in capacity from 150 watts to 1000 watts, with a standard secondary output of 10 volts. These transformers are so designed as to

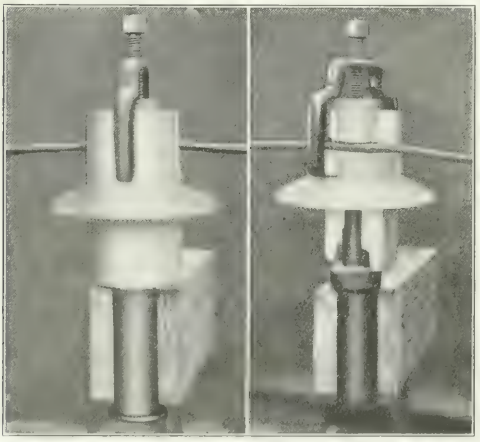


TRANSFORMERS FOR LOW VOLTAGE TUNGSTEN LAMPS.

enable the use of a very short and compact magnetic and electric circuit, thereby reducing the weight to a minimum. For this reason they are especially adapted for sign lighting. While present demand is for sign lighting, the manufacturers believe that the saving by the use of the transformers in the case of residences will cause them to be introduced for this service, especially when 20-volt, 16-cp, 20-watt lamps are put on the market, which is but a question of a few months.

Insulator of New Design.

Mr. John L. Fay, of the Union Electric & Power Company of St. Louis, has designed and patented an insulator in which attention has been specially paid to the avoidance of mechanical injury where the wire is clamped to the insulator. A great deal of thought, experiment and money has been expended in the careful design and arrangement of the petticoats, or skirts, of insulators, so as to reduce as much as possible the danger of disruptive discharges from water dripping off the various



FIGS. 1 AND 2. INSULATOR OF NEW DESIGN.

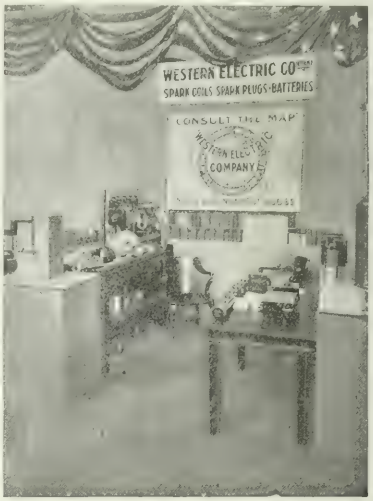
parts, and to keep dry as much as possible the under surfaces of the petticoats. Nearly all insulators having a metal clamp, set-screw or tie wire, which comes in direct contact with the wire which is supported, result in corroding, kinking or "cinching" the line wire, and if insulation is used upon the wire this results in wear and breakage of the insulation. This weakens the wire where it is attached to the insulator. In the insulator designed by Mr. Fay, which is shown in Figs. 1 and 2, there is nothing but porcelain in contact with the line wire. There is no metallic connection between the wire and the metal clamp, and no loose end of a tie wire which may reduce the insulating effect of the petticoat.

Gas-Engine Ignition System.

A new development in gas-engine ignition systems was displayed at the recent Motor Boat Show, at Madison Square Garden, New York City, by the Western Electric Company, whose exhibit is shown in the accompanying illustration.

This apparatus, known as the synchronous ignition system, embodies several new features, and was run in connection with a "Speedaway" engine, manufactured by the Gas Engine & Power Company, Morris Heights, N. Y. This system may be applied both to motor boats and automobiles.

With this device only one vibrator is used in connection with any number of non-vibrating coils. Two vibrators are pro-



GAS-ENGINE IGNITION SYSTEM.

vided, however, one being adjusted to give a heavy spark for starting with a cold engine; the other is for use when the engine is warmed up and running. This greatly reduces the battery consumption, making the system economical.

The change from one vibrator to another can be made by shifting a small switch which protrudes from the vibrator box. A pole-changing switch is also provided which is so arranged that every time the batteries are switched off and on again the direction of the current through the contact points is reversed. This feature eliminates the pitting which occurs at the platinum points in the ordinary vibrator. The non-vibrating coils are in a cylindrical, heat-resisting, insulated tube, which is mounted directly over the engine cylinders. This does away with the long high-tension leads so common in ignition systems, the high-tension leads in this case being only about 6 in. long. Any danger of leakage from the high-tension leads to the engine frame is also eliminated. The vibrators used are of special design, which insures smooth and rapid vibration; in fact, this vibrator makes 965 vibrations per second, making it the most rapid on the market. The entire system is provided with a lock switch, the key of which can only be removed when the battery is off. This system can be used successfully with any engine of three, four, six or more cylinders.

The Western Electric Company also showed a full line of

spark coils of both the motor-boat and automobile types, electric batteries and fire extinguishers. Both Marten and "Accurate" fire extinguishers were shown, and the batteries included the "Special 1900 Rapid Fire," the "Acme" and Hawthorne dry batteries, and "Vivax" storage batteries.

High-Tension Drop-Out Span Protectors.

Where high-tension lines cross telephone or other circuits it is essential that some method be provided for protecting the lower circuits from being subjected to dangerously high potentials in case the transmission line wires should break. Various methods of securing the desired results have been suggested. Some engineers require that where cross-overs occur, extra

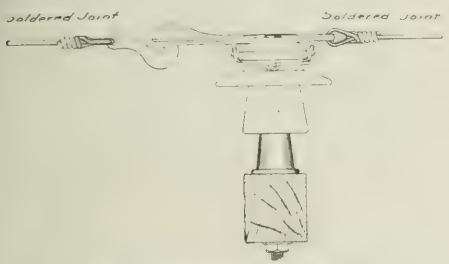


FIG. 1.—SINGLE-BREAK PROTECTOR.

high poles be placed close together so that if a break occurs the broken wires will not be long enough to reach down and make contact with the lower wires. In other cases the use of a grounded wire network or basket between the high-voltage and low-voltage wires has been required, but this has not always proved entirely satisfactory. Again, there are many cases where it is not feasible to set two high poles close together and the specifications for the grounded network often



FIG. 2.—DOUBLE-BREAK PROTECTOR.

make it a very heavy and impracticable device, especially in cases where heavy wires are used on the transmission lines.

To meet the conditions actually found in commercial practice the high-tension drop-out span protector illustrated herewith has been devised. The device consists of two parts: a fixed element secured to either the top or side of a standard insulator, and a movable element connected to the transmission line and so arranged that by means of a ground ball joint it makes positive contact with the fixed element. It will be seen that



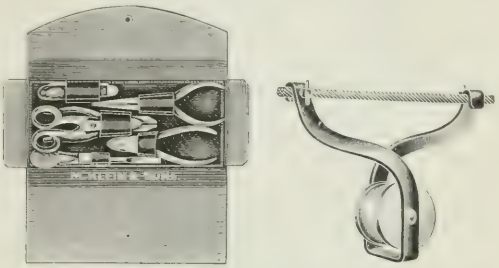
FIG. 3.—GROUND BALL JOINT.

with a span wire intact, heavy contact is maintained between the two elements of the connector, but upon the breaking of the span wire the movable element immediately drops and effectually disconnects, at the same time removing any danger of a live wire dropping down across the telephone or other wires which might be in position under the transmission wires.

The device is made in two types, No. 1 being a single-break protector and No. 2 a double-break, the use of which is obvious. These protectors are being placed on the market by the Central Electric Company, Chicago.

Tools for Line Construction Work.

Mathias Klein & Sons, of Chicago, Ill., have added to their stock of linemen's supplies and line construction tools and materials a number of new appliances, including a "Quick Samson" cable grip, a cable saw, cable roller and a pocket tool-kit for electricians. The cable grip was devised to expedite the handling of strand and messenger wire without injury to the wire. It is composed of two wedge-shaped, concave, notched



FIGS. 1 AND 2.—POCKET TOOL-KIT AND CABLE ROLLER.

jaws set in a metal casting and is so constructed that the jaws grip evenly when engaged with a cable or cable wire. At one end of the main casting are located two oblong rings to which the block and tackle may be attached. These rings are so arranged that by their use a straight pull on the wire is secured. The jaws of the grip are self-adjusting and are calculated to carry any strain necessary to tighten trolley or messenger wires.

The cableman's saw was designed particularly for use on cable work. It consists of a 14-in. silver-steel blade, one side of which is provided with coarse teeth for cutting through the lead sheath and the other side with finer teeth intended for use in cutting through the wire core of the cable. The blade is mounted in a substantial wood handle. The over-all length of the saw, which is shown herewith, is 18 in.

The cable roller is a device made to facilitate the stringing of

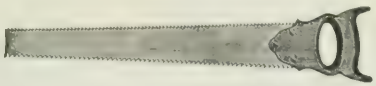


FIG. 3.—CABLEMAN'S SAW.

aerial cable. It consists of a forged-steel hanger in which is hung a maple roller. The two ends of the hanger, which are spread far enough apart to prevent rocking, are designed to hook over the messenger wire where they can be clamped to the wire by the aid of thumb-screws. The roller is provided with metal bushings to prevent it from wearing when carrying a load and to keep it in the center of the yoke of the hanger. By the aid of these rollers long stretches of cable can be strung with ease. The rollers weigh 4½ lb. each.

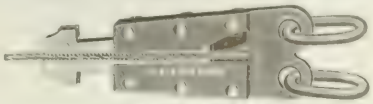


FIG. 4.—[illegible]

The pocket tool-kit, which is especially devised for the use of electricians, contains a single-bladed knife, 5-in. side-cutting pliers, 5-in. oblique-cutting pliers, 6-in. long-nose side-cutting pliers, 3½-in. blade screwdriver and 5-in. scissors. These tools, all of which are of Klein manufacture, are enclosed in a substantial pocketbook case 4 in. x 9 in. in size.

Jandus Electric Fans.

The following types of direct-current motors are being manufactured by the Jandus Electric Company, of Cleveland, Ohio, for the coming season: Swivel and trunnion desk and bracket fans in 12-in. and 16-in. sizes; oscillating desk and bracket fans in 12-in. and 16-in. sizes and 8-in. desk, bracket and telephone-booth fans. A line of fans, the same in size as the above, but equipped with induction motors, is also built in addition to

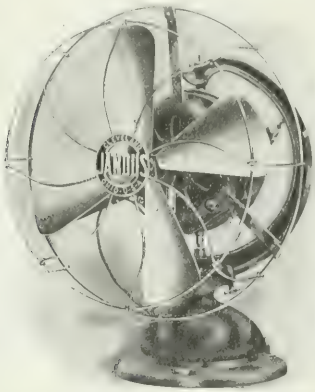


FIG. 1.—JANDUS SWIVEL AND TRUNNION DESK FAN.

direct-current and alternating-current 12-in. and 15-in. ceiling and column fans generally known as "Gyrofans." In the desk and bracket fans of the swivel and trunnion type, the swivel yoke is made by forming two ¼-in. steel rods into a strong and rigid support for the motor body, thus eliminating breakage and retaining at all times a pressure against the motor body, besides doing away with wing nuts and set screws. The oscillating type of motor has a positive drive, in that it neither employs the vane principle nor is it actuated by a train of gears, but depends upon the simplest form of differential gear

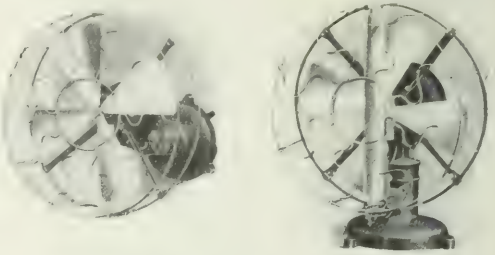


FIG. 2.—JANDUS "GYROFAN."

for its angular displacement. The "Gyrofan" consists of two fan motors pivotally mounted on a frame arranged to revolve about a vertical axis on a ball bearing. No energy is utilized for the revolution of the fixture, which results from the angular displacement of the motor shafts with respect to the vertical axis, or in other words, upon the angle at which the two fan blades impinge upon the air. The quietly revolving fixture carries the rapidly rotating fans around at the rate of about 10 r.p.m., thus blowing a strong whirling blast over a wide area and repeating it at any given point two times a minute. The fan for alternating-current circuits is manufactured for 110 volts and 220 volts, and for frequencies of 25, 40, 60 and 133 cycles. Self-starting, single-phase motors are used. The direct-current "Gyrofans" are built in the same sizes and voltages.

Colonial Fan Motors.

The entire line of the fan motors built by the Colonial Fan & Motor Company, Warren, Ohio, has been overhauled and improved in a number of ways during the past year. The line includes the well-known types built by the company last year to which has been added a universal desk and bracket fan, from which can be instantly obtained either the swivel or trunnion movement, when the fan is in the desk or bracket position. All types of fans have large, square brushes which cannot revolve and which retain their position on the commutator, thus doing away with noise and sparking. In order to obtain an increased brush surface, the commutators have been somewhat lengthened. The desk and oscillating fans are equipped with brass oil cups and brass switch levers, the latter fitted with molded rubber handles so as to preclude the danger of shock. The oscillating fan shown by Fig. 2 embodies distinctive features of construc-



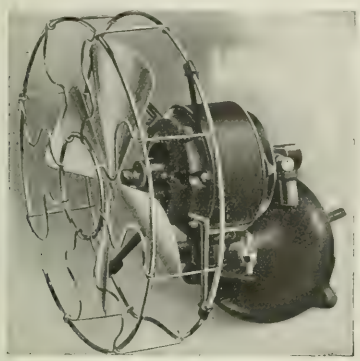
FIGS. 1 AND 2.—COLONIAL FANS.

tion. The field or rotating part travels on an entirely new type of tempered ball bearing accurately ground and polished so as to reduce friction to a minimum. A blade or vane, located just inside the guard where it is out of chance reach, operates the mechanism, being itself impelled by the air from the fan blades. Collector rings and brushes placed above a two-speed switch in the base of the fan make it possible to discard the flexible lead connections. The desk and bracket fans are built in 12-in. and 16-in. sizes and are intended for operation on 110-volt and 220-volt circuits. The three types of ceiling fans listed by the company are built for a uniform speed of 220 r.p.m. and for voltages of 110, 170, 220, 250 and 500. A rather complete line of ventilating fans forms part of the company's output.

Peerless Electric Fans.

The fan motors of the Peerless Electric Company, of Warren, Ohio, have been improved in details this season. Some of the new features relate to advance commutator construction and the employment of rectangular carbon brushes. A universal desk and bracket fan which is instantly convertible from one position to the other without the aid of tools while the fan is in operation, will be pushed this year, together with the popular oscillating fan. The universal fan closely follows the model of the swivel and trunnion type and is equipped with self-aligning phosphor bronze bearings encased by the hoods so as to prevent oil throwing or oil creeping. Ducts convey the oil back to the cups. The rectangular brushes used are of special composition carbon and graphite. The fan is built in 12-in. and 16-in. sizes for 110-volt and 220-volt circuits. Fans for railway and storage battery service are built for 25, 30, 60, 80 or other special

voltages. The oscillating fan is actuated by a shifting vane located inside the guard. The reversals are cushioned by the air from the blades so that jar and racking of moving parts are avoided. The fan body rotates on a special ball bearing and the electricity is transmitted from the main circuit through carbon brushes to collector rings mounted on the bearing shaft.



PEERLESS UNIVERSAL FAN.

The switch in the base of the fan affords two speeds. The ceiling fans are of the four-blade type intended for 110-volt, 170-volt, 220-volt, 250 volt and 500-volt circuits. Ventilating fans built in sizes of 18 in. to 48 in. and smaller units of 12 in. and 16 in., together with a line of column fans, complete the company's line.

Bates Electric Fans.

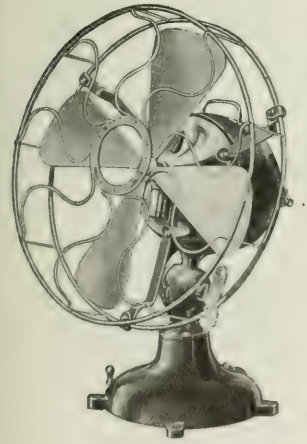
The fans built by the D. L. Bates & Brother Company, Dayton, Ohio, are intended for operation on direct-current circuits only. Three types of ceiling fans, a column fan and three sizes of desk fans are manufactured by the company. The desk fans are of the universal type and each is provided with a rheostat permitting three speeds. The armatures of the ceiling fans are large and well-ventilated and of the slotted type with form-wound armature coils. The field coils are also form-wound and are slipped over the six poles used and wedged in position. The distribution of both the field and armature coils is such that ample heat radiation is provided. Anti-friction and inter-pole bearings are employed, the lower bearing being self-adjusting by the weight of the armature. Round carbon brushes are employed which protrude through openings in the lower motor cover so that renewals may be made without removing the blades or the motor cover. The "imperial" and "electrolier" ceiling fans are built for 110-volt and 220-volt circuits only, while the "Style E" fan is built for 110-volt, 220-volt, 250-volt and 500-volt circuits.

Eck Fan Motors.

The Eck Dynamo & Motor Company, of Belleville, N. J., builds direct-current motors of the oscillating and universal desk type. The Eck "Hurricane" universal fans are made with an adjustable ball joint which allows them to be tipped forward at an angle of 15 deg. from the horizontal and also to be used as bracket fans. The fan is built in 16-in. and 12-in. sizes and for voltages not exceeding 250 volts. The motor is the same as used in previous years, with grease lubrication, square brushes, bronze bearings, and three-speed rheostat. The company's oscillating fan is shown below.

Diehl Electric Fans.

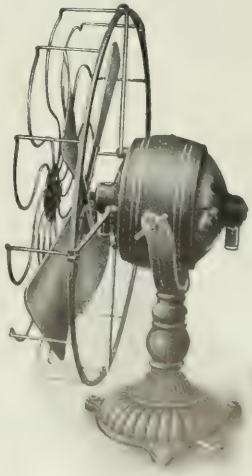
The line of fans placed on the market by the Diehl Manufacturing Company, Elizabethport, N. J., is the same this year as last, with the exception that the 9-in. desk fan will be discontinued and a new 8-in. fan will take its place. The oscillating fan built by the company is provided with the split ball feature used in the universal fans and may be adjusted in the same manner for desk or bracket use. The oscillating fans are made with 12-in. and 16-in. blades and are provided with rheostats giving the usual three speeds. Differential gears, which are enclosed in a case filled with oil, impart oscillating action from the motor shaft. The case revolves slowly by virtue of this mechanism and carries rubber-faced studs on a portion of its periphery. The bracket carries the motor on ball bearings and is arranged [illegible] upon which the studs act by friction and give the motor the desired movement. When used as a bracket fan, the angle is fixed so that the blades are in a plane about 15 deg. from the vertical, and the air current is directed downward to that extent. The line of ceiling fans built by the company is very complete. These are made for 110-volt, 170-volt, 220-volt, 250-volt and 500-volt circuits.



BATES DESK FAN



ECK "HURRICANE" OSCILLATING FAN



DIEHL [illegible]

"Standard" Fan Motors.

The Robbins & Myers Company, of Springfield, Ohio, continues to offer its line of "Standard" fans in very much the same form as in previous years. Three styles of ceiling fans have been found necessary to meet all classes of trade. The differences between these three styles are principally differences of finish and materials used in the external parts of the fans, the internal mechanism of all three models being very much alike and consisting of a deep slotted drum armature having machine-wound coils and an iron-clad field structure, the housings or end plates of which carry the bearings for the armature. Suitable oil cups are carried by the armature shaft in such a way as to supply, cleanly and copiously, lubrication to the bearings. In two styles switches are provided for controlling the speed of the fans by means of a suitable resistance coil mounted inside of the motor body.

For use on alternating current but one type of ceiling fan is offered, this being a motor of the induction type provided with self-lubricating ball bearings and speed-regulating switch. The maximum speed on all ceiling fans is approximately 200 r.p.m., which speed can be reduced practically 50 per cent by means of the switch supplied as part of the fan.

The company offers a full line of 12-in. and 16-in. desk fans for both direct and alternating current, these being provided with swivel and trunnion movements for adjusting the direction of the air current. A smaller fan, known as the residence type, is furnished in every way like the larger motors and is supplied for either alternating or direct current. This motor is of the commutator type, and has been found entirely satisfactory for the cooling and ventilating of residences and rather limited areas.

The "Standard" oscillating fan with both direct- and alternating-current motors is one of the company's best products. The oscillating movement of these fans is obtained by means of the unsymmetrical air reaction due to the presence in its path of a brass disk or vane which automatically changes its position at the end of its oscillation.

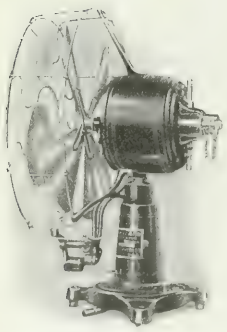
Convenient and satisfactory mounting arrangements have been made for the 12-in. and 16-in. fan motor bodies for all currents so that they may be utilized as exhaust fans for the ventilation of moderate areas requiring fresh air as well as a circulation of the air in the room. These exhaust fans may be readily mounted by covering a suitable aperture in the apartments with a board having a circular opening the size of the fan blades and fastening the exhaust fan by its ring to this board with four wood screws. The company also builds larger types of exhaust fans, up to 42 in. in diameter, for both direct and alternating current.

Century Alternating-Current Ceiling Fans.

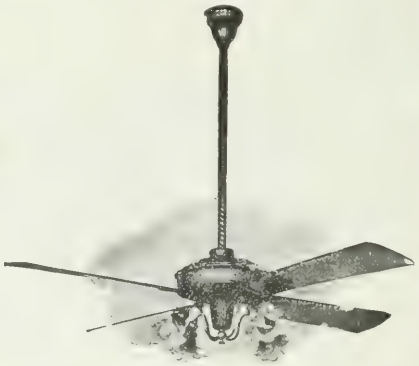
The Century Electric Company, of St. Louis, Mo., manufactures alternating-current ceiling fans exclusively. These are built for any tension between 90 volts and 250 volts and for any frequency between 25 cycles and 67 cycles. The fan can be taken apart for cleaning or inspection without having to disconnect a single wire. It is an economical energy consumer, moves a maximum quantity of air and operates practically noiselessly. The 60-cycle fans operate at a speed of 225 r.p.m. and at a corresponding speed when the frequency varies. All fans are equipped with a two-speed switch, the low speed being about 180 r.p.m. on 60-cycle circuits. Both the two-blade and the four-blade fans have a sweep of 58 in. Two-lamp or four-lamp electroliers may be attached to the oil cup of the fan when so desired. The bearings and shaft are accurately fitted so that there is no binding or sticking, and the whole weight is supported on hardened steel ball bearings immersed in oil. The fan is oiled by simply unscrewing the oil cup and pouring in the oil. The construction is such that the throwing of oil is said to be impossible.

Oscillator and Base for Electric Fans.

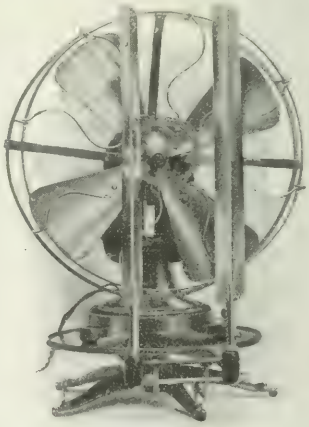
It is generally recognized that for very many conditions an oscillating electric fan or a fan guard giving the same air distribution is preferable to a fan blowing air in one direction only. In order to impart to the stationary electric fans all the advantages of the oscillating fan, the Simplex Manufacturing Company, of New York, has brought out an oscillator especially applicable for this purpose. The oscillator is a purely mechanical device operating on well-known principles. As shown in the illustration herewith, the fan is placed on a round table which oscillates freely on ball bearings and the adjustments are such that the arc through which the fan swings can be made as large as desired. The impetus to move is communicated to the table by the fan itself. Mounted on the table are two parallel vanes set at an angle, and the air from the fan impinging against these vanes causes the table to revolve until its reversing mechanism comes in contact with a setting in one of the feet of the device, when the vanes are turned and the movement of the table is reversed. No special skill is required in adjusting the oscillator to the fan, as will be inferred from the engraving. The device is made in two sizes which will very easily accommodate all electrical fans in common use.



ROBBINS & MYERS "STANDARD" OSCILLATING DESK FAN.



CENTURY CEILING FAN.



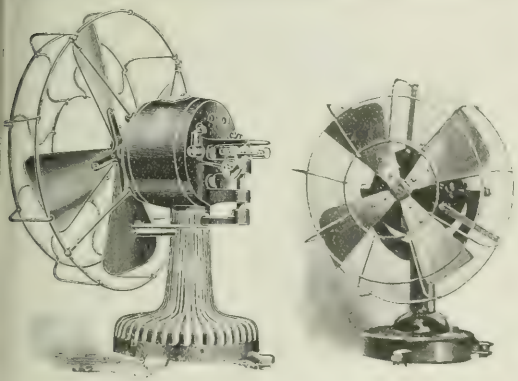
SIMPLEX OSCILLATOR AND BASE.

Fidelity Fan Motors.

To meet the demand for a fan motor of moderate price, but which would still embody thorough construction in all its parts, the Fidelity Electric Company, of Lancaster, Pa., has developed a 10-in. fan for use on direct-current circuits, in which particular attention has been paid to making the fan as efficient as possible, both electrically and mechanically. In designing the speed control, the resistance method with its attendant electrical loss has been discarded; the desired result being obtained by a simple method of field control in which at either high or low speeds all the electrical energy is used in driving the blades.

Inasmuch as the 10-in. propeller adopted is smaller than the standard 12-in. size, a specially shaped blade has been developed which is said to be very efficient in throwing the air, preventing most of the back slippage common to the older type, and bringing the 10-in. blade very close to the 12-in. breeze-producing properties. In its general construction the fan motor is well built, with wick feed oilers, copper commutator, polished brass propeller and guard, and swing trunnion attachment.

Besides its well-known direct-current oscillating fan, the company has this season placed on the market an oscillating fan

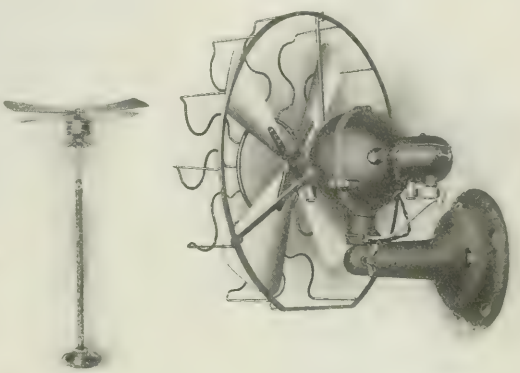


FIGS. 1 AND 2.—FIDELITY OSCILLATING AND DESK FAN MOTORS.

motor for use on alternating-current circuits, embodying the same oscillating mechanism as the direct-current fan, with a few improvements which experience has proved necessary. As this mechanism is direct driven from the motor shaft, no trouble is experienced in the operation of the fan when out of level; in fact, the operation is claimed to be satisfactory when the motor is placed at a very considerable angle, and it is often for special reasons installed in such manner.

Sprague Electric Fans.

The Lundell direct-current fans, manufactured by the Sprague Electric Company, are among the best known electric fans on the market. These fans have been kept up to date and are still very popular. The guard on the 16-in. fan this season has been slightly flattened at the bottom in order to give the fan a greater downward deflection, as shown in the illustration. A new type of Lundell fan is introduced this season in the form of an oscillating fan, for which superior advantages are claimed. The motor is durable on account of its substantial design. The oscillating movement is very simple. No small gears are used and ample lubrication is provided. The oscillating movement can be acquired or thrown out by a simple turn of the lever located on the casing which encloses the gears at the back of the motor. The arc through which the motor moves is approximately 100 deg. and the downward deflection of the desk fan is approximately 25 deg., while in the bracket fan it is approximately 100 deg. The oscillating fan is made in the 12-in. and 16-in. sizes. A very important feature in the construction of the oscillating fan is that the oscillator mechanism can be easily attached to the Lundell non-oscillating 1909-type fans. This is a distinct advantage and places the Sprague fan in a field by itself. In addition to these fans and the Type-T ceiling fans the Sprague Electric Company is placing on the market this season attractive floor and counter column fans. These fans, like the ceiling fans, have four wooden blades 8 in. wide with a sweep of 56 in. The blades are of polished white wood and are firmly

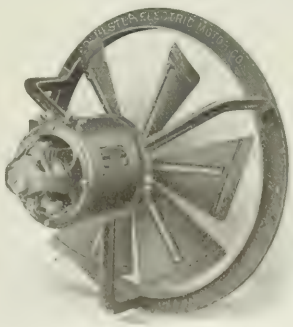


FIGS. 1 AND 2.—SPRAGUE COLUMN AND OSCILLATING FANS.

riveted to the holder, which, in turn, is screwed and locked to the fan spider. The floor and counter column fans, like the ceiling fans, have been designed with a view of making them efficient, durable and attractive in appearance, and are furnished in both plain and ornamental types.

Rochester Ventilating Fan.

The ventilating outfit of the Rochester Electric Motor Company, of Rochester, N. Y., is designed to meet the severest service encountered in practice. The motor is series wound and its temperature rise under normal conditions is 25 deg. C. above that of the surrounding air, allowing ample leeway for installations of fans in engine rooms, kitchens and other places where high temperatures abound. The motor bearings are un-

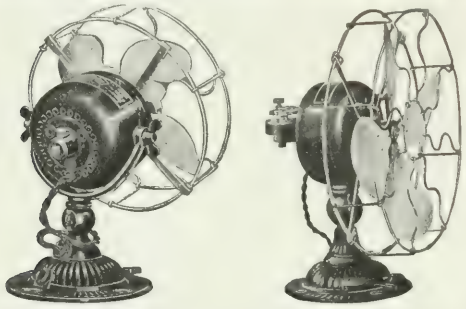


usually large and are practically dustproof. The bearing itself is of bronze and of the ball-and-socket type, one-half of the ball resting on a spherical seat integral with the supporting bracket and the other half seat being an adjusting cone held in place by locknut and key, the fraction of a turn more or less compensating for any variation that might exist in the size of ball on different bearings. The oil wells are deep enough to permit any foreign matter that might possibly work itself in to settle to the bottom, allowing the rings to furnish clean oil

to the bearings. Provision is made to oil the bearings on the fan-end of the motor without danger of coming in contact with the blades of the fan. Where desired the motors can be entirely enclosed. The peculiar feature of the fan is the curve of the blades, which is such as to give nearly uniform velocity across the entire face of the fan. This makes it possible to work against greater back pressure than usual with the disk type of fan and also permits the fan to handle a larger column of air for the same diameter.

Emerson Alternating-Current Fans.

This year the Emerson Electric Manufacturing Company, of St. Louis, Mo., offers the same large assortment of induction desk and ceiling fans as heretofore, with the addition of two new types. These are an 8-in. swivel-and-trunnion fan and an oscillating fan. The 8-in. fan has become popular for home use and for small rooms, although not displacing the larger fans for general service. It is identical in design with the company's 12-in. motor and has an induction motor without brushes or commutator and with an automatic starting device. The motor has the high-efficient form of winding and hardened steel shaft which are familiar to users of Emerson fans, and is fitted with the patented blades adopted by the company. The latter are fastened to the armature in the same manner as in the older

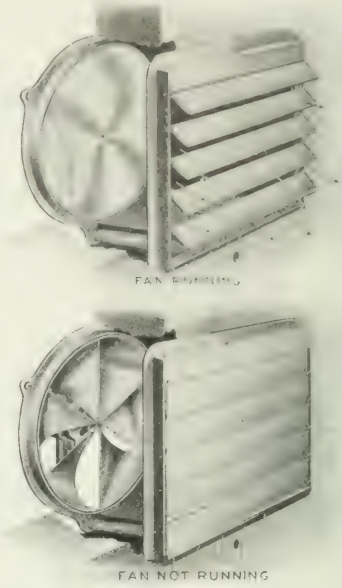


FIGS. 1 AND 2.—EMERSON 8-IN. DESK FAN AND OSCILLATING FAN.

types, making an oil-tight, dust-proof bearing which, it is said, cannot throw oil. The convertible base of the 8-in. fan permits it to be changed into a bracket fan, and the usual swivel-and-trunnion adjustments are provided. The fan has but one speed, 1650 r.p.m. The oscillating fan has a special convertible bracket base and ⅜-in. revolving steel shaft and bronze bearings, owing to the requirements of the oscillating design. The oscillating or lateral swinging movement is secured by a worm-gear attached to the rear end of the shaft, operating an adjustable lever arm which swings the fan gently from side to side. The oscillating device is positive in its action and operates with the fan in any position. Although the fans do not have the usual trunnion, the base is so designed that the fan may be tilted or depressed. The oscillating fans have but one speed. Two sizes of fans are built, 12 in. and 16 in., and the speeds are 1650 r.p.m. and 1850 r.p.m., respectively.

Ilg Ventilating Apparatus.

The Ilg Electric Ventilating Company, of Chicago and New York, has brought out an automatic shutter to be used in connection with its well-known self-cooled exhaust fans. The accompanying illustration shows the fan installed in a brick wall connected with one of these shutters. The upper part of the engraving shows the fan while running and the lower part shows the fan at rest. The shutter consists of several horizontal aluminum slats pivoted into a rigid frame and hanging free in front of the exhaust vent. The slats are arranged so that when hanging down they overlap each other, fitting closely, thus effectually preventing the ingress of sweeping winds, draughts or rain that otherwise frequently cause a reverse by blowing i through the unprotected vent when the fan is not operating The shutters are forced open by the pressure of the air curren from the fan when the latter is running and drop shut auto matically by gravity when the fan is at rest. No attention is re qu ed by the shutters and the slats, being of aluminum, are no affected by any kind of weather or salty atmosphere. Th method of ventilating the motor is indicated in the engraving



ILG VENTILATING APPARATUS.

The motor is entirely enclosed and the vacuum created in the front of the center of the fan when the latter is in operation causes the cold air from outside the motor to pass through the tube connecting with the hood enclosing the motor and out with the general exhaust. In this way the motor is protected from dust and other foreign matter and is not reduced in rating owing to being enclosed.

Westinghouse Fan Motors.

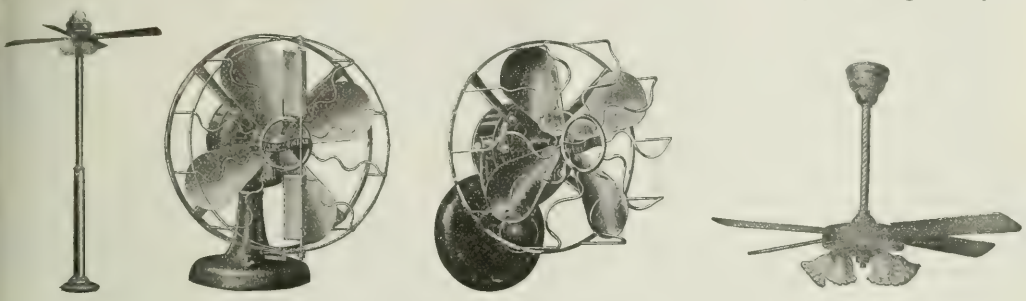
The 1909 fan motors of the Westinghouse Electric & Manufacturing Company include numerous types and sizes adapted to all kinds of commercial circuits and to any class of service to which fan motors may be applied. In addition to the standard lines of fans listed last season, several new models are presented, including 8-in. desk fans, telephone-booth fans, ventilating, oscillating fans, etc.

The direct-current fan motors are characterized by lightness in weight, noiselessness in operation and high efficiency. The frames are cylindrical, made of cast iron, and have rectangular pole pieces and field coils. The armature is of the drum type, built up of laminated sheet steel mounted upon a carefully ground tool-steel shaft. Especial care has been used in the design of the commutator so as to eliminate commutating troubles. The ceiling and column fan motors are provided with ball bearings to carry the weight of the moving part, and friction is reduced to an almost inappreciable amount.

The alternating-current fan motors are of the induction type, except the 8-in. and telephone-booth fans, which have series windings. The frames are well ventilated, and the stators and

rotors are built up of specially annealed sheet-steel laminations. The shaft is of hardened tool steel running in bushings of the best bearing metal, and the bearings are self-oiling with automatic oil returns to prevent oil-throwing.

The 8-in. desk and telephone-booth fans are designed to run



FIGS. 1, 2, 3 AND 4.—WESTINGHOUSE COLUMN, OSCILLATING, BRACKET AND CEILING FANS.

with absolute quietness and to furnish a moderate circulation of air for bed chambers and other places where a strong breeze would be objectionable. A switch is placed in the base of the motor by means of which it is started, stopped and given three speeds. The telephone-booth fan is adjustable in both the horizontal and vertical planes and suspended by springs to dampen any vibrations which might affect the telephone. The energy required to operate these fans is only about one-third of that consumed by an ordinary 16-cp lamp.

The ceiling and column fans have four blades. A number of tapped holes directly under the fan blades are provided to accommodate standard nipples or arms for electric light fitting; either two, three, four, five, six, ten or twelve lamps may be so used. The lamps are thus below the blades, so that the latter cast no shadows on articles below. The energy consumption of the motor is less than that required for three standard 16-cp lamps.

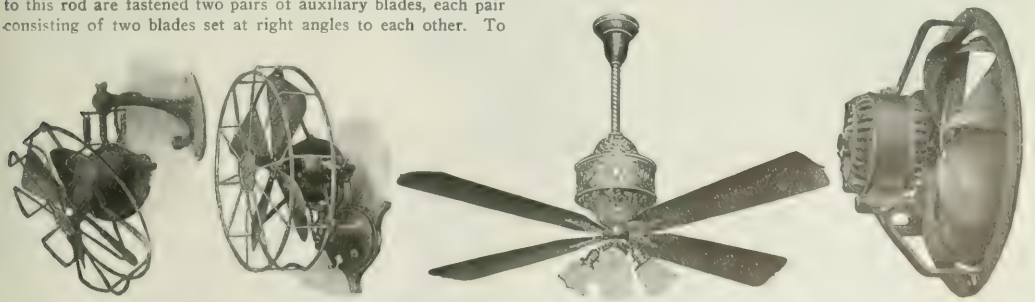
The ventilating fans differ from the desk and bracket fans in the method of mounting employed. They are designed to act as exhaust fans for the ventilation of rooms and enclosures, and consist of 12-in. and 16-in. fan motors supported on ring frames suitable for mounting in wall openings.

For places where it is desired to disperse the breeze from an electric fan over a wide area, the Westinghouse company is introducing an oscillating fan which is positive in action and of very simple construction. The oscillating device used on these fans requires a very small amount of energy. As shown in the illustration, a vertical rod free to revolve through a quarter revolution is supported in front of the fan guard, and to this rod are fastened two pairs of auxiliary blades, each pair consisting of two blades set at right angles to each other. To the bottom of the vertical rod is connected a short lever, which, as the fan oscillates, strikes cushioned stops fixed on the base of the fan, at any desired point, thus turning the rod with its blades through a quarter revolution at the end of each oscillation. The turning of the rod throws the auxiliary blades alternately parallel to the fan blades, first on one side and then on the other side of the center of the fan, and the reaction of the air upon the auxiliary blades causes the fan to turn alternately from side to side. The body of the fan is supported on ball bearings, so that it revolves freely on the slightest impulse. One valuable feature which eliminates any chance of accident from twisted leads is the transmission of the electricity from the base to the oscillator by means of brushes and collector rings.

Western Electric Fan Motors.

The line of fan motors and ventilating outfits offered by the Western Electric Company for the 1909 fan-motor season includes desk, bracket, oscillating, ceiling, telephone-booth and exhaust fans in a wide range of designs and for operation on all commercial direct-current and alternating-current circuits. Some slight changes have been made from 1908 models where improvement has been found possible and new types have been added. In the direct-current desk and bracket type the "Universal" is furnished in 12-in. and 16-in. sizes. The "Zero," which is a desk type only, is also furnished in 12-in. and 16-in. sizes. Both these fans can be operated at three speeds. The "Universal" is totally enclosed, while the "Zero" is of the open field type.

The 8-in. "Hawthorn" is a new combined desk and bracket fan and is furnished for both direct-current and alternating-current use. It is a three-speed fan which is highly desirable for residential use as well as in small offices. The energy consumption of this fan is said to be very low. Another 8-in. type is the telephone-booth, spring-suspension fan motor. This model has been improved since last season and in addition to being used in telephone booths is being used for mounting on light partitions, since the spring suspension eliminates vibration. The fan is built for direct and alternating current.



FIGS. 1, 2, 3 AND 4.—WESTERN ELECTRIC TELEPHONE, BRACKET, CEILING AND EXHAUST FANS.

In addition to the "Victor" oscillating fan, which is supplied in both direct-current and alternating-current types, a new direct-current oscillating fan is now being offered. This is

known as the "Universal" and is of the desk and bracket type. In its design advantage has been taken of the fact that the strongest air currents are at the edge of the blades, with the result that a smaller vane is used than ordinarily. The unbalanced conditions in the air currents produced by the vane cause the fan to rotate on a vertical axis through a wide arc. The vane is held in a horizontal position by a trigger which on striking a stop at the end of the path of travel releases the vane and permits it to rotate through 180 deg., where it is again held in a horizontal position until the fan has returned to the opposite stop. The vane is carried on a collar which is loosely mounted on the armature shaft and, as the vane is in perfect balance, the slightest amount of friction causes it to rotate when released by the trigger. No sliding contacts are used to carry the electricity from the stationary to the oscillating part; the electricity being fed to the motor by means of springs. The mechanism of this fan is claimed to be extremely simple, its action positive and its operation highly efficient. The oscillating part is mounted on ball bearings.

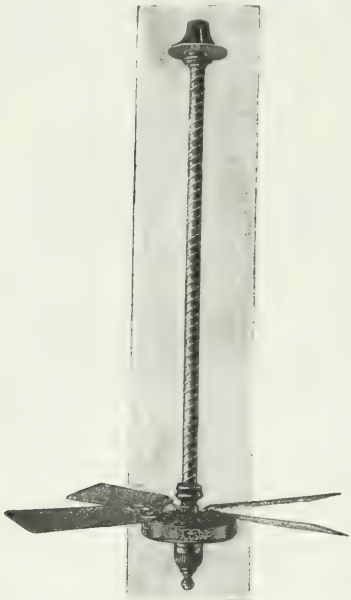
A combined desk and bracket fan for alternating current is the "Victor," which is furnished in 12 in. and 16 in. sizes the motor is designed to operate. The mechanism is arranged so as not to interfere with the convertible feature of the motor, by means of which it can be quickly adapted for either desk or wall use.

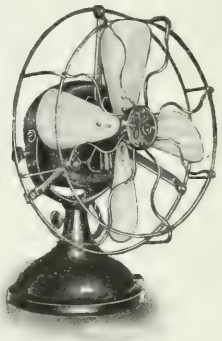
Desk and oscillating fans, as usual, are furnished in all different types for standard voltages and frequencies, or can be wound to meet special requirements if desired. Both direct- and alternating-current fans of the desk or oscillating type can be obtained with 12-in. or 16-in. blades. These, with the bracket-type fans of the same design and sizes, are available for all classes of service. An advantageous feature in connection with the direct-current desk motors is the universal joint with which they are equipped and by means of which a desk motor may be instantly transformed into one of the wall-bracket type, or vice versa, without the aid of tools.

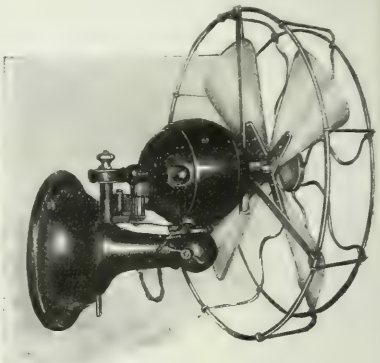
The wall and desk types of the alternating-current fans are identical with the exception that the wall type has an angular adapter in addition to the standard parts of the desk type. This adapter enables the fan to be turned so as to utilize the breeze to the best advantage.

The ceiling and column fans are fitted with four wooden blades having a 52-in. sweep for the alternating-current type and a 58-in. sweep for the direct-current type. The alternating-current fans are designed for operation on circuits of commercial voltages and for frequencies of 60 cycles or less. All ceiling and column fans are wired for two or four lamps.

Speed variations of the alternating-current fans are obtained by means of a regulating switch and reactive coil. A similar speed-controlling switch and resistor enable various speeds to be obtained with the direct-current fans. Both direct- and alternating-current ventilating fan motors are manufactured with 12-in. or 16-in. blades. Speed controllers are furnished.







FIGS. 1, 2 AND 3.—GENERAL ELECTRIC CEILING, DESK AND OSCILLATING FANS.

These fans are of the induction type, are of neat and strong construction and operate at three speeds. The line of ceiling fans includes a number of plain and highly finished types for direct and alternating current. All these fans are finished to operate on 110 volts, 220 volts or 500 volts. The "Victor" for alternating current is furnished plain or ornamental, the former in two and the latter in three speeds. The company's exhaust fans are equipped with motors best adapted to that particular style.

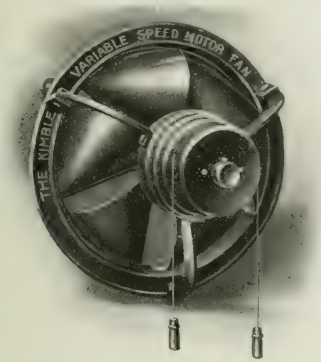
General Electric Fan Motors.

With the exception of a few slight changes the fans placed on the market this year by the General Electric Company are identical with those of last season. A line of oscillating fans has been added, but the fans, with the exception of the oscillating features, are identical with the corresponding fans of the standard types. The oscillating fans have a positive oscillating mechanism actuated by a worm on the armature shaft. This insures a uniform oscillating movement at all speeds at which however, only with the direct-current type. These fans are designed to be installed in the exhaust openings.

In the design of fan blades for the 1909 model motors, a departure from the conventional form has been made. The usual design consists of a triangular-shaped blade with a constant pitch at all points riveted to a narrow arm of the carrier. Blades of the new design are wider at the hub end than the ordinary blade and have a pitch increasing to a maximum at this point. The corners of the blades are also rounded off and ample space is provided between the fan and the motor body. The blades are made of extra heavy brass formed to shape under heavy pressure and riveted to a rigid spider. The result is a very rigid fan that is free from vibration and consequent noise. The guards are heavy and durable and are supported in such a manner that it is impossible for them to shift or work loose. No solder at all is used to hold the cross wires. This construction gives a stiff and effective guard by which the motor can be lifted without danger of distorting or breaking any of the parts, thus providing a convenient method of handling the fan.

Kimble Variable-Speed, Single-Phase Ventilating Fan.

The Kimble Electric Company, of Chicago, builds a variable-speed, single-phase ventilating outfit which is claimed to combine many advantages. Gradation in speed between the maximum and the minimum is accomplished by means of two pendant chains, as shown in the engraving, which also illustrates the older method of mounting the motor to the frame. In the newer method the frame is all in one piece. The fan is made in



KIMBLE VENTILATING FAN.

three sizes, 18-in., 24-in. and 30-in., the respective speeds ranging from 80 to 800 r.p.m., 75 to 750 r.p.m. and 70 to 675 r.p.m. The motor used is of the variable-speed, single-phase type. The speed-control mechanism is enclosed within the motor casing and variation in speed is accomplished by shifting the brushes. The energy consumed follows the load closely. Full line voltage may, it is claimed, be impressed upon the motor while it is standing still without danger to the windings. The starting current is not larger than the running current, and the entire equipment is ideally simple. The fan used is of the Blackman type.

Fort Wayne Fan Motors.

Several new and interesting features are noticeable in the Fort Wayne Electric Works' line of fan motors for the season of 1909. These features have been added as a result of the popular demand for a reliable, useful, efficient fan motor. The company has increased its standard line by the addition of new types and sizes of fan motors. The standard line of 8-in. fan motors is maintained with improvements in minor details. The 8-in. fans comprise the solid base desk fan. The universal bracket fan motor has a standard motor body, but is supported by a brass goose-neck bracket fastened to it and held by a suitable lug mounted on the wall. The fan is adjustable both vertically and horizontally. The suspended revolving fan motor is designed to hang from an ordinary incandescent lamp socket and revolves horizontally around its support, thus throwing air to all parts of a room at regular intervals. The telephone booth fan motor is also of the 8-in. size and is especially designed for such service. It is small, light running, noiseless and of somewhat slower speed than the standard 8-in. fan motor. All of the fans are made for both alternating-current and direct-current service.

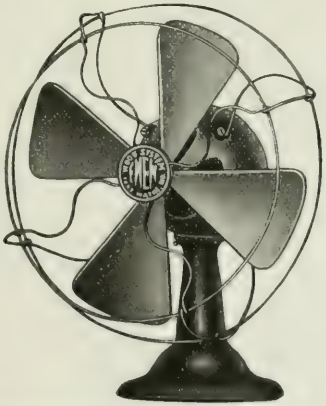
The line of 12-in. and 16-in. fan motors consists of a desk and wall bracket type for direct current. This fan may be used either as a desk fan or it may be mounted on the wall. It is adjustable horizontally and is made in both sizes. The corresponding fan for alternating current is known as the swivel and trunnion type, and is also made in both 12-in. and 16-in. sizes. This fan may be used either as a desk or wall bracket fan and is adjustable both vertically and horizontally.

An entirely new line of oscillating type fan motors is made in both 12-in. and 16-in. sizes for both alternating and direct current. The special feature of these fans is the simple automatic arrangement which swings the motor body and fan horizontally through an angle of 90 deg. at regular intervals, thus throwing the air to every part of the room. This fan may be used either as a desk or wall bracket fan, the oscillating feature being adapted for either use.

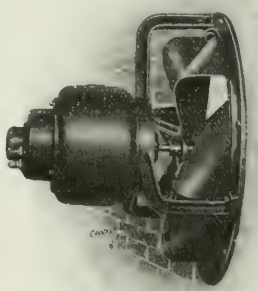
Crocker-Wheeler Ventilating Fans.

The only type of fan at present built by the Crocker-Wheeler Company, of Ampere, N. J., is designed for ventilating purposes, for heating in connection with steam-heating systems and for drying lumber, hides, textiles and other materials. The outfit is also applicable for laboratories and chemical works for withdrawing noxious fumes and gases. The fan may be attached to the wall or ventilating duct and may be operated in a vertical position. The stock sizes are 18 in., 24 in., 30 in. and 36 in. The motors are generally of the open type, but when the fan is to operate in a moist or dusty atmosphere enclosing covers are supplied. The motors are of the company's Form L type and are direct-connected by substantial arms to the wall ring. The armature shaft carries a propeller type of fan of the latest design. The speeds range from 900 r.p.m. in the smallest fan to 500 r.p.m. for the largest fan. The entire line is built for 115, 230 and 500 volts.





FIGS. 1 AND 2. FORT WAYNE OSCILLATING AND DESK FAN MOTORS.



CROCKER-WHEELER VENTILATING FAN.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

During the past week there has been some slight expansion in the trade of jobbing houses, especially in the lines of dry goods and millinery. There has also been the active business in agricultural implements and fertilizers customary at this season of the year. The manufacturers of cotton and woolen goods continue to report that they are practically running up to full capacity and that they are having difficulty in keeping up with their orders. With these exceptions, however, it may well be stated that the present condition of trade is about as unsettled as has been known in many years. The demoralization in the iron and steel business, the suspense concerning the tariff, the crisis that exists in the copper producing industry, the weakness in the security market and the excitement and uncertainty that are being created by the wheat corner in Chicago all contribute to make business conditions extremely unsatisfactory. There is little prospect that they will be much more settled until after the tariff schedules shall have been finally agreed upon. Capital is timid, and conservative business men are unwilling to invest or to expand as long as there remains an uncertainty as to what future price bases will be. The constant reiteration that there will be an open market in all the metal trades leaves both sellers and buyers in a state of doubt as to the future. During the past week the weather conditions in the West contributed to the dullness of retail business. The country roads are in such bad shape in many sections that purchasers could not get to market and the farmers' deliveries of grain and other products to the railways were seriously impeded. The electrical industries are, of course, feeling to a considerable extent the general suspension of business, but they are in no worse condition than the majority of the other manufacturing interests. Sales of small apparatus and appliances continue in fair volume, but there are few orders for large installations being booked. The most active of all the electrical branches is the lamp trade, and this is reported as being exceptionally good. Collections continue to be about in the same condition as existed for several months. They are neither as good as creditors would desire, nor are they slow enough to cause any serious inconvenience. The financial condition of the majority of the retailers throughout the entire country is better than it has been for a long time, due, of course, to the 16 months of ultra-conservatism. Business failures for the week which ended Feb. 25 were 244, against 282 the previous week, 311 in 1908, 194 in 1907, 180 in 1906, 206 in 1905.

THE COPPER MARKET.

The February movement of copper indicates that there has been a further increase of stocks to the extent of about 30,000,000 lb. The production for the month, including imports, has been apparently 105,000,000 lb. The exports were not more than 35,000,000 lb., and domestic consumption has been rather less than during the previous month, when it was a trifle more than 40,000,000. Thus it is not hard to figure that the surplus has been considerably augmented. The figures offered by the Copper Producers' Association for Feb. 1 showed that there were 144,000,000 lb. of "marketable" copper in the hands of producers. These figures were generally accepted as being at least 50,000,000 lb. below the actual surplus of copper in the country, and the saving clause was supposed to be found in the term "marketable." Taking the producers' figures, however, as a basis, it is apparent that the March 1 report will show something like 175,000,000 lb. of "marketable" copper in sight. At the present time the refineries are keeping up fairly well with the smelters, and it is probable that the copper called "marketable" will in the future more nearly represent the actual amount of metal mined. Of course, there will always be large quantities in process of smelting and refining, and these stocks can only be estimated in the broadest manner. During the week which ended Feb. 27 the price of copper sagged continually, and there was an almost entire absence of purchasers. The marking down of prices seemed to have no effect upon consumers. Inquiries for electrolytic were as few when the quoted price was 12¼ as they had been when the price was above 13 cents. The reason for this is very plain. The business of the electrical companies is not more than 60 per cent of normal, general trade conditions are unsettled by the tariff, copper statistics indicate lower prices and the prudent buyer very naturally sees the wisdom of waiting. In the London market the heavy decline has induced some speculative buying, but the demand for consumption continues to be light. On March 1, there was some stir in the market and reports were given out from all selling quarters that big sales were being negotiated and inquiries were pouring in. One statement, which was not so secretly made that any newspaper in town failed to get it, declared that the electrical companies had bought from 30,000,000 lb. to 50,000,000 lb. during the day. Another agency declared that it had received more inquiries during the day than during the previous three months. This tremendous change for the better came almost too suddenly to be greeted with credulity throughout the copper market. It was openly intimated that the instantaneous revival had more to do with Wall Street than with the metal market; that it was intended for the dealers in stocks, not the dealers in copper. Prices, however, were certainly stiffened up a bit by the movement, and there was less willingness to grant concessions below quotations. Prices, however, did not recover as much as it would be proper to expect in the presence of a 50,000,000 lb. sale. To sell in one day more copper than was sold to consumers in any one of the past three months ought to have a very radical effect on prices. Exports from New York during the month of February were 13,869 tons. The prices quoted on the Metal Exchange March 1 were:

Lake	12¼	@	13
Electrolytic	12⅜	@	12⅝
Castings	12¼	@	12½

London quotations were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	57 5 0	57 7 6
Standard copper, futures	58 0 0	58 2 6
Market	Strong.	Firm.
Sales of spot		500 tons
Sales of futures		1,900 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.25	12.75
Electrolytic	14.25	12.37½
Casting	14.12½	12.25
London, spot	£64 2 6	£55 17 6
London, futures	64 17 0	56 12 6
London, best selected	67 15 0	59 10 0

NILSON-MILLER COMPANY.—The Nilson-Miller Company, of Hoboken, N. J., has been incorporated with capital of $25,000. It is located at 1300 Hudson Street, in the shop formerly occupied by W. D. Forbes & Company, and will conduct an engineering and general machine-shop business, making a specialty of designing and building to order electrical apparatus, gasoline engines, etc., for commercial vehicle, marine and stationary use. Experimental work and the manufacture of special machinery will also be undertaken.

BUSINESS PROSPECTS IN THE NORTHWEST.—Sales Manager Allen L. Haase, of the Harvard Electric Company, Chicago, states that in a recent trip covering part of the great Northwest, and particularly Iowa and Nebraska, he found all through this territory a buoyant feeling among the business men that seems to assure a good volume of business from that entire section this year and he was especially pleased with the condition existing all through this great agricultural belt.

MACHINE TOOL CONSOLIDATION.—The Bickford Drill & Tool Company, of Cincinnati, and the Cincinnati Machine Tool Company have consolidated under the title of the Cincinnati-Bickford Tool Company. The officers of the new company are as follows: August H. Tuechter, president; Sherman C. Schauer, vice-president and general manager; W. H. Shafer, secretary; G. P. Gradolf, treasurer; H. M. Norris, mechanical engineer.

WESTINGHOUSE TURBINES.—The Portland Cement Company of Portland, Col., has purchased a 600-kw; three-phase, 60-cycle Westinghouse turbo-generator equipment, with Le Blanc condenser, a rotary converter and a switchboard. The installation of Le Blanc condenser makes it possible to utilize for condensing purposes water from an old well, which is not now usable with the present type of surface condenser. Turbines have been adopted in this plant for power extension rather than Corliss engines, two of which have already been operating for a number of years on surface condensers. With the moderate superheat and high vacuum contemplated, it will thus be possible for the turbine to effect considerable economy in operation. Although direct current is largely used at this plant, an alternating-current turbine unit was selected in connection with a rotary converter as providing greater flexibility of operation than obtainable with a direct-current turbine unit, which was also under consideration. The Lyman Mills, at Holyoke, Mass., have purchased a 750-kw, two-phase, 30-cycle, 440-volt turbo-generator. For some years Westinghouse induction motors have been installed throughout the mill to drive the various machines, with a total capacity of 900 hp. Recently the company decided to install additional generating capacity, and to this end made the present purchase.

FLAMING ARC BUSINESS CONSTANTLY INCREASING.—While business in many lines of electrical development is far from booming, there is certainly no reason to complain with regard to the trade in flaming arc lamps. The main trouble importers and dealers are now having is to keep up with their orders. Speaking of this rush of business, Mr. L. J. Auerbacher, of Fox Brothers, New York, said: "The country is just waking up to the value of the flaming arc lamp, and business and inquiries are pouring in from every quarter. Not only are big factories, foundries and other industrial plants turning out the flaming arc as the most satisfactory and economical method of lighting, but municipalities all over the country are realizing that here is a method of street lighting that excels anything heretofore devised. The flaming arcs really light the streets, and this has never been done before. There are many instances where the citizens are insisting upon the use of these lamps, and are willing to stand an extra tax in order that they may be installed. We have on hand now a deal with a city involving 4000 lamps, and there are many others pending. Railroads, too, are taking up the flaming arc for station lighting. The Boston & Albany, for instance, has recently equipped the most important of its Massachusetts stations with these lamps."

TO CONSTRUCT SEATTLE SUBURBAN RAILWAY.—The Seattle-Everett Interurban Railway Company and the Everett Railway, Light & Water Company have contracted with the Stone & Webster Engineering Corporation, Boston, for the construction of an interurban railway from Halls Lake to Everett, a distance of 13 miles. There is already built a 9-mile section of interurban railway between Seattle and Halls Lake and this, together with the new section, will form a through interurban connection between Seattle and Everett. The Seattle Electric Company will provide the connecting line between the interurban at the city limits and its own system. The road will be built entirely on private right-of-way. Catenary overhead construction will be used and energy will be supplied from a substation to be located half-way between the Freemont substation of the Seattle Electric Company, in Seattle, and the power station of the Everett Railway, Light & Water Company, in Everett. The Freemont substation receives energy from either the Puyallup water-power plant or the Georgetown turbine station. From this substation the energy will be carried at 13,000 volts to the new substation for the interurban. The present arrangements provide for improvements in the present line from Seattle to Halls Lake as well as all the work involved on the new section.

CANADIAN TELEPHONES REDUCE RATES.—The provincial government of Manitoba, which took over the Bell telephone system a year ago, has announced a general reduction in the cost of telephone service. Business telephones are reduced from $50 to $45 with 2 cents a call in excess of a certain percentage. In the residences the rate has been cut from $30 to $20, extension telephones have been cut from $12 to $6, and two-party telephones from $30 to $18. This reduction is regarded as a vindication of the municipal operation of telephones by Canadian authorities and the provinces of Saskatchewan and British Columbia are negotiating with the Bell interests in those localities for the purchase of their plants. The Alberta government has already bought out the Bell Company.

AN IMPOSTER.—We are informed that a number of electrical firms have been approached by a swindler whose plan of operation is to represent that he is an officer of some large operating company, then work up a deal, place an order, accept it, encourage as much entertainment as possible, and finally borrow money. In one instance he gave his name as George W. Reid and in another gave the name of Phillips. He is a man of good appearance, about 50 years of age, about 5 ft. 8½ in. tall, with gray hair and mustache.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market during the past week has experienced the most violent decline that has occurred since the early days of the panic in 1907. For two days, Feb. 23-24, there was a most tremendous pressure to sell and stocks broke from 3 to 10 points. Sales mounted up to well over the million mark each day and the forced liquidation of small holders ran into the thousands of shares. The decline was led by Reading and United States Steel common, although the copper shares and their kindred, the smelters, were in close attendance. The sudden weakness was attributed, and no doubt quite correctly, to the demoralization in the steel trade caused by the breakdown in the price agreement and the belief that the Supreme Court would decide adversely to the railroads in the "commodities case." In United States Steel common, especially, the liquidation was enormous. The stock has always been a favorite with small speculators. It is one of those issues in which there is always "something doing." It is recognized as a stock of great possibilities. There is no doubt but that Steel had been pushed above 50 by careful and persistent manipulation. Large blocks of it were accumulated a year ago when it was below 30, by big financial interests—who also at the same time collected vast quantities of other low-priced stocks. The price was gradually lifted along until it was well over 50, and small dealers were apparently more active at the higher figures than they had been at the lower. Whether the principals, who bought early, have unloaded their holdings at the high figures, it is hard to say. Many people in Wall Street are of that opinion and declare that the recent break was but a "shake-down" to permit rebuying at lower figures. Whether this is true or not, the demoralization of Steel prices is enough to have caused all the trouble. The ability to pay dividends on Steel common depends on the excess profits the big organization is enabled to earn. In an open market, with prices from 20 per cent to 40 per cent lower than last year, the opportunity for excess profits does not seem to be very alluring. The report that the Supreme Court has rendered an adverse decision in the "commodities case," coming just at this time, added to the panic and made the small holders of Reading—a property largely dependent on its coal business—extremely nervous. The stock broke 10 points in a few hours. At the same time the weakness of the copper situation seriously affected Amalgamated and the stocks of the smelting companies. The evident overproduction of the metal, the sagging of the price, and the admission on the part of the producers that the accumulation was greater than had been given out, all contributed to the weakness of these stocks. There was talk of a copper war and talk of curtailment; either meant loss of earnings to the big copper companies. But the panic was short lived. Two days of heavy selling and weakness, and then prices reacted. The recovery has been almost as remarkable as the sudden scare. Prices on March 1, just a week after the liquidation began, were back at the same levels that prevailed before the break. The volume of business readily contracted into the normal condition that has existed since the beginning of the year and there has been little interest shown in the market. The flurry was not a serious storm. While there may be similar occurrences during the next few months, there is not likely to be developed any permanent trend to the stock market, up or down, until after the tariff rates are settled and business has adjusted itself to the new basis. The money market continues to be easy and rates are cheap. The demand for bonds is excellent, although hardly so insistent as it was a few weeks ago. Call money on March 1 was quoted at 2 to 2½ per cent., 90 day loans at 3¾ to 4 per cent. The quotations in the table are those of the close March 1.

NEW YORK.

	Feb. 20	Mar. 1	Shares Sold
All.-Ch. ...	41	44½	1,900
All Ch., pfd	15⅜	14	1,100
Amal. Cop. .	69	70	113,088
Am. D. T..	43*	43*	
Am. Loc. ..	1	1	1,400
Am. Loc., pfd.	14*	11½	940
Am. Tel. & Cbl	78*	75*	100
Am. T. & T.	128½	128⅝	8,800
B. R. T.....	69¾	70⅛	15,800
Gen. Elec.	153½	153	4,810
Int. Met., com	11	11	19,900
Int. Met., pfd.	41	41	1,100
Mackay Cos. .	72	71*	600
Mackay Cos., pfd	72½	72½	10
Manhattan Elev.	148	147*	4
Met. St. Ry.	4		100
N. Y. & N. J. Tel.	115	115	100
Stock, com.	16	14	8815
Steel, pfd..	100⅛	100⅛	2
W. U. Tel.	89¾	90	100
West'h., com	79½	78	8,115
West'h., pfd...	118	119	

PHILADELPHIA

	Feb. 20	Mar. 1	Shares Sold
Am. Rys.	46½*	46	——
Elec. Co. of A.	11½	11¼	——
Elec. Stor. B'ty	46*	46½	——
F. S. B'ty, pfd	49*	49*	——
Phila. Elec. ...	11	11	
Phila. R. T....	27⅝	27½	
Phila. Traction	92½	92½	
Union Traction	44	44¼	

CHICAGO.

	Feb. 20	Mar. 1	Shares Sold
Chi. City Rys.	187*	187*	
Chi. Rys., Ser. 1	112½*	112½*	
Chi. Rys., Ser. 2	44*	44¼	
Com. Edison	148½	148¼	
Chi. Subways. .	26*	26*	—
Chi. Tel. Co....	84	109½	
Met. El., com.	10*	10*	
Nat'nal Carbon.	85½*	86	
Nat. Carb., pfd.	118½	118½*	

BOSTON

	Feb. 20	Mar. 1	Shares Sold
Am. Tel. & Tel.	128¾	128¾	
Com. Tel.	125*	125*	
Edison El. Ill.. ..	—	253	
Gen. Elec. ...	—	153½	
Mass. Elec. Ry..	14¼	14	
Mass. E. R., pfd.	65¼	69	
Mex. Tel. .	29½	29*	
Mex. Tel., pfd.	8*	8	
N. E. Tel.	141*	143	
W. Tel. & Tel.	7*	7	
W. T. & T., pfd.	78*	78*	

*Last price quoted.
Shares sold are for week Feb. 8 to Feb. 27.

DIVIDENDS.

Laclede Gas Light Company, St. Louis, common, quarterly, 1½ per cent, payable March 15.

Copper Range Consolidated Company, Boston, quarterly, 1 per cent, payable April 1.

Galveston-Houston Electric Company, preferred, semi-annual, 2 per cent, payable March 15.

West Jersey & Sea Shore Railroad Company, semi-annual, 2 per cent, payable April 15.

General Electric Company, quarterly, 2 per cent, payable April 15.

Chicago City Railway Company, quarterly, 1½ per cent, payable March 30.

STANISLAUS COMPANY IN RECEIVER'S HANDS.—The Stanislaus Power Company of California, which is the holding company of the Stanislaus Electric Power Company, the hydro-electric proposition which has been recently taken over by the United Railways Investment Company of San Francisco, was placed in the hands of a receiver Feb. 16 by the United States Circuit Court of California. The terms of the deal with the railway company were published in the *Electrical World* of Feb. 18. The application for the receiver was made by the Knickerbocker Trust Company, of New York. The action is entirely friendly to the sale to the railway company, and Mr. George H. Whipple, the receiver, is a member of the firm of attorneys who represented in San Francisco the bondholders' committee which brought about the deal. The chairman of the bondholders' committee is Mr. S. Z. Mitchell, president of the Electric Bond & Share Company of New York, and the details of the new financing plan were worked out by Tucker, Anthony & Company, bankers at 24 Broad Street. In speaking of the receivership a member of that firm said: "The receiver is our representative, and the receivership proceedings were taken for the purpose of hastening the completion of the sale to the railway company. We think that is the quickest and most satisfactory way to accomplish the transfer of the property. It legalizes the entire transaction. The sale of the property, under foreclosure, will be made just as soon as possible; the bondholders will buy it, and the transfer to the railway company will be made upon the basis already mapped out." A petition to intervene in the suit was later granted to James K. Moffitt and others, who own 150 of the bonds. They dispute the right of the plaintiff to make the sale of the property to the railway company.

DECREASES REPORTED BY NIAGARA COMPANIES.—The combined income account of the Niagara Falls Power Company and the Canadian Niagara Power Company for the year 1908 shows total net earnings of $1,348,029, a decrease from the previous year of $50,653. The surplus for the year applicable to dividends was $157,291, a decrease of $53,382. To the expense account of the two companies was added $108,249 for improvements and betterment. President J. O. Mills says in his report that the companies have ample cash working capital in excess of their liabilities and during the year numerous additions have been made to the plants. The number of customers was largely increased during the year. In referring to the negotiations for an Anglo-American treaty to establish the basis of water diversion from the Niagara River Mr. Mills says: "The limitations imposed by the present law, which expires June 29 next, have prevented the operation of the plants of the company to their proper and normal earning capacity. In the light of the information now available to the United States Government, is is to be expected that the restrictions which may be imposed by new legislation will permit at least the full normal operation of existing plants." The report of the Cataract Power & Conduit Company for 1908 shows net earnings of $315,531, a decrease of $19,808. The surplus for the year was $200,809, a decrease of $31,037. The Tonawanda Power Company reports for the year a surplus of $20,712, a decrease of $2,511 from 1907. The Niagara Junction Railway Company reports for 1908 a surplus of $7,315, a decrease of $24,365 from the previous year.

LAKE COPPER INTERESTS CONSOLIDATED.—The final details of the deal, which was here referred to last week, between the Calumet & Hecla copper interests and H. S. Bigelow, of Boston, have been perfected and the agreements signed. All the Bigelow holdings are in the Osceola, Tamarack, Ahmeek, Seneca, Isle Royale and Laurium copper properties. The number of shares involved in the transfer amounts to 125,000 and the amount of money involved is understood to be around $8,000,000. The Calumet & Hecla pays for the above shares partly in cash and partly in notes. Some of these notes carry 4 per cent and some 5 per cent, and a portion carries a three-year maturity and the remainder a 10-year maturity. The total issue of notes will be in the neighborhood of $5,000,000. All of the litigation on the part of Mr. Bigelow will be withdrawn and the Calumet & Hecla will elect its own board of directors in the Osceola at the annual meeting, March 4. This deal is the most important development in the Lake Superior copper region that has occurred for years and puts the situation there practically under one control.

STATEN ISLAND ELECTRICAL COMPANIES.—The Public Service Commission has made public the reports of the Richmond Light & Railroad Company, the Southfield Beach Railroad Company and the Staten Island Midland Railway Company for the year ended June 30, 1908. The Richmond Light reported total earnings of $322,297, gross income of $79,242, and a deficit for the year of $8,757. Adding previous deficits, the company had a total deficit on June 30, 1908, of $109,348. The Southfield Beach Railroad reported total earnings of $7,375, gross income of $3,058, and a surplus for the year of $3,058. Its total surplus on June 30, 1908, was $9,489. The Staten Island Midland Railway reported total earnings of $233,949, gross income of $39,837, and a deficit for the year of $10,162. Adding previous deficit, the company had a total deficit on June 30, 1908, of $32,083.

NATIONAL CARBON COMPANY PROSPERS.—The report of the National Carbon Company for its past fiscal year, which ended Jan. 31, 1909, shows that it was the most prosperous in the history of the company. The gross earnings and expenses are not given out, but the net earnings are stated to be $980,283, an increase of $55,481. After paying a 7 per cent dividend on the preferred and 4 per cent on the common stock there was a balance of $445,283. From this was deducted $407,019 for depreciation, which is the most liberal sum the company ever charged off for this purpose. There was added to the surplus account $38,264. As the consumers of the products of the National Carbon Company are largely public service companies and telephone manufacturers, the commercial depression had less effect upon its business than upon many other industries.

AMERICAN GAS & ELECTRIC COMPANY.—The report of the American Gas & Electric Company, which controls quite a number of public-service companies in the East and Middle West, for the quarter ended Dec. 31, shows quite a satisfactory increase in net earnings. The earnings of its operating companies were $652,364, an increase of $112,002 over the corresponding period of 1907. After providing for the dividend on the preferred stock and all other expenses and charges, the surplus for the quarter is $66,519, as compared with $22,463 the previous year.

TENNESSEE COPPER COMPANY.—The annual report of the Tennessee Copper Company for the year 1908 shows that the production from the company's ores was 14,464,585 lb. This is the largest output in the history of the company. The cost of the production of electrolytic copper was figured out to be 10.96 cents a pound. This cost was figured after allowing for the silver and gold that were recovered. All except about 4,000,000 lb. of the company's copper was marketed as pig copper. The net profit for the year after making a deduction of $50,000 for depreciation was $254,768. At the annual meeting of the board of directors, Feb. 25, Mr. Frederick Lewisohn was elected president, succeeding Mr. J. Parke Channing, who resigned, and Mr. Sydney Riddlestorffer was chosen resident director in place of Mr. J. H. Susmann.

TO FORECLOSE ON HUDSON RIVER WATER POWER COMPANY.—The bondholders' committee of the Hudson River Water Power Company, of which Mr. F. J. Lisman is chairman, has decided to proceed at once with foreclosure proceedings against the company. The company was incorporated in 1899 to acquire the water power created by the fall of the Hudson between Palmer's Falls and Spier's Falls. It is controlled by the Hudson River Electric Power Company. The Hudson River Water Power Company has outstanding $5,000,000 stock and $1,938,000 of an authorized issue of $2,000,000 first mortgage sinking fund gold 5s, due 1929. Interest on these was defaulted on Nov. 1, 1908.

CHICAGO RAILWAY CONSOLIDATION ABANDONED.—The Chicago Railways Company has determined to stop all negotiations looking to a merger with the Chicago City Railway until the Railways company has completed the rehabilitation plans and demonstrated that its earning power is greater than the City Railway. Mr. H. A. Blair, chairman of the board of directors of the Chicago Railways Company, says that his company is ready to consolidate, to take over and operate or to buy outright the City Railway, but that the terms must be made reasonable. He declares that the recent valuation of the South Side lines is far too high and was made by the company's own appraisers.

PACIFIC TELEPHONE & TELEGRAPH COMPANY.—At the annual meeting of the Pacific Telephone & Telegraph Company, San Francisco, Mr. Henry T. Scott was elected president and Mr. E. C. Bradley vice-president and general manager. The surplus for the year 1908, after paying all charges and the dividend on the preferred stock, was $695,471. Mr. Bradley said that the company had increased its business at the rate of 1000 new telephones a month during 1908. The total number of instruments now in use is 47,000.

RIO DE JANEIRO COMPANY TO INCREASE STOCK.—The stockholders of the Rio de Janeiro Tramway, Light & Power Company will be called to a special meeting to authorize the directors to increase the capital stock by $6,250,000. The new stock will be offered to the present stockholders at the rate of one share of new to every four shares of old stock. It is said that the whole issue has been underwritten by a syndicate at par.

MUNICIPAL PLANT SHOWS GOOD EARNINGS.—The water and light commissioners of Duluth, Minn., report that the year 1908 shows that the water and gas plants were both good money earners. The net earnings of the former were $82,389 and of the latter $21,254. Considerable construction work was accomplished during the year.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges	Surplus
Auburn & Syracuse Electric Railroad Company:					
Quarter ended Dec. 31, 1908	$91,293	$62,817	$28,476	$21,424	$2,851
Quarter ended Dec. 31, 1907	84,230	57,056	27,179	21,424	1,554
Aurora, Elgin & Chicago Railroad Company:					
December, 1908	109,578	62,553	47,025	27,996	19,029
December, 1907	109,506	62,297	47,208	28,034	19,265
Cataract Power & Conduit Company					
Year 1908	1,058,531	743,000	315,531	108,574	209,899
Year 1907	975,254	639,914	335,339	100,084	1,538
Cumberland Telephone & Telegraph Company:					
January, 1909	533,858	305,125	228,732	44,747	183,985
January, 1908	519,731	286,079	233,651	38,876	194,775
Detroit United Railways Company:					
January, 1909	559,161	354,096	204,465	153,702	62,609
January, 1908	509,695	339,493	169,592	130,046	39,161
Ft. Wayne & Wabash Valley Traction Company					
Year 1908	1,322,720	737,134	585,586	488,756	96,830
Year 1907	1,283,781	746,036	537,745	427,314	110,430
Georgia Railway & Electric Company					
Year 1908	3,372,848	1,649,994	1,722,854	833,402	889,452
Year 1907	3,309,341	1,663,282	1,046,059	784,675	861,384
Illinois Traction Company:					
January, 1909	382,956	206,492	176,464	.....	.....
January, 1908	327,910	193,654	134,256	.....	.....
Kansas City Railway & Light Company:					
December, 1908	576,141	325,276	250,865	156,089	94,776
December, 1907	512,666	261,197	251,469	152,179	99,291
Lake Shore Electric Railway Company					
December, 1908	67,092	30,790	27,302	29,106	*1,804
December, 1907	68,476	42,934	25,542	25,348	194
Milwaukee Electric Railway & Light Company:					
January, 1909	344,630	174,619	170,011	103,867	66,150
January, 1908	314,708	180,645	134,063	98,109	35,954
Memphis Street Railway Company:					
January, 1909	128,469	85,025	43,439	35,600	7,839
January, 1908	118,760	78,562	40,198	34,499	5,699
Montreal Street Railway Company					
January, 1908	295,453	202,344	93,109	30,836	62,273
January, 1907	285,515	202,504	83,011	31,933	51,078
National Carbon Company:					
Year ended Jan. 31, 1909	.....	.....	980,283	315,000	665,283
Year ended Jan. 31, 1908	.....	.....	924,801	315,000	609,801
Niagara Falls and Canadian Niagara Power Companies					
Year 1908	1,081,041	422,617	1,259,324	1,190,737	157,291
Year 1907	1,085,223	447,176	1,240,147	1,188,009	210,673
New Orleans Railway & Light Company					
Year 1908	6,010,446	3,367,418	2,642,028	2,068,316	573,712
Year 1907	6,041,291	3,270,397	2,770,894	2,025,618	745,276
Norfolk & Portsmouth Traction Company					
January, 1909	157,439	93,167	64,272	.....	.....
January, 1908	144,861	98,621	46,240	.....	.....
Northern Ohio Traction & Light Company, Akron, Ohio:					
January, 1908	144,809	81,[illegible]	63,185	.....	.....
January, 1907	176,[illegible]	81,892	94,[illegible]	43,887	[illegible]
Portland (Ore.) Railway, Light & Power Company					
January, 1909	330,[illegible]	185,877	144,[illegible]	.....	.....
January, 1908	344,[illegible]	[illegible]	[illegible]	.....	.....
Rocky Mountain Bell Telephone Company					
Year 1908	698,[illegible]	388,[illegible]	309,[illegible]	314,992	[illegible]
Year 1907	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Toledo Railway & Light Company					
January, 1909	[illegible]	125,087	[illegible]	68,604	[illegible]
January, 1908	[illegible]	130,050	[illegible]	71,013	[illegible]
Toronto Railway Company					
Year 1908	1,611,[illegible]	1,889,[illegible]	1,721,226	[illegible]	915,198
Year 1907	3,411,[illegible]	1,893,138	1,617,960	721,802	896,158
United Railways, St. Louis					
Year 1908	10,[illegible]	6,737,460	3,[illegible]	3,647,808	207,808
Year 1907	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Deficit.

GENERAL NEWS

Construction News.

LAUNSDALE, ALA.—Plans and specifications are being prepared by Edward B. Kay, of Tuscaloosa, Ala., consulting engineer, for the construction of an electric light plant and water works system in this city.

NEW DECATUR, ALA.—The Cotton Growers' Industrial Company is planning to erect a new plant, which will be equipped for individual motor drive. It also proposes to install electric generating machinery to furnish electricity to operate the factory.

NEWTON, ALA.—The Choctawhatchee River Light & Power Company is planning to commence work on the construction of dams across the Choctawhatchee River near Newton and at Blackman's Mill, northwest of Newton, in the near future. About 4000 hp will be developed, which will be transmitted to Slocomb, Dothan and other towns in southeast Alabama. The Kelly Morris Lumber Company, of Slocomb, is interested in the enterprise.

OPELIKA, ALA.—The city is contemplating establishing a water and light system and invites correspondence on the subject. W. C. Robinson is city clerk.

PRATT CITY, ALA.—Arrangements are being made by the People's Home Telephone Company to install a larger switchboard and make other improvements.

SELMA, ALA.—Plans are being considered by John H. Bolinger, of this city, for the construction of an electric light plant.

BOONEVILLE, ARK.—The Booneville Light & Water Company contemplates the installation of a hydro-electric plant in connection with its proposed water-works system, bids for which will probably be received about April 1. The cost of work is estimated at from $100,000 to $150,000. John P. Thayer is president.

EUREKA SPRINGS, ARK.—We are informed that the Citizens' Electric Company contemplates the reconstruction of its tracks in Eureka Springs during the next three months and also an extension to its system of from three to six miles. A. M. Barron is general manager.

ALAMEDA, CAL.—Arrangements are being made by the Southern Pacific Railroad Company to change the motive power for operating its trains in Alameda from steam to electricity. The company will erect ornamental poles in the center of the streets traversed.

CHICO, CAL.—Application has been made to the City Trustees by Frank C. Wilson, representing the Sierra Electric Power Company, for a franchise to erect transmission lines in Chico for the distribution of electricity for lamps and motors.

CRESCENT CITY, CAL.—The Oro Del Norte Company has purchased the Dowdle mining property and proposes to install a plant for separating the metals from the sands, to be operated by electricity. Dr. T. R. Heintz is president of the company.

DELANO, CAL.—The Whitney Power Company has been granted a franchise by the Board of Supervisors to erect transmission lines for the distribution of electricity for lamps and motors in Delano.

GLENDALE, CAL.—The City Council has decided to call an election to vote on the proposition to issue $60,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

NEVADA CITY, CAL.—The Nevada County Gas & Electric Company is considering the question of abandoning its flat rate system and installing meters.

SACRAMENTO, CAL.—George P. Robinson, of Fair Oaks, Cal., is said to have secured an option on the property and holdings of the North Fork Ditch Company for six months, the price being fixed at $350,000. The company owns water rights on the American River in Placer County, near Auburn, and furnishes water for irrigation purposes to Fair Oaks and Orangevale, 30 miles distant. It is understood that Mr. Robinson is operating for Minnesota capitalists, who are planning to construct an electric railway between Sacramento and Lake Tahoe this year, and will utilize these water rights to generate electricity to operate the system.

SAN FRANCISCO, CAL.—The Tuolumne Water Power Company has filed a mortgage in favor of the Knickerbocker Trust Company, to secure an issue of $350,000 in bonds. The mortgage covers all the property of the water company, which is located along the Stanislaus River. H. H. Veeder is secretary of the company.

SONORA, CAL.—The Board of Supervisors has granted the Tuolumne Water Power Company permission to erect transmission lines on certain of the public highways until Jan. 1, 1911. The company has also applied for a franchise to erect transmission lines along certain highways of the county.

VALLEJO, CAL.—The Board of Trustees has granted the petition of the Randall, Wright & Trowbridge Company, of Oakland, for a franchise to operate a street railway system in Vallejo. The company agrees to furnish street lamps along the route of its railway.

NEW HAVEN, CONN.—The Ives Memorial Library Committee is considering the question of installing a gas-making plant or an electric plant for lighting the building.

WASHINGTON, D. C.—Arrangements are being made to install a new system of street lighting on Massachusetts Avenue between Ninth and Fourteenth streets. It is proposed to erect posts in the middle of the street on which large arc lamps will be placed. If the plan proves successful the system will be extended to other wide streets.

PENSACOLA, FLA.—The East Pensacola City Company will soon commence work on the construction of its proposed electric railway from Pensacola to East Pensacola, about 1½ miles in length.

AUGUSTA, GA.—The War Department on Feb. 20 signed an order granting the Twin City Power Company permission to develop the water power at Price's Island, on the Savannah River, 26 miles above Augusta. It is proposed to develop 28,000 hp at a cost of about $3,000,000. The work will be done under the supervision of William H. Burr, of New York, N. Y., consulting engineer. The Ambursen Hydraulic Construction Company has the contract for the construction of the dam.

COVINGTON, GA.—The Central Power Company, which is constructing a large power plant on the Ocmulgee River, about 15 miles from Covington, has submitted a proposition to furnish electricity to operate the municipal electric plant and for private industries, and also to operate the local horse car system.

DOUGLASVILLE, GA.—The city will hold an election to vote on the proposition to issue bonds for the construction of a municipal electric light plant or to grant a franchise to J. D. House, of Douglasville. It is proposed to install a plant at a cost of from $4,000 to $8,000.

ELBERTON, GA.—The citizens have voted to issue $5,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant.

VIDALIA, GA.—It is reported that the city will hold an election to vote on the proposition to issue $9,000 in bonds, the proceeds to be used for improvements to the electric light plant and water works system.

PAYETTE, IDAHO.—The City Council on Feb. 4 passed the ordinance granting a franchise to the Idaho-Oregon Light & Power Company over the Mayor's veto. The Mayor gave as his reasons for vetoing the ordinance that 15 cents per kw-hour was too high a price, and that the franchise does not provide for proper distance of pumping water to reservoir and to minimum charge of $1 per month.

POCATELLO, IDAHO.—The City Council has granted a franchise to the Independent Telephone Company to erect a telephone system in this city.

BOWEN, ILL.—The City Council has granted a franchise to James Bennett to install an electric light plant, work on which will begin early in the spring. The street lighting system will consist of 21 lamps to begin with, and many of the business places will be equipped with electric lamps.

CHICAGO, ILL.—The capital stock of the Appleton Electric Company has been increased from $10,000 to $50,000.

GEORGETOWN, ILL.—It is reported that the Georgetown Electric Company is planning to purchase the plant and property of the Ridgefarm Electric Light, Heat & Power Company. It is proposed to dismantle the plant and furnish electrical service in Ridgefarm from the Georgetown plant. The transmission lines of the local company already extend to Vermilion Grove.

NAUVOO, ILL.—The capital stock of the Nauvoo Electric Light & Power Company has been increased from $5,000 to $10,000.

STREATOR, ILL.—The City Council has granted the Illinois Light & Traction Company a 25-year extension to its franchise for operating its electric light and gas plant in Streator. The company will make extensive improvements to its system this year, which will involve an expenditure of about $40,000.

WINNETKA, ILL.—The North Shore Electric Company has submitted a proposition to the town officials offering to take over the municipal electric light plant for $70,000 and to furnish electricity for lamps at the rate of 13½ cents per kw-hour, with free lamp renewals. At a meeting held Feb. 21 the citizens voted not to sell the municipal plant, but voted instead to expend $40,000 for improvements and extensions to the system.

CRAWFORDSVILLE, IND.—The Home Telephone Company has agreed to accept a new franchise from the city which provides that five trustees, chosen from the business men of the city, shall represent the city and direct the management of the company. It provides that the present rate of $27 for business houses and $12 for residences be continued. A guarantee of 6 per cent as dividends is also provided by the company, and all in excess of 6 per cent will be divided one-half to the company and the balance will be rebated to the subscribers. The Home company has offered $40,000 to the Bell company for its local plant, including the switchboard. If the offer is not accepted, the Home company will build a new and larger switchboard.

EVANSVILLE, IND.—The Blue Grass Telephone Company has secured a franchise to construct a telephone line through Vanderburg and Warrick counties. John Tilze is president.

HAMMOND, IND.—The South Shore & Electric Company, of Hammond, Ind., has filed amendments to its charter with the Secretary of State, giving the company the privilege to construct, maintain and operate a gas lighting and heating system in the cities of Hammond, Whiting and East Chicago, Lake County, and vicinity. C. H. Geist is president, and C. W. Fox, secretary.

INDIANAPOLIS, IND.—The Legislature has appropriated $16,000 for the construction and equipment of a power and lighting plant at the Reform School for Girls. Mrs. E. L. Ealam is chairman board of trustees.

LIGONIER, IND.—Bids will be received by R. E. Jeanerat, city clerk, until March 25 for lighting the city for a term of five years.

MUNCIE, IND.—The Interstate Automobile Company, recently incorporated with a capitalization of $300,000, will establish and equip a large plant here for the manufacture of automobiles and accessories. The plant will be operated by electrical power. T. F. Hart, J. M. Haring, F. C. Ball and T. F. Rose are directors.

NORTH JUDSON, IND.—The Indiana & Illinois Navigation & Power Company, recently incorporated with a capital of $200,000, proposes to improve the Kankakee River from near South Bend to Momenee for the construction of hydraulic power plants and the generation of electricity.

PALMYRA, IND.—The Flat Woods Independent Telephone Company has filed articles of incorporation. The company proposes to build and operate a telephone system in Palmyra, Pekin, Bradford and other towns and communities. M. A. Smith, Lawrence Ellis, Joseph Uhl and Frank A. Fessel are directors.

SHOALS, IND.—The Shoals Telephone Company is in the market for material and equipment for a new exchange, including a new switchboard. The plant was recently destroyed by fire.

SOUTH BEND, IND.—Plans are being made by the Central Union Telephone Company to entirely rebuild its local plant at a cost of about $200,000. John L. Putnam is superintendent.

WARSAW, IND.—William Thorn and associates have organized a company to construct a dam and hydraulic plant in the Tippecanoe River at Monoquet. The company will construct a plant to generate electricity to be transmitted to Warsaw and other nearby towns.

CENTERVILLE, IA.—F. S. Payne, manager of the Centerville Light & Traction Company, has submitted a proposition to the Citizens' Committee of Payne, offering to construct an electric railway from Centerville to Payne if satisfactory arrangements can be made.

COUNCIL BLUFFS, IA.—The management of the Christian Home Orphanage is planning to make improvements and additions to the home, which will include the installation of a central steam heating and an electric light plant. Plans have been prepared for the plant, and estimates will soon be asked for. At present each building has a separate heating plant.

DES MOINES, IA.—An agreement has been reached between the Des Moines Electric Company and the City Council whereby a material reduction will be made in the charges for electricity for city service and a sliding scale for cheaper service for private consumers. Under the new arrangement all lamps will be placed on an all-night and every-night schedule at the rate of $65 per arc lamp per year, and incandescent lamps at $17 each per year. Under the old schedule the city paid $95 per arc lamp furnished by the underground system, and for all-night on the overhead system $75 per lamp per year, and for moonlight schedule $65 per year. The rate for incandescent lamps is reduced from $24 to $17 each per year. Rates for electricity for motors will be reduced from a flat rate of 7 cents to a maximum of 5 and 4 cents, and a minimum of 3 cents per kw-hour. The rate for commercial lighting, which was recently voluntarily reduced from 14 to 12 cents per kw-hour, was left unchanged. It is said that the company will take steps immediately to make extensive improvements to its system, which will involve an expenditure of $250,000.

ELDORA, IA.—The Eldora Electric Light Company contemplates installing two 150 hp boilers in its plant.

GRUNDY CENTER, IA.—It is reported that the local electric plant has been sold. It is said that the new owners will remodel the plant and install new machinery.

MARSHALLTOWN, IA.—Plans are being considered to organize a company, with a capital stock of $200,000, to establish an electric plant in Marshalltown to secure cheaper rates for electricity for lamps and motors. D. T. Denmead is interested in the project.

CAWKER CITY, KAN.—Plans are being prepared for the construction of a municipal electric light plant and water works system in Cawker City.

CLAFLIN, KAN.—E. R. Burch has been granted a franchise to establish an electric light plant in Claflin.

PEABODY, KAN.—The Peabody Light & Power Company contemplates making extensions to its commercial circuits to supply electricity for both lamps and motors. Thomas Osborne is secretary.

HOPKINSVILLE, KY.—The City Light Company is considering the question of constructing a street railway system in Hopkinsville. F. K. Dewey is vice president and general manager.

LOUISVILLE, KY.—P. Campbell, manager of the Fifth Avenue Hotel, contemplates applying to the City Council for a franchise to supply electricity for lamps in the hotel and also to the business houses in the immediate vicinity of the hotel.

RICHMOND, KY.—The board of regents of the Eastern Kentucky State Normal School has awarded contracts for the power plant for the school as follows: For construction of the power house, to the Combs Lumber Company, of Lexington, Ky., and for equipment, underground distributing system and heating apparatus, to F. A. Clegg & Company, of Louisville, Ky. The cost of the equipment will be about $32,000.

HOMER, LA.—The Town Board has awarded contracts for equipment of the proposed municipal electric light plant, as follows: To the Erie City Iron Works, of Erie, Pa.; Fort Wayne Electric Works, Fort Wayne, Ind., and the Wesco Supply Company, of St Louis, Mo. Anderson Offut, of New Orleans, La., will have charge of construction of the plant.

ANDOVER, MAINE.—A bill has been presented to the State Legislature for the incorporation of the Andover Water Company with a capital stock of $50,000. The company contemplates constructing a water works system and proposes to install an electric light plant to furnish electricity to light the town. The power plant will be located about three miles from the town. The officers are: Frank P. Thomas, president; Y. A. Thurston, vice-president, and J. A. French, treasurer.

AUGUSTA, MAINE.—A bill has been introduced in the Legislature authorizing the Merrill Springer Company to generate, distribute and sell gas and electricity for light, heat and manufacturing purposes.

BIDDEFORD, MAINE.—The Pepperell Manufacturing Company has awarded contract for 125 motors, aggregating about 1000 hp, to be installed in the Pepperell plant of the company.

EASTPORT, MAINE.—The City Council has granted a franchise to E. B. Nichols to construct and operate an electric light plant in Eastport. The plant is to cost about $10,000.

KENNEBUNK, MAINE.—The citizens are considering the question of installing an auxiliary steam plant in the municipal electric light plant. A committee, consisting of A. J. Wiggin, Joseph Sayward, E. I. Littlefield, C. W. Andrews and Frank Parsons, has been appointed to look into the matter. Owing to the lack of water power during the past year, it has been necessary to cut out much of the street lighting service in order to furnish electricity for commercial lighting.

LITCHFIELD, MAINE.—A bill has been introduced to the Legislature to incorporate the Litchfield Electrical Company, which proposes to supply electricity in Litchfield. The capital stock of the company is placed at $10,000. O. Smith, I. W. Gilbert, J. E. Chase, G. M. Rogers and others are interested in the project.

LITCHFIELD, MAINE.—The main thoroughfare in the business section of the town is now lighted by electricity from the electric plant of Frank N. Adams. The plant is operated by water power and furnishes electricity for lighting the store, grist mill and Union Hall. The street lamps are furnished to the town free of charge.

RICHMOND, MAINE.—A bill has been introduced in the Legislature by Representative Allen, of Richmond, authorizing the Richmond Electric Company to supply electricity for lamps, motors and other purposes in the towns of Richmond and Bowdoinham.

SCARBORO, MAINE.—A bill has been introduced to the State Legislature to incorporate the Scarboro & Cape Elizabeth Railway Company, which proposes to operate an electric railway beginning at South Portland Heights, through South Portland, Cape Elizabeth, Scarboro and Westbrook. The capital stock is not to exceed $400,000. Samuel D. Plummer, of Portland; William F. Spear, of South Portland; Harry S. Jordan, of Cape Elizabeth; John A. Snow, of Scarboro, and others are interested in the project.

BALTIMORE, MD.—Arrangements are being made by the West Baltimore Business Men's Association to install 120 arc lamps on Baltimore Street, between Paca Street and Fulton Avenue. Already $2,500 has been subscribed, and as soon as $5,000 is raised Superintendent of Lamps and Lighting McCuen will install the lamps. The present plans provide that the merchants shall pay for electricity for 80 of the additional lamps and the city for the other 40 lamps.

CAMBRIDGE, MASS.—The State Board of Gas and Electric Light Commissioners has approved of an issue of $20,000 additional capital stock of the Cambridge Electric Light Company, the proceeds to be used to cancel outstanding indebtedness of the company.

GLOUCESTER, MASS.—The Massachusetts State Gas and Electric Light Commissioners have granted the Gloucester Electric Light Company permission to issue [illegible] additional shares of stock, at $100 per share, the proceeds to be used to pay [illegible] and for improvements to its plant.

LAWRENCE, MASS.—[illegible] the construction of the proposed Ayer Mill by the American Woolen Company. The plans call for a building 621 x 125 ft., six stories high, with a [illegible] and also an electric power station with an output of about [illegible] Charles E. Mayo is Boston, is engineer.

NORTH ABINGTON, MASS.—The Eastern Light & Power Company of Worcester and Rockland has applied to the Selectmen of Hanover for permission to erect [illegible] for the purpose of extending its high-tension line to Clapp's Rubber Mill to furnish electricity for motors.

NORTH ADAMS, MASS.—Plans are being made to enlarge the Greylock Cotton Mills, which will double the output of the mills. A new power plant will be installed to operate the entire plant, replacing the present steam plant.

STONEHAM, MASS.—The Boston & Northern Street Railway Company has been granted a franchise by the Selectmen of Stoneham allowing it to complete the electric railway through Middlesex Fells and around Spot Pond. The railway is to be built jointly by the Boston Elevated and the Boston & Northern companies.

DETROIT, MICH.—The Detroit United Railway Company has presented plans to the sub-committee of the Council for extensions to its system, which provides for the construction of 50 miles of new track.

GRAND RAPIDS, MICH.—Bids will be received by the Board of Public Works until March 11 for furnishing transformers and switches for the sewage pumping station machinery. Samuel A. Freshney is secretary of Board of Public Works.

GRAND RAPIDS, MICH.—Plans are being made by the Grand Rapids Electric Railway Company for the construction of the southeastern division of its proposed electric railway, contracts for which will be awarded in the near future. This section of the railway will extend from Kalamazoo to Battle Creek, Burlington, Coldwater and Camden, across the state line and into Ohio. Another part of the system will be built from Grand Rapids to Greenville, Edmore and Mount Pleasant. We are advised that work on construction of both of these branches will begin early this spring. C. J. Post is secretary of the company.

LUZERNE, MICH.—The Board of Supervisors of Oscoda County has granted the Eastern Michigan Power Company a franchise to construct dams on the Au Sable River in Oscoda County.

TECUMSEH, MICH.—The Tecumseh Electric Company has submitted a proposition to the City Council asking to have its present contract for street lighting, which expires next May, annulled and a new one entered into at once for a term of five years. As an inducement the company offers to make the rate for electricity for residential lighting 11 cents per kw-hour up to 50 kw-hours a month, and 5 cents per kw-hour for all consumed above that amount, with a discount of 10 per cent for all bills paid before a certain date each month.

FRAZEE, MINN.—Plans are being made to install another telephone system in Frazee, at a cost of about $5,000. E. F. Gummer, and B. Y. McNairy are the promoters of the project.

MINNEAPOLIS, MINN.—The Minneapolis General Electric Company has notified the officials of the Linden Hills district that the board of directors has approved the requisition covering the cost of extending its transmission lines to Linden Hills and to the south shore of Lake Harriet, and that work would begin on the extension as soon as the frost is out of the ground. The citizens of Linden Hills section have taken steps to organize a company to be known as the Lake Harriet Electric Company, to establish a local plant. Truman Hibbard is general manager.

ST. CLOUD, MINN.—The Granite City Railway Company is planning to construct 3½ miles of track during the coming season.

THIEF RIVER FALLS, MINN.—Bids will be received by L. Bache, city clerk, until March 15 for the construction of a local telephone plant of from 300 to 500 telephones.

CALIFORNIA, MO.—The citizens have voted to grant an electric light franchise to S. W. Carver, of Neosho, who proposes to purchase the local electric light plant. It is said that he will remodel the plant.

KANSAS CITY, MO.—Plans have been submitted to the Board of Public Works by H. C. Fowler, president of the Fidelity Trust Company, for an ornamental system of electric lamps around the Fidelity Building. The company proposes to erect and maintain the lamps at its own expense. The cost of eight posts and equipment is estimated at about $1,500.

ST. JOSEPH, MO.—The Citizens' Telephone Company has been reorganized under the name of the Home Telephone Company, with a capital stock of $2,000,000. Theodore Gary, of Macon, is president, and Homer E. Scovern, secretary.

GREAT FALLS, MONT.—The citizens have voted to grant a franchise to G. Calvin Bower and associates to construct a street railway on certain streets in Great Falls in connection with their proposed electric railway between Great Falls and Choteau.

HARTINGTON, NEB.—Application has been made to the town officials by Mark Hurlburt for a franchise to install and operate an electric light system in Hartington.

SCOTT'S BLUFF, NEB.—A franchise has been granted by the Town Council to Clarence J. Morley, of Denver, Col., and James C. Caine, of Salida, Col., to construct and operate an electric light plant. Under the terms of the franchise the plant is to be in operation within five months. The company will furnish electricity to operate the pumping station of the municipal water system. The franchise is for a term of 25 years, and the city has the privilege of buying the plant at five-year intervals during the life of the franchise.

WYMORE, NEB.—The light committee, recently appointed by the City Council to investigate the question of installing a municipal electric light plant, has reported in favor of establishing the plant. The Council has instructed the committee to prepare resolutions for the purpose of submitting the question of issuing $10,000 in bonds for the construction of the plant at the spring election.

MILFORD, N. H.—Extensive improvements are being made to the plant of the Milford Light & Power Company, involving an expenditure of about $60,000. The Milford Light & Power Company has submitted a proposition to the town offering to furnish electricity to operate the pumping station for a term of 20 years. The company offers to furnish the service for $1,200 per year, and all water pumped in excess of 35,200,000 gal. in one year is to be paid for at the rate of 3 cents for each 1000 gal. The town also to pay $150 to furnish a man to remain at the pumping station between midnight and 6 o'clock. The company also offers a new proposition for street lighting based on at least five arc lamps of 1200 cp at $100 each per year and 115 25-cp incandescent lamps at $17.50 each per year.

TILTON, N. H.—Part of the first floor of the old Peabody Mills, owned by the Tilton Mills, is being remodeled into an electrical power plant, which will be used as an auxiliary plant for the Tilton Electric Company.

BELLEVILLE, N. J.—The township committee has entered into a contract with the Public Service Corporation of New Jersey to light the streets of the town for a term of five years. Under the terms of the contract the town is to pay $12 per lamp for the first year and $15 each per year thereafter. The contract has been pending for several months.

CLOVIS, N. M.—The citizens on Feb. 23 voted to issue $125,000 in bonds, the proceeds to be used for the construction of an electric light plant, water works and sewerage systems, work on construction of which will begin at once. A. Wade, of Clovis, is engineer.

BATAVIA, N. Y.—The question of installing an additional generating unit, with a rating of 75 kw, in the municipal electric light plant is under consideration by the Board of Aldermen, for which specifications will be prepared and bids called for in the spring.

BERGEN, N. Y.—Contracts have been awarded by the Village Board for equipment of the municipal electric light plant as follows: For engine generator and two 75-hp boilers, to the Ridgeway Dynamo & Engine Company, of Ridgeway, Pa., for $4,200, and for line supplies, to the Rochester Electric Motor Company, for $1,021.

ELLIS ISLAND, N. Y.—Sealed proposals will be received at the office of the Commissioner of Immigration, Ellis Harbor, N. Y. H., until March 11 for furnishing and installing electric fixtures in the new hospital extension No. 2 Island, at U. S. Immigrant Station, Ellis Island. Further information may be obtained from Robert Watchorn, commissioner.

FULTON, N. Y.—It is said that plans are being considered whereby the Fulton Light, Heat & Power Company and the manufacturing interests at the lower dam, consisting of the Volney Paper Company, Victoria Paper Company, Gramley Paper Company, Delts Machine Works and the Hunter Arms Company, may consolidate and utilize the water power at the lower dam. It is proposed to use the entire water power by one central electric power station, which will furnish electricity to operate all the plants.

LONG ISLAND CITY, N. Y.—The Long Island Railroad Company is making preparations for the rebuilding of its North Shore division. The road will be double tracked and the motive power will be changed from steam to electricity, operated by the third-rail system. The cost of the work is estimated at about $3,000,000. The railway extends from Long Island City through Flushing, College Point, Malba and Whitestone to the terminus at Port Washington.

NEWBURGH, N. Y.—G. L. Wittman has been appointed by the Merchants' Association to make investigations as to the cost of the installation of a municipal electric light plant.

NEW YORK, N. Y.—Plans have been filed for the erection of a power house at Rikers Island for the City of New York, to cost $80,000. Trowbridge & Livingston, 527 Fifth Avenue, New York, N. Y., are the architects.

NEW YORK, N. Y.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until March 27 for furnishing and installing condensing equipment and piping for one 1000-kw alternator at the navy yard. Plans and specifications can be obtained on application to the bureau or to the commandant of the navy yard named. R. C. Hollyday is chief of bureau.

NEW YORK, N. Y.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 9 to furnish at the Navy Yard, New York, N. Y., the following supplies: Schedule 950, generator sets; Schedule 951, motors; Schedule 951, lamp sockets and rubber; Schedule 962, brass, bronze and steel tubing and steel. Applications for proposals should designate the schedule desired by number. Blank proposals will be furnished on application to the Navy Pay Office, New York, N. Y., or to the above bureau.

ROOSEVELT, N. Y.—The Roosevelt Water, Light & Power Company, which was recently granted a franchise by the Town Board to furnish the village and surrounding territory with water, has purchased a site in the Whitehouse villa section of Roosevelt, on which it will erect its pumping station, etc. The company proposes to commence work on the construction of the plant early in the spring.

SCHENECTADY, N. Y.—The Board of Supervisors has awarded a contract to the General Electric Company for the installation of 400 tungsten lamps in the State Armory to replace the incandescent lamps now in use.

BRYSON CITY, N. C.—The Franklin Manufacturing & Development Company, recently incorporated, proposes to do a general timber business and supply electricity for lights.

CHARLOTTE, N. C.—Bids will be received until March 15 for lighting the streets and other public places of the City of Charlotte with electricity for a term of five years from Aug. 15, 1909. The contract will include not less than 250 arc lamps and possibly 325 or more; the lamps to be of the latest arc type, of not less than 6.6 amp and 70 volts at the lamps. The successful bidder must erect complete and maintain the lamps with an all-night and every-night service. For further information address A. H. Washburn, chairman of light committee.

HICKORY, N. C.—The Water-Power Electric Company, of this city, Col. M. E. Thornton, president, has perfected arrangements to take over the water power at Horseford Shoals. It is estimated that 10,000 hp will be developed.

KINSTON, N. C.—The Town Council has taken preliminary steps looking to the holding of an election to vote on the proposition to issue $75,000 in bonds, the proceeds of which to be used for building a municipal telephone system and for increasing the city's water, lighting and sewerage plants, etc.

MARION, N. C.—The Marion Light & Power Company is building a storage dam by which the efficiency of the plant will be largely increased.

MONROE, N. C.—The Southern Power Company has secured a site and will begin immediately the erection of a substation for the distribution of electricity in the town. Several large manufacturing plants, it is understood, will secure electric service from the company.

MANDAN, N. D.—Plans are being made by the Mandan Electric Company to enlarge its plant, which will include the installation of two new boilers.

ADRIAN, OHIO.—Plans are being prepared by the Independent Telephone Company to install an automatic telephone plant in Adrian, to cost about $150,000.

AKRON, OHIO.—All the telephone and telegraph companies operating in the city have submitted plans for putting their wires in the downtown district under ground. The Northern Ohio Traction Company will also be required to place its wires in conduits in that portion of the city.

BUCYRUS, OHIO.—The City Council has granted a franchise to F. C. Kingsbury, of Columbus, Ohio, to construct and operate an electric light plant and also a contract for street lighting. Under the terms of the contract Mr. Kingsbury is to furnish arc lamps on an all-night schedule at the rate of $74.50 per lamp per year and on a moonlight schedule at $60 each per year. The new plant is to be completed and in operation within eight months. Through error, this information was published under Cleveland, Ohio, in the issue of Feb. 25. The city had voted to construct a municipal electric plant and had been enjoined from issuing the bonds.

DAYTON, OHIO.—The Home Telephone Company contemplates extending its system and establishing a number of branch exchanges within the next year, at a cost of from $100,000 to $150,000. R. D. Funkhouser is secretary and treasurer.

POWELSVILLE, OHIO.—The Pine Creek Telephone Company has consolidated with the Haverhill Telephone Company. A new telephone line will be erected from the Junior bridge on Pine Creek to Empire Furnace. Jacob Apel, Charles Edwards, John Dearford and others are interested in the company.

WOODSFIELD, OHIO.—The plant and holdings of the Woodsfield Telephone Company have been taken over by the National Telephone Company of Wheeling, W. Va., with several other lines in the county. It is said that the new owners will make improvements to the system, work on which will begin at once.

XENIA, OHIO.—The Board of Public Service has awarded the contract for street lighting to the Citizens' Electric Light & Power Company.

GRANTS PASS, ORE.—The City Council has granted a franchise to the Citizens' Telephone Company to operate a telephone system in Grants Pass. The company promises to install the central energy system.

NEWPORT, ORE.—The City Council is considering the question of granting a franchise for the construction of an electric light plant in Newport. Under the amended franchise the city is to lease a portion of the water front on which to construct a plant and to grant a franchise to operate an electric light plant, cold storage plant and creamery for a term of 25 years. At the expiration of 25 years the city has the option of buying the plant or releasing it. Electricity is to be furnished the city for street lamps at the rate of $1.60 per month per lamp and for pumping the water supply within the city limits. Mr. Sanderson is promoting the project.

PORTLAND, ORE.—The Portland Railway, Light & Power Company has applied to the Council of Fairview for a 50-year franchise for its branch to run through Fairview.

WYONDALE, PA.—The Chester County Electric Company is making plans to erect a large power plant in Wyondale. The company furnishes electricity in many towns in the southern part of Chester County.

BEDFORD, PA.—The City Council has granted the Altoona, Hollidaysburg & Bedford Springs Railway Company a franchise to construct and operate a street railway over certain streets in Bedford. The company proposes to construct an electric railway connecting the three named cities in its title. The railway from Altoona to Roaring Springs, about 18 miles in length, is under construction.

BLOOMSBURG, PA.—The Columbia Power, Light & Railway Company is planning to construct a 2-mile 22,000-volt 3-phase transmission line, with transformers, etc., and also to install a 500-hp water turbine, a 300-kw rotary converter and a 200-kw railway generator (belted), with switchboards, etc., in its power house. B. O. Ellis is general manager.

CORY, PA.—The Cory & Columbus Street Railway Company is in the market for a generator and gas engine.

ILOILO, P. I.—The Iloilo Electric Company contemplates the installation of a new boiler and a 200-kw generator in its power house. R. R. Landen is manager.

ANDERSON, S. C.—The Anderson Traction Company is considering the question of extending its interurban railway from Belton toward Greenville and to Greenwood.

SENECA, S. C.—The report published in last week's issue that A. B. Groscoe, of Spartanburg, had purchased the water power on Change Creek was incorrect. It is said that the property is owned by the Traxler-Taylor Real Estate Company, of Greenville, S. C.

SPARTANBURG, S. C.—A proposition for supplying electricity for lighting the city has been submitted to the Town Council by the Southern Power Company, of Charlotte, N. C.

YANKTON, S. D.—The Yankton Telephone Company has awarded a contract to the Dean Electric Company of Elyria, Ohio, for the installation of a common battery multiple switchboard with a capacity of 6,400 lines. The company contemplates other improvements, which involve a total expenditure of about $25,000 this year.

BINGHAMTON, TENN.—Work has commenced on the construction of the new electric light plant of the Binghamton Electric Power Company. J. A. Omberg, Jr., S. M. Neely, W. M. Boyle and F. W. Faxon are interested in the project. The company is capitalized at $25,000.

GREENVILLE, TENN.—An election will be held March 20 to vote on the proposition to issue $25,000 in bonds for construction of a water works system and $15,000 in bonds to establish an electric light plant. J. J. Mitchell is mayor.

MARYSVILLE, TENN.—The stock of the Rockford Electric Company has been taken over by Benjamin Cunningham, Joseph Burger, James L. Clark and Ernest Koella. It is said that the new company will commence work at once on the reconstruction of the power plant at Rockford.

MOUNT PLEASANT, TENN.—Plans are being considered by the City Council for the construction of water-works system, electric light plant and sewerage system. The cost of the work is estimated at from $75,000 to $100,000. J. G. Jackson and F. De Marco, of Mount Pleasant, Tenn., are engineers.

SPRING HILL, TENN.—It is reported that Cheek, Andrews & Jones, owners of the Spring Hill Mills, are considering the installation of an electric light plant.

WHITEVILLE, TENN.—It is reported that Edward Stewart and Rivers Norment are contemplating the construction of an electric light plant at a cost of about $5,000.

CROWELL, TEX.—The City Council has granted a franchise to L. G. Andrews and W. L. Campbell to construct and operate an electric light plant in Crowell.

FT. SAM HOUSTON, TEX.—Bids will be received until March 25 by L. J. Fleming, constructing quartermaster, U. S. Army, for installing in the post hospital an electric invalid's elevator with grill enclosures and gate complete and for electric connections to street car lines.

HOUSTON, TEX.—The City Council of Houston Heights has granted a 30-year franchise to the Houston Electric Company to extend its street railway system in that city.

SNYDER, TEX.—R. F. Brumbach, of Ennis, Tex., has been granted a franchise by the City Council to install an electric light plant.

TEMPLE, TEX.—The City Council has granted a franchise to Max Ellser and associates, of New York, N. Y., to construct an electric railway in Temple. The city of Waco recently granted the above parties a similar franchise. It is proposed to construct an interurban railway connecting Temple and Waco.

TERRELL, TEX.—The contract for the equipment of the municipal electric light plant has been awarded to Houston & Cunningham, of New Orleans, La., for $14,783. W. C. Drake is engineer in charge.

WHARTON, TEX.—The City Council has granted a franchise to J. J. Wensley, manager of the Wharton Ice & Cold Storage Company, to erect and operate an electric light plant.

SALT LAKE CITY, UTAH.—Plans are being made by the Utah Light & Railway Company for extensive improvements and additions to its system. The company will soon install an additional [illegible] steam-driven set at a cost of $[illegible], and [illegible] at its power plant on Jordan River, with a [illegible] plant the total cost is estimated at $500,000.

BRATTLEBORO, VT.—The Estey Street Gas & Electric Company of [illegible] commence work on the reconstruction of its [illegible] extending from Brattleboro to Hinsdale, N. H. [illegible] will be erected on the new poles.

LUDLOW, VT.—Owing to the [illegible] the Ludlow Electric Light Company, the manager of the company [illegible] plant are considering the question of increasing the [illegible] plant or making connections to receive power from the plant of the Cavendish Company.

FREDERICKSBURG, VA.—The City Council has [illegible] to receive bids for a franchise to [illegible] for lamps on motors and other purposes. The Fredericksburg Power Company has applied for such franchise in Fredericksburg.

NORFOLK, VA.—We are informed that the Norfolk & Portsmouth Traction Company will rebuild its Suffolk power station, which was burned Feb. 24. The power house will be equipped with machinery taken from stations which have been dismantled. E. C. Hathaway is general manager.

RICHMOND, VA.—The committee on electricity has accepted the plans of E. W. Trafford for the new electric light and power plant and recommended their adoption by the City Council. The plans have been approved by Pressy & Weller, of Washington, D. C., consulting engineers, who were selected by the Council to investigate the plans and specifications.

SUFFOLK, VA.—The plant of the Suffolk Light & Ice Company was destroyed by fire Feb. 24, causing a loss of about $10,000. Most of the equipment of the electric plant was saved. The plant was owned by the Norfolk & Portsmouth Traction Company and will be rebuilt at once.

ENDICOTT, WASH.—Preliminary steps have been taken by the local Farmers' Union in Endicott for the construction of a flour mill. It is proposed to operate the mill by electricity, to be furnished by a plant located on the Palouse River, seven miles from this town. It is also planned to furnish electricity for lighting the town.

KETTLE FALLS, WASH.—It is reported that A. H. Sperry, of Spokane, Wash., president of the Northwestern Light & Power Company, is negotiating with the owners of the water power at Meyers Falls, on Colville River, for all the power that can be obtained. It is said that the additional power will be utilized to operate an electric railway down the banks of the Columbia River to Fort Spokane.

WASHTUCNA, WASH.—It is reported that Messrs. Codd and McKenzie, of Colfax, Wash., are contemplating the construction of a power plant at the Palouse River, at the "great falls" of the Washtucna.

PENNSBORO, W. VA.—Application has been made to the City Council by O. E. Pratt for a franchise to construct and operate an electric light and power plant in Pennsboro.

CUMBERLAND, WIS.—The McKinley Telephone Company has decided to install a telephone exchange in this city and connect with the rural telephone lines in this county.

ELKHART, WIS.—The Eastern Wisconsin Telephone Company has filed amendments to its charter increasing its capital stock from $15,000 to $25,000.

LITTLE RAPIDS, WIS.—Arrangements are being made to erect a large steel and concrete pulp mill at Little Rapids, near De Pere, Wis., and to develop a water-power of about 2500 hp to operate the plant. Luther Lindauer, of Kaukauna, Wis., is interested in the project.

LYONS, WIS.—Plans are being made to organize a local telephone company to establish a telephone system, which will cover the Town of Lyons and part of the towns of Spring Prairie, Bloomfield and Geneva, and connect with the Wisconsin Telephone Company's exchanges at Burlington, Lake Geneva and Elkhorn.

MENASHA, WIS.—The Walter Brothers Brewing Company has awarded a contract to the Western Electric Company for the installation of a 150-hp Chuse engine and an 85-kw generator.

MENOMONIE, WIS.—Plans are being made to organize a farmers' telephone company to unite a circuit to connect between 100 and 200 farmers in Dunn, Eau Claire and Pepin counties. The central office will probably be located in Rock Falls.

MILWAUKEE, WIS.—Thomas J. Neacy has been granted a temporary injunction restraining the city from proceeding with the erection of the proposed municipal electric light plant.

MILWAUKEE, WIS.—The H. W. Johns-Manville Company is preparing to rebuild its plant, which was recently destroyed by fire. The plans call for power equipment of about 750 hp, all machines to be operated by motors. The plant will be equipped with special machinery of the company's own design for the special work done in that factory. The headquarters of the company are in New York, N. Y.

STURGEON BAY, WIS.—It is reported that plans are being made for extensive improvements to the municipal electric light plant, which will involve an expenditure of about $30,000. H. C. Leonhardt is city clerk.

WAUKESHA, WIS.—The capital stock of the Prospect, Guthrie & Big Bend Telephone Company has been increased from $3,000 to $10,000.

WAUSAU, WIS.—The capital stock of the Wausau Telephone Company has been increased from $20,000 to $80,000, of which the proceeds of $40,000 will be used for improvements and extensions to its system, the remaining $20,000 to be held in the treasury.

SHOSHONI, WYO.—The large dam of the Big Horn Power Company on the Big Horn River will be completed in about 60 days, when work on the installation of machinery and erection of transmission lines will commence. About 6000 hp will be developed. The plant will furnish electricity to operate the mines of the Boysen Mining Company, about 12 miles from Shoshoni, and to towns within a radius of 100 miles.

CLARESHOLM, ALTA., CAN.—Orr Jarvis, of Winnipeg, Man., has been asked by the Town Council to submit a tender for an electric light and power franchise in Claresholm.

MEDICINE HAT, ALTA., CAN.—The Southern Alberta Electric Railroad Company has secured a charter and will build an electric railway in this town and through the adjoining districts. For further information address A. M. Grace, Medicine Hat, Alta.

VICTORIA, B. C., CAN.—A bill will be introduced at the Provincial Legislature providing for government ownership of all telephones in British Columbia. The British Columbia Telephone Company has a virtual monopoly along the Pacific coast, but in the interior various local companies are operating.

PORTAGE LA PRAIRIE, MAN., CAN.—A local syndicate, represented by E. A. McPherson, attorney, is applying for a franchise here to distribute electricity for lamps and motors, and also to build an electric car system. It is stated the company is subsidiary of the Winnipeg Electric Company, of Winnipeg, Man.

WINNIPEG, MAN., CAN.—The Canadian Northern Railway Company has decided to equip its shops in Winnipeg to be operated by electricity. For further information address M. H. McLeod, general manager.

WINNIPEG, MAN., CAN.—The City Council has decided to purchase a transformer to be used in testing insulators, to cost about $10,000, for which tenders will be called. For further information address F. E. Cambridge, city electrician.

GRAND FALLS, N. B.—The contract for the construction work in connection with the hydro-electric development of the Grand Falls Power Company on St. John River at Grand Falls has been awarded to Frank B. Gilbreth, of New York, N. Y. The plant will have an output of 100,000 hp, which will be transmitted to various cities in New Brunswick and Maine. The cost of the plant is estimated at $5,000,000, work on which will begin immediately. John B. McRae, of Ottawa, Ont., is chief engineer, and Ralph Mershon, of New York, N. Y., is electrical engineer.

ST. JOHN, N. B.—A company has been organized for the purpose of harnessing the tides of the Bay of Fundy, to be utilized for mechanical purposes. The company has petitioned the Dominion Parliament for permission to incorporate.

BURLINGTON, ONT., CAN.—Bids will be received by O. T. Springer, village clerk, until March 23 for the construction of the proposed waterworks system, including electrically operated pumping machinery. Willis Chipman, 103 Bay Street, Toronto, Ont., is chief engineer.

CORNWALL, ONT., CAN.—The Long Sault Development Company is applying to the Dominion government with altered plans to develop electrical power on the St. Lawrence River in Cornwall. The plans call for the construction of a large dam.

PORT ARTHUR, ONT., CAN.—The City Council has decided to abolish the telephone and electric light commission and look after the two municipal industries from the Council chamber.

ST. THOMAS, ONT., CAN.—A number of the telephone companies operating in the southern counties have organized an independent association and will petition the Ontario government for government-owned long-distance lines and control of rates.

TILBURY, ONT., CAN.—The Tilbury Telephone Company has been granted a 20-year franchise to use the city streets on condition that charges for telephones do not exceed $12 per annum.

TORONTO, ONT., CAN.—The Hydro-Electric Power Commission has awarded contracts for equipment of the different distributing and transforming stations in connection with the Provincial Niagara scheme, which will call for an expenditure of $750,000. The Canadian General Electric Company secured the contract for two-thirds of the work, and the Canadian Westinghouse Company, of Hamilton, Ont., one-third. The contracts awarded will include the equipment for 12 stations, the chief of which will be the stepping-up station at Niagara Falls and Dundas, which will be the interswitching station for the entire system. The other stations will be located at Toronto, supplying West Toronto, Milton, Acton, Brampton, Weston and Mimico; Guelph; Preston, supplying Galt and Hespeler; Berlin, supplying Waterloo, Elmira and New Hamburg; Stratford, St. Mary's; London, supplying Port Stanley; Woodstock, supplying Ingersoll, Tilsonburg and Norwich, and Brantford, supplying Paris, St. George and Ayr.

LEVIS, QUE., CAN.—The Levis County Railway Company is installing a 250-kw Allis-Chalmers Bullock motor generator set in its substation. The company purchases electrical energy from the Canadian Electric Light Company, which is transmitted to the substation on a 11,000-volt 3-phase high-tension line.

MONTREAL, QUE., CAN.—The Montreal Street Railway Company is applying to the Dominion Parliament for the necessary power to construct and operate an elevated street railway in this city.

SHERBROOKE, QUE., CAN.—The stockholders of the People's Telephone Company have voted to issue $50,000 in bonds, the proceeds to be used for extensions and improvements to the plant.

REGINA, SASK., CAN.—Representatives of the Bell Telephone Company and the Saskatchewan government are conferring with a view to the government purchasing the Bell system in this province.

WIDEAWAKE, SASK., CAN.—A telephone company, which will have long-distance lines running to Weyburn, Yellow Grass, Milestone and other adjacent towns, is being organized by farmers in this vicinity.

Company Elections.

LOS ANGELES, CAL.—The stockholders of the United States Electrical Manufacturing Company have elected the following directors: C. L. Limback, Edgar Sharp, Carl E. Johnson, H. Stewart and W. W. Piddington. The directors have elected the following-named officers: W. W.

Piddington, president; Edgar Sharp secretary, and Carl E. Johnson, superintendent.

ATLANTA, GA.—At the annual meeting of the Southern Bell Telephone Company the following-named officers were elected: W. T. Gentry, of Atlanta, Ga., president; J. M. B. Hoxsey and J. Epps Brown, vice-presidents; D. J. Carson, secretary and treasurer; A. E. Holcomb, of New York, N. Y., assistant secretary.

CANANDAIGUA, N. Y.—At the annual election of the Ontario Light & Traction Company the following-named directors were elected: Horace E. Andrews, William K. Vanderbilt, Jr., Edward V. W. Rossiter, John Carstensen and Walter N. Kernan.

PATCHOGUE, N. Y.—At the annual meeting of the Patchogue Electric Light Company the following officers were elected: E. E. Hawkins, Jr., president; J. T. Losee, vice-president; H. S. Conklin, secretary and treasurer. The company recently increased its capital stock and is planning to extend its service to surrounding territory.

MEMPHIS, TENN.—At the annual meeting of the Memphis Street Railway Company E. E. Wright was elected vice-president to succeed John H. Watkins. James E. Beasley was elected to succeed Joseph H. Thompson as a member of the board of directors.

HAVANA, CUBA.—At the annual meeting of the Havana Electric Railway Company the retiring board of directors was re-elected.

New Industrial Companies.

THE INTERSTATE CONSTRUCTION COMPANY, of Greensboro, N. C., has been organized, with a capital stock of $50,000, to engage in all kinds of construction and contracting work by Ernest Clapp and others.

THE RECIPROCATING ELECTRIC MOTOR COMPANY, of Charleston, W. Va., has been incorporated with a capital stock of $500,000 to manufacture electric motors, by Eli T. Conner, H. McKean Conners and others.

THE OHIO ELECTRIC CARRIAGE COMPANY, of Toledo, Ohio, has been chartered with a capital stock of $200,000 by H. P. Dodge, R. R. Lee, James Brown Bell, E. W. Baumgardner, F. H. Dodge and others. H. P. Dodge will be general manager.

THE MOTOR SERVICE COMPANY, of Wilmington, Del., has filed articles of incorporation with the Secretary of State with a capital stock of $300,000. The incorporators are: F. M. Shive, S. E. Roberson and Harry W. Davis, of Wilmington, Del.

THE EMPIRE TRACK BRAKE COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 to manufacture engines, boilers, dynamos and pumps, by G. Q. Dean, Fred. Knowlton and P. K. Stauff, all of New York, N. Y.

THE ELECTRIC SHOP, of Chicago, Ill., has filed articles of incorporation with a capital stock of $1,000 to carry on a general electrical and mercantile business. The incorporators are: Harry J. Dunbaugh, J. Edwin Wing and George C. Madison.

THE SHAW DRY GAS CARBURATOR COMPANY, of New York, N. Y., has been incorporated with a capital stock of $1,000 to manufacture gas engines by Robert W. Shaw, of Stamford, Conn.; Gavin Rue and Henry Silverman, both of New York, N. Y.

THE HUNTINGTON-BARGAR MACHINE COMPANY, of Jamestown, N. Y., has been chartered with a capital stock of $5,000 to manufacture engines and machinery by William Huntington, Lewis T. Bargar and J. Delevan Curtiss, all of Jamestown, N. Y.

THE LOCKE MANUFACTURING COMPANY, of Robinson, Ill., has filed articles of incorporation with a capital stock of $25,000 for the purpose of manufacturing boilers and engines. The incorporators are: H. W. Locke, A. P. Woodworth and W. E. Fritz.

THE GEISZLER BROTHERS STORAGE BATTERY COMPANY, of New York, N. Y., has filed aritcles of incorporation with a capital stock of $100,000 to manufacture storage batteries. The incorporators are: H. M. Browne, E. J. Forhan and D. M. Barrett, all of New York, N. Y.

THE AMERICAN VALVE COMPANY, of Boston, Mass., has been incorporated with a capital stock of $100,000 to manufacture and deal in valves of all kinds. The officers of the company are: C. H. Tebbetts, of Marshfield, president, and A. B. Grover, of Winchester, Mass, treasurer.

THE UNITED MANUFACTURERS, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of manufacturing engines, machinery and tools. The incorporators are: Ernest M. Munn, Jr., A. Straussman, Walter K. Griffin, all of New York, N. Y.

THE ADVANCE ELECTRICAL COMBINATION COMPANY, of Pittsburg, Pa., has been incorporated by J. E. Womser, J. Womser and J. McPherran, all of Pittsburg, Pa. The company is capitalized at $200,000, and proposes to manufacture, sell and deal in all kinds of electrical appliances and contrivances.

THE S. H. COVET ELECTRIC MANUFACTURING COMPANY, of Portland, Maine, has been incorporated with a capital stock of $200,000 to deal in telephone and electrical merchandise. The officers of the company are: L. V. Walker, president; F. L. Pennell, treasurer, and Levi Turner, clerk, all of Portland, Maine.

THE SNYDER RAILWAY SPECIALTY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 by Benjamin F. Blair, of Glen Ridge, N. J.; Joseph A. Burdeau, of New York, N. Y., and Louis F. Starr, of Brooklyn, N. Y. The company proposes to manufacture and deal in railway specialties.

THE NEIBLA MANUFACTURING COMPANY, of Brooklyn, N. Y., has been chartered with a capital stock of $50,000 to carry on a mechanical and electrical engineering business and as machinists and metal workers. The incorporators are: A. Albion, F. C. Lambert, of Brooklyn, N. Y., and P. Lichtenstein, of New York, N. Y.

THE AMERICAN ELECTRIC FIRE ALARM MANUFACTURING COMPANY, of Pittsburg, Pa., has been chartered with a capital stock of $500,000 to manufacture and deal in electric fire alarms, etc. The incorporators are: Charles H. Hallowell, of Carnegie, Pa.; William Johnson, of Bellger, Pa., and John C. Miller, of Beaver, Pa.

New Incorporations.

WILMINGTON, DEL.—The Albion Light & Power Company has been incorporated with a capital stock of $100,000. The incorporators are: E. L. Laurie, G. W. Dorsey, Jr., and W. G. Stayton, all of Wilmington, Del.

AUGUSTA, GA.—The Georgia-Carolina Power Company has been granted a charter with a capital stock of $500,000. The company proposes to erect a power plant at Stevens Creek, which is located about two miles above the Augusta Locks, where about 8000 hp will be developed. J. L. Hankinson, W. G. Lancaster, N. B. Dial and others are interested in the project.

GLASFORD, ILL.—The Harkers Corners & Glasford Telephone Company has been chartered with a capital stock of $1,500 by D. J. Cowser, S. A. McQuown and N. T. Parr.

SHOBONIER, ILL.—The Vernon & Shobonier Telephone Company has been chartered with a capital stock of $800 by R. F. Emerson, A. G. Wilson and E. A. Thomas.

VIENNA, ILL.—The Johnson Mutual Telephone Compnay has been incorporated with a capital stock of $5,000 by A. J. Kuykendall, Guy Beauman, C. E. Ferris, J. W. Casper and W. E. George.

UNION, KY.—The Union Telephone Company has been incorporated with a capital stock of $1,000. The incorporators are: George W. Jolly, S. S. Miller, J. M. Moore, J. G. Evans, H. A. Yancey, A. L. Ramage and J. W. Robertson.

THREE OAKS, MICH.—The Chikaming & Weesaw Telephone Company has filed articles of association with a capital stock of $2,000.

WHITEFORD CENTER (P. O. OTTAWA LAKE), MICH.—The Whiteford Farmers' Telephone Company has been incorporated with a capital stock of $10,000.

BROWN VALLEY, MINN.—The Brown Valley Telephone Company has been incorporated with a capital stock of $50,000. S. Y. Gordon is president and N. J. Brown, secretary.

MINNEAPOLIS, MINN.—The Lake Harriet Electric Company has been organized, with a capital stock of $75,000, to construct an electric light plant to furnish electricity in the Linden Hills district. The officers of the company are: C. J. Gotshall, president; D. F. Darling, vice-president; C. L. Bostwick, secretary; H. B. Domberg, treasurer, and Truman Hibbard, general manager.

JEFFERSON CITY, MO.—The Missouri Electric, Gas & Water Company has been chartered, with a capital stock of $50,000, by Harry H. Tyson, Joseph Barbo, W. Goodall and others.

JEFFERSON CITY, MO.—A certificate of incorporation has been issued by the Secretary of State to the Pittsburg & Kansas City Railway Company, which proposes to construct an electric railway from Burgess, Mo., to Pittsburg, Kan., a distance of 50 miles. The capital stock is placed at $500,000, and the incorporators are: John W. Ground, William M. Calhoun, Thomas K. Irwin and F. H. Fitch.

MISSOULA, MONT.—The Missoula Street Railway Company has been incorporated, with a capital stock of $100,000, to construct an electric street railway in Missoula, for which the City Council has granted a 50-year franchise. The directors are: J. R. Wharton, W. A. Clark, Jr., and W. M. Bickford, of Butte; S. R. Luch, of Missoula, and C. B. McBroom, of Spokane, Wash.

VINELAND, N. J.—The Maurice River Light, Heat & Power Company has been organized for the purpose of constructing a dam and power plant to furnish electricity in Vineland. The officers of the company are: E. W. Maloney, of Avondale, Pa., president; E. C. Potter, of Vineland, N. J., vice-president; Marcuse Fry, of Vineland, N. J., secretary and treasurer.

PORT JERVIS, N. Y.—Articles of incorporation have been filed for the Port Jervis & Delaware Valley Railroad Company by F. A. Sawyer, of New York, N. Y.; E. Porter Emerson and Dr. W. F. Cuddeback, of Port Jervis, N. Y. The company is capitalized at $100,000 and proposes to construct and operate an electric railway, one mile in length, from a point in Port Jervis to a connection with the Port Jervis, Monticello and Summitville Railroad Company.

SMITHFIELD, N. C.—The Ivanhoe Manufacturing Company has been chartered, with a capitalization of $100,000, by W. M. Sanders, of Smithfield, and associates to build a cotton mill. The company proposes to generate and distribute electricity and also has the right to build and operate electric railways.

BOSTONIA, N. D.—The Kidder County Telephone Company has been organized with V. Strumberg as secretary.

BROEY, N. D.—The Emmons County Telephone Company has been organized, with a capital stock of $4,000, and the following-named officers: C. A. Ward, president, and William Ewell, secretary.

FARGO, N. D.—The Harvey Telephone Company has been incorporated with a capital stock of $50,000 by R. M. Hamilton, D. F. Singfried, of Fargo, N. D., and A. Peterson, of Harvey, N. D.

JAMESTOWN, N. D.—The Wright-Allen Telephone Company has been incorporated to construct a telephone line 10 mines in length. James Wright is secretary.

STEELE, N. D.—Articles of incorporation have been filed for the Kidder County Telephone Company, with a capital stock of $10,000, by John B. and Mary F. Spangler, of Steele, N. D., and George B. Perham, of Fargo, N. D.

CLARINGTON, OHIO.—The Clarington Water & Electric Company has been incorporated, with a capital stock of $35,000, by T. V. James and others.

HARRISON, OHIO.—The Johnson Fork Telephone Company has been incorporated to build, equip and operate a telephone system throughout Franklin and Dearborn Counties in Indiana, with the principal exchange at Johnson Fork. The post office address of the directors is Harrison, Ohio. H. G. Larue is president and Albert Mettler, secretary.

RESACA (P. O. PLAIN CITY), OHIO.—The Resaca Farmers Telephone Company has been incorporated, with a capital stock of $10,000, by W. R. Bigelow and others.

CHICHASHA, OKLA.—Articles of incorporation have been filed for the Chichasha Gas & Electric Light Company, with a capital stock of $175,000, by Lawrence Martin, Dennis O'Brien, A. A. Humphreys and C. E. Ross.

DONEY, OKLA.—The Beulah Union Telephone Company has been incorporated with a capital stock of $5,000. The company would like to receive prices on poles and telephone supplies at once. For further information address Frank T. Alexander.

GIBSON, OKLA.—The Sims-Renner Telephone Company has filed articles of incorporation, with a capital stock of $5,000. The directors are: J. W. Sims, Gibson, Okla; W. S. Kinnet, W. A. Renner and J. H. Renner, of Looney, Okla.

HOBART, OKLA.—The Southern Rural Telephone Company has been incorporated with a capital stock of $375 by Charles F. Nailer, J. M. Humbert, John Forsyth and A. R. Forman.

LACEY, OKLA.—Articles of incorporation have been filed for the Lacey & Western Telephone Company, with a capital stock of $3,000, and the following named directors: J. D. Patton, of Hennessey; W. S. Kinnett, J. A. Kinnett and T. E. Willis, of Lacey.

RUSH SPRINGS, OKLA.—The Isabella-Rush Springs Independent Telephone Company has been organized, with a capital stock of $10,000, to operate a local exchange at Rush Springs and Isabella with rural telephone lines between the two places. The directors are: J. A. Carver, W. T. Ruby, C. W. Runkin, A. C. Camp and W. E. Perkins, all of Rush Springs, Okla.

TALOGA, OKLA.—Articles of incorporation have been filed for the Taloga & Dewey County Telephone Company with a capital stock of $5,000 by W. B. Wixon, Pearl Wilson and others, of Taloga.

BEND, ORE.—The Crook County Water, Light & Power Company has filed articles of incorporation to build an electric railway from Redmond to Prineville; also to construct and operate power plants. The company is capitalized at $50,000. J. H. Jackson, of Redmond, Ore., is president.

MOSIER, ORE.—Articles of incorporation have been filed for the Mosier Valley Telephone Company by A. P. Bateham, J. K. McGregor and Lee Evans. The capital stock of the company is placed at $1,200.

SALEM, ORE.—Articles of incorporation have been filed for the Elkhorn Light & Power Company, with a capital stock of $10,000, by F. A. Harmon, L. Summers and John L. Rand.

CHAMBERSBURG, PA.—The Letterkenny Telephone Company has been organized to erect a rural telephone line in Franklin County. The line will be 15 miles in length and will intersect Hamilton Township at Keyler's. The officers of the company are: Reuben Rife, president; William B. Schaeffer, secretary, and Daniel Hunsecker, treasurer.

GREENVILLE, PA.—The Osgood Telephone Company has been organized with Henry Green as president and Thomas Barrows, secretary. The company proposes to cover every township in the northern and eastern part of Mercer County. The company will extend its telephone line to Greenville to connect with the Bell system in this place. It also plans to extend its lines in Crawford County, east of Atlantic.

PINE GROVE, PA.—The Pine Grove & Cressona Rural Telephone Company has filed articles of incorporation, with a capital stock of $5,000. The directors are: C. H. Maidenford, of Pine Grove, R. F. D. No. 3, is treasurer; A. J. Fidler, of Rock, Pa.; George Berger, Pine Grove, R. F. D. No. 2; Frank Rubert, of Cressona, Pa., and others.

YOUNGSVILLE, PA.—The Brokenstraw & Stillwater Telephone & Telegraph Company has been incorporated, with a capital stock of $25,000. The directors are: John A. Day, of Youngsville, treasurer; Frank D. Kinnear, of Youngsville, and W. A. Alexander, of Warren, Pa.

ARDMORE, S. D.—The Ardmore Telephone Company has been incorporated, with a capital stock of $3,700, by James A. Dell, of Lawton; Charles S. Williams, Scott W. Hill, Jay F. Blessing, of Ardmore, S. D., and Chester L. Jenson, of Hot Springs. The company proposes to construct a telephone line from Ardmore to Edgemont, S. D.

GARY, S. D.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $20,000 by I. H. Greene, A. E. Fales and George W. Horton.

CORNERSVILLE, TENN.—The Cornersville Telephone Company has been incorporated by W. B. London, A. Jones, W. G. Wilkinson and others.

DOWELLTOWN, TENN.—The Kaverside Home Telephone Company has been incorporated, with a capital stock of $3,000, by B. W. Robinson, James Davenport, Herman Williams and others.

DOWELLTOWN, TENN.—The Dowelltown Home Telephone Company has been chartered with a capital stock of $3,000 by B. W. Robinson, James Davenport, Herman Williams, M. B. Scott, C. B. White and others.

NASHVILLE, TENN.—The Temperance Hall Home Telephone Company, of DeKalb County, has been incorporated with a capital stock of $1,000 by R. S. Reynolds, J. H. Sykes, J. P. Turner, J. H. Close and R. W. Mason.

NEW MIDDLETON, TENN.—The New Middleton Home Telephone Company has been incorporated by W. H. Williams, R. M. Baird, A. F. Barry and James Barrett.

ROGERSVILLE, TENN.—The Rogersville Telephone & Telegraph Company has been incorporated with a capital stock of $5,000 by W. D. Harmon, George A. Smith, J. A. Thompson, G. S. Stansill and A. T. Bowen.

HAMILTON, TEX.—The Hamilton-Hico Telephone Company has been chartered, with a capital stock of $20,000, by J. F. Weiser, V. F. Weiser, of Hico, Tex., and Sydney G. Ross, of Hamilton, Tex.

ROGERSVILLE, TEX.—Articles of incorporation have been filed for the Rogersville Telephone & Telegraph Company, with a capital stock of $5,000, by W. D. Harmon, G. A. Smith, J. A. Thompson and others.

ROBINSON, UTAH.—The Tintic Power & Supply Company has been incorporated, with a capital stock of $5,000. The officers are: William J. Adams, president; John Adams, vice-president, and George Jones, secretary and treasurer.

SALT LAKE CITY, UTAH.—The Yellowstone Telephone Company has been incorporated, with a capital stock of $25,000, to construct a telephone line from Ashton, Idaho, to Yellowstone, Mont.

ALTA VISTA, VA.—The Alta Vista Land & Improvement Company has been chartered, with a capital stock of $200,000. The charter of the company gives it the privilege of developing water power to generate electricity for lamps and motors, etc. The officers of the company are: T. V. Elsom, president; W. G. Lane, vice-president; E. B. Harris, secretary, and P. F. Hardison, treasurer.

EMPORIA, VA.—The Emporia Hydro-Electric Power Company has been incorporated, with a capital stock of $200,000. The officers of the company are: W. Samuel Goodwin, president; G. B. Wood, vice-president; W. F. Deal, treasurer.

SEATTLE, WASH.—The Puget Sound & Pacific Power & Irrigation Company has been chartered, with a capital stock of $4,000,000, by Frank McKean and others.

SNOHOMISH, WASH.—The Everett & Tacoma Railway Company has been incorporated, with a capital stock of $2,500,000. The incorporators are: G. M. Cochran, E. Colburn, E. L. Colburn, Edgar Wright and O. E. Crossman, all of Snohomish.

WINLOCK, WASH.—Articles of incorporation have been filed for the Winlock Home Telephone Company, with a capital stock of $5,000, by J. A. Veness, Andrew Johnson and A. W. McFee.

CASHTON, WIS.—The Cashton Telephone Company has been chartered, with a capital stock of $14,000, by C. H. Cremer, Henry H. Cremer and Anna Schemmger.

FORESTVILLE, WIS.—Articles of incorporation have been filed for the Maplewood Western Telephone Company with a capital stock of $500 by Gustave Deige, Charles Hoepner and Henry Leige.

WESTBORO, WIS.—A temporary organization has been formed, to be known as the Westboro Telephone Association, to erect a party line and install a switchboard as soon as a sufficient number of subscribers are secured. J. W. Kaye is president and general manager, and C. C. Lord, secretary and treasurer.

TORRINGTON, WYO.—The Torrington Mutual Telephone Company has filed articles of incorporation, with a capital stock of $5,000. The officers are: William G. Curtis, president, and W. B. Coy, secretary.

REGINA, SASK., CAN.—The following rural telephone companies have been incorporated: Florence Rural Telephone Company, South Antler Rural Telephone Company and the Silverton Rural Telephone Company. For further information address Francis Dagger, provincial telephone expert, Regina, Sask.

Legal.

CONTRACT DECLARED ILLEGAL.—Judge Z. A. Littlejohn in a decision rendered Feb. 12 declares the contract entered into between the city of Americus, Ga., and the Americus Railway & Lighting Company nearly two years ago illegal. The company had secured certain franchises and contract for 20 years, which included lighting the city, pumping the water supply and construction of an electric street railway. The City Council recently instituted proceedings to have the contract declared illegal. The company will appeal from the decision as rendered.

Personal.

MR. ANSON W. BURCHARD, assistant to the president of the General Electric Company, has been elected a trustee of Stevens Institute.

MR. F. G. SIMMONS presented a paper at the first annual meeting of the Wisconsin Society of Engineers, held at Madison, Feb. 24-26, entitled "The Electric Interurban Roads of Wisconsin."

MR. G. C. LLOYD has resigned as secretary of the British Institution of Electrical Engineers to become secretary of the Iron and Steel Institute. Mr. P. F. Rowell, assistant secretary of the I. E. E., succeeds Mr. Lloyd as secretary.

MR. WILLIAM S. HEGER assistant to President W. H. Whiteside, of the Allis-Chalmers Company, has gone to California to spend a few months in the favorable climate of that State for the benefit of Mrs. Heger's health.

MR. W. C. BRYANT and his wife, accompanied by Mr. and Mrs. Harvey Hubbell, have gone on a trip to California for a month. It will be a complete holiday, the affairs of the Bryant Electric Company and of the Hubbell factory being left entirely behind.

DR. SAMUEL SHELDON, who has been in ill health for some time, will sail for Europe this week, where he will remain until October. During his absence Dr. Tufts, of Columbia University, will conduct Dr. Sheldon's course at the Brooklyn Polytechnic Institute.

MR. L. G. NILSON, chief engineer of Strang Gas Electric Car Company, of 15 Wall Street, New York City, has been elected president of Nilson-Miller Company, of 1300 Hudson Street, Hoboken, N. J. He will continue as consulting engineer for the Strang company.

MR. A. W. McLIMONT, electrical engineer of the Public Service Commission, First District, has resigned his position to accept the position of general manager of the Chicago & Milwaukee Electric Railway Company, of Chicago, Ill. His successor has not yet been appointed.

MR. HENRY R. TOWNE, president of the Yale & Towne Manufacturing Company, has been unanimously elected president of the Merchants' Association of New York. Mr. Towne has always taken an active interest and share in public matters and is well fitted to direct the affairs of this influential body.

MR. W. F. FOSHAY, who resigned the managership of the Fort Dodge (Ia.) Light & Power Company, to take effect March 1, was the subject of a highly complimentary notice printed in the columns of the Fort Dodge *Messenger*, dated Feb. 23, which included flattering testimonials from a number of prominent business and professional men.

MR. W. P. BOWMAN, formerly manager of the Cleveland branch of the John A. Roebling's Company, of New York, has been appointed successor in the treasurership to Mr. Henry L. Shippy, who has just resigned on account of serious ill health. Mr. Bowman has assumed his new duties, to which he brings a ripe experience and a wide knowledge of the field.

COL. FRANK S. RICHARDSON, of North Adams, Mass., was elected a trustee of the Massachusetts Lighting Companies at the annual stockholders' meeting held Feb. 16. Col. Richardson was owner and general manager for 31 years of the North Adams Gas Light Company including its electrical properties, which was recently purchased by the Massachusetts Lighting Companies.

MR. FRANK J. CLARK, of Springfield, Mass., Eastern representative of the Zucker, Levett & Loeb Company, of New York, N. Y., manufacturers of dynamos and electroplating supplies, has resigned his position to become a member of the Levett Manufacturing Company, of Matawan, N. J., which will manufacture the same line of goods. Mr. Clark will be the Eastern representative of the firm.

MR. J. W. WAGGENER, formerly superintendent of the Atchison Railway, Light & Power Company, of Atchison, Kan., has been appointed general manager of the company. Mr. Harry Askin, who rebuilt the lighting plant last July, succeeds Mr. Waggener as superintendent. Mr. Askin has advanced in the last six months from chief electrician to assistant superintendent, and now to superintendent.

MR. LAURENCE WHITRIDGE CADY, who was formerly electrical engineer for the W. J. Barr Electrical Manufacturing Company, has been made electrical engineer of the Browning Engineering Company and has been working upon their electric locomotive cranes and other conveyor machinery. He has recently designed a new line of lifting magnets. His headquarters are at the main office in Cleveland, Ohio.

MR. TURE N. STEEN, of Stockholm, Sweden, is now visiting this country and is spending some time in California. On his return to Sweden he desires to take with him various American electrical specialties and mechanical devices for representation and manufacture over there, with Swedish capital. He can be addressed in care of the ELECTRICAL WORLD. He has been to this country before and has many acquaintances here.

MR. A. E. WINCHESTER, the commissioner and superintendent of the municipal electric light plant at South Norwalk, Conn., is a candidate for one of the commissionerships on the new Public Service Commission of Connecticut when it is organized. Mr. Winchester is in many ways an ideal occupant of such a post, combining high integrity and intelligence with a very thorough knowledge of the art of illumination and of practical public service conditions.

MR. H. M. HUXLEY.—The patent law firm of Brown & Williams, of Chicago, of which Mr. C. A. Brown is the senior member, announces that Mr. Henry M. Huxley, A. M., a graduate of Harvard in 1902, has become associated with their office. He will deal specially with chemical and metallurgical work. He was at one time in the operating department of the American Steel & Wire Company and more lately assistant general manager and manufacturer of the Duplex Metals Company.

MR. J. E. FRIES, a Swedish electrical engineer who has been for some time in this country, has joined the Crocker-Wheeler forces at Ampere, N. J., and has been assigned to a position on the engineering staff under Mr. Gano Dunn, chief engineer of the company. Mr. Fries has already had considerable experience on this side of the water, especially with the Allis-Chalmers Company at Milwaukee, and more recently with the Canadian General Electric Company at Toronto. He has made a great many friends, who note this new and important connection with much pleasure.

MR. F. A. WILKINSON, the electrical engineer and manager at St. Marylebone, London, England, has resigned his appointment in order to take up private practice. He has entered into an arrangement under which he remains at Marylebone until the end of September or for six months after his successor takes up his full duties—whichever is the later date. He is now at liberty to carry out such private work as will not interfere unreasonably with his duties at Marylebone. Mr. Wilkinson intends to devote his attention particularly to colliery work, electric battery traction, electric heating and cooking, etc., following up the work that has been carried out in this direction at Marylebone.

MR. H. L. SHIPPY.—It is with profound regret that the many friends of Mr. Henry L. Shippy have learned that owing to the condition of his health he has felt it necessary to be relieved of active business cares, and has therefore resigned as treasurer of John A. Roebling's Sons Company, of New York. His connection with the Roebling interests began in 1875 and has continued ever since without any interruption. In these 35 years Mr. Shippy has made friendships and acquaintances in all parts of the globe, and has become perhaps the most widely known and widely traveled American of his day in the mechanical world. At home his manly qualities, his high business ideals and his kindliness of heart have endeared him everywhere, while in the electrical fields they are legion who are proud to claim his intimacy and friendship. No one could be more warmly esteemed than he is, and into his retirement he takes a wealth of good wishes.

Obituary.

MR. THOMAS TAYLOR JOHNSTON died Feb. 23 at his residence in Evanston, Ill. Mr. Johnston was consulting engineer for the Snoqualmie Falls (Seattle) hydro-electric plant, unique among electrical plants from having the machinery located at the bottom of the tunnel pit. At the time of his death he had supervision of the hydraulic engineering features of the Chicago Drainage Canal. Mr. Johnston was president of the Western Societies of Engineers in 1897.

MR. JAMES E. PETTIT, a well-known telegraph operator and for many years chief operator of the Postal Telegraph Company's Chicago office, died at his home in Oak Park, Chicago, Feb. 23. Mr. Pettit was a military telegrapher and served through the Civil War, during which period he spent nine months in a confederate prison. He was secretary of United States Military Telegraph Corps for 25 years. At the time of his death he was on the pension roll of the Postal Telegraph Company. Deceased was born in Peru, N. Y., March 21, 1842.

DR. C. D. WRIGHT.—We regret to note the death of Dr. Carroll D. Wright, president of Clark College; once Commissioner of Labor of the United States. He was a leading statistician, educator and philanthropist, and in every way a useful public-spirited citizen. In the early stages of his career Dr. Wright practised in Boston as a patent attorney, and was associated with Mr. T. A. Edison among his clients. He tells on the page following that on the vote recorder; and liked to tell of his recollections of Edison as a man, intensely earnest on the subject of the things in which he was interested, in was the conversion of [illegible] mechanical motion [illegible] he gave Mr. Wright [illegible] demonstrations.

Trade Publications.

BATTERY JARS are listed and illustrated in a 187 page catalog devoted to battles issued by the Illinois Glass Company, 212 Randolph Street, Chicago, Ill.

MERSEREAU [illegible] "The Garver," described by the Newark Lamp Company, Pittsburg, Pa., contains a [illegible] complete set of the Newark [illegible] made by Dudlo, Wash.

MOTOR-DRIVEN BOLTER WASHERS for alternating current and direct current are illustrated, listed and described in Bulletin No. 4060 of the [illegible] Company, Chicago, Ill.

OPALUX SHADES.—The Central Electric Company, Chicago, Ill., has issued a new bulletin descriptive of Opalux shades and reflectors, an entirely new line of appliances especially designed for use with tungsten lamps.

WIRE NOVELTIES.—The Wire Novelty Manufacturing Company, West Haven, Conn., has issued an illustrated pamphlet showing a few of the articles manufactured by it for the tinware, hardware and manufacturing trade.

TUNGSTEN LAMPS.—The economy of tungsten lamps is shown in a convincing manner in a folder being distributed by the Buckeye Electric Company, Cleveland, Ohio. This folder gives cost calculations based on actual operating conditions.

PIPE TAPLETS are discussed in a convincing manner in Bulletin No. 63 of the H. T. Paiste Company, Philadelphia, Pa. A supplement to this bulletin deals with a pull socket which is said to be capable of withstanding 12,000 makes and breaks.

CARPET SWEEPERS.—Folder No. 4122 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa., gives an outline of electric-motor-driven carpet sweepers manufactured by the Electric Suction Sweeper Company, of Canton, Ohio.

SERIES TUNGSTEN LAMP SYSTEM.—Bulletin No. 5533 of the Western Electric Company, Chicago, Ill., gives an excellent technical discussion of constant-current regulators for series tungsten systems receiving energy from alternating-current mains.

DIRECT-CURRENT INSTRUMENTS for switchboard use are illustrated and described in Bulletin No. 4643 of the General Electric Company, Schenectady, N. Y. The instruments are circular in shape and have prominent legible and well-lighted scales.

POLYPHASE MOTORS of the wound-rotor and squirrel-cage induction types are illustrated and described in detail in Bulletin 82 of the Wagner Electric Manufacturing Company, St. Louis, Mo. Auto-transformer starters for the squirrel-cage motors are also discussed.

ELECTRIC CARRIAGES for high-class service, including runabouts, stanhopes, victorias, coupes, surreys, broughams and landauletts, are neatly illustrated and well described in a catalog recently issued by the Rauch & Lang Carriage Company, Cleveland, Ohio.

GAS ENGINES.—Bulletin No. 1063 has been issued by the Allis-Chalmers Company to direct attention to the vast field of power service available to gas engines and the economies afforded by their utilization of either producer gas, natural gas or furnace gas.

TELEPHONES intended for severe service, such as that required in coal mines, are outlined in a return post card being issued by the Stromberg-Carlson Manufacturing Company, Rochester, N. Y. These telephones are of the iron-clad rust-proof water-tight type.

BUILDERS' HARDWARE.—The Merchant & Evans Company, Philadelphia, Pa., has issued a 189-page catalog devoted to all kinds of builders' hardware. The catalog contains a complete set of rules of the Master Sheet Metal Workers for the proper laying of tin roofing.

MACHINERY SUPPLIES for manufacturers and users of machinery and steam boilers, implement manufacturers, sheet metal workers, structural workers, railroads, mines, etc., are described in the February issue of the Monthly Journal and Stock List of Joseph T. Ryerson & Son, Chicago, Ill.

STEAM PUMPS.—Pony Catalog No. 76 of the Dean Bros. Steam Pump Works, Indianapolis, Ind., deals with a few of the standard styles and sizes of this company's line of steam pumps. Illustrations are given of the various pumps, together with considerable data relating to dimensional details and output ratings.

PANEL BOARDS.—Bulletin No. 23 of the H. Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, N. Y., contains a complete price list of various types of high-grade and commercial-grade panel-board switches and panel units. These devices are designed for 125-volt and 250-volt two-wire and three-wire circuits.

TUNGSTEN LAMPS.—The economy of operation of tungsten lamps in comparison with incandescent lamps of other types is strikingly shown in bulletin No. 6D, issued by the Engineering Department of the National Electric Lamp Association, Cleveland, Ohio. The lamps described are those intended for constant-voltage circuits.

ELECTRICAL TESTS.—The Electrical Testing Laboratories, Eightieth Street and East End Avenue, New York., have issued in booklet form a paper entitled "The Work of the Electrical Testing Laboratories," by Mr. W. S. Howell. This paper describes the various commercial tests which the laboratories are called upon to make.

ELECTRIC BRAKES.—Friction brakes of the magnetic type for direct-current and alternating-current motors are technically described in circular No. 1158 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. These brakes are intended particularly for use with crane and hoist motors, and motors used in steel mills.

FIBER CONDUIT.—The second edition of the general catalog of the Fiber Conduit Company, Orangeburg, N. Y., is a well-printed 84-page publication devoted to fiber conduit. Numerous illustrations are given of [illegible] of construction, also complete price lists of the various sizes of conduits and cost of installation are included.

ELECTRIC WELDERS.—An illustrated booklet issued by electric welders has been issued by the Toledo Electric Welding Company, 141 Tenth Street, Toledo, Ohio. The welders described vary in size from 250 lb. to 1250 lb. Considerable information is given concerning the energy and time required for making welds of certain sizes.

TRANSFORMERS.—Single-phase transformers of the core type rated at from 0.6-kw to 50-kw are described in detail in a catalog issued by the American Transformer Company, of Newark, N. J. These transformers are constructed of silicon steel cores, which possess non-ageing properties, in addition to low specific hysteresis and eddy-current losses.

MERCURY RECTIFIERS for charging storage batteries are discussed in an instructive manner in circular No. 1148 of the Westinghouse Electric & Manufacturing Company, Pittsburg, Pa. The rectifier outfits described in this circular are designed for from 5 to 30 amperes. An automobile battery charging outfit is described in folder No. 4105 of the same company.

DIRECT-CURRENT SWITCHBOARDS.—The F. Bissell Company, 226 Huron Street, Toledo, Ohio, has issued bulletin No. 19, covering switchboards for 125-volt and 250-volt direct-current isolated and central-station plants. The bulletin contains complete price lists of all of the switchboards, instruments, switching devices and circuit breakers illustrated and described.

HEATING DEVICES.—The Excel Electric Heating Company, 237 Broadway, New York, has issued a well-executed catalog descriptive of electric heating devices, including coffee percolators, smoothing irons, chafing dishes, food warmers, double boilers, shaving outfits, glue pots, wax heaters, sterilizers and soldering irons. Each of these devices is illustrated, listed and described.

GAS ENGINES.—Gas engines for driving electric generating outfits, air compressors and vacuum cleaning equipments are illustrated and listed in a folder issued by the Trebert Gas Engine Company, 35 Ford Street, Rochester, N. Y. Complete details of a self-contained electric generating unit designed to supply energy to 10 8-cp lamps are given in special pamphlet issued by the same company.

HYDRAULIC TURBINES are well illustrated in a descriptive catalog of the Dayton Globe Iron Works Company, Dayton, Ohio. This catalog gives much valuable information concerning the measurement of water powers, the construction of head races, wheel pits and tail races, and the arrangement of wells, etc. Illustrations are given of numerous installations in which American turbines are employed.

THE TUNGSTEN LAMPS.—The General Electric Company, Schenectady, N. Y., in Bulletin No. 4646 presents interesting data relative to the quality of light produced by the tungsten lamp, simplicity of construction of the lamp, its adaptability to both alternating and direct current circuits, and various other data relative to its life and economy. The bulletin contains also descriptions and illustrations of Holophane reflectors for use in connection with tungsten lamps.

DIRECT-CURRENT WATT-HOUR METERS.—The Duncan Electric Manufacturing Company, of Lafayette, Ind., has issued bulletin No. 8, which gives illustrated technical descriptions of watt-hour meters for direct-current house service. These instruments are driven by means of commutator type motors. They are provided with visual bearings; fire proof binding posts; non-twisting brushes; low temperature coefficient resistance, and an arrangement for compensating for friction and vibration.

DIRECT-CURRENT GENERATORS.—A list of engine-type, direct-current generators sold by the Crocker-Wheeler Company, of Ampere, N. J., is given in its Bulletin No. 110. This list, covering 15 solid pages, gives the names and addresses of companies and individuals using these generators. Generators in industrial plants, street railways, railroad and other machine shops, office buildings, stores, schools and residences are included in the list. Among the stations are several on United States battleships.

ELECTRIC CARRIAGES.—The Rauch & Long Carriage Company, Cleveland, Ohio, has issued a beautiful pamphlet illustrating and describing its 1909 types of electric vehicles. In design the publication is artistic, and in execution represents the highest state of the printing and engraving arts. One notable feature is that in illustrating vehicles, each type is shown in a photographic reproduction, bringing out every detail, and a supplementary engraving from a free-hand drawing representing the machine as it appears in service on the street or road.

LIGHTING SPECIALTIES.—Bulletin No. 101 of the Marshall Electric Company, 301 Congress Street, Boston, Mass., gives illustrations, descriptions and price lists of lamp sockets for all purposes. Pipe ends for open-conduit wiring are treated in detail in bulletin No. 102, while switches, receptacles, plugs and wall cases are treated in bulletin No. 103 of the same company. The company has also issued an illustrated catalog and price list, printed in Spanish, devoted to lamp sockets and receptacles, porcelain base switches, rosettes and extension plugs.

MOTORS IN RAILROAD SHOPS.—In bulletin No. 4649, just issued by the General Electric Company, Schenectady, N. Y., the relative advantages and disadvantages of "independent drive" and "group drive" of machine tools are demonstrated. While the title of the bulletin refers to railroad shops, the data are applicable to machine shops in general. The bulletin refers also to the relative merits of alternating current and direct current for use in this connection, and it contains numerous illustrations of machine tools operated by electric motors.

ELECTRIC TOOLS.—The Virginia Electric Tool & Manufacturing Company, Petersburg, Va., has issued bulletins relating to its line of electric tools. Bulletin No. 1 is devoted to hammers for general service for use on direct-current circuits. Bulletin No. 2 deals with plug drills. An electric hammer for riveting, chipping, calking and other work is described in Bulletin No. 3. This hammer is provided with a plunger which is operated by magnetism of an alternating nature produced by a commutated direct current. The commutating mechanism is arranged on a base plate entirely separated from the hammer proper. The hammer is, therefore, extremely simple.

GAS ENGINES AND PRODUCERS.—A well-prepared catalog issued by the Du Bois Iron Works, Du Bois, Pa., contains a table compiled from data gathered in actual practice from producer-gas and steam-generating plants, tending to show the relative economy of the former. Much detailed information is given concerning the constructive features and operating characteristics of single-cylinder, tandem and twin-tandem engines, arranged to operate with natural illuminating or producers' gas. Producer gas plants are also described, while the construction features of these plants are compared with those of steam-generating plants by means of illustrations, which show the heat losses in the various parts of the two equipments.

PUMPS.—Pumps of various types are illustrated and described in bulletins recently issued by the Blake & Knowles Steam Pump Works, 115 Broadway, N. Y. Bulletin B K-825 is devoted to vertical triplex single-acting pumps. These pumps are intended for belt drive and are suitable for operation with electric motors. Numerous forms of starting device for electric motors are illustrated in this bulletin. Double-acting piston-pattern pumps of the triplex type for belt driving are described and illustrated in bulletin B K-826. Bulletin B K-827 deals with pumps for artesian and curb wells. These pumps are rated at from 10 to 640 gallons per minute. Illustration is given of a triplex electric sinking pump, self-contained and complete with the electric motor. Belt-driven and steam-driven ammonia pumps are illustrated and described in bulletin B K-828, which also gives information concerning constructive details of these pumps.

Business Notes.

THE EATON ELECTRIC MANUFACTURING COMPANY, Chicago, Ill., manufacturers of switchboards, panel boards, steel cabinets, etc., announces that, owing to increasing business, it will move about March 15 to new and more commodious quarters at 46 North Carpenter Street.

THE DUBOIS IRON WORKS, DuBois, Pa., manufacturers of "DuBois" gas engines and steam and power pumps, has been awarded a contract for a 160-hp twin tandem gas engine, direct connected to 100-kw generator for the lighting plant of the Seventy-fourth Regiment State Armory Building at Buffalo, N. Y.

J. E. LONERGAN & CO., brass founders and finishers, 211 Race Street, Philadelphia, Pa., have announced that their business will hereafter be conducted under the title of J. E. Lonergan Co. Mr. J. E. Lonergan is president; Mr. M. A. Hudson, vice-president; H. S. Whitney, secretary, and W. E. Crofton, treasurer.

THE RIDGWAY DYNAMO & ENGINE COMPANY, Philadelphia, Pa., has sold to the Commissioners of Public Works, Orangeburg, S. C., a Ridgway tandem-compound, side-crank engine arranged for direct connection to a 90-kw Ridgway alternating-current generator. This is the third Ridgway unit in the Orangeburg electrical and pumping plant.

MR. E. E. HUDSON, formerly manager of sales of the Battery Supplies Company, Newark, N. J., has been appointed manager of sales of the primary battery department of the Edison Manufacturing Company, Orange, N. J. This company announces that it has discontinued its sales office at 10 Fifth Avenue, New York City, and that all communications should hereafter be addressed to Edison Manufacturing Company, Orange, N. J.

THE HARVARD ELECTRIC COMPANY, Chicago, Ill., requests us to deny a rumor that it had discontinued, or intended to discontinue, the manufacture and sale of Harvard brackets. Mr. Frederic Greer, president of the Harvard Electric Company, says he prefers to believe that this impression (which was given out by a manufacturer of a bracket similar to the Harvard galvanized channel steel bracket) was done through an honest lack of knowledge of the Harvard business.

MR. GEORGE B. DUSINBERRE, of Cleveland, who is well-known to the electrical fraternity both as a consulting engineer and on account of his former connection with the Westinghouse Company, has recently been appointed sales agent for the Middle West for the American Electric Fuse Company, of Muskegon, Mich., and for the Duplex Metals Company, of New York. Mr. Dusinberre will continue to make his headquarters in Cleveland, and has moved his office to 414 Prospect Avenue.

INSTALL MOORE TUBE LIGHTS.—The Moore Electrical Company, Newark, N. J., has recently installed its tube lights in a number of the large silk dyeing establishments of Paterson. Among the recent sales are: Two 66-ft. white units, one 66-ft. yellow unit and two 114-ft. "straight rim" yellow units to the Weidman Silk Dyeing Company; one 66-ft. white tube and one 114-ft. yellow hairpin tube to Formanns, Stumpf & Sharpe. It is claimed that these lights are especially adapted to matching colors.

THE HOSKINS MANUFACTURING COMPANY, formerly the Hoskins Company, of Chicago, has opened its new plant and general offices at 453 to 471 Lawton Avenue, Detroit, Mich. Here the company has an extensive factory, new equipment and enlarged facilities for making and distributing its line of electric furnaces, pyrometers and heating appliances. With the reorganization and increase of capital to $500,000, the management remains the same as before. The officers of the company are as follows: Hoyt Post, president; W. W. Talman, vice-president and sales manager; E. F. Hoskins, general manager and treasurer; Jonathan Palmer, Jr., secretary. A. L. Marsh will continue with the company in the capacity of electrical engineer.

CROCKER-WHEELER SALES.—The business booked during the week by the Crocker-Wheeler Company, Ampere, N. J., includes, among other large orders, one for two 400-kw, 575-volt, engine-driven railway generators for the City of Edmonton, Montreal, Canada. The Michigan Alkali Company, Wyandotte, Mich., has placed an order for 95 hp in small motors with which to equip its plant. An order for eight rolling mill motors aggregating 170 hp has been placed by the Alliance Machine Company, Alliance, Ohio. A notable motor application will be that of the 125-hp 230-volt motor to operate a friction saw, which has just been ordered by the Pettibone Mulliken Company, Chicago, Ill. The Hanover Street Trust, Boston, Mass., is adding a small three-wire balancer to its equipment. This building already has about 100 kw of generating apparatus of Crocker-Wheeler make. A number of other orders have been received for direct and alternating current generators of various sizes and a large number of small motors.

GREGORY SALES.—Among recent shipments of the Gregory Electric Company are the following: 150-kw. Westinghouse railway generator to Keokuk Gas & Electric Company, Keokuk, Iowa.; 150-kw. Stanley three-phase, 60-cycle alternator to Stevens Point Power Company, Stevens Point, Wis.; 150-kw. three-phase 60-cycle Stanley alternator to Northern Light, Heat & Power Company, Wahpeton, N. D.; 150-hp. General Electric three-phase, 60-cycle motor, to Terre Haute, Indianapolis & Eastern Traction Co., Terre Haute, Ind.; 125-hp. General Electric three-phase motor to Muncie Electric Light Plant, Muncie, Indiana; 75-kw. Thomson-Ryan direct-connected 250-volt generator and Alfree engine to Knoxville Electric Company, Knoxville, Iowa; General Electric Type A S alternator and Chuse engine to city of McMinnville, Tenn.; 50-kw. Siemens-Halske generator and 165-hp. Ideal engine to Marion Brick Works, Marion, Ind.; 125-kw. Fort Wayne 250-volt generator to Blind River Light, Heat & Power Company, Blind River, Ont.; General Electric A S 120 alternator to Board of Public Affairs, Lebanon, Ohio; 50-kw. Northern 250-volt generator direct-connected to Ideal engine, to the Molitor-Hummel Realty Company, Milwaukee, Wis.; two 180-kw. General Electric A S 180 alternators to Danville Light, Heat & Power Company, Danville, Ind.; 30 kw. C & C 250-volt generator to R. E. Cobb, St. Paul, Minn.

MacGOVERN, ARCHER & CO., 114 Liberty Street, N. Y., report that they have made the following shipments within the past few weeks, covering generators, motors, etc., supplied to the various lighting and manufacturing companies: Direct-current generators wound for 125 volts have been shipped to the following companies: One 60-kw unit to Burley & Stevens, Newbury, Mass.; a 100-kw generator directly connected to an engine sent to H. M. Plimpton & Co., Norwood, Mass.; a 45-kw generator to the New England Machine & Electric Company, Pawtucket, R. I.; a 55-kw belted unit to John W. Potts, Little Falls, N. J.; a 60-kw generator to T. B. Rice & Sons Company, Philadelphia, Pa., and one 100-kw generator directly connected to an engine to Herbert F. Sawyer, Boston, Mass. Direct-current generators designed for 250 volts have been shipped as follows: A 160-kw belted generator and switchboard to the Commercial Coal Mining Company, Expedit, Pa.; one 65-kw belted unit to Bernard Rice's Sons Company, N. W.; one 100-kw unit and one 250-kw unit, complete with switchboards, to the Anglo-Canadian Leather Company, Canada; two 160-kw belted generators to Hatfield & Hilles, Philadelphia, Pa.; one 75-kw engine-driven generating set to Bawo & Dotter, New York, and one 400-kw Fort Wayne generator directly connected to a 600-hp Buckeye engine, complete with condenser and switchboard, to the Illinois Malleable Iron Company; a 225-kw 575-volt direct-coupled direct-current generating set has been shipped to the Blackwood Coal Company, Philadelphia, Pa., and one 85-kw 550-volt generator with switchboard, has been sent to the Ithaca Street Railway Company, Ithaca, N. Y. Three-phase alternators have been shipped to the following companies: One 100-kw unit, complete with switchboard, to the St. Johnsbury Electric Light Company, St. Johnsbury, Vt.; one 200-kw alternator to the Geneva Electric Light Company, Geneva, N. Y.; one 150-kw unit to the W. T. Adams Machine Company, Corinth, Miss.; one 75-kw belted alternator to the Keene Electric Railway Company, Keene, N. H.; two 200-kw alternators to the Middletown Lighting Company, Middletown, O.; one 200-kw belted alternator to the Columbia Light & Power Company, Columbia, Tenn., and one 200-kw belted alternator to the Gulf Lumber Company, New Orleans, La. The following two-phase alternators have been shipped: One 75-kw unit to the Augusta-Aiken Railway Company, Augusta, Ga.; one 180-kw belted alternator to the Nazareth Electric Light Company, Nazareth, Pa., and one 150-kw belted alternator, with switchboard, to the Georgetown Electric Company, Georgetown, S. C. The following [illegible] have also been shipped: One [illegible]-cycle machine to the Mutual Light & Water Company, Brunswick, Ga.; one 60-kw unit to the Mutual Gas Company, Troy, N. Y.; one 100-kw alternator to the

American Gas & Electric Company, New York City, one 90-kw belted alternator to the La Porte Electric Company, La Porte, Ind., and one 65-kw belted alternator to the Greenville Electric Company, Greenville, Ohio. The following direct-current motors have been shipped: One 35-h.p. unit to F. E. Rice & Sons Company, Philadelphia, Pa.; one 215-hp 250-volt motor to the Atlantic Coast Lumber Corporation; four [illegible]-volt motors to Paxton & Vierling, Omaha, Neb. Three-phase motors have been shipped to the following companies: Uxbridge & Northbridge Electric Company, Boston, Mass., one 150-kw machine; Texas Rolling Mills, Fort Worth, Texas, four motors; McCarthy Bros. & Ford, Buffalo, N. Y., one [illegible]-hp [illegible]-cycle motor; the International Nickel Company, Niagara Falls, N. Y., one 75-hp three-phase motor; the [illegible] Asbestos Mines, Canada, one 200-hp three-phase induction motor; the Hinckley Fibre Company, Hinckley, N. Y., one 150-kw three-phase motor, and the Ludlow Associates, Ludlow, Mass., three 150-hp 40-cycle motors. The company has also shipped a 150-hp engine to the Lancaster & Jefferson Electric Light Company, Lancaster, N. H., and has recently made a large number of sales of motors and smaller apparatus. These sales seem to indicate that manufacturers are finding it necessary to increase their motor equipments in order to fill the orders on hand.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Lloyd Lyon, Mobile, Ala.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, 29 West 39th St., New York. Next meeting, Hot Springs, Va., May 17, 18, 19 and 20, 1909.

American Electro Therapeutic Association. Secretary, Dr. Albert C. Geyser, Wills Ave., New York City.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, Niagara Falls, Canada, May 6, 7 and 8, 1909.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 557 Frick Building Annex, Pittsburg, Pa. Next meeting, June, 1909.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago. Next meeting, Detroit, June 23, 24 and 25, 1909.

American Street & Interurban Railway Engineering Association. Secretary, Walter S. Mower, London, Ont.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York.

Association of Car Lighting Engineers. Secretary, G. B. Colegrove, Chicago & Illinois Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

Association of Edison Illuminating Companies. Secretary, S. E. Mumford, Detroit, Mich.

Association of Electric Lighting Engineers of New England. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind.

Chicago Electric Club. Secretary, S. M. McFedries, care J. L. Schureman & Co., Chicago.

Colorado Electric Light, Power & Railway Association. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, September, 1909.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 500 Fifth Ave., New York.

Electrical Contractors' Association of State of Missouri. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, 154 Nassau St., New York.

Illinois State Electric Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, V. R. Lansingh, 33 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Associates of Greater New York. Secretary, Lewis H. Woods, Imperial Hotel, Broadway and 32d St., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., 1909.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

International Independent Telephone Association. Secretary, A. C. Davis.

Iowa Electrical Association. Secretary, W. N. Keiser, Des Moines, Ia. Next meeting, Cedar Rapids, Ia., April 21 and 22, 1909.

Iowa Independent Telephone Association. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Next meeting, Des Moines, March 9, 10 and 11, 1909.

Iowa Street & Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Cedar Rapids, Ia., April, 1909.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., October, 1909.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meetings, second Tuesday in October, each year.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. C. Marshall, Port Huron, Mich.

Minnesota Electrical Association. Secretary-Treasurer, Ludwig Kemper, Albert Lea, Minn. Next meeting, Nicollet Hotel, Minneapolis, Minn., March 18 and 19, 1909.

Mississippi Electric Association. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss. Next meeting, Jackson, Miss., June 15, 1909.

Missouri Independent Telephone Association. Secretary, G. W. Schweer, Windsor, Mo.

Missouri Electric Light, Gas & Street Railway Association. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, April 15, 16 and 17, 1909.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electric Light Association. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

National Electrical Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

National Electrical Trades Association. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, Boston, Mass., June 10, 1909.

Nebraska Electrical Association. Secretary, William Bradford, Lincoln, Neb.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York.

New York State Independent Telephone Association. Secretary, R. M. Eaton, Niagara Falls, N. Y.

Northwest Electric Light & Power Association. Temporary chairman, J. D. Crary, Aberdeen, Wash. Next meeting, Seattle, 1909.

Northwestern Electrical Association. Secretary, John S. Allen, Lake Geneva, Wis. Next meeting, Milwaukee, January, 1910.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio. Next meeting, Columbus, Ohio, March 18, 1909.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Canton, Ohio, May 21 and 22, 1909.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburg, Pa., 1909.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, J. T. Halloran, 604 Mission St., San Francisco, Cal. Next meeting, Oakland, Cal., February, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting, second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meetings, fourth Monday each month. Next annual meeting, fourth Monday in March, 1909.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, J. A. Myler, Jr., 609 Juanita Building, Dallas, Tex. Next meeting, Dallas, Tex., May, 1909.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Harrisburg, Penn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next meeting, New York, March 24 and 25, 1909.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., October, 1909.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1 each year.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED FEB. 23, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

912,985. ELECTRIC HEATING DEVICE; C. Aalborg, Wilkinsburg, Pa. App. filed June 8, 1907. The electric locomotive when hauling passenger cars supplies steam to the cars to heat them. The steam is generated by electric heaters carried by the locomotive.

912,994. ELECTRIC HEATING APPARATUS; F. Conrad, Swissvale, Pa. App. filed June 8, 1907. Steam is supplied by the electric locomotive when hauling passenger cars to heat them by means of a spiral coil carrying the water, the spiral at the same time carrying an electric current which heats the water.

912,995. ELECTRIC-MOTOR CONTROL SYSTEM; W. Cooper, Wilkinsburg, Pa. App. filed April 10, 1905. Means for cutting out one motor without interfering with the control of the remaining motors in a multiple train system. A plurality of independently actuated switches, one for each motor, is provided, together with means for preventing the operation of certain of the switches without interfering with the control of the circuits of the remaining motors.

913,016. ELECTRIC LAMP; Isador Ladoff, Schenectady, N. Y. App. filed Nov. 28, 1904. An open-mesh mantle of rare earth oxides surrounds the arc and is heated thereby.

913,017. DYNAMO-ELECTRIC MACHINE; B. G. Lamme, Pittsburg, Pa. App. filed Aug. 2, 1906. Prevents the magnetization of the fixed frames which support the coils of the armatures by providing a stationary ring-wound armature with non-magnetizable supports and a short-circuited secondary outside of the said ring winding.

913,024. CLAMP FOR ELECTRICAL AND OTHER FIXTURES; W. M. Meacham, Oak Park, Ill. App. filed Jan. 28, 1905. A clamp plate for electrically insulated bushings, having an aperture to receive the bushing, spring teeth forming part of the edge of the aperture and a rib surrounding the teeth.

913,041. FIRE PROTECTION SIGNAL SYSTEM; J. G. Nolen and J. E. Shepherd, Chicago, Ill. App. filed Mar. 20, 1905. A fluid containing receptacle is provided with a diaphragm which closes the opening of the receptacle; a local alarm circuit is controlled by an electric time switch, which in turn is controlled by a movable part within the receptacle.

913,045. SPARK PLUG; H. F. Parker, Montclair, N. J., assignor to Y. T. Frazee, Montclair, N. J. App. filed Dec. 1, 1906. A spark plug includes two terminals and a movable ball intermediate the two and normally in engagement with but one terminal. The ball moves about, decreasing the tendency for the deposit of soot or carbon.

913,052. ELECTRIC TIME-SWITCH; W. E. Richter, Albuquerque, N. M. App. filed Feb. 4, 1908. An automatic time-switch for electric light switches which can be set so as to cut out the circuit at any desired time. Details.

913,060. ELECTRICAL APPARATUS; O. Schaumberg, Pittsburg, Pa. App. filed June 8, 1907. The transformer casing, which radiates heat, is filled with fluid contained in a plurality of tubes located outside the body portion of the casing, which tubes connect with end enlargements of the casing. The oil or fluid circulates through the tubes.

913,080. RINGING KEY; Klas Weman, Buffalo, N. Y. App. filed July 10, 1907. Ringing key for telephone switchboards, having a slotted tube with a serrated edge, in which a plunger slides, the plunger having a pin engaging the slots and carrying a second pin having rollers resting in the serrations.

913,081. CONTACT FOR ELECTRIC CONTROLLERS OR SWITCHES; A. White, Sunderland, England. App. filed Sept. 10, 1908. A reversible and renewable contact secured to its carrier by a screw and having wings for contacting with the controller drum.

913,086. CIRCUIT-CONTROLLING INSTRUMENT; G. M. Wells, Chicago, Ill. App. filed May 17, 1907. For burglar alarms. A needle arranged between contact arms which closes the circuit when the burglar enters. Details.

913,104. UNDULATING CURRENT APPARATUS; I. Colegrove, Hammond, Ind. App. filed Oct. 5, 1907. For producing experimental, alternating and undulatory currents of different characteristics and different frequencies. A commutator is mounted to oscillate by means of an oscillating armature and means are provided for changing the amplitude of oscillation of the commutator.

913,105. ELECTRIC CURRENT INDICATOR; F. N. Conant, Newburyport, Mass. App. filed Jan. 11, 1907. An electric lamp is mechanically and electrically connected with the fuse so that if the fuse wire is disrupted the current passes through the lamp, giving the indication.

913,122. TROLLEY RETRIEVER; T. R. Gabel, Los Angeles, and A. L. Eacrett, Hollywood, Cal. App. filed Feb. 18, 1908. A retriever in which the trolley rope is wound on a reel and the pole pulled down when the trolley jumps the wire, the reel, during the downward movement, being locked against rotation. Details.

913,155. TROLLEY-WIRE CONNECTION; G. S. Pannebaker, Lewistown, Pa. App. filed Sept. 23, 1908. For uniting the severed ends of a trolley wire, by means of an elongated body portion having a groove to receive the wire and short grooves in which the ends of the wire are clamped.

913,160. ELECTRICAL CONNECTION; G. H. Pride, New York, N. Y. App. filed April 17, 1907. Makes use of two complementary insulated sections for the socket of a lamp, one fitting into the other. Details.

913,168. TROLLEY-WHEEL SHIELD; A. A. Roth, Buffalo, N. Y. App. filed Mar. 23, 1908. The shield throws the wheel out of contact with the switch contacts when passing them, thus preventing the trolley wheels of the trailers from affecting the switch and placing the latter wholly under the control of the leading car.

913,180. TEMPERATURE ANNUNCIATOR; N. D. Wyman, Montclair, N. J. App. filed May 14, 1907. An expansible liquid in a thermometer controls the circuit. A plurality of contact points are successively connected to the rising column of liquid. An arm is adjusted to any particular contact point so as to vary the point when the alarm rings.

913,183. TELEGRAPH TRANSMITTING MACHINE; J. C. J. Alderson, El Casco, Cal. App. filed Sept. 4, 1906. For sending messages at a high rate of speed by means of a vibrator forming one terminal of a circuit with a plate for regulating the vibration of the vibrator and a key to release the vibrator.

913,209. ARC LAMP; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed May 7, 1907. An electromagnet and armature are provided, the latter co-operating with one of the electrodes to permit them to separate to strike the arc, together with a retarding device and a lost motion connection between it and the armature, so as to retard the remainder of the movement of the electrode.

913,218. PROCESS OF RECLAIMING DEVULCANIZED RUBBER; E. E. Albert Georg Meyer, New Brunswick, N. J. App. filed April 29, 1908. Mixes devulcanized rubber with a resinous soap heats to above 120 deg. C., and during a portion of the treatment compresses the material.

913,240. ROLLER-BEARING TROLLEY; W. H. Sheasby, Los Angeles, Cal. App. filed Jan. 28, 1906. A pin is carried by the harp and an insulating tube surrounds the pin with a sleeve around the tube, rollers on the sleeve, a case around the rollers, insulating means around the case and a hub around the case insulating means, together with a wheel rim carried by the hub and a brush contacting therewith.

913,264. CABLE TERMINAL; E. E. Cook, Cleveland, O. App. filed June [illegible], 1908. A cast box contains the cable and is provided with a projecting end, which prevents rain or moisture from blowing through the passages through the end into the box. The box is divided into compartments for the aerial and cable conductors, respectively.

913,[illegible]. METHOD OF CONTROL FOR MOTOR SYSTEMS; I. Greenfield, Cleveland, O. App. filed [illegible]. Includes a series-wound motor, means for changing the voltage of the circuit from a low to a high voltage. Reduces the impedance of the circuit as the voltage increases, breaking the low voltage connections before making the high voltage connections.

913,[illegible]. SYSTEM OF ELECTRICAL CONTROL FOR MOTOR VEHICLES; I. Greenfield, Cleveland, O. App. filed Jan. 28, 1908. A series-wound motor, together with means for producing a low and high voltage, a controller and connections, the controller varying the connections so as to produce a high or low resistance circuit, including the motor, to change the circuit from low to high voltage

and to change from low resistance to high resistance prior to changing from low to high voltage.

913,108. ELECTRIC ARC LAMP; W. R. Ridings, Stretford, England. App. filed Feb. 26, 1907. Cuts out the coils which operate the striking and feeding mechanism of the lamp as soon as the arc is formed, the coils being cut in again by means of a shunt-wound magnet when the electrodes are required to feed.

913,309. ELECTRIC SIGN; B. F. Salisbury, Syracuse, N. Y. App. filed Sept. 16, 1907. An electric sign composed of two plates bolted together with a series of lamp receptacles of special construction clamped between the plates so that lamps may be inserted on opposite sides of the plates.

913,351. MANUFACTURE OF SILICON CARBID; E. L. Tone, Niagara Falls, N. Y. App. filed Feb. 13, 1907. The process of making dense silicon carbid, which consists in heating a porous mass of crystalline silicon carbid in proximity to commingled vapors of substances containing carbon and silicon to a temperature sufficient to cause the carbon and silicon to combine throughout the pores of the silicon carbid mass.

913,363. SYNCHRONIZING; MEANS FOR ELECTRICAL APPARATUS; A. C. Crehore, Yonkers, N. Y. App. filed July 17, 1903. Provides means for sending special synchronizing electrical impulses over the line without interference with other transmission that may take place on the same or another line at the same time. Uses an alternating current for synchronizing, which is transmitted continuously over the line.

913,372. MEANS FOR SIGNALING OR EFFECTING OPERATIONS BY MEANS OF SOUND VIBRATIONS; John Gardner, Knott End, near Fleetwood, Eng. App. filed May 4, 1907. A submarine signaling system for use on ships in which a telephone transmitter is arranged in the hull with its diaphragm immersed in the water. Microphone contacts are operated by the diaphragm to control a signaling instrument which is contained in a local circuit on the ship.

913,383. CIRCUIT CONTROLLER; S. Holland, Park River, N. D. App. filed Dec. 11, 1907. For multiple cylinder explosion engines, for varying the time of contact; makes use of a circular casing into which the contacts project radially and a shaft carrying a roller which rotates in the casing to make successive contacts. Details.

913,390. ELECTRODE FOR GAS ELEMENTS; E. W. Jungner, Kneippbaden, Norrkoping, Sweden. App. filed May 13, 1907. A galvanic gas element in which one of the electrodes is of carbon of such high porosity as to be incapable of retaining enough of the electrolyte to fill its pores.

913,415. METHOD OF OPERATING ALTERNATING-CURRENT MOTORS; R. D. Mershon, New York, N. Y. App. filed Jan. 25, 1904. Varies the speed of alternating current motors having different numbers of poles by changing the number of poles so that the motor with the new number of poles has an equal torque at the lower speed corresponding to the torque at the higher speed.

913,419. INSULATING TROLLEY-WIRE HANGER; L. W. Moran, Grafton, O. App. filed Feb. 7, 1908. A three-piece hanger having upper and lower metallic members with an insulating stem between them.

913,430. METHOD OF PRECIPITATING METALS ELECTROLYTICALLY; A. Ramen, Helsingberg, Sweden. App. filed Aug. 27, 1906. Electrolyzes a solution containing readily electrolyzible metals while maintaining a solution of ferous salts, substantially free of such metals, about the anode of the electrolytic cell. The latter solution acts as a depolarizer.

913,437. AUTOMATIC STARTER FOR CONTINUOUS-CURRENT ELECTROMOTORS; G. A. Schoeller, Mulheim-on-the-Ruhr, and Herman Sundhausen, Essen-on-the-Ruhr, Germany. App. filed March 12, 1907. A solenoid operated by a maximum current throws in a resistance in starting and another solenoid whose circuit is closed by the maximum solenoid cuts out the resistance.

913,439. DISK INSULATOR; Louis Steinberger, New York, N. Y. App. filed Nov. 27, 1905. Comprises a disk and a neck integral therewith, the disk and neck being both provided with corrugations so as to provide increased surface for surface leakage.

913,451. TELEPHONE EXCHANGE SYSTEM; G. Babcock, Rochester, N. Y. App. filed July 7, 1905. Prevents voice currents coming from the transmitter from being heard by the receiver at the substation. The cord circuit at the central exchange is divided into two inductively separated parts provided with repeating coils, which repeat the voice currents from one line to the other, and so arranged that the voice currents from either station pass differentially through the receiving coil and the repeating coils at the central exchange, and then serially through the line limbs of the other substation.

913,480. AUTOMATIC SWITCH AND STAND FOR PRESSING-IRONS; F. E. Emery, New York, N. Y. App. filed Mar. 27, 1908. A movable electric switch on the stand is operated by the sadiron to close the circuit, and an indicator shows whether the switch is opened or closed.

913,481. AUTOMATIC ELECTROMAGNETIC SWITCH AND STAND FOR PRESSING-IRONS; F. E. Emery, New York, N. Y. App. filed Nov. 24, 1908. An electromagnetically operated switch controls the electrical heating of the pressing-iron, and a signal indicator indicates whether the switch is open or closed.

913,494. ALARM DEVICE FOR GUN TURRETS; J. L. Hall, Schenectady, N. Y. App. filed May 20, 1908. Gives an alarm when the limit in permit the movement of the guns of one turret toward the other turret on the ship has been reached, so as to avoid the danger of the blast from one turret injuring those in the other turret.

913,512. STARTING DEVICE FOR ELECTRIC MOTOR; S. C. D. Knecht, Schenectady, N. Y. App. filed Jan. 26, 1907. A starting switch and spring returned arm and a no-voltage magnet for retaining it in running position, an automatic circuit breaker in shunt with the arm, which opens the main circuit before the arm reaches the off position.

913,514. MULTIPLEX TELEPHONY; M. C. A. Latour, Paris, France. App. filed May 27, 1907. Superimposes on the positive half-waves of an alternating current a series of fluctuations from a telephone transmitter; superimposes on the negative half waves the fluctuations of a second transmitter. Provides suitable means for separating the pulsations.

913,528. SIGNALING SYSTEM; R. H. Marriott, Brooklyn, N. Y. App. filed May 17, 1906. The combination of submarine bell apparatus and telephone, the bell and telephone being located under water for leading positions of vessels in harbors. The bell is located underneath the water at the starting end, and a telephone receiver is located underneath the water on the ship. A wireless transmitter send signals. The operator on the ship receives the wireless signals and a little later the sound of the bell. By noting the difference in time between the signal and the sound, the distance between transmitter and receiver may be ascertained.

913,541. ELECTRIC MOTOR FOR HIGH TENSION CURRENTS; S. Myschkin, New Alexandria, Russia. Filed Oct. 30, 1908. An electrostatic motor without magnetic field consisting of a dielectric disk and a plurality of insulated charges coating thereupon.

913,542. TROLLEY SAFETY DEVICE; H. Nannenhorn, Chicago, Ill. App. filed April 15, 1908. Automatically breaks the circuit through a severed section of trolley wire between the supports thereof so as to avoid danger to pedestrians. Details.

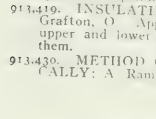
913,547. TURNBUCKLE FOR TROLLEY WIRES; H. Standwood Ogden, Mass., Pa. App. filed Oct. 19, 1908. For taking up slack in the wire without interrupting the passage of the trolley wheel upon the wire. Details.

913,557. BLOCK SIGNAL SYSTEM; G. S. Pfarrer, Nashville, Tenn. App. filed June 9, 1905. A block signal system for single track roads comprising an electrically controlled, manually operated signal with operating mechanism, including a coil circuit with means for preventing the energization of the circuit except when the track is free at one side of the signal and a portion of the track at the other side is occupied by a train.

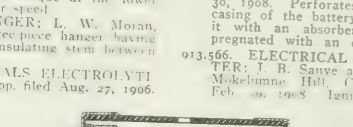
913,562. BRUSH SPRING FOR DYNAMOS AND MOTORS; J. H. Poole, Washington, D. C. App. filed March 19, 1907. An antifriction roller is mounted at the free end of the brush spring, which forms the bearing surface for the spring so as to permit high speed vibrations to take effect by lateral movements of the roller without transmitting any of said movement to the brush.

913,563. METHOD AND APPARATUS FOR REVIVIFYING DRY-CELL BATTERIES; H. B. Ramey, Alexandria, La. App. filed June 30, 1908. Perforates the outer zinc casing of the battery and surrounds it with an absorbent material impregnated with an electrolyte.

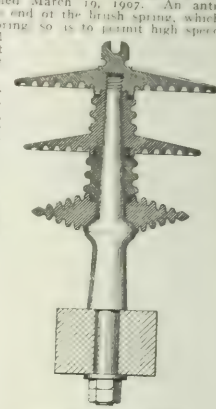
913,566. ELECTRICAL FUSE SPITTER; L. B. Sauve and F. Bernardi, Mokelumne Hill, Cal. App. filed Feb. 29, 1908. Ignites the fuse by means of a circuit controlled by a push button, the fuse being provided with a tubular cap through which the wires pass that ignite it.



913,081.—Contact for Electric Controllers or Switches.



913,105—Electric Current Indicator



913,436—Disk Insulator

913,579. ELECTRIC BROILER; G. E. Stevens, Lynn, Mass. App. filed Oct. 16, 1907. A grid, together with an electrical heating unit of an elongated form in thermo relation with the grid.

913,584. CAM FOR LAMP-SOCKET KEYS; G. B. Thomas, Bridgeport, Conn. App. filed Dec. 18, 1907. The cam is cup-shaped and made of sheet metal of oblong form.

913,588. ADJUSTABLE COUPLING FOR ELECTRIC INSTALLATION TUBES; W. H. Vibber, New London, Conn. App. filed Jan. 2, 1909. A coupling sleeve having slots at the ends with yielding binding straps entering the slots which hold the tubes in the sleeve.

913,607. TELEPHONE CALL MECHANISM; W. E. Zabst, Portage, Wis. App. filed July 8, 1908. Telephone calls for party lines with means for preventing the operation of the signal bells of the not wanted subscribers. Provides a motor for operating the controlling device for the signals, together with a latch, which normally holds the motor and releases it when the party calls.

913,613. CALL-DISTRIBUTING TELEPHONE EXCHANGE DETAILS; S. H. Browne, Pittsburg, Pa. App. filed Aug. 3, 1905. A partly automatic, partly manual telephone exchange system comprising a line relay, a delay relay, a magnet which restores the exchange switch to a position of rest, and suitable circuits in which the parts are arranged. Details.

913,615. STREET CAR TROLLEY POLE WHEEL; S. Bryan, San Diego, Cal. App. filed June 20, 1907. A trolley pole with an arm pivoted thereto intermediate of its ends and adapted to swing laterally out of the line of the pole, together with a wheel mounted on the outer end of the arm.

913,616. ELECTRIC METAL-WORKING APPARATUS; A. E. Buchenberg, Toledo, Ohio. App. filed June 25, 1908. Welds the ends of rings by providing in combination with the main work-clamping (or contact parts), auxiliary clamping parts which firmly grip the work and act to force the ends thereof together when any slipping occurs between the main clamping parts and the work.

913,660. DYNAMO-ELECTRIC MACHINE; L. Lyndon, East Orange, N. J. App. filed July 6, 1908. Carried by the axle of the car, and formed in separable sections, the rotor being secured to the axle and the stator inclosing the rotor and suspended from the truck pieces independently of the axle.

913,669. BURGLAR ALARM; C. G. Munsell, Sidney, Ia. App. filed Aug. 15, 1907. For doors and windows. A closed circuit is open by circuit breakers when the door or window is open. Details.

Rossiter, Mac Govern & Co.

ESTABLISHED 1893 (INCORPORATED)

ALTERNATING AND DIRECT-CURRENT GENERATORS AND MOTORS

Electrical Apparatus of All Kinds

WEST STREET BLDG., 90 WEST STREET, NEW YORK

TELEPHONE, CORTLANDT 4105

DIRECT CURRENT GENERATORS
500-600 Volts

1—500 K.W. Westinghouse 320 R.P.M.
1—500 K.W. General Electric 330 R.P.M.
2—400 K.W. General Electric 625 R.P.M.
2—400 K.W. Westinghouse 400 R.P.M.
2—300 K.W. General Electric 400 R.P.M.
1—250 K.W. Walker 475 R.P.M.
1—250 K.W. Westinghouse 480 R. P. M.
2—225 K.W. General Electric 450 R.P.M.
2—225 K.W. Westinghouse 575 R.P.M.
1—200 K.W. Westinghouse 510 R.P.M.
1—100 K.W. General Electric 650 R.P.M.
1—100 K.W. General Electric 650 R.P.M.
1—60 K.W. Edison 825 R.P.M.

DIRECT CURRENT GENERATORS
220-250 Volts

1—250 K.W. General Electric 400 R.P.M.
1—200 K.W. Triumph 500 R.P.M.
1—150 K.W. General Electric 515 R.P.M.
2—100 K.W. Westinghouse 500 R.P.M.
2—65 K.W. Eddy 700 R.P.M. "G"
1—65 K.W. General Electric 875 R.P.M.
1—50 K.W. Sprague Electric 720 R.P.M.
1—40 K.W. Eddy type "G" 850 R.P.M.
1—30 K.W. General Electric 1050 R.P.M.
1—22½ K.W. Westinghouse 750 R.P.M.
1—22½ K.W. Crocker Wheeler 850 R.P.M

We have other sizes in stock in our warehouses, overhauled and ready for immediate shipment. Send for list of Electrical Apparatus.

SEND FOR COMPLETE STOCK LIST

COMMONWEALTH EDISON CO.

REPAIR SHOPS

76 MARKET ST., CHICAGO. TELEPHONE RANDOLPH 1280.

FIRST-CLASS EQUIPMENT THROUGHOUT

DYNAMOS, ARMATURES, MOTORS, ARC LAMPS
INSTRUMENTS, HIGH GRADE MACHINE
WORK OF ALL KINDS

CORRESPONDENCE SOLICITED

SPARKING

reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All of this may be avoided if you use



The only article that will prevent sparking. Will keep the commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

It will put that high gloss on the commutator you have so long sought after

Send for Stick **50c. PER STICK** **$5.00 PER DOZ.**

For Sale by All Supply Houses or **K. McLENNAN & CO.** Sole Manufacturers

Room 411—130 Dearborn St., CHICAGO

POSITIONS WANTED

The rate for "Positions Wanted" advertisements of forty words or less is one dollar an insertion; additional words two cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical World, 239 West Thirty-ninth Street, New York, or 590 Old Colony Building, Chicago, as advertisers may desire.

POSITION WANTED.—A thoroughly experienced man in both technical and executive position, with the very best of references, desires position in charge of an electric light or power property about March 1. Address No. 5257, care of Electrical World, New York.

POSITION wanted by capable man with practical business and mechanical ability as superintendent for electric light company; employed 10 years as superintendent; extensive experience installing electric light and power plants, transmission lines, house wiring, etc.; technical graduate; best references. Address No. 5256, care of Electrical World, New York.

POSITION WANTED.—Five years' experience in railroad general office work, various departments, including legal stenographer; three years' college work in electricity; graduate Westinghouse engineering apprenticeship course; familiar with shop methods, testing, process specification work; references. Address No. 5305, care of Electrical World, New York.

POSITION wanted as manager of an electric light and power property in city of 30,000 or under by a thoroughly experienced man; five years as manager in last position; can give best of references. Address No. 5274, care of Electrical World, New York.

A TECHNICAL graduate, with several years' experience in electrical and mechanical engineering and sales work, would like to correspond with manufacturers of A1 products who desire representation either in New York or on the Pacific Coast. Address No. 5372, care of Electrical World, New York.

POSITION WANTED.—Technical graduate, age 25, associate A. I. E. E., as chief electrician or electrical engineer with electric railway or other enterprise, experienced in operation of power and substations; various systems and voltages up to 60,000; familiar with the care and operation of heavy machinery and maintenance of electric rolling stock; references from present employers; Middle Atlantic States preferred. Address No. 5328, care of Electrical World, New York.

DRAFTSMAN (31), mechanical engineering graduate, eight years' designing and drafting experience on steam and gas engines, general machinery, switchboards and high and low tension switching apparatus, oil switches and circuit breakers, hand motor, solenoid or air operated, snap or knife switches, relays, etc., desires position; first-class layout and detailer. Address No. 5223, care of Electrical World, New York.

POSITION WANTED.—Practical young man, fully competent, married, desires position assuming charge of hydro-electric plant or of complete small town lighting and power installation and business at salary of $100 per month; 10 years' splendid experience; no hurry. Address No. 5335, care of Electrical World, New York.

POSITION wanted as superintendent or engineer in electric light and power plant; age 37; married and strictly temperate; thoroughly competent; technical knowledge in steam-electric work; references given; guarantee to make your plant pay. Address Oscar King, Upper Sandusky, Ohio.

EXPERT instrument and meter man wants position with electric company to test and repair all electrical instruments and wattmeters used on system; extensive experience in this line; at present employed by large manufacturer of instruments and meters, but desires change. Address No. 5350, care of Electrical World, New York.

POSITION wanted as designer of D. C. motors and generators; experienced electrical engineer; technical graduate; 35. Address No. 5358, care of Electrical World, New York.

POSITION WANTED.—Technical and practical man, with 12 years' mechanical and electrical experience, desires position as assistant, electrical engineer, superintendent of electric railway or central station; now employed by large electric railway company; thoroughly competent and reliable; Middle West preferred. Address No. 5349, care of Electrical World, New York.

POSITION WANTED.—Salesman, with 20 years' experience in handling electrical supplies, including incandescent and arc lamps, dynamos and motors and who is also competent to act as sales manager, is open for position worth $5,000 or over; salary or commission. Address No. 5365, care of Electrical World, New York.

POSITION wanted by electrical engineer, 34, as superintendent or assistant with company manufacturing electrical apparatus; technical graduate; 6 years' experience in designing motors and generators, drafting, handling of stocks; executive ability; references. Address No. 5355, care of Electrical World, New York.

POSITION wanted by technical graduate; competent and practical in the design, construction, testing and operation of railway and lighting plants; moderate salary, with chance of promotion, will be accepted. Address No. 5360, care of Electrical World, New York.

POSITION WANTED.—Technical graduate, with 12 years' practical experience in central station management, desires position as manager or superintendent with progressive lighting and power company; highest-class references. Address No. 5359, care of Electrical World, New York.

SUPERINTENDENT, [illegible] position; 12 years' practical experience on equipment and maintenance; formerly with the General Electric Company and two of the largest roads in the East; can systematize and bring a dilapidated rolling stock to an efficient basis. Address No. 5366, care of Electrical World, New York.

(Continued on page 88)

POSITIONS WANTED

(Continued from page 87.)

POSITION wanted by graduate electrical engineer as assistant superintendent electric plant or factory; eight years' broad experience, two leading companies; served apprenticeship machine shop, steam side, can manage men nationalities. Address No. 5365, care of Electrical World, New York.

ELECTRICAL engineer desires change; technical graduate, experienced in design of motors and generators; familiar with shop and office systems; West preferred. Address No. 5361, care of Electrical World, 590 Old Colony Building, Chicago, Ill.

COMMERCIAL engineer, with long experience in power engineering, motor applications, proper motor equipments for factory and analyzing cost of steam drive vs. electric motor drive, also familiar with illuminating engineering, open for engagement with central station or motor manufacturer; technical graduate; 29 years old; best of references. Address No. 5368, care of Electrical World, New York.

IF YOU are looking for a man to manage or superintend your plant, one who has had 20 years' practical and technical experience in the overhead, underground and general plant construction and maintenance of both electric light and power plants, in every detail, I am positive I can fill the place; at present superintendent of two plants; desire change; present employers' and other reference; write for further details. Address No. 5369, care of Electrical World, New York.

POSITION wanted with interurban railway, large power company or electrically operated mine in Middle or extreme West; age 25; six years' experience in manufacturing, testing, engineering and railway construction with large Eastern company, with whom am still connected. Address No. 5371, care of Electrical World, 590 Old Colony Bldg., Chicago, Ill.

ENGLAND.—Engineer, A. M. I. M. E., A. M. I. E. E., shortly returning to London, could execute commissions for reliable firm; advertiser has wide experience (consulting, contracting and commercial) in Great Britain; technical college training; would consider representation of good American house. Address No. 5344, care of Electrical World, New York.

ENGINEER, 10 years' experience designing and manufacturing electrical controlling and heating apparatus, desires a position where technical ability is demanded. Address No. 5342, care of Electrical World, New York.

POSITION WANTED.—A graduate engineer who in one year as superintendent has converted a municipal light and water-works plant giving very poor service and losing $14,000 a year into a plant furnishing absolutely continuous service and making $1,000 cash profit per month will consider an offer for his services about May 1 next; references, substantiated by the official reports of the city, will be sent those interested. Address No. 5345, care of Electrical World, New York.

HELP WANTED

The rate for "Help Wanted" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical World, 239 West Thirty-ninth Street, New York, or 590 Old Colony Building, Chicago, as advertisers may desire.

(In replying to a "Want" advertisement, original letters of recommendation should NOT be forwarded.)

WANTED.—Manufacturers' agents and salesmen on commission by manufacturers of a high-grade incandescent electric lamp. Address No. 3320, care of Electrical World, New York.

WANTED.—Patent office draftsman familiar with electrical work; steady position with [illegible] in New York City; state age, experience and salary expected. Address No. 5330, care of Electrical World, New York.

WANTED.—We want a bright clear [illegible] in our sales department, they must be well-educated, high-grade, technical men; will be located in [illegible] States; salary to start $75 per month, with actual traveling expense, will be on the road about one-half the time; extra fine future for man who can make good; applications must be made in person. Address American Electric Fuse Co., Muskegon, Mich.

WANTED.—An experienced electrical engineer, thoroughly familiar with the electrical and mechanical design of D. C. motors; must be a technical graduate; write fully, giving age, qualifications, experience and salary expected. Address No. 5242, care of Electrical World, New York.

WANTED.—By a large telephone and switchboard factory, a man for the position of assistant general foreman. Address No. 5317, care of Electrical World, New York.

WANTED.—The undersigned invites applications for a position of responsibility with an electric railway company in Western Canada; applicants must have a thorough knowledge of all branches of interurban and street railway operation, including tariffs and dispatching; give age, experience and particulars as to position now held, also state salary expected. Col. A. T. Thompson, Trust Bldg., Spark St., Ottawa, Canada.

WANTED.—A working foreman for electrical repair shop in New York City; must be first-class armature winder and one who has held position before as foreman in a repair shop; state salary and experience. Address No. 5321, care of Electrical World, New York.

CHIEF DRAFTSMAN.—We want a man who has had extensive experience on both small and large work along the line of motors, generators and other electrical machinery; he should be a good executive and thoroughly up to date; write in confidence, giving full information, age and salary expected. Address No. 5325, care of Electrical World, New York.

WANTED.—First-class hydro-electric engineer to act as consulting engineer and general superintendent to the British Columbia Electric Railway Company, Ltd. Address correspondence to General Manager, Vancouver, B. C.

WANTED.—A progressive company in Southern city has an opening for a young man to solicit electric lighting and power business; must have had experience and be willing to work for a moderate salary. Address No. 5326, care of Electrical World, New York City.

WANTED.—Solicitors for incandescent lighting or power by an electric light company operating in one of the largest cities of Ontario; only men of experience and who have been successful in this particular work need apply; application to state age, experience, references and salary required. Address No. 5343, care of Electrical World, New York.

A CONSULTING engineer in New York City specializing in isolated plant design wishes to engage an additional assistant engineer; state age and in detail what knowledge and experience you have of steam and electric plant design; state salary. Address No. 5364, care of Electrical World, New York.

PHOTOMETRIST.—Young man, preferably with college training and practical experience in photometric work, to assist in tests of all kinds of lamps and illuminants; a properly equipped man can develop an excellent position in this connection. Address Electrical Testing Laboratories, 80th St. and East End Ave., New York, N. Y.

WANTED.—Salesmen well acquainted with electrical trade by a storage battery company. Apply "1-2-3-4," Electrical World, New York.

WANTED.—Cashier for gas and electric light office in town of 25,000; only parties having experience and can furnish best of references need apply; state salary expected. Address No. 5362, care of Electrical World, New York.

WANTED.—Competent [illegible] engineer, practical experience in machine [illegible] and testing of [illegible] power plant, possess of engineering ability on designing turbines and traction regulators preferred, state salary expected and date experience and former employers. Address [illegible] care of Electrical World, New York.

MISCELLANEOUS

The rate for "Miscellaneous" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical World, 239 West Thirty-ninth Street, New York, or 590 Old Colony Building, Chicago, as advertisers may desire.

FOR SALE.—Thoroughly established, going construction business; purchaser should have $2,000 to handle business properly. Address No. 5344, care of Electrical World, New York.

SWEDISH electrical engineer, with long experience in the States and in Europe, now visiting this country and soon to return home, wishes to introduce high-grade American electrical and mechanical machines and apparatus on the Scandinavian and possibly the Russian market; patents and novelties in gas and gasoline motor line suitable for manufacturing in Europe with Swedish capital are desired; also attractive electrical specialties. Address "Export License," No. 5315, care of Electrical World, New York.

ELECTRICAL INVENTORS should employ technical patent attorney, because Patent Office examiners are technical experts; but no examiner or other patent attorney than undersigned is member both A. I. E. E. and A. S. M. E. Mail invention for free advice, opinion, estimate and booklet. Delay dangerous. Edward P. Thompson, M. E., Regst. Pat. Atty., 34 East 32d St., New York. Tel. 1554 Madison Sq.

AGENCY wanted by electrical concern situated in good locality in New York City; will consider any good proposition; can introduce goods to both wholesale and retail trade if necessary. Address No. 5370, care of Electrical World, New York.

FOR SALE.—A modern equipped electric light plant in one of the richest towns in Missouri; 17 years' unexpired franchise; plant free from debt; business well established; correspondence solicited. Address No. 5356, care of Electrical World, New York.

FOR SALE.—Electrical supply and contracting business, having the cream of the customers in a town of 20,000 inhabitants; for sale on account of sickness. Address No. 5357, care of Electrical World, New York.

PROPOSALS

The rate for "Proposal" advertisements is 15 cents per line, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

NOTICE.

Applications are invited for the post of Chief Electrical Engineer to the Government of Mysore, pay R 1,500 (£100) per month; passage money to and from India will be paid by Government, on condition that applicant binds himself to serve for at least 3 years, with option for renewal on either side. Copies of testimonials, &c., to be forwarded with applications; and they should reach the undersigned not later than the 15th of May, 1909.

None but those duly qualified for the place need apply. Any other terms to be stated.

W. J. W. HULSLIN,
Secretary to the Govt. of Mysore,
Public Works Department.
Bangalore, 6th January, 1909.

Frank MacGovern J. Warren Archer

MacGovern, Archer & Co.

Electrical and Steam Machinery

114-118 Liberty Street: 'PHONE: CORT. 5577 **NEW YORK**

Direct Current Direct Connected Units

2—200 K.W., General Electric, 8 pole, 250 volts, 200 r.p.m., each with a 14&28x16 cross compound Ball & Wood engine.
2—150 K.W., Crocker-Wheeler, 115-125 volts, 8 pole type, speed 160 r.p.m., each with a heavy duty 4 valve type horizontal McIntosh & Seymour engine.
1—100 K.W., Bullock, 250 volts, 400 amp., direct connected to 12&19x14 tandem compound Erie Ball

A. C. Direct Connected Units (60-Cycle)

1—300 K.W., G. E., 3-phase, ATB, 150 r.p.m., 2300 volts, with 14&28x30 GC McIntosh & Seymour engine.
1—145 K.W., Westinghouse, 2-phase, 257 r.p.m, 2200 volts, with 18x16 horizontal Erie Ball engine.

Alternating Current Dynamos (Belted)

1—300 K.W., Westinghouse, 60 cycle, 2200 volts, 300 r.p.m., 3-phase.
2—200 K.W., G. E., ATB, 60 cycle, 600 r.p.m., 2300 volts, 3-phase.
1—75 K.W., G. E., ATB, 60 cycle, 2300 volts, 900 r.p.m., 3-phase.
1—180 K.W., Westinghouse, 60 cycle, 2300 volts, 514 r.p.m., 2-phase.
2—75 K.W., Westinghouse, 60 cycle, 2200 volts, 720 r.p.m., 2-phase.

Arc Dynamos and Lamps

1—No. 9½ B. Brush, 6.8 amp., oil regulator.
3—No. 10 A. Brush, 9.6 amp.
6—65-Light Western Electric, 9.6 amp.
600 No. 31 Brush LAMPS, 9.6 amp.

DYNAMOS AND MOTORS—ALL IN STOCK

110-125 Volt Direct Current

1—60 K.W., Edison, Compound.
1—55 K.W., G. E., 4 pole, Form H.
1—15 K.W., Edison, Compound.

220-250 Volt Direct Current

1—250 K.W., G. E., 8 pole, 3 bearing.
1—75 K.W., Bullock, 460 r.p.m.
1—50 K.W., Bullock, 460 r.p.m.
1—35 H.P., West., 575 r.p.m., Type S.
3—25 H.P., West., 850 r.p.m., Type S.
1—20 H.P., G. E., 1025 r.p.m., Type CE.
2—15 H.P., West., 560 r.p.m., Type S.
1—10 H.P., West., 635 r.p.m., Type S.
2—7½ H.P., G. E., 900 r.p.m., 4 pole
1—1 H.P., G. E., 1275 r.p.m., Type CQ.

500-550 Volt Direct Current

1—85 H.P., G. E., 800 r.p.m., Type CLB.
1—50 H.P., West., 550 r.p.m. (new).
1—30 H.P., West., 850 r.p.m., Type S.
1—25 H.P., G. E., 650 r.p.m., Type H.
1—20 H.P., West., 1040 r.p.m., Type S.
2—15 H.P., G. E., 1200 r.p.m., Type CE.
1—10 H.P., G. E., 850 r.p.m., Type H.

25-Cycle, 3-Phase Motors

1—50 H.P., G. E., Form L, 500 r.p.m., 550-440 or 220 volts. NEW.
1—75 H.P., West., Type C, 480 r.p.m., NEW.
2—100 H.P., G. E., Form K, 500 r.p.m., 220 or 440 volts. NEW.

60-Cycle, 3-Phase Motors

3—125 H.P., West., Type C, 2200 volts, 720 r.p.m.
2—40 H.P., G. E., Form M., 220 volts, 900 r.p.m.
1—40 H.P., G. E., Form K, 550 volts. 900 r.p.m.
1—35 H.P., G. E., Form M, 220 volts, 600 r.p.m.
2—30 H.P., West., Type CCL, 200 volts, 1120 r.p.m.
1—15 H.P., West., Form K, 550 volts, 600 r.p.m.
1—7½ H.P., G. E., Form K, 220 volts, 1800 r.p.m.
1—5 H.P., G. E., Form L, 220 volts, 1200 r.p.m.
1—2 H.P., G. E., Form K, 110 volts, 1200 r.p.m.

60-Cycle, 2-Phase Motors

4—125 H.P., West., Type C, 2200 volts, 720 r.p.m.
1—100 H.P., G. E., Form L, 220-440 volts, 600 r.p.m.
1—15 H.P., G. E., Form K, 220 volts, 1200 r.p.m.

SEND FOR FULL LIST OF ELECTRICAL AND STEAM MACHINERY ENGINES, BOILERS, ALTERNATING and DIRECT CURRENT MOTORS

DYNAMOS, MOTORS, BARGAINS

Largest finest stock of new and second-hand machines in New York City.

Renting, Repairing

GEORGE BENDER, 82-84 Centre St. NEW YORK

PROMPT DELIVERY

800 K.W. G.E. Dr. cn. 600 volt.
500 K.W. G.E. belted 550 volt.
425 K.W. G.E. Dr. cn. 550 volt.
225 K.W. G.E. Dr. cn. 550 volt.
Belted and dr. cn. Generators at 125 and 250 volts.

60 Cycle Alternators

Good stock of Alternators of all phases.

Engines

18 & 34 x 48 Hamilton
24 x 48 Nordberg Heavy Duty.
16 x 12 Allis Corliss Engine.
Other Corliss Engines, and Automatic Engines.

Watertube Boilers

1200 H.P. in all pressures up to 160 lbs. Our stock changes constantly. Tell us your needs.

STATION EQUIPMENT COMPANY, 204 Dearborn St., Chicago, Ill.

LESS THAN HALF COST.

30-H.P. Liddell Automatic Engine
40-H.P. Ball Automatic Engine
100-H.P. H. S. & G. Throttling Engine
100-H.P. Ball Automatic Engine
14″ x 36″ Murray Corliss Engine
14″ x 36″ Allis Corliss Engine
18″ x 36″ Allis Corliss Engine
18″ x 42″ Frick Corliss Engine
20″ x 42″ Green Corliss Engine
22″ x 48″ Allis Corliss Engine

SPLENDID VALUES, MUST BE SOLD IMMEDIATELY

GREENSBORO SUPPLY CO.

GREENSBORO, N. C.

CINCINNATI PRIVATE WIRE & TELEPHONE CONNECTION KANSAS CITY, MO.

JOHN A. STEWART ELECTRIC COMPANY.

ELECTRICAL AND STEAM MACHINERY FOR IMMEDIATE SHIPMENT

A. C. DIRECT CONNECTED UNITS
1,500 K.W., 60 cy., 3 ph., 2,300 v., R.F. Alternator d. c. to Horiz. H.D. Engine
1,200 K.W. 60 cy. 3 ph. 110 v. R.F. Alternator d. c. to Horiz. Cross Comp. H.D. Engine.
600 K.W. Westinghouse 60 cy. 2 or 3 ph. R.A. Alt. d. c. to H.D. Engine
600 K.W. Stanley 60 cy. 2 or 3 ph., Alt. d. c. to Vertical Comp. Engine.
600 K.W. G.E. R.F. Alt. 60 cy. 3 ph. 2,600 v. d. c. to Tandem Comp. auto. Engine
250 K.W. Stanley 60 cy. 2 or 3 ph. 2,300 v. Alt. d. c. to H.D. Comp. Eng.
200 K.W. Stanley 60 cy. 2 or 3 ph. 2,300 v. Alt. d. c. to H.D. Engine
A. C. BELTED
1,500 K.W., 60 cy., 3 ph., 2,300 v., 100 r.p.m. Alternator
600 K.W. Stanley 60 cy. 2 or 3 ph. 2,600 v. R.F. Alt. 257 r.p.m.
600 K.W. Bullock 60 cy. 2 or 3 ph. 2300-4,100 v. R.F. Alt., 600 r.p.m.
250 K.W., Stanley, 60 cy. 2 or 3 ph., 2,300 v., R.F. Alt. 150 r.p.m.
200 K.W., Stanley 60 cy., 2 or 3 ph. 2,300 v. R.F. Alt. 300 r.p.m.
150 K.W. Stanley 60 cy. 2 or 3 ph. 2,300 v. R.F. Alt. 720 r.p.m.
180 K.W. Westinghouse 60 cy. 2 ph. 2,300 v. 600 r.p.m.
D. C. DIRECT CONNECTED UNITS
125-250-550 volt Generators d. c. to H.D. Steam Engine
D. C. BELTED
125-250-550 volt Generators d. c. to H.D. Steam Engine
600 K.W. Westinghouse 60 cy. 2 or 3 ph. 2,300 v. 257 r.p.m.
Alternators
Motor Generator Sets
Water Tube Boilers
Motors
Belted and Direct Current
Wound armature equipment



YOU CAN SAVE 50%. TRADE PROPOSITION ACCEPTABLE

ENGINES

1,000 H.P. Triple Expansion Corliss.
600 H.P. Triple Expansion Vert. McI. & S.
20" and 36"x18" Wetherill Cross Comp.
20" and 31½"x27" Russell Cross Comp.
18" and 30"x16" Westinghouse Vert.
16" and 30"x18" Hamilton Corliss.
16" and 30"x18" Cooper Corliss Tandem.
16" and 28"x16" Erie Ball Cross Comp.
18" and 24"x16" Russell Tandem Comp.
14" and 24"x16" Hamilton Corliss.
14" and 20"x24" Buckeye Tandem.
11½" and 28"x17" McIntosh & Seymour Tandem.
30"x48" Cooper Corliss.
24"x48" Sioux Corliss, Heavy Duty.
24"x48" Hamilton Corliss.
22"x42" Harris Corliss.
22"x42" Slater, Heavy Duty.
18"x24" Russell 4-valve.
16"x36" Putnam 4-valve.
14"x36" Lane & Bodley Corliss.
20"x36" Buckeye, Heavy Duty.
15½"x15" Armington & Sims.
11"x16" Straight Line.
14"x14" Harrisburg, Heavy Duty.
13"x14" Ames Automatic.
12"x14" Harrisburg Ideal.

DIRECT-CONNECTED SETS

200 K.W. G. E., 125-volt and Corliss Engine.
2—125 K.W. Westinghouse 220-volt, Westinghouse Comp. Engines.
75 K.W. Sturtevant, 220-volt Unit.
75 K.W. 125-volt Unit.
50 K.W. 220-volt Unit.
40 K.W. Sprague 125-volt and Vertical Engine.
17 K.W. Eddy 125-volt Westinghouse.
2½ K.W. 125-volt Unit.

A. C. APPARATUS

180 K.W. G. E. 25-cy., 13,200-volt, 3-phase, Dir. Con. Slater Engine.
350 K.W. 2-phase Dir. Con. Set.
300 K.W. and 250 K.W. 3-phase Dir. Con. Sets.
300 K.W. and 250 K.W. Monocyclic, 60 cy., Dir. Conn. Units.
200 K.W. Westinghouse 3-phase, 60 cy., 2200-volt Alternator.
2—175 K.W. Stanley 25 cy., 5500-volt, 3-phase Alternators and Turbines.
75 K.W. Westinghouse s. p., 2200-volt, 60 cy.
60 K.W. Stanley 2-or 3-phase, 60 cy. Alternator.

Send for *complete* **"Bargain List No 7."**

Joseph H. Thompson, Jr.

17 BATTERY PLACE
NEW YORK

INVERNESS, SCOTLAND

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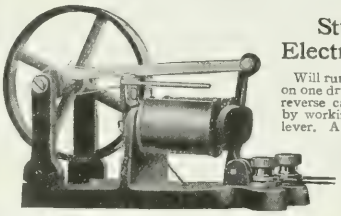
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The International Electrotechnical Commission.

As announced elsewhere in these columns, the Sub-committee on Light Standards of the British National Committee of the International Electrotechnical Commission expects to make a satisfactory report upon the question of an international candle. So far as we can learn, no definite steps have yet been taken for a similar representation before the Electrotechnical Commission of the American views on this important subject. While the Illuminating Engineering Society has done excellent work along the lines of that now undertaken by the commission, and originated the plan of securing the collaboration of the gas interest in the effort which it has made to fix an international candle, the society has no formal relations with the commission, which in this country is represented by the American Institute of Electrical Engineers, one of the several national bodies contributing financially to its support. It will be remembered that the standard candle in this country was originally obtained from England and was adjusted into original agreement with the British standard candle. During recent years, Great Britain changed her light standard from the candle flame to the Pentane gas flame. The change has apparently involved a departure of several per cent from the original value of the candle-power, so that America was left with a deviation from the concert of the Powers through no act of her own. In view of the present diversity of luminous standards, including the hefner, Carcel, Pentane candle and the old British candle, still the Bureau of Standards urged, at the instance of the Illuminating Engineering Society, the French sub-committee last year to make a motion in favor of an international candle in the neighborhood of the bougie decimale. The French committee acceded to the proposition and brought the matter up at the council meeting of the commission, in London, last October. No action was taken at the time and the matter was left in the hands of a sub-committee for further consideration.

It is earnestly to be hoped that the report foreshadowed from the British sub-committee may pave the way for the adoption of an international unit of luminous intensity in the neighborhood of the bougie decimale or 10/9 hefners. This international standard might be defined conveniently in terms of national flame standards, but its maintenance should be left to the national standardizing laboratories through the medium of seasoned incandescent lamps, interchanged and intercompared at regular intervals. If the international standard is not maintained by intercomparison of incandescent lamps, it will be likely that after two or three years a new discrepancy will present itself. Thus, if a certain ratio between the various flame standards were forthwith universally adopted as an international candle, and each national laboratory endeavored to maintain this new candle by reference to its own standard flame, it is quite possible that after a few years the international candle as kept in one country might be found to be perceptibly different from that kept in another country, for the reason that flame

standards have not yet shown themselves to be permanently reproducible in different laboratories at different times; whereas it has been found that a batch of well seasoned and standardized incandescent lamps will probably maintain their rating.

Reflection of Electrical Waves.

When an electromagnet wave runs over the surface of a uniform conducting wire, it obeys very simple laws. The current strength in the wave is equal to the voltage in the wave divided by the surge resistance of the conductor. This surge resistance is the geometrical mean of the linear inductance of the conductor and the linear elastance of the dielectric, provided that the linear loss of power in transmission is very small compared with the power that is being transmitted. The velocity of transmission in such a wave is the velocity of long-wave light in the dielectric. The electric volume energy is at all points locally equal to the magnetic volume energy. The electric intensity in electric units is at all points locally equal to the magnetic intensity in magnetic units. The rate of power transmission at any point on the conductor is the sum of the equal electric and magnetic energies in a slab of the dielectric of unit length, multiplied by the wave speed. When such a wave leaves one uniform line to enter another uniform line, the wave is undisturbed if the surge resistance of the new line happens to be equal to the surge resistance of the old line. If the two surge resistances are, however, unequal, the wave will be broken at the transition point, in such a manner that part of the wave is reflected backward from the junction along the old line, while the remainder is sent on over the new line. The ratio of transmitted to arriving components is commonly called the coefficient of transmission, and the ratio of reflected to arriving components is commonly called the coefficient of reflection. These coefficients are different in the voltage component or electric flux as compared with the current component or magnetic flux. The coefficient of transmission for the voltage component is the ratio of the new surge resistance to the mean of both surge resistances, while the coefficient of transmission for the current component is the ratio of the old surge resistance to the mean of both surge resistances. Consequently, when the wave strikes a new conductor of enormously great surge resistance, such as a very high impedance line, the voltage component approximately doubles, while the current component nearly vanishes. Whether this effect is a mere momentary surge or is sustained to show on a voltmeter, depends on subsequent waves and their resultant summation.

This subject is developed mathematically by Mr. Louis Cohen in his article on page 632 in this number. It will be seen that the final result at which he arrives is that when the inductance of the receiving terminal apparatus is very high, the voltage in the wave transmitted into it may be nearly double the voltage of the original incoming wave. The phenomena involved in wave motion are very swift and difficult to render evident. For the low frequencies of lighting and power distribution, the sportive behavior of electric waves is ordinarily relegated to the limbo of libraries not frequented by the regular student of electrical engineering. When we come to static disturbances on transmission lines, or to the phenomena of wireless telegraphy, Ohm's law is a law of the millennium, and electric wave behavior demands recognition. Formulas such as those set out in Mr. Cohen's paper are thus steadily coming into greater prominence and practical utility.

Twenty-Five Years.

The American Institute of Electrical Engineers is celebrating this week, with a banquet, the completion of its first 25 years of life. It is true that the charter date of incorporation is April 15, 1884, but some steps toward formation had been taken before that time and it was not until May 13 that the first officers were elected. The present date suits the convenience of the Institute for a celebration better than one a little later, and we may fitly regard this week as rounding out the quarter century, upon which the members are to be heartily congratulated. The Institute has indeed had a wonderful growth that was by no means implied in the struggles and difficulties of its first four or five years. At the present moment it is far and away the largest national technical society of its kind in this country; with very few rivals abroad. It had on March 1 no fewer than 6344 full and associate members. The nearest approaches are made by the American Institute of Mining Engineers with 4261 in March and the American Society of Mechanical Engineers with 3260 in January. Happily it is not upon mere numbers, however, that the body is to be congratulated, but upon years of usefulness and upon the acquisition of influence and material resources with which it is placed in a position to do even better work for the art and the profession in the next 25 years. There are many things not yet attempted by the Institute that are well within its province and which if attempted and done well will strengthen its prestige.

Upon this pleasant anniversary, when congratulations are so eminently in order, and when we may especially felicitate those who took an active share in the creation of this great and powerful organization, it seems peculiarly appropriate to make cordial reference to the services of Mr. Ralph W. Pope, who has been secretary continuously since the annual meeting of May, 1885, when the society was only one year old. This loyal and faithful service to the Institute, unmatched as to official connection with the body, except in one instance, has probably been more effective than any other factor in all this splendid growth. With serenity and sanity Mr. Pope has held to the steady tenor of his work through a score of administrations; and while many of the presidents are entitled to great credit for what they did, Mr. Pope deserves more credit than anybody else for the escape of the society from many things it did not do. Unfailingly a conservative and preservative force, Mr. Pope may always look back upon the Institute period now closing with just feelings of personal pride and gratification. And now as the Institute moves forward into its next quarter of a century, we can only hope and believe that from the rising generation of electrical engineers it will enjoy the continuance of the enthusiastic support that since 1884 has contributed to bring it to the preëminence it enjoys to-day, as the youngest but the largest of the four great national engineering societies.

Methods for Starting Induction Motors.

Additional interest in the comparative merits of various methods for starting induction motors, which were discussed in our issue for Jan. 2 and Feb. 25, is given by an article by Mr. Selby Haar and a letter by Dr. C. P. Steinmetz in this issue. Mr. Haar analyzes the performances of squirrel-cage induction motors when started at lowered voltage obtained respectively by means of auto-transformers and of rheostats in the primary circuits. His conclusions are that on the basis of the disturbance

to the supply circuits, rheostats are inferior to auto-transformers, but that on the basis of cost rheostats are preferable. The facts appear to be that the rheostatic starter affects the voltage regulation of the supply line slightly more than does the auto transformer-starter, but it accelerates the rotor to full speed with somewhat less disturbance than does the latter device; it consumes considerable power during the starting period, while the auto-transformer absorbs very little. The determining factor in the selection of the two types should be the relative cost of the energy dissipated by the rheostatic device during the infrequent starting periods throughout its life, and the extra cost of the auto-transformer starter. Probably such a basis, which seems a fair one for comparative purposes, would prove the rheostatic starter somewhat more advantageous than Mr. Haar's article might lead one to believe.

As pointed out in an editorial in our issue for Feb. 25, lowering the voltage impressed upon the primary terminals of an induction motor is similar to decreasing the e.m.f. supplied to both the field-circuit and the armature terminals of a direct-current shunt-wound motor. Such a method is considered unsatisfactory, and use is made, in practice, of a scheme for maintaining full e.m.f. upon the field-circuit terminals while decreasing the e.m.f. across the armature, thereby obtaining the required torque with the minimum of current from the supply system. An analogy to the latter scheme is found in the rheostatic starter used in the secondary circuit of a slip-ring type of motor. As shown by Dr. Steinmetz in this issue, the secondary rheostatic starter used with a slip-ring motor is far preferable to either an auto-transformer starter or a primary rheostatic starter employed with a squirrel-cage motor. It can easily be shown that on the basis of the performance of the three devices, the secondary rheostatic starter is best, the auto-transformer is next and the primary rheostatic starter last—with almost no difference between the latter two. On the basis of initial cost, the auto-transformer starter comes last, with little difference between the two rheostatic types. When compared on the basis of the simplicity of the whole equipment and the initial cost of the motor and starter, the primary rheostatic device appears to be much ahead of the other two.

The Inaugural Blizzard, Pole Lines and Wireless.

The situation on Inauguration Day points a moral. It also adorns a variety of lurid tales regarding attempts to find out what was going on and how to get there. A blizzard, poles down, as usual, telegrams at first sent 2600 miles from Washington to New York, via Richmond, Atlanta, Cincinnati and Chicago, and then none at all. Telephone service in the same cheerful condition. Wireless working some, but apparently badly queered, and unable to deliver much except expletives about the weather. It is reported that the government wireless was doing something—enough to worry the commercial wireless—and yet very little news came through that or any other channel. For all the outside world knew, Nihilists might have blown up the Capitol, assassinated the chief officers of state, looted the Treasury and escaped on a captured warship during that period of isolation. Now this sort of thing seems, and is, absolutely without excuse in this twentieth century. With the resources of telephone, telegraph and wireless at command, the isolation of the nation's capital ought to be a thing not only impossible but almost unthinkable. Had the original underground Morse line between Baltimore and Washington been in service, the result would have been different. Have sixty years or so of experience in telegraphy made no greater improvement in reliability than this? Every big storm has practically the same result in interrupting service, the present instance being merely a trifle more complete and sensational than usual. It is high time for radical improvement.

As usually constructed, trunk telegraph and telephone lines are mechanically bad. Their weakness lies in the multiplicity of wires that afford lodgement for snow and sleet and a purchase for wind pressure. The strength of a line is limited by its weakest part, and in lines of this kind the pole becomes the weakest part on account of the very large aggregate of wire strains due to loading and wind on the dozens or scores of wires. If telegraph wires are to be overhead, they should be few in number and pushed to high capacity by modern methods of fast mechanical working. It has been over and over again demonstrated that any one of numerous systems of fast telegraphy can increase the capacity per wire many fold. With a few wires of high tensile strength forming a system designed like a first-class power transmission line, the present volume of business could be done without material risk of interruption from storms. Or taking the other line of operations, the lines could readily be put underground like the military telegraph lines in Germany. Going underground involves some technical inconveniences, yet they cannot be considered very serious with the present resources available. Probably a system entirely underground would be neither necessary nor desirable. It would be quite sufficient if the shorter important links went underground, leaving to well-built overhead lines the bulk of the work. In either case, decreased repairs and less loss of business would go far toward covering the extra expense of installation. The telephone situation should be met in a similar manner by using cables or well-built overhead lines in all important stretches.

As to wireless, there is another story to tell. Taught by experience, wireless companies have learned to dodge overland working as far as possible. Hence in the present exigency they were to a certain extent unprepared. The one available private station in Washington got into communication with the outside only with difficulty, partly perhaps on account of interference with the government wireless service, and did not accomplish much. And just at this point it is pertinent to raise inquiry about the syntonic systems of which we have been hearing for the last five years. All sorts of claims are made for them, and yet when really a critical situation arises they fail to come to the front and do things. It is a pity that better syntonic work cannot in practice be done as yet. The fact seems to be that neither sending nor receiving stations are as yet properly selective, and that the steady tendency in the interest of available energy is to use the longest wave practicable, so that selection must be rather exact to do much good. Even the amateurs are using powerful apparatus now, and the complaint comes from the government stations that they cannot really work comfortably until the amateurs have gone to bed. If the government system is really to be effective, arrangements should be made, not to suppress the experimenters, but to require them to register and take out permits, of course without expense, and to work under government regulation so as to secure a minimum of general interference

International Electrotechnical Commission.

At the council meeting of the International Electrotechnical Commission, which was opened by Hon. A. J. Balfour, in October last, the question of an international unit of light was brought forward by the French Electrotechnical Committee. The proposition of the French delegates was, however, adjourned in order that committees of the various electrical engineering bodies of the world contributing to the support of the commission might have an opportunity of further studying the subject. The council also recommended that the committee in each country should endeavor to arrange matters in such a way as to satisfy the needs of both electrical and gas industries. Considerable progress has been made here, and the British committee has now appointed a subcommittee under the chairmanship of Dr. R. T. Glazebrook, F.R.S., to go fully into the details of the question. Dr. Glazebrook will be assisted by Dr. S. P. Thompson, F.R.S. (British delegate to the commission); Prof. C. V. Boys, F.R.S., as official representative of the "Gas Referees," and Mr. J. W. Helps, M. Inst. C. E., officially nominated by the Institution of Gas Engineers.

With the cordial co-operation of the gas industry thus obtained, the British subcommittee hopes soon to be in a position to report, especially in view of the experiments lately carried out at the National Physical Laboratory, which point to the probability of an eminently satisfactory solution.

Promise of Great Extensions of New York Subway Traction.

At the hearing before the Public Service Commission of the First District of New York, March 8, upon the proposition made by the Hudson & Manhattan Railroad Company to extend its subway line from the present terminus at Thirty-third Street and Sixth Avenue, up Sixth Avenue to Fortieth Street and thence under Bryant Park and Forty-second Street to the Grand Central Station, considerable interest was created by a proposition made by Mr. Theodore P. Shonts, president of the Interborough Rapid Transit Company. The new route proposed by Mr. McAdoo, of the Hudson & Manhattan Railroad Company, was warmly advocated by many business interests which center in the dry-goods shopping district on Sixth Avenue. There was practically no opposition offered to the plan, although quite a number of citizens from the Bronx and Queens boroughs entered protests upon the theory that the construction of this line might in some way retard the rapid transit plans for their sections of the city.

Mr. Shonts said, when he was placed upon the stand, that his company had no objection to offer to the plans of the Hudson & Manhattan Railroad Company or to the proposals of any other company or to any other plans that would further the advancement of rapid transportation in New York City. He said, however, that the Interborough was preparing plans that would enable it to furnish for the city all the facilities of rapid transportation that would be needed for the next 10 years. He said that these plans, as soon as they had been thoroughly approved by Mr. William Barclay Parsons, the chief engineer of the Interborough, would be submitted to the commission. He would give no details concerning them until they were formally submitted, but he said that the proposal involved the expenditure of $50,000,000 for the work of construction and that of this amount the city would be called upon to raise only $1,000,000. He said that before the plan which he was having drawn up could be put into operation legislation would be necessary in order to provide for the use of private capital in this subway construction.

While no definite information was given out as to the routes proposed in the Interborough plan, it is unofficially understood that they include an underground line from the present subway at Forty-second Street and Seventh Avenue, down Seventh Avenue and through either Varick and Washington or some adjacent streets to a terminus in the neighborhood of the Battery. They also include, so it is understood, an East Side route beginning at the subway at Grand Central Station and extending under Lexington Avenue, or possibly Madison Avenue, into the Bronx, to some outlying terminus not yet selected. It is said that it is the plan of the Interborough to build these routes as extensions of the present subway and under the existing franchise now held by the company. This, it is believed, is the point upon which additional legislation is required.

New Jersey Decision on Trolley-Holding Company.

Chancellor Pitney, of the New Jersey Court of Appeals and Errors, has delivered an opinion placing a limit on mergers by holding companies, which is of general interest on account of the principles set forth.

The case was one involving the control of trolley lines in and around Atlantic City by the Atlantic City & Shore Railway, which in turn is controlled by the Pennsylvania Railroad. The State of New Jersey in instituting the action, challenged the right of the Atlantic City & Shore Railway to acquire and own the stock and bonds of one of the trolley lines or to operate cars over its routes on the ground that such powers were not conferred upon it under the railroad act and cannot be derived from the general incorporation act. This position is upheld by the highest court of the State, and a judgment is ordered ousting the Atlantic City & Shore Railway from the trolley franchises it has acquired and requiring it to dispose of the stocks and bonds.

The opinion states that it must not be forgotten that stock ownership by one company in another is only a mode by which the former company engages in the business of the latter. But since the second company, if the law appealed to by the defendants were unqualified in its effect, might likewise hold stock in any other corporation or corporations, and these might do the same ad infinitum, stock ownership in any company under such a system would not evidence a participation in any definite kind of business, but in effect a participation in a "blind pool" subject to the uncontrolled will of the majority. There would be an end at once of all practical force if the doctrine of incorporation evidences a contract between the State and the corporation or between the corporators and stockholders themselves.

Chancellor Pitney points out in this connection that if the Atlantic City & Shore Railway had unlimited power to purchase stock or bonds in any other corporation it might not only go into the traction business in Atlantic City, but into the mining business in Colorado, or into any other sort of business imaginable and no investor would have the slightest assurance that the money he intended to embark in a railroad enterprise between Egg Harbor and Atlantic City would not be diverted into a multitude of schemes the character or results of which he had no means of telling.

The Chancellor declares his belief that the opinion he expresses of the limitations of the New Jersey corporation law is held by the legal profession in general and that the articles of association of most holding companies are made to express in terms the purpose of holding stocks in other corporations. The power of the Atlantic City & Shore Railway in the matter of holding stock is limited to such enterprises as are necessary and convenient for its declared business of operating a railroad between Egg Harbor and Atlantic City, and the fact that the street railway lines involved in the present litigation are outside of these termini is itself prima facie evidence that the control of their securities is beyond the legitimate functions of the Atlantic City & Shore Railway.

The suggestion that the trolley lines may be controlled because they are feeders for the Atlantic & Shore the court holds to be untenable, and declares that the fact that the operation of a street railway may be indirectly beneficial to a steam railroad in increasing traffic on the latter is not sufficient to bring its operation within the appropriate objects of the latter com-

pany. It is added that the court does not mean to say that by expressing such an object in its certificate of incorporation the Atlantic City & Shore could engage in the trolley business outside its termini, inasmuch as there is a distinct difference in the character of the franchises involved and in the conditions under which they may be exercised.

Indeterminate Franchises for Public Utilities.

Mr. Milo R. Maltbie, member of the Public Service Commission of the First District of New York, has made an extended report to the commission, declaring himself as being strongly in favor of indeterminate franchises for public service corporations. The commissioner believes that this plan meets the objections that are offered to both "unlimited" and "definite term" franchises. He says that the plan has worked well in other places and mentions Boston, Chicago, Washington, the States of Wisconsin and Michigan, the Philippines and Porto Rico. The indeterminate franchise is defined by the commissioner as one the tenure of which runs during good behavior or which may be terminated at anytime by the proper authorities upon the payment of a fair valuation for the actual property taken over. This method, the commissioner says, is the only one whereby a community can always and continuously control its own destinies and can at any time eliminate an objectionable corporation or group of men.

Speaking of the perpetual franchise, Mr. Maltbie says: "At this stage of our political development it is difficult to find any one outside of the direct beneficiaries of franchises who would argue that irrevocable and perpetual grants should be made. Few persons will even attempt to justify the theory which would uphold as binding upon present and future generations a grant made when the Pyramids were erected; yet that is the theory of the perpetual, irrevocable franchise. The streets of a city are not the property of a single generation which it has the right to barter or give away without limit. It would be no more foolish for the city to part with its police power than for it to part irrevocably with its control over the streets. A franchise is justifiable only for so long a time as it inures to the public benefit, and every generation and age should have the power, so far as possible, to work out its own destiny unhindered by limitations unwisely imposed by previous generations."

The limited term franchise, the commissioner believes, is an obstacle to the orderly development of public utilities inasmuch as no one can foresee the exact time when it would become the wise policy to terminate the franchise and in addition as the time for termination approaches the corporations would be tempted to go into politics to protect their interests. He thinks also that limited franchises act as a deterrent to private capital to invest in public utilities.

The indeterminate franchise, in the commission's opinion, removes the obstacles to both of the other plans. In outlining what he considers to be the proper method of granting franchises he says: "The grant should be subject to termination on purchase of the property, either by the city or by another company specially authorized by the city, at a fair valuation. The provision for purchase by another company is necessary because municipal operation may be neither feasible nor desirable. Direct methods are preferable to indirect methods, and if the city has not the power to operate or may be prevented from purchase because of financial disability, there must be a way to transfer the property directly to the lessee company or the right of revocation will be practically worthless. As profits may be small or non-existent during the first few years of a new enterprise, and as some time may be required to get under way and show what can be done, there ordinarily should be an initial period during which purchase may be made only on payment of a prescribed bonus in addition to the actual value of the property taken and possibly a very short period in which purchase may not take place at all, if the scheme is a big one. A similar bonus should be provided for on all new capital expenditures for extending the undertaking, if purchase takes place within a short time after such expenditures have been incurred."

New York Public Service Commission News.

The Public Service Commission of the First District of New York has sent a communication to the Legislature in response to the resolution of inquiry recently adopted concerning the investigation into the 10-cent fare rate to Coney Island. In its response the commission says that the decision has been delayed on account of insufficient information on the question of fares. It says that after the hearings on the subject had been held it was found that the evidence taken did not offer sufficient ground upon which the commission could arrive at a conclusive decision either that a 10-cent rate was reasonable or that a reduction could be ordered. It was found that in order to make such a decision it would be necessary to make an appraisal of the property and franchises of the four elevated and six surface routes that would be affected. Such an appraisal has been determined upon by the commission and will be made just as soon as it is possible to get at the work. The expert force of the office, which is capable of doing such work, it is said, is now fully occupied in making appraisals of railway property in Manhattan and the Bronx. Since the commission has come to this conclusion it is not likely that any decision on the question of fares will be reached in time for the traffic during the coming summer. The appraisal itself will take some time.

The Public Service Commission has issued an order forbidding any employee of the New York Central Railroad to go upon the top of moving cars within the electric zone in the neighborhood of New York City. This is done as a matter of safety on account of the many low bridges and wires which cross the tracks in this district.

The commission has approved the franchise asked for by Receiver Frederick W. Whitridge, of the Third Avenue Railroad, which had been previously allowed by the Board of Estimates, for the construction of 12,000 ft. of double-track road between Westchester Avenue and Classon Point on Long Island Sound.

The commission is determined to push its demand for side-door cars in the subway. It has informed General Manager Frank Hedley, of the Interborough Rapid Transit Company, that it considers the experiments already made as successful, and that if a second train of eight subway cars is not equipped and ready for service by April 1 the company will be called upon to pay a penalty of $1,000 a day for failure to comply with one of the commission's orders.

Indiana Legislature Passes Important Telephone Law.

By the passage of House Bill No. 273, introduced by Representative Wells, the Indiana Legislature has made an important amendment to the statute relating to the power of telephone companies incorporated in the State. The principal provision of the new act provides that any telephone company organized in the State shall have power to acquire by lease or purchase the lines, exchanges, franchises, rights and other property, or any part thereof, of other telephone companies, or to dispose of by lease or sale its lines, exchanges, franchise rights and other property, or any part thereof, and also shall have the power to acquire and hold stock and bonds of other telephone companies.

Until this amendment was made the law did not permit a company organized under the laws of Indiana to hold stock in any other company. On the other hand, the Central Union and other companies organized under the laws of other States have had such right and power. The amended law puts home companies on an equal footing with foreign companies and is expected to stimulate and strengthen the independent system in the State. Already the stock of certain independent companies has advanced several points, and the strong companies will in many localities acquire and take over the smaller companies.

Independent Telephone Merger.

The directors of the United States Telephone Company closed a contract at Cleveland, Ohio, on March 6, with representatives of the Independent Long Distance Telephone & Telegraph Syndicate of New York and St. Louis for operating in connection with the United States Company's lines in Ohio, Indiana, Michigan, New York and Pennsylvania. The contract contemplates the organization of a corporation with a capital of $2,500,000 as a preliminary company to co-operate with the United States Company.

One million dollars of this amount is to be paid in within six months. The formation of the new company will mean an extension of the Independent lines.

Indianapolis Grants Increase of Telephone Rates.

The Indianapolis City Council has ratified the new franchise granted by the Board of Public Works to the Indianapolis Telephone Company and the New Telephone Company, lessee. There was so much opposition developed to the granting of this contract that the Council had it under consideration several months and a number of civic bodies took a hand in its adjustment. Litigation also grew out of the grant and some phases are still pending. The new contract runs for 30 years, and an important provision allows a material increase in the rate for service as well as additional charges dependent upon contingencies and growth of the number of subscribers. The franchise provides that the company shall within the next two years make extensions and improvements to the plant to cost not less than $500,000, and at least one-half of this amount to be expended on the plant within the next year and a half. The work of constructing and equipping a new exchange building is to be under the supervision of inspectors appointed by the Board of Public Works, and the city reserves the right, at a certain period in the life of the contract, to buy the plant at an appraised value. Improvements on the plant will begin at once and the new exchange building started over two years ago will be completed and include a modern and costly switchboard.

Enclosed Fuse Litigation.

On Feb. 19, Judge Lowell, of the United States Circuit Court of Massachusetts, delivered an opinion in a case involving the validity of a patent covering the use of multiple enclosed fuses. In discussing the state of the art the court said that so far as the record is concerned the employment of a porous non-conducting or refractory material as a filling is first shown in an English patent issued to Mordey in 1890, and later in a patent issued to Downes in 1896. However, that Downes had no part in the discovery of the valuable quality that resides in a filling of refractory material, and denied its importance, appears from his statement that "The refractory material without the air drum or space is of no utility. No one uses it or desires so to do." Downes thus shows that he conceived the gist of the earlier patent to lie, not in the employment of refractory filling, which had been earlier employed by Mordey, but in a space unoccupied except by air. The court concludes that the discovery of the value of filling thus appears to have been made by Mordey and certainly was not made by Downes.

The court states that in the case in suit the parties agreed that the combination in the claim contested consists of three elements—namely, first, the enclosing sheath; second, the filling of a porous non-conducting or refractory material within the sheath; and third, a plurality of fusible wires or conductors disposed generally throughout the filling, but not grouped or bundled closely together. The complainant does not dispute that the first two elements are old in the art, both separately and in combination, but contends that the third element is new in combination with the first and second. After discussing at length this latter contention, the court held that the claim made for increased absorption of heat and metal seems obvious in the cases of multiple links in comparison with a single link; and that to divide the single link in an enclosed filled fuse requires only mechanical skill after a single link has been divided in an open fuse, and after it has been placed undivided in an enclosed filled fuse; and Downes has declared that filling is altogether useless except in connection with an air space, and that an air space is not found in the claim in suit nor in the defendant's manufacture. On the whole, therefore, the court considered the claim in suit to be invalid and ordered that the bill be dismissed. The parties of the suit were the D. & W. Fuse Company, complainant, and the Chase-Shawmut Company.

Electrical Development in Mexico.

A number of interesting electrical developments have recently been reported from different parts of Mexico. The most important of these is the project of installing a hydro-electric plant on the Conchos River, in the State of Chihuahua. A syndicate of Canadians who were formerly interested in the Mexican Light & Power Company have organized a company called the Mexican Northern Electric Company to carry out their plans for establishing the new plant in Chihuahua. Mr. G. F. Greenwood, of Montreal, Canada, is president of this company, and he and other stockholders are now in Mexico arranging for the commencement of construction work on the enterprise. He says that more than $5,000,000 gold will be expended in the installation of the initial hydro-electric plant, which will have a capacity of 15,000 hp. The plant will be so constructed that it can be enlarged at any time to meet the demands that may be made upon it for power. It is planned to run transmission lines from the plant to the cities of Parral, Jiminez, Chihuahua and other smaller towns, and to many of the larger mining camps in that part of the country. It is stated that the Mexican Northern Electric Company has a working capital of $15,000,000 gold. Mr. E. B. Greenshields, of Montreal, is vice-president, and Mr. Frank Thompson, of the same city, is secretary of the company.

Another large transaction in the electrical field of Mexico which is now pending is the purchase by the Guanajuato Power & Electric Company of electric light and power plants and the electric street railway system of the city of Guadalajara. These several interests are owned by the Compania de Tranvias, Luz y Fuerza, and are controlled by Mr. Fernando Pimentel, a multimillionaire of Mexico City. The Guanajuato Power & Electric Company, the stock of which is owned principally by Colorado Springs (Col.) men, has made an offer of $8,500,000 for the property of the Compania de Tranvias, Lus y Fuerza. This is in Mexican money, which is equivalent to $4,250,000 gold. The offer carries with it certain stipulations which are now being arranged in order that the deal may be consummated. One of these is that Mr. Pimentel and associates must remove from the field all competing interests. In order to do this the Pimentel people have entered into a combination with Mr. Manuel Cuesta, of Guadalajara, who owns a valuable concession from the Mexican Government for the installation of a hydro-electric plant on the Santiago River and the establishment of an electric street railway system and lighting facilities for Guadalajara, whereby a company with a capital stock of $10,000,000 Mexican money shall be formed to take over and put into operation that part of the Cuesta concession which provides for the installation of a hydro-electric plant and the building of transmission lines to Lake Chapala, where the power will be used for irrigating works. The Guadalajara field will not be invaded by the Cuesta company under the terms of this agreement. The Guanajuato Power & Electric Company recently enlarged the capacity of its hydro-electric plant at El Duro, State of Michoacan. The company is now furnishing power from the El Duro plant for the Guanajuato mining district and city and several other towns of that region, including Irapuato and La Barca. Some of its transmission lines are already more than 100 miles long, and if it enters the Guadalajara field from its El Duro plant its transmission line will be 200 miles or more long.

Missouri Electric Light, Gas and Street Railway Association.

At an executive meeting of the Missouri Electric Light, Gas and Street Railway Association, held on Jan. 22, Springfield, Mo., was decided upon as the next place of meeting, and the dates fixed for April 15, 16 and 17. A program committee was chosen, its work outlined, and a report is expected shortly. Mr. C. L. Clary, Sikeston, Mo., is secretary.

Charlotte, N. C., to Control Public Utility Rates.

By the terms of an amendment to the charter of Charlotte, N. C., the control of rates of public utilities, including telephone service, lighting service, etc., is vested in the Board of Aldermen. The amendment was vigorously fought by all of the local public service corporations, among the points made against it being the great harm entailed when they undertake to borrow money or negotiate loans or sales of bonds, etc. The Board of Aldermen later decided to cut out the unpopular section, but the bill had already passed the Legislature.

Another Addition to Boston Edison System.

The Edison Electric Illuminating Company of Boston has secured control of the Lexington Gas & Electric Company, operating in the historic suburban town of about 4000 inhabitants located 11 miles west of Boston. It is understood that the gas plant will be sold to other interests. The purchase is also understood to be a step in the further consolidation of suburban plants with the Edison system, as recently noted in these columns.

The Lexington plant has a limited distribution area, and is only of a few hundred kilowatts capacity, with little facility for economical power production on a large scale. As a part of the Edison system it will probably serve as a convenient center of distribution for both lighting and railway service in connection with certain of the Boston Suburban trolley properties.

Canadian Electrical Merger.

It is reported in government circles at Toronto, Ont., that a far-reaching electrical merger is being formed, having for its object the protection of the various independent electrical companies threatened with great loss of revenue by the initiation of the government power scheme. With an immense capitalization, it is claimed this company will merge all the companies operating within the confines of Ontario. Where the organizers hope to rival the hydro-electric commission will be in embracing in the merger the radial traction lines of the eastern provinces. Thus the same transmission lines which supply the private users will be tapped also to supply the radial lines. The latter is held to be an extremely profitable business and will be thus denied the hydro-electric commission. This, it is claimed, will put the government at a disadvantage in selling power. The trust will, it is claimed, make great sacrifices if necessary at the outset to coerce the municipalities and the commission.

International Congress of Applied Chemistry.

The provisional organization of the Seventh International Congress of Applied Chemistry, to be held in London, May 27 to June 2, 1909, has been completed and a preliminary program formulated. Among the members of the American Advisory Committee of Honor are Mr. E. G. Acheson and Dr. C. F. Chandler. Members of other American committees are Dr. John Hays Hammond, chairman, and Prof. J. W. Richards, metallurgy and mining; Prof. C. E. Munroe, chairman, explosives; Dr. W. D. Bancroft, chairman, and Messrs. C. A. Doremus, F. A. J. Fitzgerald, L. Kahlenberg, E. R. Taylor and W. R. Whitney, electrochemistry and physical chemistry. Of Section X of the congress, electrochemistry and physical chemistry, Sir John Brunner is president, Mr. G. T. Beilby vice-president and D. F. Mollwo Perkin honorary secretary. The membership subscription has been fixed at £1, which may be forwarded to the honorary general secretary, Mr. Wm. Macnab, 10 Cromwell Crescent, London, S. W.

Kuzel Incandescent Lamp Patents.

Three patents were issued Feb. 9 to Hans Kuzel, of Vienna, Austria, relating to the manufacture of the so-called colloidal tungsten lamp filament. One of the patents is on a process for manufacturing refractory metal alloys. This consists in adding to a colloidal suspension of the metal, such as tungsten, a crystalloid compound such as platinum or titanium chloride or sodium silicate; after mixing the two constituents intimately, a precipitate is added, whereby an absorption compound of the colloid and crystalloid is formed. After the precipitate is brought to a desired shape it is reconverted into the crystalloid state by heating. A second patent is on a solder for connecting incandescent lamp filaments to the leading-in wires, the solder consisting of a carbide of tungsten. The third patent is on a form of spider mounting for a tungsten filament.

A patent granted March 2 to the same inventor relates to a process for the manufacture of incandescent-lamp filaments of an alloy of antimony with one of the refractory metals, such as tungsten, osmium, zirconium, etc. According to this method antimony, either in a colloidal or finely powdered solid state, or as a sulphur or oxygen compound of antimony, is mixed with a plastic mass consisting of a "colloid" of the refractory metal with or without the addition of the metal in a powdered solid state or of colloidal oxygen compounds of the metal. Filaments are then squirted from this plastic mass and when heated to a white heat, the colloids return to the ordinary crystalline form. The filaments then consist of an alloy of the refractory metals and of antimony, the presence of the latter notably increasing the electrical resistance of the filament.

Niagara Pumping Station.

The city of Niagara Falls is to vote on a proposition to establish a new water system, pumping station and filtration plant on March 10. The plan calls for an appropriation of over $700,000, but it is hardly hoped to complete the work with this expenditure. Should the taxpayers authorize the work to go on, the new plant contemplates the abandonment of the present water-pumping station on the hydraulic canal basin. In this site and power rights the taxpayers of Niagara Falls have valuable rights through the foresight of the government of the former village of Suspension Bridge, for it was that village, now a part of the present city, that established the municipal water system, now paying a very large revenue.

In order to determine what is best to do with the rights on the canal basin, the water commissioners interviewed the Niagara Falls Hydraulic Power & Manufacturing Company, which company under recent date has written to the board stating that in consideration of the city releasing and surrendering its lease for power they will make a lease to supply 800 hp at Niagara Street and Riverway for the operation of the new pumping station at $9 per horse-power, and such additional power as the city may require at $10 per horse-power for the period of 76 years, which is the unexpired term of the power lease of the city. Furthermore, the power company offers to make no charge for excess power used by the city for fire pressure for a certain number of fires per month based on the average number of fires per month for the last five years, or a number to be agreed upon by the company and the board. The power company states it will purchase the lot on which the present pumping station is located and pay therefor the sum of $20,000 in cash or apply that amount in reduction of the rate for power at the option of the city.

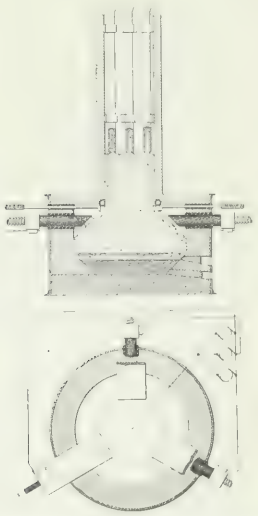
Reduction of Cable Rates.

In a newspaper interview Mr. Gustav Thalberg, of the German South American Cable Company, states that through diplomatic channels he learns that everything has been prearranged by the American Government to enter into the plan suggested by Mr. J. Henriker-Heaton, member of the British Parliament, for the acquisition of the existing ocean cables between Great Britain and the United States by the British and United States governments. This will, he says, result in much lower cable tolls, better service, and an enlargement of Stock Exchange business between both countries. "It should not be forgotten that the first ocean cable was in large part laid at the joint cost of the governments of Great Britain and the United States. Owing to exorbitant ocean cable charges only one-twelfth of the capacity of the cables between here and Europe is employed. These cables are conditioned to carry 300,000,000 words a year. In the past year the business done was less than 25,000,000 words. At 2 cents per word, instead of 25 cents, the cable companies could make more money."

Electric Refining of Steel and Reduction of Iron Ore.

In view of the recent adoption of the Héroult electric furnace by the United States Steel Corporation for steel refining at two of its works, a concise summary of the Héroult process may be interesting. It is purely a process of refining in the electric furnace steel made by the Bessemer converter or open-hearth process. The operation as carried out at the older Héroult plants is as follows:

The process of steel making in, say, the open-hearth furnace is carried somewhat further than in ordinary open-hearth practice, namely, until the phosphorus content has been reduced to the



DIAGRAMS OF HÉROULT ELECTRIC FURNACE.

desired very low extent. Since the phosphorus is in general eliminated after the carbon, this operation of getting rid of the phosphorus also eliminates the carbon and highly oxidizes the steel. This would be very undesirable in ordinary practice, but in the Héroult process this dephosphorized, decarburized and highly oxidized steel is desirable for the electric-furnace process.

When introduced into the electric furnace in the molten state three things occur: the recarburization of the steel to the desired carbon content; the thorough deoxidation of the metal, and the reduction of the sulphur content to the desired degree. For deoxidizing the metal thoroughly the neutral atmosphere of the electric furnace is of decisive importance; this condition is absolutely different from that of ordinary metallurgical practice, where heat production is always accompanied by oxidation. For the desulphurization of the steel the high temperature of the arc is of decisive importance, because the sulphur is eliminated as calcium sulphide, which passes into the highly basic slag, and in this reaction the formation of calcium carbide (which requires a very high temperature) appears to play an important rôle.

The result of the process is a thoroughly deoxidized metal, free from slag, with any desired content of carbon, while the percentages of phosphorus and sulphur are reduced to any desired extent, say each below 0.01 per cent.

Two patents, granted to Dr. Paul Héroult on March 2, refer to details of electric-furnace construction for iron-ore reduction, which, however, is a problem quite different in industrial and technical respects from steel refining. The object is to use fixed carbon electrodes in a three-phase furnace in order to avoid the trouble of sliding electrodes in water-cooled stuffing boxes. Regulation is accomplished by varying the distance of the sliding charge from the electrodes.

The furnace, as shown in the adjoining diagrams, is built as a shaft furnace with three electrodes placed symmetrically through the walls. The metal in the bottom of the hearth forms the neutral point of the three-phase system. The furnace has a base of carbon and side and overhanging walls of clay. The iron ore and carbon mixture is fed through the shaft downwards.

The movement of the charge is regulated by means of three slides, which are adapted to be withdrawn under the edge of the overhanging wall or to be projected sufficiently to move the slope back to the dotted line shown. These slides, for example, may be flat plates (water cooled, if necessary) of a sufficient breadth to cover the electrodes and protect them from the charge at the sides, and may be provided with screws at the outer end for manipulating it.

Furnaces of this type have the great advantage that they may be open at the top. The escaping gases are burned to preheat the charge. Further, the electrode is better protected against consumption than with ordinary construction. However, iron ore reduction in the electric furnace (though technically possible) is commercially impracticable under ordinary conditions, and is not yet carried out anywhere in the world on a large commercial scale.

Chicago Electric Club.

The relation of the technical journal to the industry it upholds was the general subject of the discussion at the weekly luncheon of the Electric Club of Chicago on March 3. "Publishing a Technical Journal" was the subject of the opening address by Mr. A. A. Gray, managing editor of the *Electrical Review and Western Electrician.* Mr. Gray described the practical making of the paper. Those taking part in the discussion were Messrs. Frank L. Perry, formerly business manager of the *Western Electrician;* George Cutter, of South Bend, Ind.; F. N. Sager, of the Arnold Company; J. R. Cravath and William E. Keily, associate editors of the *Electrical World* in Chicago; W. R. Bonham, Sterling Electric Manufacturing Company, and Albert Scheible, president, Ajax Line Material Company, Chicago. The large subject was informally discussed according to the individual views of the speakers, and the importance, usefulness and forms of service of the technical journal were brought out in various aspects. Mr. Eugene Wrigley, of Louisville, briefly presented the claims of the Southern Electrical and Industrial Exposition, which is to be held in the First Regiment Armory, Louisville, April 12 to 24. It was announced that at the meeting of March 10 Mr. Homer E. Niesz, of the Commonwealth Edison Company, would talk about "Central-Station Publicity." The club is flourishing and has about $1,800 in bank.

A. I. E. E. Veterans.

In our issue dated Jan. 2 a list was printed with the above caption giving the names of present members of the American Institute of Electrical Engineers of twenty years or more standing.

This list was received from a correspondent and accepted as correct, but after being printed attention was called by readers to a number of omissions. In view of the celebration the present week of the twenty-fifth anniversary of the founding of the Institute, the list is reprinted below as corrected by a careful comparison with the entries in the 1909 A. I. E. E. Year Book, and with the addition of the dates of transfers to full membership.

1884.

Alexander G. Bell, Washington, D. C.	Transferred in	1884
Adam Bosch, Newark, N. J.	" "	1885
Charles F. Brush, Cleveland, Ohio	" "	1885
Charles L. Clarke, New York, N. Y.	" "	1885
Charles R. Cross, Boston, Mass.	" "	1884
Leo Daft, Rutherford, N. J.	" "	1885
Joseph P. Davis, New York, N. Y.	" "	1904
Patrick B. Delany, South Orange, N. J.	" "	1891
Philip Diehl, Elizabeth, N. J.	" "	1884
Thomas A. Edison, Llewellyn Park, N. J.	" "	1884
Stephen D. Field, Stockbridge, Mass.	" "	1884
George A. Hamilton, New York, N. Y.	" "	1884
Edwin J. Houston, Philadelphia, Pa.	" "	1884
Francis W. Jones, New York, N. Y.	" "	1884
Nathaniel S. Keith, Philadelphia, Pa.	" "	1891
Thomas D. Lockwood, Boston, Mass.	" "	1884
C. O. Mailloux, New York, N. Y.	" "	1884
George C. Maynard, Washington, D. C.	" "	1888
John Millis, U. S. Army	" "	1888
William D. Sargent, Brooklyn, N. Y.	" "	1894
Jesse M. Smith, New York, N. Y.	" "	1891
Elmer A. Sperry, New York, N. Y.	" "	1893
Edward P. Thompson, New York, N. Y.	" "	1889
Elihu Thomson, Lynn, Mass.	" "	1891
William B. Vansize, New York, N. Y.	" "	1884
Edward Weston, Waverly Park, N. J.	" "	1884
Joseph Wetzler, London, England	" "	1884

ASSOCIATES.

Charles L. Buckingham	New York, N. Y.
E. N. Dickerson	New York, N. Y.
Charles A. Doremus	New York, N. Y.
George F. Durant	St. Louis, Mo.
T. Commerford Martin	New York, N. Y.
J. Frank Morrison	Baltimore, Md.
John C. Reilly	Brooklyn, N. Y.
Theodore N. Vail	New York, N. Y.
Charles Williams, Jr.	E. Somerville, Mass.

1885.

E. P. Roberts, Cleveland, Ohio	Transferred in	1885
Schuyler S. Wheeler, Ampere, N. J.	" "	1885

ASSOCIATES.

Ralph W. Pope	New York, N. Y.
Thomas A. W. Shock	York, Pa.

1886.

Edgar G. Bernard, Troy, N. Y.	Transferred in	1887
Alfred H. Cowles, Cleveland, Ohio	" "	1886
Minor M. Davis, New York, N. Y.	" "	1893
Rudolph M. Hunter, Philadelphia, Pa.	" "	1887
William S. Turner, New York, N. Y.	" "	1888
C. Reginald Van Trump, Wilmington, Del.	" "	1894

ASSOCIATES.

Samuel Insull	Chicago, Ill.
A. R. Ledoux	New York, N. Y.

1887.

Thomas Ahearn, Ottawa, Ont.	Transferred in	1888
Charles Batchelor, New York, N. Y.	" "	1888
James H. Bates, New York, N. Y.	" "	1889
Charles S. Bradley, New York, N. Y.	" "	1888
J. Stanford Brown, New York, N. Y.	" "	1887
C. Herbert Condict, New York, N. Y.	" "	1888
Francis Bacon Crocker, New York, N. Y.	" "	1888
Dr. Louis Duncan, New York, N. Y.	" "	1903
R. N. Dyer, New York, N. Y.	" "	1889
J. Day Flack, West Brighton, N. Y.	" "	1888
Horatio A. Foster, Baltimore, Md.	" "	1887
William J. Hammer, New York, N. Y.	" "	1887
F. Bernhard Herzog, New York, N. Y.	" "	1888
Edward J. Hoyt, New York, N. Y.	" "	1888
John W. Howell, Harrison, N. J.	" "	1888
Dugald C. Jackson, Madison, Wis.	" "	1888
William J. Jenks, New York, N. Y.	" "	1888
Edward R. Knowles, New York, N. Y.	" "	1888
A. A. Knudson, New York, N. Y.	" "	1888
H. Ward Leonard, Bronxville, N. Y.	" "	1888
John William Lieb, Jr., New York, N. Y.	" "	1888
William Maver, Jr., New York, N. Y.	" "	1888
Edward L. Nichols, Ithaca, N. Y.	" "	1888
Michael T. O'Dea, Chicago, Ill.	" "	1888
Sydney B. Paine, Boston, Mass.	" "	1888
C. Wellman Parks, U. S. Navy	" "	1888
Joseph F. Porter, Davenport, Ia.	" "	1888
Robert J. Pratt, Honolulu, H. I.	Transferred in	1887
E. Wilbur Rice, Jr., Schenectady, N. Y.	" "	1888
Elias E. Ries, New York, N. Y.	" "	1887
Andrew L. Riker, Bridgeport, Conn.	" "	1895
Albert L. Rohrer, Schenectady, N. Y.	" "	1888
Harris J. Ryan, Stanford University, Cal.	" "	1895
Frank Julian Sprague, New York, N. Y.	" "	1897
William Stanley, Great Barrington, Mass.	" "	1898
Charles A. Terry, New York, N. Y.	" "	1887
Ernst Thurnauer, Paris, France	" "	1887
Francis R. Upton, Orange, N. J.	" "	1892
W. D. Weaver, New York, N. Y.	" "	1887
Edwin R. Weeks, Kansas City, Mo.	" "	1887
A. E. Winchester, South Norwalk, Conn.	" "	1887

ASSOCIATES.

Enos M. Barton	Chicago, Ill.
Paul T. Brady	New York, N. Y.
Charles A. Coffin	New York, N. Y.
Frank E. Fielding	Virginia City, Nev.
H. McL. Harding	New York, N. Y.
Hubert Howson	New York, N. Y.
Dr. H. F. R. Hubrecht	Amsterdam, Holland
C. J. R. Humphreys	New York, N. Y.
Frank E. Idell	New York, N. Y.
William Pierson Judson	Oswego, N. Y.
Richard J. Nunn	Savannah, Ga.
Almon Robinson	Lewiston, Me.
Ferdinand W. Roebling	Trenton, N. J.
Lemuel W. Serrell	Plainfield, N. J.
Charles F. Sise	Montreal, Can.
George H. Stockbridge	New York, N. Y.
Francis R. Welles	Paris, France
Henry M. Whitney	Boston, Mass.
Edmund L. Zalinski	New York, N. Y.

1888.

Edw. G. Acheson, Niagara Falls, N. Y.	Transferred in	1888
Eugene H. Chubbuck, La Salle, Ill.	" "	1899
Samuel S. Dickenson, New York, N. Y.	" "	1889
Ludwig Gutmann, St. Louis, Mo.	" "	1893
Carl Hering, Philadelphia, Pa.	" "	1888
John D. Ihdler, New York, N. Y.	" "	1903
Arthur E. Kennelly, Cambridge, Mass.	" "	1899
Philip A. Lange, Manchester, Eng.	" "	1888
John Langton, New York, N. Y.	" "	1888
William Dennis Mars, New York, N. Y.	" "	1888
Horace F. Parshall, London, Eng.	" "	1890
Cecil P. Poole, New York, N. Y.	" "	1902
Frederick Reckenzaun, New York, N. Y.	" "	1888
Sir David L. Salomons, London, Eng.	" "	1888
Montgomery Waddell, New York, N. Y.	" "	1888
Leonard Waldo, New York, N. Y.	" "	1888
Charles J. Wharton, London, Eng.	" "	1888
Fremont Wilson, New York, N. Y.	" "	1888
Townsend Wolcott, New York, N. Y.	" "	1890

ASSOCIATES.

Henry W. Blake	New York, N. Y.
Willard E. Case	Auburn, N. Y.
Charles J. Goldmark	New York, N. Y.
Frederick Saxelby	East Orange, N. J.
Lewis Searing	Denver, Col.
Nikola Tesla	Wardenclyffe, N. Y.
Henry C. Townsend	New York, N. Y.
William H. Wiley	New York, N. Y.

Use of the Telephone for Train Dispatching.

In a paper read before the St. Louis Railway Club, on Feb. 12, Mr. W. E. Harkness pointed out the progress made in the past year in the use of the telephone in place of the telegraph for the directing of train movements and the dispatching of trains on steam railroads. The author stated that, in comparison with the present practice of dispatching trains by telegraph, there are the following differences and advantages:

The orders are issued verbally by the dispatcher to the operator or operators over a metallic circuit telephone line in place of being sent by telegraphy. By means of selective apparatus each station is called individually without signaling the other stations on the line. It has been found that the operators answer the selector bell more promptly than they do the sounder, due partially to the extra volume of sound given by the bell and also to the fact that it will ring until the call is answered.

The accuracy of the telephonic transmission is clearly shown by the fact that the dispatching and reporting of trains on a large number of roads have been handled for a year or more by telephone without mistakes having occurred.

Telephones are now used for train service over certain sections by the Lake Erie Alliance & Wheeling, the Pennsylvania, the New York Central & Hudson River, the Chicago, Burlington & Quincy, the Lake Shore & Michigan Southern, the Chicago & Northwestern, the Michigan Central, the Chicago, Milwaukee

& St. Paul, the Northern Pacific, the Delaware, Lackawanna & Western, the Great Northern, the Chicago, Rock Island & Pacific, the Union Pacific, the Illinois Central, the Canadian Pacific, the Atchison, Topeka & Santa Fé, the Erie, the West Jersey & Seashore and the Virginia Railroads.

Meeting of Boston A. I. E. E. Section.

The regular monthly meeting of the Boston section of the American Institute of Electrical Engineers was held at the Edison Building, Boston, on Feb. 17. Prof. Elihu Thomson reviewed his recent paper read before the New York section on "Conditions Affecting Stability in Electric Lighting Circuits."

ARC LIGHT DYNAMOS.

An extended discussion on arc light dynamos was held at the conclusion of the paper. Mr. C. M. Green, of the General Electric Company, Lynn, Mass., pointed out that on every arc machine there is a large number of turns on the armature, with relatively long pole pieces, which introduce large armature reactions and a tendency to buck back the field. In the Brush, Excelsior and the Schuyler arc machines the final regulation was secured by shunting the current from the field. The following table illustrates the improvement which has been made in the design of Brush arc dynamos:

No. of Machine	7½	12	13
Volts	2500	8300	15000
Amperes	9.6	6.6	4
Commutator section	3	4	4
Volts per section	833	2125	3750
Rise of temp. pole shoe, deg. C.	270	11	30
Material		Cast Iron	
Bonds on fields	Yes	No	No
Lbs. copper per kw.	54	29.5	26.2
Efficiency	70	88	85

The use of laminated pole pieces and highly saturated iron was most effectual in tending to reduce the temperature rise.

Mr. Green pointed out that there has been a marked change in the design of Brush machines. In the early machines the clearance between the armature teeth and pole faces was about 3/16 in., and the pole faces were not beveled. Excessively heavy eddy currents resulted, and if one of these machines ran for any length of time the japan was burned off the pole pieces. A bobbin can be short-circuited under full-load conditions or under ordinary working conditions and the machine will operate all night without the bobbin burning out, on account of its inductance. If a few turns are short-circuited, however, the bobbin will burn out. In the later machine the thickness of the pole shoe has been reduced from 50 per cent to 70 per cent. In addition the pole faces are beveled and on the four-pole machines the pole shoes are external, so that the flux is better distributed, giving a much less peaked wave. In the old bipolar machines there was practically little or no e.m.f. generated in the bobbins during the time in which they were in parallel, and that has been increased many times in the new designs. A few years ago the company had trouble with the Brush machines on account of flashing. The difficulty was overcome by removing 360 lb. of copper in the field, and changing the pole shoes from steel castings to cast iron. This increased the output from 8000 volts to 8500 volts. On the later machines the copper was reduced about 25 per cent all told, or 636 lb.

Practically all the four-pole Brush machines had a peculiar habit of breaking down at about 1000 volts alternating current, and yet they ran satisfactorily when not tried with alternating current. The current jumped from the armature bobbin over to the pole face. At Worcester trouble was experienced with the machine flashing. The reason appeared to be that the weather and belt were dry, and that static electricity would accumulate on the frame and then jump to the armature bobbin, which caused a flash-over. The engineers put a higher resistance between the frame and the ground, and in certain other cases where the belts were troublesome, the static could be reduced by mixing up graphite with belt grease and putting it on the belt. The usefulness of the latter did not appear to be in the least impaired. Mr. Green then discussed the use of multi circuits in Brush arc dynamos and emphasized the advantages of reducing potential strains.

MERCURY ARC RECTIFIERS.

In discussing the causes of instability of mercury-arc rectifiers Mr. Green said it is necessary to get considerable impedance between the primary and secondary coils of the transformer in order that the apparatus may run steadily. Under normal conditions of operation the transformer from one anode to the other terminal requires practically no voltage. Under certain conditions, however, gases are given out which pocket around the anode and require about 500 volts to start the arc. As a result the lamps begin to pump. It has also been found that if the load on the rectifier tubes is increased, the temperature range over which the tubes will operate becomes considerably narrowed, and this is the main reason why the change has been made from water to oil. Tubes have run over 4000 hours in oil. Another difficulty is that sometimes rectifier tubes deteriorate. As they are shut down gases are absorbed by the anodes and it is a peculiarity of the mercury-arc lamp that the anodes run hotter when the temperature of the tube is lower. As a result, the gases are quickly driven out and a high voltage is required to get the arc to transfer. In fact, sometimes the circuit is opened and a discharge produced requiring about 25,000 volts or 30,000 volts on a 50-light machine as shown by needle points; when the tubes are submerged in oil this discharge cannot very well occur. Lightning arresters were therefore put in with good success.

The John W. Mackay Junior Fellowships.

In July, 1906, Mr. Clarence W. Mackay, jointly with his mother, Mrs. John W. Mackay, gave to the University of California $100,000 for the endowment of the John W. Mackay Junior Professorship of Electrical Engineering, with the proviso that such part of the income as the regents of the university might determine, or the whole, was to be used for the salary of the incumbent of the chair, and that the residue of the income was to be devoted to the furtherance of research work in electrical engineering in the university.

In accordance with the terms of this endowment, the University of California has established two John W. Mackay Junior Fellowships in Electrical Engineering, of an annual value of $600 each. The tuition charges of the university are nominal. These fellowships are open to all properly qualified university graduates. The object of the fellowships is not to facilitate ordinary engineering or scientific study, but to enable students who have completed a college course to do research work in electrical engineering, with a view to aiding the advance of the application of electricity to scientific and industrial purposes.

The place of residence of those holding the fellowships is to be at the University of California. Experimental or other work, however, may be carried on outside the laboratories of the university. The appointment to each fellowship is to be for one year, which appointment may, however, be renewed, at the discretion of the graduate council of the university. Applications for the fellowships should be filed with the university as early as March 15 if possible.

Wireless Telephone as Fog Signal.

A patent was issued on Feb. 23 to Mr. R. H. Marriott for a scheme for determining the distance between a ship and shore station on another ship. The inventor employs wireless telegraph apparatus as one of two simultaneous means of transmitting sound to the ship from the distant point, the other means involving the water itself. By the use of a bell arranged for submarine signaling there is produced a sound that is transmitted practically instantly to the ship receiver by wireless telephony, and also at comparatively slow speed by way of the water to a separate receiver used by the same listener. The time interval between the receptions of the two signals depends upon, and is used as, a measure of the distance between the bell and the listener.

Relation of Load Factor to Power Costs.

The Chicago branch of the A. I. E. E. and the electrical section of the Western Society of Engineers held a joint meeting at Chicago March 2 to listen to three papers on "The Relation of Load Factor to Power Costs."

Mr. C. A. S. Howlett, the author of one of the papers, was not able to be present, and on account of sickness had not been able to prepare the comprehensive paper he had hoped. He briefly called attention to the early history of the Wright demand system of charging in Boston and to the fact that the policy of the company which had adopted this system had proved the most successful in the long run. He also emphasized the importance to the consumer and to the company of selecting motors which were not too large for the work to be done, thus keeping down the first cost of the installation and the cost of operation. There is a very strong tendency to purchase motors too large for a given piece of work.

Mr. J. M. S. Waring's paper pointed out how the application of the storage battery enabled a large power purchaser to secure better rates. A power rate, he said, in order to be equitable must first distribute the fixed charges on the plant in proper proportion among the various customers, so that each customer pays fixed charges on the capacity of plant required to serve him. The rate must, second, distribute the operating expenses or variable charges in proper proportion among the customers. Any rate to be equitable must have, therefore, a primary fixed charge and a variable operating charge. The large consumer of power may reduce the primary or fixed charges which are proportionate to the maximum demand which he makes upon the power-supplying company by installing storage batteries to take care of the peak of his load. He can thus purchase power at a lower rate.

Mr. E. W. Lloyd, contract agent for the Commonwealth Edison Company, of Chicago, gave some interesting figures taken from the records of a large number of consumers on his company's system. He said that it is becoming generally recognized that a consumer's load factor should determine his rate. In order to determine the load factor an instrument for measuring the maximum demand is necessary. At the present time maximum-demand meters which are satisfactory for indicating maximum direct-current power are obtainable. For alternating-current power circuits, however, no instrument of reasonable cost has yet been put on the market. As a substitute for a maximum-demand instrument, the Commonwealth Edison Company's practice had been to assume that the consumer's maximum demand was a certain percentage of his connected load in horse-power. These percentages were first determined about two years ago by figures from several thousand direct current motor installations connected to the company's lines. These motors were all provided with Wright maximum-demand meters so that the ratio of the connected horse-power to the actual maximum demand could be determined. The percentages have since been checked with records of about 4000 more customers. The company figures the maximum demand of alternating-current power customers by taking 746 watts per horse-power of motor and multiplying this by the following percentages:

	Per cent
Installations under 10 hp, only one motor used	85
" under 10 hp, more than one motor used	75
" from 10 hp to 50 hp, irrespective of number of motors.	65
" over 50 hp, irrespective of number of motors	55

At one time it was thought by some that a central station could not safely connect a load equal to more than the rated capacity of its plant. Experience has proved that, owing to the diverse character of load and the different hours of maximum demand, the connected load may be two or three times the station capacity.

In opening the discussion on this subject, Mr. W. L. Abbott, chairman, briefly reviewed the history of rate-making. The flat rate of so much per lamp per month had some obvious objections from the companies which paid the coal bills. The next plan proposed was a uniform rate per kw-hour for all electricity used without regard to when or how it was used. Since then the constant problem has been how to combine these two methods of charging so as to make a rate equitable to various consumers.

Mr. John F. Gilchrist pointed out that, logically, power should be charged for according to the peaks upon the generating plant caused by the various consumers, rather than by the individual peaks of different consumers which might occur at other times than during the peak of the station load. As this seems to be impracticable, most companies have schedules of rates based on the individual peaks and load factors of the various consumers. This is somewhat unfair, because it assumes that all consumers use their maximum demand at the time of the station's evening peak, whereas, as a matter of fact, the maximum demand of some consumers may be at 9 o'clock in the morning or at any other light-load period of the day. But this seems the only feasible way at present. He called attention to the increasing diversity of load on a large central-station system which gradually adds different classes of customers. These customers have peaks which come at different hours of the day and make it possible for the central station to handle the load more economically than would be possible with less diversity of business. For example, in a large residence district, the maximum load of any individual consumer would probably last but a short time each evening under ordinary circumstances. The maximum of various consumers, however, does not correspond, and the result is that the peak lasts four or five hours on a feeder supplying such a large residence district. There is also a nice diversity of load between power and residence business, as power business closes down at the end of the business day at the time that the residence load is coming on. In the case of a central station which also supplies street railways, the railway peak of the year is likely to occur in January or February. On account of the use of electric heaters, this peak is also related to the temperature, which is usually lowest in January or February. In case steam railroads should electrically equip their terminals, the peak load for that business would probably be in October, when the grain crops are being brought in.

The method of determining the peaks of railway loads upon which to base the fixed charges per kilowatt of maximum demand may have an important influence on the amount of such fixed charges. For example, the method of determining the maximum demand made by street railways in Chicago, as stipulated in a recent contract (see *Electrical World*, Oct. 31, 1908, page 934), is by taking the combined output of six hours, three of which shall be the hours of greatest output in the first half of the day for three consecutive days, and the other three the hours of greatest output for three consecutive days in the second half of the day. These six hours of output divided by six determine the maximum demand for the year. If momentary peaks were the basis of measurement, the Chicago railways would have to pay for about 15 per cent greater maximum demand. The yearly load factor of Chicago street railways Mr. Gilchrist stated to be from 38 to 40 per cent.

Mr. P. Junkersfeld brought up the point that a consumer should not only be charged with the fixed charges on the apparatus actually needed to serve him, but also on the apparatus kept in reserve. In a large city this reserve or insurance feature is very important as reliability of service is worth much.

Mr. G. H. Atkin said that the storage battery installed in the Plymouth Place substation by the Chicago City Railway Company reduces the maximum demand made by that company 2500 kw below what it would be if the battery were not present. This means a saving to the railway company in the purchase of power from the Commonwealth Edison Company of $37,500 per year.

Mr. J. L. Hecht said that the station characteristics as well as the load factor influence the cost of production. These station characteristics depend on the number and size of the boilers and the number and size of the generating units. For example, a station operating with one unit would show an increased economy with increased load up to the point where another unit would have to be started. This would cause a reduction in

fuel economy, but might call for increased labor; increasing load on the station after the second unit was started would reduce the cost per kilowatt, and so on. He gave figures from one station in which the output was increased from 600,000 to 800,000 kw-hours per month, with a decrease of 14 per cent in the cost of fuel and 32 per cent in the cost of labor per kw-hour. In this particular case the load factor had decreased with the increased output on account of a greater proportionate increase in peak. In another station the output increased from 220,000 to 430,000 kw-hours, the load factor also increasing, and there was a decrease of 35 per cent in kw-hour fuel cost and 34 per cent in labor.

Mr. S. M. Bushnell spoke of expenses connected with the operation of small isolated plants. He gave as typical figures covering fairly average conditions in isolated plants in Chicago fixed charges amounting to 50 per cent and operating charges amounting to 50 per cent of the total cost. Of this operating charge, about half would be coal, making the coal cost about 25 per cent of the total actual cost.

Mr. E. W. Lloyd, in closing the discussion, said that in smaller towns where consumers could be watched, it is practicable to make non-peak contracts with consumers at lower rates in consideration of these consumers shutting down during the central-station peak-load period. This would not be practicable in the city. On the other hand, the diversity of load on a large city system helps to reduce the fixed charges connected with serving a customer.

Massachusetts Underground Wire Legislation.

A hearing was given at Boston on Feb. 24 by the committee on mercantile affairs of the Massachusetts Legislature in connection with the bill accompanying the petition of Mr. John C. Hadlock to require all public service corporations using the streets to place their wires underground by 1915. The bill is considered by those affected to be one of the worst measures which has been brought before the Legislature in recent years in relation to electric service companies, and after the case had been argued against the companies by Mr. Hadlock, with little apparent impression on the committee, several representatives of the lighting, railway and telephone interests in the State registered their earnest opposition to the proposed law.

Mr. Arthur L. Spring, of the Law Department of the city of Boston, opposed the bill on account of its interference with the underground wire act which is now being followed by the companies in Boston. For the Massachusetts Electric Lighting Association, representing prominent central stations throughout the State, Mr. Everett W. Burdett opposed the bill on the grounds that wires are being buried as rapidly as the companies can bear the cost. Mr. Burdett called attention to the act as destructive of the business of the companies, saying that if it were passed there would be no electrical service financially possible except in the most congested centers. He understood informally that the cost of placing the wires of the Boston Elevated Railway Company alone, under ground, would be $12,000,000, which is more than the cost of the new Washington Street tunnel complete.

Mr. Edward H. Hall opposed the bill in behalf of the New England Telephone & Telegraph Company, pointing out that it is a thoroughly pernicious measure. The company already has over 66 per cent of its wires underground in Massachusetts. If it were required to put the balance underground in the time stated by the bill the cost would be anywhere from $15,000,000 to $25,000,000, and the expenditure of such a sum for such a purpose might drive the company utterly out of business. For the Postal Telegraph Cable Company Mr. G. P. Wardner urged that the bill would be unconstitutional. The United States laws give telegraph companies the right to locate their pole lines in the highways so long as they do not obstruct the streets. It would be impossible in the first place to operate satisfactorily a system buried underground in this way, and it would cost at least $7,000 per mile to bury the circuits, which would be entirely prohibitive. The last remonstrant was Mr. A. H. Brooks, for the Cambridge Electric Light Company. He stated that in the past year his company had expended $200,000 in underground construction. Many other of the larger companies are doing their best to place wires underground in congested centers, notably Worcester. The cost is very great, however, and lines cannot be promiscuously placed underground without hazarding the financial success of the companies.

Wireless on a Railroad Train.

By F. M. Sammis.

Doubtless readers of the *Electrical World* have seen in the daily press accounts of the experimental equipment of a New York Central train with wireless telegraph apparatus. However,

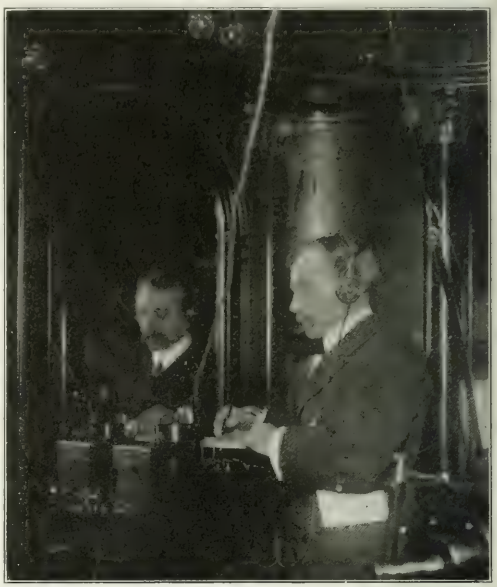


FIG. 1.—WIRELESS STATION ON PULLMAN PARLOR CAR.

a brief description of just what was accomplished and how it was done may be of interest.

As the technical head of the Marconi Wireless Telegraph Company of America, the writer has long since ceased to exhibit surprise at even apparently the wildest proposal for some new use for this means of communication. The use of wire on airships and submarine boats, and for polar expeditions, automobile and yacht races is more or less common, but when that master of ingenuity, Mr. Frederic Thompson, wishes to know whether a 10-car Pullman train can be equipped to do satisfactory work, one feels inclined to spar for time. However, after a few minutes' discussion, it was agreed to undertake the work.

Mr. Thompson had arranged with the New York Central for a 10-car special train to leave Buffalo at 9:30 a.m. on Feb. 27 and carry his "Via Wireless" and "Polly of the Circus" companies to Chicago. Since it was impossible to assemble this train before 7 a. m., but two and a half hours remained in which to make the installation. This was accomplished, however, with some time to spare.

The antenna was of necessity the horizontal type, since the overhead clearance for bridges was but 6 in. Each car was fitted with vertical iron-pipe supports, and between these and over the car roof a stranded copper wire was stretched, having hard-rubber strain insulators inserted at each end, the 10 cars being coupled together with slack-connecting wires to allow for curves.

In the center of the train was placed a buffet parlor car, and here, in the barber shop, was located the Marconi station, the

barber's chair serving as an instrument table. Two leading-in insulators were poked through a ventilator and a lead brought in from that portion of the antenna extending to the rear, and a second lead from the forward extension in like manner, thus forming two unidirectional aerials working in opposite directions. A ground connection was then made by carrying a lead through the window and securing it to one of the main journal boxes.

Four Marconi operators had been despatched a day previous to Cleveland, Toledo, Elkhart and Chicago, each with a set of apparatus and instructions to rig up the best station possible. The "Via Wireless Special" with two big express engines speeding westward, often at the rate of 70 miles an hour, was able to communicate with these stations over a distance of 60 to 80 miles. The rear section of the antenna was used until the



FIG. 2.—HORIZONTAL ANTENNA ON TOP OF CAR.

station was reached, after which the forward section was switched in.

While there was a heavy snowstorm raging and some insulation difficulties were experienced, due to coating of the insulators with soft-coal smudge, the experiment was successful to a degree, good communication being maintained with each of the stations.

Among those who made the trip at the invitation of Mr. Thompson, and who were enthusiastic at the results obtained, were Messrs. L. W. Landman, general Western manager of the Lake Shore Railroad; C. W. Chevee, general Eastern passenger agent of the Lake Shore; Harry Parry, general agent of the New York Central at Buffalo, I. W. Cooke, superintendent of the Lake Shore at Buffalo.

Report Against Municipal Lighting at Clinton, Mass.

The committee appointed by the town of Clinton, Mass., to investigate and advise with reference to the purchase and operation of the local lighting plant has reported unanimously that such a plan is at present financially impractical. The consulting engineer of the committee was Mr. James H. Vail, of New York City, who made a special report on the whole lighting situation, advising against municipal ownership, after a study of the conditions.

The present central-station and gas business is handled by the Clinton Gas Light Company. In 1907 the capital stock of the company was $80,000. In 1908 it was $120,000, with funded indebtedness of $110,000 and a floating indebtedness of $46,000. The gross receipts for 1908 were $8,928.60 for gas and $34,142 for electricity, or a total business of $43,070. The reports show that the business has not been operated with large financial success in proportion to the stated investment of the company. Mr. Vail called attention to the fact that if the town should purchase the property material economies would have to be applied to secure better results and new money must be expended to improve the equipment and obtain a higher degree of economic administration.

The present electric plant and system are, from an economic point of view, very inefficient as compared with a modern type of apparatus. On account of this condition it is evident that before long it will be uneconomical to continue operations with the present equipment. New constructions and extensions must be financed from year to year; new business must be canvassed and all the new money expended should earn twice the interest charges or its expenditure is not justified. The business must be strenuously developed to the end of increasing the gross receipts. Expenses do not increase in the same ratio as new business. Furthermore, the management placed in charge of the plants requires to be highly efficient and skilled in the work of operation, with the object of attaining from year to year a proportionate reduction in the cost of operation. The field for new business in the town is large and should be developed by more liberal illumination, greater inducements to use electric motors and an increase in the use of gas stoves.

The book values of the plant are totaled up to $142,610, and the replacement value, based upon the estimated cost to duplicate the plant and system, is $102,805. The estimated value based on the usefulness of the plant and operating system, deducting a conservative amount for depreciation, is $89,545. A saving of perhaps 15 per cent in operating expenses would accrue from the close physical association of the electric and the gas plants of the company. The gas system operates at 93 per cent of its gross earnings, is not profitable, and the net income is barely 2 per cent upon the valuation. In the electric system, with gross receipts of $34,142, operating expenses of $24,582, and a net revenue of $9,560, the ratio of operating expenses to gross earnings is 72 per cent. The net revenue for both systems is $11,638. If the entire plant and system were sold to the town at the company's price of approximately $460,000, the bond interest at 4 per cent would amount to $18,400 per year, and deducting the net revenue stated above, there would be shown a deficit of $6,762. It is evident, according to these figures, that there would be nothing attractive as a business proposition to the town in this situation. Said Mr. Vail in conclusion:

"I could not advise purchasing the electric and gas plants at the price quoted and I believe that the only way to arrive at an equitable price is to follow the course provided by the laws of Massachusetts."

In the light of this report and its inquiries the committee "is unanimously of the opinion that it would be undesirable and inexpedient for the town to establish municipal lighting at this time."

Brooklyn Edison Educational Course.

The Brooklyn Edison Company has just completed its third and most successful season of educational work under the direction of Prof. Sydney W. Ashe. The added success was due in a large measure to the general spirit of co-operation which prevailed. The scheme of having supplementary talks by Edison officials or department heads in conjunction with the lectures, bringing out both the theoretical and the practical phases of the work, has done much to arouse and maintain interest, cause discussion and stimulate attendance.

The [illegible] last year. [illegible] Brooklyn Edison system, extending from the coal pile to the consumer. [illegible] of each lecture was [illegible] previous years, which tended to broaden the benefit of this educational work by clearing up many points which were previously [illegible] As [illegible] stated by Mr. S. N. Neam of the sales department, on the value of electrical household utilities.

CURRENT NEWS AND NOTES.

PHILADELPHIA CITY WIRELESS.—The city of Philadelphia will install a wireless plant on the top of the tower of the City Hall, which is more than 500 ft. above the street level.

UNDER-WATER WIRELESS.—Francis B. De Witt, a student at Stanford University, is reported in the newspapers as having made successful experiments in the transmission of wireless through water.

A. I. E. E. ANNUAL CONVENTION.—The next annual convention of the American Institute of Electrical Engineers will be held during the week beginning June 28, 1909, at Hotel Frontenac, Thousand Islands, Frontenac, N. Y.

FRENCH LETTER-TELEGRAMS.—The French Department of Posts and Telegraphs has published statistics showing that between Dec. 7, 1908, when the service was inaugurated, to Dec. 31, 6657 letter-telegrams were sent averaging 55 words in length.

POWER FROM BAY OF FUNDY TIDES.—An electric power company is seeking authority to construct dams on a number of rivers emptying into the Bay of Fundy in order to take advantage of the power of the high tides for which the Bay is famous.

WASHINGTON STATE PUBLIC UTILITY LAW.—The Washington Legislature has passed a bill giving the Railway Commission jurisdiction over telephone and telegraph companies and power to compel physical connection between long-distance telephone companies.

INDIANA LEGISLATION.—The Indiana Legislature has passed an act requiring all cities of the fifth class to advertise for proposals when light, heat or water franchises are to be granted or contracts made. Another bill recently passed fixes the maximum price of natural gas at 60 cents per 1000 cu. ft.

TEXAS STATE LIGHTING PLANT.—A bill now before the Texas Legislature provides for an appropriation of $250,000 to build and equip at Austin an electric light, power and water works plant to supply the various State buildings. It appears that the bill is a result of dissatisfaction with the present service from the Austin municipal plant.

"TAFT IS PRESIDENT."—As its part of the Chicago celebration of the inauguration of President Taft on March 4, the Chicago Telephone Company caused all its operators to use the salutation "Taft is President!" instead of the familiar "Number, please?" on responding to calls from 11 to 11:05 a. m., corresponding to noon, Washington time.

OHIO INDEPENDENT TELEPHONE ASSOCIATION.—The annual convention of the Ohio Telephone Association will be held at the Hartman Hotel, Columbus, March 18 and 19. The first day will be devoted to the regular business of the body, and on Friday there will be discussions on construction, maintenance, operation and accounting.

SOUTHWESTERN ELECTRICAL CONVENTION.—As indicating the interest in the coming convention at Dallas of the Southwestern Electrical and Gas Association, the acting secretary, Mr. D. G. Fisher, has issued a circular containing letters from a number of prominent members who predict that the occasion will be one of unusual importance. The meeting will be held in May.

STORAGE-BATTERY VEHICLES FOR WASHINGTON CAPITOL SUBWAY.—In order to enable senators to pass quickly from the Senate office-building to the Senate chamber, the former is connected with the Capitol by a subway electric line. Two storage-battery vehicles have been supplied for this service, and on trial last week operated satisfactorily. The vehicles are of 5-hp and a maximum speed of 12 miles per hour.

CHICAGO RAILWAY CONSOLIDATION AGAIN CONSIDERED.—Since the temporary abandonment of the plans for consolidating the traction lines of Chicago under one management there have been many conferences of business interests attempting to revive the merger scheme. Executive committees of the four elevated roads are now considering plans proposing the formation of a holding company which will lease all the properties for a long time on guaranteed dividends.

FEDERAL FOREST BILL.—As passed by Congress the bill providing for reforestration permits the acquirement of lands in any part of the United States where such acquisition can be shown to be advisable by the National Forest Reservation Commission created by it, after the Geological Survey has determined that such acquisition will promote or protect the navigability of streams on whose watershed the lands lie. Originally the bill was designed to cover the Appalachian and White Mountain ranges, but the House substitute makes its provisions applicable to all States.

THIRTY-THOUSAND-DOLLAR THEFT OF INCANDESCENT LAMPS.—Through the manipulations of several of its lamp clerks, aided by outsiders, the New York Edison Company has been victimized the past two years to the extent of $30,000 or more by the theft of incandescent lamps. Three lamp clerks and a clerk of one of the large express companies are among those implicated. The scheme consisted in sending packages of lamps to an express office, where the express clerk implicated delivered them to an accomplice, driving a wagon identical with those used by the express company.

DEPARTMENT STORE ELECTRICAL SHOW.—As a sort of aftermath of the big Chicago Electrical Show at the Coliseum, one of the large department stores in Chicago is this year, as it did last year, holding a little electrical exhibition of its own. There are a number of exhibits, and the arrangement of booths and lighting effects is something like that of the Coliseum. The Commonwealth Edison Company demonstrates electric cooking and gives away cakes and other products of the electric ovens and other cooking utensils. The Chicago Telephone Company has a six-position multiple switchboard in operation, and there are exhibits of electric washing machines, potato peelers, curling irons, vibrators, batteries, medical sets, lighting fixtures, lamps, shades, etc. An automatic "military band" instrument operated by belted motor furnishes the music, which is certainly most abundant in quantity, if not expressing all the finer gradations of the art in quality. The show began on March 1 and will be continued until March 13.

WHAT CONSTITUTES A BUSINESS TELEPHONE?—As to what constitutes a business telephone or what distinguishes a business telephone from a residence telephone is an interesting and important question to be tested by the court in Elkhart, Ind. The test case grew out of a demand made by the Home Telephone Company that a doctor, paying $2.50 a month, or the business rate, for a telephone in his residence over which he "talks business" professionally. The medical man insists, however, that a telephone in a residence is, under the company's franchise, a "residence telephone" and that no more than $1.50 a month can be legally collected. The telephone having been removed, the doctor asked the court for a temporary order compelling the telephone company to reinstall the telephone until the question can be determined, and the court ordered that the telephone be reinstalled. The question will be considered on its merits in the Superior Court and considerable evidence will be introduced with a view of determining what uses distinguish a business telephone from a residence telephone.

Main and Auxiliary Steam Equipment in Waterside Station No. 2 of the New York Edison Company.

As stated in last week's issue, the steam generating plant of Waterside Station No. 2 of the New York Edison Company is composed of 96 water-tube boilers, built in batteries of two and each boiler rated at 650 hp. Forced draft is supplied to the boilers by means of 16 independent air ducts running north and south under each line of boilers. Each duct takes care of six boilers and has at each end a blower driven by a Sturtevant engine, the entire forced-draft equipment being supplied by the B. F. Sturtevant Company, of Hyde Park, Mass. Half of the fans are of the Sirocco type and half of the Multivane type. Dampers, one at the center and one at the outlet of each fan, are provided in each duct. In addition each duct has six ash-pit connections to boilers with dampers and means for controlling them from the fireroom floor. The blower engines are of the vertical, double-acting, enclosed type and are rated at 65 hp when operating at 290 r.p.m. under a throttle pressure of 120 lb. saturated steam. The blowers deliver approximately 90,000 cu. ft. of air per minute.

The products of combustion pass off through sheet-iron flues and uptakes for each section into a main uptake connecting with the stack. There are four smokestacks in use, and each takes care of a section of 24 boilers. The stacks are built of ¾-in. to ⅜-in. steel plates, 7 ft. to each course. They are 22½ ft. in diameter at the bottom and 21 ft. in diameter at the top; the top of the stacks is 300 ft. above the lower grates. To every third plate two angles are riveted for supporting the brick lining. This consists of 1 in. of concrete and 4 in. of common red brick clear to the top. Each stack has 6 in. × 4 in. angle stiffening posts riveted to the inside of the shell with horizontal ring. The stacks rest on plate girders and are anchored by 10 1⅞-in. bolts, with wind and sway bracing attached to the framing.

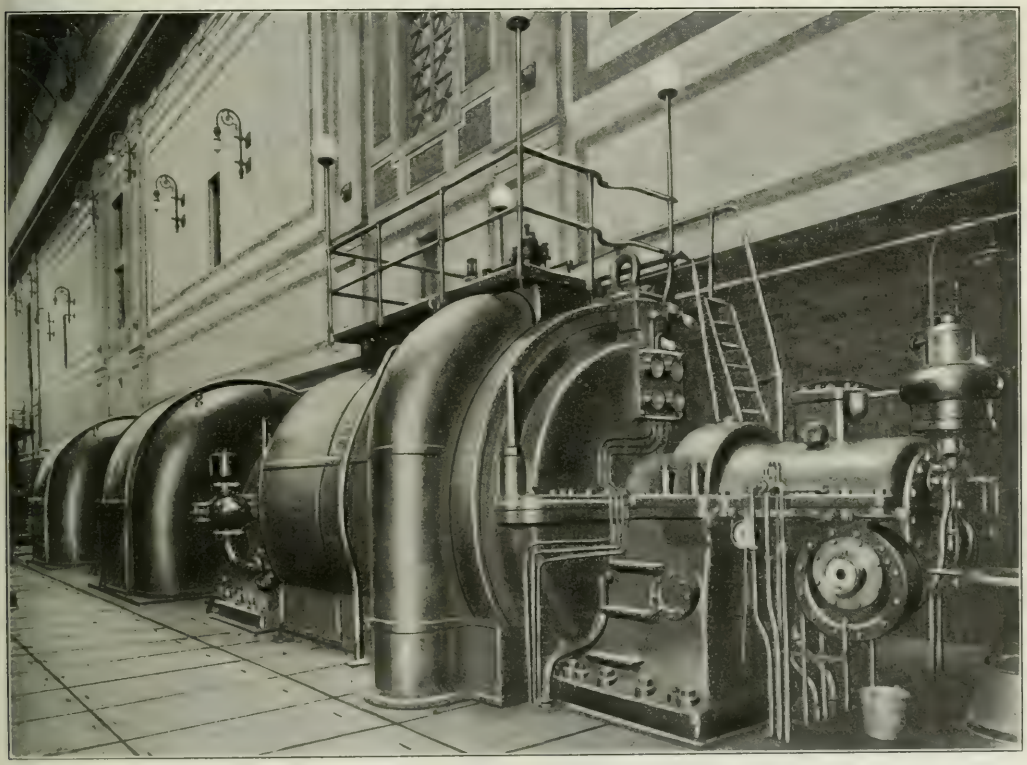


FIG. 1.—VIEW OF ONE OF THE 7500-KW HORIZONTAL TURBINE UNITS

FEED-WATER SYSTEM.

The feed-water system in use involves a number of interesting features representing what is without doubt the most recent practice in the handling and conservation of the boiler water supply for a large plant. Of chief import is the use of centrifugal boiler-feed pumps and the means adopted for measuring all water delivered and the blow-off wasted. The water for the boilers is taken from the city water mains, the water in the East River being salt and driven wells being impossible in the vicinity of the station. By the use of surface condensers all of the condensation from the large turbines is reclaimed and also practically all of the steam used for the steam-driven auxiliary machinery in the turbine room basement.

The system embraces, in general, a header and connections for the return of condensation from the hot wells of the condensers, large open feed-water heaters utilizing the exhaust from the reciprocating engines and the small turbines, and a system of feed piping with loops surrounding each of the boiler sections. Venturi meters, both indicating and recording, measure all of the feed water delivered. Each of the two pump rooms in the boiler-house basement contains two Platt Iron Works Company open feed-water heaters rated at 500,000 lb. of water per hour and four centrifugal pumps of D'Olier Engineering Company make. The heaters are each 6 ft. × 22 ft. × 11½ ft. high and contain 16 large and 16 small trays arranged in four tiers. Each heater has a total content of about 1000 cu. ft. and the content of the storage chamber is 587 cu. ft.

The hot well returns from the condensers are collected in a 12-in. header located along the north wall of the boiler room. A 14-in. pipe branching to two 10-in. pipes carry the returns into

the tops of the heaters in both pump rooms. The flow is maintained by the hot-well pumps, which are designed to operate against a head of 25 ft. A float operating on a balanced regulating valve controls the amount of water delivered to each heater. The pressure with varying quantities of water is maintained automatically by means of a pressure regulator used in conjunction with the fly-ball centrifugal governor mounted on the turbine shaft.

The water is received from the city mains through two 12-in

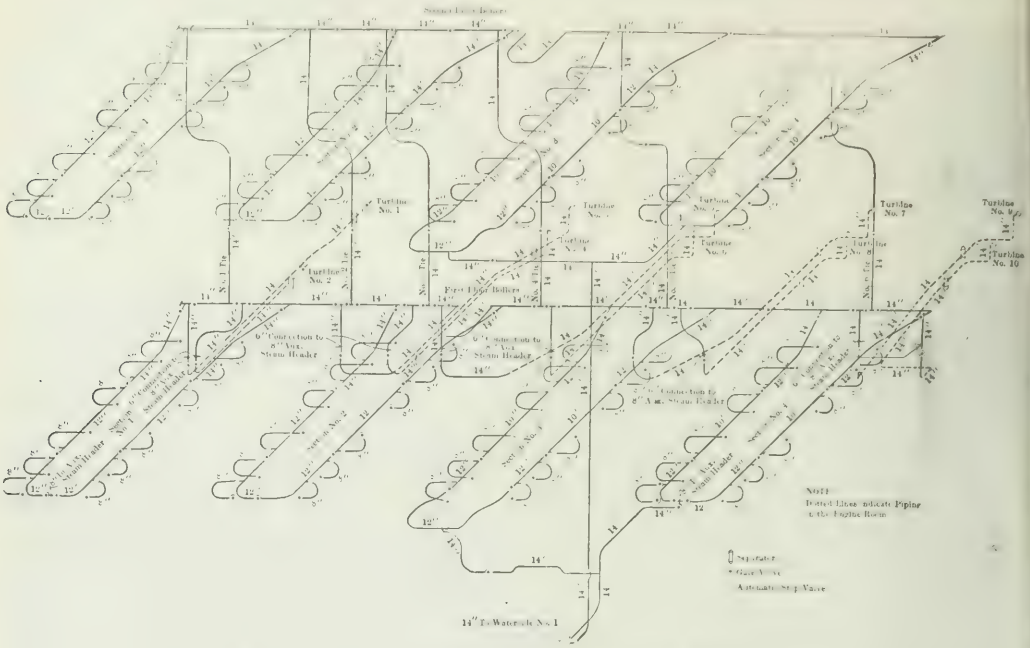


FIG. 2.—ISOMETRIC DIAGRAM OF HIGH-PRESSURE STEAM PIPE CONNECTIONS.

The centrifugal pumps are of the five-stage type with 8-in. suction from a 16-in. suction tie line connecting the bottom of the four heaters. Each pump discharges into 6-in. feed-water ring headers on each tier of boilers through four 8-in. risers. Each set of six boilers is served with a 6-in. tie line between headers and a 3-in. loop, gate valves, angle check valves and 2-in. branch pipes leading into the drums of each boiler. The pumps, which operate at 1650 r.p.m. and deliver 1000 gal. per minute against a head of 700 ft., are connected through flexible couplings to Terry steam turbines rated at 300 hp. The turbines are built by the Terry Steam Turbine Company, of Hartford, Conn. They are of the single-wheel type with wheels 3 ft. in diameter and operate under a steam pressure of 175 lb. at the throttle with steam superheated 100 deg. A constant discharge pressure

pipes, one on the First Avenue side of the station and the other on the Thirty-ninth Street side. After passing through a fish trap and check valve the water is metered by four 6-in. meters, the tail water of each being reunited in a 12-in. main and led through 8-in. branch pipes to the heaters. The flow is regulated by a float acting on a two-seat balance regulating valve. A salt-water connection is provided in the pump room in case of interruption in the city water supply.

HIGH-PRESSURE STEAM PIPING.

An isometric diagram of the high-pressure steam piping is shown in Fig. 2. Two main 14-in. headers are located in the boiler room below the second and third floors near the division wall. Six 14-in. vertical tie lines connect these main headers at intervals, and valves are arranged so that any section can be

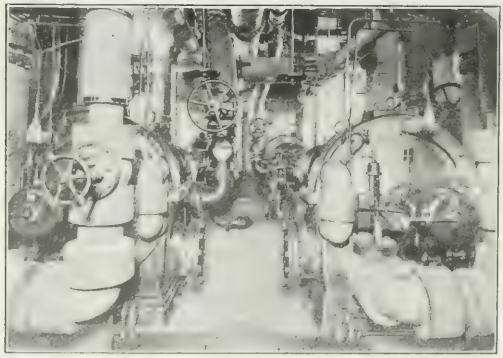


FIG. 3.—TURBINE-DRIVEN CENTRIFUGAL FEED-WATER PUMPS.

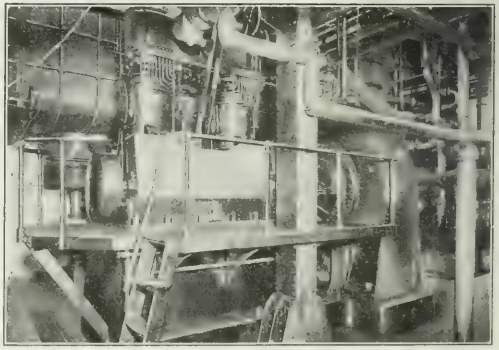


FIG. 4.—CIRCULATING PUMP FOR WHEELER CONDENSER.

isolated should occasion require it. The turbines are fed with steam from the lower header, the piping passing under the floor of the turbine room, which is 5 ft. above the lower boiler-room floor, and being supported from the steel framework of the operating-room floor. The main ring header is supplied by eight boiler-room headers made up of 10-in., 12 in. and 14-in.

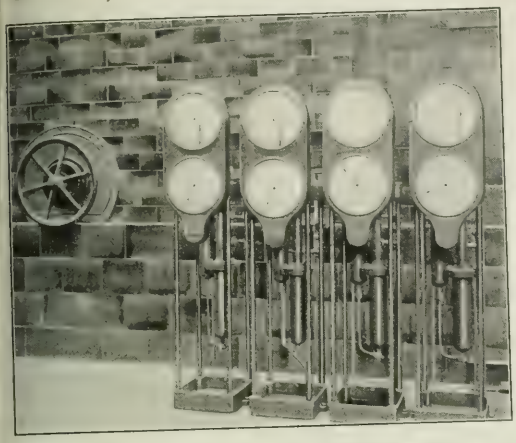


FIG. 5.—RECORDING AND INDICATING WATER METERS.

pipe, four feeding the upper and four the lower header. Besides being separated into sections by valves between each battery of boilers, each boiler-room header forms a loop over one section in each tier. The boiler manifold is connected by means of 8-in. U-bends to the headers. In the bends a combination stop and check valve is located which automatically opens when the pressure of the boiler equals that of the line. The high-pressure steam piping is made up of ⅜-in. open-hearth steel with cast-steel fittings and Whitlock double lap-joints made by the Whitlock Coil Pipe Company, of Hartford, Conn.

Encircling the boiler room above the first tier of boilers is an

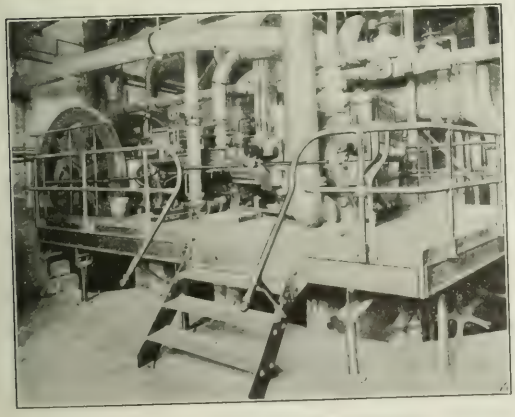


FIG. 6.—DRY VACUUM PUMP FOR CONDENSER.

8-in. ring header which supplies steam to the blower and stoker engines of the first and second tiers and to the pump and compressor rooms in the basement. Each of the auxiliaries in the turbine room basement receives steam through a 6-in. connection to the 14 in. lines supplying the turbines. All of the live steam lines to the turbines and auxiliary engines are equipped with Cochrane separators inserted near the turbines and engines.

EXHAUST STEAM PIPING.

Along the north division wall of the boiler house basement is an auxiliary header made up of 8 in., 14 in. and 24-in. pipe leading into an exhaust flue at the east end of the building through relief valves. Branch pipes lead from this header into the pump rooms to supply steam to the feed-water heaters there installed. From the opposite end of the heaters a 12-in. pipe leads to the exhaust flue or stack. All the exhaust lines from the turbine auxiliaries, step-bearing pumps and auxiliary appa-

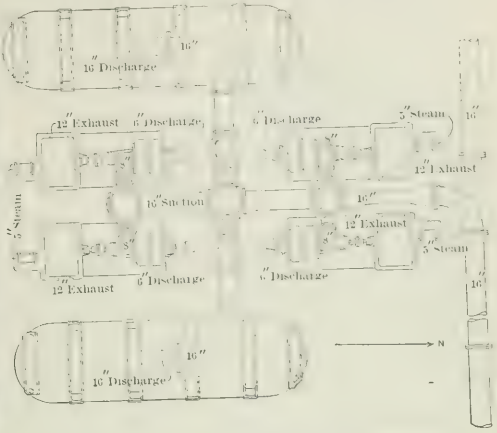


FIG. 7.—PLAN OF FEED-WATER PUMPS AND HEATERS.

ratus in the boiler-house basement connect with the auxiliary exhaust header, and since the auxiliaries in the turbine-room basement are also arranged to operate condensing when the supply of exhaust steam from other sources is sufficient for feed-water purposes, the exhausts from these are passed through Cochrane vacuum oil separators before entering the condensers. Free exhaust for the main turbines is provided by two tunnels described elsewhere in this article. Each turbine is equipped with a 36-in. pipe connection in the exhaust to the turbine and a 6-in. chronometer valve and muffler for breaking the vacuum.

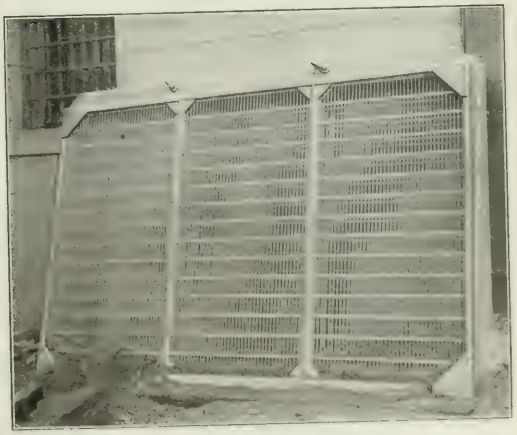


FIG. 8.—SCREENS FOR INTAKE TUNNEL.

The valve and muffler are located near the throttle. The turbines connect with the exhaust tunnels through 36-in. lines.

DRIP PIPING.

The system of high-pressure drip piping at present installed embraces a gravity drip system on all main steam headers located above the water-line of the boilers; a receiver pump drip system on all main and auxiliary lines in the basement of the turbine room and on all high-pressure pipes below the water line of the boilers, and a drip system bleeding the high-pressure

pipes from the coal tower and from the heating system. A low pressure drip system connected to the cylinders, cocks, etc., of all auxiliaries discharges into the East River.

The elevation of the gravity drip system is above the water line of the boilers, and all of the headers connected to it are drained through a 5-in. return and 2-in. drip ring header in each section of boilers. Connections are made with the main headers through 1¼ in. pipes forming a vertical loop and water

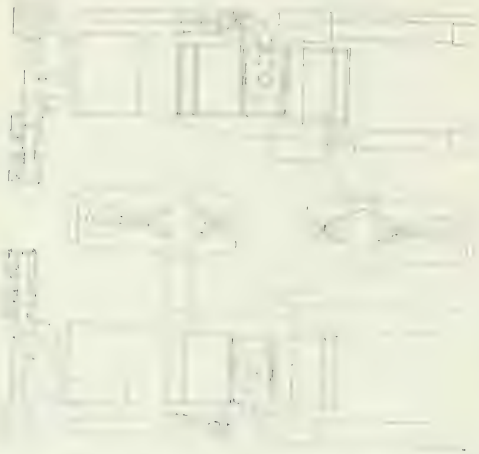


FIG. 9.—ARRANGEMENT OF ALBERGER CONDENSER EQUIPMENT.

leg in order to prevent water-hammer. The water is delivered through gate valves and check valves, entering the mud drums of the boilers. The system of ring headers is tied together with a 3-in. return drip header and by vertical tie lines between the main drip headers in each tier. A complete bleeder system for draining any part of the drip system when repairs are necessary is installed.

The drips from the separators and throttle valves in the main steam pipes to the turbines, as well as the high-pressure drips from the auxiliaries in the basement of the turbine room, find their way into a 4-in. main drip header delivering to automatic receiver pumps located at the base of four of the turbines. These pumps discharge through 2-in. lines into the gravity-drip header of the first tier of boilers. The high-pressure drips from the blower engines and feed pumps, together with the drips from the engine leads, flow through 4-in. pipes to the lower elevation of the main turbine-room drip header. The drip pumps are

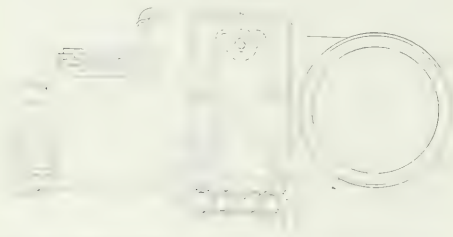


FIG. 10.—ARRANGEMENT OF WHEELER CONDENSER EQUIPMENT.

of the reciprocating type and are started automatically by means of a receiver float.

TURBINES AND CONDENSER EQUIPMENT.

The turbines in the operating room are numbered in regular rotation from the northwest corner, the odd-numbered turbines being along the north wall and the even-numbered turbines along the south wall. Running east and west the turbines are spaced 55 ft. apart, center to center, and running north and south the General Electric units are placed 28 ft. center to center, and the Westinghouse units 32 ft., center to center. The operating room is 57½ ft. wide and 306 ft. long. A plan view and photograph of this room were given in last week's issue. Turbines No. 1 and No. 2 are of the multiple expansion, parallel flow, horizontal type built by the Westinghouse Machine Company. They are rated at 7500 kw when operating at 750 r.p.m. with dry saturated steam at 175 lb. pressure at the throttle and with a pressure in the exhaust pipe of 2 in. of mercury absolute at the exhaust outlet. When operating with steam superheated 100 deg. Fahr. at the above speed, pressure and vacuum, the steam consumption at full load does not exceed 15.9 lb. per kw-hour, at half load 18.3 lb. and at 50 per cent overload 17.6 lb. The turbine is provided with a governor of the balanced poppet-valve type enclosed within the valve chest for controlling the admission of steam. In addition there is a quick-operating throttle valve in combination with the auxiliary governor which automatically closes if the turbine speed increases beyond a certain limit.

The Westinghouse units are equipped with Alberger condensing apparatus. The surface condensers are located directly under the turbines to which they are connected by an expansion joint. They are of the three-pass type and have 25,000 sq. ft. of cooling surface. The dry-vacuum pumps are of the single-stage, two air cylinders in tandem type fitted with Corliss valve gear. The wet-vacuum pumps are of the monitor duplex type and the circulating water pumps are of the double-suction centrifugal type direct-connected to two-cylinder vertical engines.

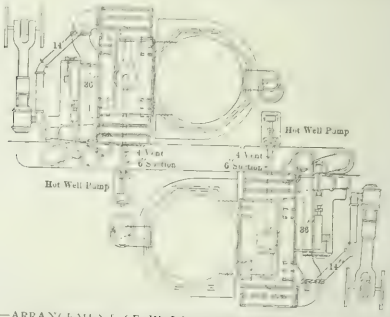


FIG. 11.—ARRANGEMENT OF WORTHINGTON CONDENSER EQUIPMENT.

The arrangement of this condensing outfit is shown in Fig. 9.

All the other main turbines are of the Curtis five-stage type manufactured by the General Electric Company. Turbines Nos. 5, 6, 7 and 9 are rated at 8000 kw and operate at a speed of 750 r.p.m. and are equipped with governors of the hydraulic type. The condensing apparatus for these units was installed by the Wheeler Condenser & Engineering Company. The condensers are of the two-pass, dry-tube type and have a cooling surface of 18,000 sq. ft. They are set to one side of the turbine, as indicated in Fig. 10, which shows the condenser equipment. The circulating water pumps are of the volute centrifugal type direct-connected to double engines. Double-acting steam dry-vacuum pumps are used and the wet-vacuum pumps are of the centrifugal type direct-connected to Terry steam turbines. These are rated at 15 hp and run at 1500 r.p.m. Turbines No. 8 and No. 10 have the same rating as the four just mentioned, but are equipped with Worthington condensing apparatus. Three-pass surface condensers with a cooling surface of 23,000 sq. ft. are used in connection with engine-driven centrifugal circulating-water pumps and horizontal, tandem, rotative dry-vacuum pumps. The wet-vacuum pumps on these turbines are of the two-stage turbine type driven by 20-hp steam turbines built by the Kerr Turbine Company, of Wellsville, N. Y. Turbine No. 3 is rated at 14,000 kw and is equipped with Wheeler condensing apparatus. The condenser has a cooling surface of 18,000 sq. ft. and the circulating-water pumps are driven by Kerr turbines. Two pumps have been installed so that in winter, when the circulating water from the river is quite cold, only

e is kept running; the other serving as reserve. During the
nmer both pumps are operated. The dry-vacuum and wet-
cuum pumps are driven by reciprocating steam engines. The
undations for turbine No. 4 are now being erected. This unit
ll be rated at 14,000 kw.

TUNNELS.

For the purpose of taking care of the intake overflow and free
haust for the large turbines a system of tunnels is installed

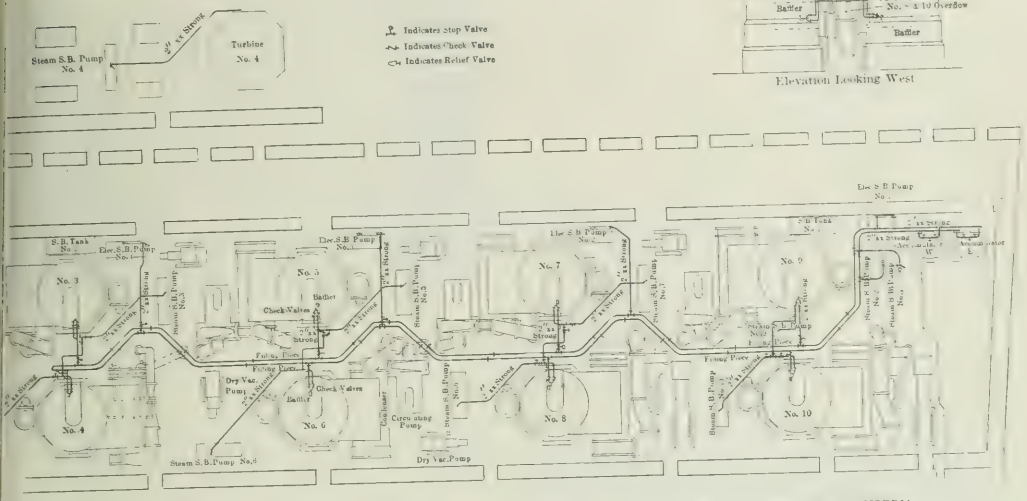


FIG. 12.—PLAN OF TURBINE ROOM BASEMENT SHOWING CONDENSERS AND STEP-BEARING OIL SYSTEM.

under the turbine-room basement. Water for condensing purposes is brought into the station from the East River and up to the suction of the circulating pumps through the intake tunnel which extend to within about 22 ft. of the west end of the station. This tunnel has a sectional area of approximately 118 sq. ft. The top of the tunnel is 16 ft. below the basement floor line and circular openings, 4½ ft. in diameter, are provided for the suction pipes of the circulating pumps. The overflow tunnels are located above the intake tunnel and about 6 ft. on either side of the center line of it. Each of the overflow tunnels has an area of about 50 sq. ft., and the overflow pipes from the condensers connect with them through openings provided in the floor. Both of the overflow tunnels unite at the east end of the building into one large tunnel extending out to the river. This tunnel is made with an outer and inner shell, of ¼-in. steel, the shells being securely fastened together by means of lacing bars and the space between them filled with concrete. The tunnel has a section area of approximately 120 sq. ft.

Paralleling the overflow tunnels and outside of each are exhaust tunnels for carrying the steam from the large turbine to the exhaust flue at the southwest corner of the building. Each of these tunnels, of which there are two, has a sectional area of 30 sq. ft., and is lined with cast-iron segments. The five tunnels are constructed in a solid concrete monolith, with separating walls approximately 2 ft. thick. At the east end of the building two electrically driven sump pumps are installed to take care of the seepage into each of the exhaust tunnels, these being below the river. The pumps are of the Watson-Stillman Company make and are direct-connected to 8-hp, 220-volt Westinghouse shunt wound motors. An automatic starter of the Cutler-Hammer Company make forms part of the motor equipment.

Over the intake tunnel, just outside of the building, a screen well 22 ft. x 12½ ft. x 29 ft. deep is erected with walls of reinforced concrete ranging from 3 ft. thick at the bottom to 2 ft. at the top. The screens consist of heavily galvanized iron gratings, as shown in Fig. 8, with others of finer mesh so arranged as to cover completely the intake tunnel. The gratings are made in four frames and weigh approximately 6000 lb. each. They are removable and are supported on yellow-pine timbers. The finer screens are constructed of ⅛-in. wire, with ½-in. mesh, three screens to the frame. Eight of these frames are arranged in four parallel guides and may be removed by a screen hoist. The latter consists of a 5-hp electric hoist with



Elevation Looking West

the necessary tackle. This is placed in a screen-well house of brick and granite similar to the masonry work of the station building.

OILING SYSTEM.

An elaborate oiling system is installed for supplying lubricant to the various engines, pumps, etc., and also for the step bearings of the vertical turbines. In the sidewalk vault east of the extension to the battery room on the Fortieth Street side is an oil receiving and tank room for engine and cylinder oil. The oil is delivered in barrels through a hatchway and separate steel tanks are provided for each lubricant. Three 2-ft. x 24-ft. tanks are provided for engine oil, and two 2-ft. x 7-ft. tanks for cylinder oil; the total storage capacity in the receiving tanks being over 2000 gal. In the roof house storage is provided for over 12,000 gal. of oil in two 7-ft. x 23-ft. tanks for engine oil

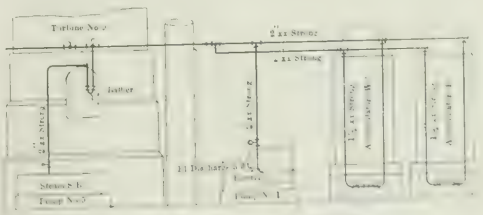


FIG. 13.—STEP-BEARING OIL SYSTEM.

and two 2-ft. x 6½-ft. tanks for cylinder oil. In addition the filter tanks have a capacity of 5100 gal. and the step-bearing tanks of 4000 gal.

In the filter room, at the west end of the turbine-room basement, are four oil pumps which draw engine oil from the receiving tanks through a 5-in. line. From the filter room the oil is pumped to the tanks on the roof through 5-in. risers connected to the discharge of the pumps. The returns to the oil

ing system are through 3-in. pipes, also. By this means a positive head of 50 lb. is maintained throughout the system and oil under this pressure is used in the operation of the hydraulic governors of the turbines. By means of cross-connections in the filter room, the roof supply can be cut off and oil pumped directly into the system. Cylinder oil is taken from the receiving room through two 2½-in. pipes and discharged through 2-in. pipes connecting with ring headers distributing cylinder oil throughout the station. The discharge is also connected through 2-in. vertical risers to the tanks in the roof house. Precaution is taken to make the oil vault, roof house and oil shaft strictly fireproof with no direct communication through doors to the station interior.

The turbines receive their supply of oil from two 5-in. pipes leading from the engine-oil tanks overhead and running along the center of the turbine-room basement to a point where taps are taken off to supply the horizontal turbines No. 1 and No. 2. From this point 4-in. mains are continued with branch pipes to supply the vertical bearings and hydraulic governors of the vertical turbines. The blower engines in the boiler-room basement, as well as the feed pumps, are supplied with oil through upper and lower ring headers consisting of two 1½-in. pipes, one for engine oil and the other for cylinder oil. The auxiliaries to the turbines in the turbine-room basement are lubricated from two similar headers. These headers are connected directly to the returns leading from the tanks on the roof.

For the step-bearings of the vertical turbines the oil is maintained under a pressure of 1200 lb. The main bearing area of the step is 168 sq. in. and the system installed for maintaining these steps under pressure is quite extensive. At each turbine is located a steam-driven, step-bearing pump, and variations in the service rendered by these units is compensated for by an

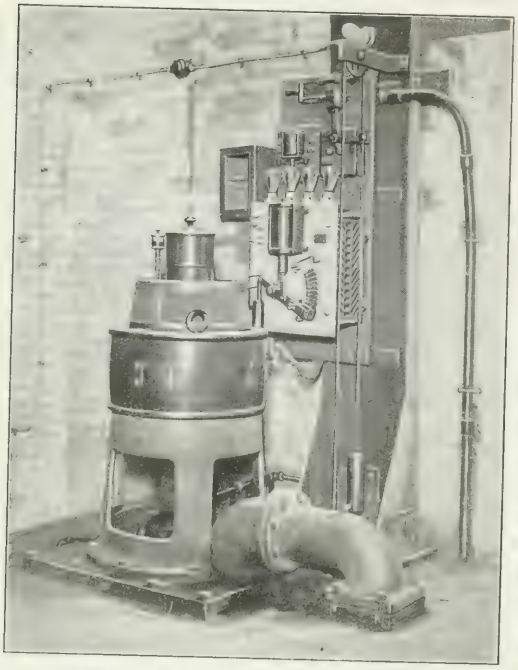


FIG. 14.—SUMP PUMP FOR EXHAUST TUNNEL.

accumulator system. Two 4-in. lines run along the center of the operating-room floor, as shown in Fig. 12, and are connected to the two accumulators located at the east end of the station. Two steam step-bearing pumps operate in conjunction with the accumulators and should these fail four electrically driven, step-bearing pumps automatically come into operation

The suction of all the step-bearing pumps is connected to a 6-in. ring header encircling the turbine-room basement and supplied with oil from two step-bearing tanks. The latter are located near the north division wall and are joined by a 6-in. equalizer pipe. The tanks in the filter room are also connected to this ring header. Each step-bearing receives its supply of

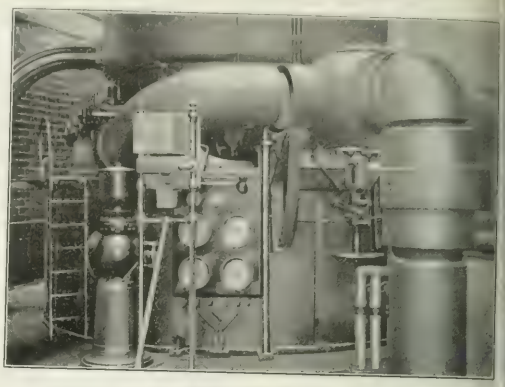


FIG. 15.—STEAM CONNECTIONS TO VERTICAL TURBINE.

oil through a 2-in. pipe, stop valve, check valve and baffler, the pressure inside the latter being maintained at 1000 lb. About 20 gal. of oil per minute is delivered to the step bearings, and the returns are led through 2½-in. pipes to a 6-in. header connecting with both the step-bearing and the filter tanks. In the filter room the oil is strained, dehydrated, cooled and returned to the step bearings.

The circulating water for the oil cooler is pumped by two single-stage centrifugal pumps made by the Lawrence Machine Company and direct-connected to a 15-hp, 200-volt Westinghouse motor. Three of the oil pumps are of the duplex piston type, built by the G. F. Blake Manufacturing Company, and one is a two-stage turbine pump, built by the Jeansville Iron Works Company. The pump is driven by a 25-hp, 220-volt Browning motor. Dirty oil is handled by three duplex piston pumps of Blake manufacture, and the cylinder oil is handled by two pumps of the same type and make.

Eight of the step-bearing pumps are of the Dean Brothers duplex-plunger type and four are of the hydraulic-triplex type built by the Platt Iron Works Company. The latter are all

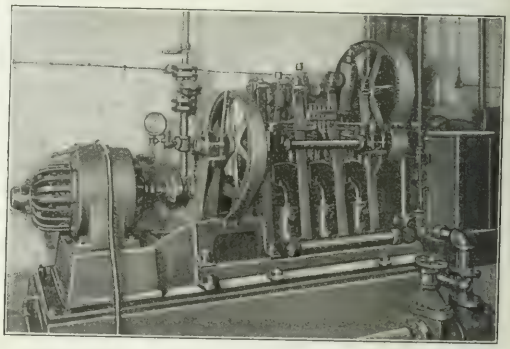


FIG. 16.—ELECTRIC OIL PUMP FOR STEP BEARING SYSTEM.

direct-connected to 15-hp shunt-wound motors of General Electric build, controlled by Ward Leonard starting boxes and General Electric speed regulators. A view of one of the electrically driven oil pumps is shown in Fig. 17.

The electrical equipment and control of the station will be treated at length in a subsequent article.

Electric Lighting at Bahia, Brazil.

By A. H. Keleher.

MEASURED by the time required to travel by steamer, the city of Bahia, Brazil, is 15 days from New York. Viewed from the standpoint of the electric illuminating engineer, Bahia is a progressive city possessing many places of interest.

The energy for lamps and motors is supplied by two central-station companies, the Bahia Light & Power Company and the Guinle Company. The e.m.f. of supply is a mixture of 110 and 220 volts, with the latter predominating.



FIG. 1.—EXTERIOR ILLUMINATION OF HEAD OFFICE OF LINHA CIRCULAR COMPANY.

Twelve thousand 20-cp incandescent lamps and about 200 hp in motors are connected to the lines of the Guinle Company. Moreover, energy is furnished to many arc lamps, and also to the two important tramway lines owned by the Guinle Company, namely, the Linha Circular, 14 miles long, and the Trilhos Centraes, 19 miles in length.

Three General Electric turbines in the Preguiça power house furnish the energy consumed by the above installation. These turbines are of the latest improved type and each is rated at 1500 kw, 2300 volts. From the power house the electrical energy is transmitted over the three-phase lines of the company to three substations at Graça, Barroquinla and Preguiça. Each of these substations is equipped with two 275-hp, 500-volt rotary converters. In general, American-made machinery predominates in the power house and each of the substations.



FIG. 2.—STREET CARS AND LAMPS IN BAHIA.

In the Preguiça power house there is a very modern equipment of Babcock & Wilcox boilers.

The workshops of the Linha Circular use the latest approved

American machinery, such as the makes of the Fay & Egan Company and those of the American Tool Works. This shop, which is located in a large, spacious building of steel construction, is under the supervision of a technical engineer who was educated in the United States, and who has done much for the sale of American machinery in Brazil. The "funeral car,"



FIG. 3.—UPPER CITY ENTRANCE TO ELECTRIC ELEVATOR

shown in Fig. 5, is one of the excellent products of this shop. This car has made a deep impression on the writer, not only because of the fact that its workmanship was excellent, but because of the novelty and practicability of the idea. Instead of using hearses to carry corpses to the cemetery it is the custom of the natives of Bahia to contract for the use of one of these

Brazil is naturally rich in her various resources, which are yet in the main very much undeveloped. In construction work of buildings, much of the material can be obtained in the country. Stone quarries, for one thing, are plentiful. The rich quarry at Retiro, the property of the Guinle Company, furnished the building stones for the edifice shown in Fig. 1 at a

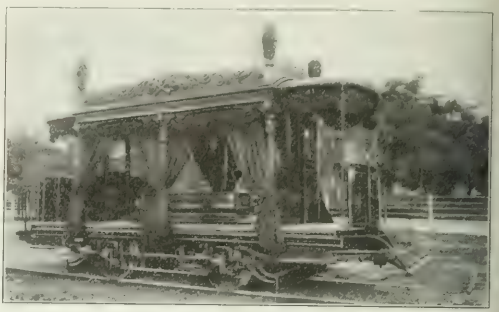


FIG. 5 FUNERAL CAR

very small cost. A Lockhardt rock crusher, with a capacity of 80 tons of rock per day, is in daily use at this quarry.

The head office of the Linha Circular Company is located right on the edge of the bluff of the Upper City, dividing the Upper from the Lower City. Its location, overlooking the beautiful Bay of Espiritu Santo, is simply superb. The offices in this building are tastefully fitted out with furniture, a part of which was made in the States. The illumination is ideal, use being made of Gem units equipped with the proper pris-

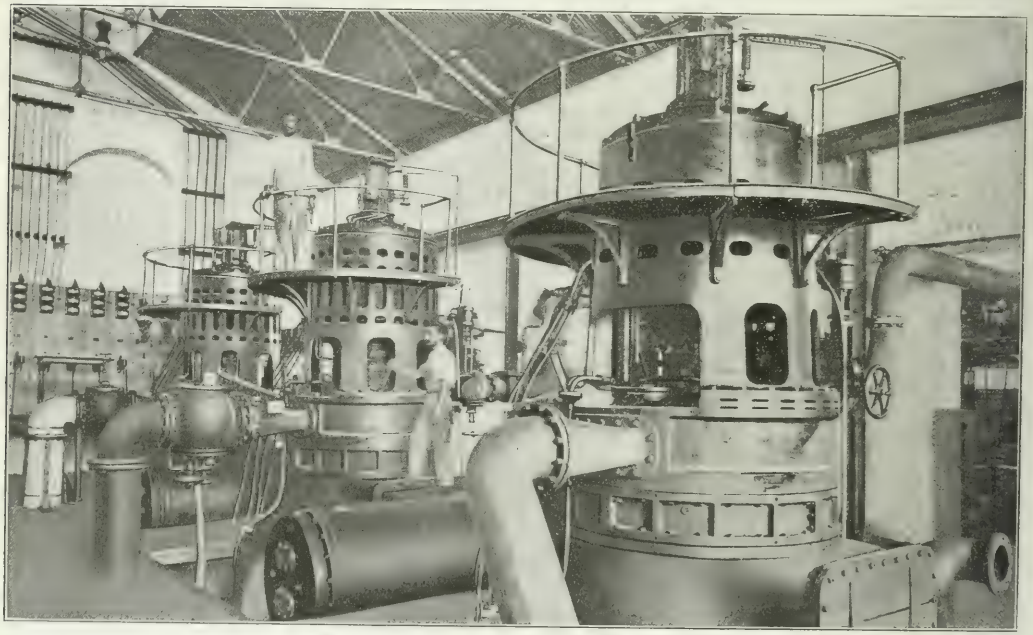


FIG. 4 TURBO GENERATOR IN THE PREGUIÇA STATION

cars, which can be obtained at the following prices: First-class car, $90; second-class, $60, and third-class, $30. The cars are even better than those of American make, due largely to the fact that some of the best woods in the world grow plentifully in Brazil.

matic reflectors for interior work and arc lamps for exterior duty.

In traveling between the Upper and the Lower City one has his choice of taking an Otis elevator or an inclined-plane railway very similar to the one which ascends Mont Royal, in

Canada. The entrance to this elevator, in the Upper City, is clearly shown in Fig. 3. The two elevators used are 25-hp 600-volt apparatus of the latest pattern. The price charged for making the voyage is 3 cents. The inclined-plane railway is operated by a cable, propelled by a 25-hp steam engine. A cog-wheel arrangement in the center of the track provides for security against accidents.

The turbines of the Guinle Company are at present greatly overloaded. This condition is not expected to last long, however, as there is now in course of construction a hydro-electric station on the River Paraguassu which, when completed, will furnish enough electric power to fulfil amply all present and future needs.

The illustrations for this article were furnished through the courtesy of Dr. Jules Brandão, technical engineer, and E. Dias Guerra, technical mechanic, both members of the Guinle Company. Therefore this article mainly describes the property of the Guinle Company and does not pretend to give data on the entire extent of the electrical work being done in Bahia, a very large part of which is in the hands of the Bahia Light & Power Company.

Electric Lighting and Railway System in Para, Brazil.

Electricity for the lamps and both stationary and railway motors in Pará, Brazil, is supplied by the Pará Electric Railways & Lighting Company, Ltd., of London. This company operates 35 miles of railway and 14.5 miles of lighting cables.

The power house, which is located on the south side of the Guajara River, contains three Siemens & Halske engine-driven, directly-coupled, 240-kw alternators designed for 50 cycles and 2200 volts; one single-phase Alsacienne generator built for the same service; three 400-kw Dick-Kerr direct-current generators; one E. C. C. 400-kw, 2200-volt, 50-cycle, single-phase generator and one 25-kw, 125-volt, direct-current exciter generator. The engine equipment consists of three 300-hp vertical triple-expansion Sachsische units; one vertical compound Belfont engine; five triple-expansion, three-crank, three-cylinder vertical 585-hp Belliss & Morcom units, and one 40-hp Belliss & Morcom compound engine. Steam is furnished by three Steinmuller water-tube boilers, one Belleville boiler and four Babcock & Wilcox marine-type boilers. These boilers operate at a pressure of 180 lb. per square inch. Each of the B. & W. boilers is fitted with an integral superheater capable of raising the temperature of the steam to 500 deg. Fahr.

Formerly there was a separately driven steam pump for pumping the water from the river for the boilers and for condensing purposes. In its place has been installed one 10-in. Invincible centrifugal pump of Gwynne's make directly coupled to an 18-hp Lancashire Dynamo Company's motor. Water is delivered at the rate of 2000 gal. per minute to a series of settling tanks made of brick and capable of holding 43,000 cu. ft. The water being rather muddy, these tanks are cleaned out every six months. There is a complete purifier and filter plant of Paterson Engineering make. The auxiliary equipment includes three sets of Worthington steam-driven, cross-compound air pumps with jet condensers and two Hayward, Tyler & Company horizontal duplex boiler feed pumps, each capable of pumping 5000 gal. of water per hour against the boiler pressure. There is also one Richardson, Westgarth & Company feed-water heater for raising the temperature of 5000 gal. of water per hour to 75 deg. Fahr. when supplied with 500 lb. of exhaust steam per hour.



FIG. 2.—ARC AND INCANDESCENT STREET LAMPS.



FIG. 1.—STREET LIGHTING AND RAILWAY CIRCUITS IN PARA.

The switchboard gallery is built up of steel framework, supplied by the General Iron Foundry Company, and stands 8 ft. above the engine-room floor. The floor of the gallery consists of 6 in. of concrete, covered with tiles. The switchboard contains all the necessary panels for the railway and lighting loads. The oil switches, isolating switches and lightning arresters are

supported on the underframe of the switchboard gallery. All of the switchboards were supplied by Messrs. Ferranti, Ltd.

At present all of the 2000-volt lighting circuits are being placed underground. The cables are of the Callenders Cable & Construction concentric type. They were tested at the factory with an e.m.f. of 10,000 volts for 30 minutes between conductors and 2200 volts for 30 minutes between outer conductor and earth; when actually laid they withstood satisfactorily 4000 volts for 30 minutes between conductors and 1000 volts for 30 minutes between outer conductor and earth. The concentric cables were laid in standard salt-glazed stoneware troughing, with bridge pieces of different sizes to suit the cables. The

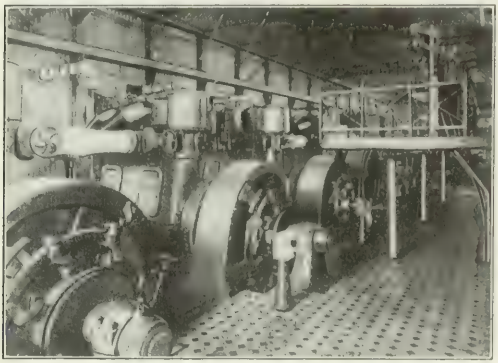


FIG. 3.—INTERIOR OF GENERATING STATION.

troughing was filled in with Trinidad bitumen, and the whole was covered over with hard-glazed stoneware bricks. There are being installed 33 underground-type transformers, of various ratings, suitably located throughout the city. The primary and secondary switches are mounted in Ferranti cast-iron pillars placed above the ground adjoining the transformer pits. Energy will be distributed on the 120-240-volt three-wire system.

The contact for the conversion of the old mule tramways into an electric railway system and for modernizing the lighting system was awarded to J. G. White & Company, Ltd., of London, by the Pará Electric Railways & Lighting Company, Ltd., of the same city, which obtained a 99-year concession in 1905.

The Coefficient of Reflection of Electrical Waves at a Transition Point.

By Louis Cohen.

THE problems of electrical wave propagation are becoming of great importance to the electrical engineer. We meet a great many of these problems in the various phenomena which may arise in high-tension transmission and distribution of electrical power. It is to be hoped that the very instructive and illuminating paper of Professor Steinmetz on "The General Equations of the Electric Circuit," which appeared recently in the *Transactions* of the American Institute of Electrical Engineers, will stimulate many others to discuss the many interesting problems which are apt to come up in connection with this subject.

In this brief contribution I wish to develop the expressions for the ratios of the reflected and transmitted waves to the incoming waves at a transition point. The results agree with those obtained by Professor Steinmetz, but the method of treatment is different and it will probably be of interest.

Professor A. G. Webster, in his discussion of a paper before the American Institute of Electrical Engineers, once remarked that he seldom spends many weeks on a problem of electrical oscillations until he has looked over Mr. Heaviside's papers. It is generally there, and so it is in this case. In his "Electromagnetic Theory," Vol. 2, page 79, Dr. Heaviside devotes a paragraph to the discussion of this problem and he derives the following expression for the reflection coefficient,

$$\eta = \frac{V_2}{V_1} = \frac{Z_1 - \frac{K}{q}}{Z_1 + \frac{K}{q}}$$

where V_1 and V_2 are the potentials of the incoming and reflected waves, Z_1 is the resistance operator of the terminal apparatus and q is a certain differential operator which is discussed at length in his books. To express η in terms of the constants of the electrical circuits would presuppose a knowledge of the operation of q, but since generally electrical engineers are not acquainted with Dr. Heaviside's methods, we will proceed to translate it into ordinary algebra:

Let V_1 denote the potential of the incoming wave.
" V_2 " " " " " " reflected wave.
" V " " " " " " transmitted wave.

Let us suppose that the potential consists of a single wave; generally it consists of more than one wave, but as far as the transition point is concerned what will be true of one wave will be true of any number of waves. The general expression for the wave developed along a line of uniform distributed capacity and inductance is*

$$V = A e^{-\alpha s} \cos(pt - \beta s) \qquad (1)$$

If we neglect the resistance, which we will do in this case, then $\alpha = 0$ and $\beta = p\sqrt{LC}$. Now let L_1, C_1 and L_2, C_2 be the inductance and capacity of the line on the different sides of the transition point, then we shall have the following expressions for the potentials:

$$\left.\begin{aligned} V &= A_1 \cos(pt - \beta_1 s) \\ V_2 &= A_2 \cos(pt - \beta_1 s) \\ V &= A_3 \cos(pt - \beta_2 s) \end{aligned}\right\} \qquad (2)$$

The currents corresponding to these potentials can be derived, of course, by the aid of the well-known relation

$$c\frac{dV}{dt} = -\frac{dI}{ds}$$

and hence we get

$$\left.\begin{aligned} I_1 &= \frac{C_1 p}{\beta_1} A_1 \cos(pt - \beta_1 s) \\ I_2 &= \frac{C_1 p}{\beta_1} A_2 \cos(pt - \beta_1 s) \\ I_3 &= \frac{C_2 p}{\beta_2} A_3 \cos(pt - \beta_2 s) \end{aligned}\right\} \qquad (3)$$

At the transition point the potential will be the sum of the incoming wave and the reflected wave, while the current will be represented by the difference of the two waves since they travel in opposite directions. At the point of transition there is no discontinuity of any sort, hence we must have the following relations satisfied:

$$\left.\begin{aligned} (A_1 + A_2)\cos(pt - \beta_1 s) &= A_3 \cos(pt - \beta_2 s) \\ \frac{C_1 p}{\beta_1}(A_1 - A_2)\cos(pt - \beta_1 s) &= \frac{C_2 p}{\beta_2} A_3 \cos(pt - \beta_2 s) \end{aligned}\right\} \qquad (4)$$

The ratio of these two equations will give

$$\frac{A_1 + A_2}{A_1 - A_2} = \frac{C_1\beta_2}{C_2\beta_1}$$

and

$$\frac{A_1 + A_2}{A_1 - A_2} + 1 = \frac{2A_1}{A_1 - A_2} = \frac{C_1\beta_2 + C_2\beta_1}{C_2\beta_1}$$

or

$$\frac{A_1 - A_2}{2A_1} = \frac{1}{2} - \frac{A_2}{2A_1} = \frac{C_2\beta_1}{C_1\beta_2 + C_2\beta_1}$$

$$\therefore \frac{A_2}{A_1} = \frac{C_1\beta_2 - C_2\beta_1}{C_1\beta_2 + C_2\beta_1} \qquad (5)$$

$\frac{A_2}{A_1}$ is the ratio of the reflected to the incoming wave. If we

*See Bedell and Crehore, Alternating Currents, p. 190.

replace β_1 and β_2 by their corresponding values, $p\sqrt{L_1C_1}$ and $p\sqrt{L_2C_2}$, and then simplify a little we get

$$\frac{A_2}{A_1} = \frac{\sqrt{\frac{L_2}{C_2}} - \sqrt{\frac{L_1}{C_1}}}{\sqrt{\frac{L_2}{C_2}} + \sqrt{\frac{L_1}{C_1}}} \qquad (6)$$

The ratio of the transmitted wave to the incoming wave can be obtained in the following way. We have by equation (4) the following relation between the amplitudes of the different waves:

$$A_1 + A_2 = A_3.$$

Replacing A_2 by its value in terms of A_1 from equation (5) we get

$$A_1\left\{1 + \frac{C_1\beta_2 - C_2\beta_1}{C_1\beta_2 + C_2\beta_1}\right\} = A_3$$

Therefore,

$$\frac{A_3}{A_1} = \frac{2C_1\beta_2}{C_1\beta_2 + C_2\beta_1} = \frac{2\sqrt{\frac{L_2}{C_2}}}{\sqrt{\frac{L_2}{C_2}} + \sqrt{\frac{L_1}{C_1}}} \qquad (7)$$

Equations (6) and (7) agree with the results which have been obtained by Professor Steinmetz. See his equations (141), (142) and (143).

The relations between the reflected and transmitted waves to the incoming wave as given by equations (6) and (7) are only applicable to the case where the wave in passing the transition point continues its travel in the form of a wave; that is, we have distributed inductance and capacity on both sides of the transition point. In the case, however, where at the transition point we have a lumped inductance and capacity, the conditions are different.

Let us denote the impedance of the apparatus at the transition point by Z, and, as before, we will denote the potential of the incoming wave by $V_1 = A_1 \cos(pt - \beta s)$, that of the reflected wave by $V_2 = A_2 \cos(pt - \beta s)$. The currents corresponding to these two waves will be

$$I_1 = \frac{Cp}{\beta} A_1 \cos(pt - \beta s) \text{ and } I_2 = \frac{Cp}{\beta} A_2 \cos(pt - \beta s)$$

Now at the transition point, the potential is the sum of the separate potentials of the incoming and reflected waves, and this must equal the drop on the terminal apparatus, which is supposed to be grounded.

We have, therefore,

$$V_1 + V_2 = ZI,$$

but the current at the transition point is the difference of the incoming and reflected wave, since they travel in opposite directions, hence we have

$$V_1 + V_2 = Z(I_1 - I_2).$$

Introducing the values of V_1, V_2, I_1 and I_2 we get:

$$(A_1 + A_2)\cos(pt - \beta s) = \frac{pCZ}{\beta}(A_1 - A_2)\cos(pt - \beta s)$$

From which we obtain,

$$\frac{A_1 + A_2}{A_1 - A_2} = \frac{pCZ}{\beta}$$

Proceeding in the same way as we did in deriving equation (5), we obtain,

$$\frac{A_2}{A_1} = \frac{pCZ - \beta}{pCZ + \beta} \qquad (8)$$

If we denote the inductance and capacity of the terminal apparatus by L_1, C_1, and neglect the resistance, we have $Z = pL_1 - \frac{1}{pC_1}$. Replacing also β by its corresponding value $p\sqrt{LC}$, equation (8) will become

$$\frac{A_2}{A_1} = \frac{C\left(pL_1 - \frac{1}{pC_1}\right) - \sqrt{LC}}{C\left(pL_1 - \frac{1}{pC_1}\right) + \sqrt{LC}} \qquad (9)$$

In the case of a free oscillation, we have $p = \sqrt{\frac{1}{LC}}$. Therefore,

$$\frac{A_2}{A_1} = \frac{\left(\frac{L_1}{\sqrt{LC}} - \sqrt{\frac{LC}{C_1}}\right) - \sqrt{\frac{L}{C}}}{\left(\frac{L_1}{\sqrt{LC}} - \sqrt{\frac{LC}{C_1}}\right) + \sqrt{\frac{L}{C}}} \qquad (10)$$

The rise of potential at the terminal, or the ratio of the maximum potential at the transition point to that of line will be

$$\frac{A_2 + A_1}{A_1} = \frac{2\left(\frac{L_1}{\sqrt{LC}} - \sqrt{\frac{LC}{C_1}}\right)}{\left(\frac{L_1}{\sqrt{LC}} - \sqrt{\frac{LC}{C_1}}\right) + \sqrt{\frac{L}{C}}} \qquad (11)$$

If the inductance of the terminal apparatus is very high, we may then write approximately equation (11) in the following form:

$$\frac{A_2 + A_1}{A_1} = \frac{2L_1}{L_1 + L}$$

The voltage may, therefore, rise to nearly twice the voltage of the line.

Bureau of Standards,
Washington, D. C.

A Comparison of the Methods of Starting Squirrel-Cage Induction Motors.

BY SELBY HAAR

THE squirrel-cage type of induction motor has long been a favorite for all sorts of industrial purposes on account of its many advantages, and it is being installed in ever-increasing numbers. The first motors were quite small—in fact, the development of large sizes may be said to have occurred within the last decade. The small motors caused no trouble when connected directly to the line, but the larger ones soon attracted the unfavorable attention of the central-station operators on account of the large starting currents, especially on circuits where close regulation was attempted. When the necessity of a starting device was recognized, the most obvious solution was a series resistance such as was used with direct-current motors. There was also developed a transformer starter; it is to compare the merits of these two types of starters that this article is written.

The only recommendation of the rheostatic starter used in the primary circuit is its low first cost. It can be constructed of cheap materials by unskilled labor, and can therefore be put on the market at a price far below that of the transformer starter. In its performance the rheostatic starter is always inferior to the transformer starter.

A motor with squirrel-cage rotor which has a torque at start of 175 per cent of the full-load value will probably have a maximum torque of from 1.5 to 2.0 times that of the starting torque.

Fig. 1, which is plotted with speed as abscissas and torque at constant impressed e.m.f. as ordinates, shows the variation of the torque of such a motor during acceleration. It will be noted from the curve that the torque increases as soon as the motor starts, the rate of increase being slower at first than it is near the maximum torque point. For the usual type of load, where the flywheel effect is not predominant, the torque required at start to overcome the static friction is much greater than that necessary to accelerate the motor after it is started, so that usually no trouble is experienced in bringing a motor up to proper speed with the same applied e.m.f. as is sufficient to start it, because the "static friction" is much larger than the running friction.

From the current curve of Fig. 2, which is plotted with speed as abscissas and current at constant impressed voltage as ordinates, it will be seen that the current is greatest at the instant of starting, decreases slowly to a point corresponding to about three-fourths speed, and then decreases rapidly from there on

The slowness of the decrease in the current causes a reduction in the effectiveness of the primary-circuit rheostatic type of starter. Unless the rheostat is very liberally designed—which means higher cost—the starting current will heat it to a high temperature, which will increase its resistance, and lower the voltage impressed on the motor and thereby decrease the torque.

An objection has been raised against the transformer type of starter for conditions requiring increasing torque as the speed increases. Where this is a real condition, it could be handled by a multi-step auto-transformer, but it is required so infrequently that one large manufacturing company is said to be changing from the multi-step to the single-step design. There is no essential difference between the two methods of starting in regard to increase of torque, the rheostat producing the effect of a motor with an extremely high primary resistance. As a matter of fact, Fig. 1 herewith represents the torque variation with rheostatic starting just as well as with transformer starting.

A very instructive method of investigating the conditions during starting is by constructing a torque-per-ampere curve. Fig. 3, plotted with speed as abscissas and torque at constant current as ordinates, is such a curve; it shows that there is little, if any, advantage in the primary-circuit rheostatic method in this respect. The increase in torque per ampere with change in speed is inherent in the type of motor.

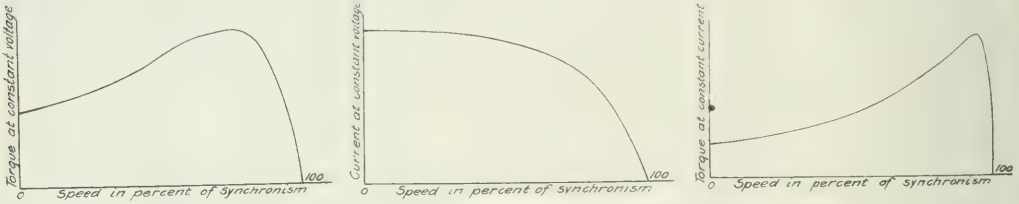
No matter what method of starting of a squirrel-cage motor is used, the starting torque required determines the minimum voltage which must be impressed on the motor; there must be sufficient torque to ovecome the counter-torque of the load.

The best design of starter provides the required voltage with the least disturbance to the supply system. The disturbance can be judged by the relative currents taken. Select, therefore, a 50-per-cent voltage tap—which will handle most cases—and assume a starting current of a squirrel-cage motor of six times the full-load value at full voltage; the line current would be three times the full-load value with the rheostat and five times the full load with a transformer starter. The smaller line current—about half the larger—with the transformer will appeal to the underwriters and perhaps permit a slight saving in the wiring. The difference in current will be negligible in a small motor, but for such a motor a starting device is scarcely necessary.

As to the burning of contacts during starting, it is possible to operate either type so as to break the circuit when the current is small. Usually—as stated above—the lower transformer voltage will accelerate the rotor to a proper speed, and the current to be broken is the no-load current at the reduced voltage.

With a rheostatic starter the current which is to be broken is also the no-load current, but it is the current corresponding to a higher voltage. The rheostatic starter has an advantage in that the motor voltage is nearer the line voltage so that there is a smaller current rush at the instant of connecting the motor to the line than there would be with a compensator.

In view of the above considerations it can be stated that when the rheostatic and transformer methods of starting squirrel-cage induction motors are compared on the basis of torque, current, etc., the conclusion is reached that the only recommendation of the rheostat is its lower price.



FIGS. 1, 2 AND 3.—TORQUE AND CURRENT RELATIONS IN A SQUIRREL-CAGE INDUCTION MOTOR

An Electric Charging Launch.

Although electricity has several decided advantages as a power for launches and yachts, such as entire freedom from danger of fire or explosion and absence from noise, heat, vibration, smoke and foul odor, it is subject to the limitation that any long-distance cruising is impracticable unless charging facilities can be found at intervals along the route.



FIG. 1.—ELECTRIC GASOLINE CHARGING LAUNCH "KILOWATT."

With a view to overcoming this objection, and to enable him to make long trips independently of charging stations on shore, Mr. Benjamin Douglass, Jr., of New York, has had built for him by the Electric Launch Company, of Bayonne, N. J., a unique floating charging plant to be used as an auxiliary to his handsome electric yacht *Cascapedia*. It is the first craft of its kind and the builders believe that it solves the question of the use of electricity in large yachts, since it can be operated at full power for 100 hours on one filling of the fuel tank, thus enabling the yacht to make a trip of 2000 miles before either craft would have to enter port.

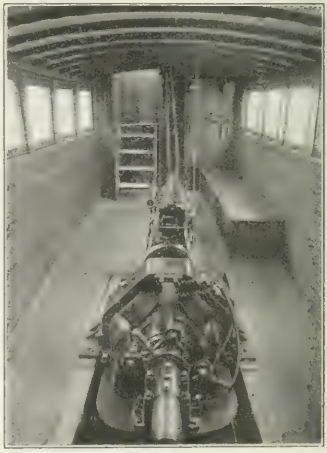


FIG. 2.—CHARGING OUTFIT OF "KILOWATT."

The name of this unique little boat is the *Kilowatt*, and

following completion, she was shipped to Palm Beach, Fla., where her owner used her during the winter. With the recharging launch as an auxiliary, the yacht *Cascapedia* is not dependent upon electricity ashore for charging her batteries. The *Kilowatt* is 35 ft. long, 9 ft. beam and 2 ft. draft. She is of the glass cabin type, with plate-glass drop windows and brass hinged ports. The hull is of very substantial construction with a spacious after deck to permit the seating of a party. The steering wheel is located on the after deck, together with engine control devices which enable one man to steer the boat and manage the engine.

The unique feature of the boat is her power equipment, which consists of a 40-hp, six-cylinder gasoline engine, with mechanical reverse gear connected to the propeller shaft. A 30-kw dynamo is directly connected to the crank-shaft at the forward end of the engine, as shown in the photograph. A slate switchboard is located on the port side of the cabin, with the necessary instruments and with switches for switching the electricity generated by the dynamo into the batteries of the electric yacht. The dynamo is so arranged that current can be generated while the boat is lying at anchor or when under way. The plant has sufficient capacity for recharging the yacht's batteries in three or four hours. The charging launch has a speed under her gasoline power of nine miles an hour and carries 400 gal. of fuel, on which she can be operated for 100 hours and recharge the yacht 10 or 12 times. On one charge of her batteries, the yacht can run 200 miles, and in connection with the auxiliary launch her radius is unlimited.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Daylight-Saving Legislation.

As noted in the daily papers recently, an attempt is being made to interest the United States Congress in a daylight-saving law which has been favorably recommended by a committee of the House of Commons of the English Parliament. This plan in effect utilizes some of the early morning daylight during the summer months and does away with a part of the necessity for artificial light in the evening during those months. The plan is to set the hands of the clock ahead 20 minutes each Sunday in April and set them back 20 minutes each Sunday in September. The effect of this is, of course, to give most people the benefit of an hour and 20 minutes more daylight in the evening, thus dispensing with artificial light for that period and giving more time for daylight recreation in summer. Owing to the inherent merit of the plan it would not be at all surprising if it were ultimately to be adopted both in England and this country, although legislation of this kind is likely to be slow. Its possible effect on electric lighting revenues is worth thinking about in making future plans. The total influence on yearly revenues would not be as great as might be thought on hasty consideration, as its chief effect would, of course, be on the revenue from residence lighting in all cities and from store lighting in small towns. Even in small towns, however, it is customary for stores to be closed after dark with the exception of one or two nights per week, so that the summer revenue from store lighting in such stores as are closed early in the evening is small. In residence lighting, where there is no minimum bill, the midsummer gross monthly revenue is only 5 per cent or 6 per cent of the yearly revenue. The minimum bill, however, tends to even up this difference, and companies having minimum bills would probably lose very little as a result of such legislation. In the case of companies having no minimum bill, the summer revenue would be cut, but this cut would be only a fractional percentage of the yearly income. However, this reduction would come during the months when the central station has the least work to do and when it can least afford to lose the revenue. The possibility of such daylight-saving legislation emphasizes the importance of renewed efforts to secure non-peak business, and especially business during the summer months. Refrigerating and waterworks pumping are the two classes of load which are most valuable for helping a central-station company to hold up its summer revenues.

Relation of the Central Station to the Electric Automobile Business.

At the recent convention in San Francisco of the Pacific Coast Electric Vehicle Association, Mr. Fred. T. Kitts, of Sacramento, presented a paper with the above title, in which he pointed out the advantages to the central station of an electric automobile charging load.

Many central stations, he said, do not as yet make a sufficiently low rate for this class of business, which fact must be due to their not having considered the question carefully, as otherwise they would realize the advantage of selling energy at non-peak hours to be used for pleasure vehicles, delivery wagons and trucks during the day, and would make a rate low enough to encourage the adoption of electrically propelled vehicles and thereby very materially increase their revenue.

Mr. Kitts stated that the electric pleasure vehicle has already displaced thousands of horses and that the modern electric truck is now coming into favor so fast that it will not be long until horse-drawn vehicles will be the exception; and when one considers the thousands of horses still plodding along the streets, the tremendous demand there will be for central-station charging current when these changes are made is evident. Many central-station people are beginning to realize the great opportunity that the electric vehicle business has to offer them and find that a little effort spent in encouraging the use of such vehicles is handsomely repaid by a permanent and desirable load connected to their mains, the securing of which requires practically no extra investment as nearly all the energy for charging vehicle batteries is used when the load on a station is light and the station apparatus would otherwise be idle.

Many central stations now spending thousands of dollars for maximum-demand indicators and other devices, and using complicated systems of accounting to improve their load factor, are finding out that the electric vehicle, in combination with other motors, is solving their problem automatically. One customer may have a high maximum demand on a lighting load, another on a power load, another on a vehicle battery. The resultant of all these is not only to keep down sharp peaks in the load curve, but, also, on account of this improvement of the load factor, enables the station to make a lower rate on all of its energy, thus encouraging greater consumption and giving a larger income.

Central-station people in looking back over their experiences can see where the popular use of the electric motor has enabled them to reduce the price of energy in general, none can regret the encouragement they offered to power business for it has built up for them a day load which keeps the station and distributing apparatus earning something during the day as well as during the evening. As to the electric vehicle, in the daytime, when the station is supplying energy for industrial purposes, and during the evening, when its product is being used for lighting, the automobile is busy using up energy stored the night before and is willing to wait until the lighting customers are satisfied before again making any demand on the station. For this reason the central station should make a very low rate for vehicle battery charging, as it is by far the most desirable business that can be secured. In cases where there would be a possibility of the charging being done at the peak, a clause could be inserted in the contract whereby a penalty would be attached for using power during certain

hours and which could be made large enough to deter customers from taking the risk of being caught violating this contract.

The central station should make an especial effort to encourage private garages and should make the rate so low that anyone who can afford to keep a horse can afford an electric automobile.

Many Eastern central stations have large garages for the care of their own machines and have discarded horse-drawn vehicles entirely, doing their heavy trucking as well as making their business calls with electrics. In this way they not only set an example to the public, but find that they save money, aside from the advertising feature which is secured by the use of such up-to-date business methods. The operation of a modern central station in connection with its necessary distributing business requires many vehicles of different classes, from the light runabout to the five-ton truck, and the central station should be the first to discard horses and thus hasten the day when electricity will be the only source of power used for all city transportation.

Interesting Facts in Des Moines Central-Station Practice.

The Des Moines Electric Company, of Des Moines, Ia., which does all the electric lighting and power business of that city of 85,000 inhabitants, has been industriously at work improving its conditions during the past few years, and some notes on its improved methods and results will be of interest. This



FIG. 1.—STEAM PLANT AND DAM.

company has two stations near each other on the west bank of the Des Moines River (see Fig. 1). One of these is a water-power plant of small capacity. The other is a large steam plant, interior views of which are shown in Figs. 2 and 3. The system of distribution is direct current in the downtown districts and alternating current in other parts of the city.

IMPROVEMENTS AND CHARACTER OF LOAD.

In the year 1908 the output was 6,504,715 kw-hours, an increase of 22 per cent over 1907. The peak load for 1908 was 2885 kw, an increase of 18 per cent over 1907. It is thus seen that the company's load is improving in the right direction; that is, the output is increasing more rapidly than the peak, indicating that the management has appreciated the importance of securing business which has a good load factor. The load factor was 23.7 per cent in 1907 and 25.6 per cent in 1908 as a result of the improved conditions.

The connected power load at the end of 1908 was 4730 hp, an increase of 11.3 per cent over 1907. By comparing the 2885-kw load with the 3200-kw station capacity it is seen that the company still had an ample machinery reserve over and above its peak load. The output for November, 1908, as compared with November, 1907, showed a 32.9 per cent increase.

While it is difficult to locate definitely all of the causes of the improvement in load factor, undoubtedly one of the things which has contributed to it has been the successful efforts of the company to increase its flat-rate window, sign and outline lighting. At the end of 1908 3.35 per cent of the total income was from this class of business. The rate offered on this flat rate lighting, which is turned on and off by the company's patrolman at specified hours, is such that the consumer's bill is the same as if he were on a meter and used his sign or window installation the same number of hours per year as under the flat-rate contract. These regular meter rates in Des Moines

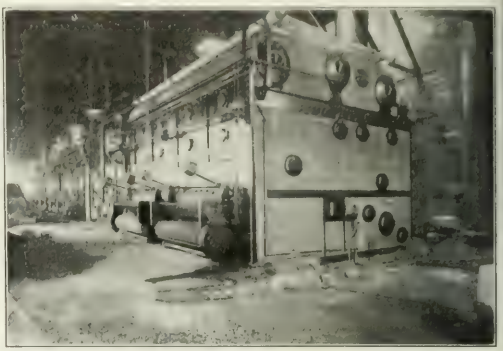


FIG. 2.—BOILER ROOM.

are 12 cents per kw-hour for the first kw-hour used per 25 watts connected per month. This is practically the equivalent of 40 hours' use per month of the consumer's connected load. For all energy used in excess of 1 kw-hour for each 25 watts connected the rate is 6 cents per kw-hour. In residences the full connected load is not taken, but only 33 per cent is used in figuring the installation upon which the 12-cent rate is based.

LAMP-POSTS IN THE DOWN-TOWN DISTRICT.

A movement was begun in 1908 and has been rapidly gaining headway to install ornamental iron lampposts at frequent intervals along the curb line on the down-town streets. Twenty of these posts were installed by the end of 1908, and 45 more are under way. The posts used are similar to those extensively employed on the streets of St. Paul, Minn. They carry five 50-cp, 125-watt, Gem lamps each. There are four bracket arms and one central globe on the top of the post. The posts are paid for by the tenants and property owners along the street. Energy is supplied to them by the company at a cost which figures about 5 cents per kw-hour. The company maintains the lamps and glassware and paints the posts. It also installs these posts as near cost as possible. It guarantees, however, that the cost of installation shall not be over $100 per post. The actual cost

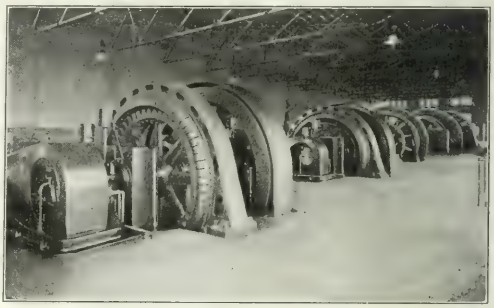


FIG. 3.—ENGINE ROOM.

averages about $85 each. The cost of the posts f.o.b. Des Moines is about $60. Fig. 4 shows these posts as erected on one of the down-town streets.

DISTRIBUTED METER READINGS.

A plan was put in force last year by Mr. P. B. Sawyer, general manager, over which he is very enthusiastic because of the

other workings of the meter reading organization which resulted. Instead of reading all the meters at or near the of the month, as formerly, and causing a great congestion work at meter-reading periods, meters are now read and tomers billed continuously every working day in the month. e old plan, pursued by many companies, was that of calling every available man for meter reading, drawing on the line l other departments to get enough men to read the meters hin the specified limits, 10 men being required for meter ding. Then the clerical force would be overworked for sev- l days getting out the bills. During this meter-reading iod other work was neglected both by the bookkeeping de- rtment and by the men taken from other departments for ter reading.

Under the new plan one man reads every month the total mber of 3249 meters which the company has connected. The ritory is divided into 25 sections, each of which represents e day's work for the meter reader. The number of consum- s in a section is made dependent on the congestion of the strict, fewer meters being assigned to the scattering outlying stricts. For each section there is one meter book represent- g one day's work, in which the leaves are arranged, as ual, by routes. For convenience in billing, the consumers' dger, which is of the loose-leaf type, is also arranged by utes, and the addressograph list is arranged in the same way. hus there is no turning back and forth in the process of mak- g out consumers' bills from the meter-route books as all the



FIG. 4.—WALNUT STREET AT NIGHT.

lists pertaining to meter reading and billing are in the same order. The consumers' ledger is indexed so that consumers can be found by name.

This plan works the meter reader and billing force steadily. There is no necessity for extra work and overtime during a part of the month. The one man who makes it his entire business to read meters is more expert than the corps of men formerly needed. The chances of error in making out bills are also reduced, because there is no congestion of work at any one period of the month. That the system is entirely practical is shown by the fact that the new plan has eliminated 80 per cent of the errors in meter reading, and the monthly grist of complaints regarding bills has been reduced from the old average of 20 to 25 each month to about one-third. Another advantage of the plan is that it insures payment of bills within a shorter time after the actual meter readings are made. Under the old plan meters were read on the twenty-second of the month and bills were sent out the first. Consequently the gross income of the company was tied up in the accounting department from the twenty-second to the first of each month. Bills are now sent out within one or two days from the time of reading. The only disadvantage of the plan, and that is rather of a bookkeeping nature, is that there is no distinct line between the gross earnings of one month and another.

IMPROVEMENTS IN METER MAINTENANCE.

The lost and unaccounted-for energy between the station busbars and the consumers' meters on the direct-current system is about 15 per cent, and on the alternating-current system about 20 per cent, indicating an excellent condition of meters and low line and transformer losses. Considerable improvement has been made recently in methods of maintaining accuracy of meters under Mr. W. C. Sharp, the general superintendent of the company, who was formerly in charge of the meter department of the New York Edison Company. Formerly the company made it a practice of testing meters for accuracy at frequent intervals, but owing to the methods used by the meter testers in recalibrating and correcting meters, the management is now convinced that much of this work was wasted, as meters would not stay calibrated very long after a meter-tester's visit. For example, on a commutator-type meter it is not conducive to accuracy to polish up the commutator and assume that if the meter is correct when the commutator is first polished it will remain correct after its surface has gone back to regular working conditions. Again, it is not sufficient to move the retarding magnets on the meter to make it run faster when the real trouble is in a worn-out jewel.

A new plan of meter calibration has been put in operation by Mr. Sharp which will be watched with interest by central-station companies having many meters. The most common plan adopted by well-organized meter departments has been to test meters at intervals dependent on the number of revolutions made by the meter per month, or dependent upon the number of kw-hours used per month. The new plan being tried in Des Moines is to classify meters according to the amount of inaccuracy they have shown in the past. Meter-testing records are kept by a card index. If a meter shows considerable error in a certain test its card is placed in a division calling for more frequent testing than if it had showed greater accuracy. The time between tests of meters is from 3 to 18 months, meters in the three months' class being those which have shown the greatest accuracy on the last test. Of course, some kinds of meter errors are caused by the peculiar location of the meter. The cards of such meters would probably remain permanently in the section devoted to meters which are to receive the most frequent tests. Whenever a meter is tested its card is not necessarily placed back in the section calling for the same frequency of testing as before. It may be assigned to another section calling for a greater or less frequency of testing, depending on its degree of inaccuracy at the time of the last test.

HANDLING MOTOR BUSINESS.

The company does not aim to do an extensive electrical supply business, but it sells motors and heating appliances. It does no wiring, but makes small repairs for customers. For use in delivering motors and similar heavy work the company maintains a one-ton electric truck, which has been found to make money by saving labor.

INTERIOR WIRING AND ILLUMINATION

Mercury-Vapor Lamps in Orchestra Hall, Chicago.

An interesting application of mercury-vapor lamps has been made in lighting the stage of Orchestra Hall, Chicago. This is a concert hall at which regular performances are given by the famous Thomas Orchestra. The lighting of the stage was complained of by the musicians in the orchestra because of the insufficient illumination on the music. The lighting of the entire hall was by incandescent lamps, concealed from the view of the audience as much as possible. The lighting of the stage was accomplished by similar lamps placed high behind the proscenium arch, out of sight of the audience. The illumination on the music scores of the orchestra was obtained partially by direct light from these lamps and partially by reflection from the light-colored sound shell back of the stage.

This illumination being insufficient, it was recently supple-

mented by the light of four Cooper Hewitt mercury-vapor lamps. These lamps, if used alone, would, of course, not be satisfactory owing to the character of their light. With the large amount of light from common incandescent lamps, however, the mixture of the yellow light of the incandescent with the greenish-blue of the mercury-vapor produces a light of satisfactory color and increases the illumination on the music scores to a satisfactory point.

Wiring with Metal Molding.

Although like wooden molding, metal molding can be used for exposed work only, it is considered to be an advance over the former and to be almost on a par with exposed conduit, notwithstanding it is not so strong as the latter. The requirements for its installation are somewhat similar to those for the installation of conduit. The molding must be continuous from outlet to outlet and must at all outlets be provided with approved terminal fittings. The metal of the molding must be permanently and effectively grounded and must be so installed that adjacent lengths of molding will be mechanically and electrically secured at all points. For alternating-current systems both wires of the circuit must, of course, be placed in the same molding.

Metal molding is at present manufactured by a number of companies, and all the fittings necessary to a complete installation can also be obtained. The base can be bent to short radius and formed into many irregular shapes by a person skilled in handling the product. A wireman capable of handling conduit ought not to experience any difficulty in installing metal molding. The molding is cut by simply scoring it with a file, when it may be broken in two. The capping is easily and quickly snapped in place. A base coupling is used at joints and at fittings in order to insure electrical continuity throughout and effective grounding. The base is usually furnished with countersunk holes for screws and bolts, and, with the capping, comes in standard lengths. The system is in reality a covered raceway so that wires can be removed and changes made within a minimum of time.

Outline Lighting in Rochester, N. Y.

Owing to the requirements of the underwriters and city offi-

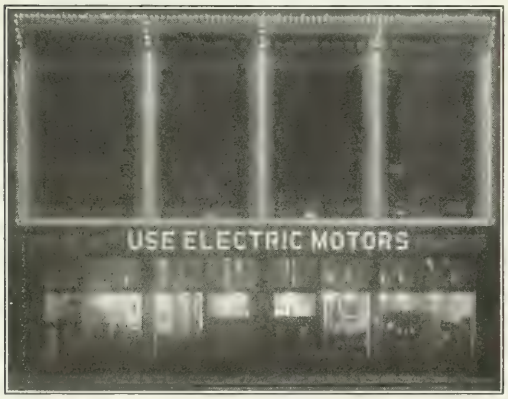


FIG. 1.—OUTLINE LIGHTING OF OFFICE.

cials there are very few electric signs in Rochester, N. Y. However, a number of merchants of their own volition have outlined their buildings with electric lamps and the amount of such illumination is increasing. The outline lighting, with few exceptions, is confined entirely to Main and State Streets. No attempt is made at elaboration, the sides and top of the buildings being merely brought out. Work of this kind must be done with conduit, so the expense is not small. Lamps of 4 cp are used and these are turned on at dusk and kept lighted until midnight. The Rochester Railway & Light Company does not, however, have any part in this work. The connected load, which now amounts to about 500 kw, came to it without solicitation; one merchant starting outline lighting and the others



FIG. 2.—MAIN STREET, ROCHESTER.

following for business reasons. The lamps are turned on and off by the merchants themselves and all the energy used is charged for at regular meter rates, there being no flat-rate outline lighting, the latter being fed from the regular lighting circuits. The number of lamps employed on 11 buildings thus outlined is over 15,000. The accompanying illustrations show two views of Main Street and also a view of the office of the Rochester Railway & Light Company on Clinton Street. The arches shown in the street do not form part of the street illumination, having been erected temporarily while a political convention was held in the city.

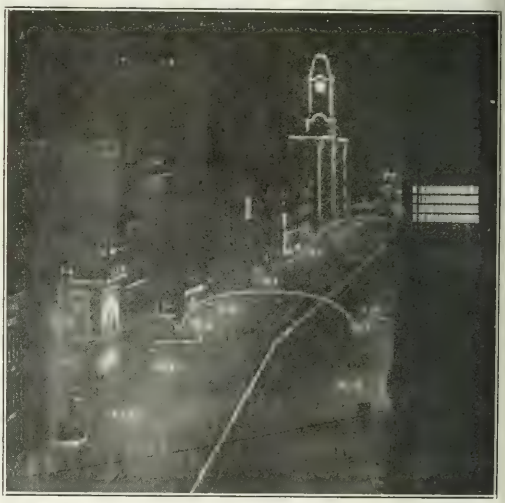


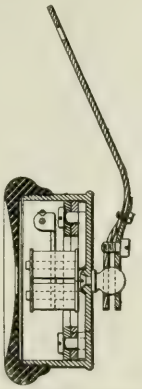
FIG. 3.—MAIN STREET, ROCHESTER.

New Telephone Patents.

TRANSMITTERS AND RECEIVERS.

There now seems to be no doubt of the efficacy of the telephone in enabling those afflicted with certain forms of deafness to hear. As each additional user renders the use of the apparatus less conspicuous, and therefore less objectionable, the result is a very marked increase in the importance of this branch of the art. This condition is reflected by the number of patents issued for improvements for such instruments. The transmitter problem is different from that of usual service, as the audiphone transmitter must be designed to "pick up," not exclude, the maximum of extraneous sounds. The receiver problem is merely that of a comfortable head receiver. There have recently been issued two patents for audiphone instruments. In one of these Messrs. C. H. Viggars and E. H. Stolz, of Chicago, have described their joint invention, which covers a transmitter. Use is made of a carbon diaphragm, opposing the middle of the rear face of which is a carbon block, not quite touching it. This latter has several cylindrical holes with axes sloping upward to the rear, and each is loaded with a single string of carbon granules or balls, not quite of the diameter of the hole. These are retained through their contact with the diaphragm.

H. E. Sullivan, of London, England, is the inventor of another improvement in head receivers. In the accompanying illustration will be noted the ball-and-socket attachment of the head band, providing for every practicable angular relation of the ear-cap and the head band. This receiver also carries with its casing an open-space protector. Each terminal carries a lug, with a machine screw through its end. The lugs and screws are so formed and placed that the two screws stand out free in parallel position, with a fractional clearance between their adjacent thread surfaces.



SULLIVAN TELEPHONE RECEIVER.

Mr. C. E. Williams, of Natick, Mass., is the inventor of the second transmitter. The microphone bottom is held to the inside of the front cover of a closed cylindrical box. Mounted upon the front of this box is a bowl-shaped resonating chamber of smaller diameter than the box. A circular row of holes just without the bowl leads through the box cover to admit sound to the box. A second row of holes through the box cover leads into the resonating bowl. Bowls of different shapes may be used, each designed to reinforce those sounds most necessary for the peculiarities of hearing of the particular user.

A head receiver attachment forms the subject of a patent issued to W. E. Peters, of Athens, Ohio, designed to relieve the physically uncomfortable pressure upon the ear of the user. This comprises a ring adapted to replace the usual ear-cap. It carries a perforated diaphragm so as to maintain the shallow, plate-like air chamber next to the diaphragm. The front edge of the ring carries a suitable facing piece. In use the ear of the user is placed completely within the ring, the facing being in contact with the head and face of the wearer, the ear having no direct pressure contact.

NEW CIRCUITS AND APPARATUS.

Most common-battery circuits are so designed that the tip contact serves upon proper occasion for both testing contact and talking circuit. In a circuit system patented by H. C. Goldrick, of Indianapolis, the tip contact is relieved of one of these functions and is used exclusively for test. The jack is so arranged that when a plug is shoved home, the tip stands clear and an auxiliary contact serves to charge the jack test ring. The plug and cord are, of course, of the three-strand type, the ring and sleeve being the talking circuit.

Another patent is that granted to C. S. Winston, of Chicago, and covering a circuit designed to throw a clearing-out drop in response to the movement of a distant subscriber's hook switch. For example, where a magneto cord pair is used to connect a magneto subscriber, or a toll line, to a common-battery subscriber over a trunk, the present circuit is so arranged that the hanging up of the receiver by the common-battery subscriber causes a current through the clearing-out drop at the distant cord pair.

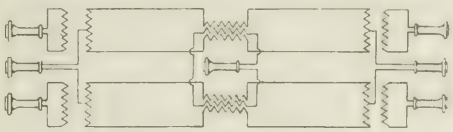
Mr. C. H. Smith, of Chicago, has patented a new design of jacks of the individually mounted variety. The jack frame is bent up so as to form a brace piece on each side of the springs. The ends of these pieces are turned over toward each other, perforated and threaded in line. A thimble screws from the front of the switchboard thereby engaging and clamping the jack. The bore of the thimble has a small key-way to engage a boss on the wrench. This same inventor has also obtained a patent for an indicating key of the multiple-plunger party-ringing type. The indicators are disks in the key-face, each associated with its own plunger. A line is ruled across each disk. When a plunger is depressed, a pin riding on a cam on the disk spindle rotates the latter and shows the ruled line turned through 180 deg. The disks return to normal upon the next depression of a different plunger from that indicated. Both of the above patents have been assigned to the Kellogg Switchboard & Supply Company.

A push-plate, locking-type, intercommunicating gang switch is the invention of H. C. Thomson, his patent being assigned to the Electric Goods Manufacturing Company, of Boston. The hook switch-lever acts with the locking plate to render the operation of the key system as nearly automatic as possible.

PHANTOM CIRCUIT

The so-called "phantom circuit" has come into very general use in the last few years. This circuit is formed by the use of two physical or all-wire metallic circuits in such a manner that each of these circuits serves as one limb of the superimposed or phantom circuit, the two metallic physical circuits thereby serving for three telephone circuits for simultaneous non-interfering use. The phantoming is accomplished usually by the means of repeating coils, the inductive relations of the various fractional windings of these coils serving to identify the various currents and keep them distinct. With the usual system, when there is an intermediate station, each physical line must be broken by the insertion of phantom repeating coils at the intermediate station. It will thus be seen that, while telephonically the physical circuits are continuous, yet conductively they are not so.

A patent recently granted to Mr. H. B. Stone, of Providence, R. I., describes a method of connecting in an intermediate station in such a way that the physical circuits are continuous conductively. The accompanying illustration shows diagrammatically such an improved circuit. It will be noted that the intermediate station is connected to the physical circuits inductively only. It will be seen that telephone currents upon the physical circuits, traversing the two limbs of the physical line, act differentialy upon the tertiary of the intermediate station repeating coil and, therefore, they are not effective in the telephone instrument at that station. For the phantom, however, the telephone currents generated in the phantom station traverse the two physical circuits. These currents reach the physical circuits at the middle points of the two terminal repeating coils, the two windings of which are differential with regard to these currents. It will be seen that both limbs of a physical circuit in parallel serve as one limb of the phantom. Therefore, the currents traversing one of the physical circuits



STONE PHANTOM CIRCUIT.

become cumulative at the intermediate repeating coil and, hence, become effective at the intermediate station. At the distant station, at the far end of the physical circuit, the phantom currents are effective at the phantom station in the usual manner.

Letters to the Editors.

Auto-Transformers vs. Rheostats for Induction-Motor Starters.

To the Editors of Electrical World:

Sirs:—The article in your issue of Feb. 25, by Mr. I. E. Hanssen, on "Auto-Transformers vs. Rheostats for Induction Motor Starters," is very interesting; the title, however, may be somewhat misleading to the casual reader, as "starting induction motors by rheostat" usually is understood to mean the starting by a rheostat in the secondary circuit, with the full voltage impressed upon the primary circuit. The above article, however, refers to the use of a rheostat in the primary circuit of the induction motor, which, as is well known, acts entirely differently from a rheostat in the secondary. The method discussed in the above article corresponds to the starting of a direct-current shunt motor, with the armature permanently connected in shunt with the field circuit and a starting rheostat in series with the field and armature circuits; in this case, in starting the field circuit gets very little voltage, and the starting efficiency therefore is extremely low. The usual method of starting induction motors by secondary rheostat corresponds to the starting of a direct-current shunt motor with full voltage on the field circuit and a rheostat in the armature circuit—that is, the method giving the highest starting efficiency.

While the above-mentioned article shows the auto-transformer, or auto-starter, method as superior to the use of a rheostat in the primary circuit, it must not be overlooked that even the auto-starter remains very much less efficient in starting than the use of the rheostat in the secondary, and for a complete comparison the values given by the latter method should be added. While the constants of the two motors referred to in the article are not given, still a fairly accurate estimation of the performance of the motors when starting at full-load torque by an armature rheostat can be made.

As is well known, inserting a non-inductive resistance in the secondary circuit of an induction motor reduces its speed, at the same torque, but does not change the current or power factor; and the current, power factor, power input, etc., of a motor when starting at full-load torque with a secondary rheostat are therefore the same as those of the same motor when running at full load and full speed.

With a 30-hp, 25-cycle motor the efficiency and the power factor at full load probably will be approximately 90 per cent. That is, with an output of 30 hp = 22.5 kw, the power input is $22.5 \div 0.9 = 25$ kw, and the kva input is $25 \div 0.9 = 27.8$ kva. Such a motor in starting at full-load torque with a secondary rheostat therefore consumes 25 kw and 27.8 kva—that is, a current of 40 amp per line; and the comparison of Table I of above article when completed by inserting the starting constants of the armature are thus:

STARTING TORQUE EQUALS FULL-LOAD RUNNING TORQUE.

	Motor No. 1			Motor No. 2		
Type of Starter.	Amp. in line.	Kva. in line.	Kw. in line.	Amp. in line.	Kva. in line.	Kw. in line
Auto transformer*	101	70	33	133	92	33.5
Primary rheostat*	158	110	91.6	158	110	72.5
Secondary rheostat	40	27.8	25	40	27.8	25
Values: Primary rheo.	1.57	1.57	2.77	1.18	1.18	2.16
Values: Auto-starter	2.52	2.52	1.32	3.32	3.32	1.34
Values: Secondary rheo.						

The difference between auto-starter and secondary rheostat is startling. While the auto-transformer starter consumes less current and less kilovolt amperes than the primary rheostat starter, the former requires from 2½ to 3⅓ times as much current to start with full-load torque than the method of starting by a secondary rheostat; it is thus much inoperative; and where frequent starting under heavy load is required and no objection exists against the sudden consumption of excess currents, the secondary rheostat is the preferable method of starting, though the auto-transformer has the advantage of permitting a squirrel-cage armature structure, and therefore owing to the extreme simplicity of the construction of the induction motor proper, this method is preferable wherever it is permissible—that is, where the motor can be started at light load, or has only infrequently to start under heavy load. When starting and acceleration under heavy load and with moderate volt-ampere consumption are of importance, as in railway service, obviously the only feasible method is the use of the rheostat in the secondary circuit.

*Taken from above-mentioned article.

Schenectady, N. Y. Charles P. Steinmetz.

The Luminous Efficiency of Metal-Filament Lamps.

To the Editors of Electrical World:

Sirs:—In the very interesting paper by Dr. Coblentz on "The Luminous Efficiency of Metal-Filament Lamps," which was published in your issue of Dec. 18 but which has just come to my notice, there is one point to which I should like to call further attention.

The curves given in Fig. 2, on page 1345 of the above issue show, according to the author, "the distribution of energy flow in the spectra of a filament of flashed carbon and of tungsten set to the same emissivity in the visible spectrum."

It would seem to me, however, that this statement does not give an entirely accurate idea of the conditions of the experiment or of the full significance of the results. Since the bolometric measurements in this experiment were kindly made by Dr. Coblentz at my request and under conditions which

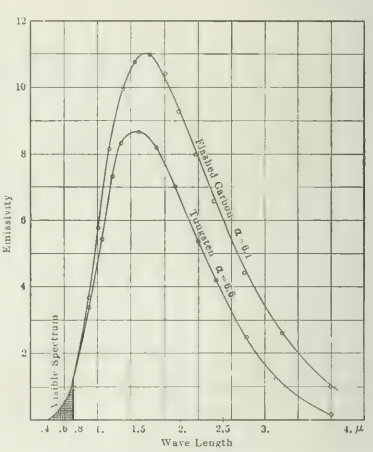


FIG. 2.—DISTRIBUTION OF ENERGY FLOW IN THE SPECTRA OF FLASHED CARBON AND TUNGSTEN. (REPRODUCED.)

had carefully specified in order to obtain a direct confirmation of conclusions which had been reached by other methods,[1] I feel that a few further explanatory remarks might not be out of place.

The curves given in Fig. 2 were obtained on the flashed carbon and osmium filaments when operating at voltages at which the two filaments show the same distribution of energy in the

[1] Hyde, "New Photometric Methods of Studying the Radiating Properties of Various Substances." Paper read before the Amer. Phys. Soc. Oct. 24, 1908. See *Abstract*, Phys. Rev., Vol. 27, No. 6, page 521, December, 1908.

visible spectrum as another flashed carbon lamp taken as an arbitrary standard. According to the measurements made by Hyde, Middlekauff and myself,[1] the lumens per watt of the osmium lamp under these conditions were very much greater than the corresponding value for the flashed carbon, indicating that the infra-red spectrum of the osmium filament is greatly suppressed as compared with that of the flashed carbon. In order to obtain a further check on this conclusion, Dr. Coblentz kindly undertook to measure for us the emission in the infra-red at the voltages which we had determined as giving the same distribution of energy in the visible spectrum—i.e., the same color. These measurements, which extended into the red end of the visible spectrum, were plotted to such scales that the ordinate in the red is the same for the two. According to our measurements the ordinates are, therefore, the same throughout the visible spectrum. The suppression of the infra-red spectrum of the osmium is shown clearly, and the numerical value of the ratio of the two areas enclosed between the respective curves and the axis of abscissas is the same to within observational error as that which we had previously obtained by the other method. (See papers before referred to.)

From this viewpoint the chief significance of the curves in Fig. 2 in Dr. Coblentz's paper lies in the illustration which they afford of the applicability of the new photometric methods of obtaining a positive qualitative criterion of "selectivity" by studying the properties of the radiating filaments under the conditions of the same distribution of energy in the visible spectrum. The question of the relative temperatures of filaments under this condition is discussed in the papers to which reference has been made.

CLEVELAND, OHIO. EDW. P. HYDE.

[1] Hyde, Cady and Middlekauff, "Selective Emission of Incandescent Lamps as Determined by New Photometric Methods." Paper read before the New York Section of the Illuminating Engineering Society, Feb. 11, 1909, printed in abstract in *Electrical World*, Vol. 53, No. 8, page 439, Feb. 18, 1909. To be printed in full shortly in the *Transactions* of the Illuminating Engineering Society.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Ventilation of Laminated Iron Cores.—A note on a recent British patent (8,997, 1908; Feb. 11, 1909). Ventilating by means of ducts in the plane of the laminations is not always effective on account of the varnish or paper insulation. In the case of the cores of transformers and the poles of single-phase commutator motors where the magnetic field is alternating and not rotary, the ventilation is effected, according to this invention, by slots transverse to the laminations. These slots must be in the direction taken by the main flux, and must be narrow. They can extend the full length of the magnetic circuit. Connecting cross-pieces can be left, or the core can be made up of parts spaced by distance-pieces.—Lond. *Elec. Eng'ing*, Feb. 18.

Turbo-Alternator.—A. KOLBEN.—The conclusion of his illustrated description of 3200-kva, three-phase generator directly coupled to a steam turbine. With unity power factor at a speed of 900 r.p.m. the efficiency is 96 per cent.—*Elek. Zeit.*, Feb. 18.

Lamps and Lighting.

Luminous Efficiency and Mechanical Equivalent of Light.—C. V. DRYSDALE.—An abstract of a paper read before the Physical Society of London. On the basis of Wien's law it is possible to calculate the energy radiated between any two wave-lengths —for instance, between the limits of the visible and compare it with the total radiation. The author has calculated the ratio of "luminous" to total radiation and the "luminous efficiency" for various temperatures. The comparison of the luminous energy so calculated with the intensity of light radiation found by Professor Fery leads to a mechanical equivalent of light of about 0.075 watt per candle, which is a fairly probable figure. The results show the enormous extent to which the luminous efficiency is dependent upon the temperature and how extremely low it is at ordinary temperatures. At 1500 deg. C. the efficiency is of the order of 1 per cent, or less, while at 2000 deg. C. it is about 3 per cent. The highest efficiency is obtained at a temperature of about 6500 deg. C., and is then only between 40 per cent and 50 per cent. This fact strongly points to the necessity for working in the direction of selective radiation or luminescence. In the discussion the opinion was expressed that the physiological effect on the eye should be taken into account in speaking of or defining "luminous efficiency." The author replied that there are three modes of defining it, of which two were due to Professor Nichols, of Cornell, who distinguished between "total efficiency" and "radiant efficiency." The former of these quantities is the ratio of the luminous energy radiated between the spectral limits to the total energy of consumption of the source of light, and the latter the ratio of the luminous energy as above to the total radiation from the source. However, neither of these definitions take any cognizance of the very different luminosities of the various spectral colors, and this had been realized by Dr. C. Guilleaume, who proposed to correct the luminous radiation by multiplying each ordinate of the radiation curve by a factor depending on the luminosity at that ordinate which is unity at the point of maximum effectiveness (0.54 μ). The author had proposed the term "reduced" total or radiant efficiency for the efficiency expressed on this basis, and this is evidently the most rational one.—Lond. *Electrician*, Feb. 19.

Flame Arc Lamps.—An illustrated description of two new flame arc lamps, the "Prima" and "Rebofa," made by an English company. The first-named is of the usual converging-electrode pattern, but in the Rebofa lamp, which has only recently been introduced, the electrodes are arranged vertically above each other. Both lamps are provided with gravity feed mechanisms, and with the usual shunt and series solenoid control of the arc. The Rebofa lamp with vertically arranged electrodes is illustrated in Fig. 1. The two electrodes are con-

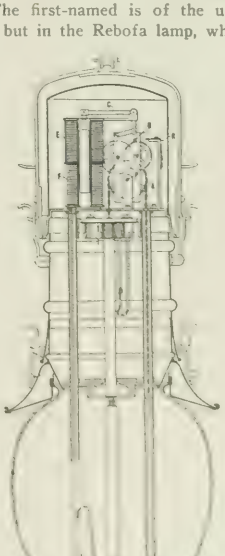


FIG. 1.—REBOFA LAMP.

nected by a chain passing over the sprocket wheel *A*, which is geared to a train of wheels ending in a fan wheel *B*. The clockwork is pivoted on the axle *P* of the sprocket wheel, and the lever *C* of the regulating gear is connected by a system of smaller levers to the clockwork frame. When the arc lengthens the pressure increases and the shunt solenoid *E* lifts the plunger and thus rocks the clockwork frame to the left. This action brings the two electrodes a little nearer together. As they burn away, the clockwork is rocked still more to the left, and finally the fan wheel *B* is brought out of contact with the fixed catch *R*. The mechanism is thus released, and feeding takes place until the series coil, by drawing down the plunger, again causes the fan wheel to be locked. An interesting point in connection with the air dash-pot provided is that the piston is made of graphite, thus avoiding any tendency for it to stick. The arc in this lamp is very short; the variation in the length of the arc is also very small. Feeding takes place at very frequent intervals, but the electrodes are moved together only a very small amount at each feed. The "economizer" is of fire-clay, supported, as shown, by a cast-iron ring. No "blow" is necessary in this pattern of lamp. The electrodes used are of special manufacture, with large impregnated cores surrounded by a comparatively thin shell of pure carbon, and owing to the disposition of the electrodes the arc burns steadily from the cores, having no tendency to burn from the hard carbon shell. The light is stated to be of a soft white color, suitable for color matching. Electrodes giving a yellow light can be used if required. Six of these lamps can be run on a 200-volt circuit. A 34-in., 12-amp lamp burns 18 hours on one pair of electrodes, and a 40-in., 12-amp lamp about 25 hours. The 40-in. lamp, when provided with 8-amp carbons, burns 22 hours. The chief advantage claimed for this type of lamp is that a greater distribution of light in a horizontal direction is obtained than with the converging-electrode flame lamps, thus rendering the lamp particularly suitable for the lighting of streets and other open spaces.—Lond. *Elec. Eng'ing*, Feb. 18.

Flame Arc Lamp.—A note on a recent British patent (1596, 1908; Feb. 11, 1909) of H. E. Moul. In flame arc lamps with converging electrodes the ash is sometimes deposited on the tips of the electrodes, thereby preventing the arc from being struck after it has been extinguished. The present invention is for a feeding mechanism in which the electrodes are fed down alternately instead of simultaneously, so that a rubbing action is produced between the fixed and the moving electrodes to scrape off any deposit. This alternate feed is effected by supporting the two electrodes by chains which pass round two slotted pulleys threaded loose on the same spindle and provided with ratchet wheels. Fixed pawls prevent the backward rotation of these wheels, and the forward movement, which is in opposite directions for the two wheels, is caused by two pawls on a rocking lever. This lever is rocked by the series coil, which is in circuit only when feeding is necessary, but then gives the rocking motion continuously, as the plunger short-circuits the coil when it rises, and thus works up and down continuously. A shunt coil controls one electrode by means of a sliding collar in the usual manner. When the plunger of the shunt coil has risen to its full amount, it opens the short-circuiting switch of the series coil and allows the latter to operate the feeding mechanism until the arc has attained its normal length. A "blow" magnet to control the arc is provided; this is arranged to insert a substantial resistance when the arc is extinguished. —Lond. *Elec. Eng'ing*, Feb. 18.

Flame Arc Lamps.—A note on a recent British patent (17,421, 1908; Feb. 11, 1909) of Koerting & Mathiesen, A. G., for ventilation of arc lamps. In arc lamps with "economizers" the vapors, instead of rising upward, move laterally and cause a deposit to be formed on the cold globe. To prevent this action the "economizer" is, according to this invention, surrounded by a cylindrical transparent chimney, and the vapors pass upward through the annular space between the neck of the chimney and the economizer. Air enters at the bottom of the main globe, which is closed at the top, and rushes through the inner chimney, taking with it the vapors. The chimney is quickly heated, and is prevented from cooling by the body of air between it and the outer globe.—Lond. *Elec. Eng'ing*, Feb. 18.

Comparison of Incandescent Lamps.—C. Leonard. The conclusion of his illustrated article on the comparison of carbon lamps with the recent high-efficiency incandescent lamps. The author shows how to find by means of a graphical method the minimum cost of the cp-hour if the cost of the kw-hour and the cost of the lamp are given. If the energy costs 14 cents per kw-hour and the carbon lamp costs 8 cents, he finds that the minimum possible cost of the cp-hour is 0.05 cent. This corresponds to a specific consumption of 3.3 watts per mean spherical candle-power during the useful life of the lamp or 2.3 watts per mean horizontal candle-power at the start. Under these conditions the carbon lamp is "rationally utilized." He then gives the following figures on recent lamps: Cp means bougies or hefner cp (1 hefner cp = 0.88 British cp)

	Volts	Mean horizontal cp.	Mean spherical cp at start.	Watts per mean horizontal cp at start	Watts per mean spherical cp during useful life.	Useful life in hours	[illegible]
Graphitized carbon lamp	110	16	12.8	2.5	3.4	500	0.4
Nernst lamp	220	31	18.9	1.8	3.25	300	1.5
Tantalum lamp	110	22	16.7	2.0	2.6	800	3.6
Osmium lamp	40	25	18.5	1.5	2.40	800	5.6
Tungsten lamp	110	22	16.3	1.25	1.9	800	3.7

Fig. 2 gives the curves of the cost of the cp-hour for different lamps. For different prices of electrical energy the abscissa give the price of the kw-hour in francs (1 franc = 20 cents) The ordinates give the price of the cp-hour in centimes (centimes = 1 cent). Curve I refers to the carbon lamp "rationally utilized"; curve II, to the carbon lamp at 3.5 watts per candle-power; curve III to the graphitized filament lamp at 2.5 watts per candle-power; curve IV to the graphitized filament lamp, "rationally utilized"; curve V to the Nernst lamp; curve VI to the tantalum; curve VII to the osmium, and curve VIII to the tungsten lamp.—*La Lumière Elec.*, Feb. 13.

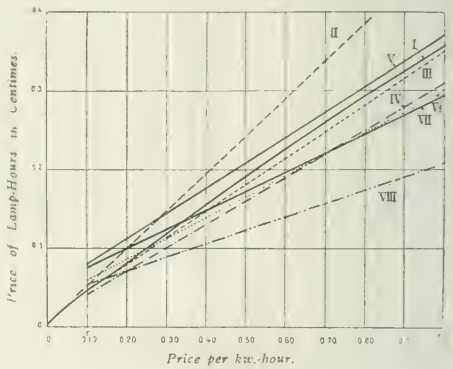


FIG. 2.—COMPARISON OF INCANDESCENT LAMPS.

Metallic-Filament Lamps.—A note on a recent British patent (2707, 1908; Feb. 11, 1909) of J. Howard. In the process of manufacturing metallic-filament lamps, after the filament has been mounted for the bulb exhausted, it is necessary to pass a much larger current than the normal working current through the filament in order to expel the absorbed gases. With high-voltage lamps, as, for example, a 250-volt lamp, a pressure of 350 volts may be necessary for this purpose, and it has been found that a discharge, which is detrimental to both the filaments and the vacuum, takes place between the filaments at the extreme ends. According to the present invention, when the filament consists of several loops in series, auxiliary leading-in wires are fitted solely for the purpose of running the lamps with the loops temporarily in parallel. A low pressure can then be used for the above operation, and there is no discharge. Lond. *Elec. Eng'ing*, Feb. 18.

Electric Lighting.—L. Gaster.—A paper read before the

Royal Society of Arts in London. The author emphasized the importance of efficient illumination as a means of preserving the eyesight, and referred to the possible dangers from ultra-violet rays. The need of co-operation between the lamp manufacturers and central-station authorities for the purpose of protecting the consumer from vendors of inferior over-run lamps was insisted upon.—Lond. *Elec. Eng'ing*, Feb. 18.

Uniform Illumination.—E. W. WEINBEER.—A third article on methods for obtaining a uniform illumination of a surface or a space. In the present article the author deals with the geometrical configuration of bodies giving out light.—*Zeit. f. Beleuch.*, No. 30.

Generation, Transmission and Distribution.

Steam-Turbine Efficiency.—Criticism is first made of a statement which has been often repeated to the effect that "the possible efficiency of a Parsons turbine decreases when the number of stages is increased, because the area exposed to fluid friction is greater the greater the number of stages." It is shown that this statement is fundamentally wrong from both the hydraulic and a thermodynamic point of view. The possible efficiency of the reaction type of steam turbine is considerably greater than that of the impulse type. In the former the losses per stage are due to the friction and shock at one row of blades only, while in each stage on the impulse type losses due to friction and shock at two rows at least are included. In actual

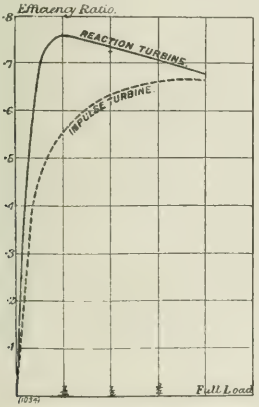


FIG. 3.—STEAM TURBINE EFFICIENCY

commercial practice there is, however, no great difference between the best recorded efficiency ratios of the two classes. This result is due to two reasons: In the first place the reaction type suffers more from leakage losses than its rival; secondly, to reduce its first cost it is commonly run at full load at a much smaller fraction of its synchronous speed than is the impulse type. The shape of the efficiency curve is compared for the two types as the load falls off. The curves given in Fig. 3 are from actual practice, the reaction turbine being a 2000-kw electric lighting unit, while the other is an impulse turbine of a well-known make and style. It is a much smaller machine than the reaction turbine with which it is compared, so that it would be unfair to compare the absolute efficiencies of the two. The difference in the character of the curves is, however, very instructive. Both turbines were governed by throttling; the efficiency is reckoned from the state of the steam in front of the first set of guide-blades, while generator losses have been allowed for. Apparently at full load the impulse turbine was just a little under-speeded, and as the average speed of the steam through the turbine is reduced by throttling down, the efficiency slightly increases at first until the output is about seven-eighths of the full load; afterward it steadily diminishes, the blade speed being too great for the reduced steam speed. With the reaction turbine, on the other hand, as the average speed of the steam throughout the turbine is reduced by throttling, the efficiency ratio continuously increases until the load is reduced to about a quarter of the maximum, although it seems certain that for some time before this point is reached the low-pressure groups of the blading have already passed through their point of maximum efficiency. At still lower loads negative work begins to be done at the low-pressure end, and the efficiency falls rapidly to zero. The two curves in the diagram show that the reaction type is very much under-speeded at full load, but so high is its inherent efficiency that it can afford to give its competitor the advantage of running at synchronism, and yet equal its fuel consumption per kw-hour —Lond. *Engineering*, Feb. 19.

Gas Engines.—B. HOPKINSON.—An abstract of a paper on heat-flow and temperature distribution in the gas engine. In the course of the expansion and the exhaust strokes of the gas engine, from a quarter to a half of the whole heat developed in the explosion is discharged into the cylinder walls. This flow of heat has little effect on the efficiency, but is important inasmuch as it necessitates the provision of special cooling appliances to carry it away, and it also requires the existence of a temperature gradient sufficient to carry it from the place where it is generated to the place where it is removed. High temperatures must exist in the uncooled parts of the engine, and great temperature differences must be between one part and another. These conditions give rise to dangers from pre-ignition, and also to severe mechanical stresses in the metal, which between them account for a large part of the practical difficulties encountered in running large gas engines. The calculations of the author lead to the conclusion that the temperature on the inner surface of portions of the engine which are efficiently cooled, such as the liner, can never rise above quite a moderate value, but the temperatures at the center of an uncooled piston may reach 400 deg. C. or more. Experiments showed that the rate of heat flow into the face of the piston is about one-eighth of the total flow in the engine. Of the fall of temperature between the center of the piston and the water-jacket about one half, say, 180 deg. C., is between the center and edge of the piston face. In consequence of this inequality of temperature there is a considerable hoop tension at the edge of the piston face, which probably amounts to several tons per square inch. Uncooled pistons of large diameter will be likely to fail by a radial crack at the edge, which in many cases may be followed by seizing of the piston on account of the sudden expansion which is thus permitted. Investigations were made as to the effect upon the metal temperature of varying the conditions of running. If the gas charge be increased by 30 per cent the total heat loss will be increased by 50 per cent, with a corresponding increase in the temperatures of the piston and the inlet valve. Retarding the ignition by 20 per cent reduces the heat loss by 10 per cent. The piston and inlet valve are then cooler, but the exhaust valve temperature is not materially affected. Thermal efficiency is reduced from 34½ per cent to 28½ per cent. Advancing the ignition by 10 per cent has little effect on the efficiency, but increases the heat by 10 per cent. Some interesting experiments were made on the phenomena of pre-ignition. In order to cause the engine to pre-ignite, an iron bolt carrying a thermo-couple at its end was introduced into the combustion chamber. The temperature of the end of the bolt heated by the explosions rose to 700 deg. C. without in any way affecting the working of the engine, but when the temperature exceeded 730 deg. C. ignitions took place from the end of the bolt. Since the effect of these ignitions is to heat the end of the bolt still further, they thus tend to propagate themselves and to become more frequent. If they once start, the engine is bound to come to rest.—Lond. *Elec. Times*, Feb. 11.

Steam Turbines vs. Gas Engines.—A paper read by Lennard Andrews and Reginald Porter before the (British) Inst. Elec. Eng. started a discussion on steam turbines versus gas engines for electric power houses. The authors of the paper have estimated the costs for a large generating station alternatively with steam and gas plant, and have arrived at the conclusion that with the price of coal above a certain figure, and with a sufficiently high load-factor a gas plant is more economical either

than a steam plant or than a combination of steam and gas engines. The figures are worked out in considerable detail. In the discussion W. B. Woodhouse and E. J. Fox championed the cause of the steam turbine, giving reasons for disputing the applicability of the authors' estimates without considerable modification. Fox particularly laid stress on the flexibility of the turbine plant for meeting the peculiar demands of an electricity supply load. Percy R. Allen, of the Castner-Kellner Alkali Company, gave an account of his favorable experience with a gas plant in a large generating station.—Lond. *Electrician,* Feb. 12 and 19; *Elec. Eng'ing,* Feb. 18.

Electric Driving in Factories.—H. B. Poynder.—After giving some notes on the rating of three-phase motors, the author points out the various difficulties that are encountered in the electric driving of different kinds of machinery, and shows how these difficulties have been overcome. In the case of printing and paper-making machinery, he advocates the use of the Ward Leonard system in preference to direct drive by three-phase motors, and explains a system suitable for the driving of calico-printing machines, in which the energy is distributed to the motors by means of a five-wire direct-current system, the motor armature being supplied with energy at nine different pressures in order to obtain the varying speeds necessary.—Lond. *Elec. Eng'ing,* Feb. 18.

Electro-hydraulic Pumping Plant.—W. A. Clatworthy.—An illustrated description of the electro-hydraulic pumping plant at the Bristol docks. This plant, which possesses several novel features, particularly in the method of electrical control, provides water power for operating various cranes, capstans, lock-gates, bridges, etc., in connection with the Bristol docks. Steam pumps, which were previously used, have been replaced by three sets of electric pumps.—Lond. *Electrician,* Feb. 19.

Small Motors.—W. Sughe.—An illustrated article in which the author shows how the small electric motor with a rating of from 0.5 to 5.0 hp is advantageous not only for central stations, but for the farmer and for small workshops. A number of examples are given to show the central-station engineers how to explain these advantages to their customers.—*Elek. Zeit.,* Feb. 18.

Gas Turbine.—M. Armengaud.—The first part of an article in which the author gives the calculation of a gas turbine in order to show that the fuel consumption would not be prohibitive.—*La Lumière Elec.,* Feb. 13.

Steam Turbine.—J. W. Kirkland.—An illustrated description of the Curtis steam turbine as built by the General Electric Company.—*Gen. Elec. Rev.,* March.

Scale and Corrosion of Boilers.—J. C. W. Greth.—A paper read before the Amer. Inst. Cem. Eng., pointing out the general characteristics of those substances which cause the scale and corrosion in boilers, and making suggestions on the softening and purifying of boiler water.—*Power,* March 2.

Traction.

Electric Ferryboat.—O. Reich.—The first part of an illustrated description of the equipment of an electric ferryboat crossing the River Rhine between Godesberg and Niederdollendorf. It is a double-screw boat and has a battery of 160 cells with a rating of 335 amp-hours for a one-hour discharge. Each of the two propellers is driven by a 300-volt, 50-hp direct-current series motor. The motors have interpoles so as to permit the regulation of the speed within wide limits and also sudden reversals without sparking at the commutator. The motors are started and regulated from the pilot house.—*Elek. Zeit.,* Feb. 18.

Installations, Systems and Appliances.

"Rotary Condensers" in Steel Mills.—A. L. Jones.—The induction motor is exceedingly well suited for steel mills, but requires an excess of magnetizing current. In planning an installation of generators for supplying energy to an induction-motor load one is confronted with the necessity of taking care of the idle current either by extra generator capacity or by supplying the wattless magnetizing current from over-excited synchronous motors; which of the methods is to be preferred depends on circumstances. If the generators are of slow speed, and hence are very large for their output, it will probably be cheaper to put in a high-speed rotary condenser. If the load is at the end of a long feeder or transmission line, a condenser installed near the motors would probably be the better arrangement, as this would save circulation of idle current through the transmission line and generator. The gain in power factor of the generator, however, is not proportional to the amount of leading current supplied. In general, no attempt should be made to raise the power factor above 96 per cent, since any further increase requires an amount of leading current out of all proportion to the improvement of power factor or generator capacity reclaimed. An over-excited synchronous motor used to supply magnetizing current for induction motors can also carry some mechanical load. With certain mechanical loads a larger proportion of leading current is available than with other loads. With the motor driving a mechanical load of 71 per cent of its rated capacity and with the field over-excited to give full current, 71 per cent of its rating is available as magnetizing current. This proportion is the most advantageous one.—*Gen. Elec. Rev.,* March.

Automatic Circuit Breakers.—C. C. Garrard.—An illustrated article on trip coils for alternating-current automatic circuit breakers. The author gives experimental results showing how the trip coil of a group feeder may, under certain conditions, be operated, owing to the momentum of the moving parts, when the circumstances are such that only one of the feeder trip coils should have come into operation. Continuous-current trip coils are generally used on alternating-current systems. The author considers whether it is not desirable to eliminate this continuous current in many cases and to work entirely with alternating-current coils. He discusses the maximum circuit breaker, reverse-power circuit breaker, and reverse relays combined with no-voltage circuit breakers.—Lond. *Electrician,* Jan. 9.

Wires, Wiring and Conduits.

Underground Cables.—J. R. Dick.—A continuation of his long serial on the design of underground mains and networks. In this section of the article the author discusses Kelvin's law for the best cross-section of cables. In practice, considerations of temperature rise obviate the necessity of elaborate calculations. Boosted and unboosted feeders, split feeders and equalizing mains are also discussed, as well as practical considerations affecting the position of feeding points.—Lond. *Electrician,* Feb. 19.

Connection Between Conduit and Overhead Lines.—An illustrated description of the system of through-running between the conduit and overhead systems on the London County Council tramways. Special arrangements for removing and reinserting the contact plows of the cars of the London County Council's tramways are provided at the ends of the Camberwell and Brixton section.—Lond. *Elec. Eng'ing,* Feb. 4.

Electrophysics and Magnetism.

Doppler Effect in Positive Rays.—J. Trowbridge.—Goldstein discovered canal rays and the Doppler effect in these rays. It is now known that in addition to the positive rays behind the cathode—the canal rays—there are retrograde positive rays which are directed to the anode, or rather away from the cathode in the direction of the anode. This latter discovery leads one to expect that the Doppler effect is to be found also between the anode and the cathode. The result of the present author's study shows that the effect does exist in this region and indicates a movement away from the cathode and toward the anode.—*Am. Jour. of Science,* March.

Atmospheric Electricity.—P. H. Dike.—A summary of various recent observations in atmospheric electricity.—*Am. Jour. of Science,* March.

Thermodynamics.—C. P. Steinmetz.—A continuation of his mathematical serial; the author now takes up in detail the thermodynamics of gases.—*Gen. Elec. Rev.,* March.

Electrochemistry and Batteries.

Electric Steel Refining.—R. Amberg.—An article on deoxidation and desulphurization in electric steel furnaces. The prin-

pal reaction in the removal of sulphur is the formation of cal-ium sulphide. In the Héroult furnace simply lime is used and lcium carbide forms in the furnace. In the induction fur-ace ferosilicon is added.—*Electrochem. and Met. Ind.*, March.

Electric Steel.—J. A. SEEDE.—An illustrated article reviewing he different electric furnaces for the refining of steel and the eduction of iron ore. The reaction by which sulphur is re-noved from steel is discussed and finally the possibilities of naking steel directly from iron ore are referred to.—*Gen. Elec. Rev.*, March.

Steel Direct from Iron Ore.—E. STASSANO.—Some notes on ne possibility of producing forgeable iron and steel directly rom iron ore in a single operation in an electric furnace. He dds some critical remarks on the Lash process.—*Electrochem. nd Met. Ind.*, March.

Electrolytic Refining of Precious Metals.—H. LACROIX.—An llustrated description of an electrolytic apparatus for refining ilver, gold, etc. The special advantages are that the process s continuous and that there is always uniform density all over he surface of the electrodes.—*Electrochem. and Met. Ind.*, March.

Water Decomposition by Alternating Current.—M. U. SCHOOP.—By decomposing water by means of alternating cur-ent there is produced a mixture of oxygen and hydrogen gases which is directly suitable for welding with the oxy-ydrogen flame. A suitable apparatus for making oxy-hydro-gen gas for welding is described. It is finally mentioned that at present there is a possibility of making hydrogen gas by de-composition of water with aluminum, on account of the present low price of the latter metal.—*Electrochem. and Met. Ind.*, March.

Electrolytic Meter.—A. FIEREZ.—A description of the Krumer electrolytic meter shown in Fig. 4. *F* and *G* are the two elec-trodes in helical form, one within the other and separated from each other by pieces of hard rubber. The current decomposes the water, the gases developed escape through the water seal at the top and the level of the water in the tube *B* indicates the number of amp-hours which have passed. The water seal at the top acts as follows: When the pressure within the ap-

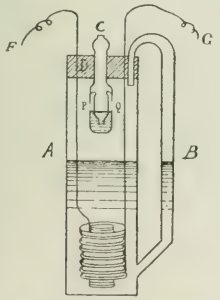


FIG. 4.—ELECTROLYTIC METER

paratus is somewhat above atmospheric pressure, the gases enter through the holes *P* and *Q* and bubble upward through the water and leave through *C*.—*Bull. de la Soc. Belge des Elec.*, January, 1909; *La Lumière Elec.*, Feb. 13.

Thermoelectric Pyrometers.—C. H. WILSON.—Both the low-resistance thermoelectric pyrometer and the high-resistance thermoelectric pyrometer are capable of accuracy, but the mistake of uniting the thermocouple of the latter with the indicator of the former should not be made. If one indicator is needed on both platinum and base metal couples it must be an indicator having a resistance of not less than 50 ohms.—*Electrochem. and Met. Ind.*, March.

High-Frequency Apparatus for Medical Purposes.—F. DESSAUER.—For the production of high-frequency currents for various medical purposes the arrangement shown in Fig. 5 has been found very suitable. *A* is the secondary of an ordinary single-phase transformer, which is operated by alternating current and not by direct current, with an interrupter. *C* is a condenser and *E* is a self-induction coil. F^1 and F^2 are two spark-gaps symmetrically arranged. The lengths of each gap can be adjusted by means of the screw *G*. The use of two symmetrically arranged spark-gaps is stated to give results very much

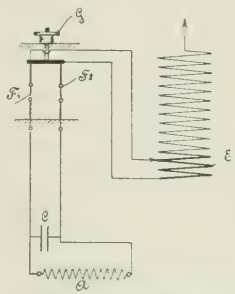


FIG. 5.—DIAGRAM OF CIRCUITS.

superior to the use of only one spark-gap, but this is the case only when the apparatus is operated with alternating current. For induction coils with interrupters this is not the case.—*Phys. Zeit.*, Jan. 15.

Selenium Cells.—C. RIES.—An article giving some notes on former work on the use of selenium vapor for the manufacture of selenium cells.—*Phys. Zeit.*, Jan. 15.

Telegraphy, Telephony and Signals.

Alternating Current for Telephony.—F. WEINBERG.—A note referring to the recent paper of A. Maior on the use of alternating current for telephony. The present author thinks that this represents the only possible solution of transatlantic cable telephony. He states that experiments have led him to the conclusion that the alternating current—a high-frequency current being used in his experiment—can easily be brought to the condition of resonance by self-inductance connected in series, and that in this way the weak undulations of the speech current can be clearly transmitted.—*Elek. Zeit.*, Feb. 18.

Automatic Telephone Exchange.—KRUCKOW.—The first part of an illustrated description of the telephone exchange of Hildesheim, which is the first automatic exchange in continental Europe.—*Elek. Zeit.*, Feb. 18.

Miscellaneous.

Method of Invention.—C. TURNBULL.—A paper in which the author points out that invention is evolutionary rather than revolutionary. He outlines a series of rules or "operators" relating to different stages in the development of invention. These are classified as follows: Selection and chain operator; equivalence operator; change of position operator; addition operator; omission and direct operator; change of proportion and increased function operator; separation operator; combination operator; transference and distribution operator; the converse or reverse operator; the constraint and freedom operator; the relay operator. What he means by his operators may be explained by "the selection and chain operator." This "works by setting forth clearly the parts on which the inventive faculty may work. In other words, the parts on which he may operate are set out like so many links in a chain, each link in turn being examined to see what can be done with it." Consider the leading-in wires of an incandescent lamp. To make them satisfactory from all points of view one may operate on the following: (1) The material of which the wire is made; (2) the shape of same; (3) constitution of the glass; (4) material or cement round the leading-in wires. A vast amount of work was done on 1, 3 and 4, but 2 was neglected until Bastian tried flattening out the wires. Then it was found that an air-tight joint could be made with flat copper wires. Probably this fact would have been discovered long ago had people only been accustomed to write down the possible parts for working on and the method of working as above.—Lond. *Elec. Eng'ing*, Feb. 18.

Underground Telegraph Cables in France—Bazille.—At present only paper cables with air insulation are used in France. The copper conductors have from 1 mm to 2.5 mm diameter, in exceptional cases up to 5 mm; capacity from 0.06 microfarad to 0.08 microfarad per kilometer; 56, 112, 224 pairs of conductors; compressed air—2 atmospheres—is used for drying. To protect the lead covers of the cables against the stray current from the tracks and return circuits of electric railroads, the lead cover is painted with a mixture of resin and other insulating materials. *Elek. Zeit.*, Feb. 11

NEW APPARATUS AND APPLIANCES

Maintenance Cost of Flaming Arcs.

By L. J. Auerbacher

Flaming-arc lamps are now being specified by many engineers for municipalities and for industrial plant lighting and naturally the question of maintenance cost is of prime importance. Flaming-arc lamps of two distinct types are now on the market, namely, the differential lamp and the so-called gravity-feed lamp. The differential lamp is generally adjusted to operate two lamps in series on 110-volt circuits, taking 10 amp for the series; whereas the gravity-feed lamp, as a rule, is adjusted at 11 or 12 amp.

Taking the differential lamp as an example, the consumption of each lamp is 550 watts, which at an average cost of 2 cents per kw-hour makes the cost $11 per 1000 hours for current. Taking the net cost of imported flaming-arc lamp carbons, the cost per trim per 1000 hours, including labor, would be $8.50, making the total cost of trim and carbons $19.50 per 1000 hours. The cost of repairs and globes per 1000 hours may be figured at $2, to which must be added interest on the investment and a depreciation of $2 per 1000 hours, making a total of $23.50 per 1000 hours of operation. At an average yearly burning of about 4000 hours the cost per hour would be $94 per year per lamp.

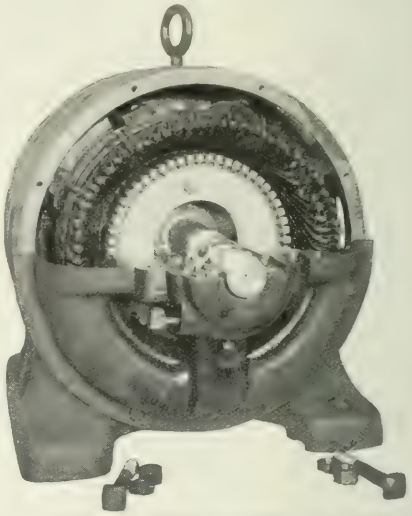
For municipal lighting, the general plan of installing these lamps is to mount two lamps on one pole, as it simplifies the wiring problem over the plan of mounting one to a pole. The height of the lamps above the sidewalk should be not less than 25 ft., so as to secure a good distribution from the high candlepower given out by these lamps. Several cities have installed these lamps with great satisfaction to the citizens, who are willing and have even initiated a scheme for paying an extra assessment per front foot in order to get the increased illumination which results. This naturally results in increased revenue to the lighting companies, not alone from the operation of the lamps themselves, but also from the fact that one brilliantly lighted thoroughfare sets the standard and other streets must soon follow the lead so as not to suffer by comparison. At the same time, private lighting is brought up to a higher standard in order to compare favorably with the standard set by the flaming-arc lamps. In other words, flaming arcs are a great stimulant to the lighting industry and should be encouraged by lighting companies for that reason, if for no other.

Induction Motors for Mill Service.

In comparison with direct-current motors for mill service the squirrel-cage induction possesses the advantage of requiring neither commutator nor sliding contact, so that it is relatively an almost indestructible machine. The only parts subject to wear are the bearings, and if these are properly constructed the motor will withstand successfully extreme service conditions. However, it is only when the motor has been designed particularly for mill service that it will exhibit the proper operating characteristics. The starting torque of a squirrel-cage induction motor depends upon the secondary resistance, upon which also depends the slip of the motor under load. An excess of secondary resistance would mean poor speed regulation and even a decrease in starting torque. It is stated that in the motor illustrated herewith the secondary resistance has been given such a value that a good starting torque is obtained without requiring an excess of starting current, while at the same time the slip and the efficiency at normal load are satisfactory.

The secondary circuit consists of a squirrel-cage winding formed of copper bars in partially closed slots bolted to end rings of heavy sheet copper having large ventilating surfaces. For the purpose of minimizing the stored rotative energy, so as to facilitate the reversal of speed in service, the rotor cores are comparatively very small in diameter and long parallel to the shaft. To meet the exacting demands of mill work, the shafts are made extra heavy and the bearings are liberally proportioned.

Squirrel-cage motors usually exert at starting a torque somewhat in excess of the value required by the load. A starting torque larger than demanded by the operating conditions causes unnecessary shocks to the motor and all connected apparatus, and the current taken may disturb the line e.m.f. and cause the lamps to flicker. It is desirable, therefore, to reduce the impressed e.m.f. to such a value as will provide the starting torque required.



MOTOR WITH BRACKET REMOVED TO SHOW STATOR CONNECTIONS, BEARINGS, ETC.

The reduced e.m.f. for starting is obtained from an autotransformer type of starter, whose switch contacts are immersed in oil. The switch contacts consist of copper rods abutting against brass rods, the movement in closing or opening being vertical. It is said that this combination of metals has proved very satisfactory in resisting injury from arcing. The contacts are in two sets, one of which closes in the starting position, and the other in the running position. In closing the switch, helical springs around the contact rods are compressed, the total compression being about 0.5 in. These compression springs insure good contact which improves slightly with use.

About ¼ in. may be worn from the end of each rod of a pair of contacts before they need replacing. In practice these contacts wear away very slowly, the wear after breaking full-load current several thousand times being very slight. When

worn out the ends of the rods, or the arcing tips, can be unscrewed with a pair of ordinary gas pliers, and the new ones substituted.

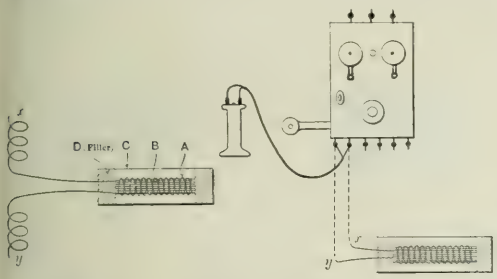
The switch is operated by means of a lever on a shaft running through the lower portion of the transformer case. This lever has three positions—namely, off, starting, and running. A locking device holds the lever in the off position and in the running position until released by pressing the thumb piece in the end of the handle. The handle will not remain in the starting position unless held there by the operator, and on being released returns to the off position.

A mechanical device prevents moving the handle directly from the off position to the running position; it must first be moved to the starting position, the extreme left, and then moved quickly back past the off position to the running position at the extreme right. If this last movement is slow the handle will be caught and held in the off position. This feature is designed to prevent allowing time for the motor to slow down while passing from the starting position, where the motor receives less than the full voltage, to the running position where full voltage is applied.

These mill-motor equipments are made by the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

Telephonic Induction Eliminator.

The device illustrated herewith has been designed for eliminating the buzzing sounds that are commonly present in receivers connected to telephone lines erected in proximity to high-potential circuits. The device provides means by which



FIGS. 1 AND 2.—TELEPHONIC INDUCTION ELIMINATOR.

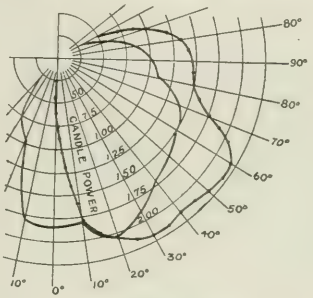
currents induced in the telephone circuit will be caused to take a shunt path in preference to the course over the windings of the receiver.

The device is shown in Fig. 1. It consists of a helix of insulated wire, *A*, having a resistance of about 4.25 ohms, wound continuously on a soft-iron core, *B*, approximately ⅜ in. in diameter and 2 in. long. The core forms an open magnetic circuit. When the core and helix have been constructed and assembled, they are inserted in a brass tube, *C*, about ⅝ in. in diameter and 2.5 in. long, each end of the tube being then filled with an insulating and moistureproof compound, as shown at *D*. It is claimed that when the coil is connected in parallel with a telephone receiver, as shown in Fig. 2, the voice current will take its intended course over the telephone receiver, while the currents produced by external influences will follow the path across the "induction eliminator."

The above-described device has been placed on the market by the Wasatch Electric Service Company, 46 Postoffice Place, Salt Lake City, Utah.

Show-Window Lighting with Tungsten Lamps.

Effective show-window trimming necessarily involves not only a frequent change in goods displayed, but the arrangement of the displays. It is therefore desirable that window-lighting fixtures should be such that the direction of the light can be changed to accord with the periodical changes in window trimming. The curves of the adjoining cut are plotted from

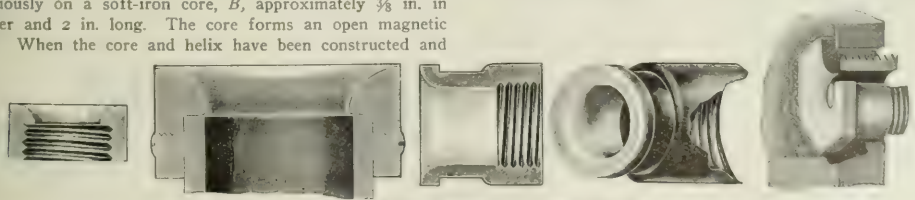


ILLUMINATION CURVES.

photometric measurements taken with a Wheeler reflector (No. 65) in two different positions, the one designed to give a maximum of light directly downward and toward the front of the window, and the other to throw the light on goods displayed at the back and on the back wall of the window. This reflector may be adjusted at any convenient angle while the lamp remains in the vertical position desirable when tungsten lamps are used. The reflector is made by the Wheeler Reflector Company, Boston.

Porcelain-Lined Bushings.

The Code requires that where metal conduits enter junction boxes and at all other outlets, etc., they must be provided with approved bushings fitted so as to protect the wires from abrasion. The device must be made of non-combustible, insulating material which will not absorb moisture. The H. Krantz Manufacturing Company manufactures a line of bushings meeting these requirements and which are especially useful in various classes of wiring work. These are made of annealed cast iron and are lined with porcelain. Fig. 2 shows a set-screw bushing which is convenient for use in places where it is found difficult to place a thread on the conduit, as, for instance, in rewiring an old building. Here all that is necessary is to counter-sink the conduit for the point of the set screw, place the bushing over the pipe and tighten the set screw. A bushing used on split outlet boxes is shown in Fig. 3. This bushing has a long neck and is held in position by means of its angular groove between the box and the cover, and makes a good ground connection between the outlet box and conduit. For conduits already equipped with wire, porcelain-lined split bushings are made. These have only to be opened, placed over the conduit and screwed together. A panel bushing is shown in Fig. 5. This is designed to be placed in slate-lined boxes without wiring gutter.



FIGS. 1, 2, 3, 4 AND 5.—PORCELAIN-LINED BUSHINGS.

A New Small-Bulb 40-Watt Tungsten Lamp.

Several months ago a 25 watt tungsten lamp was placed on the market with a bulb practically the same as that of the familiar 16-cp carbon-filament lamp, and for which it could be used as a substitute in any fixture or shade. This lamp came into immediate favor and general use, but it lacked one of the chief advantages of tungsten-filament lamps—increase of illumination without increase of current consumption.

The General Electric Company has recently placed on the market a small bulb lamp with a 40-watt tungsten filament giving double the candle-power of the present 16-cp carbon lamp, but taking only four-fifths of the current. This lamp when substituted for the carbon lamp will, therefore, not only materially reduce the cost to the customer, but will greatly increase the standard of illumination by doubling the quantity and bettering the quality of the light given.

As shown by the accompanying illustration, the lamp is about two-thirds size, and it will be seen that the bulb and base are practically the same as that of the ordinary incandescent carbon lamp. The new lamp contains the many improvements in filament construction and methods of support perfected by the General Electric Company. Like other General Electric tungsten lamps it can be burned in any position without affecting its life or candle-power and its small bulb adapts it to all ordinary shades, chandeliers and brackets.



40 WATT TUNGSTEN LAMP

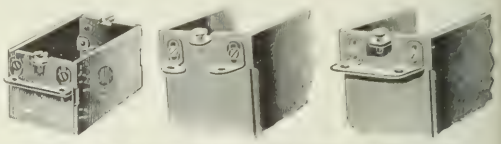
Its price is less than that of the regular large bulb tungsten lamp with shoulder base, and the operating cost, including cost of lamp and current, is less than any incandescent lamp smaller than the 60-watt tungsten. Furthermore, the customer is not required to include in the purchase of the lamp a new outfit of special fixtures, shades, etc. From a commercial standpoint, therefore, it is of particular value to the central station in maintaining its revenue from customers.

The new small-bulb 40-watt lamp can be used in installations now using the old type with shoulder base and holophane reflectors by changing the shade holder from the "H" type to the "O" type. This will raise the reflector around the lamp so as to bring the filament in correct "focus" and obtain practically the same efficient distribution of light from the reflecting and refracting prismatic surfaces.

Shallow Sectional Switch Boxes.

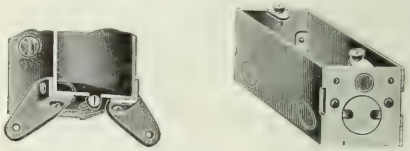
To accommodate the demand for shallow receptacles as well as shallow-type switches, the two kinds of shallow boxes of the sectional type, illustrated herewith, have been designed. They may be employed in thin partitions, outside walls or where for any reason it is not desirable to use a deeper box. Fig. 1 illustrates the loom box, single type, while Figs. 2, 3 and 4 represent types of ears used with this box. Figs. 5 and 6 show the conduit box of the single and two-gang types respectively. Fig. 7 shows the spacer used to build the box up into a number of gangs. The Chicago Fuse Wire & Manufacturing Company is the maker of these switch boxes.

Referring to Fig. 1, the box shown is 2 in. deep, outside dimensions. The switch lugs are drilled on standard centers, and being formed outward, enable the body of the box to be made short enough to allow the attachment ears to be effectually covered by the flush plate when used in old work. The box is provided with two knockouts in each end, but has none in the back. It may be built up into gangs, and the spacers may be inserted without removing the screws.



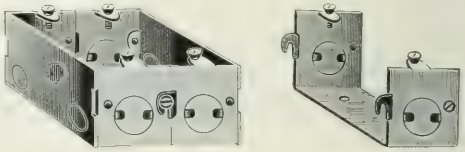
FIGS. 1, 2 AND 3.—SHALLOW SECTIONAL SWITCH BOXES.

Fig. 2 illustrates the regular type of ear. This has the sliding adjustment and reversible feature so that it may be set to various depths when used in new work, according to the thickness of the plaster. Being supported by pivoted connection it may be turned at any angle to strike the lath, which is particularly convenient in old house wiring. In the type shown in Fig. 3 the ears are recessed into the plate; this type is especially desirable for use in connection with a rotary flush switch in which the plate has no supporting screws. The type of Fig. 4 is used only in connection with new work, and is often preferred where a strong anchorage of the switch box is desired. This ear is also provided with an adjustment slot so that the face of the box may be brought out ¾ in. to ⅞ in. from the plaster line. It is of stamped steel and consequently strong.



FIGS. 4 AND 5.—SHALLOW SECTIONAL SWITCH BOXES.

The wall case of Figs. 5 and 6 measures 4 in. long, 2 in. wide, and 1⅞ in. deep, outside dimensions. This is a combination loom and conduit box, having entrance at each end for ½-in. conduit or armored cable and two ⅝-in. openings on either side for loom, these being placed as far from the center as possible so that the ends of the tubing will not interfere with the installation of the switch. As the box is only 1⅞ in. deep it lends itself particularly to use in outside walls where a 1-in. furring strip is used with ¼-in. lath and ⅝-in. plaster, in which case the conduit can be run back of the lath and it is not necessary to recess the box in the brick wall. This box is also suitable where thin partitions are constructed with 1-in. uprights for holding the lath. The combination of conduit and loom outlets in the same box makes it particularly adapted for use where changes are made from conduit or open work.



FIGS. 6 AND 7.—SHALLOW SECTIONAL SWITCH BOXES.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Business during the past week has continued to be quiet and the recovery, that has so long been expected, is yet delayed. While comparisons with the same period of last year are, of course, favorable, there is still considerable disappointment in most lines of trade over the fact that buyers continue to be so strictly conservative. For the dullness, just at the present time, there are definite reasons assigned. The chief of these is the uncertainty as to the tariff and the unwillingness of retail merchants to lay in stocks when a reduction of duties may make future prices much lower. Another reason for immediate stagnation is the unsettled and adverse weather that has prevailed over almost the entire country during the past week. Blizzard, snow and rain have visited various sections and in many parts of the South and Northwest the roads are almost impassable. The most active line, in the jobbing trade, is in cotton goods, summer fabrics and millinery. In these lines it is noted that the finer fabrics for women's wear are the most popular. This is taken to indicate a belief on the part of retailers that there is plenty of money in the hands of consumers to buy the better class of materials and that the cause of delay is largely a lack of confidence. Agricultural implements and supplies for the farm continue to be good sellers, but this is merely the seasonable activity that occurs as the planting time approaches. In the metal industries there is very little doing. The drastic cuts in the prices of steel products have as yet brought out only a moderate amount of orders. The steel mills are certainly disappointed over the returns since "letting down the bars." The best business that was done in this line during the past week was in steel rails, the only product upon which no cut was made. The New York Central Railroad placed orders for 101,000 tons. These orders, the second largest of the year, were mostly given to the independents. The building industry is quiet and plans for the coming season are slow in coming to light. There is some business being done in the lumber trade, mostly in the South and in the far Northwest, but even this is not as active as had been anticipated. In the electrical industries there is little business in sight. Orders for heavy materials are not coming forward and the business being done in small apparatus is only fair. There are many large projects on foot which will require financing, but they are held in abeyance until general business conditions improve. Collections are only fair in spite of the easy money market. Business failures for the week ended March 4, as reported by *Bradstreet's*, were 219, compared with 244 the previous week, 287 in the same week in 1908, 172 in 1907, 177 in 1906, and 190 in 1905.

THE COPPER MARKET.

It is persistently given out among the selling agencies that at least 100,000,000 lb. of copper have been sold within the past 10 days in the New York market. Whether these figures are exaggerated or not, it is certainly true that quite liberal amounts have been taken. The effect upon the market, however, has been very small. Prices have been technically marked up a quarter of a cent, but it is hardly a secret that sales are daily made below the quoted prices and that the large takings that were recently reported were all negotiated at lower figures than present quotations. Another point, worth consideration, is the fact that these sales—which were used to strengthen the prices of copper shares in Wall Street—were made almost exclusively to foreign speculators. In other words, the copper was not taken for consumption and is still in the market. Such copper should not be deducted from the figures representing surplus stocks. It has simply changed hands and has not gone into consumption. As a matter of fact the users of copper have shown little disposition to buy. All of the large manufacturing concerns continued to pursue the hand-to-mouth policy. Even the ability to purchase electrolytic copper at 12¼ cents was no inducement. The statistical position of the market is thoroughly understood and consumers are almost universally of the opinion that a material advance in price is impossible and that lower selling prices are highly probable. The report of the Copper Producers' Association for February will be issued within a few days and it is practically certain that it will show a material increase of "marketable" copper in the hands of producers over the figures given out the month previous. It is predicted that these figures will be in the neighborhood of 185,000,000 lb. This, it must be remembered, does not represent the actual amount of copper in sight. "Marketable" copper means refined copper in the hands of the refiners. It does not mean blister or pig copper ready to be refined in the hands of the smelters or in the hands of the refiners; it does not include the refined copper in the hands of speculators. Taking these stocks into consideration the stocks of copper would be increased 100 per cent. The present situation in a nutshell is this: production, 110 to 120 per cent of normal; consumption, 60 per cent of normal. The exports since March 1 have been 3874 tons. Quotations on the Metal Exchange March 8 were:

Lake	12⅞ @ 13⅛
Electrolytic	12⅛ @ 12¾
Castings	12⅜ @ 12⅝

London quotations were as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	56 12 6	56 10 0
Standard copper, futures	57 7 6	57 5 0
Market	Firm.	Easy.
Sales of spot		200 tons
Sales of futures		600 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.25	12.75
Electrolytic	14.25	12.37½
Casting	14.12½	12.25
London, spot	£64 2 6	£55 17 6
London, futures	64 17 6	56 12 6
London, best selected	67 15 0	59 10 0

BERGMANN UNITED STATES LAMP FACTORY.—It is rumored that the Bergmann Elektricitäts Werke, of Berlin, will establish a tungsten-lamp factory in the United States which will be operated independently of any of the present lamp interests. Mr. Sigmund Bergmann, president of the German Company, was for about 20 years prominent in the electrical manufacturing industry of this country under the firm names of S. Bergmann, Bergmann & Company (later the Edison Machine Works), the Bergmann Gas & Fixture Company, and the General Incandescent Arc Lamp Company. The Bergmann works near Berlin are now among the largest in Europe, giving employment to 6500 men. The capital was recently increased from 14,000,000 marks to 21,000,000 marks, and the operations from the beginning are stated to have been very profitable, as would seem to be indicated by the great growth of the manufacturing works from the small plant started by Mr. Bergmann when he returned to Germany about 1899.

CONTRACTS FOR READING, PA.—The Interstate Engineering & Supply Company, Philadelphia, Pa., S. S. Neff, president, has just let a number of contracts for apparatus to be installed in the new power station now being erected at Reading, Pa., by the Metropolitan Electric Company, among which are the following: To the Allis-Chalmers Company for three 2500-kw turbines and generators with 80 per cent power factor, designed for 60 cycles, three-phase and 13,200 volts. To the Edge Moor Iron Company, Edge Moor, Del. for sixteen 625-hp boilers. To H. R. Heinicke for two brick chimneys, each 242 ft. high. To the General Electric Company for two exciters, and to the Jeansville Iron Works Company, Jeansville, Pa., for three boiler feed pumps to be driven by turbines.

DUFFERIN (ONT.) POWER-HOUSE CONTRACT.—The Dufferin (Ont.) Light & Power Company will in the course of the next month issue contracts for the construction of a new power house, to contain three 150-kw hydro-electric units. Messrs. Smith, Kerry & Chace, Toronto, are the engineers.

BOONVILLE (MO.) PLANT.—The Boonville (Mo.) Light & Water Power Company will build a $150,000 auxiliary steam-power plant and water-works system. Mr. W. A. Fuller, Chemical Building, St. Louis, is engineer.

EXTENDING WIRELESS SERVICE.—There continues to be an active business for the wireless telegraph companies and manufacturers of wireless apparatus in equipping ships with installations. It will not be very long before every ship carrying passengers to and from this country will have voluntarily installed wireless equipment. The bill which was intended to compel this course passed the House of Representatives, but failed to get through the Senate, being sidetracked on account of the press of business in the closing hours of the session. An official of the Marconi Wireless Company says: "There is a disposition on the part of all transatlantic ships to put in long-distance service. A number of ships that have already been equipped with wireless aparatus are changing their instruments for those of higher power. The White Star Line, especially, is adopting this policy. When the *Adriatic* crossed from Europe recently it was in touch with one shore or the other every moment of the voyage. We are meeting with considerable success in the publication of our daily newspapers on board the ships. We send every day from 600 to 1000 words of the most important news and it is served to the passengers at breakfast time."

TELEPHONE OPPORTUNITIES ABROAD.—Notices of the following opportunities to sell telephone apparatus abroad are taken from the trade reports of the Bureau of Manufactures in Washington, from which details may be obtained: An American consul in Canada reports that a local telephone company contemplates extending its service a distance of 170 miles to connect with a neighboring city, in which it proposes to install a complete underground conduit system for the working of its service. The work will include the laying of a cable under a river, the construction of a system of underground conduits in every street of the city, the equipment of a modern central exchange and the installation of an automatic service throughout the city. The contract will involve an expenditure of approximately $500,000. An American consul in Africa has been asked to secure from American manufacturers an approximate estimate of cost of the equipment, exclusive of poles and wires, of a telephone system of 500 instruments.

WESTERN ELECTRIC BUSINESS INCREASING.—During January and February the orders of the Western Electric Company have shown quite a satisfactory growth. Said an official: "If the ratio of increase for these two months over the business done in December continues during the fiscal year the gross sales of the company will be something like $50,000,000. It is probably too much to expect that this will be true, but we certainly are showing a very encouraging growth. Our sales have especially shown a marked improvement in electric-light machinery." Among the large orders which the company has received was one for a low-pressure turbine, 4000-hp capacity, for the new passenger station of the Chicago & Northwestern Railroad. Sales to operating telephone companies are also very good. At the present time the company is employing about 1600 workmen, which is about 75 per cent of the normal number.

GREAT WESTERN POWER COMPANY'S PLANT.—It has been given out in California by Mr. H. P. Wilson, secretary of the Great Western Power Company, that the work of doubling the present capacity of the hydro-electric plant at Big Bend, in the Feather River, will be undertaken as soon as the weather permits. The capacity of the plant is to be increased to 144,000 hp. Work will be begun during the spring on the big dam at Big Meadows, which is high up in the Sierra Mountains. At this point a reservoir will be constructed covering 20,000 acres, in which water will be stored during the winter for use during the dry season. The new work that has been planned is expected to cost $15,000,000.

FOREST PRESERVATION AND HYDRO-ELECTRIC DEVELOPMENT.—The Crocker-Wheeler Company, of Ampere, N. J., has recently become a sustaining member of the Appalachian National Forest Association, the avowed object of which is "the perpetuation, through wise use, of the remaining forests of the country." "Our company is a large builder of hydro-electric power machinery," said one of the officials of the company, "and we believe that the preservation of the forests is of vital importance to hydro-electric development throughout the country. We want to do what we can to help preserve the forests."

ELECTRICAL PLANT FOR LARGE BREWERY.—Under the direction of Mr. J. H. Hallberg, as consulting engineer, Jacob Ruppert's big brewery plant in New York City has just installed two 500-hp Williams cross-compound engines direct-connected with Western Electric direct-current, 125-volt generators and a Williams "Monogram" 100-kw engine. The latter will be operated at 340 r.p.m. The power house of the Ruppert plant will be completely remodeled and a complete new switchboard will be installed to be used in connection with individual-drive motors.

LARGE ILLINOIS ELECTRICAL PROJECTS.—The Rock River Power Company is planning to install an electrical plant at the government dam at Sterling. The equipment will include turbines, generator, etc. The Springfield Light, Street & Power Company is considering the construction of another power plant to take the place of the two plants now operated by the company.

MASSACHUSETTS ELECTRIC COMPANIES. — The gross earnings of the Massachusetts Electric Companies increased $12,000 in February. This is an increase of about 2.66 per cent and compares with a gain of 4 per cent in January and 5 per cent in December.

FORT WAYNE GENERAL ELECTRIC TUNGSTEN-LAMP FACTORY.—The General Electric Company is installing a tungsten-lamp factory in one of the buildings of the Fort Wayne Electric Company.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market during the past week might be described as in a condition of waiting. While business has not been unusually active, the tone of the market has been strong and as a general rule prices have advanced moderately. The most important feature of the week, of course, was the inauguration of the new President. Since the inauguration the Street has done little else than discuss Mr. Taft's address. Opinions differ concerning this, but the majority of the traders in the financial district are very well satisfied and commend its temperate and judicial tone. It was not a matter of surprise that the President declared his purpose to carry out the policies of his predecessor. It was not expected that the prosecution of trusts would be abandoned, and this declaration, therefore, has not added anything to the general uneasiness of financial interests. It is the common opinion that in carrying out these policies Mr. Taft will proceed according to the methods and usages of law; that there will be no violence either of action or of language; that the minds of the public will not be inflamed against the great corporations and that only those which have clearly violated the statutes will be punished or seriously annoyed. Wall Street is particularly well pleased with Mr. Taft's expression upon the tariff. His insistence that a new bill be pushed through as

NEW YORK.

	Mar. 1.	Mar. 8.	Shares sold.		Mar. 1.	Mar. 8.	Shares sold.
All.-Ch.	13⅞	13⅞*	250	Int.-Met., pfd.	41⅛	44¼	28,480
All.-Ch., pfd.	44	43⅛*	1,700	Mackay Cos.	71½*	72⅜	400
Amal. Cop.	71	69¼	286,600	Mackay Cos., pfd.	70¾	71¼	375
Am. D. T.	35*	35*	——	Manhattan Elev.	146*	146*	——
Am. Loc.	52	51⅛	5,540	Met. St. Ry.	25	25*	25
Am. Loc., pfd.	110⅞	111¾*	600	N.Y. & N.J.Tel.	115	117*	80
Am. Tel. & Cbl.	75*	76*	125	Steel, com.	45⅛	45⅛	466,150
Am. T. & T.	128½	128½	6,915	Steel, pfd.	110⅝	111⅛	15,280
B. R. T.	71¾	72½	110,225	W. U. T.	66	65½*	1,400
Gen. Elec.	155	152*	2,200	West'h., com.	78	78	4,300
Int.-Met., com.	15	15¾	15,630	West'h., pfd.	104	110*	200

PHILADELPHIA.

	Mar. 1.	Mar. 8.	Shares sold.		Mar. 1.	Mar. 8.	Shares sold.
Am. Rys.	46	46*	——	Phila. Elec.	11½	11¾	——
Elec. Co. of A.	11¼	12	——	Phila. R. T.	27¼	28	——
Elec. Stor. B'ty	46½	46½*	——	Phila. Traction.	92½	91	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	52⅞	53⅛	——

CHICAGO.

	Mar. 1.	Mar. 8.	Shares sold.		Mar. 1.	Mar. 8.	Shares sold.
Chi. City Ry.	187*	187*	—	Chi. Tel. Co.	129¾	132¼	——
Chi. Rys., Ser. 1.	112½*	111	——	Met. El., com.	16*	19	——
Chi. Rys., Ser. 2.	44¼	41⅛	——	Nat'nal Carbon.	86	86*	——
Com. Edison.	108¼	109⅛	——	Nat. Carb., pfd.	118¾*	118¾*	——
Chi. Subways.	26*	25¼	——				

BOSTON.

	Mar. 1.	Mar. 8.	Shares sold.		Mar. 1.	Mar. 8.	Shares sold.
Am. Tel. & Tel.	128¾	128⅝	——	Mex. Tel.	2½*	2½*	——
Com. Tel.	125*	127*	——	Mex. Tel., pfd.	5	5*	——
Edison El. Ill.	253	253	——	N. E. Tel.	133	133	——
Gen. Elec.	155½	152¼	——	W. Tel. & Tel.	7*	7*	——
Mass. Elec. Ry.	14	11¾	——	W. T. & T., pfd.	78*	77½	——
Mass. E. R., pfd.	69	72	——				

*Last price quoted.
Shares sold are for week March 1 to March 6.

rapidly as possible is recognized as being the exact policy which will be of the greatest advantage to business interests in general. It is a prevalent opinion that it does not make so much difference what the customs duties in the future will be so long as the matter is quickly settled. It is the uncertainty of the working basis that is held responsible for business depression at the present time. There have been very few real occurrences to disturb Wall Street within the last two weeks. The refusal of the Public Service Commission of the Second District to modify the limitations which it placed around the proposed bond issue of the Erie Railroad was, of course, disappointing, but as very few people really expected that any modification would be obtained, this had little effect upon the market. The uneasiness concerning a possible strike of the coal miners is to some extent shaking confidence in the issues of the coal roads. It is hardly believed, however, that there will be any serious trouble, and if there were more actual news to form a basis for discussion the strike would never be mentioned. The reports from railroads are showing considerable growth. They, of course, compare very favorably with this period of last year, which was one of exceptional stagnation. Both the Pennsylvania and the New York Central systems—two of the greatest in the country—show large gains in gross earnings for February over the same month last year. There is still considerable disappointment felt that the reduction in steel prices has brought out so little new business. Aside from the rail order of the New York Central there has hardly been any new business worth mentioning. The money market continues to be easy and the demand for bonds quite active. Rates on March 8 were: Call, 1¾@2 per cent; 90 days, 2¾@3 per cent. The quotations in the table are those of the close March 8.

DIVIDENDS.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable April 1.

St. Joseph (Mo.) Railway, Light, Heat & Power Company, preferred, quarterly, 1¼ per cent, payable April 1.

Portland (Ore.) Railway, Light & Power Company, quarterly, 1¾ per cent, payable April 1.

American Smelting & Refining Company, preferred, quarterly, 1¾ per cent, payable April 1; common, quarterly, 1 per cent, payable April 15.

Mackay Companies, preferred, quarterly, 1¾ per cent; common, quarterly, 1 per cent, both payable April 1.

Philadelphia Traction Company, semi-annual, 4 per cent, payable April 1.

NEW YORK INTERBOROUGH SHOWS GAINS.—The report of the Interborough Rapid Transit Company for the quarter ended Dec. 31, 1908, shows a very substantial gain in earnings. The gross earnings for the quarter were $6,786,899, which was an increase of $485,403 over the same period in the previous year. The operating expenses for the quarter were $98,710 more than a year ago, leaving an increase in the gross of $395,693. The largest ratio of improvement was in the business of the subway division. The surplus earned for the first six months of the company's fiscal year, which ended Dec. 31, was $1,475,966, which is just about $100,000 less than the surplus required to pay 9 per cent on the $35,000,000 capital stock. This condition, however, causes no uneasiness as the quarter ended Sept. 30 is always the poorest of the year. The surplus for the last September quarter was only $91,189, while the surplus for the December quarter was $1,384,280. Travel in the summer decreases at least 20 per cent without any proportionate decrease in expenses. The Interborough's funded debt was increased $10,000,000 during the past year by the issue of new notes, and it is not unlikely that the company will have to spend a large amount of money in the near future to transform its cars into the side-door pattern that will probably be demanded by the Public Service Commission.

STANISLAUS ELECTRIC POWER COMPANY.—There has recently been incorporated in San Francisco the California Electric Railways Company, the avowed purpose of which is to build a cross-town street railway several miles long. The company is capitalized, however, at $10,000,000, and it is understood that it is really to become the holding corporation for the Stanislaus Electric Power Company and the Tuolumne Water Power Company, both of which were thrown into the hands of a receiver a few weeks ago as an initiatory proceeding, it has been reported, for turning the property over to the United Railroads of San Francisco. The details of this deal have been published in this journal and the organization of this new company in nowise interferes with the plan as outlined. It is understood that the new company will simply act as the holding company for the water-power property and will in turn be owned by the United Railways Investment Company, which is the holding company of the United Railroads.

HAVANA ELECTRIC RAILWAY COMPANY.—The report of the Havana Electric Railway Company for 1908 shows a very creditable increase in earnings. The gross for the year was $1,937,797, which was an increase of $126,909. The operating expenses only showed an increase of $6,993, and there was a decrease of more than 10 per cent in the cost of operating the power plant. The surplus applicable to dividends was $575,602, out of which was paid the full rate of 6 per cent on the preferred shares and an initial dividend of 1 per cent on the common stock. The general manager of the company says in his report that the generating equipment is ample for all of the present needs of the service and that no additions will be required for some time.

GENERAL ELECTRIC'S FEBRUARY BUSINESS.—The new orders booked by the General Electric Company during February were something less than $4,000,000, as compared with about $6,000,000 in January. This falling off was not unexpected and does not, it is stated, mean any serious decrease in the company's business. As a matter of fact, the January orders were heavily swelled because it was the close of the company's fiscal year and every salesman rushed in every order that was possible. During the past six months the company has consumed about 20,000,000 lb. of copper, and at the present time is buying metal only for its immediate needs.

HELENA (MONT.) LIGHT & RAILWAY COMPANY.—Although no annual statement of earnings has yet been published, it is understood that the Helena Light & Railway Company, which is controlled by J. G. White & Company, New York, had a prosperous year in 1908 and that its business is extending satisfactorily. During the year $20,000 was expended in the electrical department and $15,000 in the railway department. The company expects to expend $15,000 in the lighting department during the coming year and to make considerable additions to the rolling stock and track equipment of the railway.

NEW YORK MUST BUY STEINWAY TUNNEL.—The Appellate Division of the Supreme Court in New York City has decided that the city cannot acquire the Steinway tunnel, the new tube built from Forty-second Street, Manhattan, to Long Island City, which has never as yet been operated, unless it pays the present owners the construction costs. The court holds that the franchises and rights which were granted by the several Boards of Aldermen were not surrendered by the present owners, and that the construction of the subway was lawfully done.

JUDGMENTS AGAINST THE LONGACRE COMPANY.—During the past week five judgments aggregating $25,378 have been entered against the Longacre Electric Light & Power Company, New York City. These are all for interest on bonds issued by the company in 1906. The company has never as yet been able to begin business. The total bond issue was $1,000,000 and a few months ago the Public Service Commission of the First District refused to permit it to increase its stock issue to $10,000,000 and its bond issue to $50,000,000.

FREDERICK (MD.) GAS & ELECTRIC COMPANY.—Henry L. Doherty & Company, of New York City, have taken over the operation and management of the Frederick (Md.) Gas & Electric Company. The property will be put into good condition and an active campaign for business will be inaugurated. Mr. G. R. Trumbull will be the manager of the commercial department for Doherty & Company, and Mr. J. H. Enright will continue as general manager and superintendent of the plant.

TRANSFER OF WATER POWER RIGHTS.—The McCall Ferry Power Company has sold to the Susquehanna Power Company all its property privileges and rights to water power on the Susquehanna River in the State of Maryland. The nominal price paid was $5. Officers of the McCall Ferry Company, in New York, declined to make any statement as to the purpose of the sale.

MONTGOMERY (ALA.) LIGHT & WATER POWER COMPANY.—The second transmission line of the Montgomery Light & Water Power Company from Tallahoosa Falls into the city has been completed. This line, like the one that has already been in use, is operated at 33,000 volts.

MERGER OF LIGHTING PROPERTIES IN NORTHERN INDIANA.—Under the promotion of the C. H. Geist Company, of Philadelphia, the Northern Indiana Gas & Electric Company has been incorporated with authorized capital stock of $5,000,000 and a total authorized bond issue of $10,000,000. The capital stock is divided into $1,000,000 of 6 per cent preferred stock and $4,000,000 common. Mr. C. H. Geist, of Philadelphia, is president of the company, and Mr. C. W. Fox, of Philadelphia, is secretary and treasurer. The object of this new corporation is to merge the properties of the South Shore Gas & Electric Company, of Hammond, Whiting and East Chicago, Ind.; the Michigan City Gas & Electric Company, of Michigan City, Ind., and the Indiana Harbor & East Chicago Electric Company, of East Chicago, Ind. The Northern Indiana starts with no debt and $250,000 in its treasury. Managers for the properties will have headquarters at Hammond and Michigan City. It is planned to erect a new electric generating plant at Hammond next year to cost about $250,000. It is estimated that the properties now consolidated furnish the gas and electric facilities to a present population of about 85,000 in a manufacturing district distinguished by great activity. All of the three companies in the merger have municipal contracts for street lighting. The present operating staffs of the companies concerned in the merger will be continued as heretofore, it is believed.

N. Y., N. H. & H. R. R. WANTS TO OWN TROLLEY LINES DIRECTLY.—The New York, New Haven & Hartford Railroad has made an application to the Public Service Commission of the Second District of New York for permission to purchase from the Millbrook Company the stock of the New York & Portchester Railroad and the New York, Westchester & Boston Railway. These are the two high-speed systems projected from New York to Connecticut, for each of which some rights of way were secured and neither of which was ever constructed. Both of the roads were delayed by litigation and difficulty in financing, and both are now owned by the New Haven Railroad through the intermediary, the Millbrook Company. The present action does not in any way change the ownership and is taken solely for the purpose of getting rid of the dummy holding company. The New Haven company claims that it has advanced all the money that has been spent for rights of way and construction and it wants something to show for its expenditures. It claims that the construction of the line will be rapidly pushed forward.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.—There has been an active conversion of 4 per cent bonds into the stock of the American Telephone & Telegraph Company since March 1, when the plan became operative. It is estimated that between $25,000,000 and $30,000,000 worth of bonds were converted during the first week, and that before the end of th month fully $50,000,000, or one-third of the total issue, will ha been turned in. It is figured that one-half of the issue will l converted before next November. With the bonds selling in th neighborhood of 91 and the stock selling around 129 there is very good profit in making the exchange on the basis of $1 which is the figure named in the plan.

N. Y., N. H. & H. R. R. MUST DISPOSE OF ITS TROLLEY HOLDINGS.—The full bench of the Massachusetts Supreme Court has affirmed the decision of the lower court whi requires the New York, New Haven & Hartford Railroad Com pany to dispose of its stock holdings in the Worcester & South bridge, Worcester & Blackstone Valley, Worcester & Webste Webster & Dudley, the Berkshire and the Springfield Stree Railway companies before July 1, 1909. This practically check mates the plans of the New Haven road for forming a gre trolley merger in Massachusetts. No announcement has bee given out as yet as to the future disposition of these tractio properties.

WESTERN UNION TELEGRAPH COMPANY.—It is pre dicted that the quarterly report of the Western Union Tele graph Company for the first quarter of 1909 will show a sub stantial increase over the same quarter last year. The busines of the company has been gradually improving, and the net reve nues for the last quarter of 1908 approximated $2,000,000. Thi was almost double the revenues for the same quarter in 1907 It is expected that if business continues to grow better the com pany will have no difficulty in resuming the customary 7 pe cent dividend.

BOSTON ELEVATED EARNINGS.—The report of th Boston Elevated Railway Company shows that during the yea 1908 273,000,000 passengers were carried on its lines. The gros income of the company amounted to $14,074,000. Wages, cos of power, damages and legal expenses absorbed $8,441,000, o 60 per cent, of the gross income. The cost of power for th road shows a constantly increasing tendency. This is attributed to the advancing expense of coal.

METROPOLITAN SECURITIES COMPANY STOCK.—At an auction of securities in New York City March 4, 137 shares of stock of the Metropolitan Securities Company were sold for $135. This stock, the par value of which is $100 a share, and, which is 75 per cent paid in, sold on the New York Stock Exchange in January, 1903, at 128¾.

ANDERSON (S. C.) TRACTION STOCK.—The Anderson (S. C.) Traction Company is offering $150,000 preferred stock to take the company out of the hands of a receiver and to build a nine-mile extension to Pelzer. It is reported that the stock is being satisfactorily taken up.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Gas & Electric Company:					
Quarter ended Dec. 31, 1908	$652,364	$469,054	$183,310	$78,525	$66,525
Quarter ended Dec. 31, 1907	540,362	386,570	153,792	78,525	22,463
Chicago Railways Company:					
December, 1908	974,365	710,665	263,699	158,136	134,174
December, 1907	851,791	606,988	244,802	134,459	110,343
Colorado Telephone Company:					
Year 1908	2,709,701	1,866,682	843,019	.....	.....
Year 1907	2,514,366	1,756,767	757,599	.....	.....
Crosstown Street Railway Company, Buffalo:					
Quarter ended Dec. 31, 1908	195,598	126,103	69,494	47,175	18,807
Quarter ended Dec. 31, 1907	170,007	108,028	61,979	47,175	12,496
Cuyahoga Telephone Company, Cleveland:					
Year 1908	828,000	377,732	450,268	205,990	244,278
Year 1907	781,586	346,913	434,673	207,458	227,215
Easton (Pa.) Consolidated Electric Company:					
Year 1908	70,263	12,301	57,962	61,850	*3,888
Year 1907	103,997	8,230	95,767	59,525	36,242
Indiana Union Traction Company, Anderson, Ind.:					
Year 1908	1,902,330	1,058,745	843,585	854,249	*10,644
Year 1907	2,088,232	1,111,108	978,934	728,115	249,919
Interborough Rapid Transit Company:					
Year ended Dec. 31, 1908	12,115,785	5,367,514	6,748,272	.....	.....
Year ended Dec. 31, 1907	11,456,623	5,220,661	6,235,962	.....	.....
International Railway Company, Buffalo:					
Quarter ended Dec. 31, 1908	1,084,778	757,289	327,489	231,908	42,442
Quarter ended Dec. 31, 1907	1,128,063	734,312	393,750	239,926	99,013
Keystone Telephone Company, Philadelphia:					
January, 1909	89,781	44,481	45,300	.....	.....
January, 1908	87,945	47,267	40,678	.....	.....
Michigan State Telephone Company:					
Year 1908	3,366,875	2,455,447	911,428	418,300	493,128
Year 1907	3,092,225	2,044,973	1,047,252	443,251	604,001
Nashville (Tenn.) Railway & Light Company:					
January, 1909	138,660	83,585	55,384	32,450	18,552
January, 1908	124,577	79,444	45,433	30,163	11,465
Toronto Electric Light Company:					
Year 1908	1,155,582	711,712	439,870	289,254	150,616
Year 1907	1,039,716	651,926	387,790	245,503	142,287

*Deficit.

GENERAL NEWS

Construction News.

COLUMBIA, ALA.—A. D Wood, of this city, is erecting a new 15,000-spindle cotton mill. It is proposed to develop 1000 hp to drive the machinery.

HUNTSVILLE, ALA.—The Huntsville Railway, Light & Power Company has submitted a propositon to the City Council offering to furnish street lighting for a term of five years at the rate of $66.66 per lamp per year. In case electricity developed by water power is transmitted to the city within that period, the price will be reduced to $50 per lamp per year.

PRATT CITY, ALA.—Arrangements are being made by the People's Home Telephone Company to install a larger switchboard in the local exchange and to improve the telephone service generally.

SHEFFIELD, ALA.—The Sheffield Company expects to purchase mechanical stokers and feed-water heater for 1200-hp boilers and coal crusher. J. B. McClary is general manager.

FLORENCE, ARIZ.—The Consolidated Telephone Company is planning to extend its telephone line from Florence to Kelvin and Ray in the near future.

PHOENIX, ARIZ.—The People's Independent Telephone Company is preparing to extend its telephone system to the Mesa, Tempe, Scottsdale and Glendale sections.

BOONEVILLE, ARK.—The Booneville Light & Water Company has engaged W. A. Fuller, consulting engineer, Chemical Building, St. Louis, Mo., as engineer in charge of the construction of its proposed hydro-electric plant, including an auxiliary steam power plant and water-works system. A steel concrete dam about 350 ft. in length and 100 ft. high will also be constructed. A pipe line and transmission line seven miles in length will be built to supply the city of Booneville with water and electricity. It is expected that bids for construction and apparatus will be received about May 1. John P. Thayer is president and W. Earl Harrell, secretary. The cost of the combined plants is estimated at $150,000.

EUREKA SPRINGS, ARK.—The Citizens' Electric Company is planning to install a 300-kw 2-phase 60-cycle 2200-volt turbo-generator set and a 300-kw direct-current 550-volt turbo-generator set for railway service. A. M. Barron is general manager.

HOPE, ARK.—The contract for the construction of the proposed power plant in Hope is reported to have been awarded to T. C. Crosnoe for $5,460.

PRAIRIE GROVE, ARK.—A franchise has been granted to the Prairie Grove Telephone Company to install a telephone system in Prairie Grove.

AGNEW, CAL.—Contracts have been awarded by the Board of Managers of the Agnew State Hospital for boiler room, power plant equipment, etc., as follows: For engine to the Engineering & Maintenance Company for $6,750; boilers to the Risdon Iron Works for $26,400, and for generators to Barrett, Folk & Downing for $5,150. The management has authorized advertisements for bids for the construction of underground conduits for the hospital.

GRIDLEY, CAL.—The Board of Trustees has awarded the contract for pumping plant for the city water works to the Nevada Machinery & Supply Company, for $7,820.

LOS ANGELES, CAL.—The Board of Supervisors has awarded the contract for the electrical and telephone work, in connection with the proposed new hall of records and county office building, to Woodill & Hulse Electrical Company, of Los Angeles, for $15,850.

MARE ISLAND, CAL.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 23 to furnish at the navy yard, Mare Island, Cal., ammeters and voltmeters, as per Schedule 986. Blank proposals will be furnished upon application to the navy pay office, San Francisco, or to the above-named bureau. E. B. Rogers, paymaster-general, U. S. N.

SAN FRANCISCO, CAL.—Judge De Haven, of the United States Circuit Court, has issued an order to Vanderlynn Stow, receiver of the Tuolumne Water Power Company, the Stanislaus Electric Power Company and the Union Construction Company, to expend $5,000 per month in maintenance and keeping the property in good condition. George H. Whipple, receiver of the Stanislaus Electric Power Company, the Stanislaus Railway Company, Tuolumne Water Power Company and the Union Construction Company, has been authorized by Judge De Haven, of the United States Circuit Court, to expend $12,100 per month in maintenance and preserving the properties. The Knickerbocker Trust Company brought actions for foreclosure of mortgage, owing to a default on interest payment.

BRECKENRIDGE, COL.—The Central Colorado Power Company will furnish the Wellington Mines Company, of Breckenridge, with electricity to operate a ten-ton stamp mill.

BRANFORD, CONN.—Announcement has been made by the Connecticut Company that a 24-hour electric service will be established in its Branford District, comprising the towns of Branford and Guilford, beginning June 1, 1909. Electricity will also be furnished for motors. E. T. Gilbert is superintendent.

NOANK, CONN.—The Whitall Electric Company, of Westerly, R. I., has been awarded the contract for the installation of two electric motors in the carpenter shop of R. Palmer & Sons' shipyard.

DOVER, DEL.—The House of Representatives on March 2 passed a bill authorizing the State to grant a subsidy of $100,000 to an electric railway to run through the State. It is proposed to parallel the Delaware division of the Pennsylvania Railroad.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 16 for furnishing the naval station at Annapolis, Md., with the following supplies: Schedule 991—Two portable testing sets; a General Electric controller and generator. Application for proposals should designate the schedule desired by number.

WASHINGTON, D. C.—Bids will be received by the Bureau of Navigation, Navy Department, Washington, D. C., until March 24 for outside lighting at the naval training station, Great Lakes, North Chicago, Ill. Blank forms of proposals and specifications will be furnished upon application to the commandant of naval training station, Great Lakes, North Chicago, Ill. J. E. Pillsbury is chief of bureau.

AMERICUS, GA.—The contract for street lighting and pumping of water supply between the city and a local corporation having been declared invalid by Judge Littlejohn in a recent decision, the City Council will call an election immediately to vote on the proposition to issue $40,000 in bonds, the proceeds to be used to establish an electric light plant in connection with the municipal water-works system.

ATLANTA, GA.—A favorable report has been made to the General Council on a resolution granting a franchise to the Piedmont Power Company, organized to supply electricity in Atlanta. The company has a capital of $3,000,000. A power plant is located on Tugaloo River, where about 18,000 hp is said to be available. Mr. L. B. Magid, of Tallulah Lodge, Ga., is president of the company.

AUGUSTA, GA.—The Augusta Railway & Electric Company is making arrangements for enlarging its power plant and making other improvements to its system. James U. Jackson is vice-president.

CARROLTON, GA.—An election has been ordered for March 30 to vote on the question of issuing bonds for either purchasing and enlarging the local electric light plant or for building a new plant. The contract for lighting, now held by a private concern, expires shortly.

GORE, GA.—Arrangements are being made to erect a new telephone line from Greenbush to Summerville. Another line is also planned from Subligna to the Floyd County line.

GAINESVILLE, GA.—The property and holdings of the Gainesville Electric Railway Company have been sold at public auction by S. C. Dunlap, commissioner, to R. L. West, of Atlanta, for $80,000. The property is bonded at $250,000. Mr. West is manager of the General Contracting Company in Atlanta.

WALLACE, IDAHO.—The Slate Creek Electric Light & Power Company has been granted a franchise to operate its system in Wallace. The company is constructing a hydro-electric plant on Slate Creek at a cost of $200,000. H. J. Rogers is vice-president.

WALLACE, IDAHO.—The City Council has granted a franchise to the Spokane, Wallace & Interstate Railway Company, which proposes to construct an electric railway 100 miles in length, connecting Wallace, Cœur d'Alene and Spokane, Wash. William J. Hall, of Wallace, is manager.

BOWEN, ILL.—The Village Board has granted a franchise to E. E. Bennet to construct and operate an electric light plant.

EAST MOLINE, ILL.—The stockholders of the United Light & Power Company are contemplating increasing the capital stock of the company, the proceeds to be used for extending the service and increasing the equipment of the plant.

STERLING, ILL.—Arrangements are being made by the Rock River Power Company to install electric machinery at the power plant at the government dam. The work is nearly completed, with the exception of installation of turbines, generator and other apparatus.

SPRINGFIELD, ILL.—It is reported that the Springfield Light, Heat & Power Company contemplates the construction of another power plant to take the place of the two plants now operated by the company.

WEST POINT, ILL.—It is reported that contracts have been awarded by the West Point Electric Light Company for equipment for an electric light plant. The plant will have an output sufficient to supply 1000 lamps to begin with.

BLUFFTON, IND.—It is reported that arrangements have been made [illegible] Bluffton, Berne & Celina Traction Company, which pro-

poses to construct an electric railway from Bluffton, Ind., to Celina, Ohio, by the way of Berne. Rudolph Schug is president.

COLUMBUS, IND.—The Central Indiana Lighting Company has been notified that the work of putting up a new power house, installing new equipment and otherwise improving the plant must be commenced by March 15 under penalty of forfeiture of franchise. No part of the contract with the city has been fulfilled and no further extension of time will be given.

FAIRMONT, IND.—The Central Indiana Lighting Company is planning to make improvements to its system and establish a 24-hour service. J. E. Jeffries, of Alexander, is manager.

INDIANAPOLIS, IND.—The Laycock Power House Company has filed an amendment to its charter, increasing its capital stock from $100,000 to $150,000.

LEBANON, IND.—The Elizaville Co-operative Telephone Company has increased its capital stock for the purpose of extending and improving its plant. M. E. Shirley is secretary.

LIBERTY, IND.—The Town Board has granted a franchise to the Richmond Electric Light Company to light the town with electricity.

NORTH MANCHESTER, IND.—The Eel River Telephone Company has increased its capital to $30,000 for the purpose of improving and extending its system.

TERRE HAUTE, IND.—Work has commenced on the construction of the railway of the Terre Haute & Merom Southwestern Traction Company. The company plans to furnish electricity for lamps. D. M. Roberts, of Terre Haute, is president and general manager.

YORKTOWN, IND.—The citizens are considering the question of installing a street lighting system.

WHITESTOWN, IND.—The Whitestown City Telephone Company has increased its capital stock by $20,625, the proceeds to be used to make improvements and extension to its plant. J. T. F. Laughton is secretary.

CLEARFIELD, IA.—The Clearfield Telephone Company is contemplating the installation of a new switchboard and cables.

DES MOINES, IA.—Bids will be received by George F. Poorman, city clerk, for supplies for the several departments for the fiscal year ending April 10, 1910, including electrical and engineers' supplies, etc.

DES MOINES, IA.—The Board of Supervisors has awarded the contract for the installation of an electric light and power plant for the Polk County court house and jail to the Erie City Iron Works, Erie, Pa., for $10,750. Harry B. Frase is city auditor.

DUBUQUE, IA.—The Farley & Loetscher Manufacturing Company has awarded a contract for the construction of a new power house for its woodworking plant at Eighth and White Streets. Contracts for the equipment have been placed.

MARSHALLTOWN, IA.—The business men of Marshalltown are considering the question of organizing a public utilities corporation, with a capital stock of $200,000, to furnish electricity and gas for lighting purposes at a cheaper rate. At a meeting held $70,000 was raised and a committee appointed to secure the balance. It is proposed to furnish electricity at 10 cents per kw-hour and gas at $1 per 1000 cu. ft. Consumers are now paying 14 cents per kw-hour for electricity and $1.45 and $1.65 per 1000 cu. ft. for gas. D. T. Denmead, president of the First National Bank, is interested in the project.

SIOUX CITY, IA.—The New State Telephone Company is planning to erect a long-distance telephone line to Minneapolis, via Sheldon.

BELPRE, KAN.—The Belpre Telephone Company contemplates the construction of two telephone lines south of the town.

JUNCTION CITY, KAN.—It is reported that the Junction City Electric Railway, Light & Ice Company will reorganize with a capital stock of $600,000 for the purpose of entering the gas business.

PARSONS, KAN.—Work will commence at once on the construction of the local street car system. The street railway interests have purchased the plant of the Parsons Electric Light & Power Company and propose to rebuild it to furnish electricity to operate the railway. Cyrus E. Mead, of Dayton, Ohio, is building the railway.

EOLIA, KY.—The Upper Cumberland Telephone Company has made connections with the Whitesburg Telephone Company's lines and it is said that the company will erect new telephone lines to connect with the East Tennessee Telephone Company's system at Appalachia, Va. E. L. Creec, of Eolia, is manager.

LEXINGTON, KY.—Contracts will be placed by the Lexington & Interurban Railways Company in the near future for the construction of a 12-mile extension from Lexington to Hopkinsville. E. K. Dewey is general manager.

WASHINGTON, LA.—A franchise has been granted to the Valley Telephone Company, of Warren, Ark., for the installation of a telephone system in Washington. F. E. Bell is local manager.

BINGHAM, MAINE.—Arrangements are being made by the Bingham Electrical Company to replace the engine in its plant, which was recently destroyed.

FRANKLIN, MAINE.—The Franklin Power Company has applied to the Legislature for permission to transmit and distribute electricity in the towns of Farmington and New Vineyard.

KENNEBUNK, MAINE.—The committee appointed recently to look into the question of increasing the output of the municipal electric light plant has recommended that $6,500 be appropriated to purchase electricity for an auxiliary steam plant. The present plant is operated by water power, but during the low-water periods the plant has not been able to meet the demands made upon it.

PITTSFIELD, MAINE.—The Messalonskee Electric Company, of Waterville, Maine, has purchased the controlling interest in the Sebasticook Power Company, in this place. The plant is located about five miles below Pittsfield, on what is known as the Thirty Mile Rips, and has an output of about 1500 hp. The power house is also equipped with an auxiliary steam plant, with a rating of 400 hp; the company also has a large substation in this town. The new owners will continue to furnish electrical service as before and also agrees to furnish electricity for industrial purposes. Early in the spring the company proposes to erect a transmission line 16 miles long from its new plant to Waterville, where it is proposed to utilize electricity from this plant with other plants owned by the company, to be used for lighting purposes and for operating the Lewiston, Augusta & Waterville Electric Railway. The Messalonskee Electric Company now has three electric plants under its control, viz., the original plant in Oakland, with an output of 1000 hp, and the Fort Halifax Power Company's plant in Winslow, of 2000 hp, and the Pittsfield plant.

BARRE, MASS.—W. G. Webber, president of the Marlboro Electric Company, has submitted a proposition to C. E. Haven, chairman of the Board of Selectmen, offering to furnish electricity in Barre for lamps and motors. The company offers to extend its transmission lines to the town provided the town would enter into a contract for street lighting to the amount of $1,200 per year and guarantee 25 individual consumers and not less than 150 hp of 10 hours a day load for power purposes. The rate for street lamps is $18 per lamp per year for tungsten lamp of 40 cp on a 1 o'clock, moonlight schedule. The charge for electricity for commercial lighting will be from 15 cents to 12 cents per kw-hour, according to the amount consumed, and for motors from 12 cents down to 2½ cents per kw-hour, according to the amount used.

DOUGLASS, MASS.—The citizens of Douglass Center have petitioned the Selectmen for electric street lamps in the village and on the road between Douglass and East Douglass, a distance of two miles.

FALMOUTH, MASS.—The question of lighting the town by electricity is under consideration. Eugene Carpenter states that if he can secure franchises in the towns of Wareham, Bourne and Falmouth that he would install an electric light plant during the coming summer.

LAKEVILLE, MASS.—Plans are being made for the construction of the State Tuberculosis Hospital in Lakeville. The contract for construction of the buildings, including power house, has been placed.

LEXINGTON, MASS.—The plant and holdings of the Lexington Gas & Electric Company have been purchased by the Edison Electric Illuminating Company, of Boston. The company furnishes electricity and gas in the towns of Lexington and Bedford. The local electric plant will be dismantled, and electricity for operating the system will be furnished from Boston. The gas plant and business will be sold to other interests.

NORTH BROOKFIELD, MASS.—The Oxford Linen Mills Company, which recently purchased land and water rights along Mad Brook, is planning to erect a power house in the gorge below the dam and install a 250-kw generator and will transmit electricity to its mills, two miles distant. At present the mills are operated by steam power. F. E. Winchell is president of the company.

SOMERSET, MASS.—The Fall River Electric Light Company has applied to the town authorities for permission to erect transmission lines for the distribution of electricity in Somerset for lamps and motors.

SPRINGFIELD, MASS.—The members of the Springfield Power Associates are contemplating extensive improvements to the property of the steam power company, recently purchased. The association has purchased a site of about 3½ acres, on which it will erect an eight-story building to be utilized for manufacturing purposes. The motive power will be changed from steam to electricity, at a cost of about $50,000. The improvements contemplated will cost about $200,000.

TOPSFIELD, MASS.—Plans are being considered to light the town by electricity. It is proposed to organize an association and purchase electricity from either Danvers or Beverly to supply the residents with electricity for lamps and motors. Messrs. Dow, Merrill, Clark, Ward, Williams and Woodbury are interested in the project.

WESTFIELD, MASS.—The report of the municipal gas and electric plant for the last year shows a profit of $24,738, of which $11,580 came from the electric plant. Manager George Pettibone and C. N. Oakes, treasurer, recommended that the power plant be increased by 500 or 750 hp by the installation of an engine and dynamo in the present power station, at a cost of from $25,000 to $30,000.

WORCESTER, MASS.—The Worcester Electric Light Company has purchased a 500-kw Westinghouse motor-generator set for use in direct-current power service. The set consists of a 500-kw, 550 to 600-volt generator direct connected to a 2300-volt, three-phase, 60-cycle synchronous motor wound for a speed of 514 r.p.m.

ALPENA, MICH.—The Huron Portland Cement Company has recently purchased a 500-kw Allis-Chalmers turbo-generator set. It is said the company may require auxiliary apparatus.

YPSILANTI, MICH.—The Washtenaw Home Telephone Company has decided to make extensions to its system. It is said that the company will give especial attention to the rural telephone lines in the vicinity of Ypsilanti.

BROOKPARK, MINN.—Arrangements are being made to organize a telephone company to construct a telephone line to Pomeroy Lake, a distance of 20 miles.

DULUTH, MINN.—The Water & Light Board has awarded a contract for a double-acting triplex pump and accompanying appliances for the new station of the middle water system at Fifteenth Avenue and Sixth Street to the General Electric Company, Schenectady, N. Y., for $11,400.

McINTOSH, MINN.—The Garden Valley Co-operative Telephone Company has purchased the local telephone exchange. It is said that the company proposes to improve the system and extend the telephone lines into the surrounding country.

MINNEAPOLIS, MINN.—The Sageng Threshing Machine Company, of Minneapolis, Minn., will soon purchase equipment for its new plant, part of which will be electric motor-driven. The company will also purchase equipment for its power plant as follows: One 300-hp engine, new or second-hand, with condenser and heater complete; one 300-hp Babcock & Wilcox boiler, 150-lb. pressure, with pump and injector; one 150-kw, two-phase, 60-cycle, 2200-volt, 600 r.p.m. Westinghouse generator, complete with sliding rail, pulley exciter and switchboard complete. The company, which was organized a few months ago, has purchased an old street railway plant, located between St. Paul and Minneapolis, on the Minneapolis Transfer Railroad, which will be remodeled and equipped at a cost of about $75,000.

HATTIESBURG, MISS.—The Home Telephone Company has secured the right-of-way for its telephone line from Gulfport to Hattiesburg, and is now making arrangements for right-of-way from Hattiesburg to Jackson. The company recently made an appropriation of $45,000 for the erection of a telephone line to connect Hattiesburg, Meridian, Gulfport, Jackson and Vicksburg, with local exchanges in each of the cities named.

BOONEVILLE, MO.—T. W. Bast, of Sedalia, Mo., architect, has been engaged by the Kemper Military Academy to prepare plans for the construction of an electric light plant.

KANSAS CITY, MO.—The Kansas City-Southeastern Traction Company has been granted permission to increase its capital stock from $180,000 to $5,000,000. The company on Feb. 17 filed a mortgage for $5,000,000 in favor of the Carnegie Trust Company, of New York, N. Y., on about 125 miles of main lines and 65 miles of branch lines that are to be built. The main railway will extend from Kansas City to Jefferson City, and the branches from Lee's Summit to Pleasant Hill and Harrisonville; another branch line is also contemplated from the main line at Pittville, through Holden, thence to Clinton. Work on the construction of the railway between Kansas City and Lee's Summit will begin as soon as the weather will permit. Charles A. S. Sims is president.

ST. LOUIS, MO.—The Union Electric Light & Power Company has submitted a proposition to the Board of Public Improvements, offering to substitute magnetite arc lamps for the present direct-current arc lamps now in use on the streets, provided that necessary legal arrangements can be made. The change is to be made without additional cost to the city under the new contract, which goes into effect Sept. 1, 1909, under which the city is to pay the rate of $50 per lamp per year.

VALDA, MO.—A telephone company has been organized in Valda. The officers of the company are: D. W. Stephens, president; Milton Smith, secretary, and Fred Meyer, treasurer.

HAMILTON, MONT.—The citizens are considering the question of installing a municipal electric light plant.

TONAPAH, NEV.—The Nevada-California Power Company will extend its transmission lines from Tonapah to Manhattan and Round Mountain to furnish electricity to the northern camps and mines and mills. It is expected to have the system completed and in operation by May 15.

CONCORD, N. H.—The Connecticut River Power Company has applied to the Legislature for permission to increase its capital stock and to distribute and sell electricity throughout Cheshire County; also for right of eminent domain as to location of poles and wires on private property. Frank H. Streeter, of Concord, N. H., is president of the company.

ELIZABETH, N. J.—The Board of Freeholders has authorized the public grounds and buildings committee to consider the question of installing an electric light plant to furnish electricity to light the county buildings.

HOBOKEN, N. J.—It is reported that plans are being prepared for the construction of a high-speed electric railway from Paterson to Hoboken to connect with the Hudson River tunnels. It is said that the North Jersey Construction Company will build the proposed railway. The present plans include the construction of a temporary power house.

ORANGE, N. J.—The Council has decided to hold an election May 4 to vote on the proposition to establish a municipal electric light plant.

PERTH AMBOY, N. J.—The Standard Underground Cable Company is erecting a new wire mill and will install a 750-hp Westinghouse horizontal gas electric unit to furnish power to operate the plant.

ALBANY, N. Y.—The Rose Telephone Company, of Delaware County, has filed an amendment to its charter giving its permission to extend its telephone systems in various counties. The directors of the company are: Hugh K. Rose, E. Scott Rose, C. Edward Hanford, William E. King, Ferris E. Davis and E. R. Harkness.

BUFFALO, N. Y.—Mayor Adam on March 1 approved the bill authorizing the city to issue $37,500 in bonds to pay for the city's share for the proposed electric lighting plant at the city hall. The cost of the plant is estimated at $75,000, for which the city is to pay half and the county the other half.

CENTRAL ISLIP, N. Y.—Bids will be received by the State Commission in Lunacy, Albany, N. Y., until March 24 for the construction of nurses' (attendants) home, including heating, plumbing and electrical work; also for two horizontal tubular boilers, engine, generator and for switchboard, etc., at the Central Islip State Hospital, Central Islip, Long Island, N. Y. Drawings and specifications for the above work may be seen and blank forms of proposal obtained at the above institution, or at the office of the State Commission in Lunacy, 1 Madison Avenue, New York, N. Y., and at the office of Franklin B. Ware, State Architect, Albany, N. Y.

FULTON, N. Y.—It is stated that the Niagara Power Transmission Company contemplates making application to the local authorities for a franchise to furnish electricity in Fulton for lamps and motors. In case the Niagara company secures a franchise here it will be necessary to erect a substation.

KINGS PARK, N. Y.—Bids will be received until March 24 by the State Commission in Lunacy, Albany, N. Y., for the construction of power house, coal pocket and conduits, including plumbing and electrical work; also for construction of laundry building, including heating, electrical work, etc., at the Kings Park State Hospital, Kings Park, L. I., N. Y. Plans and specifications can be seen and blank forms of proposals secured at the above hospital and at the office of the State Commission in Lunacy, 1 Madison Avenue, New York, N. Y., and at the office of Franklin B. Ware, State Architect, Albany, N. Y.

LESTERSHIRE, N. Y.—The Board of Trustees is considering the question of establishing an electric light plant in connection with the municipal water-works system at a cost of about $10,000. It is said that the question will be submitted to the voters at the coming village election. At present the village has a contract with the Binghamton Light, Heat & Power Company, which does not expire until 1910. Under the present contract the village pays about $90 for each arc lamp. It is said that the company is willing to reduce the price to $70 per lamp per year if a satisfactory contract can be made.

NEW YORK, N. Y.—The Public Service Commission, First District, has approved the franchise granted to the Bronx Traction Company by the Board of Estimate, for the construction of 1200 ft. of double track from Classon Point Road and West Chester Avenue to a point east of the Bronx River. F. W. Whitridge is receiver.

NEW YORK, N. Y.—Bids will be received until March 15 by C. B. J. Snyder, superintendent school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., for installing electric equipment in addition to and alterations in Public School No. 126, on Meserole Avenue, Borough of Brooklyn; for installing electric equipment in addition to and alterations in Public School No. 128, on Twenty-first Avenue, Borough of Brooklyn; for installing electric equipment in new Public School No. 160, on Fort Hamilton Avenue, Borough of Brooklyn; for installing electric equipment in new Public School No. 163, on Benson Avenue, Borough of Brooklyn; for completing and finishing the installation of electric equipment in new Public School No. 89, on Orchard Avenue, Borough of Queens, in accordance with original plans and specifications awarded to L. F. Benn, which have been declared abandoned.

NIAGARA FALLS, N. Y.—The Niagara Falls Hydraulic Power & Manufacturing Company has submitted a proposition to the City Council, offering to take over the present pumping station and supply electricity for operating the new plant. The company offers to purchase the site on which the present station stands and supply electricity at the rate of $9 per hp up to 800 hp to operate the new plant.

POUGHKEEPSIE, N. Y.—Sealed proposals will be received by the State Commission in Lunacy, Albany, N. Y., until March 24 for the construction of power house, trestle and conduits; also for construction of conduit, including steam piping, for acute hospital, at the Hudson River State Hospital, Poughkeepsie, N. Y. Plans and specifications can be seen and blank forms of proposals obtained at the above hospital and at the office of Franklin B. Ware, State Architect, Albany, N. Y.

RIVERHEAD, N. Y.—Muralt & Co., of New York, N. Y., have been awarded the contract for remodeling and enlarging the hydro-electric power plant on the Peconic River at Tower Mills, L. I. New vertical turbines will replace the old water wheels now in use, and an additional unit of the same general design will be installed.

SCHENECTADY, N. Y.—Plans are being prepared by the General Electric Company for the installation of a complete electric light and power plant in the proposed addition to the store of H. S. Barney Company in this city.

VAN HORNESVILLE, N. Y.—It is reported that D. S. Tilyou is interested in a project to construct an electric railway from Van Hornesville to Henderson.

WEST POINT, N. Y.—Bids will be received by the quartermaster, West Point, until March 19, for furnishing and installing an electrical distributing and street lighting system for the cadet camp.

BURLINGTON, N. C.—The Southern Traction & Power Company has been incorporated to develop a water power on Haw River, near this town. J. W. Murray is the principal promoter of the new enterprise. Holdings on which 1400 hp can be developed have been secured, being

located principally in Manatee County, and the power to be developed will be disposed of to manufacturing users in that county. Application has also been filed for franchises to permit the company to build transmission lines through Reidsville, Wentworth and other towns in the State. The company is capitalized at $3,500,000.

WADESBORO, N. C.—Work at Blewitt's Falls, on the Cape Fear River, has been completely stopped, on account of litigation in which the promoting company is involved. About $200,000 has been expended on the development and the same amount will be required to finish the work on the power plant.

NEW SALEM, N. D.—The business men of New Salem are considering the question of installing an electric light plnat.

ASHLEY, OHIO.—The Village Council has appointed a committee to make investigations in regard to the cost of establishing an electric light plant here.

DAYTON, OHIO.—It is reported that an ordinance will be introduced into the Council authorizing the proper committees to confer with the officials of the street and interurban railways in regard to having the latter provide lamps on their rights-of-way, so that the city may utilize the money saved in this way to extend the lighting system into the suburbs.

FINDLAY, OHIO.—The city has subscribed $125,000 for the construction of the proposed Marion & Findlay electric railway, which will be 47 miles in length. Garry W. Meeker, of Columbus, Ohio, and R. P. Hankey, of Detroit, Mich., are interested in the project.

LORAIN, OHIO.—The Citizens' Gas & Electric Company has submitted a bid to the City Council offering to furnish electricity for lighting the streets of the city at the rate of $64 per lamp per year.

PARIS, OHIO.—The Farmers' & Merchants' Telephone Company has increased its capital stock from $1,200 to $21,000. T. W. Wartman is president.

PERRYSBURG, OHIO.—The Village Council has awarded the contract for street lighting to A. C. Tryon, of Maumee, for a term of 10 years at the rate of $50 per lamp per year. The village now pays $80 per lamp per year for the service, which is furnished by William Witzler, of Perrysburg.

RAVENNA, OHIO.—Plans are being made by the Central Union Telephone Company to rebuild its local telephone system and improve the service.

STRUTHERS, OHIO.—It is reported that the Council is considering the question of granting a franchise for lighting the streets of the town by electricity.

WOOSTER, OHIO.—Bids will be received by the Board of Public Works until March 22 for lighting the streets, alleys, etc., in the city for a term of 10 years. C. W. Van Ness is clerk.

YORK, OHIO.—Arrangements are being made by the York Telephone Company for the construction of a trunk line from Byhalia to York, Raymond, East Liberty and West Mansfield, a distance of about 30 miles. An exchange will be installed in each of the towns. As soon as this line is completed it is proposed to build a telephone line to Richwood.

MEDFORD, OKLA.—An election will be held March 17 to vote on the proposition of granting a franchise to the Medford Ice, Light & Power Company to furnish electricity in all the city buildings.

SAPULPA, OKLA.—The Sapulpa & Interurban Railway Company is preparing plans for the construction of an electric railway from Sapulpa to Glen Pool, a distance of 10 miles; also to build a local system in Sapulpa of about 5 miles, and a branch to Tanneha, 3½ miles in length. H. E. Clark, of Glen Campbell, Pa., is president, and H. H. McFann, of Sapulpa, general manager.

VINITA, OKLA.—Plans are being made to erect a telephone line to connect Vinita and Centralia. M. South, of Miles, and others are interested in the project.

JASPER, ORE.—A new telephone company has been organized, with Gainey Jacoby as president.

PORTLAND, ORE.—The United Railways Company has nearly completed its extension from Portland to Holbrook, and service will be inaugurated on the road about the middle of this month. Arrangements are being made to extend the line to Forest Grove.

REDMOND, ORE.—Arrangements are being made by a local company to install a power plant at Redmond at a cost of about $30,000. The company is capitalized at $50,000 and the officers are: Joseph H. Jackson, president; H. F. Jones, secretary and treasurer, and J. G. McGriffin, engineer, all of Redmond.

ALTOONA, PA.—The Altoona, Hollidaysburg & Bedford Springs Electric Railway Company has secured the right-of-way for its proposed electric railway from Altoona to Bedford Springs, a distance of 49 miles. The cost of the railway is estimated at about $5,000,000.

BEAVER, PA.—The Beaver County Telephone Company has made application for a franchise to operate a telephone system in Beaver.

CHESTER, PA.—The Beacon Light Company, it is said, will soon commence work on improvements to its plant, which will cost about $125,000. It is proposed to enlarge the power house and install direct-connected machinery, discarding all belt-driven machinery.

EASTON, PA.—A bill has been introduced in the Legislature by Representative Hugh W. Ramsey, of York County, providing for a State telephone exchange. The bill asks for an appropriation of $[illegible] for electrical work for the next two years, the cost of maintenance to be derived from a telephone tax. The patrons of system are to bear the cost of the installation of their telephones.

HAZLETON, PA.—Arrangements are being made by the Susquehanna & Southern Railroad Company for the construction of an electric rail from Hazleton to Pottsville, a distance of 32 miles. The third-rail sys will be installed. The company has not yet decided whether it will e its own power station or purchase electricity from the Harwood Po Company, which is now erecting a large power plant at Harwood

LANSDOWNE, PA.—The City Council has granted a franchise to Philadelphia & Delaware County Electric Railway Company to const an electric railway from Scottdale Avenue to Baltimore Avenue Union Avenue.

PHILADELPHIA, PA.—Plans are being considered by an indepen company to construct an electric railway between Bridge Street, Fra ford, and Bustleton and Somerton. The road will be about 4½ mi length. The Philadelphia Rapid Transit held a franchise for the railw which has expired.

PHILADELPHIA, PA.—Plans have been prepared by the Philadel & Reading Railroad Company for extensive improvements to one of Port Richmond docks, adapting it for the handling of ore. The sides the pier will have space for electrically operated gantry cranes, wh will have a capacity of 300 tons per hour. A power plant to operate cranes will be located on the pier.

WASHINGTON, PA.—Plans are being made by the Wheeling & L Grove Railway Company to extend its electric railway from the pres terminus at West Alexander to Claysville. The Pittsburg Railways C pany, which has recently completed an electric railway from Pittsburg Washington, has entered into an agreement with the Wheeling & L Grove Railway Company to extend its system to Claysville to connect w the Wheeling system.

WAYNESBURG, PA.—The City Council has granted the Waynesb & Monongahela Electric Railway Company a 99-year franchise. company proposes to construct an electric railway through Waynesb Washington, Jefferson, Clarksville, Mariana, Millsboro, Frederickstow Mount Morris, Carmichels, Greensboro and South Brownsville, w Waynesburg as a center.

WILKES-BARRE, PA.—The stockholders of the Consolidated T phone Companies of Pennsylvania have voted to install an automa exchange in this city at a cost of $200,000.

ANDERSON, S. C.—It is reported that the Anderson Traction C pany has decided to extend its railway from Belton to Pelzer, a distan of nine miles. At Pelzer the railway will connect with an extension to built from Greenville.

CHARLESTON, S. C.—A bill to grant a charter to the Edisto Pow Company was passed by the House of Representatives Feb. 25.

CHESTER, S. C.—The Wylie Cotton Mills have contracted with Southern Power Company for electricity to the amount of 250 hp operating the mills. The new electrical machinery will be shipped ab April 1.

GREENVILLE, S. C.—The Town Council has withdrawn the fr chises of the Greenville Gas, Electric Light & Power Company and t Paris Mountain Water Company, declaring the same invalid and ord ing that formal notice to this effect be served on the companies. T chairman of the light committee of the Town Council has been structed to communicate with the Southern Power Company as to ter for furnishing electrical service.

GREENWOOD, S. C.—It is reported that the contract has be awarded for the construction of an electric railway from Greenville Williamston. It is said that the railway may be extended from Wil ston to Greenwood.

LEXINGTON, S. C.—Plans are being considered by Perry Hall, Lexington, for the organization of a company to construct a cotton m Mr. Hall is now developing a water power of 1000 hp to generate electric to be transmitted to the mill.

WESTMINSTER, S. C.—Plans are being made by W. E. Creswell organize a company to construct a cotton mill. It is proposed to devel a water power, recently purchased, to generate electricity to opera the mill.

OKOBOJO, S. D.—The farmers in the vicinity of Okobojo ha organized under the name of the Gas Belt Telephone Company of Ok bojo. The company has purchased the telephone lines of the Gre Western system. The company proposes to erect additional rural te phone lines.

BINGHAMPTON, TENN.—Plans have been completed by J. Trenholm & Company for the construction of a large grain elevator Binghampton, to be operated by electricity, furnished by the Binghampt Power Company, whose plant is now under construction.

LEBANON, TENN.—Work has commenced on the construction the Lebanon Woollen Mills, which will be operated either by steam electricity. H. M. Freeman is general manager.

MEMPHIS, TENN.—It is reported that Eastern capitalists, represent by John B. Wheeler, are making arrangements to construct an electri railway from Memphis to Jackson. The syndicate has established hea quarters in the Lee Building, Memphis, Tenn.

CORPUS CHRISTI, TEX.—M. Ucovitch has applied to the City Council for a franchise to construct and operate an electric street railway in Corpus Christi.

EL PASO, TEX.—The Mesilla Valley & El Paso Interurban Railway Company has completed financial arrangements for the construction of its proposed electric railway to connect Las Cruces and other Mesilla Valley towns with El Paso. The company is in the market for about 40 miles of track and overhead line material, and also for complete equipment for power station. Contracts for the work will be placed through H. A. Baum, 33 Michigan Avenue, Chicago, Ill., and O. H. Baum, El Paso.

PALESTINE, TEX.—George W. Burkett, president of the Palestine Electric & Ice Company, is making arrangements to construct an electric street car system in Palestine and will soon apply to the City Council for a franchise. It is also stated that Mr. Burkett contemplates organizing a company to build an electric railway from this city to Dallas.

TAYLOR, TEX.—Application has been made to the City Council by J. B. Johnson, of Palestine, Tex., and associates, for a franchise to construct and operate an electric light and gas plant in Taylor. The Citizens' Electric Light & Power Company has petitioned the Council for a new franchise in lieu of its present franchise.

WICHITA FALLS, TEX.—The plant and holdings of the Wichita Falls Water & Light Company have been purchased by J. A. Kemp, Frank Bell and I. H. Kempner. It is said that the plant will be enlarged to furnish electricity for the proposed new electric railway between Wichita Falls and Lake Wichita, a distance of about 5 miles.

RUTLAND, VT.—The Rutland Railway, Light & Power Company is contemplating extending its electric railway from Castleton to Poultney, a distance of 6 miles. George S. Haley is general manager.

DANVILLE, VA.—The Dan River Power & Manufacturing Company, it is said, has decided to build another mill, to be equipped with 50,000 spindles and 1500 looms. The mill will be operated by electricity generated by water power, with a steam auxiliary plant. The new plant will cost approximately $1,000,000. Lockwood, Green & Co., of Boston, Mass., are the architects.

BELLINGHAM, WASH. It is reported that the power plant at Nooksack Falls, owned by the Stone & Webster Company, will be enlarged to meet the increased demand for electricity in this city. J. B Lukes is district superintendent.

TACOMA, WASH.—The Board of County Supervisors has granted John M. Bell a franchise to erect a telephone line to Longmire's Springs, the Government reserve and the National Park, through Paradise Valley.

YACOLT, WASH.—The Town Council has granted a franchise to J. Coulter for the construction of an electric light and power plant.

FAIRMONT, W. VA.—The Fairmont & Clarksburg Traction Company contemplates the construction of a new substation and the installation of two 300-kw rotary converters. G. T. Watson is manager.

BALDWIN, WIS.—The Baldwin Telephone Company is considering the question of extending its telephone lines to Hersey and Emerald.

LOMIRA, WIS.—It is reported that Steer Brothers, of Knowles, Wis., are contemplating the installation of an electric light plant in Lomira.

MILWAUKEE, WIS.—The Dings Electro-Magnetic Separator Company is completing an addition to its Bay View plant and installing Wagner single-phase motor drive.

WAYSIDE, WIS.—The capital stock of the Wayside Telephone Company has been increased from $2,000 to $10,000, the proceeds to be used for extensions to its system.

CALGARY, ALB., CAN.—The following contracts have been awarded in connection with the municipal street railway system to be built this summer: Motor generator and switchboard set to the Allis-Chalmers-Bullock Company, of Montreal, for $15,950; one 750-hp, 3 cylinder, compound engine, to the Robb Engineering Company, of Amherst, N. S., for $14,300, and a quantity of rails, spikes, ties, etc. Address Mayor Jamieson.

NELSON, B. C., CAN.—The city has purchased all the rights and equipment of the Nelson Tramway Company and will immediately reconstruct the system and put it in operation. For further information address W. Garland Foster, Nelson, B. C.

VANCOUVER, B. C., CAN.—C. F. Pretty has purchased the timber tract holdings of the Canadian Industrial Company, on the east coast of Vancouver, and proposes to install a power plant, pulp and saw mills.

VERNON, B. C., CAN.—J. C. Kennedy, of the Stav Lake Power Company, Vancouver, B. C., has completed surveys and estimates for the development of water power in this vicinity to generate electricity to operate an electric street railway system here and for lamps and motors to towns in this vicinity.

DAUPHIN, MAN., CAN.—Bids will be received until March 15 by Napoleon Tessier, secretary of Department of Public Works, Ottawa, for wiring the public building, now under construction at this place.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by M. Peterson, secretary of the civic board of control, until April 15 for two transformers, one of 30 kw at 80,000 volts and the other 200 kw at 200,000 volts, also for control equipment for same. Plans and specifications may be seen at the office of Smith, Kerry & Chace, Confederation Life Building, Toronto, Ont., Can., and also at the office of F. E. Cambridge, city electrician, Winnipeg, Man.

PORT ARTHUR, ONT., CAN.—Surveys have started at Dog Lake Falls preliminary to the development of power there by this city. Address Mayor Carrick.

TORONTO, ONT., CAN.—Cecil B. Smith has closed a deal at Ottawa involving the expenditure of $1,000,000 for power development in the Cobalt district to supply the mines there.

YORKTON, SASK., CAN.—The Yorkton Northwest Electric Light & Telephone Company has increased its capital stock from $20,000 to $50,000.

DAWSON CITY, Y. T., CAN.—The Dawson City Light & Power Company's plant will be moved to Sourdough Coal Mine, 40 miles southwest. It will also be enlarged and arrangements have been made for distributing electricity to mines within a radius of 100 miles.

GUADALAJARA, MEX.—It is reported that a syndicate of Colorado Springs men, who own the controlling interest in the Guanajuato Power & Light Company, has purchased the electric street railway system and electric light and power plants in Guadalajara for $8,500,000 (Mexican money).

Company Elections.

MACON, GA.—At the annual meeting of the directors of the Macon Gas Light & Water Company H. T. Powell was re-elected president.

CINCINNATI, OHIO.—At the annual meeting of the stockholders of the Union Gas & Electric Company the following directors were elected: Norman G. Kenan, J. T. Carew, Reuben Holden, Jr., M. E. Moch, W. E. Hutton, F. R. Williams and Charles H. Davis, all of Cincinnati; Archibald S. White, Alvin Young, A. B. Leach and H. L. Daugherty, of New York, N. Y.; F. B. Enslow, of Huntington, W. Va.; J. W. Gill, of Steubenville, Ohio, and Olaf Ussing and George Heard, of Pittsburg, Pa.

New Industrial Companies.

THE ASSOCIATED ENGINEERING COMPANY, of Louisville, Ky., has been incorporated with a capital stock of $15,000 by John H. L. Vogt, Herman F. Scholtz and T. J. McFarland.

THE KAISER DEVICE & ELECTRIC COMPANY, of Buffalo, N. Y., has been incorporated with a capital stock of $100,000 to manufacture electrical devices by Edwin D. Klopp, Frank Kaiser and C. D. Coyle, all of Buffalo, N. Y.

THE UNIVERSAL ENGINEERING CORPORATION, of Glen Cove, N. Y., has been incorporated with a capital stock of $3,000 by Henry T. Shotwell, of Glen Cove, N. Y.; Charles L. Lee, and Henry A. Ingraham, of Brooklyn, N. Y.

THE ELECTRA LIGHTNING ROD COMPANY, of Chicago, Ill., has been chartered with a capital stock of $10,000 by J. S. Swenson, E. E. Stehlik and L. M. Stehlik. The company propoess to manufacture electrical apparatus and appliances.

THE ROTHCHILD ENGINE COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Frederick Van Wyck, Joseph Rothchild and Charles H. Simmins, all of New York, N. Y. The company proposes to manufacture machinery and tools.

THE D-B CONTROL COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $100,000 by John Darby, of Summit, N. J.; Clifford D. Meeker, of East Orange, N. J., and Harold D. Meeker, of New York, N. Y. The company proposes to do a general contracting and electrical business.

New Incorporations.

DOTHAN, ALA.—The Newton Springs Telephone Company has been organized to construct a telephone line from Dothan to Hodgesville. The officers of the company are: C. L. Jackson, president; J. D. Holton, secretary, and C. F. Gilstrap, treasurer.

MILFORD, DEL.—The Draper Telephone Company has been organized by the farmers of Slaughter Neck to erect a telephone system. The officers are: Joseph Gray Davis, president; Harry M. De Puty, vice-president; J. H. Vreeland, secretary, and David Argo, treasurer.

BELLEVILLE, ILL.—Articles of incorporation have been filed for the Southern Illinois Electric Company, of East St. Louis, by Hamilton Paro, Ira L. Pendleton and Harry Bean. The company is capitalized at $6,000.

CHICAGO, ILL.—The Illinois Inland Electric Railway Company has been chartered, with a capital stock of $50,000, to construct an electric railway from Springfield through Sangamon and Christian counties to Pana. The incorporators are: George W. Davidson, Carl O. Beroth, Thomas C. Kennedy, Albert E. Wolf and William J. Eaker, all of Chicago, Ill.

CELESTINE, IND.—The New Home Telephone Company, of Dubois County, has been incorporated to build and operate an exchange and telephone lines in Celestine and Dubois County. B. Nordhoff, George W. Jacobs and L. L. Jacobs are directors.

LA PORTE, IND.—The various gas and electric plants in northern Indiana owned or controlled by Clarence H. Geist, of Chicago, Ill., and Philadelphia, Pa., have been consolidated under the name of the Northern Indiana Gas & Electric Company, with a capital stock of $10,000,000. The present local management of the various plants will not be changed, but will be under one general management. Frank J. Canall has been elected president and Rollo M. Cole, secretary. The new corporation has absorbed the gas and electric plants at Michigan City, Hammond, Valparaiso, Indiana Harbor and East Chicago.

PALMYRA, IND.—The Flat Woods Independent Telephone Company has been incorporated, with a capital stock of $500, by O. P. Martin, M. A. Smith, Lawrence Ellis and others.

CLERMONT, IA.—The Gunder & Clermont Telephone Company has been chartered, with a capital stock of $4,000. The officers of the company are: H. S. Groth, president; A. O. Olson, vice-president; G. L. Ostlie, secretary and treasurer.

Personal.

COL. W. T. GENTRY has been elected president of the Southern Bell Telephone Company, with offices at Atlanta.

MR. L. B. RAMSDEN, of Port Colbourne, Ont., has been appointed manager of the municipal electric light and power plant at Wingham, Ont.

MR. OTTO KNEY has resigned as manager of the publicity department of the Northern Electrical Manufacturing Company, in order to return to journalistic work.

PROF. B. B. BRACKETT, of the Clarkson School of Technology, gave an address March 1 before the Watertown (N. Y.) Society of Engineers on the subject "Electrical Transmission by Analogy."

MR. J. R. A. HOBSON, who has recently been acting as general commercial superintendent of the Southern Bell Telephone Company, has been appointed to that office, with headquarters in Atlanta.

MR. H. C. SLEMIN, of Rochester, N. Y., has been appointed to the dual position of sales manager and advertising manager of the Stromberg-Carlson Telephone Manufacturing Company, with offices at Rochester.

MR. C. LE MAISTRE has been appointed secretary of the International Electrotechnical Commission, London, the duties of which office he had previously discharged as acting secretary. Prof. Elihu Thomson is president of the commission in succession to the late Lord Kelvin.

MR. S. PIEK has been appointed assistant general manager of the Niagara, Lockport and Ontario Power Company, with office at Buffalo. Mr. H. B. Vincent has been appointed superintendent of the same company, with office at Mortimer, and Mr. W. E. Ryan as chief operator, with office at Mortimer.

MR. HAROLD ALMERT, of Chicago, the manager of the Wichita (Kan.) Gas, Electric Light & Power Company, has resigned with the object of taking up new work along the same line, but on a larger scale. He leaves with the best wishes of the officers and staff of the company. He will be at liberty after April 1.

MR. THOMAS G. GRIER delivered an address on the work of the Panama Canal before the Dames of the Loyal Legion, at the Grand Pacific Hotel, Chicago, on March 1. Mr. Grier, who has written a book on the canal that has been well received, is an earnest advocate of the upholding of the hands of the American engineers who are building the canal.

MR. C. S. DAVIDSON, who has been secretary of the Vermont Power & Lighting Company and the Consolidated Lighting Company at Montpelier, Vt., has resigned to accept a position with the Holophane Company, representing it in Ohio and Michigan. During 1908 Mr. Davidson secured for the Vermont enterprises some very lucrative lighting and sign business.

MR. R. B. STICHTER has been appointed general manager of the Texas Traction Company, operating the Dallas-Sherman Interurban system. Mr. Theodore Stebbins, former general manager, will continue with the company in an advisory capacity. Mr. Stichter, who is president of the Southwestern Electrical & Gas Association, resigned as general manager of the Strickland gas and electric properties to accept the new position.

MR. GEORGE WESTINGHOUSE, Jr., was married March 4 at Irton, Cumberland, England, to Miss Evelyn Brocklebank, daughter of Sir Thomas Brocklebank. The young couple will reside at Pittsburgh, where Mr. Westinghouse will resume his duties as assistant general manager of the works of the Westinghouse Air Brake Company. Miss Brocklebank and Mr. George Westinghouse, Jr., have known each other from childhood through the friendship which has existed for a period of 40 years between their fathers, which was marked by frequent exchanges of family visits.

MR. EUGEN EICHEL, who for several years was connected with the General Electric Company in this country and has frequently contributed to the technical press both here and abroad, has assumed charge as editor of *Elektrische Kraftbetriebe und Bahnen*, published in Berlin, Germany, with which journal he has been connected editorially from its commencement. He will receive assistance from a publishing committee consisting of the former editor, Prof. Dr. W. Reichel, Director of the Siemens-Schuckert Works; Director K. Wilkens, of the Berlin Electricity Works, and Privy Councillor G. Wittfield, Minister of Public Works, who is in charge of the electrification of the Prussian Government Rail-

Obituary.

MR. W. C. B. SAWLER, engineer of the Radio Telephone Compar died recently at Bombay, India, at the age of 37. Mr. Sawler was f merly connected with the Stone Wireless Telegraph Company.

MR. W. E. REYNOLDS, switchboard engineer of the Chicago Te phone Company, died at his home in Chicago on Wednesday, Feb. after a short illness. Mr. Reynolds was graduated from the electri engineering course of the University of Wisconsin in 1899, and sin was associated with the engineering department of the Chicago Telepho Company. Mr. Reynolds had a large circle of friends in the telepho field who will mourn his untimely death.

MR. H. H. WOODWORTH.—It is with deep regret that we reco the death of Mr. Harmon H. Woodworth, the advertising manager a assistant sales manager of the Automatic Electric Company, of Chicag This talented and amiable young man for the past few years had take an active share in the introduction of the company's well-known aut matic telephone system, and the literature issued by him in this co nection was admirably designed and executed.

COLONEL HENRY B. WILSON, of the banking firm of Emerson, M Millin & Company, New York, died suddenly, March 7, at Bonaire, G Colonel Wilson was 62 years of age and came to New York about 2 years ago from Ohio. He was interested in many electrical and in dustrial concerns and was a director in the American Light & Traction Company and the Consolidated Gas Company, of New York; the Western Gas Company, which controls the Milwaukee lighting plant, and th Southern Light & Traction Company, of San Antonio, Tex.

Trade Publications.

TUNGSTEN LAMPS FOR STREET LIGHTING.—The case with which the Tungsten lamp is adapted to street lighting is shown in bulletin No. 4647, just issued by the General Electric Company, Schenectady, N. Y. The bulletin contains curves showing candle-power distribution of this lamp under different conditions, illustrations of constant-current transformers and series lamp socket used in connection with the lamp, and several diagrams showing the advantages to be derived from the use of the tungsten lamp for series street lighting.

ELECTRICALLY OPERATED AIR COMPRESSOR.—Bulletin No. 1513 of the Allis-Chalmers Company describes a portable compressed-air outfit equipped with a direct or alternating-current motor, whereby the compressor with its various accessories can be brought directly to the work instead of having the compressed air transmitted from a distance through pipes and flexible tubing. A great advantage of the electric compressor is in its application to air brakes, and bulletin describes the manner in which it is adapted for this and other purposes.

STORAGE BATTERY IN STEEL MILLS.—The Electric Storage Battery Company, Philadelphia, has issued Bulletin 112, covering the use of storage batteries in iron and steel mills. Examples of installations are given, such as those at the Illinois Steel Company, Lukens Iron Steel Works, besides the Edgar Thompson Works, the Duquesne Works and the Youngstown works of the Carnegie Steel Company. The greatest application of electricity to rolling mills is, of course, the new installation at Gary, Ind., which is described. It is pointed out that the functions of the storage battery in steel and iron mills are, first, regulation at the end of the line; second, direct-current powerhouse regulation; third, alternating-current powerhouse regulation; fourth, combination direct and alternating-current regulation. In all of these cases the battery can be used as a reserve in case of a breakdown while getting other apparatus into service. It is stated that the total capacity of "chloride" batteries installed by the Electric Storage Battery Company in the various steel and iron mills is upward of 50,000 amp at the regular rate of discharge.

Business Notes.

THE AUTOMATIC SWITCH COMPANY has removed its offices to the Hudson Terminal Building, 50 Church Street, New York.

THE STAVE ELECTRICAL COMPANY, 27 West Twenty-seventh Street, New York, has appointed the Robertson Electric Company, 15 Terrace, Buffalo, N. Y., as its representative for Western and Northern New York.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY has made a change in its management, Mr. J. P. Clare having resigned and Mr. C. de Waal being appointed to the position of general manager. Mr. de Waal, who was formerly the general European agent for the company, has planned to make strong connections in all the principal cities of this country and to carry on an aggressive campaign.

WM. E. QUIMBY, INC., has leased the building 548-550 West Twenty-third Street, New York, to which will be moved the factory from South Boston. At the new location a jobbing business will be carried on in addition to the manufacture of Quimby screw pumps and the Quimby drainage pumps. The company will begin operation in the new quarters May 1.

KIMBLE ELECTRIC COMPANY IN NEW QUARTERS.—Owing to the demand for the variable speed motors made by the Kimble Electric

mpany, of Chicago, the company has found it necessary to remove larger quarters, and it is now to be addressed at 324 West Washing- Boulevard, Chicago. Here the floor space available is more than ee times as much as that of the old factory, and the manufacturing pacity is greatly increased. Mr. Kimble reports that it is difficult to ep pace with the orders for the company's new motor.

CROCKER-WHEELER ORDERS.—Among the large orders recently ken by the Crocker-Wheeler Company is one for an 800-kw and a -kw, 250-volt generator for the Emerson Manufacturing Company, lockford, Ill. Another is for a 300-kw, 125-volt lighting and power nerator for the Oakville Company, Oakville, Conn. The High Standard Steel Company, of Rockaway, N. J., has purchased two 125-kva, 23,000-volt, 60-cycle, 600-r.p.m. alternators of the coupled type. Two 50-kw turbo-generators have been ordered for the De Laval Steam Turbine Company, Trenton, N. J., and several engine-type generators of moderate size, among which are a 75-kw machine for the Franklin Square House, Boston, and a 50-kw machine for the Enterprise Building Company, Fall River, Mass. Eight motors for printing presses have been ordered for Clark & Cox, Denver, Col. Among other orders are one for three 10-hp elevator motors for the Ogden Iron & Steel Manufacturing Company, New York City, and a 40-hp induction motor for the Stiles & Hart Brick Company, Wier Branch, Mass.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 2, 1909.

[Conducted by William F. Bissing, Pat. Law, 2 Rector St., N. Y.]

913,684. ELECTRIC BURGLAR-ALARM; A. Bloch, Paris, France. App. filed March 28, 1907. For the locks of doors, etc. The circuit of an electric bell is closed by means of two contact devices arranged, for example, under the carpet of the room when the burglar enters.

913,691. VARIABLE-SPEED MOTOR; James Burke, Erie, Pa. App. filed May 17, 1905. A direct-current motor is provided with additional coils connected to a common point whose potential is between that of the positive and negative brushes. By connecting the supply mains to the brushes or to the additional point of connection, two speeds are obtained. The field strength may also be varied.

913,718. SPACE TELEGRAPHY; L. De Forest, New York, N. Y. App. filed June 25, 1907. Provides simple, harmonic impulses for tuning circuits to a spark frequency by connecting the aerial to a source of practically continuous oscillations of a frequency higher than the limit of audibility and at the same time providing a variable resistance in the earth connector with means for harmonically varying the same as by a tuning fork.

913,734. TELEPHONY; I. Kitsee, Philadelphia, Pa. App. filed Nov. 22, 1905. Provides sources of inductance along the line circuit for loading the line together with cores for the inductances normally magnetized independently of the current transmitted over the line.

913,747. APPARATUS FOR ELECTROPLATING; G. L. Meaker, Chicago, Ill. App. filed Nov. 20, 1907. The articles are passed continuously through the bath and are rotated during the plating operation.

913,753. LIGHT-REGULATOR FOR ELECTRIC LAMPS; T. E. Murray, New York, N. Y. App. filed Jan. 23, 1907. For varying the luminous intensity of electric lamps by means of a rotary shaft, a plurality of disks of non-conducting material thereon and a plurality of tapered conducting plates carried by the disks for controlling the circuit of the lamps, thus making and breaking the circuit rapidly.

913,754. ELECTRIC-FUSE BOX; T. E. Murray, New York, N. Y. App. filed March 19, 1908. The interior of the box with the cover closed is divided into three compartments insulated from each other. The insulating partitions are carried partly by the cover and partly by the box.

913,755. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed Sept. 2, 1908. A base block with removable fuse plugs with visual indicating means to show the position of the plugs. The circuit may be broken by the plugs in either the positive or negative conductor of a three-wire system or in both by reversing the position of the proper fuse plug or plugs.

913,757. ALTERNATING-CURRENT REGULATOR; R. S. McLeod, Disbury, Manchester, England. App. filed Oct. 22, 1906. Connects to the rotor a flywheel, the case of which is electrically connected to the mains and which case may be rotated at various speeds in one direction or the other.

913,782. ELECTRIC TRACTION OF THE SURFACE-CONTACT SYSTEM; D. Suchostauer, London, England. App. filed March 5, 1908. The necessary insulated conductors and studs are built in sections or self-contained units.

913,792. GERMICIDE LINING FOR MOUTHPIECES FOR VOICE-TRANSMITTING INSTRUMENTS; A. A. Williams, Charlotte, N. C. App. filed July 14, 1908. Provides a plurality of nesting cups inserted into the mouthpiece, which can be successively removed and thrown away.

913,795. TESTING SYSTEM FOR TELEPHONE LINES; C. S. Winston, Chicago, Ill. App. filed May 29, 1905. Systems in which a talking battery is located at the substation and the battery for testing the busy or idle condition is located at the central station. In making the busy test the maximum effect is produced upon the operator's receiver by means of an induction coil connected in series with the receiver, the primary of which is suitably energized, the induced current from the secondary winding adding its effect to that in the first winding to cause a distinct click in the receiver.

913,805. STAGE BORDER-LIGHT; J. C. Bronaugh, Kansas City, Mo. App. filed Jan. 30, 1908. A fireproof structure in which the lamps are protected from breakage by moving scenery by providing an angle plate with a guard secured thereto, the angle plate and guard protecting the lamp.

913,809. ELECTRIC SWITCH; E. M. Carr, Newcastle, Ind. App. filed March 14, 1908. Arranged on the pole near the consumer's premises so that the current may be turned off or on without entering the premises and comprises a switch with a pair of conductors whose adjacent portions are embedded in an insulator and a movable member carrying by one of the conductors and movable into and out of contact with the other.

913,810. ELECTRICAL SWITCH; T. Clark and I. Vlasto, Stockton Heath, England. App. filed Dec. 14, 1907. For motor starters. A spindle carries a plurality of spaced contact strips adapted to close the circuit through a plurality of resistance coils, each alternate coil wound in an opposite direction to the other coil or coils, together with a blowout.

913,814. MEANS FOR CONTROLLING DIRIGIBLE TORPEDOES; L. E. Custer, Dayton, O. App. filed July 23, 1906. An auxiliary de-coherer, positively insures a reversal of the current in the motor by means of which the torpedo rudder is actuated through suitable relays. Means are provided for preventing interference from other stations and for observing the path of the torpedo.

913,824. GALVANIC BATTERY; B. Jonas, Toledo, O. App. filed May 2, 1906. The air serves as a depolarizer in a galvanic cell having an iron electrode. A porous absorbent fabric is secured to the electrode.

913,827. PROCESS OF PURIFYING WATER; H. Korten, Chicago, Ill. App. filed Dec. 9, 1907. Purifies feed water for steam boilers by subjecting the water to electrical action and then filtering through mercury.

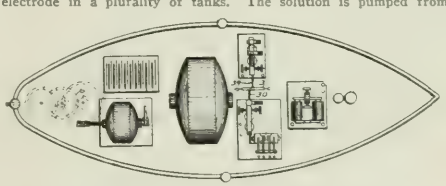
913,831. SWIVEL FOR ELECTRICAL APPLIANCES; A. A. Low, Horseshoe, and H. Hertzberg, New York, N. Y. App. filed May 4, 1907. Curling iron in which breakage of the leading-in wires is prevented by a switch contact device arranged outside of the iron with which the wires connect and which permits rotation of the wires in handling the iron without twisting the wires.

913,846. MIXED DRIVE FOR AUTOVEHICLES; H. Pieper, Liege, Belgium. App. filed Nov. 23, 1905. A gas engine has connected thereto a dynamo motor and a storage battery in circuit with the latter, the parts so related that the dynamo motor may be run as a generator by the engine or as a motor by the battery. Provides a manually operated controller for the set and also an automatic controller, the former controlling the sparking advance and the latter preventing the battery from being overcharged and for regulating the volume of the explosive charges.

913,865. MULTIPLE-SWITCH STARTER; H. J. Wiegand, Milwaukee, Wis. App. filed May 20, 1907. Opens the motor circuit unless all of the resistances are removed from the circuit by means of a retaining means which holds the switches closed, including a magnet together with a switch for controlling the magnet which must be held by the operator during the closing operation of the former switches, in order to render the magnet effective.

913,888. ELECTRIC FURNACE; P. L. T. Heroult, La Praz, France. App. filed May 3, 1907. An electric furnace having a stationary terminal, an electrode, and means for shifting a face of the charge toward and from the electrode.

913,898. GALVANIC CELL; B. Jonas, Toledo, O. App. filed April 2, 1904. Arranges a plurality of porous jars, each containing an electrode in a plurality of tanks. The solution is pumped from an



913,814—Means for Controlling Dirigible Torpedoes.

upper tank to a lower tank and back again so as to alternately empty and fill the cells with air, thus recharging the carbon elements of the cells with air, which acts upon the electrolyte, which in turn acts upon the iron element.

913,913. AUTOMATIC FUSE-BLOCK; C. O. Prowse, Hopkinsville, Ky. App. filed Sept. 25, 1907. Fuse-block and for subscribers' stations on telephone lines whereby when the circuit breaks through one fuse, it is restored through another after grounding the excessive current. A contact member is slidably mounted in a groove and a motor-actuated drum is provided connected by a cable with the contact member, to cause the above action.

913,931. TELEPHONE TRANSMITTER; C. Adams-Randall, New York, N. Y. App. filed April 14, 1905. For use with common battery systems and currents of high potential such as regulated electric light current. The transmitter has two or more independent disconnected elongated receptacles with granular resistance material therein, which can be connected in series to increase the internal resistance.

913,936. ELECTRIC BATTERY; L. P. Basset, Enghein, France. App. filed Sept. 30, 1907. An electric battery composed of thin plates of carbon with insulating material there between, the plates being perforated to permit circulation of two liquids there through, one liquid through the odd compartments and the other through the even compartments.

913,939. ELECTRICAL MEASURING INSTRUMENT; J. F. Begole, St. Louis, Mo. App. filed Feb. 10, 1908. Portable volt and watt meter having a receptacle for a translating device and a switch for varying the circuit so as to cause the instrument to operate either as a volt or as a wattmeter and so as to connect a resistance in series with the receptacle when used as a volt meter.

913,941. IONIZER OR APPARATUS FOR PRODUCING GASEOUS IONS; L. I. Blake, Denver, Colo. App. filed Nov. 17, 1908. Avoids the use of flames and discharge points by interposing between the plates of a condenser loosely packed glass wool, thus causing the entire space between the plates to glow and produce ions.

913,944. TELEPHONE TRANSMITTER; H. P. Clausen, Chicago, Ill. App. filed July 9, 1904. Relates to the granular carbon transmitter

contacts in the cord box and provides to shunt from and back metal auxiliary diaphragms suitably insulated so that the granular carbon, inclosed from the box, will have no tendency to weld between the front wall of the box and the back of the diaphragm.

913,947. TELEPHONE MOUTHPIECE; W. Gibson, Danbury, Conn. App. filed April 30, 1908. Made of glass with a cup-like shell inserted into the inner end thereof.

913,954. ELECTRIC SEMAPHORE SIGNAL; G. W. Potter, Mount Vernon, Ohio. App. filed Sept. 11, 1905. The arms of the signal are revolved by an electric motor whose circuit is controlled by the train. Employs an open circuit, normal safety being indicated by a stationary condition of the arms and danger by the revolving of them. After a limited time the circuit is broken and the motor stopped after the train passes the crossing.

913,999. MULTIPLE-SWITCH STARTER; H. P. Wiegand, Milwaukee, Wis. App. filed May 20, 1907. A controller in which a plurality of hand-operated switches control a resistance and the motor circuit is opened unless all the switches are closed and all the resistances removed from the circuit. In order that the operator may not leave the starting resistance in circuit a switch controls the operating circuit of a low-voltage magnet which switch tends to move toward a position to render the low-voltage magnet inoperative and must be held by the operator to render it operative.

914,038. BATTERY-CONTACT; J. H. Gugler, Minneapolis, Minn. App. filed Feb. 21, 1908. Particularly for the negative electrode of the Bunsen cell in which the carbon electrode is provided with a well having a metal-electrode-plated surface containing mercury so as to form contact between a leading-in wire and said electrode.

914,042. GUARD FOR THE ARMS OF ELECTRIC-CONDUCTOR SUPPORTS; G. E. Harrison and G. Burns, Detroit, Mich. App. filed May 25, 1908. A sheath for the arms of supports for telegraph wires on which the lineman may stand to protect him from shock.

914,043. SAFETY-FUSE; G. W. Hart and F. D. Reynolds, Hartford, Conn. App. filed July 28, 1906. An inclosed fuse in a one-compartment casing with a conductor located between the outer and inner surfaces of the casing and an indicator visually indicating the condition of the fuse strip.

914,045. CORD CONNECTOR AND RACK; W. E. Hill, La Grange, Ill. App. filed Jan. 12, 1907. For redistributing the cords on telephone switchboards, including a longitudinal support, clamps movably mounted on the support and insulated cord connectors carried by the clamps.

914,046. COOLING DEVICE FOR THE ROTARY MEMBERS OF ELECTRIC MACHINES; J. Hissink, Berlin, Germany. App. filed Oct. 23, 1907. A rotary member includes a carrier having longitudinal grooves at its periphery, a metal ring surrounding the groove, wires on the outside of the ring, a cap surrounding the wires, the whole arranged for air cooling.

914,100. ELECTROLYTIC PROCESS OF PRODUCING COMPOUNDS; C. E. Acker, Niagara Falls, N. Y. App. filed March 6, 1907. For making cyanides of the alkaline earths by continuously electrolyzing a molten compound of the alkali metal, alloying the separated alkali metal with a cathode metal, removing and cooling the alloy, reacting thereon with ammonia, and on the resulting nitrogen compound at a higher temperature with a carbonaceous reagent, and returning the residual metal to the cathode.

914,107. WALL PLATE FOR ELECTRIC FIXTURES; I. Bond, Evanston, Ill. App. filed March 9, 1908. A cover plate with a central raised portion provided with an opening to receive the base of the switch.

914,172. ELECTRIC ALARM; T. Norpoth, St. Louis, Mo. App. filed June 12, 1908. A burglar alarm which operates when the burglar forces an entrance through a screen or when the box containing the alarm is forcibly removed.

914,173. ELECTRIC ALARM; T. Norpoth, St. Louis, Mo. A burglar alarm which may be placed on a chair and attached to the door knob by a cord so that when the door is opened the alarm rings.

914,177. SYSTEM FOR CONTROLLING THE STRENGTH OF DIRECT CURRENTS IN ELECTRICAL CIRCUITS; M. M. Osnos, Frankfort-on-the-Main, Germany. App. filed Oct. 29, 1907. For use in circuits in which the number of translating devices may vary within wide limits, at the same time keeping the strength of current the same. Provides a motor generator in which the generator is energized by a voltage taken from the motor portion, which is suitably varied by changing the strength of field that the voltage of the generator is decreased to maintain the current normal.

914,194. ANTISEPTIC LINING FOR MOUTHPIECES; M. Scroogs, New Orleans, La. App. filed Dec. 26, 1908. A detachable antiseptic lining, comprising an outer cup, an inner cup and an inner antiseptic cup between the former.

914,207. TROLLEY FROG AND CROSSING; F. J. Venning, Pittsburg, Pa. App. filed April 15, 1908. A frog having a pan and runways with a metallic wearing plate detachably mounted on the frog.

914,214. ELECTROLYTIC PROCESS OF PRODUCING NITROGEN COMPOUNDS; C. E. Acker, Niagara Falls, N. Y. App. filed Oct. 8, 1906. The process of forming nitrogen compounds which consists in continuously electrolyzing a molten alkali compound capable of forming nitrogen compounds, alloying the separating metal with a cathode metal, reacting on the alloy with a nitrogenous reagent, separating the products and returning the residual metal to the cathode.

914,235. SIGNAL; C. N. Brown, Richmondville, N. Y. App. filed Jan. 14, 1908. A signaling apparatus for domestic use for notifying tradesmen and provided with a controlling device at the operating point so that an identical signal is indicated at both operating and receiving points.

914,251. PROCESS OF CHLORINATING ORGANIC BODIES; C. Ellis, White Plains, N. Y., and K. P. McElroy, Washington, D. C. App. filed Jan. 12, 1906. Treats aromatic hydrocarbons, particularly the polycyclic forms of electrolyzing a chloride and causing the evolved chlorin to react upon the hydrocarbon so as to form derivatives of naphthalene.

914,301. STORAGE-BATTERY STAND AND MEANS FOR RAISING AND SUPPORTING PLATES, ETC.; O. H. Nelson, Highland Falls, N. Y. App. filed Oct. 16, 1908. For elevating and holding battery plates when cleaning the cell, including a stand, a removable cell support thereon and means for raising the plates slightly free from the cell to permit removal of the support and lowering the cell.

914,305. CAR-HEATER; E. J. Rauch, Taunton, Mass. App. filed Oct. 1, 1907. A water-circulating system on the car is heated by the resistance coil in the motor circuit.

914,311. ELECTRIC-CURRENT GENERATOR; C. C. Ruprecht, Cleveland, O. App. filed July 28, 1905. A magneto generator provided with a series of pole-faces having a projecting portion carrying a winding

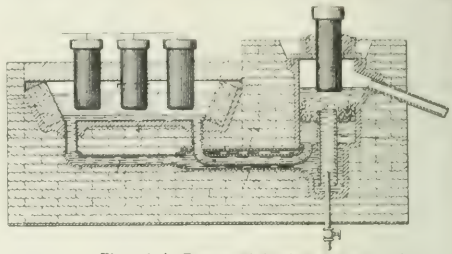
with a main inductor within the winding and inductively arranged with relation to the winding and pole.

914,327. BINDING POST; C. Richter, Pittsburg, Pa. App. filed May 16, 1908. A binding post that may be inserted in the terminal heads of cables having a body portion adapted to be inserted through the insulating wall of the cable sheath and carrying a locking bar and a threaded stem.

914,342. TROLLEY HARP OR POLE; W. A. Durant, Columbus, O. App. filed Aug. 6, 1908. A pole member having upwardly extending arms and a resilient connection between the arms which permit their separation under pressure, together with a roller on the arms having compression springs which are compressed when the arms are extended the roller engaging a trolley wire.

914,342. STORAGE BATTERY; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed Nov. 28, 1902. Employs insoluble active material in an alkaline electrolyte by providing a series of plates carrying pockets containing the active material and insulating means between the plates, preventing contact between adjacent plates and pockets.

914,343. PROCESS OF MAKING STORAGE-BATTERY ELECTRODES; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed March 30, 1905. The process of making storage battery electrodes



914,100—Electrolytic Process of Producing Compounds

which consists in associating a mass of conducting metal particles in a honeycomb arrangement and subjecting them to a welding temperature to make them integral.

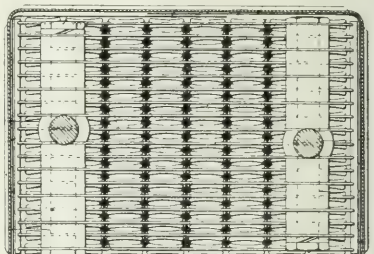
914,346. METHOD OF OPERATING ELECTRIC FURNACES; P. L. T. Heroult, La Praz, France. App. filed May 3, 1907. For varying the arc gap in arc furnaces or the degree of contact in incandescent furnaces, at the same time using a fixed electrode by shifting the face of the charge toward or from the electrode while holding the current terminals stationary.

914,354. FILAMENT FOR ELECTRIC GLOW-LAMPS; Kans Kuzel, Baden, Austria-Hungary. App. filed March 23, 1906. A filament for an electric glow lamp consisting of an alloy of tungsten with antimony.

914,355. ELECTRIC-CIRCUIT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed Nov. 30, 1901. A motor rheostat provided with a circuit breaker, a no-voltage coil controlling the circuit breaker, a control coil for the circuit breaker and a circuit contact closed by the movement of the resistance controlling element for controlling the control coil, thus avoiding damaging of the starting rheostat by permitting the contact lever to remain on the initial contact.

914,356. ELECTRIC-CIRCUIT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed Nov. 30, 1901. Avoids damaging the rheostat by holding the contact lever on the initial contact by providing a rheostat with a switch, an electro-magnetic actuating device therefor, with means whereby the switch is closed by the forward and backward movement of the movable element of the rheostat at the initial position.

914,357. ELECTRIC-CIRCUIT CONTROLLER; H. W. Leonard, Bronxville, N. Y. App. filed Nov. 30, 1901. Avoids damaging a rheostat by holding the contact lever on the initial contact by providing a



914,342—Storage Battery.

circuit breaker with a coil for holding it closed and a contact engaged by the resistance-varying element of the rheostat at or near its initial position for controlling the opening of the breaker by controlling the current in the coil.

914,365. SYSTEM FOR THE DISTRIBUTION OF ELECTRIC POWER FOR TRACTION PURPOSES; R. A. Weagant, Derby Line, Vt. App. filed June 8, 1906. An electrical conductor is automatically connected to and from a continuous conductor by the passage of the vehicle, through the action of a solenoid and core.

914,368. PROCESS OF FREEING RAW WOOL FROM ITS YOLK AND GREASE BY ELECTRICAL MEANS; J. M. Raudot, Tourcoing, France. App. filed June 8, 1906. Brings the wool into a bath and electrolyzes the bath by a current of low voltage to eliminate the grease.

914,372. PROCESS OF MAKING THIN METALLIC FLAKES; T. A. Edison, Llewellyn Park, Orange, N. J. App. filed May 30, 1905. Subjects metallic granules to successive rolling operations and anneals them in an inner gas.

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A British Illuminating Engineering Society.

We are glad to note that steps have been taken toward the formation of an active British society devoted to illuminating engineering. There has been a great deal of activity in practical illumination among our British confrères. London is at present, in fact, a gigantic station for the trial of new illuminants, and there exists a good reason for the organization of those interested in pushing along the cause of practical illumination. The same objections raised here three years ago are heard in London—that illumination is not an art at all, but a trade; that nobody wants the services of a specialist to tell him about things he already knows; that an illuminating engineer is nothing but an electrical engineer with a little common sense, etc. These various protests are now merely cause for smiling, for the new profession has proved already its right to be taken seriously, and its capability for good. The past three years have shown progress in good lighting to an extent that was hardly imaginable at the beginning of the period. And it is but the beginning of future improvements. The story of the British society will be a very similar one, and in it will be brought together as here the most diverse interests working together for a common end. In spite of predictions to the contrary, gas engineers and electrical engineers will join hands, there as here, if not with rivalry forgotten, at least with cordial good will and interest.

The fact is that illuminating engineering requires a deal of specialized knowledge that does not lie within the natural field of any other branch of engineering. It is, moreover, near enough to a fine art to demand some special gifts that few men possess. The late Luther Stieringer, for example, had a fine artistic instinct for harmonious and brilliant effects, that came through no special training in engineering, and that no engineer has at all equaled. One of the most serious questions to-day is how to find and train men who shall know what to do with artificial light beyond the mere technique of wiring in piping. Our British friends have this problem before them just as we have here, and there is as yet no definite answer Technical schools have, with a few notable exceptions, thus far fought rather shy of offering courses on illumination. The subject does not belong to electric engineering more than to chemical engineering or architecture, and hence it is not easy to fit it into any particular place, without elbowing out something that is supposed to be more appropriate just there. In course of time all this will be changed, but for the present it is mostly a case of self-education, which is a mighty good kind of education when one is a conscientious instructor. The British society has, like our own, wisely disclaimed the formal title of "Illuminating Engineers," and calls itself merely the Illuminating Engineering Society. It might well go a step further and discourage the promiscuous use of the title of Illuminating Engineer, save by those who have serious right so to denominate themselves. Our own society has been devoting much consideration to this very subject. It is unfortunately the fact that, purely for trade purposes, the title has been very improperly

used. We heard the other day of a concern that loudly proclaimed that it had forty "Illuminating Engineers" in its employ. This would be a joke were it not in such execrable taste. The two societies can do excellent work in suppressing this sort of noisy boasting by precept and example. They can also well devote some energy to a propaganda for education in illuminating matters, to the end that there may be a supply of well-trained men for the future needs of the art.

The British society starts out with influential friends and with a degree of enthusiasm that speaks well for its future. It has before it a vigorous campaign of education, and plenty of hard work. But in some respects its position is encouraging. It is in closer touch with the rapid development of things on the Continent than we are here. There is much activity in the use of new illuminants, and a stiffer fight between gas and electricity to keep things moving. There is also plenty of interest in engineering in all its branches and a better opportunity for engineers to get together than there is in our own country. Here the distances are so prodigious that much of the work of any society must be done in local sections if it is to progress rapidly. London, however, is unique in its availability as a center, and can draw in for any given cause a larger proportion of the total activity of the country than any other city in the world, Paris, perhaps, excepted. It is in many respects an ideal city for the organization of a technical body, despite its immense area. If the British Illuminating Engineering Society makes the most of its opportunities it will be able to command a respect and find a field of usefulness that will be altogether gratifying. But all this means a deal of hard work. In some respects nothing is more trying than conducting a campaign of education. As it drags its course along it seems that very little progress is being made, and it is sometimes a long time before results begin to show. Then, fortunately, they often develop with astonishing rapidity. Such has been the case with illuminating engineering in this country, and such will doubtless be the experience of our British friends. The chief thing is to keep at it persistently, never getting disheartened at things that are temporarily going wrong. When the ultimate purpose of the work is to benefit the public, the public will before long find it out and respond. Thus we give greeting to the new society, and wish it prosperity from the start and increasing success as it goes along and does its work. There is need for its work, which is the very best augury for a bright future.

Protection Afforded by Condensers Against Surge Voltages.

In Europe, one of the safeguards against atmospheric or artificial lightning in transmission—and distribution—circuits, of recent years, has been glass tube condensers connected between line and grounded at the entrance of the lines to a station. The reasoning has been that if a sudden steep wave of voltage came in over the line, it would be lowered in potential by absorption into the condenser, and thus the machinery within the station would not be subjected to the same intensity of electric stress as when no such condenser was used. The objection raised against such condensers has been not only their expense of installation, but also their influence on increasing the charging current of the line connected with them, thus lowering the plant efficiency of the machinery.

A lengthy mathematical article on the question of the advantage in such condensers has recently been published by Iwan Dory in *Elektrotechnik und Maschinenbau*. The article shows that much depends upon the duration of the disturbance giving rise to the surge. When a transmission line is quickly interrupted, we get an artificial lightning disturbance in the line or a surge. This surge runs to and fro along the line being gradually absorbed by frictional resistances, or I^2R losses. If the current on the line is interrupted with infinite suddenness, the surge of voltage will be the greatest that the said current strength is capable of creating in that particular system. But if the current is interrupted in a more gradual fashion, the surge is diminished in amplitude but sustained in duration. It is claimed that the benefit derivable from the condenser is greatest in the case of very sudden disturbances, but that, on the contrary, when the disturbance is longer drawn out, the wave of voltage may cease to be reduced by the presence of the condenser; or may be actually increased thereby. The value of the condenser as a lightning protector is thus rendered very questionable. It would seem that an automatic discharge valve is much more likely to protect a line against over-voltage than a mere elastic receptacle of the condenser type. A valve does not necessarily increase the wattless current on the line. For this reason, the electrolytic lightning protector has many advantages; being always ready to discharge over-voltages by overflow from the line, without allowing the dynamo current to follow.

Temperature Elevation of Dynamos and Transformers.

It is well known that when any electric apparatus, for example, a transformer, is placed under steady rated load starting from rest at the normal temperature of the surrounding air, the apparatus begins to rise in temperature at a certain rate, but as time goes on this rate of temperature increase declines until after a sufficient lapse of time, the temperature-elevation becomes substantially constant. According to the elementary theory of the heating of such machines under steady load, the curve of temperature-elevation with temperature is of the same shape and character as the curve of rise in the current flowing through a circuit, after closing the same upon a steady e.m.f. like that of a storage battery. In the rise of current in a circuit under steadily impressed e.m.f. as well as in the rise of temperature in a machine under steadily impressed load, there is a quantity called a "time-constant," which may be defined as the time required to raise the current, or the temperature-elevation, 63 per cent of its full ultimate amount. The electromagnetic time-constant of a circuit in the absence of iron cores is ordinarily less than one-hundredth of a second. In ironclad machines and apparatus, it is ordinarily less than one second, although it may be considerably more. The thermal time-constant of a dynamo-electric machine, or piece of apparatus, depends upon the size and nature of the same, and is commonly several hours. The thermal time-constant of a machine, such as a railway motor, may be a matter of considerable practical importance to the engineer who undertakes to provide motors for a given size of car, on an assigned length and profile of road, with a definitely prescribed time-schedule.

An article recently published by Dr. Gustav Benischke in *Electrotechnik und Maschinenbau*, deals with the measurement of the thermal time-constant of electrical machines. It shows that the time-constant may be determined very conveniently, and with

atisfactory degree of precision, by allowing a heated ma-ne to cool down under normal conditions, while observing rate of temperature decrease. If the curve of falling tem-rature be plotted, to temperature-elevation as ordinates, and ne as abscissas, the tangent to the curve drawn downward m the start, or point of initial temperature, will intersect base line, or line of zero temperature-elevation, at an inter-l equal to the thermal time-constant of the machine. If the nditions of heating after the application of load were identi-l with those of cooling after the removal of load, a tangent nilarly drawn from the starting-point of a curve of rising mperature should likewise intersect the line of maximum tem-rature rise, at a time interval from the start equal to the time-nstant. Dr. Benischke shows, however, that there is con-derable uncertainty in the time-constant thus measured on a rve of rising temperature. The best way to arrive at the re-lt is to warm the machine by the application of load, and then b determine the time-constant from the curve of cooling off.

On So-called Street Illumination.

The growth of lighting in the streets in American cities has een a curious phenomenon, and considering its character, it is ather remarkable that the net result has been even what it is. n the beginning was the old open arc lamp dispensed by the arly lighting companies at a great price. When the smooth-ongued representative of some system or other came into town o work the city fathers for a franchise, he was seldom ultra-conservative in his statements of candle-power, and by the time he was through with spellbinding the city fathers were firmly persuaded that Old Sol himself would be doing sentry duty at every street corner. Since all men are here assumed to be free and equal, all streets where men live must be of equal importance, and hence the "2000-cp" arcs must be spaced impartially in the streets save, of course, where an exception might be made in favor of some great public benefactor dispensing necessary fluids to the community. So it came about that the spacing of the arcs in the ordinary city became what from the standpoint of illumination is a huge practical joke upon the public. In the past and even up to the present time lamps for city lighting have been spaced at 600 ft. to 1000 ft. apart. The coming of the newer enclosed arcs, exploited energetically on the strength of lessened cost of trimming (obtained at the cost of luminous efficiency), did not help the matter at all when, as usual, the substitution was made lamp for lamp, since the illumination became practically negligible at about the same old distance. Very large claims were made for the distribution curves of the new arc, but unhappily the differences rose to material consequence only when the actual values of illumination were too near zero to be worth considering. It has taken a good many years to bring enough improvement in the spacing of the arcs to do material good, and even now spacing close enough to light the street as a whole is only to be found in an occasional thoroughfare in an occasional city. One reason for this neglect is that it is a troublesome and costly affair to change the spacing when once established unless one is willing to go to the extent of halving it, which implies paying for double the number of lights. Hence old errors have been perpetuated, and improvement has been very slow, especially as the tendency has been to decrease the power of the individual arcs.

The obvious faults of lighting derived from too infrequent arcs have been productive of a very active flank movement inaugurated by the gas interests. "You can see at a glance," said the gas man, "that arcs are ill adapted for street lighting on account of the bad distribution in the spaces between; what you really want to judge a street by is the minimum illumination between lamps as given, for instance, by our beautiful Welsbach"; and he then proceeded to show how uniform the lighting could be made with small units put near enough together. All of which need not be denied, but one should remember first, that big units properly spaced would give even more light, and that the argument for uniformity would hold, even more strongly, for, let us say, kerosene lamps placed near enough together, irrespective of the total flux of light rendered available. Just at the present time the advent of the tungsten lamp has enabled the central-station man to hit back at the Welsbach very effectively, but let him beware of pushing the argument for minimum illumination too far, for it is likely to fly back and smite him. The real trouble with most streets is that the light flux is not only ill-distributed but too small to do the work. Consider, for instance, a street 60 ft. wide. It contains 316,800 sq. ft. per mile of length. If illuminated by arcs it may get as much as a total of 7 kw or 8 kw, or, at the most, about one-fortieth of a watt per square foot of surface. If lighted by incandescents it generally gets no more than about half of this minute allowance. Now even with modern and efficient illuminants used indoors, with all the advantage of reflection from walls and ceiling, this is hardly enough to make darkness visible. It is about what one common 16-cp lamp would do in a dingy room 50 ft. to 60 ft. square.

If it were not for the enterprise of the storekeeper in lighting his windows for advertising purposes, the streets of most cities would be for all practical purposes in utter darkness. It is the private lighting that saves the day, though only here and there when one takes the cities as a whole. And where should the blame for bad conditions be placed? Certainly on no one group in particular. Some city governments are far too parsimonious in their appropriations for public lighting, yet in many places the expenditures for this purpose have increased with all the rapidity justified by the other expenditures and by the rate of taxation. The use of inefficient enclosed arcs, especially those of small amperage, has been a persistent cause of poor results, and so also has been the ill-cared-for gas mantle generally found whenever agitation for better lighting has died away. More than all, the general laissez-faire policy with regard to existing minor evils which characterizes American civic life, has prevented active improvements. "The lamps will do all right, only let's have them a little cheaper" is the frequent song, just as the chap mixing a highball ventures the opinion that the city water is good enough—only a thousand cases of typhoid a year, and those mostly in the "poorer quarter"—why disturb vested rights in the water company? An awakened interest in having things as they ought to be, instead of letting them go because they are not absolutely intolerable, is one of the most encouraging signs of the present time in civic affairs. The result of it is going to be great improvement all through municipal activities, and we hope and believe that public lighting will come in for its share of improvement. The "psychological moment" for action has now arrived, since the new material and methods recently available will enable great results to be reached more quickly and cheaply than has ever been possible before. The main thing is to get the work promptly under way.

Traction Rehabilitation Controversy in Chicago.

The daily newspapers in Chicago devoted considerable space during a few days last week to alleged errors in the accounting methods adopted by the Chicago City Railway Company and the Chicago Railways Company in the rehabilitation of the street railways in that city. But after the stir which the first articles caused subsided, the affair proved to be merely the result of misunderstandings of the true situation on the part of the newspapers and, to a certain extent, of the city authorities as well.

As is well known, the reconstruction work now being conducted by the Chicago railway companies is being done under the direction of the Board of Supervising Engineers, of which Mr. Bion J. Arnold is chairman and chief engineer, and under the franchise the city shares in the net profits to the extent of 55 per cent. For this reason, an important distinction is made between the expenses of construction and operation to be charged to the joint account of the companies and the city occurring after the ordinances took effect, and those properly belonging to the period before the companies accepted the ordinances. The duty of passing upon all purchases and auditing all expenditures for the joint account devolves, by law, on the Board of Supervising Engineers. In the progress of this work a question arose last October as to the proper classification of expenditures of the Chicago Railways Company some time previously, aggregating $119,000, which had been charged to the joint account by the company as an operating expense. As there seemed to be some doubt as to whether this was the proper classification, Mr. Arnold, at the request of the city and also of the Railways Company, agreed to go over all of the vouchers of both companies.

About Feb. 11, before the work of auditing these vouchers, numbering over 20,000, was concluded, Mayor Busse received a letter from Philadelphia charging that secret discounts from quoted prices were being given by different manufacturers on sales made to the Chicago City Railways Company and alleging that no credit was given for these discounts in the accounts which the company filed with the Board of Supervising Engineers as the cost of the apparatus. Both the name signed to the letter and the address given in it proved on subsequent investigation to be fictitious. A full investigation was made of the matter, however, and it was found that only the net payments made by the company were being charged on the books, and that the Board of Engineers had full knowledge of these discounts, had approved them and had seen that the city had received its proper credits for them in the joint account. The examination, however, showed that the Chicago City Railway Company had in some instances been securing somewhat lower prices in its purchases than the Chicago Railways Company. The only figures made public were those on rotary converters. For rotaries of the same size and type the Chicago City Company had paid $16.15 per kilowatt and the Chicago Railways Company $16.25 per kilowatt. During this investigation, the Mayor gave to the public press the letter mentioned and this, in connection with distorted rumors of the reasons for the audit of the Railways Company's accounts, caused some excitement until the facts became known.

In the meanwhile one of the sensational daily papers published in Chicago appears to have conceived the idea that the Board of Supervising Engineers was extravagantly administered and this view seems also to have been taken by some of the local politicians, who were perhaps piqued because the patronage of the board had not been placed at their disposal. The payroll of the board was published, and for several days the attention of the newspapers was diverted to that body. It was shown, however, that the salary of Mr. Arnold had been specified in the ordinance which was ratified at the election, and that the work of the board was being conducted very economically and efficiently. Other allegations made at the same time proved utterly groundless or due to a misunderstanding of the facts. Thus, it was said that both of the railway companies kept two sets books, and that one set was for public record and the other f the company's own information. It was shown, however, th the second set of books was simply that used by the compan for keeping the record of the disposition of the 45 per cent r profit to which the companies under the ordinances are entitl and hence was perfectly proper; and that there was only one s of books of construction and operating accounts relating the joint accounts of the city and the companies, which, mor over, were being kept upon forms prescribed by the Board Supervising Engineers and approved by the city comptroller.

The incident assumed most prominence between March 7 10, but as the facts became known the discussion subsided a by March 11 reference to the matter disappeared from the fir pages of the city press. The net result of the controversy three or four days was to make even more evident and cle that the public interests in Chicago are being well protecte

Suggested Changes in the National Electrical Code.

The Underwriters' National Electric Association has sent ou its bulletin containing committee reports and suggestions fo changes in the Code which will be considered at its meetin at 32 Nassau Street, New York, on March 24 and 25. Unanim ity of action on the part of all the associations interested evi dently being unobtainable, the committee on the groundin rule believes that while the Underwriters should use all thei moral influence in supporting a rule which may seem advisabl in order to lessen life hazard, they have no right to enforce rule which cannot be defended on the ground that it involve a fire hazard. The committee therefore recommends that th rule remain as it is, with a proviso that should its recommenda tion not be accepted and grounding be made mandatory, failur to observe the rule cannot be penalized by increased insuranc rates. Thus, so far as the insurance interests are concerned mandatory grounding rules would have merely a potentia existence.

The committee on circuit-breakers has formulated a set of specifications for their manufacture and has, in addition, prescribed a number of rules for their installation. According to the latter, the use of automatic overload circuit-breakers is recommended, and when such a device on a motor starter disconnects all the wires of a circuit, the switch ordinarily required may be omitted. Overload-release devices on rheostats do not dispense with the cut-out required if they are inoperative during the starting of the motor. Each feed wire from a railway power plant before it leaves the station must be equipped with an approved automatic overload circuit-breaker. Excepting on main switchboards, or where otherwise subjected to expert supervision, circuit-breakers will not be accepted for single-phase work unless fuses are also provided. One side of the line may be protected by a circuit-breaker and the other side by a fuse up to the maximum capacity for which enclosed fuses are made; for circuits above that capacity circuit-breakers only will be required. The circuit-breaker must not be set more than 30 per cent above allowable carrying capacity of the wire, unless a fusible cut-out is also installed on the circuit, in which event the circuit-breaker may be set as high as 100 per cent above such capacity.

The committee on cabinets reports specifications for wood, composition and metal cabinets, which go into greater detail and appear to accord more closely with present practice than the rules now in force. The laboratory report on flexible cord and cables calls for some slight changes in the present specifications covering such material with a view to preventing broken strands puncturing the insulation and to strengthening the cord against mechanical injury. Specifications covering theater stage cable, border cable and elevator lighting and control cables are reported by the committee appointed at the meeting last year. The committee on details of switchboards reports adversely to any additions to the present rules. Since 125-volt Edison plug

es have been found on 250-volt circuits, it is recommended t this type of cut-out be no longer approved for 250-volt vice and that it be limited to voltages of 125 and under. The ie committee also recommends that a rating for snap switches not standardized and that these be examined and tested as etofore. The rules governing signaling systems have been dified slightly.

The committee on auto-starters reports that in view of the lical changes being made and in contemplation by manufac- ers specifications for testing the same, both from an elec- cal and mechanical standpoint, would be obsolete within a ort while. Certain features affecting safety should be ap- ed, in the opinion of the committee; the features particularly ferred to dealing with hand-operated compensators. It is commended that these be equipped with no-voltage release so at the switch will return to the "off" position when the volt- e fails. The switch should also be arranged so that it can- t be left in the starting position and the lever so designed that cannot be moved to the running position before passing rough the starting position.

Among the suggested changes which will come up for con- deration are the following: Rule 12, outside work; new para- raph: For conduit work, wires must be placed so as to con- orm to rules for unlined conduit except that the conduit sys- em must be waterproof if the wires are not provided with a ead sheath. Another suggestion calls for supporting wires on xterior walls of buildings at least every 15 ft.; this distance to e shortened if the wires are liable to be disturbed. A fine- rint note to Section *g* is suggested as follows: Where low- otential wires enter buildings in the vicinity of awnings or where awnings are liable to be placed, wires will be considered as exposed to mechanical injury and must be protected by being run through iron conduit so that wires will clear awnings about 2 ft. The distance between inside pins on cross-arms in Sec- tion *h*, it is recommended, should be made 24 in. instead of 26 in. For show windows it is suggested that conduit or armored cable be employed except in the upper part of the win- dow well out of reach and not exposed to injury or moisture, where other forms of wiring may be employed. Numerous changes are recommended in the specifications for fittings, etc. Among the miscellaneous suggestions are the following: That metal-shell key sockets be prohibited in basements, bathrooms, kitchens and other places having grounded surfaces. That rela- tive positions of service switch cut-out and meter may be changed in order to prevent theft of electricity. That all lamps requiring over 175 watts be equipped with a base so formed that the lamps will not fit sockets or receptacles of lower wattage. That the grounding of metal ceilings to water pipes be re- quired. That rules be made requiring the wattage of Nernst lamp glowers. That self-starters be attached to all alternating- current motors. That the maximum weight of any energy- consuming device, together with the shade or other special fitting which would be allowed attached to a pendant flexible cord, be fixed. That there be a rating of wattage for ceiling and desk fans. That pilot lamps be required on all heating de- vices except luminous radiators. That insulating joints and in- sulation of fixture canopy may be omitted where straight elec- tric fixture is used with complete conduit or armored-cable system, in which the double-braided, rubber-covered wire pro- jects through the stem of the fixture connecting directly with the socket. That the use of wooden molding on metal ceil- ings be prohibited. That a rule require the circuit leading to outside lamps fed from the house system to be equipped with a double-pole switch just within the point of entrance; the re- quirement to apply to outline lighting, signs and arc lamps. That the use of knobs inside sockets and rosettes for the pur- pose of relieving joints and binding screws from strain be prohibited.

Panama Electric Power.

Six Curtis 1500-kw turbo-generators have arrived at the Isthmus of Panama for installation at Gatun and Miraflores, where power houses are now under construction for the permanent electric power generating plants which will supply electrical energy for the work of construction of the locks at Gatun, Pedro Miguel and Miraflores. Foundations are being rapidly constructed for the machinery received and the power houses will be entirely completed within a few months.

All operations in building the locks will be conducted by electric power from the time the raw material is received in scows coming up the old French canal until the concrete is in the forms at the locks. The power plant will be laid out and the feeders so arranged that the consumption of kw-hours of each operation can be ascertained. The Gatun plant will be ready first for operation. After the locks are built the steam power plants will be held in reserve to operate the locks at times when the proposed hydro-electric plants may be short of water.

Damage by "Inaugural" Blizzard at Baltimore.

While the lines of the Consolidated Gas, Electric Light & Power Company of Baltimore did not suffer damage during the blizzard of March 3 and 4 comparable with that experienced by telegraph and telephone companies, yet it was necessary to shut off current shortly after midnight on March 4 at the request of the Department of Public Safety. The rapidity with which the system was restored to working condition brought to the management of the Consolidated company many congratulations, and an account of the manner in which this work was done is given below.

An idea of the extent of the work may be gathered from the statement that the overhead system comprises 5000 miles of wire, every foot of which was inspected before service was resumed; 6000 poles; 200 miles of wires within the city's limits, and 2500 city arc lamps. Almost in the teeth of the storm the electric division of the company had its men at work. Out of the 6000 company poles there were only 75 poles down. The principal work consisted in going over the lines and cutting off foreign wires that had fallen across the feed wires. As the number of telephone and telegraph wires are many times greater than the number of feed wires, this task in itself was an enormous one, particularly as the positive orders of the management were that no chances should be taken with stray wires likely to cause damage to life or property, this making it necessary as each circuit was cleared to go over it again and inspect every foot of the lines before the current was turned on. As soon as the inspection showed that everything was in good shape the current was turned on the various circuits, and in this way the restoration of service was rapidly accomplished as the work of clearing up the lines advanced. The first service to be restored in the overhead district was that of direct-current power users. This was a great help to many small manufacturing concerns, and they were able to get this current the day following the storm. This was followed by restoration of service to the congested city districts, and within 72 hours after the storm practically every district in the city below North Avenue was furnishing current, and before the week was out all of the 2500 city arc lamps in this district, with the exception of 25, or about 1 per cent, were again in operation. The clearing up of these circuits represented quite a job in itself, as they cover 200 miles of streets. As with the other circuits of the company, every foot of the arc circuits was gone over twice, first by the men clearing up and making repairs, and second by the inspection force.

As the various circuits were cleared up and put in operation the gangs of men were split up and followed the spurs running from the circuits and the service connections from these spurs. It is the purpose of the company to follow this work of inspecting every foot of its lines right to the premises of every consumer. The replies to a communication sent to all the current users in the overhead districts showed that practically very few consumers were without current, and those that were without it received immediate attention. Most of

the replies had some word of congratulation for the wonderful work which the employees of the company had accomplished in so quickly restoring service.

All of this work was carried out by the operating department of the electric division of the company under the immediate direction of the following officials: Assistant general manager, Mr. Wm. Darbee; superintendent of distribution, Mr. W. P. Beyerle; general foreman of distribution, Mr. Wm. T. Russell. Mr. Herbert A. Wagner, director of the electric division, spent considerable time with Assistant General Manager Darbee in going over the work, these officials making a number of automobile trips all through the affected districts. About 200 men were employed in this work, including not only the regular force of the company, but additional men secured in Philadelphia and other cities.

Southern Electrical and Industrial Exposition.

The electrical part of the Southern Electrical and Industrial Exposition, to be held in the First Regiment Armory at Louisville on April 12 to 24, promises to be of considerable interest. There are 54,000 sq. ft. of floor space available on the main floor and this has been divided into over 200 exhibit spaces. The exposition company is financed by the Commercial Club of Louisville, and the business men of that city and of Jeffersonville and New Albany, Ind., are advocating the show with enthusiasm. Mr. Fred. W. Keisker is president of the exposition company, which is incorporated, and Mr. A. T. Macdonald is the secretary. Mr. G. Wilbur Hubley, of the Louisville Lighting Company, is one of the directors and also in direct charge of the division of power. The division of illumination is in charge of Mr. Lewis S. Streng.

Alternating current for lighting in the exposition hall will be furnished at 108 volts, 60 cycles, single-phase, and direct current for motors will be furnished at 500 volts. Motors of ½ hp or less may be served from 108-216-volt, 60-cycle, single-phase mains. All lamps, fixtures and appliances, including wiring in exhibitor's space, must be furnished by the exhibitor. Flat rates are provided for lighting for carbon, tungsten and arc lamps and also for motors. On meter rates electricity will be sold for power at 5 cents per kw-hour and for lighting at 6 cents per kw-hour. The company will provide a general scheme of illumination, but exhibitors are requested to install special illumination for their own spaces. Private telephones may be had from the Cumberland Telephone & Telegraph Company or the Louisville Home Telephone Company. A charge is made for exhibit space.

The promoters of the show say that the South is rather deficient in electrical development, and one of the aims of the exposition is to arouse a greater interest in electrical applications. The railroads have granted a fare of one fare plus 25 cents for the round trip from all points south of the Ohio and east of the Mississippi.

Extensions of Chicago Drainage Canal Power-Transmission System.

Considerable construction work is under way for the Sanitary District of Chicago, which operates the hydro-electric power plant at Lockport, Ill., on the Drainage Canal, and also the transmission and distribution of electrical energy from that plant. The current is transmitted to a terminal station in Chicago, at Thirty-first Street and Western Avenue, at 44,000 volts. Three substations are being built, located, respectively, at West Twelfth Street and Forty-eighth Avenue; Ashland Avenue and Thirty-seventh Street; Leavitt Street and Fullerton Avenue. Two other substations in the city are projected and will probably be built this year. Current is sent from the terminal station to these substations at 12,000 volts, and in the substations is stepped down to 2300 volts, at which pressure it is distributed to the points of consumption. For use the current is further stepped down on or near customers' premises to 110-220 volts. Some of the 12,000-volt lines are underground, and it is probable that underground lines to all the substatic will be built this summer.

In the generating station at Lockport four generators are use, having a total capacity of 16,000 kw. By the first of Ju it is expected that this rating will be increased to 20,000 by t addition of a fifth machine, while still another generator w bring the total up to 24,000 kw by the first of September unle there is unexpected delay.

The Sanitary District has taken contract to operate the m nicipal electric light and water-works plant at Blue Island, suburb of Chicago. A transmission line is being built fro Morgan Park, another suburb, where similar service is no rendered, to Blue Island, a distance of two miles. The pum of the Blue Island water works will be driven by inductio motors and Drainage Canal current will be transformed dow for lighting the streets and for commercial lighting. An a rangement has also been made by which Lincoln Park, Chicago, will be lighted by electricity from the Drainage Can plant, which will also be used to perform the pumping in th park.

An Important Telephone Decision.

The Indiana Supreme Court has rendered a decision relatin to the exchange of service through physical connection of riva lines. In this case the court was asked by the complainin company to compel the defendant company to restore the con nection which had been severed in order to enforce the paymen of disputed tolls. The court held that a telephone company i a common carrier of messages, and when the owner of on system of telephones and exchanges has made physical connec tion between his and other lines and exchanges in the surround ing country under an agreement for interchange of service fo an intermediate period, and each has developed his own tele phone system with reference thereto, the courts will, upon proper proceeding, restrain the owner of such telephone systen from severing relations with a single one of the connectin lines and exchanges, or compel him to restore a severed con nection. The court ruled, however, that the complainant shoul have paid under protest the amount claimed as due for toll and then recovered the same; that this was his adequate remedy and for his failure to invoke this remedy he was not entitle to a writ of mandamus to compel restoration of connection. The court added that after actual physical connection has been made between the lines of two systems of telephones, the property of each is impressed with such a public interest that neither can disregard it.

Students' Electrical Exhibition.

The students in the department of electrical engineering at the Michigan Agricultural College, East Lansing, Mich., gave an electrical exhibition on Thursday, Friday and Saturday afternoons from 3 to 6, on Feb. 25, 26 and 27. This is the second year of the M. A. C. department of electrical engineering and it was thought that it would help materially to show in this manner what is being accomplished in some lines of work.

Eighteen rooms in the new engineering building were used to display all kinds of applications of electricity to domestic purposes, including some examples of how the various rooms in a home should be lighted using the modern illuminants; examples of applications of motors to domestic purposes, such as pumping water, running washing-machines, sewing-machines, a little grinder for sharpening knives and two examples of vacuum-cleaning apparatus. A private lighting plant was installed, the generator being driven by a gas engine. Other exhibits were an electric welder, heating appliances, etc. Some high-tension experiments were shown and other entertainment features given each evening. The Legislature being in session, the members received a special invitation and quite a number attended. The total attendance ran up pretty well toward a thousand in the three evenings. Prof. A. R. Sawyer is in charge of the electrical engineering department of the college.

National Electric Light Convention.

n making up the program for the coming convention of National Electric Light Association, at Atlantic City, June the policy has been adopted of having editors prepare ers, with the assistance of sub-editors in various parts of country, so as to cover the subject in the most comprehensive nner. There will be two days of general convention in which program will be presented to the whole meeting, while ursday and Friday will be given over to parallel sessions, hnical, commercial and accounting.

The manufacturers' exhibition will be held in what is known the Main Building, on the Million-Dollar Pier, a large hall ectly facing the boardwalk and exceptionally suitable for the rpose. The booths, each having a frontage of 9 ft. and a pth of 15 ft., will be arranged horseshoe fashion, leaving in e center a space approximately 70 ft. wide and about 140 ft. ng. It is planned to furnish this space with rockers and rugs, king it the convention exchange. The entrance to the hall so placed that delegates must pass the exhibits to reach the eeting halls and other points on the pier. To the left of this trance will be located the office of the secretary and to the ght the registration bureau. The floor plan and a letter incorrating the details of the exhibition are in course of preparaon and will be forwarded to members within a few days.

The Trunk Line Association has authorized a rate of a fare nd three-fifths for the round trip, on the certificate plan, from l points in its territory to Atlantic City and return.

New York Public Service Commission News.

Mr. Theodore P. Shonts, president of the Interborough-Metropolitan Company, has sent to the Public Service Commission of the First District of New York the details of his proposal to build subways in the city. The general plans as offered by Mr. Shonts were accurately outlined in the last issue of this paper. They comprise a double-track subway from Forty-second Street and Seventh Avenue under Seventh Avenue and some of the other downtown streets to a terminus at the Battery; a double-track subway from Forty-second Street and Lexington Avenue, under Lexington Avenue to a terminus near 149th Street in the Bronx; the construction of a center express track on the Second Avenue and Third Avenue elevated structures; the lengthening of the platforms of the existing subway stations so as to permit the operation of 10-car express trains and six-car local trains on the present tracks. This last improvement, Mr. Shonts declares, will add 25 per cent to the capacity of the subway, can be completed within 10 months and will cost only $1,000,000. The Public Service Commission has referred these plans to its engineers, but it does not seem likely that the two newly proposed routes will meet with approval. The plans which the commission has under consideration are for a four-track subway under Lexington Avenue to a point beyond the Harlem River, one to the neighborhood of Van Cortland Park and the other to Pelham Bay Park on the Sound. The commission's plans also contemplate a four-track subway from Forty-second Street and Broadway south. It is not likely that the commission will approve Mr. Shonts' plan for central express tracks on the Second and Third Avenue elevated structures. It is pretty well understood that the commission will not approve plans for any new elevated structures nor for any additions to the existing structures. Although Mr. Shonts in submitting this proposal intimated that it must be taken in its entirety, or not at all, the commission has already accepted the plan for lengthening the platforms of the present subway, and it is probable if the Interborough does not voluntarily undertake this work at the commission's suggestion, that an order will be issued to compel the improvement to be made.

Mr. William J. Wilgus, president of the Amsterdam Corporation and former vice-president of the New York Central Railroad, has submitted a comprehensive plan to the Public Service Commission which he describes as an Inter Terminal Belt Line. This plan provides for a four-track elevated electric railroad from the terminus of the New York Central Railroad, near Sixtieth Street and North River, southerly along the waterfront to the Battery; thence a two-track elevated railroad along or near the southern waterfront to the East River and up the East River waterfront to a point near Forty-second Street; thence by subway under First Avenue and Forty-second or Forty-third Street, connecting with the Grand Central Station, and on under the same streets to Seventh or Eighth Avenue; thence under Seventh or Eighth Avenue to the Pennsylvania Railroad terminal at Thirtieth Street, and from there, by either subway or elevated structure, through Thirtieth Street to the main line on the North River front. The plan also contemplates a subway or elevated structure from the North River line through Fifty-ninth or Sixtieth Street to the Blackwell's Island Bridge, and thence under First or Second Avenue to connect with the East River line at Forty-second Street. The purposes of this road are set forth as being for transportation of both passengers and freight.

The Public Service Commission has announced that it would in the near future approve of the application made by Mr. William G. McAdoo, president of the Hudson & Manhattan Railroad Company, for an extension of that company's subway from Thirty-third Street north, under Sixth Avenue and Bryant Park to the Grand Central Station at Forty-second Street and Park Avenue. This improvement can be made without any change in the existing laws.

The Public Service Commission, acting upon the demands of the large number of persons who use the Eighty-sixth Street crosstown car line, has issued an order directing the receivers of the Metropolitan Street Railway Company to restore a through service from Eighth Avenue on the west side of Central Park to the ferry at East River on a basis of a 5-cent fare. Since the severance of this company from the Metropolitan system it has been operated in two sections, and two fares have been charged for the through trip across town.

The Appellate Division of the Supreme Court in New York City has unanimously affirmed the decision of Justice Gerard, upholding the validity of the public service law in New York. The suit in which this was rendered was brought in the shape of an effort to prevent the city from paying the expenses of the commission. The present decision holds that the law is valid and that the city is responsible for the salaries and expenses. The decision does not cover any point involving the authority of the commission over public utilities.

The Public Service Commission of the First District of New York has dismissed a complaint that has been pending against the New York Edison Company, alleging that it was guilty of a nuisance on account of the cinders emitted from the stacks of its power house near First Avenue and Fortieth Street. Commissioner Maltbie, who prepared the order, declared that the trouble had been very greatly reduced by the company, and that other improvements were in progress. He said that in view of this readiness on the part of the company to remedy the trouble, the complainants have expressed themselves as entirely satisfied.

Mr. Henry B. Seaman, chief engineer of the Public Service Commission for the First District of New York, has submitted a report in which he declares that the plan, suggested by the engineer of the Board of Estimate, to cut down the proposed Fourth Avenue, Brooklyn, subway to two tracks would lead to worse transit confusion than now exists. Mr. Seaman insists that four tracks are necessary in this subway system in order to provide for the branches which will run from the main line to Fort Hamilton and to Coney Island.

The Public Service Commission of the Second District of New York has given its consent to the consolidation of the Watertown (N. Y.) Light & Power Company and the Watertown Gas Light Company.

The Syracuse Lighting Company has made application to the Public Service Commission of the Second District of New York for consent to the making and delivery of a mortgage to secure a $2,500,000 bond issue. The bonds will bear 6 per cent interest, and the proceeds will be used for extensions in the distributing system and improvements in the central power station.

The Anniversary Dinner of the Institute.

The American Institute of Electrical Engineers celebrated the completion of its first quarter of a century with a banquet at the Hotel Astor on the evening of March 11. About 300 were present. Several unusual and unique features gave the affair special éclat. A most successful experiment was that of turning the ballroom into a Venetian chamber. Across the west end was placed a theatrical drop scene representing the Grand Canal, with the Doge's Palace, etc., and this was seen through a large balcony opening set with flowering plants, vines, etc., while border lights were placed just inside the balcony and lamps were also placed so as to illuminate some of the scenic windows. On the south side of the room a similar scene represented the approach to the Rialto, which was bordered with palms and flowers, giving an equally pretty vista. In each of the ordinary windows of the room was placed a large transparency showing some Venetian scene, and so illuminated that in whatever direction the diner looked a prospect in the City of Canals met his eye. At the back of the speakers' table were two huge American flags, surmounted by a large eagle, and through each star in the drapery of the flags came a frosted incandescent lamp. The effect was immensely pleasing and novel. From the beak of the eagle hung red, white and blue streamers carrying a transparency of the badge of the Institute and the words "Silver Anniversary" in small lamps. The speakers' table was set with regular electric light standards of very ornamental design, but each of the 50 tables on the main floor was illuminated in an original manner. In order to get away from flickering wax candles and the obstruction due to the usual electric light standards a small silver bowl was set in the middle of the table within which was placed a miniature storage battery. To this were attached three miniature tungsten lamps. Above these was placed a circular block of glass simulating ice, through orifices in which water was poured; and masses of blush roses were set so that the light of the lamps came up through the glass, the water and the flowers. Here again a very beautiful and entirely novel effect was secured. Around the ballroom runs a series of small balconies for musicians, etc., and those were all densely banked with green plants and flowers, behind which were placed a number of Cooper Hewitt mercury-arc lamps, giving the effect on the foliage and blossoms of early spring sunshine. Across the ceiling of the room were suspended strings of red Christmas-tree lamps in vines, from the intersections of which dropped shaded lights on flexible cord, supplementing the regular light of the large chandeliers. The two sides of the room not occupied by the Venetian scenery were banked with palms and rubber trees and flowers in massive antique vases. The Institute has had many effective settings for its annual dinner, but probably none in which so many special and new features were thus brought out. For all of this great credit is due to the son of the manager of the Hotel Astor, Mr. F. A. Muschenheim, who was a member of the dinner committee and has been a member of the Institute for some years. It should be added that outside the banquet hall was placed a huge sign representing the badge of the Institute picked out in frosted lamps on a colored background. This was contributed by the New York Edison Company, with which were associated the Edison companies of Chicago, Boston, Philadelphia and Brooklyn in defraying the decoration expenses of the main room.

The dinner was presided over in a felicitous manner by President Ferguson. During the serving of an excellent repast cable messages, secured through the Commercial Cable Company, were read by Mr. Ferguson from the British Institution of Electrical Engineers, signed by President Mordey; from the Verband Deutsche Elektrotechnischer and from the Société Internationale des Electriciens of France, signed by President Boucherot. Among those at the speakers' table were: President L. A. Ferguson, Secretary Ralph W. Pope, Mr. E. E. Olcott, past president, American Institute of Mining Engineers; Mr. John Bogart, past secretary, American Society Civil Engineers; Mr. W. C. L. Eglin, president, National Electric Light Association; Mr. W. W. Freeman, president, Association of Edison Illuminating Companies, and Mr. Theodore Beran, acting-president, New York Electrical Society. Immediately to the right and left of the presiding officer were the speakers of the evening.

In his opening remarks President Ferguson outlined the history of the A. I. E. E. during the past 25 years and called attention to the foreign membership of 835 as indicating the high esteem in which the Institute is held by foreign engineers. The first speaker of the evening was Mr. Jesse M. Smith, president of the American Society of Mechanical Engineers and a charter member of the A. I. E. E. He stated that although technicmen group themselves about the words civil, mechanical, electrical and other names indicating special work, yet all are engineers. The work of each group so overlaps the work of the others that in order to find himself at home an engineer must join two or more groups.

Prof. Elihu Thomson responded to the toast "The Charter Members." He remarked that the 30 living charter members may properly experience especial satisfaction for the progress of the Institute, and expressed the opinion that after another 25 years the greater strides in the electrical industries as reflected in the greater growth of the Institute will give occasion for another similar celebration, but the marvelous record of advancement in the art is unlikely ever to be duplicated.

President Ferguson announced that a diploma of congratulation will be presented to each living charter member of the Institute. In response to his request, the following seven charter members who were present rose as their names were called: C. L. Clarke, G. A. Hamilton, C. O. Mailloux, T. C. Martin, Jesse M. Smith, Elihu Thomson and E. A. Sperry.

The past-presidents had as their spokesman Mr. Frank J. Sprague, who stated that among the living 17 past-presidents one name in particular stood forth for his continuous and effective activities, that of the senior past-president, Mr. T. Commerford Martin, whose journalistic career corresponded to the whole period of existence of the Institute. Mr. Sprague pointed particularly to what he termed the "inspiration of genius which used the Library Dinner given in commemoration of Dr. Wheeler's gift of the Latimer Clark collection as the vehicle to initiate effectively the interest of our modern Crœsus in the ambitious plan of the Institute, which under the direction of our then president and other officers has reached so fitting a fruition in the splendid buildings of the Engineering Societies and the Engineers' Club," and to his success as chairman of the building fund in gathering subscriptions from corporations and individual members for the $170,000 which constituted the institution's share of the conditioned capital burden. On behalf of the past-presidents of the Institute Mr. Sprague then presented to Mr. Martin a loving cup bearing on one side the inscription:

"To T. Commerford Martin, senior past-president of the American Institute of Electrical Engineers. Presented March 11, 1909, at the Quarter Centenary Celebration of the Founding of the Institute. In appreciation of 25 years of unselfish devotion to the best interests of the Institute and the advancement of the electric arts."

On the other side were the names of the 16 donors in order of seniority, as follows: Edward Weston, Elihu Thomson, Alex. Graham Bell, Frank J. Sprague, Louis Duncan, Francis B. Crocker, Arthur E. Kennelly, Carl Hering, Charles P. Steinmetz, Charles F. Scott, Bion J. Arnold, John W. Lieb, Jr., Schuyler S. Wheeler, Samuel Sheldon, Henry Gordon Stott, Louis A. Ferguson, past-presidents of the American Institute of Electrical Engineers.

The toast "Electrical Engineering as a Profession" was responded to by Dr. Alex C. Humphreys, president of Stevens Institute of Technology, and past-president of the American Gas Institute, who criticised a recent article by Mr. R. T. Crane, of Chicago, in which higher education in general was condemned. Dr. Humphreys also spoke of the commercial side of engineering, saying that although the practice of engineering should be along the most definitely marked lines of efficiency



ANNIVERSARY DINNER, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, HOTEL ASTOR, NEW YORK, MARCH 11, 1909.

and economy, both as to original investment and return thereon, yet this fact does not form a basis for a charge of commercialism.

The evening closed with the solo singing of "Auld Lang Syne" by Mr. A. Foxton-Ferguson (B. A. Oxon), the chorus being taken up in full volume by the diners. The menu of the banquet bore the badge of the Institute embossed in colors with a silver wreath, and the dates 1884-1909. Inside were lists of the officers, the past presidents, the charter members, the offices occupied by the society since the foundation, the dinner and reception committees, and the statistics of the growth of the Institute year by year. No fewer than 16 sections were officially represented and 10 of the sections occupied one table at which the geographical names were designated on a placard.

Motors in Steel Mills.

At the meeting of the American Institute of Electrical Engineers held on March 12, Mr. B. R. Shover read a paper giving a full description of the electrical equipment of the Gary plant of the Indiana Steel Company.

The generating station contains 17 2000-kw alternators and two 2000-kw direct-current generators; the latter two machines and 15 of the former are driven by gas engines using blast-

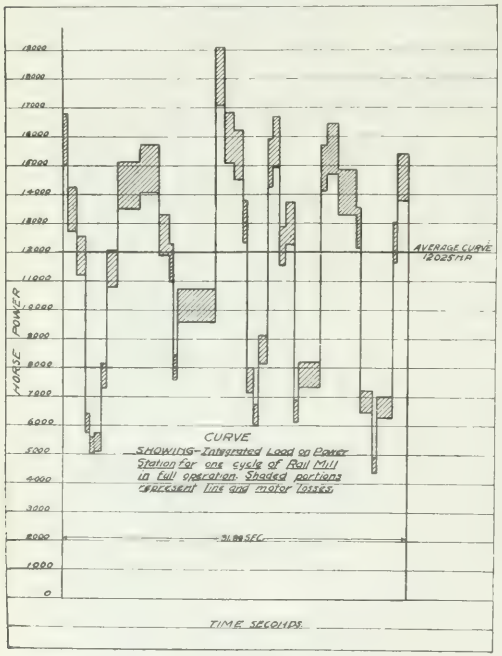


CHART SHOWING ESTIMATED COMBINED LOAD ON MILL.

furnace gas, while the remaining two alternators are driven by steam turbines. Use is made of two 4320-amp, 125-cell storage batteries for minimizing the fluctuations of load on the generating station; the batteries are joined to the alternating-current supply system by means of 2000-kw, split-pole synchronous converters.

Most of the motors are of the direct-current type receiving energy either directly from the generating station or from motor-generator substations. However, a very large portion of the energy is fed at 6600 volts to induction motors. The main rolls of the mill are driven by three 2000-hp and three 6000-hp induction motors, the combined rating being 24,000 hp. This mill has an output of 4000 tons of steel rails per 24-hour day, and is said to be the largest ever built. The induction motors are provided with heavy flywheels and are arranged with devices for varying the secondary-circuit resistance automatically in order to minimize the fluctuations in the power demanded by the motor equipment from the supply system.

To supply power to the train motors of this mill there are two circuits, each designed for 10,000 kw at 6600 volts. One circuit feeds energy to the three blooming-mill motors; that is, two 2000 hp and one 6000 hp. The other circuit feeds energy to the other three motors—that is, two 6000 hp and one 2000 hp. The accompanying diagram shows the estimated combined load carried by the motors with the mill working at full output. It shows the voltage and amperage of each of the circuits; the shaded portion indicates motor and line losses, and the upper line of the curve shows the character of the load on the system. This curve was developed to provide a basis for estimating the size of the storage-battery necessary to take care of the fluctuations and keep a relatively constant load on the generating station. The diagram shows that the load factor on the six train-motors is almost exactly 50 per cent; the motors are rated at 20,400 hp, the average load is 12,025 hp, the maximum total load 19,010 hp and the minimum 4300 hp.

Details of the control equipment of the plant are given elsewhere in this issue.

DISCUSSION.

The paper was discussed by Messrs. B. A. Behrend, Gano Dunn, D. B. Rushmore, W. T. Dean and Brent Wiley. Each of the speakers expressed his admiration for the installation described by the author, which was acknowledged to be the most important industrial application of the electric motor in existence.

Mr. Behrend outlined the difficulties encountered in the parallel operation of the alternators driven by the gas engines, and explained that successful results had been obtained by giving to the rotating mass a vibratory period differing properly from the explosion periods of the engines.

Mr. Dunn drew attention to the magnitude of the generating station and expressed the opinion that the satisfactory performance of the gas-engine units will result in the general adoption of electric equipments in steel mills. He said that although for the heavy services the induction motors are well suited, for many of the minor duties direct-current motors are preferable.

Mr. Rushmore remarked that the successful solution of the numerous industrial problems by applying electric motors would be looked upon in the future as having been the beginning of a new era in the electrical engineering history of this country.

Mr. Dean showed that the adoption of a non-reversible induction motor instead of a reversible direct-current motor equipment had decreased the cost of the motor equipment by 66 2/3 per cent. However, it necessitated the use of a three-high, continuously running set of rolls instead of two-high reversing rolls, and the addition of a lifting table.

Mr. Wiley outlined the numerous advantages of the electric motor over the steam engine for mill service, and explained that they greatly exceed the several minor disadvantages.

In closing the discussion, Mr. Shover stated that the generators show no tendency to hunt when fully loaded, although the ammeters indicate a certain amount of hunting when the load is light. This condition is attributable to the lack of uniformity of the thrusts exerted by the several pistons during each revolution. Due to the presence of the induction motors, there is required a considerable component of wattless exciting current and the power factor is correspondingly low, ranging from 30 to 70 per cent, according to the load. If trouble arises from the large exciting current, synchronous condensers will be installed.

President Ferguson announced that the problems encountered in the application of electric motors to mills have become of such importance that at the next annual convention of the Institute a special session will be devoted to the general subject of industrial power. All phases of the subject will be discussed at that time.

Hartford Tungsten Lamp-Service Practice.

A novel method of dealing with the tungsten-lamp situation in residence lighting has just been worked out by Mr. A. O. Dunham, president of the Hartford Electric Light Company. The Hartford company has for several months been trying out the service capabilities of the smaller sizes of tungsten incandescents designed for operation at 30 and 60 volts. Tests have shown that these low-voltage, extra high-efficiency lamps can be counted on for a life of at least 2000 hours. The filaments are tough and thick and will stand rough handling admirably. During the past three months several installations of these lamps in residence service have been made in a quiet way, and as a result the company is satisfied that it will be advantageous to introduce them generally on its circuits. In order to handle the situation profitably, however, Mr. Dunham has worked out a new plan of charging the customer for light used rather than billing installations on the usual basis of a price per kilowatt-hour. The following particulars of the scheme were obtained from Mr. Dunham by a representative of this journal:

The plan consists of the substitution of a meter dial reading cp-hours for the ordinary watt-hour dial of the ordinary induction meter and charging the customer a rate of .025 cent per cp-hour of service supplied. The customer pays the cost of installing the lamps initially, the charge being 20 cents each for either the 10, 20 or 30-cp, 30 or 60-volt lamps. Free renewals are to be given on all these lamps. The company installs an "economy coil" or compensator in each residence to reduce the potential from that of the mains to 30 or 60 volts, as the case may require. This compensator has the advantage of absorbing the effect of voltage fluctuations on the high-tension lines back of the subway transformers from which secondary groups of loads are fed, and it is provided with multi-voltage taps for convenience.

Mr. Dunham states that "the whole system of meter measurement has gradually adjusted itself to a certain ratio between watts, or the power used in creating light, and the other costs entering into the production of the candle-power. This has been particularly the case in house lighting. The general average price of house lighting in the larger cities and in the older stations has become about 10 cents per kw-hour—that is, the whole cost of light is placed upon the kilowatt measurement, whereas more than one-half the cost consists of distribution, management and overhead expenses. This is clearly shown by the fact that the same meter measurement of watts has an altogether different price when it is used simply as power. The price of power in the more modern stations and in the larger cities ranges from 2 to 6 cents per kw-hour, while the cost of light ranges from 4 to 12 cents, or about double the price, which would not be the fact if the customer paid for the same thing in both instances.

"For the power used the customer pays for the actual kilowatts, but for the light delivered the customer pays for the actual kilowatts used plus the various other expenses which have been attached by custom and necessity. This has placed all the stations in a peculiar relation to the old-fashioned wattmeters in regard to the new lamps, and they find themselves reduced in income if they use the new lamps to one-half of their old revenue. This cannot be avoided except by changing the measuring instrument or by raising the price of the kilowatts used to double that charged for the old lamps, because the wattmeter measures a little less than half the actual cost of the candle-power.

"If you are selling light from 10-cp or 16-cp lamps your customer is paying for the watts actually used plus all other expenses incurred; distribution, maintenance, lamps, and all other overhead expenses; that is, a sum which is calculated to double the watts used.

"We have only to remember that for the same kilowatts we should probably get an average of 5 cents for light instead of 10 cents, as we do at present. Modern stations are organized for the distribution of light more or less, some of them almost entirely for this purpose, and if they should substitute tungsten lamps for the 3.1-watt lamp, would find their income cut in two. The customer would be using only half as much energy as with the 3.1-watt lamps, and while the money paid for lights would only include this energy, all the other costs would still remain, and the station would receive nothing for them unless the price per kilowatt-hour could be doubled.

"For the business to survive and the plants to become actually without value, they must either double the price per kw-hour in light or get a meter measurement which will pay other expenses besides the watts used, and which enter into the question of candle-power supply. All questions as to the increased use of light on account of its lower cost, and the proper price to charge customers in consequence of the saving in the cost of production by using these new lamps, are entirely aside from this great basic fact that customers are now paying, not for the real kilowatts used, but for the kw-hours used plus the cost of distribution, maintenance and all other overhead expenses."

Mr. Dunham has concluded that, instead of charging for a "purely fictitious kw-hour," it would be much better to adopt the measuring instrument for the new lamps by such a change that this instrument may actually measure candle-power instead of a portion of it, namely, the watts. It is quite as easy to fix an arbitrary charge for candle-power as it is for watts by taking the present standard of charge per candle-power and putting a dial on the meter which will measure the candle-power in fact and not have to be translated into candle-power from watts.

Thus, the graphitized filament lamp gives 20-cp for 50 watts, or 2.5 watts per candle-power, and takes for every 400 cp 1000 watts; therefore, if 400 cp is established as a basis for charging, supposing that a 10-cent rate applies to 1000 watts, the central station may charge .025 cent per cp-hour. Therefore, if the dial of the meter is arranged to read candle-power instead of watts, the scale will show 400 cp-hours for each 1000 watts, as shown on the present meter.

Mr. Dunham illustrated the new plan by assuming a house having five graphitized filament lamps which are burned on the average four hours per day. These five 20-cp lamps burn 50 watts per hour each, or 1 kw-hour in four hours, for which the company gets 10 cents per kw-hour per day, or $3 per month. This, translated into cp-hours, would be 400 cp-hours per day, or 12,000 cp-hours per month, and for this makes the price per cp-hour .025 cent. If five 20-cp tungsten lamps are substituted, giving 100 cp for four hours per day at .025 cent, they cost 10 cents per day, or $3 per month, the exact income received when the less efficient lamps were in service. The company gets the same revenue and the customer a better light, while the improved efficiency of the tungsten lamp makes it possible in some cases to share the economy by a rate reduction. The company sells the consumer light, which he wants to buy, and at a fixed or lowered price, according to conditions. The company remains free to take advantage of the progress of the art and the customer is encouraged to make a progressive installation.

Enclosed Fuse Litigation.

The United States Circuit Court for the District of Connecticut has rendered a decision in a case involving a patent issued Oct. 23, 1900, to Joseph Sachs, covering the use of a thin strip of metal as the fusible element of an enclosed fuse. In the case in suit the defendant was charged with infringement of this patent. The court held that a patent of prior date granted to Mordey showed all of the elements of the patent in suit combined in the same way and for the same purpose, except that the Mordey strip is not the "thin strip of extended area" which is the novelty of the invention claimed to be infringed. The safety fuse alleged to infringe has as one of its elements a flat strip of some thickness, but attenuated at the central point so as to expedite quick breaking under abnormal current, while nothing in the Sachs patent hints at such a construction. The court decided that there was no infringement and dismissed the case. The parties to the suit were the Johns-Pratt Company, compainant, vs. the Sachs Company et al.

Meetings of N. E. L. A. Sections.

At the regular meeting of the Brooklyn section of the National Electric Light Association addresses were made by Mr. W. W. Freeman, Mr. Henry L. Doherty and President Eglin. Mr. Freeman emphasized his belief that membership in the association would aid greatly in the attainment of three essentials of every successful business man—knowledge, initiative and judgment.

President Eglin called particular attention to the notably greater benefits accruing from membership in the association as compared with the various technical and similar organizations. He spoke of the phenomenal growth of the business and the necessity for looking to the providing of means for properly handling it, by educating to the utmost every one connected with it. The association is undoubtedly the greatest single factor in this education.

Mr. Doherty, the originator of the company section idea, as well as of many of the progressive movements of the association, gave a slight sketch of his own early struggles for engineering knowledge, and said in substance that they had created in him the desire to help others gain such knowledge in an easier way, and that one of the most admirable and thorough ways for men to progress was through these organizations—through getting together and exchanging ideas and enthusiasms.

The following papers were read and discussed: "Illuminating Engineering from a Roman's Commercial Standpoint," by Mr. J. L. Wiltse; "Overhead and Underground Distribution," by Messrs. L. E. Moffitt and P. D. Sharkey; "Substations," by Mr. E. W. Babcock.

At the last meeting of the Altoona section a paper was read by Mr. J. C. Scholl entitled "Fuel Combustion for Gathering Steam."

The Rochester section has held four regular meetings. At the first of these an informal talk, illustrated with experiments, was given by Mr. John C. Parker, mechanical and electrical engineer of the company, showing some of the historic phases of the development of the electric art and illustrating the discovery of the fundamental principles. At the second meeting Mr. F. A. Willard, late commercial agent, gave a talk illustrated with lantern slides, showing the progress of the company's commercial work in gas distribution during the recent period of business depression. At the next monthly meeting Mr. T. H. Yawger, superintendent of the electric department, described the development of the generating and distribution systems in Rochester, which has been a pioneer in many of the developmental phases of the art. The fourth paper was presented March 4 by Mr. J. O. Montiganini, engineer with the electric department, and described the distribution system of the company.

The March meeting of the Chicago section will be given over entirely to entertainment. Dinner will be served at 6:30 o'clock, after which a program consisting of a number of musical selections will be given, and Mr. J. T. Mountain will take the members on a trip around the Mediterranean and up the Nile. Mr. Mountain recently made a three months' visit to this part of the world, and will show a hundred or more views.

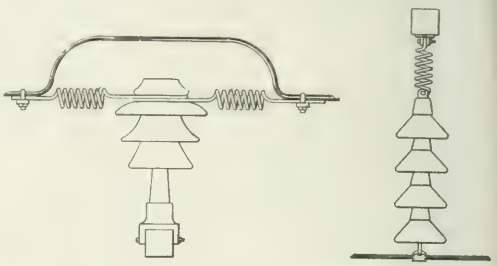
Ithaca A. I. E. E. Section.

The Cornell Branch of the American Institute of Electrical Engineers held its annual banquet Friday, March 5, at 6 p. m., in the Sibley College Club Rooms, with an attendance of about 75 members of the local branch. Mr. D. B. Rushmore, of Schenectady, was the guest of honor, and Prof. E. L. Nichols officiated as toastmaster. After an enjoyable menu a number of toasts were given. Professor Norris responded to the toast on "Speed Graphs or Acceleration on the Motor Curve," giving an interesting analogy between the speed control of the railway motor and the influence of the professor upon the working rate of the student. This banquet has become an established custom and adds materially to the enthusiasm of the members. After the banquet Mr. Rushmore addressed 125 members of the local branch on the subject of "The Application of Electricity to Steel Mills." The address was fully illustrated by lantern slides showing the various processes in the making of steel, including the mining of the ore, its transportation and unloading, conveyance to the blast furnaces; rolling, sawing and drilling of the steel product. Especial attention was directed to the use of the electric motor in these processes, and an excellent idea was given of the hard service and rugged nature of these powerful motors.

Prof. H. H. Norris has resigned the secretaryship of the local branch, and while he will maintain an active part in the work, the office of secretary has been filled by the election of Mr. B. C. Dennison, instructor in the electrical engineer department.

Protection of High-Tension Insulators.

In the accompanying illustrations are shown two forms of support for high-tension lines which are intended to protect the insulator against breaking down from lightning or any high-frequency discharge. The protective support consists of a steel-wire coil of high resistance and inductance inserted between the conductor and the earth. Fig. 1 shows the arrangement used with an under-supported insulator, while Fig. 2 shows



FIGS. 1 AND 2.—INSULATOR PROTECTION.

the scheme employed with an insulator of the under-hung type.

The above-described arrangements have been devised for reducing the charging current reaching the insulator during lightning or other disturbance, and thereby preventing the cracking of the insulators. A patent covering the combinations outlined herewith was issued on Feb. 9 to Mr. W. T. Goddard.

Steel Mill Engineers at Schenectady.

At the invitation of the General Electric Company, about 50 prominent steel mill engineers from all parts of the country met at Schenectady on the morning of March 9 for the purpose of making a study of the design and construction of electric apparatus, of particular interest in connection with steel mill work. The meeting continued over Wednesday and until the afternoon of Thursday.

During the visit of the engineers three meetings were held for the purpose of presenting and discussing papers. Mr. W. L. R. Emmett read a paper entitled "Steam Turbines." "Centrifugal Compressors" was the title of a paper by Mr. L. C. Loewenstein. A paper dealing with mill-type motors was presented by Mr. K. A. Pauly. Mr. H. E. White gave an illustrated talk on the design and operation of automatic control equipments. Lectures relating to the transmission of energy and the protection of circuits from lightning were delivered by Dr. C. P. Steinmetz and Prof. E. E. F. Creighton.

The visiting engineers were conducted through the factory to inspect the various types of apparatus described in the papers. The machines were shown in every stage of manufacture and in operation, under both normal and exceptionally severe conditions.

Municipal Ownership Checked in Massachusetts.

The Massachusetts Legislature has killed a bill to allow cities and towns to establish gas and electric light plants on a majority vote of the City Council and the voters of the municipality. The present laws require this vote twice in successive years, thereby safeguarding the existing investments in central-station property. The measure was reported adversely by the Committee on Public Lighting and was defeated in the House by a vote of 34 to 61.

Central-Station Extensions in Des Moines, Iowa.

With increasing demands for its service, the Des Moines (Ia.) Edison Light Company finds it necessary to make a considerable extension to its system. Accordingly, additions will be made to the steam generating plant, including a 2000-kw horizontal Curtis turbine and two additional water-tube boilers, with the condensers and pumping equipment to go with them. The necessary additional switchboard equipment will also be needed. Sargent & Lundy, of Chicago, are the consulting engineers for this power-plant extension.

Deterioration of Lead Sheaths.

In a paper recently read before a conference committee consisting of representatives of independent telephone operating companies, Mr. Thos. G. Spencer discussed the deterioration of lead sheaths of aerial and underground telephone cables. The author divided the causes for deterioration of the sheaths into six general groups, namely, mechanical injury, chemical decomposition, electrolysis, vibration, lightning, and impurities in the lead. In order to protect the cables from chemical decomposition and electrolysis it is desirable to build the conduit so that no water will ever lie in it—that is, the duct should slope from the middle both ways to the manholes; the joints should be absolutely watertight; electrical surveys should be made frequently and the cable should be grounded where necessary.

The effect of vibration is to crystallize the lead. Vibration may be caused by too much slack in the messenger, too little slack in the cable, the use of long spans, or by suspension from vibrating structures. The author exhibited several specimens of cable that had been injured by vibration, caused by the movement of trains over elevated and bridge structures.

Cost of Concrete Piles in a Power-Plant Foundation.

In a paper recently presented before the Boston Society of Civil Engineers Messrs. Sanford E. Thompson and Benjamin Fox gave the cost of driving cast reinforced-concrete piles for the foundation of the new power plant of the Boston Woven Hose & Rubber Company in Cambridge, Mass. The piles were 30 ft. 6 in. long, 14 in. square at the butt end and in general 9 in. square at the tip. The piles were reinforced with four ⅞-in. corrugated steel rods and loops of ¼-in. corrugated bars. The butts of the piles were extra reinforced by ⅜-in. to ½-i. steel rods.

The piles were made by a foreman and a gang of four carpenters, eight laborers and four steel men. The concrete gang mixed and placed concrete in 10 piles in 10 hours. The concrete was mixed by hand and the age of the piles when driven ranged from 30 days to 41 days. The piles were driven by a 4700-lb. hammer. The pile-driving gang consisted of a foreman, engineman, pumpman and seven helpers. The cost of preparing and driving, with all allowances, including pump hose, incidentals, connections and profit, was $1.25 per linear foot.

CURRENT NEWS AND NOTES.

MANTLE ARC LAMP.—A patent was issued to Mr. Isador Ladoff on Feb. 23 for an arc lamp in which use is made of a mantle, similar to that of a Welsbach gas mantle, which surround the arc and is heated to incandescence thereby.

TELEPHONE AND TELEGRAPH REGULATION IN NEW YORK.—A bill has been introduced in the New York Legislature extending the powers of the State Public Service Commissions over telephone and telegraph companies.

NEW JERSEY PUBLIC UTILITIES COMMISSION.—Owing to a contest between the supporters of rival bills for the establishment of a public service commission in New Jersey, it is predicted that neither bill will pass the present session of the Legislature.

PROPOSED PROHIBITION OF ELECTRICAL COAL MINING.—A new code, to regulate bituminous coal mining in Pennsylvania, which has been prepared by a commission appointed by Governor Stuart, will, if adopted, prohibit the use of electric power, according to the statement of coal operators. At a meeting held to protest against the code it was asserted that its provisions would require the removal of millions of dollars' worth of electrical machinery now in use.

POWER FORCED DRAFT NOT A PUBLIC NUISANCE.—Upon appeal, a Brooklyn court has reversed a decision which held a railway power house guilty of maintaining a nuisance, on the grounds that owing to the use of forced draft large quantities of small cinders and unburnt coal from the chimneys were distributed in the neighborhood to the discomfort of the residents. In reversing the lower tribunal the court held that the defendant does not contaminate the air with noisome and noxious vapor and gases, nor can it as well conduct its business in some remote place. The principle of a public nuisance cannot be upheld merely because particles of hard coal in place of black smoke were emitted from the chimneys.

TELEGRAPHERS STRIKE IN PARIS.—The telegraph and telephone operators employed in the bureaus of the postoffice at Paris went on a strike March 13, and according to last accounts the two services are badly muddled in consequence. The city is practically cut off from the rest of the world telegraphically and telephonically. Regarding the interruption to the London service, it is stated that the officials explain it as due to violent weather in the Channel. It is said that 6000 employees of the two branches of the service are out, and that the Government has ordered army telegraphers to Paris. The agitation also includes the railway mail clerks, and they and the telegraphers seem to be acting in sympathy with each other. A later dispatch from Paris states that the strike came to a sudden end on March 13, when the Government threatened instant dismissal, with the loss of State servant privileges, unless work was resumed.

GERMAN MARINE WIRELESS.—During a recent debate in the Reichstag, it was stated that of 167 German vessels fitted with wireless, 150 have Marconi equipment. The requirement of an English operator with Marconi outfits was criticized. In replying to the criticisms that German wireless systems were discriminated against, a Government official said that as the English wireless stations refused to communicate with ships having other than the Marconi system, the German ships had no other recourse than to install the Marconi apparatus. As England had not joined in the international agreement, English ships were not under any obligation to respond to a German vessel carrying another system. It would be a good thing, he said, to increase the number of vessels carrying the German system, but it would not be wise to emphasize too strongly the principle of nationality, since this might influence other nations to insist upon the installation of their systems.

CENTRAL STATION SOLICITORS' HANDBOOK.—The executive committee of the National Electric Light Association has authorized the publication of a solicitors' handbook, which has been edited by Mr. Arthur Williams.

RIVER ILLUMINATION.—One of the recommendations of the Chicago Harbor Commission, which recently presented an important report on the subject of maintaining and improving Chicago's water-shipping facilities, was that the Chicago River be illuminated by electricity for navigation at night.

NAVAL 3000-MILE WIRELESS STATION.—After many delays the contract for the 3000-mile naval wireless station at Washington was awarded March 10 to the Fessenden Wireless Company. The work is to cost $182,600, including the erection of a 600-ft. tower at Washington and the wireless equipment of several vessels.

THE NEW ENGLAND WIRELESS SOCIETY was incorporated under the statutes of the Commonwealth of Massachusetts on Feb. 4 for the study and improvement of wireless communication. The regular meeting is held the first Friday in each month. Mr. Gordon S. Wallace, 563 Massachusetts Avenue, Boston, is acting secretary.

NEW MACKAY CABLE.—News comes from Boston to the effect that the Mackay Companies, through the Commercial Cable Company, will lay a submarine cable between New York and Newfoundland. It is stated that the new cable will reduce the transmission time to Europe 30 to 35 per cent. The cable will be about 1700 miles long and cost at least $1,500,000.

WEST VIRGINIA INDEPENDENT TELEPHONE ASSOCIATION.—The fourth annual convention of the West Virginia Independent Telephone Association will be held in Parkersburg, W. Va., on May 27 and 28, 1909, with headquarters at the Chancellor Hotel. Arrangements have been made for exhibits of telephone apparatus and material. Mr. W. C. Handlon, Wheeling, is secretary.

WIRELESS ELECTRICAL ENGINEER WANTED.—The United States Civil Service Commission will hold an examination April 21 to secure eligibles for a position as assistant electrical engineer, expert in wireless telegraphy, in the United States Signal Service. The salary will be $1,500 to $1,800 per annum. Information as to the various places of examination can be obtained from the United States Civil Service Commission, Washington.

BOARD OF TRADE TELEGRAPH COMPANY.—The Chicago City Council committee on gas, oil and electricity has recommended for passage an ordinance granting a franchise to the People's Mutual Telegraph Company, which intends to operate a telegraph system connecting Chicago, St. Louis, Kansas City and other cities in the Southwest. It is said that this telegraph company is backed by the Chicago Board of Trade.

NATIONAL CONFERENCE ON STANDARD ELECTRICAL RULES.—The seventh annual meeting of the National Conference on Standard Electrical Rules will be held in Room 8, Engineering Societies Building, 29 West Thirty-ninth Street, New York, on Friday, March 26, at 11 a. m. The meeting will follow that of the Underwriters' National Electric Association and action will be taken on the rules adopted by the insurance interests.

APRIL A. I. E. E. MEETING.—At the New York meeting April 9 of the American Institute of Electrical Engineers, two papers will be presented on the subject of high-tension transmission. One by Mr. K. C. Randall, engineer in charge of design of the Westinghouse Company, will treat of the design of high-voltage transformers, oil-switches and lightning arresters for outdoor installation. The other, by Mr. A. B. Reynders, engineer of the Westinghouse Company, will deal with a new development in the design of high-voltage terminals and bushings.

OMAHA ELECTRICAL SHOW.—The Omaha Electrical Exposition will open on May 6 and continue 10 days, closing May 15. It will be held in the Auditorium, a handsome and spacious building in the heart of the city, and among the features will be a new and attractive scheme of decorative lighting. The show will be given by the Omaha Electrical Exposition, a corporation composed of the electrical men of Omaha and Council Bluffs. Mr. J. N. Gillan, who managed the show last year, is also the manager this year.

EXTRA FEE FOR DELIVERY OF TELEGRAMS.—According to the Supreme Court of Indiana, a telegraph company doing business in that State may charge an extra 10 cents for delivering a message in a city at a point more than one mile from its office. The case came up in Indianapolis, where the Western Union Telegraph Company refused to deliver messages free in all parts of the city. The original statute relating to this matter has been in force 56 years, it is said, and is unreasonable now, according to the court's decision, because the city has grown far beyond its old boundaries.

BENEFITS OF COMBINATION.—In his article "When Does Profit Become Usury?" in the March *World's Work*, Dr. Alexander Graham Bell says: "Now it is noteworthy that, so far as the producers are concerned, combination means peace; competition, warfare. Competition means a mob, without organization, and weak for effective work; combination, an organized force, powerful and efficient. It is only necessary that this force should be controlled in the interests of the people as a whole in order to be beneficial in every way." Dr. Bell discusses unfavorably the plan of municipal ownership.

SUBURBAN TELEPHONE RATES.—The vexed question of suburban telephone rates has come up in Harvey, Ill., which is 20 miles from the center of Chicago and in the territory of the Chicago Telephone Company. The local exchange rate in Harvey for business telephones is $48 a year, and, in addition, the regular toll rate is charged for Chicago connections. Harvey is a manufacturing suburb, and the business men there assert that this toll rate places them at a disadvantage compared with business houses in competing lines in the city. Mr. B. E. Sunny, president of the Chicago Telephone Company, contends that the rates are justified. The suburban concerns escape city taxes, and they cannot expect, in equity, to be put on the same basis with city manufacturers. The toll-line service is expensive and the company is entitled to a reasonable profit on it. The Harvey men may lay their grievance before the Legislature.

NOON MEETINGS OF TECHNICAL SOCIETIES.—Noting, perhaps, the success of the Electric Club of Chicago in holding weekly meetings at a luncheon followed by a short address and brief discussion, the Chicago section of the Illuminating Engineering Society sought an expression from its members in relation to the question of holding the April meeting at noon. A letter ballot was taken on this subject, and at the meeting of March 11 the secretary, Mr. George Harvey Jones, reported that out of 60 responses 47 were in favor of trying the experiment and 13 were opposed to the innovation. The general opinion seems to be that there are so many technical and semi-technical societies at the present time that members feel that an undue proportion of their evenings is given up to attendance at the meetings. Therefore, the idea of holding some of them during the luncheon hour at noon was hailed with general approval. It is likely, therefore, that the April meeting of the Chicago section of the Illuminating Engineering Society will be held at noon. The subject to be discussed will be some aspect of illuminating engineering appealing more particularly to the gas-lighting members.

Motor Equipment of the Gary Rolling-Mill of the Indiana Steel Company.

THE new plant of the Indiana Steel Company, located at Gary, Ind., is notable not only on account of being the largest steel plant in the country, but because it has probably the largest application of electric power in a single industrial plant. A general idea of the electrical equipment was given in an article in *Electrical World* of Sept. 26, 1908, which illustrated the large gas-engine power house and contained an outline of the other electrical features of these mammoth steel mills. An abstract of a paper by Mr. B. R. Shover, electrical engineer of the Indiana Steel Company, delivered before the American Institute of Electrical Engineers, March 12, 1909, on "The Industrial Application of the Electric Motor as Illustrated in the Gary Plant of the Indiana Steel Company," is given elsewhere in this issue.

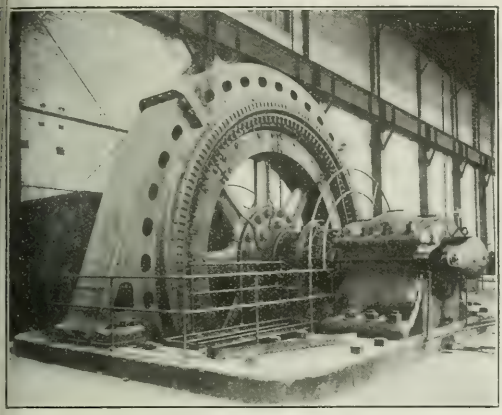


FIG. 1.—6000-HP RAIL-MILL MOTOR.

Although electricity is used for a great number of purposes around the plant, a considerable percentage of the output goes to the operation of rail and merchant mills, which are entirely motor-driven and which employ three-phase induction motors on a scale and of a size which make the driving equipment unique. The tables and transfers for handling the product through the mill and which operate intermittently are mainly driven by 250-volt, direct-curent motors which were considered to permit of greater ease of control than alternating-current motors.

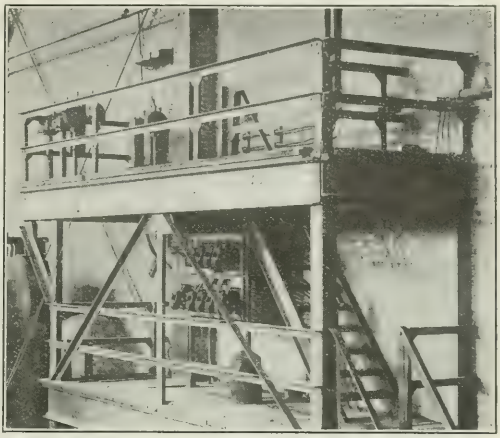


FIG. 3.—PULPIT CONTROLLING STATION FOR 250-HP RAIL-MILL LIFT.

Interest naturally centers about the large induction motors used for driving the main rolls of the mill. These aggregate 24,000 hp. They are of General Electric manufacture, 25-cycle, 6600-volt, three-phase. These large motors and their ratings are as follows:

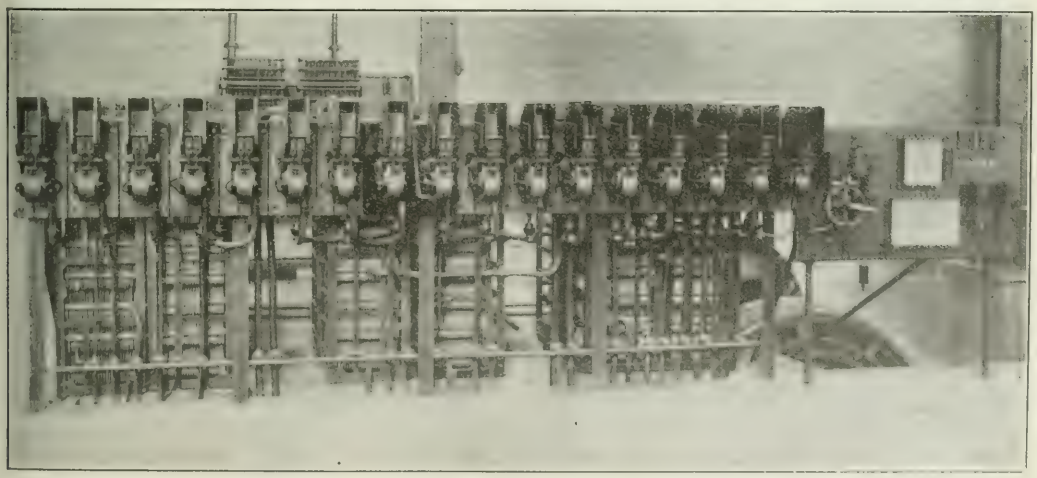


FIG. 2.—40000 HP MOTOR BOARD AND STARTING APPARATUS.

The electric power for the operation of this gigantic plant is principally obtained from gas engines. The present plant has 34,000 kw in 2000-kw gas engine units and 4000 kw in steam turbo-alternators. The steam units were installed for use during construction and in starting up. Of the total rating 30,000 kw is in 25-cycle, 6600-volt, three-phase alternators, and 4000 kw in 250-volt, direct-current generators.

Two 14-pole, 214 r.p.m. motors rated at 2000 hp with 40 deg. rise in temperature or 3000 hp for one hour at 60 deg. rise. These are provided with flywheels built up of laminated steel weighing 100,000 lb. each, and drive, through gearing, four 40-in. blooming-mill stands in the rail mill.

One 34-pole, 68.1 r.p.m. motor rated at 2000 hp continuous duty with 40 deg. temperature rise, and 3000 hp for one hour

at 60 deg. rise. This motor is provided with a flywheel built up of cast-iron sections adjusted according to the requirements of the mill after installation. This motor drives a 28-in. forming mill to which it is directly connected.

One 36-pole, 83.3-r.p.m. motor rated at 6000 hp with 40 deg. temperature rise continuous duty, with a rating for 9000 hp for one hour with 60 deg. rise. This motor has a flywheel of cast-iron sections of adjustable weight. It is directly connected to 28-in. roughing, second-edging and leading mills.

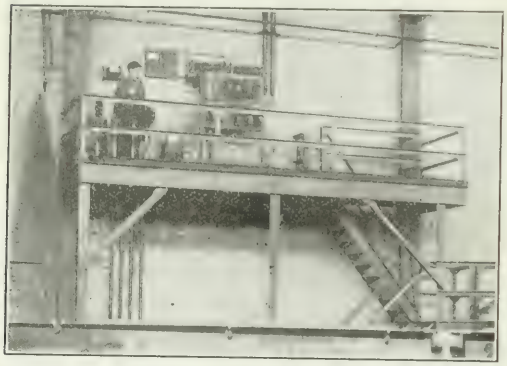


FIG. 4.—PULPIT CONTROLLING STATION, RAIL MILL.

One 34-pole, 88-r.p.m., 6000-hp motor with a continuous rating of 9000 hp for one hour with 60 deg. temperature rise. This motor has a built-up, cast-iron sectional flywheel and drives the 28-in. roughing dummy, first-edging, and finishing mills.

One 40-pole, 75-r.p.m., 6000-hp motor with 9000-hp rating for one hour with 60 deg. temperature rise. This motor has a cast-iron sectional flywheel of adjustable weight and drives the 40-in. three-high rolling mill directly connected. The cast-iron sectional flywheels are made adjustable in weight because the requirements cannot be determined accurately except by actual trial.

To prevent damage to the mill or motors by end thrust caused by the breaking of a spindle or roll, the motors are so arranged that when the end thrust exceeds 150 tons, two breakable rods, attached to the bearing pedestal will give way, allowing the rotor to move away from the rolls and revolve freely. One of the 6000-hp induction motors with this feature is shown in Fig. 1. As will be seen, the motors are located in a separate fireproof room adjoining the rolling mill, a shaft extending through the wall.

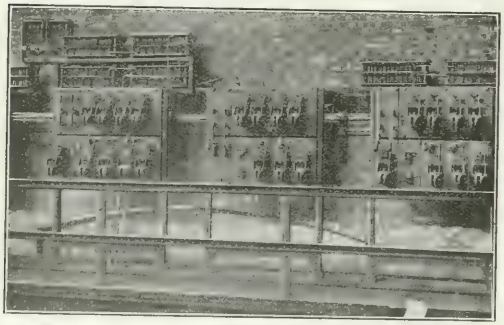


FIG. 5.—PULPIT CONTROLLING STATION, ROUGHING MILL.

In addition to the motors above mentioned, all of which drive the rail mill, there are to be two 2000-hp motors and three 6000-hp motors in the billet mill, and two 3500-hp motors in the merchant mill. The 6000-hp motors have a power factor at rated load of about 87 per cent, which increases to about 92 per cent at 9000 hp.

Of course the fluctuations in load on these motors are extreme. To keep down the fluctuation of current which will occur in spite of the large flywheels, means have been provided for automatically introducing resistance into the secondary circuits of these motors when the speed decreases by 2 per cent or 3 per cent. The resistors are connected in multiple-delta and contactors acuated from 220-volt relay circuits open and close the circuit through the resistors so as to vary its value. As the load comes on the motor, the resistance is automatically introduced into the rotor circuit and withdrawn after the load goes off. An overload relay in the main motor circuit causes the cutting in of resistance when the load exceeds a certain amount. Fig. 2 shows the secondary resistors and the contactors.

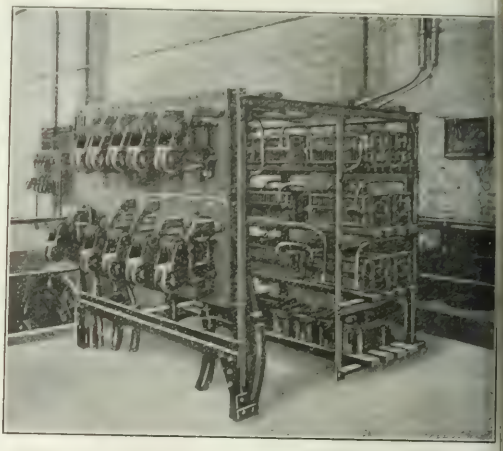


FIG. 6.—250 HP MOTOR-BOARD.

The main motors for driving the rolls are started and stopped by remote control from the pulpits in the rail mill proper, although the motor attendant in the motor room can bring them to rest independently of the master controller on the pulpit in case of emergency. The contactors and resistors for the control of the large motors are located in the motor room.

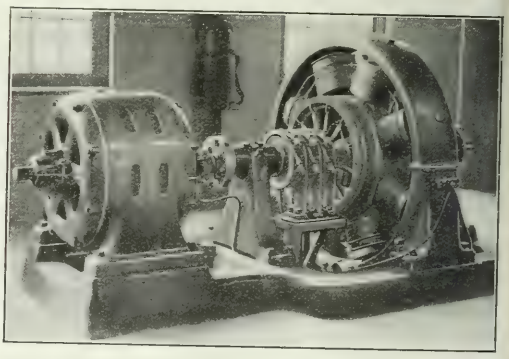


FIG. 7.—EXCITER FOR SPLIT-POLE ROTARY.

Some nice problems in motor control came up in connection with the movement of the product through the mill. For the transfers, lifting tables and ingot buggies use is made of 250-volt, direct-current motors. Motors for driving saws and drills which operate continuously (and hence present no special problems in control) are of the three-phase induction type, operated from step-down transformers at 440 volts. Con-

ers for the various direct-current motors in the rolling s and for the smaller induction motors are of the Cutler- mmer Manufacturing Company make.

here are 59 remote controllers of various kinds in use on e smaller motors in the rail and finishing mill. In the ng mill proper there are 21 table and two transfer motors. principle employed in all of the controllers for this char- r of work is that of automatically limiting the starting ent and rate of acceleration by means of series relays on contactor. These series relays prevent each succeeding tactor from short-circuiting its step of the resistor until current and torque have fallen below the amount for which relay is set. The operators in the various pulpits in working r master controllers are therefore unable to vary the rate acceleration. They simply move their master controllers to ain points and the series relays and contactors control the eleration.

ig. 3 shows a pulpit controlling station for a 250-hp motor rating a lift in the rail mill. The contactor board of the motor controller in this case is located immediately under the pulpit, since the motor is near by. In other cases the contactor board may be some distance from the master controller. Fig. 4 shows a pulpit from which the operator controls the hot saws, which are operated by 440-volt induction motors.

The tables that raise and lower the rails to the saws are worked with direct-current motors fitted with controllers whereby the operator sets the handle at a certain point, and the complete cycle of raising and lowering the table is accomplished without change of controller. This action is accomplished by master-control circuit contacts which are made and broken by the movement of the table.

Another interesting application of automatic control is in connection with the ingot buggies, of which there are two, operated from a pulpit. To prevent collision, the controllers are interlocked so that both buggies cannot be brought to the center at the same time. One buggy operates north of the table and the other south of the table, each serving six rows of four pits. These buggies can be stopped at any pit automatically, so that all the operator has to do is to set the controller on the point corresponding to a certain pit. When opposite that pit the buggy opens a switch, which in turn opens the master-controller circuit. This action drops the contactors that close the main circuit to the motor and closes a series braking circuits through the motor.

Figs. 5 and 6 give a good idea of the solenoid-operated contactors or contact makers and grid resistors controlling the direct-current mill motors.

The estimated combined load of the various motors on the rail mill in full operation shows variations from 4400 hp to 19,000 hp. Other motors about the plant in hoisting work also cause a very fluctuating load. To even up these fluctuations on the power plant two sets of storage battery, each of 125 cells, have been installed, to charge into or discharge from both the alternating-current and direct-current systems.

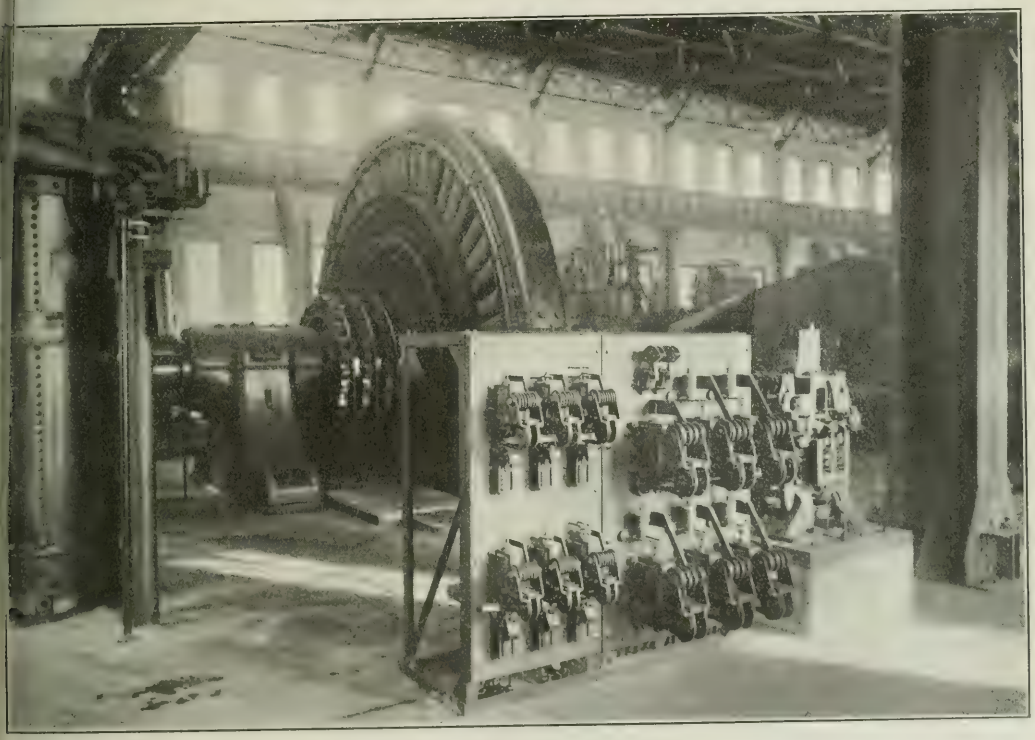


FIG. 8. SPLIT-POLE ROTARY AND EXCITER

The alternating-current charge and discharge are to be accomplished by two 18-pole, 2000-kw, split-pole rotary converters, one of which is shown in Fig. 8. The peculiar characteristic of these split-pole converters is that by varying the field excitation of the different poles, the commutator voltage can be made to vary independently of the slip-ring voltage of the converter. Thus, although the alternating-current voltage is kept constant, the batteries can be made to charge from or discharge into the alternating-current system by means of the converter.

To vary the field excitation on this split-pole converter use is made of a motor-driven exciter of the type described by Mr. J. L. Woodbridge in his paper on "Storage Batteries" before the 1908 A. I. E. E. Convention at Atlantic City. This exciter is explained and its circuit diagrams given on page 85 of this journal dated July 11, 1908. Fig. 7 shows this exciter driven by a synchronous motor. The starting board of the split-pole

rotary converter is shown in Fig. 8, in which can be seen the solenoid-operated contactors which short-circuit the direct-current resistors in the circuit from which the converter is started. After this rotary converter is brought up to speed, a 10,000-amp, direct-current, solenoid-operated switch (seen at the right in Fig. 8) is closed, so that the charge and discharge from the battery through the rotary pass through this switch and relieve the rheostat contactors of the load. This rotary converter, like the direct-current motors, is started by remote control with automatic current limiting series relays to operate the contactors in the main circuit.

For the foregoing information and illustrations pertaining particularly to the motor equipment of the rolling mill we are indebted to the courtesy of the officers of the Indiana Steel Company, and also to the Institute paper by Mr. B. R. Shover.

Electrical Engineering Features of the Alaska-Yukon-Pacific Exposition.

By A. T. Quigley.

THE stated purpose of the Alaska-Yukon-Pacific Exposition, which will be held at Seattle, Wash., from June 1 to Oct. 16, 1909, is to exploit the resources and potentialities of Alaskan and Yukon territories in the United States and in the Dominion of Canada; to make known and to foster the vast importance of the trade of the Pacific Ocean and the countries bordering thereon.

The site selected covers 250 acres, belonging to the University of Washington, which will make use of many of the buildings after the exposition closes. The State of Washington has appropriated $600,000 for university buildings and $400,000 for State buildings at the exposition. The Government has appropriated $650,000 for representation, while the citizens of Seattle have purchased $1,000,000 of stock in the exposition. The work on the buildings has progressed so rapidly that it is stated that the fair will be ready on time.

The exposition will possess many features of particular interest to electrical engineers. The more prominent of these features can be grouped into five divisions, as noted below:

TRANSPORTATION FACILITIES.

The exposition is located about five miles from the business center of Seattle. Practically all of the electrical railway systems of the city and surrounding territory are owned by the Seattle Electric Company, a corporation under the control of the Stone & Webster Engineering Corporation, of Boston. This company has found it necessary in anticipation of the unusual loads that will be thrown upon its system during the next year to make extensive additions to the generating station, substations and rolling stock. During the last two years the company has been carrying on extensive track construction operations, adding to its generating equipment and purchasing new cars. A lump order for 140 cars, to be delivered before the opening of the exposition, was placed with the St. Louis Car Company some time ago. It is estimated that in anticipation of the exposition crowds, and on account of natural growth of business, the Seattle Electric Company has during the last two years expended almost $1,750,000. While it is in no way likely any large proportion of this expenditure will be returned during the exposition period, it is certain that the Seattle Electric Company is making an effort to handle, if possible, a part of the transportation business, although a steam road passes directly through the exposition grounds. In all, the railway company will have six double-track lines available for handling the exposition crowds and arrangements are now being made whereby loop facilities will be obtained for each of these tracks so as to move the traffic more expeditiously.

An attractive feature of exposition travel will be the combined street car and water routes made possible by the location of the exposition upon the shores of Lake Washington. From the center of town three cable lines run up the steep hills over to Lake Washington, and from these points passengers will be regularly handled by adequate boat service, which even now is extremely popular with the public.

This combined street car and water route to the fair will be particularly attractive to out-of-town visitors and will be of great assistance so far as satisfactory handling of crowds is concerned, both to the electric railway company and to the exposition management because of the distribution that will result.



FIG. 1.—VIEW OF CENTRAL COURT, NEW ENGINEERING BUILDING AT RIGHT.

ELECTRICAL EQUIPMENT.

The Seattle Electric Company has obtained the contract for furnishing all industrial and lighting service to be used in connection with the exposition enterprise. For the proper handling of this load there is being built on the fair grounds a substation which will be completely equipped. In this station will be the following apparatus:

Two 1000-kw motor-generator sets, with 13,000-volt, three-hase motors directly connected to 600-volt generators; four 00-kw, 13,800-volt to 23,000-volt, air-cooled transformers, with gulators and controlling oil switches; one 13-panel switch-ard complete for handling the various voltages for motor and mp service.

Special interest is attached to this station because the energy



FIG. 2.—AT FOOT OF "COURT OF HONOR."

that is brought in on the primaries will, for the most part, come from the generating station located 50 miles away on the Snoqualmie River. When the river cannot furnish sufficient power for all needs, the modern steam-turbine station recently completed at Georgetown will be connected to the line.

The growth of the university has been so rapid that the old generating station equipment has been outgrown. A new station was, therefore, built nearer the Lake Washington shore and



FIG. 3.—PLAN OF EXPOSITION GROUNDS.

provisions have been made for all necessary lighting and heating of the university buildings, even for some time to come. The station contains the following equipment: Two 250-hp Parker water-tube boilers; two Green Engineering Company link grates; two American Steam Pump Company boiler feed pumps; one Cochrane feed water heater; one McEwen simple engine directly connected to a 100-kw, three-phase, 2300-volt Westinghouse generator and exciter; one McEwen simple engine directly connected to a 200-kw, three-phase, 2300-volt Westinghouse generator and exciter.

During the exposition this station will not be utilized to any considerable extent, at least in connection with the exposition buildings, although whatever heat is necessary will be fur-

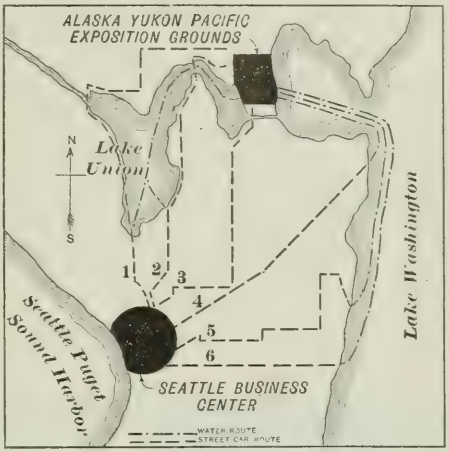


FIG. 4.—LOCATION OF EXPOSITION GROUNDS.

nished from this source. The energy for the lamps and motors, however, will be furnished by the Seattle Electric Company

LIGHTING.

From the substation energy will be carried about the grounds to the various buildings, either by underground system or by the trunk-line system which extends around the outside of the grounds or, in many cases, by a combination of both. All of the buildings on the exposition grounds have been brilliantly lighted with 8-cp frosted incandescent lamps. On those buildings immediately surrounding the Cascade Court there will be

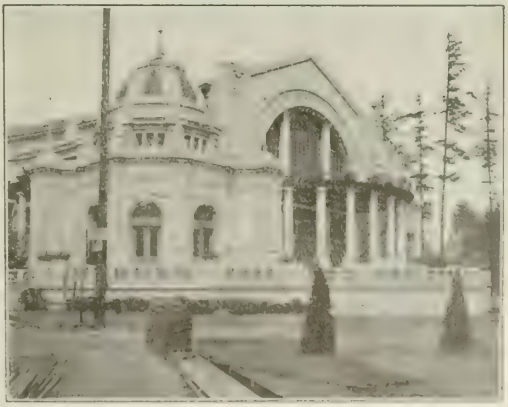


FIG. 5.—MANUFACTURES BUILDING, SHOWING SCHEME OF DECORATIVE LIGHTING

a total of approximately [illegible] lamps. The buildings for which the exposition management is responsible, including the street and park lighting, will require about 100,000 lamps. The Government and State buildings will nearly duplicate this amount, while miscellaneous requirements will undoubtedly

bring the grand total up to approximately 250,000 incandescent lamps.

It has been arranged that the total decorative load shall be handled through a suitable rheostat so that when the lamps are turned on at night the whole system will be gradually brought up from darkness to full brilliancy. The decorative lighting has been handled as far as possible in such a manner as to bring out the architectural features of the buildings. The outlines have been accentuated and a great deal of soffet and concealed lighting giving indirect illumination has been devised. An unusual difficulty was encountered in carrying out the decorative scheme uniformly on all the buildings because several of the structures are of the permanent type and must be turned over to the university after the close of the exposition and in nowise injured by exposition use. Special provision had to be made, therefore, in order to attach to the brick and terra-cotta work, of which these buildings are constructed, the thousands of incandescent lamps necessary for proper decoration. This result was accomplished by inserting, at convenient intervals during the erection of the permanent buildings, copper tie wires and to these the decorative lamps will be attached in strips.

Special attention has been given to the lighting effects around the cascades and geyser basin. Behind each one of the six falls of which the cascades are composed will be lines of lamps extending the entire width, which, when lighted, will give the rainbow effect shining through the falling water. Around

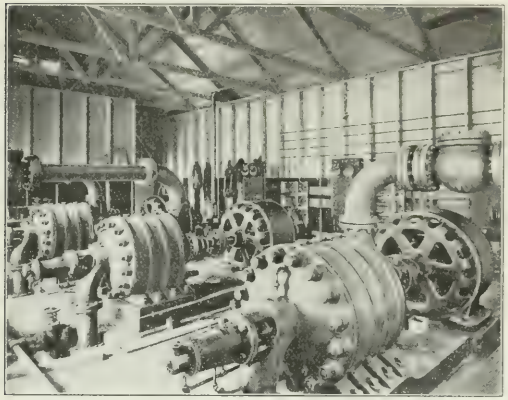


FIG. 6.—EXPOSITION PUMPING STATION.

the geyser basin, concealed from view, and in the bottom of the basin will be hundreds of incandescent lamps which the motion of the water will bring out in full beauty.

For lighting the grounds a special type of electrolier has been designed. The electrolier will be made up of an ornate staff column surmounted by a large staff ball, on the face of which will be attached 40 20-cp incandescent lamps so spaced on the ball as to give the best illuminating effect.

In the preparation of the grounds the trees and shrubs have been left standing so far as this was possible. In many portions of the grounds, therefore, and especially bordering on Lake Washington, natural park effects have resulted. In order to bring these parks into prominence at night it is planned to string thousands of lamps through the trees and along the paths.

WIRELESS TELEGRAPHY AND TELEPHONY.

For over a year a complete wireless telegraph station, controlled by the United Wireless Company, has been in commercial operation on the campus of the university. This station receives messages regularly from out-going and in-coming vessels and handles work from Alaska. During the exposition this station will be in operation as usual.

The wireless telephone will be demonstrated on the grounds [illegible]. Near the main entrance will be built a rus[illegible]tic tower 100 ft. in height in the base of which will be an e[illegible]hibit hall for wireless apparatus of all kinds. Wireless tel[illegible]phones will be installed on the grounds and daily demonstr[illegible]tions will be made by the United Wireless Company. T[illegible] wireless equipment will be installed on the top of a 50-ft. po[illegible] standing on this tower, giving a total height of 150 ft. It [illegible] planned to publish a daily newspaper containing messages fro[illegible] vessels at sea and news received by wireless.

MOTOR-DRIVEN PUMPS.

When the exposition work was started it was proposed [illegible] utilize for fire protection and general service purposes the wate[illegible] system of the city of Seattle. As the time approached for th[illegible] opening of the fair, however, it became apparent that the cit[illegible] mains would not be extended in time to take care of this extr[illegible] territory and, therefore, a complete pumping plant was rendere[illegible] necessary. Upon the shore of Lake Washington a suitabl[illegible] pumping station has been built and installed therein is a com[illegible]plete pumping plant consisting of three Worthington centrifuga[illegible] pumps, each capable of delivering 1000 gal. per minute, con[illegible]nected to Westinghouse 2200-volt, two-phase, 60-cycle, 200-h[illegible] motors. The intake crib was located some distance from th[illegible] shore line and running to this crib from the pump station ar[illegible] three 7-in. intake pipes, it being considered best to provide eac[illegible] pump with its own intake. To further secure the plant against[illegible] uninterrupted service, a double 12-in. main line extends fron[illegible] the discharge end of the pumps to the center of the fai[illegible] grounds, from which point distribution is made. Wood stave[illegible] pipe, manufactured by the Pacific Coast Pipe Company, has[illegible] been used throughout the installation with the exception o[illegible] within the pumping station proper.

For the purpose of operating the cascades and the fountains[illegible] in the cascades and geyser basin, two large pumps of the[illegible] Kroug Manufacturing Company's make, of San Francisco[illegible] have been provided and these will be driven by electric motors[illegible] The cascades will consist of six falls and the main supply of[illegible] water for operating these falls will be delivered at the head of[illegible] the cascades at the average rate of 10,000 gal. per minute.[illegible] Here again the wood stave pipe has been used, in this case,[illegible] however, designed for low pressure only.

Under the supervision of Mr. Frank P. Allen, Jr., director of[illegible] works, the grounds, buildings and the utility systems are now[illegible] practically completed, only such work as is to be done by out[illegible]side interests being in an uncompleted state.

A Phase of the Patent Situation.

By James T. Barkley.

IT may seem superfluous to discuss the general principles of the patent law as practised in this country, but as it has a vital bearing on the subject matter of what will follow it would seem best to make a brief résumé of the inherent fundamentals.

The granting of patents is in the nature of a contract, the two parties to the contract both receiving and giving. To form a starting point for the contract it is assumed as true that the inventor is possessed of an invention that is his property and that he may do with it as he chooses, just as with any other property. This fundamental fact has been disputed by some writers on the principles of patent law, on the ground that the individual owes something to the society in which he lives and from which, in a large degree, he draws his intellectual life; and although it may be, and probably is, theoretically true that our present system is partially false in its basic conceptions, it is nevertheless practical and productive of the present phenomenal industrial activity and commercial position in this country.

Taking the assumption of personal ownership as the starting point, it is obvious that the inventor may keep his invention from the public if he should so wish, and this is what would happen in the majority of cases if there were no patent law. The public would then never come into possession of the invention except by accident or negligence of the inventor in his

precautions for secrecy. To put the inventor in a position where he may without fear disclose his invention to the public, so that in the end the public may be the richer, the patent law provides for its exclusive control by the inventor for a length of time which is deemed sufficiently long to enable him to be appropriately remunerated. The public thus agrees to forbear for a definite length of time from interference with the inventor and his invention, and in consideration of this fact the inventor discloses to the public the full nature and scope of the invention. The benefit enjoyed by the public is the right to use the invention at the end of the period of protection given to the inventor.

The above is the principle of operation of the present system; it is good so far as it goes, but there is one point of vital concern which is ignored, to the detriment of the public and the false reward of the inventor. The system does not take into account what the inventor does with his invention during the period of monopoly, and he may consequently let it remain idle and thus deprive the public of whatever benefit might accrue from its use; for the public is benefited greatly by the use of a good invention even under the conditions imposed by the inventor. The large majority of the patents issued are left in this state of inactivity. In fact, the market is now glutted with inventions, the means for exploiting them being correspondingly scarce. Patents are being issued at the rate of 30,000 a year and it is obviously impossible to exploit all of these. Besides the consideration that there is not sufficient available capital for such a purpose, there is an economic limit to the speed at which changes may take place, this limit being at the point where the cost of change entirely offsets the benefit accruing from such change. This last reason probably is the real one for the inactivity of the large majority of patented devices.

Whatever the reason for the non-working, the present practice affords opportunity for a stray inventor to have a hold on an art in which he has no real rights and standing as compared with the inventors and patentees who make practical inventions and put them into practical use. In fact, there are many applications made for patents on the ground that the issuing patent may cover some valuable future improvements in its art and thus force the payment of royalties from a subsequent inventor. These applications are usually supported by a device which is crude or which is inherently wrong in the construction of a vital part, but which is theoretically good enough for the basis of letters-patent having claims so broad as to cover a large territory in which subsequent development is sure to take place.

As a result of this policy the public has a large amount of wealth tied up without receiving any returns. It might be argued that the public is none the poorer as it has given nothing which it formerly possessed, merely guaranteeing the right of the inventor to his property. However, the public is the poorer because the inventor is not removed and distinct from the State but a part of it, drawing just as much benefit from it as anyone else. The needs of the public are usually the circumstances which foster the invention, and it is almost always true that a needed invention will eventually be forthcoming. Thus the inventor is greatly dependent upon the public for the working out of his inventions. Put him on an isle by himself and he would probably invent nothing. Put him in a public in need of a particular invention and he will devise it sooner or later. Moreover, it is never the inventor who does all of the work leading up to a successful invention; the foundations have been laid by some investigator, or more usually a number of them, the inventor merely putting the results into practical use. Sometimes it may even be said that the inventor is merely an adapter of the ideas which have been worked up by the public around him. In this case the public is surely entitled to some consideration and the invention should not be given unconditionally to the inventor. It also may be that there are several inventors working on the same invention, and this is almost always the case where the invention is particularly valuable, so that the question of whom the exclusive rights belong to depends merely on which inventor has the keenest and fastest brain or the best mechanical equipment. The public gives to one of its members the exclusive and unconditional right to an invention which would have appeared shortly, even if the first inventor should have died before finishing his work. This inventor may then keep the public from the use of the invention which it would have had whether he had appeared on the scene or not.

The present system of laws is at fault in this particular point, and the people in the United States seem to be the only ones who have not awakened to this fact. In other countries there are bars, more or less effective, to prevent the inventor allowing his monopoly to remain idle, and these bars tend to keep the public clear of any unprofitable obligations and also to keep the field of invention clear to future inventors who would improve in any particular line. In this country there are thousands of patents which have never been put to use in any form, and those thousands of patents simply encumber the ground over which an inventor must go in order to make any improvement in any field. Experience has taught that there are cases innumerable in which an inventor who has accomplished practical results has been prevented from the use of his invention by an old patent which is so impractical that it could not be used, and which has therefore been allowed to remain idle.

To inventors in the European countries the United States is noted for the absence of any taxes or workings in connection with patented articles. In their own countries foreign inventors are compelled to pay an annual tax and to perform continuous working of the invention covered by a patent—in other words, to supply the public with the invention in order to continuously enjoy their protection. At present about 75 United States patents are issued weekly to residents of foreign countries, and the total number of patents issued to foreign inventors and in force at the present time is probably somewhat in excess of 40,000. It is well known, from our own experience with foreign patents, that a very small portion of the patents issued to foreign inventors is ever worked in even the smallest degree. The issuance of the large majority of these patents to foreign inventors virtually means the signing away of so much wealth without any prospect of returns. Naturally, some of the patents are issued for impractical machines and these are the ones first to fail of actual working, but it must be remembered in this connection that, as a rule, foreign patents are not taken out on devices until their worth and merit have been proved to at least some extent.

When our own inventors receive patents from foreign countries it immediately becomes incumbent upon them to pay the annual taxes prescribed and to begin the working within the specified time limit in order to prevent their protection from becoming void. In the large majority of cases the patent does not run to the full extent of the term allowed by the law, but lapses on account of failure to keep up the taxes or the working; this is not on account of the worthlessness of the devices covered by these patents, but on account of the extreme difficulty experienced by the unknown inventor in securing the services and co-operation of someone capable of handling his invention. This same difficulty is in the path of foreign inventors who obtain patents in this country, but their failure to secure the desired services does not mean the lapse of their rights under the law. Thus, by our own policy, we put our own inventors into an unfair position, giving rights to foreign inventors with which the advantages enjoyed by our inventors in other countries is not comparable.

A single change in our present system would eradicate this growing injustice to our public at home and to our inventors abroad. The adoption of a system of taxation or of compulsory working, or both, would render invalid a large number of patents which are now just so much encumbrance to the progressive and practical inventor and to the public whom this class of inventor will vastly benefit. This result is accomplished in other countries and can be done here by proper provision, taking into account the peculiar conditions now existing as the result of the past patent practice. A law to com-

pel the reasonable working of a patented device, and the forfeiture of protection for failure to comply, would remove all of the dead material from the field and give to the inventor who is of benefit to the public a larger opportunity than is now afforded.

In the European countries different combinations of taxes and workings are used with varying success. In some of the countries taxes have been depended upon to invalidate an invention which is not being worked, the theory being that the patentee will not be willing to pay taxes on an invention which is not bringing him returns. In other countries working is the prime feature and the taxes are considered auxiliary in their effect. In these countries the construction put upon working varies, but it is usually based upon the fair supply of domestic demand by domestic effort. In some countries there are laws directly prohibiting importation, while others leave the relation of importation and home manufacture to be decided by the courts.

In combination with compulsory working, taxes are apt to degenerate into a mere revenue source and gradually fail of their intention. Taken by themselves without the working, it is questionable whether they accomplish all of their purpose, and there are some possible directions in which they may do positive injustice. For instance, the cost of patenting an article is so increased that the poor inventor is denied, to a greater or lesser degree, the privileges enjoyed under a non-taxation system; his wealthy co-worker, however, may pay his taxes even if his invention is not a commercial success. In this way the purpose of the scheme may be partially or wholly frustrated. Moreover, the expectation of future returns may and will induce many patentees to pay the imposed taxes for some years, in some cases to the end of the lawful term. Under other circumstances, where the patentee anticipates no future emoluments, the taxes will not be paid on inventions that may finally prove to be of large value. In all of these cases there will be injustice done, either in that the patentee holds for himself what should be the property of the public, or that he dedicates to the public something of value which should rightly be his own.

The only solution of the problem which seems to afford relief is that offered by a judicious application of compulsory working. In general, it may be said a meritorious invention will be worked, and the law compelling working should be so enacted that it allows the inventor every opportunity to comply with its provisions under the circumstances in which he is placed. If there are any notable exceptions to the general conditions, they should be provided for, so that the inventor does not lose his property through the action of agencies beyond his control. Every facility should be accorded the conscientious and diligent inventor for being reimbursed in a fitting measure for his labor, while it should be the direct aim to revoke the monopolies bestowed on the casual inventor who does nothing to exploit his property. The technical method of invalidating the patents would depend on considerations of efficiency and simplicity. There are two main ways open, one in which proof of working would have to be filed periodically, and the other in which the initiative would depend on the interested parties filing a request for cancellation. In either case the amount of labor involved would be well paid for by the liberating of rights to the public and the cleaning up of the field for progressive and practical inventors.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Central Station Relations with the Public.

The manager of a central station noted for its successful conduct writes that one of the fundamental policies of the management has been to attract and to deserve the confidence of the public. One feature of this policy has been to maintain with the public a personal relation as contrasted with an impersonal corporate one. The good will thus acquired has been an asset in various ways, and notably in protecting the company against unfair competition by the local gas interests, and in having prospective builders include in their plans provision for house wiring.

Lost and Unaccounted-For Energy.

The percentage of electrical energy which is lost and unaccounted for between the busbars of a central station and a consumer's meters differs greatly among different companies. On some carefully managed direct-current distributing systems the percentage lost and unaccounted for is reported as low as 15 per cent. On the other hand, some alternating-current distributing systems in scattered territory, with a large number of very small transformers and with meters poorly looked after, show lost and unaccounted-for energy amounted to 70 per cent of that generated. It is impossible to say what the amount should be in a system under good management, unless the conditions are fairly well known. The lost and unaccounted-for energy depends on some conditions which are avoidable and on other conditions which are unavoidable. Among the avoidable conditions may be named failure to properly test and adjust consumers' meters, excessive loss in lines (which also causes poor voltage regulaton) and the use of numerous small transformers on an alternatng-current system where fewer large transformers would be better. Among the unavoidable conditions may be the necessity of operation in a scattered residential territory where a large number of transformers must be installed with only one or two houses connected to a transformer and the necessity of operating over long periods with little or no load, so that the transformer core and meter shunt losses are a larger proportion of the total output than if the system were better loaded. The condition of operating at almost no load all day and a part of the night may be unavoidable, but in many cases can be partially remedied by securing a load during these light-load hours. To judge from the figures of various central-station companies on this matter of lost and unaccounted-for energy, a company operating a direct-current distribution can consider it is doing excellent work if its losses are from 15 to 20 per cent, while on an alternating-current distribution losses of 20 to 30 per cent represent good practice. Conditions of scattered consumers on light load may necessitate greater losses than this, but such conditions a company should try to correct as far as possible. With plenty of day load, large transformers, meters kept accurate and low line losses, the lost and unaccounted-for energy on an alternating-current distribution should not be over 20 to 25 per cent. One occasionally hears of some remarkably low figures, but they are so uncommon as to raise the suspicion that they are due to the station output meters being slow.

Small Motors for Office Use.

Small electric motors are used to an increasing extent for operating the various labor-saving devices which are becoming a feature of modern business-office equipment. In the aggregate it is probable that the demand for small motors for this purpose, and for electric energy to operate them, will be considerable, and therefore the tendency is not only of interest to central-station managers, but it deserves active encouragement.

A representative of this journal visited the tenth annual Business Show, held in Chicago last week, with the idea of ascertaining if electric motors were used to some extent for the purpose of driving the newer labor-saving office appliances

hibited there. He was pleased to note that this was in fact e case. Where devices are of such a character that hand bor can be advantageously replaced by some mechanical urce of power, the electric motor appears to be, and of course ry naturally, the only method of driving considered. This pplies to adding machines, automatic card-printing presses, lding machines for letters and circulars, the multigraph letter rinter, sign-printing or lettering machines, letter printers, utomatic envelope sealers, automatic circular printers, address- g machines, machines that seal, stamp and count the envelopes f the outgoing mail, writing-adding machines and humidors or moistening the air.

In addition, a motor-driven automatic screw machine was xhibited, although this can be scarcely classed as an office ppliance. This is also perhaps the case with the Thor electric vasher and wringer exhibited by the Hurley Machine Company, f Chicago, and the miniature desk telephone booth shown by he Miniature Desk Telephone Booth Company, of New York.

Among the Business Show exhibitors who attach small elec- ric motors to their machines, and whose work in extending the use of these machines, many of which are very ingenious, are thus of some importance to electrical men, are the following named:

American Multigraph Sales Company, Cleveland, multigraph letter-printers and folding machines; Elliott-Fisher Company, Harrisburg, Pa., writing-adding machines; Schermack Mailing Machine Company, Detroit, envelope sealer, stamper and count- ing machine; Rapid Addressing Machine Company, New York, addressing machines; Buffum Tool Company, Louisiana, Mo., automatic office printing press; Simplex Manufacturing Com- pany, Granby, Conn., automatic envelope sealer; automatic Let- ter Machine Company, Chicago, letter printer; American Signo- type Company, Chicago, sign or placard printing or lettering machine; Sanifacient Humidor Company, Chicago, humidor; A. B. Dick Company, Chicago, automatic folding machine; Burroughs Adding Machine Company, Detroit; S. V. Feuer- stein Company, automatic card-printing press.

Central-Station Publicity.

Mr. Homer E. Niesz, of the Commonwealth Edison Com- pany, Chicago, delivered an interesting address on "Central-Station Publicity" at a meeting of the Electric Club of Chicago on March 10. Considering publicity in a broad sense, Mr. Niesz said that his company was spending perhaps $150,000 a year for this purpose. This publicity takes various forms. The greater part of the money, about $85,000 a year, is spent in newspaper and street-car advertising. This advertising is handled by an advertising committee of the central-station com- pany, assisted by an advertising agency.

Such subjects are advertised as the wiring of houses, electrical appliances in the home, general lighting and small motors for stores, and electric power for factories. Live subjects are handled in the "ads," and a feature made of pictures having the "human interest" element. The company also advertises through its own publication, *Electric City*, a handsome monthly magazine distributed free and mainly through drug stores. The purpose of this paper is to make the various applications of electricity and the name of the Commonwealth Edison Com- pany veritable household words in Chicago.

Illuminated billboards and electric signs constitute another form of advertising. A very large and conspicuous roof sign is mounted on the roof of the Harrison Street station, and it sets forth briefly points about the use of industrial power in an important manufacturing region on the West Side. The name of a large power user is a part of this sign, and this feature is changed from time to time. The firm named may be con- sidered as a sort of a reference for the use of electricity in factories.

Demonstrations of electric heating and cooking are made in different stores throughout the city. A portable booth is fur- nished for grocery stores, the plan being to have this booth in one store for a week at a time, as an attractive center for demonstrations of useful appliances for the housewife.

A showroom is located in the Adams Street building of the Commonwealth Edison Company, and is a great help to the business-getting department in making available for the in- spection of prospective customers various electrical devices. The new Electric Shop, at Michigan Avenue and Jackson Boulevard, described elsewhere in this issue, was also briefly described by Mr. Niesz. This is a permanent exhibit of elec- trical appliances, particularly for household use, and is believed to be the finest establishment of its kind in the world.

The speaker also referred to the great value to the central-station industry of the annual Electrical Show held in Chicago every January. He also laid great stress on the importance of personal representation. He said that advertising creates the desire, but that a solicitor turns that desire into action and results follow.

To show the work done by the new-business or contract de- partment of the Commonwealth Edison Company, Mr. Niesz mentioned the fact that the net new business of the company in 1908, exclusive of the large railway business carried by the company, was equal to 490,000 16-cp lamp equivalents. During the year 16,701 additional meters were attached to the com- pany's mains.

Central-station publicity is designed to educate the public to use electricity-consuming devices. The endeavor should be both to stimulate and to create this use. New demands for electricity are created by introducing new devices or by new uses of old devices. As an instance of the new demand, the prominence of small vacuum cleaners, electrically operated, was mentioned as a characteristic of the work of last year.

Mr. Niesz closed by pointing out that of course this central- station publicity is a great help to the manufacturers and dealers in all kinds of electrical appliances. Many of the manufacturers follow a policy similar to that of the central-station companies. These efforts in turn help the electric-light companies by caus- ing a greater demand for electricity to operate the devices which the manufacturers have put out. Co-operation between the manufacturers and the central-station companies is thus important. The policy of co-operation is sound in theory and excellent in practice, and too much stress cannot be laid upon it.

"The Edison Round Table."

The Commonwealth Edison branch in Chicago of the National Electric Light Association is about to issue the first number of a monthly publication bearing the name *The Edison Round Table*. This magazine is aimed to "run in series, but not in parallel" with publications of an engineering and educational nature which are available to all members of the branch. It will be handsomely printed and illustrated, with a cover. It will be a tie binding the various departments of the company in common interest and will set forth the personal side of central-station work. Brief descriptions will be given of what the "other fellow's doing," and the paper will be a means of recog- nizing individual work.

Features will be a "sermonette" (a cheerful talk on current topics) by "The Scribbler"; "The Oracle," otherwise the ques- tion box; a "postage-stamp gallery" of portraits in the depart- ment notes, all the pictures to be of the same size, to emphasize the democratic spirit of *The Round Table*, and a department headed "Auld Lang Syne," chronicling the doings of men for- merly connected with the company. The paper is in charge of a publication committee. Mr. R. F. Schuchardt, of the engineer- ing department, is editor; Mr. Dana H. Howard, of the adver- tising department, is business manager, and Mr. Harold Wright, of the contract department, is news editor. The "Oracle" is interpreted by Mr. Ernest A. Edkins, of the second vice-presi- dent's office. The aim of the little paper is to be clever, newsy and entertaining, and it is supposed that it will bring out much latent literary talent in the various departments of the company. No advertisements will be inserted.

The Chicago "Electric Shop."

Undoubtedly in its new "Electric Shop" the Commonwealth Edison Company, of Chicago, has opened the finest establishment in existence for the purpose of displaying and demonstrating the luxuries, conveniences and utilities of electricity in the home. The place is beautifully fitted up and, as mentioned in the brief description on Jan. 28 in these columns, is on the corner of Michigan Avenue and Jackson Boulevard. This is perhaps the best possible location for it in Chicago, in a region of smart hotels, restaurants, theaters and shops. Electric Shop is becoming one of the attractions of the city, and ladies have an opportunity to do their electrical shopping amid quiet and elegant surroundings, just as they select their jewels, or furs, or gowns, or furniture, in other shops. It is significant of a new order of things when one of the handsomest of the retail shops of the second city in the country is devoted to electrical merchandizing.

A large room on the corner, on the ground floor in the Railway Exchange Building, forms the main apartment of Electric Shop. This is divided by openwork screens into a reception-room and a salesroom, but architecturally is treated as one room. There is an entrance from each street, that from Jackson Boulevard being the principal one, opening into the reception-room which is the southern part of the large room, the arrangement being as shown in Fig. 1. Extending westward from the salesroom is a room fitted up as a dining-room. This has a separate entrance from the lobby of the building. Opening off the dining-room, to the south, are a kitchen and pantry. A lavatory completes the suite on this floor. In the basement, connection with which is effected by a private automatic electric elevator, are the laundry, small-motor room (household appliances), fixture-room and industrial-power room. Here also are the stockroom and the Railway Exchange substation of the Edison system, with five rotary converters having a total rating of 4500 kw. This substation is arranged for the inspection of visitors.

Electric Shop is another evidence of the enterprise and abounding faith of the Commonwealth Edison Company under the leadership of Mr. Samuel Insull. It is planned to be an advertisement of the central-station service of the highest class as well as a mercantile establishment which shall justify itself in a commercial sense. It is richly, even sumptuously, decorated and furnished, but the company is confident that the very large outlay involved will prove to be money well spent.

There are seven large show windows on the two streets, and in them are displayed examples of the wares to be found within. Above the second story of the building there is a continuous line of lights made up of 750 25-watt frosted-bulb tungsten lamps on the street fronts. This not only makes the building conspicuous, but brilliantly illuminates the sidewalks in front of the show windows. Electric Shop is open in the evening.

Tungsten lamps, with holophane reflectors, are used for window lighting. They are placed in the ceilings of the windows between screens of art-glass so as to be invisible to ordinary scrutiny. Rich hangings are provided for the windows; they were especially designed and have a lace border matching the style



FIG. 1.—RECEPTION AND SALES ROOMS, CHICAGO "ELECTRIC SHOP."

of the room. Each window bears the crest of Electric Shop. It may be mentioned here that one of the purposes of the establishment is to provide a rendezvous and restroom for ladies while downtown shopping. Comfortable chairs, writing desks and telephones are provided in one cozy corner of the reception-room for this purpose. Handsome stationery is at the disposal of guests, and it is illuminated with the Shop crest in colors. A lady is in charge of this, as of all other departments. Both men and women salespeople are in attendance.

The interior decorations are Elizabethan in style, with wainscot and beamed ceiling. The woodwork is oak, in antique gray finish, and the wainscot is in the form of richly carved panels. These panels are hinged doors, and behind them are shelves for goods, or, in one case, the switchboard from which electric circuits are controlled. On the street sides of the Shop the corresponding panels are of leaded glass and form casement windows opening into the show windows. The floor is of interlocking rubber tile, dark green in color. Scattered over it are large Oriental rugs in deep, rich colors harmonizing with

ne general tones of the rooms. The furniture is of carved ak, especially designed in the Elizabethan style, and in finish ne same as the wainscot walls. The beams of the ceiling are ichly decorated with gold and the strong primary colors. The eiling between the beams is treated in a deep old gold.

Above the wainscot is a frieze of rich art-glass running en-irely around the room and made up of 69 panels in designs rep-esenting old English coats of arms. Behind the glass are 60-vatt tungsten lamps, the light from which is reflected back to a vhite-enameled wall and thence through the deep, warm colors f the glass frieze. By this indirect lighting uniform illumina-ion of the frieze is secured, and when the lights are switched in here is a luminous band, softly but richly colored, running en-irely around the room. The effect is very fine.

A conspicuous feature of the reception-room is a fireplace of vhite Bedford stone, carved in the same style as the wainscot. n it, supported by andirons especially designed, an electrical wood fire" is apparently burning. This is a very clever illu-on imported from Germany. The top fagots are of real wood

ing of floor receptacles for tables and showcases, so that it is impossible to get very far from a connection for electric energy.

Ceiling and wall electric-light fixtures are provided in the reception- and salesrooms. They are especially designed and treated in gold and are notably handsome.

Shown on tables in the reception-room is a variety of high-class utensils for dainty electric cooking, as chafing-dishes, coffee percolators, tea-kettles, toasters and the like, in silver, copper, bronze or nickel, some with handles of ebony or other rather rare woods. The lamps and utensils shown in the reception-room are somewhat of a de luxe character. Less expensive types in profusion are to be found in the salesroom.

Before leaving the reception-room the electrical visitor should not fail to examine the switchboard, which is a particularly fine piece of workmanship, very attractive, but thoroughly practical. It is concealed behind the wainscot, as explained. When the wooden panel doors are opened, lamps placed above the switchboard are lighted automatically. The switchboard proper is



FIG. 2.—SALESROOM, CHICAGO "ELECTRIC SHOP."

and there is apparently half-consumed wood beneath. The whole is alive with the leaping light of a fire and the glow of the embers, which fitfully increase and diminish in the most natural manner. Electric light and thermostatic flashers are used to produce the effect, but are not themselves visible.

In the reception-room are a number of beautiful floor, table and portable lamps, highly artistic in design and very carefully executed. The shades are of colored glass, beautiful in form, color and tracery, which "light up" very effectively. These lamps, which form a conspicuous feature of the reception-room, are designed, both as to shades and standards, to represent various periods, as Egyptian, Greek, Pompeiian, Renaissance, Louis XV, Colonial, Viking and the like. Thus the lamp may be chosen to fit the style of the apartment which it is to adorn.

It is a feature of Electric Shop that all apparatus of whatever character may be shown in operation. Thus the display tables for lamps are wired with numerous convenient receptacles so that any lamp may be connected. In all there are about 100 baseboard outlets in the reception and salesrooms, to say noth

4 ft. 9 in. wide and 7 ft. high. It is of Monson slate with receptacles and Edison plugs on each circuit and polished copper covers on the fuses. In front of the busbars and fuses are heavy beveled plate-glass doors, set in a metal frame. It is not necessary to open these doors except to replace a fuse. Sixty-eight circuits are controlled by double-pole push-button switches set in four vertical rows in a metal plate finished in lemon brass.

The switchboard panel is made up in two sections, each controlling 34 circuits. At the top of each section is a remote-control magnet switch. One of these switches controls all the show-window lights and the other the ceiling and bracket-fixture lights in the main room. These switches are operated by two extra push-button switches at the bottom of the board and also by push-button switches placed in a patrol box in an outside vestibule, so that the general lighting may be turned off at a late hour from the outside by the company's patrolman. The outside cornice lighting is also controlled by the patrolman from this patrol box. All the circuits in the main room (110-volt di-



FIG. 3.—CEILING FIXTURE IN DINING ROOM.



FIG. 4.—CEILING FIXTURE IN RECEPTION ROOM.

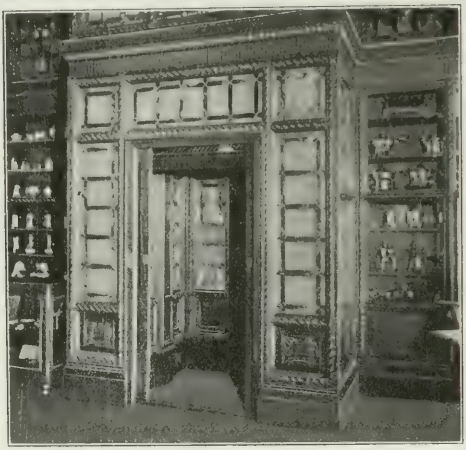


FIG. 5.—ENTRANCE TO AUTOMATIC ELECTRIC ELEVATOR.

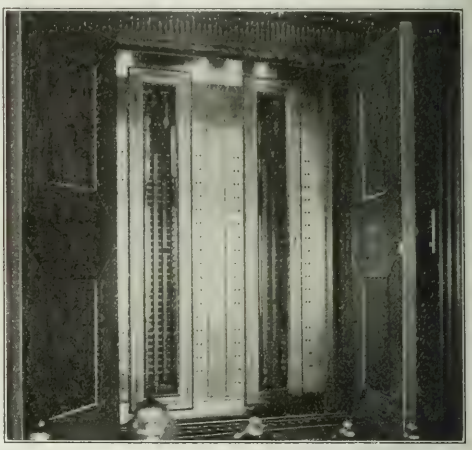


FIG. 6.—SWITCHBOARD IN RECEPTION ROOM.

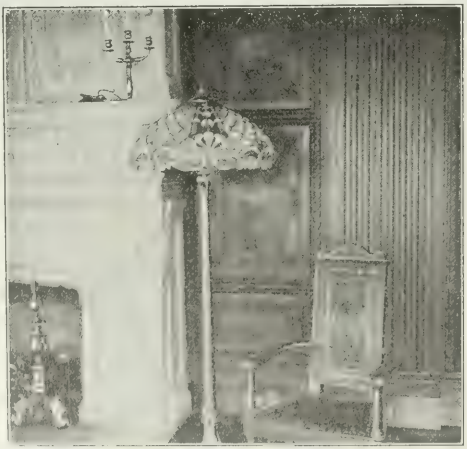


FIG. 7.—VIEW IN RECEPTION ROOM.



FIG. 8.—A CORNER IN SALESROOM.

THE CHICAGO "ELECTRIC SHOP."

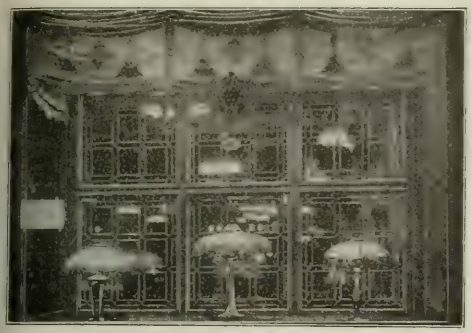


FIG. 9.—ONE OF THE SHOW WINDOWS.



FIG. 10.—DINING ROOM.



FIG. 11.—FIREPLACE IN RECEPTION ROOM.



FIG. 12.—EXTERIOR VIEW OF "ELECTRIC SHOP."



FIG. 13.—ELECTRIC KITCHEN.



FIG. 14.—VIEW OF KITCHEN.

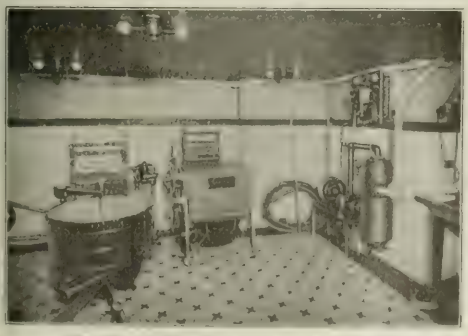


FIG. 15.—ELECTRIC WASHING MACHINES, ETC.



FIG. 16.—LAUNDRY IN BASEMENT.

THE CHICAGO "ELECTRIC SHOP."

rect current) are controlled from this switchboard. All others are fed from a large panel in the basement

The salesroom, forming the northern part of the main room, has an outside entrance on Michigan Avenue, and connects with the dining-room and also with the basement by elevator. It contains the cashier's desk and also several showcases and counters displaying electrical goods, as well as a couple of cozy corners containing tables and chairs. A great variety of electrical specialties and novelties is here offered for sale. Among these are vibrators, fancy silk shades, flashers, various kinds of sockets, adapters for candlesticks, gas or oil lamps, electric heating pads, hair-driers, curling-irons, cigar-lighters, etc. Here also are to be found vacuum-cleaning outfits, luminous and non-luminous heaters, electric stoves and all kinds of electric heating and cooking utensils, as well as the less expensive portable electric lamps.

Designed in the style of the early English Renaissance, the dining-room is a smaller apartment, but dignified and rich. The wainscot is of fumed oak, terminating in a plate rail, above which is a highly colored frieze on a background of gold. Surmounting all is a vaulted ceiling ornamented in low-relief panels treated in gold and colors. The fireplace is of old English tile.

In it is an electric "wood fire" similar to the one in the reception-room. The handsome furniture in this room was especially designed for it and matches the woodwork in style and

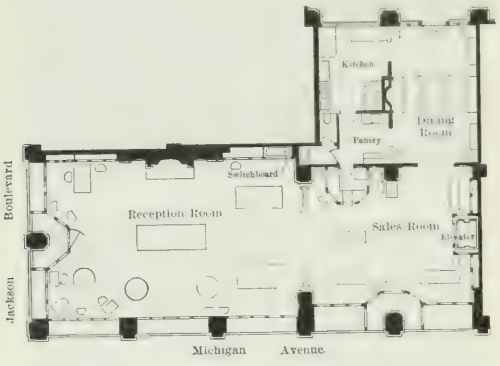


FIG. 17.—PLAN OF "ELECTRIC SHOP."

finish. The hangings are of silk brocade, after a design of the period which the room represents.

Perhaps the principal feature of this room is the lighting. There is a handsome central fixture over the dining-room table and also bracket fixtures extending from the walls. On each side of the central chandelier is an "Eye-Comfort" fixture depending from the ceiling by chains and reflecting the light of tungsten lamps to the ceiling, whence it is generally diffused through the room. There is still another system of indirect lighting from a trough or cove running around the room above the frieze from which the light is reflected from the cailing, which is of light color. Thus, in planning the illumination of one's home one can go to Electric Shop and see first one, then another of these systems tried, or a combination of two or more.

In the dining-room are a sideboard and two serving tables. The latter are connected ingeniously for electric cooking conveniences for breakfasts, luncheons or late suppers. A board, forming part of the top of the table, may be lifted up so that chafing-dishes or other utensils may be plugged in and then replaced, the cords going through holes for that purpose. A hot closet is to be another distinctive feature in connection with these serving tables.

The kitchen is designed to be a model one. The floor is of rubber tile and the woodwork is of maple varnished so that it may be cleaned easily. There are no sharp corners in which dirt may collect. The walls are of enameled white tile. All of the fittings are of the most up-to-date character, nick plated or white enameled. The porcelain sink is said to be t finest in Chicago. The electric cooking range is provided wi a metal hood and has a complete electric cooking outfit. Th are also an electric dish-washing machine with a glass front, large refrigerator operated by a motor-driven ammonia plant the basement and a kitchen table on which the operation of el tric flatirons, toasters, waffle-irons or other devices may demonstrated.

The sink in the pantry is of German silver. Here also is china-closet and an "instantaneous" hot-water heater and a foo warmer, both electric, of course. The hangings at the doors the kitchen and pantry are of a quaint design in white and y low, recalling the work of the old English samplers.

The small elevator is of the automatic household type and t cage is handsomely finished, the shaft in the main floor being e closed in a screen matching the general design. It is operat by a small three-phase, alternating-current motor and the mec anism in the basement is enclosed in glass partitions so th it may be inspected readily. The elevator is used only betwe the ground floor and the basement at present, but it is fitted wi four control push-button switches, and it may be demonstrat as though operating in a building four stories high. No oper tor is needed, and the elevator will not operate if any do leading into the shaft is open.

Directly under the salesroom are the laundry and the roo in which small motor applications for household use are e hibited. Here also is shown in operation a mercury-arc rec fier designed for the garage. This requires alternating curre of course, and there is also a small single-phase sewing-machi motor arranged to be controlled by pressure on the treadle the machine. It may be stated here that all the bells, buzze door-openers, etc., in Electric Shop are operated by alternati current by the use of low-voltage transformers.

A marble wall panel is devoted to a demonstration of mete used on customers' premises, and also of the current-consumi capacity of various types of lamps. At the top of it is a ba of 24 lamps so arranged that all the lamps or any one of the can be cut into circuit with the meters below. The topmost these meters is a direct-reading double-scale wattmeter, d signed to show the actual current consumption of vario lamps. Below this are two recording wattmeters with gla covers, one for alternating current and one for direct curre There is also an additional alternating-current integrating wat meter of different manufacture. A Wright demand meter also mounted on the board. A visitor is shown that when o lamp is in circuit the recording wattmeter can be seen in actu operation. With the addition of other lamps the speed of t revolving part, seen through the glass case, is proportionate increased, and thus it is shown, at least in an approximate wa that the motor accurately records the amount of electricity pas ing through it.

One ingenious household motor outfit is known as the "aut matic kitchen." It consists of a circular table at the edge which are mounted an egg-beater, a small churn, a fruit-jui extractor, an ice-cream freezer, a meat-chopper, a coffee-grind and a potato-peeler. Surrounded by these little domestic co veniences is one central electric motor so arranged, with tw speeds, that it may be connected to any one of the devices the table by a flexible shaft. On other tables are shown knif sharpeners, buffers for cleaning silver and other small hous hold appliances capable of being driven by electricity.

There are a number of laundry appliances, as motor-drive washing-machines, ironing-table fixtures, plain electric fla irons and a large mangle which is not only turned, but heate by electricity, taking for the latter purpose from 38 amp to amp. There is also an extractor to dry the wash by subjectin the wet clothes to the action of centrifugal force. This is a ranged on a vertical shaft and the clothes are placed in an i terior cylindrical receptacle provided with holes so that wh the device is rotated at a high rate of speed the water will f off into the outside containing tank, thus drying the cloth without the necessity of hanging them out. An electric wate

water is applied to a large tank in the laundry and affords an example of the production of hot water by electric heat on a considerably larger scale than is usually the case.

The ammonia plant for operating the kitchen refrigerator is also in the basement. This is arranged so that ice may be prepared from it for table use.

In the basement also is the vacuum-cleaning plant. This consists of the usual motor and air-pump, mounted on one base. Three cleaning outlets are provided in the baseboards of the upper rooms. These are flush with the wood and are not easily seen. By raising a metal flap a hose coupling may be inserted. Beside the hose outlet is a flush, key, quick-break switch by which, through an automatic starting-box, the motor of the vacuum cleaner in the basement may be started. This switch can be operated only by the key which goes with it. Thus it cannot be tampered with by unauthorized persons. The motor is stopped by inserting the key in another hole in the switch.

Different grades of fixtures are displayed in the fixture-room in the basement. A demonstration is also made here of the color effect of various illuminants. Another feature of this room is intended to represent an installation of special emergency lighting in the household. This emergency or burglar circuit is arranged to be controlled from a master switch in the bedroom of the head of the house. In case of necessity all the lights on this circuit can be turned on instantly to the discomfiture of the marauder. The special feature of this is that the same lights can also be used in the ordinary illumination of the rooms, which is, of course, a valuable feature.

A third room in the basement is known as the "Industrial Power Room" and contains a wide variety of motor-driven machinery, such as a lathe, a floor-surfacing machine, a blower, a grinder and buffer, a floor polisher, beer pump, deep-well and house pumps, drills, punches, dough-mixer, potato-peeler, factory sewing-machine and a number of others. Wherever practicable the machines are driven by individual motors. Here also are examples of the application of electric heat to industrial requirements, as soldering-irons, glue-pots and the like. Advantage is also taken of the opportunity afforded by this room to show motors of various types.

A stockroom is given space in the basement. Here there are bins and shelves for the electrical wares displayed so attractively on the floors above, and it is sometimes hard for the stockkeeper to meet the demand. There is an intercommunicating house telephone system of six stations, with wiring for additional stations. Electric Shop is also equipped with six city telephones.

In all there are over 200 distinct electrical circuits in Electric Shop. A separate main is led from the substation in the building and the service switches are in the basement. Allusion has been made already to the two switchboards from which the circuits are controlled. Rubber-covered wire is used throughout and all wiring is in iron pipe and, of course, executed in the most approved manner.

A specially designed electric automobile delivery wagon of handsome appearance will be used to deliver to customers goods purchased in Electric Shop.

A great deal of work has been expended on the general plan and numerous details of Electric Shop by the executive and engineering staffs of the Commonwealth Edison Company, and the architectural design was placed with D. H. Burnham & Company, Chicago. It was decided over a year ago that the work should be carried out, but actual execution was delayed, and, after four months of busy preparation, the Shop was opened on Jan. 10. Since then the wisdom of upholding the dignity and value of electric service in such an elaborate manner has been vindicated in steadily increasing degree.

To show the pains taken by the Commonwealth Edison Company to embrace in Electric Shop a wide variety of electrical apparatus used in or about the home, the following list of the names of makers of goods on exhibition (embracing also some devices used in construction) is given. An effort has been made to make the list complete, but it is so extensive that there may be some unintentional omissions.

Elevator.—Otis Elevator Company, New York.

Mercury-Arc Rectifier.—General Electric Company, Schenectady, N. Y.

Transformers (low-voltage).—Thordarson Electric Manufacturing Company, Chicago.

Incandescent Lamps.—General Electric Company, Schenectady.

Switchboards.—H. Krantz Manufacturing Company, Brooklyn, N. Y.

Meters.—General Electric Company, Schenectady; Fort Wayne Electric Works, Fort Wayne, Ind.; Wagner Electric Manufacturing Company, St. Louis.

Lamps—(floor, table and portable).—Duffner & Kimberly Company, New York; Pairpoint Manufacturing Company, New Bedford, Mass.; Handel Company, Meriden, Conn.; Colonial Art Glass Company, Chicago; H. G. McFaddin & Company (importers), New York; Bradley-Hubbard Manufacturing Company, Meriden, Conn.

Fixtures, Reflectors and Shades.—Willy H. Lau, Chicago; National X-Ray Reflector Company, Chicago; Federal Electric Company, Chicago; Phoenix Glass Company, New York; Quezal Art Glass & Decoration Company, Brooklyn; H. W. Johns-Manville Company, New York; Will & Baumer Company, New York; Macbeth-Evans Glass Company, Pittsburgh; Dale Company, New York; Plume & Atwood Manufacturing Company, New York; A. J. O'Leary, Chicago; Holophane Company, New York; Faries Manufacturing Company, Decatur, Ill.; Overbagh & Ayres Manufacturing Company, Chicago.

Switches, Sockets, Receptacles, Wiring Specialties.—Hart & Hegeman Manufacturing Company, Hartford, Conn.; Federal Electric Company, Chicago; Cutler-Hammer Manufacturing Company, Milwaukee; Arrow Electric Company, Hartford, Conn.; Pass & Seymour, Solvay, N. Y.; Harvey Hubbell, Inc., Bridgeport, Conn.

Heating and Cooking Utensils.—General Electric Company, Schenectady; Simplex Electric Heating Company, Cambridge, Mass.; American Electric Heater Company, Detroit; Inventors & Manufacturers' Sales Company, San Francisco; S. Sternau & Company, Brooklyn (designs).

Flatirons.—General Electric Company, Schenectady; Simplex Electric Heating Company, Cambridge, Mass.; Westinghouse Electric & Manufacturing Company, Pittsburgh; Pacific Electric Heating Company, Ontario, Cal.; Pelouze Electric Heater Company, Chicago.

Heated Tools.—General Electric Company, Schenectady; Simplex Electric Heating Company, Cambridge, Mass.; Vulcan Electric Heating Company, Chicago; Del Sales Company, Chicago.

Cleaning Apparatus (electro-pneumatic).—Atwood Vacuum Cleaner Company, Madison, Wis.; Duntley Manufacturing Company, Chicago; Electric Suction Sweeper Company, New Berlin, Ohio.

Refrigerator.—Wolf, Sayer & Heller, Chicago (using apparatus of Brunswick Refrigerating Company, New Brunswick, N. J.).

"Automatic Kitchen."—A. A. Automatic Manufacturing Company, New York (successor to Aderer Brothers).

Laundry Appliances.—American Laundry Machinery Manufacturing Company, Chicago; Hurley Machine Company, Chicago; A. W. Kratz, Chicago.

Vibrators.—Swedish Electric Vibrator Company, Chicago; Standard Electric Works, Racine, Wis.; Monarch Vibrator Company, Chicago; Shelton Electric Company, Chicago.

Dish-Washing Machine.—Garis-Cochrane Manufacturing Company, Chicago.

Sewing-Machine Motor.—General Electric Company, Schenectady.

Intercommunicating Telephone System.—Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y.

Miscellaneous.—H. W. Johns-Manville Company, New York (linolite); Benjamin Electric Manufacturing Company, Chicago (adapters); American Electric Novelty & Manufacturing Company, Chicago (flashlights); J. F. Sturdy, Chicago (general decoration); William A. Pope, Chicago (heating and ventilation); New York Belting & Packing Company (rubber floor).

INTERIOR WIRING AND ILLUMINATION

Standardizing Lamps and Reflectors.

Not many years ago little attention was paid to the scientific use of reflectors and other accessories for changing the distribution of light from incandescent lamps so as to get a larger amount of useful illumination on the working plane. During the past five years an increasing amount of thought has been given to this matter. It is only recently, however, that some of the principal lamp and reflector manufacturers came to a full realization of the importance of having the lamp filament and reflector in proper relation to each other if the desired results as to light distribution are to be obtained.

When the deep-bowl types of reflectors, which are now so commonly used with tungsten lamps, were first brought out, the characteristic distribution curves published with them indicated that uniform illumination might be expected over a considerable area under such a lamp and reflector. The maximum candlepower was indicated at an angle of 30 deg. to 35 deg. from the vertical. After such reflectors had been on the market some time, numerous users began to observe that in many cases much more light was concentrated immediately under the lamp and reflector than would be expected if the distribution was that indicated by the curves. Investigation of this point demonstrated that reflectors of this deep-bowl type would become concentrating rather than distributing reflectors if the lamp filaments were placed deeper in the reflectors than were the filaments on the lamps upon which the original tests were made. At that time there was no standard position for lamp filaments fixed by various lamp manufacturers, and it became evident that in order to produce definite light distributing results with reflectors, uniformity in position of lamp filaments with respect to the lamp bases as well as uniformity of holders and reflectors would be necessary. As a result, a standardization committee was suggested, this committee to consist of engineering representatives of various important lamp factories and one of the large manufacturers of reflectors.

As a result of this movement the lamp factories have fixed upon definite dimensions of lamps and filaments, so that the reflector manufacturers can design reflectors with the knowledge that if used with the sizes of lamps and types of shade holders for which they are designed, the desired light distribution will not be changed by the lamp filament not being in the expected place in the reflector. There is approximately 1 in. difference in the position given a reflector by a standard 2¼-in. holder, as compared with the holder commonly known to the trade as "Form H," which holds the reflector lower. If manufacturers' instructions are properly followed, there is no excuse for the use of the wrong holder. If users generally realized what difference in appearances and practical effect may be caused by the use of the wrong holder, more attention would be given to this point. At the present time even fixture houses need a word of caution as to this, to say nothing of other users who are not supposed to be so well posted.

Engineering and Illumination.

By H. Thurston Owens.

So much has been written concerning illuminating engineering which is obviously not "engineering" in the sense in which gas and electrical engineers understand and use the term, that many doubts have been expressed as to the necessity for a distinct branch of applied science to care for this feature of the gas and electric industry.

Two years ago a society was formed in this country, known as the Illuminating Engineering Society, whose object, as stated in its constitution, is "the advancement and dissemination of theoretical and practical knowledge of the science and art of illumination."

The requirements for membership are that "any person interested in the objects of the society shall be eligible to membership." This is surely not a rigid and exacting requirement for among those directly interested can be included the physicist, photometrist, chemist, oculist, the gas engineer and electrical engineer, the manufacturer of lighting appliances, the decorator, the architect, the plumber and the public at large. Nevertheless, the results from the formation of the society have been farreaching and credit for at least some of the improvement in lighting conditions should be given to this most successful of our youthful technical bodies.

To what extent "engineering" has been responsible for the "uplift" it would be hard to determine, but one feature of the campaign shows evidence of considerable engineering skill and application, namely, the bulletins and catalogs issued by manufacturers of lighting appliances. Should the engineer care to apply the laws of light when planning an installation, data are now available to aid him in obtaining the best results. Whether the results hoped for are effective, efficacious, economical or efficient, depends altogether upon the individual, but they should always be hygienic.

Sanitary engineers are employed to provide necessities which shall not violate the laws of hygiene, and lighting engineers have failed in the past to install lighting systems where one can work without danger of severe eyestrain. Undoubtedly artificial light can be provided in such a manner that our eyes will not suffer to any greater extent than when used under natural light, and in some cases the advantage will be on the side of the former.

When all of the varied interests meet upon common ground in a technical society, the interchange of ideas will, without question, have a wholesome influence toward better things, which means better engineering and not better salesmen of accessories; these are only the buds and blooms, the fruit will follow as the art ripens.

If interiors and streets can be illuminated in such a manner as to reduce materially the number and intensity of the evils found in our installations of to-day without illuminating engineering, all well and good; but the very installations themselves stand as "horrible" examples of "common-sense" practice and the rule-of-thumb methods of the past.

Electric Illumination of Niagara Falls Park.

A most important transformation on the State reservation at Niagara Falls has been effected by the introduction of incandescent lamps for illumination. Formerly unsightly arc lamps afforded the only outside illumination about the beautiful park. The wires running hither and thither were quite out of place in this beauty spot, where efforts were being made to return to primeval conditions. The poles marred the park scene, having no relation to the natural forest conditions, and as the distribution of light was lacking in uniformity, the results were far from satisfactory.

In 1901 the Legislature of the State made an appropriation of $7,000 to meet the expense of installing an electric lighting system in the State reservation grounds and buildings. Three electrolysis-proof conduits, having a diameter of 3 in. on the inside, were laid from the uppermost point of the reservation, known as Port Day, to the Administration Building in Prospect Park. The necessary manholes of brick with iron covers were provided, the conduits being laid in heavy concrete. In two of these conduits the Niagara Falls Power Company, at its own expense, installed cables of sufficient capacity to supply current for light and power purposes in the park, the buildings and the old inclined railway structure, agreeing to execute a bill of sale to the State at the nominal sum of $1 when the lighting system was installed. This generosity on the part of the Niagara Falls Power Company was a great help to the reservation commissioners and proved of material assistance in making it pos-

ible to give visitors to the Falls an illumination that has made pleasant the evening visits of tourists and excursionists from all parts of the world, to scenic Niagara.

In 1907 the Legislature appropriated an additional $14,000 for completing the electrical installation for lighting the grounds. The necessary lateral conduits were laid to 96 poles, while transformer stations were established at three different points. One of these is at Port Day (Fig. 1), another in the bluff along the upper river above First Street (Fig. 2), while



FIG. 1.—TRANSFORMER STATION AT PORT DAY.

the third is in the basement of the Administration Building. Each transformer station has the necessary switchboard and reduces the current from 2200 volts, the voltage at which it is received from the Niagara Falls Power Company, to 120 volts. The station at Port Day controls three branch lines, that in the bluff five lines, and that in the Administration Building seven. There are three transformers in the basement of the Administration Building, only one of which is connected with the outside lighting service, the others supplying the lighting and the electrical heating circuits of the building. This station, of course, carries the heaviest load of the three. There is also a transformer located in the old inclined railway building, which supplied the electric power service of the incline until July 6,

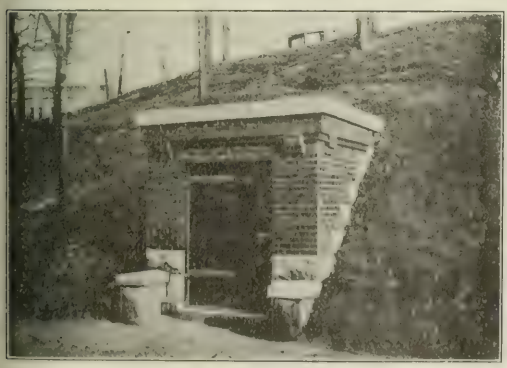


FIG. 2.—TRANSFORMER STATION CONCEALED IN BLUFF.

1907, when the commissioners ceased to operate this railway convenience, which lowered passengers from the top to the base of the cliff to take the steamer *Maid of the Mist* and view the falls from below. The railway was a double-track affair, the length having been 330 ft. The cars were lowered and raised by manila and wire cables.

Considerable difficulty was experienced in selecting the proper pole for installation throughout the reservation to carry the lamps. Superintendent Edward H. Perry was determined that these necessary poles should not be of a design that would mar the landscape, the result being the pole shown in Fig. 3 which so nicely fits the scene without intruding. These poles are 14 ft. high and of iron. Each pole carries six 32-cp incandescent lamps under an aluminum reflector protected by a galvanized-iron hood. In the illumination of the reservation the desire was to keep as much light as possible down under the foliage of the trees in summer time, when the park is most patronized. For this the aluminum reflector was deemed most desirable, for had a glass reflector been adopted there would have been expensive repair bills through the acts of children, and even of grown persons. In the case of the aluminum reflectors, it has been found a comparatively easy matter to smooth out the dents made by stone-throwing and similar causes. Every pole has its individual switch within itself, and each branch or lateral line is controlled from a different station.

Since the lighting system was installed it has afforded a very interesting study in several respects, and particularly so in regard to the lamps installed in Prospect Park along the river, where the spray cloud is swept back upon them in winter time. All familiar with Niagara conditions will recall the heavy ice they have seen pictured, or in reality, on the trees of this section of the park. The lamps came in for very similar treatment at the hands of the spray cloud and Jack Frost, but at times



FIG. 3.—LAMP POST ON N. Y. STATE RESERVATION.

when the wind is sweeping the spray of the American Fall back on the lamps the lights keep burning and it has been found that they generate sufficient heat to keep them free of ice.

All who have passed up or down the old inclined railway at Niagara will recall that at one point the gloom was rather heavy, and particularly so along the free stairway. With the installation of the new lighting system, Superintendent Perry was quick to avail himself of the ever-ready service of the current and he had a row of lights installed at the darkest spot on the stairway, greatly increasing the pleasure of those climbing up or down the long flight of stairs, while the foot travel was rendered much safer.

A still greater benefit accrued from the lighting system through driving darkness away from points along the upper river between Goat Island bridge and Port Day. This is one of the most beautiful localities on the State property at Niagara, but it was for years so marked by disorder and hoodlumism that it was found necessary to close this section at nightfall, nobody being permitted to pass certain points after dark. However, with the brightness given to the locality by the new lights, a great change was wrought and now this is one of the best patronized pleasure spots of the reserve, as it is possible for the reservation officers to see long distances along the road-

ways, under the trees and all about, the lights thus beyond question proving a splendid factor in the maintenance of order and morals.

The Administration Building is electrically heated, and in coldest weather the building is quite comfortable in all the rooms of the interior. This is the only building on the State reserve wholly heated by electricity.

The contract has been awarded and the work of installing a new double electric elevator to supplant the old inclined railway is now in progress. This elevator is destined to create many changes both in Prospect Park and on the slope below the high bank. New views will be opened above and below, and visitors to the Falls will doubtless praise the improvement, which is to cost nearly $100,000. The old stone inclined-railway building near Prospect Park will be razed. In front of its site, just inside the face of the cliff, the new electric elevator, carrying 15 people, is to be placed. The shaft is now being sunk to a depth of about 140 ft. From the bottom of this shaft a tunnel 140 ft. long and 10 ft. 4 in. x 10 in. in dimensions will extend to the face of the cliff. At the foot of the elevator there will be a waiting-room enlargement, and the outer end of the tunnel will open into an observation pavilion. This latter structure will be of rough stone quite in harmony with the cliff appearance. Three sides of glass will permit ample observation facilities from the inside, while the building will have a concourse 5 ft. wide running about its sides and front. To the left one may look upon the tumbling torrent of the American Fall as this body of water pours from the higher to the lower level, the scene being one of the most inspiring and fascinating at Niagara, while to the right the giant span of the upper steel-arch bridge, the tremendous flow and force of the tunnel stream will be observed and a fading view obtained of the distant gorge. The rare music of the plunging flood will here be greatly enjoyed by visitors, but perhaps more so as they leave the observatory and walk down the new paths to be built at gentle grade to the water's edge. These paths will be of zigzag form, about 5 ft. wide, each stretch of 115 ft. carrying one down 30 ft. to the roar of the fall. The excavated material will be used to develop new and higher levels on the rocks near the dock of the *Maid of the Mist,* while in the park above the elevator station will be wholly underground. This will open new views of the American Fall from vantage points in the park, while improving the park grades thereabouts. It is hoped that this year the telephone wires running about Goat Island will be placed underground, and when this has been accomplished there will be no wires in sight on the State property at Niagara.

LETTERS TO THE EDITORS.

Valuation of Public Utility Properties.

To the Editors of Electrical World:

SIRS:—I read with interest Mr. W. H. Winslow's letter in your issue of Feb. 25 on "Valuation of Public Utility Properties." It seems to me, however, that he has failed to meet the situation squarely.

He assumes that the producing value of equipment remains constant to the end of service. It may also be stated that the cost of replacing equipment should be equally distributed over the time during which the equipment is in service. This means a reserve accumulation during the first few years of service. If such a reserve is not provided, and other things are equal, the net earnings will be greater when the property is new than later on when some of the apparatus is being replaced. Without a depreciation reserve such expenses become a greater and greater charge to the income account. With a depreciation reserve these expenditures are charged to this account, which acts as a sponge to take up the irregularities of such expenses.

A better conception of depreciation, especially in a public service corporation, where the existence is perpetual, would seem to be that of the property wearing out in different parts at different times so that eventually the annual cost of replacing certain parts is about equal to the total depreciation of the whole property for the same year. It is thus evident that net earnings should be higher at first. Therefore, if the earnings, whether high or low, are all paid out in dividends it amounts to the payment of dividends from capital. This is made evident by glancing at the simplest of balance sheets:

ASSETS	
Plant investment	$600,000
LIABILITIES	
Capital stock	600,000

Now if the property is sold for $300,000 the stockholders will receive only 50 cents on the dollar (and water).

Let us consider the purchaser's side of the case, as Mr. Winslow has done. The first suggestion was to set aside as reserve a sum equal to the difference between the purchase price and the cost of reproduction, new. This would make the balance sheet

ASSETS.	
Plant investment	$300,000
Cash	300,000
LIABILITIES	
Capital stock for investment	300,000
Capital stock for reserve	300,000

(Capital stock is subdivided to show the case clearly. It should be under one head as $600,000.) In this case the cash balance can be invested and the plant investment will not be burdened with earning dividends on the entire capital stock. It is evident that if the books of the selling company had shown the conditions accurately, they would have had this cash or a equivalent asset. As the Supreme Court states, it is immaterial as far as the result is concerned whether this asset was spent in dividends or lost in too low charges.

Another method was to pay the purchase price, but to charge enough for electricity to give the necessary depreciation reserve when the time came for replacement. In other words, the partly depreciated plant is bought, pays dividends on actual investment but in a few years out of its earnings builds a brand-new plant—an excellent scheme for concealing earnings! It would be interesting to know what this would yield the investor when the new plant had been built and the expense of double depreciation removed.

In conclusion I wish to state that I agree with Mr. Winslow that the same rates are necessary for the same dividends at all times. But if, when the plant is new, there are not enough earnings above the dividends to provide for depreciation, there is most certainly going to be trouble later on. If they do earn enough and yet spend it in dividends, they have only themselves to blame when, later on, the courts tell them that their property has depreciated and that their stock is partly water.

WEST LYNN, MASS. F. E. HASKELL

Spiez-Frutigen Single-Phase Railway.

To the Editors of Electrical World:

SIRS:—In the article in the issue of Feb. 4 entitled "Single-Phase Equipment for the Spiez-Frutigen Railway" we note the statement that the motor-cars, locomotives and the overhead equipment will be supplied by the Oerlikon and Siemens-Schuckert companies. We beg to call attention to the fact that we also are supplying one single-phase locomotive, equipped with two motors of 800 hp each (1600 hp total), for this line. We should be glad if you would mention this in your columns.

ALLGEMEINE ELEKTRICITÄTS-GESELLSCHAFT

BERLIN, GERMANY.

The Rapid Calculation of Power Consumption in Illumination.

To the Editors of Electrical World:

SIRS:—The writer was much interested in an article entitled "The Rapid Calculation of Illumination," by Messrs. Cravath and Lansingh, on page 89 of your issue for July 11, 1908. The method which is outlined permits the calculation of the

sired mean illumination and an experimental constant presenting the consumption for the particular lamps used, the number of lamps, from the area of the illuminated surface. It gives the writer great pleasure to learn that the method described in his book "Grundzüge der Beleuchtungstechnik" (Elements of Illuminating Engineering), page 78, and in Uppenborn's "Kalender für Elektrotechniker, 1908," Part I, page 316, has been received with favor in America, since it is, indeed, the simplest and most convenient method of calculating illumination. Another reason why it is desirable to have the use of this method become widespread is that the constant watts per square foot per foot-candle—watts per lumen—which is very useful in judging the comparative merits of various illuminating methods, will become more familiar to the illuminating engineer.

In an earlier article* I called attention to the specific meaning of this quantity. In the comparison of different kinds of illumination this quantity is of great importance both for street and interior illumination, just as the specific consumption—watts per candle—is useful in comparing different kinds of lamps. As far as I know, this quantity has received little attention in America, its reciprocal—foot-candles per watt per square foot—although less convenient in calculation and practice, being most often used.

In changing the value of economy from German units—watts per lux per one square meter—into American units—watts per square foot per one foot-candle—the ratio of the units of length cancels, and the two values are inversely proportional to the ratio of the light units, and we have: One watt per lux per square meter = 1.10 watts per square foot per one foot-candle, using the new light unit as a conversion factor fixed by the International Photometric Commission.

Values of the watts per lumen for the principal practical methods of illumination are given in the above-mentioned book in a table on page 133. In order to facilitate the use of this simple method, the values of this table have been converted into American units, and are given herewith. The values are based upon the mean horizontal illumination from a distance of 1 m above the floor in interior illumination, and 1.5 m in street illumination.

The table gives only maximum and minimum values; the exact values to be chosen for given conditions depend upon the specific consumption of the lamps to be used, their arrangement, and, especially, upon the height of suspension above the surface to be illuminated. In interior lighting for small and poorly illuminated rooms, higher values, and in large and well-illuminated rooms, lower values are chosen, always taking values inside the limits given in the table. When too little is known of the governing conditions to permit an intelligent choice, a mean value must be given.

For illuminants not given in the table, the watts per lumen can be ascertained by comparison with the specific consumption—watts per candle—of the source in question, with the usual sources of similar intensity and distribution. The values given by Messrs. Cravath and Lansingh in your issue for July 11, 1908, agree well with those in the following table.

In order to amplify as much as possible the experimental data given herewith, on the consumption with different methods of lighting, it is desirable when photometric measurements are being made, that the consumption in watts per square foot per foot-candle should always be determined. For this purpose it is essential that the measurements be so made that the horizontal illumination of the interior or street area can be determined, which offers no particular difficulty when suitable methods are employed.

PRACTICAL VALUES OF CONSUMPTION WITH MOST USUAL LIGHTING METHODS.

Sources.	Consumption per Square Foot per Foot-Candle. Street Illumination. Watts.	Interior Illumination. Watts.
Carbon-filament lamps	0.9 — 1.3	0.55 — 1.3
Nernst and tantalum lamps	0.4 — 0.65	0.25 — 0.65
Metallic-filament lamps	0.28 — 0.45	0.17 — 0.45
Ordinary direct-current arc lamps	0.17 — 0.28	0.17 — 0.33
Direct-current flaming-arc lamps	0.055 — 0.13	.....
	Cu. Ft. per Hour.	Cu. Ft. per Hour.
Vertical incandescent gas lamps	0.016 — 0.024	0.012 — 0.024
Vertical incandescent pressure gas lamps	0.012 — 0.024	0.008 — 0.016
Inverted incandescent gas lamps	0.010 — 0.018	0.008 — 0.016

BERLIN, GERMANY. L. BLOCH.

Elektrotechnische Zeitschrift, 1906, page 493.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Induction Motors for Rapidly Fluctuating Load.—A description of the "spinner" induction motors which are designed to meet the requirements of textile mills, rolling mills, mining work, etc., that is to say, for use where frequent stopping and starting under load are necessary, or where rapid and violent fluctuations of load are experienced, and for work requiring various speeds. In its simplest form the "spinner" motor is a squirrel-cage induction motor, designed so that the customary stator may be allowed to revolve, a band-brake serving to control its movement. The method of operation is as follows: The rotor is connected to the load and the brake is released, thereby leaving the stator free to rotate. Electricity is then supplied to the stator windings through brushes and slip-rings, the stator beginning to rotate in a direction opposite to the normal direction of rotation of the rotor. When the stator has attained synchronous speed the brake is applied to it, and the rotor then begins to move, gradually coming up to normal speed, which latter is attained when the stator has been brought to rest. A special type of "spinner" motor is shown in Fig. 1. It consists of three concentrically arranged elements: the rotor *A*, spinner *B* and stator *C*. The stator is fixed, while the other two elements are capable of rotation. The rotor carries a squirrel-cage winding, and the spinner a former winding (which is connected to the slip-rings *D*) on its inner periphery and a squirrel-cage winding on its external surface. The stator carries a former winding, to which power is supplied in the usual manner. On the spinner *B* is also a band-brake *E*, which can be operated either by hand or magnetically, as desired. Power is taken off the rotor shaft *F*, as in the case of an ordinary motor. For middle speed the spinner is held stationary by the brake, and current is applied to its inner windings; the rotor, with load connected, then runs at normal speed, the conditions being those of an ordinary induction motor. For the higher speed the spinner brake is released and current is simultaneously

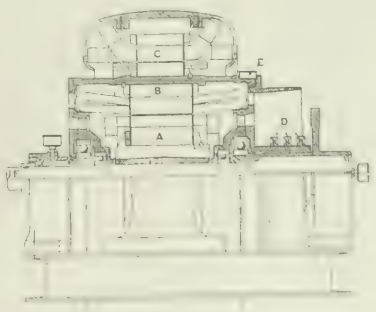


FIG. 1 DIAGRAM OF "SPINNER" MOTOR

applied to the windings of the outer member or stator, so as to rotate the spinner in the same direction as the rotor. The lower speed is obtained by applying current in the reverse direction to the stator, so as to rotate the spinner in a direction opposite to that of the rotor.—Lond. *Electrician*, Feb. 26.

Heating of Windings.—E. Arnold.—A mathematical paper on the heating of windings in dynamos with great iron length. In such machines the temperature of the copper along the winding of a coil is very variable and may reach a prohibitive value in the center of the machine, although the mean value of the increase in temperature is still permissible. The author shows how to calculate the temperature for any point of the winding and also the maximum temperature of the copper. He also determines the influence of the different factors, such as temperature of the iron, current density, insulation, etc.—*Elek. Zeit.*, Feb. 25.

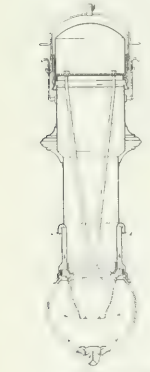
Testing of Direct-Current Machines.—W. Ludors.—A paper read before the Birmingham section of the (British) Inst. Elec. Eng. The author described a method of carrying out the Kapp-Hopkinson circulation of power test on a single lap-wound continuous-current machine. The author gave two alternative arrangements, both of which, however, necessitated the employment of an auxiliary machine. Some effects of armature reaction in lap-wound machines, and their application to the design of a constant-current generator, were also dealt with in the paper. In the discussion which followed the reading, it was suggested that the equalizing connections are unnecessary in lap-wound machines. The effect of the magnetic pull produced by the unequal excitation of the poles for the purpose of the author's test was also discussed.—Lond. *Elec. Eng'ing*, Feb. 25.

Calculation of Transformers.—J. T. Duvvis.—A mathematical paper on the design of transformers in such a way that the cost of the active material—copper and iron—becomes a minimum.—*Elek. und Masch.* (Vienna), Feb. 7.

Turbo-Generators.—Dollinger.—The first part of an article on the calculation of mechanical parts of high-speed machinery, with special reference to turbo-generators.—*Elek. Anz.*, Feb. 21.

Lamps and Lighting.

Flame-Arc Lamps.—An illustrated description of a new form of flame-arc lamp. The lamp, shown in Fig. 2, is provided with two pairs of electrodes, for burning in succession. As each pair has a burning life of somewhat over 17 hours, the total number of hours that the lamp will work with one trimming is



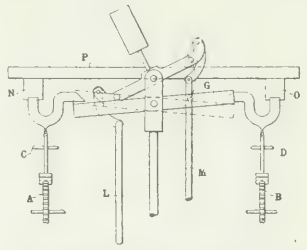


Fig. 2.—CROSS SECTION OF FLAME-ARC LAMP. Fig. 3.—SKETCH OF CHANGE-OVER MECHANISM.

about 35. The feeding mechanism is very simple, in spite of the necessity for a change-over device which comes into operation when the first pair of electrodes is nearly burned out, and a low initial cost is one of the advantages claimed. In order to prevent the deposit of ash on the globe, the lamp is fitted with an inner chimney or globe which induces a strong upward draft. Not only does this carry the fumes rapidly away, but as the globe is so close to the arc, it gets hot quickly and tends to prevent the formation of a deposit. The body of air between the globes prevents the cooling of the inner one. Another n feature is the ash tray, below which are several vertical, rad vanes, arranged to assist the upward draft of air and to act a an air-trap. The products of combustion are carried throu the inner globe and between the cover and inner sleeve of t lamp. A certain amount of ash is deposited on these me surfaces, but this can easily be wiped off when trimming t lamp. In order to obtain a better distribution of light the inn globe is provided with a number of prismatic ribs. Fig. 3 sho the change-over mechanism. The weighted electrodes are su ported by chains wound in opposite directions on drums, the being a drum for each pair of electrodes. Each drum is gear through a train of wheels to an escapement wheel. The wheels are shown at *A* and *B*. In the position shown the pa of electrodes to which the wheel *A* belongs is burning, and th anchor of the escapement, which is pivoted at *C*, is free to wor when the detent *N* rises. The anchor of the other wheel *B* which is pivoted at *D*, cannot move, however, because althoug the detent *O* rises with the detent *N*, the bar *G* engages with th upper portion of the anchor and holds it. The bar *P* is con trolled by the shunt and series solenoids in the usual manner and when the shunt solenoid rocks it up, the escapement-whee *A* is released and feeding takes place. When the first pair o electrodes is nearly burned out, a catch on one of the chain lifts the rod *L* and tilts the bar *G* into the position show dotted. The anchor of the escapement-wheel *B* is thus release and feeding of the second pair of electrodes will take place directly the arc on the first pair lengthens out. When the second two touch, the arc is transferred from the first pair to the new electrodes. The arc is thus never extinguished, and the light given out by the lamp is practically unaffected during the change-over from the first to the second pair of electrodes. After the second pair has been consumed another catch rises and pushes the rod *M* up again, so that the first feeding mechanism is ready to operate as soon as the lamp has been supplied with fresh electrodes. Attached to the bar *P* there is a rod which strikes and regulates the arc in the usual manner.—Lond. *Elec. Eng'ing*, Feb. 25.

Effect of Alternating Current on Tantalum Lamps.—O. Scarpa.—An investigation of the reasons why tantalum lamps have a much longer life when used with direct current than with alternating current. The author has observed that the surface of the metallic filaments operating for a long time with direct current gets rough, thereby indicating a change from an amorphous to a crystalline structure. This change may be due either to high temperature or to mechanical oscillations. In the case of the tantalum lamp the mechanical oscillations due to the electrodynamical reactions between the parallel pieces of the filament is of chief importance. The filament appears to vibrate with double the frequency of the current. The author could observe with a microscope the vibrations of filament under alternating current. With vertical "osmin" (tungsten) lamps the oscillations are much smaller, probably on account of the greater weight and the pasty condition of the filament and the greater symmetry of the lamp. This fact probably explains why tungsten lamps are not so deleteriously affected by alternating current—*Elettricista*, 1908, No. 19; *Elek. Anz.*, Feb. 7.

Mean Hemispherical and Spherical Candle-Power.—E. W. Weinbeer.—The first part of an article illustrated by diagrams in which the author gives a critical summary of the following methods for determining the mean hemispherical and spherical candle-power: (1) by calculation; (2) Rousseau's method; (3) Kennelly's diagram; (4) simplified Kennelly's diagram; (5) graphical method of Weinbeer; (6) ordinate-paper method of Kilmer; (7) quadrant method of Macbeth; (8) slide-rule method of Weinbeer.—*Elek. Anz.*, Feb. 14.

Generation, Transmission and Distribution.

Steam Turbines.—J. Mathivet.—In a central station containing a number of steam turbines of equal rating the problem may arise whether it is more advantageous to distribute the load of the station equally over all turbines or to run them all except one fully loaded and let the last one be loaded according to the requirements at each moment. With reciprocating

gines there is no such problem, since in order to maintain synchronism it is important to distribute the load equally over the different engines. With steam turbines, on the other hand, it is easy to maintain parallel operation of two unequally loaded groups by a very simple regulating device. Among the conclusions reached by the author is the following: If the generating station consists of several turbo-generators and their individual steam consumption varies as a linear function of the instantaneous power, then the total consumption of steam of the whole set for a given load of the plant is independent of the distribution of this load among the different turbo-alternators. In practice, however, it is important to consider how far these assumptions hold true.—*La Lumière Elec.*, Feb. 20.

Electric Motors in Cement Mills.—C. C. BATCHELDER.—An illustrated article in which the author first describes the different machines used in cement plants, such as crushers, rotary kilns, tube mills, etc. Practically all of them demand at least full load when starting. This requirement is fulfilled by the use of compound-wound field coils with direct-current motors, and occasionally by the use of high-resistance secondaries with squirrel-cage induction motors. For very large induction motors it is better to use machines of the type in which resistance is inserted in the secondary circuit while starting, but the horse-power above which this practice becomes advisable varies considerably. In cement plants the tendency is to use squirrel-cage motors up to somewhat larger rating than would ordinarily be recommended, because, where operating conditions are as severe and continuity of operation is as important as in this industry, their simplicity and ruggedness more than counterbalance the better starting characteristics of the slip-ring type of motor. It is advisable to operate the motors at an e.m.f. not less than 440 volts and preferably 550 volts.—*Gen. Elec. Rev.*, March.

Electric Pumping.—A fully illustrated description of an electrically operated pumping and air-compressing installation at Harland & Wolff's shipbuilding yard, in Belfast. The power station supplies both three-phase alternating current at 440 volts, 57 cycles, and continuous current at 220 and 440 volts. The pumps are each driven by a shunt-wound motor capable of developing 200 hp, but the pumps deal entirely automatically with the very variable demand for water according to the level of the water in the hydraulic accumulator. The feature of the arrangement is the use of the Ward Leonard control system for the pump motors, and the provision of special motor-generator sets. Each pump motor is connected direct to one of these generators and by controlling the field of the generator by a regulating field rheostat, automatically worked by the accumulator, to which it is mechanically connected, the voltage generated and applied to the pump-motor armature can be varied from 0 to 440 volts, which produces a speed variation of 0 to 60 r.p.m. on the motor. The pump motors are separately excited at 220 volts. Starting losses are entirely avoided, and since the accumulator takes up any sudden fluctuations in the demand, the speed of the pumps corresponds to the average demand for water at any time, while the momentary fluctuations on the power station are quite small.—Lond. *Electrician*, Feb. 26.

Electric Crane.—An illustrated description of a 50-ton electric crane installed at a dock in England. It is equipped with four motors worked at 440 and 220 volts direct current.—Lond. *Elec. Eng'ing*, Feb. 25.

Electric Winding.—G. HOOGHWINKEL.—An illustrated description of the electric main-shaft winding plant at the Maritime pit of the Great Western Collier Company, near Cardiff. The winding drum is coupled to a slow-speed, three-phase induction motor, and the flywheel equalizer consists of a direct-current machine acting through the medium of a rotary converter.—Lond. *Elec. Eng'ing*, Feb. 25.

Electric Power in a Bleaching Plant.—BACHRACH.—An illustrated description of the electric light and power installation of a bleaching and dying works in which the task was to change as little as possible in the existing machine-tool equipment.—*Elek. Zeit.*, Feb. 25.

Small Motors.—C. H. SCOTT.—An illustrated description of the small-motor department of the General Electric Company at West Lynn, Mass.—*Gen. Elec. Rev.*, March.

Traction.

Electric Ferry-Boat.—The conclusion of the illustrated description of the electric ferry-boat running between Godesberg and Niederdollendorf across the River Rhine. This double-screw boat has a battery of a capacity of 335 amp-hours, when discharged in one hour at a mean voltage of 295. It has a capacity of 645 passengers and also transports carriages. The total first cost of the ferry-boat was $27,750; that of the bridges for landing the passengers was $12,750. The energy consumption of a trip across the river (the width of which is 400 m) is 4.3 kw-hours. In the preceding year the ferry service was carried out by two gasoline launches, but with the electric ferry-boat the receipts increased 60 per cent over the preceding year. Tables are given of the cost of operation.—*Elek. Zeit.*, Feb. 25.

Rates of Acceleration.—F. W. CARTER.—An abstract of a paper read before the Rugby Engineering Society in which the author drew attention to the relative importance of the rates of acceleration in different classes of railway service. After showing the necessity of a high value on urban and suburban lines, the author contends that the single-phase system is, on this account, less suitable for such work than is the direct-current system.—Lond. *Elec. Eng'ing*, Feb. 25.

Interurban Railroad.—MEISSNER.—An editorial discussing the proposed electric railroad from Cologne to Dusseldorf.—*Elek. Zeit.*, Feb. 25.

Steel Ties.—A description of a method of B. E. Tilton for calculating the theoretical section of steel ties. It relates to a method of track-section design in which the parts of the roadway are treated like a bridge and its supports.—*Electric Railway Journal*, March 6.

Installations, Systems and Appliances.

Swiss Central-Station Statistics.—Statistical tables on the central stations of Switzerland for 1907. The statistics refer to 607 central stations, of which 238 generate their energy exclusively themselves; 57 stations have their own generating plant, but also buy energy from outside works; 312 buy their total energy from outside works. Only 266 stations have given detailed information concerning their equipment; the following figures relate only to these 266 stations. Slightly above 50 per cent of them are pure water-power stations, while 37.6 per cent contain both water turbines and heat engines. The first cost of stations of different size per kilowatt of rating—without storage batteries—is given in the following table:

Rating, without storage batteries, kw.	Number of stations.	First cost in francs, per kw. (1 franc = 20 cents). Prime movers and accessories.	Electric equipment (without batteries).	Total cost.
0 to 100	66	970	1,290	2,260
101 to 500	57	815	835	1,650
501 to 1,000	18	645	612	1,257
1,001 to 2,000	10	643	788	1,431
2,001 to 3,000	4	818	752	1,570
3,001 to 4,000	5	540	500	1,040
5,001 to 6,000	3	700	1,048	1,748
6,001 to 10,000	6	805	623	1,428
0 to 1,000	141	752	778	1,530
1,001 to 10,000	28	668	657	1,325

Figures of first cost in which the stations are classified according to the type of prime movers are given in the following table:

Number.	Kind of prime mover.	First cost in francs, per kw. (1 franc = 20 cents). Prime movers.	Electric equipment (without batteries).	Total cost.
87.	Solely water turbines	588	449	1,037
65.	Water turbines and heat engines	744	620	1,364
15.	Solely gas engines	711	1,008	1,719

Twenty-three per cent of all stations use direct current; 9 per cent single-phase current; 30 per cent three-phase current; 23 per cent a combination of single-phase, two-phase and three-phase current; and 15 per cent a combination of direct current and alternating current. Alternating-current works use the following frequencies: 50 (60 per cent); 40 (14 per cent); 44 45 and 45 (each 1 per cent); 40 25 (2 per cent); 18 (2 per cent);

60, (2 per cent), 58.2 v. s; 58.62 v., 70 (each 1 per cent); 33 1/3 and 50 (1 per cent); 52 and 50 (1 per cent); 53 and 50 (1 per cent). The limit for lighting was 120 volts in 30 per cent of the stations, 200 in 25 per cent and 220 in 18 per cent. In alternating-current works the high tension was between 3000 and 4000 volts in 23 cases, between 2000 and 3000 volts in 22 cases, between 1000 and 2000 volts in 20 cases, and between 4000 and 6000 volts in 17 cases. The highest voltages were 11,000; 13,500; 16,000 (three works); 20,000 (two works); 25,000 (five works), and 32,000 (one works). One of the direct-current stations operates at from 5000 to 6000 volts, two at from 8000 to 9000 volts, one at from 14,000 to 15,000 volts, and one at 25,000 volts. The number of the consumers of the 249 stations was 141,820, with 47,644 meters.—*Elek. Anz.*, Feb. 7.

Central Stations and Private Plants.—A discussion of the relative economical advantages of buying electrical energy from a central station or generating it in a private plant. Various tables of cost are given for plants of various sizes, and it is concluded that the relative advantages of a private plant, and the purchasing of energy, depend mainly upon the size of the installation and its load factor. On the whole, with the increasing size of generating stations, it may be taken that under 1000 hp it seldom pays to erect a private plant in a neighborhood where there is a power company of any magnitude; between 1000 hp and 5000 hp it would only pay in cases where the power company was working very inefficiently or liable to expend very heavy capital to reach the consumer. That these considerations are being more and more realized is shown by the fact that it is the almost universal practice on the northeast coast of England for private manufacturers or colliery owners to obtain electric power except by purchase.—Lond. *Engineering*, Feb. 26.

Storage Batteries in Steel Mills.—J. L. Woodbridge.—In steel mills storage batteries are of great importance as the power load is of an exceedingly fluctuating character. The author describes several typical installations of storage batteries in American steel plants, such as that of the Carnegie Steel Company at Youngstown, Ohio.—*Gen. Elec. Rev.*, March.

Wires, Wiring and Conduits.

Insulation and Wiring.—W. H. F. Murdoch.—"When one considers that in ordinary installation work the actual insulation of the wires themselves is of very little effect in raising the insulation of the installation as a whole, one cannot avoid the conclusion that a great deal too much stress is laid upon the wires and their insulation and testing." The insulation of a building seems to depend more on the insulation of ceiling rosettes, lamp-holders, etc., than upon anything else.—Lond. *Elec. Rev.*, Feb. 26.

Units, Measurements and Instruments.

Units.—Brylinski.—A paper presented before the International Society of Electricians in Paris. The author points out that the electrostatic c.g.s. system, the electromagnetic c.g.s. system and the practical system used by electrical engineers are only elaborations of the metric system. The systems of practical units employed in electricity and magnetism do not agree altogether, and it is important to harmonize them, but as this involves considerable difficulty it may be adjourned without many inconveniences. Field density and flux density are probably different units and have different dimensions so that it would be advantageous to differentiate between them by using different symbols. Under present conditions it seems advisable to adopt as a fourth fundamental unit the quantity of electricity. There is also an abstract of a paper by Berthelot, who makes some critical remarks on Brylinski's suggestions.—*L'Industrie Elec.*, Feb. 25.

Meters.—A note on a recent British patent (10,893, 1908, Feb. 18, 1909) of Chamberlain & Hookham, Ltd., and S. H. Holden, for a watt-hour meter of the type in which a metal disk rotates in mercury between the poles of an electromagnet. The magnetic circuit is formed of iron washers threaded on brass rods and separated by thin layers of paper. This division of the core into a number of short lengths decreases the effect of residual magnetism, and, by the use of a nearly complete magnetic circuit, the meter is rendered less susceptible to external magnetic fields. A special bracket for the support of the counting train, brake magnets, and the upper bearing for the armature spindle, which renders access to the mercury chamber easy, is also described.—Lond. *Elec. Eng'ing*, Feb. 25.

Telegraphy, Telephony and Signals.

Electrolytic Detector.—E. Revval.—An article on the electrolytic detector and its use in wireless telegraphy and telephony.—*La Lumière Elec.*, Feb. 20.

Miscellaneous.

Revocation of British Patents.—Following the recent revocation of the Bremer arc-lamp patent, the Hoegner flame-arc lamp patent has now also been revoked in England. In giving his decision the Comptroller "held that, in considering whether a patented article was manufactured mainly or exclusively abroad, he must take into account the numbers of that article which are manufactured abroad in accordance with the patent, but not imported."—Lond. *Elec. Eng'ing*, Feb. 25.

Patent Laws.—E. Adler.—A lecture held in the Electrical Society of Vienna on several points in the international patent law. *Elek. und Masch.* (Vienna), Feb. 7.

Ignition of Gas Engines.—An illustrated review of various recent electrical devices for ignition for internal-combustion engines.—*Elek. und Masch.* (Vienna), Feb. 7.

NEW APPARATUS AND APPLIANCES

Flaming-Arc Lamps.

By Theodore Stave.

Perhaps no other form of illuminant has made such rapid progress in this country during the past year as the flaming-arc lamp. It is only about three years since this type of lamp began to be considered seriously here, though the principal cities in Europe had previously adopted the flaming arc for the illumination of main thoroughfares, and almost every large German manufactory of importance had taken advantage of its economy.

As far back as 1870 successful experiments were made in Paris with a type of flaming-arc lamp known as the "Lampe-Soleil," which was hailed as a wonderful improvement in arc lamps. It was, however, soon abandoned on account of the high cost of carbons and the difficulty met in their manufacture, and it is only comparatively recently that it has been revived on account of important improvements made in the impregnated carbon. One of the principal drawbacks to the impregnated carbon is that upon cooling it becomes coated with a slag which is non-conductive and thus prevents the striking of the arc. This trouble is more noticeable in the case of vertically aligned than of downwardly inclined carbons. Through very recent developments, however, carbon makers have been able to minimize this defect to such an extent that even vertical carbons will strike up entirely satisfactorily after cooling.

It has thus been possible to develop a type of flaming-arc lamp with vertical carbons, which type has the advantage of lower energy consumption and of enabling larger carbons to be used, thus considerably increasing the hours of burning. The light distribution is also more favorable, as the maximum rays are at an angle of 60 deg. as compared with an angle of 45 deg. in the case of the inclined-carbon lamps.

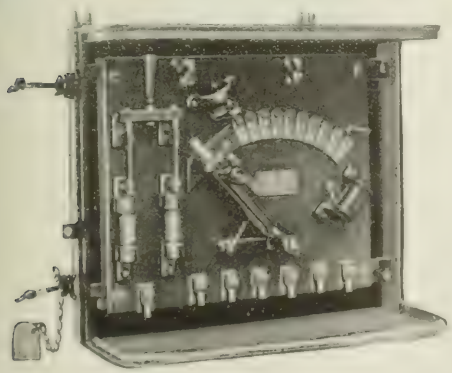
These recent improvements in flaming-arc lamps have had a very beneficial effect on the electric lighting industry, as the trend has become greater every day for more efficient illumination than with the ordinary enclosed arc lamp, which has been almost exclusively used for the last 15 years in this country wherever large areas have to be illuminated. It will not be very long before the large consumers of electric light will realize that a saving of 60 to 70 per cent can be obtained by the replacement of the old types of arc lamps by the modern flame arc, either in more light for the same expenditure or in actual saving in the cost of present lighting.

For the lighting of foundries and docks the flaming-arc lamp is of the greatest value on account of the penetrating character of its light. It has been repeatedly demonstrated that however foggy outdoors or smoky in foundry or mill, the yellow rays of the flaming-arc lamp will penetrate the murky atmosphere better than any other source of light. The result of replacing ordinary enclosed-arc lamps, which, as is well known, emit a considerable percentage of ultra-violet rays, with flaming-arc lamps is astonishing in effect. This is due principally to the richness in amber rays emitted from the flaming arc. It is a well-known fact that the amber rays are the least offensive since they have a minimum of the injurious rays of high refrangibility. This fact extends the usefulness of the flaming arc from its original employment for purely advertising purposes to numerous industrial purposes, and particularly to the lighting of foundries, mills and machine shops.

Motor-Starting Box for Battleships.

The accompanying illustration shows a controlling panel built by the Ward Leonard Electric Company, of Bronxville, N. Y., for battleship service. Aside from ordinary requirements, devices of this type must also not introduce fire hazard or take up much space. The panel consists of a line switch and fuses and motor starter with no-voltage release for use in regulating motors driving ammunition hoists. The no-voltage release is connected across the line and is independent of the current passing through the motor. The wire used for resistance is encased in enamel and is thus immune from atmospheric conditions.

The various segments are renewable from the face of the panel, and in order to prevent arcing an independent spring-operated circuit-closing switch is used which opens the circuit with a quick break. The moving contact on the controlling arm



MOTOR-STARTING BOX.

consists of a self-aligning renewable skate shoe. The starter is designed for motors rated at from 3 hp to 5 hp. The entire outfit is set into an enclosing case made up of cast-metal back and sides with a hinged cover of sheet brass. The line lead wires are led into the box through pipes screwed into the top of the box and the motor leads are led from the bottom of the box in the same manner. The rheostat is claimed to be fool-proof, and is characterized by compactness and lightness in weight.

Direct-Current Watt-Hour Meter.

The Duncan Electric Manufacturing Company, of Lafayette, Ind., has brought out a new watt-hour meter for direct-current circuits, the essential features of which are illustrated in Fig. 1 herewith. The back, magnet support and arch holding the series-field coils, compensating coil, upper bearing, brushes and compensating switch are made of pressed sheet brass, and the

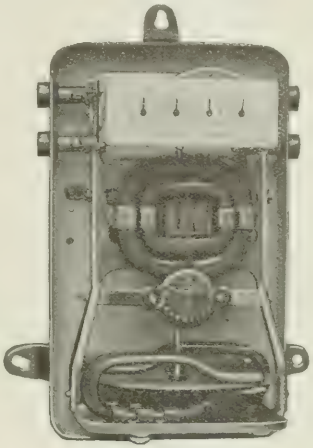


FIG. 1.—WATT-HOUR METER.

gear wheels and pinions for the registering train are cut by automatic machinery, which renders the possibility of their binding remote. The cover, which is dust- and moisture-proof, is held in position by wing-headed screws which cannot drop out. No change has been made in the multipoint switch method of compensating for friction or vibration which is used throughout the entire line of instruments. Any degree of compensa-

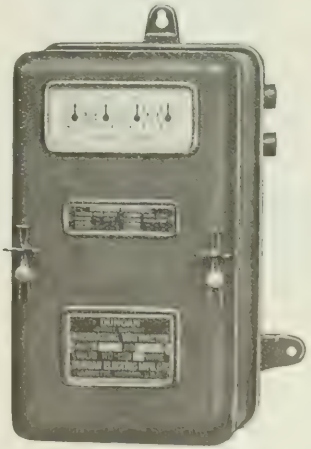


FIG. 2.—WATT-HOUR METER.

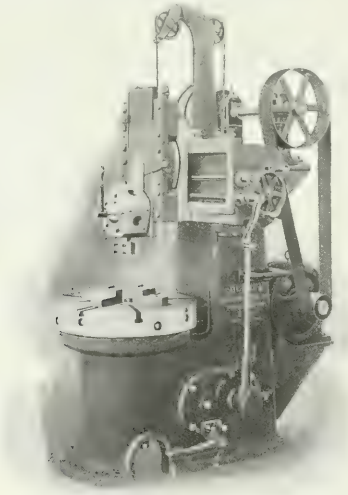
tion is obtainable by simply turning the switch lever over one or more contacts. A high turning moment is possessed by the instruments, the smallest sizes having a torque of not less than 200 mm grams, it is claimed, while the larger meters have a torque as high as 600 mm grams. The steel employed for the magnets is the same as used by the company for many years

and possesses high retentivity and permanence. For the 110-volt meters the resistance unit is of the cartridge type. The cartridge is 4 in. long and 1 in. in diameter and is held by clips which render its removal or insertion a matter of a few seconds. The unit is embedded within a fireproof composition. The other Duncan features, such as the visual bearing, the threadless jewel post, etc., are still retained, as well as the old form of armature. The latter is wound with 8000 turns of No. 40 silk-insulated wire and is mounted upon a light framework. The brushes are of the direct-tension type. To facilitate the work of testing, each meter is marked with the number of watts required to make 1 r.p.m.

The company has also brought out a full line of astatic switchboard meters in which the series-field coils are so arranged that they oppose each other and within them is placed a four-pole armature with the brushes set on the commutator at an angle of 90 deg. External fields are said to have very little effect on this type of meter. Tests made by bringing busbars as near the meter as its mechanism will permit are said to have shown an error not exceeding 2 per cent. The larger sizes of house meters also embody the features of the switchboard meters.

Thirty-Four-Inch Vertical Boring Mill.

In the accompanying illustration is shown a boring mill adapted from a standard belt-driven outfit to motor drive by the addition of a countershaft and a constant-speed, 5-hp, Westinghouse direct-current motor mounted on special brackets at the rear of the machine. The speed changes are made mechanically by the cone pulleys and by the gears in the base. There are in all 16 different speeds which give the table speeds from 2⅜ r.p.m. up to 68¾ r.p.m. The boring mill is equipped with a five-sided turret which permits five or more operations

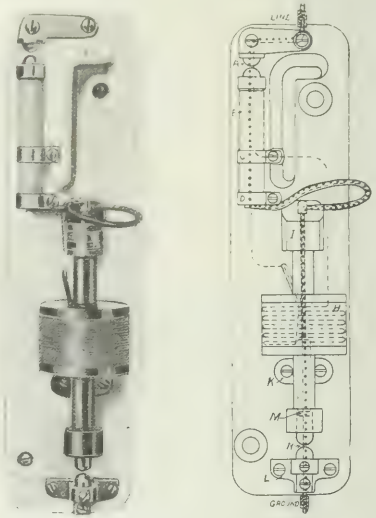


BORING MILL.

to be performed on one piece of work in any direction without stopping the machine or changing a tool. The turret is mounted on a vertical slide which may be swiveled to any angle up to 30 deg. on either side of the perpendicular. This arrangement is accomplished by first locking the weight by means of the clamp on the sheave wheel bracket on top of the machine and then by turning the crank on the vertical feed shaft. The feeds are positive, gear driven, for both vertical and horizontal motions and are provided with adjustable automatic stops. There are eight available feeds for any speed of the table. A special attachment is provided for thread cutting which may be readily applied and, if desired, can remain permanently attached to the machine without interfering with its regular operation. T boring mill, which is especially adapted to automobile wo although it can be used in different industries, is manufactur by the Colburn Machine Tool Company, of Franklin, Pa.

Lightning Arresters for Alternating-Curre Work.

Several new, although not untried, features are found in t lightning arresters of the Electric Service Supplies Compa of Philadelphia, Pa., designed for alternating-current circui of from 1200 to 20,000 volts. Among these may be mention the following: The arrester does not depend for its succes ful operation on the spark-gaps alone, nor upon the use of r sistance alone to prevent the current from following the di charge, nor yet upon combined air-gaps and resistance. A automatic circuit-breaker opens when the discharge occurs the full-voltage point of the alternating wave or when the air gaps are corroded and dirty. When the discharge occurs a or near the no-voltage point, the two air-gaps and the serie resistance prevent the normal current following the discharg The company states that experience has shown that the circuit breaker is called into operation in but one out of about fiv discharges. The total air-gap distance in the 2500-volt type i 0.095 in., and the non-inductive series resistance averages 25 ohms. The line connection is at one end of the arrester bas and the ground connection at the other end, so that parts hav ing the greatest potential difference are widely separated an flash-overs and short-circuits because of dirt or moisture on the arrester base are prevented. The total air-gap distance in the 3750-volt arrester is 0.19 in. and the non-inductive resistance has a value of 500 ohms. The construction and operation of the arresters will be readily understood by reference to Fig. 2



FIGS. 1 AND 2.—LIGHTNING ARRESTERS.

One of the discharge points is mounted on the end of the rod *B*, which is held in position by clamps *C* and *D*. The distance from *C* to the upper discharge point *A* on the resistance rod is 2¾ in. The solenoid cut-out coil *H* is supported by brackets *I* and *K*, the latter being designed to give a surface distance on the porcelain base of 2¼ in. between *K* and the lower discharge point bracket *L*. This gives a total surface distance of 5 in. on porcelain, which is considered ample for 2500 volts. To reduce still further the possibility of the discharge jumping between parts, the line connection is at the top and the discharge passes downward in practically a straight path to the ground connection. This path is indicated by the round dots in

diagram; the dashes showing the path of normal current. It will be noticed that the discharge goes through the section of the resistor *C-D*, the normal current being shunted through the solenoid coil *H*. This energizes the armature *J* and opens the circuit between the discharge point *M* and the lower end of the armature. The discharge point *M* is stationary so that the spark-gap at *N* is not changed by the operation of the arrester. The arc is thus drawn out until broken inside the tube, which is said to be practically air tight. The upper end of the discharge point *M* is of carbon. For higher voltages the arresters differ in width and length of base and have additional air-gaps. The cut-out is automatic and restores itself by gravity. It is claimed to interrupt the flow of normal current positively and thus to limit the amount of attention necessary for the discharge points to occasional inspection.

Direct-Current Flaming-Arc Lamp.

Some of the distinctive features of the "Aurola" flaming-arc lamp manufactured by the Siemens-Schuckert Works and marketed in this country by the Charles L. Kiewert Company, of Milwaukee, Wis., are indicated in the following: The direct-current lamp illustrated in Fig. 1 is tilted slightly in order to show important details. The operating mechanism consists of an armature swinging between shunt and series magnets. Attached to this armature is a frame containing a single chain wheel, reduction gear, escapement for the feed and the control of the arc distance. Characteristic of the design is the employment of only one strong, flat link chain (Fig. 3), consequently only one chain wheel is necessary. This detail insures a high degree of reliability in service and at the same time facilitates trimming operations. The button with which the carbon holders are lifted (see Fig. 3 in chain tube) is on the outside of the lamp and handy for the trimmer. The wires leading to the blow-out magnet, which is placed within a well-ventilated collar, are concealed inside of the carbon-holder guide tubes. The automatic cut-out not only interrupts the shunt, but the series circuit as well as soon as the carbons have burned away. The upper and lower castings are rigidly connected by six strong tubes. The ventilation of the globe (Fig. 2), is very efficiently arranged by an air-admitting ash tray and a long draft-producing sleeve. The current of air sweeps the inner surface of the globe and carries off any particles which might settle. The globe is thus kept clean and absorption of light from deposit is a minimum. The lamp is built for 10 amp and two burn in series across a 110-volt circuit. The steadiness of the light is especially good as the feeding intervals are small and the variation of the arc distance is kept at a minimum.

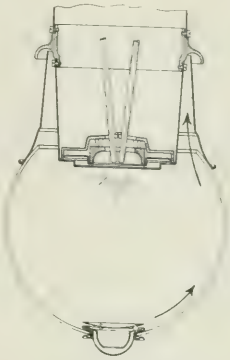


FIG. 2.—GLOBE VENTILATOR.



FIG. 1.—DIRECT-CURRENT LAMP

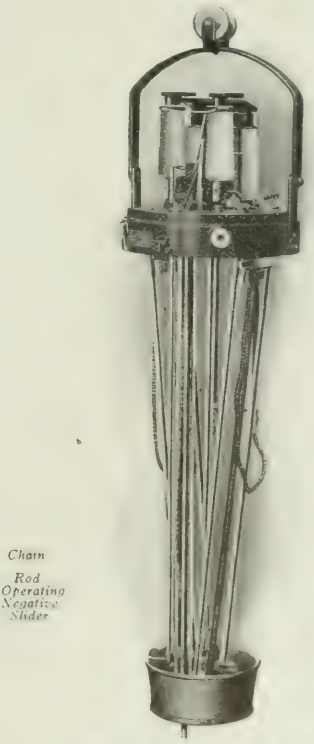


FIG. 3.—DIRECT-CURRENT LAMP

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

There has not been any material change in the general condition of business during the past week further than the development of a rather better tone and sentiment among wholesalers and jobbing interests. Actual sales have not been much improved. The near approach of the spring season and of Easter have, of course, augmented to a considerable degree the business of the retailers. In fact, shopping, in dry goods and millinery lines, has been quite active all over the country. This has been reflected by some improvement in the demand upon jobbing houses, but the buying is still marked with extreme conservatism. The export trade is very much smaller than had been anticipated, and this is attributed largely to the maintenance of high prices in this country. The unsettled condition of the coal trade adds to the general depression of business. A fair degree of activity has been developed in iron and steel industries by the recent reductions in price, but the competition in this branch of trade is particularly acute. Contracts are being taken at very low prices and promises for profits in this line of business are not particularly encouraging. The best demand that has developed has been for structural material. Rails and car equipments continue to be very dull. Prices for wire have hitherto been maintained, but it is currently reported that cuts will be made within the next few days unless business improves. The large electrical manufacturing concerns report that the steel price war and the weakness of the copper market have resulted in a marked falling off in orders for electrical apparatus. Although the companies fully expected to be operating on an 85 per cent basis by this time they are in reality only operating on a basis of between 55 and 60 per cent of their capacity. The February report for building, from 95 of the principal cities, shows a gain of 15.6 per cent over January, and a gain of almost 100 per cent over February of last year. Reports from the winter wheat crop are rather more favorable than heretofore. General rains through Texas and the Southwest have done much to benefit the gowing crops. The promise of good yields of all kinds comes from the Pacific slope. Collections are somewhat improved over February. They are not now giving any uneasiness or trouble to the transaction of business. Business failures for the week ended March 11, as reported by *Bradstreet's*, were 254, against 219 the week previous; 278 in the similar week of 1908; 186 in 1907; 187 in 1906, and 186 in 1905.

THE COPPER MARKET.

The report of the Copper Producers' Association which was made public last week had the effect of depressing the market to such an extent that the quotations on metal exchange were marked down ¼ @ ⅜ cent on all grades. The figures which were made public announce that the stock of marketable copper in the United States amounts to 173,284,248 lb. This is an increase of almost 30,000,000 lb. over the figures given out the month previous. This is not as great an increase as many statisticians had figured out. In fact, it is pretty generally believed that the term "marketable" is so restrictive that large quantities of copper which are practically ready to go on the market are not counted in the figures of the association. It is thought that the actual stocks of copper which can readily be placed on sale in this country are far in excess of the figures given out, although the latter probably correctly represent the refined metal held in producers' hands. The stocks carried in Europe are enormous and it is the weakness of the market there that has brought about the demoralized condition in this country. The truth of the situation is that the actual condition of the copper market is finally being understood and that the powerful financial interests which have so long sustained prices are either unable or unwilling to continue the work. There is as yet no effort being made to curtail the heavy production; domestic consumption is very light and has not as yet been stimulated by the lower prices and the speculators in Europe have almost as heavy a burden as they can carry. There is every reason to anticipate that the movement in March will result in a further accumulation, in producers' hands, of more than 30,000,000 lb. So far there has been no agreement made to curtail production and in the present temper of the producers such an agreement is unlikely. The output may be reduced, but it is much more likely to be by the voluntary contraction of those miners who find it cent copper unprofitable than by any mutual agreement among the principal producers. Miners who can market copper at profit at 10 cents see no reason why they should curtail their business in order to protect others not as fortunately situated On the other hand, it is not likely that prices will be allowed to go much lower and present prices should, in the near future stimulate buying. The margin of profit for many producers is almost reached. Already buying for export has been considerably stimulated and the selling agencies report some revival in inquiries from domestic consumers. Exports since March 1 part of these shipments has gone to the Continent. Prices part of these shipments have gone to the Continent. Prices quoted on the Metal Exchange March 15 were:

Lake	12½	@	12¾
Electrolytic	12⅝	@	12¾
Castings	12	@	12⅛

London prices were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	55 2 6	54 15 0
Standard copper, futures	55 17 6	55 11 3
Market	Weak.	Weak.
Sales of spot		900 tons
Sales of futures		1,500 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14 55	12.62½
Electrolytic	14.25	12.20
Castings	14.12½	12.07½
London, spot	£64 2 6	£54 15 0
London, futures	64 17 6	55 11 3
London, best selected	67 15 0	59 5 0

ALLIS-CHALMERS COMPANY'S ORDERS INCREASING.—The business of the Allis-Chalmers Company is reported to be continuously improving. The volume of orders booked during the month of February was approximately 15 per cent less than that for January, but this was attributed to the fact that owing to the many holidays there was a smaller number of business days in that month. There was practically no difference in the average daily business of the two months. The total business booked since the first of the year is about 140 per cent greater than for the same period last year. The greater part of this business has been for mining and pumping machinery, although there have been quite satisfactory orders received for turbines and gas engines. It is stated by the officials of the company that the question of dividends on the preferred stock will not be considered at this time, but in view of the fact that the physical condition of the properties is better than it has ever been before, it will not be a great while before these shares are placed upon a dividend basis. The balance sheet of the company on Dec. 31, 1908, shows assets amounting to $27,525,367.

SEEKING HYDRO-ELECTRIC POWER FOR NITRATE PLANT.—The bulletin of the Bureau of Manufactures of the Department of Commerce and Labor announces that representatives of European manufacturers of air nitrates for fertilizers are endeavoring to find in this country large water powers in order to establish plants here. The publication says: "An industry of this kind is needed, as the imports of Chilean nitrate of soda now amount to $14,000,000 a year. Difficulty is being experienced, however, in securing suitable water power at reasonable cost. Governments of other countries are said to be offering inducements for the location of the extensive nitrate mills which the company proposes to erect."

RUMORED CHANGE FROM ALTERNATING TO DIRECT CURRENT TRACTION.—It is rumored that the Washington, Baltimore & Annapolis Railroad will substitute a direct-current-system for its present single-phase alternating-current traction equipment.

ESTERN ELECTRIC MANUFACTURING POLICY.—s understood to be the present policy of the Western Electric mpany to consolidate all of its manufacturing operations at Hawthorne works, just outside of Chicago. The South nton Street buildings of the company, in Chicago, containing offices, where some light manufacturing is still carried on, for sale, but will probably be utilized for the company's ce purposes for some time to come. The large telephone le manufacturing plant, which has a capacity of 150,000,000 nductor-feet a week, has been operated as a branch of the wthorne works for several years. Mr. H. F. Albright is gen- l superintendent, in charge of all manufactures. He is located Hawthorne, as is also Mr. H. M. Sage, the assistant general perintendent. The names of the heads of the manufacturing partments at Hawthorne are Mr. A. C. Dodge, superintendent telephone apparatus shop and also of cable and rubber in- lating shops; Mr. C. M. Campbell, superintendent of power paratus shop; Mr. O. C. Spurling, plant engineer. Mr. F. L. lman, superintendent of the New York shop, reports to essrs. Albright and Sage at Hawthorne. The manager of the icago office for sales is Mr. F. V. Bennis, and the assistant anagers are Messrs. F. A. Ketcham and L. J. Baldwin. Mr. P. Sidley, the vice-president and general counsel of the mpany, is also located in Chicago.

ELECTRICAL CONCESSION AT SAO PAULO, BRA-IL.—The Mayor of the city of Sao Paulo, Brazil, has recently anted to Guinle & Company—who are the Brazilian represen- tives of the General Electric Company and prominent devel- pers of hydro-electric properties—a concession which gives em the right to sell electrical energy in the city and to use e streets for their transmission cables. This insures the con- uction of an extensive hydro-electric plant near the city on e river Itapanhau, at which it is expected that at least 60,000 p will be developed. This is the third important hydro-elec- ic plant that Guinle & Company will eventually develop in Brazil. The plant near Nictheroy and Rio de Janeiro is now elivering power in the former city and plans have recently een made to increase the capacity from 50,000 hp to 70,000 hp. The plant at Bahia, now operated by steam, may soon have hydro-electric development amounting to 50,000 hp. Rights to hree waterfalls have been secured for this purpose. Speaking of the Sao Paulo project, a representative of Guinle & Com- pany in New York said: "We expect, as soon as our plant is completed, to do a great deal toward developing the industries of the city. We will deliver energy for lighting at 6.1 cents per kw-hour and for power at 3 cents. These rates are but small fractions of those now prevailing in the city."

NEW POWER PLANTS FOR MEXICO.—Senor José Zelaya, a Mexican banker and mine owner, has been in New York during the past week financing a consolidation of a number of mining properties. The Mexican financier says that a good part of the $25,000,000 in gold recently bought by the banks of the City of Mexico will be circulated among farmers and fruit growers, who are rapidly taking up lands that have been irrigated by United States capital. He also says that plans are being drawn in Mexico for hydro-electric undertakings to the amount of about $18,000,000, which are to be operated by machinery made in the United States. The expenditure referred to includes the main canals, irrigating ditches and reservoirs. In the Chihuahua mining district there has been a remarkable example of the great value of irrigating arid lands, furnished by the promoters of a colony from the United States. These investors purchased large tracts at an average of $1.50 an acre. After the irrigating projects were developed the value of this land increased to from $75 to $100 an acre. Bountiful crops are now being raised, for which the adjacent mining camps furnish a quick cash market. It is the example of this promotion that has inspired the organization of a score of hydro-electric projects.

SIEMENS & HALSKE FLAMING-ARCS.—Through its American representative, Dr. Karl Georg Frank, the Siemens & Halske A. G. is meeting with very satisfactory returns from the sales of flaming-arc lamps in this country. It reports that inquiries for these lamps are being received in great numbers and that many towns and cities are considering their use for municipal lighting. The company has recently sold 40 "Aurola" lamps to the Ringling Circus, which will open at Madison Square Garden, New York, next week. These lamps are 3000 cp and will be served with current by the New York Edison Company. They will be used by the circus throughout the season for lighting its immense tents. Dr. Frank says that from the rapidity with which orders are being received he will sell 5000 flaming-arc lamps during the year 1909. Another product of the Siemens & Halske plant that is attracting considerable attention in America is its fire alarm system. The company makes a specialty of compact equipments of this character, and pays particular attention to ornamental street boxes. Quite a number of the smaller cities, both in this country and in Canada, have purchased installations.

CHICAGO NAVAL TRAINING STATION LIGHTING PROPOSALS.—Proposals will be received at the Bureau of Navigation, Navy Department, Washington, D. C., until noon, March 24, for outside lighting at the Naval Training Station, North Chicago, Ill. It is intended to install a complete system of outside lighting at this new training station on Lake Michigan. The contract will include labor and material, and poles, wires, conduits, incandescent lamps, brackets, globes, etc., with connection to the cables placed by others. No arc lamps are included in the contract. Detailed information may be had from the chief of the Bureau of Navigation, Navy Department, or from the commandant at the Naval Training Station, North Chicago, Ill.

FOURTH HUDSON COMPANIES' TUNNEL BORED.—The last of the four tunnels being constructed under the North River by the Hudson Companies was bored through on March 11. This tunnel is known as the Fulton Street Tube, and extends from the Hudson Terminal Buildings in lower New York to the Pennsylvania Railroad Station in Jersey City. The work of completing the tunnels and laying the tracks will be rapidly pushed forward, and Mr. W. G. McAdoo, the president of the Hudson & Manhattan Railroad Company, promises that his lines will be in operation by July 1. The power house equipment has already been installed, and 90 new steel cars have been ordered, which will be ready for delivery within two months.

PRAGUE, OKLA., CONTRACT OPEN.—Bids will be received by F. M. Newhouse, town clerk, for furnishing material for construction of an electric light plant and water system for Prague, Okla., as follows: Tower and tank, pressure pumps and accessories; motor-driven deep-well pumps, including motors; boilers, steam engine, alternating current generator, switchboard, arc lamps, regulator, transmission line equipment, etc. The Michael Cooke Engineering & Construction Company, of Joplin, Mo., has charge of the construction of the plant.

EXPORT JOURNAL OF MANUFACTURERS' ASSOCIATION.—The National Association of Manufacturers has completed plans for the publication of an export journal, to be printed in both English and Spanish. The publication will be conducted by Mr. James L. Elwell, who for a quarter of a century has been associated with R. G. Dun & Company.

NAVAL ELECTRICAL SUPPLIES.—The Bureau of Supplies and Accounts of the United States Navy Department asks proposals for 70,000 ft. of insulated conductor and six transformers. Bids are to be opened March 23.

SPRINGFIELD, O., CENTRAL STATION ENLARGEMENT.—The Springfield Light, Heat & Power Company is preparing plans for the construction of a large addition to its plant.

Financial Intelligence.

THE WEEK IN WALL STREET.

The condition of the stock market during the past week was one of extremely dull trading, with prices rather firm and well-maintained. This is explained by the fact that the stagnation in commercial circles is discouraging to traders while, on the other hand, the unusual cheapness of money relieves any pressure to sell. There have been few instances to affect the market either one way or the other. The uncertainty as to the tariff continues to be a deterrent to any activity. Until this matter is settled there is not likely to be any considerable expansion in trading. The final dismissal of the case against the Standard Oil Company would, in ordinary times, have been eagerly seized as a bull argument. When the heavy fine was imposed upon the company by Judge Landis the stock market was seriously affected. In fact, there are many who date the beginning of the present lengthened period of depression at this occurrence. The dismissal of the case had not only been anticipated but there has been for several months a feeling that corporation baiting is over, for the present at least. One demoralizing feature in

the market is the condition of the copper metal trade. It seems very evident, unless this is improved speedily, that the earnings of copper shares cannot be maintained on their present basis. The weekly and monthly reports from the railroads show continued improvement, in spite of the fact that industrial plants are being operated on but little better basis than they were a year ago. All of these things tend to develop in the stock market a waiting condition. Investors and traders are not without faith in the future, but they do not see any reason why they should engage actively in business until there is some revival in other lines. It is well-known that many large projects are on foot; that plans have been drawn for extensive developments and that the financing of these undertakings will bring into the market many new issues of bonds and will enliven conditions in money. Whether we can hope for very much in this direction before next fall is uncertain. It will largely depend upon the speed with which the new tariff bill is adopted and the settlement on a fixed basis for the steel industry. In the latter, during the past week, prices have continued to be demoralized and there is active price cutting in order to secure the little business that is offered. Money continues to be plentiful and cheap, and call loans on March 15 were quoted at 1¾ @ 2 per cent, 90-day paper at 2¾ @ 3 per cent. The quotations in the table are those at the close March 15.

NEW YORK.

	Mar. 8.	Mar. 15.	Shares Sold		Mar. 8.	Mar. 15.	Shares Sold
All. Ch.	13⅜*	13½*	250	Int.-Met., pfd.	44⅛	43½	900
All.-Ch., pfd.	43¾*	41	300	Mackay Cos.	72¾	73½*	600
Amal. Cop.	69¼	66⅝	138,025	Mackay Cos., pfd.	71¼	71¼*	200
Am. D. T.	35*	35*	——	Manhattan Elev.	146*	142½	250
Am. Loc.	51⅛	50¼	7,980	Met. St. Ry.	25*	25*	——
Am. Loc., pfd.	111¾*	111½*	100	N. Y. & N. J. Tel.	115*	115*	——
Am. Tel. & Cbl.	76*	76½	150	Steel, com.	45⅝	43¾	293,900
Am. T. & T.	128½	129⅜	5,115	Steel, pfd.	111⅜	110⅜	7,450
B. R. T.	72½	70⅜	38,430	W. U. T.	65½	65⅝	400
Gen. Elec.	152*	153¼	750	West'h., com.	78	77	2,470
Int.-Met., com.	15¾	14¾	19,500	West'h., pfd.	110*	110*	——

PHILADELPHIA.

	Mar. 8.	Mar. 15.	Shares Sold.		Mar. 8.	Mar. 15.	Shares Sold.
Am. Rys.	40*	40*	——	Phila. Elec.	11¾	11⅝	——
Elec. Co. of A.	12	11½	——	Phila. R. T.	28	27½	——
Elec. Stor. B'ty	46½*	46½	——	Phila. Traction.	91	91	——
E. S. B'ty. pfd.	40*	40*	——	Union Traction.	53⅝	53⅜	——

CHICAGO.

	Mar. 8.	Mar. 15.	Shares Sold.		Mar. 8.	Mar. 15.	Shares Sold.
Chi. City Ry.	187*	187*	——	Chi. Tel. Co.	132¼	132	——
Chi. Rys., Ser. 1.	111*	111*	——	Met. El., com.	10*	10*	——
Chi Rys., Ser. 2.	41⅛	48½	——	Nat'nal Carbon.	86*	85½	——
Com. Edison.	106½	111¾	——	Nat Carb., pfd.	118¾*	119	——
Chi Subways.	25¼	25¼*	——				

BOSTON.

	Mar. 8.	Mar. 15.	Shares Sold.		Mar. 8.	Mar. 15.	Shares Sold.
Am. Tel. & Tel.	128⅝	129⅛	——	Mex. Tel.	21½*	21½	——
Com. Tel.	129*	127½*	——	Mex. Tel., pfd.	65*	65*	——
Edison El. Ill.	253	253½	——	N. E. Tel.	133	135	——
Gen. Elec.	152¼	154	——	W. Tel. & Tel.	7*	7*	——
Mass. Elec. Ry.	14¾	15*	——	W. T. & T., pfd.	77½	77½*	——
Mass. E. R., pfd.	72	70½	——				

*Last price quoted.
Shares sold are for week March 8 to March 13.

DIVIDENDS.

American Telephone & Telegraph Company, quarterly, 2 per cent, payable April 15.

Manila Electric Railroad & Light Company, quarterly, 1 per cent, payable April 1.

Cincinnati Gas & Electric Company, quarterly, 1⅛ per cent, payable April 1.

Duluth Edison Electric Company, quarterly, 1½ per cent, payable April 1.

United Traction & Electric Company, Providence, R. I., quarterly, 1¼ per cent, payable April 1.

West End Street Railway, Boston, quarterly, 1¾ per cent, payable April 1.

Union Traction Company of Indiana, Anderson, Ind., preferred semi-annual, 2½ per cent, payable April 1.

Halifax (N. S.) Electric Tramway Company, Ltd., quarterly, 1½ per cent, payable April 1.

West India Electric Company, Ltd., Jamaica, quarterly, 1¼ per cent, payable April 1.

Springfield (Ohio) Light, Heat & Power Company, initial, 1 per cent, payable April 10.

Massachusetts Lighting Companies, quarterly, 1½ per cent, payable April 15.

Otis Elevator Company preferred, quarterly, 1½ per cent, payable April 15; common, annual, payable April 15 and October 15.

Phelps-Dodge Company, Inc., initial, 2½ per cent, payable March 31.

Bangor (Me.) Railway & Electric Company, quarterly, 1 per cent, payable April 1.

Westinghouse Air Brake Company, quarterly, 2½ per cent payable April 10.

United Gas Improvement Company, Philadelphia, quarterly 2 per cent, payable April 15.

Manhattan Railway Company, quarterly, 1¾ per cent, payable April 1.

Western Union Telegraph Company, quarterly, ¾ per cent payable April 15.

Toronto Railway Company, quarterly, 1¾ per cent, payable April 1.

PROBABLE CONSOLIDATION OF ELEVATED RAILROADS IN CHICAGO.—A movement is on foot which has for its object the purchase of the Union Elevated Railroad Company, operating the downtown elevated "Union Loop," in Chicago, and putting it into the hands of a new corporation, which according to the plan, will lease all the other elevated railway companies using the loop. It is probable that the name of the new company will be the Central Terminal Company. The plan has for one of its features the creation of a guaranty fund of $4,000,000, to guarantee the leases of the subsidiary roads. It is probable that a transfer system within a specified transfer zone will be adopted for all the elevated roads. It is likely that this plan will go through, although the scheme has not received final approval. The "outlying" companies using the Union Loop are the South Side Elevated Railroad Company, Metropolitan West Side Elevated Railway Company, Chicago & Oak Park Elevated Railroad Company and Northwestern Elevated Railroad Company. The general committee of financiers in charge of the plan consists of Messrs. Ira M. Cobb, vice-president of the Assets Realization Company; Samuel Insull, president of the Commonwealth Edison Company, and H. K. Boisot, vice-president of the First Trust and Savings Bank, all of Chicago.

UNION SWITCH & SIGNAL COMPANY.—At the annual meeting of the Union Switch & Signal Company, held in Pittsburgh March 9, the old directors were re-elected with the exception that Mr. James J. Donnell was chosen to succeed Mr. John B. Jackson. In the absence of Mr. George Westinghouse, the president of the company, who is in Europe, Mr. H. C. Prout, the vice-president, presided. The financial report of the company, which has already been published in these columns, was not encouraging so far as the business done in 1908 was concerned, but the prospects for the future were said to be very satisfactory. It was announced that the company has at the present time on hand at Swissdale orders for unfilled business amounting to $1,357,000. New contracts for block signaling and other railroad safety devices are now coming in more freely than at any time during the last 18 months. Inquiries for quotations on new business are increasing right along and are spread pretty widely over the entire country.

CHICAGO & MILWAUKEE BONDS.—A petition was filed in the United States District Court of Milwaukee on March 11 by the receivers of the Chicago & Milwaukee Electric Railroad Company to determine the validity of a $2,000,000 bond issue. The receivers of the company are apparently of the opinion that the president exceeded his authority in this matter, and that the bonds were issued without consent of the Wisconsin State Commission. The bonds were issued before the railroad was placed in the receivers' hands, and other questions besides their validity are involved.

PURCHASE PACIFIC TELEPHONE BONDS.—J. P. Morgan & Company have purchased $15,000,000 of the collateral trust bonds of the Pacific Telephone & Telegraph Company. This company is one of the subsidiaries of the American Telephone & Telegraph Company. The proceeds of this bond sale will be mainly used for refunding purposes, but there will be enough retained to make all the improvements and extensions that are necessary. The bonds bear 5 per cent interest.

SUBWAY PLANS FOR ST. LOUIS.—Plans and estimates are nearing completion for a passenger and express subway from near the Eads Bridge downtown to Taylor Avenue, in the west end of St. Louis, the cost of which has been figured at nearly $40,000,000. Four branch lines are also planned. An organization has been effected. It is expected that New York capital will be secured to finance the enterprise.

GEORGIA RAILWAY & ELECTRIC COMPANY.—The report of the Georgia Railway & Electric Company for 1908 shows gross earnings of $3,339,021, an increase over the previous year of $29,680, or about 1 per cent. The net earnings were $689,027, an increase of $42,968, or about 2.6 per cent. After the payment of all fixed charges, 5 per cent dividends on the preferred and 6 per cent dividends on the common stock there remained surplus earnings for the year of $258,576. Beginning with April 1, 1908, the company operated under a new contract with the city of Atlanta. Under the new arrangement the charge for street lighting was reduced from $75 to $60 per arc lamp per year, and the rates for service to commercial customers was reduced from 12 to 10 cents per kw-hour for lighting and from 7 to 6 cents for power—both rates being the maximum permitted. During 1908 $390,786 was expended on new construction and additions, distributed as follows: Georgia Railway & Electric Company, $321,372; Atlanta Gas Light Company, $9,414. During the year 5.37 miles of new track were built, 4.07 miles rebuilt and .26 mile abandoned. The company controls the street railway, electric light, gas, power and steam heating interests of Atlanta and its neighborhood, and operates under a perpetual franchise. The stock of the company is largely owned by Boston interests.

PHELPS-DODGE COMPANY.—The capital stock of the Phelps-Dodge Company, to the extent of $50,000,000, has been listed on the New York Stock Exchange. The company has been incorporated with an authorized capital of the amount indicated, but there has been issued so far only $44,959,660. The assets of the company consist of 199,516 shares of the Copper Queen Consolidated Mining Company, for which was paid $135 per share, or $26,934,660; 26,000 shares of the Montezuma Copper Mining Company, for which was paid $307 9/13 per share, or $8,000,000; 40,000 shares of the Detroit Copper Company, for which was paid $150 per share, or $6,000,000, and 3000 shares of the Stag Cañon Fuel Company, for which was paid $800 per share, or $4,000,000. The total output of these mines in 1908 was 115,871,304 lb. of copper, and the net profits were $5,345,162. The dividends paid by these companies in 1908 amounted to about 7¾ per cent on the Phelps-Dodge Company stock.

WESTERN UNION TELEGRAPH COMPANY.—President R. C. Clowry, of the Western Union Telegraph Company, has submitted a report to the directors which shows that the net earnings of the company for the first quarter of 1909—the receipts for the month of March being estimated—will amount to about 1¾ per cent on the capital stock. The directors have declared a dividend of three-fourths of one per cent for the quarter. The actual figures given out estimate the total net revenue for the quarter at $1,700,000, which is an increase of $369,114 over the same period a year ago. The total surplus for the quarter is figured at $519,777, which makes the present surplus of the company $16,597,682. President Clowry says that the business outlook for the company is improving; that the property is being maintained in good condition and that additional facilities are being provided.

GOOD GAINS IN TELEPHONE EARNINGS.—From all parts of the country come reports of excellent gains in the earnings of telephone companies. The business of these concerns seems to have been less affected by the general depression than any other. The annual report of the Western Telephone & Telegraph Company, which is owned by the American Telephone & Telegraph Company, shows an increase in earnings of $598,500 over the previous year, and a balance applicable to dividends of $2,060,200, a gain of $168,500. The number of exchanges operated by the subsidiary companies was 413, and the stations operated through these exchanges numbered 277,227, an increase of 15,265 during the year. An increase of $373,900 was made in the amount paid out in dividends, the total sum disbursed to stockholders during the year being $1,899,200.

TWIN CITY RAPID TRANSIT COMPANY.—The report of the Twin City Rapid Transit Company, of Minneapolis, for 1908, is entirely satisfactory. The net earnings of the company were $3,233,554, which was an increase of $158,147, or about 5.1 per cent over the previous year. In spite of the general business depression, the company devoted large sums to maintenance and improvements. During the year $1,070,475 was expended upon the care of roadbed and for new cars. In addition to this, the company spent $1,643,000 for additions and extensions. To meet this expense, consolidated mortgage bonds were sold. The balance sheet of the company shows total assets of $42,761,175.

DENVER CITY TRAMWAY COMPANY.—The proposed reorganization plan of the Denver City Tramway Company has been approved by the stockholders. This plan involves a new issue of $25,000,000, 25-year 5 per cent bonds, which will be issued up to 85 per cent of the amount expended for improvements and extensions. It is reported that the directors contemplate calling for redemption, at 105, on Nov. 1, the $6,000,000 of outstanding bonds of the Denver & Northwestern Railway, which comprises the suburban system of the Tramway Company. The directors expect to have $5,000,000 immediately available for the improvement work.

LOUISVILLE RAILWAY COMPANY.—The sale of $1,000,000 4 per cent bonds has been authorized by the directors of the Louisville (Ky.) Railway Company. The proceeds of these bonds will go to meet the expenses growing out of the purchase of the Louisville & Eastern Railway Company. The latter property will come into the possession of the Louisville Railway Company within the next few months. The Louisville & Eastern is a suburban line running from Louisville to La Grange, 27 miles, with a branch 23 miles long under construction to Shelbyville, Ky.

UNITED ELECTRIC SECURITIES COMPANY.—The semi-annual statement of the United Electric Securities Company, of Boston, shows a surplus Feb. 1, 1909, of $1,265,062, compared with $1,256,677 on Aug. 1, 1908.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings	Charges.	Surplus.
American Gas & Electric Company.					
January, 1909	$220,211	$157,318	$76,684	$26,175	$50,509
January, 1908	190,465	142,008	52,702	26,175	26,527
Brooklyn Union Gas Company:					
Year 1908	7,977,898	4,863,407	3,144,486	966,269	1,825,091
Year 1907	7,380,804	4,677,841	2,702,959	973,081	1,458,857
Denver Gas & Electric Company:					
Year ended Jan. 31, 1909	2,187,128	1,252,254	934,873	383,824	551,049
Year ended Jan. 31, 1908	1,987,864	1,185,007	802,857	375,710	427,147
Ft Wayne (Ind.) & Wabash Valley Traction Company					
January, 1909	109,673	64,272	45,401	....	....
January, 1908	103,019	57,196	45,823	....	....
Kansas City Railway & Light Company:					
January, 1909	534,527	315,197	219,330	152,830	66,228
January, 1908	296,321	158,831	137,490	151,278	86,212
Lincoln (Neb.) Gas & Electric Company:					
Year 1908	363,774	234,530	129,234	64,265	64,968
Year 1907	353,174	241,121	112,052	62,053	49,999
St. Joseph (Mo.) Railway, Light & Power Company:					
February, 1909	73,450	38,665	34,585	....	....
February, 1908	66,813	36,061	30,749	....	....
Twin City Rapid Transit Company, Minneapolis, Minn.:					
Year 1909	6,309,590	3,166,055	3,233,154	1,350,363	1,882,790
Year 1908	6,068,742	2,980,435	3,088,307	1,223,170	1,852,137
West India Electric Company, Jamaica:					
Year 1908	217,410	92,[illegible]	125,370	49,344	76,026
Year 1907	198,845	94,805	103,741	46,654	57,087
Western Telephone & Telegraph Company:					
Year ended Jan. 31, 1909	2,226,166	1,395,756	829,409	[illegible]	[illegible]
Year ended Jan. 31, 1908	2,124,414	1,[illegible]	807,862	800,000	7,862
Western Union Telegraph Company:					
Quarter ended Dec. 31, 1908	.....	.....	1,930,064	433,063	1,497,001
Quarter ended Dec. 31, 1907	.....	.....	803,942	433,062	370,880
Wilkes-Barre Gas & Electric Company:					
Year 1908	196,331	266,785	185,516	118,678	70,838
Year 1907	361,140	188,029	173,320	111,780	61,541

GENERAL NEWS

Construction News.

BREWTON, ALA.—The Council has decided to call an election to vote on the proposition to issue bonds, the proceeds to be used for the installation of a new and larger generator and engine in the municipal electric light plant.

RUSSELLVILLE, ALA.—The Russellville Manufacturing & Development Company has purchased the plant of the Russellville Ice & Cocoa Bottling Company and proposes to install an electric light plant to furnish electricity for commercial and public lighting.

GLOBE, ARIZ.—George W. P. Hunt has been granted a franchise by the City Council to construct and operate a street railway system in Globe.

PHOENIX, ARIZ.—The Old Dominion Copper Company, at Globe, has decided not to wait for power from the Roosevelt Dam, but is preparing to install a 2000-kw plant at Globe. M. Le Grand, electrical engineer, is preparing plans for the plant.

BAKERSFIELD, CAL.—Another large electric power plant is projected on the Kern River near Bakersfield, Cal. It will be located between the mouth of the canyon and the Kern River oil fields, and the power will be used to operate pumping plants on the arid plains of Kern County. The capitalists back of the project, with whom are associated John McWilliams and Henry J. Martens, have already purchased about 8,000 acres of land lying along the two banks of the river and including the river bed, which will give the new owners control of the river, with necessary right of way for a canal from a short distance below the Power, Transit & Light Company's power plant nearly to the north end of the oil fields. Mr. Martens says that no work will be begun on this enterprise before next fall.

CHICO, CAL.—Bids will be received by the Board of Trustees for a franchise to erect transmission lines for the distribution of electricity in Chico for a period of 50 years. Frank C. Wilson, representing the Sierra Power Company, has applied for such a franchise.

GLENDALE, CAL.—Preliminary plans have been made by Frank Campbell, L. C. Brand, J. F. McIntyre and D. Griswold, of Glendale, to organize a company which will furnish both electricity and gas. The company will be capitalized at $150,000.

GRASS VALLEY, CAL.—A preliminary survey is being made by Chief Engineer Trow for a large power project, which is believed to be directly connected with the California Midland Railroad. Surveys are being made for the construction of a 12-mile ditch to carry water to a point on the Yuba River, adjoining Sicard Flat, near Smartsville, where it will have a drop of over 400 ft. The power will be utilized to generate electricity to operate the railway.

HORNBROOK, CAL.—Arrangements are being made by the Siskiyou Electric Light & Power Company for the construction of its transmission line from near Snowden to Mines on the Klamath River below Hornbrook. The company will also erect another transmission line through the Little Shasta Valley from Sisson to Dunsmuir.

LINDSAY, CAL.—Harry A. Williams has purchased property located about 2½ miles south of Lindsay, and proposes to sink a well and install an electric pumping plant.

MONTAGUE, CAL.—It is reported that the Siskiyou Electric Light & Power Company will soon commence work on the construction of its proposed power plant on the Klamath River at Ward's Canyon. The plant will be capable of developing 64,000 hp and will require three years or more to build it.

OAKLAND, CAL.—The Great Western Power Company has awarded contracts to the Globe Construction Company, of San Francisco, for the construction of a power house on East Oakland Heights and a substation on Sessions Basins, at a cost of about $120,000. Contracts have already been awarded by the company for equipment and erection of transmission lines in connection with the work in this county, amounting to about $300,000.

SAN BERNARDINO, CAL.—The mining town of Hart is preparing to erect a telephone line to Barnwell to connect with the Western Union office at that station.

SAN DIEGO, CAL.—The City Council has granted a franchise to the Point Loma Railroad Company to construct and operate a street railway on certain streets in this city.

SAN FRANCISCO, CAL.—Frank L. Brown, president of the Brown-Walker-Simmons Company, and Walter Martin, president of the Eastern Oregon Land Company, are organizing a company for the purpose of promoting a power project in Eastern Oregon. While the plans have not been fully matured, it is understood that rights have been secured and that a plant for the development of electrical power will be constructed as soon as the financial preliminaries can be arranged.

SAN JOSE, CAL.—Bids will be received at the office of the supervising architect, Washington, D. C., until April 15 for lamp standards, etc., for the United States post office at San Jose, Cal., in accordance with plans and specifications, copies of which may be obtained at the above office or at the office of the custodian, at San Jose, Cal. James Knox Taylor supervising architect.

SIERRA MADRE, CAL.—The city will issue bonds to the amount of $50,000, the proceeds to be used for the construction of a municipal electric light plant.

BOULDER, COL.—At the April election the proposition to issue bonds to the amount of $40,000 for the construction of a municipal electric light plant will be submitted to the voters.

COLORADO SPRINGS, COL.—The City Council has granted the Colorado Springs & Interurban Railway Company franchises to extend its railway lines to the Printers' Home, and the new Town and Gown Golf Club grounds.

DENVER, COL.—The town of Inglewood, a suburb of Denver, has awarded contract to the Consolidated Engineering Company, of Denver, for the installation of a water-works system. The pumping plant will include two units, the first consisting of a triplex pump, connected to a 3-phase, 440-volt, 60-cycle motor; the second a horizontal centrifugal pump direct connected to a motor similar to that of the triplex pump. The pumps will have a capacity of 250 gal. per minute and will be automatically controlled by Sundh Electric Company's regulators.

MYSTIC, CONN.—The Mystic fire district has voted to instruct the executive committee to enter into a contract with the Mystic Power Company for street lighting for a term of 10 years. Under the terms of the contract the company is to furnish arc lamps at the rate of $68 per lamp per year and 20-cp incandescent lamps at $15 each per year.

NEW BRITAIN, CONN.—The City Council has authorized the Board of Public Works to enter into a new contract with the Connecticut Company for a period of three years, with the privilege of extending it to five years, at $85 per lamp per year, which is the same rate the city is now paying.

WINDSOR, CONN.—At a recent meeting of the Business Men's Association it was decided to request the Hartford Electric Light Company to extend its service to Rainbow and Haydens station to furnish electric lamps to the outskirts of the town.

WASHINGTON, D. C.—Proposals will be received at the office of the disbursing clerk, United States Department of Agriculture, Washington, D. C., until March 26 for furnishing and installing an electric generating unit and mechanical stokers. Specifications and full information will be furnished on application to the disbursing clerk. James Wilson is secretary.

ATLANTA, GA.—The County Commissioners have granted the Georgia Railway & Electric Company permission to extend its railway from its present terminus at Longley Street to the Inman yards, a distance of 1½ miles.

ATLANTA, GA.—The Atlanta Northeastern Railroad Company has applied to the Commissioners of Fulton County for a franchise to construct an electric railway on certain streets in Atlanta. The company proposes to construct an electric railway from Atlanta to Cummings, Ga., through Roswell and Alpharetta. J. L. Murphy is secretary.

MACON, GA.—Application has been made to the Town Council by the Central Georgia Power Company for a franchise to construct transmission lines in and through the town for transmission of electricity, to be generated at its plant located near Jackson, Ga.

WASHINGTON, GA.—Plans are being considered by C. S. Lucas for the construction of a hydro-electric plant about 10 miles from Washington. Mr. Lucas would like to communicate with engineers and manufacturers of machinery and equipment.

DANVILLE, ILL.—The Paris & Northern Interurban Railway Company is said to be making surveys for its proposed electric railway between Paris and Ridgefarm, a distance of about 26 miles. W. M. Bridgett is president.

EAST ST. LOUIS, ILL.—Application has been made to the City Council by the East St. Louis, Columbia & Waterloo Electric Railway Company for a franchise to construct an electric railway on Nineteenth Street from the southern limits of the city to Bond Avenue. E. F. Schoening, of Waterloo, is president.

EUREKA, ILL.—W. J. Whetzel, owner of the Eureka electric light plant, is negotiating with Samuel Ramsey, owner of the local electric plant, with a view of obtaining control of the distributing system in this village. If the deal goes through Mr. Whetzel proposes to enlarge the plant at Eureka and supply electricity in the towns of Eureka and Metamora and to farmers along its transmission lines between the two towns for lamps and motors.

FARMINGTON, ILL.—The Peoria & Galesburg Electric Railway Company has petitioned the City Council for a franchise to construct and operate an electric railway in Farmington.

NASHVILLE, ILL.—The Cairo & St. Louis Railroad, a branch of the McKinley system of interurban railways, has filed a mortgage for $250,000 in this city in favor of the Portland Trust Company, of Portland, Maine, to secure a bond issue of the same amount. The proceeds will be used for

provements, which will include the construction of an interurban railway from East St. Louis to Cairo. The company recently purchased the ro street railway system, operating between Cairo and Mounds.

OREGON, ILL.—The Oregon Electric Light & Power Company has anged its name to the Oregon Power Company and increased its capital ck from $50,000 to $150,000.

QUINCY, ILL.—Contracts have been placed by the Quincy Horse Railway & Carrying Company for a 800-kw, direct-current, 500-volt generator.

ROCK ISLAND, ILL.—The Galesburg & Rock Island Traction Company has petitioned the City Council for a franchise to construct an ectric railway on Fifth Avenue to Rock River.

ROCK ISLAND, ILL.—The City Council has awarded the contract for eet lighting to the People's Power Company for a term of five years. he company is to furnish arc lamps at the rate of $60 each per year for leet arc lamp and $33 each for alley lamps, which is a reduction of each per year on the street lamps and $3 on the alley lamps.

STREATOR, ILL.—The Streator Clay Co. will expend $50,000 in ecting a new plant in the place of the one recently burned. The lant will need all new machinery.

DECATUR, IND.—The City Council has granted the Fort Wayne & Springfield Railway Company a franchise to construct and operate its ilway in and through this city.

EVANSVILLE, IND.—Surveys have been completed for the proposed vansville, Mt. Carmel & Onley Electric Railway, which will connect vansville, Mt. Carmel, Onley and intervening towns. The railway will e 64½ miles in length.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company has bmitted a proposition to the Board of Park Commissioners offering to ive the Park Board two strips of land along the north bank of Fall Creek n return for the permission to construct a dam across Fall Creek, near the Northwestern Avenue bridge. The company is to build the dam, which hen completed becomes the property of the city, the company assuming he maintenance. The company requires the water for use of its consensers in its power plant.

JASONVILLE, IND.—The Farmers' Telephone Company, of Howesville, has applied to the City Council for a franchise to install a telephone system in this city.

LA PORTE, IND.—The Indiana Union Traction Company has filed a petition with the County Commissioners of La Porte, Starke, Pulaski and Cass counties for a franchise to construct an electric interurban railway through the counties to connect Logansport, Winamac, Bass Lake, Knox, La Porte and intermediate towns.

MONTICELLO, IND.—A company has been formed by William Thorn and others to construct a hydro-electric plant on the Tippecanoe River. The company will furnish electricity for lamps and motors.

PRINCETON, IND.—The Evansville & Southern Indiana Traction Company, it is reported, has decided to extend its railway from Paroka to Hazleton.

ROSEDALE, IND.—The Rosedale Telephone Company, recently incorporated, proposes to build and maintain a telephone exchange and system in Rosedale and Parke and Vigo Counties. Fred Wimmer, James A. Taylor and George W. Rukes are directors.

BLAIRSBURG, IA.—The Cedar View Telephone Company is planning to construct a telephone line to Webster City.

DES MOINES, IA.—C. R. Keyes, representing the Des Moines Elevated & Interurban Railroad Company, has applied to the City Council for a franchise to construct and operate an electric railway through certain streets in Des Moines.

CLAFLIN, KAN.—Plans are being made by E. R. Ruch to install an electric light plant to cost about $5,000. Clarence Sayre, of Claflin, is engineer.

FORT RILEY, KAN.—Bids will be received by Captain W. M. Whitman, constructing quartermaster, Fort Riley, until April 2, for extension to lighting system, including transformers, at this post. Plans and specifications will be furnished upon deposit of $5. Information furnished upon application.

LAWRENCE, KAN.—The plant and holdings of the Lawrence Electric Light Company have been purchased by Cyrus Mead, W. R. Sullivan and Victor Manuel, of Dayton, Ohio. It is said that the new owners contemplate the construction of a street-car system in Lawrence.

SABETHA, KAN.—Plans are being prepared by Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo., for the construction of an electric light plant and water-works system in Sabetha.

NEW ORLEANS, LA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until April 3 for furnishing and installing a 50-kw generating set and accessories at the naval station, New Orleans, La. Plans and specifications can be obtained on application to the bureau or the commandant of the naval station named. R. C. Holliday is chief of bureau.

LEWISTON, MAINE.—The Androscoggin Reservoir Company has applied to the Legislature for a charter with authority to construct and maintain a storage reservoir on the Magalloway River at Aziscohos Falls in Oxford County, and also to acquire the rights and powers of the Union Power Company, of Lewiston. Wallace H. White, of Lewiston, is interested in the project.

PRESQUE ISLE, MAINE.—It is reported that the Canadian Pacific Railway Company contemplates equipping its railroad to be operated by electricity from Aroostook Junction to Presque Isle.

SOLON, MAINE.—The town has voted to appropriate $500 to light the streets of the village by electricity during the coming year.

BROOKLINE, MASS.—A committee has been appointed to consider the question of establishing a municipal electric light plant. An appropriation of $51,000 has been proposed for street lighting for 11 months, until Jan. 1, 1910.

CAMBRIDGE, MASS.—Arrangements are being made by the Charles River Building Company for the construction of 22 eight-story warehouse and mercantile buildings on the Charles River in Cambridge. A central power plant with a rating of 5000 hp to furnish electricity for light, heat and power will be erected in connection with the project. Henry T. Anglim is president; Frederick J. Anglim, vice-president and secretary, and William J. Anglim, treasurer, all of Brockton, Mass.

CHICOPEE, MASS.—The Electric Light Commissioners are considering the question of installing new street lamps to replace the flaming arc lamp now in use. The new lamps will be furnished by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.

IPSWICH, MASS.—The report of the municipal electric light plant makes an excellent showing for the past year. The town appropriates $1,500 per year for the maintenance of 747 incandescent street lamps, which was what it cost the town under the old system, when the system included 20 gas lamps and 160 oil lamps. According to the report it cost the town $740 to light the streets; the cost including the entire appropriation, interest and depreciation is $3,790, making the cost $5.08 per lamp for the year. The committee suggests lighting the streets without any appropriation or reducing the rate for electricity from 12 to 10 cents per kw-hour to private consumers, beginning with July 1. George A. Schofield is manager.

NORTH ADAMS, MASS.—Plans are being considered for the addition to the Blackinton Mill, work on which will begin in the near future. The mill will be operated by electricity generated by water power. Arrangements will be made to connect the mill with the local electric company's system in case of emergency.

NORWELL, MASS.—The citizens are considering the question of lighting the streets by electricity.

OLDTOWN, MASS.—The citizens are endeavoring to have the streets of the town lighted by electricity, the service to be obtained from the municipal electric light plant at North Attleboro. The present plans call for the installation of 51 lamps at a cost of about $1,000, and a booster at the electric light plant to cost $600. William Plattner is superintendent of the electric plant at North Attleboro.

PITTSFIELD, MASS.—The Pittsfield Electric Company is planning to place its wires underground in the center of the city, which will involve an expenditure of about $10,000.

PLYMOUTH, MASS.—The Plymouth Electric Light Company has adopted a new schedule of rates for electricity for lamps to take effect from March as follows: For the first 100 kw, 18 cents per kw-hour; from 100 to 200 kw, 13 cents; from 200 to 300 kw, 11 cents, and for all above, 10 cents per kw-hour. A minimum charge of $1 per month will be made to all consumers.

STURGIS, MICH.—The City Council has adopted a resolution directing the Mayor and Clerk to take steps necessary to make application to the Board of Supervisors of St. Joseph County for permission to construct a dam across St. Joseph River for the purpose of developing 2000 hp, which will be utilized to generate electricity for lamps and motors.

WYANDOTTE, MICH.—Extensive improvements are contemplated to the system of the Michigan State Telephone Company in this city, which will involve an expenditure of about $40,000. A new switchboard will be installed and new instruments will replace the ones now in use.

DELANO, MINN.—The question of making improvements to the municipal electric light plant is under consideration.

DULUTH, MINN.—The City Council is considering the question of requiring that all telegraph, telephone and electric wires be placed underground on Superior Street, between Ninth and Twenty-fourth avenues East.

GILBERT, MINN.—The Virginia Light & Water Company has applied to the City Council for a franchise in Gilbert.

McKINLEY, MINN.—The question of lighting the town by electricity is under consideration.

PINE CITY, MINN.—The Pine City Electric Power Company will receive bids for the construction of its plant until April 10 (an extension of time from March 10). The company proposes to develop the water power of Snake River, about seven miles from Pine City, and erect transmission lines to Hinckley and Rush City. J. M. Allen is manager.

CHARLESTON, MISS.—We are informed that arrangements are being made to install an electric light plant in Charleston. The present plans contemplate the installation of tungsten street lamps, with the alternating-current, 1100-volt, 60-cycle system. Mayor Saunders or the Lamb-Fish Lumber Company would like to receive information in regard to the same.

MERIDIAN, MISS.—The City Council is considering the question of installing an electric light plant to be operated in connection with the water-works system.

CAPE GIRARDEAU, MO.—The Cape Girardeau Jackson Interurban Railway Company is contemplating the purchase of a new switchboard.

KANSAS CITY, MO.—Bids will be received by the Board of Park Commissioners until March 22 for furnishing material and labor for electric wiring for the bird and carnivora house for the Zoological Garden in Swope Park, according to plans and specifications on file in the office of Sayler & Seddon, architects, Gumbel Building, Kansas City. Frank P. Gossard is secretary of Board of Park Commissioners.

BEATRICE, NEB.—It is reported that the bonds for $10,000 issued for an electric light plant have been declared illegal.

ELY, NEV.—It is reported that the control of the Giroux properties has changed hands and that the new owners are contemplating extensive improvements, which will include an addition to the power plant and the installation of a new pump. Joseph L. Giroux is president of the company.

CONWAY, N. H.—A proposition to utilize the water power of Odell Falls to generate electricity is now under consideration. Arrangements are being made to charter a company under the name of the Conway Electric Light & Power Company, with a capital stock of $50,000, to furnish electricity for lamps in Conway, as the present company does not give satisfactory service.

BUTLER, N. J.—The City Council has granted the Butler Gas Lighting & Heating Company a franchase to install an elecrtic light and power plant in Butler.

EDGEWATER, N. J.—The New Jersey & Hudson River Railway & Ferry Company has contracted with the General Electric Company, Schenectady, N. Y., for a 300-kw rotary converter with transformer and switchboard complete.

NEWARK, N. J.—The Public Service Corporation expects to purchase during the next three weeks miscellaneous apparatus for its various substations, including rotary converters, transformers and switchboard apparatus, and also one 2000-kw turbo-generator set for its Camden station.

SEABRIGHT, N. J.—Owing to a decision handed down by Judge Garrison, which prevents the Consolidated Gas Company of New Jersey from erecting its transmission lines along the wires of the Central Railroad Company of New Jersey, the gas company will discontinue its electrical service in Seabright after April 1.

TRENTON, N. J.—The bondholders' meeting of the Inter-State Railway Company has decided to purchase new equipment for the power station of the Trenton Street Railway Company at a cost of about $40,000. It is also proposed to purchase new cars to replace the cars now in use and make other improvements to the system.

AZTEC, N. M.—Preparations are being made by the Eden Canal & Power Company for the construction of an electric light plant.

NAMBE, N. M.—E. H. Fisher, of Cimarron, N. M., civil engineer, has been making surveys in Nambe, with a view of utilizing the falls of the Nambe in connection with an electric power plant.

PORTALES, N. M.—Plans have been completed for the construction of an electric light plant and water-works system in Portales, to cost about $50,000. Burns & McDonnell, Scarritt Building, Kansas City, Mo., are engineers.

ALBANY, N. Y.—Franklin B. Ware, state architect, has recommended to the Trustees of Public Buildings an appropriation by the State Legislature for the construction and equipment of a new power house and for construction of conduits and piping to connect the power house with the capitol and new State education building. Mr. Ware recommends the removal of the present power house to another site.

BATAVIA, N. Y.—The citizens on March 9 voted to appropriate $3,500 for a switchboard and a new generator for the municipal electric light plant.

CLIFTON PARK, N. Y.—The Dwass Electric Company has applied to the Public Service Commission, Second District, for permission to construct an electric light plant in the town of Clifton Park to furnish electricity for lamps in Clifton Park and on the grounds of the Round Lake Association; also in Round Lake and Ushers. The company also asked for authority to issue $20,000 in capital stock. A. T. G. Wemple, of Schenectady, N. Y., and Harold J. Werner, of Mechanicsville, N. Y., are interested in the company.

CLIFTON SPRINGS, N. Y.—At the coming election a proposition to issue $8,000 in bonds, the proceeds to be used for enlarging the municipal electric light plant, will be submitted to the voters.

LESTERSHIRE, N. Y.—A committee, consisting of B. W. Livingston and W. H. Birdsall, has been appointed to make investigations in regard to the cost of establishing and maintaining a municipal electric light plant.

LEWISTON, N. Y.—The Village Board is considering the question of lighting the town by electricity. Propositions for furnishing electricity in Lewiston have been submitted by the Ontario Power Company and the Porter Fiber Company.

NEW YORK, N. Y.—The Coney Island & Brooklyn Railroad Company has applied to the Board of Estimate and Apportionment for permission to lay tracks through the Flatbush Avenue extension to the Manhattan Bridge, now under construction, and over which it proposes to operate its cars.

NUNDA, N. Y.—The Board of Village Trustees has granted the Tuscarora Telephone Company a franchise to erect a telephone system in this town.

PORT LEYDEN, N. Y.—The application of George L. [illegible] franchise to Homer E. Wilson and George W. Post, of Port Leyden, electric light plant in this town has been granted by the Public Service Commission, Second District. The Commission also granted Messrs. Wilson and Post permission to exercise the franchise granted to Mr. Seymour.

RENSSELAER, N. Y.—The Public Service Commission, Second District, has granted the Rensselaer Falls Electric Light & Power Company permission to construct and operate an electric light plant in Rensselaer Falls.

SCHENECTADY, N. Y.—The Schenectady Railway Company completes the construction of a substation at the north end of Ballston Lake on its Saratoga division, which will be equipped with two 600-kw rotary converters and two 300-kw rotary converters. The station when completed will supersede the one now in use at Ballston Lake. The new station will be connected with the Round Lake substation of the Hudson Valley Company, which is operated from the steam plant of the Delaware & Hudson Company at Mechanicsville. At present the Saratoga division secures electricity from the Hudson River Power Transmission Company's plant at Spier Falls. E. F. Peck is general manager.

WATERTOWN, N. Y.—The Public Service Commission, Second District, has authorized the consolidation of the Watertown Light & Power Company and the Watertown Gas Light Company. The commission had denied a previous application of the companies.

HIGH POINT, N. C.—The Legislature has passed the bill permitting the Piedmont Railway Company to amend its charter, allowing the company to operate between High Point and other towns.

SELMA, N. C.—The State Legislature has passed the bill authorizing this town to issue bonds for improvements, including a street lighting system and plant.

WAKE FOREST, N. C.—An election will be held April 12 to vote on the proposition to issue $15,000 in bonds, the proceeds to be used for the construction of an electric light plant.

HENSLER, N. D.—Wilcox Brothers are planning to construct a telephone line to Sanger, Center, Hensler, Deapolis and Stanton.

MANDAN, N. D.—We are informed that the Mandan Electric Company contemplates remodeling and enlarging its plant, but as yet no definite plans have been made except the purchase of two boilers. It is proposed to change the system from single to three-phase. B. K. Skeels, purchasing agent.

NORTON, N. D.—The Norton Farmer's Telephone Company has changed its name to the Norton Telephone Company and increased its capital stock from $10,000 to $30,000.

PINGREE, N. D.—A company is being organized to erect a telephone line to Deer Lake.

WASHBURN, N. D.—The Washburn Telephone Company contemplates the construction of about 50 miles of rural telephone lines.

BAINBRIDGE, OHIO.—It is understood that the Creek Power, Light & Heat Company is planning to construct a hydro-electric plant at Bainbridge, about three miles west on Paint and Rocky Ford creeks. Arthur Beisler, of Dayton, Ohio, is engineer.

CINCINNATI, OHIO.—L. P. Hazen & Company contemplate the construction of a combined power house and storage warehouse, work which will begin in the near future, at a cost of $125,000.

CLEVELAND, OHIO.—Owing to the failure of the lighting company to bid on the contract for lighting the county court house, the County Commissioners have decided to take steps to install a lighting plant in the court house. Additional improvements will be made when the new court house is completed. Only one bid was received, which was submitted by the Cleveland Light & Power Company.

COLUMBUS, OHIO.—The City Council has passed the ordinance authorizing the purchase of a generator for the municipal electric light plant at a cost of $45,000. When the new equipment is installed the plant will furnish electricity for lighting the city prison, workhouse, city hall, two public libraries, Central and North markets, and the High and Broad Street arches, and also at the garbage disposal plant when built. Plans are also being considered to operate the sewage disposal plant by electricity. The public buildings and High Street arches are now being lighted by a local company at a cost of about $8,000 annually.

SPRINGFIELD, OHIO.—Plans are being prepared by the Springfield Light, Heat & Power Company for the construction of the large addition to its plant on West Jefferson Street. The company proposes to extend its transmission lines for both lighting and power service and also to extend the heating system.

WOOSTER, OHIO.—The Wooster Brush Works has awarded a contract for the construction of a new factory building and also for a heating and power plant.

PRAGUE, OKLA.—Bids will be received until March 23 by F. [illegible] Newhouse, town clerk, for furnishing material for the construction of an electric light plant and water-works system, as follows: Tower and tank, pressure pumps and accessories; motor-driven deep-well pumps, including motors; boilers, automatic steam engine, alternating-current generator, switchboard, arc lamps and regulator, transmission line equipment, etc. The Michael Cooke Engineering & Construction Company, of Joplin, Mo., has charge of the construction of the plant.

SENTINEL, OKLA.—Jennings, Barrett & Company have been granted a franchise to construct an electric light and power plant. Frederick Jennings is engineer.

STORIA, ORE.—The City Council has granted a franchise to the Oregon Coast Railway Company to construct an electric railway on certain streets in this city. The company proposes to build a railway between Astoria and Seaside.

END, ORE.—J. W. Juston, of Portland, Ore., and Bend, are interested in an irrigation and colonization scheme, which includes the installation of a power plant.

UGENE, ORE.—Notice of appropriation of 20,000 in. of water of Lake Creek has been filed by J. W. McArthur. The water will be used for power purposes.

PILOT ROCK, ORE.—It is reported that prominent citizens of this place and other capitalists in Oregon are contemplating the construction of an electric railway from Pilot Rock to Ukiah and later on to extend the railway into Grant County.

ST. HELENS, ORE.—The St. Helens Mill Company is planning to install an electric light plant, providing sufficient patronage is guaranteed to justify the investment. Marshall Quick is interested in the project.

UNION, ORE.—It is reported that an electrical engineer has been engaged to make investigation in regard to the municipal electric light plant, which the city proposes to install at a cost of from $18,000 to $20,000.

CARLISLE, PA.—The Cumberland Railway Company has been granted a commission by the State to construct an electric railway from Middlesex to Newville, via Carlisle, and along the State road westward from Carlisle. E. Gladfelter is president of the company and J. A. Ring, secretary.

CLIFTON HEIGHTS, PA.—Negotiations have been closed by the Delaware County & Philadelphia Electric Railway for the purchase of the Terminal Railway Company's franchise between Fernwood and Sixty-ninth Street, which will give the first-named company a direct route from Lansdowne to the Sixty-ninth Street terminal. The Delaware County company is a subsidiary of the Interstate Street Railway Company.

JOHNSTOWN, PA.—The Dale Light, Heat & Power Company has awarded a contract to the Northern Electric Company, of Madison, Wis., for a generator for its power house in Johnstown for $4,100. Orders for other equipment have already been placed.

JOHNSTOWN, PA.—It is reported that negotiations have been nearly completed whereby Emmitt Green, of Pittsburgh, Pa., will purchase the stock of the Consumers' Gas Company, the Citizens' Light, Heat & Power Company and the Johnson Natural Gas Company, all of Johnstown. It is said that the companies will be consolidated in a new company, with a capital stock of $1,500,000.

LEWISBURG, PA.—Application has been made for a charter for the Lewisburg & Milton Railroad by Boyd A. Musser, J. C. H. Newcomer, C. M. Clements and others. The company proposes to construct an electric railway between Shamokin Dam and Lewisburg. The first link of the system will connect Sunbury and Lewisburg, and later extensions to Williamsport will be built.

PHOENIXVILLE, PA.—The Philadelphia Interurban Railway Company has been granted a franchise to operate an electric railway in this borough.

SHARON, PA.—The Stewart Iron Company contemplates making improvements to its plant, which will involve an expenditure of about $100,000, and will include a new steel traveling ore bridge, unloading machinery, etc. All machinery in the plant will be operated by electricity.

NARRAGANSETT PIER, R. I.—The Sea View Railroad Company is making arrangements to increase the output of its power house. A 400-kw Westinghouse-Parsons steam turbine will be installed.

SPARTANBURG, S. C.—The city has awarded the contract for street lighting to the Electric Power & Manufacturing Company for a term of 10 years. The company proposes to make improvements to its steam power plant, which will be used as an auxiliary plant. Additional arc lamps will also be installed.

NASHVILLE, TENN.—The City Council has appropriated $6,000 for the purchase of arc lamp equipment.

AUSTIN, TEX.—A bill has been introduced in the Legislature by Senator Hudspeth asking for an appropriation of $250,000 to establish an electric light and power plant and water system for the State buildings.

FORT WORTH, TEX.—Plans are being considered for improvements to the municipal electric light plant, which will involve an expenditure of $[illegible]. It is proposed to enlarge the plant to provide for increasing the street lighting system, which calls for the installation of 400 additional arc lamps. The question will be submitted to the vote of the people.

OGDEN, UTAH.—We are informed that L. B. Spencer, engineer, Ogden, is preparing plans for the construction of a power plant, the cost of which is estimated at $[illegible].

OGDEN, UTAH.—Application has been made to the County Commissioners by Lyman Skeen, Joseph A. Taylor and J. M. Child for a franchise to construct a railway from the northern limits of Ogden to Plain City.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has been granted a 50-year franchise by the County Commissioners to extend its railway from Murray to Sandy and Bingham Junction.

BRATTLEBORO, VT.—The Connecticut River Power Company has nearly completed its transmission line from the Hinsdale-Vernon dam to Brattleboro. The company contemplates erecting a transmission line on the Ashuelot Valley as far as Winchester, so as to furnish electricity in the towns of Hinsdale, Ashuelot and Winchester. The company has already closed a contract with the Estey Organ Company, at Esteyville, to furnish electricity to operate its factory.

LUNENBURG, VT.—The citizens have voted to authorize the Selectmen to enter into a contract with the Lunenburg Manufacturing Company to light the streets of the town for a term of five years.

BASIC CITY, VA.—The Council is considering the question of issuing $25,000 in bonds, the proceeds to be used for an electric light plant and other improvements.

BROOKNEAL, VA.—Plans are being considered to organize a company to construct a hydro-electric plant on Staunton River. E. R. Monroe is interested in the project.

CLARKSVILLE, VA.—The Southern Traction & Power Company, which proposes to construct hydro-electric plants on Dan and Staunton Rivers, several miles north of Clarkesville, is planning to develop 20,000 hp., which will be transmitted to Danville, Va.; Burlington, Graham and Haw River, N. C., and probably to Reidsville, N. C. Junius H. Harden, secretary of the Burgrahaw Traction Company, of Burlington, N. C., is interested in the project.

FREDERICKSBURG, VA.—It is reported that the Fredericksburg Electric Company will receive bids at once for the construction of an electric light plant. R. M. Van Dorn is engineer.

FREDERICKSBURG, VA.—The Potomac & Rappahannock Company has decided to complete its telephone line to Montross and also to build a new telephone line from Colonial Beach to Fredericksburg.

PORTSMOUTH, VA.—Bids will be received until April 13 by L. P. Slater, city clerk, for the purchase of an electric lighting franchise and contract to light the streets, public buildings and to furnish electricity for residences and commercial lighting; also for motors. Specifications for bids may be obtained on application to the city clerk.

GIG HARBOR, WASH.—The Inland Empire Telegraph & Telephone Company has applied for a franchise to erect telephone lines through Henderson, Wollochet and North Bay districts.

HOQUIAM, WASH.—E. C. Finch has applied to the City Council for a franchise to install an automatic telephone system in Hoquiam. If the franchise is granted it is said that he will erect a system at a cost of $200,000.

OLGA, WASH.—A franchise has been granted to Robert Moran to erect transmission lines along the highways of Orcas Island. It is said that Mr. Moran has completed arrangements for the installation of an electric light and water-works systems.

SEATTLE, WASH.—Contracts have been awarded for the Second Avenue cluster lamp system as follows: For construction of conduits, etc., to Charles F. McDonald, for $20,096; for generators, to Meacham & Babcock, for $8,641, and for iron poles, to the Olympic Foundry Company, for $3,955.

SUNNYSIDE, WASH.—Robert E. Strahorn has applied for a franchise to furnish electricity for lamps and motors in Sunnyside.

KAMLOOPS, B. C., CAN.—Arrangements are being made for improvements to the municipal electric light and pumping plant at a cost of about $10,000. H. K. Dutcher, Flack Building, Vancouvre, B. C., is consulting engineer.

VANCOUVER, B. C., CAN.—It is reported that the Canadian Industrial Company is preparing plans for the construction of a 5000-hp hydro-electric plant on Powell River in connection with the erection of a paper and pulp mill. Alfred Carmichael is hydraulic engineer.

BRANTFORD, ONT., CAN.—The construction of an electric railway from Delhi to Burford, for which an application for a charter will soon be made, is under consideration. Paul Huffman is interested in the project.

GRAVENHURST, ONT., CAN.—The citizens have voted to appropriate $15,000 to complete the construction of the hydro-electric power plant at South Falls.

HAMILTON, ONT., CAN.—Plans are being made for the proposed rearrangement of arc lamps, under the new contract beginning July 1, 1909. The new plans call for 730 lamps. The present system includes 242 electric arc lamps and 279 gas lamps. Under the new contract the gas lamps will be discarded.

LONDON, ONT., CAN.—E. I. Sifton, city electrical engineer, has submitted his report to the special power committee in regard to the city establishing a municipal electric light plant, and in which he advises the city to construct and equip its own plant rather than to purchase the plant of the London Electric Company. He estimates the cost of a distributing station at $235,000. The London Electric Company offers to sell its plant to the city for $506,000. The Council has decided to engage a consulting engineer to make further investigations in regard to the matter. If it is decided to install a municipal plant electricity will be purchased from the Hydro-Electric Power Commission. The plans call for the distribution of 5000 hp.

[illegible] CAN.—[illegible] tion of remodeling the municipal electric light plant, and propose to install [illegible] switchboard. M. Deschines is secretary and treasurer.

SWIFT CURRENT, SASK., CAN.—The citizens have voted in favor of the by-law [illegible] to install an electric light and [illegible]

HAVANA, CUBA.—The Havana Electric Railway Company is understood to have completed the purchase of additional street railway equipment for the property. F. Steinhart is general manager.

PARRAL, MEX.—Plans are being considered by the Mexican Northern Electric Company, of Canada, for the construction of an electric power plant on the Rio Conchas River, a short distance from Parral, at a cost of about $5,000,000. The initial equipment of the plant will provide for an output of 15,000 hp, which will be used for mining and irrigation purposes. The company may extend the transmission line as far as Chihuahua. G. F. Greenwood, of Montreal, Que., is president.

Company Elections.

COTTONWOOD, IDAHO.—At the annual meeting of the Cottonwood Water & Electric Light Company the following officers were re-elected as follows: J. W. Turner, president; W. M. Schiller, vice-president; A. L. Creelman, secretary, and B. F. Simon, treasurer.

FREDERICKSBURG, VA.—At the annual meeting of the Fredericksburg Power Company the following named officers were elected: W. G. Whitner, president; A. P. Rowe, vice-president, and Alvin T. Embrey, secretary and treasurer.

New Industrial Companies.

THE MARYLAND ENGINEERING & CONSTRUCTION COMPANY, of Baltimore, Md., has been chartered by John E. George, W. Irving Walker and Peter R. Foley.

THE AMERICAN ELECTRIC EQUIPMENT COMPANY, of Kansas City, Mo., has been incorporated, with a capital stock of $2,500, by William J. Schott, C. A. Pierson and C. Koch.

THE LISLE ENGINEERING COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $25,000, by R. W. Lisle, G. D. Whitefort and G. S. Burtis, all of Chicago, Ill.

THE INCANDESCENT LAMP COMPANY, of Kansas City, Mo., has filed articles of incorporation, with a capital stock of $5,000. The incorporators are M. E. Davis, M. F. Elroth and J. E. Trogion.

THE NEW YORK CONSTRUCTION COMPANY, of New York, N. Y., has been chartered, with a capital stock of $10,000, by Craig A. Ross, of Brentwood, N. Y.; Albert P. King, of Brooklyn, N. Y., and Irving J. Bush, of Newark, N. J.

THE CONNECTICUT MOTOR VEHICLE COMPANY, of New York, N. Y., has been chartered, with a capital stock of $50,000, to manufacture motors, engines, machinery, etc. C. M. Gilpin, H. A. Shuart, H. C. Murray, all of New York, N. Y.

THE AMERICAN CROSS-ARM COMPANY, of Chicago, Ill., has been incorporated to manufacture supplies for telephone and telegraph companies by Charles C. Case, Jr.; J. Walter Stead and John I. Liver. The company is capitalized at $150,000.

THE LA SALLE ENGINEERING COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $900,000, by Albert H. Tyrrell, N. Reardon and M. B. McConigle. The company proposes to do a general contracting and engineering business.

THE NAPIER MOTOR COMPANY OF AMERICA has filed articles of incorporation at Portland, Maine. The company is capitalized at $1,000,000 and proposes to manufacture engines, motors, etc. H. B. Clarity is president, and W. S. Quinby, treasurer, both of Portland, Maine.

THE TURNER BAFFLE-WALL & BOILER COMPANY, of Brooklyn, N. Y., has been chartered, with a capital stock of $20,000. to manufacture baffle-wall, baffle-plates, boilers, etc., by Roy Murchie, Pliny S. Riggs, of New York, N. Y., and Richard A. Wright, of Brooklyn, N. Y.

THE ELECTRICAL SALES COMPANY, of Boston, Mass., has been chartered, with a capital stock of $25,000, to manufacture and sell all kinds of electrical machinery. F. A. Barbey, of Cambridge, Mass., is president, and E. E. Williams, of Springfield, Mass., treasurer.

THE INVESTORS' ENGINEERING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $100,000, for the purpose of promoting engineering and industrial enterprises. The incorporators are T. Starrett, J. Breuchaud, P. B. Windsor, of New York, N. Y.

THE MILLER STORAGE BATTERY COMPANY, of Toledo, Ohio, has been chartered by George J. Clarence, H. and F. J. Miller, A. B. Hanson and Thomas L. Gifford. The company is capitalized at $10,000, and proposes to manufacture storage batteries and electrical supplies.

THE WATER & SEWERAGE PURIFICATION COMPANY, of Paterson, N. J., has been incorporated, with a capital stock of $1,000,000, by Frederick Saxelby, of East Orange, N. J.; Josiah A. Ludlow and Alfred Gartner, of Paterson. The company proposes to enter into contracts for the purifying of water and sewage by electrical and chemical processes.

THE BARRY-MEEKER COMPANY, of East Orange, N. J., has been incorporated, with a capital stock of $125,000, by J. Darby, of Summit, N. J.; C. D. Meeker, of East Orange, N. J., and H. D. Meeker, of New York, N. Y. The company proposes to manufacture electrical apparatus.

THE EMERSON ENGINE COMPANY, of Alexandria, Va., has been incorporated, with a capital stock of $100,000, to manufacture engines and motors for automobiles and motor boats. The officers are: Victor L. Emerson, president, Harry E. Jenkins, vice-president and A. L. Emerson, secretary and treasurer.

THE ESCO MANUFACTURING COMPANY, of Boston, Mass., has been incorporated, with a capital stock of $25,000, to manufacture [illegible] of machinery. The officers of the company are: Lemuel Pratt, president; Wilhelm E. Lundguist, treasurer, and Frank J. Flanigan, clerk, all of Boston, Mass.

New Incorporations.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the California Electric Railways Company to construct a [illegible] railway [illegible] San Francisco. The company is capitalized at $10,000,000, and it is understood that the ultimate object of the company is to take over the properties of the Stanislaus Electric Power Company and the Tuolumne Water Power Company, both of which were recently placed in the hands of receivers.

SAN GABRIEL, CAL.—Articles of incorporation have been filed for the San Gabriel Telephone Company with a capital stock of $2000, and the following named directors: H. F. Metcalf, Edgar O. Fawcett of Pasadena, and H. V. Carter, of Los Angeles, Cal., and others.

VISALIA, CAL.—The Tulane Home Telephone & Telegraph Company has been incorporated, with a capital of $25,000, by E. W. Rice, of Berkeley; G. C. Harris, B. W. Chenoweth, Scott Hendricks and T. Franklin, of San Francisco.

GLENWOOD SPRINGS, COL.—Articles of incorporation have been filed for the Mutual Light, Heat & Power Company by H. J. Holt, G. W. Parmer, Carl Hedrick and others to supply electricity for light, heat and power. The company has applied to the County Commissioners for a franchise to erect transmission lines on the county roads and will also apply to the City Council for a franchise to supply electricity for lamps in Glenwood Springs.

BRUNSWICK, GA.—The City & Suburban Railway Company has been formed and has applied for a charter for the purpose of constructing a street railway system in Brunswick and in any part of Glynn County.

JONESBORO, GA.—The Riverdale Telephone Company has been chartered, with a capital stock of $1,000, by G. M. Hine, of Clayton County, and B. S. Hine and R. T. Aderhood, of Fulton County.

OAKWOOD, GA.—The Gainesville & Oakwood Telephone Company has been organized, with the following officers: J. W. W. Simmons, president; J. N. Wallis, vice-president; H. W. Crankshaw, secretary, and L. E. Hughes, treasurer.

NAUVO, ILL.—The Nauvo Electric Light & Power Company has been incorporated, with a capital stock of $10,000, by J. A. Bortz, John Schrz and others.

COMO (P. O. REDKEY), IND.—The Como Telephone Company has been incorporated, with a capital stock of $10,000. The company proposes to build and equip a telephone exchange and system in Como and throughout Jay, Adams, Blackford and Wells Counties. The incorporators are: S. E. Hudson, Sherman Biubaker, M. H. Spahr, J. L. Resur, A. Lally, D. W. Bell, J. H. Dull and George C. May.

LAWRENCE, IND.—The Grassy Creek Mutual Telephone Company has been incorporated to build and operate telephone lines in Marion and Hancock Counties. B. F. Whitesides, John C. Roab and J. B. Mithoe are directors.

MICHIGANTOWN, IND.—The stockholders of the Michigantown Cooperative Telephone Company have voted to purchase material and equipment for the improvements and extension to its system. William Hur is president.

MT. VERNON, IND.—Suit has been brought to test the validity of the alleged perpetual franchise of the Cumberland Telephone Company to do business in this city. The city has ordered the company to vacate the streets, which it refuses on the claim of having a perpetual franchise assigned to it by the American Telegraph & Telephone Company.

ROSSVILLE, IND.—The Rossville Light & Heat Company has been chartered, with a capital stock of $6,000, to erect a light and heating plant. The directors are: Joseph E. Silverthorn, James R. Crouse and Noah W. Clark.

MONTEZUMA, IA.—Articles of incorporation have been filed for the Montezuma Electric Light, Power & Heating Company by George E. Wiltse and others. The company is capitalized at $6,000.

UNION, IA.—The Union Electric Power Company has been incorporated with a capital stock of $10,000. H. C. Chapin is president and E. A. Hunt, secretary.

EST, KY.—The Est Telephone Company has been formed, with a capital stock of $2,000. Felix Coldron, of Est, is manager.

NEW LIBERTY, KY.—The Ragland Telephone Company has been chartered with a capital stock of $2,000. The officers of the company are: M. B. Tapp, of Woodville, Ky., president; W. H. Cunningham, of Woodville, vice-president; T. E. Martin, of Rosington, Ky., secretary and treasurer.

PORTLAND, MAINE.—Articles of incorporation have been filed for the Globe Light & Power Company. The company is capitalized at $500,000, and the officers are: A. G. McPherson, president; J. R. Parsons, treasurer, both of Portland, Maine.

INTON, MD.—The Peninsula Light & Power Company has been orporated with a capital stock of $50,000 by Albert G. Towers, Harvey Cooper, and Thomas F. Garey, of Baltimore, Md. The company taken over the plant of the Citizens' Light & Fuel Company, which en in operation here for several years, and the franchise and water r recently acquired by Mr. Garey, who has commenced the work of tructing a new power plant.

APIN, MICH.—Articles of incorporation have been filed for the ers' Mutual Telephone Company. The company is capitalized at 00, and the directors are: H. L. Fox, C. W. Sutliff, A. Mehland, J. W. Cross, H. K. Gibson and J. F. Batchelor.

ALESBURG, MICH.—The Citizens' Home Telephone Company has organized to install a telephone system in Galesburg. A committee has been appointed to take steps to organize the company. W. S rence is chairman and Sidney Morton, secretary.

EW BALTIMORE, MICH.—The Anchorville Bay Telephone Company been organized to construct a telephone line to connect New Baltimore, horville and Fair Haven. H. J. Knopf is president; A. J. Christy, tary, and H. M. La Bounty, treasurer.

ORTHVILLE, MICH.—Articles of incorporation have been filed the Inter-County Telephone Company, with a capital stock of $5,000. directors are: Clement C. Yerkes, Louis A. Babbitt, Robert C. kes and Frank Thompson.

PRINGVALE, MICH.—The Springvale Telephone Company has been rporated, with a capital stock of $1,8[illegible].

AITKEN, MINN.—Articles of incorporation have been filed for the ken Telephone Company, with a capital stock of $24,000, by Herman ork, F. M. Shook, of Aitkin; C. P. De Laittre and J. L. De Laittre, Minneapolis, Minn.

BRUSHVALE, MINN.—The Brushvale Farmers' Telephone Company been incorporated, with a capital stock of $10,000, by John Holecek, ry Lordeman, August Zarling, S. Peterson and others, of Brushvale.

FAIRFAX, MINN.—The Russia-Fairfax Telephone Company has been anized to construct a telephone line. The officers are: B. Hinton, sident; Seivert Qualbert, vice-president; O. Sanness, secretary, and E. rdahl, treasurer.

PINE RIVER, MINN.—The Pine River Rural Telephone Company s filed articles of incorporation, with a capital stock of $10,000. harles W. Ladu is secretary.

SAUK CENTER, MINN.—The original stockholders of the Drogar elephone Company have reorganized and incorporated under the name the Little Sauk Rural Telephone Company, with the following named ficers: G. M. Deyo, president; Ralph C. Doty, secretary, and Alex ryden, treasurer.

CHARLESTON, MISS.—Articles of incorporation have been filed for e Charleston Light & Power Company by R. V. McGrew, J. H. Caldwell, . B. Burke, I. C. Pattison, C. E. Harris, all of Charleston. The company is capitalized at $10,000.

HELENA, MONT.—Articles of incorporation have been filed for the nited Missouri River Power Company of New Jersey, with a capital tock of $1,250,000, by S. T. Hauser and others.

CORTLAND, NEB.—The Highland Telephone Company has been incorporated with a capital stock of $21,000. M. M. Stanley is president nd T. W. Sargent, secretary.

EDDYVILLE, NEB.—The Eddyville Telephone Exchange Company as been chartered with a capital stock of $1,000, by P. G. Muchie, W. J. awson and others.

NASHUA, N. H.—Articles of incorporation have been filed for the affrey & Troy Electric Light Company, with a capital stock of $25,000, by Edwin C. Shattuck, Walter L. Goodnow and Charles L. Rich, of affrey; Robert L. Pond, Sr., and Robert L. Pond, Jr., of Boston, Mass.

BAYONNE, N. J.—The Bayonne Lumber & Manufacturing Company has been chartered, with a capital stock of $100,000, by James T. R. Proctor, James F. Burnett, Hugh C. Colville and others, of Bayonne, N. J. The company proposes to deal in lumber and do a general light and power business.

VINELAND, N. J.—The South Jersey Rural Telephone Company, of Landis Township, has been chartered, with a capital stock of $25,000, by F. Macomber, A. H. Wilson, C. Becker, E. L. Bolles, D. Mecgeorge, W. S. Claypoole, D. S. Edison, S. A. Downs, G. H. Putnam and C. N. Veale, all of Vineland.

HOPEWELL JUNCTION, N. Y.—The Hopewell Light, Heat & Power Company has been incorporated, with a capital stock of $50,000, to furnish electricity for lamps, motors and heat. The incorporators are: Charles J. McKeown, Sophy McKeown, of Hopewell Junction, and Philip Schantz, of Highland, N. Y.

PORT JEFFERSON, N. Y.—The North Shore Electric Light & Power Company has been incorporated, with a capital stock of $[illegible], by Fred T. Griswold, Frank C. Dildine, Luther H. Chambers, George E. Darling, all of Port Jefferson.

WHALLONSBURGH, N. Y.—The Essex & Whallonsburgh Telephone Company has been incorporated, with a capital stock of $[illegible], by C. W. Sherman, P. N. Stafford, W. O. Fisher, of Whallonsburgh, and others.

THOMASVILLE, N. C.—The Piedmont Railway Company has been organized to take over the Carolina Valley Railroad to Denton and proposes to extend it to the timber region. The company is capitalized at $500,000 and the officers are: Milton L. Jones, of Thomasville, president; Thomas J. Jerome, of Salisbury, N. C., vice-president, and J. L. Armfield, secretary and treasurer.

WALES, N. D.—The Wales-Moscow Co-operative Telephone Company has been organized, with a capital stock of $3,000, to construct telephone lines between Moscow and Wales. The officers are: Ole Oldmansen, president; George H. Johnston, vice-president; E. Hill, secretary, and C. P. Getchell, treasurer.

Personal.

MR. H. P. HILL, consulting engineer, has moved from 50 Church Street, New York, to larger quarters at 30 Church Street.

MR. H. B. THAYER, president of the Western Electric Company, has been elected vice-president of the American Telephone & Telegraph Company.

MR. WALTER D. SNOW, Publicity Engineer, Boston, Mass., has been elected a member of the corporation of the Massachusetts Institute of Technology.

PROF. J. B. WHITEHEAD, of Johns Hopkins University, is the writer of an article in *Popular Science Monthly* for March, on the subject of heavy electric traction.

MR. W. L. ABBOTT, chief operating engineer of the Commonwealth Edison Company, Chicago, has been re-elected president of the board of trustees of the University of Illinois.

MR. WILLIAM CARROLL, city electrician of Chicago, has received material recognition of his services from the City Council, which has increased his salary from $5,000 to $6,500 a year.

MR. HOWARD S. PHELPS, formerly in charge of the Denver office of the late Dr. F. A. C. Perrine, has been appointed superintendent of power for the Crystal River Marble Co., Marble, Col.

MR. V. R. LANSINGH, general manager of the Holophane Company, addressed the agents' meeting of the Commonwealth Edison Company, Chicago, on March 9. His subject was "Illumination."

MR. CHARLES P. TAFT, of Cincinnati, Ohio, who recently severed his connection with several corporations, has again entered the Columbus Gas & Electric Company, of Columbus, Ohio, as director.

MR. CECIL B. SMITH, C.E., Toronto, Ont., has been retained by the Calgary Power & Transmission Co., Calgary, Alta., in connection with the development of electrical power at Horseshoe Falls.

MR. T. H. McCAULEY, formerly manager of the Twin City Electric R. R. Co., at Port Arthur, Ont., has been appointed manager for the municipal street railway system being installed at Calgary, Alta.

PROF. WILLIAM C. PECKHAM, of Adelphi College, will deliver several lectures on electrical subjects at Lafayette Hall, The Bronx, under the auspices of the New York City Department of Education.

MR. CHARLES L. HARRINGTON is delivering a weekly course of lectures on electrical subjects under the auspices of the New York City Department of Education at the Harlem Branch of the Y. M. C. A.

MR. HENRY M. STEELE, who has for the past several years been with J. G. White & Company, New York City, as chief civil engineer, has, on account of ill health, resigned and removed with his family from New York to Asheville, N. C.

PROF. LOUIS A. HERDT, associate professor of electrical engineering at McGill University, Montreal, has been appointed to succeed Professor R. B. Owens as occupant of the chair of electrical engineering in the same university. Prof. Owens retires owing to continued ill-health.

MR. JOHN T. BOWEN, for seven years an electrical expert aid with the Bureau of Construction and Repair, Navy Department, has resigned from that position to engage in representing manufacturers and dealers of electrical and mechanical apparatus before the government departments in Washington.

MR. J. J. CAGNEY, general agent of the Montreal Light, Heat & Power Company, of Montreal, Que., Can., has resigned his position to accept the position of manager of a large hydro-electric plant, now under construction in Georgia. Mr. Cagney has been connected with the company for the past nine years.

MR. CHARLES E. CARTER has resigned as superintendent of the Madison Gas & Electric Company, Madison, Wis., and is now superintendent of distribution and electrical engineer for the Northern Colorado Power Company at Denver, Colo. This company operates in the northern part of Colorado and southern part of Wyoming.

MR. B. E. SUNNY, president of the Chicago Telephone Company and vice-president of the [illegible] Telephone & Telegraph Company, and Mr. Charles G. Dawes, largely interested in [illegible], have been appointed by [illegible] special commission to standardize the duties and compensation of the [illegible].

MR. GEORGE F. FENNO, for the last two years insurance engineer with the Middle States Inspection Bureau, has resigned in order to join the staff of the Geo. B. Cobeen Company, advertising engineers, New York City. Mr. Fenno is a graduate of Sibley College, Cornell University, class of 1906, and for some time after leaving school was telephone engineer with the New York & New Jersey Telephone Company.

MR. HAROLD ALMERT, who is noted in these columns, recently resigned his position as manager of the Wichita City Electric Light & Power Company, Wichita, Kan., where he has been bringing about a remarkable development of that property within the past two years, has opened an office as consulting engineer at 504 Royal Insurance Building, Chicago, and will make a specialty of building up on central station properties.

MR. F. P. WOY has resigned as manager of the Twin State Gas & Electric Company, Brattleboro, Vt., and has opened an office in Madison, Wis., to conduct a general consulting and engineering business for electric railway, electric light and gas companies. Mr. Woy was with J. G. White & Co., New York, for a number of years, and has at various times been connected with the construction and operation of plants in different parts of the United States.

MR. J. G. BOYD, for many years associated with the Columbia Incandescent Lamp Company, of St. Louis, is now connected with the Central Electric Company, of Chicago, as manager of the lamp department. Mr. Boyd, known to his intimates as "Texas" Boyd, has had a valuable experience in the sale of incandescent lamps, and, as the Central Electric Company's lamp business has grown rapidly, Mr. Boyd's long experience and wide acquaintance make him particularly well qualified to take charge of the new department.

MR. G. A. McCARTHY has become associated with Smith, Kerry & Chace, engineers, Toronto, Ont. Mr. McCarthy is a graduate of McGill University and, besides having been engaged in various railroad work, was principal assistant engineer from 1901-1905 on the construction of the power development works of the Canadian Niagara Power Company. Mr. McCarthy's immediate duties will be to construct a 10,000-hp plant for furnishing hydro-electric power to the mines in the celebrated Cobalt district. The project for the construction of the proposed power plant was organized and financed by Messrs. Smith, Kerry & Chace.

MR. W. R. PATTERSON, who retired from the service of the Western Electric Company at the beginning of the year, after a connection with that company lasting 31 years, has formed a copartnership with Mr. F. E. Davidson, formerly constructing engineer of the Western Electric Company. The new firm is doing constructing and industrial engineering work, with an office in the Monadnock Building, Chicago. Mr. Patterson was plant engineer of the Western Electric Company for a number of years before he severed his connection with that company, and he is highly regarded by the large number of electrical men who enjoy his acquaintance.

Obituary.

MR. WILLIS J. RODMAN, acting superintendent of telephones and telegraphs of the Panama Railroad, died at Colon, Feb. 28, after a long illness. Mr. Rodman had been on the Isthmus since 1905, and for some months acted as train despatcher.

MAJOR E. L. A. ZALINSKI, U. S. A. (retired), died in New York, March 10, of pneumonia. As a youth, Major Zalinski saw service in the Civil War and received a commission as lieutenant for an act of gallantry in battle. At the close of the war he received a commission in the regular army, and in 1894 was retired for disability with the rank of major. Major Zalinski is best known for his work on the dynamite gun, but was also an authority in various branches of ordnance. In recent years he devoted much attention to the subject of illuminating engineering, to which he contributed several inventions.

Trade Publications.

WIRE.—The manufacture and uses of wire are well described in an artistically illustrated pamphlet isued by the John A. Roebling's Sons Co., Trenton, N. J.

TUNGSTEN FIXTURES made with detachable link chains are illustrated, listed and described in a folder issued by the F. Wakefield Brass Company, Vermillion, Ohio.

ALTERNATORS.—The Electric Machinery Company, Minneapolis, Minn., has issued a well-illustrated bulletin, designated as No. 105, devoted to revolving-field alternators.

HIGH-TENSION SPECIALTIES.—The Central Electric Company, Chicago, is distributing a circular descriptive of its new line of disconnecting switches, fuses, lightning arresters, etc.

ARC LAMPS.—The Warner Arc Lamp Company, Muncie, Ind., is distributing return post cards for drawing attention to its vertical type flaming arc lamps. These lamps are shown in electrodes.

ROPE DRIVES.—No. 8 of Vol. XXIV of "Power and Transmission," published by the Dodge Manufacturing Company, Mishawaka, Ind., contains a well prepared description of rope drives. The publication will hereafter be known as "The Dodge Idea."

FRICTION CLUTCHES.—The Hill Clutch Company, Cleveland, Ohio, has reprinted for general distribution a paper by Prof. R. G. Dukes on "Tests of Friction Clutches for Power Transmission," which was read before the A. S. M. E. in December, 1908.

SECOND-HAND MACHINERY, including direct-current and alternating-current generators and motors, directly coupled generating sets and ventilating fans are described in a special price list issued by the Arthur Jones Company, Old Colony Building, Chicago.

PANEL BOARDS.—The March issue of "Lundell Chats," published by the Lundell Electric Manufacturing Company, Plainville, Conn., gives a list of regular panel boards carried in stock. A bulletin giving prices of these boards has also been issued by the company.

FANS.—Bulletin No. [illegible] of the Fort Wayne Electric Works, Fort Wayne, Ind., is a well-arranged publication, illustrating, listing and describing fans driven by direct-current and alternating-current motors. The fans are of the desk bracket, ceiling and ventilating types.

CREOSOTING.—A technical discussion of the preservation of wood by the creosoting process is given in Catalogue F of the Wyckoff Pipe & Creosoting Company, 50 Church Street, New York. A considerable portion of the catalogue is devoted to conduits, cross-arms and poles.

X-RAY APPARATUS.—Complete X-ray outfits and accessories for laboratory use are discussed in part of Catalogue G of the Kny-Scheerer Company, 124 West Forty-seventh Street, New York. Part 4 of the same catalogue deals with apparatus for galvanocautery, endoscopy and diaphanoscopy.

CONCRETE CHIMNEYS.—Much interesting information concerning reinforced concrete chimneys for industrial establishments is contained in a pamphlet issued by the Weber Company, 929 Marquette Building, Chicago. This company has issued a separate bulletin giving a list of Weber chimneys now in use.

TELEPHONE SERVICE.—The Western Electric Company has issued a booklet entitled "Satisfaction," which contains six excellent photographs of President Taft, showing him in the act of receiving the news of his election over the telephone. It also contains a number of well-known quotations from President Taft's writings.

THE MOORE TUBE LIGHT.—The Moore Electrical Company, 80 Malvern Street, Newark, has issued a booklet (No. 19) entitled "The Moore Light." The text treats specifically of the two colors, white and yellow, which have now become standardized. It also includes electrical data concerning standard lengths of tubes.

SECOND-HAND MACHINES.—The March "Bargain Sheet" of the Gregory Electric Company, Chicago, Ill., gives a complete price-list of alternators, direct-current motors and generators, single-phase and polyphase motors, arc lamps, incandescent lamps, watt-hour meters, switchboards, transformers and miscellaneous supplies.

STOKERS of the chain-grate type are thoroughly described and illustrated in detail in a neatly executed catalogue "G" of the Green Engineering Company, Commercial Bank Building, Chicago. The catalogue contains a valuable series of coal tables, showing the heating values and chemical compositions of the coals found in America.

ENGINES AND BOILERS.—A neatly printed catalogue dealing with slide valve and Corliss engines of the simple and compound types and boilers of the water-tube and fire-tube types has been issued by the Atlas Engine Works, Indianapolis, Ind. The catalogue contains a large amount of information for the steam engineer, arranged in convenient form for ready reference.

ELECTRIC WAGONS.—The Lansden Company, Newark, N. J., is distributing some instructive literature relating to electric vehicles. In addition to folders showing standard types of electric trucks, and questionblanks for those desiring detailed information, the company has isued a pamphlet descriptive of its wagons and showing the advantages of electric over horse-drawn vehicles.

CALENDAR CARD.—"Fear Not to Sow" is the title of a neat combined calendar and blotter issued by the Geo. H. Gibson Company, advertising engineers, Tribune Building, New York City. The company advises manufacturers of engineering supplies and equipment to prepare the way for large sales during the resumption of busines by means of intelligently directed educational publicity.

NEW TYPE OF LUNDELL FAN.—The Lundell fan has been improved still further this season by the addition of an oscillator mechanism which can be adjusted to the 1909 type of the fan. This feature is fully described in a new catalog, No. [illegible], just issued by the Sprague Electric Company, New York. The catalog also illustrates a full line of direct and alternating-current fans for all locations.

SWITCH AND OUTLET BOXES of stamped steel are described and illustrated in the new catalog, No. 23, of the Chicago Fuse Wire & Manufacturing Company. They are of the "Union" type, for both rigid and flexible conduit, and an effort has been made to illustrate every standard cover, giving detailed dimensions. Where desired, boxes are furnished with a galvanized coating applied both inside and outside by the Sherardizing process.

PERFORATED METAL.—The Allis-Chalmers Company has issued Bulletin No. 1425, having for its subject "Perforated Metal." The illustrations represent various varieties of perforated plates, the exact size and style of the perforations being shown. Perforated metal is claimed to be superior to wire cloth, being much stronger, more uniform in size of hole or mesh and less liable to tear or rust out. Unlike wire cloth, it presents a perfectly smooth surface, allowing the material to pass it smoothly and quickly.

Business Notes.

THE AMERICAN AUTOMATIC SWITCH COMPANY has removed its offices to the Hudson Terminal Building, 50 Church Street, New York.

MR. WILLIAM MARTIN has joined the staff of the Kennedy Valve

mpany, and will be manager of the New York City sales department, ith offices at 57 Beekman Street.

THE BANNER ELECTRIC COMPANY, of Youngstown, Ohio, is ported to be preparing plans for a large addition to its plant. The mpany manufactures electric bulbs and other electrical supplies.

THE KENNEDY VALVE MANUFACTURING COMPANY, New ork, announces that William Martin has joined the forces of the Kennedy alve Manufacturing Company as manager of the New York City sales epartment, with offices at 57 Beekman Street.

AUTOMATIC SWITCH COMPANY.—A note in the issue of March 1 reported that the Automatic Switch Company had removed its offices o the Hudson Terminal Building. This was an error, as the offices of he Automatic Switch Company remain at 131 Liberty Street, where they ave been located for fifteen years

ISOLATED LIGHTING PLANT.—The Indiana Springs Company, Kramer, Ind., has placed with the Central Laboratory Supply Company, Lafayette, Ind., an order for a complete electric lighting plant, to consist of two generating units, a switchboard and a number of motors. The installation is being made under the direction of Prof. J. W. Esterline, consulting engineer.

THE CUTLER-HAMMER MANUFACTURING COMPANY has opened a district office in Cleveland, Ohio, in the Schofield Building. The new office will be in charge of Mr. C. J. Kruse, who comes from the engineering department of the Cutler-Hammer Company, and who is well qualified to advise regarding the proper device to use in any case involving the control of electric motors.

THE AMERICAN BATTERY COMPANY, of Chicago, will move from 172 South Clinton Street to 312-314 Fulton Street, corner of May Street, on May 1. In its new location the company will have a three-story-and-basement building, 50 by 100 ft. in ground dimensions, with much more space than is now available. Mr. George T. Burroughs is president of the American Battery Company.

THE MASSACHUSETTS CHEMICAL COMPANY is making further additions to its plant at Walpole, Mass., to accommodate the increase in the business of the molded rubber department. The use of molded rubber goods, particularly in the electrical line, has assumed large proportions. Bushings, pump valves, rubber mats, car steps, etc., also are some of the specialties of this department of the Massachusetts Chemical Company.

MR. THEODORE STAVE, president of the Stave Electrical Company, manufacturer of the Stave flaming arc lamp, has just returned from an extended trip throughout the West. He has visited the different branches and established several new ones. Mr. Stave reports that his company's business is increasing very rapidly and, in fact, is very enthusiastic about the business outlook generally throughout the West.

MR. A. EUGENE MICHEL, who as manager of a technical advertising organization has for the past few years been identified with the publicity of numerous large manufacturing concerns, has just opened new offices at 1572 Hudson Terminal Buildings, New York. Mr. Michel will in future confine his efforts as an advertising engineer to the promotion of steam specialties and appartus, power transmission appliances and machine tools and will limit his clientele to the number of firms to whose work he can give personal attention. Mr. Michel is a graduate engineer, Associate Member of the A. S. M. E., and, with 11 years' advertising and engineering training, which includes practical experience in machine design, testing, etc., is well prepared to conduct the advertising of mechanical products.

JOHNSTON ELECTRIC COMPANY.—Beginning March 10, the firm known as the Western Electrical Company, Omaha, will conduct its business under the name of the Johnston Electric Company. There will be no change in the business or the personnel of the company. The reason given by President Johnston for making the change in name is that the establishment of an Omaha branch by the Western Electric Company, of Chicago, caused much confusion, letters and orders for one company being often delivered to the other. While there is but little similarity in the business of the two concerns, the confusion of names caused many delays and annoyances to customers of the old Western Electrical Company, which the change in name will prevent. Mr. Johnston has conducted an electrical supply business in Omaha under the name of the Western Electrical Company for the last 20 years.

CROCKER-WHEELER SALES.—Among the orders booked the past week by the Crocker-Wheeler Company are the following: A 600-kw 250-volt direct-current generator for William Rahr & Sons Co., Manitowoc, Wis., and a 500-kw generator for the Shenango Furnace Company, Sharpsville, Pa. The Dallas Cracker & Biscuit Company, Dallas, Tex,. has ordered a 75-kw, 240-volt alternator and switchboard and a number of induction motors, aggregating 33 hp, with which to operate its plant. Another similar order is from the Anderson Lumber Company, of Passaic, N. J., for a 125-kw generator and switchboard and 160 hp of induction motors. These motors are all of the squirrel cage type. A 225-hp wound rotor type induction motor has been ordered by the Youngstown Sheet & Tube Company for operating its wire mill at Struthers, O. Among the direct-current motor sales are one of a 100-hp shunt motor for the American Car & Foundry Company: an 85-hp motor to drive an air compressor for J. M. Kohler Sons Company, Sheboygan, Wis., and a 60-hp motor for the Bridgeport Brass Company's plating department, Bridgeport, Conn.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 9 1909.

[Conducted by William F. Bissing, Patent Law., 2 Rector Street, N. Y.]

914,375. ELECTROMAGNETIC CLUTCH; H. Ast, Vienna, Austria Hungary. App. filed June 15, 1906. Avoids the danger of the lubricant getting to the winding of the magnet and between the contact surfaces, which would produce slipping; throws the lubricant outward by centrifugal force through suitable guiding surfaces and lubricant guide rings.

914,386. BLOCK SIGNALING SYSTEM; H. M. Coulter, Chicago, Ill. App. filed Aug. 2, 1907. Improvement on Patent No. 794,784, relating to locomotive cab signals. The cab signals are operated mechanically, instead of electrically, by means of a series of mechanical actuating devices which are arranged along the track to actuate the whistle or bell on the locomotive.

914,395. TELEPHONE DISINFECTOR; M. A. Dohney, Chicago, Ill. App. filed Aug. 21, 1908. A disinfectant receptacle having flexible arms which engage the telephone mouthpiece, the receptacle being secured to a cord so that it may be removed from the mouthpiece and remain suspended from the transmitter when the same is in use.

914,412. RAILROAD SIGNAL; Henry A. Hoeschen, Omaha, Neb. App. filed May 27, 1907. Operated by the vibration of the rail caused by the passage of the train. A pair of levers engage the rail, and the signal bell, controlled by an electromagnet, is actuated by the levers when the train depresses the rail.

914,435. ROTARY CIRCUIT-CLOSER; Frank E. Lind, Kent, Ohio. App. filed July 9, 1908. For internal combustion engines; reduces the friction on the contact members. The electrical contact is made by means of balls, in a tubular head, which are forced apart by a radial arm so as to provide an electrical contact.

914,445. ENGINEER'S ALARM; E. McClintock, St. Paul, Minn. App. filed Dec. 18, 1905. Provides means whereby the engineer of the following train is warned, thus avoiding rear-end collisions; for double-track systems. The track is divided into blocks having normally closed circuits, short-circuited by the train, and means are provided whereby the caution and danger signal circuits on a second train are successively broken when the track circuit in the block ahead is interrupted by the passage of the preceding train.

914,461. ELECTRIC BLOCK SYSTEMS FOR RAILWAYS. C. H. Shaffer, Muskegon, Mich. App. filed April 1, 1907. For electric roads having a sectional trolley to enable the operator in the block house to signal the engineer on the car. A telephone is provided at the station and on the car, which can be switched into connection.

914,468. LOCK-OUT FOR PARTY LINE TELEPHONES. W. J. Wagner and W. E. Shields, Toledo, Ohio. App. filed Feb. 26, 1908. A lock-out device for party lines to automatically cut out all other telephones than the one in use, so as to prevent listening in or talking. Makes use of a primary circuit and a ground circuit, each having make and break contact parts, and a member which opens one circuit and closes the other, and is actuated by mechanical means and magnetic means to hold the member in position to close the ground circuit and open the primary circuit, the magnetic means being energized when another telephone in the line is in use.

914,482. RAILROAD AUTOMATIC DANGER AND SAFETY SIGNAL SYSTEM; A. F. Eells, Washington, D. C. App. filed Aug. 15, 1905. Gives an alarm on the car when the switch or draw is open; also provides means for telephoning between cars or cars and a station. Means are provided governed by the entry of a car upon a block for weakening the current in a signal circuit without interrupting it, and thereby actuating the signal.

914,483. DEVICE FOR PREVENTING COLLISIONS AT SEA; G. Erdman and G. Fischer, Berlin and Charlottenburg, Germany. App. filed Oct. 21, 1907. Automatically stops ships when they approach the danger zone by wireless apparatus which coacts with apparatus for stopping the engines of the ships. The radius of action is regulated by regulating the length of the sparks and the antenna.

914,489. ELECTRIC FURNACE; S. F. Hall, Worcester, Mass. App. filed June 1, 1908. An electric furnace with a smelting chamber in which heat is abstracted from the charge at the highest temperature by water cooling the interior and exterior walls of the furnace, at special points, thereby obtaining an equalized temperature.

914,499. ELECTRICITY RECTIFIER; T. J. Murphy, Rochester, N. Y. App. filed March 19, 1908. Converts alternating current into direct current by utilizing an electric arc which provides a gap normally impassable to the current and permits the current to flow across the gap at definite points in its wave.

914,[illegible]. SWITCH. C. D. Reitz and C. [illegible], Chicago, Ill. App. filed Dec. 17, 1907. [illegible] for electric railways, [illegible] the jumper between [illegible] to the [illegible] a second [illegible] and [illegible]

914,[illegible]. TIME INDICATING DEVICE; S. P. [illegible], Meriden, Conn. Assignor to [illegible] Co., Meriden, Conn., a corporation of Connecticut. Relates to devices of the kind which close the circuit [illegible] telephone office. The invention relates to [illegible] of a certain [illegible] seconds. See Digest No. [illegible]. A disk carrying the [illegible] is [illegible] in front of a suitable aperture [illegible] when the [illegible]

914,537. AUTOMATIC ELECTRIC IGNITER SWITCH. C. E. Vannort, Louisville, Ky. App. filed Dec. 21, 1905. An automatic switch for throwing in a battery circuit when the engine and dynamo slow

down, provided with an indicator, such as a signal lamp, to indicate when the dynamo is operating.

914,540. SPARK PLUG; Frank J. Watt, Detroit, Mich. App. filed Sept. 9, 1908. Has a tubular metal protection with a bushing of insulated material screw fitted therein, a metal bushing and a metal stem extending through the insulating bushing, the stem carrying a spring washer. Designed to avoid breakage from unequal expansion.

914,611. RAILWAY SIGNALING MEANS; T. W. Stanage, Porterville, Cal. App. filed July 13, 1908. Notifies the engineer when a second train enters the block by a suitable cab signal. A switch depressed by the wheels operates the signal within the cab.

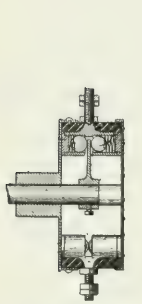
914,626. CONTACT MAKER FOR HELM INDICATORS; F. W. Wood, Newport News, Va. App. filed Dec. 19, 1907. Placed on the bridge or in the engine room to indicate the position of the helm. Multiplies the movement of the indicating arm by a second shaft geared to the shaft carrying the indicator.

914,646. STORAGE BATTERY; E. C. Ekstromer, Boston, Mass. App. filed June 3, 1907. For closing the battery casing and holding the wooden separators between the plates in position. Provides a plate having depending members arranged transversely to the wooden separators, and in contact therewith.

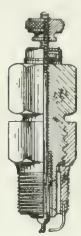
914,657. ELECTRIC ACCUMULATOR PLATE; C. F. Guyon and R. W. Vicaire, New York, N. Y. App. filed Oct. 30, 1908. Improvement on reissued Patent No. 12,195. The plate consists of alternate corrugated and non-corrugated strips of lead.

914,677. SHUNT CONTACT FOR ELECTRIC SWITCHES; W. M. Scott, Philadelphia, Pa. App. filed March 26, 1907. For preventing arcing. Eliminates the intermediate metal or shunt contacts and employs a single shunt path whose contacts consist of a mixture of carbon and finely divided metal.

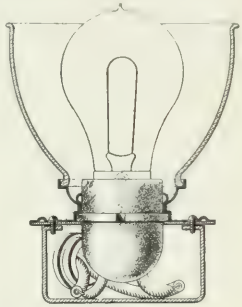
914,684. ARC LAMP; W. F. Warner, Muncie, Ind. App. filed June 25, 1906. Regulates the lamp independent of the strength of current



914,435—Rotary circuit closer.



914,540—Spark plug



914,762—Conduit receptacle.

by providing special means for operating the clutch to restrike the arc at predetermined intervals, irrespective of the consumption of the electrodes.

914,690. TELEPHONE SYSTEM; F. W. Wood, New York, N. Y. App. filed July 6, 1906. Relates to a combination of a plurality of telephone sets, each having a receiver and transmitter, a clearing out drop, a source of electrical energy and means for connecting the receiver of one set and the transmitter of another in series in one branch circuit, the source and drop in another branch circuit and the other transmitter and receiver in series in a third branch circuit, the branch circuits being connected in multiple across the branch containing the source and drop.

914,713. MULTIPLEX TELEGRAPH SYSTEM; T. Giara, Boston, Mass. App. filed July 28, 1905. Particularly for wireless telegraphy by means of which some of the impulses are sent over a conductor to one station and others through the air to another station. Uses several harmonic currents, whose impulses are sent simultaneously and received separately.

914,715. REGISTERING MECHANISM FOR TELEPHONES; V. D. Grene and K. W. Fort, Chicago, Ill. App. filed Sept. 9, 1907. Records outgoing calls by a device actuated by the telephone. Does not make use of electrical connection for operating the register. The register includes register disks with mechanism controllably connected with the call-effecting device whereby the circuits of the telephone are affected on the operating of the call-effecting device, together with means for operating the disks and releasing the circuit-affecting mechanism from the call-effecting device and restoring the circuits.

914,719. TROLLEY BASE; J. A. Hanson, Detroit, Mich. App. filed March 9, 1908. Utilizes the maximum power of the springs to lift the pole by providing an auxiliary arm and a sliding connection between the arm and the trolley arm, the auxiliary arm being actuated by a spring.

914,762. CONDUIT RECEPTACLE; James S. Stewart, New York, N. Y. App. filed March 7, 1908. An outlet box having a perforated cover plate, and a body having a vitreous housing passing through the cover plate and secured to the plate by screws. Leaves a large amount of space within the box for making connections.

914,772. PORTABLE ELECTRIC LIGHT FIXTURE; L. A. Williamson, Providence, R. I. App. filed May 29, 1908. For use in hotel rooms, etc. The light is portable and can be carried in a traveling bag and the flexible cord reels up on a spring drum within a case on which the lamp is mounted.

914,801. AUTOMATIC ELECTRICAL SIGNALING SYSTEM FOR RAILWAYS; C. Crandall, Springfield, Mass. App. filed Oct. 12, 1907. Renewed Sept. 2, 1908. Gives a signal in the locomotive cab by arranging conductors on poles along the track which are charged with high-frequency currents and induce signaling currents in the circuits on the locomotive.

914,808. RAIL BOND; F. H. Daniels, Worcester, Mass. App. filed Oct. 16, 1906. Comprises two telescopic members engaging the rail from opposite sides and having each a flanged head whose inner face is soldered to the rail.

914,816. METHOD OF PREPARING MOLDS FOR ELECTROTYPES; G. E. Dunton, New York, N. Y. App. filed Oct. 30, 1908. Shaves or planes the surfaces of the mold by an electrically heated tool and polishes the shaved surface with another heated tool.

914,837. LINE SUPPORT; I. D. Hilliard, Albany, N. Y. App. filed Nov. 1, 1906. A cheap and easily manufactured means for attaching a line conductor to the insulator by means of a pair of tie wires for each insulator, which are secured to the line wire on opposite sides thereof by clamps. If the insulator breaks or the line breaks, the tie wires hold.

914,856. ELECTROLYTIC APPARATUS; O. Meyer, Richmond, Va. App. filed Feb. 10, 1908. For the electrolytic decomposition of electrolytes, particularly sodium chlorid. The cell consists of a pipe having caps at the ends and a porous pipe arranged therein, a tube in the porous pipe and means for supplying the electrolyte to the tube.

914,868. ELECTRIC ARC LAMP; C. Oliver, Woolwich, England. App. filed July 7, 1905. An electric arc lamp with two magazines, each holding a plurality of carbons which are successively adapted to be fed in place and constitute the electrodes of the lamp.

914,869. ELECTRIC ARC LAMP; C. Oliver, Woolwich, England. App. filed July 1, 1907. Flame arc lamps having two magazines, each adapted to hold a plurality of carbons which are automatically and successively brought into position to act as the electrodes.

914,877. TELEGRAPH REPEATER; G. L. Rawdon, Cleveland, Ohio. App. filed April 30, 1908. Eliminates a number of the parts, including two local circuits and batteries, shown in Patent No. 479,178. Provides a pair of main receiving relays, each having a main magnet and a differential magnet and means whereby the armature of one relay controls directly one coil of the differential magnet of the opposite relay.

914,878. ELECTRIC SWITCH; S. G. Read, Springfield, Mass. App. filed Jan. 20, 1908. For automobiles. Can be quickly removed and replaced so that the operator may take the switch with him and guard against tampering with the machine. A block is provided with a fulcrum pocket, which receives a removable oscillatory switch arm.

914,879. SOUND DAMPER; E. Renz, Erlanger, Germany. App. filed Oct. 23, 1908. For silencing the sounds of electrically acting circuit-breakers by providing a hollow body surrounding the circuit-breaker with a flexible diaphragm which forms a sound-deadening space between the body and the diaphragm.

914,888. ELECTRICALLY HEATED CURLING IRON; B. Y. Snyder, Salt Lake City, Utah. App. filed Jan. 29, 1908. An electrically heated curling iron in which a heating member has a hollow portion, and electrically heating means are located therewithin.

914,891. ELECTRODE FOR ARC LIGHTS; C. P. Steinmetz, Schenectady, N. Y. App. filed Feb. 26, 1902. Made of magnetite so as to give a better light and prevent wasting of the electrode.

914,892. ELECTRIC CURRENT AND VOLTAGE REGULATOR; S. B. Storer, Syracuse, N. Y. App. filed Feb. 6, 1906. For maintaining a predetermined voltage automatically, a differentially wound motor with two opposing windings which are electrically balanced at a predetermined voltage, and which when unbalanced cause the motor to actuate a regulator.

914,939. ELECTRIC ARC LAMP; R. Fleming and C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Dec. 26, 1903. Flaming arc lamps which take care of the fumes that are apt to deposit on the non-consuming electrode. Provides an annular member surrounding one electrode with means for causing movement of the annular member with relation to the axial electrode whereby the axial electrode removes material deposited on the inner periphery of the annular member.

914,941. TRANSFORMER STRUCTURE; C. LeG. Fortescue, Wilkinsburg, Pa. App. filed June 8, 1907. A magnetizable core including a plurality of parallel limbs with cross members joining the same and brackets at the ends, together with clamping means for clamping each core limb concentric with the brackets at the ends.

914,946. METHOD OF WELDING; F. G. Haldy, Stamford, Conn. App. filed July 25, 1908. For welding chain links by pointing one end of the link blank and recessing the other, bringing the points together under pressure and a welding heat.

914,964. IGNITER; J. H. and J. B. Mantion and A. W. Stanley, Hull, Quebec, Canada. App. filed March 18, 1908. Cigar lighter having a receptacle containing wood alcohol with two adjacent but separate electrodes which carry a plurality of torches that can be inserted between the electrodes and dipped into the alcohol and on their withdrawal ignited.

914,972. CONTROLLER FOR ELECTRIC MOTORS; T. S. Perkins, Wilkinsburg, Pa. App. filed March 7, 1904. To prevent sparking at the brushes by inserting, through mechanical means, a resistance in the motor armature circuit when the motor is started, or when from any cause the motor acts temporarily as a generator.

914,975. PORTABLE ELECTRIC LIGHT; G. R. Radley, Milwaukee, Wis. App. filed July 27, 1905. A miniature electric lamp which may be carried by the thumb by means of a suitable ring and which is operated from a battery carried under a coat, the connecting wires passing up through the sleeve of the coat.

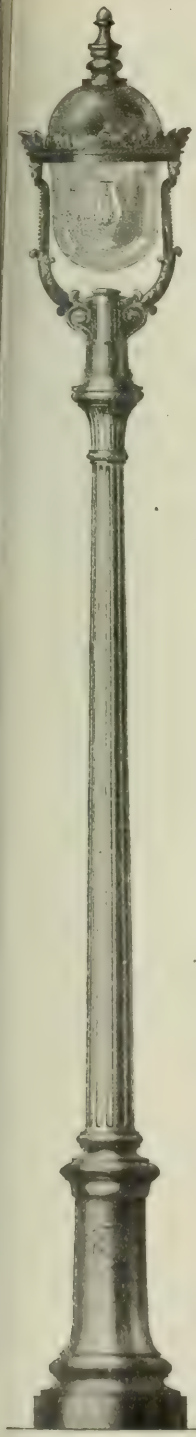
914,981. TRANSFORMER; H. B. Smith, Worcester, Mass. App. filed Sept. 4, 1906. The wires of the windings are immersed in insulating fluid and the winding consists of a plurality of substantially cylindrical coils of materially different diameters, each coil having a single layer of convolutions of a strap conductor wound on an edge.

914,995. ELECTRIC CIGAR LIGHTER; J. W. Todd, Jr., Jackson, Miss. App. filed Jan. 8, 1908. A receptacle containing alcohol in which rest the usual brushes of metal. Two metal contact strips receive the electric current and insulating material is packed between the strips. When a brush is drawn across the strips it produces a spark which ignites the alcohol upon the brush.

915,016. ELECTRIC CONTROLLER; F. E. Case, Canton, Ohio. App. filed June 29, 1908. For motors of dental engines having a compound switch and a compound rheostat. The controller comprises a lever and a disk on the same axis, one terminal fixed adjacent to the disk, the other terminal and switch being on the disk. A connection between the lever and the switch throws the switch into contact with one terminal when the lever is rotated and into contact with the other terminal when the disk is rotated.

915,052. ARC LAMP; W. R. Whitney, Boston, Mass. App. filed Nov. 16, 1903. A non-consuming electrode formed out of copper in combination with a negative electrode, which gives a flaming or luminous arc by yielding up the necessary gases to maintain the arc. The negative electrode contains titanium carbon and the like.

915,053. REVERSING SWITCH; J. Dalziel, Derby, England. App. filed April 6, 1907. For dynamos used in train lighting, driven from the carriage axle in which the pawl and ratchet which actuates the reversing switch transmits the movement directly to the switch arm without the use of a connecting rod.



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INDUSTRIAL PLANT ENGINEERS

Warren H. Miller, Electrical Engineer, Standard Oil Refineries, says on page 1003, of the Nov. 7, '08. ELECTRICAL WORLD

"On all overhead work it is poor economy to work the line men when the wind is blowing hard The torches then give a good deal of trouble to keep lit. Better put the men on some other work. If the line *must* be pushed ahead, use two torches per man," etc.

This article was written before Mr. Miller had tried the Matthews' Cable Clamp. We sent him a copy of Mr. Arthur Gillman's paper on "A Heavy-Conductor, Open Work Installation," which appeared in the Electrical World of Sept. 19, and pointed out the fact that Mr. Gillman used the Matthews Clamp in his work, and also that the use of this clamp eliminates the necessity for the cutting and splicing of power cables at corners and dead ends and therefore the use of blow torches with their troubles. Mr. Miller ordered 225 Matthews' Cable Clamps for reply.

May we get you to do the same? See our trial offer in last week's issue of this paper

MCC MCC

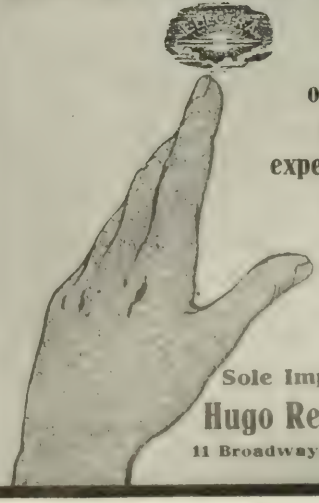
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THE MINNESOTA CONVENTION.

The second annual meeting of the Minnesota Electrical Association demonstrated that this organization is very much alive. One peculiarity of the Minnesota association not found in other State associations is the very active part taken by superintendents of municipal plants. In this State, as in Great Britain, many of the municipal-plant managers show an enterprise in working for new business of a profitable kind that would do credit to any private company.

Among the subjects taken up at convention, that of prime movers attracted the attention it deserves in a State where fuel is high and where water-powers are none too abundant. On account of this high cost of fuel in Minnesota, producer gas plants are receiving more earnest consideration than in many other parts of the country. There does not appear to have been much experience as yet with this type of plant. One such plant in the State, that at Fairmont, described in these columns in the issue of Dec. 19, 1908, seems to have been notably successful. To judge from the reports from this and other small plants throughout the Northwest, the greatest difficulty is in getting the plant started and learning to operate the engines and producers. Men who understand steam engines and boilers are plentiful, but there is as yet practically no place from which to draw men skilled in producer operation. For this reason men have to be trained after the plant is started, the result usually being that there is a period of three or four months when there is a most exasperating amount of trouble and interruption to service if dependence is placed entirely on the producer plant. After that first trying period is over and a crew is trained to run the outfit, the operation is as reliable as that of a steam plant with a similar reserve. The purchase of coal by heat-unit contract, which is becoming more prevalent, is also of special interest to Minnesota central stations because of the higher cost of fuel and the consequently greater money value of the heat units contained in coal than in cheap fuel localities.

In the matter of tungsten lamps, which is a live subject at every electric light convention these days, some very instructive figures taken from careful records on an actual installation of a large number of these lamps on ornamental iron posts in a downtown street was given by Mr. H. J. Gille from the records of the Minneapolis central station. These constitute some of the most trustworthy figures yet made public on the life of the tungsten lamp in commercial use. They indicate that tungsten lamps as now made, when burned on a circuit 2 volts lower than the rated voltage of the lamp, are giving an average life in excess of 800 hours. In fact, the average life of all the lamps on this installation since it was first put in service has been 780 hours, including those not yet

burned out, this average being considerably reduced by the shorter life of the lamps in the first installation as compared with the lamps recently used.

Electric Locomotive Types.

As noted elsewhere in this issue, the electrification of steam railroads was discussed at a recent meeting of the New York Railroad Club. The arguments presented as to the relative merits of the various systems of electric traction differed only in minor details from earlier discussions of the same subjects, each speaker emphasizing the advantages of a particular system. The most encouraging feature of the discussion resided in the noteworthy fact that the electrical engineer of each of the three roads using the direct-current, the single-phase and the three-phase systems was in each case the most enthusiastic advocate of the type of equipment adopted by his road. That is to say, experience has proved each system admirably suited for the service for which it was selected. Practical operation has shown that each type possesses in a marked degree all of the advantages claimed for it by its advocates, while the disadvantages urged against it by its opponents have largely failed to materialize.

Even Harmonics in Alternating-Current Circuits.

According to a well-known law of electrodynamics, the e.m.f. produced in a conductor when moved in a magnetic field is equal at each instant to the rate of cutting of the lines of force. When the speed is uniform the e.m.f. varies directly with the space distribution of the magnetism, and hence the e.m.f. in any single conductor on a revolving armature has an electrical-time value similar in all respects to the electrical-space value of the magnetism. Since there must be equal positive and negative values to the magnetism, each positive half-wave of the e.m.f.-time curve must be equal in area to a negative half-wave. This fact places at once a limit upon the possible shape of the e.m.f.-time wave produced by revolving machinery. When two or more conductors are joined in series to form a coil of an alternator, the e.m.f. produced in this coil has a time-value which is the algebraic sum of the time-values of the e.m.fs. in the component conductors. It will be seen, therefore, that in a single fractional-pitch coil on an armature revolving within a field core having, for example, strong trailing north magnetic pole tips and strong leading south magnetic pole tips, there would be generated an e.m.f. with a higher maximum in one direction than in the other. That is to say, the two half-waves of the e.m.f.-time curve would differ in shape, although their areas would be equal.

It may be stated in general that the coils on an armature are so interconnected and the field magnetism is so distributed that the negative half-wave of the e.m.f.-time curve is identical in shape and size to the positive half-wave, and hence it may safely be assumed that among the component sine waves of which it is formed the "even harmonics" of the fundamental are missing. In an article appearing in this issue Dr. C. P. Steinmetz shows that it is incorrect to assume that even harmonics are never present, because in certain transient phenomena in electric circuits the even harmonics of current may reach values comparable to the normal full-load current. A common example is cited in the starting current of a transformer, the transient term of which assumes a large value when the sum of the residual magnetic density and the normal operating density is much beyond the "knee" of the magnetization curve. It would seem that the facts discussed by Dr. Steinmetz would be of considerable importance in low-frequency transformers or in transformers of higher frequency in which use is made of the newer core material operated at high densities.

A Volt Scale for a Watts-Per-Candle Meter.

In the industrial photometry of carbon incandescent lamps it is commonly found convenient to operate the photometer in such a way as to indicate the voltage at which the tested lamp gives its rated candle-power. By this means lamps are separated into voltage classes so that plants and stations requiring one particular voltage can readily be supplied. This is a far more convenient procedure than rating the candle-power differently at one and the same voltage. But specifications for lamps frequently designate not only the voltage at which the lamps are to give their rated mean horizontal intensity, but also the specific consumption or watts per mean horizontal candle which they must offer. Mr. Herbert E. Ives describes on page 73 a method of applying a direct-reading scale to a specific-consumption photometer in such a manner that not only the actual specific consumption may be read off at the testing voltage when the photometric balance has been secured, but also the corresponding voltage at which a certain assigned specific consumption should be expected. Thus, if, at the particular testing voltage of 115 volts, the lamp tested was read off at 16 cp, 3.4 watts per candle, the photometer scale would also be able to indicate that at 118.5 volts the lamp would consume 3.1 watts per candle, giving, of course, a certain correspondingly increased candle-power.

The fundamental importance of uniform initial specific consumption in incandescent lamps is connected with the fact that filaments of the same material and physical condition of surface, incandescing in bulbs of the same dimensions and degree of evacuation, consume the same initial electric power per mean spherical candle when worked at the same initial temperature. The rate of evaporation of the filament, or rate of diminution of light with time, depends upon the initial temperature of the filament. Again, the initial color of the light emitted depends upon the initial temperature of the filament. In lamps of the same type and form of filament the ratio of mean initial horizontal candle-power to mean initial spherical candle-power is constant, so that the initial temperature of lamps of the same type and form of filament is defined by the initial watts per mean horizontal candle-power. The only rational basis for the comparison of lamps with filaments of the same material is, therefore, a common initial specific consumption.

The additional scale on the photometer by means of which the voltage of standard specific consumption is indicated has been worked out from a certain experimentally determined relation between rise in lamp-terminal volts and rise in specific consumption. Thus, treated carbon lamps of a certain type are found to diminish 3.5 per cent in specific consumption when raised 1 per cent in voltage, if the voltage change is small. A special form

slide rule could readily be designed for such computations; it by preparing a suitable scale once for all, the photometer an be made to point out the assigned voltage of constant pecific consumption for a fixed initial horizontal candle-power nd a fixed testing voltage. It is doubtful whether the ordinary hotometer would be improved by attempting to add such a cale to its ordinary indicator. There can be no doubt, however, that in a lamp factory where many lamps of the same andle-power and of the same type of filament have to be hotometered there might be an advantage in the use of this evice.

The Sleet Question.

We are publishing this week two interesting considerations, one regarding data on, the other touching methods of dealing with, the design of lines against sleet stresses. The winter now closing has been marked by several severe sleet storms, one of which proved conspicuously disastrous to the Washington inauguration program. A sleet storm involves a double danger to all overhead lines. In the first place, the mere weight of the icy coating may first break the wires, and then, by throwing heavy unbalanced strain on the poles, bring them down also. Second, by increasing the surface of the suspended wires, it may bring wind pressure into action to an extent that will also act so as to bring down both wires and poles. As a matter of experience, the circuits that suffer most severely are telegraph and telephone lines, the ordinary electric lighting circuits holding up well as a rule, and the transmission circuits being very rarely injured. As a rule, telegraph and telephone lines are circuits of many wires, rather small ones at that, and are upon poles of no great strength not always well maintained. Inasmuch as experience seems to show that small wires do actually accumulate as thick coatings of sleet as large ones, one would not go far wrong in assuming that the sleet strains on the pole line increase directly with the number of wires, which accounts for the facts just noted.

Mr. Collbaum's note contains much interesting information on this point. He found that in the Wisconsin storm of Jan. 28 practically all the wires in the affected region were coated with snow and sleet up to diameters ranging from 2½ in. up to as much as 4 in. During this state of affairs the temperature ranged down to —4 deg. Fahr., and the wind velocities recorded up to 40 miles per hour. This combination of cold and high wind is a very unusual one in most parts of the country, and such a record is important. It is generally assumed that sleet does not form coherently save around the freezing point, so that it is pertinent to inquire as to the exact conditions in this instance. Fortunately, Mr. Collbaum gives some valuable data on the actual weight of the coating, which proved to be about ½ lb. per running foot on wires broken down during this storm. If the coating were of the general diameter just mentioned, the evidence is conclusive that the formation was not sleet properly so called, but an agglomeration of sleet and snow of far less density than compact ice. Coatings of ice of such thickness would have weighed, say, from 2 lb. to 5 lb. per running foot, instead of ½ lb. It would be very interesting to learn what similar figures for diameter and weight of sleet-coated wires have been found elsewhere, and we trust that some of our correspondents will furnish similar data from which a clear idea of sleet density can be formed. It seems probable that a coating approximately the density of clear ice can be formed only at temperatures very near the freezing point. A coating such as Mr. Collbaum describes is dangerous, chiefly on account of wind pressure in the case of anything but small and relatively weak wires. In ordinary designs of transmission lines the coating is generally assumed at the density of clear ice, and a moderate wind pressure, always as great as 40 miles per hour, should be taken into account. It must be remembered, however, that the reported wind velocity is always given directly from the anemometer readings, which are materially higher than the true velocities, save in very moderate winds. For instance, a 40-mile wind (indicated) has a real velocity of 33.3 miles, and a 60-mile wind a real velocity of only 48 miles. The true velocities are those to be used in the preliminary computations of the pressures due to wind.

The formulas given by Mr. Glaubitz bear directly on the design of lines to meet sleet and wind strains. A glance at them shows the importance of giving close attention to the matter of deflections. Tight stringing of wires increases danger from sleet and wind without any material compensating advantages. In laying out a line it is obviously important to take into close account the climatic conditions to be met. While wind velocity increases with height above the ground, it must not be forgotten that the wind observations are taken at a distance above the ground greater than the height even of steel line towers, and, as published, are not reduced to ground level, which, in fact, would be a rather difficult thing to do. Hence probably one is likely to get a very much exaggerated idea of the actual wind pressure to be met by a line. There is very little danger of getting enough wind strain even on a sleet-covered wire large enough to actually endanger the poles.

The real risk is in breaking the wires from excess of initial tension, and by the sudden release of strain pulling down the poles by the weight of the adjacent spans. A pole line, whether of wood or steel, should be planned to allow sufficient flexing in such case to drop the catenary to the safest point without upsetting the poles. The common assumption of a rigid pole is incorrect in theory, and bad in practice. With the wires ordinarily used in high-tension transmission lines, there is very little danger to the poles from combined sleet and wind, if the wires are properly strung. In fact, transmission line design is far more likely to err in the direction of entirely needless strength than toward weakness. The alleged immunity of very high-tension lines from sleet formations is open to a good deal of doubt; in fact, there is little to show that one can rely upon it. But, on the other hand, there are practically no records of such dense and thick sleet coatings on transmission wires as have been observed on smaller wires in the quieter air near the ground, and the wind velocities allowed for are most commonly abnormally high. Ample factors of safety should be allowed without going into extreme precautions against conditions of which there is no probability. A liberal sag on long spans is the best defense against abnormal stresses.

The New Tariff Bill.

The new tariff bill introduced into Congress, March 17, makes notable changes in duties on many classes of electrical manufactures and material. Where ad valorem rates are substituted for specific rates, these changes are particularly large in certain lines, and in many cases undoubtedly much greater than were anticipated by the framers of the bill. Aside from some schedules of great popular interest, the tariff rates in the bill as introduced will without question be subject to very considerable revision, both in the House and in the Senate.

The most striking change in the tariff, so far as affects the electrical industry, is the reduction of duty on electrical apparatus and machinery from 45 per cent to 30 per cent. As there have been practically no importations under these schedules, the effect of the lower duty, if maintained, can scarcely be even conjectured. The change in the duty on arc light carbons is perhaps of greatest interest, in view of the dependence of the electric lighting industry on certain grades of foreign-made carbons. Under the Dingley bill the duty on carbon electrodes was advanced from 30 per cent ad valorem to 90 cents per 100 carbons. As the latter bill contained no specifications as to the length of the carbons, it has been the custom to import all except the higher grades in double lengths, which thus reduced the duty to 45 cents per 100; on the other hand, owing to the greater breakage of the longer carbons and the labor of cutting, the final charge on carbons imported in double lengths often fell little short of 60 cents per 100. Under the new tariff the duty has been changed to 35 per cent ad valorem. In the case of cheaper carbons this is, of course, a very considerable reduction, but for expensive carbons, such as are used in flaming arc lamps, the duty is considerably increased. Carbons under $26 per 1000 would pay less duty under the new rate, while on carbons above that value, the duty will be higher, and notably so in the case of flaming arc carbons and carbons for searchlights, in the latter case the increase being as much as 1000 per cent.

There is no change in the duty on either incandescent or arc lamps, both of which at present are classified under manufactures of metal, the duty on which remains 45 per cent.

The duty on mica has been changed from 6 cents per pound and 20 per cent ad valorem, to 30 per cent ad valorem on plain mica, and to 35 per cent ad valorem on built-up mica. While this change reduces the duty on mica of low grade or the smallest sizes, costing about 54 cents per pound or less, it increases the duty on the better grades and larger sizes, costing more than 54 cents per pound, large quantities of which are used in the electrical industries.

The duty on aluminum in crude form has been reduced from 8 cents to 7 cents per pound, and in the form of plates, sheets, bars and rods, from 13 cents to 11 cents per pound. As this is equivalent to a protection of not far from 50 per cent on the basis of present aluminum prices abroad, the decrease in duty will probably not result in any importations, but may affect domestic prices to the extent of the reduction.

Of material used in the manufacture of storage batteries, the duty on lead has been changed from 2⅛ cents to 1½ cents per pound; on red lead from 2⅞ cents to 2⅜ cents per pound, and on litharge from 2¾ cents to 2¼ cents. The price of lead has been arbitrarily fixed in this country, and the new duties, if maintained, will have the effect of lowering the upper limit of price.

The duty on zinc in pigs is reduced from 1½ cents to 1 cent per pound, and in sheets from 2 cents to 1¼ cents.

A section of the tariff bill provides for maximum duties to meet the case of customs discrimination against the United States by other countries. The effect of this section of the act can in most instances only be determined by a close examination of the tariff schedules of the world, and its provisions probably would not apply to electrical exports except in the case of a tariff war with Germany.

Proposed Federal Corporation Tax.

It is reported that President Taft has had a bill drafted for introduction before Congress taxing the dividends declared by corporations at the rate of 2 per cent. Treasury experts have calculated that such a measure would produce a revenue of $15,000,000 per year, or $5,000,000 less than the inheritance tax provided in the Payne tariff bill. The corporation tax would supersede the latter measure owing to expected opposition to it in the Senate on the ground that it would conflict with State taxation of inheritances. As none of the details of the proposed corporation tax has as yet been developed, it is not known if it applies to corporations not engaged in interState commerce, such as electric lighting, railway and telephone companies.

Electric Railways in Canada.

Electric railway building in Canada during the past year experienced a large falling off. For the year ending Dec. 31, 1908, 32.94 miles of electric railway track were laid in Canada, as against 72.27 during 1907. With the exception of a line from Brantford to Ancaster, Ont., which was built by the Brantford & Hamilton Electric Railway, and the Mount McKay & Kakabeka Falls Electric Railway, all the work was extensions to existing lines. At the present time the British Columbia Electric Railway has under construction considerably more mileage than was covered by all Canadian companies in the two years mentioned. The following is a list of the construction accomplished:

	Miles
Brantford & Hamilton (Brantford-Ancaster line)	16
Montreal Street Railway, Montreal, Que.	1.3
Winnipeg Electric Railway, Winnipeg, Man.	6.0
Toronto Electric, Toronto, Ont.	.2
Montreal Park & Island Railway, Montreal, Que.	1.9
Mount McKay & Kakabeka Falls, Fort William, Ont.	3.0
Ottawa Electric, Ottawa, Ont.	1.8
Sarnia Street Railway, Sarnia, Ont.	1.2
Toronto & York Radial, Toronto, Ont.	1.3
Total	32.9

Practically all the companies mentioned above, as well as a number of others, plan many extensions for 1909.

Large Mexican Electrical Development.

The Mexican Northern Power Company, incorporated by the Dominion of Canada, has secured the rights to a perpetual concession granted by the Government of Mexico for the development of the water-power on the Conchos River, in the State of Chihuahua, Northern Mexico, and its utilization, to generate electrical energy for the supply of cities and towns of that State and its mining districts.

The water-power, which is at Parral and has been examined by Mr. Wm. F. Tye, civil engineer, of Montreal, will develop 25,000 hp. It is proposed to build the necessary dams and transmission lines for 25,000 hp, but to install initially machinery, hydraulic and electrical, for 15,000 hp only. The cost of construction for this is estimated at about $4,500,000 gold and to increase to 25,000 hp will involve an additional outlay of $500,000. The selling price for the electrical energy is figured at $75 per annual horse-power on the peak load.

The district this company will serve is one of the largest and oldest of the mining districts of Mexico, and lies within 50 miles of the plant. The capital of the State is a city of 70,000 inhabitants. The capital of the Mexican Northern Power Company is to be $10,000,000 stock and $7,500,000 bonds. The board of directors are Messrs. E. B. Greenshields, Edwin Hanson, B. F. Pearson, S. J. Moore and others. The officers are: President, Mr. G. F. Greenwood, Montreal; vice-president, Mr. E. B. Greenshields; secretary, Mr. Frank Thompson. A number of the stockholders were at one time stockholders in the Mexican Light & Power Company, also a Canadian organization

Lectures on Electric Vehicles.

A lecture will be given on Monday, March 29, 1909, at 8 m., in the Electricity Building, Case School of Applied ience, Cleveland, Ohio, and on Wednesday, March 31, at p. m., in the rooms of the Western Society of Engineers, onadnock Building, Chicago, Ill., by Mr. Bruce Ford, of the ectric Storage Battery Company, Philadelphia. The subject the lecture will be the "Exide Battery in Vehicle and Spark- g Service," and will be illustrated with a series of lantern des. A general discussion of the subject will follow in which present are invited to take part. At the Chicago meeting address will also be given by Mr. E. W. Lloyd, contract ent of the Commonwealth Edison Company, on the relations central stations to the automobile business.

ssociation of Central Station and Electric Vehicle Companies.

At a dinner given in Boston, March 11, a new organization as formed for the purpose of uniting manufacturers of elec- ic vehicles and the managers of central lighting and power ations. The purpose of this new organization is to promote e use of electric vehicles for business and pleasure, and to imulate both the vehicle manufacturer and the central-station anager to renewed effort to increase the popularity of these hicles. Those interested in the formation of the association nsidered the body would be equally advantageous to the anufacturer and the central-station man in that the revenue erived from the sale of energy will aid in straightening out the ad line on the power station and the facilities extended by e central station for the recharging of batteries will popularize e use of these vehicles.

The meeting was well attended and addresses were made by Ir. W. H. Atkins, Boston, representing the Boston Edison ompany; Mr. William P. Kennedy, chief engineer of the tudebaker Company, and Mr. Frank J. Stone, Boston, repre- enting the Electric Storage Battery Company, and others.

The officers of the association are: President, Mr. Frank J. tone; secretary, Mr. H. F. Sands; treasurer, Mr. L. R. Wallis; xecutive committee, Messrs. Day Baker, Col. E. W. M. Bailey, . G. Thompson, A. C. Gray, A. F. Neale, J. H. Neal, E. C. anson, C. B. Davis and N. T. Wilcox.

Electric Vehicles.

As noted on page 541 of our issue for March 4, 1909, the acific Coast Electric Automobile Association held its con- ention in San Francisco on Feb. 19 and 20, at which time apers dealing with the mechanical and electrical features of lectric vehicles were read and discussed. The discussion of paper by Mr. Geo. R. Murphy brought out many interesting oints relating to the practical operation of vehicle batteries. It was stated that since the watt-hour efficiency of the lead attery is 75 per cent and that of the nickel-iron battery only 0 per cent, that latter requires 50 per cent more energy than oes the former for the same effective output. Mr. McDonald alled attention to the fact that, on account of the gradual improvements in lead batteries, tires and mechanical parts, the mileage per charge of electric vehicles is twice as great to-day s it was 11 years ago. Mr. Briggs said that, although some trouble may be experienced in removing the opinions based on earlier performances, the electric vehicle of to-day, with its improved batteries and motors, is an excellent machine. Mr. Daggett remarked that since the electric automobile is em- loyed as a town vehicle and not as a touring car a speed of 0 miles per charge, as now obtained on level road, is entirely atisfactory. Mr. Stevenson stated that lead batteries should e washed at the end of each 5000 miles of travel of the ehicle. A battery lasts about 9000 miles, so that it requires wo washings. The separators are renewed at each washing. Mr Murphy said that washing cannot be accomplished in less than one day. If the battery is properly handled only a small percentage of the separators will need renewal. The positive plates can withstand about 300 charges while the negatives can withstand from 450 to 500 charges.

Mr. Geo. C. Holberton, in discussing a paper by Mr. F. T. Kitt, entitled "Relation of Central Stations to the Automobile Business," expressed the opinion that although special prices should be made for charging automobile batteries, a supply company should not adopt the suggestion of having a clause in the contract for using energy during non-peak hours. A better plan is to use two meters, charging a certain rate for certain hours per day. In Oakland the rate for charging automobiles is 5 cents per kw-hour with a discount based on the amount of energy used. Mr. Daggett remarked that central stations should encourage electric vehicles by purchasing them for their own use, and should advertise them as they do heating devices and motors. Mr. A. C. Downing said that the Union Electric Light & Power Company, of St. Louis, by taking the agency of electric vehicles, and advertising them by means of electric signs, has developed a large electric automobile business; it cares for 75 machines per night. In commenting on a statement by Mr. Harvey that observation shows that the average mileage for all types of automobiles, including touring cars and runabouts, is 30 per day, Mr. Daggett said that this fact shows that most gasoline machines used in cities can be displaced with electric vehicles.

In discussing a paper relating to electric vehicle motors by Mr. J. G. De Remer, Mr. A. C. Downing said that the shunt and compound-wound motors are being abandoned in favor of series-wound machines. Mr. Daggett expressed the opinion that in a hilly city the series-wound motor is best.

In discussing his own paper on commercial electric vehicles, Mr. A. C. Downing said that the modern pleasure vehicle should have a life of from 10 years to 15 years, tires and batteries not being considered. The life of a commercial vehicle should be 10 years. The life of a gasoline car is much less, while its cost of maintenance is much higher. Mr. Perrine expressed the opinion that the cost of operation of an electric delivery wagon is about one-half that of a gasoline wagon for the same service. An electric delivery wagon will perform the work of two horse-drawn vehicles. Mr. Downing explained that the cells of the battery of an electric truck are divided into two groups that are connected in parallel for low speed and in series for high speed. Moreover, the field coils are arranged for series-parallel connection, thus giving four efficient speed points. Mr. Daggett stated that there are now 900 commercial electric trucks in operation in New York, 50 in Chicago, 71 in Boston, 15 in Cleveland, 70 in St. Louis, 25 in Los Angeles, 5 in Seattle and 1 in San Francisco.

The discussion of electric pleasure vehicles was opened by Mr. Vance, who remarked that the unwarranted promise by the daily newspapers of a 200-mile battery has proved a serious obstacle to the introduction of electric vehicles. The high cost of an electric pleasure vehicle has also been an obstacle. Mr. Downing stated that the introduction of electric automobiles requires merely the giving of the proper information to the public. Mr. Pfaffmann said that newspaper publicity should be encouraged, while a liberal use should be made of electric-sign advertising. Mr. Daggett stated that a vehicle battery forms an excellent load for the central station from midnight until 6:00 o'clock in the morning.

New Type of Tantalum-Lamp Filament.

A patent issued March 16 to Werner von Bolton, Charlottenburg, Germany, describes a new type of incandescent-lamp fila- [illegible] consisting of a [illegible] [illegible] [illegible]

Minnesota Electrical Association Convention.

The Minnesota Electrical Association held its second convention at Hotel Nicollet, Minneapolis, March 18 and 19. As the president, Mr. W. R. Putnam, formerly of Red Wing, Minn., has moved to Menominee, Mich., the sessions were presided over by Mr. R. E. Brown, of Mankato, of the executive committee. Mr. Ludwig Kemper, of Albert Lea, presented his report as secretary and treasurer, which showed receipts of $725.10 and cash on hand $215.59. The membership committee, of which Mr. B. W. Cowperthwait, of Faribault, is chairman, reported 17 applications for active membership and seven for associate membership during the year. The secretary and treasurer announced that seven more applications for membership had been received just before the opening of the first session. Mr. Ludwig Kemper submitted an amendment to the by-laws, providing for a standing publicity committee. Consideration of this amendment was referred to a committee of three, which reported at the last session.

Mr. Ludwig Kemper, of Albert Lea, presented a paper entitled "Buying Coal on a B.T.U. Basis." After some discussion on the coal question, Mr. T. L. Daniel, of the Minneapolis Steel & Machinery Company, read a paper on "Prime Movers for Small Central Stations," which reviewed the advantages of engines of high- and low-speed types, steam turbines and producer-gas plants for small companies. After considerable discussion on this paper the first session was adjourned.

The Thursday afternoon session was opened by the reading of a paper by Prof. George D. Shepardson, of the University of Minnesota, on "Meters." This paper gave a review of the principal types of meters and presented some curves taken from tests made by Professor Shepardson showing some of the things which alter the registration of meters, such as vibration, cleaning commutators and changing of jewels. One of the notable points brought out was the fact that vibration causes a meter to run much too fast on light load. After this paper the convention adjourned to inspect the electrical and mechanical engineering departments of the University of Minnesota. The power plant of the electrical engineering department is well designed to give students experience with a large variety of electrical and steam-generating apparatus. One of the most interesting features to many who are considering more economical apparatus for small plants is the Muenzel suction gas producer and engine, which were in operation at the time of the convention's visit. Thursday evening the convention was entertained by the jobbers and manufacturers of Minneapolis and St. Paul by a dinner at the Nicollet Hotel, followed by a theater party.

The Friday morning session was given over to a discussion of developments of day load, three papers along this line being presented. One was by Mr. Adolph Wagner, of New Ulm, on "Methods of Building Up a Day Load in a Small Central Station." Another was by Mr. E. L. Callahan, of the General Electric Company, on "Heating Appliances as an Aid in Developing Day Load." Mr. George J. Cadwell, of Minneapolis, read a paper on "Small Motors and Their Possibilities in Developing a Day Load," calling attention to the small motor applications possible in small towns with special emphasis on the advantage of single-phase motors and single-phase distribution. This question of working up a day load brought out a long discussion, and a number of members, both from private and municipal plants, gave some experiences which should be very encouraging to those who are contemplating the starting of day service.

Friday afternoon was taken up mainly with subjects related to the application of the tungsten lamp. Mr. J. R. Cravath read a paper on "The Use of Tungsten Lamps from the Illuminating Engineering Standpoint." Mr. H. J. Gille, of the Minneapolis General Electric Company, in a paper on "The Use of Tungsten Lamps for Decorative Street Lighting," gave some valuable figures on the cost of installation and life of the tungsten lamps used for lighting Nicollet Avenue, this being unquestionably one of the finest pieces of special permanent street lighting in the country.

The discussion on tungsten lamps was followed by the election of officers, which resulted as follows: President, M. H. J. Gille, contract agent of the Minneapolis General Electric Company; first vice-president, Mr. Thomas Pitts, manager Hutchinson Lighting & Manufacturing Company; second vice president, Mr. George Marvin, chief engineer, Public Service Company, St. Cloud; secretary and treasurer, Mr. B. W. Cowperthwait, secretary, treasurer and manager, Faribault Gas & Electric Company, Faribault, Minn. Executive committee: Messrs. H. A. Hildebrand, manager, Municipal Electric Light & Waterworks, St. Peter; E. F. Strong, manager municipal electric light plant, Chaska; E. W. Erick, manager, South St. Paul Electric Light, Heat & Power Company. The committee on resolutions presented resolutions expressing the appreciation of the work done in advance of the convention by Mr. W. R. Putnam, as president, and Mr. Ludwig Kemper, as secretary and treasurer, and extending the thanks of the association for the entertainment committee for the entertainment provided and the sympathy of the convention for Mr. T. R. Gordon, who was called away during the convention by serious illness in his family.

Mr. H. J. Gille, chairman of the committee appointed to consider the advisability of a permanent committee on publicity, reported favorably to the establishment of such a committee. He stated that many advertising schemes were being presented to the smaller companies throughout the State by advertising companies, and that this committee could investigate these schemes to determine whether they were legitimate or not. A motion was carried that a publicity committee of five be appointed by the coming president.

Mr. E. W. Erick asked whether members had information as to the cost of operating electric trucks, as compared with maintaining horses for the same purpose. Mr. Gille, of Minneapolis, said that the literature published by the Studebaker Automobile Company contained a large amount of information on this subject, some of which he knew personally had been obtained from experience at Minneapolis and was correct.

Abstracts of the papers and discussions will appear elsewhere in this and in following issues.

Mr. H. J. Gille, president-elect of the Minnesota Electrical Association, is contract agent of the Minneapolis General Electric Company. He has been prominent in the electric lighting field in Minneapolis and St. Paul for a number of years and has taken an active and useful part in the National Electric Light Association and in the Northwestern Electrical Association. Mr. Gille was born on a farm in Minnesota in 1870. There he remained until 15 years old, obtaining his early education in the country district school. He worked his way through Curtis College, in Minnesota, graduating in 1889. From 1889 to 1891 he was with the Acme Electric Company at St. Paul. In 1891 he went with the Northwest Thomson-Houston Company, at St. Paul. Part of his time was spent at the Lynn (Mass.) factory. He remained with this company in various capacities until 1894, when he was transferred to Chicago as assistant to Mr. F. N. Boyer, manager of the supply department.

Mr. Gille remained there one year, and in 1895 became Western electrical engineer for the Washburn & Moen Manufacturing Company. From 1898 to 1908 he was general superintendent of the St. Paul Gas Light Company. During this time he had charge of all the important changes and developments in the electrical department of that company, including the changing from overhead to underground distribution in the downtown district of St. Paul and the consolidation of several power stations into one. During that time water-power was transmitted into the city and a large substation established. Since 1907 he has held his present position as contract agent of the Minneapolis General Electric Company. During the last few years of his stay in St. Paul he gave particular attention to the commercial development of the company there, and worked up the special lighting of many

of the downtown streets by means of incandescent lamps on ornamental posts. Since going to Minneapolis he has succeeded in doing the same thing in an improved manner for Nicollet Avenue, and contracts are under way for several other prominent streets of Minneapolis. Besides his work in the executive and operating field, Mr. Gille has made several notable inventions. One of these is a system of distribution employing a number of busbars at the central station, operated at various voltages, so as to give equal pressure at centers of distribution. He is also the inventor of the solar-colored lamp car for decorative lighting and of several forms of electric signs.

Meeting of Ohio Independent Telephone Association.

The annual convention of the Ohio Independent Telephone Association, held at the Hartman Hotel, Columbus, on Thursday and Friday of last week, had an attendance of about 200, and was one of the most enthusiastic conventions held by it. President Frank L. Beam presided, and on Thursday morning addresses of welcome were delivered by Mayor C. A. Bond and President Perry, of the Columbus Board of Trade. H. S. Grimes, of Portsmouth, Ohio, responded in a brief and appropriate address. This was followed by the report of President Beam, who congratulated the association upon the rapid growth of the business, which he illustrated by statistics gathered by himself and other officers for the purpose of comparison. He vigorously objected to any exchange connections with competing companies on the ground that it would be both injurious to competition and a disadvantage to the independent movement. In fact, it would render that movement of little effect and cause the business to effectually revert to the old standard. This feeling is shared by all the members of the organization, it is believed.

A discussion regarding increase in rates brought out the statement from several members that first-class service demanded an increase in many places after the number of subscribers had passed a certain point. The trouble is that many of the exchanges started at too low a rate, with the idea that the business would not reach its present enormous proportions. Inexperience in the earlier days of the independent business is also responsible for some of the rates then fixed.

Mr. E. H. Moulton, of Minneapolis, president of the International Independent Telephone Association, in an address suggested the organization of a large financial institution to handle independent telephone securities and look after the interests of the companies. He thought this a better plan than depending upon banks and trust companies for taking care of the finances of the various independent companies. This suggestion was referred to a committee for consideration. Mr. Moulton congratulated the Ohio men on the progress they have made and upon the interest they have taken in the extension of the movement to other States. Mr. E. G. Tillotson, recently chosen president of the Cuyahoga Telephone Company and chairman of the board of the United States Telephone Company, followed with a short talk along lines of interest to those especially who have the problem of financing new companies or improvements before them.

Several plans were discussed for securing an entrance into Cincinnati, and within the next year, no doubt, an attempt will be made to invade that heretofore impregnable Bell stronghold. The next convention would be held in that city in order to arouse interest there, were it not for the fact that the constitution and by-laws provide that all such meetings shall be held in Columbus. It may be that a special meeting will be held there later in the year, when the southern Ohio counties will combine with those of Kentucky, West Virginia and Indiana in showing the business men of the Queen City the advantages to be derived from the independent lines.

All the officers of the association were re-elected as follows: President and manager, Mr. Frank L. Beam, Mount Vernon; secretary, Mr. O. O. Welsheimer, Columbus; treasurer, Mr. Ralph Renner, Columbus. Messrs. Frank A. Davis, president of the Columbus Citizens' Telephone Company, and D. J. Cable, of Lima, were chosen as members of the board of directors of the United States Telephone Company, whose lines connect with almost all the independent exchanges of the State. For this reason the officers of the long-distance company felt that the local companies should have representation on the board, and it was at their request that such action was taken. Thirty-three delegates and the same number of alternates were chosen for the annual convention of the International Telephone Association, which will be held several months hence.

In the evening a banquet was held in the large dining-room of the Hartman, with Mr. Frank A. Davis, president of the Columbus Citizens' Telephone Company, as toastmaster. The responses were as follows: "Lightning Arresters," Mr. Thomas E. Powell, Columbus; "Getting Down to Business," Mr. Charles A. Otis, Cleveland; "Thought for the Discouraged Farmer," Mr. Butler Sheldon, Columbus; "Looking Into the Future," Mr. John A. Howard, Wheeling, W. Va.; "Telephone Organization by Counties and Districts," Mr. D. J. Cable, Lima.

Reports of officials show that on Oct. 1, 1908, the total number of independent telephones in use in the State was 325,541 in comparison with 307,674 on the same date the previous year. At that time 893 exchanges were in operation as compared with 879. Toll stations numbered 1690, while a year before there were 1895. Stockholders had increased from 25,458 to 30,976. It is claimed that the Bell companies had but 171,161 telephones, 299 exchanges and 848 toll stations on Oct. 1 last. This includes Cincinnati and Hamilton County, which the independents have not been able to develop.

The second day of the convention was devoted to a discussion of subjects of particular interest to managers and held behind closed doors. In fact, it was peculiarly a managers' session and information as to the proceedings was not given out because of the nature of the meeting.

Fuel Conference at University of Illinois.

Much of the time of the Illinois Fuel Conference, held at the University of Illinois, Urbana, Ill., on March 11 to 13, was devoted to mine-accident and mine-rescue work, and to an inspection of the United States Geological Survey's laboratory at Urbana. Mr. R. Y. Williams, mining engineer of the United States Geological Survey, is in charge of the laboratory. Many mine operators and mine inspectors viewed the apparatus used in effecting rescues in coal-mine disasters. About 125 persons attended the conference. The United States Government was represented by Mr. George Otis Smith and others of the Geological Survey. The Geological Survey of the State of Illinois was represented by Mr. H. T. Bain and Dr. U. S. Grant.

The conference also held sessions devoted to the subjects of "Smoke Suppression" and "Economy in the Use of Fuel for Industrial and Domestic Use." Among those taking part in the smoke-suppression discussion was Dr. W. A. Evans, commissioner of health, city of Chicago, who presented a paper giving medical statistics showing the relative and growing importance of the so-called air-pollution diseases. Mr. Paul P. Bird, chief smoke inspector of Chicago, called attention to the needs of greater recognition by the State of the manufacturing industries. Mr. A. Bement, consulting engineer, Chicago, spoke on the need for equipment specially designed for the successful and smokeless combustion of Illinois fuels. Mr. D. T. Randall called attention to the work of the Geological Survey which is aiming to afford the usual conferences and will soon have enlightenment on the subject of burning bituminous coal without smoke. Mr. R. H. Kuss, chief assistant smoke inspector of Chicago, [illegible] that the effect of the city ordinance in Chicago has not had the effect of driving Illinois [illegible] apparatus in many cases where higher-priced Eastern fuels would have been used.

In the meeting devoted to economy in the use of fuel Mr. Bement gave some time to an exposition relating to inert matter in coal as having an influence on the economical use in m

industrial plants. Mr. D. T. Randall, engineer in charge of tests at the United States Geological Survey Experiment Station, Pittsburgh, presented a paper on "The Selection of Coal for Boiler Furnaces." Mr. R. H. Kuss pointed out that there is great need for accurate data connected with return tubular boilers applied with different forms or parts of furnaces. He also called attention to the fact that one of the prevalent causes for lack of economy is the use of too much grate surface and its co-related defect, too little draft. He made a plea for the plant owner, who received very little assistance heretofore from the different bodies studying steam plant economy.

Mr. W. H. Taylor, fuel engineer, Chicago, related some interesting personal experiences along domestic heating. Mr. J. M. Snodgrass, in charge of fuel investigations, Engineering Experiment Station, University of Illinois, devoted considerable time to the recent tests conducted under his direction, in which several house-heating plants were operated with various kinds of fuels. Mr. N. W. Lord, director of the School of Mines, Ohio State University, presented a paper on the subject of proper sampling and analyzing of bituminous coals.

One of the closing acts of the Fuel Conference was the appointment of a committee, under the chairmanship of Mr. Carl Scholz, president of the Illinois Coal Operators' Association, the duty of which is to place before the Illinois Legislature all of the important facts indicating that it is necessary to establish at the University of Illinois a department of mining engineering on a plane equivalent to the other engineering departments of that university. Steps are being taken to bring about the desired result before the present Legislature adjourns.

New York Public Service Commission News.

Propositions to build subways in the city of New York continue to come to the Public Service Commission of the First District. As yet none has been received upon which work can be commenced except that for the extension of the Hudson & Manhattan Railroad north under Sixth Avenue. The last proposal received was from the Bradley-Gaffney-Steers Company, a contracting and building corporation. In a letter sent to the commission last week this company proposed to build the Lexington Avenue subway from the Bronx down to a connection with the bridge loop now in process of construction between the Williamsburg and Brooklyn bridges. It is proposed by the company to construct this line entirely upon private capital, the company retaining the right to operate the system until such time that the city desires to purchase it. It is provided that the city may purchase the entire property at any time by paying to the company all of the actual expenses incurred for building and equipment, plus 15 per cent as an engineering profit. The city shall also pay 5 per cent per year, as interest on the money invested, during the period that the property remains in the hands of the builders. One interesting feature of the proposition is the practical partnership that is offered to the city in the operation of the road. It is proposed that the management of the property shall remain in the hands of a board of seven members, four of whom shall be named by the builders, and the remaining three to be the Mayor and Comptroller of the city and the chairman of the Public Service Commission. The proceeds from the operation of the line, after the payment of expenses, maintenance and the interest upon the cost, shall be devoted, one-half to the payment of the cost and the remainder turned over to the builders as a profit. The financial backing of this company is said to be ample, although its source is not explained. Rumor has it that either the Pennsylvania Railroad or the New York, New Haven & Hartford is behind the proposition. Mr. William Bradley, who is heavily interested in the company, was a contractor for much of the present subway, and is building a great part of the bridge loop. Mr. James S. Gaffney was formerly a member of the contracting firm of Murphy & Gaffney, who have done a large part of the tunnel work for the big Pennsylvania Railroad terminal. It is claimed that the company making the proposition has all of the necessary machinery on hand to enable it to begin work at once if its proposal were accepted and the necessary changes in the law were made. The estimated cost is about $50,000,000.

At a hearing before the Public Service Commission of the First District, upon the approval of a franchise granted by the Board of Estimate, permitting the Third Avenue Railroad Company to build a loop around the top of Fort George hill, it was disclosed that Receiver F. W. Whitridge had already begun the construction of the line, and, in fact, had almost completed his track laying. The commissioners were indignant and threatened to begin action immediately against the railroad company for the collection of penalties for the violation of the law.

Two bills were introduced in the Legislature at Albany last week increasing the powers of the Public Service Commissions in New York. One of these measures extends the jurisdiction of the commissions to telephone and telegraph companies and the other provides a number of general amendments to the law which mostly have to do with the regulation of rates and transfers upon traction lines. It provides that the traction companies shall agree as to transfers and a division of rates and that when they disagree, the commission shall have the power to settle the matter and compel the companies to accept its rulings. It gives the commissions the right to order where and when through cars shall be operated, over tracks that have common points, and to determine how many transfers may be demanded upon the payment of one fare, and the directions and time within which they may be used. Where repairs and improvements are to be made for the benefit of more than one road the commission is given the right to determine upon what basis the expense shall be divided. In addition, the amendments provide that the vessels operated by any railroad as a portion of its water route, shall be under the control of the commission, and that conduits for electrical conductors of public-service corporations shall also be under the control of the commissions. Other amendments extend and amplify the commissions' powers over the rates and contracts of all public-service corporations.

The corporation counsel of the city of Mount Vernon has protested to the Public Service Commission of the Second District of New York against its granting the application of the New York, New Haven & Hartford Railroad Company for authority to purchase the stock of the New York & Portchester and the New York, Westchester & Boston railroad companies until it has been determined which line the New Haven company proposes to build. It is charged, in the protest, that the Portchester franchise contains few restrictions, while that of the Westchester company provides that ownership could not be transferred without the consent of the city, and also provided for specified rates of fare, location of stations, construction of tracks, etc.

American Railway Engineering and Maintenance of Way Association.

The tenth annual convention of the American Railway Engineering and Maintenance of Way Association was held in the Auditorium Hotel, Chicago, March 16 to 18. A great deal of work relating to railroad engineering was accomplished, and there was a record attendance of members, 335. In addition there were several hundred guests and visitors. Mr. William McNab, of the Grand Trunk Railway, Montreal, was re-elected president and Mr. E. H. Fritch, 962 Monadnock Building, Chicago, was re-elected secretary. The association has a committee on electricity, but it has done no work, although a report is looked for at the next annual convention.

A long report was presented from the committee on signaling and interlocking, of which Mr. A. H. Rudd, of the Pennsylvania Railroad, Philadelphia, is chairman. Many of the committee's recommendations were referred back to it for further consideration, but the specifications for rubber-covered wire were adopted.

Meeting of Pittsburgh A. I. E. E. Section.

The regular monthly meeting of the Pittsburgh section of the A. I. E. E. was held in the Carnegie Institute, March 9, Mr. V. E. Reed, chairman, presiding. The usual preliminary dinner was held at the University Club, with 25 members attending.

The subject for discussion was "Single-Phase Railways," and a large attendance greeted the speakers of the evening. The papers were limited to 10 minutes in length, and a lantern was provided to assist in the presentation of the subjects under discussion. The papers presented were as follows:

"The Single-Phase Railway System," by Mr. Clarence Renshaw; "The Single-Phase Motor," by Mr. S. M. Kintner; "Catenary Line Construction," by Mr. T. Varney; "A Comparison Between Single-Phase and 1200-volt Direct-Current Systems," by Mr. F. E. Wynne; "The Single-Phase Systems in Operation," by Mr. G. D. Nicoll, electrical engineer of the Pittsburgh & Butler Street Railway Company; "The 1200-volt, Direct-Current System in Operation," by Mr. Harry Etheridge, chief engineer of the Pittsburgh, Harmony, Butler & Newcastle Street Railway Company, Pittsburgh. There was unusual interest shown in the discussion of this subject. Mr. N. W. Storer opened the discussion, and was followed by Mr. James Bryan, consulting engineer, and one of the chief advocates of the 1200-volt, direct-current system. Mr. Bryan's discussion of the subject was in a humorous vein, and the good-natured banter between the advocates of the various systems kept up a very lively interest among those present, and afforded considerable amusement. The other speakers were Mr. W. L. Waters and Mr. B. A. Behrend, of the Westinghouse Electric & Manufacturing Company, and Mr. W. E. Moore, of the West Penn Railways Company.

The next meeting will be held April 6, and will take up the subject of live-line repairs and maintenance, with a view to prevent interruption of service. The principal paper will be presented by Mr. J. S. Jenks, chief engineer of the West Penn Railways Company.

March Meeting of I. E. S., New York Section.

At a meeting of the New York section of the Illuminating Engineering Society, held on March 18, two papers were read. A paper by Mr. Bassett Jones, Jr., dealt with the theory of finite surface light sources. The author treated the subject almost exclusively from the mathematical standpoint. Mr. Albert J. Marshall presented a paper describing the lighting equipment and the illumination of the editorial offices of the New York *World*.

The editorial offices are lighted by means of mercury-vapor lamps and tungsten incandescent lamps. Each lighting unit consists of a mercury-vapor tube 27 in. in length, bent into circular form, surrounding a 100-watt tungsten lamp which is operated in series with the former lamp and serves as its "ballast resistor." The two lamps are placed within a prismatic 16-in. hemispherical reflector. The unit normally consumes 240 watts; the tungsten lamp is rated at 80 cp and the vapor tube at 200 cp.

Tests showed that with 36 units lighting a floor area of 2952 sq. ft., the average illumination was 4.0 ft.-candles. Since each unit consumed 232 watts at the time of the test, the equipment gave an effective output of 1.4 lumens per watt.

Mr. E. L. Elliott explained the fact that the light from the mercury-vapor lamp permits one to distinguish details more readily than does that from any other artificial source by stating that the eye can focus more sharply for monochromatic light than for polychromatic light, for which it must assume merely an average focus that is incorrect for both the longer and the shorter wave-lengths.

The secretary announced that during April the section will hold a joint meeting with the Municipal Arts Society and the National Arts Club at which time the subject of exterior lighting will be discussed. At the May meeting a paper will be read by Mr. Alfred A. Wohlauer dealing with the calculation and design of illumination, and a second paper by Messrs. Hopton and Watkins on the design of lighting fixtures. At the May meeting Mr. Louis J. Auerbacher will present a paper outlining the history of the flaming-arc lamp.

Dinner of Chicago N. E. L. A. Section.

Taking the form of a dinner and social gathering at the Bismarck Hotel, the meeting of the Commonwealth Edison branch of the National Electric Light Association of Chicago, on the evening of March 15, was an enjoyable affair. There were 237 persons present, and Mr. George Harvey Jones, the chairman of the branch, presided, the after-dinner exercises being in charge of Mr. John W. Ferguson, toastmaster, who with Mr. Charles A. Lind and Mr. H. B. Gear constituted the entertainment committee. The program of the entertainment embraced a piano solo by Mr. Michael F. McGovern; songs by Mr. W. R. White and Mr. R. T. Conger and by the N. E. L. A. quartet, consisting of Messrs. T. F. McDonald, Edward Lynch, Thomas J. O'Brien and George L. Ashline. Mr. T. F. McDonald gave a witty monologue, and Mr. J. T. Mountain told about "A Trip Up the Mediterranean," illustrated by lantern slides. Mr. John F. Gilchrist, assistant to President Samuel Insull, made a speech on "Team Work," containing some excellent advice, and then he proposed a song on the same subject (written by himself) which was sung by the entire audience. The burden of this song, in plain prose, is "Above all we want team work, with no single hand withdrawn, to make our company great." The evening's entertainment came to an end by the singing of the national hymn, "America."

The Electrification of Steam Railroads.

At a meeting of the New York Railroad Club, held on March 19, the electrification of steam railroads was discussed. Dr. William McClellan gave a brief history of the development of electric railways and outlined the systems now available for use under steam railroad conditions. He expressed the belief that each system is well adapted for a certain duty. For long-distance work high voltage must be used, both on account of the economical transmission of energy and the unavoidable congestion of load. Dr. McClellan entered a plea for standardization of the locations of the third-rail and overhead contact wires and the over-all clearances.

Mr. W. S. Murray remarked that the time has arrived for steam-railroad and electric-railway engineers to co-operate in the solution of the electrification problem. He claimed that the single-phase system has proved absolutely reliable and satisfactory for long-distance heavy railroad service. As showing the durability of the overhead conductor, Mr. Murray stated that at the present rate of wear the wire will remain in service for considerably more than 50 years. Experience shows that an electric locomotive covers 210 miles per day as compared with 150 miles by steam locomotives in the same service.

Mr. N. W. Storer said that for strictly terminal work the direct-current locomotive is thoroughly satisfactory, but for inter-city work alternating current must be used; three-phase can be employed, but single-phase is far preferable.

Mr. C. L. De Muralt claimed that a three-phase locomotive is much lighter and more reliable than a single-phase locomotive; moreover, its torque characteristics are advantageous rather than disadvantageous for railway service.

Mr. E. B. Katte stated that the reliability of the direct-current locomotive has been shown conclusively by the service on the New York Central, where the average delay is equivalent to one minute for each 500 miles of travel per train.

Dr. C. T. Hutchinson called attention to the fact that the most powerful locomotives in existence to-day are the three-phase, 2000-hp units of the Great Northern Railroad. Mr. N. W. Storer announced that a 2750-hp single-phase locomotive is now being designed.

Meeting of New England Electric Lighting Engineers.

The seventh annual meeting of the Association of Electric Lighting Engineers of New England was held at Young's Hotel, Boston, on March 18. The first paper was by Mr. F. C. Sargent of the Malden Electric Company on "Series Incandescent Street Lighting." The author related his experience with about 200 32-cp, 6.6-amp tungsten lamps which were installed simultaneously. Of these, in one year 70 burned out, 68 filaments were broken and 90 were broken maliciously. The total hours burned for the period were 3000, giving an average life on the total renewals of 2600 hours. Mr. Sargent referred to the malicious breakage of lamps in suburban communities as a serious problem. He had posted a notice offering $25 reward for the arrest and conviction of anyone maliciously breaking lamps or globes, and within the first month the proportion fell from 60 per cent of the total renewals to 25 per cent, and has since never exceeded an average of 30 per cent. Lamps of from 40 cp to 60 cp, when they can be placed so that the limbs of trees do not obstruct the light, should be not less than 12 ft. above the ground and an average of 15 ft. gives good results.

In conclusion Mr. Sargent compared a "so-called" 60-cp Welsbach mantle lamp with a 60-cp tungsten lamp, based on 4000 hours per year service. A Welsbach lamp with a consumption of 3.5 cu. ft. per hour and a rate of $1 per 1000, will cost $14. Add to this renewals, repairs and labor at 3 cents per night, or $10.95, gives a total cost per year for the gas lamp of $24.95. Assuming $24.95 is the price charged for the 60-cp tungsten lamp for the year and deducting three renewals at $1.10 per lamp per year, or $3.30, leaves an income of $21.65 per year for the tungsten lamp to pay for energy, labor and repairs, as a 60-cp lamp will consume 300 kw-hours in one year, the income of $21.65 is 7.2 cents per kw-hour. If the same comparison is applied for a 40-cp tungsten lamp, the income would be approximately 11 cents per kw-hour. The gas lamp depreciates rapidly in candle-power the first few hours of its life, and does not have the advantages of a variable schedule in operating. Mr. Learned, of Meriden, Conn., said that he had made shadowgraph tests which showed that the 40-cp tungsten is equal to a 60-cp gas lamp. Mr. Cowles stated that the Boston company now has over 5000 series-tungsten lamps in street service. In a few important locations in the suburbs 60-cp lamps are mixed in with the 40-cp units. The company is satisfied that a life of 1500 hours is conservative unless the breakage is excessive. The average malicious breakage in the Boston system is about one-third of the total renewals.

Mr. G. W. Lawrence, of the Greenfield Electric Light Company, presented a paper on "The Magnetite System of Street Lighting at Greenfield, Mass." There are two 4-amp, 50-lamp sets, operated on three-phase, 2300-volt, 60-cycle service. The mercury tubes are now cooled with oil, as the life with air cooling was short. Use is made of a submerged cooling coil requiring about 4 gal. of water per hour. A needle valve is installed for controlling the flow. The best results appear to be at a temperature of about 85 deg. Fahr. to 90 deg. Fahr. The tube is held in a cast-iron oil box, and the horn type of static discharger is used to prevent the tube puncturing from a discharge from air to oil. A tube can be replaced in two minutes. The average life of the parts is as follows, in the company's experience in 1908: Air-cooled mercury tubes, 448 hours; oil-cooled mercury tubes, 1433 hours. Cleanliness, simplicity, absence of revolving parts, low maintenance cost and economy of energy are points of advantage in this system.

Mr. D. A. Harrington, Boston, consulting engineer on underground construction, then presented a paper describing the solid and the drawing-in systems and discussing the advantages of each. He pointed out the methods of making multiple-duct wood conduits, treated for preservation; considered pipe conduit in connection with obstacles in construction; and showed how vitrified conduit has gradually superseded many other forms. The general plans of conduit development were considered and the following figures of average cost of construction per conduit-foot in unpaved streets with conduit of different sizes, including manholes, and using either fiber or clay ducts, were given: Two ducts, $1.50; 4 ducts, $1.90; 8 ducts, $2.60; 12 ducts, $3.10; 16 ducts, $3.60; 20 ducts, $4; 40 ducts, $6.50. In conclusion the paper described the submarine conduit of the Boston Edison Company, which has given good service under Fort Point Channel and under Reserved Channel of Boston Harbor for the past 10 years.

Mr. N. T. Wilcox, of the Stone & Webster interests, then gave a talk on "The Operation of Underground Structures in Moderate-Sized Systems." The address was largely along the line of emphasizing the value of good insulation, including some remarks upon the usefulness of the single-duct type of construction. The tendency of multiple ducts is to require thin walls. Racking manhole cables is good practice, and the use of kyanized cable cleats along the sides of manholes has given excellent results.

In the discussion of these papers Mr. L. L. Elden, of the Boston Edison Company, said that if the company were building another submarine line it would adopt the tunnel form of construction, which could be flooded and then pumped out in case of severe trouble. The cost would be about $15 per running foot. He said that in the company's high-tension cable system there had been 10 breakdowns in a year, this covering 125 miles of cable. Six faults were due to the manufacturer and four to mechanical and electrolytic troubles.

A talk was then given on "Recent Steam Turbine Developments" by Mr. J. R. Bibbins, of the Westinghouse Machine Company, Pittsburgh. Following the address of Mr. Bibbins a paper was read by Mr. C. B. Burleigh, of the General Electric Company, on the "Curtis Horizontal Steam Turbine."

Mr. Burleigh emphasized the large number of horizontal shaft Curtis turbines now in operation, there being in service or under order at present over 800 machines running as high as 3500-kw maximum. Within the past year over 275 machines have been sold. In 1908 over 230,000-kw rating of vertical turbines of this type were sold.

Railway Signal Association.

The quarterly meeting of the Railway Signal Association was held in Chicago on March 15. President L. R. Clausen was in the chair, and, after some opening business, Mr. E. E. F. Creighton, of the General Electric Company, delivered a lecture and demonstration on "Lightning Phenomena." An extensive article on this subject by Mr. Creighton recently appeared in these columns. The afternoon session was devoted to a debate on the question whether the scheme of signaling presented at the Washington meeting of the association in October, 1908, is the best that has been devised. Mr. Elliott, signal engineer of the New York Central Railroad, and Mr. Anthony, assistant signal engineer on the Pennsylvania Railroad, took the affirmative side of the question, and Mr. Stevens, of the Santa Fé, and Mr. Clausen, of the Chicago, Milwaukee & St. Paul, the negative. Mr. Balliet, of the New York Central, was called to the chair.

The debate related to various systems of signaling and after the gentlemen mentioned had used up their allotted time, the discussion became general. Among those who took part in it were Mr. Frank Rhea, of the General Electric Company, and Mr. Sperry, of the General Railway Signal Company, of Rochester, N. Y. By vote it was decided that the negative side had won the debate, but it is to be understood that this vote has no effect whatever upon the adoption of any scheme of signaling by the association. The object of the debate was to call forth a more general expression of opinion concerning the subject of signaling. A committee has been at work for three years in an effort to improve the present practice in railway signaling, and it is expected that the debate at the Chicago meeting will be of great assistance to it.

Meeting of the New England Section I. E. S.

The regular monthly meeting of the New England section of the Illuminating Engineering Society was held at the Edison Building, Boston, on March 16. The speaker of the evening was Mr. J. W. Codman, of Boston, who discussed "The Simplification of Illuminating Engineering Problems Through the Conception of Light Fluxes." The speaker reviewed thoroughly the latest practice accepted in the treatment of these problems, explaining the flux-of-light method of calculating average illumination in terms of the lumen. Lumens per square foot was considered as an expression for illumination identical with foot-candles, and the rough approximation of lumens taken as 10 times the nominal candle-power of incandescent lamps was discussed. A Reflex burner equipped with a Holophane reflector delivers about 200 lumens per cubic foot of gas burned per hour. The method of figuring lumens from the photometric curve was then considered, as well as the proportion of lumens generated which are effective on the plane of illumination. Mr. Codman then discussed the necessity for falling back on the point-to-point method of calculation to secure proper uniformity. The best methods of simplifying work with the point-to-point method by the use of special tables or calculations were also discussed, with the rules for proper spacing of light sources with regard to the height above the plane and the effect on ceiling and wall reflection.

Three tables were presented dealing with the practical use of calculations involving lumens with different light sources and shades, and in connection with a special case of room illumination. In conclusion, Mr. Codman presented a complete bibliography of recent illuminating engineering literature dealing with practical methods of work. Table I gave values for the light intensity in lumens per square foot for various services. Table II gave values of lumens per watt obtained from various lighting equipment; this table differs from the table on page 90 of our issue of July 11, 1908, in that it shows the lumens per watt rather than the watts per lumen. Table III is reproduced herewith:

Room, 24 ft. 3 in. long; 11 ft. 6 in. wide; 10 ft. 1 in. high. Three 40-watt tungsten lamps, close to ceiling. Lumens generated, 933. Test plane, 2½ ft. above floor.

	Mean foot-candles, bare lamps.	Mean foot-candles, reflectors.	Per cent increase due to reflectors.	Lumens effective, bare lamps.	Lumens effective, reflectors.	Lumens effective in per cent of lumens generated, bare lamps.	Lumens effective in per cent of lumens generated, reflectors.	Lumens per watt, bare lamps.	Lumens per watt, reflectors.
Calculated illumination	0.41	0.89	117	113	245	12	26	0.94	2.04
Measured all-dark surfaces	0.48	0.91	90	132	250	14	27	1.10	2.08
Light floor	0.50	0.90	80	137	248	15	27	1.15	2.06
Light walls	0.85	1.15	35	234	316	25	34	1.95	2.64
Light ceiling	0.94	1.17	24	258	322	28	35	2.15	2.68
Light floor and walls	0.92	1.23	34	253	338	27	36	2.11	2.82
Light floor and ceiling	0.99	1.20	21	272	330	29	35	2.26	2.76
Light walls and ceiling	1.57	1.74	10	432	479	46	51	3.60	4.00
All light surfaces	1.96	2.27	16	540	625	58	67	4.50	5.20

Chicago Subway Report.

An elaborate report has been issued by the local transportation committee of the Chicago City Council, based on the work of the city engineer and a large corps of assistants, relating to the proposed subway for street-railway traffic and other purposes under the streets of the downtown business district. It is proposed to build, ultimately, subways under the principal north and south streets in the center of the city, the subways to be large enough to accommodate four tracks—two for elevated trains and two for surface cars. The estimate is that a four-track subway will cost $3,750,000 a mile, with three-track, two-track and possibly single-track, proportionately less. The increase of population in the city is expected to make subways necessary in all the downtown streets, but at first the work will be confined to one or two north-and-south streets and one or two east-and-west streets. The subways are not intended, the report declares, for high-speed through service, but merely to improve existing service. They are to enable the cars to avoid the congestion of the surface traffic on the streets.

The work of preparing the subway report is said to have cost $75,000. Through routes are declared to be a necessity for the operation of the subway. In the proposed Wabash Avenue subway the South Side cars would enter the subway at Twenty-second and State Streets, leaving it at Orleans and Chicago Avenues and proceed possibly to Evanston. Similarly West Side cars would enter at Blue Island Avenue and Halsted Street, make the loops through State Street and leave at Halsted and Lake Streets and proceed to Austin or Oak Park.

CURRENT NEWS AND NOTES.

LICENSING ELECTRIC CONTRACTORS.—A bill has been introduced in the New York State Legislature providing for the licensing of electrical contractors after an examination by a board consisting of an electrical contractor, electrical worker and electrical inspector and upon giving a bond in the sum of $2,000.

AN ACTRESS AS ILLUMINATING ENGINEER.—In a contract with the owners of a Boston theater Miss Louie Fullller, the actress, provides for the details of electrical illumination, to which subject she states she has given much attention. In an interview she has said that some entirely new methods of electrical illumination will be used, both on the stage and in the auditorium.

DAMAGE TO MESSINA CABLES.—In overhauling the submarine cables, seven in number, between Italy and Sicily, some were found to be badly damaged by heat, the sheathing and layers of rubber being burned and in some cases the copper conductors fused. One of the cables was so deeply embedded, owing to a change in the floor of the Strait of Messina, that it had to be abandoned.

THE PARIS STRIKE.—The report from Paris that the strike of telephone and telegraph operators and postal employees had been brought to a sudden close March 13 seems to have been premature. It has continued throughout the week, but the latest reports indicate that it is practically ended, although some of the more belligerent strikers are endeavoring to prolong the disorder. M. Simyan, Under Secretary of Posts and Telegraphs, seems to have been the thorn in the flesh of the strikers, and the settlement of the trouble centers upon his dismissal or elimination.

NEW YORK ELECTRICAL SOCIETY AT THE HIPPODROME.—The 284th meeting of the New York Electrical Society will be held at the New York Hippodrome, Forty-fourth Street and Sixth Avenue, Wednesday, March 31. A special section of the house has been reserved for the members at $1 per ticket. After the performance a meeting of the society will be held on the stage, and Mr. Arthur Williams, of the New York Edison Company, will give an address on "The Electrical Equipment of the Hippodrome." Those intending to be present should advise the secretary not later than Monday, March 29, stating also the number of friends by whom they will be accompanied.

CAPITOL SUBWAYS.—The experience with the subway in Washington between the Capitol and the Senate Office Building has been so favorable that it is proposed to connect the former by subways not only with the Representative Office Building, but also with the Union Station, the Government Printing Office and the proposed new city postoffice. The cost is estimated as about $500,000. Superintendent Woods recommends that the underground passages be equipped with either a narrow-gage railroad or a monorail system, either to be operated by electricity. In the contracts let for the work of the former at $18,600, while the latter could be furnished for $14,000. The Senators use two automobiles of peculiar make in the subway leading to the Senate Office Building.

LIGHTING RAILROAD TRAINS. The University of Wisconsin has issued a bulletin of its engineering series on the subject of railroad train lighting, the author being Mr. Edward Wray, an electrical engineer of the class of 1906.

ILLUMINATING ENGINEERING SOCIETY.—At the March meeting of the council of the society it was announced that the total membership to date exceeded 1000 by 39, with 14 applications on file. A committee consisting of Prof. H. B. Dates, Dr. E. P. Hyde, with Mr. S. E. Doane as chairman, was appointed to arrange for starting a Cleveland section.

ENGINEERS' LECTURES.—Among recent lectures before the engineering students of Wisconsin University were one by Mr. M. C. Rorty, general commercial superintendent of the Pittsburgh Telegraph Company, on "Major and Minor Tactics of Business," and another by Prof. C. F. Burgess on "The Importance of Chemistry to Future Engineering Development."

BUREAU OF STANDARDS APPOINTMENTS.—The United States Civil Service Commission announces an examination on April 21 to fill 10 or more vacancies in the positions of laboratory assistant in physics and assistant physicist in the Bureau of Standards, at salaries varying from $900 to $1,200 per annum for laboratory assistant, and from $1,400 to $1,800 per annum for assistant physicist.

MUNICIPAL HEATING PLANT.—Jamestown, N. Y., has a municipal electric and water-works plant, and the possibility of operating a municipal heating plant in connection with it, utilizing exhaust steam, is under consideration. If the plan is adopted, the plant will be one of the first municipal heating plants in the Eastern States, although there is a small installation of this character in Webster City, Iowa. Two projects are under discussion in Jamestown, one to cost about $100,000 and one about $30,000 or $40,000.

ELECTRICITY POPULARIZED.—We clip the following from the *Saturday Evening Post:* "The electricity is furnished by the generator in varying quantities—sometimes more, sometimes less. But the transformer acts like a funnel, the current coming out of it always in a stream of a certain size. This, of course, is a matter of utmost importance, inasmuch as the electric 'fluid' could not be utilized satisfactorily for lighting, for running machinery, or for any other purpose, if the quantity of it delivered were constantly varying."

TRACTION PROBLEM IN NEW YORK CITY.—Theodore P. Shonts, president of the Interborough Rapid Transit Company, asserts that the traction lines of New York City—subway, elevated and surface—are called upon to provide, each year, for the transportation of 40,000,000 more passengers than the year previous. The increase of this number of passengers each year is in reality only a growth of about 4 per cent, but it adds $2,000,000 a year to the earnings of the traction lines and requires a continuous increase of facilities.

CANADIAN STATE TELEGRAPH LINES NOT PROFITABLE.—According to a report presented to the Dominion Parliament at Ottawa, Ont., Can., the telegraph lines in Canada owned by the Government are far from profitable. The annual statement shows receipts of $122,432.53, while the expenses amounted to $386,567.34. In Yukon and northern British Columbia considerable difficulty is experienced through snow slides, rock slides, blizzards, etc., and a proposition is under consideration to install wireless systems where wire trouble is most prevalent.

A. I. E. E. NOMINATIONS.—The directors of the American Institute of Electrical Engineers have made the following nominations for officers to be elected at the annual meeting in May: President, Mr. L. B. Stillwell, New York City; vice-presidents, Messrs. J. J. Carty, New York City; Paul M. Lincoln, Pittsburgh; Paul Spencer, Philadelphia. Managers, Messrs. A. W. Berresford, Milwaukee; W. S. Murray, New Haven; H. Norris, Illinois; S. D. Spring, New York. Treasurer, George A. Hamilton, New York City. Secretary, Mr. Ralph W. Pope, New York City.

WIRELESS FOR THE ORIENT. Representatives of the United Wireless Company recently sailed from Seattle in connection with a project to establish wireless telegraph stations in the Orient. They will first visit China and Japan, and later will tramp over the rough Siberian country. According to the plans, a chain of wireless stations will be established from Vladivostok to Aden. The stations will resemble those now in use in the United States, and will communicate with the numerous steamships plying in the Pacific trade, as practically every trans-Pacific line has adopted the wireless system.

PRINTING-PRESS CONTROL PATENTS.—In the operation of printing presses, which in practice must be frequently stopped, and started, and jogged a few inches at a time, it has gradually become the universal custom to make and break the circuit at a separate contactor switch which is electrically controlled by the movement of the hand-controlled rheostat operating lever. Three patents recently issued to Mr. H. Wade Leonard, and based upon an application filed more than eight years ago, relate to basic features of this system of control. The several patents contain 78, 48 and 21 claims, respectively.

INDUSTRIAL ENGINEERING.—Mr. F. A. Lindberg with George M. Brill, consulting engineer, addressed the Armour Institute of Technology branch of the American Institute of Electrical Engineers in Chicago on March 18, his subject being "Industrial Engineering." The speaker described what is required in the way of engineering for a manufacturing plant, dwelling on the lighting, power, heating, ventilation and fire protection of the modern factory. The lecture was illustrated by lantern slides, showing features of several new industrial plants. Prof. John E. Snow presided at the meeting.

PROPOSED ELECTRICAL DEVELOPMENT IN THE FAR WEST.—It is proposed to extend the transmission system of the Nevada-California Power Company from Tonopah to Ely, Nev., a distance of 150 miles, or 314 miles from the hydro-electric plant at Bishop's Creek. The Forest Service has granted permission to this company to run second transmission lines through Silver Canyon in the White Mountains. The California Electric Generating Company has been organized to build a steam electrical generating plant at Oakland, Cal., to be operated in connection with the Great Western hydro-electric power plant on the Feather River. The Siskiyou Electric Light Company, of Yreka, Cal., proposes to build a 60,000-hp hydro-electric plant at Ward's Canyon, on the Klamath River.

"WIRELESS" FOR LAKE MICHIGAN BOATS.—The four passenger steamboats comprising the fleet of the Graham & Morton Transportation Company, operating on the southern part of Lake Michigan, are now being equipped with wireless telegraph supplied by the United Wireless Telegraph Company of New York. The boats to be equipped are the *City of Chicago, City of Benton Harbor, Puritan* and *Holland.* They will also be land "wireless" stations at Chicago, Ill.; Holland and Benton Harbor, Mich. On the boats the top of the aerial masts will be about 60 ft. above the water. There will be an operator on each boat and at each land station. Kent instruments are used, with the Morse code. The "wireless" stations, both on land and on shipboard, will have public offices for the use of the passengers, being also available, of course, for emergency use in navigation if necessary. The charge for transmitting "wireless" messages for passengers will be 50 cents for 10 words. Between "wireless" stations and land; the rate will be the same as the regular Western Union rate.

High-Tension Equipment and Control of Waterside Station No. 2 of the New York Edison Company.

THE generating equipment in Waterside Station No. 2 at present consists of two 7500-kw, 25-cycle, and two 7500-kw, 60-cycle, Westinghouse turbo-generators; six 8000-kw, 25-cycle, General Electric turbo-generators which are being rewound for 10,000 kw; one 14,000-kw, 60-cycle, General Electric turbo-generator, and another of the same rating, but built for a frequency of 25 cycles, is being erected. All of the generators are three-phase machines wound for 6600 volts in the case of the 25-cycle machines, and 7500 volts in the case of the 60-cycle machines, and operate at a speed of 750 r.p.m., making the 60-cycle machines 10-pole, and the 25-cycle machines 4-pole. The rating of the 8,000-kw units and the 7,500-kw units is nominal, the former units carrying 14,000 kw at times. As the leading illustration in the March 11 number shows, the Westinghouse units are arranged in tandem; the 25-cycle machine being next the turbine, and the 60-cycle generator at the end; both being driven from a common shaft. It was not intended that the turbine should be of such a size as to drive both alternators under full load at the same time. In practice two 60-cycle alternators or two 25-cycle alternators are run under full load with the other running light or any three generators can be run at once. When the 25-cycle generator is in operation the other generator operates at a frequency of 62½ cycles. It is not desirable to operate the two 25-cycle and the two 60-cycle units in parallel and thus to tie both systems so solidly together. Moreover, in the present instance, it is not possible to do so, since there is a relative total mechanical displacement of the field structures of about 20 deg measured on the 60-cycle sides. The double unit combination is possible and advantageous, however, in that should the current in a bearing temperature for any reason, the coupling between the 25-cycle alternator and the turbine could be disconnected and one alternator driven by the other operating as a synchronous motor.

Once a turbine is started and the throttle opened wide, its control passes from the engineer to the switchboard operator. Each turbine governor is equipped with a small motor, by means of which its speed is altered for synchronizing or for dividing load. This motor is controlled from the switchboard. The field rheostats of the alternators are also operated electrically from the high-tension switchboard. The rheostats are located on the exciter floor. The field switch has opening and closing magnets and discharge coil, and a ¼-hp series motor is used to cut in grid resistance units, or vice versa. The exciter bus switches are closed by hand on written instructions from the high-tension switchboard operator to the operator at the exciter board on the main floor. A telautograph is used for transmitting these written orders, supplemented by a telephone in case of emergency.

Fig. 2 shows a cross-sectional elevation through the electrical galleries, which occupy the Fortieth Street side of the

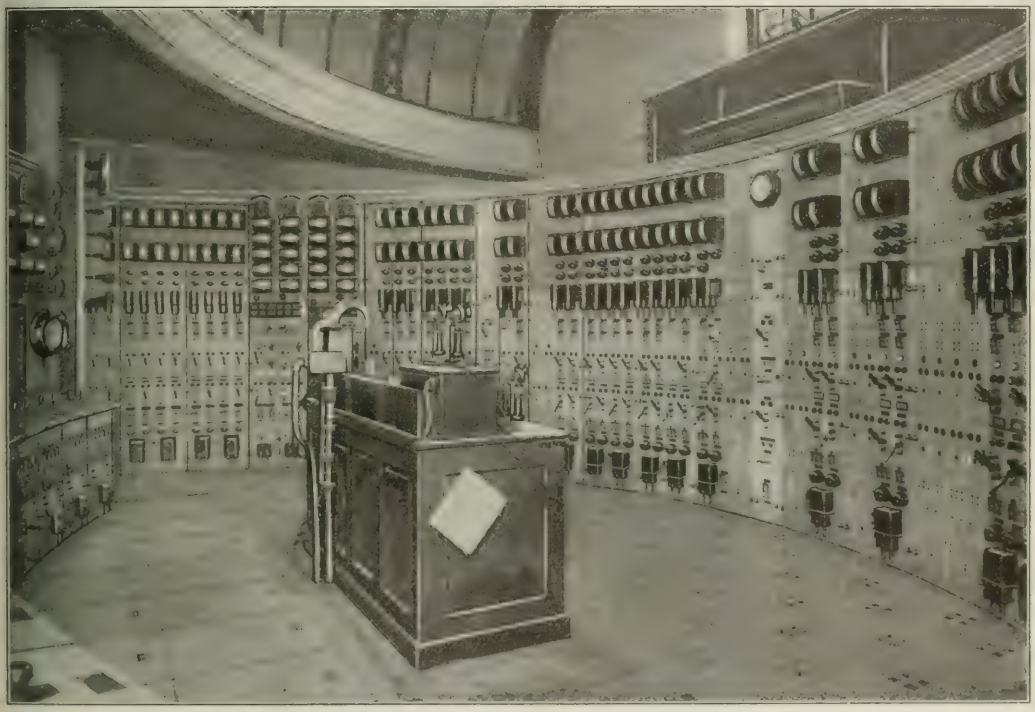


FIG. 1.—GENERAL VIEW OF HIGH-TENSION CONTROL BOARD IN WATERSIDE STATION NO. 2

station. The high-tension cables from the armature of the turbo-generators pass through brass pipes to ducts in the turbine room floor and thence up through vitrified ducts in the division wall to the main oil switches located on the fourth mezzanine floor. The high-tension feeder switches here are placed in two rows back to back, and the corresponding pairs of outgoing feeders are designated by group numbers. Both walls are provided with ducts so that the feeder cables pass down both sides and cross over on the basement floor, as indicated in the engraving. The usual precaution of running feeders to the same substations by routes of independent routes is employed. Widely separated substations are fed from the two feeders making one group, and the substation is supplied exclusively by feeders from a single section of Waterside bus. In order to protect the generators and also the system, from

hazardous short circuit conditions, reactance coils are placed on the fifth mezzanine floor to supplement the reactance of the turbo-generators and thus to limit the current given out by the generators under short-circuit. The first, second, third, and fourth mezzanine galleries are divided into four sections by stairways. The third mezzanine floor contains the series

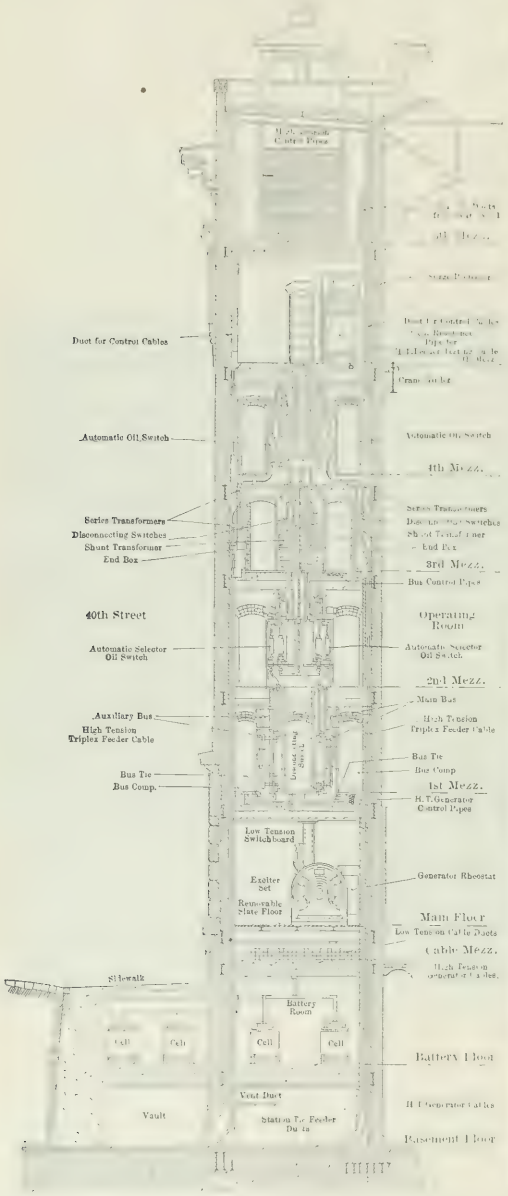


FIG. 2.—CROSS-SECTIONAL ELEVATION OF ELECTRICAL GALLERIES.

and shunt transformers for the instruments, etc. The selector oil switches are housed on the second mezzanine floor and the high-tension and auxiliary buses are placed on the first mezzanine floor. All of the switches are of the remote-control type, operated from the high-tension switchboard gallery at the west end of the operating room. The cables to the various switches, transformers, etc., are distributed through a control pipe run, which rises to the sixth mezzanine floor and occupies all of this floor.

HIGH TENSION CONTROL BOARD.

For ease of control and compactness of apparatus the high tension board of Waterside Station No. 2 is probably witho

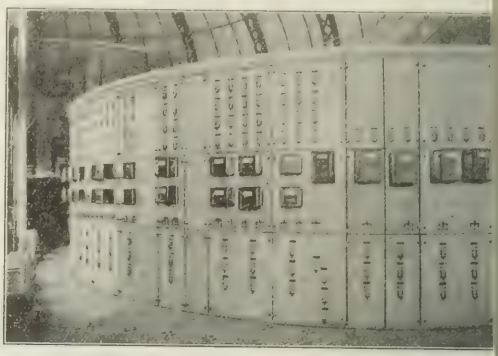


FIG. 3.—REAR VIEW OF FEEDER CONTROL BOARD.

a peer. The control board is located in an enclosed gallery from which all of the generating machinery is visible.

The generator panels and feeder panels are arranged in the ar generator panels and feeder panels are arranged in the ar of a circle with panels also on the reverse side of the arc The latter are equipped with meters, testing switches, etc. Th feeder panels face the generator panels and are shown in Fig. herewith. The generator panels for the 25-cycle units are show in Fig. 6; the 60-cycle generators being controlled from panel



FIG. 4.—HIGH-TENSION BUS GALLERY SHOWING BUS DISCONNECTING-SWITCH COMPARTMENTS.

near the ends of the feeder panels. The 25-cycle generator control panels are of the bench-board type, and in operating the pilot switches the attendant faces the turbine room below which is in direct line of vision. In the lower range of vision are the pilot switches and tell-tale lamps, while in the upper range

of vision are the instruments and return signals from the turbine room below." The switchboard attendant thus not only is cognizant of conditions from instruments and signals in front of him, but can also see the operating machinery and detect mechanical troubles with greater promptness than by surveying



FIG. 5.—GALLERY WITH SHUNT TRANSFORMERS.

a multiplicity of instruments which might not indicate any trouble until a few seconds later.

The high-tension bus is in duplicate, main and auxiliary, each of which is in four sections. A typical diagram of high-tension

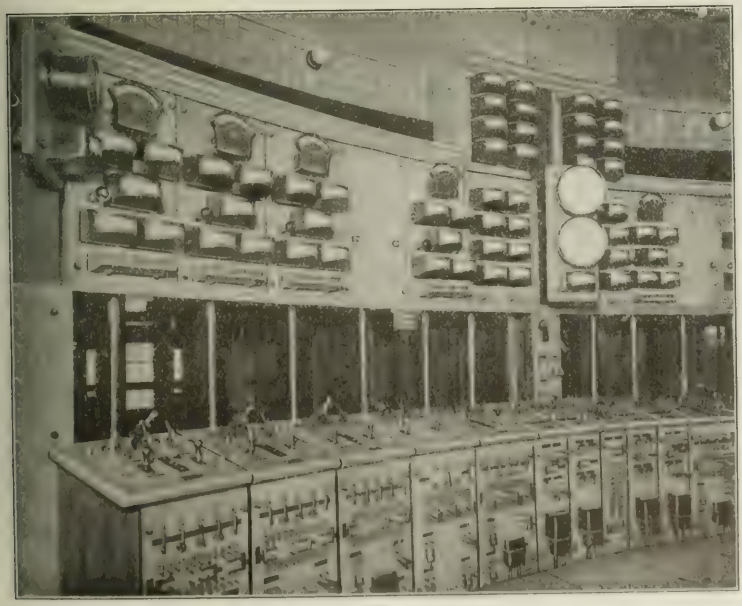


FIG. 6.—CONTROL BOARD FOR 25-CYCLE ALTERNATORS.

circuits is illustrated in Fig. 7, which shows the connections of a 60-cycle high-tension generator. A wiring diagram of a 60-cycle high-tension feeder is given in Fig. 9, and, Fig. 10 is a diagram of high-tension station tie connections. These diagrams are self-explanatory. The four bus sections are tied together by two 1,500,000 circ. mil cables in each phase, and the oil switches located in these circuits are controlled by their bus tie sections in the feeder board. The oil switches are of the triple-pole, single-throw type, rated at 2,000 amp and 6,600 volts. They are operated by non-automatic 220-volt motors,

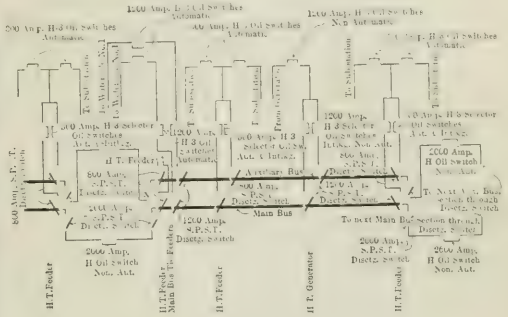


FIG. 7.—TYPICAL DIAGRAM OF HIGH-TENSION CIRCUITS.

and have oil pots in separate brick cells. These switches are located on the first mezzanine floor. The high-tension buses are made up of copper straps separated from each other ⅛ in.; the copper straps being 4 in. wide x ⅛ in. thick. The two middle sections of the buses have six straps and the end sections four straps.

The high-tension buses in Station No. 2 are tied with the corresponding buses in Station No. 1 by means of 1,000,000 circ. mil lead-covered cables, with two oil switches in each circuit. The oil switches are rated at 1200 amp. It will be noted in the feeder diagram that the selector switches connect to a common point to which two 300-amp switches are connected, one for each feeder of the group. The purpose of this arrangement is to have always two oil switches in series on every connection to the bus and still permit a selection of buses without the use of open-air hook type switches. There is a total of 75 single feeders in Waterside Station No. 2, and each is equipped with an inverse-time-element overload relay.

The control circuit connections of the main feeder switches differ slightly from general practice. In Waterside Station No. 2 the wiring is so arranged that the telltale lamps perform two functions—they indicate the position of the switch and also the continuity or lack of it, in the relay and switch operating circuits. With the lamp burning, it is a positive indication to the operator that the relay and control circuit, including the armature, fields and clutch of the oil-switch operating motor, is in perfect condition. An ammeter is placed in circuit with the series transformer and coil on the alternating-current side of the relay so that any fault here would be indicated by the non-indication of the meter. While this arrangement calls for additional control wires, the ability to tell at a glance whether the circuit is in operating condition or not compensates for the additional expense involved. Without these precautions it would be necessary to make tests from time to time, or wait until the fault made itself known by the non-operation of the circuit.

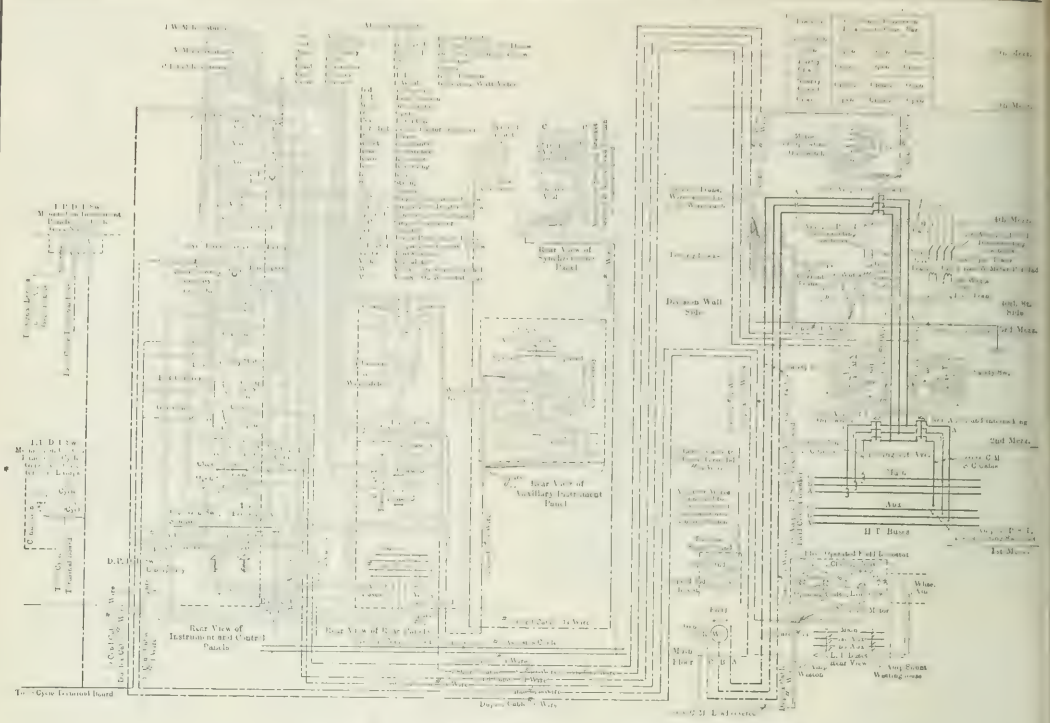


FIG. 8.—DIAGRAM OF CONNECTIONS OF 60-CYCLE HIGH-TENSION GENERATORS.

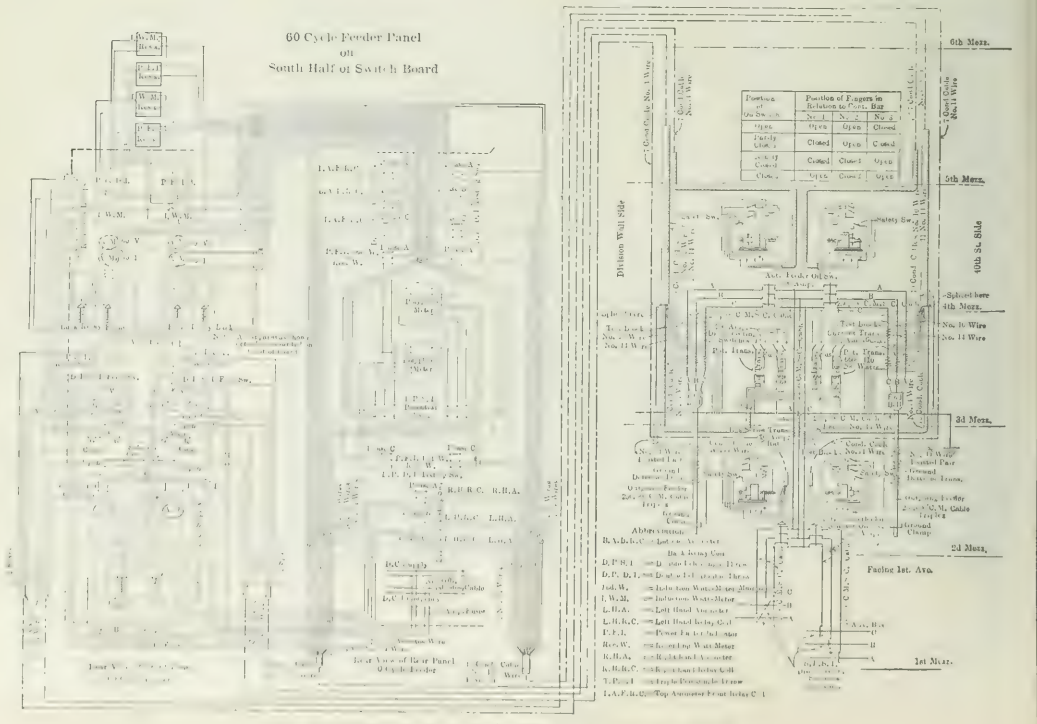


FIG. 9.—WIRING DIAGRAM OF 60-CYCLE, HIGH-TENSION FEEDER.

The high-tension feeder control board has 56 panels on each side of the arc, or 112 in all. The generator control board has 15 panels. All the relays and instruments are provided with permanent switches in series, so that if necessary they may be readily adjusted and checked while the circuits are in service. A permanent feeder testing set forms part of the equipment, so that a high-pressure break-down test can be applied to outgoing feeders. A schematic diagram of connections is shown in Fig. 12. A 25-cycle high-tension feeder is passed through a step-down transformer, giving a secondary voltage of 200. By means of a three-phase induction regulator this voltage may be varied between 0 and 400 volts, while three fixed resistances limit the current in case of break-down of feeder insulation. The circuit is also opened by an automatic triple-pole switch, which, in closing, passes the circuit through a step-up transformer to voltages varying from 7500 to 26,000, depending on the connections. This high-pressure circuit, in which are three electrically operated switches, is conveyed to testing stations on the fourth and fifth floors through a special

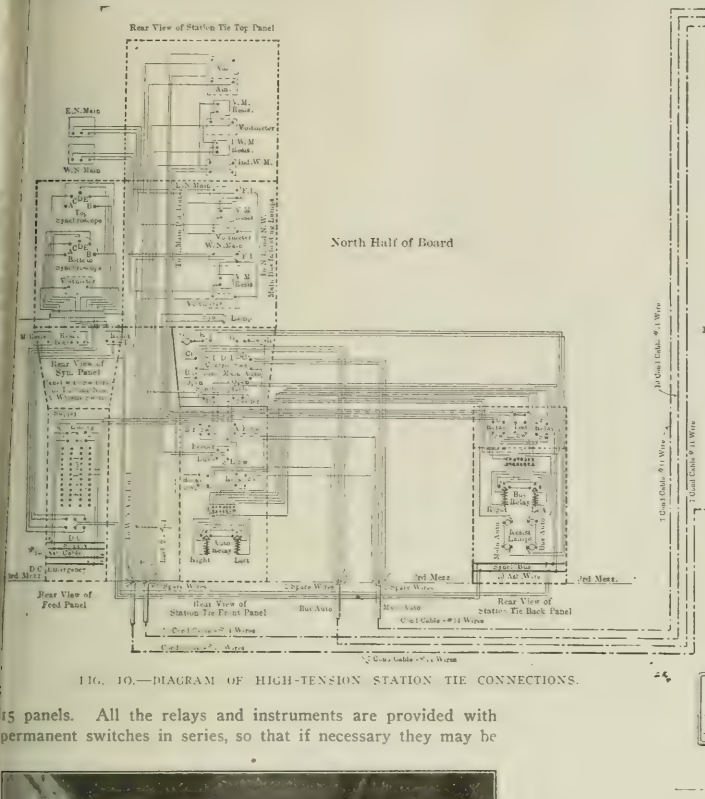
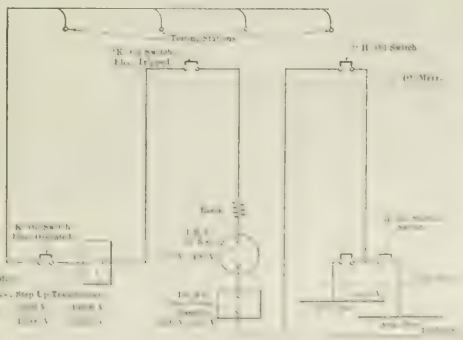


FIG. 10.—DIAGRAM OF HIGH-TENSION STATION TIE CONNECTIONS.



FIG. 11.—AUTOMATIC OIL SWITCHES CONTROLLING FEEDERS.



50,000-volt triplex cable. Connection is made between the testing station and the feeder to be tested by means of flexible cables and bayonet switches. In operation the selector oil switches are thrown by the operator at the high-tension control board. The feeder switch is operated from the feeder testing board, and when closed brings three-phase 200-volt current on the feeder testing board. This is changed in potential from 0 to 400, as previously outlined. The tests usually made are "copper-to-copper" test on all new feeders and on all feeders upon which work has been done. A copper-to-ground test may be made by simply throwing in the neutral of the secondary of the step-up transformer. The test voltage is 7500 volts. On generator cables the test voltage is 15,000. Banks of lamps and an artificial neutral resistance are also provided for testing out the phases of any feeder.

Mounted on top of the feeder control board is a feeder ground indicator. This device was designed by the New York Edison Company. On each of the outgoing feeders are placed three special series transformers. Any unbalancing of one of the feeders, caused by a ground, will induce currents in these series transformers, which in turn energizes a telephone drop in the indicator; a shutter being tripped having the number of the feeder. This action closes an alarm circuit as well as short-circuiting the main telephone drop coil. A condenser intensifies the actuating current of the transformer.

Telephone Conversations as Viewed by the Courts.

By Francis W. Lane.

THOUGH the telephone has been in existence for some 30 years as a medium for the carrying on of business transactions, it is only within a very few years that its use has become so well-nigh universal that the courts have been asked to pass upon the weight as evidence of a conversation carried on by this means. The validity under certain conditions of telephone conversations as evidence has been recognized in several States to a far greater extent than in New York, but a recent decision of the Appellate Term of the Supreme Court of that State, First Department, determines the status of such conversations so clearly that the matter becomes one of considerable interest both from the legal point of view and from the position of the public and the telephone companies.

Reference is made to a decision in the case of Rimes vs. Carpenter et al., reported in the *Law Journal* of Jan 29, 1909, as rendered by Justice Bischoff, on appeal from the Municipal Court of the city of New York. Briefly, the facts were these: The issue related to certain orders given by the plaintiff's wife, with his authority, to the agent of the defendants, who were brokers. The defendants offered proof as to what was said in this conversation in the form of the testimony of a person who had listened to the conversation over another telephone in the defendant's place of business, but was listening in another room.

The lower court ruled out this evidence and that of the identity of the speaker as the plaintiff's wife or evidence tending to show that the conversation which was overheard was the same as that covered by the plaintiff's testimony. This decision was given on the ground that the evidence was incompetent for the reason that the conversation was heard over another instrument and in another room.

In reversing the lower court the appellate judge said:

"Unquestionably a conversation overheard between parties whose voices are recognized by the witness may be proved, and there is no ground for distinction in principle between such a case and that of a conversation by telephone, which the witness overhears, where the actual connection between the instruments is shown in such wise as to identify the very conversation, and the persons holding the conversation are known. From the proceedings upon the trial it appears that the defendants could probably have shown, but were not permitted to show, [illegible] three instruments on the same wire being used by the princi[illegible] in the conversation and by the person who overheard it, w[illegible] serve as a medium of transmission whereby what was h[illegible] by one listener must have been heard by the other and h[illegible] been the actual words of the speaker. In this situation [illegible] conversation overheard by a witness would clearly be [illegible] proper subject of his testimony, where the conversation [illegible] self, as between the parties, is competent and relevant to [illegible] issues."

All the justices concurred in the decision and in view of [illegible] fact that it marks a reversal of previous practice in the S[illegible] of New York and conforms to the practice of other States [illegible] which similar cases have been decided, it seems to establish [illegible] probable future practice in the United States on fairly f[illegible] grounds.

In a somewhat similar case in Missouri—Wolfe vs. Missc[illegible] Pacific Railway, 97 Mo., 473, 481—quoted by *Bench and* [illegible] for January, 1908—a witness for the defendant was allowed [illegible] testify to a telephone conversation with some person in [illegible] plaintiff's private office, although he was unable to state t[illegible] such person was either one of the plaintiffs or their clerk. [illegible] approving the admission of this testimony, the Supreme Co[illegible] said:

"The courts of justice do not ignore the great improvement [illegible] the means of intercommunication which the telephone has ma[illegible] . . . When a person places himself in connection with t[illegible] telephone system through an instrument in his office he there[illegible] invites communications, in relation to his business, throu[illegible] that channel. Conversations so held are as admissible in e[illegible] dence as personal interviews by a customer with an unkno[illegible] clerk in charge of an ordinary shop would be in relation to t[illegible] business there carried on. The fact that the voice at the te[illegible] phone was not identified does not render the conversation i[illegible] admissible."

In this case, as well as in one decided by the Supreme Cou[illegible] of Illinois, in which the Missouri case was cited—Godair [illegible] National Bank, 225 Ill., 572, 574—it was clearly stated th[illegible] while evidence of the telephone conversation was admissib[illegible] to the case, the weight of such evidence was for the jury [illegible] determine.

The question of identity is the only important one involve[illegible] and it appears probable that in all future similar cases eviden[illegible] upon this point will be admitted, but its weight must be le[illegible] to the determination of the jury. What may constitute th[illegible] establishment of identity is suggested in a case decided by th[illegible] Kentucky Court of Appeals—Holzbauer vs. Sheeny, 104 S. W[illegible] Rep., 1038. The court said:

"Obviously the speaker whose conversation is introduced a[illegible] evidence of an admission against his interest must be identifie[illegible] in some proper manner by evidence as the party to be charge[illegible] in the suit, or the conversation cannot be received agains[illegible] him.

"If the witness was acquainted with the defendant's voice, hi[illegible] testimony that he recognized her voice is admissible as evidence [illegible] and it may constitute proof of her identity, or the identity migh[illegible] be proved otherwise. In average experience the numbers an[illegible] addresses contained in the telephone company's directory fo[illegible] public use are found sufficiently accurate to justify its sub[illegible] stantial trustworthiness. When, therefore, a person so stated t[illegible] live at the address, and bearing the same name as the party[illegible] sought to be charged, is called for by the telephone at that [illegible] number and address, and answers to the name, admitting the [illegible] identity, it is to be accepted as the same evidence would be [illegible] if the witness testifying had called in person and the ostensible [illegible] owner had answered and admitted the identity."

In view, therefore, of the position just assumed by the Supreme Court of the State of New York and of that previously taken by the courts of the States whose decisions have been referred to, it appears that the telephone is coming to be as fully recognized by the courts as a necessary and reliable agency in the transaction of business as it has long been recognized by business men themselves.

A Quick Method for Determining Sags and Tensions in Transmission Lines.

By H. J. Glaubitz.

In connection with the design of certain special towers for wireless telegraphy, in which numerous guys, together with the tower, act as the aerial capacity, the necessity arose of finding a quick method of determining the sags and tensions in the guys at different temperatures. A special case of this problem is the determination of sags and tensions in transmission lines, and as this is of more general interest there will be described below an analytical method of finding these sags and tensions quicker than the graphical one generally employed. Mr. A. J. Bowie, Jr., has written some admirable papers, which appeared in the *Electrical World* during 1906, on the same subject; while his method is similar to that given below, the expressions are too involved to admit of readier solution of the problem than by the graphical method. Particularly, much complication is avoided by the use of the diagram of maximum wind-pressures, as shown in Fig. 1. The wind-pressures as given therein are in accordance with the best American and European practice for the design of high towers. It will be noted that, as is actually the case, the wind-pressures increase with the height above the ground, which by the way, is a very important consideration in the spacing and proportioning of guys for guyed structures, as the axis of

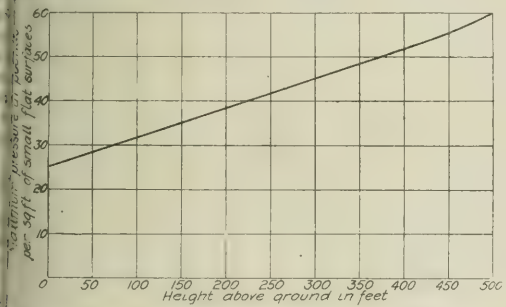


FIG. 1.—VARIATION IN WIND PRESSURE WITH HEIGHT.

the latter, when under wind-stress, should conform as nearly as possible with a straight line.

Let the problem be as follows: With a span of 1000 ft., a temperature of 70 deg. Fahr. and no wind blowing, find the deflection and tension which must be allowed in installing a 350,000-circ. mil hard-drawn copper cable so that when the wind-velocity increases to its maximum, the temperature drops to +20 deg. Fahr., and the cable is uniformly coated with a layer of ice 0.25 in. thick, the cable will not be strained more than 30,000 lb. per square inch; or, in other words, will have a factor of safety of at least 2.

As the cable will probably have to clear the ground by 25 ft. during maximum deflection it will be safe to assume the mean height of the cable above the ground to be 40 ft. Fig. 1 gives for this height a maximum wind-pressure of 27.6 lb. per square foot of flat surface, or of 13.8 lb. per square foot of projected cylindrical surface, which means a wind-pressure on the ice-coated cable of 1.357 lb. per lineal foot. The weight of the 0.25-in. ice coating (at 59 lb. per cubic foot) would be 0.299 lb. per linear foot.

Let

A = area of cross-section of cable = 0.2749 sq. in.

w = weight per foot of cable itself = 1.076 lb.

W = maximum total load per linear foot on cable, resulting from weight of cable plus the weight of ice acting vertically, and the wind-pressure acting horizontally = 1.933 lb.

M = modulus of elasticity of material = 16,000,000

y = one-half the length of the span of the cable = 500 ft.

k = thermal coefficient of linear expansion of cable = 0.0000096 per degree Fahr.

d = range of temperature below that of installation = 70 − 20 = 50 deg. Fahr.

T = maximum allowable tension = 30,000 lb. per square inch.

x = deflection in feet of center of cable when under maximum stress.

x' = deflection in feet of center of cable at temperature of erection.

s = tension in pounds at the center of the cable at the temperature of erection.

L = one-half the length of the cable, in feet, at the temperature of erection under the supposition that there is no wind blowing and that the cable has no weight.

GENERAL SOLUTION.

When the temperature decreases by d deg. the half length L of the cable contracts by kdL ft. and the resulting length is

$$L(1-kd)$$

The cable now being loaded with W lb. per foot, a tension of TA results—as the maximum allowable—with a consequent elongation of the length $L(1-kd)$ of

$$\frac{TA}{MA} L(1-kd) = \frac{TL}{M}(1-kd)$$

since the elongation of any body of uniform cross-section A, length L and under tension t equals $\frac{tL}{MA}$, as long as the elastic limit is not exceeded.

Therefore, the total length of the cable at minimum temperature and fully loaded would be

$$L(1-kd)\left(1+\frac{T}{M}\right),$$

which must equal the geometric half-length of the cable, or

$$L(1-kd)\left(1+\frac{T}{M}\right) = y + \frac{2}{3}\frac{x'^2}{y}$$

also, since very closely

$$x' = \frac{y^2W}{2sT}$$

$$L(1-kd)\left(1+\frac{T}{M}\right) = y + \frac{y^3W^2}{6s^2T^2}, \text{ or}$$

$$L = y\,\frac{1+\frac{1}{6}\left(\frac{yW}{sT}\right)^2}{(1-kd)\left(1+\frac{T}{M}\right)} \qquad (1)$$

At the time of erection only the weight w of the cable is acting on the cable; the deflection x and tension s necessary to support this dead load bear the relation

$$x = \frac{y^2w}{2s}, \text{ or}$$

$$s = \frac{y^2w}{2x} \qquad (2)$$

Since L is the length of half the unstressed cable at the temperature of erection, the elongation of L under tension s is

$$\frac{sL}{MA} = \frac{ysA}{2xMA}$$

so that the total length of the half cable is

$$L\left(1+\frac{ys}{2xMA}\right)$$

and as this must equal [illegible], the following equation is obtained for x:

$$x' = \frac{1}{2}y\left(\frac{s}{T}-\frac{T}{M}\right)\left(\frac{s}{T}+\frac{T}{M}\right)$$

From this equation x, the sag to be given the cable at erection can most readily be found sufficiently close by trial with the help of a table of cubes. After s has been determined the tension s will be found from equation (2).

EXAMPLE.

For the example under consideration the expression for x, the sag to be given to the cable during erection, is

$$x^3 - 1.5\,y\,(L - y)\,x - 0.75\,\frac{y^2wL}{MA} = 0, \text{ in which}$$

$$L = y\left(1 + \frac{1}{6}\left(\frac{yW}{AI}\right)^2\right)\frac{1}{(1 - kd)\left(1 + \frac{I}{M}\right)}$$

Substituting in the last equation the value as given for the problem, L is found to be 500.4469 ft., so that the equation for x will be

$$x^3 - 335.18\,x - 11,478 = \text{zero},$$

from which, by trial with the aid perhaps of a table of cubes, x is found to be 27.45 ft.

The tension s is now found from the equation $s = \frac{y^2w}{2x}$ to equal 490 lb.

Since for all practical purposes it is close enough to find the deflection to the third significant figure, $x = 27.5$ ft. could have been found almost immediately by inspection of the cubic equation. However, when greater accuracy is desired for academic reasons, one can determine x more closely by Newton's method of approximation.

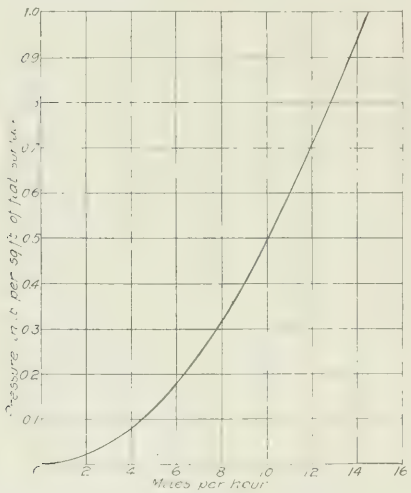


FIG. 2.—VARIATION IN WIND-PRESSURE WITH WIND VELOCITY.

Let $x^3 - ax - b = 0$ be the general form of the above cubic equation, then for any assumed value of v for x, the correction j is

$$j = -\frac{x^3 - ax - b}{3x^2 - a} = -\frac{v^3 - av - b}{3v^2 - a}$$

For $v = 27.5$,

$$j = -\frac{101}{1933} = -0.052,$$

and therefore a closer value for x is

$$x = 27.5 - 0.052 = 27.448 \text{ ft.}$$

The value of x may also be found directly from $x = 1.1547\sqrt{a}\,\text{hypcos}\,\frac{\delta}{3}$, in which δ is determined from $\text{hypcos}\,\delta = 2.5981\,\frac{b}{\sqrt{a^3}}$, but it will be found that the method of approximation given above is the most rapid for determining the value of the sag.

REMARKS.

If any wind should be blowing at the time of erection it will be necessary merely to substitute in the equations in place of the weight w of the cable, the resultant pressure w' due to weight acting vertically and the wind acting horizontally.

Fig. 2 shows wind-pressures as functions of wind velocity up to 16 miles per hour. The curve is based on Smeaton's formula

$$P = 0.005\,v^2,$$

in which P = pressure per square foot of flat surface in pounds, and v = velocity of wind in miles per hour. This formula is sufficiently close for small surfaces.

An ice coating will hardly be of cylindrical cross-section, but will rather tend to assume an elliptical or egg section, so that the wind-pressure per foot of cable would be larger than 1 lb. per square foot of projected *cylindrical* area would give. On the other hand, the chances of a combination occurring of maximum ice coating, very low temperatures and maximum wind-velocity are practically nil, and in case the cable should be strained a little beyond its elastic limit, it will elongate and thereby increase the sag and decrease the tension until equilibrium is established, even if this elongation should thus be made partially permanent.

The pressure p per square foot of projected cylindrical surface has, in accordance with the usual practice in this country been assumed to be 50 per cent of the pressure P per square foot of flat surface, or

$$P/p = 0.50.$$

There exists, however, a considerable divergence of opinion among engineers and scientists in Europe as to the correct value of P/p. The following theoretical values are given for P/p: I. Newton, $P/p = 0.67$; Von Loessl, $P/p = 0.79$; F. Hutter, $P/p = 0.45$; and from experiments, D. Irminger, $P/p = 0$

A Volt Scale for a Watts-Per-Candle Meter

By Herbert E. Ives.

VOLT scales for indicating the voltage to produce a desired candle-power have been used on photometers in many incandescent lamp factories. They are better adapted to the requirements of the lamp trade than are candle-power reading scales, because the demand is not for a large range of candle-powers at one voltage, but for few candle-powers with considerable latitude in voltages. Recently the introduction of the graphitized and metallic-filament lamps has been marked by a new and more rational classification—namely by watts per candle and total watts. To the writer's knowledge, however, there has not been developed a method of reading directly from the photometer the voltage to produce the desired watts per candle, and the watts corresponding to that voltage. Candle-power, current and voltage readings are made, none of which is necessarily the final value adopted, and sorting is done by rough calculation, aided by limit tables and by experience. It would obviously be advantageous to ascertain the voltage producing the correct watts per candle by direct reading, and if possible, the corresponding watts or candle-power at the same time. The sorting of lamps would then be more quickly and probably more accurately done than by an indirect method. The specific consumption meter volt scale here described accomplishes this object.

A watts-per-candle or specific consumption meter, designed by Hyde and Brooks, is part of the photometric equipment of the Bureau of Standards.[1] It consists essentially of a watt-meter with a variable pressure circuit resistance, so arranged that as the photometer screen moves the wattmeter indicates the value of watts per candle. This instrument lends itself to the operation of finding the volts for a given specific consumption by the method of trial and error. Where the number of lamps is small and time is not too short, it affords a convenient and exact means of finding the voltage in question. In the extensive testing done by the Bureau for various government departments, under the Bureau's specifications, carbon lamps are run on life test at a uniform specific consumption of

[1] *Bulletin of the Bureau of Standards*, Vol. II, No. 2, page 145

watts per mean horizontal candle. This fact necessitates determining for each lamp the voltage which produces this specific consumption. Finding the voltage by trial, with the consumption meter, proved too long an operation to be practicable with a large number of lamps, and a shorter procedure was sought.

Experiment showed it possible to calculate with considerable accuracy from the watts per candle at rated voltage—an initial run at rated voltage is part of the regular test—the voltage to give 3.1 watts per candle, by use of the relation $\left(\frac{V_2}{V_1}\right)^k = \frac{w_2 c_2}{w_1 c_1}$, where, for the range from 3.6 to 3.1 watts per candle, for treated carbon filaments, k has the value 3.5. The results of such a calculation may be used in the form of percentage tables, or the actual volt values may be calculated for each rated voltage encountered, and then tabulated. From such a table, for instance, it can be read that the e.m.f. of a 110-volt lamp operating at 3.5 watts per candle must be raised to 113.7 volts to operate at 3.1 watts per candle. Tables so calculated greatly reduce the work of finding the 3.1-watt voltage. It seemed desirable, however, to reduce further the number of operations, and this was accomplished by placing a scale in the consumption meter which indicates at once the data of the tables.

This scale is a volt scale, similar in idea to the volt scales used in assigning lamps to the 16-cp or 32-cp voltage, but differing in that it indicates the voltage that will produce a certain watts-per-candle. With a photometer operated at one e.m.f.—say, 110 volts—it is necessary merely to place on the consumption meter a new scale which shall read 110 at the 3.1 point—assuming 3.1 to be the watts-per-candle desired—111 at 3.21, 112 at 3.315, etc., in accordance with the voltage-watts-per-candle relation. The position of the photometer screen for the intensity match then shows on the new scale the 3.1-watt voltage.

In the Bureau of Standards work a complication arose from the fact that lamps must be photometered at the rated voltage, and the number of rated voltages is so large that separate scales for each cannot be conveniently placed on the instrument. Resort was had to an optical device to accomplish the same purpose. A series of volt scales for each value of volts from 80 to 130 were drawn, one above another, on a narrow strip of paper. Their 3.1 points being in a straight line, the volt marks when joined formed smooth curves, and the resultant complete scale consisted of a series of converging volt lines crossed at right angles by curved lines numbered to indicate the corresponding rated voltages. This scale was fastened on a small cylinder mounted to permit of rotation about a horizontal axis above the consumption meter scale. On top of the latter instrument was fastened a silvered glass mirror from whose lower surface the silver had been removed up to a line, whose curvature was approximately that of the instrument scale. This mirror, so placed that no parallax exists between the needle and the image of the outside scale, permits of reading the volts from any volt line which has been turned to a fixed pointer, by merely placing the eye in position to see the volt line at the edge of the silver mirror, and observing the needle past the edge. This operation is no more difficult than the usual sighting of a needle over its image, and as quick. Since there is no parallax, special pains need not be taken to have the eye exactly centered laterally—in fact, both eyes may be used. The instrument in this form has been used with complete success in the Bureau's testing of carbon lamps.

A possible application of the volt-scale consumption meter is in the rating and sorting of lamps according to the watts per candle the quantity now recognized as of most importance. By having factory photometers operated at constant voltages, as is done with present volt-scale photometers, it is at once evident that volt-scale consumption meters would indicate at one reading the voltage at which lamps should be rated. A further requirement must be met before the lamp is completely rated—namely, the candle-power or watts at the voltage indicated should be specified. this can readily be done by an extension of the volt scale idea. It is necessary if candle-power indications are desired, merely to have scales on the photometer head showing the candle-powers at various voltages corresponding to candle-powers at the voltage used. For instance, the 16-cp point for the 110-volt scale would be the 19.5-cp point on the 114-volt scale. These scales, whose similarly numbered points may be joined by continuous lines, may be conveniently mounted on a cylinder, as is done at present with different candle-power scales where sector disks are used. When a voltage is indicated by the consumption meter scale, the candle-power scale should be turned to the point corresponding to that voltage—a line on the cylinder, or a division on the turning mechanism. The candle-power at rated voltage is then shown by the pointer attached to the photometer screen.

If the value of the watts is desired, a similar watt-scale may be made whose readings are the candle-powers in the above scale multiplied by the common watts-per-candle. In this case the watt reading would, of course, be subject to the errors of photometric setting. An alternative form of watt-scale could be made by multiplying the actual specific consumption reading by the candle-power reading, by the use of scales, each corresponding to a certain specific consumption, mounted upon a cylinder as described above. In this way the candle-power reading is eliminated, and the value of watts at the photometer voltage may be read independently of errors of candle-power estimation. Instead of actual watts, watts at the voltage corresponding to the consumption meter indication may be plotted in a manner similar to that described for candle-powers.

It is therefore possible, by combining a volt-scale on a watts-per-candle meter with proper scales on the photometer, to read from one photometer setting: (1) Voltage to give a certain specific consumption; (2) candle-power or watts at that voltage. In short, the quantities now desired in rating incandescent lamps are ascertained at one operation.

It is of practical interest to know how accurately lamps may be placed at a desired watts-per-candle by the use of a volt-scale consumption meter. It is obvious that the placing depends upon the uniformity with which individual lamps conform to the voltage-watts-per-candle relation used in plotting the scale. Experiments with about 2000 lamps of several different makes have shown that those of any one make can be placed regularly within a range of from 3.05 watts to 3.15 watts per candle from readings made in the neighborhood of 3.50 watts per candle. With different makes the amount of "treatment" of the filament varies, thereby requiring a different voltage exponent. The change of exponent has been found to be accounted for by the changed voltage-candle-power exponent -that is, if the exponent in the equation $\left(\frac{V_2}{V_1}\right)^k = \frac{c_2}{c_1}$ is 5.5 instead of 5.5, the exponent in the equation $\left(\frac{V_2}{V_1}\right)^k = \frac{w_2 c_2}{w_1 c_1}$ is 3.7 instead of 3.5.[2] In other words, any shortcoming in the specific consumption-meter volt-scale plan is only such as would be met with in using a volt scale for candle-power work with the same lamps. In any one factory where the product is reasonably uniform, a watts-per-candle volt-scale should be quite as practical as the present volt-scale photometer.

Single-Phase Commutator Motors.

A mathematical paper on single-phase commutator motors, by Mr. M. O. Rethy, appears in *La Lumière Électrique* for Feb. 27 and March 6. He discusses the loss in the coils short circuited by the brushes in single-phase series motors. This loss is calculated when the armature revolves and Mr. Rethy explains the fact which has been observed that the formation of sparks is not greatly influenced by the speed of the motor. Finally, in order to show the value of these losses a numerical example is given. It is demonstrated that these losses de[illegible] In the example this loss at synchronism is only one-third of the value for the armature at rest.

[2] See article by F. P. Cox, Illuminating Engineering Society Convention, October, 1899.

Even Harmonics in Alternating-Current Circuits.

By Charles P. Steinmetz.

In general, even harmonics of the voltage and current waves cannot exist in alternating-current circuits; therefore, in investigating the possibility of the high voltage produced by resonance with some over-tones of the generator wave, only the odd harmonics are usually considered.

Without commutation, rectification or similar phenomena, the voltages generated by electrodynamic induction in revolving machinery, or by transformer action, and also the currents produced by these voltages, probably always have both half-waves of identically the same shape. When both half-waves have the same shape, the wave comprises only odd harmonics, since an even harmonic produces a difference in the shape of the positive and the negative half-wave. In any of the existing revolving electrodynamic machines, regardless of the distribution of the magnetic flux and the arrangement of the conductors, a rotation by 180 electrical degrees brings the induced conductor back into the same relative position with the inducing magnetism, but with reversed direction, and hence the voltage wave repeats the same values in opposite direction; that is, the second half-wave has the same shape, but the opposite direction of the first half-wave, so that even harmonics are absent.

However, even harmonics may occur in the transient waves of electric circuits. Thus the free oscillation of a transmission line which is induced by a lightning discharge in general contains numerous higher harmonics, even ones as well as odd ones, in addition to the fundamental wave.

Even harmonics of current and even harmonics of voltage frequently occur in the transient terms of current and voltage resulting from sudden changes of circuit conditions; they may reach very high values, as in the momentary short-circuit currents of alternators, in the starting currents of stationary transformers, etc. Therefore, it is not safe to assume that no even multiple of the generator frequency could exist in alternating-current circuits; while such even harmonics cannot persist continuously, they may appear momentarily and for a short time and may reach high values.

The above facts may be illustrated in the starting current of a stationary transformer. When connecting a transformer to an alternating-current circuit, a transient term of current appears, because the permanent values of the magnetism of the transformer does not correspond to the instantaneous value of the impressed e.m.f. at the moment of closing the circuit. The momentary or starting current may reach very high values. The calculation of this transformer starting current I have discussed on page 188 of "Transient Electric Phenomena and Oscillations." Taking the numerical values of the exciting current for the first complete wave, from 0 deg. to 360 deg., from the table on page 188, and resolving into a Fourier series, gives the approximate equations for the first wave of the exciting current:

$$\begin{aligned} e &= E \sin \Theta \\ i &= 108.3 \\ &- 183.8 \cos (\Theta + 28.0 \text{ deg.}) \\ &+ 112.4 \cos 2 (\Theta + 29.8 \text{ deg.}) \\ &- 53.1 \cos 3 (\Theta + 33.3 \text{ deg.}) \\ &+ 27.2 \cos 4 (\Theta + 39.1 \text{ deg.}) \\ &- 18.4 \cos 5 (\Theta + 38.1 \text{ deg.}) \\ &+ 13.6 \cos 6 (\Theta + 33.4 \text{ deg.}) \\ &- 8.1 \cos 7 (\Theta + 32.7 \text{ deg.}) \end{aligned}$$

where the circuit is assumed as closed at the moment: $\Theta = 0$; that is, at the zero point of the half-wave.

Or, substituting:

$$\Theta = \Psi - 150 \text{ deg.}$$

that is, assuming the circuit as closed at the zero point: $\Psi = 150$ deg. of the half-wave, gives:

$$\begin{aligned} e &= E \sin (\Psi - 150 \text{ deg.}) \\ i &= 108.3 \\ &+ 183.8 \cos (\Psi - 29 \text{ deg.}) \\ &+ 112.4 \cos 2 (\Psi - 0.2 \text{ deg.}) \\ &+ 53.1 \cos 3 (\Psi + 3.3 \text{ deg.}) \\ &+ 27.2 \cos 4 (\Psi - 9.1 \text{ deg.}) \\ &+ 18.4 \cos 5 (\Psi - 8.1 \text{ deg.}) \\ &+ 13.6 \cos 6 (\Psi - 3.4 \text{ deg.}) \\ &+ 8.1 \cos 7 (\Psi + 2.7 \text{ deg.}) \end{aligned}$$

The permanent value of the exciting current of this transformer, as it exists a considerable number of cycles after the start, is given on page 589 of "Alternating-Current Phenomena" (fourth edition), and is expressed by the equation:

$$\begin{aligned} i &= 3.98 \cos (\Theta - 37.6 \text{ deg.}) \\ &+ 0.85 \cos 3 (\Theta - 4.1 \text{ deg.}) \\ &+ 0.25 \cos 5 (\Theta - 1.7 \text{ deg.}) \\ &+ 0.14 \cos 7 (\Theta - 3.2 \text{ deg.}) \\ &+ 0.07 \cos 9 (\Theta - 2.5 \text{ deg.}) \end{aligned}$$

and has the effective value:

$$I = 2.89$$

As seen, the permanent exciting current contains no even harmonics, but the momentary exciting current contains a constant term and very high, even harmonics. The second harmonic, having a maximum value of 112.4 amp, almost reaches the same magnitude as the fundamental wave, which has a maximum of 183.8.

In the first wave of the starting current the effective value of the current is 176.3; the constant term is 108.3: The effective value of all of the odd harmonics together is 135.8, and the effective value of all of the even harmonics together is 82.

That is, the effective value of the even harmonics reaches nearly 50 per cent of the effective value of the total current, that is, it is of the magnitude of the full-load transformer current.

It is interesting to note that in the permanent, as well as the momentary, exciting current of the transformer all harmonics are approximately in phase; that is, they add their maximum values, and hence the wave is peaked.

Snow Loads on Transmission Lines.

By Max H. Colleohm

There are three factors entering into the mechanical design of a transmission line, namely, weight of conductor, weight of



Fig. 1.—Snow-clad line wires.

sleet and snow around the conductor, and wind-pressure acting upon the increased diameter of same. The size of wire and its weight are obtained from the commercial and electrical calcula-

ds and represent certain fixed value. The other two factors, ever, are variable and their possible value must be assumed h reference to the particular climatic conditions. These mptions for the same climatic conditions vary widely with erent engineers, and because the transmission line represents onsiderable item in the total cost of the power development, as therefore any saving in the height of the poles and their



FIG. 2.—SNOW-CLAD WIRE.

mber will reduce the cost very materially, there is a great mptation to assume so low a figure for snow and wind loads actually to stress the line beyond its elastic limit under cer- in severe conditions which, as experience shows, are not so ery remote as is generally believed.

As a rule, the amount of snow actually assumed for trans- nission lines is from ½ in. to ¾ in. all around the conductor, r about 2 in. maximum outside diameter for a heavy trans-



FIG. 3.—SNOW CLAD LINE WIRES.

mission cable. It is furthermore generally assumed that a considerable sleet and snow coating can form only at a temperature of about 30 deg. Fahr., at which the line sag would not be reduced to its minimum value. Moreover, there is no wind taken into account on the assumption that a strong wind would not allow of sleet formation on the wires.

However, the conditions experienced during this winter in Wisconsin and the neighboring States prove these assumptions to be far too low for any similar climatic conditions. The snow storm of Jan. 28 covered practically all the overhead wires of the affected region with a coating of sleet and snow to a diameter of from 2½ in. to 4 in. The temperature went down to 4 deg. Fahr. below zero, while the wind velocity was recorded as 40 miles per hour. This shows that snow will form around the wires even with a strong wind, and that the temperature may go down quite low with the snow and wind pressure still on the wires. The accompanying photographs will serve to illustrate the conditions just mentioned. Tests made on a number of broken wires showed a good average of about ½ lb. of sleet and snow per foot of wire, the maximum being a little higher. These samples were taken from wires of small size, about No. 10, but the larger wires did not show any appreciable difference in the amount of sleet and snow on them. As none of the larger cables was readily available for testing, clothes-lines of a size similar to No. 0 were taken instead, which showed also the same average snow load as the smaller wires, or ½ lb. per foot.

Although all these data were not obtained from a real high-

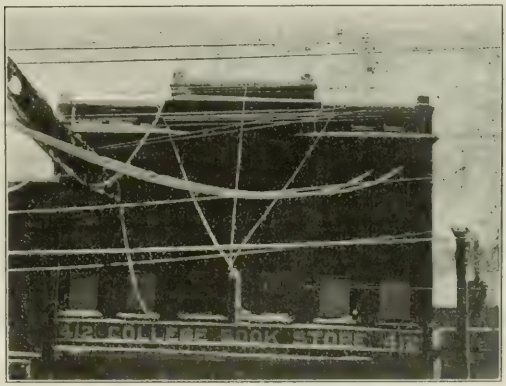


FIG. 4.—SNOW CLAD LINE WIRES.

tension transmission line, they will be equally valuable in the design of such lines. For although it is believed that high-tension wires will not allow of sleet and snow formation around them, it is nevertheless true for the grounded guard wire and for transmission lines of 11,000 volts and less, for which sleet formation has been recorded. Considering that the guard wire should be of low ohmic and inductive resistance in order to be effective—that is, either of copper, aluminum or eventually copper-clad steel wire; furthermore, that its cross-section will never be larger than that of the wires it has to protect, and finally, that its location highest above ground will expose it to the greatest wind pressure—it is obvious that full provision must be made to meet the severest conditions which are likely to arise, and the more so as, contrary to any other mechanical structure, the transmission wires are figured with hardly any factor of safety for the greatest assumed stress.

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MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Modern Salesmanship.

Mr. George Landis Wilson, of F. Cortez Wilson & Company, delivered the address after the weekly luncheon of the Electric Club of Chicago on March 17. His subject was "Goods and Selling," and he gave an instructive talk on the dignity of salesmanship. One of his points was that any salesman worthy of the name should be given the actual cost of the products that he offers for sale. Mr. Wilson said that the value of any salesman could be determined by computing the value of what he brings in minus the cost of the expenditures necessary to keep him going. He pointed out that service commands better prices than goods, and that the customer must be taught how to use the things he buys. The salesman should be consulted about the design and making of the things sold. Further, it must not be forgotten that both parties to the transaction of buying and selling must make money by it if business relations are to be permanent.

Electric Automobiles at Hartford.

Upward of 100 electric automobiles for pleasure service are in regular use in Hartford, Conn., the charging current being supplied by the Hartford Electric Light Company. On the company's circuits are 45 charging points in individual private stables or residential garages. These automobiles are largely used by ladies, and in many cases the owners do their own charging through mercury-arc rectifier outfits, the rate for energy being 4 cents per kw-hour. There are about a dozen commercial garages in Hartford, all equipped with charging facilities. The facilities for charging in the surrounding country are also good. Several commercial trucks are in service, including hotel vehicles, which can be charged while waiting between trips.

Chicago Conference on Electric Vehicles.

One indication of the renewed interest in electric vehicles on the part of manufacturers and central-station men is the announcement of an "Exide smoker," to be held in the rooms of the Western Society of Engineers, Chicago, on the evening of March 31. The meeting will be held under the auspices of the Electric Storage Battery Company, and Mr. Godfrey H. Atkin, manager of the Chicago office of that company, will preside. Mr. Bruce Ford, of Philadelphia, designing engineer for the company, will present a paper on "The Exide Battery—Its Care and Operation," illustrated by lantern slides. Following this there will be a paper on "The Relation of Central Stations to the Automobile Business," by Mr. E. W. Lloyd, general contract agent for the Commonwealth Edison Company, of Chicago. Several hundred invitations have been issued to this meeting, and all present are invited to join in a general discussion of this important subject. There are said to be about 3000 electric automobiles in Chicago alone, so it can be readily seen that the business is one of considerable importance. The electric vehicle has undoubtedly grown in popularity throughout the country, and companies furnishing electric power appreciate in an increasing degree the importance of this demand for their product, not only by reason of the actual current consumption, but by the improvement of the load factor.

In the case of the Chicago conference, the invitations have been sent to electric vehicle manufacturers, battery distributors, central-station men and superintendents of garages, and it is believed that an important and interesting conference will be the result. This is the first time that a conference of this character has been held in the West, although similar gatherings have been held in Boston and San Francisco.

Reduction in Rental Charge for Tungsten Clusters in Chicago.

The Commonwealth Edison Company, Chicago, has made a reduction in the rental charge for tungsten clusters put out on a meter basis. Hereafter the rental charge for a cluster consisting of four 60-watt tungsten lamps (including renewals) will be $1 a month where the cluster is used 90 hours or less in the month, with an additional rental charge of 6 cents a month per cluster for each additional 15 hours' use (or fraction) above the 90 hours. This is a reduction from $1.25 to 7½ cents, respectively. In addition to the rental charge, there is a meter charge for electricity used by the cluster. No change has been made in the meter rate, but it may be of interest to quote the exact language of the contract in relation to it:

"In addition to said rental charge, the consumer agrees to pay the company for electricity consumed, 13 cents per kw-hour for the consumption in each month up to and including an amount that would be equal to 30 hours' use of the consumer's maximum demand in such month, and 8 cents per kw-hour for the consumption in such month in excess of that amount, provided, that an abatement or reduction of one-half cent per kw-hour will be allowed the consumer for all the electricity consumed in each month hereunder, and provided further, that whenever any monthly bill shall be paid at the proper office or agency of the company within 10 days after its date, the consumer shall be entitled to a discount from such bill equal to one cent per kw-hour of the total consumption charged for therein. The electricity consumed shall be measured by a meter or meters to be owned and installed by the company. The maximum demand shall be ascertained by a maximum recording meter or meters, likewise owned and installed by the company, unless only one cluster is furnished hereunder, in which case the maximum demand for each month shall be taken to be 240 watts.

Maximum-Demand Rates at Aurora, Ill.

The Western United Gas & Electric Company, of Aurora, Ill., employs a system of readiness-to-serve or maximum-demand power rates which was worked out several years ago by Mr. H. L. Rice, manager. It is an unusual combination of the readiness-to-serve or Doherty rate, with a discount according to load factor.

This rate is made up of a maximum-demand or readiness-to-serve charge, and a kw-hour charge. No bill is rendered for less than $3, which constitutes the minimum monthly charge for power service. The maximum-demand or readiness-to-serve charge is a flat rate of $1 per horse-power of maximum demand or fraction thereof per month. The maximum demand or peak load of the consumer is determined from time to time as the company may see fit, or as the consumer may request. The kw-hour part of the rate is 4 cents, with the following discounts for different classes of consumers:

Class A.—Where the bill at 4 cents per kw-hour does not equal twice the maximum demand, there is no discount. *Class B.*—Where the bill at 4 cents per kw-hour is twice the maximum-demand charge or more, the discount is 0.5 cent per kw-hour. *Class C.*—Where the bill at 4 cents per kw-hour is four times the maximum demand, the discount is 1 cent per kw-hour. *Class D.*—Where the bill at 4 cents per kw-hour is six times the maximum-demand charge, the discount is 1.5 cents per kw-hour.

It will be seen from a study of these rates that the readiness-to-serve or maximum-demand charge is designed to pay the fixed operating and investment costs, which are proportionate to a consumer's maximum demand. The kw-hour charge is intended to cover the cost of operation. These costs being higher for a consumer with a good load factor using energy many hours per day than for a consumer with a poor load factor, the discount given on the kw-hour rate is made dependent on the ratio of the kw-hours to the maximum demand; or, in other words, is dependent upon the load factor.

One good point about this system, which recommends it to every central-station man who has to explain rates to the public, is that it is one which is comparatively easy to understand. It does not involve the use of the term "load factor" or any expression which cannot easily be explained to a consumer.

Boston Electric Vehicle Campaign.

The energetic manner in which the Boston Edison Company is co-operating in extending the electric vehicle business is indicated by the recent assignment of one of its staff, Mr. A. C. Gray, as special agent to devote his entire time to working among garage managers, automobile manufacturers and manufacturers' agents throughout the Boston territory. He will visit all of the garages, giving the managers and their employees such information as they need about charging outfits and the maintenance of electric vehicles. He will also inform them as to the cost for charging and give them all the information he can about the Edison company's facilities. It will be a part of Mr. Gray's work to see that present users of electric machines of all sorts know everything there is to know about the availability of charging stations, and he will also see that they are informed as to the feasibility of installing their own rectifiers

other apparatus. Much enthusiasm and real interest are loping in Boston and throughout New England over the ibilities of the electric vehicle.

he Edison Electric Illuminating Company, of Boston, has ntly placed on exhibit in the display windows of its main ding, on Boylston Street, an electric automobile, with charg- outfit and data bearing upon the cost of operation. The hine is a model "22 C" Studebaker electric stanhope phae- equipped with a 24-cell Exide battery. It is built with a 53- gage, 67-in. wheel base, 30-in. wheel diameter, and foot lever brakes on the rear axle and armature shaft. vehicle has clincher pneumatic tires, a single motor, volt- meter, side and tail lamps, tools and leather top, with mud- rds and cushions. Attached to the seat are two wax lay ires in full automobile costume, representing ladies enjoying



WINDOW ELECTRIC AUTOMOBILE DISPLAY IN BOSTON.

spin in the machine, and a realistic touch is given by an ad- acent 12-in. fan motor which blows the veils and artificial resses about in true sporting style.

Attached to the machine is a printed card giving the follow- ng data upon operating cost:

SIX MONTHS' RECORD

Operation—	
Total number of miles	[illegible]
Total number of charges	[illegible]
Average miles per charge	37.7
Operating Expenses	
Cost of current for charging battery (rate 7 cents per kw hour	$ [illegible]
Average cost per charge	0.6019
Average cost per mile	[illegible]
Maintenance	
Repairs (mechanical)	$10.15
Battery	6.00
Tires	[illegible]
Painting	24.40
Total gross operation and maintenance	130.72
Average gross expense per day	[illegible]
Average gross expense per mile	[illegible]

At one side of the machine are shown a standard General Electric charging panel and mercury arc rectifier set, with the usual instruments, circuit breakers, switches, fuses and rheostat equipment. An Exide battery, motor-driven tire pump and a Morse vapor-proof hand lamp are also shown. The exhibit has attracted widespread attention.

Central-Station Service at Albany, N. Y.

By William H. Stuart.

Albany, the capital of New York, and also the county seat of Albany County, has a population of about 100,000 inhabitants. Its electricity is furnished by the Albany Electric Illuminating Company, which has given an uninterrupted service for a quarter of a century.

The equipment of the plant consists of seven 550-hp, hand-fired Stirling boilers, two 1200-hp Knowlson & Kelly engines, one 1000-hp Allis engine, one 400-hp Greene engine and two 300-hp Harris engines. The electrical equipment comprises two 800-kw, 2300-volt Westinghouse alternators; one 300-kw, 2300-volt Westinghouse alternator; one 250-kw, 500-volt generator; two 200-kw, 500-volt generators; one General Electric machine and the other Walker, and nine 125-light Brush arc dynamos.

At present the company is purchasing considerable energy from the Hudson River Electric Power Company. About 8000 hp at 11,200 volts is delivered over two paper-insulated cables coming underground from North Albany. The steam-generating equipment is held in reserve and is brought into operation when the water-power fails. On a jack-shaft are two 550-kw synchronous motors which normally operate the arc machines. A Westinghouse 50-kw motor generator is used as an exciter. Off the main building a brick addition has been erected as a transformer station. Here are placed two sets of transformers. These are of the General Electric, hand-regulated, oil-insulated and water-cooled type rated at 40 cycles, 2000 kw. They step down from 11,200 volts, three-phase, to 2300 volts, two-phase, for the incandescent service. The motor load is fed from three 250-kw transformers.

The main switchboard is placed on a gallery and is made up of 11 panels. The high-tension panels have remote-control, hand-operated oil switches, and the busbar connections are in soapstone cells. On a separate board of 14 panels there are two panels for the three-phase, 2300-220-440-volt alternating-current motor service; two panels of white marble for the 2400-volt, two-phase incandescent service; two panels of black slate for the 500-volt rotary set; three panels for the 500-volt generators, and five feeder panels. The arc switchboard controls 14 circuits.

No. 1 buckwheat coal is used in the steam plants and is stored in a pile of about 1000 tons in a yard adjoining the station. From the coal pile a trolley is used to bring the coal to the boilers. The ashes are carted to the yard and building contractors take it away, using it for cinder concrete.

The lines are all overhead and the transformers used on the poles are rated at 25 kw and 50 kw. They are grouped where the business necessitates.

The company operates 850 Brush arc lamps at $98.50 per lamp per year. There are 70,000 16-cp lamps connected, and the motor load is about 4500 hp, of which 2500 hp is on the 500-volt service and the balance on the three-phase service. The largest single motor on the company's lines is rated at 125 hp and drives a 90-kw generator in the plant of the J. B. Lyons Company, where all the printing for the State is done. Electricity in this establishment, which was formerly supplied by an isolated plant, is brought into play wherever possible. All sorts of heating apparatus, glue-pots, presses, etc., are operated by it, besides 3200 16-cp lamps and several electric elevators.

The meter department is operated by three men, a chief and two assistants. When the meters are received they are tested and given a number. Along with this they are marked by numerals which designate the voltage, amperage and type of meter, two- or three-wire, and whether of the commutator or induction type. The meters are tested on the premises on receipt of complaint of high bills, etc. Once a year the meters undergo regular test and examination. The monthly readings are taken by the meter-department men. Most of the meters are of Westinghouse make.

The company maintains no showrooms or complaint department. The matter of display is left entirely to the contractors, and the company by its service and careful supervision of its officials has made a complaint department a thing of the past. The new-business work of the company has been in operation for almost five years. During the last three years the business has been tripled. The company employs one solicitor and at one time had an advertising campaign of follow-up letters, circulars, pamphlets, etc., but the results were not satisfactory and it was abandoned. The company is in active competition with the gas company, and it was found that to carry on the fight successfully, friendly relation with the contractors was neces-

sary. This was accomplished by having all construction work, the sale of lamps, fixtures, motors, etc., done by the contractors. The latter have prominently situated shops and stores, and employ solicitors to go after business. They advertise constantly and, in fact, do all the work of an up-to-date new-business department. A great amount of business has been brought to the company by this method. The company has been very liberal in all matters with the contractors and has helped them in every way possible. In four years 78 isolated plants have been supplanted by central-station service. The company advertises in the newspapers as a matter of policy, and on the backs of the bills are placed reminders, according to the season, of fans, heating and cooking appliances, etc.

The sign and window-lighting business nets the company many thousands a year. This business is on a flat rate and the lighting circuits are under the control of the company. The signs are furnished free under a two-year contract. The rate for a panel sign containing 24 4-cp lamps is $7.50 per month. The sign is lighted from dusk until 11 p. m. every night, when the lamps are switched out of circuit by one of the company's men. There are over 300 signs in use. Energy for lamps and heating devices ranges from 10 cents to 3 cents and for motors from 5 cents to 2 cents, according to the consumption.

Mr. A. A. Anderson, the general manager of the company, in speaking of the new-business methods and work in Albany, said that "from the very outset it was determined to do everything possible to give and maintain as perfect a service as possible, in the belief that this would be a potent factor. The service complaints are few and far between and when received are attended to with dispatch. That perfect service has fully justified itself is very apparent. There were in Albany a great many isolated plants and to-day all but one or two are discarded. By inducing contractors to get out and hustle for business we have secured very good outside aid in our work. It was at first rather slow getting contractors to co-operate along the lines that we planned, but it was not long before matters began to shape themselves, and to-day we have one of the best and most effective sets of contracting firms to be found anywhere. We help them in every way possible and do nothing in their line at all. Our increase in new business has been steady, and we owe it to our service and the good work of the contractors."

The personnel of the company is as follows: President, Mr. A. N. Brady; vice-president, Mr. R. C. Pruyn; secretary and treasurer, Mr. E. P. Gavit; general manager, Mr. A. A. Anderson; superintendent, Mr. T. Powers; chief engineer, Mr. J. D. Dennin.

INTERIOR WIRING AND ILLUMINATION

Montgomery (Ala.) City Sign.

Much interest was developed in Montgomery, Ala., in connection with a recent competition for a legend for a large sign to be erected in full view of railroad lines and having for its purpose to call attention to Montgomery as a hustling city. Numerous suggestions were received, and a committee of citizens having charge of the contest finally adopted one of two lines, "Montgomery—Your Opportunity," with the design of a key between, which will be flashed out at intervals. The letters will be 10 ft. high. The sign will be erected and maintained by the Montgomery Light & Power Company without expense to the city.

Decorative Illumination in Vienna.

The Vienna Municipal Tramways took an active part in the jubilee which was held in Vienna last December to celebrate the sixtieth anniversary of the accession to the throne of Emperor Francis Joseph I. Through the courtesy of Mr. L. Spangler, manager of the Vienna tramways system, a view given herewith of the illuminated train of cars which traver the lines of the company on the evening of Dec. 1 and also exterior view of the office building of the company, showing artistic arrangements of lamps. The train of cars was m

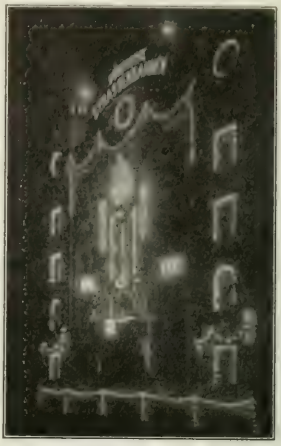


FIG. 1.—DECORATIVE LIGHTING OF OFFICE IN VIENNA.

up of two motor cars, one at each end, and a trail car betwe them. Each motor car was equipped with 575 10-cp lam arranged in circuits of five lamps each and the trail car w equipped with 750 lamps of the same size. To supply the add

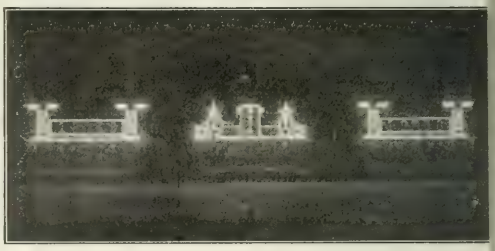


FIG. 2.—DECORATIVE LIGHTING OF A THREE-CAR TRAIN.

tional power required for these lamps while running on tl overhead system, a trailing contact was used. On the condu section of the line and auxiliary collector was also employe The car house light was effected by lamps of the same size

Tests of Indirect Illumination.

At the meeting of the Chicago section of the Illuminatin Engineering Society, March 11, Mr. J. R. Cravath presented paper entitled "Some Notes and Tests of Indirect Illumination This paper gave results of tests carried on under the supervisio of the author by Profs. J. E. Snow and E. H. Freeman, o Armour Institute of Technology, in two rooms of a residence employing a system of indirect lighting, using a central chande lier equipped with an inverted, silvered, corrugated concentrat ing mirror reflector pointed upward. This is the combinatio now being marketed under the name "I-Comfort System." Th tests were made using a tungsten lamp and measurements were taken 32 in. from the floor at regular intervals over the entir area of each room, so as to obtain the average illumination.

In one room with light ceiling and dark-green walls and rug which was about 15 ft. square and 9 ft. 9 in. high, the watt per square foot required to produce 1 foot-candle average illumi

lation (that is, the watts per lumen) were found to be 0.45. In another room, about 13 ft. square, with light-colored walls, the watts per lumen were found to be 0.35. A 100-watt tungsten lamp was employed in both these tests and all results were corrected to the rated candle-power and the wattage of the lamp. In the room with the dark walls 15 ft. square, the illumination varied from 1.9 foot-candles in the middle to 0.5 foot-candle in the corners. In the room with light walls, 13 ft. square, the illumination varied from 2.5 foot-candles in the middle to 1.2 foot-candles in the corner. The author compared the efficiency obtained in these tests with the tests made by Messrs. Lansingh and Rolph in a room 24 ft. x 11 ft., 10 ft. high, reported to the Illuminating Engineering Society convention, October, 1908. These latter tests were selected as being nearest to the conditions of the rooms tested by the author, although he uttered a word of caution as to accepting without reserve comparisons of this kind made in different rooms by different observers with different instruments. Lansingh and Rolph obtained 0.43 watt per lumen with a bare tungsten lamp at the ceiling in a room with dark walls and light ceiling, as against 0.45 obtained in a similar room with indirect lighting in the present tests. They also obtained 0.3 watt per lumen using the tungsten lamp with a bowl-type prismatic reflector, as it would most commonly be used. This would indicate that the indirect system under the conditions of this test caused a loss of about 33 per cent, as compared with the most efficient direct system employing a tungsten lamp with reflector. If no reflector were employed, but a diffusing globe absorbing 20 per cent, placed over the tungsten lamp, Lansingh and Rolph would probably have obtained 0.54 watt per lumen as against 0.45 with the lamp completely concealed, using the indirect system in the present test. In the room with light walls Lansingh and Rolph obtained a value of 0.23 watt per lumen using a bowl-type prismatic reflector with the lamp at the middle of the ceiling, as against 0.35 obtained in the present test with indirect lighting.

Commenting on the system of indirect lighting from central chandeliers in general, the author pointed out that when most of the light is first directed to the central part of the ceiling by a concentrating reflector, the illumination is very much like that obtained through a dense skylight. The shadows are about like those produced by diffused daylight coming through a skylight. He pointed out that there is considerable difference between indirect lighting of this kind, where most of the light is obtained by reflection from certain areas on the ceiling and the kind of indirect lighting which has frequently been adversely discussed in the *Transactions* of the Illuminating Engineering Society, where the walls were so very highly illuminated as to be annoying. In many cases where maximum economy is desired, a combination of direct and indirect lighting is best.

In office work the glare from highly sized papers is one of the most objectionable features of direct lighting, so that if there is a sufficiency of indirect lighting the results will be more comfortable than where there is a combination of the two. In conclusion he called attention to a mistake that is likely to be made in the use of indirect lighting from chandeliers; namely, that of not hanging the lamps and reflectors high enough. The higher the unit is hung, the greater the concentration of light beneath the fixture. If the fixture is hung low there is excessive waste of light on the walls, if the walls are dark and the room is high and narrow. Dirt always has been and always will be the greatest enemy of this type of equipment, especially in the downtown districts of large cities. Here the users must fully understand the importance of frequent cleaning and accept it as a part of the price of comfortable lighting.

In the discussion reference was made to the trial of the indirect chandelier method at a recent meeting of the Philadelphia section. The room was 26 ft. high and the lamps were hung low. The resultant inefficiency was only what might be expected for such conditions.

It was brought out that the system of indirect lighting from chandeliers has been tried many times in the past. That it has never before received the attention that is now being given to it in Chicago and vicinity is probably due to the inefficient lamps, inefficient reflectors and inefficient cleaning employed in the past. The tungsten lamp and a better knowledge of reflecting surfaces and illuminating engineering principles have brought about changed conditions.

Mr. Beebe reported that 100 bookkeepers had been working under this system in the gas offices in Chicago several months with satisfaction as regarded illumination. The ventilation of the reflector for the gas-mantle burner had given some trouble, but was being improved.

Mr. George H. Jones reported having used this system combined with a handsome table lamp in his living-room for some months. The effect was favorably commented on by many visitors. He preferred to use it with dark walls rather than with light-colored walls.

Mr. W. P. Clawsen reported several months' experience with the system in his home and spoke especially of the comfort obtained. Mr. A. D. Curtis said that several thousand inverted reflector units had been put in service the past five months.

The Intrinsic Brightness of Lighting Sources.

There is hardly any photometric quantity which has given rise to greater discussion and difference of opinion than that of "intrinsic brightness." Although it has been differently defined by different writers, it has been generally accepted as the ratio of luminous intensity of a bright surface, measured along the normal, to the area of that surface. This is the same kind of quantity as an illumination, except that an illumination is a quantity received by a surface, whereas an intrinsic brightness is a quantity emitted by a surface. An intrinsic brightness is thus essentially a sort of negative illumination. For this reason, an intrinsic brightness admits of being expressed in foot-candles, or in meter-hefners. It is usually expressed, however, in candles per square inch, or in hefners per square centimeter. For instance, if a luminous point-source of 1 cp—that is, one spherical candle—were supported at the center of a perfectly diffusing opal glass globe 1 ft. in radius, the illumination cast upon all parts of the interior wall of the globe would be 1 foot-candle. If there were no absorption of light in the opal glass of the globe, it is evident that the intrinsic brightness of the globe, as viewed from any point outside the globe, might be expressed as 1 foot-candle. But the globe would have an external surface area, neglecting wall thickness, of 4π sq. ft., or 1809 sq. in.; so that we might also conveniently describe the intrinsic brightness of the globe, still assuming no absorption in the glass, as 1/1809 candle per square inch.

It is a very remarkable fact that if we set up a camera facing a bright body, such as the sun or an enclosed arc lamp, the focused image of this bright body on the receiving plate of the camera will have the same brightness at all distances, assuming the same diaphragm and no absorption of light in the atmosphere by fog or smoke. That is, as we take the camera further back from the bright body, the focused image of the body becomes smaller, but the brightness of the image, or flux of incident light per unit of area in the image, remains constant. The sun's image would be as bright in a camera at the position of the planet Jupiter as in the same camera at the position of the earth, when the earth and Jupiter are in line, but the image of the sun would be larger when photographed at the earth than when photographed at Jupiter, always neglecting the absorption of light in transit, and assuming the same iris diaphragm. If we apply this proposition to the camera of the human eye as a particular case, the brightness of the image focused on the receiving plate, or retina, is the same at all distances from a luminous source, if the iris diaphragm is the same—that is, if the pupil of the eye retains the same diameter and area. If we stand close to an enclosed arc lamp, the image of the brilliantly lighted globe will cover a relatively large surface on the retina. When we move back from the arc lamp to a distance of, say, a couple of hundred feet, the image of the arc globe as focused on the retina will be much smaller, and

cover a much smaller area of the retina, but the image will be equally bright in the two cases, or the ratio of total light stimulus to area of retina exposed to the stimulus will be the same if the iris diaphragm aperture is the same. Consequently, for a given iris diaphragm opening, we do not diminish the intensity of the stimulus on the retina produced by a luminous source when we carry the source away from the eye. The stimulus on each particular visual unit, or rod and cone in the retina, remains sensibly unchanged. We only alter the area of the stimulus, or the number of rods and cones that are affected.

The physiological laws affecting the working of the camera in the eye has not yet been analyzed with sufficient precision to warrant a positive statement; but it seems likely that the eye automatically tries to protect the retina against excessive local stimulus at any point. It is reasonable to suppose that if the local intensity of stimulus on any individual unit of the nervous mechanism in the retina is excessive, there is danger of injury to that particular unit, no matter how small the stimulus may be on any or all of the other units. Consequently, it is reason able to suppose that the iris will be automatically constricted until the brightest object in the entire field of vision produces a local brightness of image, or local intensity of stimulus below the danger point. This view has recently received experimental support from the researches of Broca and Laporte. If the intrinsic brilliancy of a given luminous source is large, then when rays from that source are admitted to the retina, the intrinsic brilliancy of its image will be large and constant at all dis tances for a given iris aperture. The iris must tend to shut down, at any distance from that lamp until the local intensity or the brightness of the retinal image has reached a safe value.

Thus shutting down of the retina reduces the brightness of all other images in the field in like proportion, so that a printed page, or a diagram, in the field of view, will be seen very darkly, merely because somewhere on the retina a bright image has to be toned down to the safe local intensity. Obviously a much stronger illumination will be needed on the book or diagram in order to give a comfortable picture of it on the retina with the contracted iris. This artificially increased illumination may be quite unnecessary, and may represent much incidental waste of luminous power. On the other hand, if the arc lamp in the field of view were enclosed in a large opal diffusion globe, so as to reduce the intrinsic brightness of its light, the image of the lamp on the retina would be much larger, but it would also be much weaker in local intensity, and the iris would once more expand benignly. With the greater area of the pupil would come clearer seeing of all other objects, and a considerable reduction in foot-candles upon books or instruments might be comfortably permitted

A good paper on the subject of intrinsic brightness was presented by Mr. J. E. Woodwell at the recent Philadelphia convention of the Illuminating Engineering Society. The paper points out that it is commonly considered advisable to reduce the intrinsic brightness of lamps in full view to 4 or 5 cp per square inch, but the paper advocates that the reduction should be carried much further—that is, down to 0.2 or 0.1 cp per square inch. This requires either concealing the lamps from direct vision or enclosing them in suitably large translucent diffusing covers. In either case, there is a danger of losing some light by absorption, but the loss incurred in this way may be more than made up in the general reduction of illumination suitable for use with eyes that are not stopped down under the stimulus of bright, shining objects, to say nothing of the hygienic advantages.

It would therefore seem to be possible that as the wastefulness and cruelty of hanging bright, naked lights in front of concert-hall audiences come to be recognized, through the development of illuminating engineering, architects and owners of such halls may find themselves open to lawsuits either for injuries or for nuisance. Hitherto ignorance has protected bad illuminating engineering. Some day ignorance may be no excuse.

Letters to the Editors.

Valuation of Public-Utility Properties.

To the Editors of Electrical World:

Sirs:—I note that Mr. F. E. Haskell, in a letter printed in your issue of March 18, questions my position in regard to the proper method of valuing public-service plants for rate making. I am very glad, indeed, that he has done so, believing that the question should receive the fullest possible discussion, but I regret that nothing in Mr. Haskell's letter directly concerns the heart of the matter, which is whether proper returns are a function of present or reproductive value.

My position is that water furnished through mains, or electric current sent over wires, 50 years old, have—provided the service is unimpaired—the same value to the consumer as though the mains or wires were new. If Mr. Haskell supposes, from my letter, that I do not appreciate the necessity for adequate depreciation reserves, he is quite wrong. I do not, however, think that the proper position to take in the case of a company which, either from inability or any other cause, has failed to provide for replacements, is one which must cause its final bankruptcy. If a company pays dividends out of capital, its punishment will arrive when it becomes necessary to rebuild, for the expenditures for rebuilding will not increase reproductive value, and hence not add to the value for rate-making purposes. It is well known that most new ventures in the public-utility line have all they can do to get enough money to cover actual cash requirements during the early years of their operation, and, to take the position that a depreciation reserve which cannot be laid aside then, shall not be made up later, is certainly unfair and unjust. The section of the public-utility law of Wisconsin covering depreciation reads, in part, as follows, in the original bill: "Every public utility shall carry a proper and adequate depreciation reserve." Upon being shown that such a requirement would mean rates being extremely burdensome to the consumers in the case of new companies or companies operating under adverse conditions, the section was amended by adding to the above, "whenever the commission after investigation shall determine that such depreciation account can be reasonably required," thus giving to the commission the right to postpone such accumulations and order them made up later.

I do not know what Mr. Haskell tries to show in his hypothetical case, but he has not quite understood my argument. He says: "In this case, the cash balance can be invested and the plant investment will not be burdened with earning dividends on the entire capital stock." My idea was that the purchaser must set aside a sum which, *together with its interest accumulations,* would equal the sum needed for rebuilding, and with this correction Mr. Haskell's hypothetical case appears to support my argument.

The answer to the statement, "It would be interesting to know what this would yield the investor when the new plant had been built and the expense of double depreciation removed," is that at this time the rates could—and should—be reduced somewhat. But what has this to do with my assertion that unless the purchaser *did* charge for "double depreciation," he would not have funds on hand to rebuild his plant when the time arrived to do so?

Mr. Haskell appears to think that, in the case of two companies exactly alike in every respect, save that one has money in the bank, representing depreciation in physical assets, while the other has not, the former should get higher rates than the latter. By what process of reasoning can the value of the service furnished be made to fluctuate with the bank balance?

About a year ago, in helping to prepare a brief, I used the following language: "In valuing public-service plants a distinction must be made between their values to the community and to their owners. The value to the community of a plant will always be its reproductive value—that is, the cost of a plant of the same capacity and extent. The fact that age, while

n diminishing its serviceableness, does bring nearer the time w n it must be replaced, is one which concerns its owners o y."

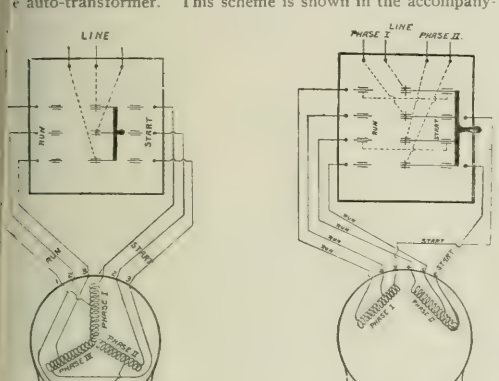
believe that the essence of the matter is contained in the s tement that the extent of the usefulness of a plant to the c mmunity is the proper measure of its rate-making value, and t s usefulness is clearly, in turn, to be measured by its repro- ctive value.

SUPERIOR, WIS. W. H. WINSLOW.

The Starting of Induction Motors.

To the Editors of Electrical World:

SIRS:—Referring to the recent articles in your paper on the arting of induction motors, by Messrs. Bailey, Hanssen, Haar d Steinmetz, I am surprised to note that all of these have mitted to mention a scheme for starting a squirrel-cage motor hich is better than the use of either the primary rheostat or e auto-transformer. This scheme is shown in the accompany-



FIGS. 1 AND 2.—SELF-CONTAINED AUTO-TRANSFORMER ARRANGEMENT FOR THREE-PHASE AND TWO PHASE MOTORS.

ing illustrations. Extra turns for starting are wound into the primary slots in the same manner and distribution as are the running coils. The machine has two sets of terminals: one set is for starting and the other for running. A double-throw oil switch connects to one or the other. The number of turns in the starting coils can be selected to suit the motor, and the starting current and torque are under control.

When connected to the starting terminals the machine exerts from 1.25 to 1.75 times full-load torque, and it will carry full load with usually about 15 per cent slip; on the running terminals the slip will be from 2.5 to 4 per cent, according to the size.

In performance this method is not materially better than an auto-transformer, but it does away with the auto-transformer losses and leakage; it is in fact the same as an auto-transformer with no core loss, no leakage, and very small copper loss, for the starting coils are wound with the same size of wire as are the running coils, and hence their resistance is low. The Richmond Electric Company has been applying this method for some years, and thousands of machines using the scheme have been built. The machine is complete in itself with no auxiliary apparatus except a standard double-throw switch.

As to expense, it adds about 40 per cent to the primary copper, about 25 per cent to the depth of the tooth, and about 1½ per cent to the stator diameter. It is cheaper than an equivalent auto-transformer.

RICHMOND, VA. E. J. WILLIS

To the Editors of Electrical World:

SIRS:—There are two numerical errors in my article which appeared in your issue for March 11. In the third paragraph on page 633, the statement "from 1.5 to 2.0 times that of the starting torque" should read "two times the starting torque." In the fourth paragraph from the bottom of the first column on page 634 the value of the line current when the transformer-starter is used should be 1.5 instead of 5 times the full-load value.

RICHMOND, VA. E. J. WILLIS

Reduction of Cable Rates.

To the Editors of Electrical World:

SIRS:—I notice in your issue for March 11, page 616, an item on reduction of cable rates in which you quote a newspaper interview with Mr. Thalberg. According to the arithmetic by which we are educated in this country, 300,000,000 words at 2 cents per word would amount to $6,000,000, and 25,000,000 words at 25 cents per word would amount to $6,125,000. I cannot, therefore, understand Mr. Thalberg's contention that the cable companies would make more money on $125,000 less revenue while at the same time they are obliged to furnish a staff for 12 times the amount of work. I only mention this as you do not appear to have commented on the fallacy of the argument.

MONTREAL, CANADA. W. J. CAMP.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Stray Flux.—M. SCHENKEL.—To determine the stray flux in an induction motor the rotor is removed from the stator, and

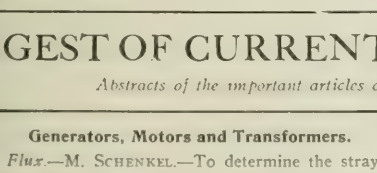


FIG. 1.—UNIPOLAR DYNAMO.

each member is supplied with normal current independent of the other. By measuring voltage and power, the inductive component of the voltage is found, and from this it is possible to determine the stray flux of the whole motor. This method may therefore be used as a check upon the short-circuit test.—*Elek. und Masch.* (Vienna). Feb. 28.

Unipolar Dynamo.—A note on a unipolar dynamo of F. Gahlish intended for higher voltages. The stationary armature is split up into a number of axial parallel conducting strips, which are connected together in series and parallel groups, as shown in Fig. 1. The magnet pole acts upon groups of short-circuited windings which lie in two armature rings axially connected by bridges of magnetic material. *F* represents pockets of stampings forming the poles; *C* and *D* are the laminated rings; *a*, *b*, *c* and *d* are the copper bars or segments.—Lond. *Elec. Engineer*, Feb. 19.

Lamps and Lighting.

Sixteen Candle-Power Tungsten Lamps.—The German Welsbach Company has placed a 16-cp, 130-volt Osram lamp on the market. The lamp consumes 18 watts, or 1.12 watts per hefner

candle (approximately 1.3 watts per British candle). It is supplied for parallel running at the price of 50 cents, and in small quantities for series running at an extra charge of 6 cents per lamp. Supports for the filaments are provided at the ends of the loops, and the lamp can be used in any position. The normal lamp is pear-shaped, but spherical globes can be obtained at an extra cost. In the first week in February some of the Osram lamps previously put on the market were considerably reduced in price in Germany, thus the 40-cp and 50-cp, 200-volt to 250-volt lamps, which originally cost $1.25 apiece, are now listed at 87 cents. A reduction in the price of the 100-cp, 100-volt to 130-volt and 200-volt to 250-volt lamps to $1.12 was also made. The Wolfram Lampen Akt. Ges., of Augsburg, has also put a 16-cp, 100-volt to 130-volt tungsten lamp on the market. This lamp is also listed at 50 cents, an extra charge of 7 cents being made for spherical bulbs. Lamps for series running are listed at 6 cents extra. The consumption is stated to be about 1 watt per hefner candle. Other German and Dutch metallic-filament manufacturers have also reduced the price of their lamps. The Zirkon-Glühlampenwerk, Dr. Hollefreund & Company, are advertising a new lamp, the "double Z-lamp," with a consumption of 0.7 watt per hefner candle. A saving of 30 per cent in comparison with Osram and other metal-filament lamps, and 80 per cent in comparison with carbon-filament lamps is claimed, but the effect on the life of the filament of running at the high efficiency is not stated.—Lond. *Elec. Eng'ing,* March 4.

Tungsten-Zirconium Filament.—A note on a recent British patent (10,590, 1908; Feb. 25, 1909) of the British Thomson-Houston Company (General Electric Company of this country). Zirconium oxalate is used as a binder for forming a filament from powdered tungsten. As zirconium oxalate is gelatinous, no further binder is required. On heating to a high temperature, the filament sinters into a homogeneous body of tungsten and zirconium oxide, and has a high specific resistance—Lond *Elec. Eng'ing,* March 4.

Enclosed Flame-Arc Lamp.—A note on a recent British patent of A. D. Jones (4977, 1908; Feb. 25, 1909). In order to enable impregnated electrodes to be used in an enclosed arc lamp, means for preventing the deposit of the ash on the glass globe must be provided. According to the present invention the globe is composed of two parts, an upper metal cap provided with external corrugations to keep cool, and a lower, transparent part maintained hot by means of an outer glass globe and an insulating air space. A rapid circulation of the fumes past the arc without local eddy currents is produced, and a white reflecting deposit forms on the cold upper metal cap, while the lower, transparent part of the globe is kept hot and clear. The globe is so shaped that a single vortex ring sweeps the whole inner surface, and it can be adapted for either vertical or converging electrodes. Not only are the burning-hours of the electrodes increased owing to the slower combustion by enclosing the arc, but the cost of electrodes should be considerably reduced.—Lond. *Elec. Eng'ing,* March 4.

Discharge of Electricity from Glowing Carbon.—J. A. Pollock and A. B. B. Rancland.—An account of experiments which were undertaken in connection with an investigation of the phenomena associated with the re-ignition of the carbon arc. For the object in view, an arrangement was required in which carbon rods should be situated somewhat as they are in an arc lamp, and in which the temperature of one of the rods could be readily controlled. The plan adopted was as follows: A cylinder of carbon, 4.5 cm long and 0.5 cm in diameter, was electrically heated, and a circuit was arranged to include an air-gap, of a few millimetres, between the middle point of the heated cylinder and the end of a comparatively cool carbon rod. The currents in the circuit were measured at different temperatures of the carbon cylinder—from 1100 deg. to 1800 deg. C.—and for various voltages across the air-gap up to the point at which an arc forms, with a view to finding the conditions under which the change from the non-luminous to the luminous discharge occurs in the case of hot carbon in air at atmospheric pressure. If I is the current of negative ions, E the potential gradient at the anode surface, and l the length of the last free run of the ions at the end of which they reach the anode surface, it is suggested that arcing commences when lEl attains a value sufficient to raise a part of the anode surface to such a temperature that positive ions are somewhat freely emitted.—*Phil. Mag.,* March.

Electron Theory of Carbon Arc.—J. A. Pollock.—The author shows that the application, to the case of the arc, of the idea of the projection of electrons from the surface of incandescent carbon leads to results as to the distribution of the potential between the carbons, in close agreement with the experimental facts discovered by Duddell.—*Phil. Mag.,* March.

Metallic-Filament Lamps for Isolated Plants.—To supply energy to a certain number of metallic-filament lamps the generating capacity of an isolated plant and hence interest and amortization are much less than with carbon lamps giving the same illumination. On the other hand, the renewal of lamps is more expensive. Nevertheless, it is shown in a table that even for isolated plants of comparatively smaller size the use of metallic-filament lamps becomes economical. This is even true for a relatively short number of hours of burning per year per lamp installed. The case of supplying lamps with energy from a storage-battery substation is somewhat similar. In the latter case it is recommended always to figure out first whether it would pay to replace the carbon lamps by metallic-filament lamps.—*Elek. Anz.,* March 4.

Hand Lamps.—W. Vogel.—The first part of an illustrated description of different forms of portable electric hand lamps for industrial purposes.—*Elek. Zeit.,* March 4.

Generation, Transmission and Distribution.

Indian Water-Power Development.—W. T. Taylor.—An illustrated description of the Jhelum River power development near Srinagar, India. The works are intended for a capacity of 20,000 hp at Mohora, but only 5300 hp will be utilized at present. The generating plant comprises four units, each of 1000 kw. Three-phase currents are generated at 3200 volts. For transmission the voltage is raised to 60,000. The article is to be concluded.—Lond. *Elec. Rev.,* March 5.

Regulating the Speed of Induction Motors.—C. Kraemer.—A translation of his recent German paper, in which he described a method for regulating the speed of induction motors whereby power corresponding to the slip is taken from the rotor and supplied again to the axis of the non-synchronous machine as mechanical power by means of auxiliary machines. The cost, advantages and disadvantages compared with other systems are discussed, and it is shown that the new arrangement is especially suitable for use in conjunction with rolling-mill motors and Ilgner sets.—Lond. *Electrician,* March 5.

Smoke Abatement.—A note on the opening of the smoke abatement exhibition now being held in Sheffield. Sir Oliver Lodge, in declaring the exhibition open, said that the ideal system of heating is a combination of the open-fire method and pipes, open fires in the rooms and pipes heating the passages. He depreciated, however, our present open coal fires. A better method is to separate the coke and gas, and in houses to burn gas only. He thought that before long gas will be used in large quantities for heating and cooking purposes, and electricity would be depended on more for lighting. He hopes that at an early date some town will try the experiment of having the gas made at the pit's mouth, where coal is cheap, bringing it to the consumers in pipes and forbidding the importation of crude coal into the town. He also mentioned, however, that a smoky flame is sometimes more efficient than a smokeless flame, as when water must be heated or where it is necessary to heat a cold surface by means of a flame. A possible remedy for the drawbacks of the present system might be the use of studs or projections on boiler plates, so that these studs could get red hot in the flame and carry the heat in by conduction. A kettle with a thick bottom which could get red hot would be more efficient than one of the ordinary kind.—Lond. *Electrician,* March 5.

Cleaning of Boiler Flues.—A note on the use of the vacuum-cleaning process for the removal of dirt in flues, etc., of large

tteries of boilers. The equipment required for the purpose cludes a special pattern of two-cylinder vacuum pump, which n be driven off existing shafting, and runs at 180 r.p.m. his pump can be placed at any distance up to 1,000 ft. om the boiler. Near the pump are placed a pair of vertical ssels acting as dust filters connected to the piping leading om the boilers. These filters are usually placed outside the ilding, under a roof, and sufficiently high to allow a cart stand underneath, for the reception of the dirt, of which ch filter when full holds about a cartload. The gun-metal eaning nozzles are attached to flexible hosepipes connected special fittings near the boilers and economizers, and 1.5-in. iping is used throughout. The standard size of equipment is apable of dealing with one ton of dust per hour, and with he two filter vessels no interruption is required for removal f the contents, as one can be filled while the other is being mptied. The system has been in use for two years at a large orks in Bradford, and it is stated that one of the sections of he economizer containing 400 pipes can be cleaned out by wo men in three hours, during which period about four cart-oads of dust are usually removed. Previous to the installa-ion of this equipment the cleaning of the economizer re-uired the work of three men for about ten hours.—Lond. *Elec. Eng'ing*, March 4.

Traction.

Single-Phase Traction in Sweden.—A long abstract of a report prepared by R. Dahlander on electric traction on the Swedish State Railways. The report deals fully with the power-house, line and locomotive equipment, and with the difficulties encountered and with the ways in which they were overcome. In his conclusions Mr. Dahlander shows that the high voltages used during these tests are quite adaptable to ordinary working, that the effect of high-tension currents on telegraph and telephone lines can be reduced to a minimum, that the single-phase motor is now a reliable machine, and that 25 cycles is the best frequency to use. For Sweden, he considers, single-phase electric traction is the best system.—Lond. *Electrician*, March 5.

Installations, Systems and Appliances.

Electric Installation of a Department Store.—An illustrated description of the electric equipment of a department store in London. All of the cables and wires used are placed in solid-drawn, heavy-gage steel tubing, which in the case of the ground floor and all floors above, is concealed beneath the flooring. A very complete system of "earthing" has been provided. Energy is brought from a central station. The supply is on the direct-current, three-wire system, the pressure being 480 volts across the outers. This voltage is in most cases used for motors, 240 volts being the e.m.f. for the lamps. There are 6000 incandescent lamps—carbon, tantalum and osram—and 286 arc lamps. A very comprehensive system of electric clocks has been installed. This system is worked from one master-clock fixed in the telephone-room, and consists of 19 dials situated on the different floors and in the offices throughout the building. An impulse from the master-clock actuates the dependent mechanism in the other clocks every half-minute. The necessary impulse to keep the controlling pendulum swinging is imparted by a falling lever when the pendulum is passing through zero. This is the time when it has the least disturbing influence, and in order that the impulse shall not be a severe blow, the impulse pallet on the pendulum is so shaped that the impulse begins gently and increases to its maximum at zero, it then decreases in like ratio. In connection with these clocks a system of signaling is used containing a number of bells which can be connected in circuit at any desired time.—Lond. *Electrician*, March 5.

High-Tension Switchboard.—An illustrated description of a form of high-tension switchgear of German make, in which the oil switches, etc., can be withdrawn complete for inspection on wheeled carriages. The arrangement is particularly suitable for mining distribution boards, and for other conditions where the space is limited.—Lond. *Elec. Eng'ing*, March 4.

Electric Ignition.—J. Lorwy.—The conclusion of his long illustrated article, describing different systems of electric ignition for gas engines.—*Elek. Zeit.*, March 4.

Automatic Control Apparatus.—H. B. White.—An illustrated description of automatic control apparatus in connection with electric operation of steel mills. They are chiefly of three types: time-limit control; counter-e.m.f. control, and current-limit control. Each one of these systems has its special advantages. The author describes control equipments for 2000 hp and 6000 hp, 6600-volt induction motors for the Indiana Steel Company's rail mills at Gary.—*Gen. Elec. Rev.*, March.

Free Oscillations in Long Lines.—I. Doery.—The conclusion of his mathematical paper. The author discusses the use of condensers as protection against dangerously high voltages. It is shown that a condenser is not only practically almost useless for this purpose, but also has direct disadvantages. The discussion of the problem is based on a mechanical analogy.—*Elek. und Masch.* (Vienna), Feb. 7.

Wires, Wiring and Conduits.

Armoring for Trailing Cables.—A note on a recent British patent (15,641, 1908, Feb. 18, 1909), of the British Insulated & Helsby Cables, Limited, and F. A. Cole. When trailing cables used in connection with portable machinery or for temporary work are protected with an armoring of round steel wire wound spirally, kinking readily occurs, because the wire covering is easily displaced. According to the present invention it is proposed to cover such cables with steel tape or strip wound spirally, the turns being spaced slightly apart. For example, a cable 1 in. in diameter would be wound with strip measuring ¼ in. wide by 1/3 in. thick, and a space of 1/16 in. wide would be left between adjacent turns. A cable armored in this way cannot be bent beyond a certain limit, because the square faces of the strip bear against one another.—Lond. *Elec. Eng'ing*, Feb. 25.

Electrophysics and Magnetism.

Positive Ions from Hot Platinum.—F. C. Brown.—An account of an investigation into the magnitude and the mode of distribution of the kinetic energy of the positive ions emitted by hot platinum. The experimental research of the author shows a close agreement between the value of the kinetic energy and that required for thermal equilibrium. This would appear to militate against the somewhat prevalent idea that the positive ions arise from chemical action. In that case one would expect the kinetic energy of the emitted ions to be increased by the heat of reaction. The small value of e/m recently obtained for the positive ions—384 for platinum—by Richardson, indicates that they are not positive electrons. The balance of evidence appears to be in favor of the view that they are atoms or molecules of some foreign substance emitted from the metal by a process similar to evaporation and involving small thermal changes. The matter can hardly be regarded as definitely settled.—*Phil. Mag.*, March.

Absorption of Radioactive Emanations by Charcoal.—R. W. Boyle.—An account of an experimental investigation of the absorption of thorium emanation by means of charcoal under different conditions. The absorption depends on the nature of the charcoal used, being greatest for cocoanut, intermediate for animal, and least for wood charcoal. It is decreased by increasing the velocity of the gas current which conducts the emanation through the charcoal. It is increased by increasing the charcoal absorbing surface; it depends on the temperature, following the law for ordinary gases, namely, that a lowering of the temperature of the charcoal causes an increase, and a raising of the temperature a decrease, in the amount of absorption.—*Phil. Mag.*, March.

Diffusion of Thorium Emanation.—S. R. [illegible]
An account of an experimental investigation. The diffusion of actinium emanation in gases, such as air, hydrogen, carbon-dioxide, sulphur-dioxide, and argon, shows no considerable deviations from the ordinary laws of diffusion. The variation with pressure of the coefficients of diffusion of the actinium and thorium emanations appears to be quite regular down to pressures of a few centimeters. A comparison of the diffu-

sion coefficients of the actinium and thorium emanation in air under similar experimental conditions give the ratio of their molecular weights as 1.42, that of thorium being the heavier.—*Phil. Mag.*, March.

Secondary Gamma Radiation. J. P. V. Madsen.—An account of an extended experimental investigation into the properties and nature of secondary gamma radiations.—*Phil. Mag.*, March.

Electrochemistry and Batteries.

Determining the Condition of a Storage Battery.—To determine the condition of discharge of a storage battery, a voltmeter is generally used, and one is satisfied if this shows about 2 volts per cell on open circuit. However, such a measurement is not exact, since the real condition of the battery is better indicated by the voltage at its terminals while being discharged at normal current. To make such a test a resistor of proper resistance may be connected in parallel with the battery and the voltmeter. Fig. 2 shows an instrument which combines the voltmeter and the resistor in one apparatus. The resistance of the voltmeter is so chosen that the battery, while being tested at normal voltage, is being discharged with normal current. For two-cell batteries, its scale is from 3 volts to 5 volts. The instrument is intended only for instantaneous measurements, as otherwise it would get unduly hot.—*Elek. Zeit.*, March 4.

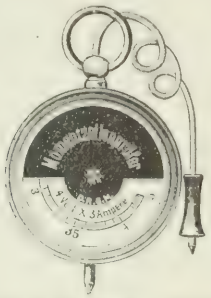


FIG. 2.—VOLTMETER FOR TESTING STORAGE BATTERIES.

Ferrosilicon.—E. Escard.—The first part of an article on ferrosilicon. In the present installment the author deals with the compounds $Si\ Fe_2$, $Si_2\ Fe_3$, $Si\ Fe$, $Si_2\ Fe$ and $Si_3\ Fe$.—*La Lumière Elec.*, March 6.

Units, Measurements and Instruments.

Measuring Small Inductances.—C. J. Watson.—When experimenting with very rapid electric oscillations it becomes necessary to measure very small inductances. A simple arrangement of doing this is illustrated in Fig. 3, which shows a kind of Wheatstone bridge, in which two inductances are balanced against two capacities, a vacuum tube being used instead of a galvanometer to indicate the equilibrium. The bridge is fed at two opposite points by the oscillating potentials of the outsides of two Leyden jars, K_3 and K_4, of which the insides are connected to an induction coil capable of giving a 2-in. spark. In order to measure the unknown inductance L_1, a pair of bare copper wires, L_2, is stretched as far as space will admit and maintained at a uniform distance, while a movable bridge allows more or less of them to be brought into action. The inductance of the latter can be calculated. It is advantageous to prepare a number of inductors of calibrated variable inductances in the form of coils containing different numbers of turns. When each of these is alternately put in L_2, and the induction coil is set in action, the vacuum tube will usually become luminous, but on sliding the movable bridge there will be found a space limited to a few centimeters, which will cause nearly the total extinction of the tube, and the middle of this may be taken as the correct position. Having thus obtained inductors of calibrated variable inductances, the parallel wires L_2, may advantageously be dispensed with, and the graduated coils used in their place, because the observer is thus enabled to remain close to the inductance bridge. Some interesting experiments can be made with this apparatus. Thus, an inductance of 6600 cm in series, with a capacity of 908 mf, was balanced by an inductance of 2720 cm; but when a capacity was placed in parallel with an inductance, the value of the latter was increased. This, which seems at first sight paradoxical, follows from the fact of the resistances being negligible with very rapid oscillations.—Lond. *Electrician*, March 5.

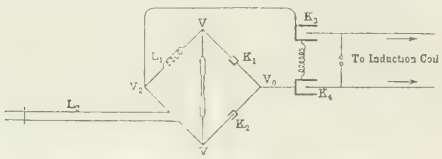


FIG. 3.—MEASURING SMALL INDUCTANCES.

Potentiometer on Alternating Current.—C. V. Drysdale.—His full British Physical Society paper on the use of the potentiometer in alternating-current circuits. An abstract of this paper has already been noticed in the Digest.—*Phil. Mag.*, March.

Direct-Current Amp-Hour Meters.—J. Busch.—Amp-hour meters which contain a motor running in the field of a permanent magnet and are in parallel with a shunt in the main line have many advantages. The author has found that they are susceptible to errors due to mercury vapors. While mercury vapor is seldom encountered under ordinary conditions of practice, errors of this kind may occasionally occur in laboratories, testing plants, etc. Mr. Busch recites one case in which amp-hour meters of the above kind were repaired simultaneously with other meters having a mercury filling; it was then found that the first meters showed irregularities and a special investigation proved that these were due to mercury vapor in the atmosphere. The source of the trouble is at the contact between brushes and commutator; when this contact is attacked by mercury vapor the meters are retarded and the retardation increases with decreasing load.—*Elek. Zeit.*, Feb. 25.

Telegraphy, Telephony and Signals.

Telephone Exchange.—H. S. Plymen.—An illustrated description of the Midland telephone exchange in Birmingham. Details are given of an improved method of party-line working. Associated with each party line are two multiple jacks, but only one answering jack and calling lamp. The answering jack and one of the multiple jacks are cross-connected at the intermediate and main distributing frames in the usual manner; the second multiple jack is cross-connected to the answering jack at the intermediate frame, but the *A* and *B* wires of the jumper are reversed at the horizontal side. This method of cross-connecting is shown in Fig. 4; it will be seen that an operator on one multiple jack rings over the *A* side of the line, and on the other multiple jack over the *B* side, in each case ringing the subscriber or subscribers on the one side only.

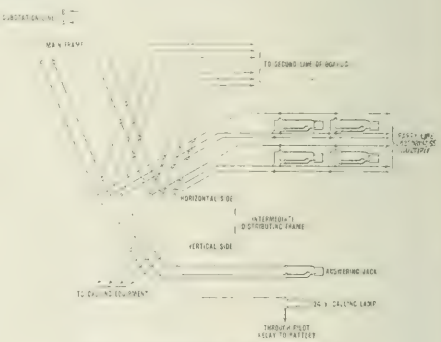


FIG. 4.—DIAGRAM OF CONNECTIONS.

The two subscribers on a two party line will thus have two distinct numbers, which may or may not be consecutive.—*Lond. Elec. Eng'ing*, March 4.

Automatic Telephone Exchange.—Kruckow.—The conclusion of his illustrated description of the automatic telephone exchange of Hildesheim, using the Strowger system. This is the first automatic telephone exchange in Germany.—*Elek. Zeit.*, March 4.

Automatic Telephony.—W. L. Campbell.—A Franklin Institute paper, describing the Strowger system of automatic telephone exchanges.—*Jour. of Franklin Inst.*, March.

Electric Clocks.—W. Krejza.—A review of the different types of electric clocks now on the market.—*Elek. und Masch.* (Vienna), Feb. 28.

BOOK REVIEW.

Elektro-Engenieur Kalender, 1909. Edited by Arthur H. Hirsch and Franz Wilking. Berlin: Oscar Coblentz. 324 pages. Price, 2.50 marks.

The ninth year of this useful little handbook maintains its character of previous years, the editors so selecting and condensing the contents as to keep the volume to a size actually to that for a pocket. The book is intended particularly for the working electrician, and the matter is, therefore, confined to practical information. The usual pair of blank memorandum books for loose insertion within the covers come with the book, and one of the two pockets in the flap cover contains an envelope enclosing commercial samples of drawing, tracing and cross-section paper.

NEW APPARATUS AND APPLIANCES

Insulating Transformer for Telephone Lines.

An insulating transformer for use on telephone lines has recently been placed on the market by the General Electric Company, the purpose of which is two-fold: First, to safeguard the users of telephones from the dangers of high voltages due either to induction or accidental contact between telephone and power lines, where these lines are on the same pole or upon a parallel adjacent line of poles; and second, to improve the telephone service by removal of the ordinary small ground-gap carbon arrester from direct connection with the line, as well as improvement through better insulation by removing the interior wiring, instrument, batteries, etc., from direct connection with the line.

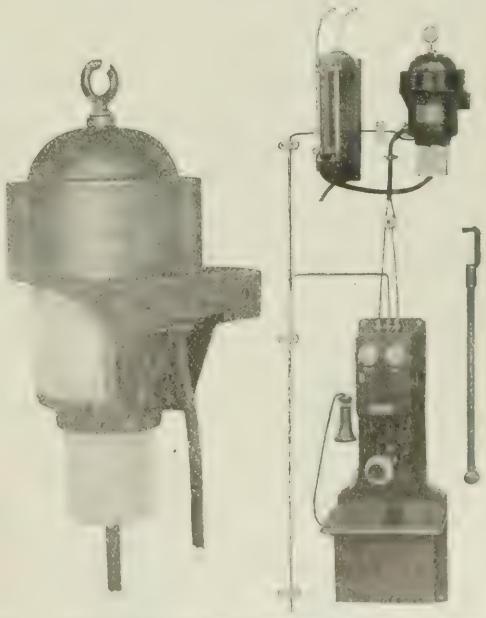
Special attention has been given to the electrical and mechanical design of the transformer; the high-frequency talking currents are transformed with small loss, while at the same time the magnetizing current, which must be supplied by the ringing generator, is very small. Tests show that the magnetizing current taken by this transformer is about half the current passed by a standard 1000-ohm bell. As can be seen from Fig. 1, the insulating transformer is assembled in a weatherproof iron case and may, if desired, be installed out of doors and mounted in any convenient place.

In designing this transformer the insulation has been considered of primary importance. A high-potential test between windings of 25,000 volts for one minute is given to each transformer before shipment. The high insulating quality assured by this test makes the transformer a sturdy piece of apparatus under ordinary conditions of operation, but the best protection is afforded when it is installed with a combined switch, fuse and lightning-arrester. This combination affords the greatest safety to both the telephone instruments and the user, even in the most extreme cases when the telephone lines come in actual contact with a high-tension power circuit.

The switch, fuse and lightning-arrester combination recommended for this service is shown at the top of Fig. 2, the whole being mounted on a base of insulating material. The long-handled insulated hook at the right of the illustration is used to pull the switch open when it is desired to disconnect the telephone and transformer from the line. The arrester is hinged at the bottom, the insulated hook engaging with a ring at the top of the arrester. The usual form of carbon arrester with mica separation is used to protect the winding of the transformer against any abnormal difference of potential which might accidentally exist between the telephone lines. This arrester is connected across the terminals of the transformer, but is not connected with the ground.

An adjustable gap-arrester is connected between the telephone lines and ground, the function of this arrester being to take care of lightning discharges, and in case of actual contact with high-tension lines, to arc over and blow the fuse, thus disconnecting the transformer and telephones from the line. Should a ground occur on the adjacent high-tension line, the voltage induced on the telephone line will not materially interfere with the service, provided the line is sufficiently well insulated. The adjustable air-gap is set just beyond the point where this induced voltage will arc across.

Tests on a 30,000-volt transmission line in actual operation

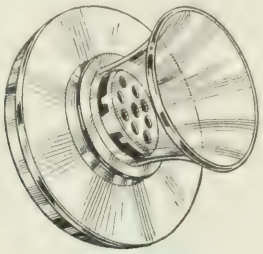


FIGS. 1 AND 2.—INSULATING TRANSFORMER AND ITS APPLICATION.

showed that a ground on one phase of the [illegible] induced a potential on the telephone line of approximately 7000 volts, measured between telephone line and earth. Notwithstanding this high-induced voltage on the telephone line it was possible to use the telephone when the transformer was installed. The line was somewhat noisier than under normal conditions, but not so noisy as to prevent satisfactory conversation.

Telephone Mouthpiece of Glass.

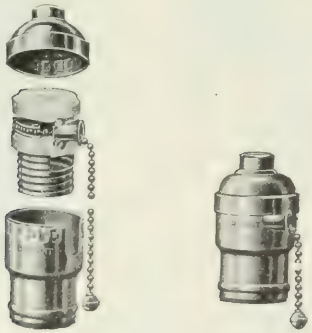
Glass mouthpieces are coming into use on telephone transmitters because they can be readily removed and cleaned or boiled if necessary to kill disease germs. The illustration shows a new glass mouthpiece invented by Mr. M. M. Wood and manufactured by the Commercial Appliance Company, 135 Adams Street, Chicago. The device is made in two parts—a metal base containing a perforated cap and the glass mouthpiece proper. Metal tongues on the base are adapted to engage the thread of transmitter openings of various sizes. By this means the base is screwed onto the transmitter after the ordinary hard-rubber mouthpiece has been detached. The glass mouthpiece is simply snapped onto the metal parts by pressure and can be removed in an instant. It is less liable to breakage than the hard-rubber mouthpiece and is said to have better "talking qualities."



GLASS TELEPHONE MOUTHPIECE.

Pull Socket for Standard Incandescent Lamps.

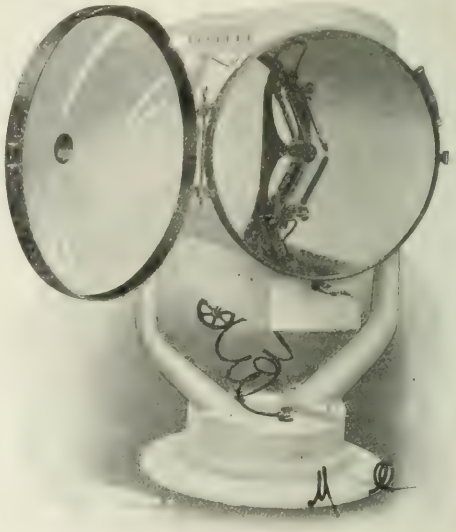
Two objections to the ordinary chain-pull sockets have been the difficulty in attaching the shell and cap when installing the socket in a husk, and the time required to wire the socket because of the necessity for removing and replacing the pull chain. The Bryant Electric Company, of Bridgeport, Conn., has brought out a socket which is said to meet the approval of the Underwriters and which can be quickly placed in a husk and also allows the pull chain to be installed at any desired point in it. By mounting the chain guide on the socket mechanism instead of on the shell it is possible to install the socket without removing the chain. These results have been obtained without disfiguring the symmetry of the socket. The switching mechanism is of the quick make-and-break type and the screw for regulating the tension of the spring used in pulling back the chain is easily accessible. This will doubtless be found convenient when it becomes necessary to substitute a chain of different length. The tension may be varied without removing the screw from its seat by simply turning it with a screw driver to the desired position, where it is automatically held. The "New Wrinkle" socket combines the elements of strength, durability, neatness, etc., which characterize the company's output.



FIGS. 1 AND 2.—PULL SOCKETS.

Alternating-Current Searchlight.

Commercially, an alternating-current searchlight has generally been considered impractical. The Carlisle & Finch Company of Cincinnati, Ohio, has spent considerable time experimenting on the problem and has succeeded in making lamps which will burn on 60 cycles. The secret of the success is said to be due to the position of the carbons. Referring to the illustration showing the reflector swung back, it will be noticed that the carbons, instead of being horizontal or vertical, are placed at an angle of 90 deg. with each other and at an angle of 45 deg. with the axis of the reflector. The carbons are fed by means of right-and-left screws which are caused to rotate at the same speed by a pair of bevel gears. Motion is imparted to the screws by means of a laminated shunt magnet, which operates a pawl-and-ratchet movement. A starting magnet separates the carbons when the lamp is switched into circuit, and after the lamp has burned long enough to have a difference of potential across the arc of 50 volts the current which passes through the shunt magnet begins to operate the pawl-and-ratchet feed and the carbons are thereafter gradually fed together as fast as they are consumed. A peep-sight is placed directly in the center of the reflector so that the arc may be observed. The ray of light thrown by the lamp, while not as concentrated or as penetrating as that from a direct-current lamp, is yet quite satisfactory and will carry from one-half to three-fourths of a mile. The light itself can be seen for many miles, but the effective range at which objects can be distinguished by the operator of the searchlight is about three-fourths of a mile. The apparatus is especially serviceable for small parks and for amusement resorts, the operation of the lamp being entirely automatic. Silvered copper reflectors or Mangin mirrors are provided with the equipment.



ALTERNATING-CURRENT SEARCHLIGHT.

Lamp Vacuum Testing Apparatus.

The life and efficiency of an incandescent lamp depend to a considerable extent upon the degree to which the bulb has been exhausted, and in order that the amount of vacuum may be readily and relatively ascertained, the Dwyer Machine Company, of Lynn, Mass., has devised a testing set for the purpose. A high-potential coil giving approximately 20,000 volts is discharged through the lamp, and of course the color of the luminous gas is an index of its density and kind. The instrument consists of a case divided into two compartments with black curtains hung on the sides to exclude the light as shown in the accompanying engraving. The testing coil, etc., are placed in the upper compartment while the lower compartment is fitted for making the tests by bringing the lamp base in contact with a brass disk projecting into the chamber, while the operator at the same time operates a pedal switch. The condition of the vacuum is indicated by the resulting phenomenon. The gas will glow with a purple, red, pink or white color, or not at all, according to the degree of the vacuum within. A lamp containing a considerable amount of air shows purple streamers branching from the filament to the glass. Such a lamp probably contains a crack in the glasswork and will burn out in a minute or two. A red glow uniformly distributed throughout the bulb indicates a better vacuum than the above. This lamp contains a little air and the candle-power will



LAMP VACUUM TESTING APPARATUS.

drop very rapidly, probably down to 10 cp within an hour. A lamp with a white glow with the slightest tint of pink close to the glass is slightly better than the above. A lamp with a whitish glow, but showing the filament very distinctly and with a marked glow about the joints while containing a better vacuum than the above, is still a very poor lamp and will deteriorate very rapidly. A lamp with a white glow uniformly distributed throughout the bulb may burn a hundred or two hundred hours without burning out, but the candle-power will drop rapidly. A lamp with a thin whitish glow more or less intermittent and sometimes hard to start is one which lamp manufacturers sometimes pass as satisfactory. After such a lamp has burned for about half an hour the glow will usually be found to have disappeared. Such a lamp will drop in candle-power much more rapidly than one with a perfect vacuum. A lamp which shows an intermittent flicker of light on the inside surface of the bulb contains a very good vacuum. Such lamps are universally passed as excellent by the manufacturers. A lamp which shows no glow whatever possesses a still higher degree of vacuum than the above, and as this "glow test" is the most severe test known for vacuum it is as high as the lamp manufacturers can obtain, and such lamps may be considered perfect. A lamp which is completely full of air cannot be made to glow.

Electricity at Railway Appliances Exhibition.

Electrical apparatus is used to such a large extent by the steam railroad companies of the country that the exhibition of railway appliances held at the Coliseum, Chicago, March 15 to 20, could not fail to contain much to interest and instruct the electrical man. The display was a large one and of much excellence, containing about 120 exhibits of a large variety of machinery and appliances used by railroads, arranged by the Road and Track Supply Association. The tenth annual convention of the American Railway Engineering and Maintenance of Way Association was held at the Auditorium Hotel, Chicago, during the exhibition at the Coliseum, and the engineers attending it were, of course, among the most interested visitors at the exhibition. Following are brief references to some of the exhibits of particular interest to electrical visitors:

The American Steel & Wire Company, Chicago, had a large space in which were shown rail bonds, tools for rail bonding, rubber-covered wires and cables and other products of the company's factories.

The Blake Signal & Manufacturing Company, Boston, displayed dispatchers' selective train-order signals for use with telephone train dispatching.

The Bryant Manufacturing Company, Chicago, had an exhibit of railway signaling supplies, including mercury contact relays, automatic motor signals, switch indicators, battery chute cases, lightning arresters and the like.

The Joseph Dixon Crucible Company, Jersey City, N. J., had an exhibit, and the representatives of the company were always willing to talk about graphite brushes for motors. There was also a display of lubricating graphite for different purposes.

The Duntley Manufacturing Company, Chicago, attracted attention by a motor-electric car for section work, equipped with a 7½-hp gasoline engine driving a 2-kw, 110-volt, direct-current dynamo. The gasoline engine is arranged to operate the car to any point on the line where its services may be necessary for repair work. It is then connected to the dynamo, which furnishes electricity for a number of portable electric tools. This outfit of small machine tools consists of an emery wheel, a wood-boring drill, a spike-driving drill and four rail-bonding drills, each driven by a small electric motor mounted on the tool and forming a part of it. This company also demonstrated its standard vacuum cleaner, operated by electricity, arranged to be connected to any incandescent electric light socket and to remove dust and dirt from floors, rugs, furniture, etc., by the vacuum process.

The Edison Manufacturing Company, Orange, N. J., displayed Edison primary batteries and "BSCO" primary batteries for railroad signaling. The letters BSCO represent the Battery Supplies Company, and this type of battery has been recently brought out. In designing this new battery an attempt has been made to reduce the labor cost of renewal, at the same time increasing the current-producing capacity and reliability of the battery. The renewal parts consist of elements assembled in one piece—a can of soda and a bottle of oil. In addition to the ordinary caustic-soda solution, the BSCO battery is also supplied with a special low-temperature solution for use where the batteries are required to operate in very cold weather.

The Electric Storage Battery Company, Philadelphia, showed types of its storage batteries particularly adapted for car lighting and signal service. It also distributed an illustrated account of electrically operated drawbridges at which storage batteries are installed and kept "floating" at all times on the system supplying the electricity so as to be instantly available in the event of any derangement.

The H. W. Johns-Manville Company, New York, made an interesting display of its products. Of particular electrical interest were lamps, the Linolite lighting system, strain and globe insulators, overhead material, catenary-construction material, tape, a full line of fuses and fuse blocks, insulators and car heaters.

The Kerite Insulated Wire & Cable Company, New York,

had a large exhibit of its insulated wires and cables. Samples of the different classes of wire were attractively displayed, and there were also large balls of Para rubber, one being said to weigh over 700 lb. Kerite is one of the oldest of the insulations used for conductors in electrical work, and it was specially mentioned for its merit in the report of the rubber-covered wire committee of the Railway Signal Association last June.

W. N. Matthews & Brother, of St. Louis, displayed their well-known "money-saving" specialties, devoting particular attention to the Matthews guy anchor, which screws into the ground like a lag screw into a pole. When it is screwed into the ground 5 ft., it is set and there is nothing further to do but to attach the guy wire. Other specialties displayed included telephone jack boxes, plugs for dispatching systems, cable clamps, cable splicing joints and lamp guards.

Other electrical exhibits were made by the Union Switch & Signal Company, Alamo Manufacturing Company, Bryant Zinc Company, Buda Foundry & Manufacturing Company, Dake-American Steam Turbine Company, Fairbanks, Morse & Company, General Railway Signaling Company, Hall Signal Company, C. F. Massey Company, Geo. P. Nichols & Brother, C. F. Pease Blueprint Machinery & Supply Company, Pennsylvania Steel Company, Pittsburgh Steel Company and Sandwich Electric Company.

Metal Molding and Fittings.

As is probably well known, metal molding has been approved by the Underwriters for open work for a number of years, although the introduction of the system has been somewhat re-

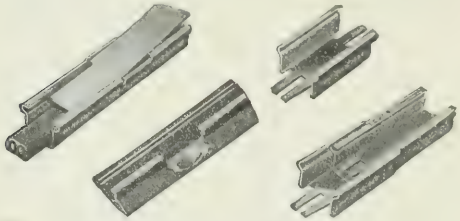


FIG. 1.—METAL MOLDING.

tarded because of the unfamiliarity of wiremen with the product. The molding, however, is now rapidly coming into use as a substitute for wooden molding and also as a substitute

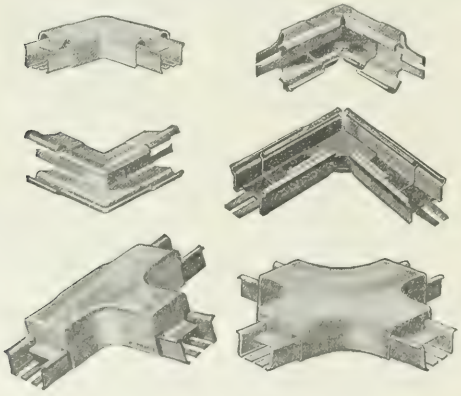


FIG. 2.—ELBOWS.

for conduit when the latter must be exposed. The "Lutz" metal molding, manufactured by the American Circular Loom Company, of Boston, Mass., is illustrated herewith. As is shown by the illustrations, the molding forms a steel raceway of suitable dimension for two wire or four wire circuits placed in the trough. The molding comes in 10-ft. lengths a is electro-galvanized inside and out. The flexible metal capp slides in two flanged grooves, thus entirely closing the racew and protecting the wires. The base is provided with count sunk holes at intervals for screws or nails used in fasteni the base to the wall or ceiling. The capping can be remov at either end or at any point desired by making two hack s

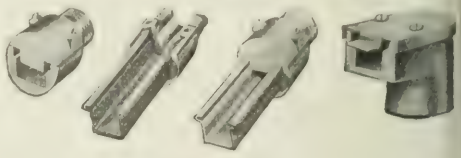


FIG. 3.—ADAPTERS.

cuts through the flanges of the base and slightly opening t cut portion so as to release the end of the capping. T lengths of molding are coupled or bonded together with prop fittings as required. The method of installing the fittings co sists in cutting slots with a hand punch or an ordinary fin toothed tubing saw in the ends of the bases to be connecte about ½ in. from the ends. The prongs of the coupling a



FIG. 4.—PORCELAIN RECEPTACLE, ROSETTE AND SWITCH BASE.

bent and inserted in the slots and the couplings snapped ov the flanges of the base and the prongs bent down. Elbows ar tees have prongs similar to those on the couplings and a connected with the base in the same manner. For the purpo of connecting the molding with rigid conduit and also wit panel boards, adapters are used. These fittings have recesse chambers to engage with the exterior flanges of the base, an

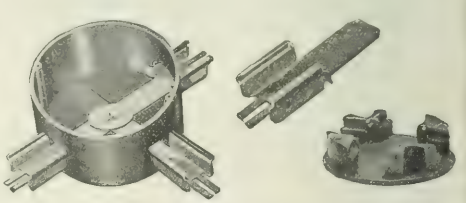


FIG. 5.—OUTLET BOX.

lugs to preserve the capping from contact with wiring con nections. They are also threaded so as to be readily connecte with rigid conduit fittings. Porcelain rosettes, receptacles an switch bases are made to straddle and fit the molding. The are furnished with wiring connections and have lugs agains which the capping butts to keep it from contact with the con nections. Outlet boxes are made for various uses and ar

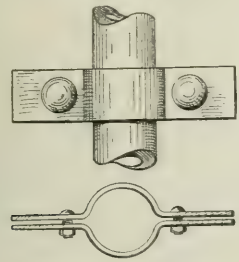


FIG. 6.—FIXTURE STRAPS.

provided with either special outlet bonds or recessed chambers to engage with the base. No outlet bushings are required. Fixture straps and toggles are provided as necessary adjuncts of the system. The accompanying illustrations show the various fittings in the line and will doubtless suggest uses for the molding where ordinary wooden molding is not applicable and where conduit would be barred because of greater expense.

Pipe and Conduit Clamp.

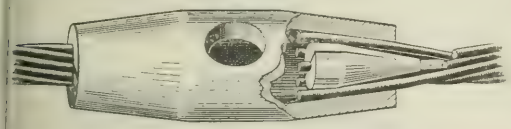
The line of pipe and conduit clamps made by the H. Krantz Manufacturing Company, of Brooklyn, N. Y., is made of steel and in three styles. One style has even sides and a bolt on each side; a second style has two extra long sides and two bolts on each side, the pipe being carried centrally; while still another style has a short side with one screw and a long side with three screws. The clamps are made to take pipe from ½ in. up to 3 in., and the square shoulders of the bolt is said to prevent its turning when the nut is screwed on. The first style of clamp mentioned is shown herewith.



PIPE AND CONDUIT CLAMP.

Messenger Splice.

Frank B. Cook, of Chicago, Ill., has placed on the market a messenger splice which has been tried out in practice and found to be valuable for the uses for which it was designed. Wherever messenger strands can be or need be spliced, the device is applicable without the use of tools. It is claimed that a complete splice can be made by any ordinary lineman within two minutes, and that the splice will be stronger than a Siemens-Martin strand. Ordinarily, if a cable-supporting messenger runs short, it means a splice, and this not only requires time and is expensive, but can only be made by an experienced man.



MESSENGER SPLICE.

With the Cook splice this operation, it is said, can be performed by anyone. Moreover, in practice, short lengths of strand are either thrown away or consigned to a miscellaneous junk heap for future use. With the splice shown herewith these short lengths of strand can be used up to advantage. These are the principal points of advantage claimed by the manufacturer, the splice also embodying the elements of low cost and reliability.

Electric Motors on Docks.

The convenience of electric motive power is well illustrated in the applications shown in the accompanying views, where electric motors are shown connected to a capstan and a winch for use in hauling vessels up to the dock. In each case the outfit is entirely self-contained, with the entire outfit on a single bedplate, which insures correct alignment of the gearing even after long service. This construction makes the installation of the outfit a simple matter, as it is only necessary to bolt the bedplate to a secure foundation and connect the motor to the power circuits. The location of the capstan may be chosen without reference to the power, for the wires may be run anywhere on the dock with little trouble at a substantial saving as compared to any other method of supplying power.

Fig. 1 shows one of the two electric capstans supplied by the American Ship Windlass Company, of Providence, R. I., to the Newport News Shipbuilding & Drydock Company, which are installed on piers in its shipyard at Newport News, Va. With a capstan on each pier at the entrance of the dry dock, it is possible to haul the ships in very rapidly and accurately. The dock is one of the largest at any of the shipyards in the world, and will take the largest American battleships now afloat. It may readily be appreciated that powerful machines

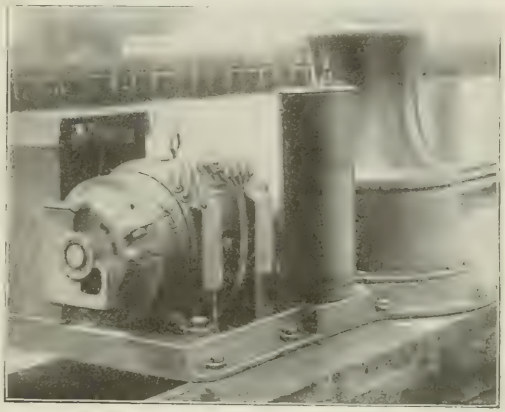


FIG. 1.—ELECTRIC CAPSTAN.

are required to do such work. Each winch is designed to pull 11,000 lb. at 30 ft. per minute. The motors are standard Westinghouse series-wound motors running at a full load speed of 560 r.p.m. The speed is controlled by a standard Westinghouse controller. The capstan is known as a 16-in. electric "gypsy"; that is, the barrel is 16 in. in diameter at its smallest part. The hauling rope is merely wound around the barrel four or five times and the loose end of the rope overhauled as the vessel is pulled into the dock by the winches.

Fig. 2 shows a powerful winch which was installed by the Interborough Rapid Transit Company, of New York, to haul barges alongside of the dock at its power station. It is driven



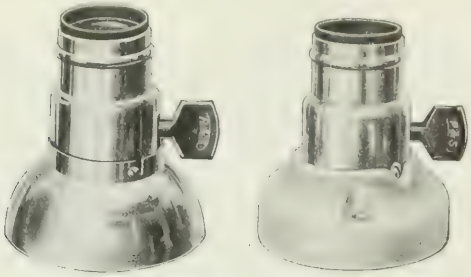
by a 25-hp, three-phase induction motor built by the Westinghouse manufacture. With the motor running at 240 r.p.m. the winch has a speed of 24 ft. per minute, and exerts a pull of 18,000 lb.

It will be noted that in the first case at Newport News series-wound direct-current motors are used, and in the second case at New York a three-phase induction motor of the short-circuited secondary type is employed. In each case the conditions are practically the same, and the different types of motors are giving satisfactory service. All of the winches were furnished by the American Ship Windlass Company, of Providence, R. I.

Lamp Receptacles for Concealed Wiring.

In the accompanying illustrations there are shown two styles of lamp receptacles recently developed for use with concealed wiring. The receptacles are built with large bases, thereby providing wide separation of the supporting screw holes, so that the receptacle can be properly fastened in a workmanlike manner.

The lamp receptacle illustrated in Fig. 1 is intended for replacing the removable rubber ring fastening which is not now



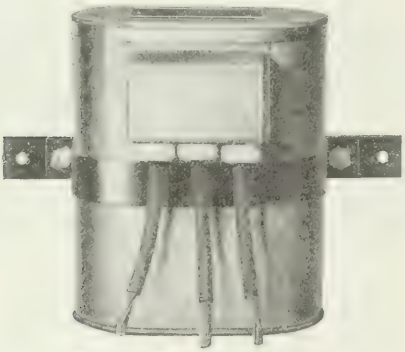
FIGS. 1 AND 2.—WIDE BASE LAMP RECEPTACLES.

sanctioned by the Underwriters. The base is recessed to allow for the projection of tubes on conduit ends. The style shown in Fig. 2 also has the latter feature, but it is equipped with an all-porcelain base. The two types here illustrated are provided with keys; similar keyless receptacles have also been developed for them.

These devices have been placed on the market by Pass & Seymour, Inc., Solvay, N. Y.

Transformer for Electric Signs.

Breakage of the fine filament of the ordinary tungsten lamps is a life-shortening obstacle not yet entirely overcome. On low-voltage lamps a thicker filament is employed so that the breakage is greatly reduced and the life increased to about 2000 hours. To take advantage of this condition and also of the increased economy possible by the use of tungsten lamps, low-voltage tungsten lamps have been employed in a number of places. For central stations operating signs on a flat-rate



TRANSFORMER FOR ELECTRIC SIGNS.

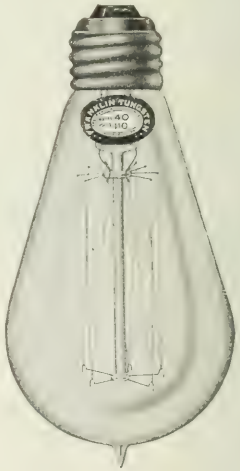
basis, it may be interesting to know that the Enterprise Electric Company, of Warren, Ohio, has brought out a Peerless type transformer especially applicable for sign circuits in conjunction with 4-cp, 10-volt tungsten lamps. The transformers are built with silicon steel cores and are mounted in sheet-steel cases provided with hangers. The design of the transformer in other respects is standard. As indicative of the savi possible by the use of low-voltage lamps, the manufactu points to the following: The 4-cp tungsten lamp has a life 2000 hours and a specific consumption of 1.25 watts per cand while the 4-cp, carbon-filament lamp has a life of 1630 hou and a specific consumption of 4.8 watts per candle. Conside ing that both lamps have an equal life of 1630 hours, the 4- tungsten lamp would require 5 watts, or a total of 8150 wa hours throughout its life, which at a 10-cent rate would bri the cost of energy to 81.5 cents. The carbon-filament lam would take 20 watts, or a total of 32,600 watt-hours in its li which at the same rate for electrical energy would bring i cost to $3.26.

The saving in energy cost would amount to $2.445, in fav of the tungsten lamp. The difference in list cost of lamps is cents, in favor of the carbon lamp, or $30 per hundred. A to this the cost of the transformer and deducting the tot from the saving made by the use of the tungsten lamps, t saving in favor of the low-voltage tungsten lamp is still co siderable, even ignoring the fact that the lamp has a long life.

Franklin Small 40-Watt Tungsten Lamp

The Franklin Electric Manufacturing Company, of Har ford, Conn., has recently made an addition of importance its regular line of tungsten lamps, namely, a small-bul standard Edison base, 40-watt size. This new lamp, like oth sizes of tungstens, has a current consumption of from 1 1.25 watts per candle, giving three times the amount of lig at the same consumption of current when compared with t carbon-filament lamp.

The Franklin tungsten lamp is so constructed that it can burned in any position owing to the manner in which the fil



40-WATT TUNGSTEN LAMP.

ments are supported by exceedingly delicate flexible spring It will be noted from the accompanying illustration tha the filaments are pulled up tightly against the supports wit no slack, which allows the lamp to be burned at any angl without any other droop to the filament than is caused by th expansion when the filament is incandescent.

The new 40-watt lamp is made up in the same size bulb a the ordinary 16-cp carbon-filament lamp and is fitted with small Edison base. This feature will be appreciated by user as no special fixture or socket will have to be purchased. Th new lamp, like all Franklin types, is a five-filament lamp, an as such is somewhat more rugged than a four-filament lamp

Transformer for Bell-Ringing Circuits.

The Connecticut Telephone & Electric Company, of Meriden, Conn., manufactures a low-potential transformer especially designed for bell circuits and as a substitute for batteries where alternating current is available and applicable. The transformer is shown herewith. It is 6¾ in. in diameter and 3 in. high. The primary is wound for 60-cycle, 110-volt circuits, and three voltages are available from the secondary, namely, 6 volts, 12 volts and 18 volts. While designed primarily to operate tele-

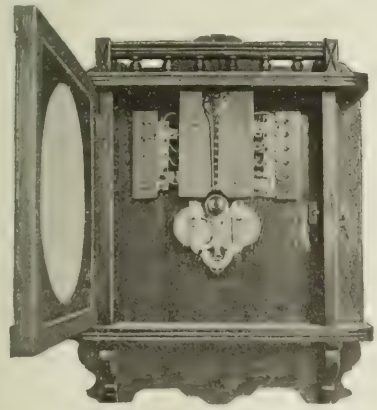


TRANSFORMER FOR BELL-RINGING CIRCUITS.

phone buzzers, annunciators, call-bells, elevator signals, gas-lighters, door-openers, etc., the apparatus can also be employed for a variety of other purposes, such as to supply energy to operate toys, window displays, miniature-lamp outfits and low-potential alternating-current devices. The amount of energy required by bells, etc., is very small, indeed, and the losses in the transformers are said to be also small. A break-down test of 2000 volts is applied to each device.

Watchman's Electric Time Detector.

The watchman's time detector shown herewith and marketed by the Eugene L. Richter Electric Company, of Philadelphia, Pa., possesses the advantage of simplicity. The operating mechanism consists of small magnets in front of which an iron armature, attached to a brass spring, vibrates. The tension on the flat brass spring is adjustable by means of a small set-screw which serves as the fulcrum of the spring acting as a lever. Projecting at right angles to the armature and attached to its



WATCHMAN'S TIME DETECTOR.

end is a needle, which pricks the paper dial used. A Seth Thomas clockwork mechanism is employed to operate the chart, which is divided into five-minute intervals and with the desired number of stations. The detector is built for any number of stations up to 54, the one shown having 10 stations. A magneto is used at each station and one turn of the crank is sufficient to cause the armature of the magnet to oscillate sufficiently to prick a hole in the paper chart and thus to indicate the time the signal from the station was sent. The paper chart also passes through a spring-actuated punch fastened to the side of the box so that if the door of the detector is opened for any reason a hole is punched in the rim of the chart. In this way should the watchman attempt to tamper with the mechanism by opening the door, the act would be detected and the time indicated. Small set-screws are placed in the fork in front of the needles to limit the play of the latter. The device is well put together and can be obtained with a self-winding clock movement if desired or with an indicating clock in addition to the one used to turn the chart.

New Appliances at the Minnesota Convention.

The Central Electric Company exhibited at the Minneapolis convention a new vibrator which will be sold under the name of the "Central" vibrator. This is of the small motor type and can be operated on either an alternating-current or direct-current circuit. Its consumption on direct current is 20 watts.

Another new appliance this company exhibited was the "Tungstometer," which is a small meter, pocket size, adapted to screw in a lamp socket and provided with a receptacle for a lamp or plug. It is calibrated to read in milliamperes and has a slide-rule attachment whereby the watts can be instantly determined if the voltage of the circuit is known.

This company also exhibited a 25-amp solenoid-operated switch controlled from a distance.

A high-tension drop strand protector, which has been developed by the transmission companies in Colorado and is extensively used there, was exhibited. This protector consists of a hook which makes a ball and socket joint. A hook of this kind placed at each end of the span which stretches over the lines which it is desired to protect. Should the line break, the hook will come out at both ends of the span so that the span will fall entirely away from the line in which it is inserted.

The "Central" rotating and oscillating fans were shown. This fan has an attachment which can be set so as to either cause the fan to rotate on its pedestal continuously, or to oscillate between fixed points. When used as a rotating fan attached to the ceiling, it may in some cases take the place of the long-bladed ceiling fans.

The new "Opalux" reflectors which this company is marketing were shown in use in several places in the hotel.

Some iron plates of "silico vanadium" steel, used in the Pittsburgh transformers, were shown to illustrate the new method of insulating the laminations from each other without the use of japan or enamel. A tough coating of gray oxide is formed on these plates, which takes the place of a japan.

The General Electric Company exhibited its new flat heating element which it uses in its new small coffee percolator and some other cooking appliances. This has the new resistance metal used in the shape of a thin ribbon stamped out of a sheet, which is placed flat against the surface to be heated with a thin piece of mica between for insulation. The same metal is used in the wire in the General Electric toaster. It is of high resistance, so that a comparatively short length of wire or other conductor gives the necessary resistance without undue fragility.

The Bryan-Marsh Company rigged up a revolving cluster arrangement whereby a number of tungsten lamps were revolved while burning without breaking, thus showing the toughness of the lamp when hot.

The Westinghouse Electric & Manufacturing Company showed its new form of transformer with coils sawed open to show the construction. Its new 8-in. fans for alternating and direct current were also a prominent feature of the exhibit.

The new Westinghouse-Nernst lamp with improved efficiency and screw burners, which make renewals simple, was shown by the Nernst Lamp Company.

The Pacific Electric Heating Company's "hot point" iron with the automatic plug disconnector, which prevents overheating, was also on exhibition.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE

There has been a distinct improvement in the condition of trade during the past week, due undoubtedly to the introduction of the tariff bill and the advance of the spring season. A fair business has been doing in nearly all lines, and the total for the week has been better than for the same period last year. Conservative buying is still the rule, and fill-in orders comprise almost the entire business that is being done. The returns from the Easter retail trade are eagerly looked for by the wholesalers and jobbers, but it is believed that the business has been fairly up to the average. Upon the volume of this trade will depend largely the condition of the stocks now in the hands of the country merchants. These are believed to be small. This belief together with the trade so far this spring leads to the optimistic opinion that a general and liberal stocking up will be necessary when the merchants again come into the market. Among the industries there is little evidence of improvement. New orders are not received in plentiful quantities and there are fewer reports of additional workmen being employed. The uncertainty as to the final basis upon which the tariff will be adopted is held responsible for this condition. In the iron and steel plants—except for some structural material and wire—there is very little new business being booked. The large electrical manufacturing concerns report few orders. Those that are received are mostly for small apparatus. Although plans are being made and specifications drawn for quite a large volume of important work, just at the present time all of these orders are held in abeyance. The promoters of large developments are waiting for the certain revival of business before contracting for heavy expenditures. While it is as yet entirely too early to predict with any certainty as to the season's crops, all indications seem to be that the average will be larger than usual and that with average weather we may expect another year of bountiful yields. The railroads continue to report increased earnings and in many cities the building industry shows commendable growth. Collections are as yet only fair, but there are few financial troubles throughout the country. Failures for the week ended March 18, as reported by *Bradstreet's*, were 224, against 254 the week previous, 303 in like week of 1908, 157 in 1907, 170 in 1906 and 204 in 1905.

THE COPPER MARKET.

The price of copper during the past week reached the lowest point touched in the past two years. This depression in price apparently had the effect of bringing into the market a number of domestic consumers who had been holding off, waiting for bargains. In addition, there were a considerable number of foreign inquiries. This activity on the part of the consumers did not, however, result in much actual business. As soon as the producers and selling agencies perceived that there was a disposition to buy, they began to mark up prices. All quotations were at once advanced ⅛ cent. In some instances, the advance was as much as ¼ cent. Even at these figures, the consumers were not permitted to purchase any round lots. Orders were scaled down and the producers declined to contract for future deliveries of any material size. One large consumer, it is said, bid 12⅛, and then 12¼, for a round lot of electrolytic copper, but could not consummate the deal. In some instances, producers refused to sell June and July deliveries at the same figures they were willing to accept for April and May deliveries. For these reasons, the actual business transacted was limited. From a statistical standpoint, there is little change to be noted. There has been little, if any, reduction in the rate of production and there is every evidence that accumulation is increasing. Imports have been rather heavier than at any time during the present year and are running heavier than at the same period last year. There has been a revival of the agitation among the copper traders for the discontinuance of the so-called "copper prices" of the Metal Exchange. As a matter of fact, these prices are largely mythical. They rarely represent the figures at which actual business is being transacted. The live interests in the copper market pay but little attention to the exchange price and rarely visit its floor. No metal is either bought or sold at the exchange. The action of the copper producers in advancing prices, as soon as there was any indication of buying, is taken to indicate that the powerful interests which have so long been in control of the market are still unwilling to relinquish their grasp. It is the general opinion that the accumulation during March will amount to something like 20,000,000 lb, bringing the stock on hand up to more than 200,000,000 lb. The exports of copper, so far, during the month including March 22, have been 14,006 tons. The quotations on the Metal Exchange March 22, were:

Lake	[illegible]	@	12⅞
Electrolytic	12⅝	@	12⅝
Castings	12⅜	@	12⅝

London prices were as follows:

	Noon.	Close.
	£ s d	£ s
Standard copper, spot	[illegible]	56 7
Standard copper, future	57 0	57
Market	Firm	Firm.
Sales of spot	[illegible]	400 tons
Sales of future	[illegible]	2,500 tons

Extreme fluctuations for this year:

	Highest	Lowest.
Standard	[illegible]	[illegible]
Lake	[illegible]	12 5s
Electrolytic	14 5s	12s 12s
Castings	14 12½	12 10s
London, spot	59 4 6s	57 4 12s
London, futures	64 17 6s	55 16s
London, best selected	65 [illegible]	59 [illegible]

WESTINGHOUSE PLANTS BUSY.—Reports of the conditions at the various Westinghouse plants in Wilmerding, East Pittsburgh and Swissvale, Pa., continue to indicate a gradual but steady improvement in most of the departments in these factories. At the works of the Westinghouse Electric & Manufacturing Company the number of employees on the shop pay roll is growing. The fact that work on the immense $5,000,000 order from the Pennsylvania Railroad Company has at last commenced has given quite an impetus to the operating activity. All the details for the design of the locomotives have been completed. The initial drawings for these will be turned over to the production department about April 1, and the construction will then begin. How many of these engines will be in the first batch has not yet been determined. The Third Avenue Railway Company, of New York City, which placed an order for 206 railway motors some time ago with the company, has supplemented its order with another 100, on which work will be commenced immediately. The Westinghouse Machine Company has received an order from the city of Philadelphia which consists of eleven 300-hp vertical gas engines. These engines will be used in the operation of the high-pressure pumping station which the fire service department of that city began to install about two years ago. At that time the Westinghouse company, after having given a practical demonstration of the superiority of gas engines over steam engines in that class of service, obtained an order for 10 gas engines. The shops of the Westinghouse Air Brake Company, at Wilmerding, Pa., and of the Union Switch & Signal Company, at Swissvale, Pa., are at the present time busier than they have been for some months.

AMERICAN MACHINERY IN MEXICO.—M. I. Sternfield, representative of Braniff & Company, of the City of Mexico, the Mexican agents of the Westinghouse companies, who is at present in Pittsburgh, says that the industrial conditions in the Southern republic are in excellent shape. This is especially true, he reports, in the mining industry. He says that the demand for American electrical apparatus is constantly on the increase. Mr. Sternfield is here to place several orders for locomotives, generators and transformers with the Westinghouse Electric & Manufacturing Company.

LIGHTING EQUIPMENT NEEDED.—The Bureau County Infirmary, of Princeton, Ill., desires a lighting plant capable of supplying from 300 to 500 16-cp lamps. Mr. F. Kramer is superintendent of the Infirmary.

ARIFF ON CARBONS.—The new tariff bill places the
y on carbons for arc lamps at 35 per cent ad valorem, in-
id of at 90 cents per 100. This is a material reduction and,
s claimed by importers, will lower the price of carbons from
to $7 per thousand. It was asserted at the tariff hearings,
t the present duty amounted to from 50 to 100 per cent on
bons according to price. This rate on some classes of car-
is was in a measure evaded by the importers by bringing in
carbons in 24-inch lengths and cutting them here. This
luced the actual duty to 45 cents per hundred, but added the
s by breakage. The ordinary half-inch carbons for inclosed
: lamps are sold in this country from $22 to $24 per thousand
:ording to the number ordered. It is claimed that these same
rbons will be sold, if the new schedule is adopted, at from
5 to $18. An importer in discussing the proposed rate said:
Under the 35 per cent ad valorem clause the importer ought
have an opportunity to get some good-sized orders. Here-
fore we have only had the little fellows and the consumers
ho wanted special high-grade carbons for picture machines or
archlights. For the big orders, the price of domestic car-
ns was cut to meet our price, the tariff always leaving for the
ller a good margin of profit. At 35 per cent I believe we
n compete and the consumer will certainly get his carbons
eaper. A carbon that cost $12 abroad would in this country
st $21 plus freight, insurance, breakage loss and our profit.
nder the new law the tax on $12 carbons would be $4.20, a
eduction in duty of more than 50 per cent. On higher priced
arbons the reduction would be much less and on lower grades
uch more. On flaming-arc carbons, for instance, costing $70
er thousand, the $9 duty was only about 13 per cent. On these
he new law will be increased. The low grade molded car-
ons, for open arc work, we have been unable to import at all
wing to the duty being more than 100 per cent; at 35 per cent
he importer may be able to enter that field. It is possible, of
ourse, that domestic producers may mark down the price so low
hat even the proposed duty will make importing unprofitable.
The consumer will benefit by the change, in any case."

THE PROPOSED TARIFF ON MICA.—The mica trade expresses itself as being fairly well satisfied with the proposed tariff of 30 per cent ad valorem upon crude mica, and say that it will probably result in a fairer arrangement of duties than the present schedule of 6 cents per pound and 20 per cent ad valorem. Under the present schedule, the cheaper grades of mica were made to pay proportionately a very much higher rate of duty than the expensive grades. In the electrical industries, a great variety of grades of mica is used. On mica which costs not more than 54 cents a pound, the new schedule will be cheaper; on higher priced mica, the new rates will be somewhat higher. One dealer expresses the opinion that a fair average price for the mica used in the electrical industries is 75 cents a pound. If this estimate is correct, the new schedule will not be of advantage to the electrical manufacturers. There is some doubt in the minds of the manufacturers of mica plates and of built up mica, as to whether the proposed duty of 35 per cent ad valorem will furnish sufficient protection for the American industry. At the present time, under a ruling of the customs authorities, this class of mica has been paying a duty of 12 cents per pound and 20 per cent ad valorem.

SMALL CHANGE IN THE ALUMINUM TARIFF.—The new tariff schedule for crude aluminum, if the proposed bill becomes a law, will be 7 cents a pound, a reduction of 1 cent from the rate provided in the Dingley bill. According to a representative of the most important aluminum producer in America, this change will have little effect upon the market price. The present price of aluminum is from 21 to 24 cents a pound, according to purity and the quantity purchased. The change will hardly make an appreciable reduction in these figures. It is not probable that there will be any material lowering of prices until the expiration of the patents under which the Aluminum Company of America is operating. This will occur during the present year.

FLAMING-ARCS FOR CIRCUS LIGHTING.—The immense Ringling circus, which opens its season at Madison Square Garden, New York, to-day, has purchased 36 flaming-arc lamps from the Excello Arc Lamp Company, which, together with 12 lamps purchased from the same company last year, will furnish the illumination for the show tents throughout the season. After leaving New York City the circus will generate its own current, having purchased for this purpose two 40-hp gas engines, belt connected, with 30-kw direct-connected enclosed-type generators, from Fairbanks, Morse & Company. These units will be mounted on wagons, with the switchboard under the seat. The energy used will be 120 volts. The circus has also purchased a 6-hp direct-connected generating unit from the same company for operating the spotlight which is thrown upon important ring features. This outfit is also mounted on a wagon.

LOW-PRESSURE TURBINE MILL AND ELECTRICAL PLANT.—The Bernon Mills-Manville Company, of Georgia, R. I., is to install a 300-kw Westinghouse-Parsons low-pressure steam turbine in connection with its present mill engine. The speed of the turbine will be 3600 r.p.m. The turbine is to run in connection with a 440-volt, 60-cycle alternator, direct-connected. The present mill engine is a 600-hp machine, and the turbine and engine together will develop 90 per cent above the normal rating of the engine alone. The generator will operate a synchronous motor on a line shaft in the mills. The machine was sold through the Boston office of the Westinghouse company.

WESTERN ELECTRIC'S BUSINESS IMPROVING.—The February business of the Western Electric Company showed an improvement of about 15 per cent over that of the same month last year. Orders are now coming in at the rate of about $45,000,000 a year. For the first quarter of the company's fiscal year, which ended Feb. 28, the sales were 30 per cent ahead of the same quarter last year. A large part of the improvement has been in the machinery department, especially in the line of electric light machinery. In the shops manufacturing this class of goods the operatives are working overtime. At present the Western Electric Company has something over 16,000 employees and the number is being gradually increased all the time.

AMERICAN ENGINE COMPANY.—The "Angle" compound engine recently introduced by the American Engine Company, of Bound Brook, N. J., is rapidly receiving recognition, especially on account of the space-saving qualities. One of these engines of 500 hp was recently selected to drive a centrifugal circulating pump connected with the condenser outfit of the Interborough Rapid Transit power house at Fifty-ninth Street and North River. A similar engine was recently purchased by the Government to be installed at the Coast Artillery School at Fort Monroe, Va.

TORONTO CABLE PROPOSALS.—The city of Toronto has issued specifications covering underground cable to the value of about $40,000. Tenders are to be in before the end of March. Further particulars can be obtained from the Electrical Department, City Hall, Toronto.

THE DURAND LAMP WORKS, Vineland, N. J., will be glad to receive trade literature relating to supplies used in the manufacture of incandescent lamps.

Financial Intelligence.

THE WEEK IN WALL STREET.

The Wall Street stock market during the past week has been unusually dull, but prices have continued to be firm. While there is little buying there seems to be just as little selling. There is no pressure being felt on the bear side, and the tendency is rather to advance than to recede. This is taken to mean that Wall Street has accepted the new tariff bill as not being very harmful to any branch of trade. The main reductions, those made in iron and steel products, had been so well discounted that they had no effect upon the industrial stocks. In fact, the United States Steel Corporation has already put its prices upon a basis in keeping with the tariff schedule as proposed in the new bill. If these rates should be finally adopted there would be no necessity for the further lowering of prices on steel products. The extreme stagnation in trading is the direct result of the dullness in all branches of commercial and industrial business. Every one seems to be waiting until the tariff schedules are settled and until there is some revival in trade. Several big bond issues are being discussed, and, while the bond market remains strong, it is hardly as eager as it was a few months ago. There seems to be plenty of money for investment in good mortgage securities, but it is not probable that either a railroad or industrial issue would be as largely oversubscribed at this time as it would have been in December

or January. The preliminary figures of the United States Steel Corporation, while they show an enormous decrease from the previous year, were not unexpected, and the stocks of the company were unchanged when they were given out. Shipments of gold to Europe have apparently had no effect upon the condition of the money market. There seems to be plenty of cash in the banks, and rates remain very easy. Call money on March 22 was quoted at 1½ @ 2 per cent and 90-day paper at 2½ @ 2¾. The quotations in the table are those of the close March 22.

NEW YORK.

	Mar. 15.	Mar. 22.	Shares sold.		Mar. 15.	Mar. 22.	Shares sold.
All. Ch.	137*	1378*	870	Int. Met., pfd..	43½	42⅝	19,375
All. Ch., pfd...	41	43	2,000	Mackay Cos....	73¼*	72⅝*	100
Amal. Cop. ...	66⅝	70½	157,800	MackayCos.,pfd.	71¾*	71*	600
Am. D. T.....	38*	38*	—	Manhattan Elev.	142⅛*	142⅛*	200
Am. Loc.	50¼	52	3,300	Met. St. Ry....	25*	28*	100
Am. Loc., pfd.	111½*	111½*	—	N.Y. & N.J.Tel.	117*	116	100
Am. Tel. & Tel.	70½*	—	—	Steel, com.....	43¼	44¼	363,900
Am. T. & T....	130⅜	130	9,640	Steel, pfd.....	110⅜	110½	15,810
B. R. T.....	70⅝	70⅞	32,690	W. U. T.....	65⅛	65	1,950
Gen. Elec. ...	153¾	153½*	1,910	West'h., com...	77	79*	1,700
Int. Met., com.	14¼	14¾	8,977	West'h., pfd....	116*	115	100

PHILADELPHIA.

	Mar. 15.	Mar. 22.	Shares sold.		Mar. 15.	Mar. 22.	Shares sold.
Am. Rys.	46*	45¾	—	Phila. Elec. ...	11⅝	11⅝	—
Elec. Co. of A.	11⅞	12⅛	—	Phila. R. T....	27½	27⅝	—
Elec. Stor. B'ty	46½	46⅝	—	Phila. Traction.	91	92¼	—
E. S. B'ty, pfd.	49*	49*	—	Union Traction.	53½	53¾	—

CHICAGO.

	Mar. 15.	Mar. 22.	Shares sold.		Mar. 15.	Mar. 22.	Shares sold.
Chi. City Ry...	187*	187	—	Chi. Tel. Co....	132	133	—
Chi. Rys., Ser.1.	111*	110*	—	Met. Elev., com.	19*	19*	—
Chi. Rys., Ser.2.	48½	40¼	—	Nat'nal Carbon.	85½	85½*	—
Com. Edison...	111¾	111½	—	Nat. Carb., pfd.	119	119*	—
Chi. Subways...	25¼*	26	—				

BOSTON.

	Mar. 15.	Mar. 22.	Shares sold.		Mar. 15.	Mar. 22.	Shares sold.
Am. Tel. & Tel.	129⅜	130	—	Mex. Tel.	2½	2½*	—
Cum. Tel.	127⅛*	127⅛*	—	Mex. Tel., pfd.	5*	5*	—
Edison El. Ill..	253½	254	—	N. E. Tel.	135	134½	—
Gen. Elec.	154	154	—	W. Tel. & Tel..	7*	7*	—
Mass. Elec. Ry.	15*	14¾*	—	W. T. & T., pfd.	77½*	77¾	—
Mass. E. R., pfd	70½	71	—				

*Last price quoted.
Shares sold are for week March 15 to March 20.

DIVIDENDS.

American Cities Railway & Light Company, preferred, quarterly, 1½ per cent, payable April 1.

Bell Telephone Company of Canada, quarterly, 2 per cent, payable April 15.

Butte (Mont.) Electric & Power Company, preferred, quarterly, 1¼ per cent, payable May 1; common, quarterly, 1½ per cent, payable April 1.

Columbus (Ohio) Railway & Light Company, ½ per cent, payable April 1.

Cumberland Telephone & Telegraph Company, quarterly, 2 per cent, payable April 1.

Electric Boat Company, preferred, quarterly, 2 per cent, payable April 1.

Evansville (Ind.) Light Company, preferred, quarterly, 1½ per cent, payable April 1.

Germantown Passenger Railway, Philadelphia, quarterly, 2.62½ per cent, payable April 6.

International Nickel Company, Bayonne, N. J., preferred, quarterly, 1½ per cent, payable May 1.

Michigan Light Company, preferred, quarterly, 1½ per cent, common, quarterly, 1 per cent, both payable April 1.

Peoria (Ill.) Light Company, preferred, quarterly, 1½ per cent, payable April 1.

Ridge Avenue Passenger Railway, Philadelphia, quarterly, 6 per cent, payable April 1.

Springfield (Mo.) Railway & Light Company, quarterly, 1 per cent, payable April 1.

Tri-City Railway & Light Company, Davenport, Ia., preferred, quarterly, 1½ per cent, payable April 1.

Twin City Rapid Transit Company, Minneapolis, preferred, quarterly, 1¾ per cent, payable April 1.

Union Switch & Signal Company, preferred and common, quarterly, 3 per cent, payable April 10.

United Railways Company, St. Louis, preferred, quarterly, 1¼ per cent, payable April 10.

Washington Water Power Company, Spokane, Wash., quarterly, 1¾ per cent, payable April 1.

Wilkes-Barre (Pa.) Gas & Electric Company, quarterly, 1 per cent, payable April 1.

TO SELL METROPOLITAN STREET RAILWAY.—A decree in the United States Circuit Court in the foreclosure suit brought by the Guaranty Trust Company of New York against the Metropolitan Street Railway Company was entered last week directing the company to pay to the clerk of the court, within 20 days after the service of the notice, the sum of $13,589,270, representing the amount of first mortgage bonds held by the company together with the interest. In default of this payment, the special master, William L. Turner, is ordered to sell the property of the railway company at auction. The date fixed for the sale is June 1. This sale will include all the property belonging to the Metropolitan Street Railway Company except the Belt Line, the Twenty-eighth and Twenty-ninth Street and Fulton Ferry lines. If the proceeds of this sale are not sufficient to meet the debts of the trust company, the purchaser will be required to make up the deficiency. The trust company holds $12,500,000 of these bonds, and the interest has been in default for 18 months. In addition, the purchaser will have to pay into court, in cash, such a sum as is deemed sufficient for the redemption of the receivers' certificates, amounting to $3,500,000, and to pay the claims of several creditors who are designated by the court. No definite plan has yet been devised for the reorganization of the Metropolitan Street Railway system, but it is promised that before the date of the sale the joint reorganization committee will be ready to offer a definite scheme for rehabilitation that will be just to all classes of security holders.

WESTERN UNION BOND ISSUE CLOSED.—The Western Union Telegraph Company has decided to close its issue of $25,000,000, 4 per cent, bonds which was authorized in the fall of 1906 and to conclude its mortgage at its present amount. Of these bonds only $10,000,000 have been issued. These were subscribed for by the stockholders at 87½. They are secured by a deposit of New York Telephone Stock to the amount of $9,733,100, the bonds being convertible into stock at par between Jan. 1, 1909, and Jan. 2, 1919. The Telephone stock deposited under this bond issue is worth more than $200 per share and pays about 15 per cent per annum. The directors of the Western Union have decided that the condition of the company at present is such that a further issue of bonds is not necessary.

OTIS ELEVATOR COMPANY.—The annual report of the Otis Elevator Company, for the year 1908, shows net earnings after a liberal charge for depreciation, of $832,772, which is a decrease of $165,332, or barely 20 per cent from the previous year. This is considered a very favorable statement considering the condition of business during the year. The profits for the year are equal to a trifle more than 7 per cent on the $6,375,300 common stock, after having paid the regular 6 per cent dividend on the preferred shares. The company also made a material reduction in its notes and bills payable.

MICHIGAN STATE TELEPHONE COMPANY.—The report of the Michigan State Telephone Company, for the year 1908, shows increases of more than 10 per cent in the gross and 18 per cent in the net earnings in spite of the business depression. The net earnings applicable for dividends were $911,429, and the company is paying 6 per cent on its preferred and 4 per cent on its common stock. N. W. Harris, chairman of the board of directors, says that the year has been the most satisfactory in the history of the company, and that its financial position is stronger than it has ever been before.

MISSOURI & KANSAS TELEPHONE COMPANY.—The report of the Missouri & Kansas Telephone Company for the year 1908 shows gross earnings of $2,653,148, as compared with $2,428,893 for the previous year. The net earnings were $491,280, as against $688,822, leaving a deficit after the payment of fixed charges of $420. The company now has a total deficit of $260,069, which has been charged to reserve for maintenance. The company is the Bell subsidiary operating in Missouri and Kansas. The general depressed condition of trade is held responsible for the decrease in earnings.

CHICAGO RAILWAYS COMPANY.—The preliminary figures of the Chicago Railways Company for its fiscal year, which ended Jan. 31, 1909—January being partly estimated—show gross earnings from all sources of $10,994,306, an increase of $434,234, or a little more than 4 per cent over the earnings under the Union Traction management the year previous. The net earnings, after making all deductions required under the ordinance, are $1,558,367, a decrease of $43,465 from the previous year. The city's portion is $857,102 and the company's $701,265.

HICAGO CITY RAILWAY COMPANY'S ANNUAL PORT.—President T. E. Mitten, of the Chicago City Railway Company, submitted his annual report to the stockholders March 16. The report covers a period of 13 months, order to bring the fiscal year to Jan. 31, as prescribed by ordinance under which the company is now operating. The port shows that 54 miles of track have been reconstructed ring the 13 months ended Jan. 31, 1909. This leaves but 13½ les to be reconstructed during the present year. Of the mpany's cars, 452 are of the pay-as-you-enter type and there e four car houses having a total housing capacity of about 00 cars. Mr. Mitten refers to an "advantageous agreement" which his company will purchase of the Commonwealth Edon Company for a period of at least 10 years, from June 1, 08, all of the electrical energy used in the operation and aintenance of its railway system. A new substation has been ilt during the year, and new rotary converters are now being stalled therein. There are now four such substations, with total rating of 36,000 kw. A large storage battery has been ded to the Chicago City Railway Company's equipment in the lymouth Place substation of the Commonwealth Edison Comany. The new underground conduit system for the distribuon of power is practically completed, and the installation of bles in it is well under way. For the 13-month period the umber of paying passengers carried was 180,243,173, and the tal number of fare and transfer passengers was 292,220,866. he company owns 252 miles of single track. Its total receipts or the period mentioned were $9,195,782. The net earnings re given as $1,026,288, and the city's 55 per cent of this nder the settlement ordinance is $564.458. To the company's roportion of the net earnings are added interest on capital nvested and "other income," including contractors' profit, rokerage, etc., making the total $2,849,483. After deducting ond interest there remained $1,620,000 paid in dividends and 379.743 carried to surplus. The report shows that, although he number of paying passengers was increased about 3 per ent during the year, the net earnings were less, owing to he interest on the additional capital invested in the extensive ehabilitation work. This interest on capital is figured in the leductions from the gross earnings before the net earnings are arrived at.

NORTHERN OHIO TRACTION COMPANY STOCK LISTED.—The New York Stock Exchange has admitted to its list the $9,000,000 capital stock of the Northern Ohio Traction & Light Company, of Akron, Ohio. As the Exchange requires accurate and detailed information of a corporation's financial condition to be made at regular periods, the listing of the stock of a public service corporation unquestionably strengthens its position as an investment proposition. The company was incorporated in 1902 as successor to the Northern Ohio Traction Company. It has a total of 214.05 miles of track and has perpetual franchises to furnish light and power in Akron and Barberton. The net earnings for 1908 were $804,049 and the surplus for the year was $143,366.

PACIFIC TELEPHONE & TELEGRAPH BONDS.—It is announced that J. P. Morgan & Company and some other New York bankers will shortly offer to the public a portion of the 5 per cent collateral trust bonds recently underwritten for the Pacific Telephone & Telegraph Company. The total amount of bonds taken in this deal was $16,300,000. About $6,000,000 of this amount was the unsold portion of the $10,000,000 issue which was underwritten in 1907 by a syndicate headed by N. W. Harris & Company. Owing to the panic and depressed condition of business, the syndicate was unable to dispose of its holdings.

CHICAGO SUBWAY PLANS.—The complete report upon a subway system for Chicago, the preparation of which has been occupying the time and energy of scores of engineers and accountants for the past seven months, was made public last week. The cost for collecting the data for the report was $75,000 and it is considered that the work is one of the most complete ever got out by a municipality. An elaborate plan for subways is outlined, the basis for which will be a line encircling the business section of the city and extending to the western suburbs. This portion of the work alone, which probably will be the first undertaken, will cost at least $50,000,000.

OSWEGO COUNTY LIGHT & POWER COMPANY.—The Oswego County Light & Power Company, which is developing a hydro-electric plant at Salmon River Falls, N. Y., has petitioned the Public Service Commission of the Second District of New York for authority to increase its capital stock from $1,000,000 to $1,100,000 and to issue $2,500.000 in bonds. The reservoir, to be formed from the construction of the dam at the falls, will cover over 7000 acres and will extend easterly to Redfield, N. Y. The engineers of the company expect to develop at least 15,000 hp.

FRANCHISE REPEAL STOPPED BY COURT.—The United States District Court at Louisville, Ky., has granted a temporary injunction restraining the city from putting into effect an ordinance recently adopted by the Municipal Council, revoking the local franchise of the Cumberland Telephone & Telegraph Company. The order is made returnable March 29. For a number of months the city has been endeavoring to force a reduction in telephone rates, which the Cumberland company has so far successfully resisted.

LOUISVILLE RAILWAY COMPANY BONDS SOLD.—The Fidelity Trust Company, of Louisville, Ky., was the successful bidder for the $1,000,000 issue of 4½ per cent second mortgage gold bonds recently offered for sale by the Louisville Railway Company. The price paid was 97¾ for the entire lot. These bonds were issued to pay for the Louisville & Eastern Railroad, a suburban line which was recently taken over.

REPORTS OF EARNINGS.

	Gross Earnings.	Expenses.	Net Earnings.	Charges.	Surplus.
American Telephone & Telegraph Company:					
February, 1909	$2,264,309	$197,381	$2,096,928	$780,834	$1,316,094
February, 1908	2,102,759	181,029	1,921,730	647,546	1,274,184
Bell Telephone Company of Missouri:					
Year 1908	2,009,355	1,346,960	662,375	.....	.....
Year 1907	1,933,429	1,392,429	540,501	.....	.....
Birmingham (Ala.) Railway, Light & Power Company:					
February, 1909	117,453	108,447	69,006	44,785	24,221
February, 1908	167,341	109,848	57,493	43,524	13,969
Chicago City Railway Company:					
13 months ended Jan. 31, 1909	9,195,782	8,169,494	1,026,288	.....	379,743
13 months ended Dec. 31, 1907	7,562,693	6,410,272	1,152,421	.....	591,178
Electric Storage Battery Company:					
Year 1908	845,705	313,180	532,525	.....	.....
Year 1907	1,075,226	387,021	688,205	.....	.....
Knoxville (Tenn.) Railway & Light Company:					
February, 1909	43,867	22,601	21,265	11,483	9,782
February, 1908	42,999	23,309	19,681	11,398	9,282
London (Ont.) Street Railway Company:					
Year 1908	235,032	167,566	67,466	38,111	29,355
Year 1907	234,477	168,038	66,438	36,119	30,318
Memphis Street Railway Company:					
February, 1909	118,091	76,788	41,303	6,000	35,303
February, 1908	112,636	75,187	37,448	6,000	31,448
Missouri & Kansas Telephone Company:					
Year 1908	2,691,773	2,210,485	491,280	1,191,280	*700,000
Year 1907	2,478,724	1,790,902	688,822	1,191,280	*502,458
National Light, Heat & Power Company:					
Year 1908	381,886	130,886	251,000	111,000	140,000
Year 1907	196,888	47,888	149,000	111,000	38,000
Northern Ohio Traction & Light Company:					
February, 1909	126,842	86,542	40,300	43,667	*3,367
February, 1908	119,301	78,466	40,835	43,667	*2,832
United Railways of St. Louis:					
February, 1909	868,000	591,618	276,382	234,917	41,465
February, 1908	784,000	540,000	244,000	233,118	22,490

*Deficit.

GENERAL NEWS

Construction News.

BIRMINGHAM, ALA.—Preparations are being made by the Aldrich Power Company to erect its transmission lines in Birmingham. The company is now constructing its line from the power plant at North Birmingham to the city limits. It is said that a site has been purchased on Village Creek, where a new plant will be erected at a cost of $500,000.

TALLADEGA, ALA.—Surveys are being made of Choccolocco Creek at Jackson's Shoals for the Alabama Power Development Company in connection with its proposed power plant, which will supply electricity for lamps and motors in Gadsden, Anniston, Talladega and other points.

PHOENIX, ARIZ.—It is said that arrangements are being made to organize a company to construct an electric street car system in Phoenix to connect with a railway, which will be known as the Suburban Railway. It is expected that gasoline-electric cars will be used. J. W. Dorris, George M. Halm, Homer B. King, F. J. Bennitt and B. A. Fowler are interested in the project.

RECTOR, ARK.—The Rector Co-operative Telephone Company has filed an amendment to its charter increasing its capital stock from $5,000 to $10,000.

AGNEW, CAL.—Bids will be received by the Board of Managers of the Agnew State Hospital, at 7 West Santa Clara Street, San José, Cal., until April 7 for constructing and installation of a complete conduit heating and lighting system. Bids will be received for the complete work as per plans and specifications and for various parts as indicated on the form of proposal. Plans and specifications may be seen at the above office, at Agnew State Hospital, Agnew, Cal., and at the State Department of Engineering, Sacramento, Cal. Plans and specifications may be obtained by application to the State Department upon a deposit of $10, which will be returned when plans are returned. Proposals should be addressed to L. M. Simonsen, secretary of board of managers.

BISHOP, CAL.—The Casa Diablo Mining Company is planning to enlarge its power plant and will install a 250-kw generator to furnish electricity for new machinery in its stamp mill. H. E. McNeil is manager.

HOLLISTER, CAL.—The plant and holdings of the Hollister Light & Power Company have been purchased by the Great Western Power Company. William Palmtag is president of the Hollister Light & Power Company.

RED BLUFF, CAL.—Notice has been filed by C. E. Burris of appropriation of 10,000 cu. in. of water in Mill Creek to be diverted from the bank and carried by a flume 7 ft. wide and 4 ft. deep to a point where an electric power plant is to be erected.

RED BLUFF, CAL.—The Board of Supervisors has granted a 50-year franchise to the Sierra Electric Company to erect transmission lines for the distribution of electricity for lamps, motors and other purposes in Red Bluff. Frank C. Wilson is secretary.

SAN FRANCISCO, CAL.—The Forest Service has allowed the Nevada-California Company a right to run a second transmission line through Silver Canyon in the White Mountains. The company already operates a 113-mile line to the Tonapah and Goldfield district.

SANTA ROSA, CAL.—The City Council has granted the Northwestern Pacific Railroad Company a franchise to construct a street railway in this city.

SUISUN CITY, CAL.—The Board of Supervisors is asking for bids for a franchise for an electric railway to connect Vallejo, Benicia and White Sulphur Springs, for which preliminary surveys have been made. Randle, Wright & Trowbridge, of Oakland, Cal., have applied to the Board of Supervisors for such a franchise.

WHEATLAND, CAL.—Arrangements are being made to install a new pump and motor in the municipal water works plant.

YREKA, CAL.—The Sisiyou Electric Power Company has filed a notice of appropriation of 450,000 in. measured under a 4-in. pressure of the Klamath River, to be taken at two points about half-mile distant from the present power plant on Fall Creek. The company will commence work this spring on the construction of a new power plant to be located on the Klamath River at Ward's Canyon, which will have an output of about 60,000 hp and will require three years to build. The company's present plant at Fall Creek has an output of 6000 hp. Jesse W. Churchill is president of the company.

BOULDER, COL.—It is reported that the Rocky Mountain Hydro-Electric Company is planning to erect a new power plant, at a cost of $1,000,000.

NEW LONDON, CONN.—The Groton & Stonington Street Railway Company is making surveys for a proposed extension of its railway from Mystic to Old Mystic, a distance of three miles.

TORRINGTON, CONN.—The State Legislature has passed the bill authorizing the Borough of Torrington to issue $50,000 in bonds to pay indebtedness of the borough and to provide for extension of sewer, street lighting and fire alarm systems.

WASHINGTON, D. C.—Congress has passed the bill appropriating the sum of $100,000 for centralizing the power, heating and lighting plant, remodeling the electric layout, and substituting electrically driven for steam-driven machinery, and for other improvements to electric light and power system at the Government Hospital for Insane, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the Bureau of Docks and Yards, Navy Department, Washington, D. C., until April 17 for furnishing and installing one electric capstan at the navy yard, Philadelphia, Pa., and three at the navy yard, Mare Island, Cal. Plans and specifications can be obtained on application to the bureau of the commandant of the navy yards named. R. C. Holliday is chief of bureau.

WASHINGTON, D. C.—Bids will be received at the office of the General Supply Committee, Room 176, Treasury Department, Washington, D. C., until April 12 for furnishing general supplies ,including electrical, engineering supplies, etc., for executive departments and independent establishments and for the District of Columbia for the fiscal year ending June 30, 1910. Blank forms with specifications to bidders will be furnished on application to the above office. W. W. Ludlow is chairman of the General Supply Committee.

ATLANTA, GA.—The Piedmont Power Company has applied to the State Railroad Commission for permission to issue $5,000,000 in bonds and $3,000,000 in capital stock. The company proposes to develop water power on the Tugalo River, below Tallulah Falls, and has applied for a franchise to distribute electricity in Atlanta.

ELBERTON, GA.—The construction of an electric railway from Iva, S. C., to Elberton, via Ruckersville, Ga., is reported to be under consideration. Guy G. Rucker, of Ruckersville, Ga., is interested in the project.

LAGRANGE, GA.—Contracts have been awarded by the Unity Cotton Mills for the construction of buildings for Unity Mill No. 2. The factory will be operated by electricity and will require about 500 hp. Fuller E. Callaway is treasurer.

LEWISTON, IDAHO.—The Nes Perce & Idaho Electric Railway has been purchased by W. A. Leet, president, and C. A. Taylor, manager, of the Willamette Valley Oil Company, of Salem. Ore. Extensions will be made.

ST. ANTHONY, IDAHO.—Surveys are being made by the Idaho Falls Traction Company, of Idaho Falls, for its proposed railway from Idaho Falls to St. Anthony.

SANDPOINT, IDAHO.—It is reported that a deal has been consummated by Byllesby & Co., of Chicago, Ill., whereby the plants and holdings of Pend Oreille Electric Light Company, of Sandpoint; the Newport Light & Power Company, of Newport, Wash.; the Flathead Valley Water Power Company, of Kalispell, Mont., together with a plant at Whitefish, Mont., and several other plants, will be consolidated. The new company will be known as the Northern Idaho & Montana Electric Light Company. The holdings acquired include numerous riparian and water rights on Lightning Creek and along Moyie and Clark's rivers, which will be developed and utilized to generate electricity. A bond issue of $10,000,000 has been authorized. The company contemplates extensive improvements and extensions to all of the plants.

TWIN FALLS, IDAHO.—Plans are being made to organize a company to construct an electric railway in Twin Falls. Application will soon be made to the City Council for a franchise. I. B. Perrine is interested in the enterprise.

CHICAGO, ILL.—Bids will be received by William Carroll, city electrician, at his office, Room 403, 76 Fifth Avenue, until March 31 for furnishing the Department of Electricity with three kva. transformers in accordance with specifications on file at the above office. Proposals must be made out on blanks furnished by the city electrician.

ELGIN, ILL.—Plans are being considered by the officials of the Aurora, Elgin & Chicago Railroad Company and the City Council for replacing the present street lamps with new arc lamps.

ELMWOOD, ILL.—The Elmwood Electric Light Company has changed its system to single-phase, 60 cycles, and will establish a 24-hour service. It is in the market for motors and other appliances. E. L. Brown is manager.

HUNTLEY, ILL.—The Village Board is considering the question of installing electric street lamps, the energy to be furnished by the Elgin & Belvidere Electric Company, of which W. L. Arnold, of Chicago, is general manager.

ROCK ISLAND, ILL.—Congress has passed the bill appropriating the sum of $12,500 for operation and maintenance of power plant at the Rock Island Arsenal.

WARREN, ILL.—W. E. Bucher, of Martintown, Wis., has been making investigations in this village with a view of furnishing electricity in Warren for lamps and motors. Mr. Bucher proposes to raise his dam at Martintown, which now furnishes 700 hp, to provide sufficient power to operate a plant of sufficient output to supply electricity in Winslow.

a, Nora and Warren. As yet no franchise has been granted, but it is erstood that one will be given on very reasonable terms.

ASONVILLE, IND.—The streets of the village have been in darkness the past three weeks owing to the plant of the Jasonville Electric mpany shutting down for repairs. H. L. Hyatt, principal stockholder the company, has made a proposition to lease the plant to the town for erm of one year, charging eight per cent on the total investment, which uld amount to about $1500 per year. A committee was appointed to into the matter and report at another meeting, which will be called to e action on the same. The town has been paying the company $1800 year for the street lighting service.

NIGHTSTOWN, IND.—An examination of the municipal electric ht plant is being made with a view of improving the plant and adding e equipment.

PRINCETON, IND.—It is reported that the Weber grist mill has been sed by John Graves, of Paris, Ill. It is proposed to operate the mill by ctrical power and also to furnish electricity to light the streets of toka, Ind.

RUSHVILLE, IND.—Plans are being considered for increasing the tput of the municipal electric light plant. It is proposed to install an ditional unit and furnish a day power service. The cost of the work is mated at $8,000.

BELLEVUE, IA.—The City Council has awarded contracts for additional equipment for the municipal electric light plant as follows: For nerator, to the Westinghouse Electric & Manufacturing Company, Pittsrgh, Pa., and for gas-producer engine, to the Foos Gas Engine Comny, of Springfield, Ohio. The improvements will involve an expenditure $6116, and, when completed, a 24-hour service will be established for th lamps and motors.

CEDAR RAPIDS, IA.—Extensive improvements are contemplated by e Cedar Rapids & Marion Telephone Company to its system in Grand apids, Marion, Mt. Vernon and Kenwood Park, which will involve an xpenditure of about $26,000. Not less than 60,000 ft. of cable will e used.

MODALE, IA.—The Interstate Telephone Company has increased its apital stock from $50,000 to $100,000. W. A. Smith is president.

WEBSTER CITY, IA.—Three new telephone companies have been rganized in Webster City, all of which are building telephone lines into is city to connect with the independent company. One of the comanies is located in Independence and Rose Grove townships and the ther two in Blairsburg and Cass.

FORT LEAVENWORTH, KAN.—Bids will be received by Captain William D. Davis, quartermaster, until April 2, for electric wiring and urnishing and installing electric lighting fixtures, transformer, watt neter and making service connections to the cavalry drill hall. Plans nd specifications may be seen at the above office and at the offices of he chief quartermasters, at Omaha, Neb., and Denver, Col., and Master Builders' Exchange, Kansas City, Mo.

TURNER, KAN.—A company has been organized by several business men of Turner to construct an electric railway from Turner to Argentine, a distance of 1¾ miles, to connect with the Metropolitan Street Railway Company's system at Argentine. The name of the company and capital stock have not yet been decided upon. The officers of the company are: J. J. Swingley, chairman; F. L. Strickland, secretary, and L. P. Hewitt, treasurer.

BELLEVUE, KY.—The City Council has passed an ordinance providing for the sale of an electric light franchise. The contract provides that, if any city or district in Campbell County shall secure cheaper rates than the contract price, rates to local consumers shall be reduced accordingly. It is expected that the Union Light, Heat & Power Company, which has the present contract will be the only bidder. The contract is to take effect Sept. 1.

LEXINGTON, KY.—The City Council has authorized the Mayor to enter into a contract with the Lexington Railway Company to furnish electricity for street lighting. Under the contract the company is to furnish arc lamps at the rate of $74 per lamp per year, which is a reduction of $4.50 per lamp per year, and to furnish 16-cp incandescent lamps on the viaduct at $8.50 each per year. The price for electricity for residential lighting is to be reduced from 20 to 18 cents per kw-hour, with a discount of 20 per cent if paid within the time limit. A reduction was also made in the charge for electricity for lamps in the city buildings.

LOUISVILLE, KY.—The City Council has granted P. Campbell Montfort of the Fifth Avenue Hotel, a franchise to erect electric lights for lamps and heat on the block on which the hotel is located.

ABILENE, KAN.—The managers of the municipal electric light plant have decided to install tungsten lamps for street lighting, commercial and residential lighting.

PLAQUEMINE, LA.—The power house of the Plaquemine Electric Light & Power Company is reported to have been destroyed by fire.

ALFRED, MAINE.—The citizens have voted to contract with the York Manufacturing Company to furnish electricity for the town for a period of ten years, at a cost not exceeding $1,500 per year.

BINGHAM, MAINE.—The citizens have voted to authorize the selectmen to enter into a contract with the Bingham & Dead River Railway Company to light the streets of the town for one year.

BINGHAM, MAINE.—The Bingham & Dead River Railway Company has applied to the State Legislature for a charter to operate an electric railway in the Dead River region. E. E. Richards, of Farmington, and Cyrus W. Blanchard, of Wilton, Maine, represented the company.

BOWDOINHAM, MAINE.—It is reported that the Bowdoinham Reduction Company, recently organized, contemplates installing an electric power plant and may furnish electricity for lighting the town.

KENNEBUNK, MAINE.—The citizens have voted to install an auxiliary steam plant in the municipal electric light station, for which $7,000 has been appropriated. It was also voted to extend the electric light system up through Alewive at a cost of $2,500. A committee, consisting of Frank W. Bonser, Edwin I. Littlefield and Philbert Raino, has been appointed to have entire charge of the electric light department.

HAGERSTOWN, MD.—Plans are being considered to double the output of the municipal electric light plant. J. O. Beard, general manager, has been instructed to ascertain the cost of the work. It is proposed to install a 1000-hp engine and a 750-kw generator, at an estimated cost of $20,000.

BOSTON, MASS.—Sealed proposals will be received at the U. S. Engineer Office, Boston, Mass., until April 26 for boilers, engines, generators, electrical cable and switchboards. Information and blank forms may be obtained on application to the U. S. Engineer offices at Boston, Mass., Seattle, Wash., Portland, Ore., and San Francisco, Cal.

BROOKLINE, MASS.—The committee appointed by the Selectmen to investigate the question of establishing a municipal electric light plant have decided against the plan and recommend that the town continue to purchase electricity from the Boston Consolidated Gas Company under the new schedule submitted to the town. The rates under the new schedule offered by the company, to take effect July 1, are as follows: Flat rate, 14 cents per kw-hour; maximum demand, primary 16 cents per kw-hour, secondary 7½ cents, tertiary 5 cents, arc lamps $110 per lamp per year; and rates to go into effect July 1, 1910, are, respectively, 16 cents, 18 cents, 7½ cents and $110. The prices at present are, respectively, 16 cents, 18 cents, 8 cents, 5 cents and $124.

HOLYOKE, MASS.—The bill to amend the charter of the Holyoke Water Power Company to enable the company to sell electricity to its tenants has been passed by the Legislature. Plans are being prepared by the company for erecting new buildings in the near future.

OLDTOWN, MASS.—The citizens have voted to establish a street lighting system in Oldtown, electricity for which will be furnished by the municipal electric light plant of North Attleboro. Work on construction of the transmission lines will begin about April 1. William Plattner is manager of the electric light plant.

WAKEFIELD, MASS.—The committee appointed to make investigations in regard to the municipal electric light plant has submitted its report, in which it advises the town to abandon the plant and to purchase electricity to operate the municipal system for a term of five years. The Malden Electric Company has submitted a proposition to the committee for furnishing electrical energy as follows: Under a five-year contract the company agrees to furnish a minimum of 200 kw at the rate of 3¼ cents per kw-hour at the switchboard of the municipal plant.

BAY CITY, MICH.—The Chippewa River Power Company has applied to the City Council for a franchise to supply electricity for lamps and motors in Bay City. The company has acquired property along the Chippewa River, in Chippewa and Midland Counties, and proposes to construct a series of dams for the development of a hydro-electric plant to generate electricity for lamps and motors. J. L. Hudson, of Detroit, Mich., is president; Wilbur F. Davidson, of Port Huron, Mich., vice-president, and Frederick B. Brown, of Port Huron, treasurer.

GALESBURG, MICH.—The Independent Co-operative Telephone Company is making arrangements for the construction of a local exchange in Galesburg and for the erection of trunk lines to Augusta, Climax, Scotts, Howlenburg, Comstock and Kalamazoo.

GRAND RAPIDS, MICH.—The city is considering the question of erecting a hydro-electric power plant. L. W. Anderson is city engineer and Prof. Lyman E. Cooley, consulting engineer.

WAYNE, MICH.—The capital stock of the People's Telephone Company has been increased from $[illegible] to $[illegible].

DULUTH, MINN.—The Duluth-Edison Electric Company, it is said, will place its wires underground as soon as the frost is out of the ground.

FERGUS FALLS, MINN.—At an election to be held April 6 the citizens will vote on the proposition to issue $5,000 in bonds, the proceeds to be used for extensions to the municipal electric light plant.

FERGUS FALLS, MINN.—The plant of the Otter Tail Power Company is nearly completed. The company is now furnishing electricity to a [illegible]

MINNEAPOLIS, MINN.—A [illegible] railway from Minneapolis to Anoka, for which the sum of $75,000 has been pledged. It is expected that gasoline-electric cars will be operated. C. A. [illegible]

WEGELAND, MINN.—A [illegible]

EARYSVILLE, [illegible]

preparations to construct an underground conduit system in the business section of the city.

ST. JOSEPH, MO.—The St. Joseph Railway, Light, Heat & Power Company has decided to increase the output of its plant by 2500 kw and will install additional equipment at a cost of $100,000. John Van Brunt is general manager.

ST. JOSEPH, MO.—The Home Telephone Company has filed with the county recorder a mortgage of $2,000,000 on its plant to secure an issue of a like amount in bonds. The company proposes to erect a new plant in St. Joseph at a cost of $750,000.

ST. LOUIS, MO.—The St. Louis, Creve Coeur Lake & Western Railway Company, which proposes to construct a street car line on Etzel Avenue and the Olive Street road to the upper end of Creve Coeur Lake, will, before transmission lines are erected, experiment a storage battery car and a gasoline-electric car. The railway will be double-tracked and will cost, approximately, $750,000.

BILLINGS, MONT.—The Madison River Power Company is making arrangements to construct a high-tension transmission line from Billings to Livingstone, which will eventually be extended to Great Falls.

LEWISTON, MONT.—Samuel W. Gebo, owner of the Spring Creek coal mines, is planning to establish an electric and gas plant, and has applied to the City Council for a franchise. The matter will be submitted to the people at a special election.

MOORE, MONT.—George I. Fogle, it is reported, contemplates the construction of an electric light and power plant.

PAWNEE CITY, NEB.—Plans are being considered to install a 30-kw, alternating-current, 1100-volt, 60-cycle generator in the municipal electric light and water-works plant. I. E. Foose is superintendent.

GOLDFIELD, NEV.—The Nevada-California Power Company is planning the erection of a new transmission line, about 314 miles in length. The new part of the line will extend from Tonapah to Ely and will furnish electricity for lamps and motors to the camps between the two cities. Electricity transmitted to Ely will be utilized to operate the hoists of the large copper mines and machinery in the smelters. The power plant is located at Bishop, Cal., and already furnishes electricity in Tonapah and other important camps.

ROUND MOUNTAIN, NEV.—L. D. Gordan, of Round Mountain camp, states that preparations are being made by his company to increase the output of its mill by 20 per cent and to equip the machinery to be operated by electricity. A compressor plant will also be installed.

WABUSKA, NEV.—Plans are being considered by the St. Ives Leasing Company for the construction of a mill and power plant on East Walker River, about 30 miles from Wabuska, where it is estimated that 300 hp can be developed.

DERRY, N. H.—A committee, consisting of William T. Morse, Frank N. Young, Cassius S. Campbell, Amos L. Proctor and Lando B. Hardy, has been appointed to investigate the question of installing an electric light plant in connection with the municipal water-works system to furnish electricity for street lamps.

EPPING, N. H.—At a recent town meeting the Selectmen were authorized to enter into a contract with the Newmarket Electric Light Company to furnish electricity to light the streets and town hall for a period of five years, with the privilege of renewing it for an additional five years.

HOOKSET, N. H.—The Selectmen have been authorized to enter into a contract with the Manchester Traction, Light & Power Company to light the streets of the village at a cost of about $1,300 per year.

MILTON MILLS, N. H.—The citizens have voted to accept the proposition of the proprietors of the Townsend's Mills to light the town with electricity furnished from the plant at the mills.

PLAISTOW, N. H.—The citizens are considering the question of lighting the streets of the town by electricity. It is said that the Haverhill Electric Company, of Haverhill, Mass., is ready to extend its transmission lines to Plaistow Centre and Westville to furnish electricity in both villages.

WINCHESTER, N. H.—The electric light committee has been authorized to enter into a contract with some electrical company to furnish electricity to light the streets of the town. It is proposed to install 75 street lamps at a cost not to exceed $1,350 per year.

ASBURY PARK, N. J.—Engineer Everett Hill has submitted a report to the Council recommending the adoption of electricity as motive power for the sewage disposal plant, the adoption of alternating current for the pumping station and the installation of a duplicate generating plant in the water-works station to furnish electricity for both the sewage pumping station and the Deal Lake pumping station, and the consummation of a contract with the Atlantic Coast Electric Light Company for service in case of break-down to the sewage disposal station. The cost of the plant is estimated at $6000.

LAKEWOOD, N. J.—Application has been made to the Secretary of State by Charles H. Le Compte and James H. Butcher, of Lakewood; R. A. Clark, Joseph W. Johnson, A. C. S. Havens and William K. Blodgett, of Point Pleasant, N. J., for a charter to construct an electric railway from Lakewood to Point Pleasant, a distance of nine miles. It is proposed to take over the franchises and rights of way of the Vanderbilt electric railway, which is now in the hands of a receiver.

NEWARK, N. J.—It is reported that the Public Service Corporation has purchased the plant and holdings of the Block Light & Power Company, of which Benedict Pitch is president, and of the Newark Block Lighting Company, of which James M. Seymour is president.

NEWARK, N. J.—At a recent meeting of the Second Ward Improvement Association an estimate of the proposed electric lighting plant for Irvington, prepared by James M. Seymour, of the Block Lighting Company, of Newark, was presented. Mr. Seymour estimates that the cost of a plant with sufficient output to supply 6000 lamps at $34,000, but, owing to the scattered population in the town, does not recommend the installation of the plant at this time.

PRINCETON, N. J.—The University Power Company has offered to deed its extensive system of conduits, built some years ago, to the town. It is understood that the company will turn the system over to the borough free of charge.

SOMERS POINT, N. J.—The City Council has declared in favor of establishing a municipal electric light plant and has adopted a resolution to call a special election to vote on the proposition to issue $15,000 in bonds, the proceeds to be used for the construction of the plant. It is proposed to have the plant in operation the coming season.

TRENTON, N. J.—R. C. Jones and J. Aspinwell Hodge are interested in a project to construct an electric railway from Trenton to Asbury Park.

FORT BAYARD, N. M.—The bill appropriating the sum of $80,000 for the construction of a central power plant and cold storage plant at the United States Army General Hospital, Fort Bayard, N. M., has been passed by Congress.

SANTA FE, N. M.—Arrangements have been completed by the Santa Fé Water & Light Company for the construction of an electric light plant in Santa Fé. Frank Owen is manager.

ALBANY, N. Y.—The Oswego County Light & Power Company has applied to the Public Service Commission, Second District, for permission to increase its capital stock from $1,000,000 to $1,100,000 and to issue $2,500,000 in bonds. The company proposes to develop the water power at Salmon River Falls and construct a power plant and erect transmission lines to supply electricity for lamps, motors and heat in Syracuse, Watertown, Oswego, Rome and Oneida, and probably for interurban railways leading out of Syracuse. It is estimated that 15,000 hp can be developed at a cost of about $3,100,000. The plant complete will cost about $4,000,000.

CASTLETON, N. Y.—The citizens are considering the question of lighting the streets of the village, for which two propositions have been submitted to the Village Trustees, as follows: The Kelly Shoe Company has offered to furnish 60 electric street lamps at $20 each per year; the Corgan Brothers offer to light the streets with acetylene gas for $1,200 per year. The question will be voted upon at the next election.

FREEPORT, N. Y.—At an election held March 16 the citizens voted to appropriate $7,500 for maintaining the street lighting system and to establish an all-night schedule; also to appropriate $15,000 for extensions to the municipal street lighting system and water-works system.

NEWARK, N. Y.—The Newark & Marion Railway Company contemplates extending its railway to Williamson, a distance of six miles. The railway between Newark and Marion, a distance of ten miles, is being operated by steam temporarily.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent school buildings, Department of Education, New York, N. Y., until March 29 for installing electric equipment in new Public School No. 162, on St. Nicholas Avenue, Borough of Brooklyn.

NIAGARA FALLS, N. Y.—It is reported that a syndicate of American and Canadian capitalists is contemplating the construction of an electric railway from Niagara Falls to Toronto, which will include the construction of another bridge about a mile below the falls.

NIAGARA FALLS, N. Y.—The Water Commissioners have decided to accept the offer of the Niagara Falls Hydraulic Power & Manufacturing Company of $20,000 for the pumping station site and water rights, in consideration of which the company will furnish electricity for operating the proposed new pumping station at $9 per hp per year.

NYACK, N. Y.—The Rockland Railroad Company has filed a certificate with the Secretary of State of the proposed extension of its railway from Nyack to Stony Point, Congers to Rockland Lake, West Nyack to Suffern, Nanuet to Pearl River, Sparkhill to State Line, between New York and New Jersey. Benjamin A. Hegeman, Jr., is president, and Arthur C. Miller, vice-president.

PORT BYRON, N. Y.—The citizens on March 18 voted to install an electric lighting system in this village. It is proposed to light the streets with 100 or 150 tungsten lamps of 50 cp; also to erect a substation and to secure electricity for operating the system from the Niagara & Lockport Power Company. The cost of the substation and street lighting system is estimated at $6,000.

ROCKVILLE CENTRE, N. Y.—The citizens on March 16 voted to appropriate $4,500 for extending and improving the municipal electric light plant.

SYRACUSE, N. Y.—The Syracuse Lighting Company has made application to the Public Service Commission for permission to issue $2,500,000 in bonds, of which $207,000 is to be used for extensions to its distributing system and other improvements to its plant, and $2,293,000 to be held for future construction and improvements.

TICA, N. Y.—The supervisors' committee on lighting the county dings has decided to engage an electrical engineer to prepare plans specifications for an electric plant to light the county buildings.

AYETTEVILLE, N. C.—The Little River Power & Transmission Comy is now supplying electricity in Fayetteville for lamps and motors for mmercial purposes and also for operating the Fayetteville Street Rail- Company's system. The city has entered into a contract for street hting, which will result in a saving of about $2000 per year. The was formerly lighted by a municipal electric light plant. The comy's plant is located on the Little River, at Manchester, 12 miles above yetteville. The power company is erecting a steam plant in Manchester be used in emergencies.

WADESBORO, N. C.—Surveys are being made with a view of develop- the water power property near Wharfstown. A. H. Richardson, of arlotte, N. C., is interested in the project.

DICKINSON, N. D.—Messrs. Hughes & Dieters are planning to enlarge eir electric light plant. Two boilers will be installed.

FARGO, N. D.—The City Council is considering the question of enterg into a contract with the Otter Tail Power Company to furnish elec- city in this city from its plant in Fergus Falls, Minn. The present ntract with the local company does not expire until next September.

GOODRICH, N. D.—The Sheridan County Telephone Company has en granted a franchise to construct and operate a telephone system in heridan County.

BAINBRIDGE, OHIO.—The Paint Creek Power, Light & Heat Comany contemplates the construction of a hydro-electric plant, at a cost of ,750,000. I. J. Miller, of Fairview Heights, Cincinnati, Ohio, is interested.

CANAL DOVER, OHIO.—The Canal Dover Board of Public Service ill award contracts on March 24 for the construction of a municipal lectric light plant, for which bonds to the amount of $35,000 have been old. The plans call for a plant of sufficient output to supply 200 arc amps and 15,000 incandescent lamps. The new plant will be located near he water-works plant and natural gas will be used as fuel. Electrical ervice in the city is now supplied by the Tuscarawas County Light & ower Company, of New Philadelphia, Ohio.

CINCINNATI, OHIO.—The capital stock of the Richwood Telephone Company has been increased from $50,000 to $65,000.

COLUMBUS, OHIO.—Bids will be received by the Board of Public Service until March 29 for furnishing material for the municipal electric ight plant as follows: Two 150-kw transformers; 76,000 ft. No. 6 B. & S. gage T. B. weatherproof solid copper wire, or an alternative bid for 99,000 ft. No. 4 B. & S. gage bare solid aluminum wire; all as per specifications on file with the Board of Public Service. Edward W. Hirsch is secretary of board.

NORWALK, OHIO.—It is reported that the Sandusky, Norwalk & Mansfield Railway Company is preparing to construct a power plant to operate its system. The company now purchases electricity from the Lake Shore Electric Company.

PIQUA, OHIO.—The Orr Felt & Blanket Company has completed arrangements for the construction of a large mill to be operated entirely by electricity, which will be generated by the company's own plant. Each machine will have an individual motor.

POMEROY, OHIO.—The Pomeroy, Rock Springs & Athens Traction Company is planning to construct an electric railway from Pomeroy to Athens. The power plant will be located on the fair grounds at Rock Springs. A. W. Lee, of Pomeroy, is chief engineer.

BARTLESVILLE, OKLA.—We are informed that John O. Taylor and James E. Hickey, of Bartlesville, and William Moore, of Nowata, Okla., are interested in a project to construct an electric railway between Bartlesville and Nowata, a distance of about 20 miles.

RYAN, OKLA.—An election will be held to vote on the proposition to issue $69,000 in bonds, the proceeds to be used for the construction of an electric light plant, water-works and sewer systems.

TONKAWA, OKLA.—Contracts have been awarded for the construction of a municipal electric light plant and extension of water-works system as follows: For construction work, to Lund & Cunyon, for $15,483; electrical equipment, to the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., for $4,040; engines, to the English Iron Works, for $2,075; for street lamps, to the Collier-Clark Construction Company, for $600; for pump to the Deane Steam Pump Company, for $1[illegible]; and [illegible] Water Works Company, for hydrants and valves $[illegible]. Burns & McDonnell, Scarritt Building, Kansas City, Mo., are engineers.

WYNNEWOOD, OKLA.—Plans are being prepared for the construction of a municipal electric light plant and water-works system.

ASHLAND, ORE.—Judge Hanna, of the United States Circuit Court, has issued a decree dissolving the temporary injunction against the city of Ashland in the suit of the Ashland Electric Light Company to prevent the city from installing an electric light plant. The City Council has authorized an issue of $[illegible] in bonds for construction of the plant.

EUGENE, ORE.—The City Council has granted a franchise to the Lane County Water Company to construct an electric railway in Oregon, to be operated in connection with the proposed Lane Electric electric railway being promoted by the company.

PORTLAND, ORE.—The City Council has authorized Gov. Vrooman, Parker [illegible] to confer with representatives of the lighting companies [illegible] and [illegible] the city.

ALTOONA, PA.—The directors of the Edison Electric Illuminating Company have decided to enlarge and remodel its plant and to extend its electrical service. Contracts for equipment, which will include dynamos, electrical apparatus, etc., boilers and engines, will be placed at once. The cost of the work is estimated at $250,000.

ELIZABETH, PA.—The City Council has granted the Peters Creek Street Railway Company a franchise to operate a railway over certain streets in this city which provides for a connection with the Pittsburg Railways Company's lines at Dravosburg.

HAZLETON, PA.—The Harwood Electric Power Company has commenced work on the construction of a large power station at the Harwood Mines, near Hazleton. Four turbines and boilers have been installed and placed in operation. Plans and specifications have been prepared by the Scofield Engineering Company, consulting engineers, Arcade Building, Philadelphia, Pa.

LANSDOWNE, PA.—The date of opening for receiving bids for street lighting has been postponed from March 20 until May. The Borough Council is advertising for bids for lighting the streets of the borough for a term of five years; also for a term of 10 years. Specifications may be secured from William C. Shuster, Jr., 17 Lansdowne Avenue, Lansdowne. John W. Davis is secretary of Borough Council.

PHILADELPHIA, PA.—Chief McLaughlin, of the Electrical Bureau, has submitted a report showing that the cost of installing 520 arc lamps (408 more lamps than now in use) on Market, Walnut, Chestnut and Broad streets, between Vine and Spruce streets, would be $15,940, while the cost of maintenance of the 408 additional lamps would be $40,824 per year.

SCHUYLKILL HAVEN, PA.—The citizens have voted to appropriate $11,000 to make improvements to the municipal electric light plant.

TAMAQUA, PA.—The Edison Electric Illuminating Company has absorbed the plant and holdings of the Tamaqua Light, Heat & Power Company. The last-named company held a contract to light the streets of the city for 10 years. J. G. White & Co., New York, N. Y., are operating managers.

WAYNESBURG, PA.—The Waynesburg & Monongahela Street Railway Company is making arrangements to commence work on construction of its proposed electric railway from Waynesburg to Monongahela, for which contracts have already been placed. W. J. Sheldon, of Waynesburg, is general manager.

WILKES-BARRE, PA.—Bids will be received by A. W. Morse, clerk of School Board, until April 26, for boilers, power plant, heating and ventilating of the High School at Wilkes-Barre as follows: (1) Boilers, breeching and stack. (2) Power plant equipment and heating and ventilating system. (3) Electrical work. Plans and specifications may be obtained after April 5 at the office of Runyon & Carey, engineers, 122 Market Street, Newark, N. J., or at the office of Owen McGlynn, Wilkes-Barre, Pa. A. E. Burnaford is president of School Board.

ANDERSON, S. C.—Plans are being made for alterations and the installation of additional equipment in the Gluck Cotton Mills, of Anderson. The company proposes to furnish electricity for lamps in the mill village, and will also supply electric service to the cottages.

SPARTANBURG, S. C.—The Electric Manufacturing & Power Company has reduced the price of electricity for residential and commercial lighting from 15 to 12 cents per kw-hour, with a discount of from 10 to 60 per cent, according to the amount consumed. A reduction has also been made for motor service. The company has also agreed to extend the street car service to various suburban towns. F. H. Knox is vice-president and general manager.

WELLFORD, S. C.—The Jordan Manufacturing Company has decided to enlarge its plant, which will be operated by electricity. The company manufactures towels and bedspreads.

LEAD, S. D.—The Homestake Mining Company is planning to construct a hydro-electric plant on Spearfish Creek at a cost of about $500,000.

WAGNER, S. D.—The Dakota Gas, Electric Light & Power Company has placed an order with the Minneapolis Steel & Machinery Company for an 80-hp Muenzel producer gas engine and suction gas producer plant. The company already has one Muenzel unit in operation.

CHATTANOOGA, TENN.—The East Tennessee Telephone Company has decided to make extensive improvements to its system in Chattanooga, which will involve an expenditure of approximately $65,000. The work will include a cable from the local exchange to St. Elmo, and from there to Lookout Mountain.

JOHNSON CITY, TENN.—The Austin Springs Railway Company is making arrangements to construct a railway between Johnson City and Austin Springs, a distance of five miles, for which surveys have been made and contracts for rails have been placed. The motive power has not yet been decided upon. J. B. Cox is interested in the project.

RIPLEY, TENN.—The capital stock of the Ripley Light, Water & Ice Company has been increased to $15,000. The company is planning to make improvements to its plant.

WELLSVILLE, UTAH.—The capital stock of the Wellsville Light, Water & Light Company has been increased from $75,000 to $100,000.

ST. ALBANS, VT.—The Vermont Power & Manufacturing Company is contemplating the extension of its transmission lines from its plant at [illegible] to Cambridge Junction to furnish electricity for lamps and motors.

COVINGTON, VA.—Application has been made to the City Council by J. M. Nettleton, J. R. Pixley and William McD. McMaster for a franchise to construct and operate an electric light plant.

RICHMOND, VA.—The committee on light has recommended the City Council to renew the present contract for street lighting with the receivers of the Virginia Passenger & Power Company for one year, beginning July 1, 1909. The contract provides that the company shall maintain, as at present, 854 arc lamps at $54.75 each per year. In addition to the present lamps, the city has the option of ordering 107 additional lamps to be located within the city limits, at the rate of $160 each per year. If less than 100 additional lamps are ordered, the charge will be increased, the rate for 50 additional lamps being $180 per lamp per year. The Virginia Passenger & Power Company has submitted three propositions for additional lamps, with a view of the city purchasing its poles and wires. The first provides that, in addition to the lamps now furnished at $54.75, the company will maintain and operate any number of additional lamps for $40 per lamp per year, provided the city will purchase and erect the additional lamps with transformers, wires, poles and equipment necessary to connect the lamps with the present system, which will remain the property of the city. The second proposition provides that the company will erect, and operate any number of lamps of the type now in use, located anywhere in the city, at $54.75 per lamp per year, provided the city will agree to purchase the entire street lighting equipment in the city at the expiration of the contract, the value to be determined by a board of three arbitrators, the total value not to exceed $50,000. The third proposition provides that the company on the expiration of the existing contract, July 1, 1909, shall sell to the city of Richmond the present street lighting system, including distributing system and transformers, etc., the price to be determined by a board of arbitrators, and to sell electricity to the city to operate the system for one year at the lowest rates, to be supplied at a central point over the city's wires.

SEATTLE, WASH.—It is reported that bids are being called in Chicago for equipping the section of the Chicago, Milwaukee & St. Paul Railroad from St. Regis, Mont., to St. Joe, Idaho, to be operated by electricity. It also reported that bids will be received for the construction of 35 miles of track between Gate City and McKenna Junction. The contract for the Tacoma Terminal has been awarded to Twohy Brothers, of Spokane, Wash.

SPOKANE, WASH.—The Okanogan Electric Railway Company, it is stated, has awarded a contract for grading about 40 miles of roadbed. The power plant will be located near Cuess. The company proposes to construct an electric railway from Nighthawk to Brewster, a distance of 60 miles. A. M. Dewey, of Spokane, is president.

SPOKANE, WASH.—Arrangements are being made by the Washington Water Power Company to construct another 60,000-volt transmission line (a tie line) from its substation on Twenty-ninth Street to the new power plant, now under construction on the Spokane River at Little Falls. The company is considering steel tower construction for the new line.

EDGAR, WIS.—It is reported that a stock company will be formed to construct an electric light plant in Edgar.

FORT ATKINSON, WIS.—The plant and holdings of the Cambridge Independent Telephone Company have been purchased by A. W. Larson, of Deerfield, who will improve and extend the system. A direct telephone line will be erected to Deerfield and also another line to Fort Atkinson.

JUNEAU, WIS.—The Milwaukee Western Electric Railway Company has secured a franchise for the section of its proposed electric railway between Hustisford and Beaver Dam. J. W. Barber, of Milwaukee, Wis., is secretary.

MANITOWOC, WIS.—The Wisconsin Knitting Mills Company is building an addition to its plant which will soon be completed. The company will expend $13,000 for new machinery for the new plant, which will be operated by electricity.

MARTINTOWN, WIS.—It is reported that W. E. Bucher, owner of water power rights in Martintown, contemplates raising the dam and constructing an electric power plant and furnishing electricity for lamps and motors in Winslow, Lena, Nora and Warren, Ill.

RICE LAKE, WIS.—It is reported that the Red Cedar Valley Electric Company has purchased the dam site and franchise on the Red Cedar River, and will construct a concrete dam and power house this spring. Four more turbines will be installed.

COCHRANE, ALTA., CAN.—The Calgary Power & Transmission Company, of Calgary, Alta., has entered into an agreement to supply the town of Cochrane with electricity for lamps and motors. The company is also negotiating with several other towns to furnish electrical service.

LETHBRIDGE, ALTA., CAN.—The Alberta government has purchased a site in Lethbridge for a telephone exchange, which will be the long distance headquarters for Southern Alberta. For further information address W. H. Cushing, Calgary, Alta.

MEDICINE HAT, ALTA., CAN.—The Southern Alberta Land Company, it is stated, is making preparations for the construction of an electric railway from Medicine Hat to its holdings.

VICTORIA, B. C., CAN.—The British Columbia Electric Street Railway Company is seeking a franchise to transmit electricity for lamps and motors in Victoria from its $1,500,000 plant to be constructed on [illegible]

SELKIRK, MAN., CAN.—Sealed tenders will be received by [illegible] secretary of the Department of Public Works, Ottawa, until March 10 for the electrical work and fixtures for the new public building in Selkirk.

WINNIPEG, MAN.—Contracts have been awarded by the city for the construction of the transmission line from the Point Du Bois power development to the Williams-on Construction Company, of Toronto, Ont., for $118,424, and for the telephone line to R. & D. McLeod, for $23,421.

WINNIPEG, MAN., CAN.—Sealed tenders will be received by Magnus Peterson, secretary of the Civic Board of Control, until April 2 for the supply of materials required for the extensions to the civic electric lighting system during the year. F. E. Cambridge is city electrician.

BRANTFORD, ONT., CAN.—The City Council has passed a by-law authorizing an agreement with the Cataract Power Company to supply the city with electricity for lamps and motors for a term of five years. Under the new contract the company is to furnish 250 arc lamps at $48 per arc lamp per year, which is a reduction of $7 per lamp on the former contract; also agrees to furnish electricity for domestic and commercial lighting at 7.65 cents per kw-hour, instead of 9 and 10 cents as formerly charged.

FORT WILLIAM, ONT., CAN.—The farmers of Paipoonge Township are organizing to secure a rural telephone system, which will be connected with this city and also with Port Arthur. For further information address Dr. D. C. Garver.

LONDON, ONT., CAN.—City Engineer Sifton has recommended to the City Council the acceptance of the offer of the Hydro-Electric Power Commission to supply 5000 electrical hp at $29.81 per hp per year.

ORANGEVILLE, ONT., CAN.—Preparations are being made for the construction of the power plant of the Dufferin Light & Power Company of Orangeville, the equipment of which will include three 150-kw hydraulic units with step-up transformers to 22,000 volts. It is said that bids for construction of the plant will soon be asked for by Smith, Kerry & Chace, consulting engineers, Confederation Life Building, Toronto, Ont.

OWEN SOUND, ONT., CAN.—A petition is being circulated asking the Government to guarantee $150,000 bonds of the Georgian Bay Power Company, a local concern.

STAMFORD, ONT., CAN.—The Township Council is considering the question of extending the electric street lighting system to Lundy's Lane, Falls View and other side streets in the town. The Ontario Distributing Company has agreed to extend its transmission lines if it can secure contracts to place 800 lamps in residences in that section of the town. A committee has been appointed to make arrangements to secure the service.

TORONTO, ONT., CAN.—Sir Thomas Shaughnessy, president of the Canadian Pacific Railway Company, states that the company will make a number of experiments with electrical storage locomotives on the western lines of the company this year.

TORONTO, ONT., CAN.—Plans and specifications have been completed by K. L. Aitken, engineer in charge of the municipal distributing plant, for copper cables, which have been approved by Alexander Dow, consulting engineer, Detroit, Mich. It is estimated that the cables will cost between $40,000 and $50,000.

MONTREAL, QUE., CAN.—The Bell Telephone Company, of Canada, has appropriated $1,000,000 for improvements and extensions during the year 1909.

MONTREAL, QUE., CAN.—Application is being made for the incorporation of the Canadian, Liverpool & Western Railway Company with powers in addition to the construction of railways, to distribute electrical power. For further information address S. G. McClenahan, Montreal, Que.

BIENFAIT, SASK., CAN.—A local and rural telephone company is being organized here. For further information address Ira F. Brown.

MANOR, SASK., CAN.—Plans are being made to organize a local and rural telephone company in Manor. For further information address W. G. Bell.

OXBOW, SASK., CAN.—The Oxbow Telephone & Lighting Company has decided to build rural lines to Auburnton, Arthur, Boscurvis and Glen Ewen. For further information, address J. P. Tripp.

WASCANA, SASK., CAN.—Steps are being taken to organize a telephone company, which will be known as the Wascana Rural Telephone Company.

Company Elections.

EUREKA, CAL.—At the annual meeting of the Humboldt Gas & Electric Company the present board of directors were re-elected as follows: W. S. Clark, Henry Deering, George Murray and H. Vance.

INDIANAPOLIS, IND.—The stockholders of the Columbus, Greenburg & Richmond Traction Company have elected the following-named officers: August Kuhn, president; R. E. Moore, of Indianapolis, Ind., secretary, and Walter J. Maconaha, of Richmond, Ind., treasurer. The old board of directors was re-elected.

CARTHAGE, MO.—At the annual meeting of the Carthage Water & Power Company the following-named officers were elected: M. B. Daly, president, and Mrs. E. Messenger, secretary and treasurer.

ACONIA, N. H.—At the annual meeting of the Laconia Electric Light Company the following officers were elected: W. L. Moran, president; F. Moran, vice-president; Thomas E. Steer, treasurer, and Fred L. Thomas, general manager.

WAYNESBURG, PA.—The Waynesburg & Monongahela Street Railway Company, recently incorporated, has organized with the following-named officers: Peter Langsdorf, of McKeesport, Pa., president; W. J. Sheldon, of Waynesburg, vice-president and general manager; J. Carson Sheldon, of Buffalo, N. Y., secretary; Charles Koehler, of McKeesport, treasurer.

New Industrial Companies.

MYERS & MOORE, of Chicago, Ill., has been chartered with a capital stock of $10,000 by A. H. Myers, J. R. Moore and C. C. Ayers. The company proposes to do a general electrical contracting and repairing business.

THE MODERN ELECTRIC APPLIANCE COMPANY, of Mobile, Ala., has filed articles of incorporation with a capital stock of $10,000. The officers are: J. J. Blacksher, president; E. E. Wager, vice-president, and B. B. Chamberlain, secretary and treasurer.

THE CENTAUR MOTOR COMPANY OF ILLINOIS, of Chicago, Ill., has been incorporated with a capital stock of $10,000 for the purpose of manufacturing motors and accessories. The incorporators are: Arthur M. Robbins, Robert E. Haley and Albert E. Lake.

THE L. S. MONTGOMERY COMPANY, of Atlanta, Ga., has been incorporated with a capital stock of $50,000 to deal in electrical supplies and specialties. L. S. Montgomery is president and general manager and Paul de V. Chaudron, secretary and treasurer.

THE NATHAN KLEIN COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 to manufacture electrical and gas fixtures. The incorporators are: Benjamin Besunder, of Passaic, N. J.; Maurice Jacoby and M. Jacoby, both of New York, N. Y.

THE MASHEK ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $50,000 by G. J. Mashek, C. S. Anderson and G. Frieling, of New York, N. Y. The company proposes to do a dredging, contracting and engineering business.

THE SCHENECTADY LINONITE COMPANY, of Schenectady, N. Y., has filed articles of incorporation with a capital stock of $80,000 to manufacture and handle electric insulation. The incorporators are: M. O. Caldwell, Harvey Leamon and Edwin Clute, of Schenectady, N. Y.

THE MONARCH ENGINEERING COMPANY, of Buffalo, N. Y., has been chartered with a capital stock of $25,000 by Harry R. Wait and B. I. Wait, of Buffalo, N. Y., and Thomas H. Hennessy, of Oswego, N. Y. The company proposes to do a general engineering and contracting business.

JAMES H. ROBERTS & COMPANY, of Kittery, Maine, has been incorporated with a capital stock of $150,000 for the purpose of manufacturing and dealing in power transmission materials. The officers are: Horace Mitchell, of Kittery, president; S. J. Morrison, of Portsmouth, N. H., treasurer.

THE COMMERCIAL LAMP COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 to manufacture lamps, machinery and appliances for light and heat. The incorporators are: Henry S. Hooker, Forsyth Wickes and Robinson Leech, of New York, N. Y.

THE GOULD SPECIALTIES CORPORATION, of New York, N. Y., has been incorporated with a capital stock of $60,000 to manufacture machinery, engines and mechanical devices by Robert M. Stephens, of Hackettstown, N. J.; Therón A. Gould, of Newark, N. J., and John B. Wentworth, of New York, N. Y.

THE McCRACKEN BANK PROTECTIVE & FIRE-ALARM COMPANY, of Terre Haute, Ind., has been incorporated, with a capital stock of $100,000. The company will establish and equip a plant to manufacture the McCracken electric alarm system apparatus. James H. McCracken, James M. Armstrong and J. D. Pollom are directors.

New Incorporations.

BIRMINGHAM, ALA.—The Birmingham District Coal, Light & Power Company has been chartered, with a capital stock of $[illegible], to furnish electricity for lamps and motors in Birmingham, for which a franchise has already been secured. The officers are: T. H. Aldrich, president, and T. H. Aldrich, Jr., secretary and treasurer.

SAN BERNARDINO, CAL.—The Needles Light & Power Company has been incorporated, with a capital stock of $[illegible], by W. B. Palmer, W. W. Peters and M. P. Thye, all of Los Angeles.

BOULDER, COL.—The Eldorado Springs Railway Company has been chartered to construct and maintain a railway at Eldorado Springs. The directors are C. W. Clark, F. M. Hawley, W. W. Seaver, C. A. Miller and H. R. Trowbridge.

DENVER, COL.—The Denver & Fort Collins Interurban Railway Company has been incorporated, with a capital stock of $[illegible], by Leslie L. De Remer and D. L. Brown, of Denver, Col.

ALEXANDER CITY, GA.—The Big Hillabee Power Company has been incorporated for the purpose of developing the water power of Big Hillabee Creek at Lindsey Shoals, six miles from Alexander City, to be utilized to generate electricity, which will be transmitted to Alexander City for lamps and motors. The officers of the company are: L. W. Robert, president; J. W. Preston, vice-president and general manager; L. W. Robert, Jr., secretary and treasurer; Park A. Dallis, of La Grange, Ga., chief engineer. The main office of the company is at Chandler Building, Atlanta, Ga.

HAMMOND, IND.—The Calumet Traction Company has filed articles of incorporation with the Secretary of State. The company is capitalized at $100,000 and proposes to construct and operate an interurban railway in and through the cities of Hammond, East Chicago and North Calumet and Center townships. The directors are Walter J. Riley, of East Chicago, Ind.; William P. Ijams, of Terre Haute, Ind.; E. L. Keating, Patrick Hanrahan and Edward Bailey.

BLAIRSBURG, IA.—The Cedar View Telephone Company has been incorporated to build a telephone line to Webster City. The officers of the company are: G. W. Coleman, president; H. L. Doty, secretary, and P. C. Stone, treasurer.

BRAINERD, MINN.—The Daggett Brook & Southern Company has been organized to operate a telephone system in Crow County. The officers of the company are as follows: Frank Kienow, president; Frank Wolvert, vice-president, and Leroy Sewell, secretary and treasurer.

KERKHOVEN, MINN.—The Murdock-Kerkhoven Telephone Company has been organized to construct a telephone line from Murdock to Kerkhoven, via Dublin. The officers are: E. T. Dana, president; L. S. Lawson, secretary, and William Pothen, treasurer.

PLATTSMOUTH, NEB.—Articles of incorporation have been filed for the Plattsmouth & Southwestern Interurban Railway Company by Charles C. Parmalee, R. B. Windham, H. D. Travis, J. P. Falter and W. W. Coates. The company is capitalized at $100,000 and proposes to construct an interurban railway between Manley and Murdock.

NIAGARA FALLS, N. Y.—The Cliff Electrical Distributing Company has been incorporated, with a capital stock of $25,000, by Paul A. Schoellkopf and Peter P. Pfahl, of Niagara Falls, and C. P. Hugo Schoellkopf, of Buffalo, N. Y.

HICKSVILLE, OHIO.—The Fort Wayne & Toledo Traction Company has been chartered, with a capital stock of $100,000 to construct an electric railway from Bryan to Fort Wayne, and from Bryan to Montpelier. The incorporators are: R. L. Bastress, C. A. Bastress, W. Behne, R. L. Starr and W. S. Tomlinson.

MT. CORY, OHIO.—The Mt. Cory Farmers' Mutual Telephone Company has been chartered by W. A. Williamson and others.

FLETCHER, OKLA.—The Fletcher Telephone Company has been incorporated, with a capital stock of $10,000, by R. C. Stout, W. E. Nix and J. L. Peden.

KANSAS, OKLA.—The Delaware Central Telephone Company has been chartered by D. A. Smith, W. J. Holbrooks and J. R. Terry.

MANGUM, OKLA.—Articles of incorporation have been filed for the Mangum Light & Power Company, with a capital stock of $100,000, by C. I. Patterson, P. J. Janeway, J. W. Chambers, C. E. Border and T. P. Clay.

MINCO, OKLA.—The Consolidated Telephone Company has been chartered, with a capital stock of $5,000, by G. Dennis, of Mustang; R. L. Bristow and A. C. Bristow, of Minco.

STERRETT, OKLA.—The Sterrett Exchange Telephone Company has been organized by citizens in Sterritt.

WAYNOKA, OKLA.—The Waynoka Electric Light & Power Company has been chartered, with a capital stock of $25,000, by Grant D. Miller and George D. Miller.

WEATHERFORD, OKLA.—The Davis Brothers Telephone Company has been incorporated, with a capital stock of $1,000, by James, Arthur and Myrtle Davis.

ALTOONA, PA.—The Homer's Gap Telephone Company has been organized with the following named officers: John Smith, president; George Moyer, vice-president; Charles R. Foutz, secretary, and B. Mathers, treasurer.

COATESVILLE, PA.—The Christiana & Coatesville Street Railway Company has been organized to construct an electric railway between the two cities named. The company will take over the property and holdings of the Philadelphia, Coatesville & Lancaster Company, which was purchased by a committee of bondholders at a foreclosure sale. It is capitalized at $400,000, of which $137,000 will be used to pay for the purchase, and it is estimated that it will cost about $162,000 to complete the road. When completed it will be leased to the Conestoga Traction Company.

DUQUESNE, PA.—The Duquesne & Dravosburg Street Railway Company has been incorporated and [illegible] March 29 to construct a street railway in the borough of Dravosburg and township of Mifflin. The company also proposes to construct a railway to Dravorsburg and West Elizabeth. The directors are: A. J. Krill, John C. Cato, T. F. Vankirk and Charles McGinley.

MORRIS, PA.—The Morrisdale Railway Company has been incorporated to construct an electric railway through Clearfield County in the vicinity of Morris. The railway will be about four miles in length. The company is capitalized at $[illegible]. Charles Steele, of Northumberland, is president.

PHILADELPHIA, PA.—The Terminal Street Railway Company has been incorporated, with a capital stock of $12,000, to construct an electric railway from the end of Market Street Elevated Passenger Railway in Upper Darby through East Lansdowne to Fernwood, a distance of two miles. The incorporators are: John Wolfenden, of Cardington, president; W. I. Shore, Joseph M. Dohen, B. J. O'Connel, of Philadelphia, and Frank B. Rhodes, of Media.

READING, PA.—The Inter-County Electric Company has been formed and will make application to the State for a charter March 29. The company is capitalized at $500,000, and proposes to construct an electric railway from Reading to Allentown, via Lyons and Tipton, 35 miles in length. The directors are: Maxwell H. Bochow, George F. Souwers, Bateman Saddington, Josiah H. Fisher and Frederick R. Perry.

YORK, PA.—The Conewago Rural Telephone Company has been organized to construct a telephone line, which will be connected with the York Telephone & Telegraph Company. The following officers were elected: E. S. Hykes, president; Jacob Bear, vice-president; S. T. Peeling, secretary, and W. H. Gross, treasurer.

WHITEWOOD, S. D.—Articles of incorporation have been filed for the Dakota Western Railway Company by H. E. Cooper, P. W. Benniwell, T. W. Thompson, of Whitewood; Samuel R. Cleaver and Fred A. Robinson, of Empire, S. D. The company proposes to construct an electric railway from Whitewood to Attainment, a distance of 30 miles.

JACKSON, TENN.—The Farmers' Telephone Company has been chartered with a capital stock of $1,000 by William Arnold, J. F. Ward, Edward Hart, Z. T. Johnson and John Steadman. The company proposes to construct and operate telephone lines in Madison and Chester Counties.

JEFFERSON, TEX.—Articles of incorporation have been filed for the Jefferson Ice, Light & Power Company, with a capital stock of $50,000, by John T. MacDonald, M. Bower and R. B. Walker.

ROCKPORT, TEX.—The Rockport & Aransas Pass Railroad Company has been chartered to construct an electric railway from Rockport to the jetties at Aransas Pass, a distance of 11½ miles. The company is capitalized at $11,500 and the incorporators are: C. G. Johnson, Harry Traylor, D. R. Scrivner and W. H. Baldwin.

GUNNISON, UTAH.—The Gunnison Telephone Company has been chartered, with a capital stock of $5,000, and the following officers: T. F. Kearns, president; Leo M. Gledhill, vice-president; Joseph Christensen, secretary and treasurer.

FELCHVILLE, VT.—The Reading Light & Power Company has been incorporated, with a capital stock of $5,000, by Elmer B. Watkins, John E. Dunsmoor, of Felchville; C. O. Randall, of Cavendish, Vt.; C. A. Preston, W. I. Root, O. D. Churchill, S. M. Sherman, P. Root, Sr., and M. S. Amsden, all of Felchville.

ISLE LA MOTTE, VT.—The Isle La Motte Telephone Company has been chartered, with a capital stock of $5,000, to construct telephone lines in Grand Isle, South and North Hero, Isle La Motte and Alburg.

ELLERSON, VA.—The Hanover Telephone Company has been chartered, with a capital stock of $5,000. The officers of the company are E. J. Flippo, of Ellerson, president; J. M. Long, Atlee, Va., vice-president, and J. B. Bradley, of Ellerson, treasurer.

GOODWINS FERRY, VA.—The Spruce Run Mutual Telephone Company has been incorporated with a capital stock of $5,000. L. A. Kessinger is president, and J. D. Scott, secretary and treasurer.

LEXINGTON, VA.—The Rockbridge Power Company has been chartered, with a capital stock of $25,000, to construct and operate a heating, lighting and power plant. W. G. Matthews is president; W. T. Paxton, of Buena Vista, is secretary and treasurer.

LOVINGSTON, VA.—The Central Telephone Company has filed articles of incorporation, with a capital stock of $5,000. The officers are: F. M. Horsey, president; J. C. Clarkson, vice-president, and E. Carter, secretary.

ROANOKE, VA.—The Craig Water Power Company has been organized, with a capital stock of $200,000, for the purpose of developing water power in Meadow Creek and Johns Creek, in Craig County, located about 20 miles from Roanoke. Plans for the project are being prepared by C. S. Wagner, consulting engineer, Brownstown, Pa. A. L. Sibert, of Roanoke, is president of the company.

ROCKY MOUNT, VA.—The Light & Power Company, of Rocky Mount, has been formed and will be incorporated, with N. P. Angle, president; D. H. Dillard, vice-president, and B. L. Fisher, secretary and treasurer.

WAKEFIELD, VA.—The People's Telephone Company, of Wakefield, has been organized, with a capital stock of $4,000 and the following named officers: J. A. Brittle, president; A. W. Holt, vice-president, and N. B. Pond, secretary and treasurer.

GEROME, WASH.—The Southwest Telephone Company has been organized to construct and operate a telephone line from Hunters to the mouth of the Spokane River. D. M. Glasgow is president.

NORTH YAKIMA, WASH.—The Central Washington Investment & Power Company has been incorporated by G. S. Rankin, Alex. McCredy and J. O. Cully, with a capital stock of $100,000, to build an irrigation system and power plant to irrigate 1700 acres of land in the Moxee Valley.

PROSSER, WASH.—Articles of incorporation have been filed for the White Bluffs & Columbia River Telephone Company to construct a telephone line from White Bluffs to Kennewick, which will eventually be extended to Priest Rapids and North Yakima. The company is capitalized at $10,000, and the officers are: F. M. Weil, president; Jay Locke, vice president, and A. W. Henning, secretary and treasurer.

SEATTLE, WASH.—The Rainier Power & Irrigation Company has been incorporated by Frank Mackean, J. J. Wilson and others. The company is capitalized at $100,000.

SPOKANE, WASH.—The Spokane-Orient Power Company, capitalized at $1,000,000, has been incorporated by C. A. Lunceford, C. H. Patten and A. R. Patten.

FOLLANSBEE, W. VA.—Articles of incorporation have been filed by the Follansbee Light & Water Company, with a capital stock of $25,000, by Thomas J. Mahan, Frank B. Mahan, C. B. Crawford and others.

MADISON, WIS.—The Apple Creek Farmers' Telephone Company of Freedom, has been incorporated, with a capital stock of $5,000, by Fred A. Zeigler, C. W. Schroeder and H. W. Wieckert.

MILWAUKEE, WIS.—The Midway Telephone Company of Deer Creek of Taylor County, has been chartered with a capital stock of $10,000, by M. B. Bircks, Almer R. Erickson and D. F. Peterson.

BAGGS, WYO.—The Lower Snake River Telephone Company has been organized by J. W. Cavender for the purpose of operating an independent telephone line in Baggs and other towns in this vicinity.

LUTHER, WYO.—The Golden Prairie Mutual Telephone Company has been organized to operate a telephone system in Luther and adjoining towns. Edward Bergland is manager.

Personal.

MR. J. F. NISBET has been appointed to take charge of the new publicity department of the Triumph Electric Company, of Cincinnati.

MR. L. L. PERRY, for some years electrical engineer with Dr. F. S. Pearson, has resigned his position. Mr. Perry has devoted his time largely to hydro-electric power-house and transmission-line work.

MR. ROBERT THURSTON KENT has resigned as engineering editor of the *Iron Trade Review*, Cleveland, Ohio, to become managing editor of *Industrial Engineering*, Pittsburgh, Pa., a new paper devoted to mechanical engineering subjects. Mr. Kent has been with the *Iron Trade Review* since 1905, and prior to that time was associate editor of the *Electrical Review*, New York.

MR. WILBUR B. FOSHAY, formerly manager of the Fort Dodge Light & Power Company, of Fort Dodge, Ia., is the successor of Mr. H. Almert in directing the work of the Edison Light & Power Company, United Gas Company and the United Gas & Electrical Appliance Companies, of Wichita, Kan. Mr. Foshay got his early training in five years' work with the U. G. I. Company. Later he was connected for a short time with the Water, Gas, Electric Light & Power Company, of Hutchinson, Kan., which place he left to take up the management of the company at Fort Dodge, where he resigned about the 1st of February. He is already in harness at Wichita and taking over the new work as rapidly as possible.

Trade Publications.

SINGLE-PHASE MOTORS for central station service are convincingly discussed in a pamphlet of the Wagner Electric Manufacturing Company, St. Louis, Mo.

MOTOR-DRIVEN PUMPS of the double-acting piston type are listed and described in Folder No. 4065 of the Fort Wayne Engineering & Manufacturing Company, Fort Wayne, Ind.

DIRECT-CURRENT GENERATORS of the belted type intended for use with internal-combustion engines are described in Bulletin No. 111 of the Fort Wayne Electric Works, Fort Wayne, Ind.

IGNITION BATTERIES.—The Zoar Battery Company, Zoar, Ohio, has issued a catalogue and price-list dealing with ignition batteries. Storage batteries for isolated plant lighting installations are discussed in a folder issued by the same company.

REFILLABLE ENCLOSED FUSES.—The Crescent Company, 103 West Adams St., Chicago, is sending out a bulletin catalogue illustrating its line of "Trio" refillable enclosed fuses. It is stated that this device will effect a saving of 33 per cent in maintenance expense.

BLOWERS.—The American Blower Company, Detroit, Mich., has issued an illustrated handbook giving interesting information on blowers and exhausters for forges and furnaces. The data are arranged in such a way as to assist the engineer in selecting the proper size and type of fan for his requirements.

FLEXIBLE TUBING for electric wires is described in a booklet issued by the National Metal Molding Company, Fulton Building, Pittsburgh, Pa. This tubing is made of a spiral fiber interwoven with a fine strong thread which binds the spiral into a tube which is run through a rubber solution to cause it to exclude moisture.

COMMUNITY COORDINATION is the title of an interesting pamphlet just issued by the International Lecture Institute, 20 Broad Street, New York City. This new pamphlet of the Institute is written for the

pose of answering most of the questions asked as to the mission of Institute, but it is not strictly a publicity circular for general distribution. The pamphlet is divided by the headings into sections, so it a section can be referred to readily in replying to correspondence to oral inquiries. The extension of the services of the Institute into industrial field has made such a printed description of its work cessary, though the pamphlet is equally applicable to applied science d the mechanic arts, in connection with which lectures are prepared d delivered also, under the same general plan.

THE VIGO ELECTRIC COMPANY, of Terre Haute, Ind., has filed ticles of incorporation with the Secretary of State, with a capital stock $200,000. The company proposes to generate and distribute electricity r heating, lighting and power purposes. The directors are Frank M. auvre, Charles Moniger and Monroe George. The company has a ant nearly completed, situated at the mouth of a coal mine five miles om Terre Haute. It has secured a contract to light West Terre Haute.

THE UNION SWITCH & SIGNAL COMPANY, PITTSBURGH, PA. At the annual stockholders' meeting, held March 9, the following were ected directors: George Westinghouse, Robert Pitcairn, William McConay, George C. Smith, Thomas Rodd, H. G. Prout and James J. Donnell. was stated that the company has orders for unfilled business amounting $1,357,000. New contracts for block signaling and other railroad safety evices are now coming in more freely than at any time during the last months.

Business Notes.

MR. W. D. WOOLLEY has resigned as general manager of the Woolley Electric Company, St. Louis, and while giving up active connection with ne company will continue to act as a director.

THE WAGNER ELECTRIC MANUFACTURING COMPANY an nounces the removal of its district office in Pittsburgh to the Lewis Block, and the appointment of Mr. Ludwig Hommel as district manager.

THE KUHLMAN ELECTRIC COMPANY, Elkhart, Ind., is sending series of letters to central stations, which in turn will take up the various problems involved in the design, manufacture and use of transformers.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati (Ice Machine Department) has brought out a line of small-belted ammonia compressors or from 2½ to 5 tons refrigerating duty. These machines are especially adapted for electric drive by belt.

THE A. & W. ELECTRIC SIGN COMPANY, of Cleveland, has opened a New York exhibition and salesroom at 1370 Broadway (Thirty-seventh Street), where modern electrical advertising signs and devices, flashers and novelties are on display.

THE MINNEAPOLIS STEEL & MACHINERY COMPANY has received an order from the Dakota Gas, Electric Light & Power Company, Wagner, S. D., for an 80-hp Muenzel producer gas engine and suction gas producer plant. This outfit will be installed in the electric light plant at Wagner, where there is already one Muenzel unit in operation.

THE GREEN MOUNTAIN ELECTRIC COMPANY, Montpelier, Vt., has announced to its patrons that it is the first company in Vermont to employ permanently an illuminating engineer, having secured the services of Mr. W. S. Kilmer, of the Kilmer Company, New York, who will design and install systems of illumination for any service.

THE HABIRSHAW WIRE COMPANY is the subject of an appreciative article in the *Yonkers Daily News* of March 13. Referring to the quantity of product, it is stated that the annual output in wire of all sizes aggregates a length sufficient to girdle the earth several times, and that of one size of wire alone the annual output is no less than 26,000,000 ft., or nearly 5000 miles.

THE NORTHERN EQUIPMENT COMPANY.—The American Boiler Economy Company, of Philadelphia, manufacturers of the Copes boiler feed regulator and the Copes pump governor, has been consolidated with the Northern Equipment Company, Old Colony Building, Chicago, Ill The branch offices of the American Boiler Economy Company will be continued under the style of the Northern Equipment Company, while the sale of Copes regulators will be handled in Philadelphia by the Adjustable Grate Bar Company.

MR. THOS. P. McCRAY, of Fairmont, W. Va., has been appointed representative, by The Fort Wayne Electric Works, of Fort Wayne, Indiana, for north central section of West Virginia. Mr. McCray is a graduate of Pratt Institute of Brooklyn, N. Y., class of 1899, and during the past ten years has had wide practical experience, having been five years with the New York Telephone Company and four years with other New York City electrical corporations. Mr. McCray's headquarters are in the McCray Building, 323 Madison Street, Fairmont, W. Va.

THE HURLEY MACHINE COMPANY, Chicago, manufacturers of the "Thor Electric" washer and wringer and the "Little Giant" floor scraper, has experienced such an increase of business that its present quarters are not large enough to turn out machines fast enough to meet the demand. It has consequently rented the Hotz & Rehm Building, northeast corner of Clinton & Monroe Streets, which it will occupy after May 1, and will then be in position to take care of the rapidly growing business. In the new place will be a large and beautifully equipped display room, showing washing machine, ironing machine, dryer, etc.; in fact, a complete home power laundry.

THE CROCKER-WHEELER COMPANY has received an order from the Sprague-Warner Company, of Chicago, for 31 small motors, ranging from ⅓ hp to 20 hp and aggregating about 150 hp. An order for 21 motors, from 1/5 to 10 hp, to drive printing machinery, has been placed by Clark & Courts, Galveston, Texas. The Pittsburgh Steel Company, Monesssen, Pa., has placed an order for two 75-hp, 500-volt motors to drive draw benches. The American Auto Course Company, Chicago, has ordered 15 small motors of ¾ hp each, and the Newton Machine Tool Company has ordered a 22-hp adjustable speed motor with 1:2 speed ratio. An order for nine crane motors has been received from the King Bridge Company, of Cleveland. The Canadian Crocker-Wheeler Company has installed a 60-kva, three-phase, 600-volt, 60-cycle belted machine for the new Canadian factory of L. E. Waterman Company, fountain-pen makers.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 16, 1909.

[Conducted by Wm. F. Bissing, Patent Lawyer, 2 Rector St., N. Y.]

915,063. BATTERY PLATE; C. W. Bender, Altoona, Pa. App. filed April 18, 1908. The surfaces of the plates are successively rolled in reverse directions, so as to pack the metal and give an outer stratum of substantially uniform consolidation.

915,075. SIGNALING SYSTEM; N. B. Cregier, Chicago, Ill. App. filed March 16, 1904. Police signaling system to avoid false reporting and compel the patrolman to report only from the box in his own territory. The location of the box is given by an individual signal circuit at the central station, so that when the policeman telephones his name, his beat is checked by the number of the box. A diagram at the central station shows the location of the substation and is provided with a visual signal for each substation on the diagram.

915,077. DESK STAND; W. W. Dean, Chicago, Ill. App. filed Jan. 6, 1904. Portable desk telephone stand and set, with a hollow base and tubular standard. The switch hook has an arm extending through the standard which controls contacts in the hollow base.

915,079. TELEPHONE RECEIVER; James Dixon, Cleveland, Ohio. App. filed Nov 23, 1908. For partly deaf persons. It is provided with an additional lug which is vibrated by the diaphragm and which can be pressed against the bony structure adjacent to the outer ear.

915,083. RAILWAY TRAFFIC CONTROLLING APPARATUS; F. I. Dodgson and W. K. Howe, Rochester, N. Y. App. filed Aug. 28, 1908. Route locking system for interlocked switches, whereby when the train has entered a certain route the route may be locked and any switch of the route automatically unlocked immediately after the train has passed off the track section containing the switch thus saving time and attention of the tower men. A battery has one pole connected to one conductor and its other pole connected to a second conductor by two feed wires which supply current to translating devices which control the switches.

915,112. ELECTRIC AND PNEUMATIC GOVERNOR; W. K. Rankin, Philadelphia, Pa. App. filed May 2, 1907. For an electric air compressor which is actuated when the pressure reaches a maximum. Means are provided whereby different degrees of extreme pressure may be had by change of attachments.

915,135. INCANDESCENT ELECTRIC LAMP SOCKET; A. Weber, Sr., Schenectady, N. Y. App. filed Oct. 1, 1906. Provides an insulating plate between the end flange on the shell and the contact plate and an insulating lining for the shell.

915,152. TROLLEY POLE; G. T. Barr, Sr., Memphis, Tenn. App. filed Aug. 3, 1908. A trolley pole that can be replaced by the motorman at the front of the car by means of a cord attached to the pole, passing around a drum to which a handle is secured, which handle is located near the motorman.

915,154. TELAUTOGRAPH; E. Belin, Paris, France. App. filed Jan. 17, 1908. For reproducing at a distance an original photograph by means of another photograph which is a copy of the first. The transmitter carries a surface slightly in relief, the variations in the relief being translated into variations of electric intensity which are then transformed [illegible] light intensity which are subsequently recorded.

915,172. MANUFACTURE OF ALLOYS OF SILICON; Hans Goldschmidt, Essen-on-the-Ruhr, Germany. App. filed April 24, 1908. For producing a calcium silicon alloy with barium or strontium free from carbon which consists in heating silicon or ferro-silicon with [illegible] presence of a flux producing a crumbling slag.

915,188. SAFETY APPLIANCE FOR RAILWAYS; C. J. Kintner, New York, N. Y. App. filed Aug. 14, 1903. For single-track roads in which [illegible] shall be [illegible] the passage thereof by the approaching car. The signal-controlling means has two circuits, one permanently closed [illegible] and the other, including the same source and connected at the opposite ends to parallel service rails, in combination with circuit-closing means carried by the car.

915,189. SAFETY SYSTEM FOR ELECTRIC RAILWAYS; C. J. Kintner, New York, N. Y. App. filed Jan 26, 1903. Particularly for the third rail type to prevent front or rear collisions, in which

any particular part of the third-rail is temporarily disconnected, when necessary, without delaying traffic. A switching device is carried by each car which automatically disconnects the motor, and semaphores are located at intervals along the track which automatically actuate the switching devices.

915,190. RAILWAY SIGNAL; C. J. Kintner, New York, N. Y. App. filed July 20, 1903. Improvements in electrically controlled railway signals in which the control thereof is effected by currents of low potential and the rails are utilized for the control. The home and distant signals in a block are controlled by the movement of the car without relays or other circuits.

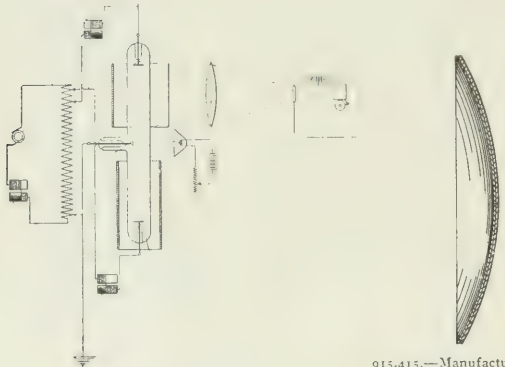
915,193. TROLLEY CATCHER; G. W. Kramer and A. G. Hague, Des Moines, Iowa. App. filed July 31, 1903. An attachment for the trolley pole to catch the trolley when the pole leaves the wire. Makes use of guard wings attached to the carrier in which the wheel is mounted, which wings project from the sides of the carrier.

915,237. ELECTRIC SIGNALING SYSTEM; H. W. Souder, Conshohocken, Pa. App. filed June 10, 1907. Improvement on 795,314 in which a signal circuit extends along the block, a circuit controller is provided at each end including an electromagnet resetting device and a resetting circuit extends along the block which is controlled by a car leaving the block.

915,238. ELECTRIC ROAD-CROSSING SIGNAL; H. W. Souder. App. filed June 29, 1907. For ringing a bell at the crossing, which is automatically operated by the current in a normally open circuit supplied with current by a normally open generator circuit, the generator circuit being closed by a passing car, which action thereupon closes the bell circuit.

915,246. AUTOMATIC ACCELERATING CONTROLLER; H. F. Stratton, Cleveland, Ohio. App. filed July 7, 1908. For use on electric cars to keep the acceleration at a certain rate which cannot be exceeded even when the operator throws the master controller rapidly to the full-on position. Provides an acceleration relay directly responsive to the acceleration of the load which gives a slower than normal acceleration on up grades and faster on down grades.

915,249. APPARATUS FOR WELDING IN ELECTRICITY; E. C. Thompson. App. filed June 11, 1907. To secure more uniform heating by the current. The article is held by means of clamping



915,280.—Electric Signaling.

dies which substantially encompass one of the parts to be joined, and blocks are provided for carrying the dies which have equally direct electrical connection with the electrode.

915,257. ELECTRICAL MEASURING INSTRUMENT; C. Wiler, Chicago, Ill. App. filed Sept. 10, 1906. For alternating or direct currents in which a stationary flat solenoid is used combined with a soft-iron armature with axes of unequal length which dips in the coil, normally presenting its long axis to the coil and when drawn therewithin presenting its shorter axis. This reduces hysteresis.

915,280. ELECTRIC SIGNALING; Reginald A. Fessenden, Washington, D. C. App. filed Feb. 8, 1907. Vacuum tube receiver for wireless telegraphy having an exhausted tube containing gas of the helium group, with several paths of discharge together with connected differential governing circuits which are unbalanced by the received impulses so as to shift the path of discharge and produce a signal.

915,290. CONTROL SYSTEM FOR ELECTRIC HOISTS; J. H. Hall and J. F. Schnabel, New York, N. Y. App. filed Aug. 10, 1908. The speed of lowering is under the control of the operator and the brake is a magnetic brake having its releasing winding in series with the motor. A controller connects the field windings of the motor and the winding of the brake in a circuit having a resistance, and the armature of the motor is connected in another circuit containing a resistance. This makes a self-protective system.

915,311. ELECTRIC VEHICLE AND CABLE REEL; F. L. Sessions, Columbus, Ohio. App. filed March 24, 1903. For coal-mine locomotives in which the electric locomotive is kept electrically connected with a distant fixed conductor by means of a cable controlled by a reel and brake.

915,328. STORAGE BATTERY JAR; C. W. Bentley, Binghamton, N. Y. App. filed June 19, 1908. Prevents short-circuiting and provides a cover for hermetically sealing the jar.

915,330. INSULATOR AND WIRE CLAMP; J. Blackburn, St. Louis, Mo. App. filed March 2, 1908. Particularly for cross-arms and adapted to hold a wire without the use of tie wires. The body is of insulating material, in the upper portion of which is formed a V-shaped notch which follows a compound curve across the insulator.

915,334. HARMONIC RINGER; M. S. Connor, Rochester, N. Y. App. filed Aug. 13, 1906. Selective apparatus for telephone systems, in which the ringer is tuned to respond to an alternating current of definite frequency, the magnet operating the ringer being polarized.

915,339. VENTED STOPPER AND STORAGE BATTERY JARS; F. Ford, Philadelphia, Pa. App. filed June 4, 1907. For filling the jar comprising a tubular casing open at each end and having at one end means for connecting it with the jar, together with a detachable stopper cone which closes the other end of the casing and is provided with a hollow cone suitably perforated.

915,348. OVERFLOW ALARM; J. A. A. Heydegger, Newark, N. J. App. filed Oct. 31, 1908. For use with drip pans of refrigerators which rings a bell and is controlled by a float when the pan is full.

915,375. INSULATING THIRD-RAIL SUPPORT; D. M. Pfautz and J. L. Luckenbach, Philadelphia, Pa. App. filed June 29, 1908. A plurality of independent supporting means carrying the third rail so that if one breaks the rail will still be supported. The rail is also provided with a hood.

915,381. OUTLET BOX; G. Pullets, New York, N. Y. App. filed April 24, 1907. The space between the box and the surface of the wall is filled in so as to prevent sparks from reaching the woodwork by means of an adjustable, spirally coiled device formed from flexible strips of spring metal.

915,406. INSULATOR; S. and W. O. Bartley, Calhoun, Ill. App. filed June 17, 1908. A sectional insulator is provided with means for preventing the entrance of rain, etc., and is effectively ventilated. Insulating material is arranged within the sections of the casing and wire-receiving recesses and cavities are arranged for the circulation of air, together with shields upon the ends of the upper casings which overhang the adjacent portions of the wire.

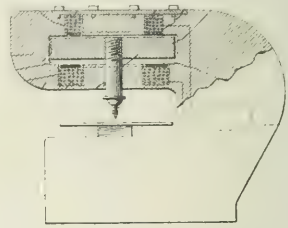
915,415. MANUFACTURE OF METALLIC MIRRORS; S. O. Cowper-Coles, Westminster, London, Eng. App. filed Nov. 8, 1907. Mirrors for searchlights are produced by electrolytically depositing upon the back thereof copper and then depositing upon the surface a yellow reflecting metal which is then ground or polished.

915,438. ELECTROMAGNETIC APPARATUS FOR RECIPROCATING MACHINE TOOLS AND THE LIKE; H. A. Hornor, Riverton, N. J. App. filed Aug. 17, 1907. For reciprocating machine tools by providing an armature and electromagnets with an automatic switching apparatus whereby the magnets are intermittently energized without attention from the operator.

915,488. FURNACE FOR THE TREATMENT OF METALS; W. Schemann and J. Brown, Bombach, Germany. App. filed Oct. 14, 1907. A furnace in which the ferromanganese is melted separately thus saving manganese. Three grooves are formed in the hearth of the furnace for the reception of the metal, a cross-conduit connects the grooves at one end, and an electrode enters the other end of each groove, the metal being supplied to the grooves.

915,518. TELEPHONE APPARATUS; F. S. Weyrs, Philadelphia, Pa. App. filed Oct. 8, 1906. Provides a holder for the telephone, thus doing away with the necessity of the user holding it. A base frame which can be clamped to the base of the telephone apparatus is provided with a pivoted rod and pivotal arms to carry the receiver.

915,526. ELECTRIC ARC STEAM GENERATOR; W. W. Wonner, Rossville, Pa. App. filed May 26, 1908. The boiler is provided with a plurality of tubes, in each of which an electrode of an arc light



915,415.—Manufacture of Metallic Mirrors.

915,438—Electromagnetic Apparatus for Reciprocating Machine Tools and the Like.

inserted. The heat of the arc pasing through the tubes enters the water of the boiler and generates steam.

915,592. TELEPHONIC EXCHANGE SWITCHBOARD; E. A. Graham, Brockley, London, Eng. App. filed June 21, 1907. Telephone switchboards for use in the navy and adapted to resist the weather, comprising a casing having a central chamber adapted to receive a number of separately removable instrument sections, an upper chamber containing a number of electrical terminals, a lower chamber receiving a number of contacts for the instrument, cords, together with a front door for the central chamber and removable doors for the upper and lower chambers.

915,625. TELEPHONE RECEIVER; A. Rector, New York, N. Y. App. filed March 13, 1908. Secures pleasanter and softer tones from the receiver by providing a hollow tubular extension, which can be fastened to the receiver over the diaphragm and has a central sound aperture corresponding with the bore of the earpiece.

915,657. ELECTRIC GLOW LAMPS; Werber V. Bolton, Berlin, Germany. App. filed May 31, 1902. An incandescent body consisting of a homogeneous body of commingled metallic tantalum and tantalum carbid.

915,668. WATER-COOLED ELECTROCARBON CONNECTION FOR ELECTRIC FURNACES; C. A. Duncan, Duluth, Minn. App. filed Oct. 5, 1908. A water-circulating means is arranged between the metal and carbon parts of the electrode so as to keep it cool.

915,700. TROLLEY SWITCH; J. J. Ruddick, Newton, Mass. App. filed May 28, 1906. A switch operated by the trolley wheel to actuate signals. A trip is provided having an inertia member (a weight), yieldly by-connected to the trip, and movable contact members connected to and operated by the inertia member.

915,719. ELECTRIC CONTROLLER; W. P. Cosper, Boston, Mass. App. filed June 27, 1909. For controlling the currents supplied to motors so as to prevent an operator turning on the current faster than the motor can carry it. A gravity-acting timing element checks the movement of the controller lever.

915,720. CONTROLLER REGULATOR; W. P. Cosper and J. O. Johnson, Boston, Mass. App. filed Dec. 21, 1907. A regulator which enables the current to be instantly turned off and which controls the supply of current by means of a tortuous passage in which means are provided to retard the turning on of propelling current but which permits instantly cutting off the current.

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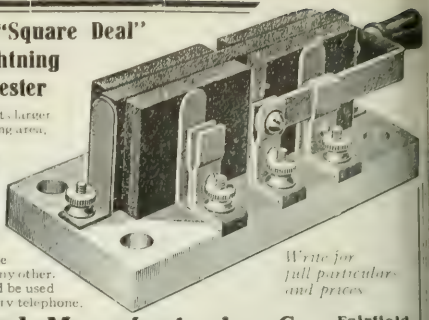
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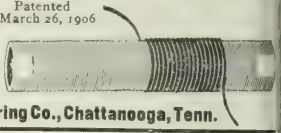
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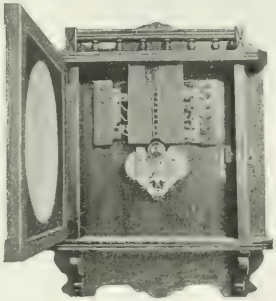
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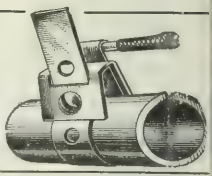
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Telephone Statistics.

The annual report of the American Telephone & Telegraph Company, of which we give an abstract elsewhere, is a most interesting document and most encouraging from the general standpoint of electrical industry. It is to be noted that during a year when economy was the order of the day, when declines in production and consumption were reported universally, this great system actually increased its gross income from $120,753,200 to $127,117,200, a gain of not less than $6,364,000. This is probably unique among large American enterprises last year. The United States Steel Corporation showed a decline of 36 per cent in gross and 43 per cent in net. The main inference is that the telephone industry is remarkably stable in bad times, and that good management had its effect. The "Independent" opposition last year was certainly not less vigorous and energetic than before. The entire Bell system, including Canada, had an income of just $140,000,000, or an increase of $7,000,000, almost to a dollar. Such figures are cheerful reading to all who believe in the even greater future lying before our electrical industries.

It is to be noted also that there was an increase in the number of stations of 179,712, making 3,215,245 straight-out Bell stations. In addition there were found to be connected into the system 1,103,144 exchange and toll stations operated by various sub-licensee, co-operative, rural and other companies. "Independent," but not necessarily opposition, making a total of 4,364,629 stations connected to the Bell network, a total gain over 1907 of no fewer than 525,629 stations. The total of exchange connections is put at a few short of six billions. The average number of daily calls per station in the United States was about six. It would appear from the income that the average yield per message was a little over 2 cents. The yield per station was about $39.50, just a shade less than in the previous year, whereas the large increase in the number of stations would have predicted a bigger drop. The recent census figures show for the whole industry in the United States a decline from $36.62 per station in 1902 to as low as $30.15 in 1907. This is due, of course, to the enormous increase in rural stations. The Bell system has had comparatively fewer of these, but it is obvious that with so large a growth it is holding up to a very high average yield. It is here that the effect of general depression is indicated, if anywhere. Last year Bell rates, as well as Independent rates in many places, were increased and the process of [illegible] service is certainly in evidence throughout the country.

The statistics of the Bell telephone system have well established by them their right to be the standard of excellence as well as anything can be the measure of excellence where the power inherent in it of growth and expansion. It is said that the system could have exhibited even greater growth last year if it had not been rather severely purged of "poor pay" subscribers and

of "no-pay" stations due to the earlier crises of insensate competition. This appears to be true, and, if true, leaves the system in very sound shape for the next step forward when times are better and when the commerce of the country turns from reviving hope into resuming activity. How far from real "saturation" the telephone industry of the country is at this moment we do not know, for the telephone habit is still growing, and seems susceptible of further cultivation. The question is whether the industry being so stable in dull periods it may not now be less responsive to prosperous times than in the past. We rather doubt the implication, but must after all wait for the answer until the dinner pail and ice pail are full again.

Electric Lighting Development.

The conditions in the electric lighting industry are reflected in the statistics afforded by the forthcoming April half-yearly issue of the *McGraw Electrical Directory*. It will show a present total of 5264 companies and municipal plants in the United States, and 5740 including Canada, Mexico and the West Indies. These figures compare with 5015 and 5464 in the corresponding edition of last year, for the North American Continent. This shows a gain for the period of 276 plants. In itself this is an appreciable advance for a year of depression and stagnation, but does not quite tell the story. During the last half year, as the compilers, we have made an effort to check up what may be termed the loss. This had not been done before. In other words, it appears that 60 plants had been absorbed or purchased in the six months just past, or had undergone a kindred change, while 17 had been consolidated; and 20 names were taken out for various reasons, such as failure to complete the plant, etc. Here is a rough measure of the mortality, which in later issues it is hoped to determine more precisely. As a matter of fact, 195 new names are given in this issue for the United States and 20 elsewhere, as compared with last October.

Of the total 5740 plants included, no fewer than 3193 carry electrical supplies, which implies the handling in the aggregate of a very large quantity of electrical material. As many as 4154 of the plants have alternating current, while apparently 1669 are direct. How many "overlap" is not quite clear. The spread of alternating-current methods is shown to be astonishing. Of the plants enumerated, 125 report themselves as pure transmission, while 594 others are either lighting and transmission, or else include railway work as well. Some of these are essentially transmission plants, but it becomes increasingly difficult to distinguish them because of the growth of closer relationships and of common ownership.

Illinois has still the largest number of plants, 398, though outside of Chicago few of them are of considerable magnitude. New York has 358 and Pennsylvania 346, the last State gaining 14 in the six months, which is rather remarkable for so settled a commonwealth. Ohio has 289, Michigan 253, and Texas the large number of 228, surpassing Indiana with 218 and Iowa with 207. Oklahoma has already 76 and New Mexico 15. The largest gain in the half-year is in New York, with 17, which compares with the 14 in Pennsylvania, and would indicate that to the newcomer, public service commissions may not be so terrible after all. As a matter of fact, the gains are distributed all over the country, few States being without some new enterprise of this kind reported.

Grounding the Secondary.

Elsewhere we present an able review of the grounded-secondary situation from Mr. W. J. Canada, whose position in the insurance field gives his opinion much weight. It has long been well understood that grounding the secondary is the only effective means of preventing fatal accidents from leaks through to the low-tension side from the high-voltage distributing wires. Such occurrences are, unhappily, by no means uncommon, whether due to faulty insulation of transformers or to cross between primary and secondary wires, directly or via foreign objects. If the consumer's circuit is thus charged, the usual insulation in lamp sockets and wires is apt to be of very little avail and a touch at an incandescent lamp may prove instantly fatal. As apparatus has been improved such risks have in measure diminished; yet the records of every year show deaths from this cause in discreditable numbers. For the last decade there has been, therefore, a steady tendency to adopt the only measure of protection that is likely to be effective in nearly every case—so to ground the secondary circuits as to put the primaries effectively to earth in case of a cross. The more progressive engineers have preached grounding in season and out of season, and the better class of central stations has already adopted the precaution as a matter really of public necessity. Some stations, little to their credit, hang back. Just what excuse to his conscience a station manager can make after his neglect of grounding has cost a townsman his life it is a bit difficult to understand. But the real cause of neglect is generally parsimony. It costs something to make a good ground and the delays and uncertainties of the law make it perhaps cheaper to kill a neighbor now and then than to protect him from danger.

The ostensible reasons for neglecting grounds are as Mr. Canada recites them: increased fire hazard, increased maintenance of transformers, and the difficulty of getting good grounds. The first named is evidently of little weight to judge from the attitude of the Fire Underwriters, whose opinion carries great weight as to the facts. The second and third are simply pleas to avoid expense. As Mr. Canada points out, there is a distinct risk of fire due to neglect of grounding, a risk certainly considerable enough to offset any risks due to grounding. And while the Underwriters do not feel justified in penalizing conditions that affect life hazards only, they are quite willing to go to the length of advising grounding. The Edison Illuminating Companies have already expressed themselves in favor of making grounding mandatory, and the A. I. E. E. while it has failed to meet the present issue fully and this year neglected to give it any attention, has more than once been recorded in favor of grounding. The chief difficulty seems to be that the question of life hazard is without the direct field of action of the Fire Underwriters, and the engineering societies have no effective means of enforcing their opinions save by the individual influence of their members, already thrown in the right direction. The N. E. L. A. has not met the issue squarely, but passed half-hearted resolutions which, very properly, were summarily vetoed last week by the Underwriters' representatives. It is the one body able to exercise the most considerable influence upon central station practice in general. What excuses has it to offer for neglecting its duty in the matter of safety precautions? We see no reason for discrimination between secondary voltages in the matter of grounding unless it is prepared to admit that the higher secondary voltages are in

measure dangerous to life as to require and receive insula-
lso effective for the primary voltages. If this is so then
igh secondary voltages must be clearly recognized as dan-
s and safeguarded, if used, by precautions far more diffi-
o carry out than any grounding. As to danger to appa-
, the replies received by Mr. Canada to his letters of in-
make it evident that this risk is practically negligible.
sformers are better made and insulated than they used to
d are fully able to meet the conditions of grounding.

e practical question of importance to every user of elec-
ly is how to enforce such regulations as will assure him
y. What is the readiest means of enforcing a universal
for grounding secondaries? Mr. Canada believes that the
has come when the Underwriters should take stronger
n, reinforced by the municipal authorities wherever possi-
nd, if need be, by the Federal Government. It seems very
tful to us whether this last step would be a practicable
as the tendency is to leave such matters in the hands of
States. The States, however, might with advantage legislate
he subject, especially since a statute could bring pressure
ear on local authorities to make the actual grounding a
g readily accomplished. There has been at times a tendency
local authorities to put minor obstacles in the way of
ing suitable grounds to an extent that has sometimes been
dedly annoying. The main thing, however, is to bring pres-
to bear on the stations that hesitate about making the
nge to a grounded system. Probably the thing most effective
oushing these lagging folk into line would be for the engi-
ring bodies interested in good construction, and particularly
A. I. E. E., to go squarely upon record as holding un-
unded secondaries to constitute culpable negligence on the
t of the company operating them. Action of such sort
uld make a successful defense in case of accident practically
ossible, and would go further to remedy the difficulty than
thing save rather drastic legislation. We hope, too, that
s year the N. E. L. A. will take an unequivocal stand in the
tter and throw the whole weight of its influence in favor
safe construction. It is lamentable that the long line of
al accidents has not been cut short ere this. If there were
ve reasons against grounding one would hesitate perhaps to
t the case so strongly, but as a matter of fact the objections
e now practically all based on unwillingness to spend the
ney necessary for the work. In the case of a public service
rporation and the safety of the public, such objections cannot
given much weight, and when, as in this instance, the sums
volved are not large, as construction accounts go, there is no
equate excuse for delaying or dodging the issue.

Chronometrical Joke.

It would be an interesting task for the psychiatrist to endeavor analyze the state of mind of the promoters of the so-called Daylight Saving Bill" which has again been advanced a stage the House of Commons and is now before a special commit-e. We in this country are used, to be sure, to the introduc-on in Legislatures and Congress of bills involving every de-ee of mental incapacity and moral obtuseness, but they are enerally killed in committees, and rarely advance to the dignity a hearing. Some very unwise concessions to fanaticism are, be sure, passed, when they are not too strongly opposed by e lobby, yet the really wild and impossible ones seldom sur-ive the committee hearings. In the House of Commons they seem just now to be taking with owlish solemnity a proposition which one can scarcely believe is really much more than a practical joke, like the bills sometimes reported and passed in the last half-hour of merriment at the end of the session of a State Legislature. The proposition is briefly to compel the setting forward of all clocks in the British Isle from April, this bogus time reckoning to continue in force until the third Sunday in September in each year. By this beneficent arrangement the dear public is to be deluded into getting out of bed and to work an hour earlier than usual during the summer months, thus saving a clear hour of daylight and an hour of artificial lighting in the evening. It would be instructive to know the real origin of this scheme, which came up first a year ago and is now enjoying a second lease of life. Did it originate with some thrifty Scot, who had a grudge against the gas and electric light companies, or was it devised by the old women of both sexes who cannot sleep in the morning for fear of losing opportunities to mind their neighbors' business?

It would seem to be logical to include in the Bill provision for a general rising bell, to be rung for half an hour from theoretical 5:30 a. m. in every parish in the United Kingdom; also a suitable curfew to prevent ungodly folk from trenching on their due hours of sleep by sitting up too many hours after the official retiring time. Without wishing to interfere in the manners and morals as regulated in foreign parts, we would call the attention of friends of this bill to the enthusiastic way in which some of our yellow journals carry out a similarly forehanded scheme by publishing 10 p. m. extras at 4:30, thus rendering it needless to sit up late for the receipt of news. It may be well, too, to indicate to our prohibitionist friends the practical gain in saloon closing time to be thus simply attained. In fact, why not legislate that 30 minutes constitute an hour, and double up the days? This should accord well with trade-unionist views and might make a suitable rider for the bill under discussion. A waggish English journal suggests that it might be well also to legislate on the question of temperature, directing all thermometer scales to be slid upward 10 deg. on the third Sunday in April, and downward an equal amount on the third Sunday in September. The beneficent applications of this sort of thing seem well-nigh limitless. Its unofficial application to pure numerics has already worked wonders in the death rates in some of our Western cities, and in bills for municipal supplies a similar process has lightened the heart of many an alderman. We fear that the game is not wholly original, although its present beautiful development strikes one as novel. Frankly, we trust that the present bill will pass, as the greatest advertisement (barring the suffragette movement) of the new century, and as fresh evidence of the far-sighted astuteness of the body that annually turns down the Metric bill. The Lords can be trusted to suppress it or to amend it into some form yet more facetious. Meanwhile, people will keep up the same old game of getting up about when they please, working as long as they please, and then turning night into day, to the profit of the dispensers of liquids and lights.

The Modern Alchemist.

Another manifesto from Professor Ramsey announces the apparent transmutation of several things into carbon. It is one of the announcements above which might appropriately be placed the old scare-head line, "Important If True." We hope it will not prove as illusory as the former report of the same investigator concerning lithium. The fact is, however, that it is high

time in the progress of events for some of the so-called elements to be broken up. It is a long time now since their structural similarities have been self-evident and since the probability of splitting some at least of the "elements" into their components has been strong. We put aside cases like radium and its allies on the ground that they are not in fact known as metals at all and cannot be discussed from the same standpoint as the ordinarily known elements. We also put aside cases like iron in which the enormous complexity of the spectrum and many anomalous points of behavior indicate exceptional structural properties. The ordinary rank and file of the elements show plain evidence of similar structure running particularly through elements of the same group, reinforcing the obvious teachings of the periodic law itself. The spectroscopic evidence alone is immensely convincing, so that there is every reason to expect that ere long some group will yield and tell the story of its elemental structure. The question in this particular instance is whether the thing has really been done or whether the announcement rests on the somewhat shaky kind of evidence as in the report of last year. Carbon is a rather commonplace sort of breakdown product, especially when nothing is said of other constituents, and from the first reports it is quite impossible to gather anything about the weight of the evidence.

If it is purely spectroscopic, obtained from traces observed in a vacuum tube, one cannot lay great stress upon it. Vacuum tubes long used and hard pushed may show traces of very queer things relating to their past history. If on the other hand Professor Ramsey has made anything like a decent yield of carbon from bismuth or anything else of his list, he has certainly achieved a remarkable success. A most interesting question is regarding the rest of the products observed. The atomic weight of carbon is not a sub-multiple of that of Professor Ramsey's sources, and hence something else, known or unknown, must have turned up. If so, what? However this may be, it is worth while saying a word or two about the situation with a view of correcting some popular errors. Assuming that Ramsey has actually broken down a pure metal and obtained carbon from it, what does the fact mean? Assuredly it does not imply the transmutation of elements in the ordinary sense of the word. It does not mean that a pound of one thing has been changed into a pound of another. It rather means that a so-called element of rather complex structure has been broken up and has yielded at least one known substance which it may or may not have contained as such. For example, one "cracks" by heat a heavy paraffin oil and obtains from it some coherent fragments of its structure in the shape of light hydrocarbons and also products that were not part of the original substance but merely constructed of its parts in course of the reaction. The basis of organic research is so to treat a complex substance as to split it up without too much disintegration into recognizable fragments. From their relations and proportions one can make a shrewd guess as to the way the parts went together in the original material. Another splitting operation by a different method may give confirmatory evidence, and finally the point is reached where the structure of the original substance is quite clear. Then, and really not until then, there is a fighting chance for building it again out of the stuff that has been recognized as suitable building material.

Load Factors and Costs.

Central-station men generally recognize that the yearly l factor (that is, the average load for the year divided b maximum load for the year) has an all-important influen the cost per kw-hour of producing power. It is not al easy to show prospective customers how important this matt although with proper presentation it is a simple business pro tion. As was recently brought out in a discussion of this ject in Chicago, electric power companies generally assur making up their schedules of rates that the maximum dema any customer will be during the period of the maximum load of the year. As a matter of fact, this may not be tr many cases, and may give rise to some injustice to ce consumers, but in a large system it is almost impossib deal with such matters except by the wholesale. In companies almost any of the ordinary motor loads is like be on during the maximum peak of the year. In large panies the diversity factor begins to help out the central tion. In fact, central-station power rates would have t considerably higher than they are were it not that the considerable diversity in the hours of demand of power u Were it not for this diversity there would be no logical son for charging less for electric power than for electric l Under conditions as they exist the very fact that a conside part of the total power load will not be in operation at time of the station peak justifies a lower rate than for l ing, because a large per cent of the lighting load is sur be on during the December peak load. Of course, as reg the investment in transformer, meter and service lines the consumer's premises, the maximum demand of the sumer governs the investment, regardless of the hour at w his maximum demand occurs; but when it comes to fee and station-capacity investment, this part of the investme determined by the aggregate demands of the various cons ers at any one time, and in the case of intermittent po service this is considerably less than the sum of the maxim demands of the various consumers. Were it not for this the fixed monthly charges to small intermittent users of po would have to be considerably higher than they are at pres It is encouraging to see how the larger a central-station sy grows, the greater the diversity of its load and the less overlapping of maximum demands of various consumers.

The Future of Free Lamp-Renewals.

There is a decided difference of opinion among promi central-station men at the present time as to a free la renewal policy. The free renewal of carbon-filament la has been the rule rather than the exception among the la electric-lighting companies of the United States, and the p tice has also extended to some of the more progressive sma companies. The reason for this is primarily to prev consumers from placing poor and inefficient lamps in use then blaming the company and electric light in general for poor results they obtained. Now that the tungsten lamp come into general use some managers have felt the po would gradually be discontinued, as at present prices tungs lamps are entirely too expensive for free renewal by cent station companies, and the consumer, recognizing this, buys own lamps without complaint. With the tungsten lamp in in all sockets where efficiency counts for much, naturally sc question may arise as to whether it is worth while for

central-station company to supply free renewals of the old carbon lamps used in the less important sockets of a consumer's installation. On the other hand, there are central-station men who firmly believe that the tungsten lamp has not materially altered the situation as regards the necessity for protecting the consumer against the cheap and inefficient lamp. At the present time the American-made tungsten lamps are pretty much all of one quality and efficiency, although varying considerably each side of rated wattage and candle-power. As time goes on it is thus logical to expect that the history of the carbon lamp will be repeated with the tungsten lamp and that cheap tungsten lamps with long life and correspondingly low efficiency will be retailed by hardware and other dealers throughout the country direct to central-station customers who are not furnished with free lamp-renewals and who cannot purchase tungsten lamps from the central stations at a lower price than from local dealers. The central station which is making active efforts to keep satisfied customers and give the best possible service for the money will probably in the future have to control the tungsten-lamp situation by the same methods that the carbon-lamp situation has been controlled in the past. This does not mean that absolute, free renewals of tungsten lamps need necessarily be given. The same purpose can usually be accomplished by selling lamps at so low a price that it is not worth while for local dealers to retail inferior lamps. In many cases it is not even necessary for the central station to do this, because the local dealers must recognize that at any time the central station, for its own protection, may inaugurate free renewals or the selling of lamps at cost, thus driving all local dealers out of the business. With such a possibility ever present and fully understood by the dealers, the central-station company usually has it easily within its power to insure a lamp of good quality and efficiency being sold in the smaller and medium-sized cities. In the very large cities such control is not feasible, and the only method is to sell lamps at a low enough price to keep the unscrupulous dealer out of the field. After all, the situation which has given rise to the present discussion of free lamp renewals is merely ephemeral, and principles adduced from it alone will be apt to prove ephemeral also.

The Carrying Capacity of Wires.

The carrying capacity of electric wires is a subject upon which much misapprehension exists. It is easy to define the carrying capacity of a wire as the strength of current which a wire can carry without being overheated. But when we attempt to define, with any degree of precision, what this strength of current is, we find ourselves involved in an embarrassing wealth of detail. Is the current carried continuously or is it intermittent? Is the wire covered with asbestos, or paper? Is it embedded in a porcelain tube or in sawdust? Is the wire out-of-doors, exposed to the wind, or is it indoors, and rubber covered? Is it in an underground conduit, or lead-covered and immersed in water? All such considerations bear upon the question of the safe carrying capacity of wires. A No. 10 copper wire will require, to raise its temperature 40 deg. C. above surrounding bodies, under normal temperature conditions, about 75 amp when suspended, bare, in calm weather out-of-doors; about 150 amp when rubber-and-braid covered, but immersed in running water; about 50 amp when suspended, bare, and horizontally in still air within doors, or when rubber-and-braid covered and supported in wooden molding. A temperature rise of 40 deg. C. would be a large rise to allow in house wires passing through inflammable materials and insulated by cotton braiding. It would, on the contrary, be a small rise to allow in bare wires or in asbestos-covered wires out-of-doors. All that can be done is to draw up tables of limiting current-strengths for wires of a specified kind of insulation, placed in a specified environment. Thus, the National Code allows 24 amp as the carrying capacity of a No. 10 copper wire, when rubber-covered, with reference to use indoors, but 32 amp when of the so-called "weatherproof" type.

The temperature-elevation of an active wire is as much a question of the strength of the cooling action as of the current strength, or heating action. It would be possible to find some unusual and unreasonable means of wrapping and enveloping a rubber-covered No. 10 wire which would make 24 amp a very hot current; and, on the other hand, by keeping the wire immersed in running water, 24 amp would be made a very cold current. Under ordinary practical conditions of house wiring, the rule gives a satisfactory safe limit, in view of the temperature at which rubber covering decomposes by thermolysis. A much stronger current could be carried without risk of melting the rubber. The rules of the National Code do not permit of the use of wires smaller than No. 14 (64 mils or 1.6 mm diameter), although this wire in rubber covering is assigned a safe current of 12 amp. Since a single incandescent lamp usually takes less than 1 amp, it would appear at first sight as though a smaller wire than No. 14 might be used with safety and economy. It must be remembered, however, that if a short-circuit occurs on the tap for one lamp, it may bring a small wire up to red heat before the cut-out blows, and that the rubber coating might, under particular conditions, become ignited thereby. The larger wire has a larger margin of safety in cold storage, or thermal capacity, against accidental short-circuits.

Moreover, there is always a danger of overloading a wire by carelessness. A tap is run to an outlet during the construction of an office building from the submains on a passage. The outlet is designed to supply a single innocent 16-cp incandescent lamp on a wall-bracket. The lamp takes less than half an ampere, and a No. 14 supply wire runs only a degree or two in temperature above its surroundings. Some day, the tenant in that office connects in a three-part plug-cluster, to which he harnesses a large and generous desk light, a comfortable fan-motor, and perhaps a commodious electric kettle, all fed at once through the No. 14 wire, which does not understand why it gets so hot. If the cut-out on that outlet is properly fused, no harm will be done, because the fuse will blow before the wire is dangerously heated; but if the tenant, discontented with the blowing of 5-amp fuses, forces in a 40-amp fuse, it would not be beyond possibilities for him to destroy the insulation on the wire. The plug-cluster itself is a beneficent convenience, but when ignorantly misused it may become a source of danger. It has been partly with an eye to such dangers that the National Code rule has been framed to the effect that a lamp circuit shall not take more than 660 watts from any one cut-out or outlet. This means 6 amp at 110 volts, or half the safe current of a No. 14 rubber-covered wire. It is clear that 6 amp is not in itself a dangerous current through an outlet or cut-out; but in connection with No. 14 wire taps, and absence of intelligent supervision, it is a wise limit.

Conference on Standard Electrical Rules.

The seventh annual meeting of the National Conference on Standard Electrical Rules was held on March 26 in the Engineering Societies Building, 29 West Thirty-ninth Street, New York City. To the list of companies and national bodies already represented in the Conference was added the name of the American Association of Electric Motor Manufacturers as an associate member. The Underwriters had been requested to appoint a sub-committee to revise Rule 12-A and inasmuch as the rule at present in force had been adopted in conference with other interests, the Underwriters desired an expression of opinion from the Conference, preferring that if this rule needed revision the suggestion to do so come from the National Conference on Standard Electrical Rules. The rule as at present in the Code is not lived up to by electric light companies and has no reference to the proximity of signaling wires, etc. The National Electric Light Association now has a committee working on standard specifications for pole lines, which committee expects to take two years to complete its work. It was suggested that the Conference appoint a committee to consider the matter of Rule 12-A, this committee to confer with a committee from the Underwriters and the N. E. L. A., and action to that effect was taken.

The Underwriters, feeling that if the Code were to be truly national in its scope, it should also contain rules which deal with the life hazard of electrical installations, stated they would have no objections to inserting such rules as the Conference suggested in the Code with a note underneath, each calling attention to the fact that inasmuch as they dealt chiefly with life hazard, the insurance inspector could not insist on their enforcement. A committee was appointed to report at the next meeting such rules as in the opinion of the Conference should be inserted in the Code. It was voted that in the revised edition of the Code, now being prepared for the printer, the Conference authorize the Underwriters to insert under the rules in Section 31-A (Theater Wiring), which dealt with life hazard, a note to the effect that compliance with the rule is recommended, but that the rule is not adopted for the purpose of lessening the fire hazard, so that no penalty could be enforced by the Underwriters for failure to observe its provisions. Mr. W. H. Blood, Jr., was re-elected president and Mr. C. J. H. Woodbury, secretary-treasurer of the Conference.

Revision of National Electrical Code.

At the seventeenth annual meeting of the Underwriters' National Electric Association, held in New York City on March 24 and 25, the various committee reports and suggestions for changes in the Code printed in the bulletin sent out by the secretary were considered and acted on. The changes do not go into effect until the revised Code is printed and distributed, which will be about July of this year. This edition will be a great improvement over previous ones and will be printed in two parts, one including the rules under classes A, B, C and E of the present Code and the other including classes D and F. All the fine-print notes will be limited to suggestions and explanations and are not to be considered mandatory; present fine-print notes, which are in effect rules, will be printed as such. Cross references will be eliminated when feasible, so that the rules will be complete in themselves as far as possible. The next public meeting of the electrical committee will not be held until 1911.

The committee appointed to consider changing the grounding rule, 13-A, recommends that the rule be not changed, and this recommendation prevailed. The committee was asked to make the rule mandatory up to and including 150 volts for alternating-current secondary circuits, and to prohibit grounding of such circuits carrying in excess of 150 volts. In the opinion of the committee, the fire hazard for one voltage was practically as great as for the other, and while the committee felt that the Underwriters should use all their moral influence in supporting a rule based on life hazard, they have no right to enforce a rule which cannot be defended on the ground that it is adopted for the purpose of lessening the fire hazard. Unfortunately the American Institute of Electrical Engineers failed to represent its views on the subject, though represented on the committee, and while the Association of Edison Illuminating Companies sent in a report favoring the grounding of the circuits while the meeting was in session, it came too late for action.

The report of the committee on circuit-breakers, covering specifications and rules, was adopted with some slight changes. Rule 21 was changed to read as follows: *Excepting on main switchboards or when subject to expert supervision, automatic, overload, circuit-breakers will not be accepted for the protection of alternating-current motors unless fuses are also provided in each phase. For single-phase motors, one side of the line may be protected by an approved automatic, overload, circuit-breaker and the other by a fuse.* This note applies up to the maximum capacity for which enclosed fuses are approved. For circuits above that capacity, circuit-breakers only will be required. Circuit-breakers must successfully operate three times with two-minute intervals intervening without incapacitating the mechanism, the condition of the testing circuit to be as given in the following table:

Ampere rating of breaker.	Per cent voltage drop in test circuit with rated current flowing.	Minimum available capacity of supply system not including overload capacity.
0-100	2	1000
101-300	3	3000
400	4	4000
500	5	5000

No filing of contacts or other repairing of the breaker is to be made during the test. Multiple breakers must comply with the above requirements whether the tests are made on all poles at once or on any pole.

The report of the committee on cabinets was somewhat modified so as to take in metal-molding systems. The cabinet must be deep enough to permit the closing of doors when switches of 25 amp rating or less are in any position. There must be a space of at least ½ in. between the walls and back of a cabinet and any live part. A space of at least 2 in. must be provided between open link fuses and metal, metal-lined or glass-paneled doors of cabinets. A space of at least 1 in. must be provided between the door of any cabinet and an enclosed fuse or any live metal part. The committee was continued to determine the best thickness of metal to be used in cabinets.

The laboratory report on flexible cord and cable was adopted with some few changes, and the whole matter was referred back to the laboratory for further consideration. The report of the committee on stage cable specifications was adopted, as was also that of the committee on switches and cut-outs with reference to the misuse of 125-volt Edison-type plug fuses on 250-volt circuits. The use of such fuses on 250-volt circuits is not approved.

The committee on Rule 64, signaling systems, suggested the following changes in the rule, which were adopted: The first eight words in section d were stricken out. A note to the effect that when the wires are carried in approved cables, sections c, d and e do not apply, was added to section e. The second and third paragraphs in section 1-3 were consolidated to read as follows: *Where the ground wire is attached to a water pipe or a gas pipe, it may be connected by means of an approved ground clamp fastened to a thoroughly clean portion of said pipe, or the pipe shall be thoroughly cleaned and tinned with rosin flux solder, and the ground wire shall then be wrapped tightly around the pipe and thoroughly soldered to it.* The last sentence in section n was changed to read as follows: *They must not come nearer than 3 in. to any electric light wire in the building, unless separated therefrom by some continuous and firmly fixed non-conductor creating a permanent separation; this non-conductor to be in addition to the regular insulation on the wire.*

The tentative report of the committee on auto-starters was adopted and the committee was continued with authority to include specifications for the construction of such devices in addition to the testing of the same.

Among the suggested changes to the rules which received favorable action were the following: Section d, rule 12, was stricken from the Code. Section b, rule 14, had the following addition made to it: *For wire smaller than No. 8 split knobs shall be used, and tie wires and knobs will not be approved.* The fine-print note to rule 40, section b, was amended by striking out reference to rules 43 and 42. Rule 49-A, section i, was amended by the addition of the following words: *Covers may also be made of porcelain or other approved material, provided they are of such form and thickness as to afford suitable protection and strength.* Section c, rule 54-A, now reads, *line terminal plates must be at least 0.06 in. thick. Rule 55, section j, was amended so that all insulating material inside of a socket must be of porcelain or other approved material.* A new section was added to rule 57 to the effect that terminals must be designed to secure a thoroughly good and permanent contact with the supply wires, which contact must not become loosened by motion of the lamp during trimming. Rule 60, section f, was amended to read as follows: *Motor starting rheostats for direct-current circuits must be so designed that the contact arm cannot be left on intermediate segments and must be provided with an automatic device which will interrupt the supply circuit before the speed of the motor falls to less than one-third of its normal value. For alternating-current circuits the automatic interrupting device may be omitted.* The ideas of many suggested changes were adopted and the rules referred to a committee for rewording. Committees were appointed on wiring and installation of high-tension motors, on fixtures and fixture wiring and on the question of changing the relative positions of the meter, cut-out and service switch so as to prevent the theft of electricity. Rule 12-A, on constant-potential pole lines, was referred to the National Conference.

Annual Report of the American Telephone & Telegraph Company.

The annual report of the American Telephone & Telegraph Company, which is dated March 16, is exceptionally interesting. In addition to the usual statistics and account of operations, it contains a general statement as to the relations of the American Telephone & Telegraph Company with associated companies, which relations are said not to be generally understood. A reply is made to criticisms of Independents, and a statement is given as to the relative money value of the parts of a telephone system.

As to the relations with the associated companies, it is stated that the parent company is primarily a holding company, holding stocks of the associated operating and manufacturing companies. As an operating company, also, it owns and operates the long-distance lines which connect all the systems of the associated operating companies. In addition, it assumes centralized general administrative functions with relation to all the associated companies, which are thus assisted and directed in the development and introduction of new ideas, methods and inventions. It has a department, organized at the very beginning of the industry, where a record is kept of practically everything known about inventions pertaining to the telephone or kindred subjects, and where every new idea is examined, and its value, so far as patent features are concerned, determined.

The engineering department takes up all new ideas, suggestions and inventions, and passes upon, studies and develops them. It has under continuous observation the study of traffic methods and troubles, with a view to improving or remedying the same. It studies all construction, present and future development or extension schemes, makes plans and specifications for the same, and gives, when desired, general supervision and advice. The department has a corps of experts which, in addition to the above work, is at all times at the service of any one or all of the separate companies. A large staff has been and is continuously engaged in the consideration of disturbances arising from transmission and other lines carrying heavy currents, and that any telephone system in many cases can even exist in the vicinity of such lines is due to the constant attention given to this subject. Every new trouble comes before this department, and when settled there it is settled for all. This has resulted in a standard commercial, operating and plant practice not only for all associated companies, but for other companies of high standing throughout the world. All devices and inventions submitted receive a thorough and painstaking investigation, and it is believed that there has as yet been no instance where any invention, system or method rejected by the patent and engineering departments of the company, has ever had any permanent success when used elsewhere.

The manufacturing department creates and builds all the apparatus which has been adopted, with the result that throughout the whole system are found standardization and uniformity. None of the companies alone could maintain such an organization, and it would be fatal to any service to introduce or try out undeveloped ideas in actual service. The legal department forms a clearing house in all legal matters for all legal departments of the separate companies, to which assistance and advice are given on all questions of general scope. The centralized general administration, in short, takes care of all those matters which are common to all companies, or which, if taken up by each company, would mean multiplication of work, effort and expense, without corresponding advantage or efficiency.

Referring to the criticism of Independents, it is stated that, in view of the preponderating Bell interests in the telephone business of the country, it is due to the parent and the associated companies at least to call attention to the misleading statements, to promises in prospectuses impossible of fulfillment, and to advertisements offering to the public securities at large discount, promising large prospective dividends, issued to build exchanges in which service is to be given at impossible rates. In all controversies as to rates, franchises and so on, in all hearings before public bodies, Bell representatives have been confronted with such promises, statements as to what interests other than the Bell were doing, and with assertions that if it were not for watered stock rates could be reduced, or the business conducted at a profit on much more favorable terms to the public. "All that experience has taught was as nothing to the promises of franchise vendors and manufacturers' agents. Established business and property were put in jeopardy, with the result that there are many instances where the public has on its hands a partially duplicate exchange with partially duplicate subscription costs, and no one has benefited except the promoters of the schemes." It is said that there is now a decided tendency on the part of the public to favor consolidation wherever there are two exchanges in the same community.

Studies have been made during the year to determine the actual rate of depreciation which should be provided for. Of the total value of the telephone plants owned by the American Telephone & Telegraph Company and associated companies, real estate constitutes 9 per cent; underground conduits and cables, 20 per cent; copper wires and aerial cables on poles, 18 per cent; pole lines, not including wires but including the ownership of rights of way over private property, 26 per cent; iron wires, 4 per cent, and central office and substation equipment, 23 per cent. As to the depreciation, real estate is standard and established. Underground conduits can be classed with real estate, or rather with permanent construction on long-term ground rents. Cables and copper wires have shown very little depreciation, but experience has not yet established a definite rate; there is, however, a net scrap value of 40 per cent. Iron wires have a life of from 8 to 15 years. Pole lines have a life of from 10 to 16 years. Central and substation equipment has a depreciation dependent on its character, the condition in which it is maintained and the policy of renewal or replacement by new or improved apparatus.

Of the total mileage of exchange wires over 50 per cent is underground. Of the total value of exchange wires 84 per cent is copper and 16 per cent iron. Of toll wires 91 per cent is copper and only 9 per cent iron. There are now underground conduits and cables between New York and Philadelphia, Chica-

go and Milwaukee and a substantial part of the way between New York and Boston. Some pole lines of the company are for a considerable length built over rights of way actually owned by the company, acquired at a cost of some $8,000,000; it is stated that these rights could not now be acquired at many times that outlay, if at all. A valuation of the exchange, toll and long-distance line plant included in the Bell system in the United States was made in 1907, based upon the replacement cost of the existing plant. This appraisement gave the plants a value of $35,000,000 in excess of the obligations outstanding against them. Several valuations of all or parts of the plants of several of the associated companies have been made either by or under the direction of public authorities, and it is stated that in every case the valuation so made exceeded the valuation as carried on the books.

The entire Bell system, including Canada, showed earnings for 1908 of $140,016,400, an increase of $7,009,500 over 1907. The total expenses were $94,042,400, an increase of $3,101,100 over 1907. The balance of net earnings was $45,974,000, an increase of $3,908,400, and the undivided profits were $13,601,400, an increase of $904,000 over 1907. The total combined assets Dec. 31, 1908, were $680,044,230, which included $54,916,000 cash and cash assets. The surplus for the same period was $31,759,600. Plant depreciation reserves were $20,728,500, and general depreciation reserves $19,751,800.

The number of stations of the Bell system in the United States operated directly by the associated companies at the end of the year was 3,215,245, an increase of 179,712. In addition, there were 1,103,144 exchange and toll stations connected to the system by its toll and long-distance lines, but operated by local, co-operative and rural Independent companies and associations having sub-license or connection contracts. Adding also the telephones employed for private line purposes, there was a total of 4,364,629 stations connected to the Bell system, as against 3,839,000 stations at the close of the previous year, an increase of 525,629 stations; 1,220,126 miles of exchange and toll service were added during the year, bringing the total to 9,830,718 miles. Including the traffic over the long-distance lines, but not including sub-licenses, the daily average of toll connections was about 463,000, and of exchange connections about 18,500,000, a decrease in the former of 31,000, and an increase in the latter of 370,000.

The total plant additions during the year amounted to $26,637,200, not including a large amount of real estate purchased from the American Telephone & Telegraph Company during the year. This is a very considerable reduction from the additions during the years 1900-7, those in 1906 amounting to $79,366,900, and in the year 1907, $52,921,400. During the year $39,736,700 was applied out of the revenue to maintenance and reconstruction purposes. The associated operating companies during the year decreased their obligations to other than the American Telephone & Telegraph Company by $2,709,000, while the cash on hand increased at the same time $2,295,000.

The gross earnings in 1908 of the Bell telephone companies of the United States, the American Telephone & Telegraph Company not included, were $127,117,200, an increase of $6,364,000 as over the preceding year. The total expenses were $91,461,600, an increase over the previous year of $3,553,600. The balance of net earnings were $35,655,600, an increase of $2,810,400, and the undivided profits were $7,076,600, an increase of $463,000. The total assets were $566,540,900, an increase of $25,178,600. During the year the surplus decreased by $633,700, and depreciation reserves increased by $5,161,400.

A New Chicago Telegraph Company.

The People's Mutual Telegraph Company, of Chicago, referred to in the issue of March 18, was granted an ordinance to use the streets of Chicago at a meeting of the City Council on March 22. This company, although expecting to do much Board of Trade business, will also enter the field of general telegraph business in the territory it serves, being, indeed, compelled to do so by the terms of its Chicago franchise. The principal office, at least at first, will be in the Chicago Board of Trade. From there its wires will lead, through existing conduits, to the Van Buren Street tunnel under the South Branch of the Chicago River, thence to the Metropolitan Elevated Railway structure and so to the western city boundary. New overhead construction will be needed from this point to Joliet, Ill., where a connection will be made with leased wires (probably belonging to Independent telephone companies) going to St. Louis and Kansas City and possibly Omaha, with entrance into the cities named. Reduced rates (day service) will be offered—25 cents for 10 words and 2 cents for each additional word, Chicago-St. Louis, with 30 and 2 cents as the Chicago-Kansas City rate. The People's Mutual Telegraph Company is an Illinois corporation, in which Chicago Board of Trade brokers, dissatisfied with existing telegraph rates, are interested. Its officers are as follows: President, Mr. Arnold Kalman, Chicago; vice-president, Mr. H. C. Stifel, St. Louis; secretary and treasurer, Mr. H. L. Stern, Chicago. Mr. W. C. Polk, of Toledo, Ohio, has done the preliminary engineering work. The Chicago & Milwaukee Telegraph Company, a distinct corporation, but also backed by Board of Trade interests, has operated a telegraph line between Chicago and Milwaukee successfully for several years.

Iowa Electrical Convention Program.

The Iowa Electrical Association will hold its annual convention for 1909 at Cedar Rapids, Iowa, April 21 and 22. Headquarters are at the Hotel Montrose. An arrangement similar to that in force last year, whereby the association provides free-of-charge space for exhibits, has been made for this year. There will be a large exhibition hall, and electrical energy required by exhibitors will also be supplied free. This hall will probaby serve both for the exhibits and meeting-place, so that not only will the exhibits be sure to receive attention from the central-station man, but the prompt calling of the meetings will not be handicapped by detention of central-station men at parlor exhibits. The plan is one which has given excellent satisfaction both to exhibitors and central-station visitors. A letter recently received from Mr. L. D. Mathes, of Dubuque, president of the Iowa Electrical Association, is so much to the point regarding the work and aims of this association that we quote from it:

"Our association has gained much in strength and is steadily improving in strength and interest. Our object is to keep close to the ground; down within reach of the men who actually handle the plants of this State. We never attempt highly technical discussions, feeling that theoretical issues can be dealt with by the individual companies through the engagement of specialists as such questions arise. Our endeavor is to analyze thoroughly the every-day problems; to talk right out in meeting, as it were, about our experiences from every angle of the operating standpoint."

Reservations for exhibit space can be made through Mr. W. N. Keiser, of Des Moines, secretary of the association. The following papers will be presented:

"Portable Vacuum Cleaners," by Mr. O. E. Brownell, Lake City; "Application of Electricity in the Conduct of the Modern Home," by Mrs. L. D. Mathes, Dubuque; "The Effect of the Introduction of the Tungsten Lamp on Central-Station Revenues," by Mr. Thomas Ferris, Osage; "Ornamental Curb-Line Illumination," by Mr. D. F. Fradette, Des Moines; "Amount of Daylight Business Sufficient to Justify 24-Hour Service, and Methods Adopted to Increase the Daylight Load," by Mr. M. A. Harrison, Nevada; "Aid of Prismatic Reflector to the High-Efficiency Unit," by Mr. Morgan P. Ellis, New York. Discussion: "On the Progress of the Introduction of Heating Units by Central-Station Companies," by representatives of the trade; "The Story of a Successful Sign Campaign, with Facts and Figures," by Mr. J. B. Lindl, Dubuque; "Selling Electrical Domestic Appliances in a Small Town," by Mr. W. W. Sterns, Humboldt; "Importance of Close Inspection of Customer's Installations," Mr. W. B. Greene, Cedar Rapids; "Does It Pay the Central Station to be Broad-Gaged in Dealing with Its Customers?" by the president.

w York Public Service Commission News.

ormation was lodged with the Public Service Commission f e First District of New York last week that the Inter- rgh Rapid Transit Company had secretly constructed an led tunnel between its line at Grand Central Station and estern end of the Steinway tunnel in Forty-second Street Lexington Avenue. At a meeting of the commission, h 29, Henry B. Seaman, chief engineer of the commission, ied that he found that an inclined tunnel had been cut een the two tubes, varying in inclination from 18 to 45 deg.. in size from 6 ft. to 10 ft. in diameter. He said that the el passed through the location asked for by the Hudson & hattan Railroad as a station site, and would interfere with construction at that point. Mr. Frank Hedley, general ager of the Interborough, admitted to the commission that had given the order for the construction of the tube some last summer, but that he had asked no permit, as he be- d it was covered by the franchise of the Steinway tunnel. Hedley said the connection was simply for carrying cables. Seaman also reported that the Steinway tunnel had gone ond its franchise in constructing a loop under Park Avenue. r. Theodore P. Shonts, president of the Interborough, has sted to the commission that if the McAdoo permit was nted it be for the use of the third level below the present way. Mr. McAdoo claims that to put his road so far under ground would render it practically useless, and intimates t this is the purpose of the Interborough's president. Mr. nts has also sent a communication to the commission pro- ing against the construction of the Lexington Avenue Sub- y as proposed by the Bradley-Gaffney-Steers syndicate. He ims that the actual return on the capital invested in the sent Subway is less than 6 per cent and that a new subway ld not be constructed at a smaller cost and would not ommodate a greater volume of traffic.

A committee of the Woman's Municipal League of New rk has petitioned the Public Service Commission to order t one car be set apart in every subway train for the exclusive e of women. The petition explicitly states that this designa- n of a separate car shall in no wise interfere with the rights women to use the other cars of the train. The commission s instructed the Interborough to show cause within 10 days hy such an order should not be made.

Receiver F. W. Whitridge, of the Third Avenue Railroad, s been given permission to construct the extension of his e around the crest of the hill at Fort George. The com- ission sharply criticized Mr. Whitridge for having gone ead with the construction before the permission was given.

The Public Service Commission of the Second District of lew York has extended to July 1 the time within which the Tarrytown, White Plains & Mamaroneck Railway Company hall vestibule its cars. This was done because the road had rdered cars which could not be delivered before that date.

The Public Service Commission of the Second District of New York has granted the Delaware & Otsego Light & Power Company permission to construct and operate an extension of ts electric line from East Sidney to Sidney Center and also to ssue $15,000 of common stock. The proceeds of this stock ssue are to be used in the acquisition of property and the im- provements of plant. The commission has also approved the lease by which the Buffalo & Lackawanna Traction Company leases its property and franchises to the Buffalo & Lake Erie Traction Company for 999 years.

Justice Fitts, of the Supreme Court, at Albany, N. Y., has handed down a decision in which he holds that the Public Service Commission law is constitutional and that the Economic Power & Construction Company, of Buffalo, is under the jurisdiction of the commission and must make reports to it. The company, which possesses a blanket charter obtained from the Legislature a number of years ago authorizing it to sell electrical energy for light and power in any part of the State, refused to report to the commission or to produce its books for inspection. The company held that under its charter it was outside the pale of the public service law. Under the present decision the company is liable to a penalty of $100 per day, since its refusal to report, or a total of $23,500. The company will appeal from the decision.

New Jersey Public Utilities Legislation.

The New Jersey House of Representatives last week passed a public utilities bill introduced by Mr. W. P. Martin, of Newark, modeled after New York legislation on the subject. Later the vote was reconsidered and the bill laid on the table Another public utility bill now before the Legislature, known as the Pierce bill and which is much less sweeping than the Martin bill, passed the Senate last year. The Martin bill provides for a commission of five members, gives power to fix rates, to examine the books of public utility companies and to value their property. In view of the differences of opinion that have developed as to the details of such a measure, there appears to be little likelihood of the passage of any public utility bill at the present session of the Legislature.

Conservation of Natural Resources.

On March 24 the American Society of Civil Engineers, the American Institute of Mining Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers held a joint meeting in the Engineering Societies Building, New York, to consider the subject "Conservation of Natural Resources."

Mr. John R. Freeman called attention to the fact that deforestation has not appreciably affected the flow of important streams, such as the Hudson, numerous lecturers to the contrary notwithstanding. Wooded land does act as a retaining reservoir with better results than does cleared land, but the percentage of wooded land to the whole area has not been decreased appreciably by deforestation. Moreover, young trees are approximately as effective in retaining water as are old trees. Greater damage is done by forest fires than by lumbermen. However, lumbermen should be compelled to take steps to prevent the starting of forest fires among the wood left drying on the ground by them. Mr. Freeman stated that the advantages to be derived from hydro-electric developments are frequently overestimated.

Dr. Rossiter W. Raymond presented a paper discussing conservation by legislation in which the dangers of legislative conservation were outlined. He expressed the opinion that the engineers should educate the public by presenting facts and not opinions for the consideration of those whose actions may affect future legislation.

Mr. Charles Whiting Baker said that the losses by fire during 1907 amounted to $215,000,000, one-half being for buildings and the other for contents. To show the extent of the fires, Mr. Baker remarked that if the buildings destroyed were placed on the two sides of a street, each house occupying a frontage of 60 ft., the street would reach from New York to Chicago.

Mr. Lewis B. Stillwell dealt with the economics of conversation as affected by hydro-electric developments. He showed that the energy now utilized at Niagara represents an actual saving of from one to two million tons of coal per year. The advisability of placing a tax upon hydro-electric developments is greatly to be doubted; they should be encouraged. Before the proposal to tax water-powers in order to assist inland waterways, information should be obtained concerning the relative costs of haulage by canal and railroads. It should be remembered that each horse-power obtained from water when utilized for 10 hours per day saves at least 7.5 tons of coal per year. A very large saving can be secured by substituting electric motors receiving energy from large central plants for the numerous steam engines in cities obtaining energy from small uneconomical boilers.

Report on Transportation Subways in Chicago.

As announced in these columns last week, a very elaborate report has been made public by the committee on local transportation of the City Council of Chicago on the question of underground transportation in that city. The report was prepared by the Bureau of Engineering of the Department of Public Works under the direction of Mr. John Ericson, chief engineer, and Mr. Thomas T. Johnston—who died about a month ago—chief assistant engineer. It comprises three leather-bound volumes, 25 in. wide and 15 in. high, each containing about 70 pages. In addition there is a supplementary pamphlet of 151 pages, describing the Boston, New York and Philadelphia subways, the Metropolitan Underground Railway of Paris and the various underground roads in London. In the report need be constructed to care for present necessities and extensions can be built from time to time as the population transportation situation becomes clarified and settled.

It is the intention to include space within the subway s ture for the accommodation of sub-surface utilities, in c that the utmost capacity of the street for all purposes wi made available. The plan calls for a "utilities gallery" ha a flexibility that will allow of its apportionment as future mands may require.

Considering "Procedure in Construction" the report has to say: "While the studies of this subject have not progre to a conclusion, it seems likely that a four-track subway n and south at the eastern side of the business district and tending from the vicinity of Chicago Avenue and Orl Street to the vicinity of State and Twenty-second Streets,

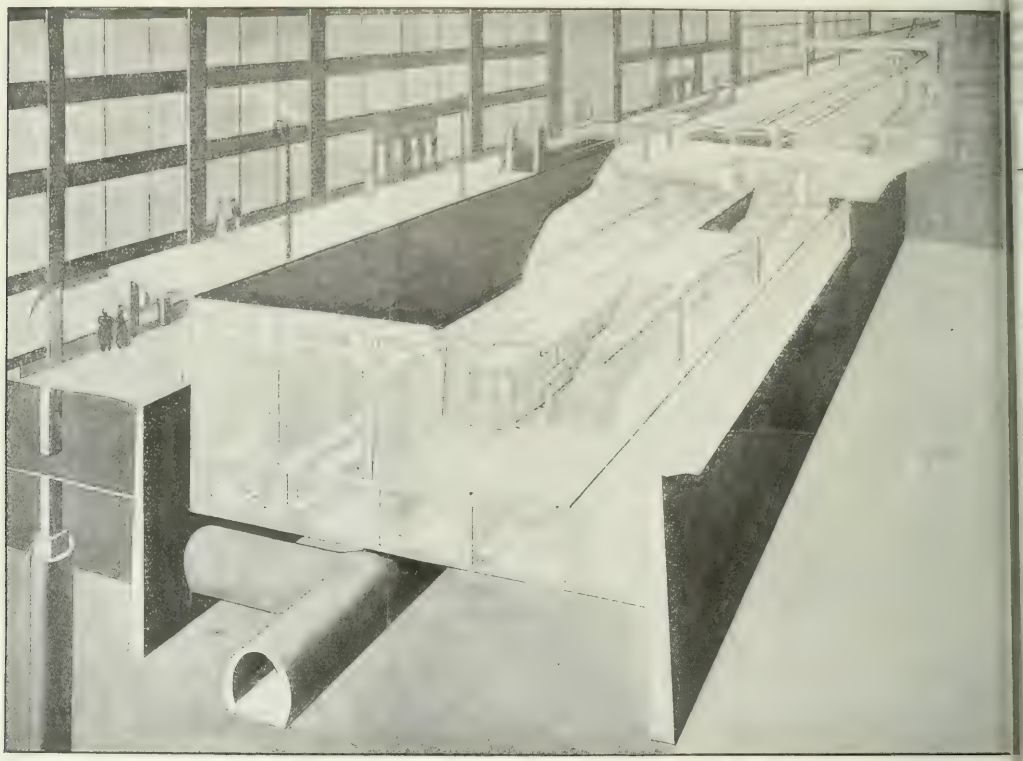


FIG. I.—ISOMETRIC VIEW OF PROPOSED SUBWAY IN CHICAGO.

proper there are 79 folded plates, each 23 in. wide and 30 in. high. Many of the plates are colored. An index is furnished with each volume.

The first volume is devoted to "General Elements" of the study of the subway situation in Chicago; the second to "Public Service Utilities," and the third to "Water Supply Analysis." It is to be understood that the report is merely preliminary, for the purpose of assisting the local transportation committee in the public discussion of the question. Only a portion of the data collected by the Bureau of Engineering is included in it. The area considered in this report for the ultimate construction of transportation subways is bounded by Chicago Avenue on the north, Lake Michigan on the east, Twelfth Street on the south and Halsted Street on the west, embracing what is known as the downtown business district.

At the beginning is an "Analysis" of the whole situation, in which it is stated that in the first instance only such subways be desirable, and that contemporaneously or following th first undertaking two east-and-west subways may be ma one reaching a terminal in the vicinity of Halsted Street a Blue Island Avenue and the other reaching a terminal in t vicinity of Lake and Halsted Streets. These West Side term nals will provide for collecting traffic of the Metropolitan El vated Railroad and the Lake Street Elevated Railroad and al of a number of surface lines now converging close to the points.

"The essence of the arrangement is the location of subw terminals, four in number, on each of the four elevated railw lines at the margin of the business district, and which are al located at points of close convergence of a large number surface lines. A large provision for future traffic requiremen will thus be brought about, and as a necessary consequence th carrying capacity of the existing transportation lines or the equivalent outside of the business district will be accomplished

A trial design has been worked out for a four-track subway from Chicago Avenue and Orleans Street at the north, through Wabash Avenue, in the central business district, to State and Twenty-second Streets on the south—a distance of a little over three miles. The capacity of such a subway would be 18,000 passengers an hour in each direction for surface cars and 25,000 passengers an hour in each direction for elevated cars, two tracks being devoted to each class of traffic. This plan contemplates the movement of 240 cars an hour on the tracks devoted to surface lines and 50 trains, each of seven cars an hour, on the tracks devoted to elevated lines. The total carrying capacity of this one subway is thus 86,000 passengers an hour, thus adding 50 per cent to the carrying capacity of the local transportation lines.

The design contemplates eight capacious entrances at each subway station. A feature will be a sub-surface foot passageway to enable pedestrians to cross the street free of danger from street traffic. Space for news stands and telephone booths has been provided. A large utility gallery has been provided below the train platforms, in which the several utilities can be of five compartments each about 11 ft. wide and from 6 ft. to 8 ft. high in the clear, located so as to receive sewer, water, gas, telephone, telegraph, electric and other public-service conduits.

Reinforced-concrete construction is recommended. The stresses due to fixed and moving loads are carefully figured out. The roof of the subway, forming the surface of the street, is to be 2½ ft. thick.

The general plan of construction is to maintain a rectangular section, utilizing all the space available between the curb walls, the street surface and the general level of the construction of the Illinois Tunnel Company. The floor in the utilities compartments may rest directly on the earth. Besides the sidewalls of the subway, four rows of columns are provided. Upon these will rest massive concrete girders, extending from wall to wall. These girders will serve to support track stringers and train platforms.

During construction sub-sidewalk areas may be used temporarily for public-utility lines, or overhead construction may be permitted temporarily.

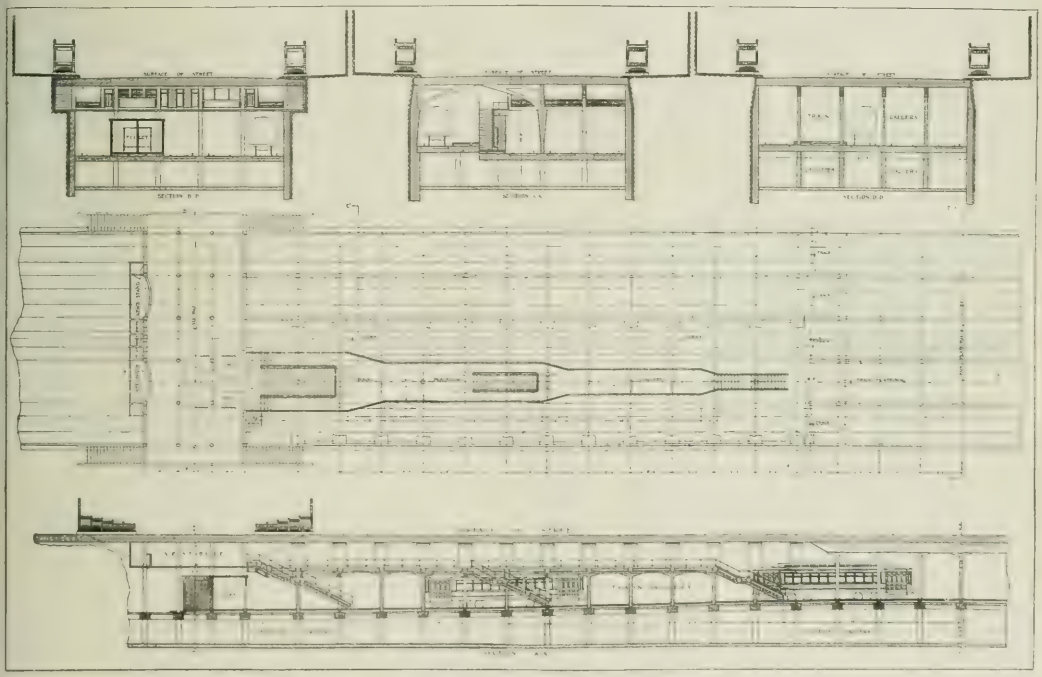


FIG. 2.—SECTIONS, PLAN AND ELEVATION OF CHICAGO SUBWAY STATION.

arranged. At street intersections and at each side of the subway utility have been provided chambers extending from the bottom of the subway to the surface of the ground, in which the utilities passing through the subway may be connected to those in the streets crossing subway lines.

Elaborate studies are made of the growth of population by areas, water supply data, traffic statistics and data and location of surface, elevated and suburban steam railways with reference to population.

The features of the proposed four-track subway are enumerated in the following paragraphs:

Island train platforms are provided, located alternately between the two tracks for the use of the elevated lines and also the two tracks for the surface lines.

The train platforms are 16 ft. wide and longer than necessary to accommodate two trains of nine cars—one train on each side.

The "utilities gallery" beneath the space for cars consists

The general idea has been to place water and gas pipes in the bays nearest the curb line, electrical conduits in the next bay, with the center bay kept clear, as far as possible, for convenience in handling material for repairs, changes, etc.

It is estimated that the cost of making the subways, excepting such costs as will pertain to foundations of buildings, will be as follows:

	Cost per mile.
Four-track subways, as in Wabash Avenue	$3,750,000
Three-track subways, as in Washington Street	3,375,000
Two-track subways, as in Van Buren Street	3,000,000
One-track tunnels, as under the river	800,000

DATA ON PUBLIC UTILITIES

Volumes II and III, embracing a large amount of data on the subject of various existing or proposed public utilities in the streets, were really prepared first, before the scope of the investigation was enlarged to embrace the location and preliminary designing of the subways. Among other subjects

treated in Vol. II are the underground constructions of the Commonwealth Edison Company. This utility will require more space than any other if its business should expand in proportion to the requirements of the changed character of buildings now replacing the other structures in the business district. A number of distribution diagrams are given, and various typical underground conductors used in the Edison system are illustrated.

In relation to city electrical utilities, data are given of street lighting, fire-alarm telegraphs and the police telephone system. Data are also given relating to the use of the streets by the Chicago Telephone Company, by the gas company, by the telegraph companies and also relating to sub-sidewalk occupancy. One section relates to the miscellaneous occupancy of streets and alleys as by various steam pipes, chutes, vaults, tunnels, etc.

A survey is made of the elaborate system of comparatively deep tunnels belonging to the Illinois Tunnel Company and underlying the streets in the business district. This network, sometimes referred to as "Underground Chicago," embraces 65 miles of tunnels. In these tunnels merchandise, coal and freight are transported on narrow-gage electric railways, pulled by 250-volt, direct-current electric locomotives. The company is not allowed to carry passengers, and the highest portion of the tunnels must be at least 19 ft. below city datum. The main business at present is to transfer freight from one railroad terminal to another. This utility need not be disturbed by subway construction except at river crossings where the tunnel can be diverted without affecting its usefulness.

Other data given relate to bridges and viaducts and their foundations, and also to the occupancy of property for railroad use.

Volume III is devoted to water supply analysis and a study of high-pressure water systems. It is estimated that the water supply with the high-pressure system will require at least three times as much space in the future as at present, while sewers will probably require 50 per cent more space.

Brookline Lighting Committee Reports Against Municipal Ownership.

After an investigation lasting over two years, and in accordance with the advice of Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology, the municipal lighting committee of the town of Brookline, Mass., has reported adversely on the proposition to consider the establishment of a municipal lighting plant in the town. This report is of more than ordinary interest on account of the position of Brookline among American municipalities. The town is the wealthiest community under the old-fashioned form of town government in the world; it is perhaps the most famous of the Boston residential suburbs, and is unique in its location within the borders of adjacent portions of the city proper. Practically, Brookline is a residential section in the midst of Boston; politically, it is a separate community. From the standpoint of wealth, therefore, the town is in a position to buy and operate any equipment for economical energy production on the market, and the unanimous report of the committee against municipal electric lighting is therefore of special significance.

In taking up the question of a municipal plant the committee found it necessary to determine what would be a fair rate for the existing company—Boston Consolidated Gas Company, Electrical Department—to charge in the town. It was soon found that no progress could be made by comparing the rates paid in Brookline with those charged in other localities on account of different conditions of production and distribution. There is little manufacturing in the town and many of the residents leave during the summer, entirely cutting off their consumption of energy. A detailed inventory was, therefore, made by Professor Jackson of all the company's electric equipment within the town borders. Assuming the rate at which energy could be delivered at the town line to be 3.5 cents per kw-hour, a study was made to determine the reasonableness of the existing rates, 8 per cent being taken as a reasonable return upon the company's investment.

The valuation of the property aggregated $320,250 on the basis of reproducing it new. The energy sold in Brookline during the year ending June 30, 1908, was about 1,422,000 kw-hours. The estimated energy generated was 1,777,500 kw-hours. The maximum demand was about 760 kw. The population of Brookline is about 24,900.

Professor Jackson reported that a contract rate of 14 cents per kw-hour would appear to be reasonable for electric incandescent lighting, or by maximum demand, 16 cents primary, 7.5 cents secondary and 5 cents tertiary charge per kw-hour; and for arc lamps on the streets $110 per annum per all-night lamp of the character in service. The rates charged to the consumers in Brookline for the year ending June 30, 1906, included a flat rate on contract of 18 cents per kw-hour, and maximum-demand primary, secondary and tertiary rates, respectively, of 20 cents, 8 cents and 5 cents per kw-hour for incandescent lighting; 13 cents per kw-hour with various discounts for energy used by motors, and $124.10 per arc lamp on the streets per all-night service throughout the year. The incandescent lighting rates were decreased Jan. 1, 1908, by reducing the maximum-demand primary rate from 20 to 18 cents and reducing the flat rate from 18 to 16 cents. The estimates of Professor Jackson showed that the company would be still earning 8 per cent on its investment over and above all expenses and depreciation reserve, had all the rates been reduced by 20 per cent instead of by the amounts outlined above.

The service in Brookline comprises commercial electric lighting, commercial electric energy supplied to motors, and arc lighting for the streets. The first of these items demands over 80 per cent of the total peak load, and it is the most expensive service to render, when measured in the cost per kw hour. The second, or motor, item demands not much over 2 per cent of the total maximum load, and the remainder of the maximum load is comprised in the arc-lighting service. The arc lamps are operated many more hours per year than the incandescent lighting load that goes to make the major portion of the peak load, and the arc-lamp load is therefore much more desirable for a plant than is the Brookline incandescent load.

The report states that in case the town should go into the municipal lighting business it might buy energy at wholesale rates from either the gas company or the Boston Edison Company, or it might build a generating plant of its own. To meet the requirements of the present load in Brookline, with a reserve of one-third equipment above ordinary maximum load requirements, a plant built by the town would necessitate a generating rating of not less than 1000 kw, which would be put in three independent generating units and auxiliary appliances, housed in a suitable building. The cost of such a plant and building would be about $148,000. Assuming that the land could be obtained for $12,000 makes the aggregate generating-plant investment $160,000, which would have to be added to the investment of $320,000 put into the distributing plant and business. This would make a total investment of $480,000 for the town for the complete electric plant and business in operating condition. If such a plant were operated with intelligent economy the cost of generating and delivering energy to the terminals of the station would amount to not over 3⅛ cents per kw-hour when 8 per cent is allowed for interest on the investment for the generating plant and a proper depreciation reserve is provided.

The private customers who are now supplied with electrical energy by the Boston Consolidated Gas Company do not provide an ideal load for such a plant because a great part of their use of energy is of only short duration each day and a high peak load occurs during the Christmas holidays. This fact makes it necessary to provide a relatively large amount of machinery with a correspondingly large investment for the purpose of taking care of an output of a relatively small number of kw-hours with the result that interest and depreciation which come into the cost of generation are relatively large per kw-hour, and the expense per kw-hour at the terminals is

ter than would be the case in the instance of a generating on serving more diversified population.

he town of Brookline could probably buy wholesale energy from the Boston Edison Company at a price as low as 2½ s per kw-hour, which, with an allowance for substation at- ance, would make the average cost per kw-hour delivered he secondary busbars of the substation not far from 2.5 s. This fact makes it undesirable for the town to build own generating plant. The town simply could not com- with such a price when generating energy solely for the l provided by itself and its citizens.

he gas company has agreed to reduce its rates from 16 cents kw-hour flat rate for electric lighting to 14 cents on July 909, and to again reduce this rate to 13 cents on July 1, 0. It also agreed to reduce on July 1, 1909, its maximum- and rates by the following amounts: Primary rate, 18 ts to 16 cents per kw-hour; secondary rate, 8 cents to 7.5 ts per kw-hour. The arc-lamp charge will be reduced to o per year. The saving to the town arising from the last eed concessions in rates would amount to $14.10 per year each arc lamp, of which there are now over 260, and it uld also mean a reduction of nearly 28 per cent from the rate in force before 1908. Professor Jackson states that s concession is sufficiently large to make it a questionable ject for the town to enter upon electric lighting for itself. e difficulties in the situation are increased by the fact that gas company might refuse to sell its electrical distributing nt to the town without the town taking over the company's s distributing plant, and the town might, therefore, be forced go into the manufacture and distribution of illuminating s. The town could gain no advantage at the present time going into the gas business.

During the period of negotiation between the committee and e gas company, the Boston Edison Company appeared in the tuation as a purchaser of the gas company's electrical plant. is understood that the regular Edison retail rates will go to effect in the town when this arrangement is completed.

The approval of the purchase of the electrical business of the as company by the Massachusetts Gas and Electric Light ommission, if granted, will open the way toward the best olution of the whole question of rates in the town of Brook- ne, and the building of a municipal plant or the entering of ne town into the business of electrical distribution will accord- gly not be necessary for the most efficient results.

Electric Railways and Publicity in Massachusetts.

Publicity is playing a most important part at the present time in Massachusetts in awakening the public to an accurate appreciation of the electric railway situation. In engineering and transportation circles it is well known that electric traction is face to face with two most difficult problems at this time; the problem of securing a square deal at the hands of the people, and the problem of earning enough money to pay a fair return upon the investment. The first dilemma is shared by electric railways in common with all kinds of public service corporations, while the second difficulty bears perhaps a little more heavily at this period upon the electric traction industry than upon any other quasi-public undertaking. These facts have been made plain to workers in the railway field by able discussions of conditions in the technical press and before electric traction organizations; they have been brought home to operating officers of even the largest urban systems through executive orders to administer departments with maximum economy, and they have been keenly appreciated by the manufacturers and supply men who have striven for many months to overcome the handicap of a reduced demand for their products from the consuming railways. The feeling is now general that it is time to place the facts of the situation plainly and clearly before the public, which is disposed to act fairly and sanely when conditions are once thoroughly understood. Three movements in this direction during the past week in Boston are worthy of attention as indicating the possibilities of practical publicity in improving the whole tone of the electric railway business in the State of Massachusetts.

At the meeting of the New England Street Railway Club, on Feb. 25, Mr. Frank Hedley, vice-president and general manager of the Interborough Rapid Transit Company, New York, devoted a portion of an address to the plain statement that unless the public can be acquainted with the real inwardness of the electric traction situation with respect to very limited returns and the injurious effects of ill-advised legislation, it will ere long be practically impossible to enlist capital for needed improvements, to the great detriment of the whole community. He showed that the field of the electric railway is far from fully developed as yet; pointed out that additional facilities are essential for the best good of all citizens, and finally emphasized the need of both the public and the companies doing business fairly and squarely, without capital inflation or ignorant efforts to alleviate difficulties by destructive legislation.

Mr. C. S. Sergeant, vice-president of the Boston Elevated Railway Company, then showed how the successive improvements in methods on New England's largest system have demanded money, which has to a great extent come out of earnings; that through the increasing demand of the public for additional facilities and the enormous extension of the use of free transfers, combined with a constantly increasing cost of operation due to advances in the price of labor and materials, the purchasing power of the nickel from the railway standpoint has dropped from 5 cents to 3.15 cents. Mr. Sergeant stated that he believes that the public wants service, and that a broad campaign of publicity is absolutely essential for the proper spreading of the facts, not only in Massachusetts, but throughout the electrical world. No employee is too humble to do his share in bringing out the facts, and all over the country manufacturers can help by educating their employees through bulletins and otherwise to see that attacks on the reasonable prosperity of the railways are plainly, though indirectly, attacks on their own bread and butter. If the hundreds of thousands whose livelihood depends upon the welfare of public service corporations can be made to see how intimately their own conditions of employment or lack of it depend upon giving the companies a just

	Cents	Cents	Cents
General.			
Salaries and office expenses	.16		
Insurance	.025		
Pensions and rewards	.025		
			.210
Conducting Transportation.			
Cost of energy	.585		
Wages	1.45		
Removing snow	.01		
Other transportation expenses	.10		
			2.145
Maintenance of Roadway.			
Maintenance of roadbed	.185		
Maintenance wires	.05		
Maintenance car houses	.045		
		.28	
Maintenance of Equipment.			
Maintenance of cars	.175		
Maintenance motors, etc.	.22		
Maintenance other equipment	.015	.41	
Depreciation		.08	.770
Damages and legal expenses			.300
Direct Payments to Public.			
Taxes	.355		
Rental subway and East Boston Tunnel	.10		
			.455
Other Fixed Charges.			
Interest	.365		
Rentals	.47		
			.835
Dividends			.285
Total			

hearing and a fair return, the situation cannot but be measurably improved.

Following Mr. Sergeant, Mr. P. F. Sullivan, president of the Boston & Northern Street Railway Company, corroborated Mr. Hedley and voiced the appearance of improved conditions in his present observation. He urged the benefits of honest business dealing in the administration of all public service corporations.

After the above meeting, the Boston *News Bureau* printed an outline of the financial situation of the Boston Elevated Railway Company for the benefit of the public, which naturally looks upon this corporation as one of unlimited wealth and power.

The *News Bureau* series takes up the main question of capitalization, pointing out that in Boston for every dollar of securities issued more than a dollar has gone into the property, and showing just where the nickel goes under present conditions. It is shown that the company is engaged in the business of retailing transportation, and that patrons of large retailers in other lines know and expect that a considerable part of their purchase money is profit for the merchant, even with the modern business maxim of large sales and small profits. A summary of the disposition of each nickel is given in the table on page 775, the data being for the Boston system.

The net result is that only about one-fourth of a cent out of each nickel is available for dividends in this property, which is known the world over for its able administration and sensitive regard for the desires of the traveling public. It is significant that nearly half a cent out of each fare collected goes into the public treasury through taxation.

The most direct local appeal that has thus far been made to the public in the interest of educating it to the situation of the electric railways in Massachusetts as a whole is found in an article printed in the Boston *Transcript* of Feb. 27 from the pen of Mr. Frederic W. Coburn. This writer reviews the conditions in a clear and straightforward manner, showing how the three-cent fare has failed in Cleveland and indicating that even the five-cent fare may be inadequate on large systems as transfer privileges extend and as the cost of living rises. The net result of this campaign, which is now well under way, is likely to be a consideration at no very distant day of an extra charge for a transfer to other systems.

Meeting of Boston Section, A. I. E. E.

A meeting of the Boston section of the American Institute of Electrical Engineers was held on March 17, when Dr. C. P. Steinmetz reviewed his paper on "Prime Movers," as read recently before the Institute in New York. In discussing the paper, Dr. A. E. Kennelly called attention to its interesting character, particularly on account of the great scope which it covers. Thus, in its first section it took up the economy of prime movers, then passed to the questions of service continuity and reliability, and concluded with an analysis of the physical features of the various types of prime movers. Dr. Kennelly said that it is very fortunate that the analysis does not show that one particular kind of prime mover is superlatively good and the other bad.

Regarding the gas turbine Dr. Steinmetz stated that considerable work has been done. The difficulty is not in the gas turbine itself so much as in the compressor. In a gas cycle the gas must first be compressed, after which combustion follows and then expansion. One can have a combustion chamber where the combustion takes place at moderate pressure, and by combustion there the volume of the compressed air and gas is increased in temperature and the air is sent against the turbine blades. When the air is very hot this might be a little difficult, but there are now available materials which can withstand high temperatures. The real difficulty is due to the fact that the compressor is not economical. In the steam turbine the boiler produces steam, but with the gas turbine the air must first be compressed. Turbine and centrifugal compressors are too inefficient to be used, because after all in any air cycle the output is the difference between the work of compression and the expansion at higher temperature and higher volume. If the compression is at low efficiency one is liable to consume more power than is secured by expansion. This condition would give a negative output. If one could find an efficient compressor the gas-turbine problem would be solved probably in a very short time. The turbine itself presents the least trouble.

Prof. Elihu Thomson said that experiments have been carried on for a long time at Lynn in regard to the gas turbine. Use had to be made of the reciprocating compressor, which, of course, might as well have been a gas engine. If one considers the matter of compressing by stages with air, the efficiency does not work out properly and from 50 to 60 per cent is a high value. Professor Thomson stated that if oil is use can be pumped into the combustion chamber, but when is used it is necessary to employ two compressors, one for and one for air at, say, from 12 to 15 atmospheres, so that conclusion is that the only possible room for a gas-turbine rangement would be one working at low pressures, prob not more than two or three atmospheres. It may be poss to get these pressures in a large volume by ordinary centrift arrangements.

An inquiry was made about the useful life of prime mov on the understanding that the useful life of a reciprocating gine is on the same basis as the useful life of a turbine gas engine, because the latter are rapidly improving. question was if the economy of the steam turbine and the engine are equal to or superior to the economy of the recip cating engine, and what tests have established, if any, economy of the steam turbine above that of good reciprocat engines. Dr. Steinmetz replied that at present the field fairly divided between the reciprocating steam engine and steam turbine. The general co-economy of the two types fairly the same. Possibly the turbine is a little more efficient cause it is increasing at a greater rate in its use than the ste engine. There cannot be any great difference in steam consun tion between the two prime movers because if there were, of them would not be used as much. If the steam consun tion of the turbine be decreased by 10 per cent the ste turbine would be much more economical under average co ditions than the steam engine. The latter would then have give way to the steam turbine.

Dr. Steinmetz said that there is a decrease in consumpti of approximately 8 lb. or 9 lb. of steam per kw-hour betwe the old steam turbines installed in the Fisk Street station, C cago, and the new ones which are being installed. The ones took about 21 lb. of steam and the new ones, to the b of his recollection, take a little less than 13 lb. Incidenta the machines are of the same size, and the rating of the stati is increased some 30 per cent without increasing the space, simply replacing the old turbines by new units. These opera at 175 lb. and 150 deg. Fahr. supertemperature. The efficien curve is nearly flat from 75 per cent load to 25 per cent ov load.

Proposed Railroad Subways in Chicago.

The Illinois Central Railroad Company is committed to t electrification of its Chicago terminal, including the extensi suburban passenger service. When its trains are electrifie they could be easily operated in a subway connecting the Ill nois Central terminal with the other five great steam railroa terminals in Chicago. This idea of a railroad subway is sa to appeal to the Illinois Central officials, but Mayor Busse, Chicago, is reported to have declared that such a subway, built, shall not be exclusively an Illinois Central affair, but sha be for the use of all the railroads. However, the other rai roads have not yet agreed to electrify their terminals, althoug they seem to think that the idea of a subway connecting thes terminals is a good one. The matter has received some dis cussion apropos of the recent report of the local transportatio committee of the Chicago City Council on street-railway sub ways, a summary of which appears elsewhere in this issue. I is probable that the matter of street-railway subways will b disposed of before the question of a subway to connect the ter minals of the trunk-line railroads is seriously taken up.

Meter Charges in Boston to Be Discussed

A petition has been filed by Joseph J. Leonard and others o Boston with the Massachusetts Gas and Electric Light Commission, claiming that the meter charge of $1 per month, made by the Edison Electric Illuminating Company, when the energy consumption is less than that amount in value, is excessive. A hearing will be given by the board on April 6, at its office in Boston.

Award of John Fritz Medal.

he John Fritz Medal for 1909 has been awarded by the d of award specially selected for the purpose and consist- of four members of each of the national engineer societies, dr. Charles T. Porter for his work in advancing the knowl- e of steam engineering and in improvements in engine con- iction. The public ceremony of the presentation of the dal to Mr. Porter will take place in the large auditorium of Engineering Societies Building, 29 West Thirty-ninth eet, New York, at 8:30 p. m. on Tuesday, April 13, 1909. s the wish of the board to give distinction to the event and make these awards year by year memorable and fittingly spicuous. Members of all branches of the profession are refore particularly invited to be present, and particularly those represented in the four national organizations of en- eers participating in the creation of the medal fund. Be- es the simple ritual of the presentation of the medal, in the sence of invited guests and distinguished representatives of gineering, there will be addresses by representatives of the r groups of the profession most concerned, as follows: he Debt of Modern Industrial Civilization to the Steam En- e as a Source of Power," by Dean W. F. M. Goss, of the iversity of Illinois, member A. S. M. E. and A. I. E. E.; he Debt of the Modern Steam Engine to Mr. Charles T. rter," by Prof. F. R. Hutton, of Columbia University, norary secretary, A. S. M. E.; "The Debt of the Era of el to the High-Speed Steam Engine," by Mr. Robert W. nt, of Chicago, member A. S. C. E. and past-president S. M. E. and A. I. M. E.; "The Debt of the Era of Elec- city to the High-Speed Steam Engine," by Mr. Frank J. rague, of New York, past-president A. I. E. E., member I. M. E. and A. S. C. E. Mr. Henry R. Towne is chair- n of the board of award. The committee of arrangements nsists of Messrs. Henry R. Towne, Charles Warren Hunt, harles Kirchhoff, Schuyler Skaats Wheeler and F. R. Hutton.

N. E. L. A. Convention Exhibits.

The exhibition to be held in connection with the coming meet- g of the National Electric Light Association at Atlantic City ne 1-4, will be held in the main building of Young's Million- ollar Pier. The booths will have twice the floor area of those last year, namely 135 sq. ft., and will be arranged in horse- oe form, leaving in the center a space approximately 70 ft. ide by 140 ft. long. It is planned to furnish this space with gs, rockers, chairs and tables, and make it a "Convention Ex- ange." It is believed that under this arrangement every one f the 49 booths will have equal advantages, and preferred loca- ons will be practically eliminated. The booths will be fur- ished in every detail, including two sign boards, and will be overed with matting. Backs of burlap will extend to a height f 7 ft., and side partitions to a counter height. The prin- ipal sign board will extend the length of the booth at the back, nd will be 10 in. high. The secondary sign will be somewhat maller, and will hang below the principal sign. Both direct and lternating current at 110-220 volts (3-wire) will be available or the operation of exhibits.

Abandons Free Lamp-Renewals.

At the Minnesota Electrical Association convention, March 9, Mr. N. M. Argabrite, manager of the Winona Railway & Light Company, Winona, Minn., announced that his company on Jan. 1, 1909, did away with all free lamp-renewals. It had been the policy of the company formerly to furnish free re- newals of common carbon-filament incandescent lamps. This action is partly the result of the coming of the tungsten lamp. The Winona company now retails 16-cp carbon lamps at 20 cents and tungsten lamps at list price. There are two con- tractors and dealers in the town who also sell lamps.

Third Annual New York Electrical Show.

Active preparations have already begun for the New York Electrical Show to be held in Madison Square Garden next October, and the management is putting forth every effort to make it the finest exhibition of the kind ever given. The decorations, illumination and general arrangement of the exhibitors' spaces will be distinctly novel, and the whole interior will present a uniform appearance. The accompanying illustration is reproduced from a sketch giving the main features of the



VIEW OF DECORATIONS AT MADISON SQUARE GARDEN.

decorations. A new departure has been inaugurated this year whereby the space sold to exhibitors will include decorations and current for lighting. This will relieve the manufacturers from much detail work, and make it necessary only to install and remove exhibits. Especial attention will be given to working industrial exhibits, and there will be a great display of electrically operated machinery representing many classes of manufacturers.

Chemical Extinguisher for Electric Fires.

On Friday afternoon, March 26, a test was made in Waterside Station No. 1 of the New York Edison Company with a new chemical fire extinguisher called "Pyrene," said to be a non-conductor of electricity and to possess valuable fire extinguishing properties. The substance is a combination of gases in liquid form and is put up in a small vacuum pump. The actual make-up of the liquid is not ascertainable, but chemical tests show it to contain chiefly carbon tetra-chloride. In order to show the liquid to be non-conducting, an arc was formed between the leads of a three-phase cable under a tension of 14,000 volts. The liquid was squirted at the arc and extinguished it without the operator feeling any effects whatever. The substance was then tried on a direct-current circuit of 250 volts. Arc lamp carbons were bunched together so as to form two electrodes about 4 in. in diameter. The circuit was completed through a water rheostat and a current of approximately 4000 amp passed from a motor-generator set. The operator maintained an arcing distance of approximately 1 in. and all attempts to extinguish the arc with the small pumps on hand were futile. The chloride fumes were also very trying on the lungs of the operator and the spectators invited to witness the demonstration. The liquid was then squirted all over the commutator of a 5-hp, direct-current motor in operation and also on the armature and field coils without apparently affecting the operation of the motor. Outside the station the substance was successfully applied in extinguishing calcium carbide fires, gasoline fires and burning saturated waste. The liquid is said not to injure material with which it comes in contact and to be independent of climatic conditions. It evaporates quickly, giving off inert gases which do not support combustion.

Boston Edison Employees' Club.

Several years ago the management of the Boston Edison Company sought, in common with other large corporations, to encourage a community of interest among its employees that would lead to closer harmony of social interests throughout the organization. In the early days officers and men were closely associated, seeing each other every day, and the social life was coincident with the business activity. As the company grew, however, this intimate relation necessarily suffered to some extent. At no time, however, did the officers lose interest in those under their authority, but always kept in mind the possibilities of some organization that would bring them all together from time to time, not to be criticized nor crowded to increased activity, but for the sake of the mere pleasure and entertainment to be found in "getting together."

A club was started among the employees and the results were satisfactory for a time, but the scope of the organization was not as complete as general experience in corporation development has proved possible in later years. It was found that a wider range of interests must be included. The list of employees was constantly increasing and it was useless to keep up a club organization unless the plans included "what everybody liked."

As a result the present Edison Employees' Club was organized under a new set of by-laws in October, 1907, "For the



BOSTON EDISON EMPLOYEES' CLUB.

purpose of instruction and entertainment and to promote a closer feeling of friendship between the employees of the many departments of the company."

From the first the new club has proved remarkably successful. Of the 850 employees of the company over 600 are now members. There is a small initiation fee, together with annual dues, which afford a fund from which the expenses of the numerous entertainments can be defrayed. These small payments by the members stimulate their interest in making the club active. Of course, the membership includes the employees in every department, messenger boys, clerks, stenographers, linemen, electricians, firemen, engineers, oilers, bookkeepers and all of the officers of the company, including president and general manager, Chas. L. Edgar, and general superintendent, Wm. H. Atkins. Every one takes an active interest and gives his ideas as to what should be done for entertainment and for improving the time through co-operative study or in classes that attend lecture courses.

The club holds its regular meeting on the first Friday evening of each month in the auditorium of the Edison Building, 39 Boylston Street. The management of the company has set aside the entire third floor of this building for the convenience of the employees, especially club members. The room is fitted with a stage, upon which plays and vaudeville entertain[ments] are given. There is ample and comfortable seating ca[pacity] and the conveniences are all that can be found in the m[odern] clubroom. There is a complete library of books on elec[trical] subjects, together with some fiction, and files of the a[ll] papers as well as of all leading technical magazines are [main]tained. Broad tables and comfortable chairs make the li[brary] room an attractive place for reading and study, and it is [open] generally throughout the day for the accommodation of [those] in the company.

The club meetings are devoted chiefly to forms of ente[rtain]ment, it being regarded as specially important to provid[e] suitable recreation. After the meetings the chairs are cl[eared] away and dancing is enjoyed, and frequently light refreshm[ents] are served.

One specially important feature of the club work this w[inter] is a course of lectures on "Electrical Engineering" by [Mr.] Sydney W. Ashe, of New York. These lectures started [with] the elementary principles of electrical work, profusely [illus]trated by the use of a stereopticon and with experim[ents] which Prof. Ashe makes before his audience. He will [take] the class through almost the entire field of practical wor[k in] electricity. There will be 20 of these lectures, co[mmencing] on every Thursday until next June. To accommodate t[hose] who must work through the silent watches of the night [the] lecture is given at 1 o'clock in the afternoon, and repe[ated] at 7 o'clock in the evening for those who are at w[ork] during the day. A small additional fee is charged those [who] attend these lectures, but nearly the entire membership [has] joined the course.

The young women employees of the company are as [much] interested in the success of its work as are the men. They [at]tended in large numbers every monthly meeting, and took [upon] themselves the program for the March meeting. The en[ter]tainment included a short play, "The Bachelor's Dream," [tab]leaux, vocal and instrumental solos. The men will giv[e a] similar entertainment in June.

The annual dancing party of the club was held in [Paul] Revere Hall, Mechanics' Building, on February 12. This [is] always a social function in the company, attended by nearly all the employees, each of whom has the privilege of invi[ting] one friend.

Bowling contests have been especially followed with [much] interest by the club members this winter. Each departm[ent] of the company selected a team after competitive cont[ests] among the applicants, and the bowling series have been [car]ried on with enthusiasm. Many creditable scores have [been] rolled up. The same plan of selection is adopted in the s[um]mer for the organization of baseball teams, so that each [de]partment gets out its best ball players for a series of ga[mes] in what may be very properly called the Edison League. [For] two years delightful outings have been held, at least once e[ach] summer, at some one of the shore resorts, and plans [are] already formulated for the one next summer.

The management of the club is under the direction of [an] executive committee, composed of one member from each [de]partment of the company, who is elected by the club memb[ers] in his department. The officers are as follows: Presid[ent] Mr. H. W. Moses; first vice-president, Mr. L. L. Elden; sec[ond] vice-president, Mr. W. L. Frisbie; secretary, Mr. John J. Bu[rk]ley; treasurer, Mr John H. Guy; assistant treasurer, Mr. T. [J.] Golden. This committee is sub-divided into entertainme[nt], athletic and house sub-committees.

Massachusetts Legislative Notes.

The committee on mercantile affairs has reported adverse[ly] to the House in the case of the Dean bill, which required t[hat] the rate for a single telephone call for three minutes sho[uld] not exceed 5 cents between Boston and any place within a [15] mile radius. The committee also reported leave to withdr[aw] to the Senate on the Abbott bill to set a 5-cent maxim[um]

charge similarly in the limits of the city of Boston. It refused to favor the Guild bill to allow the Massachusetts Transmission Company to take land for the purpose of power distribution by electricity. The bill gave the right of eminent domain, subject to final review by the Gas and Electric Light Commission. The committee on education has reported a bill providing that the State shall pay half the expenses of maintenance when the commission on industrial education certifies that a city or town has appropriated funds for the maintenance of an industrial school. The committee on labor has reported leave to withdraw the Ross bill restricting the hours of labor of women and minors employed by public-service corporations. The Senate has accepted the adverse report of the committee on mercantile affairs on the Ives bill for legislation relative to cutting wires for the moving of buildings. The House has accepted the committee's adverse report on the Ives bill providing special police officers for gas, electric light, telephone and telegraph companies.

Annual Meeting of the New England Street Railway Club.

The annual meeting and banquet of the New England Street Railway Club were held at the Hotel Somerset, Boston, on March 25. Mr. W. D. Wright, of the Rhode Island Company, Providence, was elected president for the ensuing year. The club has now a total membership of 727, and has been a power in electric-railway circles for the past nine years. Among the speakers at the banquet were Mr. D. L. Prendergast, Boston, toastmaster; State Treasurer Chapin, of Massachusetts; Mr. James F. Shaw, president of the American Street & Interurban Railway Association; Mr. James F. Jackson, recently chairman of the Massachusetts Railroad Commission, and Mr. P. F. Sullivan, president of the Boston & Northern and the Old Colony Street Railway companies. Mr. Jackson defended the policy of permitting railroad monopoly under wise regulation and laid special stress upon the spirit in which laws and policies should be administered. He said that supervision may be carried so far into details as to become wasteful and burdensome; public control cannot be too scientific or it will call to mind the surgical operation that is a perfect success, followed by the death of the patient. If railroad arrogance is to be followed by official conceit and intolerance, and the evils of the past are to be exchanged for an oppressive and obstructive governmental policy, men of the ability which the service demands will leave it, and a weaker conduct of affairs will only hasten the day of public ownership. Mr. Shaw alluded to the popular prejudice against public service corporations and asked the fair-minded public to meet them half way.

CURRENT NEWS AND NOTES.

EX-SECRETARY CORTELYOU HEAD OF CONSOLIDATED GAS.—Ex-Secretary George B. Cortelyou has been elected president of the Consolidated Gas Company of New York City, which organization controls all of the larger electric lighting companies of Greater New York.

EIGHTY-CENT GAS IN LYNN, MASS.—The Lynn Gas & Electric Company has announced that the price of gas will be reduced from 90 cents to 80 cents per thousand cubic feet, beginning July 1. The electrical department of the same company supplies 446 direct-current arcs, 536 alternating-current arcs, 60,000 incandescent lamps and 4300 hp in motors.

MEETING OF THE ELECTRIC RAILWAY GENERAL MANAGERS' ASSOCIATION.—The Electric Railway General Managers' Association, which held its previous meeting in Lexington, Ky., will hold its next meeting in Fort Wayne, Ind., May 26. The Lexington meeting was given up to discussion of operating questions and purchasing operating material.

GROWTH OF AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION.—Between Sept. 30, 1908, and Feb. 15, 1909, 35 electric railways have joined the American Street and Interurban Railway Association, thereby increasing by 13.5 active members in four months. In the same interval 369 associate members have joined the association, increasing this grade no less than 148 per cent.

BROOKLYN ENGINEERS' CLUB.—The Brooklyn Engineers' Club will remove May 1 from its present quarters, 197 Montague Street, to its new home, 117 Remsen Street. The club, which has between 300 and 400 members, was formed 13 years ago. Its objects, however, are rather those of a society than a club, among these objects being the advancement of engineering knowledge and practice, and the maintenance of a high standard of professional ethics.

WORCESTER SECTION AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—The regular meeting of the Worcester Polytechnic Institute branch of the American Institute of Electrical Engineers was held on Friday evening, March 26. Mr. W. S. Murray, electrical engineer of the New York, New Haven & Hartford Railroad Company, gave an illustrated lecture on the "Electrification Problem in Steam Railroad Work," with special reference to the New Haven installation.

LYNN GENERAL ELECTRIC DINNER.—The 11th annual dinner of the General Electric Company to its employees was given at Lynn on March 19 at the American House. Two hundred and fifty were present at the dinner, including a delegation from Schenectady. Mr. Charles E. Pierce acted as toastmaster. Dr. A. E. Kennelly spoke on the subject of wireless telegraphy with particular reference to the Fessenden plant at Brant Rock. Prof. Elihu Thomson and Dr. C. P. Steinmetz participated in a following discussion of wireless.

RIFLE ELECTRIC LIGHT.—Among the rifles taken with him by ex-President Roosevelt are two equipped with small electric lights at the gun sight, to enable accurate shooting to be done at night. On each side at the tip end of the gun is a miniature electric lamp. On the under side of the rifle stock is a small dry battery, and a button on the trigger guard enables the electric circuit to be completed. Upon pressing the button the light on the barrel brings the rifle sight into clear view of the shooter, thereby enabling him to aim accurately.

ELECTRICITY FROM THE SUN'S RAYS.—Messrs. E. J. Dickey and G. H. Cove, of Haverhill, Mass., claim to have invented a method whereby the sun's rays can be directly utilized for the generation of electrical energy, and have completed an experimental apparatus to demonstrate their claims. The sun's rays fall on the face of plugs "of a special alloy" which protrude through a cement block about 1 in. The difference in temperature between the extremities of the plug gives rise to a difference of potential, and the resulting electric current is stored in storage batteries. It is claimed that a block 5 ft. square will store from the sun on a clear day sufficient energy to light five 16-cp lamps for a period of four or five hours.

ELECTROCHEMICAL SOCIETY.—The New York section of the American Electrochemical Society will hold a meeting at 8:15 p. m., on April 2, at the Chemists' Club, 108 West Fifty-fifth Street. Prof. W. D. Bancroft will present papers entitled "The Chemical Electrolysis of Acetates" and "Electrolytic Production of Anilin." Two papers entitled "A Modified Oxyhydrogen Gas Coulometer" and "A New Form of Laboratory Apparatus" will be presented by Dr. J. W. Turrentine. Mr. Maximilian Toch will read a paper on "The Protection of Steel Against Corrosion." The annual meeting of the society will be held on May 6, 7 and 8, at the Clifton Hotel, Niagara Falls, Canada. The membership of the society is now about 1000.

BOSTON I. E. S. SECTION.—The Boston Section of the Illuminating Engineering Society has taken measures to extend its usefulness through the appointment of a number of committees to forward actively plans to render the section of the greatest possible service to its members and to the art of illumination. The next meeting of the section will be held April 20.

THOUSAND MILES BY TROLLEY.—Mr. A. A. Anderson, president, and other members of the Central Electric Railway Association, which met in Cleveland last week, made the journey from Louisville to that place in a private electric car via Fort Wayne, Ind., and will return in the same manner. The total distance of the round trip falls but a few miles short of 1000 miles.

NEBRASKA ELECTRIC LIGHT CONVENTION.—The 1909 convention of the Nebraska Electrical Association is to be held at Omaha, May 11, 12 and 13, during the Omaha Electrical Show. The Millard Hotel has been selected as headquarters, and all of the sessions will be held there, as last year. The secretary of the association is Mr. Wm. Bradford, of the Lincoln Gas & Electric Light Company.

AUTOMOBILE CLUB TAKES UP AERONAUTICS.—The Automobile Club of America has made an agreement with the Aero Club of America whereby the latter becomes the "Aviation Section" of the former. This is in accordance with a decision at the recent international Paris automobile congress, that automobile clubs should occupy themselves with means of aerial flight in which light gasoline motors are employed.

NORTHWESTERN UNIVERSITY ENGINEERING DEPARTMENT.—On March 25 the Northwestern University at Evanston formally inaugurated the Swift Hall of Engineering, a $100,000 building presented by Mr. Edward F. Swift and his mother, together with $50,000 for maintenance. The university some time ago formulated an organization for engineering instruction, which will go into full force the beginning of the next school year.

CHICAGO PARK LIGHTING.—The Forest Park Fair Grounds & Amusement Company, of Chicago, has entered into contract with the North Shore Electric Company to secure electricity to light its grounds and some of the buildings. The Sanitary District of Chicago had a pre-existing contract to supply electricity to this suburban amusement park, and the new contract is of especial interest because it is supplemental to the older contract.

HIGH-TENSION TRANSMISSION.—At the meeting of the American Institute of Electrical Engineers, to be held in New York April 9, a working demonstration of high-tension insulators will be made by Mr. A. B. Reynders, who will present a paper entitled "Condenser Type of Insulation for High-Tension Terminals." High-voltage transformers and protective and controlling apparatus for outdoor installation will be discussed in a paper by Mr. K. C. Randall.

ARKANSAS PUBLIC UTILITY OPERATORS.—The second annual convention of the Arkansas Association of Public Utility Operators will be held at Hot Springs on May 12, 13 and 14, with headquarters at the Arlington Hotel. In addition to the address by the president, Mr. D. A. Hegarty, papers will be presented by Messrs. J. M. Hewitt, S. A. Stearns, B. C. Fowles, C. J. Griffith, J. E. Cowles and S. E. Sawyer. Tungsten lighting will be discussed by Mr. Cowles.

NON-RESIDENT LECTURES AT THE UNIVERSITY OF MINNESOTA.—Mr. Edward P. Burch, consulting engineer, Minneapolis, is giving a course of 10 lectures on "Electric Traction for Railway Trains," at the College of Engineering of the University of Minnesota. The lectures include a history of electric traction; advantages of electric traction; characteristics of steam and electric locomotives; motor-car trains; electric-railway motors; power required for trains; steam, gas and water-power plants; the transmission system; electrification of steam railroads.

ELECTRIC RIVETING MACHINE.—A consular report describes a recent type of riveting machine made at Oerlikon, Switzerland, which combines the mechanical advantage of hydraulic riveting and the economy of electric power. An expensive generating plant is necessary for pneumatic riveting, while the hydraulic-electrical apparatus, which weighs 2750 lb., is complete in itself, is easily transported and can be suspended for operation horizontally or vertically. The motor operating the hydraulic arrangement is of 5 hp and designed for an alternating current at 240 volts.

BILL TO REGULATE TELEPHONES.—A bill has been introduced in the Legislature of New York prohibiting telephone pools, trust agreements and combinations. It also requires all long-distance telephone companies and all local exchanges to admit telephone connections at all exchanges with all rural lines applying therefor at the maximum rate of 25 cents per month for switch charges for each telephone on any rural line admitted and fixes minimum rates to be charged for messages according to the distance, 10 cents being the rate for messages sent a distance of 15 miles or less. The violation of the pool and trust provisions is subject to fine or imprisonment or both and forfeit of franchise.

ELECTRIC CLUB OF CHICAGO.—An address rather out of the ordinary, but nevertheless greatly appreciated, was delivered at the weekly luncheon of the Electric Club of Chicago on March 24 by Judge Frederick L. Fake, of the Municipal Court. The speaker talked about the general principles of the law and its administration by the courts, referring both to civil and criminal law, with something about the law of contracts. The burden of the talk was to the effect that if men endeavored to do right in their relations with other men and conducted themselves in a reasonable and prudent manner, the law should have no terrors for them. It was announced that Prof. A. A. Radtke, of Armour Institute of Technology, would address the club at the meeting of March 31 on the subject of "Public Service Commissions."

PUBLIC SERVICE COMMISSIONS LAW.—In a privately printed pamphlet entitled "The Shortcomings of the Public Service Commissions Law of the State of New York," the statement is made that certain statistics quoted were compiled by the secretary of the Empire State Gas & Electric Association. We are informed by the secretary of that association that the figures quoted are merely a summary of figures given in the commission's statistical report, and that neither the secretary nor the association is responsible in any way for the publication of the pamphlet nor for the opinions expressed therein. The pamphlet vigorously attacks the New York Public Service Commission whose activities, it is predicted, will, if continued, deprive the Empire State of its long-continued supremacy.

MISSOURI ELECTRIC CONVENTION.—The third annual convention of the Missouri Electric Light, Gas and Street Railway Association will be held at the Colonial Hotel, Springfield, Mo., on April 15, 16 and 17. The presidential address of Mr. W. B. Hays will be delivered in the forenoon on April 15. The tungsten lamp will be treated from the viewpoint of the central-station manager by Mr. Paul J. M. Loewe. Mr. C. W. Hough will read a paper entitled "Insurance on Public Service Plants." High-tension transmission will be discussed by Mr. O. Wiemer. Prof. H. B. Shaw will present a paper dealing with engineering equipment stations. "Records," by Mr. P. A. Bertrand; "Equitable Rate-Making," by Mr. C. W. Hough; "Office Systems and Accounting," by N. J. Cunningham, and "Building of the Day Load," by E. L. Callahan, are the titles of other papers to be read and discussed.

Plant of the Lee Electric Light Company at Clarinda, Ia.

THE city of Clarinda, Ia., has a population of about 4000. Electricity for all purposes is furnished by the Lee Electric Lighting Company, which also manufactures ice, pumps water and supplies steam for heating purposes. Inasmuch as the company did a business in 1908 amounting to $55,000, yielding a revenue of approximately $14 per capita, a detailed description of the generating station, together with some notes on the company's methods of conducting its business, will be of interest.

In September, 1902, when the station was first started, Clarinda had a small, direct-current plant, consisting of two Hawkeye generators and a Gates high-speed engine. This station was owned by the Clarinda Electric Light & Power Company, whose business amounted to approximately $8,000 per year. Mr. J. Ren Lee and Mr. Rufus E. Lee formed a copartnership and started in opposition to the company, having obtained a franchise in February, 1902. The business grew so rapidly that in January, 1905, it was decided to incorporate the company under the name of the Lee Electric Light Company. The company was granted a new franchise for furnishing electricity, heat and gas.

A view of the generator room of the company's station, which operates 24 hours a day, is shown in Fig. 1. The equipment comprises four return tubular boilers, equipped with Jones stokers, manufactured by the Under-Feed Stoker Company of America; three Murray Corliss engines, one of which is direct connected to a 150-kw, two-phase, 60-cycle, 2200-volt generator, another connected by rope drive to a 100-kw, two-phase, 2200-volt Warren alternator, and the third direct connected to a 15-ton Linde compressor. The new switchboard shown in Fig. 1 was added to the plant in 1907, and the alternators are operated either single or in parallel, the voltage of the circuits being controlled by a Tirrill regulator.

Two feed pumps are located in the basement and, as all the steam mains are brought into the basement from the heating system, that portion of the plant was naturally quite hot. Advantage was taken of this condition, however, by placing the fan blower forming part of the stoker equipment in such a position as to draw its supply of air from this part of the basement, and thus not only to lower the temperature in that portion of the plant, but at the same time furnish heated air to the stokers.

Fig. 2 shows a view of the boiler room. The stoker equipment here shown was installed in 1907, and the fuel used is Iowa slack. During the winter months steam heat is furnished to the buildings in the business center, as well as to a limited number of residences. The city's water supply is pumped from this station, as is also an independent supply for the Chicago, Burlington & Quincy Railroad Company's tanks. The water delivered to the tanks is used for locomotives, so that there is no particular advantage in having it cold; in fact, it is conducive to economy to have the water warm. It so happened that the electric light company could kill two birds with one stone, not only delivering tepid water to the railroad company's tanks, but also utilizing the water first for condensing purposes, passing it over condenser coils in the plant before delivery.

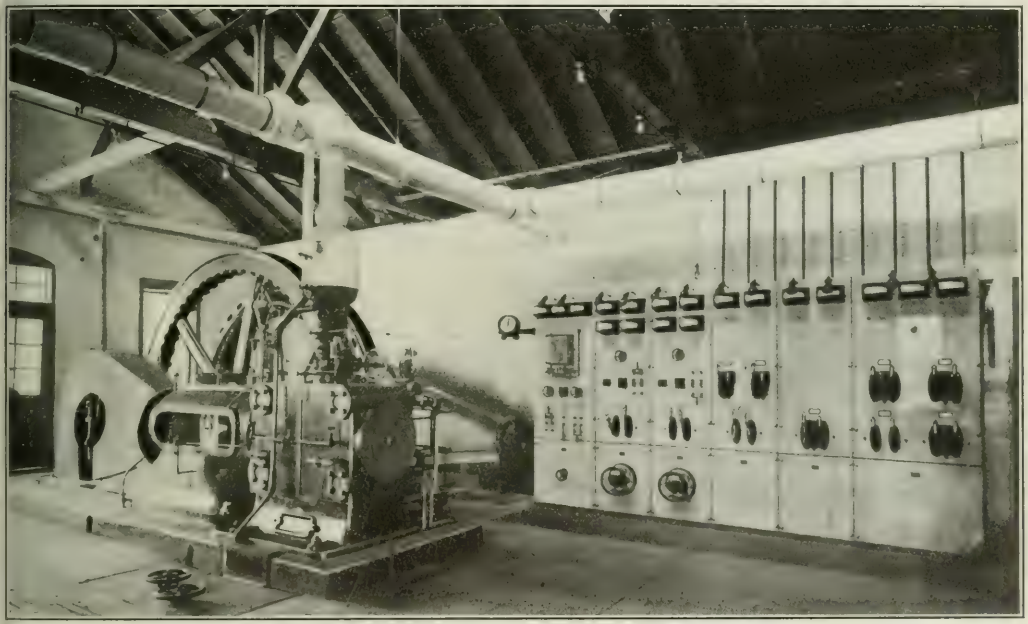


FIG. 1.—GENERATOR ROOM OF THE LEE ELECTRIC LIGHT COMPANY

The ice factory has been in operation for four years, and, together with the cold storage department of 25,000 cu. ft. capacity, has proved a very profitable branch of the business. The company thus controls commodities which cover a range of utilities, excepting electric railways, which in a town of this size would hardly be required. The various commodities are produced in seasonable combination, so that the entire steam output of the station is fully utilized, both directly and in auxiliaries, throughout the year, and the cost to the consumer of any service is quite reasonable.

The city lighting consists of 80 4-amp, 110-volt, 60-cycle Adams-Bagnall arc lamps, which burn every night until 1 o'clock, the city paying for the same at the rate of $42.80 each per lamp. Since the power house is located very near the center of the town, it was found advisable to divide the lamps on three single-phase circuits, which are used in balancing the load. From the station a 2200-volt primary circuit is run to the manufacturing part of the town for the purpose of supplying all motors with 220-volt, four-wire, two-phase service.

Clarinda is built around the public square, and, as this is

very evenly built up, the company has experienced no difficulty whatever in balancing the phases. Large transformers are placed at four different points around the square, and a network of three-wire, 110-volt circuits supplies the lamps in this portion of the city.

On the first of the year, or approximately six years after the plant was placed in operation, the company had 450 meters in service; three-fourths of these are rented at a rate of 25 cents per month, and all customers are charged a minimum of $1 per month, exclusive of the meter rental. During the year 1908, 482,180 kw-hours of energy were generated, and the company's receipts from the sale of energy during the year were approximately $28,000. Energy is furnished to 48 motors, ranging in rating from 1 hp to 20 hp, and aggregating a total of 275 hp, not including motors under 1 hp. The company further has in service 150 desk and ceiling fans, and about 75 flatirons. It furnishes energy to every concern in the town using electricity for motors, with the exception of one, a rolling mill, and there is not a single gasoline engine in operation in Clarinda. Carbon-filament lamps are renewed free of charge in sizes ranging from 4 cp to 32 cp. The total number of 16-cp equivalents wired up is 7000.

The heating system consists of ordinary steam mains laid around the public square, and, with the exception of two side

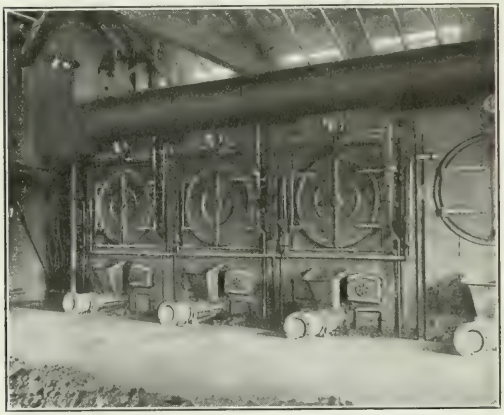


FIG. 2.—BOILER ROOM OF THE LEE ELECTRIC LIGHT COMPANY.

streets, this takes in all the district served. The company furnishes steam to 22,000 sq. ft. of heating surface, for which it receives an income of $5,600 annually. All radiation connection was installed in accordance with the company's specifications, but during the cold weather the company was able to heat every radiator in town with a back pressure of 3 lb., and in ordinary weather a back pressure of 2 lb. is carried. Condensation is returned to the station by gravity, and is used for boiler-feed purposes, and also for making ice. During the past year a few condensation meters were installed, but the greater part of the heating load is supplied on a flat rate.

The company does all the wiring in town, a very large part of which is placed in conduits. All the outside construction is of the best, the poles being neatly painted, strain insulators being installed on all guy wires running to the ground and nothing but the best material is used throughout. On junction poles all cross-arms are doubled, and galvanized hardware is employed exclusively.

The company's ice factory was erected in May, 1906, and has proved to be a good investment. The 15-ton ice machine installed was furnished by the F. W. Wolff Company, of Chicago, and during the past season 4922 tons of ice were manufactured, the income from which was, in round numbers, $12,000. The ice was sold at prices ranging from $2 to $5 per ton. During the winter season, as previously stated, the condensation from heating mains is returned to the station, and after it has been reboiled it is used for supplying distilled water to the ice factory.

The Lee Electric Light Company also does a merchandise and supply business. During the past year, aside from the work done in Clarinda, its income from this contracting work



FIG. 3.—GENERAL VIEW OF GENERATING STATION.

amounted to approximately $10,000, and the net profit realized on this work was $2,300. The accompanying statement is furnished by the company, and shows the business done for the past year:

From electric light rentals	$28,000
From steam rentals	5,600
From fan rentals	300
From merchandise, net profit	2,300
From ice	12,000
Discounts taken on material purchased	200
Total	$48,400
Operating expense in round numbers	34,000
Net profit	$14,400

The above expense account includes a sum of $4,800, which is the depreciation estimated for the past year. This also includes an item of $620, which is set aside each year from a fund created to take care of any accident to employees or to the



FIG. 4.—ICE STORAGE HOUSE.

plant. The company paid a 5 per cent dividend for each of the three years it was operated by the Lee Brothers, and during the first year of its incorporation a dividend of 7 per cent was declared. In the succeeding three years the dividend was 8 per cent. During that time there has been a charge for de-

preciation of approximately $13,000. The company is incorporated for $50,000, with a paid-up capital of $42,000, and $1,000 in treasury stock. Outstanding are $18,000 in bonds, against which there are assets amounting to $90,000. The station has been giving continuous service since June, 1905, and since August, 1905, has been fortunate enough never to have a complete shutdown. The maximum rate charged for electricity for lamps is 15 cents per kw-hour. The flat rate for steam is 30 cents and 50 cents on meter basis.

The officers of the company are as follows: President, Mr. William Orr; vice-president, Mr. G. William Richardson; secretary, treasurer and general manager, Mr. Rufus E. Lee. These officers, together with Mr. J. Ren Lee and Mr. A. F. Galloway, constitute the board of directors.

Wiring of the Babbitt Soap Factory at Babbitt, N. J.

THE wiring in the B. T. Babbitt soap plant on the Hackensack Meadows, at Babbitt, N. J., presents a number of interesting features. The conditions to be met in laying out the system were almost as rigidly fixed from the beginning as if electricity were to be installed in an old plant. Eleven principal and five subsidiary buildings were provided for in the plans, and the processes of manufacture determined the location of the power house at the southwest corner of the main group, as shown in Fig. 1. The significance of this position, electrically, will be appreciated when it is stated that the shortest feeder is 50 ft., and the longest 775ft. Electricity for motors is required only during the day, while energy for lamps is needed all night in one department, the glycerine building, and must be available in all other parts of the plant for emergencies. The installation was made to conform to the rules of the Associated Factory Mutual Fire Insurance Companies.

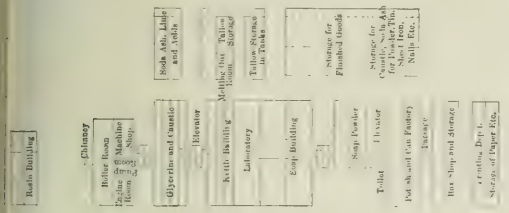


FIG. 1.—PLAN OF BUILDINGS.

The electrical energy is furnished by two Crocker-Wheeler 240-kw, three-phase, 60-cycle, 240-volt generators which are direct-connected to Buckeye engines. They run at 150 r.p.m. There are two exciters, one motor driven, the other direct-connected to a small Buckeye engine. The former is rated at 25 kw and is used for exciting both generators under ordinary conditions; the latter is a 50-kw machine and is used for starting up the plant and to carry the lighting load at night. Its size was determined by the lighting requirements.

The switchboard was built by the Albert & J. M. Anderson Manufacturing Company. It consists of two generator panels, one exciter panel, three motor and two lighting feeder panels. It is equipped with synchroscope, voltmeters, main and field ammeters and indicating wattmeters. A separate feeder for motor circuits is provided for each department in the works and each feeder has its own switch and watt-hour meter on the switchboard. In addition, there is one polyphase watt-hour meter to record the total alternating current lighting load and one watt-hour meter for the total direct-current lighting load. The main switch for the 50-kw exciter is double-throw and connects the machine with either the exciting busbars or the direct-current lighting busbars.

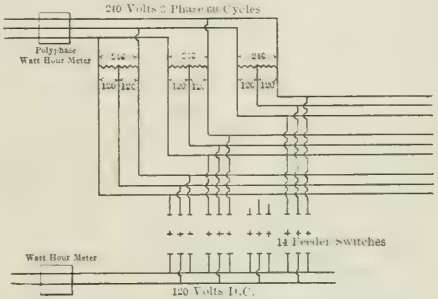


FIG. 2.—DIAGRAM OF CIRCUITS ON LIGHTING PANELS.

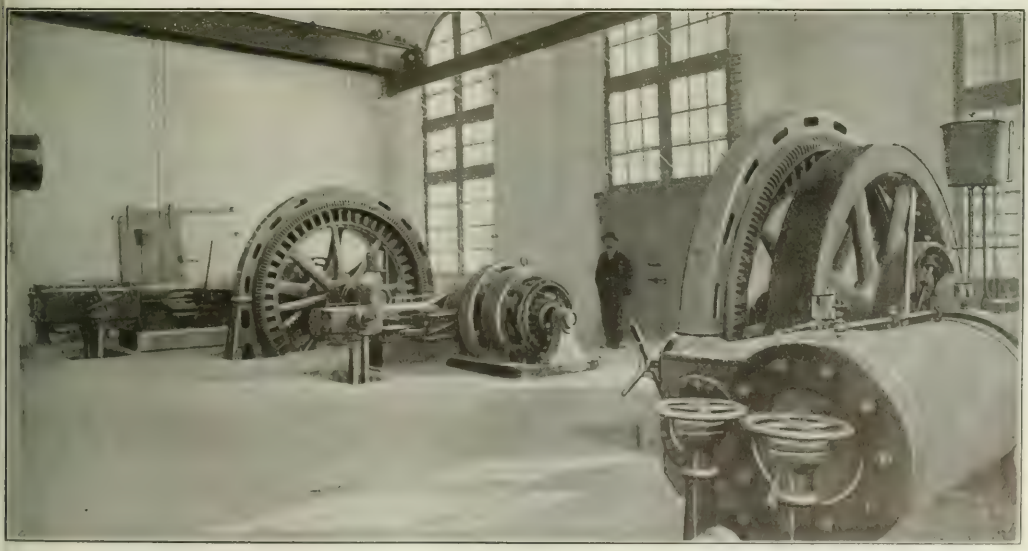


FIG. 3.—GENERATOR ROOM OF BABBITT SOAP FACTORY.

The lighting is done either from the main generators, on the

three-wire system, using a single-coil transformer across each phase, or from the 50-kw exciter set. As the transformers give 120 volts between the outside wires and the neutral, the voltage of the exciter is reduced when it is used on the lighting circuit. The switches on the lighting panels of the switchboard

back of the switchboard, the feeders run directly into a la pull box behind the board, which extends through the west w of the engine room into the boiler room. From this box th run along the east wall of the boiler room to another box, a placed in the wall, and extending through into the passagew

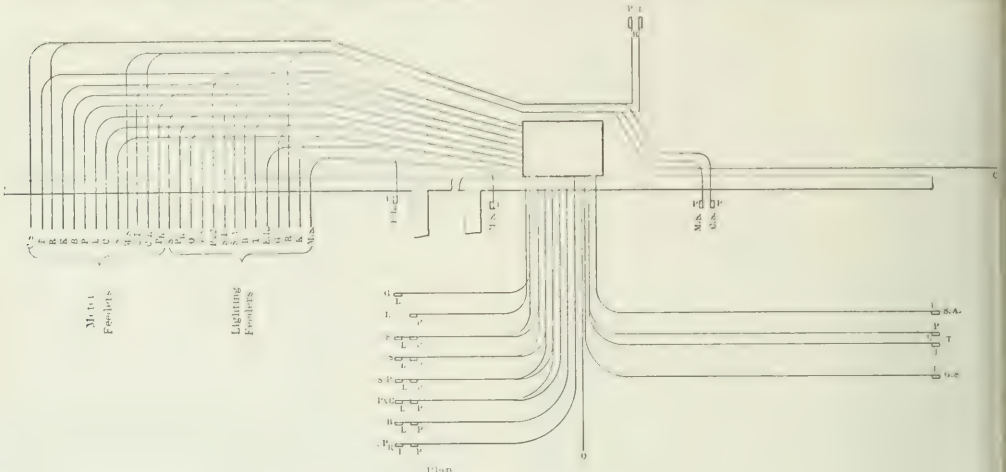


FIG. 4.—DIAGRAM OF FEEDER CIRCUITS.

are triple-pole, double-throw and are wired to connect the feeders to the alternating-current busbars on the up throw and

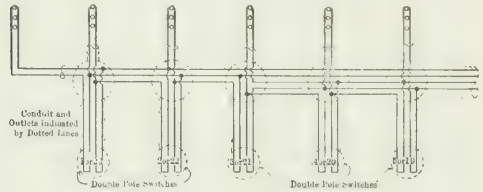


FIG. 5.—DIAGRAM OF LIGHTING CIRCUITS OVER KETTLES.

to the direct-current busbars on the down throw. When connected to the direct-current busbars the outside wires both be-

that leads straight through eight of the principal buildings a the small ones connecting them. The conduits are run throu this passageway suspended from the ceiling on pipe-hang rolls, branching at the proper points, as shown in Fig. 4. O other pull box was used midway of the passage to facilita pulling in the long cables. The feeders to the detached buil ings cross the intervening spaces underground in conduit. Le cables are used in these underground stretches.

The lighting circuits are run in conduit in the power hou in all buildings where they are exposed to grease or moi ture, and in all passageways. In other parts of the plant th are run on porcelain cleats on the ceilings. There is no op wiring on the walls. All circuits are run from the panel boar and switch boxes to the ceilings in conduit which terminates condulets for open work. White lead was used in all condu

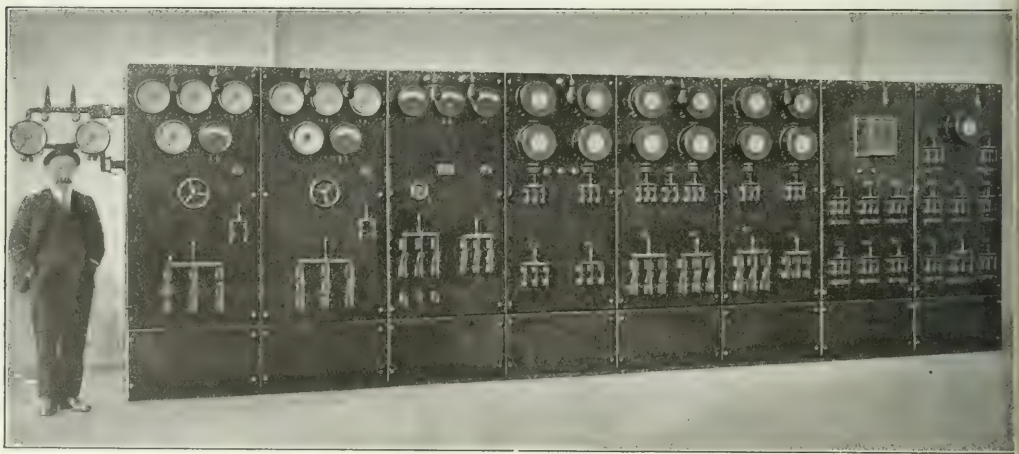


FIG. 6.—MAIN SWITCHBOARD IN BABBITT SOAP FACTORY.

come positive and the neutral becomes negative. The circuits are shown in Fig. 2. The feeders are so apportioned among the phases that the system is not unbalanced.

All feeders are run in conduit. From outlet plates on the

joints, and the specifications required that they should b screwed tight and made moisture-proof. All outlets are eithe cast-iron boxes with screwed connections or condulets.

Most of the conduit is run on the structural steel work, be

g clamped to trusses, purlins or beams. Where it is located n the ceilings and at right angles to the beams, it is run rough the nailing strips instead of being bent under the beams. he exposed wires also are run through the nailing strips in orcelain tubes. This necessitated boring many hundreds of oles, which was done with an electric breast drill. The energy as supplied from the 50-kw exciter which was run for the urpose, by the contractor, as soon as it was set up.

The feeders for motors were calculated for 5 per cent drop t full load, figuring on the ultimate capacity of the departments erved. Conduits were installed to receive such feeders, but hen it was known that the ultimate capacity would not be eached for some time, smaller feeders were installed.

Each motor feeder terminates at a motor panel board. In nany departments these panels are really small switchboards, ut all are mounted on the walls in iron-lined boxes, and have he busbars and connections on the front. The panels were de-igned for the ultimate capacity of the departments they serve, hough in some cases they are not yet fully equipped. The bus-

thought desirable to make the saving in copper as, under all ordinary circumstances, there will be no need for light without motors except on a very few circuits at a time. It was considered necessary to have energy for lamps available all over the plant at all times for the watchmen.

A lighting feeder is run to each of the main buildings. In almost all cases a panel board is installed on each floor and in some of the larger buildings more than one on a floor. Where there is one above another the lower one is equipped with continuous mains, not fused, and the feeder is continued up without reduction in size.

The lighting panel boards are mounted in iron boxes. Those in the power house and the glycerine building are three-to-two-wire convertible boards, for the reasons already given. All others are simple three-wire boards. New code fuses are used on the panel boards and no fuses outside. All circuits are, therefore, limited to 12 16-cp lamps. Each board is equipped for from one to three additional circuits. The lighting mains were figured to give 2 per cent drop, as nearly as practicable.

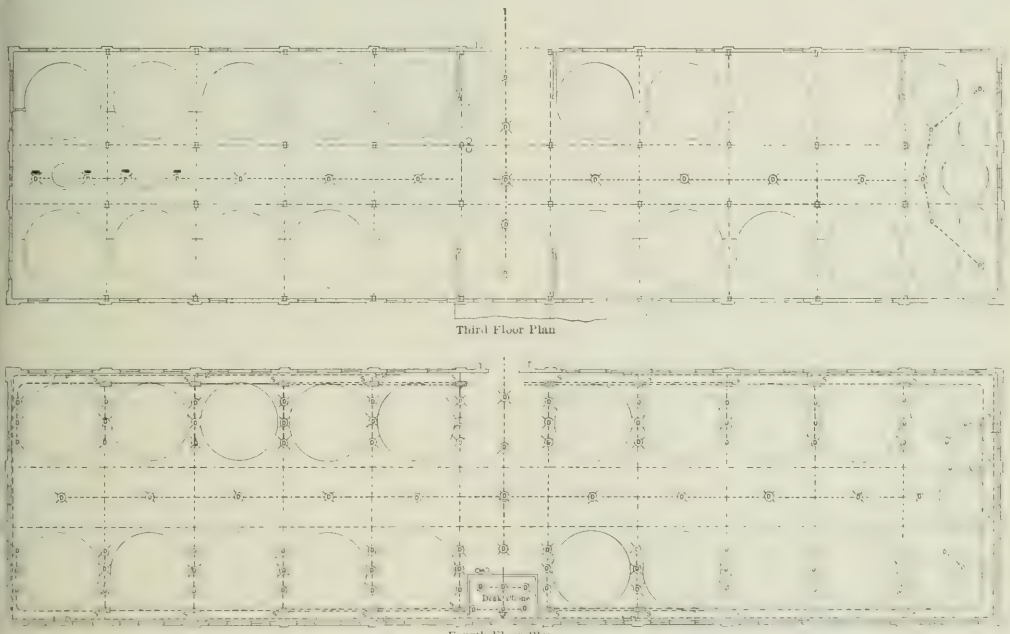


FIG. 7.—WIRING PLANS, KETTLE BUILDING.

bars, switches and connections were designed for the same current densities as on the main switchboard. All switches are fused with new code fuses.

The motor mains are run entirely in conduit. They lead to single motors or to groups according to the nature of the work. The motors are equipped with oil-starting switches or compensators, according to size, which are fused for both starting and running positions. A single-phase circuit of 100-amp capacity is run to the laboratory to provide for electrically heating chemical apparatus.

The lighting feeders were calculated for 3 per cent drop. In the case of the engine-room feeder this necessitated the use of resistances of 0.04 ohm, designed to carry 54 amp continuously in each of the outside wires.

For the power house and the glycerine building, which must be fully lighted at night, the neutral wires of the feeders were made double the size of the outside wires. Therefore, these buildings may be fully lighted from either source of electricity. All of the other feeders are of three equal wires. They are made safe for the use of direct current by fusing the neutral wires the same as the others at the main switchboard. It was

For open-work, slow-burning weatherproof wire, white outside, was used. All drop cords are reinforced.

Incandescent lamps are used throughout the plant and these are fitted in sockets of porcelain. The amount of light required varies greatly in the different departments. The minimum, in some storage rooms, is one 16-cp lamp to 400 sq. ft. of floor space. From this the amount is graduated according to requirements to the maximum in the printing room and in laboratories and offices, where special lamps are provided in addition to those used in obtaining a good general illumination. The control of the lamps also varies somewhat. All circuits are provided with switches on the panel boards. The boxes are all locked and the keys are kept by foremen. In portions of the plant not used all of the time, such as storage rooms, snap switches are placed near the doors to control circuits or groups of lamps located to conform to the aisles in which goods are stored. Key sockets are used only in the offices and on the pendant lamps in the machine shop.

Special attention was given to the lighting of the soap kettles. These must be brightly illuminated at times, when great clouds of steam are rising from them, and they may be left dark for

long periods. To provide sufficient light, water tight marine receptacles were placed in groups of three between the kettles and controlled by switches so connected that each kettle can be surrounded by lighted lamps independently. The circuits used are shown in Fig. 5. In addition, lamps in the aisles between the kettles provide general illumination. A circuit was also run around the room, under the windows, and plug receptacles were so placed that a portable lamp could be attached within easy reach of any kettle. All of the lamps and wiring for the room are shown in Fig. 7, which is quite typical of the circuit drawings for the whole plant.

Compartments where tallow is melted from casks are also lighted by lamps enclosed in marine fixtures. In these leather gaskets are used in place of the usual rubber ones on account of the grease. For light outside the buildings, a hooded fixture was placed over each of the many doors and on each of the telephone poles along the road leading to the railroad station.

The plans and specifications for the electrical power plant, equipment and wiring were prepared by Howard R. Barton. The entire electrical installation was put in by Messrs. Peet & Powers.

Power Station Without Operating Attendant.

That the day is not far distant when small water-powers throughout the country now undeveloped will practically all be utilized for electrical generation, can be predicted, not only on general economic grounds, but as a result of improvements in the working control of such installations which render unnecessary the presence of an operating attendant. Several plants of this character have been described in these columns, and below is given an account of another example.

The plant obtains its power from Sandy Brook, a small stream flowing from Massachusetts into the town of Colebrook, Conn., and which in a course of about 15 miles has a drop of approximately 1000 ft. Twelve dams have at various times been built at points along the stream, some of which at present are abandoned. The present plant comprises a crib-work dam 140 ft. long, formerly used by a paper mill, and which was rebuilt for its present service. A canal about ¼ mile long, with gates and racks at each end and a service tube 36 in. in diameter,

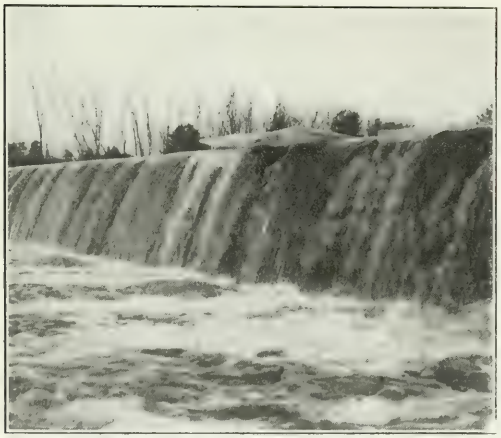


FIG. 1.—VIEW OF FALLS.

carry the water to the power house shown in the illustration, which is located over the pit of a former overshot water wheel, later replaced by a pair of vertical turbines.

The available head is 26 ft. and the present generating equipment consists of an 18-in. Rodney-Hunt horizontal turbine, belted direct to a 30-kw, 250-volt Triumph direct-current generator. The wheel is controlled by a Lombard governor.

The point of particular interest in relation to the plant is that it is started in the morning and left without attention until noon, when it is shut down for inspection and oiling, and after restarting is again left until shutting-down time. As the governor opens or shuts the gate in one second, the entire factory load carried by the plant can be thrown on and off at will with very little change in voltage. A transmission line consisting of a pair of No. 3 0 wires transmits the electrical energy to a



FIG. 2.—LOOKING UP TAIL RACE.

wood-working factory a half mile distant, where an equipment comprising the usual outfit of a complete wood-working plant with some special machinery is driven by a 30-hp, 220-volt Triumph motor. A Sturtevant engine is connected with the main shaft by a friction clutch, and, as steam is kept up for a dry kiln, the engine can be thrown into gear at any time in case of low water or excess load.

The plant described is situated at Colebrook, about seven miles from Winsted, Conn., and is owned by the Colebrook Manufacturing Company, manufacturers of wooden specialties, of which Mr. H. C. Spaulding is president and treasurer. For the information herein contained we are indebted to Mr. Spaulding, who for many years was prominent in the electrical field, having been connected for some years with the Thomson-Houston Electric Company, the Siemens & Halske Electric Company, and more recently with the Triumph Electric Company.

Grounded Secondaries.

By W. J. Canada.

THE grounding of secondaries is now advocated by practically all engineering societies, and by a majority of the electric light and power companies. From the large number of cities where all secondaries are grounded there comes nothing but praise for such an arrangement. The principal argument for this grounding is the protection of life, and particularly the life of the ordinary citizen.

Outside of the earnest advocates of grounded secondaries two prominent interests look at the matter from somewhat more complicated viewpoints. On the one side are the insurance interests, who take the stand that protection of life can hardly be made a basis for fire-insurance rate differences, which would be their only method of establishing the requirement or enforcing it. On the other hand, certain lighting companies oppose grounding on the basis of (1) greater probability of fires in connected buildings, (2) greater number of transformer breakdowns, due to this condition, and (3) the difficulties of securing effective grounds.

The insurance interests have had much reason for their stand

in the matter. The general public is only too ready to combat the improvements urged by fire insurance companies, even when losses are frequent from defective construction and figures available. But for a fire insurance company to decline writing a risk because of a life hazard would be indefensible. If it can, however, be readily shown that the condition of ungrounded secondaries may introduce a serious fire hazard, the insurance interests will be fully supported in a campaign for grounded secondaries. Their negligence to charge an additional premium to cover such a hazard would then amount to a discrimination against safely grounded circuits. Balancing such a possible fire hazard from non-grounding, however, one finds a corresponding increase in buildings having one wire grounded. The determination of the relative fire hazard of grounding and non-grounding once being made, the underwriters' argument against requiring grounding will either stand or fall.

When the great majority of lighting companies urge a general requirement for grounded secondaries, the adverse reasons advanced by the minority should be carefully scrutinized. If on examination it is found that grounding will increase the number of electrical fires, and that this argument is an opinion only of the opponents to grounding—and is refuted by the general experience of municipal authorities, lighting companies, and especially by the figures of insurance losses—it should be concluded that it is entirely baseless. If in actual experience transformer breakdowns and consequent operating difficulties and costs are not increased, then another argument against grounding is dismissed.

The difficulty of obtaining suitable effective grounds might be affected considerably by various considerations, including absence of underground water-mains, moisture of soil, and cost of maintenance. An examination of the possible variation in these conditions throughout the country should reveal whether cities opposing grounding on this basis were peculiarly ill-fitted for such grounding by these conditions. If it were learned by such investigations that none of the given reasons was substantiated in any valid way, it could be concluded that ulterior motives were influencing this opposition to grounded secondaries and the next effort would then naturally be directed to the study of such motives and their validity, together with the causes for concealment.

In examining the underwriters' standpoint and its relation to the lack of unanimity for this movement, it must be recognized that the Federal Government has no code on its books or in force offering any electric wiring regulations whatever. This is practically the case with all of the States, and even in cities a great number are still without ordinances on the subject. Where cities have ordinances and have made provision for their enforcement, the personnel of the inspection department too frequently is politically hampered by such relations. The fire department is not authorized to regulate wiring in any way. Under these circumstances the fire hazard of defective electric wiring arrangements early developed sufficiently to force its recognition by fire insurance companies. Certain arrangements of wires were found to be generally incendiary, and fire insurance companies began the custom of charging additional premiums for such defects, or even of canceling policies in more serious cases. In the absence of effective restrictions or supervision by the authorities, the requirements of insurance companies become the general rule for wiring. The companies adopted the code formulated by the associated building societies, and considered construction in accordance therewith safe. Many complaints were made, much litigation resulted and opposition arose on all sides. This code became known as the "Underwriters' Rules," and was abused accordingly. But credit for the code is due to the insurance companies, as their consistent attitude, based on experience, first made it a working force, and it is established to-day on a sure basis, though yet unsupported by statute. Unfortunately, the rules for wiring should recognize and tend to abate the resultant life hazard. The underwriters have brought it to recognition as a standard for low fire hazard, and they feel unwilling to change the status of the code as a standard of fire safety in an effort to enforce provisions tending only to reduction of the life hazard.

For many years it has been an axiom of underwriters that the grounding of one side only of building circuits necessarily increases the fire hazard. Actual losses from such circuits, and the much greater theoretical probability of fire, both unite in the proof. Five-hundred-volt grounded railway circuits are therefore prohibited inside of buildings. This, however, is a simple case, as the demand for 500 volts on lighting circuits would naturally be small. The difficult case is the 110-220-volt secondary and 2300-volt primary, which the progress of the art has made standard. Primaries and secondaries are ordinarily parallel on the same pole line; transformers offer one path of breakdown, contacts or breaking branches of trees another. With secondaries grounded, excessive voltage in buildings is largely avoided, but the somewhat larger probability of short-circuit remains. In case of short-circuit, however, there is a considerable spacing between wires, where only 110 volts, or, at most, 220 volts, are feeding the leak or short-circuit; but with the 2300-volt circuit on wires, this same spacing can in no way be regarded as a safe one, and the accidental contacts and injuries to the installed wiring make negligible contacts become dangerous leaks, leaks become serious short circuits, and even with wires installed in a thoroughly safe manner for 300 volts, breakdowns may occur at almost any point from the imposition of 2300 volts. In the event of a short circuit, the arc in either case must be enormously greater with the higher voltage.

In the early years of electric lighting a great part of the building circuits were fed by direct current, but the rapid increase of the alternating-current systems soon brought up this question, and many lighting companies from theoretical considerations began the grounding of the secondary systems. The 1901 edition of the Electrical Code permits, and the edition of 1903 and subsequent editions recommend, the grounding of secondaries, leaving it to inspection departments to require it if they deem it necessary. Municipal departments have often made this requirement. The average underwriter's inspector believes thoroughly in grounding as a safeguard to property as well as to life, and frequently service companies have grounded their distributions at the recommendation of underwriters' inspectors. Experience has gradually developed the greater fire hazard of ungrounded secondaries, by repetition of fires, and the time seems to be ripe for the assumption of a definite code requirement for this protection, on the ground of added fire hazard, and for charging additional insurance premiums for buildings connected to ungrounded secondaries.

The objection of the opposing electric lighting interests that the fire hazard is increased by grounding secondaries being thus refuted, it will nevertheless be necessary to examine the validity of their other adverse criticism. Correspondence with 50 cities in this country where grounded secondaries are in use has failed to elicit any note of criticism by service companies on added maintenance cost of transformers, or of public dissatisfaction with any phase of the service rendered. As these cities include large and small, old and new systems, this evidence may be considered substantial proof of feasibility from the operating standpoint. These reports also come in from all classes of territory, covering circumstances of dry soil, cost of maintenance, etc., of the same nature as in those cities combating the grounding of secondaries by such arguments. As regards the difficulty of maintaining effective grounds, this is an evasion only, wherever good systems of iron water-mains exist, as in 99 per cent of all cities of the country. The cost is not large for a well-protected ground wire, sweated into a lug and with good connection to the water-pipe. Since there is normally no current, there is no electrolytic action. In practice there has been no observation of greater sensitiveness to lightning of transformers in such systems. Proper lightning arresters will dispose of any tendency to weakness in electrical storms. If lightning arresters become somewhat less effective in higher altitudes, transformer breakdown paths become more resistant in the same proportion.

In a majority of cases where service companies oppose grounding, certain circumstances which might reasonably be

expected to give rise to such opposition are noted, even though invalid as arguments against the practicability of grounding. A large proportion of companies opposing this protective method, and giving one or all of the above reasons for their opposition, will be found to be defendants in law-suits based on negligence in not grounding secondaries. Deaths, serious injuries, fire losses, all are among the circumstances of these suits though not much noted in the daily papers. Private complainants rarely, and insurance companies who may be losers in fires still more rarely, take this course. To be sure, the proportion of convictions is not large. This, however, will hardly be considered remarkable when the mystery surrounding the origin of fires or accidents to persons is well examined. Of course, if a man is found dead in the street with a live wire lying across the body, and it is badly burned, the circumstantial evidence might be considered fairly complete. The parallel instance with fires is even more difficult to find. The absolute evidence of cause of fire is ordinarily lost by the destruction of the cause, and this is especially true in electrical fires.

But the fact remains that well-founded convictions do occur. These suits must be stubbornly contested, however, as admission of error would be followed by excessive damage awards and, in many cases, by a whole family of new suits. The uncertainty of issue, the difficulty of absolute proof and the cost of suit are all that deter many individuals and companies from bringing suit on these grounds. The service company is therefore practically restrained from an admission of the suitability and serviceability of grounded secondaries for preventing injuries to life and property. An ordinance or, better yet, a statute would in these cases bring about the desirable grounding, with no prejudice to such companies, as the laws are not retroactive. This may probably be found the most feasible course in procuring the grounding of secondaries.

Ultimately the statute will be necessary, and a Federal statute should cover this with other electrical matters, giving a legal basis to construction rules which are a real necessity and the very best our experience offers. These are now based on the sanction of custom only. Such enforcement as exists at present is by municipalities or by underwriters contested and precarious.

To develop the completeness of the argument for grounded secondaries, a few instances of fires and injuries to persons might be useful.

Among other cities of the country there is one with ungrounded secondaries in which there have occurred periodic breakdowns between primary and secondary, generally during heavy sleet-storms, and of such wide effect—due to interconnected secondaries—as to include as many as 50 fires started at one time. Some of these fires were easily extinguished, some caused very considerable losses; in one case $60,000 worth of property was consumed, and the proof destroyed by the fire. Arcing of fuses, breakdowns of fixtures and the like in adjacent buildings gave only circumstantial support to the hypothetical cause of the principal loss. The evidence was decided to be incompetent, but the doubt existing as to the cause was effectually dissipated, and subsequently a settlement was effected outside the courts.

In another city an absolutely new and perfectly standard installation had just placed fixtures when a transformer became overloaded and developed a fault. Several fixture-insulating joints were broken down and slight damage done to the building, no serious fire being communicated in this case. This city has since grounded all secondaries, and has never expressed a doubt of the benefit from every standpoint.

In an Eastern city wires were crossed during a severe storm, and 2300 volts entered several buildings, doing damage particularly in one with no insulating joints on fixtures. A hole was burned in a gas pipe and the ceiling at several outlets was somewhat burned. Prompt discovery prevented serious damage, the loss being about $100.

Fire in a small Western city was started by contact in a heavy wind-storm between the primary and secondary. The old code cords broke down and lamps exploded in a room containing an open stock of cotton-batting, starting a fire with a loss of $20,000. Firemen started to fight the fire before cutting the current off from the building, and in throwing the stream some 10 ft. to the metal ceiling, four firemen were thrown down, but without particular injury. The normal voltage was only 110 volts. The wires were then cut before the firemen again proceeded to fight the fire.

During a severe electrical storm in a city with ungrounded secondaries, a breakdown occurred in two different transformers, starting two fires, one by arcing to a gas pipe and igniting the gas—loss, $100; one by arcing to metal ceiling—no loss. The second occurrence was peculiar, as this transformer for nearly a week maintained a voltage of about 400, between receptacle terminals and the above-mentioned metal ceiling. Representations were made to the lighting company; it made the test, but delayed nearly a week before repairing the defective transformer. This city still retains its ungrounded secondaries. The lighting company is affiliated with others having outstanding suits for nearly $100,000, based on negligence in maintaining ungrounded secondaries.

In a Western city a man was severely burned about the hands and feet while touching a socket, necessitating two amputations. The transformer feeding the shops in which this man worked had proved inadequate. Another had been installed without a ground wire, though this was the practice, and the transformer proved defective.

In another city where the secondaries are grounded, a young girl held in her arms a small child who touched a defective lamp-socket. The older girl was killed; the young girl was uninjured. An examination located no permanent ground in the transformer, which had been left ungrounded.

A city requiring the grounding of secondaries had the following accident: An engineer, holding a portable lamp in one hand, touched the valve of a gasoline engine with the other. He was instantly killed. A thorough test revealed a breakdown between the primary and secondary in the service transformer. The secondary ground had been omitted. A number of deaths and injuries from similar causes can be given.

Of the many instances of injuries in basements the following is a fair example: A man entered his cellar and in handling a portable lamp was killed. Transformers were not grounded in this city and the service transformer had a complete breakdown. In another city three like accidents have occurred within the past year.

A banker entering his vault carried with him a portable lamp with a defective socket. He was picked up dead a short time afterward. The transformer was defective and the secondaries were not grounded. Damages were assessed on the service company, and there were three trials before final decision.

Bathroom accidents are perhaps the most frequent of all, some 30 deaths of this kind being reported during the year 1908. In some cases the crossing of the primary and secondary is discovered, and in others the breakdown of the transformer. These cases are avoidable by the grounding.

It should be borne in mind, however, that sockets, fixtures and wires should be removed from the possibility of contact with persons. In some of these injuries it may be remarked that the secondary will test entirely free from contact with the primary, and such accidents have occurred where the secondaries were grounded thoroughly. A town in the Central States had all the secondaries for some time effectually grounded. Nevertheless, a man standing on a hot-air register turned on a wall-socket and was instantly killed. Careful tests proved the effectiveness of the ground and developed the entire innocence of the service company. Without this grounding a suit might have resulted.

As a last instance the following coroner's report may be of interest: "I find that the deceased came to his death by reason of an electric shock received by coming in contact with an electric lamp cord containing a brass socket with incandescent lamp. Said shock was received while the deceased was standing on a damp cellar floor and manipulating said wire, which contained a current of electricity. Said current found a path

though his body to the earth. I find that the light was furnished by the ——— Company.

The effects of the passage of an electric current of high power through the human body are exceedingly variable and uncertain. It sometimes produces instant death and again no harm whatever results. As is known, nervous shock, more or less severe, burns and a variety of nervous disorders or even death may follow.

It is unquestionably the urgent and imperative duty of every municipality to provide for a rigorous inspection wherever electricity is used in any form, and take such action as shall abolish hazardous electrical conditions.

I therefore recommend the passage of an ordinance to create the office of city electrician, to define the duties of such office, and to establish rules and regulations concerning electrical wiring and appliances."

In this case no connection could be proved between primary and secondary. It must be remembered that lack of such proof must necessarily be frequent, as the most numerous central-station troubles with line switches opening are because of temporary swings of primary against secondary wires or against trees, or are because of limbs falling across both primary and secondary. Yet no record is left after such a momentary cross, and the proportion of fires from this trouble is very low.

Circumstantial evidence, however, frequently leads to jury decisions adverse to lighting companies who have failed to protect their lines by grounding, and the very difficulty of their proof and the Fabian policy pursued in such cases by the lighting companies really tend to strengthen the case against them. There is, moreover, no case in which an injury to person or property from electric wiring with a grounded secondary wire has been decided as negligence of the service company.

Lighting interests which have opposed the protection of life and property by the grounding of secondaries will do well to abandon their opposition on defensible evidence, or better yet, to abandon their position at the earliest opportunity. If the balance of fire hazard is reasonably against non-grounded secondaries, insurance interests should also unite to secure the remedy in its most practicable form. The opposition is in the minority, but the indecision means continuance of conditions adverse to property and to public safety.

The matter should be decided by the Committee on Recodification of the Code now in session and included in the National Electrical Code as a definite requirement, and the deserved prestige of these rules be supported by underwriters, municipalities and, if necessary—as is done with successful reduction of fire waste and loss of life in other countries—by action of the Federal Government.

Energy Costs in a Small Turbo-Engine Plant.

The study of electric generating costs in small central stations operating combined steam-turbine and engine-driven apparatus is of general interest at the present time, in view of the opportunities often presented to correct tendencies toward inefficiency. The following data cover the cost of producing electricity in a station of about 1000-kw rating at normal output, for the years 1906, 1907 and 1908. The design of the plant does not favor the production of power at the highest efficiency, since the station is undergoing a process of evolution from the belted type of plant to direct-connected units, and at present both arrangements are in daily service.

The station equipment in 1906 consisted of two Babcock & Wilcox water-tube boilers, each having 54 4-in. tubes and rated at 104 hp, with 120-lb. steam pressure; one 170-hp B. & W. boiler, having 81 4-in. tubes and one 144-hp B. & W. boilers, with 144 3-in. tubes. The total capacity of the boiler plant was 678 hp, and the installation remained unchanged throughout the three years. The prime movers in the plant in 1906 consisted of one Greene cross-compound condensing engine with 12-in. x 22-in. x 36-in. cylinders, rated at 175 hp and running at 190 r.p.m., and one similar engine with 16-in. x 30-in. x 48-in. cylinders, rated at 350 hp and running at 100 r.p.m. Three 150-kw belted alternators and three 44-kw Brush arc dynamos constituted the electric generating equipment. A 500-kw steam turbine was added in 1907.

Table I gives the output of the plant for the three years and the total cost of manufacture:

TABLE I

	1906.	1907.	1908.
Kw-hours delivered at switchboard	1,344,382	1,227,617	1,479,898
Kw-hours sold	933,461	1,913,092	1,285,196
Kw-hours sold for power	131,275	77,035	216,204
Cost of manufacturing:			
Fuel	$8,867	$11,754	$14,751
Oil and waste	570	356	389
Water	807	1,007	1,239
Wages at station	6,896	8,527	8,771
Repairs of building	40	81	130
Steam equipment repairs	904	2,069	4,837
Electric equipment repairs	47	141	257
Totals	$17,831	$23,959	$30,374

Reducing the more important of these costs to the unit basis (see Table II) gives the fuel, labor, steam-plant repairs and miscellaneous costs, with the total per kw-hour manufactured by the company. Cumberland coal and coke were used in 1906, costing, respectively, $4.29 and $3 per ton; in 1907 the coal cost $4.27 per ton and the coke $3, and in 1908 the coal cost $4.51 and the coke $2.35. In the latter year the company also burned screenings at a cost of $1.97 per ton. About 40 per cent of the fuel consumption in 1906 was coal, and in 1907 the coal burned was about 31 per cent of the total fuel used. In 1908 the coke was 17 per cent, the coal 80 per cent, and the screenings 3 per cent of the total fuel used.

The force required to handle the plant were three engineers, one electrician, one dynamo-tender and two firemen, a total of seven men for each of the years covered.

TABLE II.

	Cost in cents per kw-hour manufactured.		
	1906.	1907.	1908.
Fuel	.85	.96	.995
Wages	.66	.695	.595
Steam plant repairs	.168	.327	.133
Miscellaneous	.200*	.127	
Totals	1.715	1.950	2.050

*Included for 1906 under miscellaneous.

These figures show that the cost of operation is increasing seriously in this station from year to year, the total being 70 per cent greater in 1908 than in 1906, and on a 42 per cent increase of output. The cost per kw-hour manufactured is rising, from 1.715 cents in 1906 to 2.05 cents in 1908, or a gain in the unit expense of about 20 per cent. Without making a thorough examination of the plant it is difficult to point out the remedy, but the causes of the increase in cost may in a general way be ascertained. In the three years, with a fixed number of men handling the plant, the wages cost rose from $6,896 to $8,771, but the station output increased enough to offset this; the labor cost actually dropped from 0.66 cent to 0.595 cent, so that little objection to this part of the expense can reasonably be made. The figures show that even in a plant running toward higher operating expenses the wages need not be reduced to cut the whole unit cost, but that a raise in wages may be accompanied by increasing efficiency in the labor charge.

Fuel cost rose from $8,867 to $14,751 between the 1906 and 1908, or from 0.85 cent to 0.995 cent per kw-hour, a matter that needs close investigation at the plant. The entire process of manufacture from the delivery of the coal through to the bus-bar should be examined at the station. The cost of coal rose 22 cents per ton in three years, but this would increase the fuel expense by only about $300; in fact, the reduction in the cost of coke would offset this to an extent of 65 cents per ton. The station cannot, therefore, plead the excuse of higher coal cost. The efficiency and accuracy of all the apparatus from the meters to the coal scales needs investigation. Finally, the old equipments and its methods of handling should be subjected to expert examination to determine the cause of its poor economy and find the reason for the excessive repairs of steam equipment. If the water rate of the relatively new turbine and the evaporative powers of the boilers have not lately been tested, the time is at hand when this should be done.

Line Poles Purchased in 1907.

The U. S. Bureau of Census has compiled in co-operation with the U. S. Forest Service a report on line poles purchased in 1907, which is issued by the latter as publication No. 9 of "Forest Products." It is stated that the figures include the purchases of practically every company that bought poles during the year.

The total purchases of poles in 1907 were less than in 1906 by 66,668. There was, however, an increase of $758,471 in the total cost of all kinds of poles. The average cost per pole showed an increase of 27 cents. Cedar poles formed 63.3 per cent of the total number for 1907. The next in rank were the chestnut, which formed 18 per cent of the total. The highest average cost of all lengths of poles used for all purposes is shown for cypress, $5.17 per pole. Most of these poles were bought by the electric railway and electric light and power companies. Tamarack, which is shown separately this year for the first time, had the lowest reported cost, 74 cents per pole. Most of these tamarack poles were purchased by the telephone and telegraph companies.

In 1907 the telephone and telegraph companies purchased 2,311,651 poles, or 65.9 per cent of the total. This was 84,071 poles less than in 1906. The electric railway and electric light and power companies bought 901,559 poles, or 25.7 per cent of the total. The purchases of these companies decreased by 23,117 poles. On the other hand, the purchases of the steam railroad companies in 1907 increased by 40,520 over those in 1906. In 1907 the highest average cost is shown for the poles purchased by the electric railway and electric light and power companies, $6.02. Although the number of poles purchased by these companies was far below the number purchased by the telephone and telegraph companies, the high average cost caused the total cost of the purchases of the former to constitute over half the total cost of all poles purchased. Following are tables of data applying to the purchases of electrical companies:

TELEPHONE AND TELEGRAPH COMPANIES.

	Number	Cost at Point of Purchase	Average Cost per Pole	Number	Cost at Point of Purchase	Average Cost per Pole
	1907.			1906.		
Cedar	1,620,679	$2,950,200	$1.81	1,532,906	$3,079,852	$2.01
Chestnut	404,128	766,072	1.90	661,898	1,510,484	2.28
Cypress	22,981	24,647	1.07	21,395	36,559	1.71
Pine	48,063	47,497	0.99	121,609	478,427	3.93
Oak	66,422	23,100	0.35	2,980	1,500	0.50
Juniper	18,462	30,457	1.65	38,331	91,854	2.40
Redwood	8,052	15,313	1.90	7,140	24,390	3.42
Fir	6,691	3,964	0.59	9	94	10.44
Tamarack*	12,827	6,615	0.52	....	....	....
All other	94,346	103,064	1.09	9,454	11,789	1.25
Total	2,311,651	$3,977,019	$1.72	2,395,722	$5,234,949	$2.19

ELECTRIC RAILWAY AND ELECTRIC LIGHT AND POWER COMPANIES.

	1907.			1906.		
Cedar	459,178	$3,276,080	$7.14	497,014	$2,128,703	$4.28
Chestnut	187,077	762,626	4.08	263,035	975,505	3.71
Cypress	183,501	1,066,016	5.81	78,286	200,120	2.56
Pine	26,969	134,748	5.00	39,374	185,510	4.71
Oak	2,347	4,715	2.01	4,208	9,902	2.35
Juniper	19,098	77,493	4.06	18,268	70,945	3.88
Redwood	6,586	37,852	5.75	7,749	40,879	5.28
Fir	3,408	9,284	2.72	8,308	19,010	2.29
Tamarack*	1,057	3,632	3.44	....	....	....
All other	12,338	49,601	4.02	8,434	19,731	2.34
Total	901,559	$5,423,847	$6.02	924,676	$3,650,395	$3.95

*Not separately reported in 1906.

Nearly 30 per cent of the poles purchased in 1907 were between 25 ft. and 30 ft. long, while 2,670,810, or 76.1 per cent, were under 35 ft. The timber of greatest average length was the cypress. Of these poles, over 60 per cent was between 40 ft. and 45 ft. long. The shortest were the oak, nearly 60 per cent of which was under 20 ft. long. These short oak poles had the very low average cost of 33 cents, mostly due to their use by the lesser companies in localities where small oak is the cheap timber.

While a great number of the poles consumed are used for the construction of new lines, fully two-thirds are used for renewals. Decay is the great cause of destruction of poles. It is estimated that approximately 95 per cent are destroyed by this cause, and only 5 per cent by breakage or mechanical abrasion. The average life of untreated poles of all species is estimated at 13 years. This may be much prolonged by preservative treatment, the best known of which is the creosote process. The most complete figures available on the effect of this treatment are those furnished by the German Postal and Telegraph Department, which, on the basis of 52 years' observation, give creosoted Baltic poles a life of twenty-one years.

No figures are available for the number of poles treated annually in the United States. The reports from the consumers for 1907 show that at least 396,199 poles, or over 11 per cent of the total number purchased, received some preservative treatment. Of this number, 106,781 were purchased already treated, while the balance, or 289,418, were treated with some preservative after purchase. Telephone and telegraph companies bought 47,272 treated poles, and in addition treated 183,376, making a total of 230,648, or 10 per cent of the total number purchased by these companies. Steam railroad companies purchased 37,869 treated poles, and applied treatment to 43,460 more, making a total of 81,329, or 27.6 per cent of the total number purchased. The electric railway and electric light and power companies purchased 21,640 treated poles and treated 62,582 after purchase, making a total of 84,222, or 9.3 per cent of the total number purchased.

German Central-Station Statistics and the Proposed Taxation of Electrical Service.

As has been previously reported in these columns, Germany has decided to follow the example of Italy and tax electrical service in various forms, and a measure for this purpose is now before the Reichstag. Italy has taxed electric lighting and power installations for the past 10 years. The government offers as an excuse for its proposed system of taxation the fact that the industry to be thus burdened is rapidly growing and on account of its prosperity is able to carry a moderate tax which will give a greater income from year to year.

The growth of German electrical generating stations is indicated by the following figures:

	1895.	1905.
Number of stations	375	1,530
Capacity, kilowatts	46,000	859,000
Service connected, kilowatts	47,000	1,101,000

The cost of generation in very small stations has decreased. There are cases where the entire charges, including repairs, interest and depreciation, have been only 1.4 cents with steam engines, 1.3 cents with steam turbines, and 1.1 cents with gas engines.

These figures are among the grounds for the Government's claim that no industry is better able to bear a tax, particularly as it is likely that future improvements will cost even less than at the time taxation is introduced. In 1903 and 1906 the items entering into the generation of a kw-hour, such as fuel, lubricants, salaries and wages, were in the various cities mentioned below as follows:

	1903, cents.	1906, cents.	Decrease, per cent.
Aachen or Aix	1.55	1.25	19
Barmen	2.37	1.85	23
Cologne	1.0	.95	9
Dusseldorf	1.55	1.4	10
Elberfeld	1.15	1.0	10
Hanover	2.2	2.1	5

The Government has directed attention to the great difference between the generating cost and the selling price of German central stations. In the year 1903 the direct operating costs per kw-hour averaged as follows in stations of the sizes given:

	Cents.	
Over 5000 kw	2.5	(Group I)
From 2000 to 5000 kw	3.0	(Group II)
From 1000 to 2000 kw	3.25	(Group III)
From 500 to 1000 kw	3.5	(Group IV)
From 250 to 500 kw	3.75	(Group V)
From 100 to 250 kw	4.0	(Group VI)
Under 100 kw	5.0	(Group VII)

There are, however, some stations where the costs per kw-hour are materially below 2.5 cents, and others where they are materially above 5 cents. Among the lowest stations are that

at Aachen, 1.93 cents; Berlin, 1.52 cents; Breslau, 1.93 cents; Cassel, 2.23 cents; Charlottenburg, 1.53 cents; Düsseldorf, 1.57 cents; Essen, 1.32 cents; Frankfort-on-Main, 1.55 cents; Upper-Schleswig, 1.12 cents. Among the higher costs are Achern, 6.04 cents; Blankenese, 6.22 cents; Dantzic, 6.52 cents; Carlsruhe, 5.25 cents; Liegnitz, 5.87 cents; Wurms, 8.12 cents; Stettin, 5.16 cents.

The income per kw-hour sold was as follows:

Group.	Number of stations.	Cents per kw-hour.	Percentage of original investment.
I	14	5.6	17.3
II	10	7.42	19.6
III	19	7.25	14.8
IV	23	7.5	16.1
V	15	9.15	13.9
VI	10	10.0	12.8
I	7	9.27	8.6

The charge for lighting current in 1906 by 1005 power stations was divided as follows: Forty-one charged over 15 cents per kw-hour, 359 between 12.75 cents and 15 cents, 477 between 10.25 cents and 12.5 cents, 128 10 cents or less. From this it will be seen that the average price for lighting current is between 10.25 cents and 15 cents per kw-hour in about 84 per cent of the stations.

Energy for power purposes is sold by 997 stations as follows: One hundred and thirty-two charged over 10 cents per kw-hour, 36 between 7.75 cents and 10 cents, 113 between 6.5 cents and 7.5 cents, 276 between 5.25 cents and 6.25 cents, and 404 between 4 cents and 5 cents. These figures show that the average price for power purposes is between 4 cents and 6.25 cents per kw-hour in 68 per cent of the power stations.

An example of a profitable power plant is the Berlin Electricity Works, which pays the city annually about $1,250,000, in spite of which its dividends are 10 per cent to 11 per cent. In the fiscal year from June 1, 1906, to June 1, 1907, this company furnished 143,000,000 kw-hours at an average selling price of 3.97 cents at a direct operating cost of 1.47 cents per kw-hour. The city of Berlin therefore received 10.75 cents per kw-hour. The energy sold by the company was distributed as follows:

	Kw-hour.
Private lighting	28,500,000
Public lighting	3,400,000
Factories	48,900,000
Storage batteries	5,100,000
Street railways	56,200,000
Company use	3,800,000

The following table, covering the profits of power stations in 1906, is also of interest, as percentages of the original investment:

Size of station. kilowatts	According to the Central Station Society. Number.	Maximum per cent.	Minimum per cent.	Average per cent.	According to Dettmar. Number.	Average per cent.
50 to 100	10	8.55	1.82	5.68	18	7.1
100 to 250	11	14.82	1.60	7.36	73	9.2
250 to 500	17	13.04	4.15	8.40	20	11.7
500 to 1000	29	13.60	3.14	8.50	..	..
1000 to 2000	25	14.84	5.02	8.96	..	..
2000 to 5000	17	19.26	5.65	9.53	..	..
Over 5000	14	14.83	5.41	9.59	..	..
	123		Average	8.5	111	9.3

In 1905, 283 municipal power stations in Prussia furnished 139,000,000 kw-hours and had a surplus over operating expenses alone of $4,575,000. The investment was $31,125,000, and if interest, depreciation, sinking fund and renewals are placed at 10 per cent of this sum, the net profit was about $1,475,000, or 1.05 cents per kw-hour, and with a difference between the generating and selling cost of 3.22 cents per kw-hour.

In the fiscal year 1906-1907, 57 stock companies paid an average dividend of 5.1 per cent. In 1904, 38 of the larger municipal power stations furnished 133,000,000 kw-hours and had a surplus of $2,150,000 and a gross income of $7,800,000. According to this, a charge of 5.87 cents means a surplus of 1.62 cents per kw-hour.

Taxation is proposed as follows: For electrical energy sold, there shall be a charge of 5 per cent of the selling price, provided that this taxation does not exceed 1 cent per kw-hour. For electrical power generated only for the owner's consumption there shall be charged 0.1 cent per kw-hour. In certain cases where the energy cost is very high, a reduction of 5 per cent will be made. The only plants that will not have to pay taxation are those of less than 1.5-kw capacity. Taxes are to be paid for electrical energy by the manufacturer, not by the user. The consumer can, however, be made to pay the increase.

It is also proposed to tax electric lamps as follows:

Incandescent lamps, from 1 to 15 watts..... 1.25 cents each
Incandescent lamps, from 15 to 25 watts..... 2.50 cents each
Incandescent lamps, from 25 to 60 watts..... 5.00 cents each
Incandescent lamps, from 60 to 100 watts..... 6.25 cents each
Incandescent lamps, over 100 watts.....12.50 cents each

For arc lamp carbons, 25 cents per pound. For mercury-vapor and similar lamps, 25 cents for capacity up to 100 watts and 25 cents additional for each increase over full hundreds. To carry out the lamp taxation effectively, the law will specify that cases of certain size must contain only a given number of lamps, and, the cases will receive a revenue stamp or seal.

The income the Government expects to get will be made up as follows:

(A) For energy sold: 700,000,000 kw-hour, at 1 cent, and 300,000,000 kw-hour, at 0.5 cent, giving a total of $850,000.
(B) For energy used by the manufacturer only: 2,000,000,000 kw-hour, at 0.1 cent, and 3,000,000,000 kw-hour, at 0.5 cent, or a total of $3,500,000.
(C) Lighting material, aside from mercury-vapor lamps, etc.: 30,000,000 incandescent lamps, at an average of 5 cents each, or $1,500,000, and 7,000,000 lb. of carbons, at 25 cents each, or $1,750,000, aside from the mercury-vapor lamps, etc. The tax would amount to $7,500,000, of which 500,000 would be required for administration.

This proposition on the part of the Government is naturally opposed by the electrical interests, which claim that the Government has made serious errors in its estimate and the technical societies have denounced the proposed tax as a punishment of progress.

It is also pointed out to the Government that of the $7,500,000 income, $1,000,000 will come from Government or municipal stations, $250,000 would be lost on account of the decreased taxation value of certain factories, so that in the end, after all such reductions are made and the administration cost is deducted, not more than about $3,500,000 would be left to the Government as net revenue. It is also said that the effort would not be worth the trouble, and it has been suggested by various engineers that instead a tax should be placed on coal, which could be easily controlled.

This matter of taxing electrical energy is, of course, of great interest to the electric railways. At the last street railway congress in Munich, O. Petri, taking as an example 88 railways operating their own stations, 72 of which bought energy, submitted two tables as follows:

A. [illegible] POWER

	Maximum, per cent.	Minimum, per cent.	Average, per cent.
Traction cost in percentage of operating expense	31.8	12.9	19.6
Power cost, cents	1.9	5.25	1.05
Cost of energy, cents	[illegible]	1.0	1.5

B. PURCHASED POWER

Traction cost in percentage of operating expense	40.8	10.1	27.7
Power cost, cents	4.7	1.05	1.82
Cost of energy, cents	4.25	1.6	2.92

To compare these tables properly, there should be added to Table A 0.5 cent for interest and depreciation, thus making the absolute costs of energy average 2.2 cents per kw-hour, as against 2.92 cents per kw-hour for home energy. The average cost of power for all of the railways is therefore 2.45 cents, corresponding to 3.34 per cent of the investment. Mr. Petri showed that a reduction in energy cost from 2.45 cents to 1.5 cents per kw-hour would increase railway dividends 2 per cent and if energy could be reduced to 0.75 cent per kw-hour, as in the case of hydro-electric transmission, the dividends would increase to 2.3 per cent. From this, it will be realized, of course, that the railway company would not only have to pay more for energy on account of the tax, but could not make up for it because the fare would be the same as before.

Should the taxation on coal be made on the same basis as that on energy it would result in an income of $12,500,000. The electrical industries use only one-fifth of all the coal consumed in Germany.

Comparative Energy Costs in Two Central Stations.

In the comparison of central-station energy costs the idea is widely held that the larger of two similar plants may be expected to show a better cost record per kw hour of output. That the size of plant is less influential in determining the cost of unit operation than many other factors becomes ap-

parent from a study of the following figures of production expense for two central stations located within 50 miles of each other, designed along similar lines, with the same type of engines; with water-tube boilers, and serving manufacturing and residential customers. In each case the company operates the local street lighting system. The figures cover the four years ending June 30, 1908, and for convenience the plants are designated as Stations A and B.

Table I gives the energy delivered at the switchboard, the energy sold for industrial purposes, and the normal rating of the plants in engine horse-power for each year.

These figures show that a rough comparative equipment rating of a little over 2 to 1 was maintained throughout the four years; that the generated output of the smaller station increased more rapidly, relatively to that of the larger station; that both stations maintained the same rating of equipment for the first two years, and approximately doubled their rating by the last year. During the four years the energy generated by plant A increased by about 31 per cent, and B by 67 per cent. Between 1905 and 1908 in Station A the sales for motors increased by 104 per cent and by 230 per cent in plant B. The ratio of energy sales for motors to generated output increased from 22 per cent in plant A in 1905 to 33 per cent in 1908. In Station B the ratio was 30 per cent in 1905 and about 58 per cent in 1908. The growth of business and particularly the development of the motor load were therefore more favorable to economy of operation, other things being equal, in the smaller plant. Figures to be quoted later emphasize that this is not without influence in the efficient production of energy at the central-station busbars.

TABLE I

	1905		1906		1907		1908	
	Plant A.	Plant B.	Plant A.	Plant B.	Plant A.	Plant B.	Plant A.	Plant B.
Kw hours at switchboard	1,601,[illegible]	1,916,145	5,560,328	2,835,687	5,9[illegible]	3,240,618	6,043,204	3,288,623
Industrial kw hours	1,000,[illegible]	574,168	1,688,545	[illegible]	2,668,136	1,610,791	2,915,[illegible]	1,894,874
Engine hp	3,750	1,500	3,750	1,500	3,750	3,000	6,750	3,000

The equipment of Station A for the years 1905 to 1907 inclusive consisted of the following principal elements:

Four 400-hp Babcock & Wilcox unit boilers, steam pressure 160 lb.; two 750-hp McIntosh & Seymour vertical cross-compound condensing engines; one 2250-hp McIntosh & Seymour engine of similar type; two 600-kw and one 1500-kw General Electric alternators; and two 125-kw, 500-volt direct-current generators, driven by a direct-connected alternating-current motor.

In 1907 two more boilers were added, the units being duplicates of the previous installation. These were also operating in 1908, giving a total steam generating rating of 2400 boiler horse-power. In 1908 the company began to operate a new 3000-hp McIntosh & Seymour cross-compound vertical engine, directly connected to a 2000-kw alternator. This unit brought the total engine rating to 6750 hp.

The equipment of Station B in 1905 and 1906 was as follows:

Two 258-hp Stirling boilers operating at [illegible] steam pressure at 150 lb. Total boiler horsepower, 774. One 600-hp and one 900-hp McIntosh & Seymour engines, one 450-kw and one 600-kw General Electric alternators.

In 1907 two Stirling boilers were added, of the same type and rating as those previously installed, thereby bringing the total boiler rating of the station to 1290 hp. The company has also added another generating set, consisting of a 1500-hp McIntosh & Seymour engine, directly connected to a 1000-kw alternator. The total engine rating was thus raised to 3000 hp. For the year 1908 the station equipment was the same as in 1907.

Table II shows the number of men required to operate each plant for the four years covered:

TABLE II

PLANT A

1905.	1906.	1907.	1908.
Engineers 4	Engineers 4	Engineers 4	Engineers 4
Wipers 2	Oilers 2	Oilers 2	Oilers 3
Dynamo men 1	Wiper 1	Wiper 1	Wiper 1
Firemen 6	Coal passers... 2	Coal passers... 2	Coal passers... 2
	Switchb'd men 3	Switchb'd men 4	Switchb'd men 4
	Firemen 4	Firemen 6	Firemen 6
Total 16	Total 16	Total 19	Total 20

PLANT B

1905	1906	1907.	1908
Engineers 4	Engineers 4	Engineers 4	Engineers 4
Oilers 3	Oilers 3	Oilers 3	Oilers 3
Firemen 3	Firemen 3	Firemen 3	Firemen 3
			Helper 1
Total 10	Total 10	Total 10	Total 11

The generator output of plant A increased about 30 per cent in the four years; and the total number of station employees increased 25 per cent, the rated equipment of the plant increasing 80 per cent in this period. In plant B there was an increase of only 10 per cent in the number of station employees, while the output generated gained 68.5 per cent, with an increase of 100 per cent in equipment rating.

Table III gives the cost of manufacture, omitting cents, in each plant for the four years.

TABLE III.

Plant	1905.		1906.		1907.		1908.	
	A.	B.	A.	B.	A.	B.	A.	B.
Fuel	$23,224	$15,025	$26,[illegible]	$ 7,918	$33,276	$23,336	$41,546	$30,046
Oil and waste	1,383	278	870	316	947	713	1,118	607
Water	2,751	589	2,68[illegible]	594	3,987	818	3,281	1,253
Wages (station)	19,941	8,329	22,472	8,776	20,328	9,239	20,920	6,951
Repairs (building)	816	1,182	1,700	1,647	554	1,196	1,241	2,162
Repairs (steam)	1,863	1,254	2,130	945	1,887	893	3,558	2,680
Repairs (electric)	1,696	279	3,[illegible]	118	1,743	179	2,762	89
Total	$51,675	$26,807	$62,061	$30,342	$62,822	$36,374	$74,426	$46,794

Table IV shows the kind of fuel burned and the cost per ton delivered at the plant for each plant during the four years reviewed, and the fuel and total cost of manufacture per kw-hour at each station:

TABLE IV

	1905.		1906.		1907.		1908.	
Plant.	A.	B.	A.	B.	A.	B.	A.	B.
Kind of fuel.	Soft coal	Soft coal, coke.	Soft coal.	Soft coal, coke.	Soft coal.	Soft coal, coke.	Soft coal.	Soft coal, coke.
Cost per ton	....	$3.49	....	$4.23	....	$4.50	....	$4.84
Cost per ton	$3.35	4.80	$3.66	4.48	$4.00	4.48	$4.40	4.44
MANUFACTURING COST PER KW-HOURS IN CENTS.								
Fuel	.505	.783	.520	.632	.575	.720	.688	.910
Labor	.425	.435	.404	.310	.341	.285	.346	.302
	.190	.182	.196	.128	.131	.115	.196	.208
Total	1.120	1.400	1.120	1.070	1.050	1.120	1.230	1.420

These figures show that the cost of coal for the stations increased steadily during the four years in each plant; that in one year the smaller plant generated electricity more cheaply than did the larger station, and in the other years there was a difference of only 0.2 cent in favor of the larger station on the average. The best record was made in 1907 by the A plant, the cost then being 1.05 cents total, per kw-hour, manufactured. Plant A's cost was the same per kw-hour in 1905 and 1906, although the principal items varied somewhat. The

total cost of manufacture increased from $51,675 to $62,061, and the cost of coal rose from $3.35 to $3.66 per ton. The kw-hour output increased 12.1 per cent. The wages cost increased about $3,000. The miscellaneous costs were practically the same. The labor costs decreased about as much per kw-hour as the fuel costs increased. Continued output increased the efficiency of the labor per kw-hour, in 1907, the cost being 0.341 cent, in spite of an increase in the number of employees at the station. Fuel cost increased to 0.575 cent per kw-hour. The miscellaneous costs decreased, bringing the total costs down to 1.05 cents, although the coal cost increased 34 cents per ton. In 1907 plant A sustained another rise of coal cost, from $4 to $4.40 per ton. The labor cost was 0.346 cent per kw-hour. The coal cost rose to 0.688 cent, with a total cost of 1.23 cents per kw-hour.

Plant B produced electricity at a manufacturing cost of 1.4 cents per kw-hour in 1905, and at 1.07 cents in 1906. There was a reduction in fuel, labor and miscellaneous costs per kw-hour. An increase of about 50 per cent in output was largely responsible for the reduction in total cost per kw-hour. In 1907 the cost of fuel increased, and the output did not grow sufficiently to offset it, so the total cost of manufacture per unit rose from 1.07 cents to 1.12 cents. In 1908 the total cost of manufacture increased from about $36,000 in 1907 to about $47,000, the total cost per kw-hour rising from 1.12 to 1.42 cents. The principal increase in cost in 1908 was due to a heavy rise in the price of coal from $4.50 to $4.84 per ton. The output remained substantially the same in 1908 as in 1907, and the fuel cost per kw-hour rose from 0.720 to 0.910 cent, an increase of 26.4 per cent.

As a whole, the figures show that in some instances the small plant may produce electricity more economically than a larger one, although handicapped by a considerably higher price of coal. Careful fostering of the motor load during non-peak hours will do much to lessen the cost of producing each kw-hour.

Low-Grade Fuels and the Power Plant.

By C. M. Ripley.

CHEAP steam is the foundation of power-plant economy. A great amount of attention has been paid to gaining a small percentage in the economy of engines or pumps, though this does not warrant as much attention as does the question of cheapening the cost of the steam. This fact is illustrated by the following figures:

Assuming that 70 per cent of the value of the fuel has been used in changing the water in the boilers into steam at 80 lb. to 125 lb. pressure, the next point to consider is what percentage of this steam energy may be used on the engines and pumps and other power-producing apparatus. A simple high-speed engine requires 35 lb. to 45 lb. steam per hp-hour under usual load conditions, a compound high-speed engine from 22 lb. to 26 lb., simple pumps from 150 lb. to 250 lb. and compound pumps 75 lb. to 100 lb. per hp-hour. As an engine or pump or other mechanical horse-power is equal to 2545 heat units per hour, and the production of a pound of steam under usual working conditions of feed water and pressure requires approximately 1000 heat units, the foregoing figures of steam per hp-hour show that with the compound engine about 10 per cent of the steam energy is used, with the simple engine about 6½ per cent and with the simple pump about 1½ per cent; or, reducing these percentages to the original basis of the heat in the coal, allowing for the 30 per cent lost, the compound engine actually utilizes about 7 per cent, the simple engine 4½ per cent and the simple pump 1 per cent; or, putting it yet another way, from 93 per cent to 99 per cent of the energy in the coal is wasted.

Considering these figures, it will be seen that doubling the efficiency of a simple pump would decrease the loss only from 99 per cent to 98 per cent, while doubling the efficiency of a dollar's worth of coal would decrease the fuel bill by 50 per cent. Furthermore, the increased efficiency of engines or pumps would be a real saving only where exhaust steam is more than enough for heating and other low-temperature uses, while the saving from cheaper fuel would be a direct benefit at all times under all conditions.

The writer has known plants with compound engines where the cost per kw-hour was greater than in a plant of similar size equipped with simple engines, owing to the high cost of steam in the former.

Relative Values of Steam Fuels.

Bituminous coal has a much larger percentage of volatile matter than any other fuel in common use to-day. As a general rule, a great deal of this volatile matter escapes up the chimney before perfect combustion takes place, thus losing much of the hydro-carbons, which are from 20 per cent to 40 per cent of the weight of the coal. It is for this reason that it is difficult to get over 60 per cent or 65 per cent boiler efficiency ordinarily with this fuel. Anthracite coal, however, gives a greater proportion of its heat (70 per cent to 80 per cent) to the boiler. This follows from the fact that the volatile matter in anthracite is from one-tenth to one-quarter that contained in bituminous coal. The fixed carbon in the anthracite has small tendency to disappear up the stack, since it remains on the grates until perfectly consumed.

The above comparison is made on the assumption that both boilers are carefully fired, although there is a greater possible loss from the poor firing of anthracite than is the case with bituminous.

Use of Coke Screenings.

Coke, with its very high percentage of fixed carbon and its low percentage of voltatile matter, lends itself well (everything else being equal) to a high boiler efficiency. Since coke screenings cost only a little more than half as much as a No. 1 buckwheat and but little more than a third as much as the larger size anthracite, we can see great possibilities of economy, provided the heat units are not reduced in the same ratio as the difference in prices. And right here is a very interesting fact—coke screenings have about 12,000 b.t.u. per pound and buckwheat and pea coal also have about 12,000 b.t.u. per pound. These considerations lead to the following conclusion with regard to coke as a fuel:

1. Greater boiler efficiency, due to less gas content. 2. Economy, due to lower price on the basis of heat units. 3. Less expense in each handling and cleaning of fires. 4. Less chance of sooty tubes and flues, owing to low per cent of volatile hydrocarbons which make most of the soot.

It should be noted also here that the gas companies must avoid the presence of sulphur in gas, and thus the very best quality of gas coal from West Virginia and Pennsylvania is purchased. Thus it is that coke contains but a very small percentage (much less than 1 per cent) of sulphur, although some coals run as high as 3 and even 3.9 per cent of sulphur. The detrimental effect of sulphur upon the boiler, the flue and the steel stack shows up in pitting and is very expensive to repair.

Forty years ago, according to the statement of Mr. R. C. Miller, of the National Coal & Coke Company, coke screenings were used in manufacturing establishments for the burning of firebrick and other purposes aside from the manufacture of power. About six years ago Mr. P. R. Moses, consulting engineer of New York City, became interested in the possibility of applying coke screenings to the engine rooms of the big hotels, apartment houses and office buildings, where expensive sizes such as pea coal and larger had been in use extensively.

It was not many years ago that the culm-banks around the mouths of the mines were considered to be valueless. When methods were developed for burning the smaller sizes of anthracite those persons who were far-sighted enough to gain title to those unsightly old waste piles have become wealthy.

Methods of Burning Low-Grade Fuels.

With this in mind, together with the theoretical advantages of coke screenings and other low-grade fuels, it simply remained to develop a method for their use in the regular operation of a

power plant. Much of the No. 3 buckwheat coal and coke screenings necessarily is dust, and yet, strange to say, there are several plants that are burning this fuel in New York City to-day with natural draft. As a rule, the same grate surface required to burn pea coal or No. 1 and No. 2 buckwheat sizes is sufficient to burn properly coke screenings and No. 3 buckwheat, although it has proved advisable in several instances to lengthen the grates somewhat. Since the volatile hydro-carbons are almost absent in coke screenings, the danger of having too much grate surface for the boilers' heating surface is not as great as with other fuels. Moreover, a great many boiler systems have been found laid out with insufficient grate surface in order to burn properly the lower-grade fuels. They should never have less than 1-3 sq. ft. of grate area per horse-power.

The grate openings for the smaller sizes of buckwheat—i.e., ¼ in., 5/16 in. and sometimes ⅜ in.—where the draft is good, are suitable for the use of coke screenings. It has been found that, owing to the small amount of ash, the fires have to be cleaned less often, and therefore there is less loss of the fuel, due to the falling through the grates into the ashpit. In one factory building the fireman understood the fuel so well that on an inspection trip one afternoon at 5 o'clock it was stated that the fire had not been cleaned since 4 o'clock that morning.

Coke screenings should be wet down slightly before firing, but the porous nature of coke should be borne in mind while doing this, that too much moisture may not be added to the detriment of heating value. It should also be remembered that for this reason also any water sprinkled on the top of a large pile will be absorbed by the top layer and will therefore not penetrate to the interior of the pile, so the rule has been laid down that small piles be made previous to the sprinkling.

Firemen have been instructed to cover only lightly the fires, even to a less extent than is done with the smaller size of buckwheat. The manner of cleaning out the ashpit in order to save the intense heat on the grate bars should be part of the instructions to the firemen; but since the amount of ashes is so small this is a very simple matter. It is a fact proved in a dozen instances and more that the amount of ashes is really reduced 25 per cent to 50 per cent after the introduction of the fuel.

In an endeavor to introduce this fuel the owner of a plant will often state: "Our plant (or boilers, or grates, or draft, etc.) is such that no cheaper fuel than that which we are now using could possibly be burned." The inertia of such a man must first be overcome, but now that the prevention of waste and the conservation of our natural resources are getting so much attention all over the country, this is not so difficult a matter as it was several years ago.

Examples of Economy From Use of Coke Screenings.

It is impracticable to give here detailed cost reports from any of a number of plants whose owners have been progressive enough to avail themselves of such fuels, but following are brief summaries of the results attained in a factory, a loft building, a hotel, two apartment houses and a hospital:

1. A downtown factory building introduced the use of coke screenings about six months ago. The fuel bills for this period as against the same period the year before averaged 25 per cent less.

2. A large loft building containing 14 electric elevators and a heavy power load is selling electricity to its tenants at 20 per cent less than central-station rates, and these receipts pay almost the entire expense of the plant operation. Since coke screenings were introduced the fuel bill has decreased 25 per cent and the ash-removal bill has decreased 33 per cent.

3. A hotel, with refrigerating plant, four electric elevators, a kitchen and 1,200,000 cu. ft. to heat, besides other uses in the laundry, saved over $2,000 in the 1908 fuel bill, as compared with that of 1907.

4. A large apartment house, with 87 families, has burned coke screenings for about five years, ever since the building was constructed. Electricity sold to the tenants produces an income of $6,000 annually. There are eight electric elevators, refrigerating coils in each apartment, and the building is very much exposed to the cold winds along the front of the Hudson River. Coke screenings at slightly over $2 per ton of 2000 lb. are used, and the annual bill for fuel is about $7,000, running about $650 per month through the winter. The service of the house is of a very high class.

5. Another apartment of 2,000,000 cu. ft. and 50 families has only a heating plant, and the average expense for heating during October, November and January has been but $9.25 per day, using coke screenings with natural draft. This cost includes steam dryers for the tenants, hot water and also liberal heat for the highest class of apartment-house service in New York City.

6. Coke screenings have been introduced but one month at a hospital on the West Side of New York, replacing pea coal at $4.10 per ton. Instead of 9000 lb. per day of this expensive fuel, there are used only between 6000 lb. and 7000 lb. per day of coke screenings at slightly over $2 per ton.

It is the belief of the writer that the use of this fuel will add revenue to the gas companies throughout the country and will also result in great saving to the manufacturers of power, as soon as ignorant prejudice against it can be overcome.

Coal Specifications.

In a paper presented before the Illinois Fuel Conference held at Urbana, Ill., March 12, Mr. D. T. Randall, engineer of tests at the United States Geological Survey Experiment Station, Pittsburgh, discussed the various points relating to the economical use of fuel, including furnaces, draft, kinds of fuel, influence of ash, moisture, volatile matter, etc., and concluded with a draft of specifications for the purchase of coal.

The United States Government, which has, he stated, an annual fuel bill of $10,000,000, analyzes and tests much of its fuel. In a single contract for the present year of 400,000 tons of coal, the specifications required a heat value of 14,600 lb.-Fahr. heat units. In order to compare the cost of coals used by the Government in the larger cities of the country, it has been customary to calculate the cost on the basis of the number of cents per 1,000,000 heat units. It is interesting to note that for last year's contracts the cheapest coal was delivered in Louisville costing only 7.1 cents per million units. The cost in Boston for similar coal was 16.3 cents and in St. Paul the price was 17.1 cents. Anthracite coal was delivered in Eastern cities at prices ranging from 8½ cents per million heat units for buckwheat coal to 14 cents for pea coal, and as much as 20 cents in some cases for egg and broken coal.

Having decided upon a kind of coal to be used for a plant, the purchaser naturally desires to have some assurance that he may be able to secure the coal in question, or one of practically the same composition, for a given period. This has led to the use of specifications for the purchase of coal. If the size of the contract and other conditions warrant the use of a specification, then the proposal for coal to be of value should contain at least two general statements regarding the kind and character of coal.

The bidder should state in his proposal (1) the commercial name and size of the coal to be furnished. The size should be specified within certain limits in order to avoid disputes when coal is delivered. (2) The character of the coal to be furnished, in the following form:

PROXIMATE ANALYSIS

	As received.	Dry coal.	Free from moisture and ash.
Moisture			
Volatile matter			
Fixed carbon			
Ash			
Sulphur, separately determined, per cent			
Lb. Fahr. heat units in coal as received (not dry)			

The price per ton should be stated for coal of the specified quality. The price to be paid on coal delivered should vary

rectly with the heat units in the coal "as received," this value be modified further, if advisable, by corrections, as follows: For more or less ash in the dry coal. 2. For more or less latile matter in the "combustible," allowing in all cases 2 cent or 3 per cent variation without premium or penalty. limiting value may be placed on the percentage of sulphur the coal which will be accepted. Corrections for ash and latile matter are best expressed in the form of a table. In aking corrections for variations in the quality of the coal dered, it may in some cases be more convenient to make all anges in the price on the basis of change of the heat units. The reasons for basing contract on the items mentioned above e as follows: "The heat units in the coal as received" corcts for changes in heating value due to changes in both ash d moisture. The heat units in the coal as delivered being the ost direct measure of its value to the consumer, it is reasonle that the contract should be based principally upon this lue. This value may be determined and reported directly by e chemist. This results in a premium for better coal and a nalty for coal not up to the standard. As has been shown ove, so far as is now known the presence of small amounts moisture in the coal has but little effect on the efficiency of e boiler. As coals from the same mine or group of mines o not usually vary more than 3 per cent or 4 per cent in moisre, it hardly seems worth while to correct for the small nount of heat lost in evaporating it. By basing the value of al on the b.t.u. as received (moist), the variations in heatg value as otherwise affected by the moisture are provided or.

"Ash in the dry coal" is independent of changes in moisture the coal, this figure always being the same no matter what e moisture content may be. Coal delivered from the same ines may vary considerably in the percentage of ash. A reasonable allowance, such as 1 per cent or 2 per cent from the verage, would seem to be desirable, as such a variation is lmost unavoidable in commercial products. Inasmuch as the eating value is taken care of by the heat-unit determinations, he only remaining correction to be made for the ash is the xtra trouble in handling the coal and ashes and the possible eduction of the capacity of the equipment. When the ash reatly exceeds the amount for which the furnace was deigned, the reduction in capacity may become a serious matter nd would justify a rapidly increasing penalty. For the first per cent or 4 per cent increase or decrease in the ash it is nly necessary to provide for the difference in the cost of the handling, which is between ½ cent to 1 cent per ton for each per cent of ash in the coal. If corrections other than for eat units are to be made, and the ash is a factor, the specifiations should be based upon the percentage of ash in the dry oal for reasons which are explained elsewhere.

If volatile matter is to be corrected for, then "Volatile matter in 'combustible'" is preferable to "Volatile matter in coal." It should be the same, or nearly the same, regardless of variations in moisture and ash in the coal, and it is more properly a measure of the difficulty to be experienced in burning coal, as it is the direct ratio of the volatile matter to that part of the coal which is actually burned. It is reasonable to have a penalty for great variations in the volatile matter from the standard specified, for the reason that furnaces are not all equally well designed to burn coals high in volatile matter. This should not in any way affect the dealer or operator, provided the coal is furnished from the same mine, as the volatile matter should remain practically constant and a reasonable limit should be established within which no change in the price would be made. This variation could well be 3 per cent either way from the standard established. The value for volatile matter should be based on volatile matter in the "combustible" (coal free from moisture and ash), as this value remains nearly constant in the same coal. Premiums or penalties for lower or higher volatile matter may properly vary according to the existing local conditions.

Sufficient information is not available on which to base a reasonable rate for correction for sulphur in coal.

Employer's Liability—Fellow-Servant Rule.

By John Edson Brady.

In these columns has previously been discussed the liability of an employer to one in his employ who is injured through the negligence of a co-employee, taking up the fellow-servant rule, which relieves the employer from liability in such cases, and the limitation upon that rule, known as the superior-servant rule, which makes the employer liable where the negligent servant is superior in rank to the injured employee. This limitation as it exists in Illinois and other States has already been referred to. There are, however, a few other States in which the limitation has been recognized by the courts.

The superior-servant rule has been adopted in Kentucky to the extent of holding the employer legally responsible for the gross negligence of a superior employee, which results in injury to a subordinate. But the liability is limited to gross negligence. The employer is not liable in Kentucky to the subordinate for the consequences of what the law terms "ordinary negligence" on the part of a superior servant. Louisville Railroad Company vs. Collins, 2d Div., 114, was the first Kentucky case in which the superior-servant rule was applied. The facts were as follows: An engineer in the employ of the defendant railroad company started up his locomotive, while the plaintiff, who was his subordinate, was at work beneath it. The plaintiff sued the company for damages for the injuries received and obtained a verdict for $5,000. On the appeal, it was held that the engineer had been grossly negligent and the judgment was, therefore, affirmed. Judge Robertson said: "It (the company) is, therefore, responsible for the negligence or unskilfulness of its engineer, as its controlling agent in the management of its locomotives and running cars, and that responsibility is graduated by the classes of persons injured by the engineer's neglect or want of skill. As to strangers, ordinary negligence is sufficient; as to subordinate employees, associated with the engineer in conducting the cars, the negligence must be gross; but as to employees in a different department of service, unconnected with the running operations, ordinary negligence may be sufficient."

In Kentucky Distilleries & Warehouse Company vs. Schreiber, 73 S. W. Rep. 769, the plaintiff was employed in the meal-room of the defendant's distillery. Being temporarily in the mash-room, he was ordered by one who had authority over him to turn on the cold water feeding into the mash-tubs. He undertook to obey the order and mounted the trestle and removed the cover on the mash-tub just under the cold-water pipe. Just at this juncture the hot water, feeding into the mash-tub, was turned on by someone in an adjoining room. The plaintiff being close to the hot-water pipe, received the full force and effect of the scalding water. The company was held liable for the reason that it was the duty of the superior servant to acquaint the plaintiff with the peril attending the work which he had been ordered to do, and that, in failing to observe this duty, he was guilty of gross negligence. Kentucky is the only State which has adopted this particular limitation on the superior-servant rule—i.e., that to hold the employer liable for the negligence of a superior servant, resulting in injury to a subordinate, the negligence must be gross. Gross negligence is defined in Illinois Central Railroad Company vs. Elliatt, 59 S. W. Rep. 13, as a failure to use such care as careless and inattentive persons usually exercise under like circumstances.

The State of Texas also has a superior-servant rule peculiar to its own jurisdiction. There the employer is not liable for the negligence of every servant of a higher rank than that of the injured servant. He is liable only where the injured servant was under the direction and control of the superior and could be discharged by the latter. The rule may be an arbitrary one, it is admitted by Justice Pleasants, in Bering Manufacturing Company vs. Femelat, 79 S. W. Rep. 869, but it is uniformly recognized by the courts of Texas. Thus it has been held that a conductor, having superintendence and control over a brakeman, but having no authority to employ or discharge him, is

not a superior servant, for whose negligence the brakeman can recover against the company. Campbell vs. Cook, 86 Tex. 630. This doctrine does not apply where the negligence complained of is the omission of a duty owed by the master to the servant, the performance of which he has delegated to one of the employees. Such omission is the negligence of the master himself, the consequences of which he cannot avoid by the attempt to delegate his duty to one who has not discharged it.

In North Carolina the liability of the master to one servant for the negligence of a superior servant is not, as in the State of Ohio, made to depend entirely upon the relative rank of the two employees.

The test applied in that State is whether the subordinate feels constrained to obey the orders of his superior, by reason of the fact that he has just grounds for believing that a failure or refusal to obey may be followed by his discharge from the service. Under these circumstances the employer must answer for the negligence of the superior employee. The fact that the superior has authority to employ and discharge his subordinates is not, in North Carolina, alone sufficient to charge the master with liability for his negligence. Webb vs. Richmond Railway Company, 97 N. Car. 387. In Logan vs. North Carolina Railroad Company, 116 N. Car. 940, the plaintiff, a section hand in the employ of the defendant railroad company, had been injured as a result of the failure of the section boss to stop the handcar on which the plaintiff was riding in time to avoid a collision with an approaching train, and the carelessness of the section boss in directing the removal of the car from the track. The section boss had full authority to employ and discharge hands. It was held that the plaintiff and the section boss were not fellow servants; consequently the fellow-servant rule, under which the company would have been free from liability, did not apply and the plaintiff was permitted under this decision to recover damages.

On the other hand, the employer is not relieved from liability simply because the negligent servant has not been invested with the authority to employ and discharge those under his control; for, while the fact that the superior servant possesses this power may be evidence that the subordinate's fear of loss of employment is well founded, it is reasoned that to make the master's liability dependent upon the possession of this power by the negligent superior servant would afford the employer an opportunity to avoid just responsibility by placing the actual power to employ in another than the immediate superior, while the superior's recommendations of employment and discharge would always be favorably acted upon. A. & E. Encyc. of L., Vol. 12, p. 928.

In an Arkansas decision, that of Boyd vs. St. Louis Railroad Company, 58 Ark. 66, which arose before the passage of the act defining who are and who are not fellow servants, it was held that the foreman of a squad of railroad workmen, engaged in building and repairing bridges and trestles, who had power to employ and discharge the men, and to oversee and direct their work, was so far a vice-principal as to make the railroad company liable for his negligence in giving inconsistent orders to the men, resulting in an injury to one of them. The superior-servant limitation of the fellow-servant rule seems to be distinctly favored in Georgia. In Blackman vs. Thomson-Houston Electric Company, 102 Ga. 64, it was held that one who was employed in the capacity of engineer for an incorporated manufacturing company, but who was under a duty generally to obey the orders of a person placed in authority over him, having power temporarily to withdraw him from the performance of the special work for which he was employed, and to assign him to other duties, was not a fellow servant with such superior. 12 A. & E. Encyc. of L., 929.

In the work just cited it is said: "The very great confusion which has been shown to exist in the law of fellow servants in those jurisdictions where the superior-servant limitation has been adopted, and the inability of the courts of those different jurisdictions to agree upon some common principle, by which to determine the employer's liability for the negligence of a superior servant, furnishes strong evidence that these courts have, in their recognition of this anomaly in the law, radic departed from sound principle. According to the view wh harmonizes best with the analogies of the law, and which f nishes the safest guide in the majority of cases, the mast liability to one servant for the negligence of another in now depends upon the comparative rank of the negligent serv True, the master may be liable for the negligence of a super servant, but it is not because of his superior rank. It is beca he is charged with the performance of one of the master's p sonal duties. And it is immaterial whether the servant who charged with, and fails in the performance of, the mast personal obligation ranks above or below the servant who injured."

In most of the States the superior-servant rule is repudiat either expressly or impliedly, and it is held that the fact t the person whose negligence caused the injury was of hig grade than the injured servant, or that the latter was subj to the direction and control of the former, and was enga at the time of the injury in executing the orders issued by former.

And such a situation does not prevent an application of fellow-servant rule, under which the master is not liable t servant who is injured through the negligence of a co-work Among the States which have refused to accept the superi servant limitation may be mentioned New York, Connectic Indiana, Maine, Massachusetts, Minnesota, New Jersey, Pe sylvania and Wisconsin.

Suggested Patent-Law Amendments.

Mr. Isaac L. Rice in an article in the March issue of *T Forum*, discusses present abuses and imperfections of t United States patent system, and offers a number of su gestions as to changes in patent laws and in Patent Office pr tice. To bring the patent system to a proper footing requir he believes, a complete change of the theory which now unde lies patent law, namely, that a patent monopoly is a priv privilege derogatory to the personal rights of each individ affected by it, and that therefore the right to the privile must be established anew against every individual contesti it, by suits in personam. From this false theory, all the i congruities and iniquities of our patent law flow as logical co sequences. The very contrary is true: a patent is an obligati assumed by the public for a valuable consideration which must enforce as a public duty against all infractors; and t proceedings relating to patents should therefore be in re That is to say, before the public definitely assumes the oblig tion, it must be definitely ascertained whether the claima is entitled to be considered an inventor and whether the public benefited by the invention, and this once ascertained and esta lished, the patent should be held good and valid against the world

The paper concludes with the following suggestions f changes in the present patent system.

1. The establishment in Washington of a federal court ha ing all the powers of a court of chancery invested with e clusive original and appellate jurisdiction throughout the Unit States in patent and kindred causes, whose process shall r throughout the United States and its possessions.

2. The publication of an official weekly patent gazette co taining in extenso all patents granted within the preceding we and which shall be open to subscription or for sale in sing numbers.

3. All grants of patents to be provisional for a period of si months and subject during such period to proceedings for a nulment on part of the public.

4. All persons desiring to obtain a decree for the annulme of any patent to file severally with the clerk of the court complaint containing the allegations claimed to constitu grounds for annulment. Such grounds should be fixed by lav well defined, and under principles easy of application, since b the publication of the invention incident to the granting of patent the patentee loses his property therein for the benefit c

he public, and therefore annulment is tantamount to confisca ion.

5. Upon the filing of any complaint, the clerk shall immediately notify the patentee by mail of such complaint and also cause to be served upon him a copy thereof. Within two months after such service the patentee shall file his answer and the clerk shall likewise cause a copy thereof to be served upon the complainant, after which service the case shall be placed upon the calendar and brought to trial within nine months after the grant upon all the complaints simultaneously. If the complaints are numerous, the court shall upon application of the patentee appoint a special master in chancery to collate and marshal the issues, and the court during trial may make such rulings as may be proper to prevent cumulative testimony. If the state of the calendar is such that the case is not likely to be reached within that time, then upon motion by any of the parties, any judge of the court may appoint a master in chancery vested with all the powers of the court for the purpose of conducting such trial.

6. At such trial the parties shall appear with their experts and witnesses, who shall be examined orally, and shall produce such testimony as may have been taken by commission under special authority of the court upon issues of fact, and the case shall be heard uninterruptedly during court hours until completed, whether the same be before a judge or before a master.

If the trial is had before a master, he shall file his report within three months after such trial, and such report shall have the effect of a final decree unless disapproved by the court within 30 days thereafter, and a new trial granted.

7. The decree may sustain the validity of the patent, may amend it so as to conform with the evidence, or may annul it. Any of the parties may appeal from the decree to the Appellate Division of the Court within 60 days after service of the entry thereof, which service shall be caused to be made upon all the parties by the clerk of the court. If upon the hearing of such appeal any judge may find it necessary to ask questions of the counsel of either party, which cannot be answered by the testimony of record, such counsel shall be entitled to subpœna further witnesses for examination before the appellate division on the points to be elucidated; and such testimony shall form part of the record as though it had been originally given in the trial of the case.

8. In the absence of any proceedings for annulment of a provisional patent for the space of six months after its grant, or upon entry of a final decree, the issue of the patent shall take place, and upon such issue it shall be held valid against the world and subject only to cancellation on the ground of subsequently discovered fraud.

9. In the event of any infringement of a patent, the patentee may bring suit against the infringer in the patent court for an injunction and an accounting, and on proper affidavits shall be entitled to a preliminary injunction restraining the infringement of the patent pendente lite, the only defense permitted in such a suit to be that of non-infringement.

10. In order to prevent a patent from ruining existing industries, persons affected may petition the court for a compulsory license, and upon the patentee being heard the court may, where the evidence sustains the petition, in its discretion, order the patentee to give the licenses prayed for, but only on terms which in the opinion of the court will afford the patentee ample remuneration and provide for amortization.

11. The duration of a patent should date from the final issue, and be limited to seven years, with the right on part of the patentee to obtain two several renewals of his patent of five years each.

12. As under the proposed legislation patent rights would become valuable property, the fees should be sufficiently high to defray at least all the expenses connected with the maintenance of the Patent Office and of the patent court. They should be so graded as to be comparatively low for the provisional grant, considerably higher for the final issue, and correspondingly increased for each renewal

Storm and Lightning Protection to Line Wires.

By T. W. Poppe.

The recent sleet storm in New York has shown the mechanical weakness of the wires throughout the storm region. The ice gathering on the wires did but little damage; the greater damage was done by the ice accumulating on the twigs and smaller branches of a large branch of a tree and so weighting it that it broke off. In many cases it broke off close to the trunk of the tree and fell, throwing its weight upon the wires.

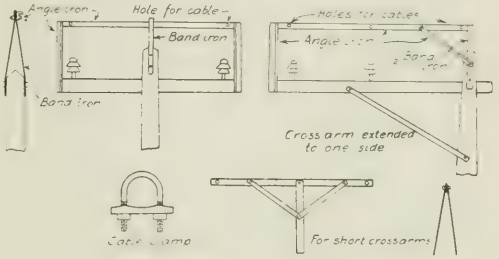


FIG. 1.—DETAILS OF CROSS-ARMS.

bearing them downward. In some instances the wires were broken. Where the voltage was sufficiently high the damp branch falling on the wires produced an equivalent to a short-circuit, causing the circuit-breakers or fuses in the power houses to disconnect the wires from circuit. In some districts where high-tension wires had been broken and repaired it was possible to supply electricity, but lack of confidence in the ability of the entire line to withstand the balance of the storm caused the managers to disconnect the entire system from use. This was in most cases a wise move, as had any wires broken and fallen to the ground in such a manner as to be in the path of pedestrians, a lawsuit against the electric light company would undoubtedly result.

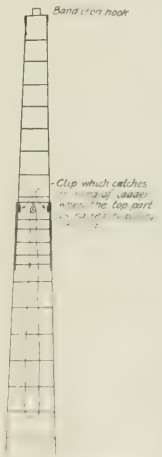


FIG. 2. LADDER.

Had the lines been protected against such dangers the position of the affected electric light companies would have been much stronger than they are now. The gas man or company who would not use happenings of this nature to the disadvantage of the electric light company would indeed be asleep. These lines can be more cheaply protected from such dangers when the poles are being installed, and it is strange that the erecting engineer does not take precautions against any troubles of this nature. The protection of wires and electrical machinery from lighting justly engages the engineer's attention and consideration, and a danger which threatens at any time to render the machinery and lines just as useless as lightning is apt to do deserves just as much consideration.

To equip properly the pole lines now in use so as to protect them from sleet, wind and lightning is a comparatively inexpensive matter. The pole lines as now constructed need not be exchanged and the wires can remain as they are. The changing of either would be an expense in two ways: To change one would mean changing the two, and changing the wires would mean oftentimes cutting the customers out of service. This should be avoided at all times if possible. If means be taken to prevent any weight from striking the wires, part of the problem is solved. This can be done by installing a galvanized steel cable consisting of seven strands of No. 10

wire above and parallel with the electric wires. As the wire carrying the highest voltage are generally on the top cross-arm on a pole, which is about 9 in. from the top, a rigging as shown in Fig. 1 can be constructed of 2-in. angle iron. The brace from the middle of the horizontal angle iron need be only ½ in. x ½ in., band iron. The holes shown in the horizontal angle iron are for the stranded cable to be drawn through, pulled taut and fastened by using the cable clamp on each side of the angle iron.

This cable support can be fastened to the pole by boring a

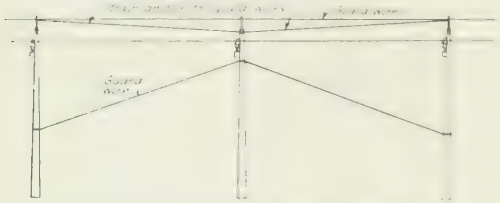


FIG. 3.—ELEVATION OF POLES SHOWING GUARD CABLES.

hole through the pole and clamping the two pieces of band iron, forming the middle brace, to the pole using one bolt. Placing the end supports of the cable supporters is a more difficult matter, as they are on the end of the cross-arm and hard to work upon to advantage or safely. However, if necessary, an extension ladder, as shown in Fig. 2, can be used. The hook shown is to rest on the cross-arm where the latter will support it, while the pin carrying the insulator will prevent it from moving from its position. In the end of the cross-arm a

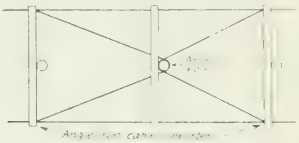


FIG. 4.—PLAN VIEW OF POLES.

¼-in. hole should be bored to a depth of 4-in. This will allow a ⅜-in. x 3½-in. lag bolt to enter without danger of splitting the arm. This lag bolt will hold the upright angle iron braces firmly. After five of these cable supporters are placed in position two cables should be fastened to the top of one pole. This will serve as an anchorage for this section of cable. The cables should then be drawn through the holes in the cable supporters. To reduce the friction caused by the cable rubbing the sides of the hole in the angle iron a compound of a consistency of jelly

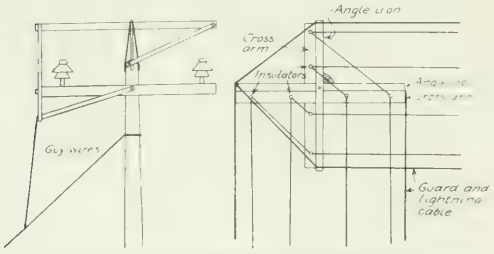


FIG. 5.—METHOD OF SUPPORTING AND ANCHORING CABLES.

should be used to lubricate it. The cables should be drawn taut and fastened to the sixth pole from the anchor pole. They can then be fastened by using the cable clamps (Fig. 1), placing one on each side of each horizontal angle iron. Tin wires should not be used, as the strength of the fastenings represent a great part of the strength of the entire section of cable and supports.

Fig. 3 shows the guard cables in position. The object of anchoring the cables every seventh pole is to allow the cable to carry any weight it might be called upon to carry without taking enough slack cable from the rest of the line to allow the cable to settle on the electric light wires. The entire line can be protected in this manner. Where the pole line changes its course and goes at right angles, Fig. 5 shows a plan of supporting and anchoring the cables and strengthening the cable supporters. The cable supporter is connected to the guy wire which sustains the pole by means of a seven-strand cable. The guy wire should also be of seven strands. Stranded wire will sustain a greater weight than solid wire of an equal diameter. There should be no strain insulators on these guy wires. The reason for this will be apparent later.

To utilize these cables in protecting against lightning is now a simple matter. At every pole used as an anchor a No. 6, or larger, copper wire should be soldered to the cables and connected to earth. Each cable supporter connected to a guy wire serves as a partial ground, hence avoiding the use of a strain insulator. A good ground connection can be secured by driving a piece of 1-in. galvanized iron pipe 15 ft. long into the ground. The wire from the cables to ground should be soldered to this pipe. The grounding of the cables at every seventh pole will give a stroke or discharge of lightning many points to dissipate itself and enter the ground. Should it be feared that the guard wires are too far apart and thus will not afford proper protection against the falling of small branches between them onto the wires, a third or fourth cable can be installed by making proper holes for them in the horizontal angle irons which form the top of the cable supporters. There is no question about the above arrangement making a good lightning arrester, as it is putting the ground above the wires. Dr. Steinmetz has said that the best lightning protection was to put the wires under the ground and if that was impossible to put the ground above the wires. This puts the ground above the wires, virtually because of its many ground connections, and is the nearest approach to the ideal conditions guarding against lightning.

A Peculiar Meter.

By F. J. Murman.

A meter installed in a residence which had been registering properly for two years, all at once seemed to behave in a peculiar manner. According to the index, the meter was recording backward, but an inspection of the installation showed

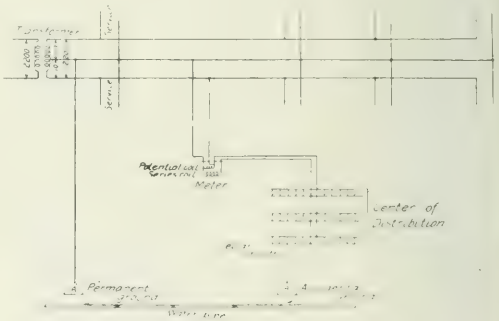


DIAGRAM OF CONNECTIONS.

that the meter was apparently connected properly, and with a 16-cp lamp burning the disk rotated in the forward direction.

The installation was two-wire, 110 volts, and was supplied from a three-wire overhead secondary system, with grounded neutral. The main switch was located on the third floor, the meter in the cellar and the center of distribution on the first floor. The distance from the main switch to the meter was

... No. 8 wire being used for mains, and the distribution ...uits being of No. 14 wire.

...he writer, being called into the case, found the secondary ...em considerably unbalanced so that the neutral wire carried ...siderable load. It was also found that the series coil of the ...ter was connected to the neutral, or grounded, leg of the ...e-wire secondary system and that an accidental ground was ...the cellar circuit. When the installation was inspected in ... daytime the system was not unbalanced, therefore, with a ...p lamp burning the disk rotated in the forward direction, ...hough not at the proper speed, on account of the series coil ...g shunted by a ground on each side of same.

...t night, with the cellar lamps burning, the disk rotated in ... forward direction, but very slowly, although a number of ...ps were also burning in various parts of the house at the ...e. It was then discovered that by turning off all the cellar ...ps the disk rotated in the backward direction. The case ...s then summed up as follows:

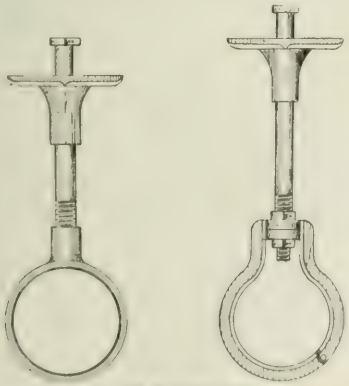
Certain changes in the secondary system resulted in transposing the service wires supplying energy to this particular installation, thus connecting the series coil of the meter to the grounded neutral. When the line *L* was loaded, due to the system being unbalanced and as the cellar lamps were not used, the ground circuit would help to supply energy to the system, and the current through the series coil of the meter would relatively reverse and cause the meter to record backward; but when the cellar lamps were burning, the cellar circuit wires, being of limited capacity, were loaded, then the circuit took the iron-copper path and the meter would record in the forward direction. The trouble was corrected by clearing the accidental ground and connecting the series coil of the meter to an ungrounded leg of the system.

This incident indicates the necessity for careful inspection of installation details when making periodic tests of meters.

Pipe-Hangers.—II.

By W. H. Wakeman.

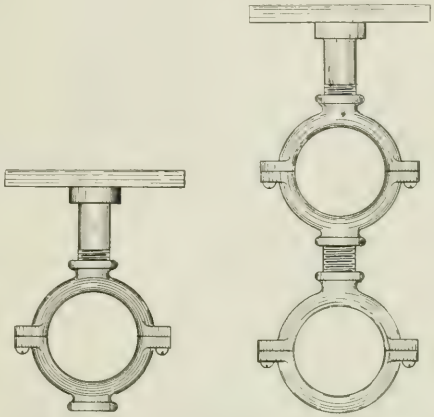
In the first issue of March a number of hangers for pipes were illustrated and described. The number of hangers was by no means exhausted, and various others are herewith shown. Fig. 1 illustrates a cast-iron hanger that is strengthened and made adjustable to a limited extent by a bolt concealed when the pipe line is finished. The ring is solid, but may be raised



FIGS. 1 AND 2.—PIPE HANGERS

or lowered by the threads shown. Fig. 2 represents a malleable-iron hanger, with a hinged ring held in place when closed by two check nuts which can be turned without a wrench. It is a mistake to make nuts fit so closely that it becomes hard work to turn them with a small wrench, as they ought to be tapped one size larger than the bolt, for they seldom work loose in ordinary service. They should not require oil, because oil will retain dust which settles on the hangers and in due time cause them to become clogged and difficult to handle.

The type of hanger shown in Fig. 3 admits of only slight adjustment in any direction, but the ring is split horizontally and held in place by screws or bolts as required. The lower half is removed before the plate is fastened in place, thus reducing the weight that must be carried and held by the workman in more or less inconvenient positions while locating a line of hangers. After the lag screws or bolts, according to the design adopted, are securely fastened, holding the plate against the timber, the pipe is raised into proper position and temporarily supported there, the lower half of the ring is attached as illustrated, and the work is done.



FIGS. 3 AND 4.—SINGLE AND DOUBLE PIPE HANGERS

Bolts are frequently considered stronger and more reliable for such work than screws, but this is not necessarily true. If a nut is only ½ in. thick, tapped for 14 threads per inch, it holds by seven threads. If a screw is tapped into a hanger that is ½ in. thick, it holds by seven threads; hence there is no difference in this respect. As a general rule, the workmanship is better where screws are used, because holes must be bored in one-half of the hanger to be tapped for the screw, hence the other is often bored the right size to be a loose fit for the body of the screw. On the other hand, when bolts are used the holes are cast in the iron with no attempt made to bore or ream them to a workmanlike fit. They are large enough to admit the bolt

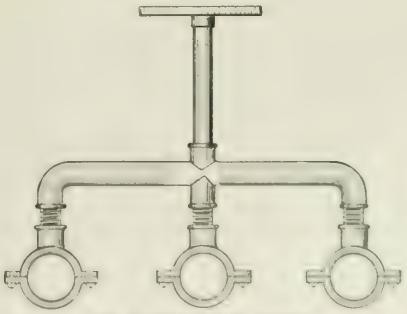


FIG. 5.—[illegible] PIPE HANGER

very easily, and if the holes [illegible] respond, there is still room enough for the bolt to go in without stripping the thread. [illegible] would be with turned bolts and reamed holes, while the cost is much less.

The hanger shown by Fig. 4 is designed for two pipe lines, one above the other. The rings are of equal diameter in the

illustration, but they can be changed for different sizes if desired. So far as the pipe alone is concerned, it looks better to have the larger one in the lower ring, but when the hanger is considered the larger pipe ought to be near the ceiling. This is partially due to the fact that the ring and plate would be

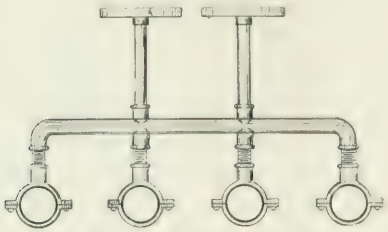
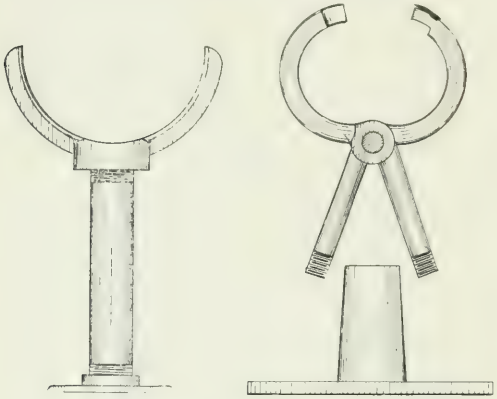


FIG. 6.—HANGER FOR FOUR PIPE LINES.

heavier for the greater diameter. Then the other appears as an attachment only, giving the whole a natural appearance from a mechanical point of view. This scheme constitutes a very neat arrangement for a certain case that was referred to the writer a short time ago, where steam was to be carried through a shop to heat the office, which was located as far away from the boilers as possible. The shop floor consisted of concrete laid directly on the earth, hence a return pipe could



FIGS. 7 AND 8.—PIPE SUPPORTS.

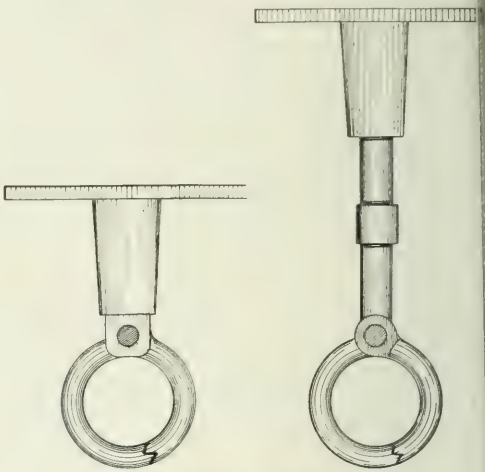
not be located under it. There was a good chance to hang the steam pipe overhead, with the return pipe directly under it, thus making a double pipe hanger very convenient. One difficulty to be overcome in such a case is the necessity for giving the pipes proper pitch in opposite directions. The steam pipe ought to pitch from the boilers and the return pipe toward them. This can be accomplished by using a short nipple between the rings shown in Fig. 4 at the end of the steam pipe and gradually increasing the length used in other hangers until the maximum is reached near the boilers. Water can be raised from a receiver below the radiators by a trap and discharged into the above-mentioned return pipe.

Fig. 5 illustrates a neat and practical arrangement of rings for carrying pipes by the use of one base plate. It is a good idea to apply this triple-ring hanger to the support of pipes of equal diameter, but where they must differ, the larger should be located in the center, and two of the same size used in the others to balance the whole. It is not necessary to carry the pipes all on the same level as the length of nipple can be varied at pleasure.

Fig. 6 shows four rings supported by means of suitable connections from two plates, giving a symmetrical, firm and well-balanced support for four pipes, maintaining the proper distance between them at all times, while either one or al them can be taken down at pleasure without disturbing thing except the supporting part, which is held in place by screws.

Fig. 7 illustrates a pipe rest of simple design. In m cases the return pipes of heating systems are located near floor in the basement and are suspended by extension han from the ceiling. A pipe rest located directly on the floo more substantial, is less prominent and is affected less by traction of expansion due to changes in temperature, th fore, it seems to be more desirable. When a 4-in. pipe th always full of water when in service is suspended by exten hangers, the central part of which consists of ⅜-in. pipe imperfect threads and loose couplings, there is evidently m chance for improvement along this line, yet these conditi represent common practice.

The scheme shown in Fig. 8 can be used as a pipe res the position indicated or may be reversed and converted int hanger. It is shown open, ready to be clasped around the p When closed it can be screwed into the plate with which it longs, but, of course, it is necessary to turn the plate for purpose, also to secure the desired height. Fig. 9 represe the hanger clasped and adjusted in the plate ready for When made in this form it is adjustable to only a limited



FIGS. 9 AND 10.—PIPE HANGERS.

tent, but nipples of any required length can be used, as illu trated in Fig. 10, thus extending the hanger and its field of us fulness at the same time.

The extensive use of iron girders for supporting the floo of shops and factories demands the manufacture of applianc for attaching hangers to the underside of these girders, to car steam, water and gas pipes of various sizes. Fig. 11 shows simple clamp which proves useful for this purpose as it hook

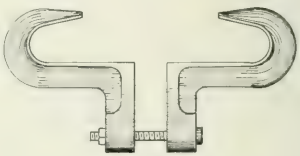


FIG. 11.—CLAMP.

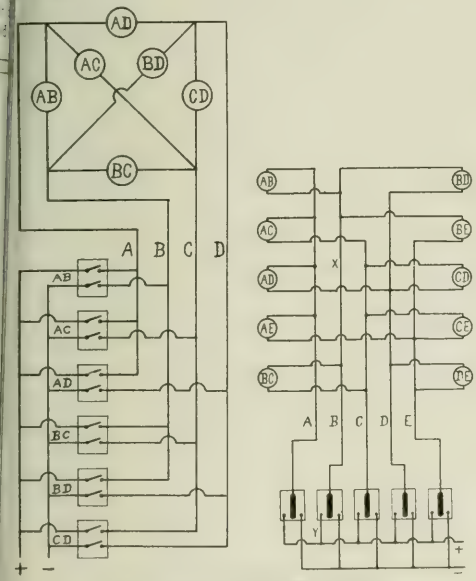
over both edges of the lower side of a girder and becomes very firm and reliable support. The central space between th hooks at their base should be filled with iron or some othe suitable substance, provided the bar or link does not fill it, i order to make a good appearance when the hanger is complete

LETTERS ON PRACTICAL SUBJECTS

A METHOD OF OPERATING SIGNALING DEVICES.

The method here described enables one to operate any one of a number of signaling devices, such as lamps or relays, at a distant point with the use of fewer wires than are required by the ordinary methods, and does not require the use of special apparatus. The receiving device must, however, respond to the definite voltage, but not to half of this voltage. For this purpose incandescent lamps are suitable. The voltage may be so selected that the lamps receiving one-half of this voltage just fail to glow. The lamp receiving full voltage will then be lighted.

Fig. 1 illustrates a sending station (at the bottom of the illustration) connected by four wires to a receiving station (at the top of the illustration). At the receiving end a lamp is connected between every possible pair of wires, all of the lamps being alike. There are six such pairs of wires: *AB, AC, AD,*



FIGS. 1 AND 2.—SIGNALING CIRCUITS.

BC, BD, CD, and the lamps are here designated by the wires to which they are connected. Let any two wires, such as *A* and *B*, be supplied with an e.m.f. of e volts at the sending station by closing the switch *AB*. Neglecting the drop in the wires, the lamp *AB* receives the full voltage e. The current also flows from *A* to *B* through two series of two lamps each, *AC* and *BC* in series, also *AD* and *BD* in series. The lamp *CD* is connected to the middle points of the two series of two lamps, and both terminals are at the same potential. Lamps *AC, BC, AD, BD* receive the voltage $e \div 2$, and if e be properly selected they just fail to light. Of the six lamps, *AB* alone receives voltage enough to cause it to light. On account of the symmetry of the connections the same reasoning may be applied to any other lamp.

Suppose now that there are N wires, designated as *A, B,* . . . *N*, between the stations. There are $N(N-1) \div 2$ combinations of two wires each, and consequently any one of that number of lamps may be lighted. Let it be the lamp *AB* and let i amp be the current consumed by a lamp when fed with the voltage e. When the voltage e is supplied to the wires *A, B,* lamp *AB* receives this voltage. Current also flows between *A* and *B* through the various series of two lamps each, such as *AC* and *BC, AD* and *BD,* . . . . *AN* and *BN,* there being $N-2$ such series, since there are $N-2$ wires besides *A* and *B*, and each of these wires joins to the middle point of a series of two lamps. Each of the other lamps, such as *CD, CE* . . . . *CN, DE,* . . . . etc., neither of whose terminals connect to either *A* or *B*, joins the middle points of two series of two lamps each and receives no current. Each series of two lamps consumes $i \div 2$ amp, neglecting the variation of resistance with temperature, and $N-2$ such series consume $(N-2)\,i \div 2$ amp. Adding to this the current i consumed by the lamp *AB* the total current consumed is $Ni \div 2$. The economy in wire is gained at the expense of using $N \div 2$ times as much current as would be required if it flowed through only one lamp.

In the table are given, for the various number of wires between stations, the number of lamps of which any one may be lighted at will, and the current required for operation, where the current used by one lamp receiving the voltage e is taken as unity.

Number of wires.	Number of lamps.	Current.
2	1	1.0
3	3	1.5
4	6	2.0
5	10	2.5
6	15	3.0
7	21	3.5
8	28	4.0
9	36	4.5
10	45	5.0
11	55	5.5
12	66	6.0

To connect the wires to the source of electricity double-pole, single-throw switches, as shown in Fig. 1, may be used; or a double-throw switch may be substituted for two single-throw switches.

Fig. 2 shows a five-wire system controlling 10 lamps, but with a single-pole, double-throw switch for each wire. To light a given lamp, for example, *CD*, the *C*-wire switch is thrown in one direction and the *D*-wire switch in the other. The first switching device requires more complicated wiring, but is more easily operated since there is but one switch to be operated for each indication and each switch may be designated by the indication that it controls. The mistake of closing two switches, such as *BC* and *CD*, at the same time may result in a short-circuit unless special means, such as resistance between the source of electricity and the switches, be used to prevent it.

The second method requires the operation of two switches for each indication, and it is less easy to designate what switches to operate in order to give a certain indication. The number of different signals that may be transmitted with a given number of wires may be doubled by using between each pair of wires two receiving devices sensitive to opposite directions of current. These may be polarized relays. So far the resistance of the wiring has been assumed to be negligible with reference to the resistance of the receiving devices. If the resistance is symmetrically distributed, for example, equal resistances placed in series with each of the lamps or equal resistances located in each of the line wires; this requires that the voltage at the sending end be higher than that required by the lamps, but does not unbalance the distribution of voltage to the lamps. If the resistance is unsymmetrically located, as, for example, an abnormally high resistance at the point *X* or *Y*, Fig. 2, the lamps may not always receive the proper voltage and a special study of the case should be made where it is necessary to have the resistance unsymmetrically placed.

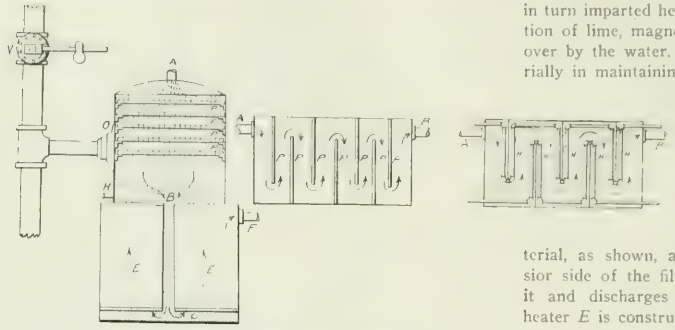
The foregoing shows that an increased number of signaling devices may be operated, one at a time, with a given number of wires, by placing a signaling device between every wire and every other wire at the receiving station. These devices may be lamps, relays, etc., which respond to a given voltage, but not to half of the voltage. The saving in wire is accompanied by an increase in the current required.

ELIZABETH, N. J. E. P. McDERMOTT, Jr.

FILTERING FEED WATER.

The fact that feed water should in most cases be filtered before being fed to steam boilers is now almost universally recognized, and filters are employed in very many modern plants. There are various systems employed for the filtration and

elimination of the scale-making ingredients carried in suspension by the water. Some feed-water heaters are constructed to heat and filter the water at the same time, while others receive the water after it is filtered by an independent filter. Some years ago no attempt was made to filter the water for steam boilers. At first the cold water was pumped directly into the boiler without passing it through any kind of heater, thus



FIGS. 1, 2 AND 3.—FEED WATER FILTER

facilitating the rapid destruction of the boiler, not to mention the waste of fuel incident to such practice. The addition of the feed-water heater to the plant served to lengthen the working life of the boiler, and resulted also in a more economical use of fuel. No engineer operating a plant of any pretensions would think of doing without a feed-water heater nowadays, and in the near future small plants will also be equipped with some system of filtration that will insure clean feed-water for the boilers.

To pump impregnated unfiltered water into a boiler is poor engineering to say the least, especially when the enormous amount of heat thrown away daily in the exhaust steam of the various plants is taken into consideration. Fig. 1 illustrates a sectional view of a type of feed-water heater that has combined with it a filtering chamber. The cold water and drips from different apparatus enter the heater at *A* and fall into pan *P*. When this pan is full, the water overflows and falls into the next pan P^1 in the form of a thin sheet or film, and this overflowing of the water is continued from pan to pan until it enters pipe *B*. The water now falls into chamber *C* and passes upward through the perforated bottom or screen, and through whatever filtering material may be inserted in the chamber *E*. The water will now appear at pipe *F*, which is connected with the boiler feed pump. If the quantity of water filtered and heated is greater than the amount required by the boilers, the surplus water will overflow at *H* and pass out to the sewer or storage tank. The exhaust steam entering the heater passes through the oil eliminator *O*, and striking the thin sheets of falling water raises the temperature of the water considerably. If the amount of water entering the heater be lessened and the back pressure valve *V* be partially closed, the temperature of the feed-water may increase to 210 deg. Fahr. In operating a heater and filter of the "open" type it is good practice to gage the amount of water entering the heater so as to prevent waste or loss at the overflow. Fig. 2 is a plan view of an independent filter and is not combined with a heater. The cold water and returns from the various drips, etc., enter at *A* and after circulating through the filtering material as indicated will flow out at *B*. The water is then taken by the pump and discha into a "closed" heater, whence the water flows to the bo With this style of filter it was found that the eliminatio scale-making ingredients carried in suspension by the w was not sufficiently rapid, so the partitions *P P*, etc., were moved and heating coils inserted in their place and sheet partitions were fitted between each coil, as shown at *H*, Fig Exhaust steam being utilized to heat the coils, the heated in turn imparted heat to the water, compelling a greater dep tion of lime, magnesia or what injurious material was car over by the water. The filtration of the water assisted m rially in maintaining a clean feed-water heater, which in t aided an elevation of the feed-water t perature. Fig. 4 illustrates an import type of filtering plant, the filter be shown at *F*, the foreheater at *E* and main closed heater at *H*. The feed-wa passes through the foreheater *E*, whe the water flows into the gravel or c side of filter *F*, through the filtering m terial, as shown, and thence up through the sand or exc sior side of the filter and out at *D* where the pump *P* tak it and discharges it into the main heater *H*. The fo heater *E* is constructed with three chambers, the middle cha ber being fitted with a number of brass tubes. The up chamber is divided in two parts by the plate P^1. The lo chamber is the largest and is provided with a mud-drum a blow-off cock. The cold feed-water flows through the tub on one side and up through the other side as indicated, then out to filter *F* through pipe *I* where it circulates through t filtering material as before explained. The exhaust enters t tube chamber of the foreheater *E* as shown, and circulat around the outside surface of the tubes. The cold water ente ing the tubes causes condensation, which is carried by means of a drip shown at *D*. By lowering the bac pressure valve *V* or by partially closing the valves *M* a *N*, the feed-water temperature can be raised to the boilin point or above it, depending of course on the amount of ex haust steam flowing in the main exhaust pipe *G*. The additio of the foreheater to the filtering plant eliminated a large amou of deleterious matter that would otherwise have to pass throug the main filter. Thus the filtering material in *F* remained clea for a much longer period of time, thereby obviating the nece sity of changing it often. Previous to the installation of th

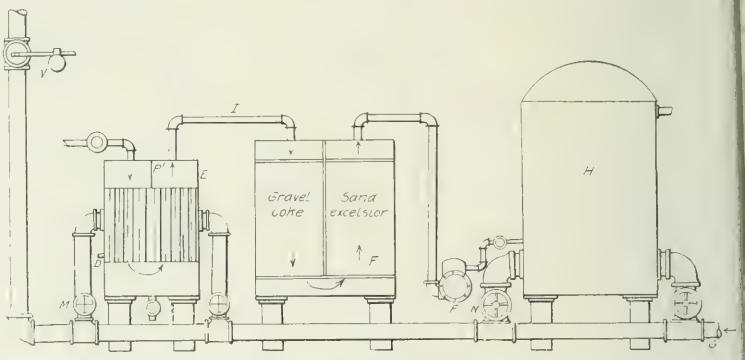


FIG. 4.—CONNECTIONS OF FILTERING PLANT.

foreheater the filtering material had to be changed every six months, but now once a year is sufficient. Of course, the mud drum attached to *E* should be blown regularly and particularly in the morning before starting up the plant, if the latter is shut down over night.

BOSTON, MASS. K. W. DENTON.

ATTRACTIVE ELECTRIC SIGNS.

Electric signs may be divided into three classes: those formed of letters giving the name of the concern or the merchandise

and perhaps extolling its advantages; those which show in part or in whole pictures of the articles to be advertised, and freak conceptions which arrest the attention of the observer for a time by the novelty or mystery. It is with the third class of sign that the writer wishes to deal. The design, construction and operation of startling electric signs have taken the attention of some very excellent designing engineers, though it is safe to predict that this matter is at present in its most crude state and that it will continually increase in efficiency and attractiveness. Meanwhile, the demand for freak signs is increasing rapidly and it behooves both the designing engineer and the electrician to give this matter the attention which it demands and is entitled to. A sign arranged for the corner of a building at the intersection of two streets is diagrammatically represented by Fig. 1. The building walls *a* and *b* have been cut away, as shown, leaving the post at the corner if required by the building-inspecting department. If they will let the corner be removed so much the better. The height of each opening is equal to its width, so the holes in the walls must be square or they may be made round, if so desired. The inner sides of the openings thus made are closed by means of mirrors *c* and *d*. The presence of these mirrors makes the action of the apparatus all the more striking. The mechanism of the installation consists of the arms *e* and *f*, which are journaled at the center upon a shaft.

Each of these arms carries one incandescent lamp. Thus there are four lamps upon the arms, two of which are white and two are red. The arms are arranged to revolve in opposite directions and make about 60 to 70 complete revolutions a minute. A small electric motor is used for rotating the lamp-arms and for driving the commutator, which is necessarily the vital portion of this piece of apparatus. Before describing the commutator it will perhaps be best to try to represent what this apparatus accomplishes in the way of disturbing the peace of mind of the passerby until he must look at the whirling light in spite of himself. Fig. 2 shows the manner in which the lamps are displayed. The apparatus is made to go through a sort of cycle consisting of 16 complete revolutions of each double arm. The commutator makes one complete revolution during each cycle, and therefore must be geared to the revolving arms in the proportion of 1 to 16. Referring to diagram *A*, Fig. 2, the arms *a* and *b* carry white and red lamps, respectively, and are marked "white-1" and "red-1." These arms revolve clockwise while the other set of arms, *c* and *d*, revolve counter-clockwise upon the same axis and carry white and red lamps known as "white-2" and "red-2" and are distinguished in that manner through all the following diagrams. The arrows

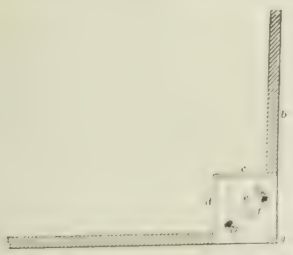


FIG. 1.—DIAGRAMMATIC REPRESENTATION OF A FREAK ATTENTION COMPELLER.

in the circle surrounding each diagram indicate the direction in which the lamps revolve, and this may be simplified by remembering that red and white lamps marked "1" always revolve clockwise, while red and white lamps marked "2" always revolve counter-clockwise. This must be fully understood in order to comprehend the manner in which the various effects are secured as shown by the diagrams in Fig. 2. In the arrangement here described each effect is sustained through two complete revolutions of the arms of the "startler," as this device may well be called. As each diagram represents one complete revolution of both sets of arms, therefore, the diagrams are shown in pairs, each pair being alike. Diagrams *B* and *C* show white lamps only, but revolving in opposite directions. Diagrams *D* and *E* show the white lamps revolving in opposite directions with a flash of red each time the white and red lamps cross each other. This is one of the most "teasing" effects presented by this mechanism. The next diagrams, *F* and *G*—the third effect—is simply one white and one red lamp revolving in opposite directions. This effect merges into the next, consisting of revolving red lamps in opposite directions,

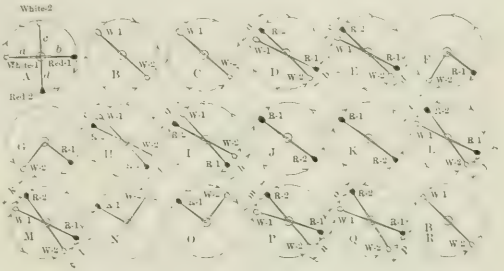


FIG. 2.—LIGHTING CYCLE WORKED OUT IN REVOLUTIONS.

enriched by flashes of white when the white and red lamps pass each other, much the same as in effects *D* and *E*, except that those were white with red flashes, while *H* and *I* are red with white flashes. This effect merges into solid red lights revolving in opposite directions during the revolutions *J* and *K*, then the red lamps are flashed with white again in effects *L* and *M*, which in turn merge into white and red in opposite directions much the same as in *F*, *G*, except that the lamps, both white and red, revolve in opposite directions in effects *N* and *O*. Effects *P* and *Q* call for another flashing of red against white lamps revolving in either direction, the white lamps revolving steadily in either direction, while the reds are flashed at the point of opposition of the lamps, to use an astronomical term. If the operations be tabulated the following will be the result:

A—Arrangement of lamps and arms.
BC—Two revolutions, No. 1 white clockwise, No. 2 white counter clockwise.
DE—Two revolutions, Nos. 2 and 1 white clockwise, Nos. 1 and 2 red flash counter-clockwise.
FG—Two revolutions, No. 1 red clockwise, No. 2 white counter-clockwise.
HI—Two revolutions, Nos. 2 and 1 white flash clockwise, Nos. 1 and 2 red counter-clockwise.
JK—Two revolutions, No. 1 white and red clockwise, No. 2 red and white counter-clockwise.
LM—Two revolutions, Nos. 1 and 2 white flash clockwise, Nos. 1 and 2 red counter-clockwise.
NO—Two revolutions, Nos. 1 and 2 white clockwise, Nos. 1 and 2 red counter-clockwise.
PQ—Two revolutions, Nos. 1 and 2 white clockwise, Nos. 1 and 2 red flash counter-clockwise.
BC—Two revolutions. Same as *BC* at beginning, thus completing the cycle.

The manner in which the lighting and the flashing of the lamps may be effected is shown in Fig. 3, which represents a 19-brush commutator and the lay-out for the same. The line wires are attached to the outermost sections of the commutator, or rather to the brushes belonging to those sections. Each lamp has been given two brushes: one for the positive, the other for the negative terminal of the lamp wires. While the working of the sign could be accomplished by means of only one commutator section to each lamp, the negative connections being in common, it is evident that the display possibilities are much greater where there are brushes for each lamp return wire, as well as for the positive wire. Therefore, the double brushes were used. It will be observed that the positive brushes are all grouped together at one end of the commutator, while the negatives are grouped in a corresponding manner at the other end. This permits one-half the commutator sections to be in electrical contact with each other while insulated from the commutator shaft and from the other half of that device. The negative end of the commutator is electrically connected and insulated in a similar manner, thereby securing a very easily made and maintained commutator. By referring to the development portion of Fig. 3, the arrangement of the necessary

contacts becomes visible at a glance. The sections are marked 1, $R1+$, $R1-$, $R2+$, $R2-$, $W2-$, $R1-$, $W1-$, and —. These characters refer to leads to and from lamps of corresponding color and direction of rotation, bearing in mind that all the lamps marked 1 revolve in a clockwise direction, while those marked 2 revolve in a counter-clockwise direction. The column of letters at the left of the development diagram refers to the revolutions of the lamp-arms. The dotted lines extending horizontally across the development represent the movement of the commutator during one revolution of the lamps. Thus, the spaces to the right of *JK* between the dotted lines are the particular portion of the commutator which will be revolved beneath the brushes during the two revolutions diagrammed at *J* and *K*, Fig. 2, which would be the ninth and tenth revolutions of the lamps. It will be seen that there are some very short commutator segments shown, and these are for the purpose of working the flash which takes place at four points in the display cycle. For instance, in revolutions *C* and

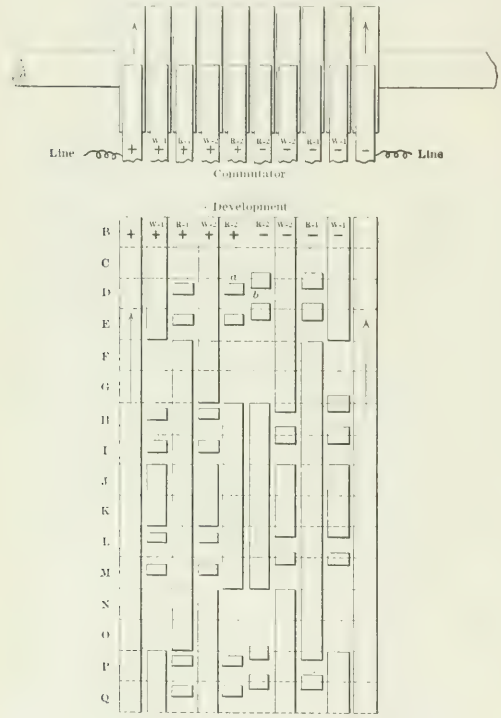


FIG. 3.—COMMUTATOR AND DEVELOPMENT.

D, $R1+$ and $R2+$ are to give flashes at some predetermined portion of the revolutions *D* and *E*. The position of the contacts in the dottel space shows that contact will be made and the red lamps lighted somewhere in the first quarter of each revolution named. This is easy enough. Although the exact point at which it is desired the lamps shall glow is not shown by Fig. 3, it cannot be known until a lay-out on a larger scale shall have been made of the angular revolution of each pair of lamps and proper allowance made for the time necessary to bring the lamps to a bright glow after the commutator and the brush have made contact. This is comparatively easy, and the time can be determined with great exactness by means of a pair of trial contacts, which can be advanced or retarded to determine the exact point at which the brush should touch the commutator segment. But easy as the proper lighting of any flash-lamp may be, the extinguishing of that lamp at the proper instant is quite a different matter. In Fig 2 it will be noted that the flash points are indicated by the letters *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*, *j*, *k*, *l*, and *m*, *n*, *o*, *p*. Each of the spaces indicated by one of these letters covers approximately one-eighth of a complete revolution of the lamps and arms. The space covered by any one of these letters would then equal one-eighth or less of the proper space *DE*, *HI*, *LM* or *PQ*, shown between the dotted lines in Fig. 3. Allowing the commutator to be a little more than 5 in. in diameter, the segments representing revolutions of the lamps would be 1 in. long, and to make a flash of one-eighth of a revolution a brush must be on a segment exactly ⅛ in. long. This is not practicable. There would be no wearing quality to such brushes, and there could be not thickness to the brush which must be presented radially to the segment in order to make and break the contact quick enough. To avoid all this trouble and to allow the regular tangential brushes to be used, the expedient has been adopted of putting in good, wide contact segments and then cutting out the lamps by means of the negative brush-segments. It is for this purpose that the double-brush arrangement for each lamp is found advantageous. Considering, for example, the segments in section *D* below $R2+$ and $R2-$, it will be noted that the distance between the forward end *a* of the positive segment and the rear end of negative segment *b* is very small. But the distance *ab* represents the time electricity will pass through lamp *R2* and the lag due to time of lighting and time of extinguishing can be closely allowed for by sliding *a* or *b* ahead or backward, as found necessary. In addition to the commutator shown by Fig. 3 it will be necessary to provide collecting rings on the shaft about which the lamp-arms shall revolve. Two plain rings and brushes for each lamp will be necessary, four rings to each pair of arms, or eight rings in all. These may be mounted upon the hubs of each pair of arms. There will be very little wear, as no sparking need occur, the circuit never being broken between these rings and their brushes. In addition to a 1 to 16 gearing (positive) for driving the commutator described and shown by Fig. 3, there must also be equal gearing connecting the two sets of lamp-arms so that these shall revolve in opposite directions at the same rate of speed. Link belting or spur gears may be used for this purpose, but the engineer should not trust to friction gearing, such as ordinary belts, for the proper synchronism cannot be maintained. By means of six sprocket wheels, including a nine-toothed one on a motor running at 300 r.p.m. and a few feet of link belting and one countershaft, the lamp-shaft and the commutator can be driven in good shape, the reverse motion of the two sets of lamp-arms being included in the material noted above. This is a cheap drive which may be used to advantage when there is a space of several feet between the motor and the shaft upon which the lamp-arms are located. The countershaft in this case should be placed close to the motor, and the commutator next to the lamp-shaft, though the latter is not necessary. It simply brings the commutator close to the lamps, but the distance between motor and lamp-shaft is necessary on account of the slight angular arrangements requisite to obtain the required reverse motion in one of the lamp-arms with the chain drive.

WILLOUGHBY, OHIO. JAMES F. HOBART.

CONVENIENT LAMP SOCKET.

Oftentimes electric-light companies receive complaints from customers of low voltage and poor light, whereas the trouble may be due to old lamps. To send a man with a voltmeter to measure the potential at the meter, while it may satisfy the electric-light company, may or may not satisfy the customer. It has been suggested that in place of a voltmeter test a man convince the customer by means of a new lamp. For this purpose a double socket may be connected to a flexible cord to the other end of which a plug is attached. If the voltage is right, it is an easy matter to convince a customer that the trouble is with the lamps by simply burning a new lamp and one of the customer's lamps side by side in the double socket. The difference is seen in an instant and may be accentuated by first burning the old lamp over a paper and then the other.

COLUMBUS, OHIO. HENRY WITTPENN.

QUESTIONS AND ANSWERS

Is it possible to correct or rewind a 110-volt direct-current fan motor any way to operate on a 110-volt, 60-cycle circuit? C. J. B.

A fan motor primarily designed for direct-current circuits cannot be made to operate satisfactorily on alternating-current circuits. There are, however, on the market series alternating-current commutator motors designed primarily for such service which will also operate satisfactorily on direct current.

Kindly give a brief history of the electric arc lamp. C. C. S.

The first practical arc lamp was that of Foucault, 1844. In this hard carbons were first used for electrodes, and the lamp was regulated by hand as in the case of the present projection lamps. The first automatic arc lamps were those of Wright, 1845; Staite, 1847; Archereau, 1848, and Foucault, 1849, none of which, however, was a practical form. Lacassagne and Thiers in 1856 were the first to use the differential principle. Serrin, in 1857, and Duboscq, in 1858, completed the clock-work lamp, now used entirely in Europe with only changes in detail from the originals. The clutch lamp was patented by Brush in 1878.

If a transformer is supplied with a primary e.m.f. of 1000 volts and has 1000 turns on the primary, how many turns must there be in the secondary to have an e.m.f. of 104 volts at the terminals of the secondary? J. R. L.

When upon the primary terminals of a transformer having 1000 turns there is impressed an e.m.f. of 1000 volts, the e.m.f. of the transformer is 1 volt per turn. This same value of voltage will be obtained on each turn of the transformer independent of whether it belongs to the primary circuit or the secondary circuit, so that in order to obtain a secondary e.m.f. of 104 volts it will be necessary to use 104 turns. You will, of course, understand that the secondary e.m.f. would be 104 volts on no-load and that it will decrease with the increase of load on account of the losses within the transformer, reaching probably 100 or 102 volts at full-load.

An alternator supplies energy for a three-phase induction motor rated at 35 hp, 88 amp, 220 volts. The meter readings in the station indicate 88 amp, 2600 volts, and the power factor is about 70. The transformers are connected in delta, and the primary is fused for 18 amp. The fuses for the motor are rated at 120 amp per phase, yet at times they blow. I claim that the motor is overloaded and delivers about 40 hp to the shaft; but in the mill where the motor operates they claim that the motor does not give more than 20 to 25 hp. E. B. DeP.

An induction motor designed for a normal current of 88 amp at 220 volts is not operated at overload when it requires from the supply system a current of 8 amp at 2600 volts. The normal current at the latter voltage would be 7.5 amp, while the extra ½ amp would hardly be more than sufficient to supply the extra transformer loss. According to the data supplied your three-phase, 35-hp motor and the connecting transformers are using a total of about 25 kw, which is not excessive, although the motor is practically fully loaded.

Will you kindly inform me if there are any articles describing the principle and advantages of the split-pole synchronous converter? Also articles regarding the improved type of single-phase commutator motor referred to in the editorial in the issue of January? L. D. B.

The split-pole synchronous converter is a machine invented by Mr. Woodbridge and described several times in papers presented before the American Institute of Electrical Engineers. It was discussed quite fully at the meeting of the American Institute of Electrical Engineers, held in New York during February, 1908, and also at the recent Atlantic City convention of the Institute. Outlined descriptions of this machine were given in our columns. The improved type of single-phase commutator motor referred to in our issue of January is a machine invented by Mr. Alexanderson, of the General Electric Company, and described by him in a paper presented before the American Institute of Electrical Engineers in January, 1908. An outline of this machine was also given in our columns.

I am seeking information on the following: In a magnetic exchange of 100 telephones giving party-line rural service at $12 per annum, how much of the amount is usually required for exchange or central service? How much for the care of subscribers' stations? How much for use of telephone instruments? For reserve against damage by storms? For profit? C. S. S.

According to the most reliable information that we have been able to obtain, the operating expenses of the average telephone system of the United States are subdivided in, roughly, the following proportions:

Salaries of general and other officers	$5.25
Salaries of clerks, etc.	4.65
Wages	26.37
Maintenance and legal expenses	13.33
Rentals and royalties on instruments and apparatus	2.84
Rentals of office and other real estate	2.50
Rentals of conduits and underground privileges	0.68
Telephone traffic paid or due to other companies	0.44
Miscellaneous	0.82

The operating expenses as outlined above form about 70 per cent of the gross receipts from operation.

Have had a strange experience with a generator, and would thank you for any information on the matter. I was turning down the commutator of a 100-kw, 500-volt generator taking energy from another similar machine to supply the shunt-field coils, and energy for the armature was taken from an exciter. The exciter was working on a motor-generator set, the motor of which was wound for 2200 volts and the generator of which was giving 60 volts. The exciter was working as a compound machine and was rated at 9 kw. The field circuit was closed, and on closing the 60-volt armature circuit the machine made 8 or 10 revolutions in one direction and then quickly stopped and started to turn in the opposite direction 4 or 5 times, when the armature fuse blew. Evidently the series field in the exciter bucked the shunt field; but they were both working together or in the same direction when started. After short-circuiting the series field coils in the exciter, no further trouble was experienced. H. F. F.

The action described can be attributed to the interrelations existing when the armature of a separately excited machine is connected to a series-wound generator. This action is fully described in Nichols' "Physical Laboratory Manual." When the armature of the separately excited machine is stationary, the series-wound generator tends to send current through the armature in a certain direction and to accelerate this armature to a certain speed. As the armature increases in speed its counter-voltage increases also so that finally the counter-voltage equals and overpowers the voltage of the series generator. The current in the circuit is then reversed, the magnetism of the series generator is also reversed; it builds up e.m.f. in the reversed direction and sends a reversed current through the armature of the other machine, brings it to rest and accelerates it to a certain speed in the reversed direction

An alternating-current induction motor is wound for 220 volts, two-phase, 60 cycles. The machine has 72 coils and is of the four-pole type Can it be changed to a three-phase motor either "delta" or "Y" connected without reducing or increasing the voltage? If the voltage is reduced or increased, what percentage of the above voltage will it be? C. F. K.

The coils of a two-phase, 220-volt, 72-slot induction motor of the four-pole type can readily be rearranged so as to render the motor useful on three-phase circuits. There being 72 coils total, there are 18 coils per pole and hence nine coils per pole per phase (per group) in the motor as now wound. These coils should be disconnected and then rearranged into 12 groups, each containing six coils. There are now three groups per pole, one group being for each phase. The four groups for each phase should be joined in proper series parallel arrangement to produce three windings for the three phases. When these three windings are joined in star the motor could be operated at the same magnetic density as used before at 200.3 volts, or they could be joined in delta and operated at 155.5 volts. It might be well to remark in this connection that instead of operating the star connection at, roughly, 270 volts it be operated at 220 volts: the motor could carry its normal full load at a slightly increased copper loss and a slightly decreased iron loss, so that the efficiency would be practically unchanged. This is the method ordinarily employed.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

The Electric Automobile at Rockford, Ill.

About three years ago an account was given of the remarkable development of the electric automobile business at Rockford, Ill. Since that time the number of electric vehicles at Rockford has doubled, and the city still holds the record of having the largest number of electric automobiles per 1000 of population of any city in the United States. Assuming that the population of Rockford is 50,000, in accordance with the post-office census, Rockford now has 2.6 electric automobiles per 1000 of population, there being 130 of these vehicles in use.

The electric automobile business in Rockford has not been the work of a day, but has been a gradual development. The unusual number of vehicles is due to the combination of several favorable conditions. The city is fairly level and well paved, and its size is such that the electric automobile is sufficient for all purposes within the city limits and for a limited amount of touring to neighboring towns. For a number of years direct current was distributed over an unusually large area, so that nearly all the larger residences were supplied with direct current easily available for charging automobiles. As a result of this, many private garages were built. A third and very important element in connection with starting the electric automobile business in Rockford was the care of batteries by the central-station company. The company had a storage battery of its own for voltage regulation purposes, located behind its offices in the main part of town. Adjoining this battery-room was a charging shed where charging would be done at any time. Besides charging the company's battery, the battery man would look over a consumer's vehicles and make any necessary small repairs. He would also keep track of the condition of batteries and would not allow them to deteriorate for lack of attention as they might have done without such expert care.

At present the central-station company has largely withdrawn from the battery charging and maintenance business, leaving this to the public garages. In this way the business has been gradually transferred and the garages are encouraged to sell and maintain electric vehicles. There are six public garages which do charging that are also prepared to maintain storage batteries.

RATES.

The Rockford Electric Company makes a rate of 4 cents per kw-hour to public garages which sign a contract agreeing not to charge during the company's peak. As a matter of fact, there would seldom be any desire to charge during the peak, as the vehicles are frequently in use during the early evening. These garages charge 6 cents per kw-hour for electricity used in charging. In other words, the wholesale rate is 4 cents and the retail rate 6 cents. The garage gets the 4-cent wholesale rate by virtue of its non-peak contract.

The rate to private garages is 6 cents per kw-hour, which is the same as the rate charged by the public garages. The charging in private garages would not naturally be on the peak, because if the charge were begun early in the evening the owner will have to get up in the night to cut the current off unless he let the vehicle charge all night and thus become much overcharged. The natural course is to let the vehicle begin charging at bedtime and cut it off in the morning.

There are 55 private garages. Some of these house several vehicles. Only two private garages use alternating current. Until two years ago there was nothing but direct-current service in the city. Although most of the residence district in which these garages are located has been changed from direct to alternating-current distribution for lighting within the past two years, a direct-current charging circuit has been allowed to remain through this district. On this circuit but little attention has to be paid to voltage regulation. It is being maintained because the company did not wish to ask all of its automob customers to purchase rectifying outfits when the change w made to alternating current.

Among the various garages are agencies for the followi electric vehicles: Pope-Waverly, Babcock, Baker, Woods a Studebaker.

YEARLY REVENUE

The yearly revenue of the Rockford Electric Company fro vehicle charging for the year 1908 was $60 on the average f each vehicle in the city. The average yearly income for ea vehicle in private garages was $42.50. This indicates that t vehicles charged at the public garages are used more than tho in the private garages. This is as would be expected.

The Rockford Electric Company also does charging of sparl ing batteries for gasoline automobiles at 50 cents each, the ra made by the public garages.

The largest garage, kept by the Joslyn Automobile Compan keeps a record of the batteries on all vehicles which at any tin come under its care so as to enable it to give owners the be service possible.

Non-Peak Power at St. Cloud.

The Public Service Company of St. Cloud, Minn., operatin in a town of 10,000 population, has 90 motors connected to it circuits. Most of its power is obtained from water. One in teresting feature of this company's load is that some of th power is on feeders which the company has the option to dis connect at times of peak load if there is not sufficient capacit at the power house to carry this power load in addition to th lighting load.

A Big Washing-Machine Motor Load.

The municipal electric light plant at New Ulm, Minn., seem to hold the record to date of electric washing-machines in us per 1000 inhabitants. Mr. Adolph Wagner, superintendent o the plant, reports that there are now about 65 electric motor driving washing-machines in the town, the population of whic is about 6000. There is thus more than one electrically driver washer for every 100 people. Many of these washers are of th cheaper types, adapted to any kind of power drive, and costing motor and all, from $30 to $40.

Renting Vacuum Cleaners in Minnesota.

The Albert Lea Light & Power Company has had for some time a $125 Duntley vacuum-cleaning outfit with 1/6-hp motor, which it has rented out at the rate of $1.50 per day, including delivery. An employee of the company delivers the machine at 5:30 p. m. and calls for it at 5:30 p. m. next day. The machine is engaged for several weeks ahead during house-cleaning seasons and for two or three days a week at other times, according to Mr. Ludwig Kemper, manager of the company.

At New Ulm, Minn., a similar machine has been purchased by Mr. Adolph Wagner, superintendent of the municipal plant, and this machine is rented out at the rate of $1 per day, including delivery.

Electric Automobiles at Minneapolis.

There are about 100 electric runabouts and 20 electric trucks in use in the city of Minneapolis. The largest of these trucks has a capacity of 15 tons. The Minneapolis General Electric

mpany gives its regular power rates for this class of busi-ss. The company has two kinds of power rates, both of hich give automobile charging a low figure per kw-hour.

The retail-power rate on the discount meter basis is 7½ cts per kw-hour for the first 52 hours' use per month of the rly maximum demand; 5 cents per kw-hour for the next 52 hrs' use; and 2 cents per kw-hour for all current used in ess of 104 hours per month of the yearly maximum demand. The retail power rate on a readiness-to-serve basis is $3 per nth per kilowatt of yearly demand, plus 2 cents per kw-hour f all current consumed. A maximum demand of 2.5 hp is umed in all cases for electric runabouts. About half of the ctric runabouts in the city are charged and cared for in the ners' private garages. The income to the central-station mpany from private garages is about $70 per vehicle per year.

Trial Electric Irons in New York City.

The United Electric Light & Power Company, supplying ternating current throughout the Borough of Manhattan, w York City, has recently sent to 100 of its consumers 5-lb. ctric irons on six months' trial. In forwarding the irons the mpany has stated that they are sent without cost of delivery rental, and are left at the consumer's premises for six nths' trial. If at the end of the trial the iron has not wed to the housekeeper's satisfaction that it is a useful, de-able and economical adjunct to the home, it will be called by the United Company and returned without expense to consumer. In addition to the irons which the United Com-ny has placed on trial with its consumers, a number of re-ests have been received and 100 more will shortly be deliv-d. If at the end of the six months' trial the iron proves tisfactory to the consumer, it will be sold outright by the ited Company for $3.50.

Business-Getting Methods of the Edison Electric Light & Power Company, of Amsterdam, N. Y.

By William H. Stuart.

The first electric light plant was started in Amsterdam, . Y., a city of 28,000 inhabitants, about 1885. The load was rried by one central station operated by three distinct com-nies: the Amsterdam Arc Light Company, the Amsterdam reet Railroad Company and the Edison Incandescent Light Power Company. The three companies were consolidated ter under the name of the Edison Electric Light & Power mpany, which in turn is controlled by the Fonda, Johnstown Gloversville Railroad Company. Energy is purchased from e latter company and distributed from a substation on Hen-etta Street, which is also used for railway purposes. Elec-icity is received at a potential of 13,000 volts and transformed a potential of 2000 volts for primary distribution circuits econdary 115-volt, single-phase circuits are used for lighting nd 230-volt, three-phase circuits for motor service. There are 99 arc lamps used for the street lighting, and the greater part f the commercial lighting load is obtained from business uses, mills, signs, etc. There are quite a few flatirons and so some heating and cooking appliances attached to the com-ny's lines. The motor load aggregates 760 hp., the largest ngle motor being rated at 50 hp.

The meter department is in charge of one man, who also oks after inside trouble-work and does small repairing jobs, c. A complete record is kept of the meter from the moment enters the company's possession. The meters are read every nonth, and on complaint the trouble is investigated at once by e office force and if not adjusted an order is issued to read, xamine or test the meter complained of.

The office of the company on East Main Street forms a part of the building and waiting-room of the Fonda, Johnstown & Gloversville Railroad Company. No showroom is maintained, the space available being only sufficient for bookkeeping departments, superintendent's and assistant's offices, and a small storeroom for incandescent lamps. In a short time the company expects to secure more commodious quarters on Main Street near the present office, where considerable room will be given to show purposes and for new-business work.

About three years ago a special solicitor was engaged to increase the load, the other employees and officials of the company also helping. The city was laid out in sections and each district thoroughly canvassed. As a further help the company advertised in the newspapers and trolley cars and distributed printed matter with the monthly bills. For a year the advertising matter of the Curtis company was used with good results. In two years the load was increased about 200 per cent. This was partly due to a low rate in effect at that time.

The rate for energy for lamps, signs and heating devices is 5 cents, less 10 per cent for prompt payment. The energy rate for motors is 3½ cents per kw-hour, with a discount of 5 per cent if the bill is paid within 10 days. Lower rates are given for large consumption. The minimum charge on all lighting installations is 50 cents per month. The minimum charge on the motor installations is $2 per month.

About three years ago the field at Amsterdam was entered by a water-power company and immediately the rates then obtaining for energy were lowered so as to hold the business and also to get new customers. The old base rate was 12 cents per kw-hour. Both companies suffered by rates too low for profitable business. The competing company is now in the hands of a receiver, and it is expected that in a short while the old schedule will be restored. The new-business work of the company was stopped during the financial depression, but will be started again very shortly with additional and renewed force

The officials of the company are: President, Mr. William Harris; vice-president, Mr. S. H. Shotwell; secretary, Mr G. M. Place; treasurer, Mr. L. K. Brown; manager, Mr. W. H. Collins, and superintendent, Mr. T. H. Pettengill.

Tungsten-Lamp Street-Lighting Results.

Mr. H. J. Gille presented a paper at the Minnesota Electrical Association convention at Minneapolis, March 19, on the use of tungsten lamps for street-lighting in which he gave figures on the life of lamps used in the installation on Nicollet Avenue, Minneapolis, described in the issue of July 19, 1908, page 141. He also called attention to the advantages of having brilliantly lighted down-town streets and offering suggestions to other companies in lighting their respective communities.

BENEFITS TO CITY.

The prosperity of any city is in no way shown to so marked a degree as in the illumination effects which the city presents by night to the stranger. After the offices and commercial houses have closed for the day, leaving the business district quiet, is the time when the city is judged by the visitor, who usually stops at some hotel and goes out into the streets. Then it is that the progressive merchant shows his wares in the show-windows under the most favorable conditions and gains many a future patron otherwise beyond his reach.

The advantages gained by the city with distinctive decorative street illumination cannot be overestimated. It produces a cheerfulness at night and extends a welcome to the visitor. The system of artificial street illumination should be artistic as well by day as by night—not too spectacular, but dignified.

In Minneapolis the development of the ornamental street-lighting system was the result of the energy of the Publicity Club. The plan carried out was to have the property owners pay for the installation and the tenants pay for the maintenance. At this writing two streets have been equipped and the club is now working on a large extension of this system.

The tungsten lamp has made ornamental street lighting possi-

ble on account of the greatly reduced cost. In fact, the cost with the carbon-filament lamp was almost prohibitive.

COST OF INSTALLATION.

In regard to the cost of installation and maintenance in Minneapolis, the cast-iron columns, complete with machine work, drilling and tapping, cost $85 per post delivered; erection, equipment and connections of post complete with five 100-watt tungsten lamps, $60 per post, making a total cost per post erected complete, $145.

COST OF OPERATION.

The Minneapolis General Electric Company operates these lamps for $78 per post per year. This includes energy, renewal of lamps, replacement of broken globes, repainting of posts once each year, cleaning globes at periodical intervals, and turning on and off. The lights on the four side-arms burn from dusk until 12 o'clock, and the lamp in the top globe from dusk to dawn each night.

LIFE OF TUNGSTEN LAMPS.

The lamps that are in use are General Electric, and are burned tip up. Records were kept on date of installation and removal of each lamp. In the first six months there were renewed 383 lamps. The average life of all burned-out lamps was 561 hours. If it is figured in the lamps of the original installation not burned out, of which there were 85, there is an average life of 725 hours. Of the original lamps not burned out there are seven center lamps which have burned an average of 2316 hours and 78 side lamps which have burned 1380 hours. It appears that the lamp used during the second three months was a better lamp than the first ones, as the company lost 223 lamps the first three months and 160 lamps during the last three months. The first three months the average life was 349 hours for lamps burned out, and the last three months 858 hours for lamps burned out. Adding the two together makes 561 hours, and adding the lamps not burned out of the original installation makes 725 hours. [Since this paper was written Mr. Gille informs us that the record for 246 days has become available, which shows the average life for all lamps for that period, including those not burned out, to be 780 hours. The lamps are bought for a potential of 2 volts higher than the circuit.—EDS.]

PROPOSED SYSTEM FOR OUTLYING STREETS.

In developing this system of street-lighting it may be interesting to state that the company is now working out ornamental street-lighting for the outlying districts with two 100-watt lamps on the post in the same position as on the side arms of those now in use. It hopes to be able to use a post that will cost considerably less money for the reason that a post can be designed for two lamps using 12-in. globes with the tip of the lamp up that will cost not to exceed $30, and with overhead connections the total expense of installation would be reduced to the minimum.

The system which is installed in Minneapolis at the present time is connected to the underground system and it is necessary to have patrolmen turn each individual post on and off. However, in the outlying districts, the company will endeavor to connect quite a number of posts on one circuit. In working out a system of illumination, especially for underground connections, it was found that the series system would be prohibitive for the reason that the cost of installation was very high. However, in the outlying districts it may be possible to work out the series system satisfactorily.

This system of illumination has great possibilities for the reason that it is the most satisfactory street illumination that has been devised up to the present. Its popularity is increasing and the tungsten lamp has made developments of this system possible on account of the efficiency of the lamps.

Electric Refrigeration in a Dairy.

BY R. L. LLOYD.

An article on the subject of mechanical refrigeration printed several months ago in the *Creamery Journal* included among its other deductions the following statement: "To the man who can afford the first outlay, the modern compressor supplies by far the cheapest and handiest way of producing the refrigerating effect; the first cost shows a constantly diminishing tendency."

The prohibition put upon the use of chemical preservatives, the enforcement of the food laws, and the strict attention given to milk inspection, are making the milkmen much more particular than they were some years ago. That they are appreciating the advantages of mechanical refrigeration with electric motor drive and central-station service is evident from the widespread introduction of the system.

An interesting case in this line is that of a dairy which handles 4000 qt. of milk per day and requires nine wagons for delivery purposes, where a refrigerating machine was installed three years ago. The machine is of the upright type, eight ton capacity, and is operated from a countershaft by a 15-hp motor. The dairy in question is illustrated in Fig. 1, and an enlarged view of the machine in Fig. 2. The machine is located in the rear of the dairy (Fig. 1), barely showing behind the workman at the right. The motor is up above in the center, inverted on the ceiling, where it is well out of the wet and slop incident to this business. In the right foreground is the pasteurizer, after leaving which the milk is passed through the cooler, and the temperature quickly reduced to 40 deg., when it is bottled and stored in the refrigerator until delivered.

The cooler just mentioned is divided into an upper and a lower section. The upper section, which receives the warmed

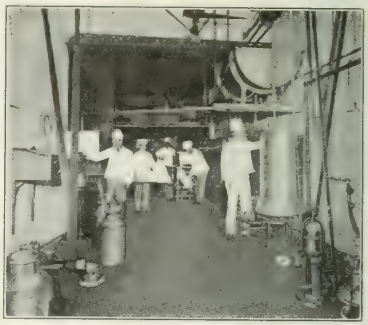


FIG. 1.—THE DAIRY.

milk, is cooled by water at 56 deg. from an artesian well. The lower portion carries refrigerated brine at a temperature of about 20 deg., which completes the rapid cooling of the pasteurized milk as it flows by gravity over the black tin tubes, within which the cold brine and water circulate.

The capacity of this pasteurizer is 60 40-qt. cans of milk per hour. About two hours are required for the pasteurizing and cooling of the day's supply. In round figures 100 cans of milk, each weighing 100 lb., or 10,000 lb. of liquid, must be cooled from 100 deg. to 40 deg. in two hours. This means that $10{,}000 \times 60 \times 0.9$ (specific heat of milk) $= 540{,}000$ lb.-Fahr. or b.t.u. must be removed from the milk in two hours, or 270,000 b.t.u. per hour. A refrigerating machine rated at 1 ton per 24-hour day utilizes 11,875 b.t.u. per hour; so that if direct expansion were used, and all this work were accomplished by the machine, there would be required a machine rated at over 22 tons on a 24-hour basis. The difficulty is overcome by the use of the brine, and the work required in one hour is accomplished with a smaller unit, spreading it over a period of three or four hours and storing it up in the brine tank.

To the left in Fig. 1 is seen the outside of the refrigerator box. This room is 26 ft. x 14 ft. and 8 ft. high, and is well insulated, with 11-in. walls. About 6 ft. of the rear end is partitioned off as a sort of freezer for the better keeping of cream. This section is cooled to 28 deg., while the main room is maintained at 32 deg. to 40 deg. The brine tank is located above this room and although entirely separated from it, is

ally a part of the refrigerator box. It contains 2000 gal. of lcium chloride brine. Some of the expansion coils are im-ersed in this brine and some are on the inside walls of the om. The freezer carries 50 per cent more feet of pipe in roportion to the cubic capacity than the main room. Eight or n hours' operation of the refrigerating machine in hot weather ols this mass of brine to 15 deg. Fahr. The brine is kept in otion by a small pump 12 or 15 hours out of every 24, except winter weather when the outfit is not needed. This same ump circulates the brine through the cooler as above explained. Vinter and summer operations differ to meet the varied con-itions as found. When the temperature of the water from the ity supply gets down to about 40 deg., as it will in Philadelphia round Christmas-time, this water is used and turned into both ections of the cooler and accomplishes the same result as the

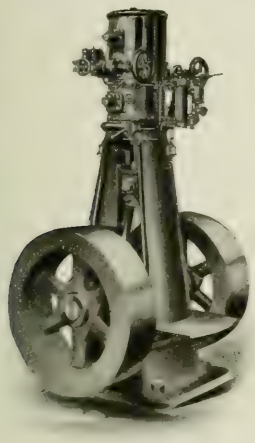


FIG. 2.—VERTICAL REFRIGERATING MACHINE

well-water and brine, without expense for pumping or cooling.

This method achieves a very economical refrigerating system, as the table herewith shows:

Total kw-hours per year	16,30[illegible]
Average kw-hours per month	1,36[illegible]
Maximum kw-hours per month (July)	2,832
Minimum kw-hours per month (February)	[illegible]00
Total kw-hours summer season (four months)	9,867
Total kw-hours winter season (four months)	576
Total yearly bill for electricity	$741 08

The ice necessary to cool the milk while on the delivery wagons is purchased during about 3½ or 4 months at regular market rates.

Some dairies have adopted the expedient of installing an ice-making plant to meet this need for ice. This is generally regarded, however, as a mistake. It increases the entire cost of refrigeration on account of the larger investment necessary and the additional space occupied, both of which are unproductive during the largest part of the year; and the electricity bills will usually be found to be higher, entirely out of proportion to the saving on ice bills. This might look like an argument against the installation of refrigerating machines, but it is not so. The making of ice and the production of refrigeration direct are two separate propositions. If everyone who wanted refrigeration must first make ice, small machines would never pay at the prices existing. There are losses at both ends—in making the ice, and in recovering the refrigeration by melting. These are avoided by direct refrigeration. Then, too, the machine must be of double size when figured in ice making—that is, a 2-ton machine making only 1 ton of ice and must be operated 24 hours per day to do it. Thus it is evident that where a 1-ton equivalent of refrigeration is applied direct costs $1, one ton of ice to do the same work of cooling would cost $2 if made by the same apparatus.

Standards for Gas and Electric Light Service in Wisconsin.

Prof. Charles F. Burgess, of the University of Wisconsin, who is the expert on light and heat of the Railroad Commission of Wisconsin, read a paper before the Engineering Society of Wisconsin at Madison on Feb. 25, discussing the standards for gas and electric service prescribed by the commission.

Professor Burgess stated that in many respects the gas and electric utilities are similar, through the fact that they both supply to the public the means for securing light, heat and power. They are active rivals in developing markets for each of these three commodities, and this in turn means that these industries are progressing.

After referring to the competition between these two classes of utilities and to their development, Professor Burgess said that with these rapidly developing arts the establishment of standards is a difficult matter when it is desired that such standards shall not imply the enforcement of stationary conditions. The public has gained much through the progress of the gas and electric industries, not only by reduction in price, but more in the amount of service which can be obtained for a dollar, and much more may be expected in the future. There was, he said, comparatively little in the way of precedent to guide in the fixing of standards. In certain places there were municipal and other government rules referring to the accuracy of gas and electric meters. Similar standards were found for restrictions as to the purity of gas. In a few localities the heating value of gas was prescribed, and in most cases where regulation of gas was attempted the principal restriction was in reference to the "candle-power." A most important factor in the adequacy of gas service relates to the pressure, but in comparatively few instances had standards relating to pressure been adopted.

The principal factors affecting adequacy of electric service are uniformity of voltage, and lamp efficiencies. In reference to these, no standards were found other than those which have been voluntarily adopted by individual companies for their own use. It is obvious that standards which are satisfactory in one locality may not be satisfactory in another. This may come through a difference in conditions relating to the supply of raw materials, through density of population, etc.

Professor Burgess said that in the matter of regulation of electric pressures the public has as great, if not greater, interest than in the regulation of gas pressures. This is due to the fact that the greater proportion of electricity is used for illuminating purposes in the incandescent type of electric lamp, and in such lamps the efficiency of illumination varies in a much larger ratio than does the variation of voltage. A 10 per cent decrease in voltage may result in a 50 per cent decrease in light. A close approach to ideal conditions—that is, constancy of voltage—is physically possible, but it may involve such excessive expenditure as to be prohibitive on the part of the company and undesirable on the part of the public, and it is in recognition of this factor, together with the desire to establish a reasonable limit upon the voltage fluctuation that rule 23 prescribes a maximum variation of 6 per cent of the minimum value.

Prior to the adoption of the standards by the commission, a conference was called, to which were invited representatives of each of the utilities in this State, as well as representatives of the governing bodies under which these utilities operate. In addition to this, invitations were sent to some of the leading authorities outside of the State, including representatives of the National Bureau of Standards. At this meeting the various factors were discussed and the stenographic report constitutes a record on file in the offices of the Railroad Commission. Professor Burgess stated that when further investigation and future development show the desirability of changing any of the rules, it is the intention that such changes shall be preceded by open hearings, at which those interested will be invited to take part.

As to the advantages of standards, Professor Burgess said that

the chief benefit is the insuring to the public of a reasonable and adequate service. That the public has gained much in this way has been abundantly demonstrated in the short time that the standards for gas and electric service have been in force in the State of Wisconsin. From a comparative study of the conditions before and subsequent to the decision of the commission on this matter, it is shown that there has been a marked improvement in the voltage regulation and in gas pressures, in uniformity of heating values, and less inaccuracy in meter registration.

It is, he said, a common, though erroneous, belief that discrimination between consumers is largely a matter of rate, but it can be shown that even greater discrimination may exist with rates on an equal basis, through errors in meters, through variation in gas pressures and electric voltages, through heating values of gas, and in efficiency of translating devices. Ninety-cent gas has little meaning unless the heating value of the gas is taken into account, and the people of one city who are paying $1.25 for gas may, in fact, be getting cheaper service through better quality than a neighboring place where the price is $1. While the strict enforcement of the standards adopted cannot completely eliminate discrimination from the standpoint of service, the discrimination which is legalized is such as cannot be avoided under commercial and practical conditions.

Improvement in service has been brought about in some cases by the extension and remodeling of plant and equipment, but in many more cases improvement has been effected through closer study and decrease in the carelessness of operators, with little, if any, capital outlay. At the beginning of the investigation there were few gas and electric pressure-recording gages in use in this State outside of the city of Milwaukee, while at the present time liberal use is being made of such instruments.

Various secondary benefits have resulted. Complaints on the part of consumers and misunderstandings between the public and the utility companies have been greatly reduced. The gas and electric companies have themselves been benefited, since the rules which are consistent with good management cannot work to the disadvantage of any of them, and good management is forced upon certain companies who are short-sighted enough not to appreciate the commercial advantage to be derived through furnishing good service. Satisfactory standards cannot do otherwise than contribute to progress.

The existence of rules defining what constitutes efficient equipment is a safeguard for many of the smaller companies in purchasing meters and other similar equipment. Of all the mass of technical literature which the gas and electric manager has at his command, there is little, if any, of it in which is pointed out the weakness of existing apparatus. Each manager is compelled to learn the shortcomings of the apparatus found on the market through the school of experience, and in this process the public may frequently be made to suffer. The routine work of the inspectors in the employ of the Railroad Commission results in an accumulation of data from which conclusions as to the efficiency of various types of apparatus may be drawn, and this information is in a measure available to the managers of the plants operating in the State.

The enforcement of standards and the prohibition of the use of equipment which cannot meet the requirements of good service induce the manufacturer to pay special attention to improvement, and evidence has been brought forth to show that manufacturers are equally interested with the utility companies in working to standards, and to this extent are the manufacturers, managers and public brought into co-operative relations.

Professor Burgess stated that the inspectors in the employ of the Railroad Commission are chosen as men who have had technical training, who have had experience in plant management and operation, and who, by reason of such experience, supplemented by wider experience acquired in inspecting numerous plants in Wisconsin, are competent to give assistance to less experienced managers who are frequently found in charge of some of the smaller plants. It is by no means the purpose of the engineering staff to act in the capacity of consulting engineers for the companies, but, incidentally, the plants may secure certain useful information which might otherwise come only through the employment of outside expert service.

One of the important premises upon which the Wisconsin standards are based is that efficient and good business management shall not be interfered with. This is in recognition of the principle that really good management is that in which both public and company share alike in the prosperity of the business. It is in recognition of this principle that no specific regulations are laid down as to what lamp-renewal policy shall be pursued by each electric company. It is an unsettled question among electric authorities as to what method is really the best one, and the Wisconsin standards of service require only that some suitable system of making lamp renewals shall be put in force by each company, leaving it to the management to select that which, in its judgment, best meets the conditions. It is required that a description of this method be made public and be placed on file with the Railroad Commission.

With this information, and with the accumulation of data based upon the observations on the working out of the various systems, Professor Burgess said it was possible that more specific recommendations, and even rules, may be adopted at some future time.

The standards thus far adopted have for their purpose the securing of reasonable and adequate service, but it may be pointed out that this is not necessarily synonymous with satisfactory service, if by satisfactory service is meant that which produces satisfied customers. It has been an interesting observation that in certain cities where service may be considered as adequate, as judged by compliance with the standards, there is more complaint on service than in certain other cities where the service is much poorer, and this is due to a certain element in plant management which cannot be met by a standard—that is the personal relations which may exist between the management and the public. Some companies are particularly successful in fostering a feeling of confidence and friendliness on the part of their consumers, while the management of other companies may be less fortunate and even neglectful of the commercial and other advantages which come through satisfied consumers. The only rule of the commission which touches upon this feature is that which requires gas companies to keep a record of complaints and to furnish a classified summary of such complaints to be submitted to the commission each month.

Whenever it happens that a gas or electric public utility makes a general reduction of rate of charge for service, the fact is usually given wide publicity through the press, but whenever a marked improvement in the quality of service is effected, which may mean much more to the consumers than does a small reduction in price, strange to say, this gain for the public does not appear to have general recognition. The public appears to be less appreciative of improved service than it is critical of defective service. Professor Burgess said that the record file in the engineering department of the commission has reached somewhat large proportions, and it contains many evidences of improvements which have been effected through the application of, or, at least, since the adoption of, the standards of service. These records show that instances of defective service have been pointed out to the utility companies and that many of such defects have been remedied. A great many more defects have been discovered by inspectors and remedied by the companies without even having been made a matter of record, and in very few cases have the companies showed unwillingness to comply with requests for improvements when practicable.

In addition to the regular routine work of inspection, additional work of a research nature is being planned and to a certain extent has already been undertaken. This research has to do particularly with matters which are of special interest from the standpoint of the public, such, for example, as the efficiency of gas water-heaters, the effect of variation of gas pressure upon efficiency burners, and the relative advantages of different methods of street illumination. In carrying out work of this nature the engineering staff is receiving assistance from various laboratories of the University of Wisconsin.

INTERIOR WIRING AND ILLUMINATION

Practical Photometry.

We have published recently several important articles dealing with standards of light and their relations, and with various phases of the present illuminating situation. As a whole, these various studies leave the impression that the subject of light and its measurement is in a rather undetermined and unsatisfactory state. So, indeed, it is from the standpoint of pure theory or of systematic philosophy, yet the case is not so bad practically as at first sight it would seem. Even as regards standards one need not sink into despair. True, there is no primary standard of a precision comparable with the standards of length and mass, and improvement in this respect is greatly to be desired; yet as a matter of fact the working standards in the form of incandescent lamps can be trusted down to the limits of precision in photometry, and that is farther than actual commercial measurements are likely to go for some time to come. A group of standard lamps compared, like the international standards of length, at one place, and distributed to the various nations undertaking to abide by them, could be trusted to hold the working unit intact for all commercial purposes for years—long enough to allow the development of a first-class primary standard to carry on the work. So long as a meter stick is exact, well within the limits of precision feasible in its required use, it is a pretty good practical meter stick, irrespective of its precise relation to the earth's quadrant or to wave length of light. When the outstanding discrepancy with respect to the so-called standard candle is settled or compromised by agreement, as is soon likely to be the case, it will be at once possible to have working standards agreeing among themselves with an exactness far within the errors that must be expected in first-class commercial photometry. Photometry at best is not a process of the highest precision, yet it is fairly comparable with the work of the ordinary run of commercial electric measuring instruments like voltmeters and ammeters, and is considerably better in exactness than the commercial meters by which the raw material of lighting is sold.

Hence, pending a long research on primary standards it is possible to have secondary standards of intensity that in the practical commercial sense are thoroughly efficient for the purpose in hand. The chief step that needs to be taken is the general acceptance of such secondary standards and a working agreement as to the terms of the comparisons with them. Our canonical standard of intensity is referred to the mean horizontal value while, as a matter of fact, commercial illuminants depend for their practical value on the total flux of light in all directions. It is now quite easy to determine by means of the sphere photometer the mean spherical "candle-power" of a source by direct reference to the working standards, so that we have at once available a consistent measure of light flux for commercial purposes—accurate, certainly, within the commercial measurements of the light-giving stuff sold. Until commercial meters are more accurate than photometers, one need not worry much about the residual errors, though, of course, every effort should be made to reduce them. The immediate practical need is a general agreement on the mean spherical candle-power which is proportional to the total light flux, instead of the shiftless scheme of evaluating only such part of the flux as is convenient for imposing upon the ignorant. Until there is agreement upon so simple a matter as this, further refinements are farcical. One can go a long ways in practical illuminating engineering without complicating the issue further. When it comes to the determination of illumination in situ, experimental work is complicated by the existence of a plurality of sources which, while the sum of their effects can be measured or, for that matter, calculated under certain fixed assumptions, remain of somewhat indeterminate relative utility. For example, there is not yet general agreement as to whether street illumination should be reckoned by the normal or the projected components of the light, and in interior work a similar discrepancy is introduced by the practical difference in utility of light from several sources. Such purely practical questions as are here involved are in the commercial sense vastly more important than the residual errors of photometry or the discussion of new units and nomenclature.

Another matter of very great and immediate importance is settling a basis, if only a temporary one, for color photometry. Modern illuminants run through a wide gamut of hues, and as yet satisfactory comparisons are undeniably troublesome, at least as regards the extremes. Here is a vital matter that needs thorough investigation. At present it is a constant source of contention. Until some of these fundamental matters are cleared up, it seems to us impracticable to reduce illumination to anything which approaches an exact science, or to clothe it in the garments of precise terminology. The unwillingness of even technical writers to fall in with an excellent system of units devised now a dozen years since, has been deplored, but from one point of view it is much better to hold it in abeyance for a while than to try to force it into use before the art has advanced far enough to utilize it intelligently. It is on record, and being consistent is not likely to be replaced by anything radically different. It holds the field, so to speak, until such time as practice gets within hailing distance of it. When that time comes—the time when scientific illumination has emerged from the present state of uncertainty—useful terms will slip from the pen naturally enough. For the present there is much work at hand merely to arrive at a general working agreement about fundamentals, the establishment of working standards, the settling of most points about methods of measurement and the determination of really fundamental physical relations. For such work the way is already clear and the main thing is to pursue it without wandering off into a quagmire in pursuit of theoretical will-o'-the-wisps. There is nothing more intensely practical in its ends than illuminating engineering, and while it chances to involve a great mass of intricate theory that must eventually be worked out, the vital issues for the time being are broad ones bearing directly upon every-day commercial work. The data and methods now at hand, while not ideal, are good enough to insure vast progress in the art when they are intelligently applied. It is a time for the illuminating engineers to get busy and get together—to produce the best results possible from the material at hand. It is the poor workman who quarrels most with his tools.

The Use of Tungsten Lamps from the Illuminating Engineering Standpoint.

In a paper presented at the recent convention of the Minnesota Electrical Association Convention, Mr. J. R. Cravath discussed the tungsten lamp from the illuminating engineering standpoint. Tungsten lamps, he said, require different treatment from ordinary incandescent lamps because of their greater size of bulb, higher candle-power and higher intrinsic brilliancy of the filaments. We commonly find tungsten lamps of 48 cp and 80 cp in use where carbon-filament lamps of only 16 cp or 32 cp were before used. This means an increased amount of light, but if the illumination is to be comfortable to the users, as well as efficient in its most practical sense, the direct light from the filament must be shaded, not only because of its effect on the eye, but because, as will be explained later, it is usually necessary for reasons of reflection efficiency.

If we are to use tungsten lamps efficiently, so as to meet competition of various kinds, we must study the points likely to cause loss of efficiency in connection with the various ways that tungsten lamps can be used. By the word "efficiency" in this sense is referred not only to the actual illumination in foot candles delivered where we most wish it as measured by a portable photometer, but also to the various physiological and psychological effects which go to make up

our judgment as to whether there is ample and sufficient illumination in a room. In other words, he used the term "illuminating efficiency" as referring to that which enables us to see clearly and to best advantage the things we most wish to illuminate. To obtain efficiency in this sense we must not only provide for efficiently reflecting or directing the light to places where it is most needed, but we must also consider the effect of the lamps themselves on the eye. Other things being equal, that room will appear best illuminated which has the light sources most completely shaded from the eye. This is for the reason that a bright light has two effects on the eye which interfere with the clearness with which we see surrounding objects. One of these effects, the oculists tell us, is that a bright light entering the retina of the eye reduces the sensitiveness of the retina to surrounding objects. The nerves appear to concentrate their attention on the light to the partial exclusion of surrounding objects. The other effect, which is slower in its action, is that the pupils of the eyes automatically contract in the presence of a bright light in order to protect the retina. Less light is admitted to the eye, and thus objects in a room with very brilliant light sources are apparently not so well illuminated as they would appear to be if the pupils were allowed a wider opening.

If we hang a bare incandescent lamp pendant in a room, a large proportion of the light of such a lamp is given off at angles near the horizontal. This light strikes the walls of the room at such angles as to be reflected back and forth between the walls and ceilings many times before reaching the plane we most wish to illuminate. Thus there is much loss by absorption on the walls and ceilings, as each reflection involves some loss of light.

We therefore have as a fundamental principle that efficient illumination can only be accomplished where the light reaches the working plane with but few reflections. Any scheme which permits a large amount of the light of a lamp to be given off horizontally without being intercepted by a reflector is sure to be wasteful, because such light does not reach the working plane directly or even after one or two reflections, but must be reflected back and forth many times before the light reaches the plane with the illumination of which we are most concerned.

There are two methods of securing good results in the use of tungsten lamps, both of which are being extensively used at the present time. Both involve the use of correctly designed, deep reflectors which intercept the large flux of light given off in horizontal directions and direct it in such a way that it can be efficiently utilized.

The method with which we are most familiar may be termed the direct-lighting system, in which a considerable percentage of the light is obtained directly from the lamp and the reflector placed over it. In this system, as applied to the general lighting of rooms, the lamps are placed pendant, equipped with deep reflectors. These deep reflectors, if scientifically designed, reflect from 55 to 75 per cent of the light downward at angles below 75 deg. from the vertical. They also shade the direct light of the filament from the eye, except at the tip of the lamp, which should be frosted. The general lighting of a room by this plan must be accomplished with translucent reflectors; that is, reflectors which allow part of the light to pass through to illuminate the ceilings and sidewalls.

There are four types of translucent reflector on the market for use with tungsten lamps at the present time: Prismatic reflectors, clear, enameled and frosted, as made by the Holophane Company; plain opal reflectors, as made by the Phoenix Glass Company and by Gillender & Sons; sand-blasted or frosted reflectors, as made by the last two companies, and "Opalux," a modification of opal, supplied in the West by the Central Electric Company. The sand-blasted reflectors, of course, allow more light to pass through and reflect less than the opal or prismatic. The amount that passes through an opal reflector is so dependent on the density of the opal that no general rule can at present be given as to relative performance of the opal and prismatic types. As a general principle, however, similar shapes of opal and prismatic reflectors g similar light distribution.

Enough has been said so far about the importance of havi reflectors completely cover the lamps so that we hardly need peat that any shallow or flat reflector which exposes a la portion of the lamp filament is not only inefficient, becaus allows a large flux of light to escape horizontally, but also p duces bad illuminating results because of the blinding eff the lamp is likely to have on the eyes of those in the ro In many cases it would be better to leave off the reflectors e tirely than to use small and shallow ones. A flat reflector te to darken the ceiling and allows excessive light to go to t side walls. This darkening of the ceiling with excessive si wall illumination adds to the glaring, blinding effect. In so cases glare is the only thing that will satisfy a customer, l our efforts should be in the opposite direction. We are doubtless experiencing difficulty in the smaller towns in per ading our central-station customers to invest the few ce necessary for shades and reflectors to cover tungsten lam This is especially true in the small towns, where rows of ba lamps hung on drop cords have heretofore been the rule i store lighting. The drop cord in itself is excellent for su porting tungsten lamps, but it is best the lamp be hung hi and that it be used with a deep reflector.

A second method of lighting which has attracted consid able attention from time to time is the indirect system, in whi the lamp is concealed and the light is obtained by reflecti from a light-colored ceiling. In this system the same prin ples as laid down in connection with reflectors for direct lig ing apply. To secure efficiency, a large percentage of the lig must be directed upward to the central part of the ceiling the room is small in order that the rays reflected from the ce ing may strike directly the central part of the room which wish most to illuminate. The reflector should, therefore, deep and of correct design, just as that used in direct lightin The efficiency of this system is less than that of a good dir system by 33 per cent or more. However, as compared wi an inefficient direct system, its efficiency may be higher. Ta a direct system in which considerable light may be allowed escape sidewise and in which the lamp is equipped with enclosing globe of diffusing glassware, which in itself absor considerable light. In such a case the efficiency of the dire system may be even lower than that of a correctly designed i direct system. The efficiency of the tungsten lamp has open up the indirect lighting field in a way that it has not be opened before. It is certainly a very comfortable method illumination. If it is to be efficient, it is evident that the ce ing must be of very light tint, that the reflector used for direc ing the light to the ceiling be of high efficiency, and that th user thoroughly understands the importance of frequent clea ing, since the reflector and lamp are hidden and likely to unnoticed. Indirect lighting manifestly calls for an opaq reflector, unless it is to be only partially indirect. Of the opaq reflectors, those with mirror coatings, such as the X-ra Frink and others, give the highest efficiency. White enam metal, polished metal and aluminum are considerably lower tha the mirror in reflecting efficiency. There is, however, co siderable difference in the life and the efficiency of differe kinds of mirror coatings. Some of them are notably short-live and unable to withstand the heat of the lamp.

It is evident that we may employ a combination of direct an indirect lighting. In fact, most of our so-called direct lightin is really a combination of the two methods, because part of th light is received direct from the lamps and reflectors and pa by reflection from the ceiling and walls. We can reduc shadows considerably by increasing the amount of indire lighting with translucent reflectors, by turning these reflecto upside-down and pointing them toward the ceiling. This giv some of the effects of an indirect-lighted room, but retains th disadvantage of more or less exposed sources of light and sti causes shadows sufficiently sharp to be somewhat annoyin One of the practical advantages of indirect lighting by reflectio

m the ceiling with the sources of light entirely concealed is t it is not necessary to pay so much attention to shadows as direct-lighting systems.

Another combination of direct and indirect lighting which, the writer's opinion, is to have a field of considerable usefulss, is a system wherein the general lighting is by the indirect thod, with lamps concealed behind opaque reflectors, this neral lighting to be supplemented at points where specially gh illumination is needed by completely shaded lamps, uipped with opaque reflectors. This does away with all the noyance caused by exposed lamps and produces excellent relts at reasonable cost. How great this annoyance of exposed mps is can only be realized by one who has used for some ne a system in which no lamps are exposed.

None of the systems enumerated is to have any monopoly the field in the future. Each will have its proper place.

Electric Signs on Atlantic City's Board Walk.

The name Atlantic City is inseparably connected with the mous Board Walk which skirts the ocean front, and is conuous from the Inlet to beyond the city limits, a distance of



FIG. 1.—ELECTRIC SIGN.

ver five miles. The walk varies in width from 20 ft. to 60 ft., nd is a rendezvous for fully 80 per cent of the people visiting nd residing at this all-the-year-round resort. The commerial possibilities of the walk for advertising purposes have not een overlooked by what are known as general or national



FIG. 2.—ANIMATED ELECTRIC SIGN.

advertisers. As a consequence the walk possesses a large number of electric signs, some of which are of the animated type, and all of which are large. Without exception, the signs which are of the individual letter, skeleton type, erected on angle-iron framework, well braced to withstand the raging storms which sometimes sweep in from the Atlantic, are located on the roofs of the houses which line one side of the walk.

During the winter some of the signs are discontinued, but



FIG. 3.—SIGN WITH VARI COLORED LAMPS.

in the spring, when the regular season opens, and the promenaders become more numerous, the electric signs come into prominence again. The accompanying illustrations show a number of the large signs now in operation. The sign shown in Fig. 2 is one of the most attractive on the walk, chiefly because it is animated. It is located below Maryland Avenue, and faces the Steel Pier. About 1500 lamps are used in its make-up; those within the bottle and glass outline, as well as those within the stream issuing from the mouth of the bottle, being connected on a flasher. The lamps are lighted and extinguished in such sequence that a flowing effect is produced, the bottle emptying and the glass becoming fuller and fuller.

The sign shown in Fig. 1 is located at the corner of Pennsylvania Avenue, and faces toward the Steel Pier. It contains 600 lamps; the garter being outlined in red, and the clasp in white, the other lamps being white. Below Young's Pier at the corner of St. James Place is the sign shown in Fig. 3. This faces south along the Board Walk, and contains 1500 lamps of various colors. The diamond-shaped decorations, chain and bracket are studded with green lamps, the ovals with red lamps and the legend with white lamps. Like the sign shown in



FIG. 4.—LARGE ELECTRIC SIGN.

Fig. 1, the lamps burn steadily. Fig. 4 shows a sign at the corner of Kentucky Avenue, facing up the Board Walk toward the piers. The razor handle is outlined in red, the border is studded with red and green lamps, and white lamps are used

in the rest of the design. The number of lamps in the sign is 1500.

Above Kentucky Avenue, facing toward the south, is the sign shown in Fig. 5. This contains 1150 multi-colored lamps, and is quite effective. Below Missouri Avenue, facing Young's

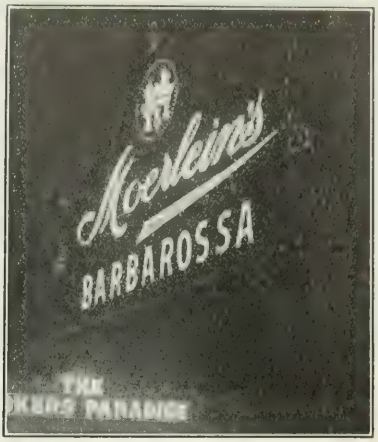


FIG. 5.—ELECTRIC SIGN.

Million-Dollar Pier, is the immense sign shown in Fig. 6. This measures 60 ft. x 90 ft., and contains 3300 lamps. The border, which represents a fancy frame, is made up of vari-colored lamps, and the name is outlined in white lamps. The sign

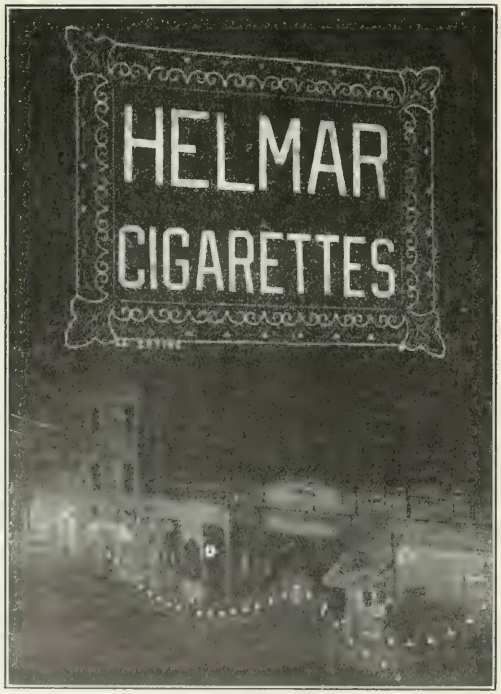


FIG. 6.—IMMENSE ELECTRIC SIGN ON FLASHER.

stands silhouetted against the black sky, and can be seen from great distances. To add to its effectiveness the name is flashed. The energy for all of the signs is supplied from the mains of the Atlantic City Electric Company.

Letter to the Editors.

A Much-Needed Investigation.

To the Editors of Electrical World:

Sirs:—The determination of the proper size of rail-bond t be used in any installation is almost invariably performed i one of the following irrational ways:

(1) By making the conductivity of the bond metal equal t that of the rail; (2) by asking the advice of the manufacturers (3) by doing what other people have done in similar cases; (4 by guessing.

The writer, having seen all of these methods employed wit indifferent success in various installations, attempted the fol lowing system:

1. Determining the current which the bond will have to carr continuously and for short intervals, and selecting a size o conductor which will accomplish this without overheating.

2. Assuming perfect contact at the terminals, calculating th bonding efficiency of the line with a bond of the size selecte above. If the conductance of the line is, say, 90 per cent o what it would be with continuous rails, this size is ample, i the conductance is less than, say, 90 per cent, the size should b increased. It should be noted that the bonds constitute such small proportion of the line that even if of low conductivit the whole line may still have a high average conductivity. Th bonding efficiency, E, of a line is given by the following for mula, in which

k = average efficiency of bond
L_1 = length of rail
L_2 = length of bond

$$E = \frac{L_1}{L_1 + \frac{L_2}{k}(1-k)}$$

Thus, if the bond is 2 ft. long and has an area of 500,000 circ mils, and the equivalent copper area of the rail is 1,000,000 circ mils.

$$k = \frac{500{,}000}{1{,}000{,}000} = 0.5$$

$$E = \frac{30}{30 + \frac{2}{0.5}(1-0.5)}$$

The resistance of the joint is neglected, as any size termina may be used for any size wire.

3. The mechanical conditions are investigated, and if th size determined by electrical considerations is not great enough to meet the mechanical requirements, it must be correspond ingly increased.

The writer's attempts to work on this basis were frustrated at the very start through the impossibility of obtaining data on the carrying capacity of bonds, especially for currents of short duration. The steady carrying capacity is seldom of use as on the average railway the current is intermittent. An investigation of the literature issued by the bond manufacturers, of the handbooks, textbooks and files of *Science Abstracts* and correspondence with various people led to the conclusion that the subject has not been investigated.

The writer suggests that those in charge of college laboratories who may feel inclined to add to our useful store of knowledge can do so by investigating the short-period carrying capacity of various types of rail bond under working conditions and publishing the results for the benefit of the electrical profession.

The fact that the bond manufacturers do not supply this information is a striking commentary on the way some of them do business. Imagine a shoemaker who couldn't tell the size of his product and made his customers buy shoes either by matching the size of their gloves, by asking the advice of the manufacturer, by the size that other people wear, or by guessing! Yet, is this not what the bond manufacturers are doing?

New York. William A. Del Mar.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Three-Phase Induction Motors.—W. ROGOWSKI AND K. IMONS.—In a former paper the authors have shown that the sual calculation of stray fluxes must be modified and that for he case of transformers and alternating-current commutator notors it is advisable to introduce the conception of the "mutual oil factor." In the present paper the authors solve the same roblem for induction motors. They give new rules for calulating and measuring the stray fluxes for three-phase induction motors. The paper is to be concluded.—*Elek. Zeit.*, March 11.

Flywheel Load-Equalizing Sets.—T. E. ROBERTSON AND F. HOLDEN.—A note on a recent British patent (3284, 1908; March , 1909) of the British Thomson-Houston Company. Two arrangements are described. In the first a motor-generator is mounted on the same shaft with a flywheel and an auxiliary machine with opposing shunt and series windings. The series winding and the armature of this machine are in series with he armature of the motor. When the load comes on the uxiliary machine is caused to generate and to reduce the pressure across the motor terminals so that the speed of the whole set can drop, and the flywheel give up its energy, without the motor current increasing. In the alternative arrangement the auxiliary machine is mounted on a separate shaft with its own flywheel and speeds up and thereby reduces the pressure across the motor terminals when the load comes on, its series winding in this case being in series with the load.—Lond. *Elec. Eng'ing*, March 11.

Compensated Auto-Transformer.—A note on a recent British patent (28,652, 1907; Feb. 25, 1909) of H. M. Hobart, F. B. Cramer and E. Coad. This is a combination of an auto-transformer and an ordinary transformer, a few secondary turns of the transformer being connected in series with each section of the auto-transformer. The voltage drop in any one circuit, due to the loading of any other, in the case of the transformer, is equal and opposite to that in the case of the auto-transformer. Thus the pressure across any one section of the combined transformer will be unaltered by change of load on any other section; the pressure across each section will vary with the load on that section.—Lond. *Elec. Eng'ing*, March 4.

Linseed Oil.—A note on the dangers of linseed oil in the construction of dynamos, etc. Linseed oil is a commercial commodity on account of the rapidity, as compared with other oils, with which it absorbs oxygen; but, since no means are available for arresting the oxidation at any given point, this characteristic becomes a positive danger as regards electrical work. With proceeding oxidation there is liability of the formation of a brittle powder which rapidly absorbs moisture to the detriment of the insulation.—Lond. *Elec. Rev.*, March 5.

Electric Ignition.—J. LOEWY.—The first part of an illustrated paper on the electric ignition of gas engines for automobiles and for stationary purposes.—*Elek. Zeit.*, Feb. 25

Lamps and Lighting.

Radiation Constants of Metals.—W. W. CORLENTZ.—In Wien's radiation law,

$$E = c_1 \lambda^{-5} e^{-c_2/\lambda T}$$

E is the radiation with wave-length λ at the absolute temperature T, and c_1 and c_2 are two constants, while a is the so-called "radiation constant." It has a value of 5 for a "black body" and 6 for platinum. The author has determined the same constant for different metals used in the new metallic-filament lamps. He has also determined the energy curves for various filaments. One method in demonstrating the great difference in the emissivity in the infra-red as compared with the visible spectrum, due to the difference in the value of a, is to set the various filaments to the same intensity in the visible spectrum and observe the difference of their energy curves in the infra-red. These curves are given in Fig. 1 for carbon, tungsten and osmium. A glance at the figure shows that the carbon lamps emit about one-third more infra-red energy than the metal filaments for the some radiation in the visible spectrum. This alone is sufficient to explain the higher efficiency of the latter, without introducing the question of a selective emission in the visible, the term "selective emission" being used to indicate an abrupt change in the energy flow curve with change in wave-length. The results of the investigation of the author show that the so-called radiation constant a of all the metals examined is higher than that of platinum at the same temperature. Osmium seems to have the highest value $a = 7$. Contrary to the results of previous investigations, the present work shows that the so-called "radiation constant" a decreases

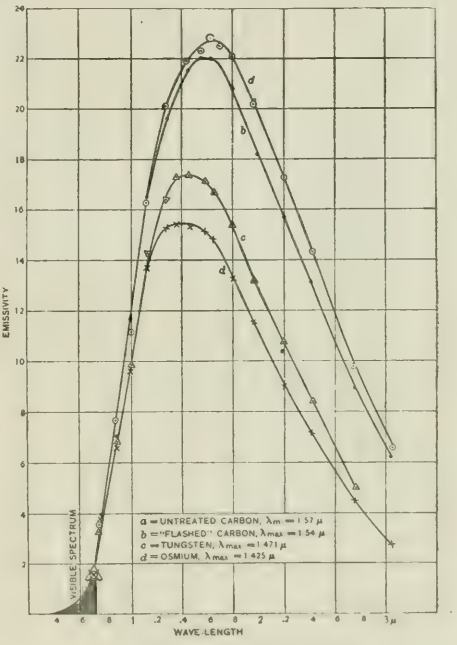


FIG. 1.—SPECTRAL RADIATION CURVES.

uniformly with rise in temperature; that is, a has a tempera ture coefficient probably similar to that of electrical resistance Theoretically, this decrease must occur, but whether the change takes place abruptly or whether it is a gradual change remains undetermined. It is, therefore, an open question whether or not there is a "radiation constant" a for metals. This fact is of vital importance in the application of optical pyrometers.

Lamp filament	λ max	Temp.	Constant a
"Metallized" carbon...	1.564	[illegible] C	[illegible]
Tantalum ...	1.849	[illegible]	[illegible]
Tungsten ...	[illegible]	[illegible]	[illegible]
Osmium (2-watt lamp on [illegible] volts)	1.425	[illegible]	[illegible]

although the "optical constants" of the metals show no appreciable temperature coefficient in the visible spectrum. The accompanying table gives approximate values of the "constant" a of four metals as used in the 110-volt lamps investigated when under "normal operation." The "normal" operating temperatures, computed on the assumption that the con-

stants are the same as for platinum, are given in the third column of this table. The values, of course, are only approximations, and are all much lower—from 300 deg. to 500 deg. less—than found by Waidner and Burgess, using an optical pyrometer. This is, of course, due in part to the assumption made that these metals have the same constants as platinum, which is contrary to observation.—*Bull. Bureau of Standards,* Vol. 5, No. 3, February.

Efficiency in Illumination.—A. J. Sweet.—The author gives a diagram, reproduced in Fig. 2, in which is shown the relation which the renewal cost of the lamp bears to the cost of energy at different costs per kw-hours. The curves apply to the 16-cp, 3.1 watts per candle, 110-volt carbon-filament lamp. Curve *A* represents the renewal cost, expressed as a percentage of the total cost of operation, including renewal. Curve *B* represents energy consumption cost, likewise expressed as a percentage of the total cost. Within the range of cost at which electrical energy is commonly available to the user of light—from 8 cents to 15 cents per kw-hour—the renewal cost is almost negligible as compared to the cost of energy. If a less efficient lamp had been taken as an example, the life of the lamp would have appeared as a still less important factor. Efficiency of illumination is really the combined effect of three different kinds of efficiencies. First, there is the efficiency of visual perception, this being the efficiency with which the eye receives light energy and transforms it into visual perception. Second, there is

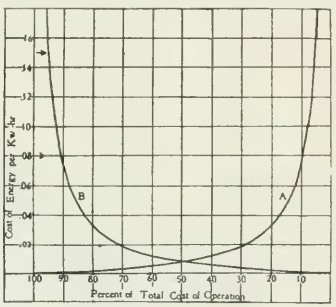


FIG. 2.—RELATION OF RENEWAL COST AND ENERGY CONSUMPTION.

the efficiency of light distribution, by which is meant the relation between total light energy generated and light energy useful in producing desired conditions for visual perception. Third, there is the efficiency of the light source, by which is meant the efficiency with which chemical or electrical energy

Kind of lamp.	Mean Spherical cp.	Watts, per cp.	Number of cp per kw.
Common 56-watt carbon-filament incandescent lamp, rated at 3.5 watts per candle, 16 horizontal candle-power	13.2	4.24	236
Common 50-watt carbon-filament incandescent lamp, rated at 3.1 watts per candle, 16 horizontal candle-power	13.2	3.78	264
Three-glower 264-watt Nernst lamp	81	3.26	307
"Gem" 125-watt graphitized-carbon-filament lamp of 60 horizontal candle-power	40.7	3.67	326
44-watt tantalum lamp, 22 rated, horizontal candle-power	16	2.75	364
Direct-current 5.1-amp enclosed arc on 110-volt circuit, 0.5 in. carbons	213	2.63	380
Alternating-current unclosed 5.7-amp arc, taking 388 watts on 110-volt circuit, 0.5-in. carbons	152	2.55	392
Tungsten 60-watt, 1.25 watts per candle, 110-volt lamp	37	1.62	641
Luminous 8-amp arc, 440 watts, two in series on 110-volt circuit	1,020	0.431	2,320

is transformed into light energy. Each of these factors is of importance in determining the resultant efficiency of illumination. Efficiency of visual perception depends upon three conditions. These are: (a) the intrinsic brilliancy of the light source and of the surrounding light-reflecting objects; (b) the color of the light, and (c) the intensity and steadiness of the light. Each of these conditions is briefly considered in turn. Efficiency in light distribution depends upon two important factors, namely, the distribution of light which emanates from the illuminating unit, and the size of the unit as the location of centers of light distribution. The amount light which is reflected from differently colored paper is per cent from white paper, 50 from orange, 40 from yellow, from light pink, 25 from light blue, 18 from emerald green a 10 from dark-brown paper. As to the use of shades a globes, the author remarks that a correct distribution of lig about the illuminating unit is an indispensable condition efficient illumination and low cost of operation. No lig source now on the market gives of itself correct distributio Hence, suitable glassware to modify and correct the distrib tion should invariably be used. The problem of correct distri bution and proper means of obtaining it is a highly technic problem to be solved only by a competent illuminating eng neer. The author finally compares the efficiency of differe sources of light and shows that on the basis of the radiatic laws the efficiency of an incandescent lamp increases with t temperature of the filament. The following summary of var ous electric lamps is given in the accompanying table. Th candle-power always means spherical candle-power.—*Ele Jour.,* March.

Tungsten Lamp.—A note on a recent British patent (338 1908; March 4, 1909) by J. W. Howell for a method of makir joints between tungsten lamps and leading-in wires. The en of the nickel wire is bent into a hook, and the end of the fil ment, previously coated with a paste of finely divided tungste or copper mixed with gum arabic, is placed in the hook. A arc is drawn from the extreme end of the hook and a globu of fused metal runs into the corner of the hook, thereby fusin the paste and filament together. A portion of the coatin above the joint is merely hardened and appears to prevent th filament from breaking at the joint. The joint can be als made by heating the hook to a white heat.—Lond. *Ele Eng'ing,* March 11.

Electric Hand Lamps.—W. Vogel.—The conclusion of h illustrated description of various modern types of portabl electric hand lamps. Older hand lamps often had metalli parts on the outside, so that when something within the lam got out of order the outer metallic parts were liable to becom charged. Such cases have even resulted in fatal accidents. I the construction of the modern types of lamps such accident have been rendered impossible. However, the reliability o operation does depend not merely on the construction of th lamps themselves, but also on the conducting wires. It is ver important to keep them always in good condition.—*Elek. Zeit* March 11.

Generation, Transmission and Distribution.

Limits of Energy Transmission.—A. M. Taylor.—A pape read before the Birmingham section of the (Brit.) Inst. Elec Eng. The object is to draw attention to certain possibilitie in the way of commercial developments that, as far as th author is aware, have been somewhat overlooked. The author' proposal is that electrical storage on a large scale should b carried out at the distributing centers, the reliability of the lin being thereby increased to an extent that would warrant a sec ond line being dispensed with. At the same time a case fo storage batteries can be made out on other grounds. Such fixed charges as wages, management, taxes, water-power pur chase, rights, etc., are all reduced with the reduction in the size of the generating station and line, and these would, of themselves, the author estimates, alone more than pay for the cost of maintenance of batteries and auxiliaries.—Lond. *Electrician* March 12.

Smoke Abatement by the Distribution of Electrical Energy.—S. E. Fedden.—A note on a paper read at the recent Smoke Abatement Exhibition in Sheffield. The author urged that the supply of electrical energy is doing much to reduce the amount of smoke in towns. The rate of progress of energy supply by the Sheffield municipal electricity works is of interest in this connection. In 1902 the department had only 527 hp of motors connected to its mains; in 1905, 3617 hp; in 1907, 7004 hp, and this year no less than 12,000 hp of motors are connected, the amount of energy sold for motors now ex-

ding that sold for lamps. The coal consumption at the depsend generating station is equivalent to from 2.5 lb. to lb. per hp-hour sold, whereas the private plants displaced nsumed on an average about 10 lb. of coal per hp-hour, so at a considerable saving of coal is taking place, in addition the fact that the coal at the large station is being burned der conditions making for smokelessness.—Lond. *Electrician*, arch 12.

Yorkshire Boiler.—W. H. CASMEY.—A paper read before the alifax Engineers and Firemen's Association, discussing the nstruction and the advantages of the Yorkshire boiler. The lvantages of the Yorkshire boiler over any other of the lindrical type are stated as follows: Higher efficiency and aporation, lower cost and less ground area and brickwork, nduction and radiation losses one-third less than in the ancashire boiler for the same evaporation. The boiler is solutely fool-proof; that is, it is quite impossible for a crown ate to come down owing to the expanded flues, because the isible plugs are at the back end of the boiler. The boiler is horter and distributes the heat and water proportionately, the xpansion and contraction will be much less, cross-strains are voided and the life of the boiler will consequently be a long ne.—Lond. *Electrician*, March 12.

Motors with Controllers Attached.—An illustrated descrip- on of a three-phase motor fitted with slip-ring rotor and hort-circuiting device, of German make, which is started by a and-wheel. The starting device consists of a controller ounted on an angle-iron frame and is bolted to the motor eet and fitted to the original terminal board of the otherwise nchanged standard motor. The case of the starter also con- ains the necessary starting resistors, in addition to the con- roller drum, which is operated by the hand-wheel. Both are mmersed in oil, by which means the desired small dimensions ogether with good insulation and sufficient cooling, are at- ained. The lifting of the brushes after the short-circuiting f the slip-rings has taken place is effected by means of a evel, connected to the hand-wheel of the controller.—Lond. *Electrician*, March 12.

Electric Pumps.—D. E. CARPENTER.—In a continuation of his llustrated serial on the application of automatic controllers to direct-current motors, the author discusses the control of pump motors. He describes the float type and the pressure type of master switch.—*Elec. Jour.*, March.

Gas Power.—An illustrated description of the gas-driven blowing plant of the Indiana Steel Company, and the mechani- cal and operative features of blowing house No. 3, at Gary, Ind.—*Elec. Jour.*, March.

Traction.

Speed Control on Electric Railways.—P. DAWSON.—A con- tinuation of his very long illustrated serial on electric traction on railways. In this instalment the author describes three types of multiple-unit control, namely, the electromagnetic shunt system, the electropneumatic system, and the electro- magnetic system developed by Dick, Kerr & Company, in which the return current from the motors operates the contactors. Car wiring is next discussed and, finally, the safeguards and methods of installation required in connection with the use of high-tension apparatus.—Lond. *Electrician*, March 12.

Trackless Trolley Cars.—A description of a system of omni- buses which are run on ordinary roads without rails, but re- ceive current from overhead wires. In a system of this kind, which is used to a considerable extent in Austria, the electric motors are made part of the wheels. The omnibuses are of light weight and can run on narrow roads and can easily move to one side so as to let other carriages pass. The cost of operation per kilometer—including electric energy, mainte- nance, taxes, wages, etc.—is said to be from 4 to 6 cents. The capacity of the omnibuses is 24 passengers.—*Elek. Zeit.*, March 11.

Installations, Systems and Appliances.

Leeds.—The first part of an illustrated description of recent extensions to the Leeds lighting station for energy supply pur- poses. The newer section of the station contained for some time only two pairs of steam engines, each pair aggregating 4000 hp and directly coupled to two-phase alternators. Re- cently two 3000-kw steam turbines have been installed.—Lond. *Electrician*, March 12.

Electrophysics and Magnetism.

Magnetic Properties of Carbon-Tungsten Steels.—T. SWIN- DEN.—An abstract of a paper read before the Leeds section of the (Brit.) Inst. Elec. Eng. The paper described the con- tinuation of an investigation of the properties of a series of

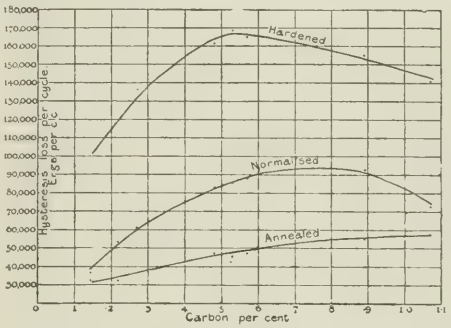


FIG. 3.—MAGNETIC PROPERTIES OF CARBON-TUNGSTEN STEELS.

constant-tungsten increasing-carbon steels. The tungsten con- tent was maintained at 3 per cent. The relevant results of past workers are given. The tempering of hardened magnets is dis- cussed and it is shown that apparently a definite value of in- tensity exists for every magnet. The correlation between mag- netic and other properties is finally discussed and the import- ance of using the correct quenching temperature is mentioned. The change of hysteresis with the percentage of carbon is shown in Fig. 3, the tungsten content being always 3 per cent. A decisive maximum of hysteresis is found in the hardened series at about 0.52 per cent carbon. Microsections of all the steels in the cast, rolled, normalized, annealed, hardened and tempered conditions have been examined. One of the most interesting points is that concerning the tempered bars.

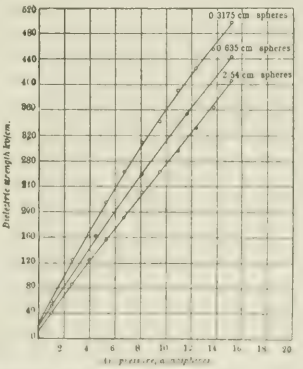


FIG. 4.—RELATION BETWEEN DIELECTRIC STRENGTH AND AIR PRESSURE.

The magnetic tests showed a tremendous increase in permeabil- ity caused by tempering, yet the crystalline structure is prac- tically unaltered. It may be that the permanence is governed by constitution and permeability to crystallization, but many facts point to the latter being of secondary consideration in both cases.—Lond. *Electrician*, March 12.

Dielectric Strength of Compressed Air.—E. V. WATSON.— An illustrated paper read before the (Brit.) Inst. Elec. Eng. Particulars are given of experiments made by the author with the object of determining as accurately as possible the manner

in which the dielectric strength of air changes when it is compressed to pressures higher than atmospheric, chiefly with a view to its employment for the insulation of certain classes of high-tension apparatus for which oil or other insulation is not suitable. Spherical electrodes were used and the results obtained with three different sizes of spheres are given in Fig. 4, which shows the relation between dielectric strength and air pressure. The dielectric strength of air at ordinary temperature—17 deg. C.—follows very nearly a linear law, but the curve when produced back does not pass through the origin; that is to say, the dielectric strength cannot be strictly said to be proportional to the pressure. If an empirical formula be desired for the lowest curve in the diagram, the equation

$$\text{dielectric strength} = 20 + 25.6 \times \text{atmospheres},$$

expresses the relation with sufficient accuracy between the pressure of 3 and 15 atmospheres absolute.—Lond. *Electrician*, March 12.

Self-Demagnetizing Factor of Bar Magnets.—S. P. Thompson and E. W. Moss.—An abstract of a paper read before the Physical Society of London. The authors discuss the significance and definition of the self-demagnetizing factor of magnets in general and of bar magnets in particular; they redetermine the values of the self-demagnetizing factor for bar magnets of circular section and determine the values for the self-demagnetizing factor for bar magnets of rectangular cross-section of various proportions. In general, for every bar magnet there is a self-demagnetizing action in the value of which at the middle of the bar depends, for a given intensity of magnetization, on the length of the bar relatively to its cross-section, on the permeability of its parts, and on the distribution of its surface magnetism. Experiments were first made on the values of the self-demagnetizing factor for bar magnets of circular section and the results were compared with those obtained by Du Bois and Riborg Mann. The values obtained were lower than those found by either of the former experimenters. Experiments were made to determine the self-demagnetizing factor for bar magnets of rectangular cross-section, and it was found that for equal values of the dimension-ratio the factor for bars having a sectional ratio of 2 to 1 was about 93 per cent of that for bars of square section, while for flat bars, having a sectional ratio of 10 to 1, the value of the self-demagnetizing factor went down to about 75 per cent of that for bars of square section.—Lond. *Electrician*, March 12.

Magnetic Hysteresis and Wave Form.—M. G. Lloyd.—An account of an experimental investigation, the chief results of which are as follows: For a definite maximum value of the flux density, the hysteresis is greater with a flat wave of flux, but the effect is small and from the industrial standpoint negligible, even with very distorted waves. If, however, the time-wave of flux is dimpled, the hysteresis may be much increased. The hysteresis determined by the ballistic method may be smaller than that which obtains with the use of alternating current, but the differences are small. The separation of hysteresis and eddy-current losses by means of runs at two frequencies, using the Steinmetz formula, is not accurate, but is a close approximation when the sheets are thin.—*Bull. Bureau of Standards*, Vol. 5, No. 3, February.

Electrochemistry and Batteries.

A Carbon-Plate Rheostat for Control of Small Electric Furnaces.—C. R. Darling.—A description of a rheostat exhibited before the (Brit.) Phys. Soc'y. The defects of the ordinary carbon-plate rheostat—the difficulty of accurate control when consuming a large amount of power—is overcome in this instrument by the use of four rows of plates, each 2 in. square in area, there being 22 plates in each row. Each set of plates is provided with a separate adjusting-screw, and hence may be kept at different degrees of tightness. By means of simple connecting devices, the plates may be used in series or parallel as desired. This form of rheostat is found to be well adapted for regulating electric tube furnaces and for varying the current to any desired extent during the calibration of instruments, etc.—Lond. *Electrician*, March 12.

Carborundum.—M. L. Baradue Muller.—A review of the properties, applications and methods of manufacture of carborundum.—*Revue de Metallurgie*, February.

Units, Measurements and Instruments.

Determining the Stray Currents in Water Pipes.—C. W. Kinney.—A note on a method by which the author measured the stray currents from a tramway system in a water pipe. The instruments available were an ammeter and a 600-volt voltmeter with a low-reading calibration terminal. The determination was made as follows: The water pipe was exposed for about 6 ft. of its length. Three places on the pipe, 2.5 ft. apart, were filed bright and the drop in voltage, as indicated by the voltmeter, between the first and second points and then between the second and third points was noted. After these readings had been taken, an ammeter reading was taken between the rail and the middle point on the water pipe. While the ammeter was still connected, voltmeter readings were taken as before. The voltmeter drop between points 1 and 2 showed less than one-half of 1 per cent of the original value. Thus the voltage drop between points 2 and 3 could be assumed to be due entirely to the current in the ammeter. The normal current in the pipe was then calculated by a simple proportion; that is, the current during the first test bore the same relation to the ammeter reading that the voltmeter throw between points 2 and 3 during the first test bore to the throw of the voltmeter needle when the ammeter was connected, since the voltmeter was of the uniform-scale type. It was, therefore, not necessary to determine the actual value of the divisions on the voltmeter scale in order to find the amount of current in the pipe.—*Elec. Jour.*, March.

Silver Voltammeter.—Jaeger and von Steinwehr.—An account of an investigation made at the German Reichsanstalt. The amount of silver deposited in the voltammeter does not, within the limits of experimental error, depend on whether the older form of voltammeter or the voltammeter due to Richardson is used. Absolute measurements gave, it is true, a difference of some ten-thousandths, but it was impossible to discover a measurable difference in accurate relative measurements. The removal of the oxygen during electrolysis by displacing the air by an inert gas, such as nitrogen, causes no appreciable difference in the amount deposited compared with the amount deposited when oxygen is present. This result is in accordance with the latest measurements of the (Brit.) National Physical Laboratory and contradicts the older measurements of most early observers. The values arrived at with the international ohm and legal ampere for the Weston standard cell correspond in a satisfactory manner with the results arrived at by the Reichsanstalt in 1908, while the value for this cell obtained by using the silver voltammeter corresponds very closely with the recently published results of similar work at the (Brit.) National Physical Laboratory.—Abstracted from *Zeits. f. Instrument* in Lond. *Electrician*, March 12.

Thermoelectric Pyrometer.—A description of a simple thermoelectric pyrometer for students, exhibited recently by Mr. C. R. Darling before the Physical Society at London. The hot junction of nickel and steel, or iron and constantan, is protected by a mild-steel cap, bored from the solid, and about 6 in. in length. This cap is screwed to an iron barrel of any desired length and the wires pass from the junction through twin-bore fireclay to terminals screwed into a piece of hard fiber. The terminals are made of the same metal as that of the wire attached, and leads of the same wire are taken to a cold junction, kept in oil, and the indicator. The pyrometer is easily put together by the students and is used to form a temperature-scale from the deflections of a galvanometer by insertion in molten metals or salts of known freezing points. The mild-steel cap resists the action of molten substances far better than does porcelain or silica and enables the junction to follow a changing temperature more rapidly. The errors incidental to the forms in which no provision is made for a cold junction are avoided, and no damage ensues from dropping or rough usage, as in the case of pyrometers protected by porcelain or

sca. The cap, when worn out, is readily replaceable.—Lond. *Electrician*, March 12.

Combined Meter-Bridge and Potentiometer.—A description of a combined meter-bridge and potentiometer with new tapping-key device for pyrometric and general laboratory work. It was exhibited by C. R. Darling before the Physical Society of London. The arrangement of this apparatus is that of an ordinary meter-bridge, with four gaps, but with 4 m of stretched wire, so that 1 m, 2 m, 3 m or 4 m of wire may be used in a bridge test. Between each pair of wires is placed a groove, through which pass a rod of phosphor-bronze on which the tapping key slides. These rods are connected to a terminal at the side. Hence it is not necessary to connect directly to the keys. The keys are furnished with two knife-edges and may be depressed onto the wire on either side of the groove in which they slide, thus facilitating the finding of the balance-point. Each wire is furnished with an arrangement for tightening. The apparatus may be used as an ordinary bridge or as a bridge with calibrated wire, it being possible to calibrate the wire by the aid of others. It may also be used for the measurement of the e.m.f. of thermal junctions, constants of cells, etc., and all of the ordinary purposes of a stretched-wire potentiometer.—Lond. *Electrician*, March 12.

Transformers for Measuring Instruments.—An illustrated description of a new design of an English make of transformers for measuring instruments. The chief features are a constant ratio over a range of from 10 per cent to 100 per cent and a very small phase displacement. The improved working conditions are due mainly to the use of a completely closed magnetic circuit, there being no air-gap whatever. The core plates are stamped out of the sheets in their complete and final form, and the coils are wound on the arms by means of a special device. This method of stamping out the core plates in one piece has the further advantage that it ensures uniformity of manufacture, which is not dependent upon the skill of the individual workman, as in the case of transformers in which the core plates are butted or otherwise joined.—Lond. *Electrician*, March 12.

Magnetic Testing.—M. G. Lloyd.—A paper on errors in magnetic testing with ring specimens. The author discusses the magnetizing force and the losses for both rectangular and circular sections.—*Bull. Bureau of Standards*, Vol. 5, No. 3, February.

Resistor of Standard Resistance.—E. B. Rosa.—A description of a new form of standard resistor. The object of designing it was to exclude the effect of humidity in the air upon the value of the resistance. For this purpose the coils are enclosed in vessels filled with oil and hermetically sealed.—*Bull. Bureau of Standards*, Vol. 5, No. 3, February.

Meter and Relay Connections.—H. W. Brown.—In a continuation of his illustrated serial the author deals with meter and relay connections for six-phase circuits and discusses especially the double-delta connection and the diametrical connection.—*Elec. Jour.*, March.

Telegraphy, Telephony and Signals.

Multiplex Telegraphy.—M. H. Magunna.—An illustrated paper read before the International Telegraph Congress at Lisbon. The author described the latest method of Mercadier for multiplex telegraphy. Alternating currents of different frequencies are produced by means of operation of tuning forks. At the receiving station they act on "monotelephones" which are tuned to the pitch of the tuning forks in the transmitting station. These "monotelegraphs" actuate relays which operate ordinary Morse or Hughes apparatus.—*Elek. Zeit.*, March 11.

Wireless Telegraphy.—F. Kiebitz.—A critical discussion of the principles of construction of wireless telegraph stations. The modern methods for producing high-frequency currents have such a high efficiency that any further increase of efficiency would not produce any considerable advance in wireless telegraphy. On the other hand, improvement may be made by selecting the dimensions of the transmitting system according to Drude's formulas. By using several antennas it is possible to send wireless telegraph messages in a certain desired direction without reducing the distance of transmission. For a receiving station it is advantageous to couple a non-periodic detector circuit with the antenna circuit by magnetic induction. —*Elek. Zeit.*, March 11.

Miscellaneous.

Electric Ignition.—J. Loewy.—The first part of an illustrated paper on the electric ignition of gas engines for automobiles and for stationary purposes.—*Elek. Zeit.*, Feb. 25.

NEW APPARATUS AND APPLIANCES

Impulse Type of Steam Turbine.

The steam turbine built by the Kerr Turbine Company, Wellsville, N. Y., utilizes the principle of the Pelton waterwheel, so successfully employed under high heads of water. The buckets on the turbine, like the buckets of the waterwheel, are of the double-cup variety, excepting that in the turbine they are made of a form suitable for the use of steam.

The turbine is of the multi-stage, bucket and nozzle, impulse type, each stage consisting of a set of nozzles and a bucket wheel with double-cap buckets set in its periphery, and the whole enclosed in a sectional casing of cast iron.

There are two points only at which the shaft is in actual rubbing contact with the stationary parts of the turbine, and these are the bearings. The bronze bushings which prevent leakage of steam from stage to stage at the points where the shaft passes through the diaphragms and through the steam and exhaust ends are reamed a few thousandths of an inch larger in diameter than the shaft and have radial clearances outside so as to take any position corresponding to that of the shaft, while the steam pressure holds them to a ground metal to metal seat in the diaphragm casting. In addition to these bushings at the steam and exhaust ends of the turbine, there are packing glands for soft ring packing. Between the soft packing glands and the metal glands is a chamber which receives the leakage from the metal gland and discharges it through a pipe connection to one of the low-pressure stages of the turbine.

At the exhaust end of the turbine, if it is to run condensing, is a corresponding chamber which is supplied with water. This furnishes an effective means of sealing the shaft against leakage of air into the vacuum. In the case of a non-condensing turbine the soft packing is all that is required.

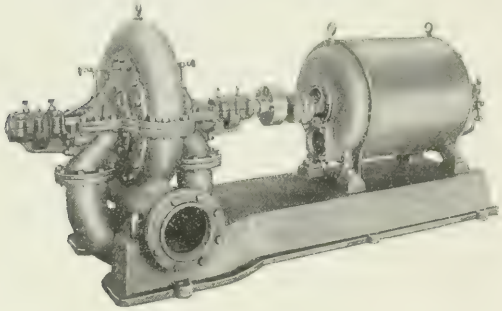
The shell or cylinder of the turbine is made up of two end castings, between which are diaphragm castings, which contain the nozzles, and divide the cylinder of the turbine into separate stages. The diaphragms are accurately centered with each other and with the two end castings by turned and bored tongue-and-groove joints. Outside the grooves the diaphragms are in contact on an accurately faced metal-to-metal joint. The groove is packed with fibrous packing. The end castings carry the weight of the turbine and are provided with accurately faced supports which are bolted to the bed plate.

The buckets are drop-forged from steel, and the spindle or rotor is made up of a steel shaft, upon which are mounted the bucket wheels, the number of which depends upon their own diameter, range of steam pressure which the turbine is to operate and the r.p.m. of the driven machine. The bucket wheels are machined and slotted to receive the buckets, the shanks of which are inserted and riveted into dove-tailed slots. The rotor runs with remarkable freedom from vibration. The

bucket wheels are mounted on cast iron rings, threaded on split hubs and keyed to the shaft. The wheel is thus easily and quickly removable. Because of the comparatively light weight of the rotating element, a shaft of small diameter is used, both in the bearings and in the glands where the shaft passes through the turbine casing. This permits a design of bearing which is at all times safe from overheating, as the actual surface speed of the shaft in the bearing is not great, notwithstanding the high rotative speed of the shaft.

The governor employed is of the centrifugal type, and is mounted on the end of the shaft, rotating with it. The movement of the governor weights, which are of semi-annular section, is effected by knife-edge and rolling contacts. Freedom of movement is thus secured without lubrication. The speed regulation is made to suit the requirements of the driven machine. Ring oiling bearings, arranged with a special device and grooves for delivering a large quantity of oil, are employed. The oil reservoirs into which the rings dip are of more than usual proportions. A suitable thrust-bearing is provided in connection with the exhaust end-bearing, by means of which the bucket wheels are kept in correct position with reference to the nozzles. The form of coupling used for connecting the turbine with other machinery is said to run absolutely noiseless and not to absorb power.

The application of the turbine to the driving of both direct and alternating current generators has been quite successful. The simplicity of the turbine makes it easy to operate, and the regulation being quite close, the paralleling of alternators



TURBINE-DRIVEN CENTRIFUGAL PUMP.

is readily accomplished. The steam consumption of the turbine is said to compare favorably on non-condensing work with that of high-speed engines of the same rating working under similar conditions, while on condensing work the economy is said to equal that of the best high-speed compound engines of the same rating at full load, and to show somewhat better results on partial loads.

The turbine has also been widely applied for driving centrifugal pumps, for boiler feed and other purposes, where the speed of the pump is high enough for direct connection to the turbine. The combined unit forms an ideal means of moving water and other liquid against moderate or high heads. The motion being purely rotary there is an absence of jar. The turbine has been used for driving centrifugal boiler feed pumps of single-stage or multiple-stage type, and the simplicity of the set in contrast with the ordinary reciprocating sets is very marked. As there is no oil in the exhaust from the turbine, this can be passed directly into either a closed or open-feed water heater. Such pumps, working of a necessity against comparatively high pressures, must run at high rotative speeds, which are favorable for the economical working of a turbine of this type. It is estimated that under these conditions, aside from the reliability, the turbine will require less steam to do a given amount of work.

For driving centrifugal pumps delivering a large volume of water against a low head, as in circulating water for condensers, the economy of the turbine is not so good, for the reason that these pumps run at a comparatively low speed.

Exhibits at the Worcester Electrical Show

An electrical and mechanical exhibition was opened in Mechanics' Hall, Worcester, on March 27, under the auspices of the Worcester County Mechanics' Association. A large variety of products of interest to the electrical and machine trade was displayed. The Worcester Polytechnic Institute, Department of Electrical Engineering, exhibited several thousand dollars' worth of standards tested at the Reichsanstalt, English Board of Trade laboratory, and American Bureau of Standards. It showed a mercury arc rectifier set, apparatus illustrating the principle of the rotating magnetic field, Kelvin, Wolff, Weston and Westinghouse instruments. The Washburn shops of the Institute exhibited motor-driven, variable-speed drills, lathes and grinders of recent design.

The Shepman Envelope Company, of Worcester, showed a motor-driven gumming, folding, drying and counting envelope machine having a capacity of 80,000 envelopes daily. The Power Maintenance Company, of Worcester, exhibited a full line of telephone and bell fittings, small motor, lighting and automobile supplies. The Coghlin Electric Company, of Worcester, showed a "Wigwam" portable house fully equipped with electric lighting in plain and ornamental styles, heating appliances for the kitchen and bedroom, sewing machine motor and bathroom heating equipment, electric vibrators and vacuum cleaner. The Leader Manufacturing Company, of Hartford, showed a motor-driven suction cleaner of the portable type, for domestic service. The machine is operated from an ordinary lamp socket.

The W. D. Kendall Company, of Worcester, exhibited a full line of Shelby tungsten incandescent lamps, Simplex heaters, Holtzer-Cabot motor-driven house pumping set operated by friction drive, and a line of Holtzer-Cabot buffing, polishing, grinder and lathe motors. The pumping set is a relatively new design, consisting of a rotary bronze pump having a capacity of 500 gal. of water per hour. It is run by a ½-hp, direct-current or a 1-hp, alternating-current motor, and occupies a floor space of 17¼ in. x 18¾ in. x 18 in. An Excello arc lamp was shown and a Holtzer-Cabot automobile ignition magneto was also exhibited. O. S. Kendall & Son, Worcester, showed Simplex vacuum cleaners, motor driven and hand operated.

Alsten & Goulding, Worcester, had an exhibit of Wheeler & Schebler magnetos, the Hoyt automobile measuring instruments, Packard cables, the Globe sheet-steel battery box, "Worcester" combination rotary switch, Klaxon horns, spark coils, timers, plugs and accessories.

The Acme Wireless Construction Company, of Cambridge, Mass., displayed apparatus for wireless telegraphy, with working exhibits. The Coates Clipper Company, of Worcester, showed flexible shafts for portable motor-driven outfits. The Dow Surgical Battery Company, of Boston, showed the Arnold vibrator. The Blake Pump & Condenser Company, of Fitchburg, Mass., showed pumping equipment of recent design.

Power for the exhibition was furnished by the Worcester Electric Light Company, which had an attractive display of electric heating and cooking appliances of General Electric make, tungsten lamps with the prices of burning tabulated for the convenience of the public, luminous radiators, fan motors and small apparatus for domestic service on central-station circuits, portable drill and flatirons. All the machinery in the exhibition was motor-driven.

Electricity in the Hotel La Salle, Chicago.

The large and handsome Hotel La Salle, which is rapidly approaching completion in Chicago, will have many features of electrical interest. Electricity will be generated in a 1100-kw private plant in the sub-basement. This will include three Crocker-Wheeler generators, rated respectively at 500, 350 and 250 kw. These machines are wound for 250 volts direct current, and are direct-connected to Fitchburg four-valve cross-compound engines. The generators are guaranteed to withstand

per cent overload for two hours and 25 per cent overload ntinuously. The Western Electric Company is building a itchboard 30 ft. long, consisting of 14 panels and equipped th I-T-E circuit-breakers, etc. Steam is produced in five ilers having an aggregate rating of about 2000 hp. Auto- tic stokers are provided, and each one is driven by a direct- nnected Crocker-Wheeler motor.

Extending 21 stories above the street level and two stories low it, the hotel contains 1035 guest rooms, and about 20,000 -cp incandescent lamps will be installed to light the building. e fixtures are especially designed, and some of them, notably the ballroom and in the main dining-room, will be very -ge and handsome. All wiring of every description, includ- g telephone and bell wiring, is run in iron conduit. The rridors will be lighted by 60-watt tungsten lamps, but ordi- ry carbon-filament lamps will be used in the guest rooms. ch bedroom is provided with an electric reading-lamp placed a stand at the side of the bed.

Electric cooking will be a feature of the German restaurant ill, and this innovation will undoubtedly attract much atten- n. Every bathroom in the house will have electric curling- n heaters, and all doors to clothes-closets will be equipped ith revolving door switches, automatically cutting in and out e light inside the closet with the opening and the closing of e door. Electric motors having an aggregate rating of about o hp will be needed in the hotel. In addition to the heavier achinery they will drive revolving entrance doors, vacuum- eaning pumps, dumb-waiters, potato-peelers, dish-washers, lver-buffers and ice-cutters used for making cubes of ice for ed drinks.

In the laundry electricity will not only be used to operate the achinery, but electric heat will be relied upon for ironing and her purposes. The valets' room will be equipped with electric atirons and an electric drier to be used particularly for the rpose of expediting the work of pressing trousers. The car- age call will be electrical and noiseless. Where there is a long ne of waiting carriages for guests the doorman at the carriage ntrance will press the number of each individual carriage call n a keyboard resembling that of a typewriter, when the number esired will appear in figures of electric light on each side of ne canopy over the entrance. Each guest room will be pro- ided with a telephone of a special flush type, only the trans- itter and receiver projecting from the wall. A 1200-line tele- hone switchboard will be installed, and a force of about 20 elephone operators, divided into eight-hour shifts, will be eeded. Forty trunk lines will connect this switchboard to the ain exchange of the Chicago Telephone Company.

Holabird & Roche, Chicago, are the architects for this fine otel, and the Arthur Frantzen Company is the electrical con- ractor.

Reinforcing Decayed Poles.

The accompanying illustrations show a process for rein- orcing decayed wooden poles by means of concrete without isturbing the electric circuits which the pole supports.

The pole to be reinforced is supported by tripods or held ecurely in place by temporary guy ropes or wires; the earth s then removed for a distance of about 18 in. from the sides of the pole to a depth that will expose the solid portion of the utt remaining. The decayed portion of the pole is then scraped ut. Half-inch steel rods from 3.5 ft. to 6 ft., and pointed at oth ends, the upper end being bent at right angles to form a og or point from 5 in. to 6 in. long, are used for reinforcing. The straight end of the rod is driven into the sound portion of the butt at an angle by the use of a special driving tool. The upper portion of the rod is then bent in toward the pole and the dog is driven in to its full length. The length of the rod used is such as to permit the proper anchorage of its lower end in the sound wood of the butt, and to allow the portion ex- tending above the ground to be of sufficient length to span the decayed section of the pole and be driven into perfectly sound wood. The points of the rods are usually driven into the pole from 12 in. to 18 in. above the ground level. Concrete is filled in around the pole, replacing the decayed portions of the wood and forming a protecting sleeve or envelope. This concrete extends above the ground sufficiently far to cover the upper

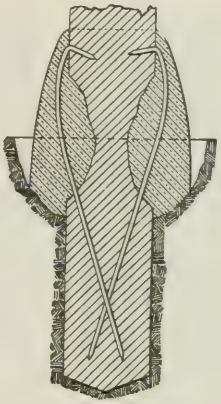


FIG. 1.—DIAGRAM OF METHOD OF REINFORCING DECAYED POLES.

terminals of the rods and protect them from the action of the moisture in the air, thus forming a sort of collar above ground, and tapering from about 3 in. thick at the ground level to about 1.5 in. at the top. It is finished off in a sightly fashion by a form designed for the purpose. Where the butt of the pole is partly rotted away, the rotten portions are removed and the



FIG. 2.—POLE READY TO RECEIVE CONCRETE REINFORCEMENT.

space is filled in with concrete, thus providing an anchorage for the rods either in the solid wood of the butt or in the con- crete.

If the butt is entirely rotted away a concrete base is made of

slightly larger dimensions than the pole in which the rods are firmly anchored. The pole is cut off squarely and rests upon this concrete base. The upper portion of the rods projecting from the base and surrounding the pole is then bent in and the





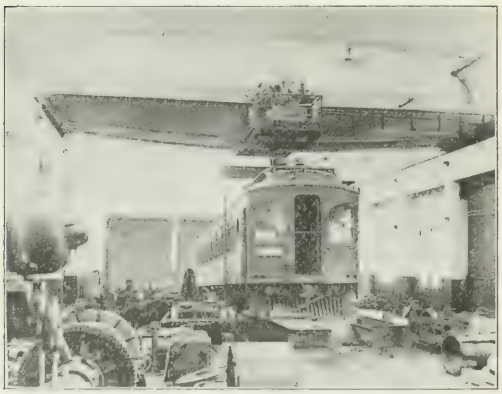
FIGS. 3 AND 4.—POLES REPAIRED WITH REINFORCED CONCRETE BASES.

dogs are driven home as in the first case. A concrete shell, such as before described, is placed around the pole to protect the rods, thus giving poles reinforced by either method a similar appearance above ground. The steel rods and concrete form a practically homogeneous mass said to be superior in strength to the wood alone when new, and equally capable of sustaining the side strain which every pole must stand. It is stated that the cost should not exceed $3.50 per pole, while the life is increased by 10 years.

The process described above has been patented by Mr. R. S. Orr. His patents have been purchased by the Pittsburgh Reinforced Pole Company, Pittsburgh, Pa.

Electric Crane for Car Repair Shop.

The accompanying illustration shows the interior of the car repair shop of the Washington, Baltimore & Annapolis Electric Railway at Academy Junction, Md. The electric traveling crane



ELECTRIC CRANE IN CAR SHOP.

was provided to be used just in setting the new shop machinery and later to handle car bodies and heavy running gear parts. The traveling crane is used to place a wall crane on any pilaster where needed, so that a small number of wall cranes will render very good service over the entire shop. The traveling crane has a span of 42 ft. and is provided with a 5-ton main hoist and a 6-ton auxiliary hoist. The main hoist is operated by a 20-hp motor, the auxiliary by a 15-hp motor, the bridge travel by a 15-hp motor and the trolley travel by a 3.5-hp motor. The motors are Westinghouse 550-volt, direct-current machines; the controllers were built by the Electric Controller & Manufacturing Company, Cleveland, Ohio. The traveling crane was designed, built and erected by the Whiting Foundry Equipment Company, Chicago. The designing engineers for the repair shop were the Roberts & Abbott Company, Cleveland, Ohio.

Low-Pressure Turbo-Generator Plant.

There was recently placed in successful operation at the Vandergrift plant of the American Sheet & Tin Plate Company an outfit consisting of a Rateau steam regenerator, a Rateau-Smoot low-pressure turbine and a Smoot direct-current generator. It utilizes the exhaust steam from reversing blooming-mill engines which work intermittently and at widely varying loads, thus having a supply which is constantly differing in volume. The generator was installed in order to overcome this variation and to supply the turbine with a steady flow of steam.

The regenerator is a cylinder, 40 ft. long, 8 ft. in diameter, containing about 45 tons of water. This water is heated by the exhaust steam from the mill engines; the storage of heat energy within the water is such that the engines may be completely shut down for two minutes and yet the regenerator will supply steam to the turbine at the rate of 25,000 lb. per hour. If the mill engines are idle for more than two minutes live steam is admitted to the regenerator for the continuous operation of the turbine.

The turbine is a 600-kw unit receiving steam at atmospheric pressure from the regenerator and exhausting into a condenser at not over 3 lb. absolute; thus its pressure range is from 15 lb. to 3 lb. per square inch. It is of the impulse type originated by Professor Rateau and redesigned by Mr. C. H. Smoot. The steam admission is controlled by a fly-ball governor which maintains the speed within 1 per cent from no-load to full load. Details of the Rateau turbine have already been described in our columns.

The generator is a 250-volt direct-current machine operating

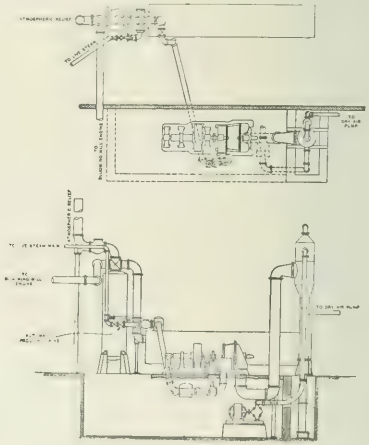


FIG. 1.—LOW-PRESSURE TURBO-GENERATOR PLANT.

at 1500 r.p.m. It is provided with four main poles and four commutating poles. The commutator is in two sections, held together against centrifugal force by nickel-steel retaining rings shrunk in place. The commutation is said to be first

ass, and the fact that the commutator does not have to be bricated removes a serious objection to the use of direct-rrent generators in plants such as the Vandergrift one, where e metallic dust in the air might settle on the oily surface

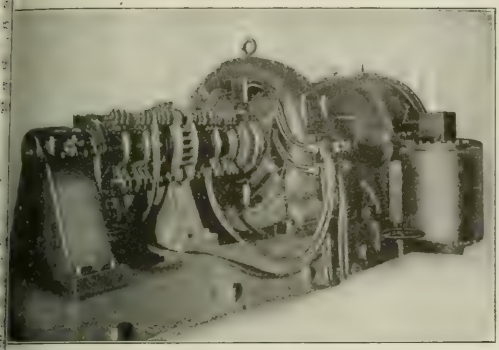


FIG. 2.—LOW-PRESSURE TURBO-GENERATOR.

nd cause short-circuits which would seriously injure the nachine. The generator is of the open-frame type with no orced-air circulation. It was designed by Mr. Smoot.

The above-described equipment was built by the Ball & Wood Company, Elizabethport, N. J.

Fixture for Tungsten Lamps.

As a means to combating gas competition and improving the ervice of customers, the tungsten lamp has firmly established tself, and with the advent of the so-called tungsten arc fixtures he electric light managers secured a very effective weapon for ighting gas competition or giving dissatisfied customers more ffective illumination for the same input. Recognizing the field for a moderate-priced, high-grade, durable fixture, the Central Electric Company, Chicago, Ill., developed the cluster illustrated herewith and which is known as the "Tungstolite." This does not differ materially from the accepted standards, and embodies a number of structural features. The reflector, 18 in in diameter, consists of an opal glass shade, formed to the proper angle to give the best diffusion of light and the highest reflecting qualities. The brushed brass canopy is 4 in. x 5 in., the stem consisting of ½-in. iron pipe covered by 1-in. brushed

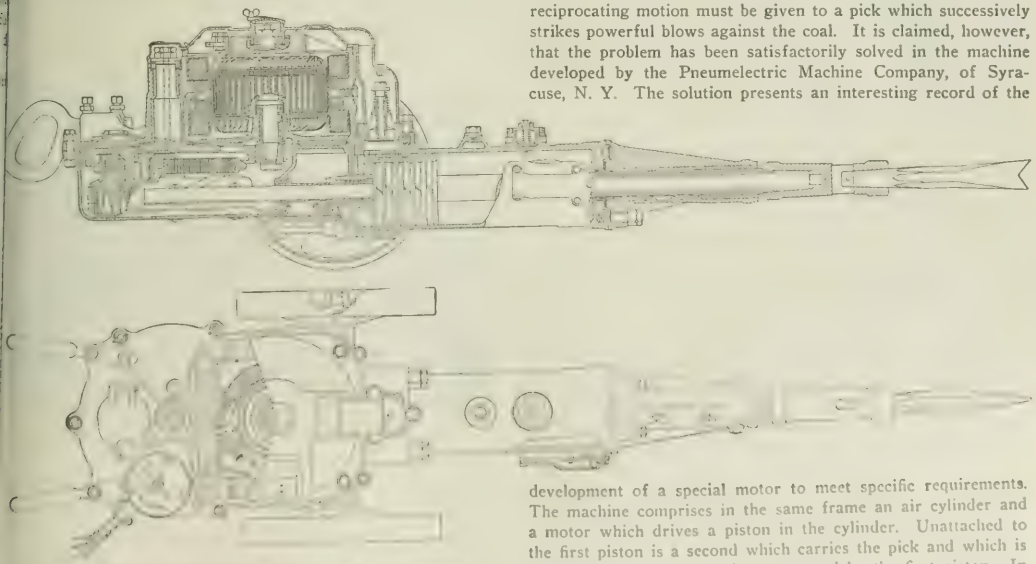


FIXTURE FOR TUNGSTEN LAMPS.

brass casing, thus giving a pleasing and uniform effect. Each fixture is supplied with an iron crowfoot fastened to a white porcelain steel reflecting plate, on which the sockets are mounted. It measures 25 in. over all when assembled with lamps, and can be used with 25-watt, 40-watt or 60-watt tungsten lamps as desired. Each fixture is packed in a substantial, individual wooden box ready for immediate shipment; these individual boxes are then mounted in shipping crates, so that when received the crates only are opened and each fixture can be forwarded to its destination without unpacking and without danger of breakage. Several combinations are furnished enabling the use of 3-, 4- or 5-lamp clusters.

Motor-Driven Pneumatic Coal Puncher.

The application of electricity to coal mining presented no great difficulties so long as a motor was required to drive the chain type of machine. But serious obstacles were encountered in the attempt to actuate directly the puncher type in which a reciprocating motion must be given to a pick which successively strikes powerful blows against the coal. It is claimed, however, that the problem has been satisfactorily solved in the machine developed by the Pneumelectric Machine Company, of Syracuse, N. Y. The solution presents an interesting record of the development of a special motor to meet specific requirements. The machine comprises in the same frame an air cylinder and a motor which drives a piston in the cylinder. Unattached to the first piston is a second which carries the pick and which is actuated entirely by the air compressed by the first piston. In its early stages it was prophesied that the motor would not withstand the heavy jar and the effect of concussion. This effect was, however, practically overcome by the ingenious cushioning of the pick-carrying piston. The transformation of circular into rectilinear motion presented an interesting prob-



FIGS. 1 AND 2.—ELEVATION AND PLAN OF COAL PUNCHER.

lem which was solved by the use of gears, as shown in the accompanying illustration.

The claim is made by the manufacturers that the motor is the lightest built for its output. Much of the trouble in the early days of its design arose from the fact that the motor must be enclosed and consequently that ventilation and heat radiation must receive the most careful consideration. Exhaustive tests were made under conditions considered equivalent to those in the mine. Successful ventilation and cooling were finally attained in the following manner: The air to be compressed is drawn in through the armature and field windings

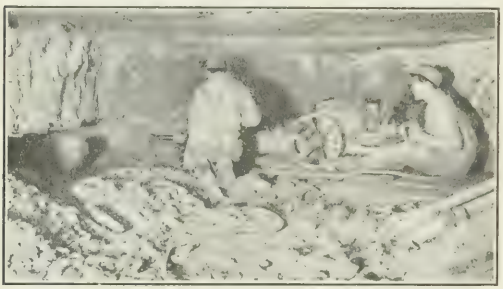


FIG. 3.—COAL PUNCHER IN OPERATION.

at each forward stroke of the air-compressing piston. By this means about 28 cu. ft. of cool air per minute passes over the heated parts at a velocity of about 2.5 ft. per second when striking about 165 blows per minute. This equipment has been found very effective, and is at the same time entirely automatic, no auxiliary appliances being required. The motor, which is of the ordinary series-wound, four-pole type, possesses no unusual features tending to make it complicated or requiring special generators for supplying energy. This motor, whose shaft is vertical, is completely enclosed, the motor frame and gear-case cover being made in one piece of cast steel; by this means strength, minimum weight and simplicity are secured. Support for the upper or commutator end of the motor shaft is furnished by a Hess-Bright radial ball bearing. At the lower end there are provided a ball thrust-bearing for taking the weight of the armature and a long bronze bushed bearing for taking up the lateral thrust due to the motor drive.

The armature is wound in such a way that each slot contains one-half of two independent coils which are machine wound and insulated before they are placed in the slots. The insulation on the coils is of the water-resisting quality. The field coils are also waterproof and are held in position with clamps so that they cannot vibrate or be injured.

New Factory for Manufacture of Electrical Instruments and Circuit-Breakers.

The Roller-Smith Company has moved into its new factory, near Bethlehem, Pa., and now possesses one of the most complete plants in the country for the manufacture of electrical instruments and circuit-breakers. The company was organized last July, as detailed in the *Electrical World* at the time, and was in effect a combination of The Whitney Electrical Instrument Company, of Penacook, N. H., and The Switchboard Equipment Company, of Bethlehem. The purpose of the new organization is the manufacture of the lines of instruments and circuit-breakers which in the past have been made by the above respective companies, and also the manufacture of electrical apparatus of allied lines.

The new factory is a two-story brick building of the gallery type, with monitor roof, and a one-story building containing chiefly the heating plant, foundry, pattern room and enameling ovens. It is located on a 2½-acre plot, on the main road between Bethlehem and Allentown. The main factory building is arranged for general machine shop, tool room, wood working room, grinding room, plating room and stock room on the first floor, with offices, draughting department, experimental department, circuit-breaker assembling department, instrument-assembling department, and lavatories on a gallery, 25 ft. wide, extending around the entire shop and surrounding a light well under the monitor. The main floor is concrete, reinforced where necessary for heavy presses. All of the departments above referred to are separated by 4-in. hollow tile partitions, thus reducing the danger of fire and its convenience of dust to a minimum; all doors are iron-clad, and all interior windows made of heavy wired glass. On the floor power is divided into three units, driving respectively the main machinery, the grinding and wood-working machinery, and furnishing current for plating and charging the two 8000-amp. storage batteries which are used for testing both instruments and circuit-breakers. All power is furnished by the Lehigh Valley Transit Company from its large stations at Allentown, both alternating and direct current being supplied. On the gallery floor are separate power units for the finer machine work on circuit-breakers and for the precision lathe work employed in the manufacture of instruments.

In the northwest corner of the main floor is a large wood-working department for the manufacture of instrument cases and cabinet work for all the different types. Adjoining is the finishing room, where the cases are finished and made ready for the last step; the varnishing is done in an adjoining room, separated by fireproof partitions.

To the east of the carpenter shop is the grinding room, in which all of the grinding and polishing of the metal parts are done. This room is, like the others, made both fireproof and dustproof, and is properly equipped for the removal of all the dust thrown down by the grinding and polishing machines operating here. Adjoining is a similar room, in which is done the plating of the metal parts.

In the southeast corner of the first floor is the stock room and shipping department, so located and arranged as to be at once convenient to all parts of the shop, and also for the speedy handling of outgoing and incoming material. With the exception of the southwest corner of the lower floor, which is given over to a complete tool room operating in connection with the machine shop, the balance of this floor is used for the general machine shop where the heavier parts of the circuit-breakers and instruments and tools are made and machined. On



FIG. 1.—NORTH END OF INSTRUMENT ASSEMBLY ROOM.

this floor also are the storage batteries and the boards for the testing and calibrating of circuit-breakers, which, through these batteries and auxiliary apparatus, may be directly calibrated up to and including 10,000 amp.

Just at the head of the entrance stairs on the gallery floor are the offices of the factory, consisting of one general room and two private offices. The superintendent's office is so arranged that practically every point in the shop can be seen by him without his leaving his desk. Next to the offices is the draughting department, and adjoining it and a part of it, the experimental department, where all experimental work and de-

gning is completed before the drawing is given to the shop r manufacture.

Along the west and a part of the north sides of the gallery carried on the manufacture of some of the smaller parts of struments and circuit-breakers, and also the assembling of rcuit-breakers. On the north side is the precision tool work, here are located the several precision and jeweler's lathes quisite to the manufacture of the finest parts of the instruents.

The entire east gallery, which is separated from the rest of e shop by dust-proof glass partitions, is given to the assemling of instruments. This large room, which is directly lighted through three outside walls and from the monitors through e fourth, was designed particularly for this purpose, and is ntirely free from vibration, as there is no machinery beneath and none but the small precision lathes within 50 ft. of it. n this room, in addition to commodious benches all around he four sides, are large transverse benches on which assembling he work is done. In addition to the builders' paper, which lies etween the 3-in. spruce and 1-in. maple floor throughout the econd floor, heavy tar paper was laid with hot wiped joints, hus minimizing the chance for dust to the lowest degree. The urrent required for the calibration of instruments in this room drawn from the storage batteries directly beneath.

Just north of the main building is a one-story building, in hich are the heating boilers, the blacksmith shop, the foundry, he pattern room, and the enameling room. Both buildings re heated by the vacuum steam system, steam being supplied y twin boilers manufactured and installed by The Messinger Manufacturing Company, Tatamy, Pa., the boilers being so rranged that in severe weather they may be coupled up and n more moderate weather the fires of one withdrawn. In the ame room with the boilers, and on the same level, are four urnaces for the melting of the brass, aluminum and copper for astings of these respective metals; all the castings used in the ircuit-breakers and meters, with the exception of iron castings, re made by the company under its own supervision. In this oom, also, is the blacksmith shop, where the magnets used in he instruments are made. Adjoining the foundry room, and onnected therewith, is the pattern room, in which are kept ll of the wood and metal patterns required for both instruments and circuit-breakers. Next to the pattern room, and



FIG. 2—NORTH END OF CIRCUIT-BREAKER ASSEMBLING ROOM.

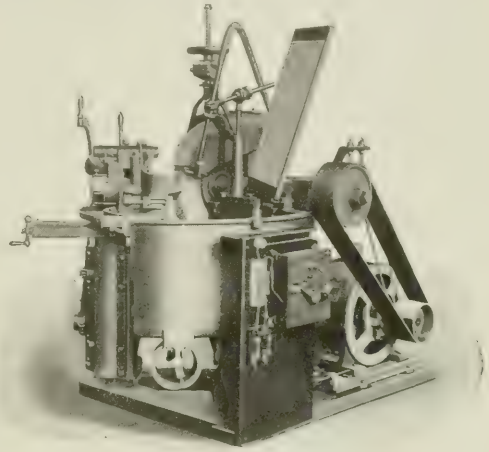
separated therefrom by a solid fireproof wall, is the enameling room, which, because of the class of work, is as fireproof as modern methods can make it.

Both the main factory and foundry buildings are constructed on the unit plan, the east walls being so built that without in any way weakening the floor and roof they can be knocked down, it being the intention of the company to build on the east side of the present factory a duplicate of the present shops.

The company reports that since it began the regular manufacture of its products, about Jan. 15, it has increased the force by over 50 per cent, and even yet is slightly handicapped and compelled to look to neighboring labor markets for the high-skilled operatives it needs.

Grinding Tools by Machinery.

Perhaps nothing is a better indication of the progress which is being made in the organization of machine shops than the development of tool grinders, from the old form of soft grindstone running at a slow speed up through the higher-speed emery wheel to the present automatic tool-grinding machine. The advantages of doing work by a definite system instead of in a haphazard manner is well understood and the production



ELECTRICALLY DRIVEN TOOL GRINDER.

of interchangeable parts is the result. But the standardization has gone further than to the finished product and now includes the tools used in the machines.

With the perfection of a machine to grind the various tools that are used on planers, lathes, boring mills, shapers, slotters, etc., in fact, practically all the machines used in machine shops, and one which will do it automatically and accurately, a great stride has been made toward uniformity of tools and hence maximum production from the machines.

Such a machine has been designed and placed in the market by Wm. Sellers & Company, Inc., which is claimed to do the work better than is possible by any other method. It is first necessary to adopt standard forms and cutting angles for the various tools and then every tool ground thereafter will conform to the standard which has been found to be the best suited to that work.

Illustrated herewith is an electrically driven universal tool grinder which will grind all manner of cutting tools except those with concave curves and re-entrant angles less than a right angle. It is shown driven by a 7½-hp, direct-current, constant-speed motor of Westinghouse manufacture, running at 975 r.p.m. The motor is mounted on the subbase of the grinder, and a starting rheostat with fuses and switch is also mounted by the side of the grinder, resulting in a most compact and convenient equipment.

With the grinder the company supplies a set of tools which it has found from experiment to be best designed for various classes of work, but provision is also made so that any form of tool, within the limitations of the machine previously mentioned, can be ground correctly to the standard adopted. It is to be especially noted that this machine is operated successfully by unskilled labor because of the automatic feature by which shapes are accurately duplicated both rapidly and reliably.

A rotary pump forces water to the tool being ground through

a system of jointed pipes ending in an adjustable nozzle, furnishing a large volume of water at a low velocity. This arrangement is so made as to prevent the water from splashing and keeps it away from the working parts. With the machine is supplied a table which shows the adjustments for various tools, etc., so that it is very simple for an unskilled operator to learn to do all the grinding of the cutting tools.

Combination Junction-Box and Pothead.

When lead-covered cables are terminated in power houses and substations, the insulation at their ends is always carefully sealed in by means of potheads to prevent moisture from entering between the lead sheaths and the cable. It is manifestly inconsistent to open cables in a similar manner in underground manholes where moisture conditions are much worse, without likewise sealing the insulation against moisture. The G. & W. Electric Specialty Company, 128 West Jackson Boulevard, Chicago, which has made a specialty of designing and manufacturing porcelain potheads and cable terminals for power-station and arc-circuit work, is just placing on the market a combination junction-box and pothead for use in manholes or in other places where lead-covered cables terminate in junction or fuse boxes.

The external appearance of this box is shown in Fig. 1 and the details in Fig. 2. The lid laps over the sides of the box so as to form an inverted bell which catches the air under the lid as water rises around the box and prevents water from entering the box. As a protection against moist air and dust, a heavy rubber gasket is placed in the lid, and lugs and bolts make it possible to draw the lid down tightly on the box. The lid of the porcelain box has locking handles, by means of which the enclosed cartridge fuse can either be removed with the lid of the box when the cover is taken off or left in circuit in the bottom of the box.

The fuse clips are entirely above the level of the entering cables. Consequently the cables can be sealed in by pouring suitable insulating compound in the box nearly up to the fuse clips. This completely covers and seals the insulation at the end of the lead-covered cable. At the same time the manipulation and installation of the terminals are comparatively easy. The method of installing and connecting the box will be plain from a study of Fig. 2, which shows the box taken apart. In this cut, the part numbered 2 is one of the fuse clips. In the bottom of this clip is the cable terminal lug into which the cable conductor is sweated; the clips are removable during this sweating process in order that their temper may not be affected by the heat. After the cable has been sweated into the terminal (2) the porcelain block (3) is slipped into the terminal and fastened with the screws (4), producing the combination seen in (1). This porcelain block (3) when slipped into the terminal lug also slips into the recesses made for it in the lower part of the ends of the box (5), the fuse terminal clip thus being held in place. This process being repeated for the other terminal, the porcelain box is sunk in the iron box and hot compound poured in up to the level of the fuse clip. The lead-cover sheath is wiped to the wiping thimbles which are fastened the iron box, as seen in Fig. 1.

These boxes are made for single-, two-, three- and fou conductor cable. They are designed for voltages up to 66

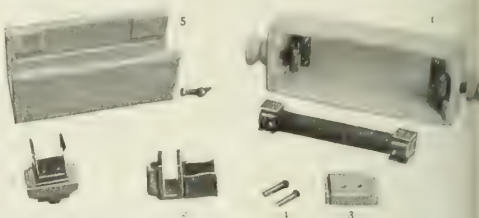


FIG. 2.—DETAILS.

These various types are made both for ½-tap for branches an for straight-tap, as shown. The box is about 14 in. long. Wit the types available it is therefore possible to either insert main fuse or to make the box serve as a branch connector. Th difficulties of locating the trouble on branch circuits whe cables or lines must be cut are well known.

Detachable Flush Switch.

To install the old style of flush push-button switch in a w plastered wall of a new building is to subject it to a hardshi which it is little fitted to overcome. The steel parts, th springs, the metal rivets and pins promptly corrode—especiall in cases where they are not used at once—and the spring break when it is attempted to operate them, or a break-down only a matter of time. When this occurs a complete ne switch is necessitated, the wires have to be disconnected an in so doing are often broken and have to be spliced.

While it may be true that some of the old-style switche installed 10 to 15 years ago are still in use, this may be ac counted for by these having been made of all cast parts, very heavy and capable of carrying 25 amp or more. In some cases it took the strength of a man with a muscular thumb to work them. Since the ruling of the Underwriters of about 10 or 12 years ago limited circuits to 12 lights, the switches have been made of lighter construction to get an easier push. In an installation in New York of about 5000 switches, three complete

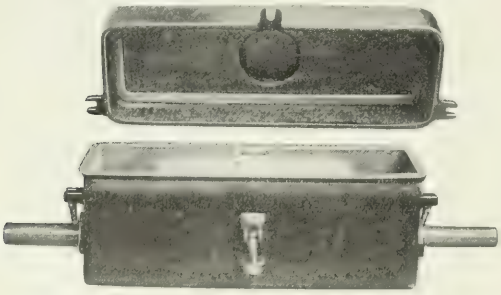
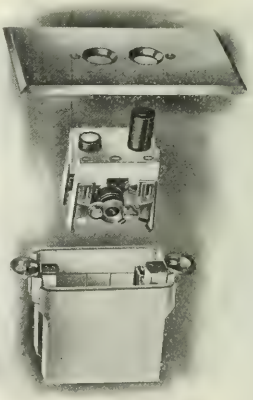


FIG. 1.—VIEW OF BOX.



DETACHABLE FLUSH SWITCH.

equipments of different-make switches were used in eight years. To meet this situation the detachable flush switch, illustrated herewith, has been brought out by the Metropolitan Switchboard Company, New York. It will be seen that the mechanism of this switch is in a plug form which can be withdrawn without disturbing the connections in the contact-box part, and allows a new plug to be inserted when necessary. The three parts shown, the contact box, the plug mechanism and the face plate, are packed in separate boxes. The contact box, which is any iron outlet box, is provided with a sheet-fiber cover or filler to prevent the dirt getting into the contact box before the plug mechanism is inserted. The plug mechanism is wrapped in oiled tissue paper and packed in a strong box and need not be inserted until the decoration of the walls is finished. The face plates are of the old, familiar type except when special ones are required.

It is claimed that this switch saves money for the wiring contractor, as the accessibility of the binding post enables the fireman to connect them up quickly. The use of them also enables the contractor to finish once for all the wiring of a building and does not oblige him, as in the case of the old-style switch, to stuff the outlet boxes with paper and return to install his switches after the rough plastering is done.

To the owner of a plant it appeals at once, as former troubles with the old-style switches are done away with and a breakdown of a switch means nothing more to remedy it than to push a plug in a receptacle. As to design and workmanship, it is merely necessary to state that in an actual test one of the mechanisms was operated 31,400 times.

A Well-Lighted Store.

The store of S. A. Anderson, located at 440 Main Street, Buffalo, N. Y., illustrated herewith, is a good example of the economical and highly efficient lighting effect obtained by the use of tungsten lamps in combination with prismatic reflectors. The illustration was reproduced from an unretouched night photograph. Prior to the installation of these lamps the store was lighted by three enclosed arc lamps and the windows by means of 15 16-cp carbon-incandescent lamps mounted in a reflecting gutter. Under the old conditions the store was as well lighted as its neighbors, but since the installation of the light is far superior to that obtained under the old conditions, being, in fact, a close approximation to sunlight. In the store there were formerly installed three 5-amp, 110-volt direct-current arc lamps, having a total current consumption of 1650 watts. The new equipment consists of four General Electric 250-watt tungsten lamps with the lower portion of the bowl frosted, and provided with satin-finished prismatic glass reflectors. They give twice the effective illumination obtained from the use of the arc lamps and with a power consumption of only 1000 watts as against 1650 watts. This is a 40 per cent saving; that is, giving a reduction of 40 per cent in the bill for the same hours' use of the lamps or less 65 per cent longer use for the same cost.

In the window 15 16-cp, 50-watt carbon-incandescent lamps were formerly used, with a power consumption of 750 watts, giving an effective illumination of 240 cp. These were replaced by three 250-watt tungsten lamps, similar to those in the store, and equipped with the same satin-finished reflectors. The power consumption in this case was the same as with the carbon lamps, namely, 750 watts, but the effective illumination was more than three times as great, being 750 cp as against 240 cp. In addition to this, it should be taken into account that the periodical disturbance caused by trimming arc lamps is altogether avoided, as the tungsten lamp has an effective life of 800 hours, and, unlike its predecessor, the carbon lamp, it will maintain its full lighting efficiency throughout its effective life. The light is not only evenly diffused, but the slight variations in voltage which occur in the average lighting circuit will not cause any flickering in the tungsten lamp.

The saving in bills for power consumption assured by the use of tungsten lamps is obvious, and it was Mr. Anderson's prompt appreciation of their many advantages that caused him to scrap the old lighting outfit in his Buffalo store and substitute tungsten lamps.



STORE WINDOW LIGHTING WITH TUNGSTEN LAMPS

tungsten lamps it stands out conspicuously as an example of effective illumination.

As the very practical question of cost is of vital importance in store illumination, it is interesting to compare the amount of energy consumed under the old and new conditions, bearing in mind at the same time that with tungsten lamps the quality of

Nernst Lamp Chandeliers.

The Nernst Lamp Company has added to the line of Westinghouse Nernst chandeliers a new type equipped with candelabra lamps for instantaneous lighting. The candelabra lamps are mounted in a vertical position, one directly above each of the burners, and have the appearance of additional ornamentation when not burning. The candelabra lamps burn only while the heater tubes are in service and are automatically cut out with the heater tubes. When used on the 220-volt type chandelier the candelabra lamps are connected two in series. On the 110-volt type, they are connected in multiple. Chandeliers with this equipment are made in all the standard Renaissance and Art Nouveau designs.

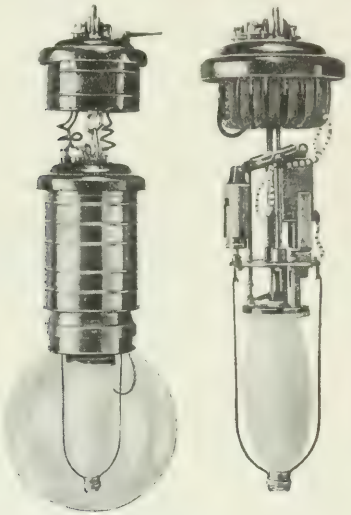


CHANDELIER

New Arc Lamp for 25-Cycle Circuits.

As the pulsations of a 25-cycle enclosed carbon arc are visible to the eye, light emanating from such a source cannot be considered satisfactory for many classes of artificial illumination, and will not ordinarily be used in any case where a more suitable circuit is available. With the more extensive use of lower-frequency alternating current for railroad and stationary motor power, there are parks, railroad terminals, factory buildings and factory yards to be lighted. For such general illumination the 25-cycle enclosed arc is being used and considerable satisfactory. Heretofore the only enclosed arc lamp available has been a modification of some lamp designed for higher-frequency circuits, such modifications consisting of the use of extra or more flexible springs to take up the vibration of the mechanism.

Fig. 1 shows the external appearance and Fig. 2 the mechanism of a lamp designed by the General Electric Company to



FIGS. 1 AND 2.—ARC LAMP FOR 25-CYCLE CIRCUITS.

meet these exacting requirements. The frame is of the well-known two-rod type. The mechanism consists of a rocker frame carrying the lamp magnet and suitable current-adjusting counterweight. The armature is of standard laminated construction, but is stationary and held rigidly to the lamp-base casting. By the use of this considerable weight in the moving element, and by making the armature a part (mechanically) of the lamp frame, objectionable vibration is absorbed or deadened, thereby permitting the elimination of all springs. The lamp is as quiet and free from vibration in starting and operating as standard lamps for higher frequencies.

Where this lamp is to be operated on 220-volt or 440-volt circuits, an external as well as an internal compensator must be used (Fig. 1) and a third binding post placed on the lamp top, while for 110-volt circuits the lamp is self-contained.

Electric Welding Machines.

Electric welding machines are not intended to be universal in their application. The device does not take the place of a blacksmith and weld anything from a barrel hoop to a propeller shaft. The welder is a special machine designed for the manufacturer who has thousands of pieces of one kind to weld, and for this work the machine is without a peer. The Toledo Electric Welding Company, of Toledo, Ohio, manufactures a line of electric welders, each of which is suited for a particular class of work. Two of these machines are illustrated herewith. As is well known, the underlying principle of the electric welder is very simple and is an adaptation of the fact that a poor conductor offers so much resistance to the flow of e tricity that intense heat is set up. The degree of heat dep on the current and the resistance. For welding purposes al nating current having a tension of about 4 or 5 volts is pre able. Electricity at this potential is easily obtained by mean the transformer, which forms part of the welding equipm To give some idea of the power required and the time it ta

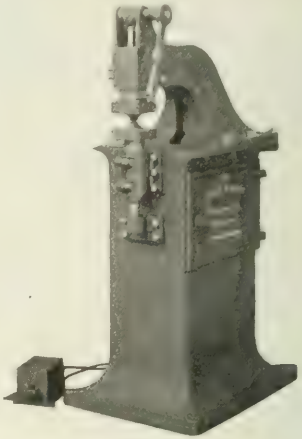


FIG. 1.—SPOT WELDER.

to make a weld, the following table for round iron and st is appended. The time may vary from that given, as the great the current the shorter the time.

Diameter of rod, inch.	Kw.	Time in seconds.
¼	5	5
½	8	10
¾	12	20
1	18.5	30

The power required varies for the different sizes nearly as t cross-sectional area of the material at the point where the we is to be made. Best results are obtained when the surface free from rust and scale. Fig. 1 shows a spot welder. this machine two pieces of iron wire, for instance, are plac one across the other on the lower die in the form of a cros The lever handle is pulled forward, thus forcing the upper d down until it touches the wire, the foot switch on the floor pressed and the weld completed. Fig. 2 shows a welder f

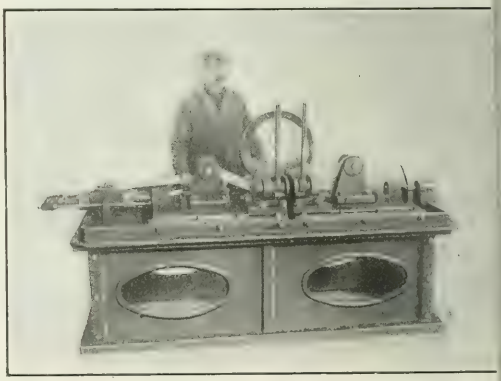


FIG. 2.—WELDER WITH HYDRAULIC RAM.

iron and steel up to 1½ in. cross-section. The machine i shown with a heavy ring in the clamping jaws. A helper in serts the stock and the man doing the welding pumps the leve shown in front which operates a 5-ton hydraulic jack to forc the ends together. A weld is made in 40 seconds and the work is accurate and uniform.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Conditions of trade during the past week have shown very little improvement. In all lines there seems to be a disposition to delay. Every one is waiting until after the tariff is definitely settled, and many opinions are expressed that there will be no satisfactory volume of business until the fall. It is not the reduction in the tariff rates that has brought about this condition so much as the uncertainty. When once settled, manufacturers and merchants will adjust themselves to the new conditions, and business will proceed upon the new basis. It is the general opinion that this basis will be lower than that which has prevailed in recent years, and that the price of labor will necessarily be reduced. Whether the process of readjustment will bring about strikes and disturbances is a question. It is believed, however, that no serious disturbances will occur. In jobbing and wholesale lines the limited business done during the past week has been purely from hand to mouth, and only small-in orders and orders for absolute necessities are being received. In the industrial field there is very little business being transacted. The equipment situation is unimproved, and, while many railroads have plans perfected for large orders, few are being placed. The electrical companies report the same condition of affairs, and say that, while there is good business in prospect, little is being received at this time. The crop situation is entirely satisfactory, and the promise of abundant yields was never better at this season of the year. Railroad earnings continue to show increases over the same period last year, and net earnings are vastly improved, owing to the economies of operation. Collections continue to be only fair, but there are few business troubles to disturb trade. Business failures for the week ended March 25, as reported by *Bradstreet's*, were 226, compared with 224 in the previous week, 246 in the similar week of 1908, 166 in 1907, 169 in 1906 and 207 in 1905.

THE COPPER MARKET.

There has been some revival of speculative activity in standard copper warrants in the London market during the past week. This activity it is believed has been mainly for the American account, and has resulted in a material advance in the prices of futures, with a consequent strengthening of the tone of the entire market. In addition to this there has been a trifle more activity in buying for consumption in this country. This buying has been principally for wire drawers and brass manufacturers, and, while it has not been extensive, has had the effect of encouraging producers and putting up prices. During the week there has been an advance of from ¼ to ⅜ cent through the entire list, and copper sellers continue to refuse to make contracts for round lots for future delivery. Thus it will be seen that the condition of the copper market appears to be materially improved, in spite of the fact that buying continues to be abnormally light and production continues to be unprecedentedly heavy. Exports have been a trifle greater during March than in February, and will probably amount to 50,000,000 lb., and domestic consumption will be in the neighborhood of 40,000,000 lb., making the total takings for the month about 90,000,000 lb. As the production and imports will easily amount to 110,000,000 lb. there will be an apparent accumulation of 20,000,000 lb. This addition will bring the Copper Producers Association's figures of "marketable copper" up to near 300,000,000 lb. It is generally believed that the actual amount of copper in sight in this country is far greater. While there has been a continuance of the talk of curtailment that has been intermittently heard since the beginning of the year, it is highly improbable that such a course will ever be undertaken. The producers who can market copper at 10 or 11 cents, at a profit, have no disposition to close their plants, or to shorten output, in order to protect their brethren who cannot get 12 cents. Concerted action is therefore absolutely out of the question. On the other hand, the producers whose cost is highest are for the most part very extensive establishments, and are held by powerful financial interests. For these it is better business to continue operations at a small loss rather than close. The latter course means a continuance of carrying charges and a disintegration of working forces. During the past week there has been a revival of the talk of forming a new metal exchange or at least abandoning the present institution, but nothing has so far come of it. At the annual meeting of the Exchange, March 29, the, so-called, administration ticket was re-elected without organized opposition. Only 74 votes were cast, and P. R. Jennings was chosen president. Exports of copper for March, including March 29, have been 20,454 tons. Quotations on the Metal Exchange March 29 were:

Lake	13
Electrolytic	12⅝
Casting	12⅜

London prices were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	57 1 3	56 17 6
Standard copper, futures	57 16 3	57 12 6
Market	Firm	Easy
Sales of spot		250 tons
Sales of futures		2,500 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard		
Lake	14 5s	12.55
Electrolytic	14 25	12.12½
Casting	14.12½	12.00
London, spot	£64 5 0	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	65 15 0	59 0 0

ELECTROCHEMICAL ENGINEERS AND EXPERTS.—Messrs. Delton, Mailloux & Company announce the establishment of offices in Paris and in New York, and that they are prepared to undertake all kinds of electrochemical engineering and expert work. M. Henri Delton has an established reputation in Europe as an electrochemical engineer of ability and experience. He has been identified with many important electrochemical industries there and has had occasion to design, construct and operate numerous electrochemical plants for different purposes. He is retained as the technical adviser and the consulting engineer of several electrochemical concerns in various countries. Mr. C. O. Mailloux's success and reputation and his large clientèle as a consulting electrical engineer are adequate evidence of his extended and diversified experience in electrical engineering and construction work of all kinds. The announcement states that the firm has at its disposal the experience and data of numerous electrochemical plants and processes of all kinds. The firm can thus predetermine costs and results with certainty and is in a position to design new plants or redesign and modernize existing plants with precision. It will also assist clients in the development of new processes and methods or in introducing them in various countries, and, in general, is ready to place its knowledge, experience and facilities at the disposal of those who have electrochemical problems of any kind to solve and who wish to attain practical, industrial or commercial results in the shortest time and with the least expense.

GENERAL ELECTRIC COMPANY EQUIPS ELECTRIC HOTEL.—The Stanley Hotel, at Estes Park, Col., is to be operated entirely by electricity. F. O. Stanley, the proprietor, is sparing no expense in the equipment of the house, and has acquired the water power which, at a distance of four miles, will provide enough electric energy to not only supply all of the electricity for use in the hotel, but for his own private residence and other cottages in Estes Park; street lighting will also be supplied from the same source. Mr. Stanley is determined to make this hotel representative of the latest ideas in applications of electricity, and has ordered from the General Electric Company a complete electrical equipment for his kitchen and laundry. When open for regular service this summer the hotel will be "up to the minute" in all of its electrical appointments. The hotel is designed to accommodate between 200 and 300 guests.

EXTENDING WIRELESS IN THE GREAT LAKES.—Just at the present time there appears to be a tremendous development in the direction of equipping the shipping of the Great Lakes with wireless telegraph apparatus. The United Wireless Company has recently made contracts to install upon the Graham & Morton fleet of steamers its apparatus, and has in prospect contracts with several other large steamship companies operating in the same waters. Stations for overland and lake service are being established at many points on the shores of the lakes, and are expected to be in operation shortly after navigation is entirely opened. The following cities have been definitely decided on for wireless stations, being the principal ports by the lake traffic: Duluth, Chicago, Milwaukee, Manitowoc, Wis., Benton Harbor, Holland, Grand Haven, Ludington, Petoskey, Macinac Island, Sault Ste. Marie and Detroit, Mich.; Toledo and Cleveland, Ohio, and Buffalo, N. Y. A representative of the United company says that many other stations will be equipped during the coming summer. It is intended by the company to develop an extensive inland service in this section of the country, and it is believed that commercial messages will be transmitted in sufficient quantity to make the investment a paying one. In this locality the United company is adding to the capacity of its Waldorf-Astoria station. This will be made a 5-kw station, with the wires elevated upon high steel towers. It is expected that under favorable conditions this station will be able to communicate with Havana and Porto Rico.

SISKIYOU ELECTRIC POWER COMPANY.—The Siskiyou Electric Power Company, Yreka, Cal., has recorded claims to 450,000 in. of water of the Klamath River, to be taken at two points about half a mile distant from the present power plant on Fall Creek. Alex. J. Rosborough, secretary of the company, is the claimant. The water location carries the entire flow of the river at low water. The company will begin work soon on a new power plant which is to be completed within three years and which will have a capacity of 60,000 hp. The plant will be located at Ward's Canyon and will necessitate a tunnel for the gravity line. The company's present plant at Fall Creek is developing about 6000 hp, but will soon be insufficient to meet the demands upon it.

LONG ISLAND RAILROAD TO BUY $2,000,000 MOTOR CAR EQUIPMENT.—Specifications have been prepared by the Long Island Railroad and bids will soon be asked for 120 steel passenger motor cars. These cars with their motors will cost in the neighborhood of $2,000,000. They are intended for service through the Pennsylvania tunnels under the East River, which it is now promised will be completed in the spring of 1910. Only steel cars will be used in these tunnels and in the suburban service in Long Island territory adjacent to New York.

CHICAGO ELECTRICAL WORK IN PROSPECT.—Among the Chicago concerns which are preparing to build new electric plants or extensions to old ones, for which engines, generators, motors, switchboards and other equipment will be required, are the W. M. Hoyt Company, Hart, Schaffner & Marx, the Chicago Reduction Company and the Gutmann Company, tanners. Mr. Martin C. Schwab, 161 State Street, Chicago, is the consulting engineer for all of these plants.

BERGMANN TUNGSTEN LAMPS.—The P. H. Klein, Jr. Company, 110 Liberty Street, New York, is introducing the "Wolfram" tungsten lamps in the 25-watt size, which gage is now regularly made at the Bergmann Electrical Works of Berlin, Germany, of which the Klein company is the U. S. representative. This new lamp corresponds in size and shape to the ordinary 16-cp carbon filament lamp, and can be burned in any position.

YORK (PA.) HYDRO-ELECTRIC PLANT.—C. C. Spahr, a leading contractor of York, Pa., has purchased the water rights on Connewaga Creek, three miles from Wellsville, York County, Pa., where he will install a water-power plant. A concrete dam is built across the creek, and there is sufficient water at all stages to generate 150 to 200 hp. It is estimated that the plant when completed will cost approximately $25,000.

ELECTRIC MOTOR FOR A PAPER MILL.—The Raymondville Paper Company, Raymondville, N. Y., will add four motor-driven pulp grinders to its electrical equipment. Electrical energy for the plant is transmitted from the hydro-electric station at Massena Falls.

ELECTRICALLY EQUIPPED COLD STORAGE PLANT.—A consular report states that the Arcadia Cold Storage Company, of Halifax, N. S., has been organized to build a $500,000 cold storage plant which will be electrically equipped.

NAVAL PROPOSALS.—The U. S. Navy Department is asking proposals for the supply of 11 induction motors to be delivered at the Norfolk Navy Yard. Bids will be opened April 9.

Financial Intelligence.

THE WEEK IN WALL STREET.

Trading in stocks during the past week has been on a relatively small scale. The daily transactions have averaged less than 500,000 shares until March 29, when there was a spurt in activity, and there has been small interest displayed, either among the speculators or investment buyers. The tone of the market continues to be strong, and the net changes recorded have been, almost universally, advances. One of the striking features of the market is the stubbornness with which the active list resisted the sudden demoralization of traction stocks. When Interborough-Metropolitan preferred broke 7 points within a few hours, and Third Avenue sold off 6 points, the balance of the list maintained its steadiness, and in many cases actually advanced. It is pretty thoroughly understood that there will be little activity in trading until the settlement of the tariff question. There is to be no general resumption of business until the new basis is adopted, and, in the last analysis, the stock market is entirely dependent upon actual business. There has always been an opinion that the gross earnings of railroads are something of a barometer. These are certainly encouraging at the present time. In both January and February the gross earnings have materially increased. The fact that the earnings have increased is not so important, because it is well known that there have been rigid cuts in the charges for maintenance and improvements. This latter fact, however, is in itself hope-inspiring, from the fact that when the railroads begin to buy again they will need large quantities of equipment. Copper stocks continue to be surprisingly strong in view of the statistical position of the metal market. This is attributed by many to manipulation, but it is more likely due to the confidence speculators have in the ability of the financial interests behind the copper producers to maintain prices, even in the face of reduced consumption. The money market continues easy, and the demand for bonds is good. Rates quoted March 29 were: Call, 1½@2; 90 days, 2½@2¾ per cent. The quotations in the table are those of the close March 29.

NEW YORK

	Mar. 22.	Mar. 27.	Shares sold.		Mar. 22.	Mar. 27.	Shares sold.
All.-Ch.	13⅝*	14⅜	1,732	Int. Met., pfd..	42¾	40	580
All.-Ch., pfd...	43	43½	1,900	Mackay Cos....	72⅛*	73½	100
Amal. Cop. ...	70½	74¼	127,200	MackayCos.,pfd.	71*	71¾	165
Am. D. T.....	35*	35*	—	Manhattan Elev.	142¾*	144	900
Am. Loc.	52	54¼	5,350	Met. St. Ry....	28*	21*	100
Am. Loc., pfd.	111½*	114½*	12,400	N.Y. & N.J.Tel.	116	117¼*	100
Am. Tel. & Cbl.	70½*	72½*	——	Steel, com.....	44¾	47⅛	253,400
Am. T. & T....	130	132¼	12,400	Steel, pfd.....	110½	112⅜	9,300
B. R. T.....	72⅛	74⅝	30,170	W. U. T.....	65	66⅞	2,100
Gen. Elec.	153½*	157½	4,700	West'h., com...	79*	83⅜	4,400
Int.-Met., com..	14¼	13	28,600	West'h., pfd....	115	115*	——

PHILADELPHIA.

	Mar. 22.	Mar. 27.	Shares sold.		Mar. 22.	Mar. 27.	Shares sold.
Am. Rys.	45¾	45½	——	Phila. Elec. ...	11⅜	11⅞	——
Elec. Co. of A.	12½	12½	——	Phila. R. T....	27⅞	28⅞	——
Elec. Stor. B'tv	46⅝	46½	——	Phila. Traction.	92¼	92½	——
E. S. B'tv, pfd.	49*	49*	——	Union Traction.	53¾	54⅜	——

CHICAGO.

	Mar. 22.	Mar. 27.	Shares sold.		Mar. 22.	Mar. 27.	Shares sold.
Chi. City Ry...	187*	187*	——	Chi. Tel. Co...	133	132¼	——
Chi. Rys., Ser.1.	111*	111*	——	Met. El., com...	19*	19*	——
Chi. Rys., Ser.1.	110*	110*	——	Nat'nal Carbon.	85½*	85½*	——
Com. Edison....	111½	111½	——	Nat. Carb., pfd.	119*	119*	——
Chi. Subways...	20*	17½	——				

BOSTON.

	Mar. 22.	Mar. 27.	Shares sold.		Mar. 22.	Mar. 27.	Shares sold.
Am. Tel. & Tel.	130	132½	——	Mex. Tel.	2½*	2¾	——
Com. Tel.	127½*	126½	——	Mex. Tel., pfd.	5*	6¾	——
Edison El. Ill..	254	251	——	N. E. Tel.	131½	132½	——
Gen. Elec.	151	158	——	W. Tel & Tel.	7*	7*	——
Mass. Elec. Ry	14¾*	15	——	W. T. & T., pfd	77¾	77	——
Mass. E. R., pfd	71	72½	——				

*Last price quoted. Shares sold are for week March 22 to March 27.

DIVIDENDS.

Bell Telephone Company of Missouri, quarterly, 2 per cent, payable April 1.

Bell Telephone Company of Pennsylvania, quarterly, 1½ per cent, payable April 15.

Central & South American Telegraph Company, quarterly, 1 per cent, payable April 7.

nicago Telephone Company, quarterly, 2 per cent, payable
ch 31.
lectric Storage Battery Company, preferred and common,
terly, ¾ per cent on each issue, payable April 1.
anchester (N. H.) Traction, Light & Power Company, quar-
, 2 per cent, payable April 15.
exican Telephone & Telegraph Company, semi-annual, 2½
cent, payable May 1.
exican Telegraph Company, quarterly, 2½ per cent, payable
il 14.
ational Light, Heat & Power Company, quarterly, 1¼ per
, payable April 1.
ew England Telephone Company, quarterly, 1½ per cent,
able April 15.
ew York & New Jersey Telephone Company, quarterly, 1¾
cent, payable April 15.
hiladelphia Company, common, quarterly, 1½ per cent, pay-
May 1.
cranton Electric Company, preferred, quarterly, 1½ per cent,
able April 1.
rinidad Electric Company, Limited, quarterly, 1¼ per cent,
able April 10.
G. White & Company, preferred, quarterly, 1½ per cent,
able April 1.

IERGER OF ELECTRICAL CAR LIGHTING PROPTIES.—The United States Light & Heating Company, which incorporated in January under the laws of Maine, for the pose of taking over several electric car-lighting properties, completed its organization. The authorized capital of the company is $17,500,000, consisting of $2,500,000 7 per cent ulative preferred and $15,000,000 common. No bonds are horized. The company has taken over the Bliss Electric Lighting Company, of Milwaukee, the National Battery mpany, of Buffalo, and the United States Light & Heat- Company, of New Jersey, which has a plant at 22 Thames eet, New York City. The new corporation begins life with ery impressive board of directors and officers, and, according a prospectus which has been issued, offers promise of hand- e returns to investors. The directors are: Edwin Hawley, sident and director of a number of railroads; Julius E. nch, chairman of the board of directors of the Railway el Spring Company; William H. Silverthorn, president of Railway Steel Spring Company; Theodore P. Shonts, presiit of the Interborough-Metropolitan; Newman Erb, presit, Wisconsin Central Railroad Company; Charles A. Stark, president of the New York Air Brake Company, and alter S. Crandell, who is connected with the firm of Hawley Davis. The prospectus above referred to says that of the ,500,000 capital stock $1,000,000 preferred and $4,500,000 of mmon will be retained in the treasury. It is also stated that is intended to produce a working capital of $267,000. The ect of the incorporation is set forth as the manufacture of ctric light apparatus in which the generating power is obned from the car axle. It is also announced that the United ates Light & Heating Company, of New Jersey, is the owner a patent roller-bearing power transmission in which the strain taken away from the armature. These are Moscowitz patents. rough the National Battery Company the new concern expects obtain its storage batteries at a saving. It is also obtained at 35 railroads are prepared to install the company's lighting rvice. One source of revenue, according to the prospectus, the sale of the patent rights in foreign countries, which it is imated will realize the sum of $6,000,000. The net revenue of e company after paying the dividend on the preferred stock figured at $1,125,000. The Cutler-Hammer Manufacturing Comny, of Milwaukee, owned by the Bliss Company, and interests osely identified with it owned the National Battery Company. is stated, however, that the Cutler-Hammer Company has no nnection with the new organization unless it be in the relaon of stockholder. The officers of the new company are . H. Silverthorn, president; Julius E. French, first vice-presint; Edwin Hawley, second vice-president; C. A. Starbuck, ird vice-president, and W. S. Crandell, secretary and treaser. The company expects to have a plant and be in operation ithin a few months; in the meantime the plants of the subsidiaries are being operated.

PUBLIC SERVICE INVESTMENT COMPANY.—Stone Webster, Boston and New York, have organized under the ws of Maine a holding corporation under the title of Public ervice Investment Company, for the purpose of taking over the firm's holdings in seven important public service corporations. The new company will have a capitalization of $1,000,000 preferred and $2,000,000 common stock, the former being 6 per cent cumulative. The entire capital stock of the new company, except five shares necessary to qualify directors, will be issued to Stone & Webster in payment for the following securities now owned by that firm: Jacksonville Electric Company, common stock, $350,000; the Minneapolis General Electric Company, common stock, $350,000; Houghton County Electric Light Company, common stock, $500,000; Pacific Coast Power Company, capital stock, $700,000; Columbus Electric Company, preferred stock, $100,000; the Seattle Electric Company, common stock, $100,000; Tampa Electric Company, capital stock, $75,000; total, $2,175,000. The securities of the new company are being offered in blocks of 10 shares of preferred and four shares of common for $950. The present earnings of the securities transferred are at the rate of $104,750 per year, which is sufficient to pay the 6 per cent on the preferred and 2 per cent on the common, leaving a small surplus. Speaking of the purposes of the new organization, a representative of Stone & Webster said: "We took this method of bringing some fresh capital into our enterprises. We preferred to organize a holding company and sell some of its securities rather than dispose of any of our holdings in the corporations we are operating. All of the stock of the new company has been subscribed and the members of the Stone & Webster firm hold control."

McCALL'S FERRY POWER COMPANY.—An eminent domain bill has been introduced in the Pennsylvania Legislature giving the McCall's Ferry Power Company permission to consolidate electric lighting companies. It is said that a plan is on foot to combine many of the light and traction companies of southeastern Pennsylvania. Philadelphia and New York capitalists are back of the plan which includes the hydro-electric plant at McCall's Ferry on the Susquehanna River. More than $10,000,000 has been expended already in building the dam and installing machinery. It is intimated in Philadelphia that the Pennsylvania Railroad will make use of the energy generated to operate its trains between Harrisburg and Philadelphia. Inquiry at the main office of the McCall's Ferry Power Company in New York, brought forth the response that at this time the officials of the company were unwilling to give out any information concerning their future plans.

NEW YORK STATE RAILWAYS.—The New York State Railways, with offices at Rochester, has been organized to take over the electric lines known as the Vanderbilt System in central New York. The capital of the new company is placed at $23,240,200. A certificate has been filed with the Secretary of State at Albany showing that the new company had consolidated the Rochester Railway, the Rochester & Sodus Bay and the Rochester & Eastern Rapid Railway companies. The officers of the new holding company are Horace E. Andrews, president; William K. Vanderbilt, Jr., and John J. Stanley, vice-presidents; Edward L. Rossiter, treasurer, and Joseph C. Collins, secretary. William C. Brown, president of the New York Central Railroad, is a member of the board of directors.

PIONEER TELEPHONE & TELEGRAPH COMPANY.—The report of the Pioneer Telephone & Telegraph Company, of Oklahoma, for the year 1908 shows gross earnings of $1,356,703 against $1,125,388 for the previous year. In spite of this increase, the net earnings declined more than $20,000 and the surplus was only $22,751 against $63,945. The president of the company reports that owing to the depressed condition of business during the year it was deemed unwise to make any larger extensions and improvements than were absolutely necessary to protect the property. As soon as business conditions are improved the management of the company expects to extend its service to meet all the demands of the public that the company serves.

SAO PAULO TRAMWAY, LIGHT, HEAT & POWER COMPANY.—The directors of the Sao Paulo (Brazil) Tramway, Light, Heat & Power Company—the stock of which is largely held in Montreal—will issue $1,500,000 new common stock, bringing the issue up to $10,000,000. It is intended to divide the stock later into part preferred and part common.

CORTELYOU HEADS CONSOLIDATED GAS.—George B. Cortelyou, former Secretary of the Treasury, has been elected president of the Consolidated Gas Company of New York. The stock of the company has been constantly advancing recently, and it is now stated that the 80-cent rate will not interfere with the company's power to earn full dividends.

METROPOLITAN REORGANIZATION PLANS.—No definite plan for the reorganization of the properties formerly in the Metropolitan Street Railway System has yet been announced, and it is doubtful if any has been agreed upon. A man connected with the reorganization committee is authority for the statement that, while some progress has been made on a plan of reorganization, nothing can yet be announced as to the scheme nor the means by which it will be financed. No plan, he said, contemplated any attempt to delay the foreclosure sale set for June 1. He indicated that the reorganization committee would attempt to buy the property at this sale. It is pretty well understood that the Interborough-Metropolitan Company has sold its holdings of Third Avenue stock in the open market, and that it received a price considerably in advance of present quotations. It is taken that the money thus secured will be used as a basis for the fund necessary to protect the company's holdings of Metropolitan Street Railway stock. The surface lines on Manhattan are now doing an excellent business, and the introduction of pay-as-you-enter cars has materially increased receipts. It is believed that upon a reasonable capitalization satisfactory dividends can be earned.

AMERICAN LIGHT & TRACTION COMPANY.—The executive committee of the American Light & Traction Company has recommended to the board of directors that a stock dividend of 10 per cent be paid in November of this year. The effect of this recommendation has been to rapidly advance the price of the shares on the curb market in New York. This price has gone up 24 points within the past week. Emerson McMillan, president of the company, says that the company's earnings have been equal to the most sanguine estimates of the directors. On the present earnings the rate of 8 per cent cash and 10 per cent in stock can be continued indefinitely. The board of directors intends to declare this 10 per cent stock dividend annually in February, from the balance in the treasury. Of the $15,000,000 in common stock shares only $8,239,300 has been issued. This leaves a sufficient amount to continue the annual 10 per cent distribution for more than seven years.

NEW ENGLAND TELEPHONE COMPANY.—The requirements for extensions and additions to the New England Telephone Company have been already financed for one and a half years ahead. It is estimated that the construction requirements for the fiscal year, which began Jan. 1, will amount to $1,700,000, and for 1910, $1,800,000. To meet these requirements the directors have decided to issue $3,563,400 additional stock at par. Half of this amount will be available by the middle of July and the balance by next January. The new stock is to be issued in the ratio of one share of new for each 10 of old. This gives to the present stockholders rights which are estimated to be worth from $2 to $2.50 per share.

GREAT WESTERN POWER COMPANY.—The California Electric Generating Company has organized in California in connection with the Great Western Power Company for the purpose of building and operating the latter's steam power plant in Oakland. This plant will be leased to the Great Western Power Company and will be operated in connection with the Great Western hydro-electric power plant on the Feather River. The company has $2,500,000 preferred st authorized, of which $600,000 is issued, and $5,000,000 co mon stock, all issued. Beginning Jan. 1, 1913, the Gr Western Power Company guarantees the 6 per cent divide on the preferred stock.

CAR LIGHTING & POWER COMPANY.—The Car Lig ing & Power Company has been incorporated under the l of Maine by the reorganization committee of the Consolida Railway, Lighting & Refrigerating Company, to take over property of that company, which was recently purchased receiver's sale by the committee. The capital stock of the n company will be $8,000,000, divided into shares of $25 each. T properties which are acquired by the new company are: T Consolidated Railway, Electric Lighting & Equipment Compa Lindstrom Brake Company and Railway & Stationary Refrig ating Company.

MEXICAN TELEGRAPH COMPANY.—The annual rep of the Mexican Telegraph Company for 1908 shows a decl in gross earnings of about 22½ per cent from those of previous year. Returns, however, were greater than for year before 1907. Since the first of the present year conditi are said to be improving. The gross receipts for last year w $811,342, and the surplus remaining after the payment of di dends, etc., was $324,612. Regular quarterly dividends at rate of 10 per cent per year were paid on the common stock

CENTRAL & SOUTH AMERICAN TELEGRAPH.—T report of the Central & South American Telegraph Compa for 1908 shows a decrease in earnings from the previous y and an increase over any year prior to 1907. The gross recei for the year were $1,664,506. After paying $574,260 in divide and the fees to the Mexican Government, there was left $3 527 to be added to the surplus. This company was incorpora in New York, and owns and operates cables and telegra lines in Mexico and Central America.

WESTINGHOUSE PROFITS IN RUSSIA.—The balan sheet of the Westinghouse Company in Russia for its ninth y shows a net profit of 191,742 rubles (almost $99,000). T company has a capital of 300,000 rubles. It is not part of program to pay any dividend at this time.

MASSACHUSETTS LIGHTING COMPANIES.—T gross earnings of the Massachusetts Lighting Companies for month of February were $65,079, compared with $56,405 l year, an increase of $8,673.

HOLLISTER (CAL.) LIGHT & POWER COMPAN SOLD.—The Great Western Power Company, of Californ has purchased the property and power plant of the Hollis Light & Power Company.

DAN RIVER POWER & MANUFACTURING CO PANY.—The capital stock of the Dan River Power & Ma facturing Company, Danville, Va., has been increased fr $3,000,000 to $3,500,000.

AMERICAN TELEPHONE & TELEGRAPH COMPAN —An abstract of the annual report of the American Telepho & Telegraph Company for 1908 will be found in the front p of this issue.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplu
American Telephone & Telegraph Company:					
Year 1908	$27,808,970	$2,003,956	$25,895,013	$7,773,306	$18,121,
Year 1907	25,609,671	2,130,381	23,479,290	7,209,902	16,269,
Central & South American Telegraph Company:					
Year 1908	1,664,506	677,160	987,346	574,260	328,
Year 1907	1,749,045	556,666	1,192,379	551,031	607,
Cumberland Telephone & Telegraph Company:					
February, 1909	524,412	311,946	212,466	42,627	160,
February, 1908	511,848	285,980	225,868	37,552	188,
Detroit United Railway Company:					
February, 1909	519,592	348,711	170,881	154,457	27,
February, 1908	465,526	332,046	133,480	135,122	2,
Mexican Telegraph Company:					
Year 1908	811,342	100,719	611,623	287,010	324,
Year 1907	1,047,531	182,163	865,368	287,010	578,
Milwaukee Light, Heat & Traction Company:					
February, 1909	100,255	29,281	70,975	59,920	11,
February, 1908	94,726	29,505	65,221	55,980	9,
Minneapolis General Electric Company:					
January, 1909	105,640	41,123	64,517	30,222	34,
January, 1908	93,936	38,846	55,090	30,046	25,
Pioneer Telephone Company, Oklahoma:					
Year 1908	1,356,703	1,187,852	168,851	146,100	22,
Year 1907	1,125,388	935,968	189,420	125,475	63,
Schenectady Railway Company:					
Quarter Ended Dec. 31, 1908	213,243	154,441	53,338	.....	
Quarter Ended Dec. 31, 1907	246,272	167,054	74,261	.....	
Seattle Electric Company:					
January, 1909	402,841	250,293	152,517	86,727	65,
January, 1908	365,750	239,585	126,165	75,843	50,
Twin City Rapid Transit Company:					
February, 1909	483,101	273,784	209,317	133,963	75,
February, 1908	453,944	253,644	200,300	122,789	77,

GENERAL NEWS

Construction News.

BREWTON, ALA.—The citizens on March 20 voted to issue additional bonds, the proceeds to be used for installing new machinery in the municipal electric light and power plant.

CAMP HILL, ALA.—The proposition to issue bonds for an electric light plant will be voted upon at the coming election.

DOTHAN, ALA.—The City Council is considering an ordinance providing for an issue of bonds for extensions to the water, light and sewer systems.

PHOENIX, ARIZ.—An election will be held within 30 days to vote on the proposition to grant franchises to a competing telephone company and to a suburban motor railway. Dr. Foss is president of the telephone company and E. J. Bennett is promoter of the railway.

PHOENIX, ARIZ.—The Board of County Commissioners has granted a franchise to T. N. Clanton and H. E. Kell to erect and operate a telephone system in Buckeye Valley, extending from Agua Fria River to the lower end of what is known as Arlington County.

MORRILTON, ARK.—The Home Telephone Company will make improvements to its system, including the installation of a new switchboard, at a cost of $1,250. E. J. Massey is manager.

BODIE, CAL.—James S. Cain is promoting a project to develop two water powers capable of developing 30,000 hp, one of which is located on Rush Creek and the other on Leevining Creek. It is proposed to utilize the power to generate electricity to be distributed within a radius of 50 miles if sufficient number of contracts for power can be placed. It is said that the owners of the South End Consolidated, the new Bodie Bonanza, Dow Drift, Golden Star, Golden Harp and other mines have agreed to place contracts for power; the mills and mines at Aurora will also take electricity, and the lines will probably be extended from there to other mines and camps.

DOWNEY, CAL.—J. R. Gordan, proprietor of the local electric light plant, is planning to extend his transmission lines to Rivera, Norwalk and Artesia as soon as possible.

FRESNO, CAL.—Preliminary action has been taken by the Board of Supervisors to enable the San Joaquin Light & Power Company, of Fresno, to make important extension of its transmission lines in various parts of the county. The first transmission line of the company will be extended from the Fresno copper mines through the Academy country and thence to Sangor, a distance of 19 miles; the other extension will consist of a second wire out of the Fresno substation to connect with the town of Clovis.

PLACERVILLE, CAL.—Notice of appropriation of 15,000 inches of water in the south fork of the American River has been filed by H. C. Marsh, to be utilized for irrigation, mining, municipal purposes, and to generate electricity.

QUINCY, CAL.—The Round Valley Water Company has been granted a franchise by the Board of Supervisors to construct transmission lines through the streets of Indian Valley and along the highways of Indian Township for the distribution of electricity.

RED BLUFF, CAL.—Notice of appropriation of 10,000 cu. in. of water to be taken from Mill Creek has been filed by A. T. Foward. The water will be used for power and domestic purposes.

RED BLUFF, CAL.—The Sierra Electric Company, which was recently granted a franchise in Red Bluff, proposes to build two power plants, the first of which will be located on Digger Creek, above Manton, and will have an output of 2000 hp. The second plant will be located some distance below the first and, utilizing the water again, will have the same output as the first plant. Both plants can be increased to 3000 hp each if needed. The county is to receive 2 per cent per annum of the gross receipts of the company after it has been in operation five years.

REDLANDS, CAL.—An agreement has been entered into by the stockholders of both the Edison Electric Company, of this city, and the Home Gas & Electric Company, whereby the former takes over all of the electric business of the city and the plant of the Home company, and the Home company takes over the gas plant and gas business of the Edison company, with the privilege of taking also the gas plant and business of the Edison company in Riverside. The entire transfer is to be completed within a short time. The Home company began business Jan. 1, 1906. John B. Miller, of Pasadena, Cal., is president of the Edison company, and W. L. Frost is the local manager. W. R. Cheney is president of the Home company, and C. S. Chesnut is general manager.

SAN BERNARDINO, CAL.—Bids will be received by the Board of Supervisors for a 50-year franchise granting the right to erect a telephone and telegraph system in this city. Charles Post is county clerk.

SAN JACINTO, CAL.—We are informed that Roach & Chambers, owners of the local electric light plant, contemplate disposing of their plant in the near future.

WASHINGTON, D. C.—Bids will be received until April 6 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards and naval stations the following supplies: Philadelphia, Pa.: Schedule 1051—Two electric deck winches. Brooklyn, N. Y.: Schedule 1041—Equipment for electrically driven coaling gear machinery, with appurtenances, for U. S. S. *Florida*. Schedule 1042—Five complete sets of turret turning equipment; five complete sets of mechanical variable-speed gear equipment, and five sets of electric equipment for the U. S. S. *Florida*. Schedule 1043—Three ash-hoisting engines for U. S. S. *Florida*. Schedule 1046—Erecting steel foundation for turbo-generator set; fabricating and erecting the steel operating floor around turbine power plant. New Orleans, La.: Schedule 1052—Twelve copper-shell multiple direct-current arc lamps; main cut-out panel board and distribution cabinet, and two panel boards and distribution cabinet; cotton-covered lamp cord and rubber-covered and waterproof wire; conduits; 50 conduit elbows and 2750 ft. conduit, with couplings; junction boxes, bushings, etc. Bids will also be received at the same place until April 13 as follows: Mare Island, Cal.: Schedule 1037—Two chain ammunition hoist motors, with spare parts. Application for proposals should designate the schedule desired by number.

ATLANTA, GA.—The State Railroad Commission has authorized the Piedmont Power Company to issue $3,000,000 in bonds. The company was recently organized to develop water power in the vicinity of Tallulah Falls, on the Tugaloo River, in North Georgia. Louis Magid is president.

DOUGLASVILLE, GA.—The town has voted a bond issue of $10,000 for an electric light plant in preference to granting a franchise to a private corporation.

JACKSON, GA.—The Flovilla & Indian Springs Railway has applied for a franchise to construct and operate its railway.

MACON, GA.—O. R. Nolan and others have filed a bill in the courts to cause the Central Georgia Power Company to be enjoined from proceeding with the construction of its large plant at Capps and Lloyd shoals, near Jackson, Ga. The power company has served notice that it will proceed to condemn a portion of the land of the complainants near the power plant. The State court set the third Monday in April for the hearing, but did not enjoin the construction of the dam.

MANCHESTER, GA.—Contracts for the construction of buildings for the Manchester Cotton Mills have been awarded to Pike Brothers, of La Grange, Ga. The company will let contracts April 5 for its 1000-hp power plant. The cost of the entire plant is estimated at $600,000. A. L. Walker, Austell Building, Atlanta, Ga., is engineer.

TOCCOA, GA.—Plans are being made by J. D. Prather, of Toccoa, and C. G. Rolston, of Pittsburgh, Pa., for the construction of a dam on Tugalo River. The cost of the dam is estimated at $150,000.

VALDOSTA, GA.—At an election to be held April 14 the citizens will vote on the proposition to issue $30,000 in bonds, the proceeds to be used to enlarge and extend the street lighting system.

WAYCROSS, GA.—The City Council is considering the question of installing an electric light plant to be operated in connection with the water works system.

WAYCROSS, GA.—The City Council has declared forfeited the franchise of Loomis, Pettibone and others for gas and electric plants and an electric railway system, the Council claiming non-compliance and demanding the $6,000 bonds given as evidence of good faith. A committee has been appointed to investigate the matter and report at the next meeting of the Council.

CAMBRIDGE, IDAHO.—The Cambridge Development Company is contemplating developing the water power of Rush Creek Falls, to be utilized to generate electricity for lamps and motors in Cambridge, and later to extend its transmission lines to other towns. It is proposed to tap the creek just above the falls, where a fall of 100 ft. can be secured by running a pipe line of 500 ft. The company would like to interest some one with capital in this enterprise. For further information address D. H. Clare, Cambridge, Idaho.

MULLAN, IDAHO.—The capital stock of the North Idaho Telephone Company has been increased from $25,000 to $100,000.

CHICAGO, ILL.—The remodeling of the lighting plant at the University of Chicago is under consideration. Harry Pratt Judson is president of the university.

COLUMBUS, IND.—The Central Indiana Light Company has awarded a contract to the Westinghouse-Church-Kerr Company for the construction and equipment of a new power plant. The plant will furnish electricity for the street railway system and also for lamps in this city.

GREENCASTLE, IND.—The City Council favors the granting of a franchise to a new company which proposes to construct and equip a new electric light and power plant in this city.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company has awarded a contract to the General Electric Company, Schenectady, N. Y.,

for an 8000-hp steam turbine, direct connected to a 5000-kw generator, to be installed in the Mill Street station in Indianapolis.

PENDLETON, IND.—The Pendleton Telephone Company has increased its capital stock from $10,000 to $20,000. E. D. Allen is secretary.

SOUTH BEND, IND.—The Central Union Telephone Company has ordered plans for the construction of a modern exchange building.

VINCENNES, IND.—The Vincennes, West Baden & Louisville Traction Company has been voted a subsidy of nearly $50,000 by the Township of Vincennes. The company proposes to construct an electric railway from Vincennes to Jasper via Petersburg. A. M. Yelton, of Vincennes, is secretary.

SIOUX CITY, IA.—Preliminary surveys have been taken for the construction of an electric interurban railway between Sioux City and Hartington, Neb. C. T. Johnson, of Minneapolis, Neb.; Messrs. Burgel and Morten, of Hartington, Neb., and James F. Toy, of Sioux City, Ia., and others are interested in the project.

VILLISCA, IA.—The Villisca Light, Power & Fuel Company has awarded a contract to the Condon Construction Company, of Chicago, Ill., for a general overhauling of its power station and distribution system. An additional steam engine will be installed to take care of the day load, and the distribution system will be made one frequency instead of two as at present.

ANTHONY, KAN.—The City Council is reported to be making arrangements to establish a municipal electric light plant, the cost of which is estimated at $10,000.

DELPHOS, KAN.—It is reported that estimates are being prepared for a municipal electric light plant and water works system to cost $30,000.

MARION, KAN.—Plans are being prepared by Burns & McDonnell, Scarritt Building, Kansas City, Mo., for a new municipal electric light plant and water works system at Marion, the cost of which is estimated at $60,000.

LEXINGTON, KY.—The Kentucky Water, Heating & Illuminating Company has sold its franchise permitting it to erect transmission lines in Lexington for the distribution of electricity, which it purchased from the city last fall at a cost of $6,100, to the Midland Electric Company. It is said that the new company will erect a plant at once. Pendleton Beckley, of Louisville, Ky., is president of the Midland Electric Company.

PARTRIDGE, KY.—The Upper Cumberland River Telephone Company contemplates the erection of telephone lines from Partridge to Harlan via Poor Fork, a distance of 30 miles. T. J. Smith, of Partridge, is manager.

ST. FRANCISVILLE, LA.—Improvements are being made to the municipal electric light plant, and the electric light system is being extended through the town.

ELLSWORTH, MAINE.—A bill has been introduced in the State Legislature, authorizing the Bar Harbor & Union River Power Company to acquire the property and franchises of the Ellsworth Power Supply Company.

MADISON, MAINE.—The question of installing a new water wheel and dynamo for the municipal electric light plant is under consideration; also the placing of more arc lamps on the streets.

MONTICELLO, MAINE.—A company has been organized in Monticello to take electricity from the Maine & New Brunswick Electric Power Company. It is said that supplies and equipment have been purchased for the plant.

BALTIMORE, MD.—The Maryland Telephone Company has abandoned its suburban service, but will continue to use its long-distance station when its lines are rebuilt. The abandoned exchanges include Towson, Catonsville, Ruxton and Roland Park. The primary cause of abandoning the service was the blizzard of March 4, which practically demolished all the suburban lines of the company. C. E. Bryan is general manager.

MT. WASHINGTON, MD.—The County Commissioners have decided to authorize the Mount Washington Electric Light & Power Company to install 40 electric lamps along the county roads between the villages of Cockeysville and Texas. The company will extend its transmission line from Lutherville to Cockeysville and Texas and will furnish electricity for lamps to the residents along the roads. The service will be ready by May 15.

BONDSVILLE, MASS.—The Boston Duck Company has applied to the State Legislature for permission to supply electricity to its tenement houses and also to the street railway when occasion requires extra power.

CLINTON, MASS.—The Board of Selectmen has awarded the contract for street lighting to the Clinton Gas Light Company for a term of four years, under which the company agrees to furnish incandescent street lamps of 25 cp at the rate of 8 cents per lamp per night and arc lamps of 1200 cp at 33 cents each per night. The company also agrees to replace the present incandescent lamps with 40-cp tungsten lamps. In consideration of a four years' contract the company is to give a discount of 5 per cent on all bills and also a discount of 5 per cent on last year's bills, which amounts to about $650. The present cost of street lighting is $13,000 per year.

LYNN, MASS.—The directors of the Lynn Gas & Electric Company have made a voluntary reduction in the price of gas from 85 cents to 80 cents per 1000 cu. ft., to take effect July 1, 1909.

WAKEFIELD, MASS.—At a recent town meeting the citizens v to continue to operate the municipal electric light plant and no purchase electricity from out of town, as recommended by the ori committee appointed to investigate the matter. A second comm was appointed, which reversed the report of the first committee, the later report was accepted.

GRAND RAPIDS, MICH.—The Grand Rapids-Muskegon Power C pany is contemplating the installation of a steam auxiliary plant. said that the plant will be built as an addition to the present power h on the west side, but will be large enough to contain equipment cap of generating from 25,000 to 30,000 hp.

LANSING, MICH.—Orders have been placed by the Northern C struction Company for rails and general equipment to be used in construction of the proposed Lansing-Jackson interurban railway of Mason to Jackson. J. M. Bramlette, superintendent of construct has established headquarters at Rives Junction, Mich.

LANSING, MICH.—Arrangements have been made by the Michi Power Company for the organization of an auxiliary company whe the company will furnish electricity for lamps and motors in Charl Bellevue and surrounding country. The Michigan Power Company cently secured a 30-year franchise and also a 10-year contract for st lighting in the city of Charlotte. The company has also made sim arrangements in Bellevue.

MARQUETTE, MICH.—The annual report submitted by the light power commission shows a net profit of $36,288 for the municipal elec light and power plant for the year ending March 9, 1909, which is increase of $7,000 over the net earnings of any previous year. In a tion to this the commission has paid off $5,000 of its outstanding bo and has expended $34,139 for new equipment during the year. The p now represents an investment of $233,101, of which $137,601 has been out of the earnings of the plant.

SAULT STE. MARIE, MICH.—The Sault Ste. Marie Gas & Elec Company has recently been reorganized, and it is said the company templates an expenditure of about $25,000 in improvements this year.

TUSTIN, MICH.—The capital stock of the Lake & Oscola Teleph Company has been increased from $450 to $2,000.

CANBY, MINN.—The Farmers' Mutual Telephone Company, of G S. D., has applied for a franchise to enter the city.

DULUTH, MINN.—The Duluth Telephone Company is making p arations to place its wires underground.

LONG PRAIRIE, MINN.—George Lapo and others are interested i project for the construction of a telephone line, 11 miles long, to Dinkel-Dreher neighborhood.

ST. PAUL, MINN.—The question of extending the transmission li of the municipal electric light plant to Kasota is under consideration.

WELLS, MINN.—The managers of the municipal electric light pl are said to be considering the question of establishing a 24-hour service

HATTIESBURG, MISS.—The Southern Lumber & Ice Company, i reported, is making plans to install an electric light and power plant

BOZEMAN, MONT.—The contract for construction of the interurb electric railway from Bozeman to Salesville, 20 miles in length, has b awarded to the Westinghouse, Church, Kerr & Company, of New Yo N. Y. Later the railway will be extended from Salesville to Three For a distance of 35 miles.

BUTTE, MONT.—A 50-year traffic agreement has been entered into the Montana Independent Telephone Company, of Butte, and the Int state Telephone Company, of Spokane, Wash., which will give reside of Butte and of western Montana telephone communcation with Spok and other towns in the Inland Empire. A through copper circuit fr Butte to Spokane and a new telephone line from Mullan, Idaho, Missoula, Mont., will be built at once.

ROUNDUP, MONT.—The question of installing an electric light pl in Roundup is under consideration.

WHITEFISH, MONT.—It is reported that the Flathead Valley Wa Power Company is making arrangements to construct a substati in Whitefish.

JOPLIN, MO.—The Board of Public Works has placed a contract w the United Iron Works Company, Joplin, Mo., for a 500-hp boiler to installed in the municipal electric light plant.

UNIVERSITY (P. O., ST. LOUIS), MO.—The proposition of issui $20,000 in bonds for the construction of an electric light plant will submitted to the vote of the people.

BROKEN BOW, NEB.—At the coming election the citizens w vote on the proposition to grant a franchise for an electric light pla The city will reserve the privilege to purchase the plant in 10 years.

PLAINVIEW, NEB.—H. J. Nelson, city clerk, would like to cor spond with parties with the view of establishing an electric light pla in Plainview.

WAHOO, NEB.—The new municipal electric light plant system completed and placed in operation. The lamps for the street lighti system have not been installed, but will be erected soon. The price electricity for lamps has been reduced from 8 to 5 cents per kw-hour.

RENO, NEV.—A bill has been introduced in the Nevada Assem which provides for the granting of a franchise to the Nevada Telephor Telegraph Company for a telephone and telegraph line from Reno

y, via Carson City, Dayton, Fort Churchill, Goldfield and Tonopah. he company has offices in Goldfield, Ely, Tonopah and Carson City, and soon as this franchise is secured will begin building its line into Reno.

TONOPAH, NEV.—Plans are being considered by the Western nelters Corporation for the construction of a large smelter on the irson River, near Brunswick, Nev., work on which will begin in June. he plant will be operated by water power.

CLOVIS, N. M.—Plans are being prepared by Burns & McDonnell, onsulting engineers, Kansas City, Mo., for an electric light plant, water orks and sewer systems in Clovis, for which bonds to the amount of 25,000 have been voted.

NAMBE, N. M.—E. H. Fisher, of Cimarron, N. M., writes that he ntemplates developing the water power of the Pecos and Nambe Rivers, nd will erect two power plants with a total output of 5000 hp. The st of the work is estimated at about $500,000.

SANTA FE, N. M.—A telephone company has been organized at Stanley to construct a telephone line from Stanley to this city. The company capitalized at $6,000.

ALBANY, N. Y.—The proposed bill appropriating $450,000 for the urchase of a site, construction and equipment of power house to furnish ght and heat for the Capitol and new State Educational Building, and or construction of conduits to connect the buildings, has been approved y the State Trustees of Public Buildings. The Trustees also decided o recommend to the Legislature an appropriation of an additional $1,000,000 for carrying on the work of constructing the State Educational Building. The cost of the building complete is estimated at $4,000,000.

BUFFALO, N. Y.—Governor Hughes has signed the bill permitting the ity to issue bonds to pay for its share of installing an electric light plant n the city hall. The cost of the plant is estimated at $75,000, to be divided between the city and the county. The county has already provided its share. It is expected to have the plant installed within six months.

CLIFTON SPRINGS, N. Y.—At an election held March 16 the citizens oted against the proposition to issue $8,000 in bonds, the proceeds to be used for enlarging and improving the municipal electric light plant.

GASPORT, N. Y.—The business men of this village are considering the uestion of lighting Main Street with electricity.

HERKIMER, N. Y.—The plant and holdings of the Herkimer County Telephone Company was sold at referee's sale March 24 to C. H. Poole, of Utica, N. Y., representing independent telephone interests, for $16,000.

NEW YORK, N. Y.—The Board of Estimate has appropriated $102,000 for the installation of an electric light plant in the New York Public Library.

NICHOLVILLE, N. Y.—The electric light plant of the Nicholville Electric Lighting Company was destroyed by fire March 16, causing a loss of about $10,000. The plant was built about a year ago and was located on the east branch of the St. Regis River. The company supplied electricity in the villages of Nicholville, Fort Jackson, Hopkinton, Moira and North Lawrence, and was making arrangements to extend the transmission lines to Brushton. The company has announced that it will rebuild the plant at once and hopes to have the system in operation again within four months. The streets of the villages will remain in darkness until the plant is completed.

RAYBROOK, N. Y.—The State Tuberculosis Hospital has petitioned the Legislature for an appropriation for additional conduit work, the cost of which is estimated at $9,100.

ROCHESTER, N. Y.—Plans have been prepared for a new electric railway, to be known as "the Scenic Route," which will extend from Rochester to Batavia, thence to Mumford, Leroy, Scottsville, Silver Lake, Portage Park and other towns and villages that have no electric railway connections with Rochester. D. C. Salyerds, of Scottsville, is principal promoter of the enterprise.

ROCHESTER, N. Y.—Plans and specifications are being prepared by C. C. Peck, consulting engineer, E. & B. Building, Rochester, N. Y., for an electric power plant to be installed in the new building to be erected by W. N. Clark & Company, who are now ready to receive proposals on the following machinery: Two 125-hp horizontal tubular boilers, one 50-kw or 75-kw generator direct connected to auto high-speed engine, and one 15-ton steam engine-driven ice machine.

SYRACUSE, N. Y.—Contracts have been placed for the extension of the Rochester, Syracuse & Eastern Railroad Company from Port Byran to Syracuse.

UTICA, N. Y.—The supervisors' committee on installing an electric light plant to furnish electricity for lighting the county buildings has engaged Horace B. Sweet as consulting engineer to make an estimate of the cost of installing and operating the plant.

BURLINGTON, N. C.—The Board of Aldermen has granted the Southern Power & Traction Company a franchise to supply electricity for motor [illegible] concerns using 25 hp or more. The reduction of 25 hp was made on account of arrangements having been made to equip the municipal electric light plant to furnish a day service for power. The Southern Power & Traction Company is planning to build a large dam across the Haw River, where it is proposed to develop [illegible] hp. The company has secured franchises in Burlington, Graham, Reidsville, Westover and other towns to furnish electricity.

CANTON, N. C.—G. N. Henson, cashier Bank of Canton, and D. J. Kerr, electrical engineer of the Champion Fiber Company, are considering the question of erecting an electric light plant.

CHARLOTTE, N. C.—The Southern Power Company expects to have its new plant at Rocky Creek, on the Catawba River, in South Carolina, completed by April 1. This plant will be the third hydro-electric development in operation, and the company is now pushing work on the fourth and one of the largest developments under its control at Ninety-Nine Islands, on Broad River, near Gaffney, S. C. Much of the work at this plant is done by electrical power transmitted from plants of the company at a distance of 50 miles or more.

DUNN, N. C.—The City Council contemplates the purchase of machinery for the municipal electric light plant as follows: One 100-hp engine at 125 lb. pressure, 250 to 300 r.p.m.; two 100-hp boilers, return tubular, 125 lb. pressure; one 75 to 90-kw single-phase 60-cycle 2300-volt generator, complete with exciter. Offers of second machinery in good condition will be considered. H. B. Charles is superintendent of municipal electric light plant.

DURHAM, N. C.—The Erwin Cotton Mills Company has selected a site in West Durham for its proposed new mill, with power plant and warehouses. The mill will be operated by electricity, which will require about 2000 hp to drive the machinery. The cost of the plant is estimated at about $2,000,000. Plans and specifications are being prepared by F. P. Sheldon & Sons, engineers, of Providence, R. I.

GREENSBORO, N. C.—The North Carolina Public Service Company, capitalized at $3,500,000, has taken over the property of the Greensboro Electric Company. The Southern Power Company will furnish the Public Service Company with electricity. The officers of the new company are: L. H. Hole, Sr., president; Bird S. Coler, vice-president; L. H. Hole, Jr., secretary and treasurer, all of New York, N. Y., and Z. V. Taylor, of Greensboro, general counsel.

NEWBERN, N. C.—Bids will be received by James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., until April 23 for the installation of a conduit and wiring system and extension of the present gas-piping system in the U. S. post office, court house and custom house at Newbern, N. C.

RALEIGH, N. C.—A series of demonstrations of cooking by electricity have been given here by the General Electric Company in behalf of the Carolina Power & Light Company, of Raleigh. The Woman's Club of Raleigh is interested in the movement, which is attracting general attention.

SALISBURY, N. C.—The Southern Power Company is making arrangements to extend its transmission lines to Salisbury and Vance Cotton Mills, which will be completed in a short time. The motive power of the Vance Mills will be changed from steam to electricity. The Southern Power Company is erecting a steel tower line to Salisbury, by the way of Albemarle, which is expected to be completed about June 1, when electricity for use in Salisbury will be transmitted by the new route.

WILMINGTON, N. C.—The Tidewater Power Company contemplates improvements to its properties at Wilmington and Wrightsville Beach, which will include the installation of an engine and additional generating equipment at the Wilmington plant.

FARGO, N. D.—The Otter Tail Power Company, of Fergus Falls, Minn., has submitted a proposition to the City Council offering to supply the city with electricity for street and commercial lighting and operating the water works plant at the rate of 2½ cents per kw-hour. Paul Doty, president of the Union Light, Heat & Power Company, also offered to furnish the city all the electricity it required at the switchboard at the same price as the Otter Tail Power Company offered, and to sell the city its street lighting equipment. It is not expected that any action will be taken for some months.

GRAND FORKS, N. D.—The Board of Regents of the University of North Dakota will soon let contracts for the construction of a new power house, plans for which have been prepared.

CANAL DOVER, OHIO.—Struthers-Wells Company, of Warren, Pa., has been awarded the contract for the construction of the municipal electric light plant for $34,700.

CANTON, OHIO.—Plans have been prepared by the Stark County Telephone Company for extensions and improvements to its system in Canton and Alliance, which will involve an expenditure of about $32,000.

CLAYTON, OHIO.—The School Board has decided to install a power plant at the new manual training high school to be used by the students in electrical engineering. R. L. Peterson has been engaged as consulting engineer in connection with the work.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has filed notice with the Secretary of State of an increase in capital stock from $[illegible] to $[illegible]. Samuel Sneed is president and S. C. D. Lyon [illegible].

CLEVELAND, OHIO.—Judge [illegible] in the Federal Court has authorized the receivers of the Cleveland street railway system to expend $42,250 for new boilers. Six 300-hp boilers in the Viaduct station will be replaced with the same number of units of double the capacity. The court denied receivers permission to spend $600,000 in relaying 23 miles of track, but instructed them to make temporary repairs.

FOSTORIA, OHIO.—The Citizens' Telephone Company has petitioned the City Council for a franchise to [illegible] a competing [illegible] system in the city.

PARIS, OHIO.—The capital stock of the Farmers & Merchants' Telephone Company has been increased from $12,000 to $24,000.

WEST LIBERTY, OHIO.—The City Council is considering the question of purchasing the local electric light plant, to be operated by the municipality. The committee has been appointed to investigate municipal ownership plants in other cities, and report to the Council.

WEST TOLEDO, OHIO.—The Town Trustees have entered into a contract with the Toledo Railways & Light Company for street lighting for a period of five years. Under the terms of the contract the company is to furnish 34 arc lamps at the rate of $60 per lamp per year. The lamps are to be installed within 60 days.

ANADARKO, OKLA.—Work has commenced on the construction of the hydro-electric plant and dam across the Washita River, which will include the construction of a reinforced concrete dam, with spillway 132 ft. wide, and power house 33 x 37 ft., according to plans of the Ambursen Hydraulic Construction Company, of Boston, Mass. The equipment will include two 100-kw generators direct connected to turbines, to be operated under a 14 ft. head of water; also a turbine-driven pump to supply water to the city. The cost of the work is estimated at about $80,000. The O'Neil Engineering Company, of Dallas, Tex., has charge of construction of the plant.

BLACKWELL, OKLA.—Plans are being prepared by Burns & McDonnell, consulting engineers, Scarritt Building, Kansas City, Mo., for the construction of an electric light plant and water works system in Blackwell to cost about $40,000.

CAPITOL HILL, OKLA.—The Council has granted a franchise to the Oklahoma Gas-Electric Company to furnish electricity in the town, subject to a vote of the people.

HYDRO, OKLA.—Burns & McDonnell, consulting engineers, Scarritt Building, Kansas City, Mo., are preparing plans for an electric light plant and water works system at Hydro to cost about $25,000.

KIOWA, OKLA.—At a recent election the citizens voted to issue $31,000 electric light and water works bonds.

LEHIGH, OKLA.—The citizens have voted to issue $12,500 in bonds, the proceeds to be used for the construction of an electric light plant. The O'Neil Engineering Company, of Dallas, Tex., will have charge of the construction of the plant.

OKEMAH, OKLA.—The city has voted to issue $55,000 in bonds, the proceeds to be used for the construction of an electric light plant and water works system.

SENTINEL, OKLA.—We are advised that the Town of Sentinel has not yet awarded a franchise for an electric light plant, as reported in the issue of March 18, but contemplates an issue of bonds for construction of a municipal plant, on which a vote will soon be taken.

WALTER, OKLA.—The citizens have voted to grant the O'Neil Electrical Company, of Dallas, Tex., a 20-year franchise to furnish electricity in this city. The company proposes to develop the water power of Cache Creek, and will furnish electricity for lighting and manufacturing purposes.

WATONGA, OKLA.—Arrangements are being made to install a new engine and generator in the municipal electric light plant, at a cost of about $3,500. J. C. Stanfield is clerk.

JOSEPH, ORE.—The Wallowa Lake Light & Power Company, recently organized, proposes to furnish electricity for lamps and motors in Joseph and other cities.

JOSEPH, ORE.—The Joseph Electric Light & Power Company is making extension and improvements to its plant, and has applied to the City Council for a new franchise in this city.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until April 19 for furnishing supplies during the fiscal year ending June 30, 1910, as follows: Wire cable, wire, boiler tubing, steel, brass, copper, etc., as per circular (No. 499). Bids will also be received at the same place until April 21 for furnishing the following supplies: Centrifugal pumps, copper, wire cable, steel and brass tubing, etc., as per circular (No. 500). Blanks and general information relating to these circulars may be obtained at the above office and at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing agent.

HAZLETON, PA.—The Hardwood Light & Power Company, which is now erecting a large power plant in Harwood, has secured contracts to furnish electricity to operate all the street car lines between Berwick and Danville, and also for operating all the electric lighting plants in the same section.

KECKSBURG (P. O. MT. PLEASANT), PA.—J. M. Keck, owner of the Kecksburg Mineral Springs, contemplates building a large addition to his bottling establishment and will install an electric lighting plant.

PHILADELPHIA, PA.—The Construction Company General, 547 Drexel Building, Philadelphia, Pa., would like to correspond with manufacturers of electrical equipments, arc and incandescent lamps, copper wire, concrete mixers, steam engines, natural gas engines, boilers, etc. The company was recently organized to do a general contracting business for the purpose of constructing electric light plants, water works and sewer systems, and other public improvements. Harry A. Locke, of Philadelphia, Pa., is president of the company.

READING, PA.—Mayor Rick has signed the ordinance granting Reading Electric Light & Power Company and the Metropolitan Electric Company, lessee, permission to construct and maintain underground conduits from the western boundary line of the city and on certain streets in the city to connect with the plant of the Reading Electric Light & Power Company, which is leased to the Metropolitan Electric Company.

SEWICKLEY, PA.—The Borough Council has accepted the plans for the construction of a municipal electric light plant, for which a bond issue of $30,000 was authorized over a year ago, but owing to the financial depression the bonds were not sold.

STEELTON, PA.—The Steelton Light, Heat & Power Company has decided to enlarge and increase the output of its plant, which will include the installation of steam engines direct connected to alternating-current three-phase generators. It is said that the company does not intend to dispense with the electrical service from the York Haven Power Company's hydro-electric plant on the Susquehanna River, at York Haven, but will rely upon it in times of extraordinary demand or emergency.

TOPTON, PA.—It is stated that the Inter-County Electric Company will soon award contracts for its proposed electric railway between Lyons and Allentown, a distance of 21 miles. The power station will be located at Alburtis. The company also proposes to furnish electricity for lamps and motors. Maxwell H. Bochow, of Topton, is president and general manager.

UPPER DARBY, PA.—The Upper Darby Township Commissioners are considering the question of extending the street lighting system to Addingham, Oakview, Garrettford, Fernwood, East Lansdowne, Primos, Cardington and Milbourne.

WELLSVILLE, PA.—C. C. Spahr, of York, Pa., has purchased the old flouring mill on Conewago Creek, three miles from Wellsville, which he proposes to install a hydro-electric power plant for the purpose of furnishing electricity for lamps and motors in Wellsville and to farmers in this vicinity. Mr. Spahr also plans to extend the transmission line to Dover, seven miles distant. The plant will have an output of from 150 to 200 hp and will cost approximately $25,000.

PASCOAG, R. I.—H. B. Rust & Company, of Providence, R. I., has submitted a proposition to town officials offering to take over the electric plant of the Pascoag fire district and to operate it for a term of 15 or 20 years, and to enter into a contract with the town to furnish street lamps for $4,000 per year, and at the end of the time to turn the plant over to its present owners in good condition. The company states that it will require an expenditure of about $15,000 to put the plant in good order. The district voters decided to appoint a committee to investigate the matter and report at a later meeting.

LEXINGTON, S. C.—The citizens are considering the question of establishing a municipal electric light plant and water works system in Lexington.

OLDHAM, S. D.—The question of establishing an electric light plant in Oldham is under consideration.

MORRISTOWN, TENN.—Arrangements are being made to improve and increase the output of the municipal electric light plant, which will involve an expenditure of about $25,000. Contracts have already been placed for machinery and equipment.

ROCKWOOD, TENN.—The city is considering a bond issue of $20,000, the proceeds to be used for improvements to the municipal electric light plant, street work and other public work.

BRYAN, TEX.—The citizens on March 2 voted to issue $75,000 in bonds, the proceeds to be used for the construction of an electric light plant, water works and sewer system. As yet no engineer has been employed. J. T. Maloney is Mayor.

OLNEY, TEX.—Daugherty Brothers, of Alpine, Tex., are reported to be interested in the construction of an electric light plant and ice factory in Olney.

OLNEY, TEX.—T. H. Kemp is reported to be interested in a project to establish an electric light plant in Olney.

PORT ARTHUR, TEX.—Arrangements are being made by the Southern Texas Telephone Company to enlarge and improve its system in Port Arthur.

SAN ANTONIO, TEX.—The San Antonio Gas & Electric Company contemplates the construction of a new power plant, to cost about $125,000.

PROVO, UTAH.—Two estimates for the construction of electric power plants have been submitted by Mayor Decker to the City Council, both prepared by L. L. Nunn, of the Telluride Power Company. One plan is for a plant to be located at the north fork in Provo Canyon, with an output of 1600 hp, to cost $102,000; the other to be located at the mouth of the canyon, at a cost of $117,000, with an output of 1400 hp.

SALT LAKE CITY, UTAH.—A bill has been introduced in the State Legislature asking for an appropriation for the Agriculture College of Utah, the proceeds to be used for the installation of an electric power plant to furnish electricity for lamps and motors for the several departments of the college and for lighting the grounds.

WALLINGFORD, VT.—The Rutland Railway, Light & Power Company has commenced work on the construction of its substation at Wallingford. The equipment of the station will include two 75-kw transformers, to change the voltage from 6600 to 2300 volts, with a 5-kw light transformer for street lighting service, and a three-panel switchboard. The cost of the building with equipment is estimated at $3,000.

RICHMOND, VA.—Special commissioners in the case of the Virginia Passenger & Power Company are instructed in a decree of the United States Circuit Court to proceed with the sale of the property named after advertising four weeks. The court has ordered the sale of the properties, in which Frank J. Gould is large interested. Bondholders who objected to the sale have filed a petition with the Supreme Court to take the case.

ORIENT, WASH.—C. H. Patten, A. R. Luncheford and associates, of Spokane, Wash., it is said, will soon commence work on the construction of a dam and power plant on Boulder Creek, near where it empties into Little River, where it is claimed that 2500 hp can be developed with a normal flow of water. The cost of the dam and power plant is estimated at $200,000. The plant will furnish electricity to Orient and towns and mines in this vicinity.

PORT TOWNSEND, WASH.—It is reported that surveys are being made for an electric railway from Hadlock to Port Townsend, covering the old Northern Pacific franchise.

PORT TOWNSEND, WASH.—The County Commissioners have granted a franchise to C. D. Chapman, of Seattle, Wash., to erect transmission lines for the distribution of electricity to Bremerton and Port Townsend from the Dosewallip River. Mr. Chapman is said to have secured a contract from the Navy Department to furnish electricity to the Bremerton Navy Yard.

PROSSER, WASH.—C. E. Forsyth, of White Bluffs, has secured a 20-year franchise for the White Bluffs & Columbia River Telephone Company.

SEATTLE, WASH.—Bids will be received at the office of James Knox Taylor, supervising architect, Treasury Department, Washington, D. C., until April 19 for the installation of an electric wiring system for the U. S. Government buildings at the Alaska-Yukon Pacific Exposition at Seattle.

SPOKANE, WASH.—It is reported that the Northern Idaho & Montana Electric Light Company contemplates the construction of a large hydro-electric power plant at Cabinet Gorge, on Clark Fork River, where it is said that 75,000 hp can be developed, at a cost of about $2,000,000. The company was recently incorporated and has taken over several electric light and water plants in the northern part of Idaho and Montana, including the plant of the Pend Oreille Electric Light Company, of Sandpoint, Idaho; the Newport Light & Power Company, of Newport, Wash.; the Flathead Valley Water Power Company, of Kalispell, Mont., and others. The company proposes to furnish electricity for lamps and motors in every town in the northern part of Idaho and Montana, and will also furnish water to the different cities through the local plants acquired.

SPOKANE, WASH.—The Inland Empire Portland Cement Company, recently incorporated, will soon commence work on the construction of a large plant, which will involve an expenditure of about $1,000,000. The company has purchased the mineral holdings of Lewis P. Larson, of Spokane, located near the mouth of Sullivan Creek, and also his water rights on that stream. Water rights have also been filed on Sullivan Lake, which will be raised to increase its storage capacity. It is estimated that from 8000 to 12,000 hp can be developed under a head of 465 ft. The cement mill will be operated by water power, which will require 2000 hp, and the rest of the power will be utilized to generate electricity for use of the company and for commercial purposes. F. A. Blackwell, president of the Idaho & Washington Northern Railroad Company, is interested in the company.

CLARKSBURG, W. VA.—The Fairmont & Clarksburg Traction Company is securing rights of way for its proposed extension from Grasselli and Bridgeport, a distance of three miles, to be made this coming summer.

WHEELING, W. VA.—Albert M. Schenk states that he has closed a deal with Pittsburgh capitalists to build a high-speed electric railway connecting Wheeling with Pittsburgh. It is said that the Wabash tracks will be used. The railway will cost $1,500,000, and it is expected to have the road in operation by the spring of 1910.

BARABOO, WIS.—The City Council is considering the question of establishing a municipal electric light plant.

PRESCOTT, WIS.—The Prescott Light & Power Company is said to be making arrangements to erect an office building and substation on Orange Street.

SPARTA, WIS.—The directors of the Sparta-Melrose Railroad Company have closed a deal with the Western Transportation Company, of St. Paul, Minn., which will insure the immediate construction of the railway from Sparta to Melrose, 26 miles distant. The railway will run by the way of the new Government reservation and will be equipped with either electric or gasoline motors.

CHEYENNE, WYO.—Bids will be received by Captain V. K. Hart, acting quartermaster, U. S. A., at the office of the constructing quartermaster, Cheyenne, Wyo., until April 24 for furnishing all labor and material required in the construction and remodeling of the electric lighting system at Fort D. A. Russell, Wyoming, as follows: (1) Constructing primary, secondary service transmission and street lamp lines; furnishing and installing cut-outs and street lamp brackets and installing transformers; removing part and remodeling part of old line. (2) Furnishing and installing tungsten lamps, switchboard and all apparatus for substation. (3) Furnishing all watt meters and transformers. (4) Installing interior conduit wiring and arc lamps for lighting cavalry drill hall. (5) Construction of buildings for transformer substation, in accordance with plans and specifications which are on file at the above office and in the offices of the Chief Quartermaster, Department of Missouri, Omaha, Neb.; Chief Quartermaster, Department of Colorado, Denver, Col.; Chief Quartermaster, Department of the Lakes, Chicago, Ill.; Depot Quartermaster, St. Louis, Mo., and Quartermaster, Fort Leavenworth, Kan.

CALGARY, ALB., CAN.—It is reported that the Calgary Power & Transmission Company will commence work immediately on its proposed power development at Horseshoe Falls, which will involve an expenditure of more than $1,000,000.

CRANBROOK, B. C., CAN.—The Board of Trade has petitioned the Provincial Government to build a telephone line through the Kootenay country.

CRESTON, B. C., CAN.—The Goat River Power Company has secured permission for the construction of a 10-mile tramway to Duck Creek.

DUNCANS STATION, B. C., CAN.—The Portland Canal Mining Company is making arrangements for the installation of a power plant, aerial tram and concentrator at an approximate cost of $75,000. C. H. Dickie is president of the company.

FERNIE, B. C., CAN.—The Cranbrook Telephone Company, of Cranbrook, B. C., has decided to build a telephone line between Fernie, B. C., and Lethbridge, Alta.

NELSON, B. C., CAN.—The Allis-Chalmers-Bullock Company, of Montreal, Que., has received the contract for the installation of the second unit of the civic power plant for $74,900.

BRANDON, MAN., CAN.—The City Council has applied to the Municipality of Winnipeg for service from its civic power plant at Point du Bois, which is about 200 miles from this city.

TORONTO, ONT., CAN.—Bids will be received until April 30 by Mayor Joseph Oliver, chairman Board of Control, City Hall, Toronto, Ont., for underground cable. Specifications can be seen and forms of tender obtained at the Electrical Department, City Hall, Toronto.

IBERVILLE, QUE., CAN.—The Town Council has awarded a contract to the Northern Electric & Manufacturing Company, Ltd., for installing a Western Electric generator, exciter and switchboard for the municipality.

MONTREAL, QUE., CAN.—The Merchants' Light & Power Company has applied to the Dominion Legislature for a charter to supply electricity and gas within a specified territory in Montreal for lamps and motors. The company is to be capitalized at $1,500,000 with power to increase it to $3,000,000. The petitioners for incorporation are: Odilion Lemire, J. B. Letendre, B. Mercier, A. T. Vallieres, O. Lecompte, L. J. Tarte, J. Durand, R. A. Brossard and others.

ALAMEDA, SASK., CAN.—The organization of the Alameda Rural Telephone Company has been completed, and plans call for the immediate construction of 68½ miles of rural telephone lines for 60 subscribers.

BELLE PLAINE, SASK., CAN.—Sealed tenders will be received by John Poyser until April 15 for the construction and supply of all material for the proposed telephone line of the Stoney Beach Rural Telephone Company.

GOVAN, SASK., CAN.—The organization of the Govan Rural Telephone Company has been completed, and tenders for the construction of a telephone system will be called for soon.

GREY, SASK., CAN.—Sealed tenders will be received by Elmer Auld, Grey, Sask., until April 3 for the construction of 24 miles of telephone pole line, 30 poles to the mile, and 72 miles of wire for the Grey-Milestone Telephone Company.

MELVILLE, SASK., CAN.—The Council is considering plans for a local telephone system. For further information address Leon Benoit, secretary.

NORTH BATTLEFORD, SASK., CAN.—Several syndicates have applied to the City Council for franchises to supply electricity for lamps and motors in this city. No decision has yet been made by the Council.

WILCOX, SASK., CAN.—Sealed tenders will be received by A. E. Hadley until April 5 for all work and materials necessary for the construction of a telephone system for the Wilcox Rural Telephone Company.

New Incorporations.

ROGERS, ARK.—The Rogers & Pea Ridge Interurban Railway Company has been organized and will soon apply for a charter to construct an interurban railway between Rogers and Pea Ridge. The officers of the company are: A. P. Potter, president; J. F. Walker, vice-president, Bryan Snyder, secretary, and J. J. Putnam, treasurer.

PLACERVILLE, CAL.—The Heddens Mining & Electric Company has been incorporated, with a capital stock of $[illegible] by [illegible] to develop mining claims and [illegible] power plants. The directors are: H. Meehan, [illegible] Cal.; Ralph L. Boyer, San Diego, Cal., and Daniel R. R. Caldwell, of Sacramento, Cal.

SAN FRANCISCO, CAL.—The Dunfee Electric Company, capitalized at $[illegible], has been incorporated by C. H. Dunfee, J. Dunn, A. L. Shaw, L. W. Shaw and A. M. Hunter.

SAN FRANCISCO, CAL.—The Sacramento Valley Power Company has been incorporated, with a capital stock of $800,000, by P. C. Morf, H. C. McPike, L. Q. Havan, J. J. Dailey, J. F. McCue, F. W. Nightingill and F. A. Potter.

SAN FRANCISCO, CAL.—The Equitable Light & Power Company has been incorporated, with a capital stock of $750,000. The company is installing electric plants in the Phelan Building and the Whitney Building and will be ready to supply electricity and hot water in the near future in that locality. It is said the company contemplates the construction of another plant outside the city. The directors are: F. G. Cartwright, A. E. Long, Leo Meyberg, M. S. Wilson, M. D. Levenson, C. N. Beal, of San Francisco, and James Fisher, of Berkeley, Cal.

SAN FRANCISCO, CAL.—The California Electric Generating Company has been organized as a subsidiary corporation of the Great Western Power Company for the purpose of constructing and operating an electric steam generating plant in Oakland. This plant will be leased to the Great Western Power Company and will be operated in connection with the Great Western power plant, located on the Feather River. The company is capitalized at $7,500,000 and $5,000,000 in bonds have been authorized. The construction of the power house is well under way, and steam turbine generator units with a rating of 13,500 hp will be installed at first. The power house is so arranged that additions can be made to the plant as needed.

RIFLE, COL.—The Cache & Beaver Telephone Company has been incorporated with a capital stock of $20,000 by Otto Hahnwald, Lloyd Shultz and J. B. Elrod, of Rifle, Col.

GRIFFIN, GA.—The Middle Georgia Interurban Railway Company has been incorporated, with a capital stock of $200,000, by Charles F. Howe, of Milledgeville; L. W. Roberts, of Atlanta, Ga., and W. F. Smith, of Flovilla, Ga. The company proposes to construct an electric railway, 70 miles in length, connecting Griffin and Social Circle, with branches to Flovilla and Monticello.

DANVILLE, ILL.—The Paris-Northern Railway Company has been incorporated with a capital stock of $5,000 to construct an electric railway from Ridgefarm to Paris, for which surveys have been completed. The capital stock of the company is $5,000 and the directors are: W. M. Bridgett, R. C. Parks, L. C. McGee, George G. Roland and Charles Troup.

FLAGG CENTER, ILL.—The Flagg Center Telephone Company has been incorporated with a capital stock of $35,000 by John Gibson, A. B Eyster, John T. Lansden and Robert Gibson.

PERU, ILL.—The Cedar Point Telephone Company has been chartered with a capital stock of $11,000 by Elmore H. Whittaker, Robert H. Johnston and John Martens.

TINLEY PARK, ILL.—Articles of incorporation have been filed for the Tinley Park Electric Light Company, with a capital stock of $2,500, by E. B. Quackenbush, Frances Youker and Albert J. Kelly. The company proposes to construct and operate an electric light and heating plant.

CROSS PLAINS, IND.—The Farmers' Mutual Telephone Company has been organized, with a capital stock of $890. Daniel Denmore is president of the company, and Martin Vanosdan, secretary and treasurer.

FLORA, IND.—The LeBaw Electric Company has been incorporated to build and equip an electric light plant in this city. William B. Alonzo, of Reuben; Darwin and I. M. LeBaw are directors.

HARRISON, IND.—The Flat-Wood Independent Telephone Company has been incorporated with a capital stock of $500 by O. P. Martin,

INDIANAPOLIS, IND.—The directors of the Indianapolis Telephone Company will ask for bids immediately for the construction of a branch exchange in the Irvington suburb. The cost of building and new equipment is estimated at $80,000.

INGALS, IND.—The Fall Creek Telephone Company has been incorporated to build and operate a telephone system in the western part of Madison County, with principal exchange in Ingals. Charles Hiday, G. W. Pelligrew and P. T. House are directors.

EDGEWOOD, IA.—The Edgewood Farmers' Telephone Company has been incorporated, with a capital stock of $2,000 and the following officers elected: R. L. Phelps, president; J. A. Stone, vice-president; J. S. Wait, secretary, and U. G. Elliott, treasurer.

IOWA FALLS, IA.—The Iowa Falls & Owaso Telephone Company has been chartered with a capital stock of $2,450 and the following directors: J. M. Rankin, John Robertson, Joseph Brewster and others.

MERIDEN, IA.—The Farmers' Telephone Company has been organized for the purpose of taking over the Liberty-Meriden, West Lines, Mill Creek and Town Mutual telephone lines. The following officers have been elected: J. E. Weise, president; D. Holly, secretary, and Robert Miles, treasurer.

MILES, IA.—The Miles & Bryant Telephone Company has been incorporated with a capital stock of $500 by William Baty, John P. Millhaem and others.

JENNINGS, LA.—Articles of incorporation have been filed for the Lake Arthur, Jennings & Northern Railway Company to construct an electric railway from Lake Arthur through Jennings, to connect with a point on the Colorado, Southern, New Orleans & Pacific Railroad, about 50 miles in length. W. B. Conover, of Jennings, is president.

NEW ORLEANS, LA.—The New Orleans & Seashore Railway Company has been chartered, with a capital stock of $2,000,000, to carry out the plans of the New Orleans & Seashore Air Line Railway. The company proposes to construct an electric railway from Amesville, opposite New Orleans, to Grand Isle, La., a distance of 55 miles. The charter of the company gives it the privilege of extending its railway the full length of Grand Isle, with a branch to Bayou Lafourche and along the bayou from Rockport to the Gulf of Mexico. The incorporators are: James W. Porch, J. H. Menge, J. D. W. Benson, Leo A. Marrero and Lamar C. Quintero, all of New Orleans.

SOLON, MAINE.—The Solon Electric Light Company has filed articles of incorporation, with a capital stock of $10,000. The officers are: C. A. Paul, president, and P. S. Longley, treasurer and clerk, both of Solon.

BOSTON, MASS.—The Public Service Investment Company has organized as a holding company for the Stone & Webster operating companies, of which there are 28, having an outstanding capitalization over $113,000,000. The company is capitalized at $3,000,000.

BRANCH, MICH.—The Carr Telephone Company has been organized with a capital stock of $575 to build a telephone in Branch. W. I. Ingalls is president.

CRYSTAL, MICH.—The Crystal Telephone Company has been incorporated, with a capital stock of $5,000. The officers of the company are J. P. Spencer, president; George Ingersoll, vice-president; R. L. Ruedge secretary; George Felton, treasurer, and J. G. Deyoe, general manager.

TWINING, MICH.—The Twining Mutual Telephone Company has been organized with a capital stock of $5,000 and the following named officers elected: C. J. Shreve, president; G. H. Hollister, vice-president A. H. Townsend, secretary, and John J. Finerty, treasurer.

WOODSTOCK, MICH.—The North Star Telephone Company has been incorporated, with a capital stock of $120,000.

WYANDOTTE, MICH.—The Detroit River Telephone Company, of Wyandotte, has been incorporated, with a capital stock of $50,000, for the purpose of operating a telephone service in Wyandotte, Ford City, Gross Isle and Trenton. The incorporators are: F. T. Moran, Arthur H. Barker, James E. Bailey, S. E. Fisher and T. A. E. Weadlock.

KELLOGG, MINN.—The Telephone Company of Kellogg has been organized with a capital stock of $10,000 and the following officers: M. K. Woife, of Kellogg, president; Charles Gengnagel, vice-president; L. C. Cooke, secretary and manager, and J. D. Bricher, treasurer. The company has taken over the old Dwelle telephone line from Kellogg to Plainview, which will be connected with the local system.

RED LAKE, MINN.—The Red Lake & Eastern Marshall Telephone Company has been incorporated to construct a rural telephone line from Gryla to Thief River Falls. About 50 miles of wire will be erected.

LEWISTOWN, MONT.—The Husen Creek Telephone Company has filed articles of incorporation with a capital stock of $5,000 for the purpose of constructing and operating a telephone line between Lewistown and the divide between Cottonwood Creek and the east fork at Snow Mountains in Fergus County.

McLEOD, MONT.—The Main Boulder Telephone Company has been incorporated with a capital stock of $2,000 by G. W. Moore and others.

HUBBARD, NEB.—The Hubbard Telephone Company has been organized and the following named officers elected: D. Hartnett, president; William Reninger, secretary, and William Geortz, treasurer. The company will erect a telephone line 27 miles long.

NORTH PLATTE, NEB.—The South Side Mutual Telephone Company has been granted a charter, with a capital stock of $5,000. The incorporators are: J. W. Crow, J. L. Shuck and others.

STAMFORD, NEB.—Articles of incorporation have been filed for the Highline Mutual Telephone Company by I. K. Ashford, Charles Hoppe and others. The company is capitalized at $10,000.

LACONIA, N. H.—Articles of incorporation have been filed for the Winnipesaukee Telephone Company, with a capital stock of $180,000, by Jasper N. Keller, of Surrey; Fred W. Story, and William F. Knight, of Laconia, and others

JERSEY CITY, N. J.—The Chester Power Company has been incorporated, with a capital stock of $50,000, by Oscar L. Wild, R. R. Arrington and T. H. Graham. The company proposes to construct and operate street car lines and to supply light, heat and power. F. R. McDermott, 259 Washington Street, Jersey City, is agent.

VINELAND, N. J.—Articles of incorporation have been filed for the South Jersey River Development Company by Elwood C. Potter, Marcus Fry and Winslow W. Walls, all of Vineland, N. J. The company is capitalized at $100,000 and proposes to construct dams to supply water power and to generate electricity.

STANLEY, N. M.—The Stanley Telephone Company has been incorporated with a capital stock of $6,000 to build a telephone line from Stanley to Santa Fé, a distance of 60 miles. The officers of the company are: J. H. Darnell, president and general manager; J. O. Leatherwood, vice-president, and W. C. Scovel, secretary.

ROCHESTER, N. Y.—The New York State Railways has been organized, with a capital stock of $23,140,200, to take over the properties of the so-called Vanderbilt system of electric railways. The company is a consolidation of the Rochester Railway, the Rochester & Sodus Bay and the Rochester & Eastern Rapid Railway companies. The officers of the new company are: Horace E. Andrews, of Mentor, Ohio, president; William K. Vanderbilt, Jr., of Great Neck, N. Y., and John J. Stanley

f Cleveland, Ohio, vice-presidents; Joseph C. Collins, of Rochester, ecretary, and Edward L. Rossiter, of Greenwich, Conn., treasurer.

TOWANDA, N. Y.—The Bradford County Traction Company has en organized by George R. Hill, E. F. Kizer, O. L. Haverly and dward Whalen. The company proposes to construct a railway system Towanda Borough, for which it has already secured a franchise. pplication has been made to the State for a charter.

HENDERSONVILLE, N. C.—The Appalachian Power Company has een chartered, with a capital stock of $250,000, by George E. Ladshaw, . L. White, of Spartanburg, S. C., and others to develop a water ower on Green River and its tributaries.

THOMASVILLE, N. C.—The Pleasant Grove Telephone Company has een incorporated with a capital stock of $650 by J. E. Meredith, of homasville, and others.

HARVEY, N. D.—Articles of incorporation have been filed for the Harvey Telephone Company with a capital stock of $50,000 by R. H. Hamilton, D. F. Siegfried, of Fargo, and A. Peterson, of Harvey, N. D.

McCLUSKY, N. D.—Articles of incorporation have been filed for the Lamont Telephone Company, with a capital stock of $4,000, by Emanuel Klundt, of Denhoff, N. D.; Jacob Triebwasser, John H. Regler, of McClusky, and others.

VELVA, N. D.—The Prosperous Farmers Telephone Company has been incorporated to construct a telephone line between Velva and Max. C. M. Mills is president, and H. E. Christianson, treasurer.

ALLIANCE, OHIO.—Articles of incorporation have been filed for the Power & Illuminating Company by Grant Snyder, J. H. Forbush and A. S. Kirkbride, of Salem, Ohio; J. L. Richert, of Leetonia, Ohio, and H. H. Hasford, of Ft. Wayne, Ind. The company is capitalized at $75,000 and has taken over the plant and holdings of the Sebring Light Company. It is understood that the company proposes to furnish electricity to the Youngstown & Ohio River Railroad Company, the Stark Electric Company and other interurban electric railways. The company has a large power plant in West Point, Columbiana County.

CAREY, OHIO.—The Carey Farmers' Telephone Company has been chartered with a capital stock of $10,000 by E. F. Hoy and others.

HARRISONVILLE, OHIO.—The Harrisonville Independent Telephone Company has been incorporated, with a capital stock of $10,000.

MARYSVILLE, OHIO.—The Farmers' Telephone Company has been organized to erect a telephone system in Raymond, Byhalia, York, East Liberty and West Mansfield. The officers of the company are: J. D. Coe, president; C. W. Vanhinney, vice-president; W. N. Plotner, secretary, and W. N. Thomas, treasurer.

WHARTON, OHIO.—The Wharton Telephone Company has been incorporated with a capital stock of $10,000 by G. M. Wichner and others.

OKLAHOMA CITY, OKLA.—The Weeleetka Water Power Company has been incorporated, with a capital stock of $10,000, by C. T. Blake, of Hobart; S. T. Ambler and H. Goffin, of Oklahoma City.

WHEATLAND, OKLA.—The Davis Brothers' Telephone Company has been incorporated with a capital stock of $500 by Jesse P. Davis and A. D. Davis, of Wheatland.

SCHAEFFERSTOWN, PA.—The Schaefferstown Telephone Company has been chartered with a capital stock of $5,000 to construct and operate a telephone system in Lebanon County. S. H. Bomberger, of Schaefferstown, is treasurer.

SHAWVILLE, PA.—The Shawville Rural Telephone Company has been organized and the following named officers elected: Harrison Straw, president; A. B. Lansberry, vice-president, and E. E. Murray, secretary.

DE SMET, S. D.—The De Smet-Mathews Telephone Company has been incorporated, with a capital stock of $3,000, by R. A. Rounseville, Luke Kelly and others.

PLEASANT SHADE, TENN.—The Pleasant Shade Telephone Company has been chartered with a capital stock of $1,000 by G. W. McDonald, G. W. Cornwell, John C. Hesson, J. B. Organ and J. A. Sanderson.

WALLING, TENN.—The Walling Light & Power Company has been chartered, with a capital stock of $5,000, by Jesse Walling, H. R. Walling, E. M. Walling, S. J. Stroud and Samuel Lively.

WICHITA FALLS, TEX.—The Wichita Falls Water & Light Company has been incorporated, with a capital stock of $10,000, by Henry Sayles, J. A. Kemp, Frank Kell and others.

DANVILLE, VA.—The Providence Telephone Company has been incorporated by C. B. Flinttop, of Danville, Va.; D. G. Wilkins, of Blanch, N. C., and others. The company is capitalized at $5,000.

HAYMARKET, VA.—Articles of incorporation have been filed for the Bull Run Telephone Company, with a capital stock of $5,000. The officers of the company are: William Beverly, of Bull Run, president; Leo Howdershel, vice-president, and P. D. Brawner, of Broad Run, secretary and treasurer.

LOVINGSTON, VA.—The Rockfish Telephone Company has filed articles of incorporation with a capital stock of $1,500. The officers are: H. T. Harris, president; J. C. Everett, vice-president, and Thomas Boyce, secretary and treasurer.

ROCKY MOUNT, VA.—The Light & Power Company, of Rocky Mount, has been incorporated with a capital stock of $[illegible] to own, operate and construct [illegible] plant. The officers of the company are: N. P. Angle, president; H. D. Dillard, vice-president, and B. L. Fisher, secretary.

FAIRVIEW, W. VA.—The Proctor & Peabody Telephone Company has been incorporated with a capital stock of $5,000 by E. R. Parsons, Albert Garner and J. M. Wells, of Proctor; C. U. Ramsey, of Woodlands, W. Va., and E. C. Yoho, of Welcome, W. Va.

BIENFAIT, SASK., CAN.—The Bienfait Rural Telephone Company has been organized, with A. E. Watt as president and Ira F. Brown, secretary and treasurer, to construct a rural telephone system.

TREGARVA, SASK., CAN.—The Tregarva Rural Telephone Company has been incorporated, with main office in this town.

New Industrial Companies.

THE FOWLER ELECTRICAL SUPPLY COMPANY, of Toledo, Ohio, has been incorporated, with a capital stock of $30,000, by Harry R. Fowler and others.

THE RIDGWAY-McSHERRY COMPANY, of Freeport, Ill., has been incorporated, with a capital stock of $2,500, by F. W. Ridgway, R. J. McSherry and G. H. Luedeking. The company proposes to do electrical construction and repairing work.

THE HUGHSON STEAM SPECIALTY COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $50,000, by E. M St. John, A. G. St. John and R. G. St. John. The company proposes to do general contracting and construction work.

THE BALL ELECTRICAL COMPANY, of Richmond, Va., has been incorporated, with a capital stock of $1,500, for the purpose of dealing in electrical supplies. The officers are: R. H. Ball, president; A. L. Lucas, vice-president; B. A. Ruffin, secretary and treasurer.

THE LYNN-WIGGINS COMPANY, of Columbus, Ohio, has been incorporated, with a capital stock of $10,000, for the purpose of dealing in electrical supplies. The incorporators are: Harry Lynn, Charles A. Wiggins, Lomanna Wiggins, Mary L. Lynn, and Edna A. Lynn.

THE NATIONAL DIETGRAPH COMPANY, of Portland, Maine, has been organized, with a capital stock of $1,000,000, for the purpose of dealing in electrical and other appliances. The officers are: A. F. Dunham, of Portland, president, and M. S. Wells, of Portland, treasurer.

THE NATIONAL CLOCK & ELECTRIC MANUFACTURING COMPANY, of St. Louis, Mo., has been chartered with a capital stock of $100,000 by Theodore H. Wurmb, Robert Baumann, Joseph G. Beckmann and others. The company proposes to manufacture clocks, adding machines, etc.

THE NOVELTY IRON WORKS, of New York, N. Y., have been incorporated with a capital stock of $20,000 by George W. Boyd, of Brooklyn, N. Y.; William A. Ritchie, of Hoboken, N. J., and William Boyd, of Jersey City, N. J. The company proposes to manufacture engines, boilers and machinery.

THE IDEAL AUTOMATIC MANUFACTURING COMPANY, New York, N. Y., has been incorporated with a capital stock of $200,000 to manufacture pumps, engines and governors. The incorporators are: Charles P. McMullen, Victor E. Downer and Edward B. Shoule, all of New York, N. Y.

THE NEW YORK OILLESS BEARING COMPANY, of New York, N. Y., has been chartered with a capital stock of $25,000 to manufacture oilless bearings, machinery and engines. The incorporators are: George Murch and Caleb M. Peellee, of New York, N. Y., and Delphin H. Spicer, of Brooklyn, N. Y.

THE METROPOLITAN SMOKELESS FURNACE COMPANY, of New York, N. Y., has been chartered by Michael F. Burns, of Brooklyn; Solomon M. Schatzkin, of Rutherford, N. J., and Frank L. Burns, of Brooklyn, N. Y. The company is capitalized at $25,000, and proposes to manufacture furnaces, engines and boilers.

THE MARNET CONSTRUCTION COMPANY, of Gloucester, N. J., has filed articles of incorporation with a capital stock of $100,000 for the purpose of doing a general contracting and construction business. The incorporators are: Rollin Morris, of Bryn Mawr, Pa.; J. M. Devlin, of Gloucester, N. J., and Percival A. Wilson, of Philadelphia, Pa.

THE BENN ELECTRICAL CONSTRUCTION COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000 for the purpose of manufacturing and installing electrical apparatus. The incorporators are: William A. Bandbach, Maude E. Hunt, both of New York, N. Y., and Louis F. Benn, of Bayonne, N. J.

THE TRACTION ENGINEERING COMPANY, of New York, N. Y., has been chartered, with a capital stock of $5,000, to manufacture electrical and mechanical apparatus, railroad equipment and dynamos. The incorporators are: C. C. Mann, of Brooklyn, N. Y.; Lewis S. [illegible]

THE CENTURY ENGINEERING COMPANY, of New York, N. Y., has been chartered by Arthur S. Lewis, of Brooklyn, N. Y.; Henry C. Townsend, Jr., of Upper Montclair, N. J., and Edward M. Jellinck, of [illegible]

THE LONG DISTANCE LOCOMOTIVE CONTROL COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $[illegible] for the purpose of manufacturing electrical and mechanical

devices for signaling or controlling railroads, trams or cars. The incorporators are Hugo Deab, Arnold Stern, of New York, N. Y., and O. H. Wickham, of Brooklyn, N. Y.

THE WIRELESS ELECTRIC APPLIANCE COMPANY, of Grand Rapids, Mich., has been organized, with a capital stock of $[illegible], to manufacture a generating battery and wireless electric lamps, under the patents of Philip Young. The company proposes to erect a plant, but has not yet selected a site. It is said that one of these batteries weighing less than a pound has run a ½-hp motor for about 200 hours constantly. Philip Young is president; Lester B. Markham, treasurer, and H. M. Dunham, secretary.

THE CONSTRUCTION COMPANY GENERAL, of Philadelphia, Pa., has been incorporated with a capital stock of $125,000 to do a general contracting business. The company proposes to take contracts for the construction of electric light plants and water works and sewer systems and other public works, especially in the South. Harry A. Loche, of Philadelphia, Pa., is president; Martin D. Krespach, vice-president; K. M. Denzler, secretary and treasurer, and W. D. Griffith, consulting engineer of the Southern Division. The executive offices of the company are at 547 Drexel Building, Philadelphia, Pa.

Personal.

MR. A. M. LITTLE, formerly with Pass & Seymour, Solvay, N. Y., has resigned to accept a position as general manager of the Mohawk Electric Supply Sompany, of Syracuse.

MR. A. L. HARLEY, chief of the engineering department of the Fort Wayne Electric Works, delivered a lecture March 21 before the Fort Wayne Electric Club on "Dynamos and Motors."

MR. J. F. JONES, formerly of the transformer department of the Fort Wayne Electric Company, has accepted a position in the transformer department of the Wagner Electric Manufacturing Company of St. Louis.

MR. GEORGE A. ILER, formerly associated with the New River Company at Carlisle, W. Va., is now with the Interborough Electric Service Corporation, 203 Greenwich Street, New York, as its general manager.

MR. HENRY A. LARDNER, for many years on the New York staff of J. G. White & Company, has taken charge as manager of a branch office of that company, which has just been opened in the Alaska-Commercial Building, San Francisco, Cal.

MR. G. D. HENDERSON has resigned as chief engineer and electrician of the Pratt (Kans.) Light & Ice Company, to become general manager of the Eureka (Kans.) Light & Power Company. The latter plant has been purchased by Mr. Henderson and associates and will be thoroughly overhauled.

M. HENRI DELTON, of Paris, France, has associated himself with Mr. C. O. Mailloux and others to practice as electrochemical engineers and experts, under the firm name of Delton, Mailloux & Company, with offices in Paris and New York. M. Delton is widely known in Europe as a successful electrochemical engineer and has there been identified with a number of important electrochemical industries.

MR. HAROLD H. CLARK, lately electrical aide in the Bureau of Yards and Docks of the U. S. Navy Department, has been transferred to the Department of the Interior, where he received the appointment of electrical engineer and was detailed to take charge, in Pittsburg, of an investigation instituted by the Technological branch of the Geological Survey, relating to the employment of electricity in mine work.

MR. H. J. GILLE, contract agent of the Minneapolis General Electric Company, was elected president of the Minnesota Electrical Association at the recent meeting of that body, as noted in our issue of last week. The career of Mr. Gille illustrates the increasing tendency of central stations to recruit their administrative and commercial staff from the technical branch. From the time of college graduation in 1889 to 1895 he was connected with the Acme Electric Company and the Thomson-Houston Company, taking the practical course of instruction in the shops of the latter company at Lynn. After serving as electrical engineer with the Washburn & Moen Company from 1895 to 1898, he became general superintendent of the St. Paul Gas Light Company, during which period he carried out the extensive improvements which have made the electrical plant of this corporation one of the best examples of modern electrical engineering in this country. Since 1907 Mr. Gille has been with the Minneapolis General Electric Company, where his work in improving the methods of street lighting have been particularly noteworthy.



MR. H. J. GILLE.

MR. GEORGE W. CRAVENS has opened an office as consulting engineer in the Fort Dearborn Building, Chicago, and will take up the mechanical, electrical and structural design of power plants for any purpose, the design of special apparatus, either mechanical or electrical, and also undertake the invention and development of new devices where desired. Mr. Cravens has had over 18 years' experience along these lines, a large portion of which was with the General Electric Company at its Lynn and Schenectady works. Since leaving Schenectady he has been with the Goodman Manufacturing Company, Chicago, makers of mining machinery. Mr. Cravens is a member of various technical and scientific societies, is a contributor to the technical press, and is the author of a large number of patentable inventions.

MR. FRED W. INSULL, secretary and treasurer of the North Shore Electric Company, Chicago, has resigned to accept a position with the Northern Idaho & Montana Power Company, in which H. M. Byllesby & Company, of Chicago, are actively interested. Mr. Insull, who is a cousin of Mr. Samuel Insull, is a business man and accountant of unusual ability, and his resignation, due to Mr. Insull's desire to enjoy the bracing climate of the Rocky Mountain region, was accepted with genuine regret. Mr. John H. Gulick, auditor of the Commonwealth Edison Company, has been elected as his successor, retaining all his duties with the Commonwealth company. Mr. E. D. Alexander has been appointed assistant secretary and treasurer of the North Shore company and will execute the active duties of the office. Mr. Alexander has been manager of the Southern District office of the Commonwealth Edison Company, but this office is about to be abolished, the administration of the company being concentrated in the downtown office.

Obituary.

COL. D. H. GARRETT.—We regret to note the death of Col. D. H. Garrett, who had been manager of the Philadelphia office of the Columbia Incandescent Lamp Company, of St. Louis, for the past seven or eight years. He died in Philadelphia on March 19 after a long illness. He was widely known and highly popular throughout the territory he covered, and his death is deeply mourned by a large circle of friends.

WILLIAM HENRY WAHL, secretary of the Franklin Institute, died in Philadelphia on March 23. Mr. Wahl was born Dec. 14, 1848, and, after attending Philadelphia public schools, was graduated from Dickinson College in 1867, and received the degree of Ph.D. from Heidelberg two years later. He became resident secretary of the Franklin Institute in 1870, serving to 1874, and again from 1882 to January of this year, when he was made honorary secretary. Mr. Wahl was editor of the *Polytechnic Review* of Philadelphia from 1876-8; associate editor of the *Engineering and Mining Journal*, 1878-80, and editor of the *Manufacturer and Builder*, 1880-95. He also edited the *Journal of the Franklin Institute* during the long period of his secretaryship. Many years ago Mr. Wahl experimented upon the reduction of refractory oxides by means of aluminum, for the production of carbon-free chromium, etc., thus having anticipated, in a general way, the later alumino-thermic method of Goldschmidt. He was also an authority on nickel plating, his book on the subject having been standard for a long period. As secretary of the Franklin Institute Dr. Wahl was a most thoroughly competent administrator, and much of the success of the Institute during the last generation is to be ascribed to his indefatigable energy and excellent judgment.

Trade Publications.

X-RAY APPARATUS and auxiliary devices are listed and described in a circular issued by the Kelly-Koett Mfg. Company, Covington, Ky.

DIEHL FANS.—The Diehl Mfg. Co., Elizabethport, N. J., has issued Bulletins 22 and 23, covering its line of electric fans for the coming season.

HEATERS of both the electric and gas types are listed, described and illustrated in booklets issued by the Denver Gas & Electric Company, Denver, Col.

ELECTRIC WELDERS for all services are described in an illustrated folder issued by the Toledo Electric Welding Company, 141 Tenth Street, Toledo, Ohio.

GRAPHITE for industrial purposes is treated in an instructive manner in the March issue of *Graphite*, published by the Joseph Dixon Crucible Company, Jersey City, N. J.

THERMIT.—Complete instructions for the use of Thermit in railroad shops are given in a pamphlet issued by the Goldschmidt Thermit Company, 90 West Street, New York.

PORCELAIN for electrical insulation in standard and special forms is illustrated, briefly discussed and listed in a bulletin issued by the Adamant Porcelain Company, Broadway, Va.

ELECTRIC GAS IGNITION.—A. L. Bogart, 123 Liberty Street, New York, has issued an illustrated descriptive price-list devoted to electrical devices for igniting illuminating gas.

INDUCTION CLUTCHES for planers, which operate similarly to induction motors, are discussed in Bulletin No. 102, of the Wheeling Mold & Foundry Company, Wheeling, W. Va.

WESTINGHOUSE TUNGSTEN BULLETIN.—The Westinghouse Lamp Company has issued a bulletin pointing out the advantages and uses of tungsten lamps of the various types.

CENTRIFUGAL PUMPS, designed particularly for use with electric motors, are treated in an interesting and instructive manner in Catalogue of the D'Olier Engineering Company, Philadelphia.

TELEPHONES.—Automatic intercommunicating telephones of the all-metal construction are illustrated and described in Circular No. 1103 of the Western Electric Company, 463 West Street, New York.

"HYGRADE LAMPS."—The Hygrade Incandescent Lamp Company, Newark, Mass., has issued from its New York office, 136 Liberty Street, an illustrated price-list of "Hygrade" metal and carbon filament lamps.

RHEOSTATS.—The American Electric Fuse Company, Muskegon, Mich., has issued a perpetual catalog devoted to Allen-Bradley rheostats and electric controlling apparatus. The rheostats are of the carbon resistor type.

WATT-HOUR METERS for direct-current house service are well described in Bulletin No. 8 of the Duncan Electric Manufacturing Company, Lafayette, Ind. Each part of the meter is illustrated and discussed in detail.

TUNGSTEN FIXTURES.—The Metropolitan Electrical Supply Company, of Chicago, has issued a special catalog, listing attractive tungsten lighting fixtures suitable for residence, store or office use. Many new designs are shown.

MILLING MACHINES.—An elaborately illustrated, neatly printed catalogue of the Miles-Bement-Pond Company, New York, is devoted to heavy milling machines. Almost all of the machines described are arranged for electric motor drive.

WATT-HOUR METERS.—House-type watt-hour meters for direct-current circuits are fully described in Bulletin No. 8 of the Duncan Electric Manufacturing Company, Lafayette, Ind. The bulletin contains much useful information relating to the installation and operation of watt-hour meters.

IRON AND STEEL.—Joseph T. Ryerson & Son, Chicago, Ill., have issued an elaborately illustrated 46-page pamphlet descriptive of their "Iron and Steel Department Store," which is said to carry the most comprehensive stock of iron, steel and allied fittings and specialties in the world.

ROTH MOTORS AND DYNAMOS.—Bulletins Nos. 182 and 193 of Roth Brothers & Company, Chicago, have for their subject steel frame, direct-current dynamos and motors, which machines are made in sizes from 4 hp to 30 hp. Illustrations show applications of the motor to a large variety of machines.

THERMIT.—The Goldschmidt Thermit Company, 90 West Street, New York, has issued a bulletin giving complete instructions for welding castings and forgings by means of Thermit. Vol. 2, No. 1, of *Reactions*, published by this company, contains accounts of many instances of welds made by the Thermit process.

FANS.—Bulletin No. 22 of the Diehl Manufacturing Company, Elizabethport, N. J., contains illustrations and descriptions of direct-current ceiling fans, with and without lamp fixtures. Universal fans, for wall and desk use, with and without oscillators, are treated in Bulletin No. 23. Each of the fans described is listed also.

ELECTRIC RAILWAY.—Bulletin No. 21 of W. S. Barstow & Company, 50 Pine Street, New York, is a neatly executed 24-page publication giving a well-illustrated technical description of the equipment of the Oregon Electric Railway system, which extends from Portland to Salem, a distance of 50 miles, with a 26-mile branch to Forest Grove.

CENTRAL ELECTRIC PUBLICATIONS.—The Central Electric Company, of Chicago, has issued a circular describing its various types of fan motors, particular attention being given to an oscillatory-rotating fan embodying several new features. Other recent publications of the same company are a circular in "New Wrinkle" pull socket, and a trade list of "Opalux" shades.

TUNGSTEN LAMPS.—The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., has issued Circular No. 1160, dealing with tungsten lamps designed for a specific consumption of 125 watts per candle. The circular contains an analysis of the cost of energy and replacement for carbon and for tungsten lamps, the results being greatly in favor of the latter.

DIRECT-CURRENT MACHINERY.—The Eck Dynamo & Motor Company, Belleville, N. J., has issued Bulletin No. 39, devoted to protected type generators rated at from 0.025 kw to 15.0 kw; No. 40, dealing with motors of from 0.03 hp to 20 hp; No. 41, relating to worm-geared motors for very slow speeds; No. 46, covering back-geared motors for ratings from 0.08 hp to 20 hp, and No. 47, in which motor-generator sets of from 0.075 kw to 12.0 kw are illustrated, described and listed.

VALVES.—The Nelson Valve Company, Philadelphia, Pa., has issued a 220-page, cloth-bound, neatly illustrated publication as its 1909 catalog of valves. The catalog shows gate, globe, angle and check valves in large variety and of various metals. Among the new features are included the newly patented bronze swing check valves, and hydraulically and electrically operated gate valves. Steel gate and globe valves for high pressures and superheated steam are listed. Another new departure of note is the list of open-hearth steel fittings. The use of cuts showing both inside and outside views is generous, the descriptive articles and dimensioned lists immediately opposite the engravings facilitate easy and critical study of each of the valves.

HYDRO-ELECTRIC PLANT OF GREAT NORTHERN POWER COMPANY.—The Allis-Chalmers Company has issued, in pamphlet form, a description of the hydro-electric development of the Great Northern Power Company, one of the largest in the world. During more than 30 years the development of a great water power for supplying the manifold industries at the head of Lake Superior had been seriously considered, and numerous projects, based on the improvement of the St. Louis River, were put forth at intervals. The Great Northern Power Company, as a preliminary to the designing of its works, secured Government records of rainfall for 37 years, and its own gagings of river flow were conducted for a period of seven years, these latter including the most abnormal term of rainfall deficiency that has ever been known, ending in the year 1902. The minimum flow at the date when this drought showed its culmination was about 500 cu. ft. per second. The company took this figure and the period of deficiency which it marked as the basis for calculating the water storage necessary, after arbitrarily increasing the deficiency by 20 per cent. The successful solution of the many difficult problems involved in the construction of this gigantic enterprise makes it one of the notable accomplishments of modern engineering practice.

Business Notes.

THE J. G. WHITE COMPANY, New York, has opened a branch office in the Alaska-Commercial Building, San Francisco, with Mr. Henry A. Lardner as manager.

THE STANDARD UNDERGROUND CABLE COMPANY has removed its New York office from 56 Liberty Street to 50 Church Street, where it occupies a suite on the nineteenth floor.

MR. HAL. C. KIMBROUGH, formerly of the home office at Lockport, N. Y., of the American District Steam Company, is now occupying a responsible position in the Chicago office of the company.

ROTH SALES.—Roth Brothers & Company, of Chicago, have recently sold through their New York sales manager, George F. Schumicke, a large number of motors, including 8 motors for a picture-framing plant and 14 motors for a wood-working plant.

THE SIRIUS COMPANY, 2 West Twenty-ninth Street, New York, is importing a line of flaming-arc electrodes that have met with quite a demand during the short time they have been on the American market. Mr. Ralph Straschnow is manager of the company.

OXY-ACETYLENE CENTRAL-STATION EQUIPMENT.—Mr. W. I. Reich, consulting engineer, 245 West Twenty-fourth Street, New York, has installed in the Twenty-fourth Street shop of the United Electric Light & Power Company, New York, a portable oxy-acetylene welding outfit, which will be used in the company's automobile and truck repair department.

FOX BROTHERS & COMPANY, 126 Lafayette Street, New York, have opened a branch office in the Syndicate Trust Company Building, St. Louis, for the sale of their Polar flaming-arc lamps, Radiant lamps, contact couplings and carbons. T. P. Gleeson, formerly of Smiley & Gleeson, will be in charge of the St. Louis office and will cover the Southwestern territory.

DOSSERT & COMPANY, 242 West Forty-first Street, New York, report having received the following large orders during the current week: From the Compagnie Egyptienne Thomson-Houston, Cairo, Egypt, 500 cable taps and 500 back-connection lugs; from the Western Electric Company, for shipment to Johannesburg, South Africa, 300 front-connection lugs, 200 two-way, 100 three-way and 100 cable taps; from the United Electric Light & Power Company, 2000 flat-shank terminal lugs for service cut-outs.

WILLIAM A. READ & COMPANY, bankers, 25 Nassau Street, New York, announces that the firm agreement expired by limitation March 31, and that Charles Hazard, who has been one of its members, retired from business. William A. Read and Joseph H. Seaman, the remaining members of the old firm, have associated with themselves as copartners John Hallett Clark and John W. Hornor of New York, James Dean of Boston, and W. M. L. Fiske of Chicago, to continue the business under the same firm name.

ANGLE-COMPOUND ENGINES.—The owners of the new Belnord apartment house, at Eighty-sixth Street and Broadway, New York City, one of the largest apartment houses yet built, have recently placed an order with the American Engine Company, of Bound Brook, N. J., for three angle-compound engines, one of 200 hp and two of 100 hp. This type of engine is exceptionally adapted to isolated plant work, because of its relatively small space requirements and the entire absence of vibration.

MR. W. P. PRESSINGER, who recently resigned as general manager of the compressor department of the Chicago Pneumatic Tool Company, has organized the W. P. Pressinger Company, to handle the various cleaning machines, both portable and stationary, made by the Bonnot Manufacturing Company, of Philadelphia, Pa., and formerly sold by the Chicago Pneumatic Tool Company. The new company has opened offices and salesrooms at 32 West Thirty-fourth Street, New York City, and will establish local agencies at all distributing points throughout the Eastern territory.

MR. L. ROBINSON has been appointed manager of the insulating department of the Standard Varnish Works, with headquarters in New York. Mr. Robinson has been identified with the Standard Varnish Works during the past four years. In this period he has spent a great

portion of his time in familiarizing the trade with the exceptional values of the vacuum drying and compound filling process. For fifteen years previously Mr. Robinson held many responsible positions in the operating end of electric railways in the United States, Canada and Europe. With this thorough preparation, and four years' experience in exploiting Standard Varnish Works Insulating Specialties, Mr. Robinson enters his new position thoroughly familiar with the large field with which he has to deal.

MR. J. G. BOYD, formerly traveling in the interests of the Columbia Incandescent Lamp Company in Iowa, Minnesota and surrounding States, has become manager of the lamp department of the Central Electric Company, and will hereafter be permanently located in Chicago. Mr. Boyd has been one of the best known lamp salesmen in the territory west of Chicago for many years, being a prominent figure at the various State electric light conventions and a welcome visitor to many central stations because of his broad knowledge of the small central-station business and the problems which the manager of the small central station has to meet. He is one of the best posted men in the country on voltage conditions as they actually exist of central stations throughout the territory in which he formerly traveled.

NERNST LAMP INSTALLATIONS.—The lighting of the handsome new storerooms to which the John A. Renshaw Grocery Company recently removed, at the corner of Ninth Street and Liberty Avenue, Pittsburgh, is accomplished by Westinghouse-Nernst chandeliers, equipped with 132-watt Westinghouse-Nernst lamps and inverted gas burners. The chandeliers are of the Art Nouveau design, and are finished to correspond with the hardware decorations of the building. The new White House, of San Francisco, which was opened for business Saturday evening, March 13, is lighted by multiple-glower Westinghouse-Nernst lamps in ornamental fixtures. The total installation consists of 1000 glower units. This is one of the finest stores in the rebuilt downtown district, and the opening was attended by no less than 75,000 people. The new First National Bank and the remodeled Dollar Savings Bank, of Youngstown, Ohio, will both be lighted by multiple-glower Westinghouse-Nernst lamps in ornamental housings.

INSTRUCTION OF FACTORY EMPLOYEES.—The Harvard Electric Company has arranged for a lecture course, in order to give a employees a practical idea of electrical construction, especially with regar to cable hangers, wire joints, sectional switch boxes, test connector lightning arresters, steel brackets, fuses, cable terminals, conduit box etc., manufactured in the Harvard company's Chicago factory, in the many varied phases, uses and applicability, instead of confining them the knowledge of the certain parts which each makes. This lectur course is for the exclusive benefit of the Harvard Electric Compan employees. It is planned to give short talks after the luncheon hou At night there will be frequent illustrated lectures. Throughout th course authorities in the electrical engineering field will be called upo Mr. Allen Lee Haase, sales manager and a "bracket engineer," wi discuss all phases of the channel steel bracket and the "reasons why" it i more economical than wood or heavy malleable iron brackets. M Frederic Greer, general manager of the company, will take up mor general topics of pertinent interest.

HIGH-VOLTAGE OUTDOOR SWITCHES.—The Kelman Electric Manufacturing Company, of Los Angeles, Cal., reports having complete its first 30,000-volt self-contained outdoor type of oil switch, which wa furnished complete with a 25-foot steel tower and disconnecting switche to the Globe Light & Power Company, of Visalia, Cal., and that number of 12,000-volt outdoor type circuit-breakers are nearing com pletion for the San Joaquin Light & Power Company, of Fresno, Ca Other orders recently received for standard indoor type of apparatus ar as follows: Utah Light & Railway Company, Salt Lake City, Utah, 45,00 volt switches; Pacific Light & Power Company, Los Angeles, Cal., 15,00 volt circuit-breakers; Pacific Electric Railway Company, Los Angele Cal., 30,000-volt circuit-breakers; Mt. Whitney Power Company, Visali Cal., 30,000-volt circuit-breakers; LaGrange Water & Power Company LaGrange, Cal., 30,000-volt switches; San Joaquin Light & Power Com pany, Fresno, Cal., 30,000-volt circuit-breakers; Nevada-California Powe Company, Goldfield, Nev., 50,000-volt switches and circuit-breakers Northern California Power Company, Redding, Cal., 75,000-volt circuit breakers.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Lloyd Lyon, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West 39th St., New York. Next meeting, Hot Springs, Va., May 18, 19 and 20, 1909.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, Niagara Falls, Canada, May 6, 7 and 8, 1909.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, Little Rock, Ark. Next meeting, Hot Springs, Ark., May 12, 13, and 14, 1909.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, 557 Frick Building Annex, Pittsburg, Pa. Next meeting, June, 1909.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago. Next meeting, Detroit, June 23, 24 and 25, 1909.

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, Walter S. Mower, London, Ont.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York.

ASSOCIATION OF CAR LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, S. E. Mumford, Detroit, Mich.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Indianapolis, Ind.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, September, 1909.

EASTERN STATES INDEPENDENT TELEPHONE ASSOCIATION OF PENNSYLVANIA, NEW JERSEY, MARYLAND AND DELAWARE. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

ELECTRIC CLUB, CHICAGO. Secretary, W. S. Taussig, 204 Dearborn St., Chicago. Meets every Wednesday noon at Chicago Automobile Club.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 500 Fifth Ave., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 200 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meetings, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 154 Nassau St., New York.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, J. W. Fluckner, 503 Fifth Ave., New York.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., 1909.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Ia. Next meeting, Cedar Rapids, Ia., April 21 and 22, 1909.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, Des Moines Life Bldg., Des Moines, Ia.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Cedar Rapids, Ia., April, 1909.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James Nicholson, Newton, Kan. Next meeting, Wichita, Kan., October, 1909.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Ferguson, Mount Vernon, Ky. Regular meetings, second Tuesday in October, each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-Treasurer, Ludwig Kemper. Albert Lea, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Gas & Light Co., Jackson, Miss. Next meeting, Jackson, Miss., June 1, 1909.

MISSOURI ELECTRIC LIGHT, GAS & STREET RAILWAY ASSOCIATION. Secretary, C. L. Clary. Next meeting, Springfield, Mo., April 15, 16 and 17, 1909.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Schweer, Windsor, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist 29 Adams St., Chicago. Headquarters, 33 West 39th St., New York. Next meeting, Atlantic City, N. J., first week in June, 1909.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next meeting, Boston, Mass., June 7-9, 1909.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, William Bradford, Lincoln, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet Street, New Orleans, La. Meetings second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, Seattle, September, 1909.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis. Next meeting, Milwaukee, January, 1910.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Canton, Ohio, May 21 and 22, 1909.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburg, Pa., 1909.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, J. T. Halloran, 604 Mission St., San Francisco, Cal. Next meeting, Oakland, Cal., February, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting, second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meetings, fourth Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, J. A. Myler, Jr., 609 Juanita Building, Dallas, Tex. Next meeting, Dallas, Tex., May, 1909.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary,, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., October, 1909.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 23, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., New York.]

915,741. APPARATUS FOR OPERATING RAILWAY SIGNALS; C. J. Coleman, New York, N. Y. App. filed July 30, 1907. The signal is shifted by means of a gas motor, and the tank which produces the gas (carbon dioxide) is arranged near the signal

915,768. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Belleville, N. J. App. filed June 9, 1906. A storage battery is used to steady the load with a direct and alternating current system, so that the battery compensates on each of the generating plants. Employs a motor generator between the alternating and direct-current sides of the system, and in the direct-current side utilizes a battery and booster, providing an auxiliary e.m.f.

915,774. COMPOSITION OF MATTER FOR AND PROCESS OF MAKING INSULATING MATERIAL; Carl A. Keller, Chicago, Ill. App. filed Dec. 26, 1907. Mixes hydraulic cement with a waterproofing compound and an insulating asphalt by first mixing cement and sand, then molding and the evaporating, heating and impregnating with asphalt.

915,786. ELECTRICAL PLATING RACK; D. B. Moyer, Detroit, Mich. App. filed March 16, 1908. A cathode hanger for electro-plating, having a conducting rod in a vessel containing and a detachable conducting branch rod, dipping into the tank.

915,797. GUARD FOR ELECTRIC RAILWAY BONDS; J. J. Sapper and J. G. Brueggemann, St. Louis, Mo. App. filed Aug. 26, 1907. Includes a plate having a flange on three sides forming a chamber, with a pair of horizontal apertures through the plate at its end and a stud integral with the plate within the chamber.

915,824. ELECTRIC HEAD CAP; G. M. Branaman, Kansas City, Mo App. filed April 25, 1908. For electric treatment of the ear, etc., in which a battery is supported by head gear and ear bobs from the terminals of the battery, the entire apparatus being strapped to the head

915,846. ELECTRODEPOSITION OF METAL ON HOLLOW ARTICLES; E Friedheim, Paris, France. App. filed March 26, 1907. Deposits on the interior of hollow straight tubes and uses a plurality of conducting rods, connected to a common supporting anode with insulating sleeves and hollow cathodes around the anodes.

915,895. ELECTRIC LOCOMOTIVE; F. L. Sessions, Columbus, O. App. filed Oct. 24, 1903. Electric locomotives for coal mines in which the current is supplied through a flexible cable from the source instead of by fixed conductors. Uses a cable reel which can be actuated from a chain drive and friction clutch from the electric motor.

915,915. ELECTRICAL SYSTEM OF DISTRIBUTION; F. J. White, Brooklyn, N. Y. App. filed Jan. 8, 1906. Storage-battery system in which the battery is regulated by automatic regulation of a booster in series with the battery wheel. Provides a regulating coil for the booster in the battery circuit, so that its current varies in accordance with the variations of current in the battery circuit.

915,951. CONTROLLER FOR ELECTRICALLY DRIVEN PULSATORS; A. H. Gibson, Easton, Pa. App. filed Jan. 4, 1909. A controller for a motor-operated air compressor, combined to compress air which is thereafter supplied to drills. Details in the construction of the rheostat and controller.

915,974. AUTOMATIC THERMO-ELECTRIC CONTROL; H. W. Leonard, Bronxville, N. Y. App. filed Jan. 5, 1906. Particularly for soldering irons, combines with the heated conducting mass which emits heat at varying rates, a resistance device having movable element which automatically supplies heat to the iron, according to the demand.

915,988. PROCESS FOR REGENERATING ELECTRIC ACCUMULATORS; Carl Jaskow, Lemgow, Germany. App. filed May 2, 1904. Subjects the electrodes to electrolysis in a diluted non-acidic solution.

915,990. JUNCTION BOX COUPLING; E. S. Morrell, Philadelphia, Pa. App. filed Sept. 25, 1908. For attaching conduit pipes to outlet

boxes without requiring screw threads on the box or pipe. Makes use of elements to secure the pipe to the box.

916,091. WIRELESS TELEGRAPHY; J. Morgan, Wilkesbarre, Pa. App. filed May 17, 1907. The antenna extends into the earth and is insulated therefrom and is arranged in a helix. A capacity is arranged on the other side of the apparatus.

916,611. BATTERY CHUTE; C. O. Poor, Rochester, N. Y. App. filed May 18, 1908. Battery chutes for railroad signal work, consisting of a cylindrical tank in the earth below the frost line. The tank has a battery elevator in it to raise and lower the batteries when required.

916,633. PROCESS FOR PRODUCING ELECTRO-DEPOSITS WHICH CAN BE REMOVED FROM THEIR BASE; H. Schmidt, Cologne, Germany. App. filed Aug. 9, 1907. Produces electric deposits, removable from the base, by electro-depositing on a rotary cylinder at an electro-motive force at which no visible alteration takes place and then electro-depositing metal on the first layer.

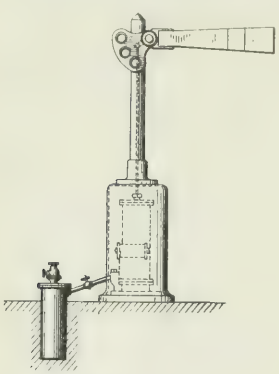
916,638. TRAIN SIGNAL SYSTEM; H. H. Sharp and W. R. Vanaman, Atlantic City, N. J. App. filed June 12, 1908. For conductors' use to signal the motor man. Indicators are on each platform, and a conducting system, including a circuit controller, is operated by a signal cord.

916,639. ELECTRIC SWITCH FOR SIGNAL CONTROLLING APPARATUS; N. T. Shaw, Los Angeles, Cal. App. filed March 14, 1908. The motorman can operate the switch without leaving the car, the device operating in conjunction with a semaphore signaling system.

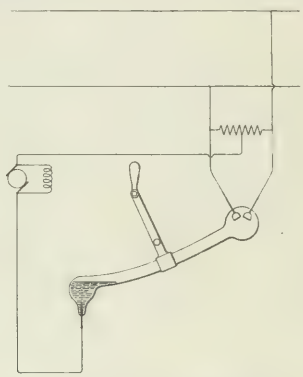
916,665. BRUSH HOLDER; W. A. Turbayne, Lancaster, N. Y. App. filed Aug. 8, 1907. The brush is held yieldingly against the commutator, the pressure of the spring acting on the lever, the spring being adjustable to vary the pressure.

916,717. TESTING SYSTEM FOR TELEPHONE LINES; W. W. Dean, Chicago, Ill. App. filed June 29, 1903. The test relay of the system is normally separated from the operator's connective means, so that if one or more of the cords is short-circuited the test relay is not deranged. Instead of severing a strand of the cord circuit, the connection of the strand with the ground is normally opened and closed through the listening key.

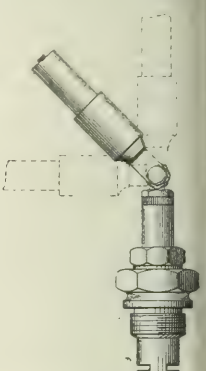
916,740. ELECTRIC BRAZING APPARATUS; W. M. Fulton, Knoxville, Tenn. App. filed Jan. 26, 1907. A work supporting horn, a work carrier, an electrically heated brazing bar, which is movable into and out of brazing position, the carrier being controlled by the bar



915,741.—Apparatus for Operating Railway Signals.



916,223.—System of Electrical Control.



916,390.—Terminal Connector.

moving means, and the current being cut off from the brazing bar when the latter moves into brazing position.

916,742. COMBINED FIRE-ALARM TELEGRAPH AND TELEPHONE SYSTEM; M. Garl, Akron, O. App. filed July 23, 1907. A series of alarm boxes, a normally closed line circuit and a normally broken ground circuit, with means for cutting a telephone into the line circuit at each of the boxes, and means for placing the telephone at the central in a separate circuit with the alarm-box poles and simultaneously breaking the line circuit.

916,755. ELECTROLYTIC PROCESS; Henry L. Hollis, Chicago, Ill. App. filed Aug. 15, 1907. Process of coating iron sheets with tin by immersing them as cathodes in an electrolyte, viz., a solution of a tin salt of a fluorin acid and a colloid, and causing current to flow through the solution.

916,767. INCLOSED FUSE; P. S. Keefer, Bridgeport, Conn. App. filed Aug. 6, 1908. Has a tubular casing and a metallic cap which closes the end. A blade is secured to the end plate and projects through an opening in the cap.

916,783. FLOAT-CONTROLLED SWITCH FOR FILLING TANKS; S. W. Netherton, Roberts, Ill. App. filed Aug. 9, 1907. For use on tanks into which water is pumped by means of a gasoline engine, which is automatically stopped when the float reaches the top of the tank. Details.

916,220. RAILWAY SWITCHING APPARATUS; J. D. Taylor, New York, N. Y. App. filed April 18, 1904. So constructs the indication mechanism in an interlocking machine that it cannot be affected by currents from the prime source of energy, even though the wires be crossed or grounded. Provides an electric motor and a clutch driven thereby, with a switch and lock operated by the clutch.

916,223. SYSTEM OF ELECTRICAL CONTROL; Percy H. Thomas, East Orange, N. J. App. filed June 19, 1905. For systems in which a vapor electric device is included across a supply circuit, the substraction of the potential from the supply circuit being regulated by the length of the vapor path. The path is varied by tilting or by means of a magnet, and the invention contemplates the application to an alternating-current circuit.

916,235. SUBSCRIBERS' TELEPHONE INSTRUMENT; A. H. Weiss, Chicago, Ill. App. filed Sept. 1, 1904. A desk telephone in which the stand has a hollow base and hollow stem, a bunched set of flat springs for the switch being located in the base and controlled by rollers on an arm attached to the hook.

916,245. TELEPHONE TRANSMITTER ATTACHMENT; R. L. Woodward, Jersey City, N. J. App. filed Dec. 4, 1908. The operator may close the mouthpiece of the telephone in order to prevent conversations from passing through the telephone by means of a flap valve located in the transmitter to which a finger piece is connected, the latter being on the outside of the transmitter.

916,269. DEVICE FOR CONTROLLING ELECTRICALLY DRIVEN STAGES, LIFTS AND THE LIKE; A. Bohmer, Magdeburg, Germany. App. filed Feb. 21, 1908. The travel of the elevator is automatically limited by breaking the electric circuit at a predetermined height of the elevator. The switch is held closed against the action of the spring by a detent, which is released by controlling means operated from the driving motor.

916,280. FIRE-ALARM SYSTEM; J. Donitz, Leipzig, Germany. App. filed Dec. 28, 1906. A system divided into several sections which normally form a single circuit and are operated from a single battery. Each section is provided with a thermostat, which gives the signal at the central. Details.

916,294. ELECTRIC SIGNAL BELL; H. W. Eden, Detroit, Mich. App. filed Jan. 9, 1908. Means for securing the insulating parts in a call bell, the latter having a sheet-metal frame and an insulated filler for the opening in the frame.

916,306. LIGHTNING CONDUCTOR AND ANTIHUMMER; Ed Hall, Waterloo Township, Kan. App. filed May 29, 1908. Prevents danger from lightning and the objectionable buzzing. Provides a heavy metallic core, which is secured to the main-line wire through which the current passes, and a yoke consisting of a heavy looped bar around the core, which is connected to ground.

916,313. SPARK PLUG; A. W. S. Herrington, Madison, N. J. App. filed May 7, 1908. Avoids the common dangers of spark plugs by providing a central cable-piercing contact member consisting of a sharp cone which embeds itself into the end of the cable wire and is integral with the central conducting wire forming one terminal of the spark plug.

916,320. SECONDARY BATTERY; H. F. Joel, London, England. App. filed July 17, 1908. Produces a continuous circulation of the electrolyte from the bottom to the top of the cell, thus bringing the dense electrolyte from the bottom into active circulaion.

916,321. SECONDARY BATTERY; H. F. Joel, Forest Gate, England. App. filed Oct. 11, 1907. Same objects as 916,320. The electrodes of the cell are flat and are separated by insulating strips inclined toward each other so as to form tapered channels.

916,342. DEVICE FOR PREVENTING ACCIDENTS ON RAILWAYS; J. M. Long, Los Angeles, Cal. App. filed Feb. 4, 1907. When a bumper is struck by a wheel, it closes a circuit so as to give a signal to stop or shut off the current.

916,343. MOTOR-STARTING DEVICE; W. O. Lum, Schenectady, N. Y. App. filed July 18, 1907. By throwing in a single switch the motor is safely controlled by means of an automatic motor starter having a series of contacts, a circuit controller with a bias to starting position, an electrically controlled device for moving the element to running position, and means for de-energizing such device and releasing the element when the latter reaches running position.

916,348. ELECTRICAL HEATER; J. A. Mears, Jr., and C. Ellis, New Rochelle, N. Y. App. filed April 7, 1908. A heater which is thoroughly ventilated and which includes a spirally coiled wire arranged on a ventilated spindle provided with holes.

916,355. ELECTRIC CLOSET APPLIANCE; M. D. Murray, West Homestead, Pa. App. filed Nov. 27, 1908. For medical use. Details.

916,373. POLARIZED RELAY; H. J. Roberts, C. A. Soans and A. H. Graves, Chicago, Ill. App. filed Jan. 25, 1908. Polarized relay in which the movement of the armature in one direction automatically locks one or more switch springs, and the movement in the other direction returns the contact members to normal.

916,390. TERMINAL CONNECTOR; Charles Cuno, Meriden, Conn. App. filed March 28, 1908. A terminal connector for securing a quick and positive electrical connection, and to avoid strains upon wire connections. Particularly useful on gas engines for automobiles.

12,920. TELEPHONE SYSTEM (Reissue); R. H. Manson, Elyria, O. App. filed July 1, 1907. Telephone systems in which a common battery is located at central, in which the transmitter is placed directly in the line and supplied through a coil with many turns around an iron core and the receiver is placed in a Wheatstone bridge, connected so as to avoid differences of potential, except those due to the talking instruments. No condenser or induction coil is used, and the direct current is excluded from the receiver and fluctuating current allowed to pass therethrough.

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EXPORTS AT LOW MARK.

The foreign trade of the country has necessarily been in sympathetic relationship with the domestic trade as to bulk and value; and now that the signs are multiplying as to improved conditions in internal commerce, it is to be hoped and expected that exports will soon increase. The decline has been steady since the booming period of 1906-7, but it is not unreasonable to look for a large outflow of American electrical goods in the near future, unless new elements intervene to check the demand. During February the exports of electrical instruments, etc., were valued at $462,856 as compared with $479,779 in 1908; while for the eight months the total was only $3,768,831 as compared with $4,837,402 in 1908 and $5,714,192 in 1907. There is quite a sharp drop here, but it occurs very largely in shipments to the United Kingdom, whose trade depression has been so prolonged like our own. In 1907 England took electrical instruments and appliances to the extent of $1,237,363 in the eight months, while in the recent corresponding period the amount was only $400,469. Turning to heavy electrical machinery, another marked decline is seen. The exports this February were only $508,736 as compared with $844,047 a year ago. Here the falling off in orders is due to Mexico during the eight months, with a sharp drop for the month. During the eight months 1908-9, the grand total was $4,233,597, but last year it was $6,109,412. In like manner the demand from Mexico dropped from $1,009,977 to only $430,072 and Japan gave equal evidence of lessened consumptive capacity by taking only $641,920 instead of $1,040,917. Here is pretty well a million of the entire loss for reasons we can all very readily understand.

But international trade is not dead. Its springs are not choked up permanently. Population is increasing, civilization is spreading, and the electrical arts and applications are expanding rapidly. An evidence of the opportunities in foreign markets is afforded this week by the working agreement effected between a group of great German capitalists and industrial corporations headed by the Deutsche Bank and the syndicate heads of the French Société Générale and the French Imperial Ottoman Bank for the development of important undertakings in Turkey and the Near East, a region now in a receptive mood as to modern improvements. This syndicate is to devote its attention to the creation and building up of electric street railways, electric lighting plants and telephone systems, and is at once proceeding about its business. Now a good deal of the money thus expended will go into the purchase of German and French apparatus, but such instances may be appropriately cited [illegible] showing how the areas to be supplied [illegible] American capital will long be needed for home development, but the American manufacturer [illegible] markets constantly provided for him all over the world by such foreign enterprise as this. The influx of English and German capital into Mexico, for example, has been distinctly a benefit to the United States in the past, and will prove so again.

The Inductance of a Straight Wire.

In the transmission of power over wires, as in wire-telegraphy, wire-telephony, electric lighting and electric power-transmission, the inductance of a straight wire, considered by itself, is ordinarily a meaningless term. The inductance of the conductor is referred to its associated return conductor, which is either another wire or the earth itself. But in wireless telegraphy and telephony the inductance of a straight wire has a recognizable meaning. The inductance is referred partly to another portion of the same wire and partly to free space. A curve sheet for obtaining the inductance of a short straight wire in a dumb-bell oscillator is given by Mr. G. E. Marsh on page 865 of this number. The linear inductance is a simple function of the ratio of length to diameter of the straight wire. The formula and curves given in the article are fairly reliable for determining the inductance of rod-sphere dumb-bell oscillators; but they are only roughly applicable to long straight wires forming part of a complete metallic circuit even when the distance between the going and return conductors is very great. In such a case, strictly speaking, the length l in the formula takes another meaning and the formula is not reliable. It is advisable to restrict its application to the particular case in wireless telegraphy where it has been found to apply.

Ratio of Connected Load to Maximum Demand.

For a number of years it has been the practice of a considerable proportion of the larger central-station companies to make residence rates according to a system, in which a high rate per kw-hour is charged for a certain number of hours' use per month of the consumer's assumed maximum demand, all energy in excess of this amount being billed at a much lower kw-hour rate. In most cases the maximum demand of residence consumers has been assumed to be a certain percentage of the connected load. A few of the largest companies have installed maximum-demand meters at each consumer's premises, in order to determine actually from month to month what the real maximum demand is. While all have admitted that the installation of maximum-demand meters is in principle the correct method, few companies have felt that they could add to the investment per consumer an amount equal to the cost of the maximum-demand meter, because it is well known that the interest and depreciation on meters and lines necessary to serve small consumers form a large proportion of the total service cost.

The figures presented elsewhere in this issue, which are compiled from the maximum-demand meter readings of thousands of residence consumers of the Commonwealth Edison Company, of Chicago, are of the greatest value to all central-station companies which are now arbitrarily assuming the maximum demand of residence consumers as a certain percentage of the connected load. Heretofore such figures showing the ratio of maximum demand to connected load and based on actual practice from a large number of consumers have been lacking. It is also interesting to note that the Chicago company is about to take advantage of the option given it in its recent rate ordinance, permitting the removal of the maximum demand meters from residence consumers of less than 1 kw connected load, and to assume the maximum demand as a certain percentage of the connected load. The figures from these records show that the actual maximum demand of small connected loads is larger than that of larger loads.

The Calibration of a Ballistic Galvanometer.

In the days before the advent of the ubiquitous trolley-c and electric railroad, there were numerous Thomson reflecti galvanometers with fixed coils and suspended needle-systen These instruments have nearly all passed away, and the risi generation knows them not. Many are lost in dust and oblivio or have fled to a better world in which there are no troll cars. A few peacefully repose on museum shelves, as evidenc of past magnetically unperturbed conditions. In those day ballistic galvanometers carried massive, slowly moving su pended needle systems. The e.m.f. induced in the coils by t swing of the needles was comparatively small, but it was neve theless quite appreciable; and when the capacity of a condens was measured by observed discharge deflection, or when mag netic flux in a search coil was measured by observed ballisti deflection, a correction had to be applied for the e.m.f. induce in the galvanometer by the needle's swing, which virtually in creased the resistance of the galvanometer when a shunt wa applied to the same. A paper on the magnitude and observa tion of this correction was read in 1873 by Mr. Latimer Clar before what is now the Institution of Electrical Engineers i Great Britain. Nowadays, ballistic galvanometers are nearl always D'Arsonval instruments, with fixed magnets and sus pended coils. Their magnetic power is relatively considerable so that the e.m.f. which they induce in the coil by the swing o the same is far from negligible. If condensers are compare by discharge deflections without any shunt on the galvanometer the correction for self-induced e.m.f. is ordinarily negligible but when either a shunt is used or the galvanometer circuit i closed through a search-coil, the galvanometer behaves a though it had a virtually increased resistance. The correctio is sometimes ignored, but the error involved may be large.

The subject is discussed by Prof. C. M. Jansky in an articl printed elsewhere. He shows that the extra resistance tha must be injected into the circuit in order to halve the deflection is the virtual resistance of the circuit including the extra re sistance of induced e.m.f. Since, however, there is always a little uncertainty in reducing a swing to one half, owing to scale-error, damping error, and other small disturbances it is still better to double the impressed e.m.f. by doubling the number of turns in the search coil and finding the extra resistance necessary to reproduce the original deflection. This is the same test as Professor Jansky describes, except that instead of keeping the same e.m.f. and finding the extra resistance for half deflection, we double the e.m.f. and find the extra resistance for the same deflection. If the additional number of turns in the search coil introduces appreciable extra resistance into the discharge circuit, independent correction should be made for this effect.

The Radiation of Incandescent Lamps.

A recent and important paper by Coblentz in the last number of the *Bulletin* of the Bureau of Standards gives a better view of the nature of the radiation in modern incandescent lamps than anything previously published. As our readers well know, the efficiency of a lamp filament, or for that matter any other light-giving body, depends on the proportion of the total energy radiated which lies within the useful limits of the visible spectrum. We say the useful limits, since it is evident that for purposes of ordinary seeing deep-red or deep-blue radia-

n is comparatively useless since its effect on the eye is nearly gligible compared with that of the light in the visible bright rts of the spectrum. Hence in incandescent lamps it would of great value to obtain a filament material which will give t when heated an abnormal proportion of radiation in the light part of the spectrum. But most solid bodies do not give ticeably selective radiation at any temperature, and the best at can be done with them is to push the temperature so gh as to extend the radiation, at low temperatures invisible, much as possible into the visible region. For such non-lective substances, the so-called "black bodies," there is a finite relation between the wave length of the radiation of aximum intensity and the working temperature; and un-rtunately the temperature required to push along this maxi-um far enough toward the visible spectrum to give high ficiency is quite beyond the endurance of the filament material.

Hence the prospect of high efficiency lies in the direction of lective radiation. This is, of course, most highly conspicuous incandescent gases or vapors which give line or banded pectra, whence the enormous light-giving efficiency of the aming arc. But so far as incandescent solids are concerned, he spectra are in general continuous without marked peculiari-ies of any kind. A few rare oxides, however, do show bands f conspicuous selective radiation and have been utilized in he Welsbach mantle and the Nernst glower. When the new igh-efficiency incandescent lamps began to appear, the question f selective radiation again came to the front. Platinum was lready suspected of a certain amount of selective action, and although the new filaments were undoubtedly worked at con-siderably higher temperature than the older ones, there was good reason to think that selectivity also played a part in the improvement—just how much being in doubt on account of considerable uncertainty as to the real temperature of opera-tion. The measurement of temperatures near those of high incandescence is of extremely dubious accuracy. Consequently, while many claims of selective radiation have been made, they have rested on rather uncertain foundations. In the present research Coblentz addressed himself to the investigation of this selectivity and has added very greatly to our knowledge of the subject, with due credit to previous investigators. And one of the most beautiful features of the work is that it is a complete and convincing example of the application of highly theoretical reasoning based on abtruse phenomena of theoreti-cal physics, to the most important practical conclusions. The data are of just the sort that the so-called "practical" man likes to poke fun at, and the enthusiasts on "technical educa-tion" too often look upon with ill-disguised contempt. The connection between researches on the reflecting power of gold and silver for ultra-violet light, or on the index or refraction of fluorite, and the cause of the high efficiency in tungsten lamps is, we grant, not altogether obvious, although in fact important.

The practical question to be answered was whether metallic filaments must be driven to an enormously high temperature with consequent impairment of life in order to reach high efficiency, or whether one may reasonably expect to find mate-rial which gives radiation sufficiently selective to ensure good efficiency at practicable temperature. Now, in comparing the spectra given by various incandescent filaments, it is fairly evident immediately that there is no marked selective radiation such as is given by a flaming arc or even by a Welsbach mantle. The spectra are quite continuous and save for temperature variations, remarkably similar, as indeed the similarity of color shows. Within the visible spectrum then, selectivity is not apparent. Is there any reason to expect help from it by reason of a general increase of radiation in the visible spectrum apart from that due to increased temperature? At this point of the investigation theory stepped in with an affirmative answer. Broadly, reflecting and radiating powers stand in reciprocal relation, and radiation and absorption in direct relation. Now, in examining the reflecting powers of metals for light ranging from the extreme ultra-violet to the depths of the infra-red, cer-tain facts stand boldly out. Practically all pure metals reflect the long wave lengths of the invisible infra-red very brilliantly and quite uniformly; therefore, one should not expect from them either generally strong or locally strong radiation. On the other hand, they all show very marked decrease in reflecting power in the visible and ultra-violet regions. Except in strong-ly colored metals like gold and copper, the decrease in reflective power is gradual, though striking in the visible spectrum; hence one should expect abnormally high, though generally regular, radiation in this region as compared with that in the infra-red, where, from the standpoint of luminosity, energy is wasted. Copper, which shows strongly selective reflection of the visible rays, glows green when melted in virtue of this peculiarity.

From these reasons, and others as well, still further from the apparently practical, one has reason to expect that metals which reflect visible light rather badly and infra-red light well, will prove to be abnormally good radiators of visible wave lengths when heated to incandescence. Following up this line of experiment, Coblentz finds that such metallic filaments when worked for equal luminosity in the visible spectrum actually gave relatively less waste radiation in the infra-red than other solids, and therefore their high efficiency is not due alone to high temperature but to true selective radiation for short wave lengths, not showing itself in narrow bands that are conspicuous at a glance but in a broad-band effect covering practically the whole bright part of the spectrum, although very possibly modified in the ultra-violet, as is the case, for instance, of silver, which although a magnificent reflector in the visible spectrum, is black as black velvet for a narrow space in the far ultra-violet. Comparing lamps with filaments of "metallized" carbon, tantalum, tungsten and osmium, Coblentz has found the selective increment of useful radiation in the order named, the effect being trivial in the first named and especially strong in the osmium. In all cases the matter of comparative tempera-ture is a little dubious, so that close comparisons of radiating power are difficult to make. There is evidence of rather marked variation of the radiation constants according to temperature, and also with change of the character of the filament surface through use, which accounts, at least in part, for the erratic photometric results often obtained from metallic-filament lamps. Enough is already evident to show that there is at least a light-ing chance to get a filament material which shall give good [illegible] working efficiency without being pushed to a destructive tem-perature, and this paper will prove a valuable [illegible] for the investigator.

Tariff on Flaming-Arc Carbons.

Representations are being made to Congress by flaming arc lamp commercial interests on the injustice of the great increase of duty on flaming-arc carbons which the Payne bill would impose. It is pointed out that the proposed tax would add 50 per cent to the present duty on this class of carbons, the result of which would be still further to handicap the use in this country of the most highly efficient form of electric light known, and which is so highly appreciated abroad as shown by its rapid adoption there. The suggestion is made that instead of increasing the duty, flaming-arc carbons be transferred to the free list in view of the great benefit that would thereby be conferred on the electric lighting industry, and also because there are no indications that the manufacture of this class of carbon will be undertaken in this country, which class is even more special in character than carbons of other high grades that have always been imported, even under an exorbitant duty, owing to the impossibility or great difficulty of their domestic manufacture.

Appraisal of New England Telephone & Telegraph Company Completed.

The Massachusetts Highway Commission and experts employed by it have been engaged for the past year in securing a careful inventory and appraisal of all property of the New England Telephone & Telegraph Company. The firm of D. C. & Wm. B. Jackson, engineers and experts, of Chicago and Boston, was retained as consultant in this work, and the appraisal is in many respects the most thorough that has ever been made of a telephone property extending over a diversified territory. A summary report of the results of the inventory and appraisal has just been made by Prof. Dugald C. Jackson of the above firm, and the Highway Commission has transmitted the report to Governor Draper, with the request that a special message be addressed to the Legislature for the appropriation of approximately $35,000 to enable studies to be made by which the equitableness of the rates may be determined for different classes of service. An abstract of Professor Jackson's report will be printed in the next issue of this paper.

The commission feels that as a result of its work it is now in a position to determine not only the value of any part of the plant which the company uses in any locality, but also the value of the plant used for each class of service. Studies of traffic, cost of operation, amounts needed for repairs, replacements, construction and reconstruction, and items chargeable to capital must all be considered to determine what rates are fair and reasonable in the various localities for different kinds of service. The commission states that there appears to be room for reductions in rates, with further analysis of the work of the company, to determine where such reductions may properly be made.

The Tariff on Mica.

In the House of Representatives an amendment has been accepted making a change in the duty on mica as originally formulated in the Payne bill, whereby the tax on the smaller sizes is almost restored to its present magnitude. The present duty on mica is 6 cents per pound and 20 per cent ad valorem. This was changed in the Payne bill to 30 per cent ad valorem. Under the above-mentioned amendment crude mica will be taxed 5 cents per pound and 20 per cent ad valorem, and manufactured mica 10 cents per pound and 20 per cent ad valorem. So far as relates to non-manufactured mica the difference from the present rate of duty is in the reduction of the specific duty from 6 cents to 5 cents per pound, the ad valorem duty remaining the same.

The electrical industry is particularly interested in the small sizes of mica, as but a comparatively small amount of large plates is used in electrical manufacture, except built up plates. The high duty on the smaller sizes of mica, which in so cases amounts to almost 100 per cent, bears severely on electrical industry. American mica is, as a rule, not sufficier pure for most electrical uses, and in the past the product has not been large enough to supply the market. As p viously pointed out in these columns, in 1907, when the price mica was double the price that prevailed in 1905, the dome production was increased only by 15 per cent, while during t same period the increase in importations of mica was 300 p cent. During this period the price of mica increased over 1 per cent, and yet with only the very small increase in dome production noted. The amount of capital employed in mining of mica in this country is very small, and probably over 1000 men are employed in this industry. On the oth hand, all purchasers of electrical apparatus are directly terested in securing a lower duty than is conceded by amendment to the Payne bill. The original ad valorem d in that bill involved a great reduction in the tax on the small sizes of mica, and according to the newspapers the change to higher rate was secured by the mica manufacturing interests.

Illumination Features of the Southern Electrical and Industrial Exposition.

The Southern Electrical and Industrial Exposition, whi will be held April 21-24 at the First Regiment Armory, Loui ville, one of the largest buildings of its kind in the countr will be notable for the class and extent of its electrical displa and especially on account of its electrical illumination feature Tungstens, Nernsts, Elblights, linolites, and, in fact, every know make of light will enter into this service. The street lightir will be done entirely with the Elblight. Nernsts and linoli will be used in the art gallery and on the floor of the Expos tion wherever possible. The entire Exposition will be hel under electric light both day and night, arrangements havin been made to shut off all daylight. The ceiling of the Expos tion will be hidden under a canopy of green cloth studded wit electric lamps, the hanging decoration having been abandone

An enormous electric clock—in fact said to be the largest elec tric clock ever made—will swing backward and forward at on end of the Exposition. This clock will consist of a pendulur stem 35 ft. long, carrying five rows of electric lights and dial 25 ft. in diameter, studded with tiny electric blubs. Fiv thousand electric lamps will be used on the clock. The dia differs widely from the ordinary clock dial in that although i indicates hours, minutes and seconds, it has no hands. Th time by minutes is indicated by 60 series of lights, each con taining 32 electric globes and radiating from an ornamenta centerpiece to the outer edge of the dial. Shorter rows o different colored lights indicate the hour, and these change thei position 12 times during each 60 minutes. The seconds ar shown by 60 lights placed at equal distances around the extrem outer edge of the face. The hour figures are about 3 ft. high and are outlined in colored globes. Each second the illumination in the outer circle of lights moves round one, and when the entire clock has been encircled the lights indicating the minutes also advance, while the hour hand makes its slow journey at five-minute intervals.

The great central tower, which will rise 40 ft. from the floor of the Exposition, will be a glow of light, several thousand lamp bulbs being used in its illumination. The Exposition will demand 486 kw of electric power, as compared with 275 kw used at the recent Chicago show.

Another feature of the Exposition will be the exhibition of the Marconi system. An earnest effort was made to get the now famous Jack Binns to operate this system, but he is under contract to appear in Boston during the run of the Exposition.

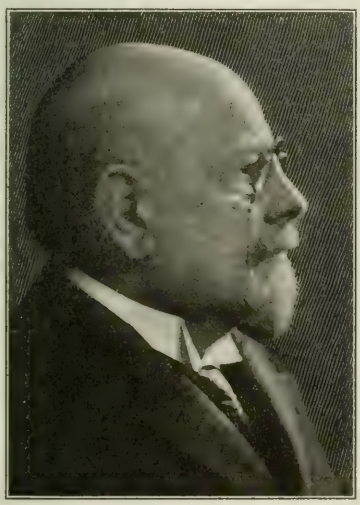
The street leading to the Armory will be a perfect glow of light, thousands of Elblights being used in this branch of the illumination.

A myriad of electric bulbs has been used on the enormous ceiling of the big Armory, and when the decorations are in place these will glow like stars in the firmament.

Emil Rathenau.

The seventieth birthday of Mr. Emil Rathenau, founder and ad of the Allgemeine Elektricitäts Gesellschaft, was made e occasion also of a jubilee celebration of the distinguished anufacturer's entry into the industrial field, in which for ore than a generation he has been the most conspicuous Ger- an figure. This celebration was marked by a banquet, at hich were gathered leading representatives of the State, of ience, the professions, the industries and of the financial orld.

The Emperor wrote a letter of hearty congratulation, and was presented at the banquet by former State Secretary von Holl- ann; Chancellor von Bülow and other Ministers also sent ongratulatory messages. Among the members of the Govern- ent Ministry at the banquet were von Einem, Minister of Var; von Studlt, Minister of Education and Fine Arts; Del- ruck, Minister of Commerce, and Dernberg, Minister of the olonies. The Mayor of Berlin and official representatives of



MR. EMIL RATHENAU

the Berlin Chamber of Commerce, University of Berlin and a number of other distinguished bodies were present. Engrossed resolutions were presented in the name of the directors of the A. E. G., the Berlin Board of Trade, the German Electrotechnical Association and several other bodies. Prof. Dr. Slaby responded in highly complimentary terms to the toast for the guest of honor, and the remarks of Mr. Rathenau following this response are given in abstract below.

Mr. Rathenau received his academic education at a Berlin Gymnasium, and, after an apprenticeship of four years in a machine shop, studied at the Polytechnikum in Hanover and at the Technical High School in Zurich, in the latter schools following a course in engineering. He has received from the Charlottenburg Technical High School the honorary degree of Dr. Ing. (Doctor of Engineering). His earliest work was in mechanical engineering and in the manufacture of machinery, and while subsequently closely identified with electricity, his activity as a manufacturer, industrial organizer and financier has had a wide range.

In the course of his remarks, in acknowledgment of the honor paid him, Mr. Rathenau referred to his early interest in American methods of manufacturing organization and the use of special machinery. Some German manufacturers had in the early seventies imported from America special machinery, but without much success, either because its precision was not sufficiently appreciated at the time, or that the workmen lacked the necessary skill. During a visit to the United States on the occasion of the Centennial Exposition in 1876 he made a study of American industrial methods; he said he would never forget the treasure stores of the machinery hall, and returned home with a firm desire to introduce American methods into German industries. At this period he became also interested in the telephone, and endeavored to induce the Postmaster-General to adopt his plans for securing its introduction into Germany. In this he was, however, at first not successful, being informed that not more than 23 connections could be counted on for Berlin! Later the Minister offered to introduce the telephone for public service at the cost of the Government, which plan was finally carried out.

In a conversation with the late Werner von Siemens after a visit to Paris, the backwardness of Berlin in the matter of lighting as compared to Paris, where the Avenue de l'Opéra was then lighted with Jablochkoff candles, was discussed. As a result, Siemens had a dynamo designed, and Mr. Rathenau constructed the steam engine for the first portable lighting installation, which was tested at a country place. A few years later he made a visit to the Paris International Electrical Exposition of 1881, where he was amazed at the complete and practical nature of the Edison exhibit. In this connection he paid the highest compliments to Edison, whose immeasureable services to electric lighting have not, he said, met with their full meed of appreciation, as is also true with respect to his great inventions in connection with the telegraph, telephone and other electrical applications.

Upon his return from the Exposition and with the aid of German banking firms, a research association was organized, with Mr. Rathenau at its head, to investigate the technical possibilities of electric lighting. As a result of these studies the first German electric light installation was made in Berlin in 1882, and the following year the German Edison Company was formed, which in 1887 became the Allgemeine Elektricitäts Gesellschaft.

In 1884 the company sought and obtained a lighting franchise from the city of Berlin, and the Berliner Elektricitäts Werke was established under an agreement that all machinery should be purchased from the Edison company. It is interesting to note that Mr. Rathenau's idea of establishing an organization for the study of technical questions was by him applied in 1900 to an investigation of high-speed electric traction, and recently to aeronautics.

In giving some reminiscences of the early days of electric lighting, Mr. Rathenau said that to attract attention to the new method of illumination plants were installed by his company in the Union and several other clubs in Berlin. At a banquet given at one of these in celebration of the new system of lighting, the lamps gradually grew dim, whereupon Mr. Rathenau, though the guest of honor, disappeared, and in his dress suit personally attended to the plant until the morning hours, as the extinguishment of the lights at that time would have dealt a severe blow to the electrical industry. In 1884 arrangements were made for an electric lighting exposition in Munich, but, the plans going awry, the research society organized by Mr. Rathenau undertook the lighting of most of the exhibition buildings with electricity, and also the lighting of a theater in which small ballets were given. The illumination of the latter was so successful that a contract was immediately closed for the electric lighting of the Royal Theater of Munich.

In conclusion, Mr. Rathenau said that the Allgemeine Elektricitäts Gesellschaft, after 25 years of existence, demands 1000 times the capital and 5000 times the staff of the early research society upon which it was founded.

Electric Vehicle Conference in Chicago.

Considerably over 100 men interested in promoting the electric vehicle industry attended a smoker given at the rooms of the Western Society of Engineers in Chicago, at the invitation and under the auspices of the Electric Storage Battery Company, on the evening of March 31. Mr. Godfrey H. Atkin, manager of the Chicago office of the company, presided. There was a paper on the central-station aspect of the question by Mr. E. W. Lloyd, general contract agent of the Commonwealth Edison Company. Mr. J. M. Van Splunter, of the Chicago office of the General Electric Company, gave a talk on mercury-arc rectifiers. Mr. H. M. Beck, of the Chicago office of the Electric Storage Battery Company, read a paper written by Mr. Bruce Ford on "The Exide Battery," and Mr. Hanson Robinson, of the Studebaker Automobile Company, of South Bend, Ind., read a short paper written by Mr. Kennedy, of the same company, on the commercial electric power wagon. The discussion was interesting, and at the end of the meeting all present were invited to a nearby German restaurant, where the Electric Storage Battery Company was the host at a "Dutch supper." The meeting was one of several of similar character held by the Electric Storage Battery Company and it was both instructive and pleasant.

In stating the object of the meeting at the opening, Mr. Atkin noted a marked improvement in the attitude of the public toward the electric vehicle. This is due, comparing the machines of the present day with those of a few years ago, to superior mechanical construction, larger radius of operation and better care of the car by its owner or garage manager. He stated that the meeting and others like it were intended to bring together the manufacturer, the dealer and the central-station men.

Mr. Lloyd's paper, an abstract of which is given elsewhere in this issue, was a practical exposition of the attitude of the central station toward the electric vehicle, particularly in the matter of rates of payment for electricity used in charging it, based on the experience of Chicago.

Mr. Van Splunter's talk on rectifiers was of a somewhat technical nature. He explained the theory of the mercury-arc rectifier and the construction of the working machine, which he described as simple, reliable and compact. A hint he gave in relation to the tubes was that they will undoubtedly last longer if not handled too much for cleaning or otherwise. In addition to charging storage batteries he said that the mercury-arc rectifier has several other uses, as in supplying current for moving-picture arc lamps and for dental engines.

Mr. Ford's paper, read by Mr. Beck, was a very clear exposition of the Exide battery, illustrated by lantern-slide pictures. Mr. Ford said, among other things, that the life of a positive plate is practically proportional to the number of charges received, depending, however, on the treatment which the battery is accorded. The number of charges may range from 200 to 350, due to the care given the battery. The batteries should be cleaned before some positive sign of the need of cleaning is given by the operation of the battery. It was explained how thin-plate cells have more capacity for the same weight than standard cells. Nevertheless, these cells will not give as many discharges as standard cells. At the completion of his paper, Mr. Ford gave the following practical rules for the guidance of users of vehicle batteries:

1. Keep the electrolyte above the top of the plates. 2. Do not allow the batteries to remain an unnecessary moment in a fully discharged condition, and at intervals see that the battery is charged to its maximum. 3. Never replace evaporation with anything but pure water. 4. Do not make a practice of charging batteries when only a small percentage of their capacity has been taken out. This rule, however, may be modified in the case of batteries standing with little or no work, in which case they should be freshened by charging from time to time to prevent their sulphation from local action.

The paper on the commercial electric power wagon, written by Mr. Kennedy and read by Mr. Robinson, stated that nearly 4000 vehicles of this character are in use in the United States. Almost any kind of power wagon is cheaper in operation than the use of draft animals. If the commercial truck has been slow in coming into use in the United States the fact has been due to unscientific investigation of the question. Where it is proposed to substitute power wagons for animal-drawn wagons the situation should be thoroughly canvassed from an engineering viewpoint.

In the discussion Mr. Van Splunter said that the mercury arc rectifier will, if handled intelligently, produce unidirectional current that will not injure the battery. If batteries are undercharged, they may show sulphation, and this fault may be attributed to the rectifier unjustly. Some intelligence is required to use the rectifier, as is the case with any means of charging. If thought desirable, a time switch may be arranged to cut out the rectifier in charging at a predetermined time.

Mr. H. H. Rice, vice-president of the Waverly Company, of Indianapolis, said that the electric car is a business proposition and does not conflict with the gas car. He spoke of the fact that, in the case of the rectifier, with a little calculation in arranging the charging, the arc will go out before the battery is overcharged. He said that all concerned should emphasize the simplicity of the electric carriage, the battery and the charging apparatus. The electric car is to be used just as the horse and carriage are used, except that the owner will get more out of it; but he does not need to know all the details of the apparatus and the theory on which it is based. Women may operate the electric car with ease, and emphasis should be laid on the simplicity of the vehicle. In relation to the question of rates of payment for electricity furnished garages for charging, brought out by Mr. Lloyd, the speaker did not favor the proposed mileage basis. Tires, for instance, make a great difference in current consumption. He favored a kw-hour basis. Possibly, if charging is done in off-peak hours, a flat rate may be figured out, with the idea of making the cost of electricity plain to the customer. Everything connected with the operation of the electric car should be made as simple as possible.

Mr. Ernest Lunn, superintendent of storage batteries for the Commonwealth Edison Company, spoke of the operation of a modern garage by his company, using its own commercial vehicles, of which it has had from 9 to 13 in constant service in recent years. Especially good care is taken of the batteries, and Mr. Lunn said that they had records of 11,000 miles of use with positive plates and 14,000 miles with negative plates. He advocated the amp-hour meter of the mercury type for use in charging electric vehicles to determine exactly in advance the amount of current to be put into the battery.

Keen interest in the subject was shown by everyone present and all seemed to consider the meeting very well worth while. Among the out-of-town central-station men present were: Messrs. P. H. Korst, Janesville, Wis.; Austin Burt, Waterloo, Ia.; J. S. Maltman, Kankakee, Ill.; J. W. M. Burton, Paxton, Ill., and J. J. Dawes and E. W. Osborne, Rockford, Ill. Out-of-town automobile men included, among others, Messrs. Edward C. Witwere, Studebaker Company, South Bend, Ind.; C. T. Wayne, Winona, Minn.; J. Wilkie, Sheboygan, Wis., and R. F. Garretson, Michigan City, Ind.

Manufacture of Metallic Filaments.

A patent was granted March 30 to Fritz Blau, Berlin, Germany, on a method for the production of tungsten incandescent lamp filaments. When in the process of manufacture filaments were heated to a whiteness in an inert gas considerable inconvenience was encountered, especially with very thin filaments, owing to irregular deformations of an extensive nature, often making the filaments quite useless. It was discovered, however, that these deformations were due to the use of an alternating current, and that when a direct current was used instead, they no longer occurred. The claims relate to such use of direct current in the manufacture of metallic filaments.

Electrical Illumination at Niagara Falls.

It is now assured that the work of beautifying the débris side of the New York bank of the river below the upper steel-arch bridge at Niagara Falls is to be continued this spring. Landscape Architect Frederic Law Olmsted and Artist Millet have recently been to the Falls studying the present condition of the work done last year and the needs of the approaching season. They were accompanied by Mr. McComber, who has charge of the planting, and who has remained at the Falls to start the work of the spring. Thousands of new roots will be put in and the effort will be to improve the appearance of the bank below the new plant of the Aluminum Company of America. The necessary shrubs for the work have been ordered and will be shipped to Niagara in time for planting.

Mr. W. D'Arcy Ryan, of the General Electric Company, recently visited Niagara Falls and laid before a committee of interested citizens from Niagara Falls, Ont., and Niagara Falls, N. Y., his proposed plan for illuminating the Falls of Niagara next summer. The plans as outlined by Mr. Ryan were most pleasing to the committee, and efforts will be made to raise the funds necessary to their support. The plans call for two batteries of lights, one to be known as the Cliff battery, the other as the Gorge battery. It is planned to excavate a recess in the Canadian cliff opposite Goat Island, this shelf to be 128 ft. long and 12 ft. wide, the height of the excavation to be 8 ft. Here will be installed 20 projectors, each 30 in. in diameter. The Cliff battery will consist of 12 projectors, each 60 in. in diameter. These will also be placed in a recess which is to be 126 ft. long, 12 ft. high and 10 ft. deep, the front to have the appearance of an ancient fortification. The previous illumination was of 1,500,000 nominal candle-power, whereas the proposed illumination will be of 2,500,000 nominal candle-power.

An elaborate color scheme is contemplated in connection with the operation of the lamps. The first illumination of the Falls of Niagara under Mr. Ryan's auspices is still remembered as a fascinating night spectacle, but it is promised that the beauty of the scene will be greatly enhanced if the present plans are carried into operation.

Proposed Public-Service Commission in Illinois.

The bill introduced in the Senate of the Illinois Legislature by Senator S. A. Ettelson, of Chicago, last January, providing for the establishment of a State Public Service Commission is still pending. It has been referred to the Senate committee on corporations and public utilities, and several public hearings have been held. The hearing for the central-station interests has not been held yet, however, and no doubt managers of electrical properties in Illinois may obtain the date of that hearing, which is undecided at this writing, by applying to Mr. Ettelson at the State Capitol at Springfield.

The bill is patterned after the law creating the public service commissions in the State of New York, known as the Hughes law, except that it provides for the regulation of telephone companies as well as railroads, street railways and common carriers, companies furnishing electricity for light, heat and power, and gas companies. It may be remarked that in the present session of the New York Legislature at Albany an amendment to the New York State law, bringing telephone companies under the authority of the commissions, is pending.

It is provided that the commission shall consist of seven members, to be appointed by the Governor. The term of office shall be five years. The commission shall appoint a legal counsellor and a secretary. Its principal office shall be in Springfield and no person shall be eligible for appointment to the commission or under it who holds any position with any corporation of the class affected. Each commissioner shall receive a salary of $10,000 a year. The salary of the counsel is the same sum, while the secretary is to receive $6,000. An annual report is to be made to the Legislature.

In relation to railroads and street railways, the commission is to see that the companies furnish safe and adequate service at just and reasonable charges. Such matters as switch and sidetrack connections, tariff schedules, joint tariffs, unjust discrimination, false billing and the like, are to be passed on by the commission. It is also provided that the commission shall have power to investigate the cause of all accidents on railroads or street railways within the State. The commission may establish a uniform system of accounting to be used by railroad and street-railway corporations.

In relation to the electrical companies and the gas companies the commission is given general supervision over them. It shall from time to time examine the methods employed by these companies in manufacturing and supplying electricity for light, heat or power and transmitting it and have power to order such improvements as shall best promote the public interest. It may prescribe methods of regulation of the electric supply system and fix the initial efficiency of incandescent lamps furnished by the persons, corporations or municipalities selling electric current. It has authority to prescribe uniform methods of accounting. It shall require every person or corporation under its supervision to submit to it an annual report giving detailed information about the finances of the company, the location of its plant and system, with a full description of its property and franchises. Similarly, every municipality engaged in operating gas or electric plants is required to make an annual report to the commission. The commission has power to enter upon and inspect the properties of the corporations under its supervision and to examine their books and affairs.

Inspectors of gas and electric meters shall be appointed who are to ascertain the accuracy of all gas or electric meters used for measuring the quantity of gas or electricity furnished by any corporation. No gas or electric meter shall be used unless so inspected and stamped. If any consumer shall request the commission, in writing, to inspect his meters, this shall be done. If the meter is found to be defective to the prejudice of the consumer within 4 per cent, if an electric meter, or 2 per cent, if a gas meter, the inspector shall order the company to remove the meter, replacing it with the correct meter, the expense to be borne by the corporation. If, on the other hand, meters so tested should be found to be correct, the expense of the inspection and tests shall be borne by the consumer. A uniform reasonable charge shall be fixed by the commission for this service.

No company shall begin construction or exercise any rights or privilege under any franchise not heretofore actually exercised without first obtaining the permission of the commission. No municipality shall build any new gas or electric plant without a certificate of authority granted by the commission. All issues of stock, bonds and other forms of indebtedness by the corporations must be approved by the commission. No company may transfer or lease its franchise without the consent of the commission. Provision is made that in case of complaint of the quality of the supply of electricity by any city or village government, or by formal action of not less than 50 customers, the commission may inspect the plant and methods of the company complained of. After a hearing, the commission, "within lawful limits," may fix the maximum price for gas or electricity to be charged by such corporation, and may also order such improvements as will in its judgment improve the service.

Any corporation failing to obey the orders of the commission renders itself liable to a fine of $1,000 for each offense, and in case of continued violation, each day shall be deemed a separate offense. Provision is made for recourse to the courts to enforce these penalties.

In relation to telephone companies the commission is also given general supervision. It has power to fix the value and standard of telephone instruments and apparatus, to control the quality and character of telephone service. Here also uniform methods of accounting may be prescribed. Annual reports are also required, and in general the commission has the

same powers as in the case of other corporations affected. Telephone inspectors are to be appointed to inspect the apparatus, and only approved apparatus may be used.

The act, if passed, is to take effect July 1, 1909. The public service commission thus created will supersede the present Railroad and Warehouse Commission, and all duties of that commission shall devolve on the new one. The sum of $200,000 is appropriated for the use of the commission.

Proposed Changes in New York Public Service Commissions Law.

Provision for the following changes in the Public Service Commissions law of New York State, affecting electric light and subway companies, which are understood to have the approval of the commission, is made in a bill now pending before the Legislature:

In the paragraph describing the terms *gas plant, electric plant* and *electrical corporations,* the jurisdiction of the commission is eliminated over private plants in which current is generated by the owner of a building for his own use and that of his tenants. The jurisdiction of the Public Service Commission is extended to holding companies. The commission is given the right to bring an action to vacate the charter and franchises of a corporation which is not exercising all of the franchises or is using a franchise without authority.

Five subdivisions of paragraph 65 are entirely new and relate to safe and adequate charges, unjust discrimination, unreasonable preference, etc. The jurisdiction of the commission is extended over all property owned, leased, operated or controlled by any gas or electric corporation and is enlarged as to investigations and the ordering of improvements.

Its power is extended for the purpose of determining whether the nature, class, character and efficiency of the supply system, etc., confirm to a order issued by the commission; the commission under this section has power to examine and investigate the methods and property employed in manufacturing, etc. Powers are also extended to allow orders, forms of accounts, etc., to be prescribed. The commission may, upon a hearing had upon its own motion, or upon a complaint, fix by order the proper, just and reasonable charges to be made, etc. The rate fixed, however, is subject to revision by the commission upon its own motion or upon a complaint of a corporation after the time fixed.

The power of the commission in regard to tax accounts, etc., is extended and power is given to require all corporations specifically to answer all questions upon which the commission may desire information, and also to file periodic reports and the exaction of $100 per day fine if the reports are not filed when required. Power is given to require electric corporations to print and keep open for public inspection schedules showing all rates and charges, etc. One section specifies that if it appears that a gas or electric corporation is engaged in carrying on any other business than the operating, controlling and managing of a gas plant, and if the other business is not subject to the jurisdiction of the commission and its operations are kept separate, the company, in that respect, is not subject to the provisions of the Public Service Commissions act. An entirely new section gives the commission power to appoint inspectors of electric meters, etc., and another clause authorized the fixing of uniform and reasonable charges for the inspection and testing of meters. It is provided that no person or corporation shall begin the operation of its gas or electric plant without first requesting permission of the commission nor exercise any privilege not heretofore exercised without such permission. The commission in whose district the construction is to be made or privilege or franchise exercised shall have the right to require maps, plans, etc. In giving such permission the commission may impose conditions and requirements.

Several changes are made in regard to the approval of issue of stock, bonds and other forms of indebtedness. This section provides that no short-time notes shall, in whole or in part, directly or indirectly, be refunded without the consent of the commission, and no short-time notes, without the consent of the commission, be issued to refund, extend or to provide money on short-time notes unless the specified time of payment is not more than one year from the date of the issue of the note to be refunded, extended or paid. The present paragraph relating to hearings, etc., and orders fixing the price of gas and electricity, is amended providing that the price of gas or electricity may be fixed by the commission for a period not exceeding three years until the commission, upon its own motion or complaint of corporation, etc., may fix a higher or lower maximum price.

Massachusetts Legislative Notes.

The committee on mercantile affairs of the Massachusetts Legislature has withdrawn the report on the Dean bill to establish a toll rate of 5 cents per call within 15 miles of Boston. The committee has also reported on the bill to allow the Heat Telephone Company to sell stock at a private sale, favorable action being recommended. The House has accepted the report of the same committee against allowing the Massachusetts Transmission Company to take land by right of eminent domain. The Senate has accepted the advance report of the committee on the Abbott bill to make telephone rates uniform in the city of Boston. The Haigis bill relative to the distribution of the franchise taxes of public service corporations has been referred to the next Legislature by the committee on taxation.

Magnetite Arc Lamps.

A patent issued on March 9 to Dr. C. P. Steinmetz, the application for which was filed on Feb. 26, 1902, covers the use of arc-lamp electrodes composed wholly or largely of magnetite. When the positive electrode is made of this material the arc gives off a brilliant white light having a spectrum like that of iron. The inventor states that the negative electrode need not be of magnetite because the composition of the positive electrode determines the quality of the light. He suggests the use of certain impurities, such as magnesia, lime or alumina compounds, in the positive electrode for improving the performance of the lamp.

In a patent issued to Dr. W. R. Whitney, on March 9, the use of copper for the negative electrode is disclosed. This electrode is so constructed that the heat generated by the arc will maintain it at a certain temperature which is below that of oxidation of the copper, but which is high enough to prevent the electrode from becoming too good a condenser for the products of combustion of the arc.

Industrial Education.

The educational committee of the American Institute of Electrical Engineers has secured for a special meeting to be held April 16, a paper by Dean Herman Schneider, of the University of Cincinnati, entitled "Fundamental Principles of Industrial Education." As noted from time to time in these columns, the University of Cincinnati has for several years been conducting a course of industrial education along radically new lines and it is reported, with excellent results. Full details of this work are given in Dean Schneider's paper.

This is the first of several papers which will be presented on industrial education. The aim of the educational committee is to lay before the Institute members the problems of industrial and technical education. Last year the committee devoted its attention to the problems of technical education. This year some phases of more elementary industrial training will be presented. A plan for applying the co-operative idea in electrical engineering education was outlined in a paper by Mr. M. W. Alexander, at the annual convention last year. Dean Schneider believes that the co-operative principle applies to industrial as well as to technical training and that it can be carried out in a practical manner.

Illuminations for the Hudson-Fulton Celebration.

During the early fall New York City will devote considerable ney and time to the joint Hudson-Fulton celebration, and eparations are already being made of various kinds. The y has made a special appropriation of not less than $300,000, which $200,000 has already been approved, and numerous dies are making plans to co-operate and participate. Day and ght parades by land and sea are being organized, with special hibitions, lectures, meetings and entertainments.

The question has now come up of special illuminations appro iate to the occasion, and plans are already under discussion. a recent letter to Col. Henry W. Sackett, secretary of the udson-Fulton Celebration Commission, a number of sugges ns have been submitted by Mr. Arthur Williams, general in ector of the New York Edison Company, as follows: "May e suggest that for an event of this kind nothing could be ore attractive than electric illumination and decoration? This uld take several forms. With or without an evening parade utline lighting' on the buildings facing Broadway and Fifth venue, or incandescent lamps, at regular intervals, looped ross these thoroughfares would be very attractive. The latter as the form of decoration selected by the Inaugural Com ittee at Washington, though there was no night parade, and e effect was strikingly good. As you are doubtless aware, n fête and other special occasions the public buildings of Paris e shown in outline.

"Something which I think has never been attempted in this ty would be the illumination of the Washington, the Union, e Madison Square and the Riverside Parks, the lamps being aced in the foliage. The mercury-vapor lamps, efficient in e use of current, produce a remarkable effect in this kind of ghting. Likewise the flaming-arc lamps, of enormous candle ower, are very attractive under these conditions. There are lso several important points at which searchlights could be dvantageously used. The Washington Square Arch, the ailors' Monument and General Grant's Tomb would look well rought into bold night relief. The play of searchlights from ll buildings, including the *Times*, Metropolitan and Singer owers, the *World*, the Flatiron and other buildings, most of hich have powerful lamps, would add to the scene. Many ew York concerns have searchlights which we think they ould be glad to use on that occasion.

"A very attractive use of searchlights might be the night llumination of the North River, much the same as the Falls are lluminated at Niagara. This occurring for one or two nights ould not be expensive and would seem an appropriate use of hat river at the time."

All the facilities of the New York Edison Company have een placed at the disposal of the commission, and it is sug ested that other electrical companies and bodies might like to end their aid in various ways. An electrical float has been roposed for the parade which is to be made up of typical dis lays of that character.

Buying Coal on a Heat-Unit Basis.

At the Minnesota Electrical Association convention at Min neapolis, March 18 and 19, Mr. Ludwig Kemper, manager of the Albert Lea Light & Power Company, gave a paper entitled "Buying Coal on a B. T. U. Basis." Mr. Kemper's company has been purchasing coal on a heat-unit contract in which the payment per ton is in proportion to the number of lb.-Fahr. units as determined by samples of each car taken by a disin terested laboratory.

Mr. Kemper first called attention to the fact that to burn coal efficiently, with the proper apparatus, the following re quirements should be kept in mind. First, the fuel should be fed to the furnace as uniformly and continuously as possible. Second, the air supply should be only slightly in excess of the amount theoretically required. Third, sufficiently high temperature should prevail in the furnace to ignite the gases given off from the coal. Fourth, these gases should be completely mixed with air before they strike cooling surfaces. Fifth, boiler settings should be tight and heating surfaces clean. Some of these requirements are easier met with certain types of furnaces, grates and boiler settings than with others, but a reasonable efficiency in burning coal may be reached by careful operation of furnaces at present in commercial use. The question of generating steam resolves itself into two separate and distinct parts: first, the purchase of a fuel of suitable grade which will give the largest number of heat units for one cent in front of the boilers; second, the burning of this fuel under the boilers in such a way as to get as much work as possible from these heat units. The value of the coal is determined by the number of heat units it contains, its moisture and ashes.

The heat units are the active matter; moisture and ashes are a detriment. In purchasing coal the first matter to be decided is which grades of coal can be burned with good efficiency and without cutting down the steaming capacity of the equipment. The grades of coal suitable for the average plant range over far wider limits than supposed usually. Long years of use of certain grades of coal have made many an engineer feel that it is impossible to burn other grades; where if the test was made under proper direction and supervision often better results would have been obtained by these other grades of coal.

After deciding on the grades of coal to use, it should be bought on a heat-unit basis, making proper allowance for ashes and moisture. The fuel should not be bought on a heat-unit basis of a test car, but on a guaranteed heat-unit basis, which means that every car of coal bought contains the same number of lb.-Fahr. units. As it is impossible to get coal which is absolutely alike all the time, the contract must be made in such a way that a proportionate premium is paid if coal contains more heat units than guaranteed, and a proportionate rebate allowed if the coal contains less heat units than guaranteed.

To buy coal under such a guarantee, it is necessary to have all the coal tested during the year. This, of course, should be done by a disinterested party at the expense of the consumer.

After coal is purchased in this manner the extraction of the heat units out of the fuel and the transmission of them to the heating surfaces must be brought about. How to do this the author does not state; but he recommends two items, which will enable one to gage the results obtained in the operation of the boilers, the testing of flue gases for CO_2 and temperature. If the percentage of CO_2 in the flue gas is low, it means that the boilers are running inefficiently and if the flue temperatures are high, it means that the heat is going up the chimney instead of into the boiler.

By buying coal under strict specifications and guarantees and by watching boiler-room operation, Mr. Kemper says the station manager will be able to reach better economies than heretofore; and will find that expenditures made for this purpose will prove a good investment.

In discussing this paper Mr. Kemper was asked the cost of testing for heat units under such contract in a plant using 1200 lb. fuel per year. Mr. Kemper replied that this would probably be from 10 cents to 15 cents per ton. While this might seem like a high price to pay simply for testing, it is not when it is considered that coal not purchased under a heat-unit contract is likely to average from 4 to 8 per cent below that purchased under such a contract, the original sample car being the same in both cases. The reason for this is that more care will be taken by the miners and dealers in selling coal for shipment on heat-unit contracts than for ordinary contracts. His company has operated under such a contract for three years. It is found that the coal purchased in the winter is likely to be lower in heat units than that purchased in the summer. He gave as a reason for this the fact that in summer more careful selection can be made at the mines. In the winter when there is a great demand for coal the miners skip the coal as fast as it can be taken out, without selection. This would seem to indicate that no selection would be made at any period of the year for contracts not on a heat-unit basis.

Ten-Year Lighting Contract Under Consideration in Boston.

Mayor G. A. Hibbard, of Boston, is considering a 10-year contract of the city with the Edison Electric Illuminating Company for general street illumination. Superintendent of Streets Guy C. Emerson has been making a thorough study of the matter within the past few weeks, and has given various interests an opportunity to demonstrate what they can do with different kinds of lamps at prominent locations in the city. Mr. Emerson has reported to the Mayor that in his opinion the best results are those obtained by the Edison company with the magnetite arc lamp. A contract has been drawn up by Superintendent Emerson providing for the use of the magnetite lamp, and on the basis of the number of lamps at present in use it is estimated that the cost of lighting the city per year will be $360,000, which means a saving of $75,000 per year of the present expense. It is stated that the Mayor's principal cause for hesitation is the term of the contract, although this is a customary length in Boston. The last contract with the Edison company expired on March 20, and since then the city has been paying for its lights at the same rates as were then in operation.

Graphitized Carbon-Filament Patent.

A patent granted March 30 to Dr. W. R. Whitney, on an application filed Feb. 8, 1904, relates to the graphitized carbon filaments of the type used in the "Gem" lamp. Research led to the discovery that if an ordinary carbon filament be heated at certain extreme temperatures in a carbon-tube electric furnace the characteristics of the filament undergo some remarkable changes. Thus, the cold resistance of the filament is very much lowered, while the resistance at running temperatures is not appreciably reduced. A lamp with a filament thus treated, if run at such a candle-power as to give it the life of an ordinary carbon lamp, has a higher efficiency, or if the lamp is run to give the same efficiency, its useful life is increased. The process, in brief, consists in firing an ordinary base filament at a very high temperature, allowing it to cool, then subjecting it to the ordinary flash or treating process, whereby it receives a deposit of graphitic carbon, and then firing it again at a very high temperature. The specifications describe minutely every detail of this process and include much general information on the subject of incandescent lamp manufacture and on the phenomena involved.

New York Public Service Commission News.

The Public Service Commission of the First District of New York has approved the proposal of the Hudson & Manhattan Railroad Company to construct a subway from Thirty-third Street under Sixth Avenue and Forty-second Street to the Grand Central Station. The proposed plans of the company have been slightly changed, at the suggestion of the commission, so that the extension will not interfere with the building of any future subways either under Broadway, Thirty-fourth Street, Forty-second Street or Lexington Avenue. The proposed tunnel will occupy the next level beneath that of the present subway. The station will be from Park Avenue east toward Lexington Avenue. The construction of this station will forestall any extension of the Interborough's subway through Forty-second Street to Lexington Avenue, but the commission points out that there will be no difficulty about making connection with Lexington Avenue through Forty-first Street. The commission also finds that it will be necessary for the Interborough to abandon the pipe gallery it recently constructed connecting the present subway with the Steinway tunnel. The terms of the franchise have not yet been fixed by the commission and will not be determined until after the public hearing on the matter which has been set for April 21. It is presumed that the franchise will be similar to that now held by the Hudson & Manhattan Railroad for its tunnel und Sixth Avenue from Ninth Street to Thirty-third Street. Th provides for a 25-year period from the date on which ope tion was begun, giving the city the right to purchase at any ti after that by paying the original cost of construction. The t nel company also pays the city $9,000 a year and 50 cents year per lineal foot of single-track line as rental for the fi 10 years and $15,000 a year and $1 a foot for the last 15 yea The tunnels from the State line under the Hudson to t Church Street terminal and to Ninth Street and Sixth Aven were granted under separate franchises and pay the same ren charges, but the city is not given the right to buy.

Concerning this tube, Mr. Frank Hedley, general manag of the Interborough, testified before the commission that t gallery was constructed entirely for the purpose of carryi cables which would enable the Interborough company to su ply energy from its power house in Manhattan, not only to t Steinway tunnel, but also to the trolley lines of Queens Bo ough. The Interborough company is largely interested in the properties, and it is intimated if the Steinway tunnel is p into operation in connection with the present subway that th interest will be largely increased.

It came out at the hearing before the Public Service Co mission that the Steinway tunnel under the East River is wired with the overhead rail and that it can be opened f traffic at any time when a suitable arrangement for operati is concluded.

The Hudson & Manhattan Railroad has notified the Pub Service Commission that it has put into operation the sugge tion made by the Women's Municipal League that the rear c of each train be reserved for women. The experiment havi proved popular with the women passengers, the general ma ager of the Interborough has notified the commission that he ready to adopt the plan in the subway whenever the commissi makes the request.

The Public Service Commission of the First District of Ne York has sent to the Legislature a report upon the Eleven Avenue franchise of the New York Central. The report is comprehensive review of the history of the franchise and the various acts of the Legislature that refer to it. No opi ion is expressed as to the validity of the franchise, but the ir pression is given that the commission considers the railroa right as questionable. The chairman of the commission h also sent Ira A. Place, vice-president of the New York Ce tral, a letter in which he expresses objections to many featur of the railroad's pending bill for the construction of a combin tion elevated and subway freight line in Eleventh Avenu The proposed bill repeals the Saxe law, which contemplat the construction of a freight subway.

The Board of Estimate of the City of New York has con to the conclusion that the Public Service Commission is spen ing too much money and has voted to cut down the appropri tion from $987,500 to $800,000.

The commission has voted to defer action upon the appl cation of Receiver F. W. Whitridge, of the Union Railroa Company, for a franchise to extend his line from Third Av nue, along Pelham Avenue to the Southern Boulevard. Th Board of Estimate granted this franchise March 1, and whi the commission admits that there is a public necessity for th line, it disapproves of some of the features of the propos franchise.

Authorization has been given by the Public Service Con mission of the Second District of New York to the New Yor New Haven & Hartford Railroad to purchase all the stock of th New York & Portchester Railroad Company and of the Ne York, Westchester & Boston Railway Company. The effe of this purchase is to do away with the Millbrook Compan the holding organization of the New Haven company. Th New Haven officials stated at the hearing that it was their in tention to complete the construction of the New York, Wes chester & Boston line at once, except where that line and th Portchester line were permitted to consolidate. A bill fo that purpose is now pending in the Legislature.

on-Sparking, High-Power Factor, Single-Phase Series Motor.

n a lecture before the Franklin Institute, on March 11, Dr. S. McAllister described a type of single-phase commutator tor which operates without sparking and at very high-power tor throughout a considerable range of speed.

The circuit diagram of the motor is given in Fig. 1, while its erating characteristics are indicated in Figs. 2 and 3. The achine is similar in construction to an inter-pole direct-rrent motor equipped with compensating coils for counter-lancing the armature m.m.f. The flux in the commutating le is in time-quadrature with the main field flux and has a lue which varies inversely with the armature speed. This ux is produced by a m.m.f. which is the resultant of two m.fs. in opposition, one of which varies directly with the lue of the main field flux and the other with the product of e field flux and the speed. The latter m.m.f. is produced by e current in the secondary of a transformer whose primary connected across the brushes on the armature. The former .m.f. is due to a current in a circuit—largely non-inductive—nnected in parallel with the main field windings.

As noted in Fig. 2, the flux obtained at the commutating le differs throughout a large speed range by only a small nount from the value for perfect neutralization of the trans-

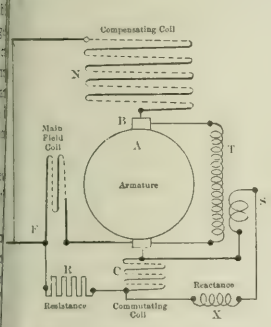


FIG. 1.—CIRCUITS OF MOTOR.

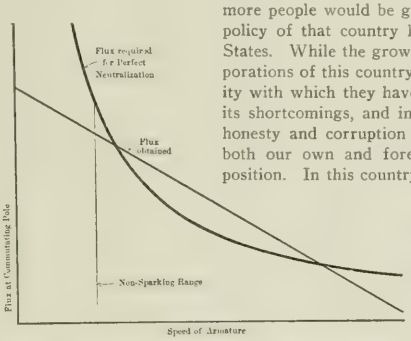


FIG. 2.—RELATION OF FLUXES FOR NON-SPARKING.

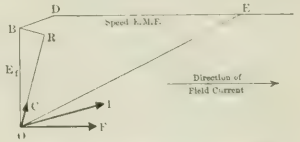


FIG. 3.—RELATIONS OF CURRENTS FOR POWER-FACTOR IMPROVEMENT.

former e.m.f. produced in the coil under the brush so that non-sparking conditions are obtained during normal operation.

The current which exists in the circuit in shunt with the field winding not only provides a component of m.m.f. for the commutating pole, but it has a condenser effect upon the motor circuits, as shown in Fig. 3. In this illustration OF is the constant value and phase position of 1 amp of field current. OB is the e.m.f. impressed across the main field coil; this e.m.f. is also impressed across the circuit composed of the commutating coil and the resistance in series. The e.m.f. across the commutating coil is represented by the line BR, while the e.m.f. across the resistance is shown by OR; the current through this circuit is shown by OC, being in time-phase with OR and in time-quadrature with BR. The resultant current through the armature and compensating coil is OI, which is the vector sum of OF and OC. BD shows the voltage consumed in the resistance of the armature and compensating coil circuits.

Under speed conditions there is generated at the armature an e.m.f. in time-quadrature with OB; such an e.m.f. is shown at DE for a certain value of speed; at this speed the total impressed e.m.f. is OE, while EOI is the angle of lag of the current behind the e.m.f. When the speed reaches a higher value the e.m.f. lags behind the current—that is, the current is in time-advance of the e.m.f., so that it possesses a leading quadrature wattless (condenser) component. Under all speed conditions the time-lag of the current is decreased by the angle FOI below the value with unshunted field coil, and hence the power-factor is improved to a corresponding extent.

Discussion on Public-Service Commissions.

At the meeting of the Electric Club of Chicago on March 31 the subject of public-service commissions was discussed. Prof. A. A. Radtke, consulting engineer and professor of electrical engineering in Armour Institute of Technology, was the principal speaker. He began by pointing out that the policies adopted in Europe and in this country in relation to the treatment of public-service corporations are almost diametrically opposite. Abroad the attitude of governments has hampered the growth of public utilities. These governments fail to recognize the fact that a new enterprise is in danger of being superseded by some later advance, and that capital cannot take a large risk unless compensated by proportionately large privileges.

In the United States, generally the policy has been to grant public-utility companies an open field, and to foster private ownership. New enterprises require the utmost freedom during the period of their growth. Government control interferes with such advancement and should not be encouraged. Comparing the two methods, it is seen that the people of the United Kingdom have one-quarter of the street-railway facilities, one-third of the electric lighting facilities and less than one-quarter of the telephone facilities that they must have before they are as well supplied as the people of the United States. In addition, 120,000 more people would be given employment in Great Britain if the policy of that country had been similar to that of the United States. While the growth and strength of the public-utility corporations of this country must be attributed to the broad liberality with which they have been treated, the policy is not without its shortcomings, and in this country the tares of political dishonesty and corruption have been reaped. But the policies of both our own and foreign countries are swinging to a mid-position. In this country the movement has resulted in the partial control of public-utility concerns by commissions, while abroad there have been legislative amendments to previous laws.

Professor Radtke devoted some time to a discussion of the Massachusetts law. A State commission in that State has control of the public-utility properties. This commission has numerous duties, including the regulation of rates, the issuing of stock and bonds, the approving of new companies and the testing of meters. Last year it had under its control the affairs of 143 companies. The commission benefits the existing public-service companies by limiting ruinous competition in one field. In fact, it must first be established that there is room for a rival company before a petition for a franchise can meet approval. The efficiency of this system is attested by the fact that 70 per cent of the companies pay from 5 to 20 per cent dividends.

The speaker then referred to the work of the public-service commissions of the State of New York, citing particularly the application of the Long Acre Light & Power Company, of New York City, for permission to issue a large amount of stock and bonds. The petition was denied by the commission of the city district, which said that while for a time both city and commercial lighting might be offered by both companies at a considerably reduced rate, it might be expected that competition under such conditions would be sure to be expensive, even though for a time apparently economical or profitable. Experience shows that a new company entering a territory already occupied does not necessarily depend for its financial success on the sale of electricity to the city and its citizens. It has been repeatedly demonstrated, said the commission, that the profits of the new concern do not so much depend upon its dealings with

the public as upon relations which it may be able to establish with the company first in the field. The temporary advantage to a portion of the public is reasonably sure to be followed by an undue burden upon the public as a whole through the larger capital demanding a return, much of it representing an unwarranted duplication of property as well as losses. In closing, the speaker referred to Senator Ettelson's bill for the establishment of a public-service commission now pending in the Illinois Legislature. He thought that this bill was worthy of the support of the members of the Electric Club.

In the discussion, Mr. Fred. J. Postel expressed his belief that the idea of a public-service commission is a good one. However, too many or too minute and burdensome rules may create an injustice. Thus, in the question of rates, it may be a great advantage to a central-station company to be able to take some particular business at low rates where the company can control the time when the electricity will be used and thus materially improve its load factor. But it is possible that some public-service commissions in fixing rates will not take this situation into account. Answering this objection, Professor Radtke said that in Massachusetts the commission was always open to petition. It knows exactly the condition of a company's affairs, having access to its books. No hardship is thrust on any company, and the commission is not disposed to hamper the company in taking any legitimate business.

Speaking as a central-station man Mr. H. E. Niesz, of the Commonwealth Edison Company, said that the general results of the work of public-service commissions to date have been quite satisfactory, both to the public and to the public-service corporations. It is to be borne in mind that the expense of maintaining such commissions is sometimes great, as has been shown in the case of the New York commissions, and as it is the taxpayers' money that is being spent, the fact may well be borne in mind in discussing the subject. The speaker did not believe that the central-station companies, as a general rule, object to public-service commissions. These companies have nothing to conceal. But he pointed out that with regulation must come a measure of protection for the companies. If the rates are to be fixed, the company must have the privilege of earning money for its stock and bond holders and also for the development of its field, without the fear of unfair competition or of confiscation. Mr. Niesz gave it as his opinion that the central-station business in this country is on a basis of profit smaller than that of almost any other industrial business.

Mr. Perry R. Boole asked if public-service commissions oversee municipal as well as private plants. Professor Radtke answered that he believed this to be the case, particularly in Massachusetts, where no favoritism is shown to the city plant. He said that in many instances municipal plants had been started long after the private company came into existence, and had reaped the benefits of the latter's pioneer work. Mr. W. D. Ray, of the Sanitary District, remarked that the character of the men composing the public-service commissions shaped, to a large extent, the policy and action of those bodies. In Illinois this will be as true as in other States. Mr. Ray believes that the commission idea is a step in advance. Mr. H. F. Holland told of the working of the Massachusetts law from his own personal observation. He said that a municipality cannot put in a new plant in that State without first offering to buy the existing plant, if there is one, at a fair price. His experience has led him to favor the commission idea.

On motion of Mr. W. R. Bonham, the civic committee of the club was instructed to report on the proper attitude for the club to take toward the Ettelson bill.

Museum of Safety and Sanitation.

Announcement has just been made of the election of the following officers of the Museum of Safety and Sanitation: Acting-president, Mr. Philip T. Dodge; vice-presidents, Messrs. Charles Kirchhoff, T. C. Martin, Prof. F. R. Hutton and R. W. Gilder; treasurer, Mr. Robert A. Franks; plan and scope committee, Prof. F. R. Hutton, Mr. William J. Moran, Dr. Thomas Darlington, Messrs. H. D. Whitfield and P. T. Dodge; director, L. William H. Tolman. Among the charter members are Messrs. P. H. Dodge, Elbert H. Gary, Richard Watson Gilder, Dr. Thomas Darlington, Charles Kirchhoff, T. Commerford Martin, Philip T. Dodge, Prof. E. R. A. Seligman, Irving Fisher, William J. Moran, Henry D. Whitfield, A. R. Shattuck and Prof. F. R. Hutton.

The Museum of Safety and Sanitation has its office at the Enginering Societies Building, 29 West Thirty-ninth Street. The objects of the museum are to study and promote means and methods of safety and sanitation and the application thereof in any and all public or private occupations whatsoever, and of advancing knowledge of kindred subjects; and to that end to establish and maintain expositions, libraries and laboratories and their branches, wherein methods and means for improving the general condition of the people as to their safety and health may be studied, tested and promoted, with a view to lessening the number of casualties and avoiding the causes of physical suffering and of premature death, and to disseminate the results of such study, researches and tests by lectures, exhibitions and other publications.

A 6600-Volt Single-Phase Railway.

A 77.5-mile, single-phase railway has been placed in operation between South Bend, Ind., and Pullman, Ill. The line is known as the Chicago, Lake Shore & South Bend Railway. The rolling stock at present consists of 48 passenger cars, 1 flat cars, 1 snowplow and 1 utility car. Each of the large passenger cars is equipped with four 125-hp Westinghouse single-phase motors arranged for multiple-unit control. Along the main portion of the route use is made of a trolley e.m.f. of 6600 volts, but through the cities and in the shop and yard the trolley e.m.f. is lowered to 700 volts. In each case single phase current is utilized, no direct current being employed. Thus the control equipment retains the simplicity of the single phase outfit. The trolley wire is of No. 4-0 groved section supported by a ½-in. steel catenary cable. There are 10 sub stations. Two are at the terminals of a 33,000-volt transmission line and eight are used for supplying energy at low tension in the city section and in the car shops near Michigan City. The cars are provided with both wheel and pantograph collectors; the latter is used only at 6600 volts, while the former can be operated at either 700 volts or 6600 volts.

Improved Street Lighting in Boston.

The Edison Electric Illuminating Company, of Boston, has installed 21 magnetite arc lamps of the 6.6-amp size on Tremont and Boylston Streets and Commonwealth Avenue to demonstrate the capability of these large units to meet the general conditions of illumination in that section of the city. Pending the signing of a new contract between the city and the company, the same prices that prevail with the enclosed arcs now in service, $118 per year per lamp, will be used as the basis of payment. The street department is now considering an offer of the company for lighting by magnetite lamps at a reduced rate, the total number of arcs under consideration being 3800. The experimental magnetite lamps are mounted on 25-ft. poles. At Copley and Park Squares and on the parade ground of Boston Common a number of General Electric flaming arcs have been installed experimentally on poles 50 ft. high. On secluded streets in the West Roxbury, Dorchester and Brighton districts about 1000 40-cp tungsten lamps have displaced naphtha lamps at a saving of about $10,000 per year to the city, and in the business districts about 50 gas-mantle lamps have been displaced with a saving of $1.50 per lamp per year. The city has tried and rejected some gas lamps with automatic clockwork lighting attachments, which were installed in the Back Bay district.

CURRENT NEWS AND NOTES.

) *PATENT RETALIATION.*—The committee in charge e Payne bill has announced the omission of the retaliatory t section.

Y SIGNS LEGAL IN NEW YORK CITY.—The New State Board of Appeals has affirmed the right to erect signs on the roofs of New York City buildings.

SLA GAS TURBINE.—Nikola Tesla has announced the ntion of an explosive gas turbine whereby sea-going vessels he states, be propelled at from 40 to 50 knots an hour.

IE EARLIEST OHM.—A correspondent writes that in a printed in 1836 he found the word "ohm" employed to gnate a wine measure used in Strasburg, the content being English-gallons.

ONNECTICUT INSPECTOR OF ELECTRIC-LIGHT TERS.—An act has been introduced in the Connecticut Leg- ure providing for the inspection of gas and electric meters, for the appointment of an inspector and deputies.

OLD MEDAL FOR EDISON.—The Royal Academy of den has awarded to Mr. Thos. A. Edison the Adelskiold medal for his inventions in connection with the phonograph the incandescent lamp. This medal is conferred only once o years.

LIDING SCALE HEARING IN BOSTON.—The com- ee on public lighting of the Massachusetts Legislature has luded hearings on the bill to allow gas and electric light panies to adopt a sliding scale system. Counsel A. E. Pills- y concluded his argument in favor of the bill on March 30.

EW YORK TO CHICAGO BY TROLLEY.—The com- ion of the Kensington & Eastern Electric Railway between cago and South Bend, Ind., gives a continuous trolley nection between Chicago and Cleveland. Between New York Cleveland there are yet several breaks in trolley connec- n.

. E. L. A. RAILROAD RATES.—The Central Passenger sociation has authorized a rate of a fare and three-fifths on certificate plan from points in its territory to Atlantic City l return for delegates to the thirty-second convention of the tional Electric Light Association to be held June 1, 2, 3 l 4.

GOVERNMENT WIRELESS WAVE LENGTH.—The nior Wireless Club of New York City has petitioned the ited States Government to establish a definite wave length army and navy wireless service in order that private wire- s stations may select wave lengths that will not interfere th such service.

NEW YORK WIRE SUBWAYS.—The United States Su- me Court has decided against the New York Lines Com- ny in a case involving its right to construct underground re subways and conduits in New York City. This decision cures the monopoly of such service to the present company ntrolled by the New York Edison Company.

FESSENDEN WIRELESS TELEPHONE SYSTEM.—In newspaper interview Prof. Elihu Thomson states that Prof. A. Fessenden has developed a wireless telephone system hich is so successful that the Navy Department failed to in- terfere with the waves in recent tests of the system. He added at before long it is confidently believed that talking by wire- s telephone will become a feature of everyday life in New ngland.

THE ELECTRIC VEHICLE AT THE N. E. L. A. CONVENTION.—The electric vehicle promises to be one of the conspicuous features of the coming National Electric Light Convention at Atlantic City. Aside from exhibits of automobile storage batteries, apparatus and accessories, it is probable that manufacturers will show the latest types of their vehicles.

WIRELESS EMERGENCY NEWS STATIONS.—The Buffalo *Evening News* in establishing a wireless station said that it was installed in order to enable the paper to receive its news when telegraph and telephone toll lines are thrown out of service by storms. The Pabst Brewing Company has also installed a wireless plant in order to be less dependent upon unreliable wire telegraphic service.

"WIRELESS" FOR HOTELS.—Following the lead of the Waldorf-Astoria Hotel, New York, a wireless-telegraph outfit will be installed on the roof of the Auditorium Annex Hotel in Chicago by the United Wireless Telegraph Company, of New York. It is said that similar equipments will be placed in hotels in St. Paul and Duluth, Minn., and perhaps in Buffalo and other cities. In addition to the Waldorf-Astoria in New York the Bellevue-Stratford in Philadelphia is now so equipped, and messages are exchanged satisfactorily between these stations and also with vessels on the Atlantic.

GAS ENGINES VS. STEAM TURBINES.—In a discussion at the March meeting of the Cornell University A. I. E. E. branch on the Institute paper by Mr. B. R. Shover on the Gary electrical plant, Prof. R. C. Carpenter compared the cost of the installation and operation of gas engines and steam turbines and expressed the opinion that the latter installation would result in a lower cost per kw-year. This was explained in part as due to the high rate of depreciation which obtains in gas engines, because of the dust in producer gas and to the high cost of repairs.

BRITISH REVOCATION OF FOREIGN PATENT.—In the first court review of the revocation of a patent under the new British patent law, it was held that the policy of the act was to secure fair play, and not protection, which Parliament could always secure whenever it thought fit. In the present case the patent was granted in 1902 for the manufacture of stone tiles or slabs. The important point was that, although worked in France, Germany and Belgium, it has never been worked in Great Britain. The court held that a new British industry might have arisen if the patent rights had been fairly used between Great Britain, this country and foreign countries and there was no evidence that there were economic conditions or other causes which precluded the new industry being started here. The revocation of the patent by the Comptroller was justified, and the appeal from the decision dismissed, with costs.

PROF. H. H. NORRIS, who for the past 13 years has been connected with the faculty of Cornell University, has been appointed head of the Department of Electrical Engineering, a position formerly held by Prof. Harris J. Ryan, now of Stanford University. Professor Norris pursued studies in engineering at both Johns Hopkins and Cornell, receiving the degree of M.E. from the latter university in June, 1896. He served as instructor in electrical engineering at Cornell from 1896 until 1901, when he was appointed assistant professor of electrical engineering. Since 1905 he has served as professor of electrical engineering. Professor Norris was superintendent of the Electric Railway Test Commission at the St. Louis Exposition in 1904. He is a frequent contributor to the technical and semi-technical press on electrical subjects, and is the author of several text-books. He has been active in the affairs of the American Institute of Electrical Engineers and is chairman of its educational committee. The same appears on the official A. I. E. E. ballot for the coming election as a nominee for [illegible]

SOUTHWESTERN ELECTRICAL CONVENTION.—The Southwestern Electrical and Gas Association will make a special effort to have a comprehensive trade exhibition in connection with its coming convention in May at Dallas. The Electrical Contractors' Association of Texas will hold its annual meeting in connection with the Dallas convention.

AN ELECTRIFIED POLICEMAN.—A St. Louis policeman has applied for transfer to a beat where he will not be subject to the baleful influence of escaping electricity. At present he is stationed at a street crossing in order to pilot people across electric railway tracks, and he claims that stray electricity seeping through the ground in that vicinity is injuring his health.

ENGINEERING STUDENTS' TOUR.—Ninety students of the department of electrical and mechanical engineering of the Ohio State University are making a tour of inspection of the principal industries of the Central West. On April 3 they visited the plant of the Fort Wayne Electric Works, the General Electric Lamp Works and the works of the Western Gas & Construction Company at Fort Wayne, Ind., and also the electrical power plants located there.

PANAMA WIRELESS STATION.—The Navy Department will soon open a wireless station at Porto Bello, Isthmus of Panama. A mast 130 ft. high is being erected at one of the hills at the entrance of the harbor. The work is being done under the supervision of Major Fuller, of the Marine Corps, in command at Camp Elliott. The station will be used for general naval purposes and, in addition, official messages of the Isthmian Canal Commission will be transmitted between Porto Bello and the wireless station at Colon.

NEW YORK ELECTRICAL SOCIETY AT THE HIPPODROME.—The New York Electrical Society held a special meeting on the stage of the New York Hippodrome, after the regular evening performance on March 31. Mr. Arthur Williams described the electrical equipment upon which the effectiveness of most of the scenes depends. Although use is made of 7000 incandescent lamps, 110 arc lamps and 250 hp in motors, the whole equipment consumes only 800,000 kw-hours per year. The energy is supplied by the New York Edison Company. A description of the electrical equipment of the Hippodrome was given in our issue for May 5, 1906.

STEAM ALUMNI ASSOCIATION OF PRATT INSTITUTE.—The alumni of the evening classes of '06, '07, '08 and '09 in steam and the steam engine at Pratt Institute held a dinner at the Imperial, Brooklyn, on April 3, at which the Evening Steam Alumni Association of Pratt Institute was formally organized. As many of the graduates of the institute are employed in New York and vicinity the association is to meet once a month, except during the summer, to discuss operating problems and present papers on subjects of general interest. The officers of the association for 1909-10 are: Mr. P. V. Wheeler, president; Mr. Archibaud Hill, first vice-president; Mr. E. W. Cavanagh, second vice-president; Mr. M. Chalmers, assistant instructor in steam engineering, secretary-treasurer; Messrs. F. C. H. Bull, L. J. Radin and John E. Audley, executive committee.

MICHIGAN TELEPHONE TAXATION.—A bill now before the Michigan Legislature provides for an ad valorem tax on telephone and telegraph companies instead of a specific tax as is now assessed. The measure was advocated by Governor Fred M. Warner in his pre-election speeches and was endorsed by the Republican State convention at its meeting in Detroit last fall. The specific tax now assessed on telephone companies is 3 per cent of gross earnings. Opponents of the ad valorem tax have a substitute measure raising the specific tax to 4 per cent, and the war rages around the two measu Another measure is before the Legislature to bring the t phone and telegraph companies under the control of the S Railroad Commission and providing for an interchange messages between competing companies. This latter mea has passed the House. The measure gives the commis power to fix rates.

CALIFORNIA HEROULT ELECTRIC FURNACE PLANT.—The electric process iron smelter of the Noble E tric Steel Company at Héroult, Cal., is about to be started The cost of electrical energy at Héroult is $12 a horse-po or $16 per kw-year. In an experimental furnace which m several test runs last year, it is stated that 1½ tons of i were produced per day at a cost of $4.20 for electric ene per ton of pig iron. With the larger furnace now near completion, there will be produced from 15 to 20 tons of iron a day, with an expenditure, it is believed, of $4 per ton electrical energy. It is claimed that iron can be made at plant for $16 a ton. The electric smelting furnace for iron consists of a concrete stack 20 ft. high, with electrodes fi in the walls of the crucible, the charging being done from top, so that a long column of charge is preheated before reaches the fusion zone between the electrodes. The electro are 24 in. apart.

FIRE DAMAGE TO TELEGRAPH OFFICE IN ROCHESTER.—Associated Press dispatches report that a fire in Re olds Arcade, Rochester, N. Y., on March 30, caused, am other damage, considerable loss to the local office of the W ern Union Telegraph Company, which is in the building. a time telegraphic communication was interrupted. The t loss is estimated at $250,000, but only a portion of this will on the telegraph company. Rochester is a city possessing peculiar significance to persons familiar with early telegrap history, for it was the home of Hiram Sibley (after wh Sibley College at Cornell University was named) and o number of others who made fortunes by their foresight in p ceiving, in the early days, the great possibilities of the elect telegraph. One of the associates of Mr. Sibley, and an intim friend, was Don Alonzo Watson, who for many years ha dingy office in Reynolds Arcade. Mr. Watson was reputed be the possessor of a large amount of ready cash, and his of in Rochester was somewhat analogous to that of the late Rus Sage in New York. Mr. Sibley, Mr. Watson and their fell investors in early telegraphic securities have all been dead a number of years.

RAILROAD ELECTRIFICATION IN CHICAGO.—In annual report to the City Council of Chicago on March 29 t retiring committee on local transportation referred to the el trification of steam-railroad terminals in Chicago in the follo ing terms: "This work is of such a radical nature and will quire such a great expenditure of money to carry it out th much time is required to prepare for undertaking the act work. This committee believes that substantial progress being made by the Illinois Central Railroad Company in investigation of the question." At a conference held April 1 between representatives of the Chicago city gover ment and the Illinois Central Railroad it was said that t railroad company is working out plans for the electrific tion of its suburban service at an estimated cost of $8,000,0 but that it is unable to give any information relating to t time when it will actually begin construction work. Pre dent Harahan, of the railroad company, is thus reporte "We have only made a small start on the plans, and are not out of the woods yet. The proposition is so big th anyone would be foolish to hazard a guess as to when shall be able to begin construction." Nothing was said abo the suggestion of Mr. E. H. Harriman, perhaps not made ve seriously, that the city pay half of the expense of the termin electrification.

An Austrian Central Station Operated by Oil Engines.

In medium-sized European towns it frequently happens that the municipal gas works, after many years of service, having reached the limits of their capacity, the future wants of population must be provided for either by extending the works and their pipe system or constructing an electric power house. In the majority of cases the latter alternative is given preference, electrical energy being better adapted than its competitor to supply the light, heat and motive power required under the most variable conditions by the population of a town. The superiority of electricity, apart from its undoubted advantages as an illuminant, is also acknowledged for motive power as gas engines hardly lend themselves to the variable requirements of small consumers, and while suitable for buses are out of the question when increasing traffic calls for the construction of a street railway. In choosing the prime mover for the dynamos, in case there are no waterfalls or collieries in the neighborhood, oil engines have been preferred very frequently in recent years because of their small space requirements, easy superintendence and the fact that they are always ready to work at a moment's notice.

A typical instance of a municipal electric plant designed for diesel engine operation is the power house recently constructed by the Austrian Siemens-Schuckert Works for the old Moravian town of Iglau. This plant supplies the town and its surroundings with electricity for all purposes in addition to feeding an electric railway 2.5 km in length, recently substituted for the old omnibus line connecting the town and railway station. A



FIG. 2.—EXTERIOR VIEW OF CENTRAL STATION.

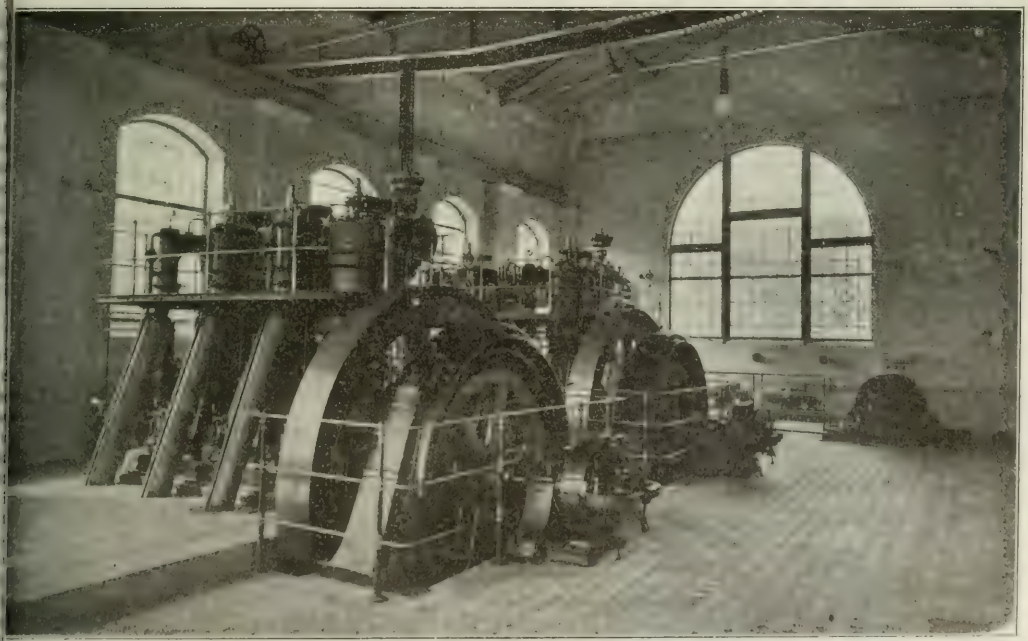


FIG. 1.—ENGINE ROOM OF IGLAU CENTRAL STATION.

The new generating power house was erected midway between the railway station and the town, and was provided at first with two three-cylinder engines of 200 hp, driving two alternating current generators, rated at 165 kv-amp and wound for 2400 volts at a speed of 187 r.p.m., with exciters mounted on the same shaft. A two-cylinder Diesel engine of 140 hp was subsequently installed and driven through belt transmission, a set consisting of a 100 kv-amp, 2400-volt alternator and a 32-kw, 500-volt direct-current dynamo intended for feeding the railway load. Oil tanks of a capacity sufficient for several months' supply have been provided. Tests made have shown only 272 grams of oil, as against the warranted consumption of 300 grams, to be used up for each kw-hour on full load. A motor-generator set, consisting of a 50-hp high-tension motor with slip-rings direct coupled to a 32-kw direct-current generator is also installed for feeding the railway load during the time the small Diesel engine set is not in operation. One of the large sets supplies the energy to the motor driving the generator. There is also a battery floating on the railway system, which can be used as reserve equipment in emergencies.

The current generated at 2400 volts and 50 cycles is led by insulated conductors to the high-tension switchgear room, which

contains all the apparatus carrying high tension. This room is closed on the front by a large marble board on which are mounted the measuring instruments and switches.

From the switchgear room electricity is fed through underground cables to the mains of the town, the conversion from high to low tension being effected by a four-conductor system at a tension of 190 or 110 volts in transformer stations of which 14 have been so far installed. Nine of these stations have been located in kiosks, whereas the remainder are situated in the central station, schools, factories, etc.

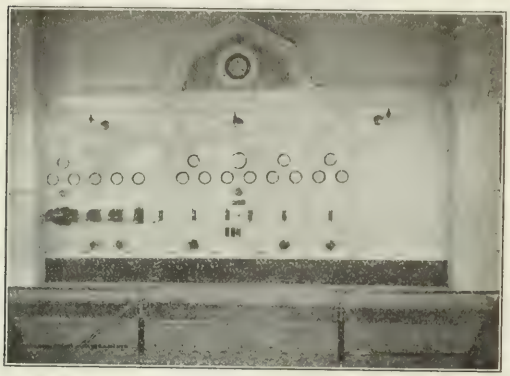


FIG. 3.—SWITCHBOARD.

Each transformer station will contain two transformers, each rated at 50 kva, only one of which has been so far installed. The stations further contain at the high-tension end cable terminals, section switches and fuses, and at the low-tension



FIG. 4.—TRANSFORMER HOUSE.

end fuses, switches and lightning arresters for the transformer as well as the station terminals of the four-conductor cables connecting the overhead conductor system to the transformer station. The junctions of the transformer with the cable terminals are carried over busbars, thus allowing a second transformer as well as a further cable connection to be readily a simply thrown into circuit.

The low-tension system consists of overhead lines carri mostly along the fronts of houses and partly on poles. T



FIG. 5.—HIGH-TENSION SWITCHGEAR ROOM.

circuits feed upward of 4000 lamps in houses, a theater install tion and a number of motors. Of the latter a total of ov 200 hp has been so far connected to the system. It is co templated to connect to the system a number of factories, situat outside of the town, through special transmission lines. order to further the small industries the municipality has pu chased a number of electric motors which are leased to use on the payment of a yearly interest, and final payment of t capital, so as to allow the motors, after a number of years, become the property of the users. A similar process has al been used successfully in connection with lighting installatio The public lighting, which has so far consisted of gas lam fed from the gas works, is to be replaced shortly by an electr system.

Low-Voltage Equipment and Control i Waterside Station No. 2 of the New York Edison Company.

AS pointed out in the issue of March 25, the field rheosta of the turbo-alternators in Waterside Station No. 2 the New York Edison Company are electrically operat from the high-tension switchboard. The rheostats are locat on the exciter floor. The field switch has opening and closi magnets and discharge coil and a ¼-hp motor is used to c in grid resistance units or vice versa. To insure an uninte rupted supply of excitation current there are four 150-kw moto generator sets and two 500-kw motor-generator sets, togeth with storage batteries of 290 cells. All the generators wh connected to the exciter bus have instantaneous reverse-curre relays in circuit so adjusted that a reverse flow of 25 per ce full-load current into a defective generator will immediate trip the circuit-breaker and thus prevent any unusual dema on the exciter system. While it is possible, but not at all pro able, that all of the motor-generator sets might become inoper tive, the generator field coils could be excited from the stora batteries or from the external Edison system. Emergency r serve connections are also provided with the Metropolitan Stre Railway system and with the Brooklyn Edison system. It therefore evident that the supply of excitation current is saf guarded as far as human ingenuity can do so. All the ele tricity for switch control and signal systems is taken from th exciter section through widely separated feeders so that injur to one will not throw out the other.

Fig. 1 is a view looking down the exciter gallery, showing th

r-generator sets. The 500-kw sets are used for supplying ical energy to the lamps and motors in the station, while maller sets are used for excitation purposes only. The consist of 220-hp, 25-cycle, three-phase Westinghouse tion motors driving 250-volt shunt-wound generators. The

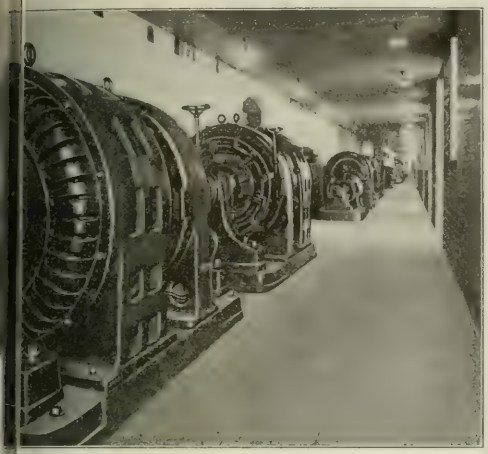


FIG. 1.—EXCITER ROOM IN WATERSIDE STATION NO. 2.

r sets comprise 675-hp, 6300-volt, 25-cycle motors and 300- generators. One of the sets is of Westinghouse manufac- and the other of General Electric make. Other apparatus is room are two booster sets, one compensator and end- switches. A Westinghouse booster set is made up of two

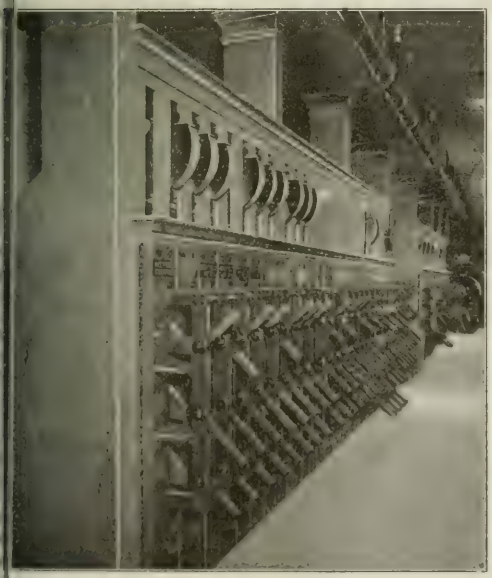


FIG. 2.—EXCITER SWITCHBOARD.

kw generators and one 150-hp motor. The other booster is of Crocker Wheeler design and consists of two 30-kw. volt generators and a 110-hp, 240-volt motor. The com- sator was built by the Northern Electric Company. It con- ts of two 75-kw. shunt-wound generators having a voltage range of from 125 volts to 150 volts and is equipped with starting rheostat with overload and underload attachment.

EXCITER BOARD.

The exciter switchboard shown in Figs. 2, 3 and 4 is of special design, although conforming with the Edison Company's

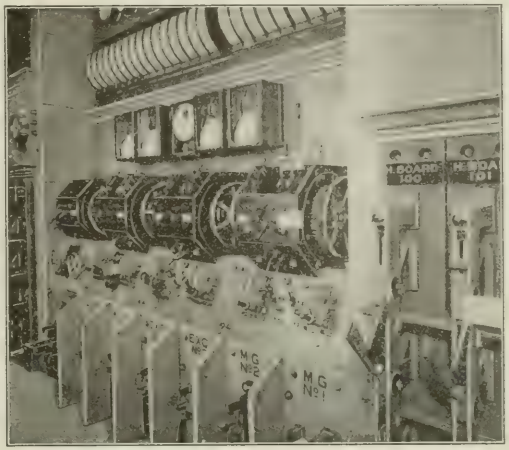


FIG. 3.—CONTROL SECTION OF EXCITER SWITCHBOARD.

standard substation switchboard practice. The positive and negative sections of the board are separated by the control section; the buses and connections of the same polarity being separated by barriers front and back. As shown in the engravings, the switches are of the Van Vleck edgewise type, possessing the advantage of economizing space. The board is tied in with the motor-generator light and power board located at the west end of the room and with the storage batteries. The two large motor-generator sets and the four exciters are controlled from the center of the starting section, as well as the end-cell switches of both batteries. There are three sets of buses on the positive and negative sides of the feeder bus section. The buses are made up of rolled copper strips separated from each other by slate barriers and are supported on the studs of the edgewise feeder switches. A complete diagram of the exciter-board connections is shown in Fig. 5. Besides the usual edgewise voltmeters and ammeters, the starting section is equipped with eight end-cell switch indicators, four for each battery; four graphic voltmeters with master clock, two on each battery circuit; four double-dial rheostat frames for supporting rheostat dials for motor-generators; interlocking starting switches for exciters and motor-generators; push-button switches for the motors operating the end-cell switches, tell-tale lamps, etc. The negative and positive sides of the board are equipped with four 2000-amp edgewise, single-circuit, battery and booster switches of special design, built for four buses. The other single-circuit switches are designed for three buses and are rated at 1200 amp. The reverse-current relays are mounted in each exciter circuit on the back of the board. The negative board has in addition four exciter circuit-breakers.

The main light and power [illegible] feeders that serve the station with electricity is built similarly to the exciter board with positive and negative sections separated by the control section. This board is fed directly from the large motor-generator sets and is tied in with the exciter board, with a storage battery, with Waterside Station No. 1 and with the street network.

[illegible]

The battery room is located under the electrical galleries on the Fortieth Street side of the station. The floor arches are topped with four layers of Hydrex and asphaltic pitch covered with concrete to a depth of [illegible] and with [illegible]

porting the cells. The piers are capped with sheet lead and over all the floor piers and up the side walls to a height of 6 ft. a layer of acid-proof mastic is spread. The room is drained through lead pipe connections from a lead box embedded in the floor, and ventilated by means of a motor-driven fan through protected ducts.

three-wire system and 20 end cells. Each element is contained in a lead-lined wooden tank, supported on a double tier of insulators resting on vitrified brick laid in sulphur. The tiers are separated by a wooden frame. The capacity of the battery is 2000 amp for one hour on each side of the three-wire system. It will thus be seen that the reserve battery capa-

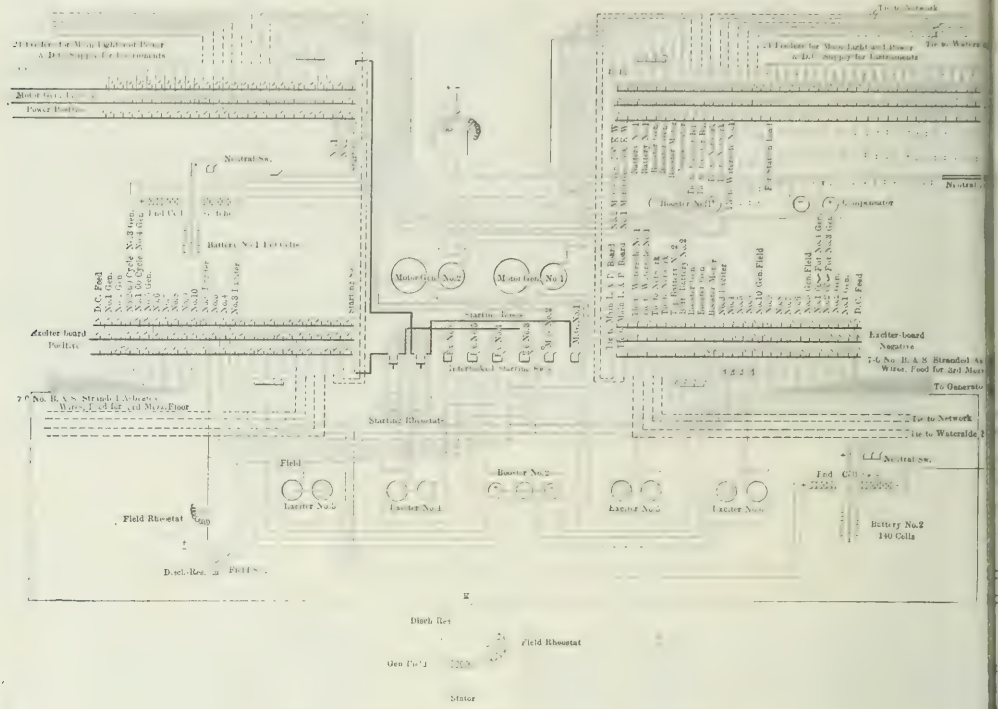


FIG. 4.—DIAGRAM OF EXCITER SWITCHBOARD CONNECTIONS.

The equipment comprises two batteries made by the Electric Storage Battery Company. Battery No. 1 has 150 cells of the R-39 type and battery No. 2 has 140 cells of the same type.

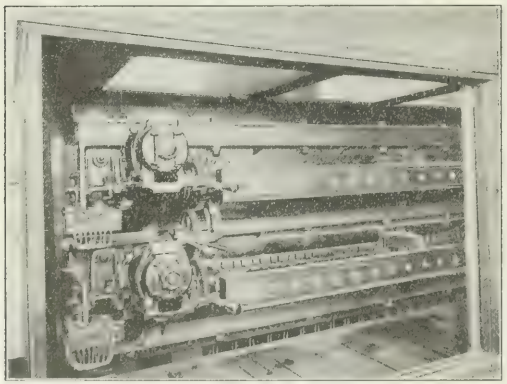


FIG. 5.—MOTOR-OPERATED END-CELL SWITCHES.

Each battery is equipped with electrically operated end-cell switches with two sliding contacts. Battery No. 1 is connected to the main light and power board and battery No. 2 is connected to the exciter board. Battery No. 1 has 75 cells in series on each side of the three-wire system, 20 of which are end cells; battery No. 2 has 70 cells in series on each side of the

is 4000 amp at 270 volts or 8000 amp at 135 volts. The nom rate of charge is 570 amp and the maximum rate 800 amp each side of the system.

For each battery there are four 24-point regulating switc two on each side of the system. The traveling brush is fi with an automatic control switch and circuit opener an motor operated, the motors being of Sprague make and r at ⅛ hp for battery No. 1 and ½ hp for battery No. 2. T switches are located in the exciter room. (See Fig. 5.)

SIGNALING SYSTEMS.

There are two general systems of transmitting signals tween the switchboard operator and the engineer at the turb throttle. One system relates to the governing of the turb and consists of an illuminated sign located on the west of the turbine room, and used in conjunction with a sig whistle. The other system relates to the stopping and start of the turbine, and instructions are transmitted to the engin by means of illuminated signals located on the wall, as sh in Fig. 7, or on a stand near the turbine throttle. Means provided in this latter system for transmitting return sig to the switchboard operator.

In addition there are three whistles of different sizes sounds: one operating from the high-tension board, another fr the direct-current switchboard and an emergency alarm whi sounded by the system operator. These whistles are opera by means of solenoids energized from the exciter section. 6 shows the connections to the signal for regulating the g ernor. Single-pole, single-throw switches, located on the fr of the generator pedestal, are used for operating the whi relay and for flashing the turbine board. By means of sn knife switches located under the synchroscope panel of

ne board a red or green panel of the illuminated sign may ashed individually. The illuminated sign for the turbine is and engine signals is made of sheet iron, and is set flush the engine-room wall. The turbine numbers, 1 to 10 in- e, are stenciled in white, and above each numeral is a

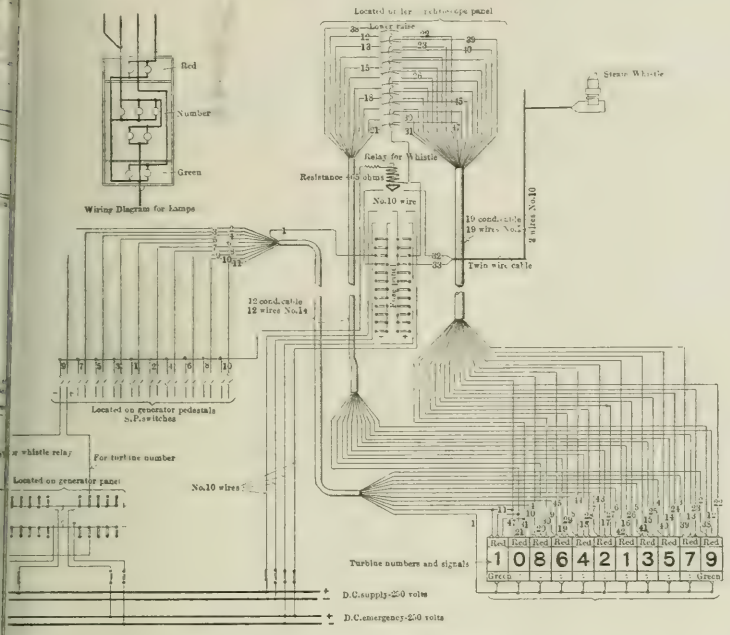


FIG. 6.—DIAGRAM OF SIGNAL CIRCUITS

arate ground-glass panel to indicate red for "raise," and ow a similar panel to indicate green for "lower." Within se sheet-iron boxes are the lamps and circuits for illumi- ing the turbine numbers and the signals mentioned. With s equipment the operator at the generator pedestal can blow signal whistle and flash the turbine number, and can also w the whistle, and flash either a red or green signal, to- ther with the corresponding turbine number. Fig. 7 shows e signal box used to impart certain instructions to the engi- er at the throttle of the turbine. Below the frequency in- ator on this signal box are small, ground-glass illuminated ates containing the following legends: "Start," "Stand By," oad Off," "Full. Speed," "O. K." and "Shut Down." The gnals for the Curtis turbine sets are identical with those for e Westinghouse sets, with the exception that they are mounted stands near the turbine. For operating the call whistle there installed on the exciter board a hand-operated oil switch.

The boiler signal system consists of an electric carriage call, ed for transmitting numbers from the system operator to the remen in the boiler room. The number flashed indicates to e foreman the number of boilers that will be required within e next 15 minutes. Working in conjunction with the carriage ll is a registering time-clock, so that the signal and the time was transmitted are automatically recorded. In addition to ese systems there is a complete intercommunicating telephone stem connecting the high-tension and low-tension switchboards. stem operator, foremen, superintendent, substations, etc here is also a pneumatic tube service maintained between the stem operator's desk in Waterside Station No. 1 and the gh-tension control board in Waterside Station No. 2. In rder to insure the greatest possible safety for the workmen the stem operator transmits all orders in writing. For trans itting messages between the high-tension control board and e direct current switchboard a telautograph is employed.

that a written record is kept of all the orders passed between both switchboards.

Every precaution is taken to render communication between the system operator and the various substations by telephone reliable and instantaneous. The telephone lines to the substations are routed through two telephone exchanges. The lines and switchboards are in duplicate, and the trunks within the station are carried in separate conduits. While the company has heretofore depended entirely upon the telephone for transmitting orders between the system operator and the substations, it was appreciated that this system was too slow in cases of emergency. The Edison company has, therefore, installed a signal system similar to a fire alarm. The purpose of this system is to convey simultaneously to all of the substations signals which will reach the operator no matter in what part of the substation he may be. There is a series of 10 signal buttons connected in multiple to private telephone trunk lines. By pressing any button its signal is transmitted to all of the stations. Thus, should the system operator anticipate any trouble which would need prompt attention, all substations would be apprised of this condition at once. The distribution of all electricity from both Waterside stations is under the exclusive control of a system operator. Feeders and rotary converters are put into or out of service only on his order and he receives at frequent intervals reports from all substations, giving the load on each high-tension feeder and the reserve held in the storage batteries. Before him is a complete map of the system, including stations, substations and feeders. By means of suitable markers the system operator can tell at a

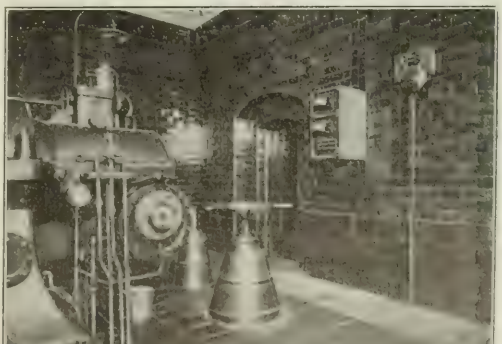


FIG. [illegible]

glance what feeders are connected, their routes and their loads. [illegible]

LIGHTING AND MOTOR EQUIPMENT

For supplying electricity for various purposes throughout the

station there are two separate and distinct systems of conduit, panel boards, etc., installed. Incandescent and arc lamps are connected to the Edison three-wire system, having a potential of 240 volts across the outside wires. The motors are connected to two-wire, 240-volt circuits. Both of these systems are supplied with electricity from the power and lighting board in the exciter room. Conduit is used throughout the installation, which conforms strictly to the requirements of the National Board of Fire Underwriters, and to the laws, rules and regulations of the Department of Water Supply, Gas and Electricity. The turbine room is lighted by means of arc lamps hung from the walls on ornate brackets, and by incandescent lamps placed upon the roof girders. The arc lamps are controlled from panel boards conveniently located on the walls of the turbine room. The girder lamps, which are rated at 8 cp, are spaced about 18 in. apart, 40 to the girder, and are controlled from a panel board on the sixth gallery. In addition, each turbine has an individual panel board for controlling the lamps mounted upon the wall near the machine, and has about 80 incandescent lamps distributed over it. These are fed through flexible conduit.

The boiler room is lighted by arc lamps hung in the main aisles opposite each passageway between boilers, and by incandescent lamps located as follows: One on a flexible arm bracket placed at the water-gage glasses, one at each steam gage and one above the boiler drums. Outlets on the working circuits are also distributed around the boilers and behind them. The boiler-house monitors and coal pockets are lighted by incandescent lamps, together with arc lamps hung over the coal pockets and controlled from panel boards located on that floor. The battery room is lighted from special four-lamp clusters, fitted with enameled sheet-iron shades hung from the arches by loricated tubing. The electrical galleries, offices, stairs, etc., are lighted throughout by incandescent lamps.

Arc lamps are hung on the outside of the coal tower at each corner, and on outriggers over the water sufficiently long to hold the lamp over the middle of a coal barge moored to the wharf. A number of arc lamps and incandescent lamps are distributed in the coal tower and around the various engines and motors. Incandescent lamps are also mounted on the boom overhanging the river. These are guarded and shaded so that the light from them shall not shine into the eyes of the operator in the tower above, but be directed downward to the traveling bucket.

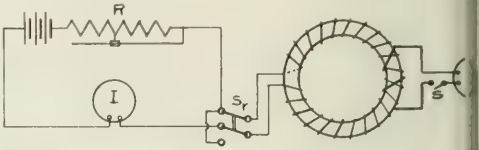
In addition to the motors already mentioned in previous articles, electric motors are used for passenger elevators, machine-shop tools and for driving the large cranes which span the turbine room. The latter are rated at 50 tons and 75 tons, respectively. The 50-ton crane was built by the Shaw Electric Crane Company. The main hoist is capable of lifting 50 tons and the auxiliary hoist 5 tons. The main-hoist motor is rated at 65 hp, the auxiliary motor at 22 hp, the trolley motor at 7½ hp and the bridge motor at 22 hp. The controllers are placed in the rear of the operator's cage, and the levers are brought in front of the operator. Each hoist has an automatic limit switch, which prevents over-travel of the lower block in the hoist. In addition there is provided a load brake, which is applied by the weight of the load, and released by the rotation of the motor in a lowering direction; and a motor brake, which is released by the current which operates the motor, and applied by gravity when the circuit is interrupted. The crane, built by the Case Manufacturing Company, is rated at 75 tons, and is equipped with General Electric motors of the dust-proof series reversible type. The main-hoist motor is rated at 75 hp, the auxiliary hoist at 30 hp, the trolley hoist at 15 hp and the bridge motor at 50 hp. The crane is provided with all of the customary safeguards.

There are three passenger elevators in operation, which are of the Otis Company's electric type. Two are located in the boiler house and the other in the elevator and stair shaft at the Fortieth Street and First Avenue corner. The latter is intended for general passenger service and is capable of lifting 2500 lb. at 300 ft. per minute. The other two are intended primarily for freight service and can lift 4500 lb. at a speed of 200 ft. per minute.

Calibration of a Ballistic Galvanometer

By C. M. Jansky

In one of the late "Handbooks for Electrical Engine there is given under the subject "Magnetic Testing of I the equation $B = 10^8 K r \theta \div 2 a n$, in lines per square c meter, r being the resistance of the ballistic galvanomet the throw and K the constant of the galvanometer; the r ber of turns on the exploring or secondary coil is n and cross-sectional area of the iron ring is a. Fig. 1, taken f the handbook, shows the connections for this experin which are well known. The author states that $K = C$ $(\theta^1 10^6)$, where C is the capacity in microfarads of the



CONNECTIONS FOR TESTS WITH A GALVANOMETER.

denser, e the e.m.f. in volts to which the condenser is char and θ' the throw of the galvanometer. In another handb for electrical engineers are given the same directions for t ing the magnetic properties of iron by the ring method.

It is the purpose of the present article to point out fallacy of this method for determining the constant K. sults obtained in this way, though consistent, are not the rect values. The reason for the inaccuracy lies in the fact the conditions under which the galvanometer is used are the same in the two cases.

In determining the constant K, the circuit consists of galvanometer and condenser, and the galvanometer behaves if it were on open circuit. In the other case the galvanom is closed through a circuit of low resistance in most cases, the oscillations of the galvanometer coil are greatly dam by the induced current produced by the coil swinging in magnetic field. The smaller the resistance the greater damping.

There is nothing new in this statement of the problem, the fact that the two handbooks give wrong directions se to indicate that a wider knowledge of the principles invol is necessary.

Mr. David Robertson[1] showed that if a secondary coil o turns be connected in series with a galvanometer whose res ance is G, Q, the quantity of electricity, may be expressed the form $Q = (N n - q d) \div (R + G)$, where N is the cha in the number of lines linked with the search coil, d is the flection of the galvanometer, and q is the product of the nu ber of lines cut by the galvanometer coil and the number turns which cut them when the deflection is unity. K is ballistic constant of the galvanometer determined in accol ance with the equation $Q = K d$.

Solving for $N n$,

$$N n = K (R + G) d + q d$$
$$= K \left(R + G + \frac{q}{K} \right) d$$

This expression shows that the correct value of $N n$ is obtained when $\frac{q}{K}$ is neglected. The correction $\frac{q}{K}$ may considered as an addition to the resistance of the galvanome and the apparent resistance of the galvanometer is $G' = G +$

This apparent resistance may readily be found by observing deflection of the galvanometer when only the search coil is the circuit, and then introducing sufficient resistance to red the deflection one-half.

[1] David Robertson, London *Electrician* Vol. 19, p. 901.

the first case

$$N n = K\left(R_1 + G + \frac{q}{K}\right) d_1$$

the second case

$$N n = K\left(R_2 + R_1 + G + \frac{q}{K}\right) \tfrac{1}{2} d_1$$

Then

$$R_1 + G + \frac{q}{K} = \tfrac{1}{2}\left(R_2 + R_1 + G + \frac{q}{K}\right)$$

$$R_2 = R_1 + G + \frac{q}{K}, \text{ and } G + \frac{q}{K} = R_2 - R_1$$

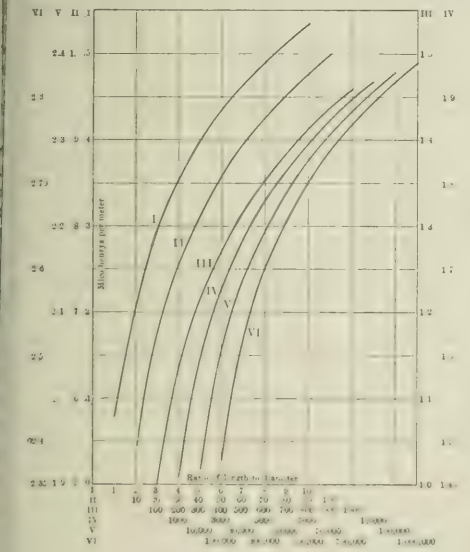
By using this value for the resistance of the galvanometer circuit the constant K as determined by the condenser method may be used.

Results obtained by the above method may differ from results obtained when the galvanometer is calibrated by means of a standard coil by as much as 10 to 15 per cent.

The Inductance of a Straight Wire.

By G. E. Marsh.

In either the practical or experimental application of Hertzian waves, the determination of the inductance of a circuit, or a part of it, is a frequent problem. When the case is that of the Hertz dumb-bell or open-linear type the inductance is constituted by the rod joining the balls or plates and interrupted at the spark-gap. The capacity of the circuit, possessed mainly through the presence of the balls or other expansions of the conductor, can be calculated by means of simple formulas.



INDUCTANCE CURVES

The inductance of the rod portion is given in microhenrys per meter by the expression $\frac{2l}{1000}\left\{2.303 \log_{10} \frac{4l}{d} - 1\right\}$, where l and d are in centimeters, and l is large in comparison to d.

The accompanying curves permit the inductance of a straight circular-section conductor to be quickly ascertained. When using a Hertz or similar oscillator for generating electromagnetic waves, the capacity, inductance and wave-length can be computed in a few seconds. The length of the emitted wave can be most conveniently found by means of the diagram described by Mr. W. W. Massie in the *Electrical World* for Aug. 18, 1906.

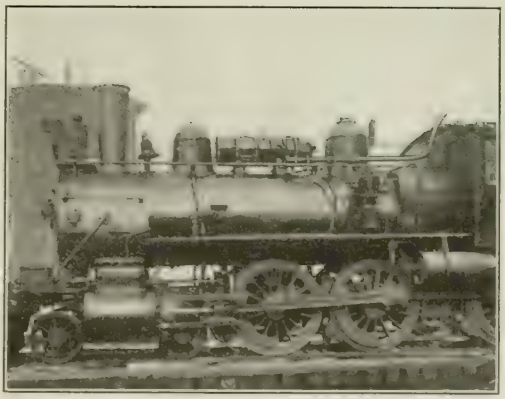
To illustrate the application of the curves let it be desired to find the inductance of a wire 3 m long and 0.4 mm in diameter. The value of l/d in this case is $\frac{300}{0.4} = 750$. Taking 750 as the abscissa, found in line III, moving upward until curve III is intercepted and then proceeding to the column III, on the right, the inductance is found to be 1.4 microhenrys per meter, and hence giving a total value of three times 1.4, or 4.2 microhenrys.

In general, it is in the field of wireless telegraphy that the determination of the inductance of a single wire is required, but the curves are applicable to any straight portion of a circuit that is far removed from the part carrying the return current and when the frequency is high.

Train Lighting at 110 Volts by Turbo-Generator on Locomotive.

Suburban train operation, differing from through train operation in that there is no changing of locomotives and rarely of cars from one end of the run to the other, offers exceptional opportunity for simplicity in electric train lighting. This fact is amply demonstrated by the new equipment adopted as standard by the Chicago, Burlington & Quincy Railroad in its suburban service out of Chicago. The arrangement has been tried on one train making a regular daily run in the evening from Chicago to Aurora, a distance of about 40 miles It consists simply in placing a turbo-generator on the locomotive with electrical connections to the cars.

The accompanying picture shows the generating set mounted on a locomotive with the dynamo end toward the smokestack. The generating outfit is rated at 20 kw and consists of a horizontal Curtis steam turbine directly-coupled to a two-pole, 110-volt direct-current dynamo. The whole unit is ironclad, the covers being clamped in with gaskets, so that it is stormproof. Steam is taken at the locomotive boiler pressure on different classes of engines, running from 140 lb. to 180 lb., the variation being entirely taken care of by the governor. The turbine turns at



TURBO-GENERATOR ON LOCOMOTIVE BOILER

4500 r.p.m. The whole unit is 5 ft. 6 in. long, 2 ft. 8 in. high and 1 ft. 11 in. wide. It weighs 2300 lb. and is securely bolted on top of the shell of the locomotive boiler, as shown

There is a marble panel in the cab of the locomotive on which are mounted a voltmeter and a rheostat. Ordinarily all the attention that is needed to operate the train-lighting set is for the fireman to open the steam valve when he wishes to put the turbine in operation and close it when the run is over, but should the number of cars in the train vary (although this is ordinarily not the case) the difference in resistance on the dynamo circuit, as indicated on the voltmeter, is met by manipulating the rheostat.

From this locomotive unit nine standard suburban passenger coaches are lighted and also the headlight and lamps in the

locomotive cab. The locomotive headlight is a 50-cp carbon filament stereopticon lamp, arranged with the usual reflector, and is said to give six times as much light as the oil lamp which is usually used on suburban service. In the cab there are four electric lamps arranged to illuminate the gages or placed on lamp cord so that they may be used anywhere about the cab or in the tender if needed.

The lamps used throughout for car lighting are rated at 16 cp. There are nine cars, as stated, and each one has 21 lamps. Four of these are on the platforms, one is in the toilet room and 16 are placed in the body of the car underneath the deck sash. These lamps are staggered down the length of the car so as to get the best distribution of light. The car has an enameled ceiling, old ivory in color, and this, of course, helps the illumination.

The circuit from the dynamo is led down and back to the rear of the tender where a straight Gibbs connector is applied, and these connectors are used throughout the train length. There are no steam connections between cars and no storage batteries so that the system is simplicity itself. Entire reliance is placed on the electric lighting outfit, and no other means of illumination are provided. Of course, the lighting unit on the locomotive makes some demand on the boiler, but in practical operation the firemen say that they can see no difference in firing a locomotive which has the lighting set on it and one which is not so equipped.

Of course, this system could not be used without modification if it were necessary to detach the locomotive from the train, but for suburban service it seems to be particularly well adapted because it is compact, out of the way and requires almost no attention. The oil cups on the turbo-generator are large, and it is not necessary to fill them more than once a week.

Mr. C. B. Young, mechanical engineer of the Chicago, Burlington & Quincy Railroad Company, has made a study of the train-lighting problem, and the present equipment represents his idea of the best and simplest system for suburban service. He is in favor of the commercial 110-volt system because lower voltages mean special equipment. Practical railroad men appear to be greatly pleased with the system which the "Burlington" has adopted as standard for all its suburban trains, and 15 additional equipments have been ordered.

This scheme of lighting trains by electricity without storage batteries and with the dynamo mounted on top of the locomotive boiler is a step toward straight dynamo lighting of railroad trains, and as such is worthy of the careful attention of railroad officers in the opinion of the "Burlington" officials.

The Patent Situation.

By Gorham Crosby.

The article by Mr. James T. Barkelew, on a phase of the patent situation, in your issue of March 18 gives rise in the writer's mind to several criticisms. It would appear from Mr. Barkelew's article that the commercial and general interests of the United States are suffering greatly because of much-needed legislation relating to patents. Although there is always chance for improvement, and it cannot be doubted this may be true with respect to the patent laws of the United States to-day, nevertheless our present patent laws do not work any such injury to the interests of the public as would appear from Mr. Barkelew's statements.

Concerning the statement of the principles of patent law, the writer has no comment to make. It is true that the benefit enjoyed by the public for its consideration to forbear for a definite length of time from interference with the inventor and his invention is the right to use the invention at the end of the period of protection given the inventor. It is also true that the present system does not take into account what the inventor does with his invention during the period of monopoly, and that a large majority of patents issued are left in a state of inactivity. The article would make it appear that these patents are a great hindrance, and form stumbling blocks for the future inventor who endeavors to make improvements along certain lines which these inactive patents have been granted. Although this may be so in a very few cases, it is not so to an extent sufficient to warrant the changing of the patent law for this purpose merely. An extremely large number of these inactive patents contain only claims which are so narrow that any skilful mechanic could devise an apparatus which would give to the public substantially the same advantages without infringing the claims of the patent or becoming liable in any way to the patentee. That is, of all the inactive patents which the article represents as standing in the way of future progress, only the smallest percentage are so drawn, or of such a nature, that they can prevent or hinder in any way the legitimate investigator from going ahead with his work and reaping the same profits therefrom as if these inactive patents were not in existence.

It would appear from Mr. Barkelew's article that he proposes some sort of legislation whereby these inactive patents could be made void, so that the public could manufacture and operate under it, and derive the consequent benefits without the payment of royalties. And yet he says there is not sufficient available capital to exploit all of these patents, and that there is an economic limit to the speed at which changes may take place, this limit being at the point where the cost of the change entirely offsets the benefit accruing therefrom. What then would be the advantage to the public of having these patents made void, if, after they were open to all, there is not enough capital to exploit them, or if the cost of making the changes to bring them into practice is wholly unwarranted for economic reasons? To take the patentee's rights away from him under these conditions is to deprive him of something which he might just as well maintain. Why not then let the patentee retain his rights until the public does desire his improvements, or until capital is forthcoming with which to exploit them? When the public desires the use of the patentee's improvements it will be glad to pay him for them, and until such time the patent had better be idle in the patentee's hands than to be made void when no one wants to use it, thereby depriving the patentee ever afterward of receiving any profit from his probably meritorious invention.

The article states that this economic reason is probably the real one for the inactivity of the large majority of patented devices. If this is the reason, how is any change in the patent law going to avoid the inactivity of these patents? If the patentee is forced to work his invention when the public and the progress of the art to which it belongs do not warrant it, it is simply placing an additional burden upon the inventor without anyone deriving any advantage therefrom. It is, it would seem, the purest fallacy to require an inventor or patentee to manufacture or work his invention when the public or the state of the art does not need it. In substantially every case the inventor, patentee or assignee will be glad to work his invention when the proper time comes, when there is an opening in the market for it and capital is forthcoming.

The contention that a stray inventor may obtain a hold on an art in which he has no real right and standing, as compared with inventors and patentees who make practical inventions and put them into practical use, is, I believe, greatly exaggerated. If the application of the stray inventor is supported by a device which is crude, or which is inherently wrong in the construction of a valuable part, the courts are quick to take notice of this fact and see that it does not improperly restrain the public from utilizing the improvements of a more meritorious inventor. The decisions of the court are many in which patents supported by crude and inoperative devices have been held not infringed by meritorious machines, although the original patent had many broad claims.

It is not clear how the public has any large amount of wealth tied up without receiving any returns because of such practice. The fact that the inventor is greatly dependent upon the public for the working out of his inventions is no argument why he should be deprived of his right to receive profit from his labors. The public is more than repaid for the grant of monopoly by

e free use of the invention which it may have at the expiration the term of the patent. If the invention is one which cannot put into commercial use for economic reasons, or because of k of available capital, this is just so much loss to the patentee, d so much gain to the public, since the actual time during nich the monopoly may be active is just so much shortened. ne patent grant is not given to the inventor unconditionally, nce he is required to give his invention to the public at the piration of the term of the patent; and if there are several ventors, the most equitable and practical way is to give the nopoly to the one who first diligently places the invention fore the public in the form of an application for a patent.

It is believed by many that the great commercial activity of e United States is due largely to the liberal patent laws of is country. The more burdens placed upon the inventor and tentee the less is the incentive to the creative mind to work t improvements which will be of value. The United States overnment needs no taxes, since the present fees required of e inventor in obtaining a patent have proved amply sufficient support the Patent Office and to pay all expenses incurred connection therewith. To place the burden upon the inventor work his invention when it is not desired by the public, or hen there is not sufficient capital to put it into commercial use, simply to place upon the inventor a tax in another form, a x which is more burdensome than any of the monetary taxes w imposed by foreign nations. What good can the public rive from the device covered by the patent being manufac ured or worked in any way, when the public does not desire e device, and when there is not enough capital available to roperly put it on the market? Absolutely none.

The article argues that because Great Britain and other ountries have made patent laws which require a working of e invention after a short period of time, that the United States ould also do so in order that foreign inventors in taking out atents in this country may not have an advantage over Ameri an inventors taking out patents abroad. Can it be possible at we should cut our own throats in order that we may get ack at the foreign patent laws because they are not favorable us? Certainly not. The comparatively few United States atents issued to residents of foreign countries form no ground r this. We cannot see how the issuance of these patents to oreign inventors means the signing away of any wealth with ut any prospect of returns, whether or not they are issued for npracticable machines. If they are issued for impracticable ma hines, they in no way hinder the progress of the art here; and they are for practical, valuable machines, they will in due me be worked here when the public desires it.

While our own inventors may be placed in what may appear an inferior position by granting rights to foreign inventors to which the advantages enjoyed by our inventors in other countries are not equal, nevertheless, this is no excuse for hampering our own progress. Since out of the large number of inactive patents in this country there are so few which in any way hinder the commercial progress here, and since the imposing of further taxation or compulsory working, or both, only tends to further burden the inventor or his assignee without increasing the advantages to the public, there is no cause to make any change in our present system on the grounds stated. The provision of a law compelling the payment of taxes or compulsory working, or both, would no doubt mean the voiding of a large number of patents here; and aside from the burdens concurrent therewith, this action would further deaden the stimulus for invention by putting before the inventor the proposition that unless he was in the beginning financially well backed, he would probably lose his entire rights before ample opportunity had been provided to put his invention on a commercial footing.

Of all the burdens placed upon patentees in foreign countries, perhaps the one forbidding importation could be best exercised here without doing material damage. At least the laws here should not provide for any greater incumbrance upon the patentee than to require him to give a license in case he refuses to manufacture himself, when the public demands the invention. If there were any great number of idle patents which were hindering future progress, the most we would suggest would be to change the laws so that any party who desired to use the invention could obtain a license, in case the patentee refused to manufacture at all. The burden of obtaining such a license should be placed upon the party desiring it, and should only be granted after the wilful refusal of the patentee to grant one under reasonable terms.

We think such controversies could be well taken care of in the present Federal Courts, or possibly in a Court of Patent Appeals, which has recently been suggested as a court of final resort for all patent cases.

We believe that substantially the only case in which an idle patent hinders the progress of commercial arts is when corporations obtain control of patents covering devices similar to their own manufacture for the purpose of preventing others from manufacturing competing devices with their own. Such cases, however, are so few that a law designed to prevent these wealthy corporations from doing this would so much burden the poor inventors that more harm than good would result therefrom.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Electric Irons in Salt Lake City.

Mr. B. W. Mendenhall, commercial agent of the Utah Light & Railway Company, of Salt Lake City, reports as to his company's flatiron campaign for 1907 and 1908 that his company purchased 4000 Pacific irons during those two years. Of this number 751 were on hand Jan. 1, 1909. During the two years 52 defective irons had been replaced under the one-year guarantee. Irons in service Jan. 1, 1909, were therefore 3187. Of this number 1560 were put in service during 1907 and 1627 in 1908. The irons defective have been less than 2 per cent of the total number in service. These irons have always been sold subject to a 30-day trial, whether paid for in cash or billed at the expiration of the trial period. The last seven months of 1908 the records show the following: Number of irons put out on trial, 942; number of irons sold for cash, 256; total number of irons put out, 1198; number of irons returned 796; per cent of irons returned, 5 5. The large number of the irons returned were returned because the parties could not pay for them, were leaving town, had no use for the iron and various other reasons.

A Remarkable Flatiron Campaign.

From Dec. 15 to March 15 the contract department of the Commonwealth Edison Company, Chicago, distributed 10,000 electric flatirons to its customers. Deducting Sundays, holidays and half-holidays from this three-month period there remain 68 working days, giving an average of 147 irons sold daily. These figures constitute a remarkable record for the Commonwealth company.

The irons were delivered by special flatiron solicitors and demonstrators, who attached them and explained their use, showing the proper way to regulate the heat, the most convenient way to attach the cord, and especially calling the attention of the customer to the advisability of using the irons

in the daytime while the lamps were not being used in order to prevent, as much as possible, affecting the maximum demand.

All irons were delivered under a six-months' loan plan. The subscriber signed a card requesting the delivery of an electric flatiron, to be loaned by the company for a period of not less than six months. There is no rental charge for the iron, and the subscriber agrees to use it regularly on the company's service. The subscriber also agrees to be responsible for the iron and agrees to return it upon demand if he should cease to have a regular use for it, or if he should vacate the premises in which it was installed.

The flatirons were delivered mostly to houses and apartments, although a few were placed in stores. The company is now using the same force of men for the purpose of calling upon the customers who have received these irons to inspect them, and at the same time to care for any complaints or repairs.

A very complete and systematic organization was effected by Mr. George B. Johnson, of the contract department, to handle this flatiron campaign. On an average 20 men solicitors were employed. These were divided into "crews," consisting of a captain and four others. The captains reported to a supervisor, who, in turn, reported to Mr. Johnson. Commissions were paid, based both on orders and on demonstrations. The city was divided into routes, and an exhaustive system of records was established and kept. Three delivery wagons, each capable of holding 75 irons, were kept busy, and these were supplemented by two buggies in the later stage of the campaign.

While the flatiron solicitors were making their rounds they received orders for other electrical apparatus or took steps to remedy any causes of complaint that might be found. The irons put out are all new, and each was stamped with a different number by the Commonwealth Edison Company for purposes of identification. The introduction of 10,000 flatirons has been accomplished most satisfactorily, and it now remains to watch the effect of this additional day load on the company's mains and to make permanent arrangements with subscribers as to ownership of the irons.

Advertising Electricity.

By William Plattner.

Judicious advertising is judicious publicity. Advertising, rightly done, will cause customers to have confidence in the electric light company and increase the sale of electricity by bringing in new customers and teaching the old ones the new appliances. Advertising that creates confidence may be termed policy advertising.

The square deal is a policy that every electric light company would do well to adopt, and this is given when a representative of an electric light company is frank, fair, open-and-above-board, and pleasing and gracious in manner; when he takes great pains to enlighten and not to deceive or excite a customer. Confidence is engendered in the customer when the electric light company's manager looks at the subject under discussion from the customer's point of view and is conciliatory in correspondence. A letter rightly worded wins friends for the electric light company and is good policy advertising.

Even the disagreeable duty of shutting off the electric current and taking out the meter for non-payment may be utilized in advertising to further the policy of the company. It may be good judgment to carry the idea one more step, and when the man goes to disconnect a customer and remove the meter, he should leave a neatly printed card which will state that the electric light company regrets having to discontinue the service on account of non-payment of an electric light bill, and hopes that the customer will soon be enabled to pay up and have the service continued and the meter reinstalled.

Intelligent, careful and pleasant workmen advertise in an excellent manner the policy of the electric light company. The electric light or power bill goes from the company once a month, and the delivery and payment of the same often constitutes the only connection between the two, year in and year out. Is it any wonder that the electric light and power company is often misunderstood? When the electric light and power company fails to tell and tell again its policy and its methods, some enemy of the company does the work. A progressive electric light and power company talks to its customers every day through the local daily paper.

Local newspaper advertising is, in the writer's opinion, the very best method of reaching the people quickly, effectively and economically. The electric light and power company should follow after the manner of the paper. Tell one thing each day, tell something new each day; never let the same advertisement appear in the same make-up more than once. A good plan is to run a policy advertisement one day, and an electrical appliance, heating and cooking or motor advertisement the next day.

An electric light and power company that gives the people a square deal, regards reasonable public demands, and hammers these facts into the public's head, day in and day out, through its employees and the local newspaper, has little fear from inimical legislation, and its days should be long and golden—so should its nights.

Estimating Monthly Demand from Experience.

The number of small customers of the Commonwealth Edison Company, of Chicago, has in recent years become so large that it has been possible to estimate quite accurately the average relation between the maximum and connected load of this class of consumers, and in consequence to discontinue the use of maximum-demand meters in this service. Accordingly a notice has been issued to customers having installations of less than the equivalent of 20 lamps of 50 watts each, as follows:

"Notice is hereby given that the use of the company's maximum-demand meter now installed in your premises will be discontinued, and that hereafter your monthly maximum demand will be otherwise fixed as provided in the city ordinance governing the company's rates. The maximum-demand meter will be shortly removed from your premises."

The relation above referred to, from which the following table was derived, was obtained by making a careful study of the records of some 25,000 customers by classifying them according to the kind of business and number of lamps connected and comparing the connected load with the maximum for the different months of the year as recorded by the Wright maximum-demand meter readings:

Number of 50-watt lamps connected, or their equivalent.	Kw-hour at full rate per month.		Corresponding maximum in 50-watt lamps.	
	Commercial customers.	Residence customers.	Commercial customers.	Residence customers.
6	9	8	$6.00	$5.33
7	10	9	6.66	6.00
8	11	10	7.33	6.66
9	12	10	8.00	6.66
10	13	11	8.66	7.33
11	14	11	9.33	7.33
12	13	12	10.00	8.00
13	16	12	10.66	8.00
14	17	13	11.33	8.66
15	18	13	12.00	8.66
16	19	14	12.66	9.33
17	20	14	13.33	9.33
18	21	15	14.00	10.00
19	22	15	14.66	10.00

As the table "kw-hour at full rate per month" was worked out for the benefit of the bill clerks, and as it does not show the relation between the maximum and connected, the second table, "Corresponding maximum in 50-watt lamps," was added for the benefit of those to whom this relation may be useful. The former is obtained from the latter by reducing the maximum to kilowatts and multiplying by 30 hours' use of the maximum per month. For customers having five lamps or less the connected load is used for the maximum.

In making the count of the customer's installation, only the lamps are included and, therefore, the current used by flatirons and other heating appliances is included in the low-rate portion of the bill, which is figured at 7 cents per kw-hour. This method also has other advantages in that it eliminates the objection of some customers to having so many meters installed, and also the complaints of other customers of the great varia-

ions from month to month in the primary portion of their bill, due usually to some social affair that occurred only one night in the month. Another advantage is the saving of the investment in demand meters, and the cost of reading and caring for them for a large number of small customers.

Central-Station Handbook.

The Commonwealth Edison Company has issued in attractive form for the benefit of its customers a handbook setting forth the method and requirements of the company for supplying electric current for light, heat and power. The information contained is based upon the questions most frequently asked of the company's employees, together with such information as may be of interest to those using or desiring to use electricity for lighting, heating and power purposes.







ILLUSTRATIONS FROM CENTRAL-STATION HANDBOOK.

Instructions are given as to the manner and form of application for service, together with hints concerning arrangements to make with contractors and for securing a city permit for an installation, etc. Following are given rates for service, together with a simple explanation of the maximum-demand system. The next section is devoted to the reading of meters, several types of which are illustrated. The reader is then informed as to the method of figuring bills, a specimen of a light and of a power bill being given. Information follows as to different classes of incandescent lamps, including special types. Attention is called to the repair department maintained by the company for the benefit of its customers, and of its shops for repair work on electrical apparatus. The concluding section is devoted to electric heating and cooking appliances, which is handsomely illustrated. Several of the illustrations of the handbook are reproduced herewith.

Automobile Charging in New Jersey.

By William H. Stuart.

Electric automobiles in New Jersey are far outnumbered by gasoline machines. The reason for this is attributable to the hilly nature of the country, especially in the northern part of the State, and also to the fact that the sale of electric cars has not been pushed to the same extent as those driven by other means. The Public Service Corporation of New Jersey has endeavored at various times to stimulate interest in electric machines by the installation of charging stations throughout the territory covered by it. In Jersey City some years ago a 10-hp motor-generator set was installed in one of the largest garages. Electricity at a potential of 500 volts was sold to operate this set at a net rate of 7½ cents per kw-hour. The average monthly consumption of this equipment was 400 kw hours. The highest consumption was recorded during the summer months and the lowest during the winter season. The effort to introduce electric machines in Jersey City was unsuccessful and the company removed the generator set to Orange, a wealthy suburban town. In Jersey City those persons owning electric machines are charging them at their own residences, energy being used from a mercury rectifier and purchased at the rate of 10 cents per kw-hour, less a discount for consumption, regulated by the maximum demand. There are quite a number of electric vehicles in Jersey City that are charged in this manner. One consumer who has a mercury-rectifier equipment for automobile charging has his installation rated at 4 hp and it is fed from the company's lines on the maximum-demand power rate. The service supplied this consumer is alternating current at 208 volts. The average monthly maximum demand of this installation as recorded by a Wright demand meter is 1½ kw. The monthly energy consumption for the past 12 months is as follows:

1908.	Kw-hours.	1908	Kw-hours
April	141	November	105
May	150	December	153
June	171	1909.	
July	103	January	137
August	134	February	170
September	137	March	150
October	168		

The average monthly consumption of this consumer is 151 kw-hours, which under the rate would make the average monthly bill $8.31.

In the Orange division of the company, a territory which comprises four or five small towns, forming one of the most beautiful suburban residential districts in the country, there are about 10 automobile garages. Of these only four are equipped for charging electric machines. The largest and principal garage is located on Main Street, near Halstead Street, and has accommodations for about 100 cars. This garage charges electric automobiles at a rate of 10 cents per kw-hour. The price for charging a 12-cell battery car is about 75 cents to 80 cents, and as the average car carries a 12-cell battery the price is a fair estimate for the cost of charging an electric machine. This garage has a monthly flat rate of $25 per car, which includes charging the batteries, cleaning, washing and the general overhauling of the cars, such as oiling, small repairs, etc. There is an additional charge of $10 per month made if the car is to be delivered to the owner's address when needed and called for when the user is through with it. This brings the cost of operating an electric car, with no bother or trouble, to $35 per month. The electric-light company sells the energy to the garage at its regular power rate of 10 cents per kw-hour with discounts based on consumption and governed by the maximum demand. The average price paid on this rate is about 6 cents per kw-hour. There are quite a few persons using electric cars who do their own charging with the aid of a mercury-rectifier outfit. The service supplied by the company is 220

volts, alternating current. In Orange the electric automobile is under the handicap of hilly roads. A great many of the streets are nothing but a succession of hills and dales which, of course, goes to increase the amount of power required for the operation of automobiles. The company in this territory will not make any decided changes in regard to the charging of electric automobiles and will conduct its work as at present for some time to come.

In Newark, while there are more electric cars than elsewhere throughout the State, there has not been until recently a garage equipped to charge these machines. Most of the garages and automobile salesrooms in Newark are located along Halsey Street, south of Broad Street. In the midst of this automobile neighborhood the Electrical Maintenance Company, of Newark, has opened a testing shop and charging station at 286 Halsey Street. The method of charging is to have the cars brought into a garage adjoining and connections made there for electric supply. A flat rate per car is made based on the size of the car. This charging station has only been in operation for a short time and has proved a success. Electricity is used through a motor-generator set. In Newark there are quite a number of mercury rectifiers on residential circuits. The average energy consumption per month for these installations is about 170 kw-hours. It is expected that before summer the local automobile salespeople will make a special effort to increase the sale of the electric machines. Every year there has been an increase in the number of cars sold and used. The electric light company is ready to help, by the introduction of charging outfits and special rates, as soon as the business warrants its doing so.

There are two other places where electricity is supplied by the Public Service Company for charging purposes: one is Elizabeth, where there are three garages with electric charging equipments. The largest garage has a 6-hp motor-generator set. The average monthly net bill, after the discounts on the power schedule are allowed, is about $10. There are also quite a few private charging equipments in the city to which energy is supplied at the regular power rates. Elizabeth has more electric machines than in any other city in New Jersey except Newark. Englewood possesses only one garage that can charge electric machines.

While so far the electric machine seems not to be in favor throughout the State, it can be made popular. Every city and town has electric service so that batteries may be charged, and the Public Service Corporation is ready to place in commission throughout its entire system all the advantages that a large and complete central-station system affords, to meet the needs and requirements of electric automobiles should their number increase to any extent.

Relation of the Central Station to the Automobile Business.

At the electric vehicle smoker, held in Chicago on the evening of March 31, Mr. E. W. Lloyd, general contract agent for the Commonwealth Edison Company, presented a short paper on "The Relation of the Central Station to the Automobile Business." The speaker expressed his belief that the relation between the garage owners and private owners of automobiles, on the one hand, and the central station on the other, ought to be of the most cordial description. He thought that the greater future growth of the electric automobile business will be in connection with the commercial truck. Information compiled as to the cost of operating this type of wagon indicates that the cost of maintenance is cheaper than that of horse-drawn vehicles.

Speaking of the cost of converting alternating to direct current for charging, the opinion was expressed that the efficiency of mercury-arc rectifiers is considerably higher than that of the motor-generator set under ordinary working conditions. This fact is of importance where only alternating current is available. In Chicago direct current is available as far north as North Avenue, west to Ashland Avenue and south to Thirty-ninth Street. In this district the current can be used direct for charging by the use of a resistance box.

The Commonwealth Edison Company has established a maximum rate of 5 cents per kw-hour for electricity used for charging in public garages. The consumer can secure a lower rate than this on the Wright demand system, where his conditions are such that he can use electricity for charging during long hours. Usually where there is complaint of a high rate, it is found that the cause is due to the fact that the consumer is a short-hour user. If it is possible for public garages to operate so that they can charge long hours at a low demand, the rate for electric energy for this class of service goes to a low figure. For instance, with a maximum of 15 kw 10 hours a day the rate is as low as 3¼ cents per kw-hour, with a corresponding reduction for larger installations and longer hours' use. Should the garage be able to charge batteries for 15 hours a day, the rate on a 15-kw demand would be slightly under 3 cents per kw-hour.

As the average charging time for vehicles is about four hours a day at approximately 3 kw per vehicle, it seems reasonable to suppose that by charging 25 or 30 per cent of the total number of vehicles stored, a garage should be able to use the maximum about 12 hours a day, thus earning a rate that makes the business profitable to the garage owner. Assuming a full charge of four hours every day for the ordinary pleasure vehicle, at the rate above mentioned, the cost of each charge would be about 35 cents.

Curves were given showing the manner in which the rate per kw-hour reduces with the different hours' use of 10-, 15-, 20-, 30-, 50- and 100-hp outfits.

Mr. Lloyd gave the garage rate for the charging and keeping of electric pleasure vehicles in Chicago as between $30 and $40 a month. This includes storing, cleaning and charging of the machine. This method of payment did not appear to the speaker to be the correct one, because not equitable. He thought the equitable way would be to require a fixed payment for the storing and cleaning of the machine and a secondary payment based on the miles run per month. It would be easier to determine the cost of charging the batteries of the average machine, and by putting the secondary payment on a mileage basis the customer will more readily understand how this payment is determined than by fixing payment at a rate per kw-hour. Or there could be a fixed price, made by the garage, for each complete charge. The objection to this method, however, is that it is not always necessary to deliver a full charge to a machine, and for this reason this method would not always be absolutely fair, although on account of the difference in mileage of different machines on the same charge, it may sometimes be preferred. It does not seem to be proper that a doctor having an electric runabout used many miles a day should have the service at the same monthly price as another man who uses his machine only occasionally.

If it is decided to base payment for charging on so much a mile, even this should not be a flat secondary rate, but ought to be varied according to the mileage per month. For instance, up to and including 100 miles a month there should be a certain rate per mile; from 100 to 300 miles a month, the rate per mile should be slightly lower, and for 300 to 500 miles a month a still lower rate per mile should be made, and so on. The reason for this is that the cost of charging for low-mileage users is higher per kw-hour than for a frequent user, even if the garage owner has his own plant. Short-mileage users compel the garage to run the charging apparatus short hours daily. In that case the overhead costs on the garage plant are larger per unit than where the battery can be charged for long hours daily.

Mr. Lloyd stated it to be the desire of the Commonwealth Edison Company to encourage cordial relations between the company and the garage owner. It does not desire to sell energy at a price that is prohibitive, because it knows that its interests and those of the garage owner are identical. If he pays too much for the energy, he loses money on charging the vehicles and therefore becomes a dissatisfied customer. The company stands ready at all times to assist garage owners in

using electricity in the most economical manner, and it believes that with a little co-operation it will be possible to increase the hours of charging considerably over what appears to be the practice at the present time.

A few figures collected during the month of February indicate that the average charging time for public garages on the Chicago central-station system during that month was only five hours. The average bill per customer was $31.12 for public garages and $7.40 for private users. However, in summer the time of charging is no doubt considerably longer. On the other hand, during a bad winter the average charging time during the month of February will be considerably below five hours under present conditions. It would appear that in summer, when the garage owner is put to the most expense for electricity, conditions are such that he could charge batteries much longer hours by slightly rearranging his business. If, under present conditions it is necessary for the garage to make a flat rate per month for charging electric vehicles, an arrangement should be made with customers allowing for a reasonable time for charging.

The maximum rate of 5 cents per kw-hour is fixed to encourage the use of the electric vehicle, particularly its charging in public garages, and this rate is not allowed to private users. The company appreciates that the time of the maximum use of energy is in summer, when it has the most electricity for sale. On this account it offers this maximum rate, which does not appear to be too high for the garage owner to make a reasonable profit.

INTERIOR WIRING AND ILLUMINATION

Illumination in the Past, Present and Future.

It would be most interesting to know the real increase in candle-power hours per capita as exhibited in, let us say, the past 50 years. We start at that early date merely to get back of the petroleum period, at least so far as its full development is concerned. In the days of candles and whale oil and camphene how much light was available? One might delve in musty files of old papers and perhaps find the annual consumption of whale oil, but who to-day could give anything much better than a guess regarding the light produced? To judge from dimensions and appearances, some of the old argand oil lamps might have given ten or a dozen candle-power per burner and the double lamp found on the parlor tables of the well-to do was therefore good for possibly 20 cp to 25 cp. The smaller and commoner lamps gave hardly more than a quarter of this meager amount. In the larger cities, of course, gas was already common, and on open gas flame was about the same then as now—although a venerable friend, a New York gentleman of the old school, once vehemently asserted that they never had furnished decent gas in the metropolis since they left off making it from resin! The camphene lamp of evil repute on the score of safety gave a whiter and clearer light than the whale oil, but was commonly used in rather small lamps, while coal oil, then recently introduced on a modest scale, gave hope of better things.

To-day there are somewhere about 40,000,000 incandescent lamps connected in this country. These foot up, on the modest assumption of an hour a day of burning, to about 1500 cp-hours per capita. The practical amount is, of course, much more than this since there are millions in the country even now who depend entirely on other lights than electric. Gas lighting would add largely to the total figure and oil would swell the total more than at first thought would seem possible. Altogether, the average person, if such a thing can be imagined, gets an astonishing amount of artificial light in these days, and is steadily demanding more. In the half century past, for a given amount of artificial light exclusive of actual lights has increased twenty-fold—perhaps even more. The increase is both in the amount of light and in the hours of burning. People worked longer hours then than now, and in particular the use of light in the morning was greater 50 years ago than to-day. But night is at the present time almost unknown in a modern city, where life hums from dusk to daybreak. We do not remember that any one has ever measured the diffuse illumination of a moonless city night as compared with the velvety blackness of the country. Certainly the difference is conspicuous, almost as great as the difference in noise and the modification of winter temperature. Silence and darkness are alike unknown in a twentieth century city. But at the present rate of increase in lighting one falls to wondering what the next half century will do. Will the gentleman of 1959 sleep at all, and will he use 100-cp lamps where he is now satisfied with modest sixteens? Will the peak be at 5 p. m. or at midnight? Of only one thing are we sure—that the consumer will put up the same old protest and cherish the same old grouch over his monthly bills.

Viaduct Lighting at Kansas City.

By Edwin R. Weeks

Kansas City, Mo., and Kansas City, Kan., are built chiefly upon bluffs which rise to heights of from 150 ft. to 200 ft., and overlook the bottom land at the confluence of the Missouri and the Kansas (Kaw) rivers. The Kansas River Valley here attains a width of two miles, and is occupied by the wholesale, manufacturing, live stock and railroad interests.

In 1844 this bottom land was overflowed from bluff to bluff. However, the flood of 1844 was so completely out of the memory of men that the great flood of 1903 came as a surprise, and, finding the vast interests of the valley wholly unprepared, severed all the usual means of communication between the cities. An urgent demand arose for an elevated highway to span the lowlands. The two municipalities not being in condition to meet the need, a syndicate of New York and New England capitalists took up the enterprise, and, according to the plans of the civil engineers, Waddell & Hedrick, proceeded to construct a steel and reinforced concrete viaduct from bluff to bluff, thus reducing the team travel distance between the two business centers 25 per cent and the time by way of street car more than 50 per cent.

The present structure comprises about two miles of roadway, two electric elevators to lift teams and loads from the lowland streets to the viaduct roadways, and 8345 ft. of double-track railway. This structure has now been in service for two years, during which time its lighting has caused an amount of popular comment altogether out of proportion to its cost. The lighting features, unique at the opening of the structure, are still noteworthy, transforming the viaduct into "an illuminated boulevard from State to State." As the spectators on the bluffs watch the two parallel rows of lamps stretch in a series of curved and straight lines through the broad valley of the Kaw, they see one of the most striking night spectacles of the continent; so striking, indeed, that impromptu estimates of the total number of lamps in circuit range from 4000 to 8000, while the actual number is only 600. This display never fails to arrest the attention of travelers by rail or boat. It is the most conspicuous feature of the evening view from all prominent points for many miles up the Missouri to the north, the Kansas to the west, and down the Missouri, which here makes a short bend and flows almost due east across the State.

This viaduct was the first roadway to be lighted by the tantalum lamp, which was selected for this purpose by the engineers soon after its introduction. Lamps of 22 cp are placed 36 ft. apart on each side and are staggered to give a symmetrical arrangement and a more nearly uniform light distribution. The circuits are so designed that any one-third of the lamps may be used without changing the [illegible] tion. Either the north or the south one-half of the lamps, or any one-third of such one-half may also be used separately, thus affording many degrees of illumination to fit the requirements of the occasion. Each lamp is supported by a fluted cast iron

post and is enclosed in a 10-in. clear glass ball standing 9 ft. 2 in. over all from the roadway. The cast-iron holders are fitted with molded-mica sockets, and molded-mica insulating joints are inserted between the holder and the top of each post. After the lamp has been placed in position it is thoroughly taped to guard against moisture in the socket in case of accident to the glass ball. Flexible rubber rings were first used for this purpose, but it was found that the vibration set up by passing cars caused the rings to unscrew and withdraw the lamps from the sockets, and, in some cases, to project them with sufficient force to break both the lamp and the glass ball. Some trouble was also experienced in keeping down breakage of glass balls, and consequently of lamps, from the wind which has full sweep between the bluffs from three directions. By means of spring-brass clips, however, this difficulty has been overcome to such an extent that during a recent two-days blow (80 miles per hour at times) the loss from this source was less than 3 per cent.

The energy is distributed by direct current on the 250-500 volt, three-wire system, two lamps in series, and the supply is taken by meter either from the three-phase, 25-cycle or the 500-volt, direct-current circuits of the Kansas City Railway & Light Company. In the Viaduct company's storeroom on West Eighth Street are the motor-generator and balancer sets, and double-throw switch and switchboard, with the usual equipment of instruments and apparatus required to utilize energy from either of the two sources above indicated. Since these circuits are fed from dynamos on prime movers in separate power houses, they afford an unfailing supply. This storeroom, as well as all terminal lamp posts and ticket offices, is equipped with at least one lamp on each of the three circuits, to provide light at these points, whichever one of the circuits may be in use. Each ticket office is also wired with a series of carbon lamps connected to the trolley circuit for use in case of accident to both of the regular supply sources.

The purpose of the system of lighting selected was not simply to light the roadways, but was to design a layout which could be made a part of an independent power plant with which ultimately to run not only the lamps on the viaduct and its approaches, together with the roadway elevators, but also several thousand lamps and 12 elevators in a mammoth warehouse to be built in connection with the viaduct. It might also be noted that the civil engineers in charge of this enterprise fell into the common error of architects and other builders in not calling in the electrical engineer until all of the iron for the structure up to the top hand-rail was on the ground and partly in position, thus making it impossible, as was first designed, to use the hand-rails as conduits for the feeders on the main viaduct. These feeders were therefore placed in the first space underneath the hand-rail; however, when the stockyards extension and other approaches are built, the castings for the base of the posts will be so changed that the original plan can be followed. The three lower rails will then be used as shown in the drawings, the ends being bushed as in conduit work and keyed stationary in each lamp post, with expansion provided for by suitable sleeved gaps in one of the three intervening posts, every fourth hand-rail post being extended into a lamp post.

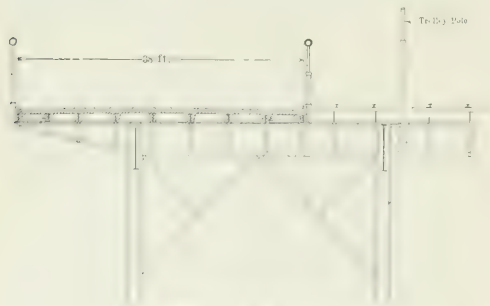


FIG. 1.—SECTION OF MAIN VIADUCT.

The desideratum in viaduct lighting is the uniform distribution of a light that will not dazzle the eye. While some arc lamps give more light per unit of electric power than can be produced by the most efficient incandescent lamp, the use of such arcs at necessarily longer intervals—288 ft. according to the service company's plan in this case—produces widely varying degrees of light; gives a painfully brilliant light at some points, injurious to the eyes of both man and beast; instead of

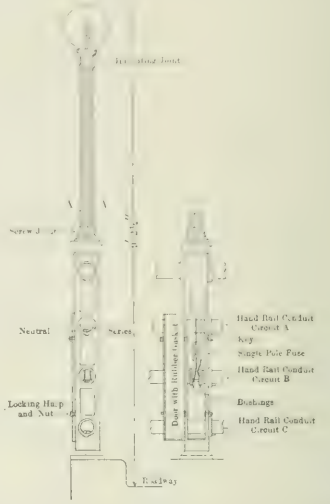


FIG. 2.—DETAIL OF LAMP-POST AND HAND-RAIL CIRCUITS.

aiding sight, it seriously interferes with the ability to see. However, with 22-cp lamps at short intervals the illumination is more nearly uniform, the eye is not dazzled and the sight is not impaired. The lower voltage, better control of degree of illumination, the more striking spectacular effect, bringing out the architectural and linear features, were also among the considerations which led to the selection of the incandescent lamp.

The recent invention of the tantalum lamp offered the only means of further material energy economies, the tungsten lamp not being a commercial article at that time. Some tantalum lamps were, therefore, imported, and after testing them for both candle-power per watt and for effective roadway lighting, as well as for life with direct current and alternating current, and the ability to withstand vibration, an order for 1000 was placed. The vibration caused by passing trains is so considerable that neither Welsbachs nor tungstens could be successfully employed. At any time, however, that the tungsten 125-volt filament is built to withstand this vibration, it can be substituted for the tantalum lamp now in use.

The average lamp life during the first two years' service was 658 hours, which, of course, takes into consideration the breakage by wind and by the not infrequent small boy with stone or air gun, as well as that due to the enthusiasm of adults headed for prohibitory Kansas under loads of Missouri whiskey.

The illumination with all lamps in use is such that a 10-cent piece can be easily seen on any part of the roadway. In a plant 4 ft. above the roadway the minimum is 0.16 ft.-candle and the average is 0.17 ft-candle. The power consumption is 14 kw per mile. The loss due to use of clear glass balls instead of balls with some form of intensive reflector is deemed to be more than offset by the advantage of spectacular advertising.

The system of arc lamps, 288 ft. apart, proposed for this viaduct by the chief engineer of the Kansas City Railway & Light Company would have cost less to install, but the minimum operating expense, even at the city rate of $65 per lamp

r annum (the rate quoted the Viaduct Company was $80), ould have been about double last year's expense with the esent system. The cost of installing natural gas with Welsich lamps might have been less, but, at the municipal rate for ich service, $12 per lamp per annum, its operation would have en more than twice last year's expense with the tantalums.

WO YEARS' MAINTENANCE EXPENSE OF 600 44-WATT TANTALUM HIGHWAY LAMPS.

nergy, aggregate, 24 months' meter bills	$1,689.92
ttendant, part of time otherwise employed	1,400.00
enewals, tantalum lamps and glass balls	970.23
ncidentals, fuel, telephone, oil, etc.	149.20
xtraordinary repairs due to flood of 1908 and damage to circuits by iron contractor in repairing hand-rail	404.64
nterest, two years at 5 per cent per annum on $25,000, the added cost of present equipment	2,500.00
Total expense for two years' operation	$7,122.99

As seen from the accompanying table, the total cost of operating the present system for two years on the moonlight chedule, modified, indeed, to meet the state of the weather and he exigencies of business, was $7,122.99, or $5.93 per lamp per nnum for each of the 600 lamps in use.

It will be seen from the statement given above that the alue $5.93 includes interest on the added cost of the present nstallation, as well as some extraordinary expenses which should not again occur. The present price of tantalum lamps s also 25 per cent less than was that paid for renewals during he period under consideration.

New Telephone Patents.

DESK STAND.

Messrs. E. R. Corwin and C. A. Bals, of Chicago, have jointly patented a desk stand, their patent having been assigned to the Corwin Telephone Manufacturing Company. The stand has the appearance of the familiar telephone, the patent referring exclusively to the details of construction. The most novel feature lies in the mounting of the entire switching device upon a base-plate, which base-plate may, through the aid of spring clips, be released from its position in the base of the instrument and removed in its entirety. The base-plate carries the switch springs only, the cord to the transmitter proper being attached within the stem of the instrument to a terminal, which registers with a corresponding contact of the base-plate when this is slipped into place. The improvement lies in the easy method of removing the switch springs from the base of the stand so that they may be examined from all sides.

AUTOMATIC LISTENING SYSTEM.

For some time past improvements in manual switchboards have contemplated the automatic connection of the operator's telephone to a cord-pair as soon as this pair is put in use by the insertion of the answering plug in the answering jack of the calling line. Along this same line is the invention of Mr. W. A. Wynne, of Raleigh, N. C. Mr. Wynne, however, associates his automatic listening-relay with the individual subscriber's line, rather than with the cord-pair. To this end he adds a relay to the subscriber's line-circuit, which relay operates in conjunction and simultaneously with the line-signal device to connect the operator's telephone circuits of the corresponding position directly to the calling subscriber's line. When the answering plug is inserted the connection of the operator with the subscriber's line is severed and thereafter she uses a listening key. It is presumably the idea that only one call will come in at a time and that, therefore, the operator will be able to respond to the subscriber and receive his requests without doubt as to who the calling subscriber is.

DEVICE FOR AUGMENTING RECEIVING.

Mr. O. Frazier, of Brazil, Ind., under the title "Telephone," has obtained a patent for an arrangement of circuit which he claims greatly augments the volume of the received sound. His device consists of a coil, in series with a battery, bridged across the transmitter and receiver of an ordinary magneto telephone set. The inventor accurately describes this coil, stating that it is provided with a core and wound with two sizes of wire, a coarse wire next to the core and a fine wire coil of higher resistance wound outside of this, exactly as in the usual induction coil. His patent specifies that two-sized wires such as this must be used and that one end of the coarse wire and one end of the fine wire shall be soldered together, the coils thus being used in series. It is difficult to understand just what is gained by this construction over that used in the ordinary retardation coil.

SERVICE-MEASURING SYSTEM.

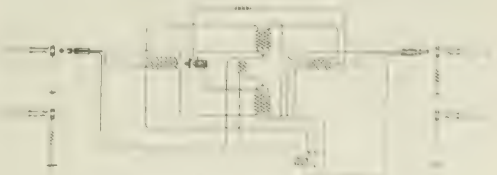
A rather novel idea in measured service is described in a patent granted to Mr. C. M. Beattie, of Rochester, N. Y. There are two elements to this service-measuring system, one of which is a device which counts the number of calls and the other of which is an indicator which records the duration of each call. The latter record is made by means of definitely timed impulses received over the subscriber's line from the central office. These impulses are not sharp changes of current, but are slow variations of the current from the maximum to minimum, definitely timed, the rate of change being so slow as not to be noticeable in the telephone. Mr. Beattie has assigned his patent to the Telechronometer Company.

COMBINED ALARM AND TELEPHONE SYSTEM.

There have been devised recently numerous schemes for combining watchmen's clock systems, fire-alarm systems and burglar-alarm systems with the ordinary telephone line, the idea being to increase the efficiency of the telephone line. Mr. G. Babcock, of Rochester, New York, has patented a system referring particularly to the combination of the telephone system and the watchman's clock. He provides each watchman with a particular style of key, the spindle of which is made like an ordinary telephone plug, while in the handle is a complete step-by-step signal-sending device, such as is used in messenger systems. Each key has its own code of signals to indicate at the central office just which key has been used. The device is so arranged that when a watchman inserts his key and gives it a partial turn to send in a signal, he will automatically wind up a spring within the key handle. When the key is released the handle returns to normal under the action of the spring and by this means drives a make-and-break wheel which transmits the number of the watchman who has called.

NEW REPEATER CIRCUIT.

As is well known, the requirements of operation of the telephone repeater are fast becoming understood, and there have in the last year or two been numerous patents covering devices to meet these requirements and to render this apparatus more and more commercial. Little has been done in the past to make the various adjustments take place automatically. Such an automatic arrangement is, however, described in a patent granted to J. J. Skidmore, of Boston, and assigned by him to



SKIDMORE TELEPHONE REPEATER.

the American Telegraph & Telephone Company. The device is based upon the fact that in order to avoid singing at the repeater the two sections of the line upon either side of it must be in as exact and most nearly perfect balance as the greatest amount given to the talking currents in passing the repeater. This repeater is put in a special cord circuit adapted to be connected to any line, as shown in the accompanying view. The lines of different length and characteristics are connected to racks with different amounts of resistance between the

jack sleeves and earth. This resistance may have any value whatsoever. It will be seen that there is a circuit between the two-plug sleeves of the cord-pair which includes a battery, a relay coil and an induction-coil winding. It will be seen also that the other winding of the induction coil is included in the bridge wire of the repeater circuit. The primary or retransmitting circuit of the repeater is controlled by the relay contacts. If the lines used in any case are short ones and therefore not requiring a repeater, the jack-sleeve resistances will be high enough to cause the control relay to fail. If two longer lines, sufficiently balanced, are connected, the relay will operate and the impedance of the bridge coil will be low because of the low resistance of its secondary circuit. If shorter lines are used where the terminal changes may produce "singing" with a very efficient repeater, the efficiency is automatically reduced through the added resistance of the secondary of the bridge-coil.

Letters to the Editors.

The Patent Situation.

To the Editors of Electrical World:

Sirs:—I have read with much interest the article by Mr. James T. Barkelew in your issue of March 18, entitled "A Phase of the Patent Situation."

It seems to be that strict justice, both to the public and the inventor, is sought for by Mr. Barkelew in his proposed reformation of patent laws. I must, however, take issue with him as to the equity of his views with respect to the "rank-and-file" of inventors, however desirable statutory enactment of these views may be to the "practical inventor"—that is, the successful inventor—the "commissioned officers," to revert to my simile.

Why not take the merchant in a small business and levy burdensome taxes, which, while ruining him, would have but little hardship for his wealthier competitor? True, as Mr. Barkelew gravely observes, his proposed methods, though he formulates no specific measures, would remove "much dead material from the field," but apparently we are not to consider the rights of the owners of this "dead material" secured to them by Federal grants by consent of the whole people. Whatever may be the truth from an ethical standpoint regarding the debt due to society by the individual for his mental as well as his physical environment, the fact remains that the advantage to be derived by a person from an invention, born of his mental processes, is, and of right should be, his. Any other view must be, and is, contrary to the views of a democracy. The law recognizes this and secures the inventor in the enjoyment of what is justly his property. But even so, the law is singularly unjust to inventors and authors under the present patent and copyright laws. The inventor receives no tangible asset from the people—i.e., the Government—by a grant of letters-patent. He only receives a deed which certifies he is the owner of his own property, even as a land-owner proves his right to own land by his deeds securing him the right of ownership. It is unjust that the one deed is limited to 17 years, while the deed of the other, the property owner, secures the right to the enjoyment to himself, his heirs or assigns to the specified property in perpetuity.

The man who by his efforts becomes possessed of an acre of land and the man who by his efforts becomes possessed of a new process or new machine are both property owners. Why should the law differentiate between their respective properties? Is a land-owner required to work his land? I live in a State where hundreds of thousands of acres of land under private ownership are lying fallow. Which will produce the more good to the public, compulsory working of land or patents? True, the inventor pays no taxes on his "property," but this is small compensation for its loss after 17 years.

Mr. Barkelew would even deny the inventor this crumb. He would tax him. And this is not enough: he must work his invention, and do so regularly, or have his property confiscated, to use a polite term. Mr. Barkelew seems to realize to some extent this unjust condition; but on the plea apparently of the greater good to the greater number he feels justified in urging this further abridgment of the rights of inventors, such as taxation, etc.

"The greater good," etc., is democracy, of course, but until it is applied to other property owners it were unjust to single out the inventor—in very truth a most useful member of society—whose hands and mind more than others are not shackled or trammeled by the gross conservatism that sneered at Stephenson and laughed at Watt, that has persecuted with undeserved odium every man with a new idea. The discerning man cannot shut his eyes to the fact that the "age of steel" is as much the product of the inventor as of the business man. I appreciate Mr. Barkelew's frankness; I believe in his sincerity but I protest against his conclusions. As one of the "ridiculed," the "average inventor," the genius if I succeed, the fool, the crank, if I fail—for such is the portion of the "average" inventor—for the good of inventors at large I respectfully ask for them a hearing in your columns.

Barstow, Tex. William C. Mayo.

[Another communication commenting on Mr. Barkelew's article, by Mr. Gorham Crosby, will be found on page 866. Both Mr. Mayo and Mr. Crosby, however, indulge in generalities which have little or no specific bearing on the patent situation of the moment. A patent system ideal in form and spirit would, if perverted, be of little avail either to the inventor or to the public. The matter at issue appears not to be the actual imperfection of our present patent system, but the manner in which it is administered to the detriment of the bona-fide inventor.—Eds.]

The Tariff Bill and Patents.

To the Editors of Electrical World:

Sirs:—Section 41 of the Payne tariff bill provides that whenever a patent is issued by the United States to a foreign patentee it shall be subject, with respect to the manufacture of the invention covered by said patent in this country, to all the conditions that are imposed by the native country of the patentee to citizens of this country, who have obtained a patent in said country.

If such a measure should pass and become a part of the patent law of this country it would no doubt be greeted with a sentiment of great satisfaction on the part of all those who obtain patents in foreign countries where patentees are called upon to put their inventions upon the market within a certain period, subject to revocation of the patent.

Personally, I am inclined to the opinion that such a measure as proposed by section 41 referred to must be considered only fair and, in my opinion, it will do more to bring about a much-desired and much-discussed amendment in foreign patent laws as regards the requirement of actually working a patented invention in the country where the patent issued, than any negotiations carried on through diplomatic channels.

It is perhaps known to the readers of your publication that Switzerland has already waived, regarding patents issued to citizens of this country, the requirement that a patented invention must be carried out in Switzerland; and negotiations are also pending now between this country and Germany to cause Germany to also waive the request that an invention patented in Germany must be actually carried out in Germany, where the patent was issued to a United States citizen.

At the last congress of the International Association for the Protection of Industrial Property, held at Stockholm, the question of compelling the patentee actually to work an invention in the country where the patent issued was again the subject of an extended discussion, and the representatives of the various countries unanimously, I believe, advocated the insertion in the patent laws of the different countries a clause that a patentee should be compelled to grant a license or licenses, upon

easonable terms, to manufacturers who desire to place the invention on the market where it could be shown that the invention was not carried out at all or that the public demand for he patented article is not sufficiently complied with. Such a lause is, in my opinion, not only entirely justifiable, but will lso prove of great benefit to the industry of every patent-ranting country; and if a bill containing such a clause were ntroduced in this country, it should, and certainly would, I elieve, meet with the hearty approval of the manufacturing ndustry of this great country.

New York. Alfred Müller.

Even Harmonics in Alternating-Current Circuits.

To the Editors of Electrical World:

Sirs:—In the issue of March 25, page 734, is an interesting ommunication by Dr. Steinmetz on even harmonics in alter-ating-current circuits. The facts cannot be disputed, but I ish to call attention to an innovation in the use of the term *armonic.*

Technically, it is always understood that a quantity to be armonic must be capable of analysis into a constant plus a ries of simple sine or cosine terms whose frequencies are all hole multiples of the fundamental, such as

$$= A_0 + A_1 \cos (wt - \delta_1) + A_2 \cos (2wt - \delta_2) + \text{etc.} + A_n \cos (nwt - \delta_n) + \text{etc.}$$

his equation must hold for all values of the time t—that is, or subsequent as well as the first complete period. It is evi-ent that in the case cited by Dr. Steinmetz, the equation for he current i does not conform to the facts in subsequent eriods of the electromotive force, and that therefore the cur-ent is not harmonic in the strict sense of the term. The ansient wave under discussion may be analyzed into two parts, he harmonic and one non-harmonic. The former part must ave odd multiples only, unless the circuit has parts of recti-ying tendencies.

It seems to me, therefore, fair to say that the case under scussion is not a harmonic wave with even harmonics (even ultiples) present.

Ann Harbor, Mich. Geo. W. Patterson.

To the Editors of Electrical World:

Sirs:—When a switch is closed connecting a transformer to a alternating-current circuit, the exciting current which flows not at first periodic[1] for two reasons: The magnetic con-tion in which the core has been left by previous use is not general that which would correspond (in the normal cycle) zero current. Secondly, closing will not, in general, be ade at the point in the e.m.f. cycle corresponding to zero irrent. For the current to have a periodic variation these two nditions must be fulfilled, but ordinarily they are not ful-led, and a large first surge may result upon closing the cir-uit. After a number of reversals the current gradually ap-roaches its normal value and becomes periodic. In the mean-me it may be said to have a definite frequency, since it has a aximum or minimum value every time the e.m.f. passes rough the value zero. It does not necessarily reverse in rection, however, as is illustrated in the oscillogram of Mr. . Jensen, shown in your issue for Sept. 14, 1907, where in one se the current is unidirectional for the first three half-cycles e.m.f.

To speak of the harmonics in such a non-periodic quantity ems meaningless, yet in the *Electrical World* for March 25 r. Steinmetz takes this case as an illustration of an electric rrent in which *even* as well as *odd* harmonics accompany e fundamental frequency.

Any variable quantity which returns after a certain time T its initial value can by the method of Fourier be resolved into periodic components, each having a frequency equal to some integral multiple of $\frac{1}{T}$. If the quantity has the same series of values recurring after each interval T, the Fourier series represents the permanent wave-train. Each term in the Fourier series then has a physical meaning, as it represents an actual harmonic component which repeats its alternations indefinitely. When the values are not repeated during successive periods, the harmonics cannot be said to have any physical existence. The expression still gives a mathematical representation of the function during a limited extent of its range, and only in this range, for if other values of the time are substituted in the expression the corresponding value of the varying quantity does not agree with its actual value.

Nothing makes this point more evident than to carry out the analysis with the use of the measured ordinates of the curve in the first half-cycle only. When only odd harmonics exist in a wave this is all that is necessary to give a complete analysis, since the same numerical values of the ordinates are repeated in the second half-wave. Such an analysis carried out in the case cited by Dr. Steinmetz would give a series of terms containing only odd harmonics, which would represent the first half-wave correctly, but would not give proper (actual) values for the second half-wave. It is for that reason defective in the same way that the series of terms given by Dr. Steinmetz is defective, and does not admit of any physical interpretation. Judging by the above analysis one would say that there were no even harmonics in the first half-wave; judging by Dr. Steinmetz's series, one would say that even harmonics were present; neither is correct, for only a periodically varying quantity may properly be said to contain harmonics.

It seems unfortunate that Dr. Steinmetz should have picked out this case as an example of unsymmetrical waves since such waves, containing even harmonics, are easily produced in other simple cases, such as a bipolar generator with unsymmetrical poles. I have produced them by coupling together the shafts of two generators giving, respectively, 60 and 120 cycles and connecting the terminals of the generators in series.

In conclusion I would point out that the final paragraph of the article referred to is very misleading. Dr. Steinmetz says: "In the permanent as well as in the momentary exciting current of the transformer, all harmonics are approximately in phase: that is, they add their maximum values and hence the wave is peaked."

Now, when the fifth, ninth, etc., harmonics are in phase with the fundamental, a maximum of the harmonic coincides with the maximum of the fundamental, but with the third, seventh, etc., harmonics, a minimum of the harmonic coincides with a maximum of the fundamental. Consequently, with both sets of harmonics occurring in phase, the troughs of some counteract the crests of others, and the wave may be quite flat. I think it is from one of Dr. Steinmetz's valuable books that I have made this note of the equation for a wave which is very flat: $e + \sin\Theta + 0.225 \sin 3\Theta + 0.053 \sin 5\Theta$.

Washington, D. C. M. G. Lloyd.

Starting Induction Motors.

To the Editors of Electrical World:

Sirs:—The method of starting induction motors, described by Mr. E. J. Willis in your issue of March 25, is certainly of great interest to many motor manufacturers and designing engineers. At the first glance the method appears to be very good, and even superior to any other. It should be noted, however, that the addition of a starting winding in the motor has a number of serious disadvantages over the rheostat or the auto-transformer method, and some of which are as follows:

Placing extra turns for starting inside the motor adds to the machine the complications incident to a separate starter. Experience in repairing windings proves that a winding which can be repaired with the least trouble and in the shortest time is the best.

An induction motor with the combination winding suggested

[1] By a periodic quantity I understand one which repeats the same series of value after a definite time called the period, or one in which the series of values is repeatedly decreasing, as in a damped wave.

by Mr. Willis has twice as many connections and in total from 20 to 50 per cent more turns than would be required if the motor had no starting winding. From this fact it is apparent that besides the added complication and difficulty of winding, there are also many more chances for short-circuits and other trouble due to increase in number of turns and connections.

As far as the performance in starting is concerned, the arrangement mentioned by Mr. Willis and the auto-transformer arrangement are practically equal if both are properly designed. On the other hand, the losses in starting are of small importance unless the motor is to be started very frequently.

In order to obtain a proper performance under running conditions it is necessary to make the motor with the combination winding larger on account of the necessity for deeper slots and consequently higher leakage constant. Mr. Willis states that the depth of the teeth are to be increased approximately 25 per cent and the stator diameter about 25 per cent. These figures can, however, apply only on some particular motors, as the size as well as the characteristics of the motor will affect the percentage. The percentages given by Mr. Willis appear small, but it does not follow that the increase in cost would also be small, as the actual weight of copper and punchings will be increased considerably, and the labor will also be increased, thereby obviously increasing the cost of the motor. Furthermore, it will be rather difficult, or practically impossible, to make the starting winding inside of the motor adjustable for different starting torque or starting current.

From the few points outlined above it can be seen that the scheme of placing a starting winding in the motor or, in other words, in high-priced storage-rooms, is very undesirable.

PITTSBURGH, PA. H. C. SPECHT.

Suggested Effect of High-Tension Mains.

To the Editors of Electrical World:

SIRS:—I see in certain American papers a statement that the high-tension mains which convey 14,000 hp from the Muskegon River to Grand Rapids, Mich., are worked at a voltage of 110,000, over a distance of 50 miles; and it is suggested that both agricultural and other effects may be anticipated from the visible brush discharge from these elevated mains.

I suspect that the brush discharge is most marked in the immediate neighborhood of the metallic poles or towers which support the insulators, and is weak in between. Nevertheless, some effect might be anticipated if the potential were continuous, or of one sign; but, inasmuch as it is sure to be alternating, any expectation of an influence on crops or on fog is almost bound to be disappointed. A negative result is to be expected beforehand.

BIRMINGHAM, ENGLAND. OLIVER LODGE.

[The brush discharges referred to are only visible on very dark nights, and then only faintly. The discharges occur on all parts of the line, and are not noticeably increased near towers. In the substation, with all lights out and the room in total darkness, brush discharges are also easily discernible, even when not visible along the line. In a recent test, when the line voltage was raised from 110,000 to 120,000 volts, the intensity of the brush discharge was considerably increased.—EDS.]

Expert Testimony.

To the Editors of Electrical World:

SIRS:—I have read with great interest your editorial in the issue of Feb. 11, entitled "Expert Testimony," and desire at the outset to state that it is by all odds the most rational dissertation upon the subject that I remember to have seen. Having had over 25 years' experience as a teacher of the common law and as an expert, I desire to emphasize some points while modifying others.

So far as I am able to judge, there is only one species of statements that may not be open to difference of opinion, namely, mathematical demonstrations. The degree of certainty in ordinary human affairs can never rise above what is called moral certainty, and the contrary is always conceivable. For the great majority of disputed questions of fact the evidence does not rise to the dignity of moral certainty, but ranges from a slight to a high degree of probability, the humane rule of reasonable doubt requiring a higher degree of certainty in criminal than in civil cases in order to warrant a conviction.

Why, then, since we find difference of opinion in science, art, law, medicine, politics and theology—notably in the last three as witness the various parties, schools and sects—should expert evidence stand alone as requiring a unanimity of opinion formed in no other sphere of human experience? Expert witnesses stand upon precisely the same ground as other witnesses; and their ability and integrity, once their capacity has been established upon a preliminary examination to a sufficient extent to warrant their admission as witnesses, are subject to the same tests as those of other witnesses. There is no more reason for the adoption of a special rule as to experts than in the case of other evidence.

If those who so vehemently declaim against expert testimony would take the pains to investigate the law and practice upon the subject of opinion evidence, they would find that the fault is not with the law; that the rules upon this important subject are reasonable and just, and that in the average law suit upon the trial of a contested issue of fact, there is quite as much conflict of testimony on contested facts as upon matters where opinion evidence is admissible. They would also find that under the control of able courts and counsel, results quite as accurate are reached under the common-law form of procedure as in foreign systems of judicature.

The fact is that the difficulty is inherent in the subject matter and cannot be remedied by changing the form of the tribunal. The remedy, then, so far as there is one, lies, as you have justly stated, with the court and counsel. The nature of the subject matter cannot be changed. The notorious abuse of the privileges of counsel in the exercise of cross-examination—that supreme test of truth—can and ought to be corrected by the court, which, while allowing the utmost latitude in the search for truth, should never allow it to be perverted into an engine of oppression and abuse. I do not see, however, under our system, how the right of counsel to call such witnesses as they see fit to support their side of the issue, can be curtailed so long as the witnesses properly qualify. Judicious cross-examination is here again the supreme test of truth, and so long as our tribunals are human I know of no better test.

In my experience as an expert this privilege of counsel is rarely abused. I have had only five or six cases in which I could justly complain of court or counsel, and in these cases by reason of my long experience, I was able to take good care of myself.

I do not believe that an officially appointed band of experts would remedy the evils complained of, and it would be likely to introduce others equally bad. Craft and graft, political pull and brazen effrontery, coupled with lack of knowledge on the part of the appointing power of the real merits of the men seeking appointment, would, in my opinion, deteriorate rather than improve the present conditions.

Again, as you so well state, the position of an official expert to be paid at a nominal figure and blackguarded in cross-examination by both sides, is not one for self-respecting persons to desire, and most likely the incumbent would merit the abuse. A really honest, modest and capable man would be at a decided disadvantage under such a rule, while the limitation of nominal compensation would be disregarded in practice. The compensation of experts will, like everything else, be subject to the law of demand and supply, and parties and courts will get no more real value than is paid for.

Again, in criminal cases, constitutional provisions will prevent any such plan as a submission to referees. It is a well-settled principle of American constitutional law that in all criminal prosecutions the accused shall enjoy the right to be confronted with the witness against him and to have compulsory process for obtaining witnesses in his favor. See Cooley's Constitutional Limitations, p. 318. Const. U. S. Amendments art. VI; Const. Ill (1870), art. 9, and other State constitutions

y change of this salutary rule would, judging by past ex-ience, probably introduce evils and abuses greater than those ight to be remedied.

What then is the remedy for these and other abuses?—which lo not admit are greater than many others, nor a tithe as at as the sensational press would have us believe. I an-er that it cannot be remedied in a day by statutory law. It st be left to an enlightened public opinion, care in the educa-n of candidates for admission to the bar, full and fair cross-amination under the direction of an able and fearless court. der these conditions miscarriages of justice will be more rare than they now are. Indeed, under present conditions, so far as my experience extends, such miscarriages of justice are very rare. When they do occur they are known far and wide and exploited by the press to the utmost limit, while in hundreds—nay, in thousands—of other cases of which the public hears nothing, there is no just ground for complaint. To limit and obstruct the use of expert testimony because its use is sometimes abused would in many cases operate as a denial of justice. In many cases there are no other sources of information open to court and jury.

CHICAGO, ILL. MARSHALL D. EWELL.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

ir-Gap Reluctances.—W. HARTNELL.—A communication on amp-turns necessary to send a given flux across the air-of a dynamo with a slotted armature. The author gives the lowing formula, which is practically correct for the usual portions of teeth and slots: Let L = the length (effective) the pole face, assuming that there were no slots (see Fig. 1); = width of slot; G = width of air-gap. Then deduct for each a length $= \frac{S^2}{4\,G - S}$. For example, let $L = 195$ mm, $S =$ mm, $G = 3$ mm. The space lost by each slot would be 6 according to the above formula. If on the average there e 7½ slots under the pole, the effective length of the slotted nature under the pole face would be $195 - 7\frac{1}{2} \times 6 = 150$ mm. From this the amp-turns to drive the given flux across air space can be calculated as usual for an armature carry-no current. The above formula is based on the conclusion

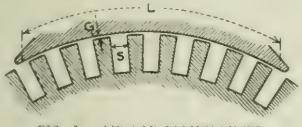


FIG. 1.—AIR-GAP RELUCTANCES.

t the effect of the slot is nearly equivalent to lengthening $+ S \div 4$, the flux over the slot.—Lond. *Electrician*, March 19.

peed Variation of Induction Motors.—A note on a recent tish patent (4113, 1908; March 11, 1909) of W. Fair-ather. The stator winding can be connected for either two-se or three-phase working; by changing over from three-se to two-phase, the synchronous speed is increased by one-d. To supply the two-phase currents from the three-phase ply, either the Scott arrangement can be used, or, as de-ibed in the specification, special auto-transformer windings be provided on the stator of the motor. By arranging for erent numbers of effective poles in the usual way a series different speeds can be obtained.—Lond. *Elec. Eng'ing*, rch 18.

osts of Alternators.—P. GIRAULT.—A note in which the hor simplifies the method of Potier which requires the owledge of a wattless characteristic curve. The present hor shows that only one single point of this curve is re-red if the short-circuit curve is known.—*La Lum. Elec.*, rch 13.

hree-Phase Induction Motors.—W. ROGOWSKI AND K. ROWS. The conclusion of their illustrated paper on stray ses in three-phase induction motors. The authors describe methods for measuring the stray fluxes and for predetermining them.—*Elek. Zeit.*, March 18.

Lamps and Lighting.

ungsten Lamp.—An account of a recent British patent (3577, 1908; March 11, 1909) of the British Thomson-Houston mpany (the General Electric Company of the country) ddered tungsten is mixed with cupric oxide and a cadmium bismuth amalgam, and the resultant mass is squirted into filaments. On baking, the mercury is distilled and some of the cadmium reacts upon the cupric oxide, thereby producing copper and cadmium oxide. On further heating in a vacuum, the remaining cadmium, the bismuth and finally the copper and the cadmium oxide are evaporated. This last component soaks up the liquified cadmium and bismuth at the earlier stage and prevents the formation of globules of molten metal, which affect the uniformity of the filament. The remaining tungsten is finally sintered together.—Lond. *Elec. Eng'ing*, March 18.

Metallic-Filament Support.—An account of a recent British patent (3248, 1908; March 11, 1909) of H. Hoge and the "Z" Electric Lamp Manufacturing Company. A circular base of glass or porcelain, with small holes all around its periphery, is fixed in the neck of the lamp and the resilient supporting wires, insulated from each other, rise from the center of this base. A leading-in wire enters the same hole in the base as the beginning of one filament loop and is welded or cemented to it. The end of the first loop enters the same hole as, and is cemented to, the beginning of the second loop, and so on. Each loop is supported at the top by being passed through a ring at the extremity of a supporting wire. Two separate circular bases, one for the supports and the other for the filaments, may be fixed in the neck of the lamp, each being pierced at the periphery as described.—Lond. *Elec. Eng'ing*, March 18.

Exterior Lighting.—E. L. ELLIOTT.—An illustrated article giving general considerations on exterior lighting. Reference is made to an empirical rule that a street may be considered suitably illuminated when it is possible to read the time on the face of an ordinary-size watch having black symbols on a white ground. The average eye can readily do this with an illumination of 0.01 ft.-candle. The author then discusses three methods of measuring illumination, whether on the horizontal, vertical or normal (the latter meaning illumination on a surface perpendicular to the rays of light). The author in discussing the three methods is inclined to give a preference to the one last mentioned.—*Illum. Eng.*, March.

Generation, Transmission and Distribution.

Gas Power.—C. E. LUCKE.—A discussion of the gas-power plant as a means of fuel conservation. While in all cases gas-power plants can be made to generate energy for less fuel than can steam plants of the same size, the saving in fuel is in some cases accompanied by a saving in energy cost, and is, therefore,

Fixed charges on investment of engine, producer, electrical generator, switchboard, foundation, building, pipings, etc.	0.304 cent
Repairs and maintenance	0.040 cent
Labor	[illegible] cent
Miscellaneous	0.046 cent
Coal	[illegible] cent
Lubricants	[illegible] cent

a profitable thing to do while in other cases it is not. The differences of conditions that produce the different results are chiefly those of size of plant and kind of fuel supply. The gas-power plant is not yet completely adapted, although rapidly

becoming so, to all kinds of fuel, and many of the most popular kinds of coal, notably of the bituminous sort, are still giving the producer trouble. For small power plants, in the neighborhood of 100 hp, gas is most satisfactory. The author gives the figures tabulated on page 877 for a 75-hp gas-producer and engine plant burning small anthracite coal at $4 per ton of 2000 lb. and operating at full-load half the time. These figures are based on an expensive type of plant and with liberal labor allowance and a high price for coal.—*Eng. Mag.*, April.

Cost of Energy.—J. A. JECKELL.—A paper read before the Birmingham and District Electric Club on reducing the cost of energy in works and factories. The author points out the importance of reducing the standing charges and discusses the wasteful way in which, in many cases, energy to drive factories is made and used. He advocates the testing of coal every week or month, to pay attention to soft-water supply and to the removal of oil from water before returning it to the boiler. He also discusses the use of mechanical stokers and the necessity of careful tests of the engines, and the best ways of arrangement of shafting. It may pay to drive one part of the works by electric motors supplied with energy from the town mains, and to drive the rest of the works with a non-condensing steam engine, the exhaust steam being used in winter to heat the shops and in summer to heat the feed water to the boilers.—Lond *Electrician*, March 19.

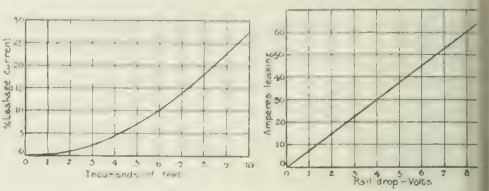
Water-Power in Dalmatia.—H. TENZER.—The first part of an illustrated description on water-power developments at the Kerka River in Dalmatia. In 1894 a small plant was erected containing a 300-hp turbine driving a 220-kw single-phase alternator. The energy is transmitted to a factory. In 1898 an experimental plant for calcium carbide manufacture was erected, and a larger commercial plant for the same purpose, with a capacity of 5000 hp, was opened in 1903. Recently a still larger plant, containing four sets of 6000 hp each, was erected, three-phase currents being generated at 3000 volts, the frequency being 42. The article is to be concluded.—*Elek. Zeit.*, March 18.

Power-Station Design.—A fully illustrated summary of power-station designs adopted for railway or general public-service plants, ranging in rating from 800 kw to 24,000 kw, and for use where space limitation is not the determining factor. The article is accompanied by statistical tables and plans of different stations. The summary includes reciprocating-engine, turbo-generator, combined turbine and reciprocating-engine, and gas-engine installations.—*Electric Railway Journal*, March 27.

Raw-Hide Gearing.—R. LIVINGSTONE.—An article giving tables and diagrams showing the amount of power which raw-hide gearing will transmit.—Lond. *Electrician*, March 19.

Traction.

Stray Current from Electric Railways.—J. G. AND R. G. CUNLIFFE.—A paper read before the Manchester Section of the (British) Inst. Elec. Eng. The reasons for the non-fulfilment of early predictions of electrolytic destruction, due to "vagabond currents," are discussed, also the possibility of much damage being encountered and the precautions thereby rendered necessary. The general mass of the earth is at a uniform potential and behaves like a conductor. The potential of normal earth can be changed locally owing to the high specific resistance of the soil. For practical purposes the authors have fixed the limiting distance at 3 ft., to which the influence of a track, having a drop of potential below 7 volts, extends. (A drop of 7 volts as maximum "between the points of the uninsulated return furthest from and nearest to the generating station" is fixed by the British Board of Trade regulations.) There is a much heavier current flowing in the trolley wires than in the rails, and it is this difference which is responsible for magnetic disturbances experienced at a distance from the track. If the vagabond current flowed in the ground close to the rails such disturbance would be at a minimum, and the further away the currents flow the greater is the magnetizing effect. The length of the section must, therefore, be limited in cases where it is of unusual importance that the magnetic disturbance should be as small as possible. Fig. 3 gives the relationship between rail drop and vagabond currents, with given length of section, and Fig. 2 shows the effect of length of section on the leakage cu rents. Claude found from 12 to 15 per cent of the total curre to be vagabond on complicated networks, and 25 to 30 per ce on long lines, while Parshall found that on a line eight mil long the vagabond current was as high as 60 per cent of t total. Neither Claude nor Parshall could find any appreciat



FIGS. 2 AND 3.—STRAY CURRENTS FROM ELECTRIC RAILWAYS.

current flowing in the pipes, and a most careful search of t Manchester system affords no evidence of such currents. T potential gradients indicate that after overcoming the resistan due to bunching, encountered within 3 ft. of the rails, the cu rent has become diffused over such a wide area that practical no further resistance is opposed to its flow—that is, a pi situated over 3 ft. from the rails would carry little more cu rent than if made of earth, and the majority of pipes are at greater distance than this. Whatever current does, from a cause, enter the pipe must do so with a very low-current de sity and at a distance from the point at which it leaves the ra and must leave with a low density at a distance from the neg tive feed point owing to the lower resistance of a long retu path than of a short one. Summing up, then, it appears tha (1) In order to reduce danger of corrosion to a minimum it necessary that the rail drop should be limited; (2) the limi generally imposed are still too high to afford protection again magnetic disturbances, and, therefore, special regulations fi ing the maximum length of section ought to be imposed in ir portant cases.—Lond. *Electrician*, March 19.

Electric Energy Transmission for Main Marine Propulsion. An illustrated description of the "paragon" system of W. Durtnall. In Fig. 4 the turbine (or gas engine) shaft *A* shown driving a three-phase alternator, *B* being the rotating fie magnet and *C* the stator. An exciter *E* supplies continuo

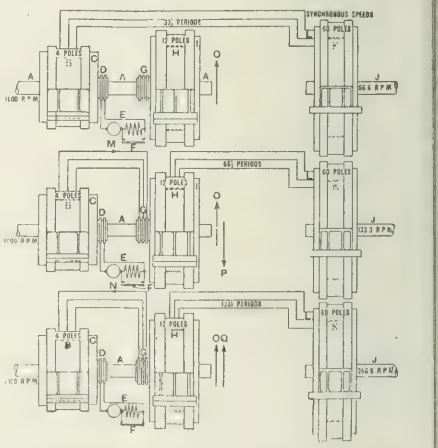


FIG. 4.—MARINE PROPULSION BY ELECTRIC ENERGY.

current to the rotor *B* by means of the slip-rings *D*, and switch *F* is provided for short-circuiting the exciter for makin the system "dead." In the first diagram the current is take to the motor coupled to the propeller shaft *J*. This mot is of the squirrel-cage type, *K* being the short-circuited rot and *L* the stator. This arrangement gives a low speed for th

ropeller shaft. For intermediate and high speed, while the xciter field is short-circuited the connections are changed, as hown in the second and third diagrams. In these the current seen to be taken through a rotary transformer, the primary f which is indicated by *H* and secondary by *I*, the primary be- ig connected to the turbine shaft *A*. By altering the connec- ons so that the magnetic flux in *I* revolves with or against he rotor, current of two frequencies can be supplied to the ator of the squirrel-cage motor, thus giving the intermediate nd high speeds of the propeller shaft. In this way three peeds are obtainable from the squirrel-cage motor coupled to he propeller shaft. By merely altering the connections from he three-phase generator *BC*, the direction of rotation of the notor can, of course, be easily reversed, while for starting up r revolving the propeller at very low speeds, the stator *C* of he generator is allowed to revolve in bearings. If allowed to evolve freely, it will, of course, attain practically the same peed as the rotor, but if braked it will then supply current of ery low frequency to the squirrel-cage motor, which latter will un at correspondingly low speeds. In this way any speed de- ired can be obtained at the propeller shaft and it is important o notice that at whatever speed the latter rotates the turbines re always running at their maximum, and, therefore, most conomical speed. The advantages of the system are pointed ut.—Lond. *Electrician*, March 19.

Mountain Railway.—R. Gundell.—An abstract of a paper on he electric equipment of the mountain railway in Wildbad, Germany. This is a cable road, the cable being driven by a 60- p motor. Energy is supplied from the lighting network of he city, but in order to equalize sudden changes of load a torage battery is provided.—*Elek. Zeit.*, March 18.

Interurban Railway.—An illustrated description of the Oregon lectric railway system which consists of a high-speed inter- rban electric railway, 50 miles long, connecting the cities of Portland and Salem, Ore., with a branch line 20 miles long to Hillsboro.—*Electric Railway Journal*, March 20.

Installations, Systems and Appliances.

Protection of Low-Pressure Circuits.—G. Kapp.—A descrip- ion of a safety device for low-tension circuits. The apparatus can be adjusted to switch out automatically such circuits as soon as the potential of any part of the same with respect to earth exceeds a certain predetermined value. In cases where transformers are used it is often required by the regulations hat a breakdown between the high-pressure and the low-pres- sure sides must either be prevented or made non-injurious. In spite of the opinion of other engineers, Goerges has proved ex- perimentally that this condition can be fulfilled by an excess- pressure safety device consisting of a thin sheet of mica placed between two electrodes. These electrodes become welded to- gether even with quite small currents, so that within a few sec- onds the low-pressure line is either earthed or short-circuited, as the case may be. It has been found that the device is made still more effective by inserting tinfoil between the electrodes and the mica. As a result of a prize competition in Italy a new protective device, which has proved very satisfactory, has been designed by Arcioni. Arcioni's solution is based on the prin- ciple that the safety device must not be limited to the trans- former alone, but it must protect the whole network where breakdowns are also possible. The determining factor on which the action of the protecting device must be based is solely the potential of the conductor with respect to earth. The apparatus exhibited was intended for three-phase circuits, and consisted of three parallel alternating-current magnets, symmetrically placed around an axis. One-half of each pole was wound with short-circuited coils, so that the damping effect thus caused a torque to be exerted on an aluminum disk in front of the poles. To prevent the rotary field of the three magnets acting, the inner portions of the disk were cut away, thus leaving three broad arms displaced at 120 deg. Consequently only the three alternating fields act between the poles and the arms of the disk. The latter is not allowed to revolve, but only to move through a small angle sufficient to close a relay, when the sum of the three torques becomes large enough to raise a counter weight. The exciting coils of the magnets are connected to the three conductors and joined in star, the start point being earthed. Hence, so long as the insulation of all three con- ductors is the same and there is no breakdown from the high- pressure side to low pressure, each magnet is excited with 87 per cent of the interlinked pressure. The counterweight is adjusted so that it is not raised by the torque existing under these conditions. Further, on account of their very high fre- quency, the torque exerted by each pole is proportional with respect to earth. Consequently any displacement of the neutral point means an increase in torque, so that by suitably adjusting the counterweight the apparatus can be set to actuate the relay as soon as any predetermined limit of pressure is exceeded. The relay can be made to operate the main cut-out of a short- circuiting device of some description. Experiments were made with this apparatus in the substation at Porta Volta, in Milan. The interlinked pressure was 170 volts at 42 cycles, the normal potential of a wire above earth being thus 98 volts. The high- tension side of 3700 volts was now placed in contact with one of the low-tension conductors and it was found that the safety device never failed to operate as soon as the pressure reached 174 volts, the current flowing from the neutral point to earth being about 30 milli-amp. Normally, the potential of the neu- tral point with regard to earth was zero, and no current flowed. The apparatus, therefore, satisfied the additional condition that it should cause no telephonic disturbances.—Lond. *Electrician*, March 19.

Combined Lighting and Heating System.—C. F. Holmboc.—When considering the question of erecting a special generating plant for a large office building, or buying the energy from a central station, one should consider the possibility of installing a combined lighting and heating system, exhaust steam being used for heating. In the case of buying the energy from the central station it is necessary to install a separate heating system. The author considers the advantages which can be obtained with the combined lighting and heating system for two cases: in the first, the different concerns in the building have to pay for lighting according to the energy consumed, which is determined by meter; in the second case, they pay for lighting a yearly flat rate.—*Elek. u. Masch.* (Vienna), March 14.

Electricity on Board Ship.—A. P. Chalkley.—A paper read before the Newcastle section of the (British) Inst. Elec. Eng. While generally an e.m.f. higher than 120 volts is not used on shipboard, the considerable quantity of cables required makes a higher voltage advisable in many cases. One of the new British battleships is to be equipped with a three-wire system with 220 volts between the outers, the lamps being used at 110 volts and the motors working on 220 volts. Turbo-generators have de- cided advantages over reciprocating engines on board ship. The author then discusses in some detail the methods of wiring, heating and ventilation, of forced-draft fans, auxiliary uses for electric motors, and electromechanical propulsion.—Lond. *Elec. Engineer*, March 19.

Charging for Electrical Energy.—W. T. Ryan.—A comparative discussion of the following nine principal methods of charging for electric energy: Flat rate; meter rate; classifica- tion of rates (domestic lighting, motor service, etc.); Wright maximum-demand system; Doherty rate, "four C system" (equipment charge and energy charge); double-rate meter; a charge based on the customer's minimum monthly guarantee; combinations of the above.—*Eng. Mag.*, April.

Leeds Electricity Works.—The conclusion of the illustrated description of recent extensions to the lighting station of Leeds for energy supply purposes. The switchboard arrangements are described in detail. Extensions have been made since the system was changed over from single-phase to two-phase. The supply to all consumers is now two-phase at 200 volts (in a few exceptional cases a supply being given at 400 volts), and where direct current is required a motor-generator is usually installed.—Lond. *Electrician*, March 19.

Wires, Wiring and Conduits.

Earthing the Middle Wire.—It is the general custom in Eng- land to comply with the Board of Trade regulation in regard to

earthing the middle conductor of a three-wire system by inserting a resistance between the middle wire and the earth connection, such resistance being frequently short-circuited by a fuse. That an "earthing" device is not essential to the satisfactory and safe operation of an electricity supply network is proved by the excellent record pertaining to the electric supply department of the St. Pancras Council. Notwithstanding that this Council's mains have been in use for 13 years without an "earth" connection, no fire or accident on a consumer's premises has been attributed to electrical causes, nor has any trouble, beyond that arising from external damage, been experienced with the mains. The non-observance of the regulation has, however, recently been brought to the notice of the board and it has now been decided to connect the middle wire of the system to earth through an automatic switch arranged to break the circuit when the current exceeds 25 amp.—Lond. *Electrician*, March 19.

Electrophysics and Magnetism.

Properties of Matter.—J. J. THOMSON.—A review of his first three lectures before the Royal Institution on the properties of matter. The author discusses the principal reasons for assuming non-continuity of the structure of matter; the range of molecular attraction; the vortex theory of ether; the electronic theory of matter and its relation to radioactivity, and the theory of gravitation.—Lond. *Electrician*, March 19.

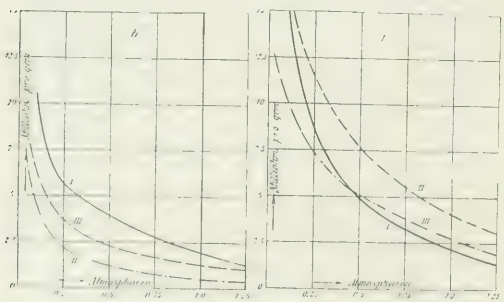
Electrochemistry and Batteries.

Welding Aluminum.—M. U. SCHOOP.—An illustrated description of a new method of autogenous welding of aluminum with the oxy-hydrogen flame and a reducing flux which removes the oxide film always present on aluminum surfaces.—*Electrochem. and Met. Ind.*, April.

Ferrosilicon.—J. ESCARD.—A continuation of his serial. In the present installment the author describes various methods of making ferrosilicon in the electric furnaces and especially the method of Gin.—*La Lumière Elec.*, March 13.

Units, Measurements and Instruments.

Contacts in Apparatus.—G. J. MEYER.—The first part of an illustrated paper read before the Electrical Society of Berlin. To test the quality of contacts two methods my be used, namely, either the direct measurement of the voltage drop or the measurement of the heat evolved at the contact. The measurement of the voltage drop gives a direct indication of the quality of the contact, but only at the temperature at which the test is made. The test in which the heating of the contact is measured is somewhat affected by the wires in the neighborhood. The measurement of the voltage drop or resistance of the contact is quick and easy, but rather inaccurate. It is advisable to test a number of identical contacts in series. The results of heat tests are best plotted graphically in a diagram which gives the change of temperature with the time. Such curves are very approximately logarithmic curves, if the conditions of the resistances in the apparatus remain constant. The quality of a contact, of course, depends essentially on the smoothness of



FIGS. 5 AND 6.—CONTACTS IN APPARATUS.

the two contact surfaces. The author gives microphotographs showing the difference in structure of cut surfaces when treated either with emery paper and with sand blast. The surfaces may be made smoother by plating with tin or nickel. The sistance of the contact as a function of the pressure of the t contact surfaces upon each other is shown in Fig. 5, in wh the ordinates represent the contact resistance in milliohms square centimeter and the abscissas represent the pressure atmospheres. Curve I refers to brass contacts treated w emery cloth, curve II to the same contacts treated with sa blast, and curve III to the same contacts treated with sand bl and nickel plated. Fig. 6 gives analogus curves, of which relates to brass contacts, II to copper contacts and III to br contacts with insertion of tinfoil. The paper is to be cc cluded.—*Elek. Zeit.*, March 18.

Condensers of Large Capacity.—G. SCHULZE.—An account an investigation carried out in the German Reichsanstalt. T author has investigated the practical behavior of an alumin electrolytic condenser. The capacity is approximately inversi proportional to the voltage of formation, if one passes from low to higher voltages. Each electrode when formed at 100 vo has a capacity of 120 microfarads, only one-half, however, l ing effective. When used with the alternating current at e.m. below 90 volts effective, the power factor was about 0.05. higher voltages the energy losses increase and they also increa when the condenser is in circuit for a longer period. In th case it is advisable to use several condensers in series. Wh connected to the circuit continually for a week the condens did not show any visible change.—*Elek. u. Masch.* (Vienna March 14.

Recording Vacuum-Meter.—An illustrated description of recording vacuum-meter devised by R. Fuess, and shown in Fi

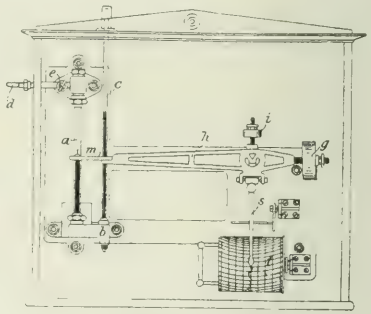


FIG. 7.—RECORDING VACUUM-METER.

7. The two tubes *a* and *c* communicate at the bottom. Mercur is contained in the two tubes to a certain height. There is "perfect" vacuum in the tube *c* above the mercury, while th top of the tube *a* is connected through *e* and *d* with the con denser or other apparatus the vacuum of which is to be meas ured. The difference of the level of the mercury in the tw tubes gives directly the pressure in the condenser, or the leve of the mercury in the tube *a* may be used directly for indicat ing the vacuum. For this purpose a small piece of iron float on the surface of the mercury in *a*. A permanent magnet *m* surrounds the tube *a* at this place and rises or falls with the mercury in the tube *a*. The magnet *m* is fixed to the arm o the balance *h*, while equilibrium is established by the counter weight *g* on the other arm. The pointer *s* makes the record or the revolving drum *t*.—*Elek. Zeit.*, March 18.

Meter.—An illustrated announcement of the Reichsanstalt by which a single-phase induction meter of the Isaria Meter Works is admitted for calibration.—*Elek. Zeit.*, March 18.

Telegraphy, Telephony and Signals.

Cable Relay.—S. G. BROWN.—An account of a lecture held before the Royal Institute in London in which the author explained the limitations which exist in the carrying capacity of submarine cables and the means adopted to extend it. In speaking of receiving instruments, he discussed the syphon recorder of Lord Kelvin and his own drum-cable relay. This apparatus, in addition to enabling clearer signals to be received

at high speeds, can be employed to work various other instruments, through further relay and local circuits, such as punching machines, in which the signals can be automatically punched on a paper strip for further transmission. The apparatus consists essentially of a moving-coil receiver, similar to the syphon recorder, the coil of which carries a long, light pointer. The end of this pointer moves over the surface of a rotating drum, upon which it presses very lightly. The middle part of the surface of the drum, upon which the pointer rests in the zero position, is made of insulating material, and on both sides are metal surfaces with which the pointer makes contact when deflected. The rotation of the drum minimizes the friction, and condensers short-circuiting the contact prevent deleterious effects of the minute sparking that might occur. An inductive shunt in parallel with the suspended coil improves the sharpness of the signals, and a most ingeniously arranged local correction circuit to a great extent obviates the wandering zero by causing correcting currents, sensibly proportional to the disturbing earth currents, to pass through a second winding of the suspended coil. These and other refinements have enabled a considerable increase in signaling speeds to be obtained. In some recent experiments on the Eastern Telegraph Company's cable from Porthcurno (Cornwall) to Gibraltar, the ordinary speed of 140 letters per minute was increased to 240 letters per minute under ordinary duplex traffic conditions, and by special arrangements a speed of 280 letters per minute was reached. Another advantage of the Brown relay system over the ordinary syphon recorder is that considerably less attention is required.—Lond. *Elc. Eng'ing,* March 18.

Telegraphy and Telephony in Germany.—Some statistical notes on telegraphy and telephony in Germany in 1906 and 1907. The number of telegraph stations increased from 34,554 in 1906 to 37,408 in 1907, and the number of towns with telephone exchanges from 28,132 to 30,985; the number of telephone exchanges from 28,218 to 31,086, and the number of telephone connections from 677,088 to 766,247. There is now one telephone exchange for every 1956 inhabitants. The length of telegraph and telephone lines in Germany is 4,527,456 km; of the telephone lines within cities, which have a length of 2,846,356 km, there are 2,200,000 km underground.—*Elek. Zeit.,* March 18.

Telephone Exchange.—A description of a new telephone exchange, with central-battery equipment, which will be opened very shortly in Manchester by the National Telephone Company. A considerable number of subscribers' lines will be changed over from the older central exchange, which is equipped on the call-key system. The general arrangement of the new exchange follows the latest standard central-battery practice of the company, with the addition of a new lamp-flashing circuit on the trunk positions.—Lond. *Elec. Eng'ing,* March 18.

Directed Wireless Telegraphy.—A. Muntell.—A theoretical paper on Zenneck's explanation on directed wireless telegraphy with partly horizontal antennas, and the effect of the earth in this case.—*Phys. Zeit.,* March 15.

Miscellaneous.

Revocation of British Patents.—With respect to the working of the new British patent law, the hearing of the appeal of the British Westinghouse Company against the decision of the Comptroller-General of Patents to revoke the Bremer flame-arc lamp patent is of interest. The Westinghouse Company has abandoned the argument that the lamps were manufactured in that country to an adequate extent to meet the demand, but assert that they have satisfactory reasons—the chief of which is that the period of a license granted to another firm is not yet terminated—for not manufacturing to a larger extent. The respondents assert that this very argument shows that the Westinghouse Company never intended to manufacture the lamps to any considerable degree in that country. The proceedings have been suspended for a few weeks in order to enable the Westinghouse Company to put in further evidence.—Lond. *Elec. Eng'ing,* March 18.

Legislation.—The new Electric Lighting Acts bill proposed for England. It deals with the compulsory acquisition of land for generating stations, the breaking up of streets outside of the area of supply, supply in bulk, supply of electricity to tramways and railways, maximum prices, certification of meters, etc.—Lond. *Electrician,* March 19.

Convention.—The seventeenth annual meeting of the German Association of Electrical Engineers will be held in Cologne from June 2 to 5.—*Elek. Zeit.,* March 18.

NEW APPARATUS AND APPLIANCES

Electric Lighting at the Alaska-Yukon-Pacific Exposition.

By A. J. Quigley.

The electric lighting scheme for use in the main streets and vistas of the Seattle Fair was a problem over which the engineers spent considerable study before any satisfactory solution was found. It was desired to produce an electrolier that would first of all carry the festive idea and at the same time give efficient lighting results at a reasonable cost.

The cut herewith shows two electroliers of the type selected. Over 200 of these will be used on the grounds for the main street lighting. The base or pedestal is made of wood, as well as the support underground and the skeleton frame inside. The remainder, however, is made of staff. Thirty-nine 20-cp lamps are used on the ball, the spacing at the bottom being closer than at the top so as to throw as much as possible of the light downward. Mica molded weather-proof sockets are used in the construction of the ball, these being cast in the staff-work itself so that the lamp practically screws into the ball. A pair of No. 8 feed-in wires tap onto the network of socket wires inside the ball and are carried down through the shaft. The finished result has proved very satisfactory, both as to appearance in the daytime and as to the lighting effect at night.

The electrolier, as shown, can be produced in quantities for about $15 including lamps. Ventter & Griswold Company, electrical contractors, of Seattle, were the successful bidders on both the underground feed-wire system and the electroliers



Electrolier at Alaska-Yukon-Pacific Exposition.

and have now about completed these contracts. By April 1 current can be turned on the whole system—10 months ahead of the opening date of the fair.

Steel Service Boxes.

Illustrated herewith are new service boxes designed by the J. Lang Electric Company, of Chicago, to combine a main switch, main fuse, meter loop and panel board in one panel and cabinet. The object is to do away with the necessity of two separate boxes, reducing the number of connections and

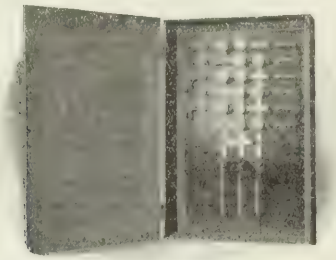


FIG. 1.—SERVICE BOX.

simplifying the installation. The "Universal" service box, as it is called, is particularly useful in small installations such as residences, apartment buildings, small stores, etc. It can be used on a two-wire, 110-volt system or on a three-wire, 250-125-volt system. Means for converting from one system to

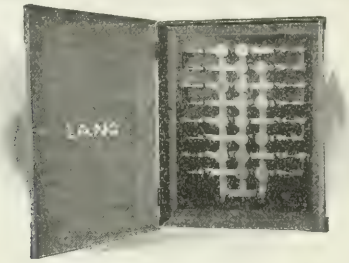


FIG. 2.—SERVICE BOX.

another are provided on every panel. Fig. 1 shows the style "S G" service box. It is a "Universal" panel board with switches in the branches, fused switch and a meter loop in the mains.

Fig. 2 illustrates the style "T G" steel service box with switches in branches and terminals only in mains. Each steel

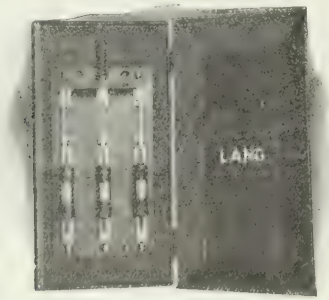


FIG. 3.—SERVICE BOX.

box is furnished with three knockouts for ½-in. conduit in each end and knockouts for ½-in. conduit along the sides, 5⅛ in. apart. The boxes are constructed of No. 16 gage sheet steel.

In Fig. 3 is shown a service box containing a Lang "Paragon" knife switch, with plain finish and spaced for 250 volts. Boxes for 25-amp to 100-amp switches are 3½ in. deep. Those for 150 amp to 200 amp are 5 in. deep. Boxes may be furnished with fuse extensions under the handle end. The doors may be closed with the switch open or closed.

Electric Curling Iron.

Mr. Herman Bollin, of Chicago, with the co-operation of Mr. J. L. Burgard, has invented an electric curling iron that seems to have several meritorious features. Both parts of the curling iron are supplied with heating elements. The wooden handles are hollow, and, as shown, the flexible cords from an incandescent-lamp socket lead through them to the metal parts. Either direct or alternating current at 110 to 116 volts may be used. The resistance wire in the jaws is said to be so designed that on application of the current the temperature of both parts



ELECTRIC CURLING IRON.

of the iron increases to about 375 deg. Fahr. in about one minute, and remains constant at that temperature. There is claimed to be no danger of burning the hair, and in using the device no odor of singed hair is perceptible. The use of the electric iron results in a great saving of time compared with alcohol or gas-heated tools. The device is also safe in the hands of the inexperienced and occupies little space so that it can easily be packed in a trunk or suit-case. The metal parts are finished in nickel and the heated portions can be renewed easily if necessary.

Deltabeston Magnet Wire.

Since Deltabeston magnet wire was first placed upon the market every effort has been made to improve its qualities. Only the purest fiber is used in the insulation which is so treated that the wire is claimed to be absolutely indestructible so far as any temperature rise to which it may be subjected in actual service is concerned. In addition to being heat-proof, the wire is also made water-proof by thoroughly impregnating the insulation with a compound which prevents any absorption of moisture. Recently tests were made to compare the properties of this wire with those required and covered by the United States Government specifications. The specification reads in part as follows:

"When subject to a temperature of 160 deg. C., neither the asbestos covering nor the water-proof compound shall be injuriously affected. Six-in. samples of wire with carefully paraffined ends shall be immersed in fresh water at a temperature of 22 deg. C. for a period of 24 hours. The per cent of water absorbed by the insulation during such immersion shall not exceed 4 per cent." These tests more than fulfilled the requirements, and a contract was awarded to the D. & W. Fuse Company as a result.

Automatic Motor Starters.

Motor starters with no fixed time element have found favor with engineers by reason of the protection afforded the motor in starting. The time required for bringing a motor to full speed should be in direct proportion to the load to be started, or, better still, the current should have a fixed value throughout the starting operation. To obtain this result series relays have been used in connection with various types of solenoid starters. Voltage magnets controlled by the counter e.m.f. or by the drop in line voltage have also been used with success in some types. The Monitor automatic starter illustrated herewith makes use of the armature current itself as the governing element, and the resistance steps cut out successively as the current falls off. By this means the armature current during the starting operation is limited to a predetermined value and no overload device or series relay is required to protect the motor from overloads. The method of control is novel and is protected by patents.

Fig. 1 shows a 10-hp motor starter with four sections of resistance. The small solenoids shown are all in series with the motor armature and are compounded so that they can only cut out in their proper order. The compounding is controlled by the main contacts and there are no auxiliary contacts or cut-outs in the starter. The action of the starter is as follows: When the motor switch is closed, the four-step magnets and the master magnet, which is also in series, are energized. The master magnet removes the mechanical support from the cores of the small solenoids which carry the contacts. As the motor speed increases the current falls off until the first solenoid is weakened enough to drop its core, closing the contact. This contact cuts out a section of resistance, the solenoid itself and part of the second solenoid. With the cutting out of resistance the current increases slightly and again falls off as the motor speeds up, permitting the second contact to close. In the same manner the third and fourth contacts close in order, completing the operation. In the larger sizes a carrying switch, also worked in series, short-circuits the entire starting device after the last contact closes and carries the current on laminated contacts. The mast magnet also serves as a no-voltage release, returning to the starting position instantly when the current is cut off. It is claimed by the manufacturers that it will always bring the motor to full speed in the shortest time consistent with the load, but always with a safe limitation of the armature current. The starter will not pass more than the predetermined amount of current to the motor at any time during the starting operation, no matter what the load may be. The starter is in no way affected by atmospheric or climatic conditions. The rheostat is of non-corrosive metal with

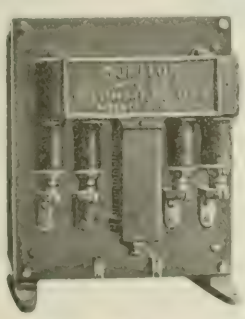


FIG. 1.—10 HP. STARTER.

negligible temperature coefficient. The contacts are of graphite and copper, and no sliding or rubbing contacts are used. No dash-pot or mechanical retarder is used and the construction is simple and rugged throughout. By reason of its simplicity, rugged construction and certainty of action under all conditions the starter is claimed to be fool-proof. No carelessness or inattention can possibly result in throwing a motor on the line until it comes up to speed. The Monitor Manufacturing Company also makes a line of reversing elevator controllers, both for electric and manual control, making use of the Monitor starter. The line of printing-press controllers is very complete, covering all sizes from the small job press to the largest rotaries, and has a number of novel features. Fig. 2 shows a push-button controller with dynamic brake, armature and field control, locked speed device and adjustable solenoids. The locked speed is a new feature and has found favor with printers, as the speed can be set and locked at any point, and the motor returns to the given speed each time it is started, insuring uniform speed throughout the running of a job. The adjustable solenoids have a wide range and are set to give the press a perfect start by cutting out at a point close to the running load. The development of the apparatus has extended through several years, and the apparatus has been thoroughly tested in service. The sales are controlled by the Monitor Sales Department, Baltimore, Md.

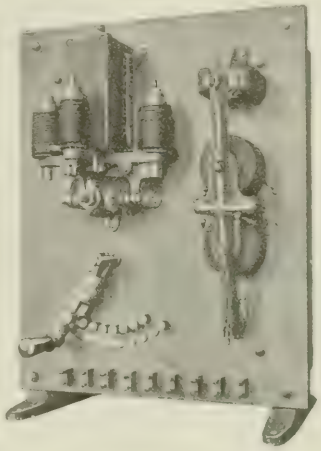


FIG. 2.—PRINTING PRESS CONTROLLER.

Philadelphia House-Furnishing Show.

At Horticultural Hall, Philadelphia, from March 29 to April 3 inclusive, there was held what was called the Second House Furnishing Show. A number of exhibits were made, among them being that of the Philadelphia Electric Company, which occupied 20 spaces, and included an exhibit of the latest utensils for electric cooking and heating in actual use. Another feature was a display of electric laundering appliances, such as pressing irons, electric washers and wringers.

The Sanitary Electric Cleaning Company, of Philadelphia, showed a line of "Invincible" electric renovators, for which they had the local concession, and the Electric Suction Sweeper Company, of New Berlin, Ohio, showed the Hoover electric suction sweeper, in connection with demonstrations in various sorts of cleaning. The Keller Manufacturing Company, of Philadelphia, exhibited the "Santo" cleaner, which it claims is absolutely safe to use where there are children, as all the machinery is enclosed, and there are no revolving parts to injure the furnishings. Robbins & Myers Company, Springfield, Ohio, exhibited a full line of its standard fans, including all the popular types of ceiling and desk fans, alternating-current oscillating fans and 9-in. household fans; also, a complete line of motors in more than 40 sizes, ranging from 1/10 hp to 15 hp.

Device for Interrupting the Circuit on an Excess Load.

The indicator manufactured by the Excess Indicator Company, of Lynn, Mass., is intended primarily for lighting circuits, its function being to open and close the circuit whenever the load under contract has been exceeded. This causes the light to flicker until the excess load has been turned off. The foundation of the instrument is a heavy slate base, upon which

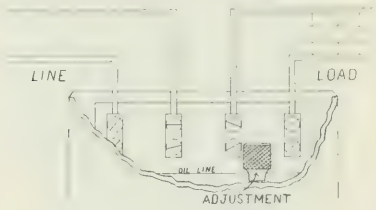


FIG. 1.—TWO-WIRE CONNECTIONS.

a magnet with series and shunt coils is mounted. The coils have laminated cores, the shunt core being connected with a heavy double-pole switch. The series coil, which is placed above the shunt coil, and in a three-wire circuit is doubled, has a stationary core. Set upon an adjustable pinion is a heavy clock spring, which is attracted by the series coil whenever the

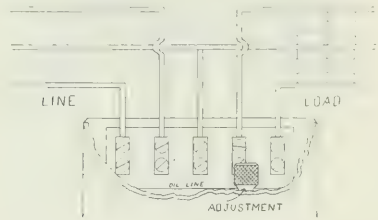
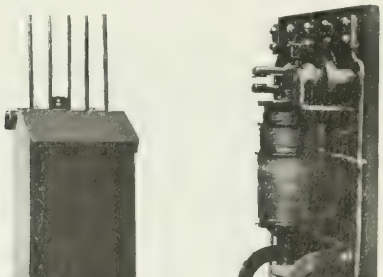


FIG. 2.—THREE-WIRE CONNECTIONS.

current passing is sufficient to cause the magnet to overcome the tension spring. The series coils are balanced so as to attract the spring whenever either side of the circuit is overloaded. A hard fiber pinion is provided for adjustment. This is accomplished by turning the pinion in a counter-clockwise direction, so as to reduce the tension upon the spring. A reverse motion increases the tension for a greater load. The contacts for the shunt circuits are made of coin silver. The mechanism is immersed in transil oil, which tends to keep all of the parts properly lubricated, and the circuits being broken in this oil sparking and wearing of the contacts is eliminated. Provision is made for outside connection with heavy brass binding posts. This connection may be made after the instrument has been set up, and any readjustment effected without disconnecting the device. The whole is enclosed in a substantial cast case, which can be sealed to prevent interference. The range of the adjustment of the instrument is said to be great, considering the delicacy of its operation. The device, it is claimed, will operate equally well on a load of ½ amp to 60 amp, and the adjustment can be made within 10 per cent of any predetermined demand. The designs provide for two- and three-wire instruments on direct current, and also for instruments for alternating current on any frequencies from 25 cycles to 133 cycles. The apparatus is built for currents up to 500 am



FIGS. 3 AND 4.—EXCESS INDICATOR WITH AND WITHOUT CASE.

Electric Grab-Bucket Hoist.

The Sprague Electric Company, of New York, has brought out an interesting electric grab-bucket hoist applicable for loading any loose material such as coal, coke, sand, broken stone, etc. The bucket, which may be of the clam-shell or orange-peel type, is operated by three ropes, two of which are anchored to one drum and are called the holding ropes, and one of which is anchored to the second drum and is called the lacing rope. The two holding ropes serve to hold the bucket when it is digging and dumping and also prevent it from spinning around. The lacing rope is used to close and open the bucket. All three ropes hoist the load. The action of this type of bucket hoist is clearly shown in the engravings, when the bucket is shown shut and in its uppermost position.

Three motors are employed: a hoisting motor, a lacing motor and a traversing motor. In the hoist shown these are rated at 10 hp, 15 hp and 10 hp, respectively. The bucket is operated

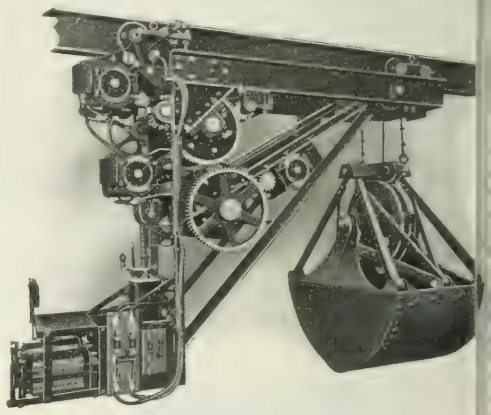


FIG. 1.—ELECTRICALLY DRIVEN GRAB-BUCKET HOIST.

without the multiplicity of levers and clutches often found, the control being accomplished by means of one controller handle, the connections of which are shown diagrammatically in Fig. 2. Two controllers are mounted back to back and the drums geared to be turned from one handle, which also prevents the slackening of either rope at any time or the overhauling of one rope faster than the other, which might in either case result in damage to the machinery. The controller, which is shown with eight steps, is of the cylindrical type and so arranged that the handle may be revolved continuously in one direction, thus enabling the operator to reach any desired point quickly from the "off" position.

The operation is as follows: Suppose the bucket to be dropped into the material which is to be raised. The controller handle is turned so that the fingers make contact in line 1, closing the circuit through the motor on hoist *A*, overhauling the closing rope and thus closing the bucket. At the same time the circuit is closed through the motor of hoist *B* with enough resistance in circuit to keep the current down so that the motor pulls just hard enough on the rope to keep it taut. As soon as

the bucket is closed the controller handle is turned so that the fingers make contact on line 2, thus cutting out part of the resistance from the motor circuit on hoist *A*, causing it to start the bucket slowly while the hoist *B* is still keeping its rope taut, following the speed of the closing hoist *A* automatically.

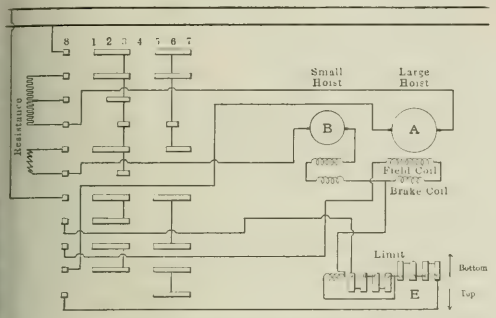


FIG. 2.—CONTROLLER CONNECTIONS.

The controller handle is now turned to step 3, which cuts all the resistance out of circuit of both motors, thus lifting the bucket at full speed, the closing hoist *A* being assisted to a certain extent by the hoist *B*, but not enough to cause the bucket to open. As soon as the bucket has reached the desired height the controller handle is turned to step 4, open-circuiting both motors, allowing the brakes to be applied and bringing the bucket to a stop. Should the operator through negligence allow the hoist to continue, the circuit is automatically opened on both hoists by a limit switch. The handle may now be moved to step 5, which reverses the closing hoist with all the resistance in circuit. Motor *B* being open-circuited the holding rope is held while the rope *A* is slackened off, which action allows the bucket to open and dump its load. The step 6 cuts out all the resistance in series with the closing motor, allowing it to lower rapidly and closing the circuit through the motor *B* in the same direction as it was before, but with so much resistance in circuit that a very small current is allowed to pass, thus causing the motor to exert enough pull to hold the bucket open. As soon as the bucket has reached the material to be moved, motion on one of the hoists is stopped by turning the handle to "off" through position 7. This last step is provided for slowly lowering the load without opening the bucket if it is desired to do so and is the same as step 6, but with resistance in circuit with the motor *A*. In all the operations described it will be noted that while motor *B* is in circuit the current is passed always in the same direction that is, tending to cause the motor to hoist, the variation in pull being accomplished by varying the amount of resistance in series with the motor.

Another advantage is that the limit switch *E* is so connected that it breaks the circuit of both motors when the bucket has reached the upper or lower position for which the limit is set. The switch is resetting, and after it has opened in one direction it does not prevent the hoist being operated in the other direction.

The operator's cage, which may be open or enclosed, carries

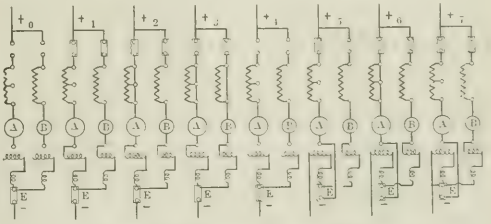


FIG. 3.—CONTROLLER CONNECTIONS.

the controllers, grid resistance, switches and fuses. The trolley carriage travels on an I-beam. The brakes are applied with a spring and released by solenoid coil and plungers, the coils being connected in series with motors, thus insuring their action in case of failure of either the motor or the main circuits.

Series, steel-frame, crane motors are employed, fitted with removable pole pieces, box-type brush holders, etc. The bucket

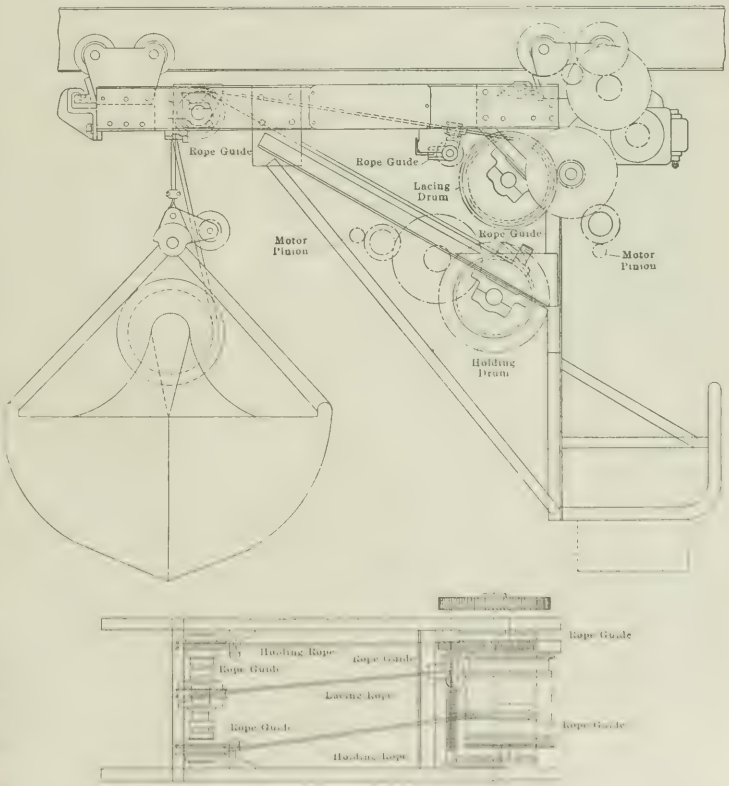


FIG. 4.—SIDE ELEVATION AND PLAN OF HOIST.

is rated at 1½ yd. and the lift is 50 ft. The hoisting speed is 150 ft. per minute and the traversing speed 350 ft. per minute. The type of electrically driven grab-bucket hoist, which is shown in Fig. 1, is also made for alternating-current motors.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Trade conditions continued to be irregular throughout the country during the past week. There has been little evidence of improvement, although there is a growth of optimistic feeling, which is due, no doubt, to the promise that the tariff matter will be speedily settled, and that the spring weather is bringing about an access of retail business. The Easter season has been up to the average, according to the reports from the West, and retailers are in consequence fairly well sold out. Current demands upon jobbing houses and wholesalers are, of course, light, as this is, at the best, an interseason period. The orders that are received are mainly for filling in, or for rush delivery. The crop situation throughout the country is reported to be entirely satisfactory, and there is every reason to believe that an abundant yield will be realized unless the weather conditions are abnormal. In the industrial world there is little to report in the way of improvement. The iron and steel business is still dull, although some contracts have recently been made for structural material. Competition, however, in this line is keen, and prices are very low. Pig iron is dull, even at the low level of present prices. Orders for bars, plates and rails are very small, and the equipment manufacturers report little new business. Wage reductions are more frequently reported, and there is still talk about a sweeping cut by the United States Steel Corporation. So far strikes have not been frequent, and there seems to be a disposition on the part of wage-earners to bear their share of the present depressed condition of business. In cotton and woolen goods there is some increase of activity, especially in the yarn trade. Immediate orders for finished goods are not very much more active, but inquiries indicate that stocks are very light throughout the country. The failures for March as reported by *Bradstreet's* for the first quarter of the year 1909 are fewer than for last year, and the liabilities are lessened. During the first quarter there were 3312 failures, which is a decrease of 21 per cent over the number last year. The liabilities are 64 per cent less. Failures for the week ended April 1 were 204, against 226 the week previous, 247 in 1908, 137 in 1907, 155 in 1906 and 170 in 1905.

THE COPPER MARKET.

In spite of the very much more hopeful tone in the copper market and the recent advances in quotations, there has been in reality little improvement either in the demand or in the statistical position. The passing flurry of interest in Standard warrants in London was enough to cause the American producers to put up prices immediately and also to stimulate exports and local buying for the moment. The interest, however, was transitory and local consumers have not seriously come into the market for the very simple reason that orders for finished material continue to be distressingly light. Producers and selling agencies persistently declare that the copper situation has materially improved; possibly it has, but it does not look as yet as if the condition were one to grow hilarious over. The accumulation during the month will probably exceed that of February. The output from domestic ores will amount to about 90,000,000 lb., the imports will be near 25,000,000 lb., making a total for the month of 115,000,000 lb. The exports for the month were 42,000,000 lb. and the domestic takings at the outside were not more than 50,000,000 lb. Thus the total disposed of copper was not more than 92,000,000 lb. during the month, while the known production was 115,000,000 lb., leaving an accumulation of 23,000,000 lb. This added to the figures of the Copper Producers' Association, which are known to be ultra conservative, brings the present stock of "marketable" copper to almost the 200,000,000 lb. mark. In spite of these figures there is no movement on foot to curtail production, nor is such an effort probable unless the carrying burden becomes much heavier than it is at present. The cost of shutting down the properties of the principal producers is too great to make such a course preferable to operation at a loss. At Butte, for instance, the maintenance cost during a shut-down is estimated at $300,000 per month. On April 5, the last day under review, there was renewed pressure to sell, but only small lots were disposed of. Prices remained officially unchanged, but there is a general understanding that round lots might be secured a shade under quoted figures. The exports for March were 20,824 tons, and for the present month up to and including April 5 have been 2,144 tons. Quotations on the Metal Exchange April 5 were:

Lake	12⅜ @ 13
Electrolytic	12½ @ 12⅝
Castings	12⅛ @ 12⅜

London prices April 2 were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	57 6 3	57 7 6
Standard copper, futures	58 0 0	58 0 0
Market	Steady.	Quiet.
Sales of spot		100 tons
Sales of futures		1,000 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Castings	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

THE TARIFF RATE ON ARC-LIGHT CARBONS.—The importers of ordinary electric light carbons are, as a rule, very well satisfied with the proposed change in the tariff as contained in the Payne bill. The importers of flaming-arc carbons have, however, made a strenuous protest to Washington, claiming that the new duty will increase the rate 50 per cent, and the National Carbon Company, the only American manufacturer, has made earnest efforts to have the old tariff remain. The main imports of carbons are those for inclosed arcs, and it is claimed by the importers that the new tariff will reduce the price of these to consumers from $5 to $8 per thousand. Speaking of the change in rate, one of the most prominent of the importers said: "We will be perfectly satisfied with the new bill. It will not only open up to us competition in enclosed arcs, but it may even permit us to compete for the very cheap grade of copper-covered carbons used in open-arc lamps. Heretofore the importation of these carbons has been impossible, owing to the $9-per-thousand rate of duty. The result has been that the American consumer has been charged several times the price that would be a reasonable profit on their manufacture. Heretofore we have been unable to sell carbons for enclosed-arc lamps to any large consumers, because the carbon manufacturers in this country were always willing to cut prices on big orders below the figure at which we could import, even when we imported in double lengths. It is claimed by some that the new tariff rate will vastly increase the duty on flaming-arc and searchlight carbons. These are very high-priced materials, and, of course, 35 per cent ad valorem will amount to much more than $9 per thousand." One of the principal importers of flaming-arc lamps and carbons has written a letter to Senator Aldrich calling his attention to the hardship to the flaming-arc industry if the proposed tariff is adopted. It is pointed out that the flaming-arc industry is new in this country and that the carbons are almost all imported. The proposed tariff, it is claimed, would increase the duty 50 per cent, seriously crippling the industry without protecting any industry. It is suggested that flaming-arc carbons be made an exception in the paragraph relating to carbons and that they be put on the free list.

ELECTRICAL SUPPLIES FOR PANAMA CANAL.—The Isthmian Canal Commission will receive in Washington, up to April 15, proposals for considerable quantities of supplies for electrical transmission lines on the Panama Canal work. Lead-covered cables, all kinds of insulated wire, joints, connections, insulators, switches, lightning arresters, etc., are included in the advertisement. Full specifications will be sent upon application to the commission's purchasing department.

CROCKER-WHEELER COMPANY. — The Crocker-Wheeler Company reports that business booked during March showed improvement over the February bookings. The demand was largest for direct-current machinery. The greatest improvement was shown in motors for the printing trade and the steel industry, although all classes of business show some improvement. During the past week an order was received for 350 hp of rolling-mill motors for the West Penn Steel Company, Breckenridge, Pa., and a 250-kw direct-current machine was added to the large power plant already installed at the Northwestern Terra Cotta Company, Chicago. A 50-kw generator, to be driven by a DeLaval steam turbine, was ordered for lighting and power for the McCahan Sugar Refining Company, Philadelphia. Another large order recently booked is for 14 three-phase, 60-cycle squirrel-cage induction motors, aggregating 220 hp, for Johnson & Johnson, New Brunswick, N. J. Other recent induction motor sales are those for 160 hp of the wound rotor type for the Buffalo Copper & Brass Company, of Buffalo, and a 20-hp for the Frick Company, Waynesboro, Pa. The Eastwood Wire Manufacturing Company, Belleville, N. J., has ordered a 250-kw engine-type direct-current generator, and the Atlantic Hotel, Bridgeport, Conn., has purchased a 35-kw similar machine. A large rolling mill near Pittsburgh has placed an order for 244 hp of direct-current motors of the rolling-mill type. Other direct-current sales are those of 20 motors for the Lanston Monotype Machine Company, Philadelphia; a 75-hp motor for the W. W. Herron Lumber Company, Mobile, and six motors for the F. P. Little Electric Company, Buffalo. The Denver office of the company recently ordered a number of small 230-volt direct-current motors which will be installed in the plant of the Cox-Clark Engraving Company, Denver. The motors will be used for individual drive on engraving and electrotyping machinery as follows: A 3-hp motor driving a planer; a 1-hp motor driving a router; a 1-hp motor driving a saw; ½ hp each on a trimmer, a beveler and a tub rocker, and a ½-hp motor driving a jig-saw and drill.

AMENDMENTS TO MICA SCHEDULE.—One of the amendments to the proposed tariff bill which has been admitted by the Ways and Means Committee, provides that crude mica shall pay a duty of 5 cents per pound and 20 per cent ad valorem, and that manufactured mica shall pay a duty of 10 cents per pound and 20 per cent ad valorem. Under the present law these rates are 6 cents for crude and 12 cents for manufactured, the ad valorem duty being the same. The Payne bill proposed that the duty on mica should be 30 per cent ad valorem, which included crude mica and trimmed, or partially manufactured, mica. Mica plates to be admitted at 35 per cent ad valorem. These plates came in heretofore under the heading of manufactured mica, paying 12 cents and 20 per cent ad valorem. These proposed amendments are said to be the direct result of the urgent protests of the North Carolina mica mining interests. This section furnishes the majority of the mica mined in this country, and the mine owners claim that a duty of 30 per cent meant the destruction of their business. Importers declare that they would much prefer that the duty should be what the Payne bill proposed than what is proposed in the new amendments. They claim that the rates in the Payne bill would cheapen very materially the mica used in the electrical industries, whereas the specific and ad valorem duty proposed in the amendments will make very little difference from the present rate. The majority of the mica used in the electrical industries is, they state, of the cheaper grade, running from 12 to 25 cents per pound. Ninety per cent of this mica comes from India or from Canada. It is said that American mica is, as a general thing, unsuitable for use in electrical machinery.

WESTINGHOUSE ORDERS BETTER IN MARCH.—The orders received by the Westinghouse Electric & Manufacturing Company during the month of March are reported to have increased about 30 per cent over the previous month, thus making March the best month so far this year. None of the orders was exceptional in size. It is reported that the number of inquiries and invitations for tenders of new work are unusually large, giving every prospect for a continuous increase. Work on the $5,000,000 order from the Pennsylvania Railroad for the electrification of the New York Terminal is progressing rapidly. It is stated that within the next week or so the Pennsylvania Railroad will be ready to issue orders for the construction of the substation apparatus for Manhattan and Long Island City. As there will be several of these substations built, the electrical equipment, consisting of rotary generators, transformers and other auxiliary apparatus, will amount to considerable, all of which will add to the activity at the Westinghouse plant. The month of March has also been a very good one with the Westinghouse Machine Company. The first quarter, however, has always been considered especially good in the machinery business, because orders are then placed for early fall delivery. But while the usual increase has been noticeable, it is observed that the quota of orders this year has not been made up as heretofore by contracts received from the large consumers; on the contrary, the orders received, for March particularly, were of very ordinary size, not one being larger than $60,000.

THE ALUMINUM TRADE.—At a meeting recently held in London, the shareholders of the Aluminum Corporation, Ltd., decided to appoint a liquidator for the voluntary winding up of the company. The British Aluminum Company, Ltd., had made an offer to purchase the property and interests of the corporation, but the shareholders preferred a different method of liquidation. The Aluminum Corporation was formed in 1907, with a nominal capital of $2,500,000, and at once began to build extensive works in North Wales. Construction work was pushed and the machinery and plant were installed with a view to an output of 1000 tons of aluminum per year. The failure of the company to succeed in financing its undertaking leaves the plant in an unfinished condition. One part of the equipment of the plant that was particularly interesting was the use that had been made of aluminum for providing the large-scale electrical fittings. The activity of this company has done much to stimulate the use of aluminum for electrical purposes in England. Trade in that direction is better than it has ever been in the history of the metal. In this country there is little being done at the present time in the aluminum business. Few sales are being made, and the prices are about where they have been for the past six months, from 20 cents to 23 cents per pound. In England the price at the present time is £60 per ton or about 14.6 cents per pound.

KENSINGTON & EASTERN RAILROAD.—The Kensington & Eastern Railroad Company has been granted a franchise by the Chicago City Council authorizing it to construct and operate a four-track electric railway from 115th Street, Kensington (a suburb of Chicago), in a southeasterly direction to the south city boundary of Chicago just east of Howard Avenue. Beyond the city limits the line will be built for a short distance in Cook County, Illinois, and at the Indiana State line it will connect with the Chicago, Lake Shore & South Bend Railway, an important interurban railway extending to South Bend, Ind. The road is to be electrically operated (although steam-hauled trains may use the same tracks), and permission for overhead construction is granted. It is stipulated that in Chicago no wires shall cross any street, alley or public place at a height less than 21 ft. 6 in. above the track of the railway. The duration of the franchise is 20 years, and the rate of fare within the city limits shall not exceed 5 cents. One provision of the ordinance is that at least 80 per cent of the electric trains on it shall stop at such places within the city limits for local passengers as may be designated by the City Council, provided the distance between these stations is not less than one-quarter of a mile. At Kensington the road will connect with the suburban service of the Illinois Central.

NEW HAVEN RAILROAD PREPARES ELECTRIFICATION PLANS.—It has practically been admitted by the officials of the New York, New Haven & Hartford Railroad that preliminary work has been done on plans looking to the electrification of that division of the road between Stamford and New Haven, Conn., and the construction of an additional large power house at Naugatuck Junction, where a site has been secured. An official of the New Haven admitted in testifying in a smoke-nuisance case that such plans were under way. It is now stated that W. S. Murray, electrical engineer of the railroad, has perfected his plans for the power house, and is preparing plans for the electrification. These plans are now being considered by the officials of the road, but nothing has yet been definitely given out concerning them. At the offices of Westinghouse, Church, Kerr & Company, the engineers who constructed the power house at Cos Cob, Conn., it was said that no instructions [illegible] firm by the railroad company. It is claimed that the extensive tests which have been made upon the operation of trains by electricity have convinced the officials of the railroad that it will [illegible]

WESTERN UNION'S BUSINESS IMPROVED.—The officials of the Western Union declare that the volume of business at the present time is the largest that the company has had since the operators' strike, more than a year ago, and that it nearly equals the high record of normal periods. It is also stated that the operating ratio is lower than ever before, a condition which will materially benefit the net earnings.

NEWARK TECHNICAL LIBRARY.—The Free Public Library of Newark, N. J., has established a technical and scientific department in order to meet the needs of the working man and student. In addition to large collections of technical books and periodicals, trade catalogs are kept on file, and also the United States, English and Canadian Patent Office publications. The list of electrical books already exceeds 700 titles.

HALL SIGNAL COMPANY.—Reports made by officials of the Hall Signal Company show that the demand from the railroads and traction companies for signal equipment during the month of March was much larger than for any month since the beginning of the period of depression. The company's operations are now 50 per cent of full capacity, which is twice what it was this time last year.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market during the past week has been very much more active than during any week since the first of February, and the buoyant feeling that has been observed even during the days of dull trading became very much more prominent. Most of the active issues recorded material advances during the week, and some of them on April 5 recorded new high figures for the year. Steel common has been exceptionally strong, and the Harriman securities have been prime favorites among both speculators and investors. While the general condition commercially and industrially has not improved to a very marked degree, the impression seems to have suddenly obtained that the bottom has been reached, and that from now on only good news would be forthcoming. This sentiment, backed by the fact that railroads are increasing in earnings every week, was sufficient to make the market strong. The upward movement was no doubt started by the liberal buying of American securities in London. On more than one occasion this has been the start of an upward trend to our stock market. It is claimed that there was a considerable short interest in the Street, and that this was forced to cover, thereby adding to the upward tendency of prices. It is doubtful if there is any short interest at the present time that is serious enough to cause trouble. Political conditions in Europe during the past week were very much improved, and it is now practically assured that there will be no Balkan war. This in itself has a strengthening influence in our market. The money market remains very strong, both in this country and in Europe. There seems to be an abundance of cash in the banks on both sides of the ocean, and rates for first-class loans continue to be very low. The gold shipments of this country to Europe during the past year have amounted to about the same amount as was drawn from Europe immediately subsequent to the panic of 1907. Imperial banks abroad are particularly strong in gold, and this country has all that it requires. The bond market, while not as active as formerly, is still very satisfactory, and several issues that were put out during the past week were immediately subscribed. Rates for money April 5 were: Call 1½ @ 2 per cent, 90-days 2½ per cent. The quotations in the table are those of the close April 5.

NEW YORK.

	Mar. 27.	Apr. 3.	Shares Sold.		Mar. 27	Apr. 3.	Shares Sold.
Allis-Ch.	14⅜	15⅛	7,850	Int.-Met., pfd..	40	43⅞	94,100
Allis-Ch., pfd...	45⅞	47⅜	9,850	Mackay Cos...	73⅛	74¼	830
Amal. Cop. ...	74⅜	77⅛	103,260	MackayCos.,pfd.	71¼	71	1,535
Am. D. T.....	35*	29*	——	Manhattan Elev.	144	144*	363
Am. Loc.	54¼	56	10,100	Met. St. Ry....	25*	25	200
Am. Loc., pfd..	114*	114⅜*	200	N.Y. & N.J.Tel.	117¼*	119½	305
Am. Tel. & Cbl.	76½*	76*	100	Steel, com.....	47⅛	51½	743,725
Am. T. & T....	132¼	131⅞	28,000	Steel, pfd.....	112⅜	113⅞	26,070
B. R. T.....	74⅝	77⅛	142,470	W. U. T.....	66⅞	67	1,100
Gen. Elec.	157½	159⅝	5,000	West'h., com...	83⅛	84½	5,007
Int. Met., com .	13	14⅞	33,750	West'h., pfd..	115*	115*	——

PHILADELPHIA.

	Mar. 27	Apr. 3.	Shares Sold.		Mar. 27.	Apr. 3.	Shares Sold.
Am. Rys.	45¾	46	——	Phila. Elec. ...	11⅞	11¾	——
Elec. Co. of A.	12½	12½*	——	Phila. R. T....	28⅞	29⅞	——
Elec. Stor. B'ty	46½	44¾	——	Phila. Traction.	92¾	92½*	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	54⅞	55⅛	——

CHICAGO.

	Mar. 27	Apr. 3.	Shares Sold.		Mar. 27.	Apr. 3.	Shares Sold.
Chi. City Ry...	187*	187*	——	Chi. Tel. Co...	132½	133*	——
Chi. Rys., Ser.1.	110*	110*	——	Met. El., com..	19*	19*	——
Chi. Rys., Ser.2.	40¾*	41*	——	National Carbon.	84½*	84	——
Com. Edison...	111½	112*	——	Nat. Carb., pfd.	119*	119*	——
Chi. Subways ..	27½	27½*	——				

BOSTON.

	Mar. 27	Apr. 3.	Shares Sold.		Mar. 27	Apr. 3.	Shares Sold.
Am. Tel. & Tel.	132⅛	131⅞	——	Mex. Tel.	23¼	23	——
Cum. Tel.	126¼	128*	——	Mex. Tel., pfd.	65*	65*	——
Edison El. Ill..	254	258¼	——	N. E. Tel.	132½	132½	——
Gen. Elec.	158	160	——	W. Tel. & Tel.	5*	5*	——
Mass. Elec. Ry.	5	4¾	——	W. T. & T., pfd	75	75	——
Mass. E. R., pfd	72½	72¼	——				

*Last price quoted.
Shares sold are for week March 29 to April 3.

DIVIDENDS.

Brooklyn City Railroad Company, quarterly, 2½ per cent, payable April 15.

Cincinnati, Newport & Covington Light & Traction Company, preferred, quarterly, 1¼ per cent; common, ⅞ per cent, both payable April 15.

Mexican Light & Power Company, quarterly, 1 per cent, payable April 15.

Radio Telephone Company quarterly, 1 per cent, payable April 15.

Southern New England Telephone Company, quarterly, 1¼ per cent, payable April 15.

INTERNATIONAL SMELTING & REFINING COMPANY.—The organization of the recently incorporated International Smelting & Refining Company has been effected by the election of John D. Ryan, president, and Dennis Sheedy, Denver, vice-president. In addition to these the following directors were elected: Urban H. Broughton, Charles E. Brooker, Thomas F. Cole, Adolph Lewisohn, E. C. Converse, Thomas Morrison, of Pittsburgh; C. A. Congdon, of Duluth; Charles H. Sabin, Denver; William D. Thornton and Charles F. King. J. W. Allen was elected secretary and treasurer. The authorized capital stock of the International company is $50,000,000, but only $10,000,000 will be issued at the present time. The company has purchased from the United Metals Selling Company the refinery operated at Perth Amboy, N. J., under the title of the Raritan Copper Company. This is the largest refinery of its kind in the world and has a capacity of 26,000,000 lb. per month. A new smelter is being constructed by the company in Utah which will be in operation by Jan. 1, 1910, and will have a capacity, to start with, of 2000 tons a day. This smelter will be built on the plan of the Washoe smelter and will be a direct competitor of the Garfield plant of the American Smelting & Refining Company.

MANHATTAN TRACTIONS EARNING CHARGES.—The report recently published by the Public Service Commission concerning the operation of the traction lines in Manhattan, for the quarter ended Dec. 31, 1908, shows that the surface systems, Metropolitan, Third Avenue, Second Avenue, etc., have earned while in the receivers' hands a surplus in excess of fixed charges and taxes. The last quarter of the year is not one of the best, but the receivers have operated the roads so successfully that the lines are able to pay their way. Metropolitan Street Railway earned $3,277,273 gross for the quarter, and the net earnings, after paying operating expenses, were $819,807. After paying taxes and interest on the bonded debt there was a surplus, but not sufficient to pay the high rentals upon their properties. The Third Avenue Railroad, after paying taxes, interest and rentals, had on hand $205,721.

CANADIAN WESTINGHOUSE COMPANY.—The annual report of the Canadian Westinghouse Company, Ltd., for 1908, shows net earnings of $320,377, a decrease of $106,676 from the previous year. The loss was comparatively less than that of many American manufacturing plants in similar lines and the company was able to pay its regular 6 per cent dividend on an increased capital stock and show a net surplus at the end of the year of more than $40,000. At the annual meeting the old board of directors was re-elected and subsequently the following officers were chosen: President, George Westinghouse; first vice-president, L. A. Osborne; third vice-president and general manager, Paul J. Myler; secretary, John H. Kerr.

CHICAGO & MILWAUKEE ELECTRIC FINANCING.—A special committee of Chicago & Milwaukee Electric bondholders has formulated a plan for raising $500,000 which is needed urgently to protect the property and its franchises. The plan provides for the retirement of the existing $5,000,000 of bonds by a preferred stock issue and the issue of $700,000 mortgage bonds, bearing 5 per cent, to run 20 years. Holders of 1919 and 1922 bonds would get the first preferred stock at the present market values of their holdings, 84 and 60, respectively, and the balance of the face value in second preferred stock. Common stock to the amount of $5,000,000, without voting power, but with power to retire the preferred at par and accrued dividends, would be issued for the present stock on a basis of 1 to 5 for the preferred and 1 to 3 for the common.

BROOKLYN RAPID TRANSIT EARNINGS.—The daily earnings of the Brooklyn Rapid Transit Company are reported to be increasing at the rate of from $3,000 to $5,000 over those of a year ago. Notwithstanding this the gross returns for the first eight months of the fiscal year show a falling off of almost $400,000, while the company paid $258,000 more in taxes. The operating expenses have been cut, however, to such an extent that there remains a slight improvement in net. President Winters declares that the improvement in the short-haul business of the company since the opening of the Belmont tunnel to Atlantic Avenue has more than offset the loss in through business.

KANSAS CITY, OZARKS & SOUTHERN RAILWAY.—The new electric freight and passenger line, known as the Kansas City, Ozarks & Southern Railway, that is now being constructed from Springfield, Mo., to Mansfield, Mo., on the St. Louis & San Francisco line, has been sold to St. Louis capitalists. Work was suspended on the property in January after about seven miles of roadbed had been completed. The new owners will push the construction to completion. Orders have been placed already for rails and cars. It is proposed eventually to extend the line to the lead and zinc mining districts of northern Arkansas.

RIO DE JANEIRO TRAMWAY.—The Rio de Janeiro Tramway, Light & Power Company, which is owned principally by Canadians, will ask its shareholders for authority to increase the capital stock from $25,000,000 to $40,000,000. It is intended to issue only a portion of the new stock at the present time. The immediate issue will probably amount to $6,250,000, which has already been underwritten at par. The earnings of the company for February were $434,044, an increase over the same month last year of $39,140.

FONDA, JOHNSTOWN & GLOVERSVILLE RAILROAD.—The Public Service Commission of the Second District of New York has approved the application of the Fonda, Johnstown & Gloversville Railroad Company for an increase of its capital stock from $2,500,000 to $3,000,000. The company is empowered to issue 5000 shares of preferred stock at par. One condition of the permit requires that all the property now held by the Sacandaga Park Company shall be transferred to the railroad company.

NEW BEDFORD STREET RAILWAY.—The Union Street Railway Company, of New Bedford, Mass., has petitioned the railroad commissioners for authority to issue $100,000 new bonds, and also to increase the capital stock by $225,000. The proceeds of these new issues are to be used in paying off the floating debt and for improvements. It was voted that the price at which the new shares shall be offered to the stockholders is $140 for each share of the par value of $100.

CHICAGO ELEVATED RAILWAY TRAFFIC.—The Northwestern Elevated Railway, of Chicago, made another large increase in its traffic in March, compared with the corresponding month last year, owing principally to the extension of its operating mileage. This increase amounts to nearly 13 per cent. The South Side Elevated reports a very slight increase for March, 1909, compared with the corresponding figures of a year ago.

MILLERSBURG LIGHT, HEAT & POWER COMPANY.—At a recent meeting of the Millersburg (Pa.) Light, Heat & Power Company Dr. Marion Ulrich was elected president; E. H. Leffler, secretary and treasurer, and Frank H. Kirk, general manager. During the past year the company has installed two S. Morgan Smith waterwheels of 100 hp each and has practically reconstructed its power house.

ILLINOIS CENTRAL ELECTRIFICATION PLANS.—The officials of the Illinois Central Railroad have transmitted estimates to the representatives of the city of Chicago showing that the cost of electrification of the road's suburban service would amount to $8,000,000. In the report of the officials no mention was made of E. H. Harriman's suggestion that the city pay one-half the expense.

NASSAU LIGHT & POWER COMPANY.—The Public Service Commission of the Second District of New York has authorized the Nassau (County) Light & Power Company to issue first mortgage bonds to the amount of $80,000. The bonds are to be sold for not less than 90 and the proceeds are to be used to pay the floating debt of the company and to make improvements and extensions.

MARCONI WIRELESS COMPANY'S REPORT.—The balance sheet of the Marconi Wireless Telegraph Company of America shows assets of $6,090,000, against $6,079,444 the previous year. The liabilities of the company are nominal. The lack of improvement in the company's earnings is attributed to the falling off in steamship travel during the recent period of depression.

NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY.—The statement of the New England Telephone & Telegraph Company for the year 1908 shows gross earnings of $11,259,130, an increase of $579,504. The net profits were $2,560,413, an increase of $394,210. The surplus for the year was $2,360,413, an increase of $194,210.

COMMERCIAL CABLE COMPANY.—The Commercial Cable Company, the cable operating subsidiary of the Mackay companies, has issued a balance sheet dated Dec. 31, 1908. This balance sheet shows total assets of $51,431,270; the balance in cash in bank is shown to be $1,508,387, and the reserve fund to be $6,922,882.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American District Telegraph Company:					
Year 1908	[illegible]	[illegible]	785,882	398,088	[illegible]
Year 1907	[illegible]	2,304,214	712,960	396,889	316,061
Bell Telephone Company, of Buffalo:					
Year 1908	1,723,430	1,070,382	[illegible]	487,362	163,595
Year 1907	[illegible]	[illegible]	636,969	[illegible]	162,555
Binghamton (N. Y.) Light, Heat & Power Company:					
Year 1908	[illegible]	[illegible]	[illegible]	[illegible]	30,428
Year 1907	[illegible]	[illegible]	68,924	[illegible]	39,630
Canadian Westinghouse Company, Ltd.:					
Year 1908	[illegible]	[illegible]	320,377	[illegible]	40,440
Year 1907	[illegible]	[illegible]	[illegible]	[illegible]	111,832
Illinois Traction Company:					
February, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
February, 1908	[illegible]	183,368	[illegible]	[illegible]	[illegible]
Georgia Railroad Company:					
February, 1909	[illegible]	178,718	[illegible]	59,478	[illegible]
February, 1908	[illegible]	[illegible]	[illegible]	58,244	[illegible]
Mexican Telephone & Telegraph Company (Mexican currency):					
Year ended Feb. 28, 1909	[illegible]	148,575	[illegible]	[illegible]	[illegible]
Year ended Feb. 29, 1908	[illegible]	[illegible]	209,367	[illegible]	[illegible]
Montreal Street Railway Company:					
February, 1909	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
February, 1908	[illegible]	201,140	68,775	[illegible]	[illegible]
New England Telephone & Telegraph Company:					
Year 1908	[illegible]	8,898,717	2,360,413	[illegible]	[illegible]
Year 1907	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Portland (Ore.) Railway, Light & Power Company:					
February, 1909	[illegible]	[illegible]	187,625	[illegible]	[illegible]
February, 1908	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

*Deficit

GENERAL NEWS

Construction News.

MONTGOMERY, ALA.—The City Council is considering a proposition submitted by engineers representing the General Electric Company and H. R. Worthington for the installation of an electric pump with a capacity of 8,000,000 gal. and an electrically operated air lift for water in wells. It is proposed to install the electric pump independent of the present plant, to be connected with both the steam power plant and station at Tallassee of the Montgomery Light & Water Power Company. This plan is proposed instead of the installation of new boilers at the old steam plant, and it is estimated that the cost will be but little over $12,000, the estimated cost for installation of boilers.

VETO, ALA.—The Alabama holdings of the Morgan County Telephone Company were sold at Veto, March 13, to the bondholders of the company for about $131,000. The company owns long-distance lines and franchises extending from Birmingham, Ala., to Indianapolis, Ind.; also extensive system in Kentucky, Indiana, Ohio and other Northern States. The company will continue to operate its Alabama system.

WEST BLOCTON, ALA.—A company is being organized to develop a water power of from 75 to 100 hp, to be utilized to generate electricity for transmission from three to eight miles. E. D. Reynolds is interested in the project.

BEEBE, ARK.—Plans are being considered by local capitalists to install an electric light plant in Beebe.

CAMDEN, ARK.—The proposition to establish a municipal electric light plant in Camden is under consideration.

EUREKA SPRINGS, ARK.—The City Council has granted a franchise to the Greenwood & Winona Party Telephone Company to erect a telephone system in Eureka Springs.

MONTAGUE, CAL.—The Siskiyou Electric Power & Light Company is receiving copper wire at Montague, Cal., for its new 60-mile transmission line, work on which will begin immediately, and will probably be completed from Fall Creek to Session and Dunsmuir during the coming summer. The object of the company is to serve the county and to furnish electricity for lamps and motors, and especially for the installation of pumping plants. It is expected that the line will be extended to Redding and connect with the lines of the Northern California Power Company. The new power line to Dunsmuir will connect with the present line at Montague by a cross-line. J. W. Churchill is president.

NEVADA CITY, CAL.—Arrangements have been completed by the management of the Pittsburg-Cold Flat Potosi group of mines for the installation of electrical power.

OAKLAND, CAL.—The Central Oakland Light & Power Company, recently incorporated, has purchased a site for its plant on Alice Street. The company will supply electricity for lamps and motors and steam heat and power in Oakland and other cities and towns. A. M. Hunt and James Fisher, of Berkeley, and others are interested in the enterprise.

REDDING, CAL.—The incorporation of the Sacramento Valley Power Company has been made to merge the Shasta Power Company and the Northern Light & Power Company. Though competitors in the same field, the Shasta Power Company and the Northern Light & Power Company have their lines so connected as to supply each other's system with electric power in case of emergency. The Shasta Power Company has a power plant on Snow Creek, 28 miles east of Redding, and valuable water rights at the base of Mount Lassen. Its power lines cover the city of Redding. The Northern Light & Power Company's power plant is located on Old Cow Creek and also furnishes electricity in Redding.

SACRAMENTO, CAL.—The Board of Trustees has awarded the contract for furnishing and installing the pumps and apparatus for the municipal water plant to the Dowk Gas Engine Company for $5,600. The pumps can be operated by either steam or electricity.

SACRAMENTO, CAL.—Application has been made to the Board of Supervisors by the Central California Traction Company for a franchise to construct and operate an electric railway from Thirty-first and Y streets to Sacramento Avenue in Oak Park, thence to Magnolia Avenue, and to the Upper Stockton Road, and along the latter a distance of 1½ miles to a point where the company has a private right of way to Stockton. The company proposes to build an electric railway between Sacramento and Stockton. Later the system will be extended south through the San Joaquin Valley. George W. Peltier is interested in the company.

SAN DIEGO, CAL.—The San Diego Southern Railway Company has filed amendments to its charter increasing its capital stock to $5,000,000 with provision to construct an electric railway to Los Angeles at any future time, should conditions warrant it. The company is contemplating the construction of a railway to La Jolle.

SAN JOSE, CAL.—The San José Railway Company is making arrangements to rebuild its entire street railway system from narrow to standard [illegible] of track. J. L. Barker is [illegible]

SANTA BARBARA, CAL.—The Pacific Improvement Company has petitioned the City Council for a franchise for permission to construct a transmission line to the Hope Ranch, four miles west of the city. It is said that the company contemplates installing a "trackless trolley" to the ranch.

SANTA CRUZ, CAL.—The Coast Counties Electric Light & Power Company is extending its transmission line from Watsonville to Logan eight miles distant, where it will furnish electricity to the quarry of Granite Rock Company. The Granite company is now using steam power and has contracted with the electric company for 200 hp.

TRINITY CENTER, CAL.—The electric power plant connected with the Bonanza King Mine was recently destroyed by fire, causing a loss of about $65,000. The plant furnished electricity to operate a stamp mill and to light the mine. It is said that the mine and mill will be closed down until the plant is rebuilt.

WHEATLAND, CAL.—The Board of Trustees has awarded the contract for a 500-gal. pump and a 50-hp motor for the municipal water works system to the Abner Doble Company for $2,000.

DENVER, COL.—The Denver, Colorado Springs & Pueblo Interurban Electric Railroad Company, recently incorporated to construct an electric railway from Denver to Pueblo, a distance of 120 miles, is planning to construct the section between Denver and Colorado Springs, 75 miles in length. The power station and repair shops will be located in Denver. Arthur E. Van Dusen is secretary.

WASHINGTON, D. C.—The Washington, Spa Spring & Gretta Railroad Company has filed a mortgage to secure an issue of $500,000 in bonds to construct its proposed electric railway from Fifteenth and H streets, N. E., to Berwyn Heights and Laurel, Md., a distance of about 18 miles. James C. Rogers and others are interested.

WASHINGTON, D. C.—Bids will be received until April 13 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the various navy yards and naval stations the following supplies: New York, N. Y., Schedule 1077, electrical supplies, semaphores; Schedule 1083, steel tubing, etc.; Schedule 1095, electrical wire. Bids will also be received at the same place until April 20 as follows: Brooklyn, N. Y., Schedule 1053, seven wireless telegraph outfits, complete. Applications for proposals should designate the schedule desired by number.

DE FUNIAK SPRINGS, FLA.—The citizens will vote April 15 on the proposition to issue $10,000 in bonds, the proceeds to be used to establish an electric light system.

PANAMA SPRINGS, FLA.—The citizens are considering the question of establishing an electric light plant and water-works system.

STARKE, FLA.—The City Council has decided to make improvements to the municipal electric light and water plant, which will include the installation of the following machinery: One 100-kw generator; 150-hp boiler, engine, etc. The cost of the work is estimated at $12,000. William R. Collier, of Atlanta, Ga., is consulting engineer, and W. L. Wall, superintendent.

AUGUSTA, GA.—Contracts have been awarded for the construction of the buildings for the Manchester Cotton Mills and the Unity Cotton Mills; the first named will be equipped with 20,000 spindles and 500 looms for the manufacture of cotton cloths, at a cost of about $450,000. The new building of the Unity mill will be known as No. 2 mill and the equipment will include 10,000 spindles and will be operated by electricity. Fuller E. Callaway is president of the Manchester Cotton Mills and treasurer of the Unity Cotton Mills.

CONYERS, GA.—The State Railroad Commission has granted the Panola Light & Power Company permission to issue $25,000 in bonds and $25,000 in capital stock, making the total stock issue $50,000.

DAWSON, GA.—Telephone exchanges at Cuthbert, Fort Gaines, Edison and Shellman have recently been purchased by Dr. J. G. Dean for approximately $30,000, including long-distance lines between all of the towns named. A number of improvements will be made.

FITZGERALD, GA.—Preliminary surveys have been completed for the proposed electric railway between Fitzgerald and Ocilla, 12 miles in length. The company expects to be ready to award contracts for construction of the road by May 31. The power station will be located on Lake Beatrice between the two cities. The plant will also supply electricity for lamps. A. Holtzendorf, of Fitzgerald, is secretary and general manager. The General Engineering & Contracting Company, of New York, N. Y., has charge of the engineering work.

KOOSKIA, IDAHO.—The Kooskia Milling & Power Company is said to be contemplating the installation of a lighting plant.

CHICAGO, ILL.—The Chicago & Milwaukee Electric Railroad Company, it is reported, will soon commence work on improvements to its system, which will include the installation of additional equipment in its power station at Highland, Ill.

CHICAGO, ILL.—The Commonwealth-Edison Company has awarded contracts for the construction of two substations to the E. P. Strandberg

ompany for $54,000. One of the stations will be located at Grand Cross- ng and the other at 9345-51 South Chicago Avenue.

STEWARD, ILL.—The Village Council has granted E. T. Beitle a anchise to construct and operate an electric light plant and water-works ystem in Steward. It is said that Mr. Beitle will install a plant at a cost $10,000 with sufficient output to supply electricity for 400 lamps. Con- acts for machinery and material have already been placed.

CLOVERDALE, IND.—The Town Board has decided to establish a unicipal electric light plant in Cloverdale.

CROWN POINT, IND.—Arrangements are being made by the Gary & outhern Traction Company to commence work on construction of its roposed electric railway. The railway will connect Gary and Crown oint, a distance of about 12 miles. The company has not yet decided pon the location of the power house. H. W. Seaman, The Rookery, hicago, Ill., is president.

ELKHART, IND.—The St. Joseph Valley Traction Company, which s constructed a 20-mile section of its railway, which is to connect lkhart, Bristol, Middleburg, Shippsman and Lagrange, contemplates an xtension into Elkhart this year, a distance of 15 miles; also to connect ith the Toledo & Western Railroad on the east at Pioneer, a distance of miles. Gasoline motor cars will be operated at first, and later the ilway will be equipped to be operated by electricity. The company is pitalized at $700,000. H. E. Buckley, 275 Michigan Avenue, Chicago, , is president, and R. Jones, of Lagrange, is manager.

FORT WAYNE, IND.—Preparations are being made by the Ft. Wayne efrigerator Company to enlarge its plant to take care of its increasing siness. The improvements will include an electro-galvanizing plant d a nickel plating department.

HOBART, IND.—We are informed that the Gary, Hobart & Valparaiso raction Company is planning to commence work on its proposed electric ilway in April. The railway will be 17.5 miles in length and will connect e cities named in title. Blake A. Mapledoram is chief engineer.

KNIGHTSTOWN, IND.—The Reliance Engineering Company, of Cin- nnati, Ohio, has made an investigation of the municipal electric light ant and has recommended changing some of the single-phase, 125-cycle namos for three-phase, 60-cycle machines.

ROSSVILLE, IND.—Arrangements are being made by the Rossville ght & Heat Company for the installation of a light and heating plant Rossville. James E. Silverthorn is president and James R. Crouse is ecretary of the company.

SOUTH BEND, IND.—Preliminary arrangements are being made by e Central Union Telephone Company for improvements and extensions its system in South Bend, which will involve an expenditure of about 00,000.

COUNCIL BLUFFS, IA.—The Nebraska-Iowa Long Distance Tel- hone Company has taken over the system of the Mills County Tel- hone Company. The new company contemplates large extensions to toll lines and will build an exchange at Neola.

DES MOINES, IA.—The Iowa Telephone Company, it is said, has cided to expend $1,000,000 in repairs and extensions to its system.

KEOKUK, IA.—The Keokuk Electric Railway & Power Company is id to be in the market for a 1200-kw generator to supply electricity for ilway service. A. D. Ayres is manager.

MARSHALLTOWN, IA.—The plant of the Petersen Heat, Light & ater Company has been ordered to be sold at a sheriff sale by Judge B. Bradshaw, of the United States District Court. N. M. Hawkins as appointed receiver for the company at the request of the Iowa Heat- g Company, of Oskaloosa. The sale is ordered to pay the cost of the ceivership, aggregating $ [illegible]

MILTON, IA.—Plans are being made to organize a company to be pitalized at $10,000 to install an electric light plant in Milton.

MUSCATINE, IA.—The Citizens' Railway & Light Company contem- ates increasing the output of its plant and expects to award contracts ring the next two months for a steam turbine and generator. F. M. alker is manager.

CLAFLIN, KAN.—Contracts have been awarded to E. R. Rack for e construction of an electric light plant and equipment which will clude a 25-hp Weber gasoline engine and a Western direct-current nerator.

EUREKA, KAN.—The local electric light plant has been purchased by D. Henderson and Mr. Seamonhorn. The new owners will install w machinery in the plant and rebuild the transmission lines this spring. D. Henderson is manager.

NELLERSON, KAN.—Arrangements are being made by the Nelson elephone Company to construct a new telephone exchange building. A w switchboard will be installed and the entire system overhauled. Leroy Sandy is manager.

FRANKLINTON, LA.—The Washington Lumber Company has made application to the City Council for a franchise to install an electric light plant. George S. Lucy is manager of the company.

BETHEL, MAINE.—Work on the construction of the new hydro-electric power plant of the Bethel Electric Light & Power Company, for operating the plant will be purchased from the Maine Sprague Power Co.

BRUNSWICK, MAINE.—The Brunswick Electric Light & Power Company is building a new hydro-electric power station, which will be equipped with three 300-kw generators. V. Bagley is superintendent.

CALAIS, MAINE.—The International Power Company has made application to the New Brunswick Parliament for a charter. The company proposes to construct a dam on the St. Croix River half way between Baring and Woodland, where a site has been secured. The water power will be utilized to generate electricity, which will be used for commercial purposes. The company also proposes to construct an electric railway from St. Stephen to a point near Sprague's Falls on the New Brunswick side of the dam. George A. Curran and I. R. Todd are interested in the project.

PRESQUE ISLE, MAINE.—The Aroostook Valley Railroad Company contemplates building an electric railway during the coming summer from Presque Isle and Washington, with extensions later to Wade Plantation, Mapleton, Perham and Ashland.

PRESQUE ISLE, MAINE.—The Maine & New Brunswick Electrical Power Company has been granted permission by the State Legislature to extend its transmission lines to connect with the electric systems of Tracy's Mills, Centreville, Florenceville, East Florenceville, Bristol, Bath and Hartland, N. B. A. R. Gould is manager.

CAMBRIDGE, MD.—The Cambridge Gas Company and the Dorchester Electric Light & Power Company have been consolidated. The new company is capitalized at $100,000, and the following officers elected: E. C. Harrington, president; John G. Mills, secretary, and E. C. Dillon, treasurer.

BOSTON, MASS.—Bids will be received until April 26 at the U. S. Engineer Office, Boston, Mass., for furnishing boilers, engines, generators, electric cable and switchboards. Information and blank forms may be obtained on application to the U. S. Engineer Offices, at Boston, Mass.; Seattle, Wash.; Portland, Ore., and San Francisco, Cal.

NEW BEDFORD, MASS.—The Union Street Railway Company has applied to the Railroad Commissioners for permission to issue $100,000 in bonds and also to increase its capital stock by $250,000, the proceeds to be used to pay floating indebtedness and for improvements.

NEW MILFORD, MASS.—The New Milford Fire Association has authorized C. M. Beach, president, to enter into a contract with the Electric Light Company under the terms of which the company agrees to install 21 new lamps within four months.

NORTH ADAMS, MASS.—Arrangements are being made to enlarge the Blackinton Mills. A power plant to furnish electricity for lamps will be installed, to be operated by water power. An auxiliary steam plant will be provided.

OXFORD, MASS.—The Selectmen are contemplating replacing the arc lamps on Main Street with 80-cp tungsten lamps. The Webster & Southbridge Gas & Electric Company has the contract for street lighting.

SHELBURNE FALLS, MASS.—The Shelburne Falls Electric Light & Power Company has reduced the price of electricity for lamps from 20 cents to 15 cents per kw-hour.

SPRINGFIELD, MASS.—The United Electric Light Company is planning to place its wires underground along about four miles of streets in this city this year, which will involve an expenditure of about $40,000. The company will also erect a special power circuit to Brightwood.

SPRINGFIELD, MASS.—Under the terms of the new contracts made by the street lighting committee with the United Electric Light Company the city will save about $23,000 during the next five years. The price for furnishing electricity for lamps for the municipal buildings has been reduced from 9¼ cents to seven cents per kw-hour, and for motors from 4 8-10 cents to three cents per kw-hour. The rate for arc lamps served by underground conduits has been reduced from $85 to $83 per lamp per year, and for overhead circuits from $73 to $71.50 each per year, and incandescent lamps $15 per lamp per year. Under the new contract the present 40-cp incandescent lamps are to be replaced with lamps of 60 cp, the company agreeing to supply the poles. The contract calls for not less than 1000 arc lamps. The charge for incandescent lamps served by underground conduits will be $20 per lamp per year.

SUDBURY, MASS.—At the annual town meeting a committee, consisting of Waldo L. Stone, Frank F. Gerry and I. Stanley Rice, was appointed to consider the question of establishing an electric lighting system in the town.

WORCESTER, MASS.—Contracts have been awarded by the Spencer Electric Company for the construction of another building, which will be used for general manufacturing purposes. The machinery will be operated by electricity and the company [illegible] the necessary electric equipment later. A new tempering building and large power plant is now under construction.

GRAND RAPIDS, MICH. [illegible]

[illegible] Power Co.

HILLSDALE, MICH. [illegible] ments to the municipal electric light plant which will involve an ex- [illegible]

INTERNATIONAL FALLS, MINN. [illegible] Company [illegible] Co. of New York, N. Y.

about ... by ... Provision will be made to install another unit later. The plant will furnish power to a large paper mill and other manufacturing plants. It is expected to have the plant in operation by June 1, 1909.

OWATONNA, MINN.—The Public Service Operating Company is planning to rebuild its electric light plant.

GRENADA, MISS.—The question of issuing $5,000 in bonds for improvements to the water and light plant will be submitted to a vote of the people. S. T. Tatum is mayor.

JACKSON, MISS.—The Mississippi Home Telephone Company has been granted permission by the Alabama & Vicksburg Railroad Company to construct a telephone line along the railroad company's right of way from Jackson to Meridian.

MERIDIAN, MISS.—W. F. Wilcox, manager of the municipal waterworks system, has submitted to the City Council a report showing that an electric light plant can be installed in connection with the water-works system at a cost of $75,000. The estimate is based on a plant with sufficient output to supply 500 arc lamps and sufficient incandescent lamps to light the municipal buildings. The proposed plant will not furnish electricity for commercial or residential lighting.

NEWTON, MISS.—Plans and specifications are being prepared by Xavier A. Kramer, electrical engineer, Magnolia, Miss., for a municipal electric light plant in Newton. The plant will have an output of 75 kw.

SENATOBIA, MISS.—The Board of Aldermen is contemplating the extension of the electric lighting system.

CASSVILLE, MO.—It is reported that work has commenced on equipping the Cassville & Western Railway to be operated by electricity. The railway is five miles in length and connects Cassville with Exeter, and is now operated by steam. The company, it is said, contemplates extending the railway to Carthage, Mo., and also to Eureka Springs, Ark. Water power on the White River will be developed to generate electricity for the road. The company, it is said, will erect a power house in Cassville.

KANSAS CITY, MO.—The Kansas City, Ozark & Southern Railway has been sold to St. Louis capitalists. The company is building an electric and passenger railway from Mansfield to Ava, work on which was suspended in January. The new owners propose to complete the road at an early date, and it is also proposed to extend the line to the lead and zinc mining district of North Arkansas. Orders have been placed for rails and cars.

KANSAS CITY, MO.—Arrangements are being made by the Interstate Railway & Power Company to commence construction work in May on the Iola-Chanute division and also the section between Lawrence, Kan., and Kansas City, Mo., of its proposed electric railway. The road when completed will be about 300 miles in length. The present plans call for the construction of two power plants, the main station to be located at Chanute and a smaller one at Lawrence, Kan. The company also proposes to furnish electricity for lamps and motors. This company is successor to the Southern Kansas Railway, Light & Power Company, of Chanute, Kan. R. C. Rawlins, of Kansas City, Mo., is president and general manager.

MOBERLY, MO.—It is stated that the citizens of Moberly and Huntsville have accepted the proposition made by Messrs. Manning and Wellman, of Ottuma, Ia., to build an electric street railway in Moberly, and an interurban railway between Moberly and Huntsville, at a cost of $100,000. Moberly is to give a bonus of $30,000.

ST. JOSEPH, MO.—The Interstate Railway Company and the Missouri River & Cameron Railway Company have applied to the county court for rights of way for their proposed electric railways between St. Joseph and Kansas City. The Interstate Railway will be equipped with the third-rail system, while the Missouri River & Cameron Railway is a combination electric and steam railway and will use the overhead trolley system. Joseph A. Corby is president of the Interstate Railway Company.

SPRINGFIELD, MO.—Plans are being made by the Ozark-Bell Telephone Company for extensive improvements to its system, which will consist mainly of placing its cables underground. The cost of the work is estimated at $55,000.

OMAHA, NEB.—The Western Shore Electric Railway Company has applied to the City Council for a 50-year franchise to operate a street railway over Calhoun road and the river road, and certain streets which will connect the two roads.

OMAHA, NEB.—The County Commissioners have granted the Nebraska Traction & Power Company a franchise to cross certain public roads. The company proposes to build an electric railway from Omaha to South Omaha, Ralston and Papillion, about 6.5 miles in length.

ALLENHURST, N. J.—It is understood that a bill is being prepared to be presented to the State Legislature asking for permission to sell the Allenhurst municipal electric light plant to the Atlantic Coast Electric Light Company. The borough has operated a municipal plant for some years, but it is said that enterprise has proven a failure. James M. Ralston is mayor.

BLOOMFIELD, N. J.—Arrangements are being made for the construction of a large plant for Scott & Bowne, of New York, N. Y., in Bloomfield, which will include the construction of a power plant with an output of ... hp.

EGG HARBOR, N. J.—The plant and holding of the Atlantic Coast Electric Company in Egg Harbor have been purchased by the Enterprise Gas Company, of the place, for a consideration of $...

PERTH AMBOY, N. J.—The Merchants' Progressive Association has been formed for the purpose of securing a better illumination of Seventh Street.

WILLIAMSTOWN, N. J.—The citizens are considering the question of establishing an electric light plant and water system.

AZTEC, N. M.—It is said that the irrigation project proposed by the Turley Ditch Company, recently incorporated, with a capital stock of $600,000, will require the construction of a power plant on the San Juan River, near the Colorado line.

BATAVIA, N. Y.—The project of constructing the Genesee & Orleans Railway from Batavia to North Orchard Harbor, on Lake Ontario, a distance of 30 miles, has been revived and plans are being made to commence construction work this summer. George W. Mische, of Rochester, N. Y., is interested in the project. The road will be operated by electricity transmitted from Niagara Falls.

BROADALBIN, N. Y.—The Broadalbin Electric Light & Power Company contemplates extending its transmission lines into the farming districts. J. B. Crane is manager.

BROOKLYN, N. Y.—The contract for installing electric equipment in new Public School 162 has been awarded to E. J. Duggan for $8,440. C. B. J. Snyder is superintendent school buildings.

BROOKLYN, N. Y.—Bids will be received by Bird S. Coler, president Borough of Brooklyn, Borough Hall, Brooklyn, N. Y., until April 14 for furnishing all labor and materials required for constructing motor pit, shaft tunnel and drainage structures and appurtenances, complete, for the power plant for Gowanus flushing tunnel at the head of Gowanus Canal, Borough of Brooklyn. Blank forms and further information can be secured and plans and drawings may be seen at the office of the Bureau of Sewers, 215 Montague Street, Brooklyn.

NEW YORK, N. Y.—Bids will be received until April 16 by Allen N. Spooner, Commissioner of Docks, Pier "A," foot of Battery Place, North River, New York, for furnishing all labor and materials required for installing mechanical and electrical equipment on Piers Nos. 53, 54, 56, 57, 58, 59, 60, 61 and 62, North River, between Bloomfield and Twenty-second streets, on the Chelsea section, in the Borough of Manhattan. Blank forms and further information may be obtained and plans and drawings may be seen at the above office.

CENTRAL ISLIP, N. Y.—Morris Kantrowitz, of Albany, N. Y., has been awarded the contract for the construction of the building to be erected at the Central Islip State Hospital, Central Islip, for $103,700. The contract includes the installation of two horizontal tubular boilers, engine, generator and switchboard, which will be purchased by the contractor.

GLOVERSVILLE, N. Y.—The Public Service Commission, Second District, has given its approval of an increase of capital stock by the Fonda, Johnstown & Gloversville Railroad Company from $2,500,000 to $3,500,000. The company is given permission to issue $500,000 only of stock, to consist of 5000 shares at $100 each, the proceeds to be applied to discharge its obligations.

HUNTINGTON, N. Y.—Work has commenced on the construction of the new Long Island Railroad depot, which will also be utilized as a substation. Electricity for the station will be transmitted from the power house at Long Island City.

LONG ISLAND CITY, N. Y.—The Department of Water, Gas and Electricity is changing all the 40-cp tungsten street lamps in the Borough of Queens to tungsten lamps of 60 cp, of which it is expected that 2000 will be installed before the end of the year. The arc lamps of 1200 cp, costing $90 each per year, are to be replaced with lamps of 2000 cp, to cost $100 per lamp per year. It is said that 825 additional gas and electric incandescent lamps will be distributed throughout the borough.

LYONS, N. Y.—Plans have been prepared for repair shops to be erected by the New York Central Railroad in Lyons. The plant will be equipped with an air compressor of 500 cu. ft. capacity and a complete line of woodworking and ironworking machinery. Electrical power will be used. The company has not decided whether to install a plant or to purchase the power needed.

NEW YORK, N. Y.—The Public Service Commission, First District, has granted Frederick W. Whitridge, receiver of the Third Avenue Railroad Company, permission to continue the work on the Fort George extension.

NEW YORK, N. Y.—The general contract for the construction of the large department store to be erected by Gimbel Brothers, at Greeley Square and Thirty-second Street, has been awarded to Thompson-Starrett Company, of New York, N. Y. The plans call for the installation of 41 passenger elevators and six freight elevators, which will call for considerable power equipment, hydraulic machinery, etc. D. A. Burnham & Company are the architects.

NEW YORK, N. Y.—The New York & North Shore Traction Company has obtained a franchise from the Board of Estimate and Apportionment to construct and operate a double-track street railway from the intersection of the proposed tracks on Chestnut Street, Murray Hill, Queens, to Whitestone. This will be a spur of the railway to be constructed from Little Neck to Flushing.

NIAGARA FALLS, N. Y.—Extensive additions are being made to the plant of the Development & Funding Company, of Niagara Falls, includ

ng the erection of several buildings, power plant and transformer station. The plant will be operated by electricity generated by Niagara power.

PATCHOGUE, N. Y.—The Public Service Commission, Second District, has given the South Shore Traction Company permission to extend its railway system in the villages of Sayville and Islip.

RIVERHEAD, N. Y.—Application has been made to the Town Board for a franchise to construct and operate a street railway in Riverhead. It is proposed to build and maintain an electric railway from Riverhead depot to Orient Point. John E. Root, of New York, N. Y.; George W. Reeves, Frederick M. Lewis and J. Madison Wells, of Greenport, and George F. Stackpole, of Riverhead, are interested in the project.

ROCHESTER, N. Y.—H. B. Graves, 74 State Street, Rochester, N. Y., is contemplating the installation of a 75 hp gas producer plant and two gas-engine-driven generators to furnish electricity for lamps and elevators, and is ready for estimates on the above equipment.

ROSLYN, N. Y.—The Public Service Commission, Second District, has authorized the Nassau Light & Power Company to issue its first mortgage bonds to the amount of par value of $80,000, the bonds not to be sold at less than 90 per cent of their par value, the proceeds to be used to take up outstanding obligations, for the acquisition of property and construction, completion, extension and improvements to its plant and distributing system.

SENECA FALLS, N. Y.—The Geneva-Seneca Electric Company is contemplating the installation of a new street lighting system in Seneca Falls.

WATERTOWN, N. Y.—The City Council has authorized E. W. Sayles, city engineer, to prepare plans and specifications for the construction of a municipal electric light plant for the city.

GREENVILLE, N. C.—Bids will be received by Thomas J. Jarvis, chairman executive committee, until May 4, for the construction of power house and infirmary at East Carolina Teachers' Training School, also for machinery, including boilers, stack, engine, laundry machinery, ice plant generator, etc. Further information and specifications can be secured from Hook & Rogers, of Charlotte, N. C., and H. W. Simpson, Newbern, N. C., architects.

HENDERSONVILLE, N. C.—The Appalachian Power Company, recently incorporated, contemplates the construction of a power plant on Green River at Potts Shoals, seven miles from Hendersonville. The company will furnish electricity for lamps and to manufacturing concerns.

ROCKY MOUNT, N. C.—F. C. Topleman, manager of the Home Telephone Company, is making preparations for installing an improved service to Spring Hope, after which it is contemplated that other interurban extensions will be rebuilt and improved.

WINSTON-SALEM, N. C.—The P. H. Hanes Knitting Company is installing new machinery in its No. 2 mill, which will be operated by electricity.

CLEVELAND, OHIO.—H. Schmidt has applied to the City Council for a franchise to construct and operate a double-track street railway upon certain streets in the city.

CLEVELAND, OHIO.—The Cleveland Worsted Mills Company is making preparations to construct an addition to its power plant, work on which will begin soon. The company is in the market for a 1500-kw, alternating-current generator direct connected to a Corliss engine. George B. Rider & Company, Century Building, Cleveland, Ohio, are the engineers.

COLUMBUS, OHIO.—It is reported that arrangements are being made by the Columbus, Delaware & Marion Railway Company to close the gap between the northern terminus of the Columbus, Delaware & Marion Railway and one of the railways out of Toledo. John G. Webb is president.

HAMILTON, OHIO.—Plans are being made to extend the transmission lines of the municipal electric light plant to Warwickshire.

LIMA, OHIO.—The Western Ohio Railway Company is considering the purchase of an 800-kw generator. F. D. Carpenter is general manager.

SPRINGFIELD, OHIO.—George W. Baker, president of the Springfield & Washington Railway Company, has submitted a proposition to the merchants and business men of this city and the residents of Clifton, Cedarville and Jamestown, offering to build an electric railway connecting the above places if stock to the amount of $50,000 is subscribed.

OKEMAH, OKLA.—The citizens recently voted to issue $55,000 in bonds for the construction of a water-works system and electric light plant, of which $5,500 will be utilized for the electric plant. O. J. Bussey is chairman of town trustees.

OKLAHOMA CITY, OKLA.—Homer W. Hurst, of Hobbsville, is reported to have made application to the City Council for a franchise to construct and operate an electric railway in Oklahoma City.

PORTLAND, ORE.—The City Council has passed the blanket franchise asked for by the Portland Railway, Light & Power Company for its proposed extension.

PORTLAND, ORE.—Arrangements are being made for the construction of an electric railway between Kenton and the new Swift packing plant on Columbia Slough, a distance of 2½ miles. Bids have been asked for track laying and overhead wiring. Electricity for operating the road will be secured from the plant of the Mount Hood Railway Company, on the Columbia. A company has been incorporated, with a capital stock of $50,000, by C. C. Colt, J. C. Good, George S. Herriott and C. H. Carey.

PORTLAND, ORE.—A syndicate composed of Samuel Hill, Hewett Hedley, E. A. Stuart, W. G. Collins and M. A. Arnold, of Seattle, Wash.; William M. Ladd, P. L. Willis, W. F. Burrell, F. H. Page and I. N. Fleischner, of Portland, Ore., has purchased the entire stock holdings of the National Securities Company, of Los Angeles, Cal., in the Home Telephone Company, of Portland, the Home Telephone Company of Puget Sound and the Northwestern Long Distance Telephone Company, of Portland. Plans are now being prepared for extensive improvements to the Portland plant, which will involve an expenditure of $200,000, and $500,000 later. A large amount will also be spent on the plant of the Home Telephone Company of Puget Sound in the near future. The new company has been incorporated under the name of the Home Telephone Company. Harvey Lindley is president and general manager.

ROSEBURG, ORE.—Kendall Brothers, owners of the local water and electric light systems, have applied to the City Council for a franchise to construct a street railway system in Roseburg.

BEAVER, PA.—Owing to a disagreement between the College Hill Council and the Beaver Valley Electric Light Company, the street lighting service has been discontinued for the past week. The Burgess vetoed the contract and the Council failed to pass it over his veto. As yet nothing has been done on the electric light plant for which bonds to the amount of $15,000 were recently authorized. It is said that the contract has been awarded to the Westinghouse Electric & Manufacturing Company.

CARLISLE, PA.—The Town Council has granted a franchise to the Cumberland Railway Company to construct and operate its railway over certain streets in the town. The railway will be about 15 miles in length.

GROVE CITY, PA.—Application has been made to the City Council by the Slippery Rock & Grove City Railway Company for a franchise to construct an electric railway in the city. The company proposes to build an electric railway from Slippery Rock, via Harrisville to Grove City.

MEADVILLE, PA.—The Meadville & Conneaut Lake Traction Company is contemplating the purchase of mechanical stokers. F. R. Shryock is general manager.

NORTHEAST, PA.—Plans have been completed by Ballinger & Perrot, engineers, for a large plant for the Grape Products Company, in Northeast, for the manufacture of unfermented grape juice and allied products. Two electric elevators will be installed, for which bids will be received by the engineers. The power plant will include two boilers, engines and generators, which will be purchased by the company direct.

WOONSOCKET, R. I.—The new mill of the Woonsocket Machine & Press Company will be operated by electricity, which will be furnished by the Woonsocket Electric & Machine Company. Three motors with a total rating of 110 hp are being installed. The old plant of the company is operated by a steam engine and gas engine. It is said that the electric motors are to replace the gas engine.

CENTERVILLE, S. D.—A proposition to construct an interurban railway from Sioux City to Centerville is under consideration by the farmers of Union and Clay Counties. Fred Heglin and John Norin, of Dalesburg, and A. S. Anderson, of Alsen, have been appointed to investigate the matter.

AUSTIN, TEX.—The water and light committee is reported to have decided to adopt the plans prepared for rebuilding of the dam. The cost of the dam, machinery and equipment is estimated at $750,000. The new site is located about 2000 yds. above the present dam at Mount Bonnell.

CALVERT, TEX.—The City Council has awarded the Calvert Electric Light Company a new contract for street lighting. It is said that the company will erect a new electric light plant.

CORPUS CHRISTI, TEX.—The City Council is considering two applications for a street railway franchise, one from Arnim & Arnim, of Lavaca County, and the other from J. W. Arnold, of San Angelo, Tex.

PARIS, TEX.—The City Council is considering the question of establishing a municipal electric light and power plant.

SAN ANTONIO, TEX.—We are informed that the San Antonio Traction Company expects to place contracts for the construction of a four-mile extension to Palm Gardens during the next two weeks.

SAN MARCOS, TEX.—The Texas Irrigated Farm Company has made application for a franchise to construct and operate an electric light plant in San Marcos.

WACO, TEX.—The City Council has granted the Citizens' Railway Company a franchise to extend its railway across the Brazos River, on the suspension bridge, into East Waco.

WHARTON, TEX.—The City Council has granted a 50-year franchise to [illegible] to construct and operate an electric railway in Wharton.

COLD SPRINGS, UTAH.—We are informed that the Snowdrop Gold Mining & Power Company expects to [illegible] work on the construction of its power plant at Cold Springs [illegible] electricity for power to the mining [illegible] C. A. Snow is president and manager.

PROVO, UTAH.—The Telluride Power & Transmission Company has [illegible] to construct a power house [illegible] complete system of electric railways [illegible] Provo and Lake Shore to Cedar Valley. The [illegible] of obtaining by purchase [illegible] Work on the [illegible] Provo and Salt Lake City will begin within [illegible].

BARTON HEIGHTS, P. O. RICHMOND, VA.—The Capitol Association has decided to issue $[illegible] in bonds, the proceeds to be used

for construction of an electric light plant and water work system. The proposition will be submitted to the vote of the people.

BEDFORD CITY, VA.—Plans are being considered for the construction of an electric railway from Bedford City to connect with the Virgian Railway. It is proposed to secure electricity for operating the railway from the Roanoke Street Railway & Electric Company. B. E. Rice, industrial agent of the Virgian Railway; Robert N. Gaines, of Bedford City, and H. C. Webb, of Stewartsville, are interested in the project.

BUENA VISTA, VA.—Contracts have been awarded by the Rockbridge Power Company to the General Electric Company, of Schenectady, N. Y., for the entire equipment of the new power plant at the Goose Neck dam, four miles below Buena Vista.

CLINTWOOD, VA.—It is reported that the business men in Clintwood are planning to organize a company to construct an electric railway from Clintwood to the nearest point on the Carolina, Clinchfield & Ohio Railway, which is being constructed through Dickenson County down the McClure River. The railway will be about six miles in length. Roland E. Chase, A. A. Skeen and Columbus Phipps, all of Clintwood, are interested in the project.

FREDERICKSBURG, VA.—We are informed that the City Council has granted a 30-year franchise to the Fredericksburg Electric Company to furnish electricity for lamps, heating and motors in Fredericksburg. The Council also granted a franchise to the Electric Generating Company (an ally of the Fredericksburg Electric Company) to construct a flume and power house within the city limits. The Fredericksburg Electric Company contemplates an expenditure of about $25,000, and the Electric Generating Company will expend about $100,000. Work on construction of these plants will begin about the middle of this month. William C. Whitner is consulting engineer.

HIGHLAND PARK (P. O. RICHMOND), VA.—The proposition to issue $50,000 in bonds, the proceeds to be used for electric lighting, water supply and sewerage, will be submitted to the vote of the people.

CHEHALIS, WASH.—The Valley Development Company is making arrangements to proceed with its power development at Packwood Lake, in the Cascade Mountains. The plans call for the erection of a large dam at the outlet of Packwood Lake, about eight miles distant from Sulphur Springs, and fluming the water a distance of six or seven miles, near the farm of August Snyder, where a large power plant will be erected. It is understood that the company proposes to transmit electricity to Southwestern Washington, to the Sound cities and to Portland.

CONCONCULLY, WASH.—Arrangements are being made for the Conconcully Copper Mining Company for the installation of an electric light and power plant to furnish electricity for lamps and motors for the mines and also for the town of Conconcully. R. H. Hargrove is president of the company.

EVERETT, WASH.—The Everett Railway, Light & Water Company has awarded a contract to the Stone & Webster Engineering Corporation for the construction of a substation, the equipment of which will include one 500-kw motor generator, with switchboard and transformers.

NORTH YAKIMA, WASH.—The Central Washington Investment & Power Company, recently organized by George S. Rankin and others, contemplates furnishing electricity for lamps and motors through the entire valley, including the section now under irrigation.

OLGA, WASH.—It is reported that Robert Moran, of Rosario, Wash., contemplates the construction of an electric light and power plant and water-works system in Olga, for which a franchise has been secured.

SPOKANE, WASH.—The Spokane-Orient Power Company, recently incorporated, proposes to develop the water power of Boulder Creek, near Orient, where a fall of about 300 ft. can be secured capable of developing 2500 hp. The company will supply electricity in Orient and other towns in that vicinity. C. H. Patten and C. A. Lunchford, both of Spokane, are interested in the project.

WASHOUGAL, WASH.—It is reported that a dam will be erected about two and one-half miles from Washougal, where 1000 hp will be developed for an electric light and power plant. The transmission line is now being erected. Cottrell & Son have a franchise for an electric system in Washougal.

WINLOCH, WASH.—The business men of Winloch have organized a local telephone company, with the following officers: J. A. Venness, president; C. Rountree, vice-president; R. Whistler, secretary; J. V. Warren, treasurer, and C. E. Leonard, manager.

YACOLT, WASH.—J. M. Coulter, who was recently granted a franchise by the Town Council, contemplates the construction of an electric light plant at a cost of about $10,000.

BELOIT, WIS.—The Beloit Water, Gas & Electric Company contemplates making extensions to its system for the purpose of furnishing electrical service to manufacturing plants, particularly to the metal working industries.

JANESVILLE, WIS.—The Janesville Machine Company is preparing to enlarge its implement factory, which will be equipped with elevators, air hoists and a complete trolley connection. The company will also increase the equipment of its power plant, which will include the installation of a 100-kw, 250-volt, direct-connected generator.

KNOWLES, WIS.—It is reported that Sterr Brothers contemplate the construction of an electric light and power plant in Knowles.

NEENAH, WIS.—The citizens are considering the question of establishing a municipal electric light plant. A committee has been appointed to investigate the matter.

NEW RICHMOND, WIS.—The Willow River Lumber Company contemplates increasing the output of its power plant.

WAUWATOSA, WIS.—The Milwaukee Light, Heat & Traction Company, of Milwaukee, has been granted a franchise by the Town Board to construct and operate an electric railway in Wauwatosa.

GRAND FALLS, N. B., CAN.—Additional equipment consisting of air compressors, electric motors, drills, tunneling machines, pumping, hoisting engine, derricks, concrete mixer, rock crushers, gasoline tow boat, scows, machine and blacksmith shop tools, etc., will soon be purchased by Frank B. Gilbreth, of New York, N. Y., to be used in connection with the construction of the hydro-electric plant on the St. John River, at Grand Falls, N. B., for the Grand Falls Power Company. This equipment is for the contractor's plant, the hydro-electric machinery for the permanent equipment of the main power plant will not be purchased by Mr. Gilbreth, who has the contract only for the construction work involved in the development of the water power. John B. McRae, of Ottawa, Ont., is chief engineer, and Ralph Mershon, of New York, N. Y., electrical engineer.

STELLARTON, N. S., CAN.—The Edgarton Tramway Company, Ltd., is reported to have purchased the power plant of the New Glasgow Electric Company and proposes to move the plant from New Glasgow to Stellarton.

CHIPPAWA, ONT., CAN.—The Village Council has granted the Welland County Telephone Company a franchise to extend its telephone lines to this village.

LONDON, ONT., CAN.—The London Street Railway Company is considering the question of providing additional power for its system during the coming summer, but as yet has not decided upon the electrical equipment to be installed. C. B. King is manager.

MIDLAND, ONT., CAN.—The Simcoe Electric Railway & Power Company, it is said, will commence work on the construction of its proposed electric railway to connect Penetanguishene, Midland, Virginia Harbor, Waubaushene and Coldwater. The company is planning to build a power plant on the Swern River at Big Chutes, and also proposes to furnish electricity for lamps and motors. James Playfair and Douglas L. White, of Midland, are among the directors.

PETERBOROUGH, ONT., CAN.—At an election held recently the citizens defeated the proposition to issue $15,000 in bonds to construct a municipal power plant in connection with the new water-works dam.

New Industrial Companies.

THE SOUTHERN ENGINEERING COMPANY, of Dallas, Tex., has been incorporated, with a capital stock of $5,000, by Robert L. Shaffer, Henry M. Raynolds and John F. Bruhns.

WINFREY, SCHLAFLI & PORTER, of Houston, Tex., have been incorporated for the purpose of carrying on a civil, mechanical and industrial engineering and contracting business. H. P. Porter is general manager.

THE RELIANCE ELECTRIC COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $10,000, to do a general electrical construction business by Edward A. Cassin, Theodore C. Gordon and E. M. Schultz.

THE CERO COMPANY, of Rutherford, N. J., has been incorporated, with a capital stock of $100,000, to do a general mechanical engineering business, by W. P. Smith, A. P. Coon and P. T. Davis, of Rutherford, N. J.

THE CHICAGO STEAM SPECIALTIES COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $100,000, by E. D. Packard, A. Jackson and F. P. Leffingwell. The company proposes to manufacture machinery, etc.

THE ARKICYDE COMPANY, of Colonie, N. Y., has been incorporated, with a capital stock of $50,000, by William S. Milliken, of Troy; James H. Nerns and Frank W. Spreter, of Cohoes, N. Y. The company proposes to do a general electrical business.

THE AMERICAN THERMOSTAT COMPANY, of Elmira, N. Y., has been chartered, with a capital stock of $25,000, by Burchard C. Johnson, Arthur McClellan and Byron R. Johnson. The company proposes to manufacture thermostats and electrical devices.

THE AMERICAN PRODUCER GAS ENGINE COMPANY, of Hoboken, N. J., has been chartered by F. H. Loomis, G. A. Rifflard and D. E. Griswold, all of New York, N. Y. The company is capitalized at $100,000 and proposes to do a geenral mechanical engineering business.

THE FRANKLIN SUPPLY COMPANY, of New York, N. Y., has been chartered, with a capital stock of $5,000, by Benjamin Fox, Isidor Cohen, of New York, N. Y., and Max Kafsky, of Brooklyn, N. Y. The company proposes to deal in gas and electric fixtures and gas and electric supplies.

THE COMBINATION ENGINE POWER COMPANY, of Boston, Mass., has been chartered, with a capital stock of $100,000, for the purpose of manufacturing and selling engines and machinery. The officers are: J. L. Arnold, of Manchester, president, and G. B. Clark, of Boston, treasurer.

THE YOUNG-GRAY COMPANY, of Toledo, Ohio, has been incorporated by E. R. Young, J. B. Mueller, T. N. Young, V. I. Gray and J. W. Lyons. The company is capitalized at $25,000 and proposes to manufacture all steam, electrical and hydraulic, air, refrigerator, heating and drying machinery.

THE INTERNATIONAL MARINE INDICATOR COMPANY, of New York, N. Y., has been chartered, with a capital stock of $500,000, to manufacture engines, machinery and mechanical and electrical appliances. The incorporators are: E. E. Dickey, E. J. Miller and S. Jarus, of New York, N. Y.

THE ELECTRIC DEVELOPMENT COMPANY, of East Orange, N. J., has filed articles of incorporation, with a capital stock of $1,000,000. The incorporators are: L. S. Holmes and W. Huck, Jr., of East Orange, N. J. The company proposes to do a general electrical and mechanical engineering business.

THE MOTOR LEAGUE OF AMERICA, of Syracuse, N. Y., has filed articles of incorporation, with a capital stock of $100,000, for the purpose of manufacturing motors, engines, cars and vehicles. The incorporators are: Alexis A. Schlachter, Ernest Woods and T. Aaron Levy, of Syracuse, N. Y.

AMERICAN REGENERATOR COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $150,000, to manufacture steam regenerators or accumulators and appliances, tools, etc. The incorporators are: C. A. Wendell, L. E. Varney, of New York, N. Y., and C. Munoz, of Montclair, N. J.

THE ADVERTISCOPE LAMP COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, to manufacture lamps for illuminating and advertising purposes. The incorporators are: Max Stutt, Isidor I. Zeeman, Benjamin Hodes and M. Solomon, all of New York, N. Y., and H. E. Lazarus, of Chicago, Ill.

New Incorporations.

EUREKA SPRINGS, ARK.—The Greenwood & Winano Party Telephone Company has been organized for the purpose of erecting a rural telephone line on the south of the city to connect with the Eureka Springs telephone system. James Hull is president, and George Russ, treasurer and business manager.

EUREKA SPRINGS, ARK.—The Ozark Traction Company has been incorporated, with a capital stock of $50,000, for the purpose of constructing an electric railway from Eureka Springs to connect with towns in north Arkansas. The officers: S. M. Mitchell, president; W. T. Sellers, vice-president; B. J. Rosewater, secretary, and O. H. Orendorf, treasurer.

FRESNO, CAL.—Articles of incorporation have been filed by the Sierra Park Electric Company, of Fresno, for the purpose of developing water power of the San Joaquin River to be utilized to generate electricity. The company is capitalized at $100,000. The incorporators are: C. K. Kirby, of Fowler; John W. McLaughlin, of Fresno; C. K. Kirby, Jr., of Fresno; F. K. Kirby, of Fowler, and D. C. McLaughlin, of Fresno.

MODESTO, CAL.—The Modesto Interurban Railway Company has been chartered, with a capital stock of $200,000, by T. K. Beard, G. P. Shafer, H. T. Crow, W. H. Frazine, George Perley, D. E. Saunders and J. L. Dennett, all of Modesto. The company proposes to construct an interurban railway from Modesto, Empire, Waterford and Oakdale, also from Modesto to Newman and Crows Landing. The railway will be about 53 miles long. It is said that the company contemplates operating gasoline electric cars.

TULARE, CAL.—The Tulare Home Telephone Company has been chartered, with a capital stock of $25,000. The directors are: G. C. Harris, B. W. Chenoweth, Scott Hendricks and Thomas I. Franklin, of San Francisco, and Edward W. Rice, of Berkeley, Cal.

ATHENS, GA.—The New Timothy Telephone Company has been organized to construct a telephone line from New Timothy to Athens & Winder. The officers of the company are: W. I. Russell, president, P. I. Duncan, secretary and treasurer, and H. P. Hardeman, general manager.

HULL, GA.—The Free State Telephone Company has been incorporated, with a capital stock of $2,500, by J. C. Cook, W. F. Matthews, B. Chandler, G. H. Rice, and others. The company proposes to construct a telephone line from Hull via Neese to Danielsville.

BRYON, ILL.—The Tri-City, Northeastern & Interurban Railway Company has been organized for the purpose of constructing an electric railway from Watertown Rapids City, Port Byron, Cordova and Albany. The company is capitalized at $10,000. The officers are: J. W. Simonton, of Port Byron president, W. H. Ashdown of Port Byron, vice-president, George W. Turner, of Hampton secretary, C. H. Peck, of Albany, treasurer, and Wallace Treckler, chief engineer.

CHICAGO, ILL.—The Telepost Company, of Illinois, has been incorporated, with a capital stock of $10,000, to construct and operate telephone and telegraph lines, by C. C. Robertson, W. R. Watson and C. R. Holton.

ELGIN, ILL.—The Elgin & Sycamore Railway Company has been chartered with a capital stock of $ [illegible] to construct an electric railway from Elgin to Dixon and to Aurora. The incorporators are: B. C. Bailey, E. S. Bailey, F. J. Hohing, F. W. Merrick and F. N. Rogers, all of Elgin.

ELGIN, ILL.—Articles of incorporation have been filed for the Elgin & Evanston Railway Company by C. A. Sayer, J. A. Hessler, A. W. Hellis, E. F. Reynolds and G. H. Norton, all of Berwyn, Ill. The company is capitalized at $2,500 to construct an electric railway from Elgin through Desplaines to Evanston.

PERU, ILL.—The Cedar Point Telephone Company has been incorporated, with a capital stock of $1,100, by Elmore H. Whitaker, Robert H. Johnston, and John Martens.

LOGANSPORT, IND.—The Logansport, Bass Lake & Laporte Electric Company has been incorporated to build an electric railway 60 miles in length, to cost about $900,000. The incorporators are: James C. Fletcher, John W. Long, Peter Henderweele, Henry C. Schrecker and C. H. Peters.

SOUTH BEND, IND.—The Manufacturers' Utility Company has been incorporated to acquire sites, build and maintain water-power plants to generate electricity; also to construct buildings and lease the same to manufacturers and other persons. R. M. Miller, August Nelson and John Thomas are directors.

CLEGHORN, IOWA.—The Cleghorn Independent Telephone Company has been incorporated, with a capital stock of $1,000.

EDGEWOOD, IOWA.—The Edgewood Farmers' Telephone Company has been chartered, with a capital stock of $5,000.

THOMPSON, IOWA.—The Thompson Telephone Company has been organized by a number of local business men. The company has purchased the local telephone exchange from W. A. Eckels, of Nora Springs.

CLYDE, MINN.—The Farmers' Mutual Telephone Company has been incorporated, with a capital stock of $10,000.

ERIE, MINN.—The Red Lake-Eastern Marshall Farmers' Telephone Company has been incorporated, with a capital stock of $10,000, by Alex F. Lattimore, of Erie, and others.

MINNEAPOLIS, MINN.—The Christmas Lake Telephone Company has been organized, to erect a telephone line between Christmas Lake and Lake Minnetonka.

FLORENCE, NEB.—The Western Shore Electric Railway Company has been incorporated by L. M. Allen, L. C. Nebergall, D. C. Gould, J. F. Munro and J. T. McVittie. The company is capitalized at $150,000 and proposes to construct an electric railway from Florence to Blair.

KEARNEY, NEB.—The Union Valley Telephone Company has been incorporated, with a capital stock of $5,000, by Patrick Fitzgerald, George Bischel, N. B. Freeman, H. G. Reiter, and others. The company proposes to construct telephone lines through Center and Thornton Townships.

STAMFORD, NEB.—The Highland Mutual Telephone Company has been incorporated, with a capital stock of $10,000, by I. K. Asford, Charles Hopper, and others.

KNOWLES, N. M.—The Knowles-Monument Telephone Company has been chartered, with a capital stock of $1,000, by J. L. Emerson, W. U. Dannelley and H. F. Christian, all of Carlsbad.

SELMA, N. C.—The Selma Telephone Company has been incorporated with a capital of $5,000 by T. H. Atkinson, of Washington, D. C.; L. H. Allred, of Selma, and others. The company has a franchise to build rural telephones in the Selma district.

BROFY, N. D.—The Emmons County Telephone Company has been incorporated, with a capital stock of $4,000, and the following named officers: C. A. Ward, president, and William Foell, secretary.

HOMESTEAD, N. D.—The Wyndmere & Homestead Farmers' Telephone Company has been formed, with N. C. Jensen, president, and G. O. Sandem, secretary.

CARNEGIE, OKLA.—Articles of incorporation have been filed for the Carnegie Power & Improvement Company, with a capital stock of $100,000. The company proposes to construct a dam and power house. The equipment will include four 250-hp gas engines, direct-connected to generators. The company will furnish electricity for lamps and motors in Carnegie, Hobart, Gotebo, Mountain View, Apache and Lawton. The officers are: John V. Roop, of Hobart, president; W. T. Croslen, of Chichasha, Okla., vice-president and general manager; J. T. McCormick, of Little Rock, Ark., secretary and treasurer.

HINTON, OKLA.—The East Niles Telephone Company has been incorporated with a capital stock of $1,500 by William Woods, H. B. Tillinghast and J. C. Ridge, all of Niles.

[illegible] by A. W. Cilk and others.

LAWRENCEVILLE, PA.—The Browntown Telephone Company has [illegible] are: Fred A. Burr, Ezra Maxwell, Charles Phelps, Leon Terwilliger, [illegible]

MERCER, PA.—The [illegible]

Trade Publications.

PUMPS.—Catalogue No. 52, of the Dean Bros. Steam Pump Works, Indianapolis, Ind., deals with hydraulic pressure pumps. These pumps are of the reciprocating type, driven either by steam engine or electric motors.

ELECTRIC CLOCKS.—S. S. Besore, Urbana, Ill., has issued an illustrated, descriptive bulletin, dealing with self-winding clocks. These clocks are wound by means of self-contained electro-magnets, receiving energy from dry cells.

CARBON BRUSHES.—The Morgan Crucible Company, Ltd., Battersea Works, London, Eng., has issued a well-prepared catalogue, giving much specific information concerning Morganite and Battersea carbon brushes for electrical machinery.

MOTORS.—The Westinghouse Electric & Manufacturing Company has issued a series of "Talks" on motors. No. 4 is devoted to a discussion of the relation of the electric motor to central-station business. No. 6 deals with textile-mill motors.

WIRING SPECIALTIES.—The Fanclevr Specialty Company, Lamson Plain Station, Boston, Mass., has issued a catalogue devoted to conduits, switch-boxes, junction-boxes, mouldings and moulding-boxes. The fittings described are illustrated in detail, and fully listed.

MILL-SERVICE INDUCTION MOTORS.—Polyphase induction motors of the constant-speed, squirrel-cage type, designed especially for steel-mill service, are well illustrated and completely described in Circular No. 1164 of the Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa.

STEAM HAMMERS for all industrial purposes are discussed in a neatly executed catalogue issued by the Niles-Bement-Pond Company, New York. Specifications are given of single-frame hammers rated at from 250 to 4000 lb., and of double-frame hammers rated at from 1500 to 3000 lb.

CENTRIFUGAL BLOWERS.—The American Blower Company, Detroit, Mich., has issued an artistic catalogue, discussing the advantageous features of Sirocco centrifugal fans. Tabulations are given of fans ranging in diameter from 6 in. to 90 in. They are well adapted for direct connection to electric motors.

ELECTRICALLY DRIVEN WASHING MACHINE.—With the title of "A Penny Pays for the Washing," the Thompson Bros. Company, of Grinnell, Ia., has issued a handsome little pamphlet descriptive of a type of washing machine especially adapted to be driven by an electric motor. Some of the illustrations are in colors.

GAS AND GASOLINE ENGINES.—The Otto Gas Engine Works, Philadelphia, Pa., have issued neatly executed catalogues, illustrating and describing gas and gasoline engines. These engines are particularly well suited for driving electric generators. Engines intended for this duty are treated as standard for ratings of from 3.5-hp to 160-hp.

TRANSFORMERS.—The Pittsburgh Transformer Company, Pittsburgh, Pa., is distributing illustrated descriptions of its transformers. Plate No. 1023 shows a 1000-kw oil-insulated water-cooled unit; Plate No. 1026 illustrates a 300-kw oil-insulated self-cooled unit, while Plate No. 1049 deals with a 200-kw self-cooled oil-insulated circular-pattern transformer.

INSTRUMENTS.—Electrical instruments of precision are thoroughly discussed, illustrated and listed in Bulletin No. 84, of the Wagner Electric Manufacturing Company, St. Louis, Mo. The instruments are of both the direct-current and the alternating-current types, and include voltmeters, ammeters and wattmeters for both portable and switchboard use.

Personal.

MR. CHAS. E. WADDELL will deliver a course of lectures before the Biltmore Forest School, Biltmore, N. C., on the subject of the application of the electric drive to woodworking machinery.

MR. L. H. STEVENS has resigned as superintendent of plants of the Public Service Corporation of New Jersey to become vice-president and general manager of the Bird-Archer Company, New York.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company, Chicago, is spending the Easter holidays in London, his old home. Mr. Insull sailed from New York on March 30 and expects to be back on his Chicago office in about four weeks from that time.

MR. BRUCE FORD, in charge of the department of development and design of the Electric Storage Battery Company, Philadelphia, is making a satisfactory recovery after an operation for appendicitis at a Germantown hospital.

MR. W. G. T. VIBBER has purchased the interest of Mr. W. H. Emery in the Marlborough Electric Company, of which he becomes president. Mr. Edward C. Mason has been elected treasurer, and Mr. C. S. Davis general manager of the company.

MR. W. F. CAPEN, general superintendent for the Postal Telegraph Company in Chicago, has been promoted to a higher position in the New York office. Mr. T. W. Carroll, who has been assistant general superintendent, has been appointed to fill the position formerly occupied by Mr. Capen, and Mr. F. W. Conger, superintendent, has been given the office made vacant by Mr. Carroll's promotion.

MR. [illegible] has resigned from the U. S. Patent Office, [illegible] to have been an examiner the past three years, to engage in the practice of patent law, with offices in McGill Building, Washington, D. C. Mr. [illegible] is a graduate of Rush's Preparatory Institute and Law School of the George Washington University, and prior to entering the Patent Office was an assistant in the laboratory of the Bureau of Standards. He will make a specialty of electrical and mechanical cases.

MR. J. L. McGILL, formerly manager of the Minneapolis office of the Western Electric & Manufacturing Company, has been appointed manager of its Atlanta and placed in charge of the district office in that city. The Minneapolis office has been placed under the jurisdiction of the Chicago district office in charge of Mr. T. P. Gaylord. Mr. W. D. McDonald, the Chicago office, goes to Minneapolis to succeed Mr. McGill. The Milwaukee and Omaha offices are already under the Chicago district office, and now Minneapolis is under the same.

MR. H. C. SLEMIN has been appointed to the dual position of sales and advertising manager of the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y. Mr. Slemin has occupied the position of advertising manager of the same company since February, 1905, after three years of service with the company in various other lines of work, including charge of the cable business. Mr. Slemin after leaving the manual training school in Chicago went with the Western Electric Company in 1896, and after going through several departments in the works and spending considerable time in the drafting room, he entered the apparatus engineering department. Three years later he entered the engineering sales department, and after spending a year and a half there entered the employ of the Stromberg-Carlson Telephone Manufacturing Company in 1904 to take charge of the apparatus engineering department.



MR. H. C. SLEMIN.

Obituary.

MR. CHARLES G. CONNER, of the Sprague Electric Company, died March 27, following a surgical operation. He became ill in his office on Feb. 17, and was immediately taken to his home and from there to the hospital. On the 19th he was operated upon because of an intestinal abscess. Blood poisoning set in, and for a little more than a week he made a hard struggle for life. The funeral was held at his late residence, 524 Righter Street, Philadelphia, on March 30 at 1 p. m. The interment was in Indianapolis. Mr. Conner was manager of the Philadelphia office of the Sprague Electric Company from Feb. 16, 1903, until his demise. He made a large circle of friends by his cordiality, straight business dealings and thorough knowledge of the electrical business. Mr. Conner leaves a widow and a son three years old, to whom sincere sympathy is extended.

Business Notes.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY, of New Jersey, has removed its offices from 141 Broadway to 91-93 Mercer Street, New York.

HARVEY HUBBELL, INC., of Bridgeport, Conn., has awarded a contract for the construction of a new factory building, which will be located on State Street, between Bostwick Avenue and Mt. Grove Street.

PETTINGELL-ANDREWS TRADE-MARK.—The Pettingell-Andrews Company, Boston, has adopted as a trade-mark a design based on the word "Exemplar." This trade-mark will be used on all literature of the firm and also on lines of electrical goods of special quality.

THE MUNDER ELECTRIC COMPANY is moving its factory from Springfield, Mass., to Central Falls, R. I., where it has another large manufacturing plant. The company will retain its sales office and carry a complete stock at its present location, 32 Taylor Street, Springfield, Mass.

ROTH BROTHERS & COMPANY, of Chicago, Ill., expect to occupy their new factory, located at Loomis and Adams Streets, about May 1. The equipment of the old shop will be installed in the new factory. New machinery will be purchased later. The company will have about double the space of its present quarters.

THE COLUMBIA ELECTRIC HEATING & MANUFACTURING COMPANY has secured an option on a site in St. John, Ore., and is having plans drawn for a factory for the manufacture of electric irons. The company now operates a plant in Los Angeles. Peter Ottis and T. F. Faulconer are engineering the matter.

THE LIBERTY MANUFACTURING COMPANY, Pittsburgh, has issued a statement relating to rumors to the effect that, owing to internal differences, the company will go out of business. These rumors, it states

...e been circulated for the purpose of injuring its business and are ...ounced as without foundation and absolutely untrue.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, is erecting ...new factory plant of double its present capacity. The new shops will ...tain all the latest labor-saving devices, and many new features regard... the general layout. It is expected that the new plant will be ready ... occupancy some time in the early fall.

THE FAIRMOUNT ELECTRIC & MANUFACTURING COMPANY, ...adelphia, has purchased the patents of the "H. W. W." wire connector ...test clamp, which is in extensive use by telephone companies through... the field since 1902 and has given universal satisfaction, and has com...nced its manufacture, after adding some slight improvements.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION.—Mr. ... M. Sanborn, president of the National Contractors' Association, of ...hanapolis, who has recently been in New York in connection with the ...vention of the association to be held in Toledo, Ohio, July next, is ...guine as to the success of the coming meeting, all indications pointing ...the largest gatherings the contractors have held.

NEW INSULATORS FOR DYNAMO AND TRANSFORMER ...NDINGS.—The Dielectric Manufacturing Company, St. Louis, is plac... on the market a new insulating compound for the coils of dynamos, ...tors, transformers, etc., which is claimed to be a radical improvement ...present compounds. The new material is called "Petrite," and is ...med to be so tough and durable as to warrant the employment of a ...e conveying the idea that the coil is petrified by its use.

THE ROBINS NEW CONVEYOR COMPANY has leased the entire ...lding at 72 Front Street, New York City, and on April 1 removed its ...ces from 38 Wall Street to this new location. The machinery and ...er effects of the Duane Street factory are now being removed into the new quarters as rapidly as possible. Greatly increased facilities are provided by the new location, particularly for the manufacture of Robins laminated leather belting and Robins genuine balata belting.

ELECTRICAL EQUIPMENT OF THE NEWARK CITY HALL.—The power plant of the recently completed Newark City Hall, which is the finest public building, architecturally, in the State of New Jersey, was supplied by the Sprague Electric Company and consists of three 100-kw, 100-r.p.m., 125-volt, engine-type, direct-current generators, direct-connected to Hewes & Phillips Corliss engines. The generators furnish power for lighting service and the operation of blower motors. The ventilating system consists of blowers, belt driven by Sprague motors. Messrs. E. M. Waldron & Company were the general contractors for this building, and the electrical apparatus was selected and installed under the direction of Mr. James M. Seymour, Jr.

THE BIRD-ARCHER COMPANY, 90 West Street, New York, has secured the services of Mr. E. H. Stevens, formerly general superintendent of plants of the Public Service Corporation of New Jersey, who has resigned that position to become vice-president and general manager of the Bird-Archer Company. During his 15 years' experience in power-plant operation costs and management, Mr. Stevens has had complete charge of plants aggregating several hundred thousand horse-power, and is therefore exceptionally well prepared to deal with questions about feed-water treatment. During the past five years he has used Bird-Archer compounds exclusively in New Jersey public service plants, and is well posted on the results that can be secured by using boiler compounds. Mr. Stevens will have complete charge of sales, and will give his personal attention to inquiries from large plants which have heretofore shown serious economy losses and high operating costs on account of the scale, oil deposits and other troubles caused by bad feed-water.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MARCH 30, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

...931. (REISSUE.) PLURAL LAMP-SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Feb. 23, 1909. A socket with a readily removable casing in which the base is provided with the lamp engaging parts, and pairs of shells are arranged one within the other, the inner shell having sockets and the outer shell openings registering with the sockets.

...414. ADJUSTABLE INSULATED JOINT; T. H. Brady, New Britain, Conn. App. filed Feb. 21, 1908. A flexible joint so as to permit aligning the main feed pipe as it comes through the wall by providing a ball and socket connection between the bracket pipe and the main feed pipe, with adjusting screws and insulating material surrounding the main pipe and a sleeve carried by the joint.

...418. RAILWAY SWITCH AND SIGNAL CONTROLLING AND OPERATING SYSTEM; J. T. Cado, Arcola, N. J. App. filed Aug. 8, 1908. Reduces the trouble due to crossing and grounds by providing a low potential controlling circuit with a high potential circuit for operating the switches. A device which indicates the position of the switch is actuated by an inductive impulse originating at the device operated.

...428. WIRELESS SIGNALING; R. A. Fessenden, Washington, D. C. App. filed Nov. 17, 1905. The vessel or receptacle has a diaphragm provided with a perforation whose wall is formed of refractory material and a constant flow of liquid is forced through the perforation, thus avoiding fouling by slight particles of dirt which are carried through.

...429. RECEIVER FOR ELECTROMAGNETIC WAVES; R. A. Fessenden, Washington, D. C. App. filed July 3, 1906. A stream of liquid coming from a nozzle impinges on the diaphragm and forms the receiver.

...435. SUPPORT FOR ELECTRIC WIRES OR CONDUCTORS; C. C. Gould, Philadelphia, Pa. App. filed March 25, 1908. The [illegible] a tubular member thereon having a wall at the inner end and a sleeve of resilient coiled material which encircles the post and can be tightened.

...436. JUNCTION BOX; E. T. Greenfield, Kiamesha, N. Y. App. filed Oct. 10, 1906. The box has a bottom portion separable from the side walls to which the wires may be secured while the bottom is separated from the [illegible] not obstructed by the sides.

...[illegible] TELEPHONIC RECORDING APPARATUS; R. D. [illegible], New York, N. Y. App. filed Dec. 6, 1907. Prints the fact that a call has been received over the telephone when a subscriber is absent and [illegible] a local circuit [illegible]

...[illegible] AUTOMATIC GAS-LIGHTER [illegible] App. filed July 8, [illegible] automatically by the [illegible] parts and automatic [illegible] published by means [illegible]

...462. PLURAL ARC LAMP; R. E. Leve, New York, N. Y. App. filed Aug. [illegible] and [illegible]

...[illegible] ELECTRICAL SHOT-FIRING MACHINE FOR MINES; W. E. M[illegible] Wyoming, [illegible] [illegible] the operator may know [illegible]

...916,483. COMBINATION WIRELESS TELEGRAPHY INSTRUMENT; J. E. Ostrander, Staatsburg, N. Y. App. filed Sept. 5, 1907. An improved coherer in which the passage of the current through the coherer operates the sounder and completely breaks all circuits passing through the coherer which produces an effective de-coherence.

...916,486. BINDING-POST; H. E. Reave, New York, N. Y. App. filed Apr. 27, 1908. Especially for stranded wires in which a threaded flat post is secured to a slotted base and is provided with a perforation to receive the wires.

...916,495. PROCESS AND APPARATUS FOR MAKING CALCIUM CARBID; J. S. Deymour, Whitney Point, N. Y. App. filed Oct. 4, 1905. The material is injected into the combustion chamber in powdered form commingled with combustible material and with a supporter of combustion in a blast which impinges upon the material.

...6,505. RELAY; L. H. Thullen, Edgewood, Pa. App. filed March 18, 1905. The releasing point of the relay is substantially the same as the picking up point. No iron core is used and the armature is movably mounted within the core space, so that when no current passes it assumes a position that is outside of the position which it will assume when the magnet is energized.

...6,537. JUNCTION BOX; C. W. Davis, Edgeworth, Pa. App. filed Oct. 15, 1908. For manholes so as to permit the addition of parts from time to time without disturbing the parts originally installed. It has a portion for busbars and a trough-shaped portion having openings for the ends of the cable.

...916,538. TELEGRAPH KEY; F. Wm. De Tray, Aurora, Ill. App. filed Aug. 15, 1907. Provides a separate mechanism so that the part producing the dots cannot produce the dashes, thus reducing mistakes. A swinging lever is used with a second contact element having a pivotal mounting on the actuating lever and a stationary bearing for the second element that effects its swinging movement on the lever when said lever is operated.

...916,541. VARIABLE-INDUCTANCE WINDING; M. Eastham, Boston, Mass. App. filed March 27, 1908. For wireless telegraphy to avoid breaking the circuit when the slide passes from turn to turn. Provides a plurality of wires, preferably of different lengths, connected into one side of the circuit so that the slide bridges from a turn of one wire to the corresponding turn of the other wire without breaking the circuit.

...916,548. ELECTRIC FURNACE; C. W. F. Gorrell, Ottawa, Ontario, Canada. App. filed April 7, 1906. For fusing refractory materials which are non-conductors at normal temperatures, particularly for reducing sulfid ores. The electrode has a metallic body with a tip of refractory material together with means for directing a refrigerant to the body and separately directing a fluid through the tip.

...6,552. SUBSTATION TELEPHONE SET; R. Hansen, Sioux City, Iowa. App. filed Dec. 9, 1907. A wall set having the usual writing shelf with a transmitter bracket pivotally adjusted on the box and a complete talking circuit wholly within and supported by the rigid part of the box.

...916,575. SECONDARY BATTERY; W. Morrison, Chicago, Ill. App. filed June 8, 1903. A reversible galvanic battery having an alkaline [illegible] tact with the positive electrode, the latter being located above the negative and insulating means therebetween so as to divide the electrolyte between the electrode. The excess of zinc is oxidized by the electrolyte without dissolving it, thus producing a current.

...[illegible] SECONDARY [illegible] W. [illegible] Ill. App. filed June 20, 1903. A storage battery plate having an [illegible]

...[illegible] PROJECTILE, [illegible] ELECTRIC [illegible]

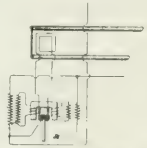
...[illegible] RAILWAY SIGNALING [illegible]

the signal controlling circuits and the source of power is alternating. The source supplying the track is placed at the center of the block and the block limits are defined by bonds of negligible impedance. Two relays are arranged on each side of the source and one operates responsively to the opening of the other.

916,688. ELECTRICALLY OPERATED SINGLE OR VIBRATORY GONG-RINGING DEVICE; Nathan Endel Denver, Colo. App. filed Jan. [illegible] 1908. Automatically rings the gong when the car is starting still unless the motorman throws the crank handle against the stop post of the controller, and rings intermittently from the time the motorman starts the car until it has attained speed. An electrically operated bell is controlled from a crank handle working over a series of contacts.

916,745. SIGNAL LAMP; P. A. Kingston, Danville, Ill. App. filed June 26, 1908. A caboose signal lamp in which the color may be changed from the inside of the caboose and having a double casing so that the lamp will not sweat. A pivoted frame carrying the colored glass moves in front of the window and is operated from the inside of the car.

916,721. DEVICE FOR TIGHTENING OF CABLES; C. Kramer, Frankfort-on-the-Main, Germany. App. filed April 16, 1908. For transportation of coal between ship and shore in which the rolling of the ship varies the distance and in which the tension on the cable is kept the same by an automatically operating stretching motor which takes up the bight in the cable through the intermediate agency of a pulley bodily moved by the motor.



916,727. TELEGRAPH KEY; R. L. Leaf, Alhambra, Ill. App. filed April 30, 1908. Does away with the shiftable bar which makes and breaks the connections and avoids the failure to close the circuit when the message has been transmitted. The circuit is automatically completed when the operator releases the button by means of an arm located over the key bar which is let go when the key is released.

916,674. Railway Signaling System.

916,741. ARMORED CONDUCTOR; G. A. Lutz, New York, N. Y. App. filed June 17, 1907. For flexible conduits in which a plurality of longitudinally arranged strips pass around the central axis and receive an insulated cable and a winding of flexible metal bound around the strips to hold them in position.

916,742. FLEXIBLE CONDUIT; G. A. Lutz, New York, N. Y. App. filed June 17, 1907. Like 916,741, but a binding wire is wrapped spirally around the conduit in a groove in the conduit sheath.

916,743. OUTLET OR JUNCTION BOX; G. A. Lutz, Plainfield, N. J. App. filed Feb. 12, 1908. The junction box has flanges surrounding the outlet and offset from the walls and seats and knockouts detachably secured in the seats.

916,776. ELECTRIC HAND-LIGHTING GAS-BURNER; A. J. Perkins, Revere, Mass. App. filed Oct. 21, 1908. A "pull down" gas burner which turns on the gas and moves a spring electrode in contact with the burner tip electrode. The movable electrode pin is done away with and a spiral spring with a projecting end carried by the lever forms the movable electrode.

916,792. TRANSFORMER; H. F. Selinger, St. Louis, Mo. App. filed May 21, 1908. For use with small-sized transformers for switchboard instruments. Induces internal losses by winding the wire directly on the core instead of on a form.

916,793. PRODUCTION OF SILICON; G. O. Seward, East Orange, N. J., and F. Von Kugelgen, of Holcombs Rock, Virginia. App. filed May 14, 1907. Produces silicon by subjecting a silicon compound and a reducing agent to sufficient heat to volatilize it, at the same time maintaining above the zone of reduction a cooler zone containing a non-oxidizing atmosphere in which the volatilized silicon is condensed.

916,812. INCANDESCENT ELECTRIC LAMP SOCKET; A. Weber, Sr., and John Weber, Schenectady, N. Y. App. filed July 18, 1904. Consists of a pair of interlocking, tubular sheet metal members, one adapted to telescopically receive the other, with mutually abutting cut metal edges to prevent separation when interlocked and other means for preventing a relative movement of the interlocked members.

916,829. LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed July 14, 1904. Insulating means for lamp sackets. The socket is also provided with a readily separable locking connection between the supporting plate and casing.

916,833. POCKET ELECTRIC INCANDESCENT LAMP; Fritz Blau, Berlin, Germany. App. filed April 28, 1906. A dry battery energizes the lamp and the battery is movable within the lamp so that by raising the battery by pushing the finger through an opening in the base of the container, the circuit is made.

916,840. RELAY; S. Cabot, Brookline, Mass. App. filed Nov. 29, 1906. A relay operated by wireless telegraph currents in which an electrolytic sensitive detector is used which receives the incoming waves and through the supplementary action of the condenser produces a discharge across a fusible contact member attached to a diaphragm, thus reducing the resistance of the contact and allowing a local battery current to flow which gives the relay current.

916,843. CONTROLLER; H. W. Cheney, Norwood, O. App. filed Nov. 1, 1907. Potential starters for induction motors in which the controller is prevented from moving backward from a running to a starting position. The controller is biased backward to off position when in any starting position and biased forward to off position when in running position.

916,844. ELECTRICAL CONNECTING DEVICE; E. A. Colby, Newark, N. J. App. filed Dec. 14, 1905. For sealing electric conductors in glass walls where currents of strength exceeding 5 or 6 amp are used. Makes use of a thimble of platinum, the glass being molded around the thimble and the thimble is reduced in thickness at the open end, which receives the connecting wire whereby the rate of radiation of metal and glass is inconsiderable in effect.

916,863. OVERHEAD ELECTRICAL CAR SYSTEM; G. Heineman, San Francisco, Cal. App. filed Sept. 13, 1907. Supplies the electric cars with current by means of a supply cable and a series of distributing wires connected to depending contacts which are actuated by the trolley brush of the cars.

916,866. METHOD OF TREATING ALUMINOUS MATERIALS AND PRODUCTS THEREOF; A. C. Higgins, Worcester, Mass. App. filed March 20, 1906. Makes an abrasive by fusing an aluminous material and cooling or chilling the product.

916,877. ELECTRODE FOR ARC LAMPS; F. Kalkner, Nuremberg, Germany. App. filed Aug. 11, 1908. Arc lamps for projecting lantern [illegible] the negative carbon is smaller than the positive carbon and has a thick metallic casing surrounding it to reduce heating by the current passing through it.

916,879. VAPOR ELECTRIC CONDUCTOR; O. Kruh, Schenectady, N. Y. App. filed July 11, 1907. For rectifying alternating currents. Employs a plurality of anodes and a single cathode, together with a single starting electrode located adjacent to the cathode and receiving current from the alternating means.

916,888. RAIL BOND; A. Light, Spadra, Ark. App. filed Sept. 7, 1908. A rail-bond provided with sleeves which surround the bolts that connect the rail and fish plates. It is made in one piece and consists of a neck with a hollow sleeve at each end.

916,895. SPACE TELEGRAPHY; John S. Stone, Cambridge, Mass. App. filed Dec. 14, 1905. Avoids interference, particularly "static" interference, even in cases where the condenser is serially included in the elevated conductor by providing protecting means across the condenser which has an impedance so much greater than that of the condenser that it operates as an open circuit.

916,896. RAILWAY SIGNALING; S. D. Ströhm, Philadelphia, Pa. App. filed Aug. 29, 1891. For controlling the engines of railway and avoiding the danger of collision by providing the engine or motor car with a circuit including an electromagnet which is controlled to shut off the power by means of the movement of a semaphore arranged along the track.

916,898. MOTOR CONTROL SYSTEM; E. W. Stull, Norwood, O. App. filed Dec. 31, 1906. A motor control system making use of a plurality of switches in series with means for closing them simultaneously and opening them consecutively so as to localize the arcing at one switch.

916,900. PROCESS FOR ELECTROLYTICALLY PRODUCING PERMONID OF HYDROGEN; G. Teichner, Nuremberg, Germany. Forms peroxid of hydrogen from persulfuric acid and separates the peroxid from the sulfuric acid produced.

916,905. CARBON, FILAMENT, AND METHOD OF MAKING THE SAME; W. R. Whitney, Glenville, N. Y. App. filed Feb. 2, 1906. A new form of graphite having a metallic temperature-resistance characteristic, which has a higher resistance when hot, the method of making it being to heat ordinary carbon filament to a high temperature, to drive out impurities, then flashing and then firing to a degree sufficiently to permanently change the resistance characteristic.

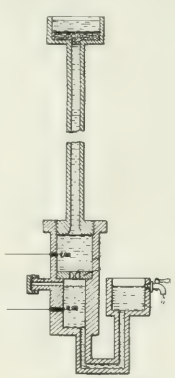
916,909. PLURAL LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed Aug. 25, 1906. A plural lamp socket having a casing, a group of sockets carried by the casing and a central socket with means for connecting one of the contacts of the central socket with one contact of all the other sockets and means for connecting the opposite sockets, the other central socket being insulated.

916,918. ELECTRICAL CIRCUIT BREAKING AND MAKING DEVICE FOR TELEGRAPHIC PURPOSES. C. Edward Davies, Ottawa, Ontario, Can. App. filed Nov. 27, 1907. A repeater making use of two instruments, each of which includes an electromagnet, a pivoted armature and a spring for retracting the armature. Details.

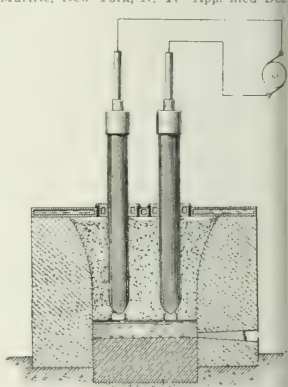
916,928. DYNAMO-ELECTRIC MACHINE; D. Hall, Norwood, O. App. filed Jan. 31, 1906. Dynamo-electric machines having auxiliary commutating field poles intermediate the main field poles for reducing the sparking at the brushes, the inner portion of the auxiliary poles being adjustable so as to vary the length of the poles.

916,931. CONNECTIVE DEVICE FOR ELECTRICAL CONDUITS AND THE LIKE; A. McMurtrie, New York, N. Y. App. filed Dec. 13, 1907. For use at the ends of armor tubes; avoids the screw threads on the sheaths by coupling through a flange on the armored tube and a nut on the end of the tube.

916,932. HOODED CONNECTOR FOR ELECTRICAL CONDUITS AND THE LIKE; A. McMurtrie, New York, N. Y. App. filed Dec.



916,942.—Signaling.



916,793.—Production of Silicon.

13, 1907. See 916,931. The housing has a sheath and is provided with an attaching portion angularly disposed with relation to the sheath receiving portion.

916,937. CONDUIT COUPLING; R. McKean Thomas, Elizabeth, N. J. App. filed May 22, 1908. Makes use of a stove bolt coupler for connecting the armored cable to the junction box.

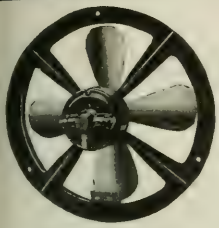
916,938. ELECTRICAL BOX COUPLING; R. McKean Thomas, Elizabeth, N. J. App. filed May 22, 1908. Makes use of a stove bolt connector for connecting the cable to the junction box.

916,950. TRANSMITTER; R. Hansen, Muskegon, Mich. App. filed May 1, 1907. Means for adjusting the carbon cell in the bridge by slotting the bridge and providing binding posts mounted in and through enlarged ends of the slot.

916,958. ELECTRICAL CIRCUIT CONTROLLER; H. W. Eichbaum, Venice, Cal. App. filed June 8, 1908. Particularly for operating switch-throwing and gate-moving means in which the switch is moved by an electric motor and is held in locked position by a bolt operated by an electromagnet.

Westinghouse

Electric Fans



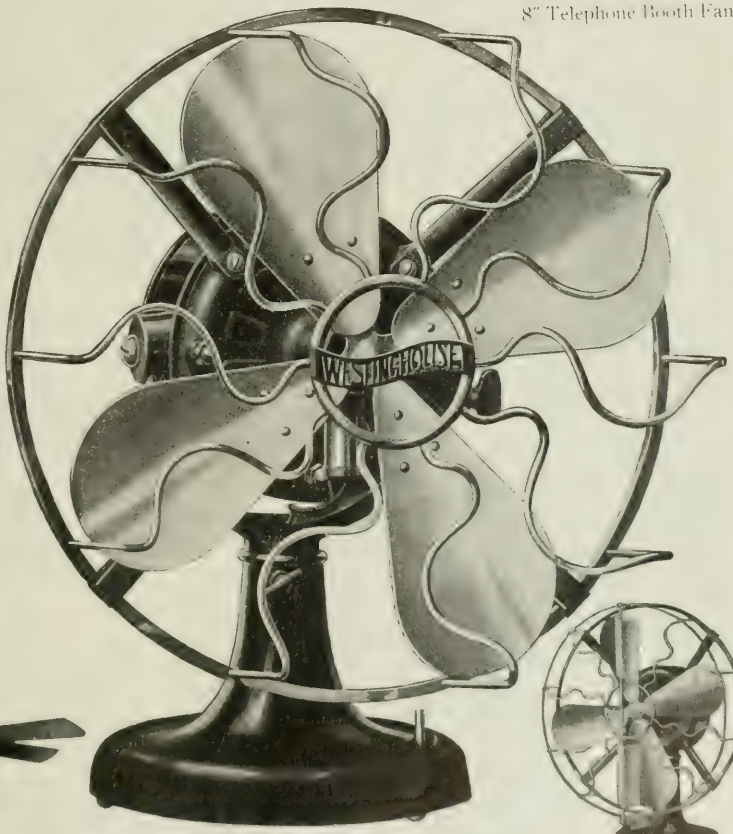
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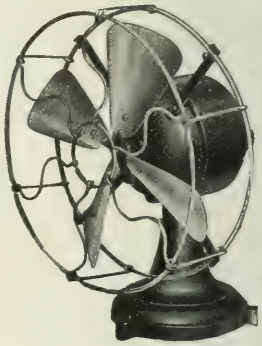
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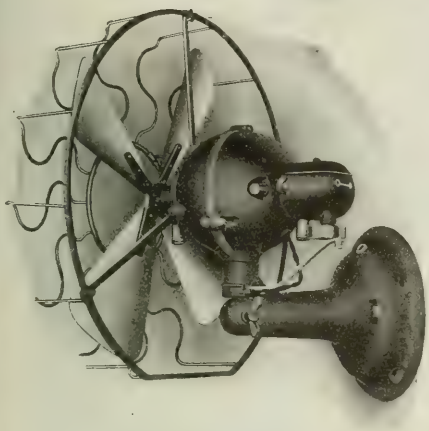
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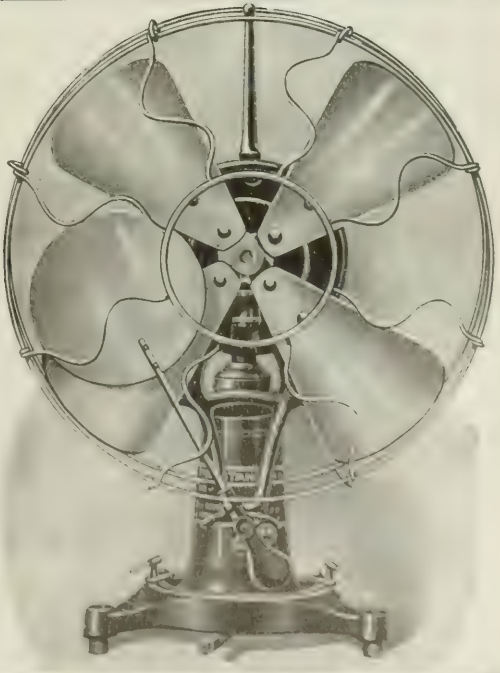
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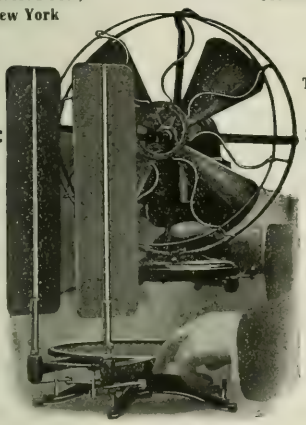
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MATTHEWS CABLE CLAMPS KEEPS POWER ON ROLLS

INDUSTRIAL PLANT ENGINEERS

Warren H. Miller, Electrical Engineer, Standard Oil Refineries, says on page 1003, of the Nov. 7, '08, ELECTRICAL WORLD:

"On all overhead work it is poor economy to work the line men when the wind is blowing hard. The torches then give a good deal of trouble to keep lit. Better put the men on some other work. If the line *must* be pushed ahead, use two torches per man," etc.

This article was written before Mr. Miller had tried the Matthews' Cable Clamp. We sent him a copy of Mr. Arthur Gillman's paper on "A Heavy-Conductor, Open Work Installation," which appeared in the ELECTRICAL WORLD of Sept. 19, and pointed out the fact that Mr. Gillman used the Matthews' Clamp in his work, and also that the use of this clamp eliminates the necessity for the cutting and splicing of power cables at corners and dead ends and therefore the use of blow torches with their troubles. Mr. Miller ordered 225 Matthews' Cable Clamps for reply May we get you to do the same?

←MCC MCC→

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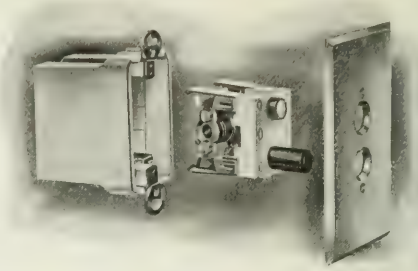
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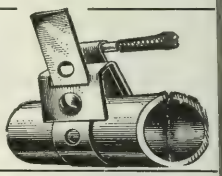
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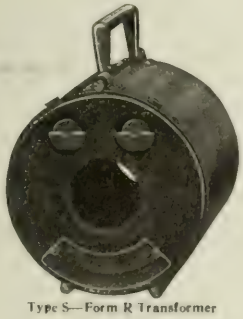
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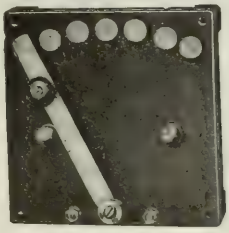
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The Report of the International Conference on Electrical Units and Standards, 1908.

The report of the International Conference of Government Delegates on Electrical Units and Standards, held in London last October, has lately been issued in the time-honored blue-paper cover that denotes the British official document. It is a remarkable document from various standpoints. In the first place, it is brief and easily comprehended. It is also translated into French and into German, evidently by qualified translators and not by a scribe. There are nine articles and a preamble in the resolutions, signed by the delegates. The preamble recites the customary adherence to the c.g.s. electromagnetic fundamental units, the decimal derivatives of which are the ohm, ampere, volt and watt. It is then declared, in effect, that the international ohm, ampere and volt are to be recommended as a concrete set of units representing the c.g.s. derivatives. The international ohm, prepared according to a certain specification, is the first primary unit. The international ampere defined by an electrolytic measurement, following another specification, is the second primary unit. The international volt is defined in terms of the international ohm and international ampere.

\- - -

The above resolutions invert the order of units adopted by the first International Electrical Congresses, which made the volt second and the ampere third. The new plan purports a realizable precision of 1 part among 100,000 in both the international ohm and the international ampere, whereas the inference to be drawn from the appended schedule for preparing Weston normal cells is that a precision of only 1 part among 10,000 is thereby obtainable. However, the advantage of the new resolutions is that they are definite and eliminate inconsistency in the concrete primary standards. This is a more important consideration, from an international standpoint, than the question of the relative precision realizable. The watt is defined correctly enough as "the unit of power," a decimal derivative of the c.g.s. unit of power; whereas, by an unfortunate choice of language, the international watt is inaccurately defined as "the energy expended per second" by 1 amp under a volt. This makes a watt appear to be a unit of *energy*. A more precise definition would have been, "the international watt is the *power* expended" by an ampere under a volt, or *the rate* at expending energy measurable in units of energy per second. The same inaccuracy appears in the French translation, but the German translation avoids the inaccuracy, and states the matter correctly.

Perhaps the most important work of the conference as set forth in its resolutions, is in its recognition of the fact that, in order to maintain the highest degree of conformity between the concrete units defined and subscribed to, it becomes desirable to establish an international electrical laboratory, to be equipped independently of any national electrical laboratory and admin-

istered under international inspection. A permanent international commission for this purpose is recommended to be established by the various Governments. Pending the appointment of a permanent international commission, the president, Lord Rayleigh, was urged to nominate an international committee of 15 "to formulate a plan for and to direct such work as may be necessary in connection with the maintenance of standards, fixing of values, intercomparison of standards, and to complete the work of the conference." This committee of 15 has been nominated. It enlists two Frenchmen, two Englishmen, two Germans, two Americans, one Belgian, one Russian, one Italian, one Austrian, one Dutchman, one Swiss and one Japanese. It is further proposed to consider whether the work of the new international commission may be incorporated with the existing International Commission of Weights and Measures, at Sèvres, in France. It would certainly seem very fitting that the international laboratory which now maintains and dispenses the international meter and gramme should also maintain and dispense to national laboratories the international ohm, ampere and volt. If this plan can be brought into successful operation, the international conference of 1908 will have achieved an epoch-making advance in international electrical accomplishment. There will be one world laboratory, under joint national operation, for the maintenance of a common system of concrete standards.

Synchronous Commutators.

If we consider the action of an ordinary synchronous converter in a substation, steadily at work converting alternating currents into direct currents, we may observe: (1) that the machine automatically maintains a set of polyphase alternating voltages between the segments of the commutator, and (2) that it also maintains a synchronous rotation of the commutator with respect to the brushes, whereby the said polyphase e.m.f. system delivers a constant direct-current e.m.f. between the brushes. The above essential conditions of operation in a synchronous converter have led electrical engineers to aim at simplifying the machine by developing the required polyphase e.m.f. system in a stationary transformer structure, and supplying this polyphase e.m.f. to a simple commutator, with a little synchronous motor to maintain the required synchronous relative motion between the commutator and its brushes. In particular, Hutin and Leblanc developed at Paris, in 1892, a machine called a "panchahuteur" consisting of a polyphase stationary transformer, having its secondary windings connected to the segments of a stationary commutator, the brushes of which were rotated by a small synchronous motor, and delivered direct current. The same machine was found to be capable of converting direct currents into alternating currents, either single-phase or polyphase; and the name panchahuteur, a slang term for a circus clown, was suggested for the machine by an electrical engineer who witnessed the range and flexibility of its behavior.

In France the panchahuteur has been in limited industrial service for a number of years. In this country practice has always adhered to the rotary converter. The advocates of the pure rotary commutator have claimed that the rotation of the armature structure in the converter, in order to secure the polyphase e.m.f. system, resembled the alleged old Chinese custom of burning down the inhabited pigsty each time that roast pig was desired. But it must be borne in mind that the converter possesses certain advantages by way of reliability not inherent in a simple rotating commutator—namely, that if the frequency varies within ordinary working limits powerful magnetic forces are automatically evoked tending to keep the commutator in step; whereas, in the rotating commutator, if the little synchronous motor does not keep the brushes on the proper segments, violent sparking may be expected. In other words, the advocates of the converter have always laid stress on the reliability of the machine, both in starting and in sudden emergencies. The article by Messrs. J. B. Whitehead and L. O. Grondahl, on page 914, describes in detail the performance of a 5-kw experimental rotating commutator. The description, taken in conjunction with the oscillographs, presents many interesting features.

Operating Producer-Gas Plants.

While the number of small central stations operating on producer gas in this country is yet very limited, the results obtained in existing gas plants so far indicate that the gas producer and gas engine will play an important part in the operation of small central stations in future without regard to the outcome of producer gas in large plants. The anthracite gas producer, when properly taken care of, seems to be giving excellent results in several small central stations. In such stations the poor economy of a steam plant operating under similar conditions makes it possible to use expensive anthracite coal and still show a saving over the operation of a steam plant, unless the steam plant is operated very near to the soft-coal mines.

Unreliability has been the principal drawback to the producer plant. To judge from the experiences of central stations which are operating successfully with small anthracite producers, the greatest difficulty to be overcome in starting a new plant is the general lack of experience of both owners and operators with producer plants. It has come to be a matter of common knowledge that the gas engine alone, aside from the producer, is a machine which requires an entirely different kind of knowledge for its operation than does a steam engine. There are not enough gas engines in use to render it easy to pick up experienced gas-engine operators. Frequently steam engineers or machinists have to be trained for the service and the company operating the gas-engine plant has to pay for their education and experience—many times in the form of annoying interruptions to service. But when the operators are thoroughly familiar with the gas engine it is a perfectly reliable piece of apparatus, unless possessed of some inherent mechanical defect due to bad design or material.

When we come to gas-engine and producer operation, together, conditions are 10 times worse than with the engine alone as regards lack of experience of owners and operators. The producer is an entirely new piece of apparatus to most central-station operators. In the suction producer, which is the one commonly used in small plants, the gas is made from moment to moment by the engine as it draws air through the firebed in the producer. In this respect it is radically different from a steam engine drawing its supply of steam from a boiler, as the boiler has considerable steam-storage capacity, and the fires

nder it can be manipulated with great freedom without caus-ng a shutdown of the engine. In the case of the gas pro-ucer, on the other hand, the quality of the gas is dependent pon a rather exact manipulation of the fires, moisture supply nd air supply. After the proper routine has been thoroughly cquired and the attendant has learned to detect immediately in-ications of faulty gas supply in the engine and to apply the emedy promptly at the producer, the operation of the producer lant becomes simple and reliable; but until the operator has eached that point it is likely to be anything but reliable. The nitial symptoms of different kinds of troubles must be thor-ughly learned by the operators, all of which takes time. The sson to be drawn from all this is that it is best not to depend n starting up a producer plant for giving regular service until he operating force has been trained to the new apparatus.

Educational Shams.

This is the age of physical, mental and spiritual breakfast oods, of substitutes and just-as-goods. We stand firmly for opular education, for liberal opportunity for learning, and raightforward democracy in educational institutions, but we elieve in calling things by their right names, and in that intel-ctual honesty which is the foundation of science. Therefore, hen there appears a tendency, however well intentioned, in ducation, that means putting a premium on the superficial nd lowering the already too low existing standards, we feel oved to protest. A bill is now under discussion in the an-ent Commonwealth of Massachusetts which, if carried through, ill do more to demoralize genuine education than anything et seriously proposed. In brief, the plan is as follows: Any own or city which is willing to lend space in its school build-ngs is to have established in it through the medium of tutors nd peripatetic professors borrowed from other institutions, a ull-fledged "college" with the power of granting degrees of arning. It is figured that by this device the goods can be elivered at the cost of about $134 for the four years' course. y this means, too, the students have the opportunity of living t home and of securing work, if necessary, while pursuing heir studies, and the "aristocratic ideals" of the ordinary col-ge designed for the "privileged few" would be eliminated. t is only fair to state that the remarkable institution, with its o-called "distributive centers," is to have a genuine endow-ent, and has the support of a certain number of "educators," ostly of the kind rampant in the public schools

In effect, the ambitious high-school principal would be able o add a "college" to his plant and to go through the solemn arce of playing university by the aid of the kind of college rofessor who can find time to travel about the country giving ctures. The "tutors" presumably would be selected from ocal talent. If the present school plants are to be thus used, is sufficiently obvious that the college work would in the ain have to be done in the evening. Evening schools are no ew thing, and are, of course, capable of doing well when roperly administered, but they put the pupils at a material isadvantage from taking them after a day's work. The advo-ates of the proposed institution seem to be a-quiver with sym-athy for the poor student who now has no chance at the lleged aristocratic college, and propose to give him a near-ducation as an annex to his public school art, nature study and music—things now thrust upon him, on the ground that he has no spiritualizing influences in the home. It is sheer nonsense, in view of actual history, to assume such an attitude, and it is well-nigh insulting to the student of small means. The alumni lists of all the American colleges are rich in the names of honored and distinguished men who have had to make their own way in the world—who have walked, if need be, from their native farms to the nearest college town, settled down to the grim work of earning their way unaided, and have won out. No mollycoddles these, whining about lack of opportunity and the college for "the privileged few," waiting apathetically for the peripatetic culture, but the stern stuff of which a nation's greatness is built. There are hundreds of them in the colleges to-day, and they will be heard from later. They are a power for good in the life of the college as they have always been, because they mean business, and theirs is the "college spirit" that the promoters of the present makeshift denounce as an aristocratic idea imported from England.

Massachusetts has already a round dozen of higher institutions of learning. If any more are really needed, the old Commonwealth must be in a bad way. The most seriously objectionable feature of the present proposal is that, with utterly insufficient equipment, it proposes to give the semblance and the name of a college education while necessarily unable to give its substance. To come to particulars, how would the laboratory courses fare, and what kind of instruction could be expected in them? The present promoters ask now merely the privilege of granting the A.B. and A.M. degrees, but when the poor, dear student wants to enrich his course with science and professional studies, the demand for the B.S., D.Sc., LL.B., M.D., E.E. and other degrees will be too strong to resist. And evidently with several great institutions granting a degree for a three years' course, that, too, will have to follow, and we shall have the edifying spectacle of 50 high schools, with their meager equipment and overworked teachers, grinding out professional degrees with none to say them nay, save the promulgators of this unique scheme, whose wisdom and respect for thorough scholarship are sufficiently in evidence already. It would seem that with the high schools and their auxiliary private institutions, the excellent classes of the Y. M. C. A. and similar bodies, enough opportunity now exists below the college grade, except as there is a need for the thorough and genuine trade and commercial school. If the promoters of get-culture-quick methods would turn their attention to these neglected matters there might be opportunity for doing something really effective, provided they were capable of the thoroughness which is demanded in so serious a task. Good practical schools of this class are important in function, but all too few. For every college and university, using these terms in their better sense, there are needed half a dozen of these eminently useful institutions, and their foundation would be a great public benefit. There are already, in fact, more alleged colleges and universities than are necessary efficiently to serve the community. If endowments for higher learning are available, they can do better work by providing equipment and scholarship in existing institutions than by adding to the number still more of inferior grade. Intensive rather than extensive work is the need of American education. From the kindergarten up, the superficial has been too much at a premium. Let us have no more but less of it.

Senate Increases the Duty on Arc Light Carbons.

The tariff bill reported this week by Senator Aldrich, chairman of the Senate Finance Committee, makes notable increases in the duty on arc-light carbons, not only over the rate in the Payne bill, but also over the present Dinley rates. The Dingley bill changed the former duty of 30 per cent ad valorem to $9 per 1000 carbons. This rate was fixed in conference, and it was charged that a rate of duty higher than intended by Congress was surreptitiously substituted in the bill while in conference, the discovery not having been made until after its passage. The Payne bill fixes the duty at 35 per cent ad valorem, which is a decrease on all grades of carbons except those for flaming-arc and searchlight lamps. In these cases the ad valorem rate increases the duty on flaming-arc lamp carbons about 50 per cent, and on searchlight carbons as much as 2000 per cent. The Aldrich bill imposes a duty of $7 *per 1000 ft.* on arc-light carbons, and the increase of the tax follows from the custom of importing carbons in long lengths. Flaming-arc lamp carbons, for example, are usually imported in lengths of 600 mm, or about 2 ft., and consequently the Aldrich measure will increase the tax on these from $9 to $14 per 1000, or about 55 per cent. Enclosed arc-lamp carbons are imported in lengths as long as 28½ in. The increase in tax on these will therefore be from $9 to $16.59 per 1000, or about 66 per cent.

It is stated that the arc-light carbons imported form less than 15 per cent of the total consumption. Few flaming-arc lamp carbons are made in this country, and carbons imported for enclosed arc lamps are only those of a special quality not manufactured here. On several occasions German workmen have been brought over to make carbons of the latter quality, but without success, either through want of proper materials, or lack of incentive to persevere, owing to the situation of the arc-carbon industry. The inferiority of street lighting in the United States as compared with Germany has been ascribed to the relative cheapness of good carbons in the latter country. Should this be correct, the practically prohibitive rate of the Aldrich bill will increase the handicap, besides lowering the revenue from this source and without creating a situation tending to lead to any improvement in the manufacture of domestic carbons.

Preliminary National Electric Light Association Program.

The program for the National Electric Light Convention, to be held at Atlantic City, June 1-4, has been as far as practicable so arranged that members interested only in a particular subject may not be obliged to be present during the entire convention. In order to be able to cover most effectively the large variety range of subjects to be considered at the meeting there will be simultaneous sessions on the third and fourth days.

The program for the two sessions of Tuesday is necessarily somewhat miscellaneous in character, including the usual addresses, some reports of committees and several papers. A feature of this day will be an illustrated lecture by Mr. Paul Bauder on "Quality of Light." The morning of Wednesday will be occupied by a "manufacturers session," at which papers relating to new apparatus will be presented, with the condition that the authors of such papers shall confine them to information not previously published. The afternoon of Wednesday will be devoted to an executive session and the public will not be admitted.

Simultaneous sessions on Thursday will deal respectively with technical and business subjects. Under the first-mentioned head there are 14 papers covering as many subjects. At the business sessions, commercial and managerial questions will be considered. On Friday there will be simultaneous sessions for the consideration respectively of questions relating to accounting and to a miscellaneous program including the relation of the isolated plant to the central station, advertising, domestic uses of electricity and the electric vehicle. The program as here printed is subject to additions and to changes as to distribution of papers. Following are the titles of the reports and papers to be presented:

Tuesday.

"Report of Committee on Uniform Accounting," by H. M. Edwards, chairman; "Report of Committee on Progress," by Mr. T. C. Martin; "Report of Committee on State and Company Branches," by Mr. R. M. Searle, chairman; "Report of Committee on Meters," by Mr. Geo. Ross Green, chairman. "Private Policy," by Mr. Paul Lupke; "Latest Developments in Street and Park Lighting," by Mr. J. W. Cowles.

Wednesday—Manufacturers' Session.

"Advance Information Regarding Developments in Storage Batteries," by Mr. Jos. Appleton; "Advance Information on New Types of Arc Lamps," by Mr. A. J. Mitchell; "The Status of the Arc Light," by Mr. N. R. Birge; "Recent Types of Arc Lamps and Their Operation," by Mr. C. E. Stephens; "Methods of Manufacture of Incandescent Lamps, Carbon, Metallized, Tantalum and Tungsten Lamps, Showing by Samples Various Processes," by Mr. J. E. Randall; "Some Recent Developments in Electrical Apparatus," by Mr. E. W. Allen; "Distributing Transformers," by Mr. E. G. Reed; "Future Requirements of Central-Station Companies," by Mr. P. Torchio.

Thursday—Technical Program.

"Report of Committee on Gas Engines," by Mr. J. B. Klumpp, chairman; "Report of Committee on Grounding Secondaries," by W. H. Blood, Jr., chairman; "Report of Committee on Protection from Lightning and Other Static Disturbances," by Mr. B. E. Morrow, chairman; "Report of Committee on Overhead Line Construction," by Mr. Paul Spencer, chairman; "Condenser, Cooling Towers and Auxiliaries," by Mr. M. R. Bump; "Reactances in Connection with Turbo-Generators," by Mr. P. Junkersfeld; "Unique Features in Power-Plant Design," by Mr. G. L. Knight; "All-Day Efficiency Tests on Station Transforming Apparatus," by Mr. S. M. Farmer.

Thursday—Commercial Program.

"Methods of Introducing Tungsten Lamps and Their Effect on Central Station Income," Mr. W. H. Atkins, editor; "Practical Illuminating Engineering in the Commercial Department," Mr. G. A. Sawin, editor; "Cost of Obtaining New Business," illustrated with curves, Mr. R. M. Searle, editor; "Can a Display Room Be Conducted Upon a Profitable Basis?" Mr. Frank B. Rae, Jr., editor; "Advantages to Be Derived from Uniform Comercial Department Forms and Methods," Mr. C. N. Stannard, editor; "Compilation of Load Factors," Mr. E. W. Lloyd, editor; "Power," Mr. H. J. Gille, editor; "The Advantage of Group-Drive in Certain Installations," Mr. C. A. Graves, editor; "New York High-Pressure Fire System," "Development of Revenue from Existing Customers," Mr. T. I. Jones, editor; "Electrical Heat for Industrial Purposes," Mr. Charles J. Russell, editor.

Friday—Miscellaneous Program.

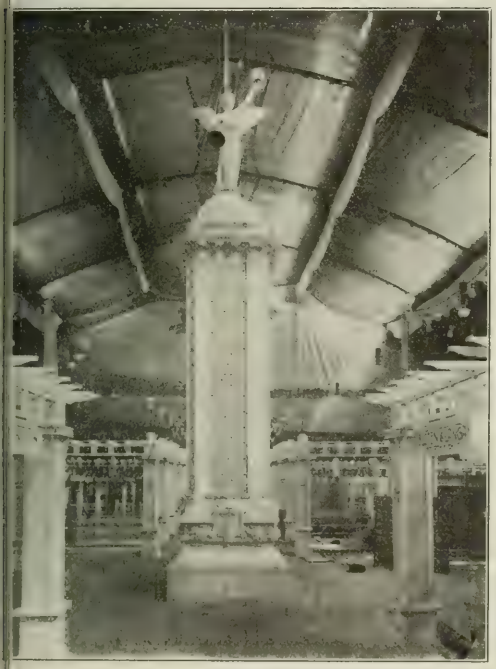
"Electricity for National Advertising," by Mr. George Williams; "Isolated Plants—Lighting, Power, Arguments Successfully Used, Experience of Various Companies," Mr. R. S. Orr, editor; "Central Station Operation of Steam Plants in Connection with Lighting Company's Service," S. Morgan Bushnell, editor; "Novel Methods of Advertising in Small Towns," Mr. Alex. J. Campbell, editor; "Electricity for Domestic Purposes—Installation, Domestic Appliances," Mr. M. E. Turner, editor; "Effect of Various Conditions of Maintenance on the Efficiency of Illumination," Mr. A. L. Eustice, editor; "Relation of Electric Vehicles to Central-Station Business," Hayden Eames, editor.

Friday—Accounting Program.

"Depreciation," by Mr. G. E. Claflin; "Payrolls," by Mr. W. W. Freeman; "Cost Accounting," by Mr. A. V. R. Coe; "Supplies," by Mr. E. A. Baily; "Branch Offices," by Mr. E. J. Allegaert.

Louisville Electrical Show.

On Monday evening President Taft touched a button at the hite House which started the machinery in the Southern ectrical Exposition at Louisville. Though many exhibitors re late in their preparations, all had their space filled by the ening day. The electrical exhibits are principally from the iddle West, but States as far east as New York are fairly presented. That many manufacturers were late in awakening the opportunity was indicated by applications for space equal amount to that already allotted, received after the lists had en closed. The affair was designed as an industrial as well an electrical exposition, and a certain amount of space had en assigned to Louisville manufacturers in general lines; however, the electrical concerns had made their applications lier, the management might have made the show an all-elec- cal affair. In the main the makers of electrical appliances for



VIEW OF CENTRAL ROTUNDA BEFORE EXPOSITION WAS OPENED

ne lighting and labor saving contented themselves with presentation in the large exhibits of the two Louisville light- and power companies which act as their agents in the uisville territory. Lamps and large power appliances of irly all the well-known makes were well represented, as re the electrical publications. The exhibits of the *Electrical orld*, *The Engineering Record* and the *Electric Railway urnal* are in a good location at the intersection of the two ncipal aisles, and the booths attracted favorable attention by son of the taste displayed in their decoration.

The two exhibits which most excited the public interest were "handless" electric clock, described in these columns last ek, and the Marconi wireless outfit. The latter is not con- cted at present for actual demonstration, but the incidental tures of the men in charge and the "dummy" illustrations of method of sending and receiving, keep the space in front of exhibit crowded at all hours.

The general illumination scheme was based on artistic ideas, h an absence of any straining for novelties and fanciful ects, neither was there any attempt at impressing the public by mere profusion or massing of light. Some idea of the success which rewarded the efforts of Mr. G. Wilbur Hubley, of the Louisville Lighting Company, who acted as director of power, and Messrs. Lewis S. Streng and B. F. Allen, of the Kentucky Electric Company, director and vice-director of illumination, may be had by reference to the illumination on the "Falls City" picture. The picture is a gigantic panorama, done in oil, of New Albany and Jeffersonville—Louisville's two largest suburbs. The canvas covers the entire north wall of the Exposition main hall—about 7000 sq. ft.—and no special lighting is provided, the nearest lamps being those on the girders of the roof and about the exhibits on the floor; nevertheless, every detail of the big picture stands out at its proper value and is visible from any part of the huge main hall, no glare or "shine appearing on any portion of it."

Virtually all the interior lighting is accomplished with frosted incandescents of various types and sizes, there being only a moderate but judicious use of flaming arcs. Down each aisle and around each booth are two lines of festooned frosted incandescents, the first line 10 ft. above the main floor and level with the ceilings of the booths, and the second 15 ft. above the floor and strung along the capitals of the ornamental pillars at the corner of the booths, the pillars being 16 ft. apart. Sixteen-cp incandescents are used for these festoons at intervals of 12 in. Higher up are lamps surmounting the peaks of the various superstructures and mounted on "link" staves on top of the pillars; other lines follow the balconies, while on the roof girders are 32-cp incandescents and flaming arcs. Within the booths the exhibitors were allowed a reasonable latitude in their illuminations, but all excesses in the way of quantity calculated to mar the general effect were forbidden. All booths are ceiled over, an arrangement which gave the exhibitors a reasonable opportunity for display; nevertheless, the directors found it necessary to curtail some of the plans brought forward by lessees of space. Those who grumbled at this were better satisfied when they saw the results brought out by the test illumination.

The exposition current is furnished by the Louisville Lighting Company and the Kentucky Electric Company, each taking care of half the total consumption and each providing a "breakdown" equipment to take care of the whole in case of accident to one or the other. The consumption by the Exposition, including a "white way" approach for two blocks along Walnut Street to the Exposition, is estimated at 65,000 kw-hours for the 12 working days on an estimated lighting equipment of 25,000 4-cp lamps and excluding the numerous small extra consumptions incidental to such an undertaking. The figures, considering the dimensions of the main hall of the Exposition Building, 48,000 sq. ft., give a good illustration of economy and efficiency to those who view the excellent effect obtained.

Aside from the "white way" approach to the Exposition there is extra street illumination by the city of Louisville throughout the business district and also an increase in the number and lighting duration of electric signs of merchants, which together make an increase in the total draft on the power and lighting companies almost equal to that of the Exposition proper. Something like 200 large signs were put up in the shopping district during the days immediately preceding the Exposition, besides a large number of smaller ones. Two of these affairs would as exhibits be worthy a place among the chief attractions of the Exposition proper. One of them is probably the largest changeable letter sign in the country which girdles the sides of a clothing establishment; it is 202 ft. long with 36-in. letters. The other affair, also put forth by a clothing house, is a roof sign at one of the most prominent corners in the city. It is 53 ft. long and 35 ft. high, the height of the letters ranging from 18 in. to 12 ft.

The Exposition opened financially as a success both for the management and the exhibitors. Almost from the beginning of the advertising campaign of some months orders from Southern territory, which is almost virgin ground for many lines, began increasing. The number of visitors from the far South promises to be surprisingly large

Incandescent Lamp Exhaust Litigation.

The United States Circuit Court for the Southern District of New York has rendered a decision in a case involving a patent (No. 726,293) granted to John W. Howell, April 28, 1903, on an application filed Nov. 9, 1897, relating to the chemical exhaustion of incandescent lamps. The court states that the only difference between the patented process and that practised by Malignani is that after pumping all the air which can be conveniently removed from the bulb by the vacuum pump, the connection is closed by Howell by pinch-cock pressure, and in the other case, which is claimed to infringe the Howell patent, by fusing the glass bulb extension by heat. The court expressed doubt if the use of the pinch-cock involved invention, but not passing on this point, held that the fusing process did not infringe the Howell patent. The parties to the litigation were the General Electric Company, complainant, and the Hill-Wright Electric Company.

Chicago Train to Atlantic City Convention.

To accommodate the Western visitors to the annual convention of the National Electric Light Association, to be held in Atlantic City June 1 to 4, a special train will be run from Chicago to Atlantic City over the Pennsylvania Railroad. It will leave the Union Station at 3 p. m. on Sunday, May 30, arriving in Atlantic City about 2 p. m., May 31. This train will be dispatched as a second section of the well-known "Pennsylvania Special," the 18-hour train between Chicago and New York. An equipment equal to that of this handsomely appointed train is promised. Mr. John J. Schayer, of the Commonwealth Edison Company, 139 Adams Street, Chicago, has been appointed Western master of transportation for the convention and he will be glad to give information about the special train not only to Chicago visitors, but to all others who may find it convenient to rendezvous in Chicago and take the special. Mr. John F. Gilchrist, of Chicago, secretary of the association, is also active in the effort to assure a strong Western delegation.

New York Public Service News.

The Public Service Commission of the First District of New York has drawn up a tentative franchise for the extension of the Hudson & Manhattan Railroad under Sixth Avenue and Forty-second Street from Thirty-third Street to the Grand Central Station. The terms of this franchise were foreshadowed in our last issue. They are practically the same as those under which the present Sixth Avenue tunnel was constructed. The terms of the franchise are subject to change by the commission after the public hearing which occurs on April 13. The commission is of the opinion that this franchise is the most liberal to the city that has ever been granted. It provides that at the end of the 25-year period, which will be July 10, 1927, the city may buy the line for what it cost to construct it, this cost being determined by appraisers. The franchise is void unless the consent of the Board of Estimate is obtained within six months and unless within the same period the company is able to file with the commission the consent of the owners of one-half of the property on the streets under which the line passes. The line must be ready for operation within three years after construction work begins. The company must pay to the city $9,000 annually for the first 10 years and $15,000 for the remainder of the 25-year period as rental. It also must pay to the city for the first 10 years an annual assessment of 50 cents for each linear foot of single track and an assessment of $1 a year for the remainder of the franchise period. It also must pay to the city $500 a year for each entrance and exit to its stations. The tunnel must be constructed of steel and masonry or of iron or of any two of these materials combined. Excavations must be made without obstructing traffic and the tracks must be constructed on the most approved plan to reduce noise and tremor. The company is required to file with the Comptroller a bond of $200,000 for the faithful performance of the terms of the franchise. The franchise is perfectly satisfactory to the officials of the railroad with the exception that the feel that the annual rental of $9,000 is too high. Under the various franchises authorizing the construction of the McAdoo tunnels, the company will be paying, when this new line is completed, four of these $9,000 rentals; one for each of the two tunnels under the Hudson River, one for the Sixth Avenue line and this last one for the extension.

The Public Service Commission has granted the Interborough Rapid Transit Company until May 5 in which to equip a second experimental train with side doors for service in the subway. The side doors in the second train will be located in the center of the car, the engineers of the company having decided that the side doors in this location will be much more satisfactory and less dangerous than at the ends of the car, as was proposed by the commission's expert, Bion J. Arnold. It is pretty well understood that the commission is determined that the subway trains shall be equipped with side doors.

The Public Service Commission has received an application from the Pelham Park Railroad Company and the City Island Railroad Company for permission to issue $50,000, 5 per cent 25-year bonds each. The purpose of these issues is to construct a monorail system railroad for passenger transportation between Bartow on the New Haven Railroad and City Island on the Sound.

Senator Travis and Assemblyman Robinson have introduced bills in the New York Legislature intended to carry out the recommendations made by the Public Service Commissions for changes in the law providing for the construction of rapid transit lines. The main features of these bills, which are identical, are that they exempt from the city debt limit the bonds that are issued for the construction of self-sustaining rapid transit roads; they amend the existing law so that some method of constructing rapid-transit lines in outlying boroughs can be provided whereby at least a portion of the cost can be paid for by local assessment; they provide that rapid-transit lines may be built either with city money or with private capital with the title to the property either in the city or in the company; in the latter case the property will be subject to taxation. The latter provision contemplates the granting of a franchise for a fixed period with a provision that the city may at any time after 10 years become the absolute owner by making full payment for the property taken without any payment for the franchise. If the city does not buy the property after 10 years and before the expiration of the period fixed in the contract the property belongs to the city at the end of the period free and clear without any payment. While the railroad remains in the hands of the company the net profits must be divided equally between the company and the city. The present operating term of 20 years is retained in these laws with a provision for an extension of 20 years more. There is an alternative provision that independent rapid transit railroads may be constructed with city money by the lowest bidder for construction and that the city may then contract with private parties to equip and operate, but that any such contract is subject to termination after 10 years by the city making payment according to the terms fixed in the contract. The operating contract can only be made for a limited term of years and at its expiration the city must buy the equipment at an appraisal price. Under this contract, the city also gets an equal share of the net profits. Other provisions in the proposed laws permit the public service commissions to take advantage of the methods outlined in some of the recent offers that have been made for the construction and equipment of subways. The titles to these lines, however, must rest with the city at all times. Amendments also allow the construction, ownership and operation by private parties of extensions to existing lines, but such extensions must be subject to purchase by the city at any time after 10 years and must become the property of the city after a lapse of a suitable period without any payment whatever.

The lower branch of the New York Legislature has defeated by a decisive vote the bill providing for the control of telephone and telegraph companies by the Public Service Commissions.

Ice Jam at Niagara Interrupts the Electric Service.

The ice and water conditions which prevailed in the Niagara gorge last Friday and Saturday, and which still existed when this report was written, will long be remembered as remarkable and unusual. On Wednesday, April 7, a fierce gale swept the lake region and Niagara. This storm resulted in a breaking up of the ice in Lake Erie, so that tremendous quantities of it poured down the Niagara River to the falls. All day Wednesday the wind kept the ice close to the American side of the river, but on Thursday and Friday the stream carried ice on nearly every square foot of its surface. This mass plunged over the Horseshoe and American Falls, and passing down in the gorge of the river, the ice was forced up against the shores on both sides. It soon reached the guard rail of the Gorge road, and then, as the river still kept rising, the icy mass was jammed high over the tracks for miles of distance on the New York side. Poles were battered down, wires fell, and other damage was done to the gorge road property, but how much is not known at this writing. It is likely that it will take weeks, perhaps months, to make repairs. Docks, boat houses, pumping stations of private owners, as well as trap nets were carried away by the ice.

Friday night the river in the gorge reached its highest point. The ice in the gorge between the falls and Lake Ontario caused the flood to back up, and these conditions endangered the station of the Ontario Power Company at the water's edge on the Canadian side. By Saturday morning the station was out of commission and the company found it necessary to issue the following statement.

"During the night the unprecedented accumulation of ice below the falls, extending for nearly nine miles to Lewiston and beyond, caused the water to rise about 40 ft. above normal. The maximum record for high water in the past, covering a period of 70 years, is about 28 ft. above normal. The power house is designed with its windows about 7 ft. above the highest previous known height of water. Last night, however, the water exceeded this previous record by about 12 ft., and the water and ice poured through the windows and south door of the power house, at once causing a stoppage of the machinery. Temporary connection is being made, through the courtesy of the Electrical Development Company, with that company's works, and the steam reserve plants at Rochester, Syracuse, West Seneca and elsewhere are being used to supply a portion of the load in the State of New York. The intention is to supply the public-service corporations first, such as railroads and lighting companies, and afterward the manufacturers and private users.

"No permanent damage is done to the power house or its machinery. As soon as the water is pumped out of the power house it will only be necessary to clean and dry the machinery before resuming full operation. The money loss is extremely small, but the inconvenience suffered by customers is, of course, serious.

"A recurrence of the accident is impossible, as the windows will be built up solid to a height above any possible rise of water in the future, and the south door, which is not necessary to the operation of the works, will be closed with masonry."

At the same time that the water damaged the station of the Ontario Power Company it reached a height of 2 ft. above the basement floor of No. 2 station of the Niagara Falls Hydraulic Power & Manufacturing Company, but as the basement is shut off the water did not get in. The turbine and generator installation was still about 8 ft. above the water and no damage was done. This would indicate that the torrent of water that plunged over the falls was held back by the ice between the station of the Niagara Falls Hydraulic Power & Manufacturing Company and the falls, forcing it to back up into the Ontario station, as it did not flow off rapidly enough to care for the downpour over the falls. While the Ontario Power Company's steel towers were placed high above the river below the Devil's Hole, the ice reached and damaged them.

Meeting of Electric Vehicle and Central Station Association.

The regular monthly meeting of the Electric Vehicle and Central Station Association was held at the Edison Building, Boston, on April 7. The speaker was Mr. Day Baker, New England manager of the General Vehicle Company, his subject being "The Congested Streets of Boston, and a Remedy." Mr. Baker discussed the various schemes which have lately been studied by various public and semi-public organizations with the object of reducing traffic congestion, and showed that the cost of teaming tunnels runs into the millions with additional excessive operating expense. Street widening is also impracticable for financial reasons, in a city like Boston. Passenger transportation methods have progressed far in advance of those for handling merchandise in cities. The horse in the large city is the true cause of congestion, as well as a menace to health. It is estimated that the horse is responsible for an annual expense of $65,000 in the Boston Street Department alone.

Mr. Baker then reviewed the sphere of the electric vehicle and described a large number of prominent applications. When it costs a dollar a foot to house a delivery-stable equipment it pays to consider the advantage of electricity. Five times the space is needed for horse-and-wagon service as for the electrical installation. A number of cases were cited where marked economies have resulted from the superseding of the horse by electricity. Arnold, Constable & Company, of New York, save 28 per cent over horse costs and handle the work better. Electric vehicles have just doubled the routes of R. H. Macy & Company, New York, compared with horses. On account of improvements in the past few years the cost of operation of the electric vehicle has been reduced 30 per cent, with 30 per cent increase in mileage and speed. Electric vehicles occupy only half the space on the streets that is required by horse-drawn teams.

The Boston Edison Company recently placed in service a modern single-motor General Vehicle Company delivery wagon, which is used by the lamp department. This wagon makes a speed of 12 to 14 miles per hour, and is capable of doing about 40 miles per charge. This is about the maximum number of miles over which deliveries can be made in a single day by two men. On the battery box is marked "Electric Wagon Operated by Edison Current." This vehicle will travel twice as fast as a horse and do double the work per day. The car replaces an older one, and the improvement in design is shown in the table:

	Old car.	New car.
Weight of battery, lb	2,000	1,050
Weight of two motors on old car, lb	500	....
Weight of one motor on new car, lb	....	200
Weight of car, lb	4,850	3,240
Mileage	25	40
Cost for energy, 4 cts. per kw-hour, cents	84	44
Cost of energy per mile, cents	3.6	1.1

The Narragansett Electric Light Company, of Providence, R. I., uses an electric pump wagon which will pump out a manhole in 15 minutes against two hours' work by three men under the old régime. For electric light and telephone work a vehicle properly equipped will draw 280 ft. of cable in 7 minutes against 30 minutes required by six men with a hand-windlass. The New York Telephone Company finds that an electric truck will do about double the work of a two-horse heavy truck. The truck is equipped with an electric winch for hauling cables and with a pair of shears for pole-setting. This vehicle will accomplish in half the time what formerly called for a portable derrick and from 8 to 10 men. The Western Electric Company has had an electric truck in service since 1906 in competition with regular two-horse trucks with the result that from 75 to 100 per cent more work is done. The Adams and American express companies are making extensive use of the electric vehicle, the former company having over 300 electric [illegible]. The latter company is said to [illegible] per cent on delivery and 30 per cent on freight cars and plans based on costs, including interest, depreciation and all operating expenses. Traffic room in the streets is increased 200 per cent by the use of electric vehicles.

Development of the Central Georgia Power Company, of Macon, Ga.

By S. Mays Ball.

A total amount of $30,000,000 will be spent in water-power development within the State of Georgia within the next few months, according to the officials of the Central Georgia Power Company, of Macon, Ga. Interested in the Central Georgia Power Company are some of the strongest financial interests in the United States and Canada. Among the number may be mentioned A. B. Leach & Company, of New York; J. E. Aldred, of Montreal, vice-president of the Shawinigan Water & Power Company; H. S. Holt, of Montreal, largely interested in Canadian Pacific railways and one of the wealthiest men in America; F. B. Schenck, of New York, president of the Liberty National Bank; J. I. Buchanan, of Pittsburgh, president of the Pittsburgh Trust Company, and a score of other wealthy men of New York, Boston, Pittsburgh, Chicago, Montreal and other cities in the North and East.

In addition to the large dam being built across the Ocmulgee River eight miles from Jackson, Ga., which will when completed generate 20,000 hp, immense dams will be built on the Flint and Oconee rivers. The Central Georgia Power Company, of Macon, which is constructing the large dam near Jackson, Ga., will also build the dams across the Oconee and Flint rivers. The dam on the Oconee River will be located near Milledgeville, Ga., and will, it is said, be by far the largest water-power plant in the South, generating when completed 45,000 hp. The dam to be built across the Flint River will be located near Reynolds in Taylor County, Ga., and will also be one of the largest plants in the South. Work on the latter plant will begin within the next 30 days.

Nearly 500 men are now at work on the $3,000,000 dam near Jackson referred to above. This dam will be completed by Jan. 1, 1910, and will then be ready to distribute power to middle and central Georgia. The output will be used in mills and factories and for lighting the streets and homes of Macon, Monticello, Forsyth, Griffin and Jackson. It will also operate the trolley line now under construction between Macon, Ga., and Atlanta, Ga. Work on the interurban line, which has been at a standstill for a week or so, will be resumed within the next few weeks, the money, it is stated authoritatively, being all in sight.

The Flint River, it is reported semi-officially, will generate sufficient power to supply southwest Georgia, Albany, Americus, Bainbridge and other adjacent towns.

Following in the wake of this development will be many trolley lines which will connect almost every part of the State. The road from Macon to Atlanta, mentioned above, is part of this project, as is one to run from Macon south to Albany and other points in the fertile southwest portion of the State. An interurban line from Macon to Indian Springs, the well-known health resort, and then on to Jackson, Ga., it is reported, will be built so soon as the power is available.

President W. J. Massee, of the Central Georgia Power Company, states that his company is flooded with letters from people in the East anxious to move their plants into his territory, or to put up new plants to take advantage of the very cheap power in view. The rains have kept back slightly progress on the dam near Jackson, on the Ocmulgee, but the work is being rushed at this time. The dam is being built in 45-ft. sections. The fourth section is also under construction. These sections run to a height of 30 ft., will extend across the river, and then be raised to their final height of 100 ft. The dam will be more than 1200 ft. in length, 100 ft. high, 93 ft. at the base and 8 ft. and 9 ft. at the crest. A minimum of 16,000 hp, and a maximum of from 23,000 hp to 25,000 hp will be generated at this dam. The foundations are built firmly in the river, the base going 16 ft. below the bed of the river, which is of rock. This dam will be the largest in the State of Georgia and there are quite a few good-sized ones therein. But the one on the Oconee River above referred to will make the Ocmulgee River dam look insignificant. For instance, the Ocmulgee dam will back water 14 miles up the river and cover 3000 acres of land which has been purchased at an average price of $20 per acre, while the Oconee dam will cover by its backwater probably more than 12,000 acres of land. Every bit of the underbrush will be cleared away before the water is turned on at the Ocmulgee dam. There are 150 men at work on clearing-off the ground to be covered by water. The contractors, Lane Brothers & Company, will complete the Ocmulgee dam, so they say, by Jan. 1, 1910. Work is now being done by both day and night forces.

Mexican Electrical Development.

Following is further information in relation to a large projected electrical development in northern Mexico to which reference was made in the issue of March 25.

The company concerned, the Mexican Northern Power Company, includes some members of the syndicate of Canadians who installed the great hydro-electric power plant and system of transmission lines at Necaxa, near Mexico. The present concession is for the establishment of a hydro-electric plant on the Conchos River at a point 17 miles above the town of Santa Rosalia, State of Chihuahua. This concession is now nominally owned by Juan A. Creel and Joaquin Cortazar, both of the city of Chihuahua, and Paul Ginther, of Santa Rosalia. The syndicate has already acquired a site for one of its proposed hydro-electric plants to be erected on the Conchos River at La Joya. Engineers are also now investigating a proposed site near Santa Rosalia. It is stated that by building a dam 60 m high across the Conchos River near Santa Rosalia 24,000 hp can be developed. The proposed dam will impound 1,840,000,000 cu. m of water, making a lake that will cover 100 sq. miles of territory. The concession also authorizes the use of the impounded water for irrigation purposes.

It is claimed that from this lake 150,000 acres of land in the Conchos River valley can be irrigated. The company expects to begin the erection of these two hydro-electric plants within the next three months. Transmission lines will be built and the electric power distributed to towns and mining camps within a radius of 200 miles. The Federal concession for the proposed hydro-electric plant at La Joya was owned by Messrs. Schoendube and Neugebauer, of Mexico. It is stated that about 15,000 hp can be developed at La Joya, making a total of nearly 39,000 hp for the two plants. The La Joya is situated about 90 miles from Chihuahua and 65 miles from Parral, the two chief cities of the State.

The Mexican Light & Power Company has resumed construction work on its big Tescapa dam, which is a part of the Necaxa system of water-storage reservoirs in the mountains near Necaxa. Considerable tunnel work is also being done in connection with this system. The Necaxa dam is nearing completion.

An electric light plant is being installed at Santa Rosalia, State of Chihuahua, by the Compania Productora de Hielo y Electricidad.

The firm of Veyan, Jean & Company, which has entered into a contract for lighting Mexico City, is installing a large hydro-electric plant, which it expects to complete inside of a year. It is building a canal from the Alameda River, from which the initial power will be obtained. The firm expects to have its lighting system completed and ready for inauguration by September, 1910.

It is reported that the Compania de Tranvias, Luz y Fuerza, which owns the electric street railway, steam and lighting and power plant in Guadalajara, is negotiating for the purchase of the concession owned by Manuel Cuesta Gallardo, for the establishment of a complete lighting and power system for that city. Mr. Gallardo has planned to erect a large hydro-electric plant on the Santiago River, near Guadalajara, and not only transmit the electrical energy to that city, but also to supply the power for operating large irrigating pumps at Lake Chapala.

he Compania de Tranvias, Luz y Fuerza was recently reor-nized. It now has a capital stock of $6,000,000. Fernando mentel y Fagoaga, of Mexico, owns a majority of the stock the company.

William A. McClaren contemplates installing a hydro-electric ant on the Fuerte River, in the State of Sinaloa. Emanuel mor has applied to the Government for a concession to util-e the water of the San Geronimo River for the operation of a dro-electric plant which he will install in the State of orelos. The Compania Hidro-Electrica Queretana will erect nother dam on the San Juan River, in the State of Queretaro, provide additional power for operating its hydro-electric plant.

David John Pullinger has obtained a concession from the ederal Government for the construction of a dam on the resa River, in the State of Durango, to provide the initial ower for a hydro-electric plant which he will erect there. He pects to generate 2000 hp. W. O. Temple is arranging to stall a hydro-electric plant on the Mayo River, in the State Sonora. The Compania Salinas de Mexico is electrifying its rge salt-refining plant at Salinas, State of Coahuila. It will tain its power from the plant of the Benito Jarez Mines ompany. The Federal Government has granted authority to se Luis Requena to install a hydro-electric plant on the epeji River, in the State of Hidalgo. The first electric light-g plant in the State of Campeche was inaugurated on March in the city of Campeche by the Campeche Light & Power ompany. The event was marked with elaborate official cere-onies in which the Governor of the State, Tomas Azmar y ano., took a leading part. The celebration consisted of a rand display of fireworks, a ball in the Governor's palace, ecial fiesta observances in the plazas, band concerts, a per-rmance by the local dramatic society and a banquet. The ant is of 750-hp capacity. The town has 20,000 population nd has six suburbs. There are other towns of considerable ze in the State which have no electric light plant.

The opening to the outside world of a stretch of several undred miles of territory bordering on the Pacific Ocean by ne building of a railroad down the western slope of Mexico as awakened a keen interest in the possibilities of large hydro-lectric projects on the part of American investors. It is tated that in the mountains, which abruptly border the costal lain, are many rivers and waterfalls which would afford an bundance of power for hydro-electric plants. There are many ich mining camps and growing industrial centers scattered hrough that region which would consume a large amount of ower, it is claimed. Several engineers are now in the field n various localities making investigations in the interest of arties who contemplate installing hydro-electric plants.

Northwestern University College of Engineering.

The new College of Engineering of Northwestern University, at Evanston, Ill., reference to which appeared in the issue of April 1, will be in full operation at the beginning of the school year next autumn. The director is John Fillmore Hayford, C.E., while Prof. O. H. Basquin, associate professor of physics, s acting as secretary of the engineering faculty. Dr. Henry Crew, for a number of years professor of physics at North-western University, is also a lecturer in the school of engi-neering.

A five-year course of study is planned. The studies of the first four years of this course fulfil all requirements for the liberal arts degree of bachelor of science, which will be con-ferred on students at the end of this term. On the completion of the full five-year course a bachelor's degree in engineering will be given. In the third year the course in physics will em-brace electricity and magnetism. Direct-current work will be taken up in the fourth year, and alternating-current phenomena and applications in the fifth year.

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ne Compania de Tranvias, Luz y Fuerza was recently reor-nized. It now has a capital stock of $6,000,000. Fernando mentel y Fagoaga, of Mexico, owns a majority of the stock the company.

William A. McClaren contemplates installing a hydro-electric ant on the Fuerte River, in the State of Sinaloa. Emanuel mor has applied to the Government for a concession to util-e the water of the San Geronimo River for the operation of a dro-electric plant which he will install in the State of orelos. The Compania Hidro-Electrica Queretana will erect nother dam on the San Juan River, in the State of Queretaro, provide additional power for operating its hydro-electric plant. David John Pullinger has obtained a concession from the ederal Government for the construction of a dam on the resa River, in the State of Durango, to provide the initial wer for a hydro-electric plant which he will erect there. He pects to generate 2000 hp. W. O. Temple is arranging to stall a hydro-electric plant on the Mayo River, in the State Sonora. The Compania Salinas de Mexico is electrifying its rge salt-refining plant at Salinas, State of Coahuila. It will otain its power from the plant of the Benito Jarez Mines ompany. The Federal Government has granted authority to se Luis Requena to install a hydro-electric plant on the epeji River, in the State of Hidalgo. The first electric light-g plant in the State of Campeche was inaugurated on March in the city of Campeche by the Campeche Light & Power ompany. The event was marked with elaborate official cere-onies in which the Governor of the State, Tomas Azmar y ano, took a leading part. The celebration consisted of a rand display of fireworks, a ball in the Governor's palace, ecial fiesta observances in the plazas, band concerts, a per-rmance by the local dramatic society and a banquet. The ant is of 750-hp capacity. The town has 20,000 population nd has six suburbs. There are other towns of considerable ze in the State which have no electric light plant.

The opening to the outside world of a stretch of several undred miles of territory bordering on the Pacific Ocean by ne building of a railroad down the western slope of Mexico as awakened a keen interest in the possibilities of large hydro-lectric projects on the part of American investors. It is ated that in the mountains, which abruptly border the costal lain, are many rivers and waterfalls which would afford an bundance of power for hydro-electric plants. There are many ich mining camps and growing industrial centers scattered rough that region which would consume a large amount of ower, it is claimed. Several engineers are now in the field n various localities making investigations in the interest of arties who contemplate installing hydro-electric plants.

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returns of 72 gas companies, 56 electric light companies
d of 16 persons or manufacturing companies engaged in mak-
or selling gas or electricity for light or heat. Twenty-four
companies supply electricity and 26 municipal plants made
urns to the board. Six new companies were chartered in
8 with gas or electric lighting powers, and five corporations
re chartered for fuel and auxiliary purposes.

The board recommends that legislation be enacted to bring
so-called anti-stock watering laws affecting gas and electric
mpanies into substantial conformity with the 1908 act which
mits railroad corporations and street railways to offer new
ck to their stockholders at such price not less than par as
Railroad Commission deems to be in the public interest.
pervision would be by the Gas and Electric Light Commis-
n. The board states that "some considerations vitally affect
policy of the existing law with respect to gas and electric
ht companies which are not so apparent to other public-
vice corporations. The market value of stock is determined
rhaps quite as much by the earning power of the stock and
nsequent potential dividend as by its established dividend and
relation of its dividend to the prevailing rate of interest.

"Gas and electric companies sell but one commodity or serv-
, or at most two, and the earning power is directly de-
mined by the prices which they charge. The present law
pressly provides that stockholders shall not be entitled to
ce additional issues of less than the market value thereof.
the extent to which the market value is determined by the
rning power, the effect of the actual application of the law is
capitalize as against the public the existing earning power
the company, regardless of whether that earning power is
sed upon reasonable prices for the gas and electricity sup-
ed, or not . . . The continued prosperity of the larger
s and electric light companies, the growing tendency to more
dely recognize their desirability as safe and permanent in-
stments, and their gradually increasing rates of dividends
steadily forcing up the market prices of their stocks, and
effect of the actual law is to work disadvantageously to the
blic."

To remove any doubt as to the meaning of Section 5, Chapter
9, Acts of 1908, the board recommends that a gas company
all be distinctly authorized to sell its electrical business and
operty to an electric light company whose lines are in the
me or a contiguous municipality, under the supervision of
e commission.

During the fiscal year the approval of the board was given to
e issuing of $1,487,200 capital stock, par value, and $200,000
bonds by gas and electric light companies.

The gas companies of the State earned $10,433,307 in 1908,
mpared with $9,789,482 in 1907. Their total operating ex-
nses for 1908 were $7,690,012, compared with $6,997,830 in
07. The gas companies had a surplus of $3,583,412 in 1908
id $3,203,469 in 1907. They declared in dividends $2,826,039
1908, against $2,314,661 the year before. Twenty-nine de-
ared no dividend. The total assets of the gas companies on
ne 30, 1908, were $60,028,172 and in 1907 $55,270,896. The
s companies paid in taxes $672,834, including State super-
sion, or 6.2 cents per 1000 ft. of gas sold. The average price
id for coal gas by meter was $0.948 per 1000 ft., compared
ith $0.998 in 1907.

The electric light companies earned a total of $10,401,550 in
08, against $9,776,430 in 1907. Their total operating ex-
nses for 1908 were $6,145,599, compared with $5,715,467 in
e preceding year. The gas companies made net profits of
38,094 in their electrical departments in 1908, as against
89,618 in 1907. The apparent profit for the year was $151,152
mpared with $259,804 in 1907. The dividends declared in
08 were $2,019,033, as against $1,826,802 in 1907. Thirty-one
mpanies paid no dividend. The gross profits of electric
ghting increased nearly $200,000 in the year 1908. The total
sets of the electric light companies in 1908 were $41,034,852,
mpared with $38,867,967 in 1907. The actual surplus was
1,828,516 in 1908 and $2,490,760 in 1907, or 13.78 per cent on
e capital in the former year and 12.14 per cent in the latter.

The electric companies paid in taxes in 1908, $1,393,119, and the rate of dividends averaged 9.65 per cent on the stock of these companies.

High-Tension Transmission Apparatus.

The meeting of the American Institute of Electrical Engineers on April 9 was held under the auspices of the high-tension transmission committee. Mr. K. C. Randall presented a paper describing high-voltage transformers and protective and controlling apparatus for outdoor installation. Transformers rated at as high as 500 kva have been built for this purpose, and units for potentials up to 60,000 volts are in service. Well-made gasketed joints, with deep, overhanging eaves and carefully sealed-in outlets, have been found to give good results in rendering the transformer cases weather-proof. Non-freezing oil should be used in order that operation in severe weather may not be endangered. By treating the high-tension transformer as part of the line all switching could be done on the low-tension side, and when necessary fused knife switches on the high-tension side would serve to disconnect the transformer.

The advantage of outdoor apparatus lies in cheapening the installation due to a saving in building; there is also less life and property hazard. The disadvantages are absence of protection from weather when inspecting, overhauling or making repairs, and exposure to molestors. The problem, as a whole, was, first the transformer; second, the switch; and, third, the protective apparatus. The author stated that all of these have been worked out and some experience obtained. The problem now is to decide when outdoor apparatus is warranted. This is a question of the station rather than the apparatus, and is subject to the individual conditions of each case.

Mr. A. B. Reynders read a paper outlining the theory upon which the construction of the condenser type of bushing is based. When uniform insulating material is used for separating a conductor from the case, the dielectric near the conductor is subjected to greater electrostatic stress than is that near the core; when the former stress exceeds a certain value the whole insulation gives away. By inserting conducting sheets throughout the insulating material the mass is divided into numerous small condensers between which the impressed e.m.f. is divided in inverse proportion to the capacities of the various condensers. In practical application of the above principles, the bushings are constructed by rolling up on a metal tube, paper and mica, or paper alone, using as a bond some material like shellac. At regular increases by steps in diameter, for example 1/16 in., a layer of tinfoil, making one complete turn, is inserted during the rolling process. Great care is exercised to obtain accurate diameters, especially when the thickness of insulation is small. No air space or wrinkling of the paper is allowable, or poor results will inevitably follow. After being completely wound, the tube is placed in an ordinary engine lathe and the ends are tapered in steps, the amount of taper depending on whether the end is immersed in oil or surrounded by air. After the turning process is completed, the entire terminal is treated with some insulating varnish in order to prevent the absorption of oil into that portion projecting into the oil, and the absorption of moisture in that portion which is in air.

With a bushing constructed by the above method, there yet remains one point of weakness; namely, the edges of the tinfoil are sharp, and the potential which exists between these edges and ground may be high enough to cause corona effects in the surrounding medium. A remedy is found in making the radius of the end of the tinfoil layer large enough to reduce the stress to safe limits; a metal ring of suitable diameter is placed at the corners where the tinfoil ends. For outdoor service a bell-shaped metal cap is placed in electrical contact with the metal layer.

Mr. W. S. Moody called attention to the fact that when concentric cylinders are inserted throughout insulating material all

of the insulation defects are placed directly in series so that there is greater danger from destruction by conduction. He stated that six years ago there had been constructed an 80-in. terminal that has withstood 500,000 volts and is still in service. The bushing consists of a tube of low-grade insulating material tapering in diameter both ways from the point at which the lead is supported, which tube is filled with a high-grade insulating liquid such as oil or asphaltum.

Mr. P. H. Thomas remarked that the difficulties encountered in insulating a terminal passing through a metallic case can be greatly reduced by employing a conductor of large diameter and providing an extra large opening through the case. He stated that the method suggested by Mr. Randall is open to the serious objection that the apparatus will be exposed to the weather at the time when inspection and repairs are necessary.

Mr. D. B. Rushmore said that the outdoor installation can never compete with the indoor on the basis of the operating features, but it may possess some few economical advantages for substations of limited output. Considerable difficulty has been encountered in finding a non-freezing liquid suitable for the electrolyte in lightning arresters; however, such a liquid is in use at the present time.

Mr. P. M. Lincoln expressed the opinion that the condenser-type of bushing represents the greatest advance made in high-tension apparatus during the last four years. The bushing is so constructed that the weak spots in the insulation are eliminated; that weak spots are placed in series is of no importance.

Mr. E. M. Hewlett explained that it is possible to construct a simple bushing possessing a breakdown e.m.f. equal to the equivalent spark-gap corresponding to its length, so that it is unnecessary to resort to the complications of the condenser-type.

Mr. S. Piek stated that the possibility of installing high-tension apparatus outdoors is shown conclusively by the successful operation for several years of 60,000-volt outdoor series transformers on the lines of the Niagara, Lockport & Ontario Power Company.

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During the evening practical demonstrations were made of the efficacy of the condenser type of terminal. When two similar terminals, one having solid insulating material and the other being built up of alternate layers of insulating and conducting material, were tested it was found that the latter withstood more than double the e.m.f. required to cause an arc to be produced across the former. The e.m.f. which reached values as high as 250,000 volts during rain tests on transformer terminals was produced by means of apparatus furnished by the Electrical Testing Laboratories and the New York Edison Company. President Ferguson being unable to be present on account of sickness in his family, Mr. J. G. White, senior vice-president, served as the presiding officer.

Inventory and Appraisal of New England Telephone & Telegraph Company.

Prof. Dugald C. Jackson, of the firm of D. C. & William B. Jackson, engineers and experts, Chicago and Boston, has submitted a summary report of the inventory and appraisal of the property of the New England Telephone & Telegraph Company, made for the Massachusetts Highway Commission during the past year. The total value of the company's property is estimated at $46,540,819. Of this the property valuation Massachusetts is $34,133,279, and the valuation in adjace States is $12,407,549. The company has 247 exchange centr offices which provide telephone service for substantially all Massachusetts. Of these offices 46 are located in buildin owned by the company. The number of operators' positions exchange switchboards is 2367. The length of telephone co ductors in the Massachusetts system is sufficient to provide nin complete two-wire metallic circuits around the equatorial ci cumference of the earth.

EXHIBIT 1.—INVENTORY SHOWING EXTENT OF PLANT IN MASSA CHUSETTS.

Buildings owned by company	
Parcels of land owned by company	
Exchange central offices	2
Operators' positions at exchange switchboards	2,3
Length of pole lines (approximate), miles	3,8
Length of underground conduits { feet	3,100,9
{ miles	5
Underground ducts { feet	14,370,6
{ miles	2,7
Manholes in underground conduits	11,2
Aggregate length of pole lines and conduits, miles	4,4
Length of open wire on pole lines { miles	67,5
{ feet	5,264,1
Length of aerial cable, miles	9
Length of conductors in aerial cables, miles	66,8
Total length of overhead conductors { miles	134,4
{ feet	6,663,3
Length of underground cables { miles	1 2
{ feet	52,5
Length of submarine cables, miles	1
Length of conductors in underground and submarine cables, miles	318,2
Aggregate length of aerial, underground and submarine cables, miles	2,2
Aggregate length of telephone conductors in all cables and wires, miles	452,6
Number of poles	310,1
Number of subscribers' telephones on Aug. 31, 1908	199,3

Exhibit 1 shows the extent of the company's plant in Massa chusetts and Exhibit 2 shows the total value of property i Massachusetts divided as in Exhibit 1. The value given fo each kind of property in Exhibit 2 includes the value of all th collateral materials that accompany the particular main divisio

The appraisal shows that the total value of the physical plan used for local service is $22,885,082. The total value of loca plant in metropolitan Boston is $4,463,843, and in the suburba district immediately surrounding, $6,446,838. The total valu of local plants in the 11 cities of the State, which are of sub stantially 50,000 inhabitants or over is $6,872,411. The re mainder of the local plants in the smaller cities and rural dis tricts amounts to $5,979,248. The total value of the toll plan is $9,641,913, which is 42 per cent of the value of the local plant The average net current assets and cash on hand which ente into the company's capital amount to $1,560,000. This repre sents the funds that are required in its current operations.

When the appraisal was taken in midsummer of 1908 ther were 42,749 telephones in use in metropolitan Boston; 34,88 in the inner zone of the suburban district; 19,456 in the oute zone; 56,729 in use in the 11 cities mentioned as a group before and 54,540 in use in the remainder of the State. These ar distributed as 20,201 main telephones; 17,143 private branch exchange terminal telephones, and 5405 extension sets connect ing with 19,159 subscribers' circuits in the metropolitan district There are 29,672 main telephones, 2519 private-branch instru ments and 2697 extension sets connecting with 16,556 sub scribers' circuits in the metropolitan district (five-mile radius of Boston); 16,875 main telephones, 702 private-branch in struments, and 1879 extension sets connecting with 8770 sub scribers' circuits in the outer zone of the suburban district. In the 11 principal cities outside Boston there are 45,516 main telephones, 5113 private-branch instruments, and 6100 exten sion sets connecting with 23,581 subscribers' circuits. In the remainder of the State are 48,558 main telephones, 1892 private-branch instruments, and 4090 extension sets connect ing with 19,399 subscribers' circuits. The inventory shows in detail the number of each kind of circuit and telephone for each of the 241 sections. The inventory and appraisal show accu rately how much and what kind of property the company possesses in all parts of the territory which it serves.

The appraisal shows that for each $100 worth of property the

e returns of 72 gas companies, 56 electric light companies d of 16 persons or manufacturing companies engaged in mak- g or selling gas or electricity for light or heat. Twenty-four s companies supply electricity and 26 municipal plants made turns to the board. Six new companies were chartered in 08 with gas or electric lighting powers, and five corporations ere chartered for fuel and auxiliary purposes.

The board recommends that legislation be enacted to bring e so-called anti-stock watering laws affecting gas and electric mpanies into substantial conformity with the 1908 act which rmits railroad corporations and street railways to offer new ock to their stockholders at such price not less than par as e Railroad Commission deems to be in the public interest. pervision would be by the Gas and Electric Light Commis- on. The board states that "some considerations vitally affect e policy of the existing law with respect to gas and electric ht companies which are not so apparent to other public- rvice corporations. The market value of stock is determined rhaps quite as much by the earning power of the stock and nsequent potential dividend as by its established dividend and e relation of its dividend to the prevailing rate of interest.

"Gas and electric companies sell but one commodity or serv- e, or at most two, and the earning power is directly de- rmined by the prices which they charge. The present law pressly provides that stockholders shall not be entitled to ke additional issues of less than the market value thereof. the extent to which the market value is determined by the rning power, the effect of the actual application of the law is capitalize as against the public the existing earning power the company, regardless of whether that earning power is sed upon reasonable prices for the gas and electricity sup- lied, or not . . . The continued prosperity of the larger as and electric light companies, the growing tendency to more idely recognize their desirability as safe and permanent in- stments, and their gradually increasing rates of dividends e steadily forcing up the market prices of their stocks, and e effect of the actual law is to work disadvantageously to the ublic."

To remove any doubt as to the meaning of Section 5, Chapter 9, Acts of 1908, the board recommends that a gas company all be distinctly authorized to sell its electrical business and roperty to an electric light company whose lines are in the me or a contiguous municipality, under the supervision of e commission.

During the fiscal year the approval of the board was given to e issuing of $1,487,200 capital stock, par value, and $200,000 bonds by gas and electric light companies.

The gas companies of the State earned $10,433,307 in 1908, mpared with $9,789,482 in 1907. Their total operating ex- nses for 1908 were $7,690,012, compared with $6,997,830 in 07. The gas companies had a surplus of $3,583,412 in 1908 d $3,203,469 in 1907. They declared in dividends $2,826,039 1908, against $2,314,661 the year before. Twenty-nine de- ared no dividend. The total assets of the gas companies on ne 30, 1908, were $60,028,172 and in 1907 $55,270,896. The s companies paid in taxes $672,834, including State super- sion, or 6.2 cents per 1000 ft. of gas sold. The average price id for coal gas by meter was $0.948 per 1000 ft., compared ith $0.998 in 1907.

The electric light companies earned a total of $10,401,550 in 08, against $9,776,430 in 1907. Their total operating ex- nses for 1908 were $6,145,599, compared with $5,715,467 in e preceding year. The gas companies made net profits of 38,094 in their electrical departments in 1908, as against 89,618 in 1907. The apparent profit for the year was $151,152 mpared with $250,804 in 1907. The dividends declared in 08 were $2,019,933, as against $1,826,802 in 1907. Thirty-one mpanies paid no dividend. The gross profits of electric hting increased nearly $200,000 in the year 1908. The total sets of the electric light companies in 1908 were $41,034,852, mpared with $38,847,067 in 1907. The actual surplus was 828,516 in 1908 and $2,490,760 in 1907, or 13.78 per cent on e capital in the former year and 12.14 per cent in the latter.

The electric companies paid in taxes in 1908, $1,393,119, and the rate of dividends averaged 9.65 per cent on the stock of these companies.

High-Tension Transmission Apparatus.

The meeting of the American Institute of Electrical Engineers on April 9 was held under the auspices of the high-tension transmission committee. Mr. K. C. Randall presented a paper describing high-voltage transformers and protective and controlling apparatus for outdoor installation. Transformers rated at as high as 500 kva have been built for this purpose, and units for potentials up to 60,000 volts are in service. Well-made gasketed joints, with deep, overhanging eaves and carefully sealed-in outlets, have been found to give good results in rendering the transformer cases weather-proof. Non-freezing oil should be used in order that operation in severe weather may not be endangered. By treating the high-tension transformer as part of the line all switching could be done on the low-tension side, and when necessary fused knife switches on the high-tension side would serve to disconnect the transformer.

The advantage of outdoor apparatus lies in cheapening the installation due to a saving in building; there is also less life and property hazard. The disadvantages are absence of protection from weather when inspecting, overhauling or making repairs, and exposure to molestors. The problem, as a whole, was, first the transformer; second, the switch; and, third, the protective apparatus. The author stated that all of these have been worked out and some experience obtained. The problem now is to decide when outdoor apparatus is warranted. This is a question of the station rather than the apparatus, and is subject to the individual conditions of each case.

Mr. A. B. Reynders read a paper outlining the theory upon which the construction of the condenser type of bushing is based. When uniform insulating material is used for separating a conductor from the case, the dielectric near the conductor is subjected to greater electrostatic stress than is that near the core; when the former stress exceeds a certain value the whole insulation gives away. By inserting conducting sheets throughout the insulating material the mass is divided into numerous small condensers between which the impressed e.m.f. is divided in inverse proportion to the capacities of the various condensers. In practical application of the above principles, the bushings are constructed by rolling up on a metal tube, paper and mica, or paper alone, using as a bond some material like shellac. At regular increases by steps in diameter, for example 1/16 in., a layer of tinfoil, making one complete turn, is inserted during the rolling process. Great care is exercised to obtain accurate diameters, especially when the thickness of insulation is small. No air space or wrinkling of the paper is allowable, or poor results will inevitably follow. After being completely wound, the tube is placed in an ordinary engine lathe and the ends are tapered in steps, the amount of taper depending on whether the end is immersed in oil or surrounded by air. After the turning process is completed, the entire terminal is treated with some insulating varnish in order to prevent the absorption of oil into that portion projecting into the oil, and the absorption of moisture in that portion which is in air.

With a bushing constructed by the above method, there yet remains one point of weakness; namely, the edges of the tinfoil are sharp, and the potential which exists between these edges and ground may be high enough to cause corona effects in the surrounding medium. A remedy is found in making the radius of the end of the metal layer large enough to reduce the stress to safe limits; a metal ring of suitable diameter is placed at the corners where the tinfoil ends. For outdoor service a bell-shaped metal cap is placed in electrical contact with the metal layer.

Mr. W. S. Moody called attention to the fact that when concentric cylinders are inserted throughout insulating material all

of the insulation defects are placed directly in series so that there is greater danger from destruction by conduction. He stated that six years ago there had been constructed an 80-in. terminal that has withstood 500,000 volts and is still in service. The bushing consists of a tube of low-grade insulating material tapering in diameter both ways from the point at which the lead is supported, which tube is filled with a high-grade insulating liquid such as oil or asphaltum.

Mr. P. H. Thomas remarked that the difficulties encountered in insulating a terminal passing through a metallic case can be greatly reduced by employing a conductor of large diameter and providing an extra large opening through the case. He stated that the method suggested by Mr. Randall is open to the serious objection that the apparatus will be exposed to the weather at the time when inspection and repairs are necessary

Mr. D. B. Rushmore said that the outdoor installation can never compete with the indoor on the basis of the operating features, but it may possess some few economical advantages for substations of limited output. Considerable difficulty has been encountered in finding a non-freezing liquid suitable for the electrolyte in lightning arresters; however, such a liquid is in use at the present time.

Mr. P. M. Lincoln expressed the opinion that the condenser-type of bushing represents the greatest advance made in high-tension apparatus during the last four years. The bushing is so constructed that the weak spots in the insulation are eliminated; that weak spots are placed in series is of no importance.

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ompany has outstanding $83.67 of par value in stocks, bonds nd notes. The aggregate value of the entire property and a omparison of it with the total outstanding securities are shown n Exhibits 4 and 5. It appears that the company has been aying for such expenses as engineering and interest, espe-ially on new construction, out of earnings instead of out of its apital account. The appraisal shows that the company has no ater in its securities; affords information on which the com-ission can decide how much money the company should be llowed to return on its investment, and how much it should be

EXHIBIT 2.—APPRAISAL OF PROPERTY, SHOWING VALUE OF PROPERTY BELONGING TO BUSINESS IN MASSACHUSETTS.

ubstation equipment	$3,217,240
rop wires leading to subscribers' premises	668,315
oles and fittings	4,266,173
onduits and manholes	7,588,632
ires on poles	2,724,017
erial cables	1,465,213
nderground and submarine cables	4,718,066
witchboards	4,094,067
urniture and tools	453,078
and and buildings	2,344,469
eneral supplies	1,040,000
et current assets and cash on hand	1,560,000
Total	$34,133,270

*Book value, from Auditor.
†Round figure representing average condition.

easonably expected to expend in the average year for reconstruction, against the ravages of age or obsolescence.

As a result of the study of the complete plant, Professor ackson applied percentages to each kind of construction inolved, considering first cost, rate of depreciation, probable effects of changes in the art and the acts of municipal bodies, pecial misfortunes due to the elements and any salvage that ight be recovered from discarded plant. In this way a figre of 7.3 per cent is reached for the average yearly reconstruction account for the property (exclusive of land, general upplies and working capital) used in Massachusetts business, $2,240,000 on the existing plant. It seems proved that the

EXHIBIT 3.—APPRAISAL, SHOWING VALUE OF PROPERTY BELONGING TO BUSINESS OUTSIDE OF MASSACHUSETTS.

pparatus and equipment	$9,771,766
and and buildings	210,783
nvestment in other companies	1,945,000
et current assets and cash on hand	480,000
Total	$12,407,549

*At cost value, from auditor.
†Round figure representing average condition.

ompany is not building extensions out of annual receipts under olor of the reconstruction account, and the exacting inspection f the plant shows that it is maintained in excellent condition.

The appraisal puts the board in possession of standards by hich to measure the reasonableness of the total sum annually ollected by the company from its subscribers, but fuller traffic ata and apportioned cost records must be gathered and nalyzed before recommendations as to the company's relative eatment of localities and classes of customers can be put on a rmer foundation. There appears ground for an early re-ision of rates in the Boston metropolitan and suburban dis-

EXHIBIT 4.—APPRAISAL, SHOWING DIVISION OF PROPERTY VALUE BETWEEN THAT IN MASSACHUSETTS AND THAT OF ADJOINING STATES TOGETHER WITH THE TOTAL VALUE OF PROPERTY.

alue of property in Massachusetts	$34,133,270
alue of property adjoining Massachusetts	12,407,549
alue of entire property of the New England Telephone & Telegraph Company	$46,540,819

icts. The great importance of a full and comprehensive telehone service and the large part which the telephone plays in te business welfare and social convenience of the State justify rther expenditure for a traffic, rate and cost study. Improved ethods of accounting are desirable to show more fully the ffect of changes in the rates for any particular service.

Additional complexity is introduced into the rate question by ie relations of the toll service to the local service. In the ap raisal the two classes of plant were carefully separated, but rther figures and more careful means of separating local and toll operating results are needed. Figures for gross receipts seem to indicate that at present the long-distance toll system is not earning its own operating expenses, reconstruction charges, and return on the investment.

The report concludes with a recommendation for a further appropriation to enable at least a year's study to be given to the traffic and rate problem in a way that shall serve to establish a sound basis upon which future rate problems may be adjudged. Within a short time it is expected that certain recommendations will be made as to the rates in the Boston and suburban districts as a direct result of the appraisal now completed.

EXHIBIT 5.—APPRAISAL, SHOWING VALUE OF PROPERTY COMPARED WITH OUTSTANDING SECURITIES OF TELEPHONE COMPANY.

Appraisal value of entire property of New England Telephone & Telegraph Company	$46,540,819
Total par value of the company's outstanding stocks, bonds and notes, as given by the company's auditor for Aug. 31, 1909	$38,939,850

Final Hearing on Franchise of Connecticut River Transmission Company.

As noted in our issues for Feb. 11 and 25, the Massachusetts Gas and Electric Light Commission has given hearings on the appeal of the Fitchburg Gas & Electric Light Company against the franchise of the Connecticut River Transmission Company, on Feb. 3, 9 and 19. A continued hearing was given on March 12, at which time Mr. E. W. Burdell, counsel for the Fitchburg company, showed that the minimum charge brings in a revenue of only $845 out of a total of $44,000 received from the sales of energy for motors.

Among those who testified were F. P. Royce, vice-president of the Fitchburg company; Charles L. Edgar, president of the Edison Electric Illuminating Company, Boston; A. S. Pratt, of Stone & Webster, and Philip Cabot, president of the Turners Falls Power Company.

Mr. Cabot submitted a report by the law firm of C. S. Davis & W. Rodman Peabody, Boston, an abstract of which is given herewith: "The question for the Massachusetts commission to consider here is not whether competition will cause an immediate lowering of the price of power for these particular consumers, but whether it will bring the price to a permanent lower level than will a regulated monopoly.

"If a central station is to be regarded by the State as the natural agent for the supply of electricity in the district which it serves, it should be required to furnish such energy at the lowest reasonable cost. If it can produce such energy more cheaply from water-power than from a steam plant, it should do so, and vice versa. If a combination of plants gives the most economical results, well and good. If a steam auxiliary must be maintained for emergency service, the charges upon it must be considered in all rate making.

"If electrical energy manufactured by a water-power company should be distributed locally by the existing central station, the price which the consumer pays will naturally be based upon the cost of producing electricity, transmitting it, distributing it and of maintaining reserve steam-plant capacity. It may well be that the same management shall control the whole transaction. The small consumer has no reason to object, since the transmission company cannot bring power to the city and distribute it more cheaply than the local company can distribute the power which it buys from the water-power organization. If the consumer purchases surplus power from the water-power enterprise for only a part of the year, he cannot expect to buy steam-generated power in emergencies from the local lighting company at the price it could afford to make him on longer-term contracts. If the local company loses much of its motor business it will have to charge a higher price for lighting. The true remedy for the small consumer who finds that the local company is selling at too high a price is to appeal to the commission and have the equitableness of the rate adjudicated."

The latter portion of the report discusses the history of the London & District Electric Supply Company's plans as the matter has been considered in Parliament and by the Board of Trade. The parallel is drawn between the Connecticut River case and that of the London company, and the report concludes by stating that the London matter has finally been postponed for another year as a result of the adverse report of the House of Commons against the undertaking of supplying electrical energy in the local fields to large consumers and in bulk to the authorized distributors of the territory from a central generating plant of the London & District Supply Company.

At the final hearing on the appeal held April 8, arguments were presented by Counsel Everett W. Burdett, Esq., Boston, for the Fitchburg company, and by Counsel Jeremiah Smith, Jr., Boston, for the Connecticut River organization. Mr. Burdett reviewed the peculiar features of the franchise granted the Transmission company by the Board of Aldermen of 1908, showing how the small power user was in reality not certain of securing service from the hydro-electric company unless acceptable to the latter, and at rates depending on such local conditions as might apply. Mr. Burdett argued that in the French King Rapids charter granted by the Legislature of 1908 the State had fixed its definite policy with regard to the sale of power in Fitchburg, units of not less than 300 hp being the clear intention for the water-power enterprise. Although under a different company, and developing a different site, the transmission pertinently should fall under the same regulations that applied to the French King company, for the interests are the same and so is the market. Previous legislation is limited, but it authorizes water-power companies to approach a market already served by a central station only after close limitations of the amount of power which shall be the minimum sold to any one consumer. The Fitchburg company welcomes the entrance of an organization into the field that will deal with large users exclusively under such terms as apply to the French King company. Although the ability of the company to supply primary power without the considerable use of steam auxiliaries has been questioned, the fundamental issue is whether the entry of the corporation into the community is in the public interest. Considerable misapprehension exists in Fitchburg as to the benefits the small consumer will derive from this power.

Mr. Burdett then said that a solution of the question would be for the Transmission company to sell the local company secondary power at a price which, supplemented by the service of the local company from its steam plant, will enable the Fitchburg company to sell and distribute at as low rates as could the Transmission company. The effect would be to cheapen the cost of the general output of the local company. If the commission and city will co-operate with the parties there is no reason why a settlement should not be made with advantage to all.

For the Transmission company, Mr. Smith argued that the sole question is: What will best promote the public interest? Manufacturing is the chief industry of Massachusetts, and local factories must compete with other parts of the country enjoying cheaper fuel, supplies and labor, less stringent regulations and closer proximity to raw materials. Low-priced hydro-electric power will encourage new development and better aid in the meeting of competition. The Transmission company can successfully occupy the field; its plant is 90 per cent completed and the field of supplying low-priced power to manufacturing interests on a large scale is practically unoccupied. There is no policy in the State prohibiting the introduction of low-priced power. There will be no permanent benefit to the public from the competition of two substantially similar electric light companies. The exclusion of this power would work serious injury. Public interest requires the admission of the Transmission company on some terms, and it is doubtful if the public interests will be best conserved by the entry of the Transmission company into the small-power business. A mutual agreement between the companies appears to be a fair way out of the problem.

For the commission, Chairman Barker then closed the h
ings by stating that the board appreciated the more than l
importance of the case as a precedent, and that a decision wo
be rendered at the earliest possible day.

Massachusetts Legislative Notes.

The committee on taxation has reported leave to withdr
on the Reynolds bill providing for the imposition of an exc
tax on telephone and telegraph companies on the basis of
annual gross receipts of such corporations per mile of sin
wire operated by them in each town of the State.

Governor Draper has suggested that the Legislature app
priate $35,000, to be refunded by the New England Telephon
Telegraph Company, for further investigation of the cost
service and rates in Massachusetts by the Highway Commissi

The committee on public lighting has reported favorably
the bill to authorize the consolidation of the electrical busin
and property of a gas company with the business and prope
of an electric light company in the same or a contiguous mun
pality. The House has refused to discharge this bill from
orders of the day under suspension of the rules, but will c
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ompany has outstanding $83.67 of par value in stocks, bonds nd notes. The aggregate value of the entire property and a omparison of it with the total outstanding securities are shown n Exhibits 4 and 5. It appears that the company has been aying for such expenses as engineering and interest, espe- ially on new construction, out of earnings instead of out of its apital account. The appraisal shows that the company has no vater in its securities; affords information on which the com- nission can decide how much money the company should be llowed to return on its investment, and how much it should be

EXHIBIT 2.—APPRAISAL OF PROPERTY, SHOWING VALUE OF PROPERTY BELONGING TO BUSINESS IN MASSACHUSETTS.

Substation equipment	$3,217,249
Drop wires leading to subscribers' premises	668,315
Poles and fittings	4,266,173
Conduits and manholes	7,588,632
Wires on poles	2,724,017
Aerial cables	1,465,213
Underground and submarine cables	4,718,066
Switchboards	4,094,067
Furniture and tools	453,078
Land and buildings	2,344,369
General supplies	1,040,000
Net current assets and cash on hand	1,560,000
Total	$34,133,270

*Book value, from Auditor.
†Round figure representing average condition.

easonably expected to expend in the average year for recon- truction, against the ravages of age or obsolescence.

As a result of the study of the complete plant, Professor ackson applied percentages to each kind of construction in- olved, considering first cost, rate of depreciation, probable ef- ects of changes in the art and the acts of municipal bodies, pecial misfortunes due to the elements and any salvage that might be recovered from discarded plant. In this way a fig- ure of 7.3 per cent is reached for the average yearly recon- truction account for the property (exclusive of land, general upplies and working capital) used in Massachusetts business, or $2,240,000 on the existing plant. It seems proved that the

EXHIBIT 3.—APPRAISAL, SHOWING VALUE OF PROPERTY BELONGING TO BUSINESS OUTSIDE OF MASSACHUSETTS.

Apparatus and equipment	$9,771,766
Land and buildings	210,783
Investment in other companies	1,945,000
Net current assets and cash on hand	480,000
Total	$12,407,549

*At cost value, from auditor.
†Round figure representing average condition.

ompany is not building extensions out of annual receipts under olor of the reconstruction account, and the exacting inspection of the plant shows that it is maintained in excellent condition.

The appraisal puts the board in possession of standards by which to measure the reasonableness of the total sum annually collected by the company from its subscribers, but fuller traffic data and apportioned cost records must be gathered and analyzed before recommendations as to the company's relative treatment of localities and classes of customers can be put on a firmer foundation. There appears ground for an early re- vision of rates in the Boston metropolitan and suburban dis-

EXHIBIT 4.—APPRAISAL, SHOWING DIVISION OF PROPERTY VALUE BETWEEN THAT IN MASSACHUSETTS AND THAT OF ADJOINING STATES, TOGETHER WITH THE TOTAL VALUE OF PROPERTY.

Value of property in Massachusetts	$34,133,270
Value of property adjoining Massachusetts	12,407,549
Value of entire property of the New England Telephone & Telegraph Company	$46,540,819

tricts. The great importance of a full and comprehensive tele- phone service and the large part which the telephone plays in the business welfare and social convenience of the State justify further expenditure for a traffic, rate and cost study. Improved methods of accounting are desirable to show more fully the effect of changes in the rates for any particular service.

Additional complexity is introduced into the rate question by the relations of the toll service to the local service. In the ap- praisal the two classes of plant were carefully separated, but further figures and more careful means of separating local and toll operating results are needed. Figures for gross receipts seem to indicate that at present the long-distance toll system is not earning its own operating expenses, reconstruction charges, and return on the investment.

The report concludes with a recommendation for a further appropriation to enable at least a year's study to be given to the traffic and rate problem in a way that shall serve to establish a sound basis upon which future rate problems may be ad- judged. Within a short time it is expected that certain recom- mendations will be made as to the rates in the Boston and suburban districts as a direct result of the appraisal now com- pleted.

EXHIBIT 5.—APPRAISAL, SHOWING VALUE OF PROPERTY COMPARED WITH OUTSTANDING SECURITIES OF TELEPHONE COMPANY.

Appraisal value of entire property of New England Telephone & Telegraph Company	$46,540,819
Total par value of the company's outstanding stocks, bonds and notes, as given by the company's auditor for Aug. 31, 1909	$38,939,850

Final Hearing on Franchise of Connecticut River Transmission Company.

As noted in our issues for Feb. 11 and 25, the Massachusetts Gas and Electric Light Commission has given hearings on the appeal of the Fitchburg Gas & Electric Light Company against the franchise of the Connecticut River Transmission Com- pany, on Feb. 3, 9 and 19. A continued hearing was given on March 12, at which time Mr. E. W. Burdell, counsel for the Fitchburg company, showed that the minimum charge brings in a revenue of only $845 out of a total of $44,000 received from the sales of energy for motors.

Among those who testified were F. P. Royce, vice-president of the Fitchburg company; Charles L. Edgar, president of the Edison Electric Illuminating Company, Boston; A. S. Pratt, of Stone & Webster, and Philip Cabot, president of the Tur- ners Falls Power Company.

Mr. Cabot submitted a report by the law firm of C. S. Davis & W. Rodman Peabody, Boston, an abstract of which is given herewith: "The question for the Massachusetts commission to consider here is not whether competition will cause an immedi- ate lowering of the price of power for these particular consum- ers, but whether it will bring the price to a permanent lower level than will a regulated monopoly.

"If a central station is to be regarded by the State as the natural agent for the supply of electricity in the district which it serves, it should be required to furnish such energy at the lowest reasonable cost. If it can produce such energy more cheaply from water-power than from a steam plant, it should do so, and vice versa. If a combination of plants gives the most economical results, well and good. If a steam auxiliary must be maintained for emergency service, the charges upon it must be considered in all rate making.

"If electrical energy manufactured by a water-power com- pany should be distributed locally by the existing central station, the price which the consumer pays will naturally be based upon the cost of producing electricity, transmitting it, distributing it and of maintaining reserve steam-plant capacity. It may well be that the same management shall control the whole trans- action. The small consumer has no reason to object, since the transmission company cannot bring power to the city and dis- tribute it more cheaply than the local company can distribute the power which it buys from the water-power organization. If the consumer purchases surplus power from the water- power enterprise for only a part of the year, he cannot ex- pect to buy steam-generated power in emergencies from the local lighting company at the price it could afford to make him on longer-term contracts. If the local company loses much of its motor business it will have to charge a higher price for lighting. The true remedy for the small consumer who finds that the local company is selling at too high a price is to ap- peal to the commission and have the equitableness of the rate adjudicated."

The latter portion of the report discusses the history of the London & District Electric Supply Company's plans as the matter has been considered in Parliament and by the Board of Trade. The parallel is drawn between the Connecticut River case and that of the London company, and the report concludes by stating that the London matter has finally been postponed for another year as a result of the adverse report of the House of Commons against the undertaking of supplying electrical energy in the local fields to large consumers and in bulk to the authorized distributors of the territory from a central generating plant of the London & District Supply Company.

At the final hearing on the appeal held April 8, arguments were presented by Counsel Everett W. Burdett, Esq., Boston, for the Fitchburg company, and by Counsel Jeremiah Smith, Jr., Boston, for the Connecticut River organization. Mr. Burdett reviewed the peculiar features of the franchise granted the Transmission company by the Board of Aldermen of 1908, showing how the small power user was in reality not certain of securing service from the hydro-electric company unless acceptable to the latter, and at rates depending on such local conditions as might apply. Mr. Burdett argued that in the French King Rapids charter granted by the Legislature of 1908 the State had fixed its definite policy with regard to the sale of power in Fitchburg, units of not less than 300 hp being the clear intention for the water-power enterprise. Although under a different company, and developing a different site, the transmission pertinently should fall under the same regulations that applied to the French King company, for the interests are the same and so is the market. Previous legislation is limited, but it authorizes water-power companies to approach a market already served by a central station only after close limitations of the amount of power which shall be the minimum sold to any one consumer. The Fitchburg company welcomes the entrance of an organization into the field that will deal with large users exclusively under such terms as apply to the French King company. Although the ability of the company to supply primary power without the considerable use of steam auxiliaries has been questioned, the fundamental issue is whether the entry of the corporation into the community is in the public interest. Considerable misapprehension exists in Fitchburg as to the benefits the small consumer will derive from this power.

Mr. Burdett then said that a solution of the question would be for the Transmission company to sell the local company secondary power at a price which, supplemented by the service of the local company from its steam plant, will enable the Fitchburg company to sell and distribute at as low rates as could the Transmission company. The effect would be to cheapen the cost of the general output of the local company. If the commission and city will co-operate with the parties there is no reason why a settlement should not be made with advantage to all.

For the Transmission company, Mr. Smith argued that the sole question is: What will best promote the public interest? Manufacturing is the chief industry of Massachusetts, and local factories must compete with other parts of the country enjoying cheaper fuel, supplies and labor, less stringent regulations and closer proximity to raw materials. Low-priced hydro-electric power will encourage new development and better aid in the meeting of competition. The Transmission company can successfully occupy the field; its plant is 90 per cent completed and the field of supplying low-priced power to manufacturing interests on a large scale is practically unoccupied. There is no policy in the State prohibiting the introduction of low-priced power. There will be no permanent benefit to the public from the competition of two substantially similar electric light companies. The exclusion of this power would work serious injury. Public interest requires the admission of the Transmission company on some terms, and it is doubtful if the public interests will be best conserved by the entry of the Transmission company into the small-power business. A mutual agreement between the companies appears to be a fair way out of the problem.

For the commission, Chairman Barker then closed the hi
ings by stating that the board appreciated the more than l
importance of the case as a precedent, and that a decision wo
be rendered at the earliest possible day.

Massachusetts Legislative Notes.

The committee on taxation has reported leave to withdr
on the Reynolds bill providing for the imposition of an exc
tax on telephone and telegraph companies on the basis of
annual gross receipts of such corporations per mile of sin
wire operated by them in each town of the State.

Governor Draper has suggested that the Legislature app
priate $35,000, to be refunded by the New England Telephon
Telegraph Company, for further investigation of the cost
service and rates in Massachusetts by the Highway Commissi

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N. E. L. A. EXHIBITION.—The exhibition to be held in onnection with the National Electric Light Convention to be eld at Atlantic City, June 1-4, promises to be one of the most uccessful in the history of the N. E. L. A. Five days after nding out a circular to prospective exhibitors 75 per cent of e space available was taken.

PUBLIC SERVICE COMMISSION BILL IN ILLINOIS EGISLATURE.—There is a prospect that the Public Service ommission bill now pending in the Senate of the Illinois Legisature will be reported out of committee within the next two eeks. The bill, which was introduced by Senator Samuel A. ttelson, of a Chicago district, was the subject of a notice last eek in these pages.

EIGHTY-THOUSAND-VOLT WINNIPEG HYDROLECTRIC PLANT.—Work has been commenced on the ater-power development at Point du Bois for a 20,000-hp enerating plant, the current to be transmitted to Winnipeg. he transmission line, the total length of which will be 75.5 iles, will be over a right-of-way 100 ft. wide. The total ater power available at Point du Bois is stated to be 60,000 hp.

ELECTRICAL FEATURES AT GARY TO BE DISUSSED.—A joint meeting of the Electrical Section of the Western Society of Engineers and the Chicago branch of the merican Institute of Electrical Engineers will be held at the Western Society's rooms, Chicago, on the evening of April 16. he speaker will be Mr. B. R. Shover, electrical engineer of the diana Steel Company, at Gary, Ind., who will discuss some of e electrical features of the new "Steel City" at Gary.

I. E. S. NEW ENGLAND SECTION.—The April meeting f the New England section of the Illuminating Engineering ociety will be held in the auditorium of the Edison Building, Boylston Street, at 7:30 p. m., April 20. Mr. S. R. Keyes, of e Boston Edison Laboratory, will read a paper on "Some Recent Tests on Street Lighting." The entertainment committee, of which Mr. E. C. Kimball, 39 Boylston Street, Boston, is chairman, will endeavor to provide some plan for the getting together of members for dinner before the section meeting. All who shall be in Boston that evening are requested to send their names to Mr. Kimball as soon as possible.

ILLUMINATING ENGINEERING SOCIETY.—A recent canvass of the membership of the Illuminating Engineering Society showed that 56 per cent of the members are connected with the electrical part of the industry, 22 per cent with the gas part, the remaining 22 per cent being oculists, architects, etc. A large increase in the percentage of gas men is expected during the present year. Although the place and date of the next annual convention have not yet been selected it is probable that the convention will be held in New York City early in the fall.

BOSTON NEWSPAPER WIRELESS PLANT.—The Boston *Herald* has signed contracts with the Stone Telephone & Telegraph Company for the installation of a wireless telegraph equipment for general news service on the tops of the newspaper's buildings on Tremont and Mason Streets. There will be an aerial 222 ft. long, 143 ft. above the ground at one end and 97 ft. above the street at the other terminus. A three-circuit type of receiver will be installed, and the detector will be of the Wollaston electrode type. Leads from the aerial will be joined together in a circuit running through the roof to the reportorial department in the *Herald* mechanical building. The object of the plant is to render the newspaper less dependent on unreliable wire telegraphic service.

ELECTRIC FIRE INSURANCE RISKS.—The Continental Insurance Company of New York has entered a protest against a resolution adopted March 16 by the Underwriters' Association of the Middle Department on the subject of electric risks. The resolution, which will come up for final action April 20, recites that as the concentration of financial control of electric railway properties and allied classes has produced conditions which threaten the gradual loss of the business to stock companies under present methods of control by the various underwriting associations, the association should relinquish jurisdiction over all rates and rules respecting the properties of electric railroad, electric power or gas illuminating companies, except risks the electric features of which are incidental and apart from the main purpose for which they are maintained and operated, or electric light or gas plants owned by municipalities.

CORRECTIONS.—In our issue for April 8, on page 868, in an article entitled "Estimating Monthly Demand from Experience" the dollar mark should not have been used over the last two columns in the table. As the heading indicates, the values in the table refer to the maximum number of 50-watt lamps that would be used simultaneously in commercial and residence districts. In the same issue, on page 876, the statement that the stator diameter would be increased 25 per cent, which appears in a letter by Mr. H. C. Specht, should read 2.5 per cent, which is the relative increase in the diameter of the stator of an induction motor provided with the self-contained auto-transformer starter described by Mr. E. J. Willis in our issue for March 25. The second equation, on page 732 of our issue for March 25, should read

$$L = y \frac{1 + \frac{1}{6}\left(\frac{3W}{AT}\right)^2}{.1 - kd\left(1 + \frac{T}{M}\right)}$$

instead of

$$L = y \frac{1 + \frac{1}{6}\left(\frac{3W}{AT}\right)^2}{1 - kd\left(1 + \frac{T}{M}\right)}$$

as a reference to equation (1) on page 731 will show.

INDIANA MUNICIPAL LEAGUE.—The Indiana Municipal League will hold its next annual meeting at Lafayette, Ind., June 22, 23 and 24. Mr. Joseph T. McNary, of Logansport, Ind., is president of the league.

ELECTRICAL ACTIVITY IN DENVER.—The city electrician of Denver issued in March 535 electrical permits, an increase of almost 100 over the same month last year. During the month 907 inspections were made.

DAY SERVICE IN BATH, N. Y.—A sufficient number of contracts having been secured, the Bath (N. Y.) Electric & Gas Light Company announces that it will re-establish a day electric service for lights and motors, beginning May 1.

TEXAS A. I. E. E. BRANCH.—The students of the junior and senior classes of the electrical-engineering department of the A. & M. College of Texas have organized a student branch of the American Institute of Electrical Engineers under the direction of Prof. F. A. De Lay, head of the electrical engineering department. This is one of the strongest departments of the college

BOSTON SIGNS NEW LIGHTING CONTRACT.—Mayor Hibbard, of Boston, has just signed a new five-year contract with the Edison Electric Illuminating Company for street lighting. The contract calls for the payment of $380,000 a year and may be extended by the city to a period of 10 years. If a 10-year contract is entered into the price is only $360,000 a year. A board of arbitration is provided which will consist of the scientific heads of Harvard and the Boston School of Technology, together with a third whom these two arbitrators will choose.

STEAM AND ELECTRIC RAILWAY FREIGHT EXCHANGES.—The Lackawanna, Grand Trunk, Ohio Central Dispatch and the Ontario & Western Railroads have agreed to prorate with the Toledo & Western, an electric line, on through rates and divisions on freight shipments that it originates. The arrangement goes into effect May 1 and is of exceptional interest and importance, owing to the previous unwillingness of steam roads to interchange freight traffic with electric roads.

BOSTON MEETING OF MECHANICAL ENGINEERS.—A meeting will be held in Boston on April 16 for the purpose of discussing a plan for holding in that city meetings of the American Society of Mechanical Engineers similar to those held in New York, for the reading and discussion of papers. Members of all Boston societies interested in mechanical engineering are invited to attend the meeting, at which President Jesse M. Smith and Secretary Calvin W. Rice, of the American Society of Mechanical Engineers, will be present, and also Mr. Willis E. Hall, chairman of the A. S. M. E. committee on meetings.

ELECTRICAL ENGINEERS IN PERU.—Consul-General Taylor, of Callao, Peru, reports that the only concern in Lima employing a foreign electrical engineer is the Empresas Electricas Asociadas, an American (Mr. Alfred L. Kenyon) being under contract at a high salary. Other electrical engineers are employed by the company, but are all subordinates at a salary of $75 per month, which seems to be the average paid electrical engineers. Many applications are received for these positions, especially from Americans and Germans, but Peruvians who have more or less mastered the art are generally given the preference over foreigners.

STORAGE-BATTERY LECTURE.—At a meeting held under the auspices of the Electric Storage Battery Company in Assembly Hall of the Case School of Applied Science, Cleveland, Ohio, on the evening of March 29, Mr. H. M. Beck, engineer of the operating department of the Electric Storage Battery Company, Chicago office, delivered a lecture giving in detail the development of the "Exide" battery up to its present stat After the lecture there was a general discussion of the subje which brought out useful information in relation to the care an operation of the storage battery. Various parts of the batter described were on exhibition for the inspection of the guest About 250 were present at the meeting.

ELECTRIC DISPLAY AT BRIDGE CELEBRATION.—No definite plans have yet been completed by the Queensbor Celebration Committee for an electrical display at the form opening of the Queensboro bridge on June 12. Quite a numbe of plans have been suggested to the committee, and it is sai that within a week or 10 days some definite scheme will b adopted. The grandiose scheme suggested of spreading ove one side of the bridge, from shore to shore, an electrical ma of Long Island was never seriously considered, although an nouncements were published that it would be undertaken. I is probable, however, that the electrical display will be th most prominent feature of the opening celebration.

PENNSYLVANIA RAILROAD SIGNAL TRAINING SCHOOL.—The Pennsylvania Railroad has started a signa course of three years for the training of signal engineers Upon graduation the men are eligible to appointment as assist ant signal inspectors in the signal engineer's office. After attain ing this they will be considered in line of appointment to th following positions: Assistant supervisor of signals, superviso of signals, inspector, assistant signal engineer and signal en gineer. The interlocking signal system of the Pennsylvani Railroad has increased threefold in the past six years. A present there are 12,408 signals in service, covering 3385 mile of road, or over 70 per cent of the entire mileage, and repre senting a value of more than $5,000,000.

ELECTRIC CLUB OF CHICAGO.—At the meeting of th Electric Club, of Chicago, on April 7, there was a general dis cussion of the subject of "Electric Heating Devices," opene by Mr. E. L. Callahan, and reported elsewhere in this issue The matter of securing permanent quarters for the club wa brought up in a brief report from the house committee, pre sented by Mr. Perry Boole in the absence of the chairma of the committee, Mr. W. R. Pinckard. The subject was briefl discussed, but it was decided that the time had not yet arrive for taking this important step, and the matter was therefor laid on the table. At the meeting of April 21 Mr. B. E. Sunny president of the Chicago Telephone Company, who is not onl a representative electrical man, but a public-spirited citizen a well, will address the club on the subject "Chicago Charte Bills." Mr. Sunny has devoted much attention to this subject and owing to this fact and to his prominence in the industry a large attendance is anticipated.

PROPOSED RAILROAD ELECTRIFICATION IN ILLINOIS MUNICIPALITIES.—It is said that Mayor Busse, o Chicago, with the influence of the city administration, wil favor an amendment to the cities and villages act of the Illinoi statutes to provide that city governments may prescribe by ordi nance the motive power by which cars or trains shall be oper ated within the limits of the municipalities and change the form of this motive power whenever, in their judgment, such change is necessary. Although the Illinois Central Railroad Company is committed to the eventual electrification of its terminal in Chicago, it is said that its plans are too vague and its progress too slow to suit the city government of Chicago which hopes, therefore, to secure additional power to enforce its wishes. On the part of the city authorities it is pointed out that nothing more radical is proposed than the elevation of the railroad tracks in the city of Chicago—a work of great magnitude which has been successfully accomplished, or nearly ac complished. It is claimed that the city has the right to demand that all the railroads shall eventually electrify their lines within the city limits of Chicago.

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N. E. L. A. EXHIBITION.—The exhibition to be held in nnection with the National Electric Light Convention to be ld at Atlantic City, June 1-4, promises to be one of the most ccessful in the history of the N. E. L. A. Five days after ding out a circular to prospective exhibitors 75 per cent of space available was taken.

PUBLIC SERVICE COMMISSION BILL IN ILLINOIS EGISLATURE.—There is a prospect that the Public Service mmission bill now pending in the Senate of the Illinois Legis- ure will be reported out of committee within the next two eks. The bill, which was introduced by Senator Samuel A. telson, of a Chicago district, was the subject of a notice last ek in these pages.

EIGHTY-THOUSAND-VOLT WINNIPEG HYDRO- LECTRIC PLANT.—Work has been commenced on the ter power development at Point du Bois for a 20,000-hp nerating plant, the current to be transmitted to Winnipeg. e transmission line, the total length of which will be 75.5 les, will be over a right-of-way 100 ft. wide. The total ter power available at Point du Bois is stated to be 60,000 hp.

ELECTRICAL FEATURES AT GARY TO BE DIS- SSED.—A joint meeting of the Electrical Section of the estern Society of Engineers and the Chicago branch of the nerican Institute of Electrical Engineers will be held at the estern Society's rooms, Chicago, on the evening of April 16. e speaker will be Mr. B. R. Shover, electrical engineer of the diana Steel Company, at Gary, Ind., who will discuss some of electrical features of the new "Steel City" at Gary.

I. E. S., NEW ENGLAND SECTION.—The April meeting the New England section of the Illuminating Engineering ciety will be held in the auditorium of the Edison Building, Boylston Street, at 7:30 p. m., April 20. Mr. S. R. Keyes, of Boston Edison Laboratory, will read a paper on "Some Recent Tests on Street Lighting." The entertainment committee, of which Mr. E. C. Kimball, 39 Boylston Street, Boston, is chairman, will endeavor to provide some plan for the getting together of members for dinner before the section meeting. All who shall be in Boston that evening are requested to send their names to Mr. Kimball as soon as possible.

ILLUMINATING ENGINEERING SOCIETY.—A recent canvass of the membership of the Illuminating Engineering Society showed that 56 per cent of the members are connected with the electrical part of the industry, 22 per cent with the gas part, the remaining 22 per cent being oculists, architects, etc. A large increase in the percentage of gas men is expected during the present year. Although the place and date of the next annual convention have not yet been selected it is probable that the convention will be held in New York City early in the fall.

BOSTON NEWSPAPER WIRELESS PLANT.—The Boston *Herald* has signed contracts with the Stone Telephone & Telegraph Company for the installation of a wireless telegraph equipment for general news service on the tops of the newspaper's buildings on Tremont and Mason Streets. There will be an aerial 222 ft. long, 143 ft. above the ground at one end and 97 ft. above the street at the other terminus. A three-circuit type of receiver will be installed, and the detector will be of the Wollaston electrode type. Leads from the aerial will be joined together in a circuit running through the roof to the reportorial department in the *Herald* mechanical building. The object of the plant is to render the newspaper less dependent on unreliable wire telegraphic service.

ELECTRIC FIRE INSURANCE RISKS.—The Continental Insurance Company of New York has entered a protest against a resolution adopted March 16 by the Underwriters' Association of the Middle Department on the subject of electric risks. The resolution, which will come up for final action April 20, recites that as the concentration of financial control of electric railway properties and allied classes has produced conditions which threaten the gradual loss of the business to stock companies under present methods of control by the various underwriting associations, the association should relinquish jurisdiction over all rates and rules respecting the properties of electric railroad, electric power or gas illuminating companies, except risks the electric features of which are incidental and apart from the main purpose for which they are maintained and operated, or electric light or gas plants owned by municipalities.

CORRECTIONS.—In our issue for April 8, on page 868, in an article entitled "Estimating Monthly Demand from Experience" the dollar mark should not have been used over the last two columns in the table. As the heading indicates, the values in the table refer to the maximum number of 50-watt lamps that would be used simultaneously in commercial and residence districts. In the same issue, on page 876, the statement that the stator diameter would be increased 25 per cent, which appears in a letter by Mr. H. C. Specht, should read 2.5 per cent, which is the relative increase in the diameter of the stator of an induction motor provided with the self-contained auto-transformer starter described by Mr. E. J. Willis in our issue for March 25. The second equation, on page 732 of our issue for March 25, should read

$$1 + \frac{1}{6}\left(\frac{3W}{AT}\right)^2$$

$$\cdot 1 - kd)\left(1 + \frac{T}{M}\right)$$

instead of

$$i + \frac{1}{6}\left(\frac{3W}{AT}\right)^2$$

$$G - kd)\left(i + \frac{T}{M}\right)$$

as a reference to equation (1) on page 731 will show.

INDIANA MUNICIPAL LEAGUE.—The Indiana Municipal League will hold its next annual meeting at Lafayette, Ind., June 22, 23 and 24. Mr. Joseph T. McNary, of Logansport, Ind., is president of the league.

ELECTRICAL ACTIVITY IN DENVER.—The city electrician of Denver issued in March 535 electrical permits, an increase of almost 100 over the same month last year. During the month 907 inspections were made.

DAY SERVICE IN BATH, N. Y.—A sufficient number of contracts having been secured, the Bath (N. Y.) Electric & Gas Light Company announces that it will re-establish a day electric service for lights and motors, beginning May 1.

TEXAS A. I. E. E. BRANCH.—The students of the junior and senior classes of the electrical-engineering department of the A. & M. College of Texas have organized a student branch of the American Institute of Electrical Engineers under the direction of Prof. F. A. De Lay, head of the electrical engineering department. This is one of the strongest departments of the college.

BOSTON SIGNS NEW LIGHTING CONTRACT.—Mayor Hibbard, of Boston, has just signed a new five-year contract with the Edison Electric Illuminating Company for street lighting. The contract calls for the payment of $380,000 a year and may be extended by the city to a period of 10 years. If a 10-year contract is entered into the price is only $360,000 a year. A board of arbitration is provided which will consist of the scientific heads of Harvard and the Boston School of Technology, together with a third whom these two arbitrators will choose.

STEAM AND ELECTRIC RAILWAY FREIGHT EXCHANGES.—The Lackawanna, Grand Trunk, Ohio Central Dispatch and the Ontario & Western Railroads have agreed to prorate with the Toledo & Western, an electric line, on through rates and divisions on freight shipments that it originates. The arrangement goes into effect May 1 and is of exceptional interest and importance, owing to the previous unwillingness of steam roads to interchange freight traffic with electric roads.

BOSTON MEETING OF MECHANICAL ENGINEERS.—A meeting will be held in Boston on April 16 for the purpose of discussing a plan for holding in that city meetings of the American Society of Mechanical Engineers similar to those held in New York, for the reading and discussion of papers. Members of all Boston societies interested in mechanical engineering are invited to attend the meeting, at which President Jesse M. Smith and Secretary Calvin W. Rice, of the American Society of Mechanical Engineers, will be present, and also Mr. Willis E. Hall, chairman of the A. S. M. E. committee on meetings.

ELECTRICAL ENGINEERS IN PERU.—Consul-General Taylor, of Callao, Peru, reports that the only concern in Lima employing a foreign electrical engineer is the Empresas Electricas Asociadas, an American (Mr. Alfred L. Kenyon) being under contract at a high salary. Other electrical engineers are employed by the company, but are all subordinates at a salary of $75 per month, which seems to be the average paid electrical engineers. Many applications are received for these positions, especially from Americans and Germans, but Peruvians who have more or less mastered the art are generally given the preference over foreigners.

STORAGE-BATTERY LECTURE.—At a meeting held under the auspices of the Electric Storage Battery Company in Assembly Hall of the Case School of Applied Science, Cleveland, Ohio, on the evening of March 29, Mr. H. M. Beck, engineer of the operating department of the Electric Storage Battery Company, Chicago office, delivered a lecture giving in detail the development of the "Exide" battery up to its present sta After the lecture there was a general discussion of the subj which brought out useful information in relation to the care a operation of the storage battery. Various parts of the batt described were on exhibition for the inspection of the gues About 250 were present at the meeting.

ELECTRIC DISPLAY AT BRIDGE CELEBRATION. No definite plans have yet been completed by the Queensbo Celebration Committee for an electrical display at the form opening of the Queensboro bridge on June 12. Quite a numl of plans have been suggested to the committee, and it is s that within a week or 10 days some definite scheme will adopted. The grandiose scheme suggested of spreading ov one side of the bridge, from shore to shore, an electrical m of Long Island was never seriously considered, although a nouncements were published that it would be undertaken. is probable, however, that the electrical display will be t most prominent feature of the opening celebration.

PENNSYLVANIA RAILROAD SIGNAL TRAINI SCHOOL.—The Pennsylvania Railroad has started a sig course of three years for the training of signal enginee Upon graduation the men are eligible to appointment as assi ant signal inspectors in the signal engineer's office. After attai ing this they will be considered in line of appointment to t following positions: Assistant supervisor of signals, supervis of signals, inspector, assistant signal engineer and signal e gineer. The interlocking signal system of the Pennsylvar Railroad has increased threefold in the past six years. present there are 12,408 signals in service, covering 3385 mil of road, or over 70 per cent of the entire mileage, and rep senting a value of more than $5,000,000.

ELECTRIC CLUB OF CHICAGO.—At the meeting of t Electric Club, of Chicago, on April 7, there was a general d cussion of the subject of "Electric Heating Devices," open by Mr. E. L. Callahan, and reported elsewhere in this iss The matter of securing permanent quarters for the club w brought up in a brief report from the house committee, pr sented by Mr. Perry Boole in the absence of the chairm of the committee, Mr. W. R. Pinckard. The subject was brie discussed, but it was decided that the time had not yet arriv for taking this important step, and the matter was therefo laid on the table. At the meeting of April 21 Mr. B. E. Sunr president of the Chicago Telephone Company, who is not on a representative electrical man, but a public-spirited citizen well, will address the club on the subject "Chicago Chart Bills." Mr. Sunny has devoted much attention to this subje and owing to this fact and to his prominence in the industry large attendance is anticipated.

PROPOSED RAILROAD ELECTRIFICATION IN ILL NOIS MUNICIPALITIES.—It is said that Mayor Busse, Chicago, with the influence of the city administration, w favor an amendment to the cities and villages act of the Illinc statutes to provide that city governments may prescribe by orc nance the motive power by which cars or trains shall be ope ated within the limits of the municipalities and change t form of this motive power whenever, in their judgment, su change is necessary. Although the Illinois Central Railro Company is committed to the eventual electrification of i terminal in Chicago, it is said that its plans are too vague a its progress too slow to suit the city government of Chicag which hopes, therefore, to secure additional power to enforce i wishes. On the part of the city authorities it is pointed o that nothing more radical is proposed than the elevation of t railroad tracks in the city of Chicago—a work of great magr tude which has been successfully accomplished, or nearly a complished. It is claimed that the city has the right to dema that all the railroads shall eventually electrify their lines with the city limits of Chicago.

The Havana Central Railroad.

By Reginald Gorham.

CUBA now possesses an up-to-date long-distance electric railway, which, moreover, is operated by a wide-awake company fully alive to the possibilities of the country. The Havana Central Railroad comprises two main lines, both with the same terminus in Havana, one of which runs in a southwesterly direction through the great pineapple and tobacco-producing districts to Guanajay, 31 miles distant, while the other serves an extensive grazing and fruit-growing land, in the center of which is the important town of Güines, although the actual terminus of the line is at a large sugar mill three miles beyond the town and 35 miles from Havana. A brief description of the two routes may be of interest.

On leaving the Arsenal Station, the trains skirt the bay for a short distance, leaving the ancient fortress of Atares on the right and the power house on the left, and soon pass the extensive workshops and car-sheds at Luyanó. At Underdown Junction the two lines branch apart, the Guanajay going to the right and passing through some of the most popular residential sections of the capital, notably Marianao, nine miles distant. Almost during the entire journey the train runs through land devoted to the cultivation of pineapples, which industry has attained to great proportions during the last few years, and largely owing to the exceptional facilities for transportation afforded by the company's special trains drawn by electric locomotives; 750,000 crates being shipped from the Havana Central wharf alone last year, as against 430,000 the previous season. A great deal of tobacco is grown in the part of Cuba traversed known as the "Buelta Abajo" and famous as producing the finest tobacco in the world. On reaching the terminus of the line, Guanajay, communication with important agricultural centers is afforded by the company's automobile service from that point.

The scenery on the Güines line, although not quite so interesting as that met with on the other route, is still beautiful, the royal palm being everywhere in evidence. The land seen in the first part of the journey is principally devoted to cattle raising. At Jamaica is situated a large stone quarry on the hillside, from which most of the material is obtained for building the government roads. Beyond San José, 20 miles from the start, the principal product of the soil is the sugar cane, the company making a specialty of transporting not only the cane but the sacks of sugar. Extra trains are run during the tourist season to enable visitors to visit the large mill of "Providencia," where the whole process of extracting the sugar from the raw cane can be observed.

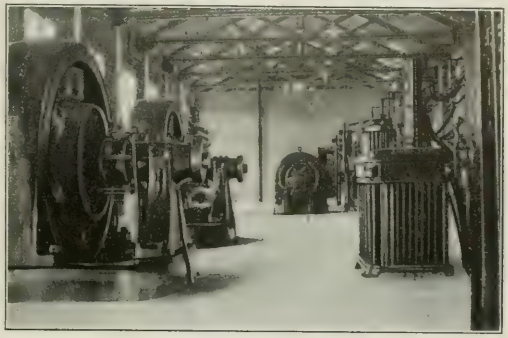


FIG. 2.—INTERIOR OF GUINES SUBSTATION.

The engineering features of the system are decidedly interesting. The line is operated on the overhead trolley system, direct current being supplied at 600 volts. The system of distribution is high tension, three-phase, [illegible] cycles, the transmission line being 13,200 volts, which is transformed down and converted in six substations, there being [illegible] on each line.

The power house is a fine example of modern electrical engineering practice and contains seven 750-hp Munoz boilers with chain-grate stokers. The engine room contains three vertical Curtis turbo-generators, made at Schenectady, N. Y., two being

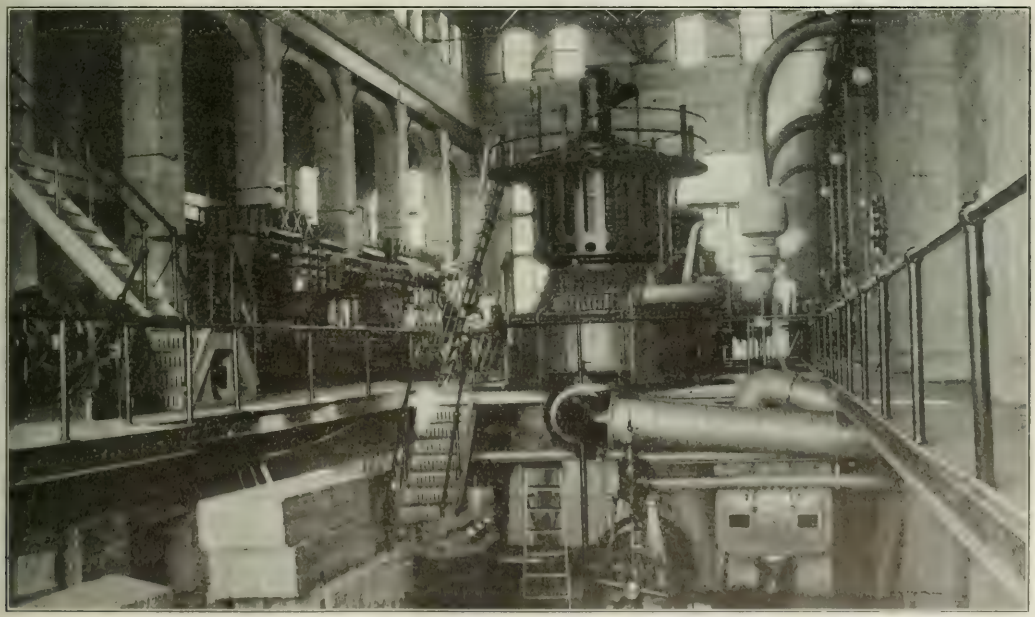


FIG. 1.—VIEW OF INTERIOR OF POWER HOUSE.

of 2000 kw and one of 1000 kw. These machines generate current at 2200 volts, 25 cycles, which is transformed up to 10,000 volts for transmission. The exciting plant consists of one motor-driven set, 125 volts, 360 amp, running at 750 r.p.m., and one steam turbine set, 125 volts, 250 amp, running at 1600 r.p.m. The handsome black switchboard is 48 ft. long, and is arranged for remote control, the high-tension switches being placed on an upper gallery. Rotary converters are placed in all the substations, and there are three in the main power house. Motor-generators for lighting are also installed, as the company

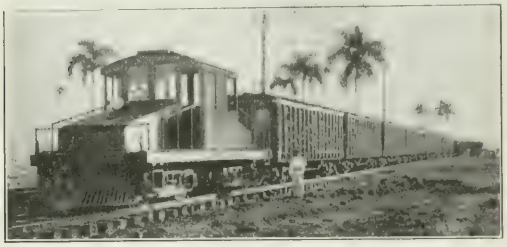


FIG. 3.—SUGAR CANE TRAIN ON GUINES LINE.

supplies a great deal of current for town illumination and power work in various industrial establishments along the line of route. The track is rock-ballasted throughout, and is laid with rails weighing 75 lb. per yard.

There are 20 passenger motor cars and 10 trailers; they are 56 ft. long and hold 62 people, except a few which have a small compartment for baggage, whose seating capacity is 56. They were manufactured by the Wason Manufacturing Company, of Springfield, Mass., and are equipped with four General Elec-

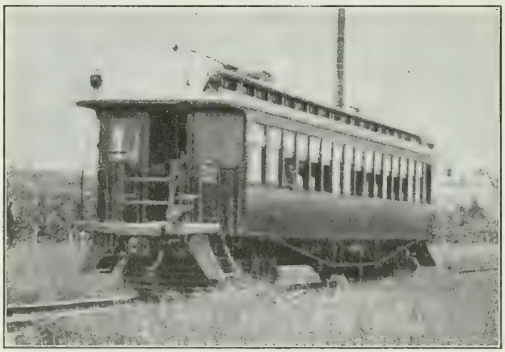


FIG. 4.—PASSENGER CAR ON GUINES LINE.

tric motors of 75 hp each. The trains, which are of two, three or four cars, are operated on the Sprague multiple-unit system. The locomotives, 10 in number, weigh 40 tons each, and are equipped with four General Electric motors of 90 hp each.

The line was constructed by the company, under the supervision of Mr. A. W. K. Billings, of Havana; it is now controlled by the United Railways of Havana, an English company, of which Mr. L. S. Diaz is vice-president and chief engineer, and Mr. W. S. Webster, assistant engineer.

Oak Forest (Ill.) Infirmary Power Plant.

Work is in progress under the direction of the Board of County Commissioners of Cook County on an infirmary for irresponsibles and dependents at Oak Forest, Ill., about 20 miles southwest of the center of Chicago on the Rock Island Railroad. About $2,000,000 will be expended on what is really a little settlement consisting of 25 buildings. The institution consists of various wards, hospitals, administration buildings, and the like, and will have its own railroad station. A prominent feature will be a power station supplying heat, light, power and water to all of the buildings in the group. All the structures are of brick and of fireproof construction. Nevertheless a complete system of fire protection is provided, with a standpipe in each building and a general water-tower 109 ft. high and 15 ft. in diameter with a capacity of 130,000 gal. Under the power house there will be an additional reservoir for water to be used if needed in case of fire. The water is obtained from deep wells.

The power house has ground dimensions of 102 ft. x 160 ft. and is 45 ft. high. It has a stack 190 ft. high, made of radial brick, and contains five 350-hp boilers equipped with automatic chain-grate stokers. There is also a complete equipment of coal- and ash-handling machinery, with a track scale and a coal crusher. The pumping equipment includes not only the pumps for the fire-protection service, but also those needed in the operation of the power house. A Gamewell fire-alarm system is installed, and all buildings are connected to it. In case of an alarm of fire the engineer starts up the high-pressure pumps and at the same time sounds an alarm on a steam whistle said to be sufficiently powerful to be heard for a distance of 10 miles, supplying a means of summoning outside help if necessary.

Three slow-speed simple Corliss engines in the power house will be direct-connected to 250-volt, direct-current Western Electric generators having respective ratings of 350 kw, 250 kw and 150 kw. A steam-driven refrigerating plant will be a part of the power-house equipment. A marble switchboard of 15 panels is equipped with ammeters, Thomson wattmeters and Westinghouse graphic instruments for amperes, watts and volts. Eleven sets of paper-insulated, lead-covered feeders will conduct electricity to the various buildings and points of distribution about the grounds. They are provided with extra-heavy lead armor. All wires, steam pipes and water mains are to be carried underground in reinforced concrete tunnels 5 ft. wide and about 7 ft. high. A complete intercommunicating telephone system of the Stromberg-Carlson type is provided for the use of the institution.

Electric light is used to illuminate the grounds and buildings. Eighty-five arc lamps will be needed in the power house and about the grounds; those for the latter purpose being set on ornamental iron posts, and about 10,000 16-cp incandescent lamps will be connected to the electrical circuits in the buildings. The three-wire system is used, and lamps and motors are supplied from the same mains. All interior wiring is in iron conduit. In the power house two separate sets of mains are provided for lighting. The lamps are connected on alternate mains, so that if a fuse should blow out in one circuit the plant would not be in darkness. The panel boards in the various buildings are of approved type with snap switches on each circuit and Edison plug fuses. The general lighting in the various buildings is controlled by flush push-button switches located at convenient points in the rooms.

About 30 electric motors, ranging from 2 hp to 30 hp in rating and aggregating about 300 hp will be needed to drive the pumping machinery, coal crusher in the power house, ventilating fans, woodworking machinery, laundry machinery, dough-mixer, ice-crusher, elevator, dumb-waiters and other machinery. In the laundry electricity will be used for heating flatirons, and in the ward buildings outlets for electric foot-warmers are provided at the head of each bed. To these outlets heating pads or other electrical appliances can be attached at the discretion of the nurse in charge. About 300 or 400 electric foot-warmers will be needed.

It is expected that the work on the grounds and buildings will be completed about Dec. 1, and that the institution, when fully equipped, will be able to care for 2000 inmates. Holabird & Roche, Chicago, are the architects for this little village, if such it may be called, and the Masterson Electric Construction Company, of Chicago, is the electrical contractor.

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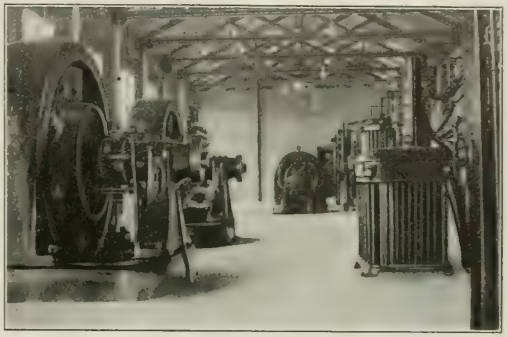


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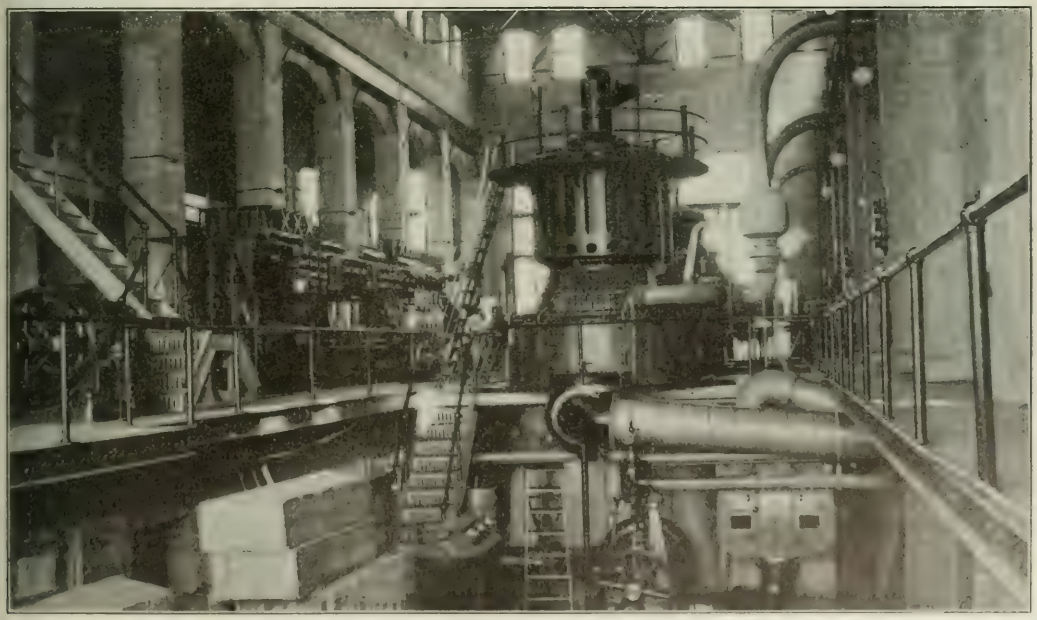


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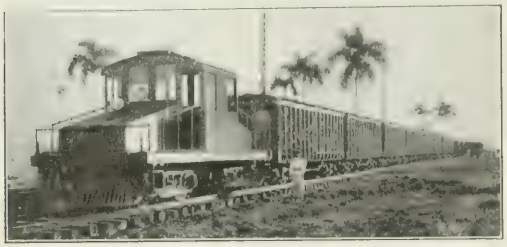


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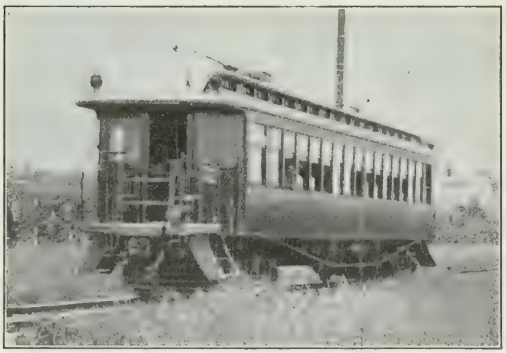


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Electric light is used to illuminate the grounds and buildings. Eighty-five arc lamps will be needed in the power house and about the grounds; those for the latter purpose being set on ornamental iron posts, and about 10,000 16-cp incandescent lamps will be connected to the electrical circuits in the buildings. The three-wire system is used, and lamps and motors are supplied from the same mains. All interior wiring is in iron conduit. In the power house two separate sets of mains are provided for lighting. The lamps are connected on alternate mains, so that if a fuse should blow out in one circuit the plant would not be in darkness. The panel boards in the various buildings are of approved type with snap switches on each circuit and Edison plug fuses. The general lighting in the various buildings is controlled by flush push-button switches located at convenient points in the rooms.

About 30 electric motors, ranging from 2 hp to 30 hp in rating and aggregating about 300 hp will be needed to drive the pumping machinery, coal crusher in the power house, ventilating fans, woodworking machinery, laundry machinery, dough-mixer, ice-crusher, elevator, dumb-waiters and other machinery. In the laundry electricity will be used for heating flatirons, and in the ward buildings outlets for electric foot-warmers are provided at the head of each bed. To these outlets heating pads or other electrical appliances can be attached at the discretion of the nurse in charge. About 300 or 400 electric foot-warmers will be needed.

It is expected that the work on the grounds and buildings will be completed about Dec. 1, and that the institution, when fully equipped, will be able to care for 2000 inmates. Holabird & Roche, Chicago, are the architects for this little village, if such it may be called, and the Masterson Electric Construction Company, of Chicago, is the electrical contractor.

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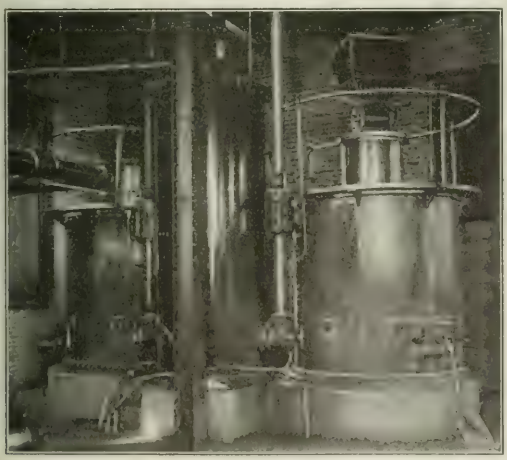


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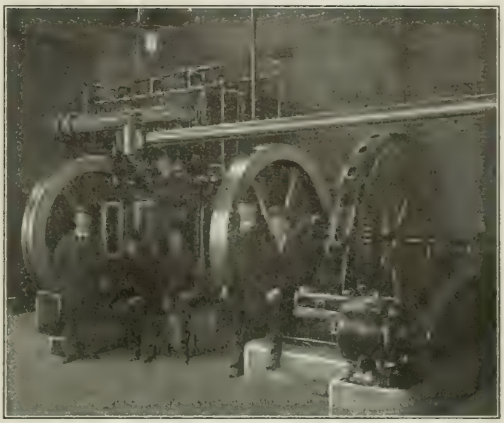


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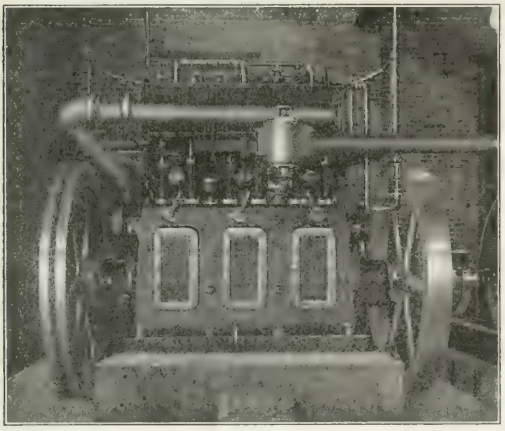


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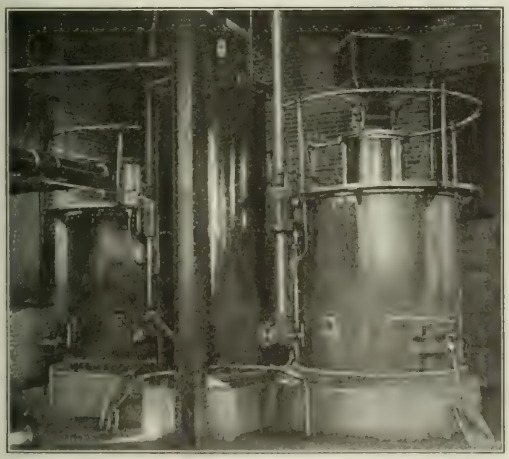


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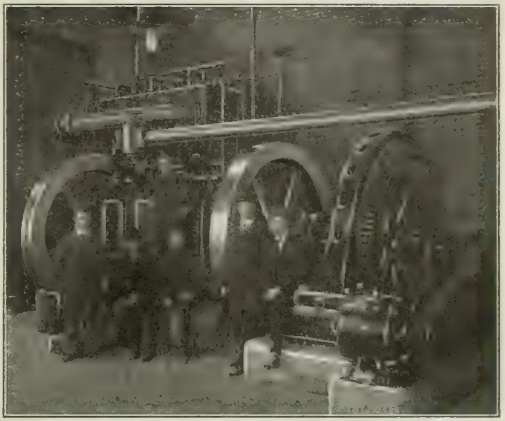


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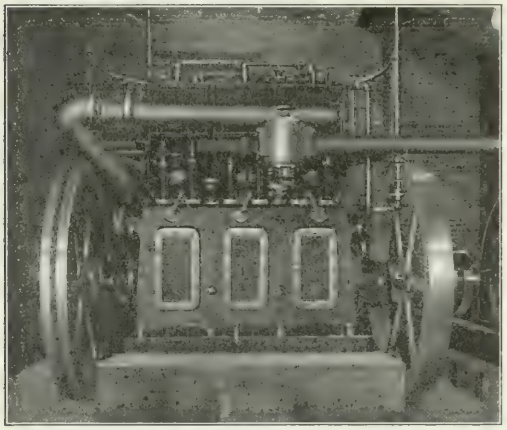


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all values of the sine being considered positive because negative parts of the wave are reversed with reference to the brushes by the method of connection. As B varies from O to $2\pi/n$, from $2\pi/n$ to $4\pi/n$, etc., the value of the continuous e.m.f. passes from a minimum to a maximum and back again to a minimum. The smaller the number of phases, the greater the value of $2\pi/n$ and hence the greater the fluctuations. Since there is one maximum for every $2\pi/n$th part of a cycle, there are as many direct-current maxima per cycle as there are phases. As the number of phases is increased, the difference between the maxima and the minima is decreased and it is possible to obtain direct current as uniform as may be desired by increasing the number of phases. The difference between maximum and minimum when 12 phases are used is about 3.5 per cent; for 24 phases it decreases to less than 1 per cent.

Any number (n) of phases of e.m.f. may be obtained from a quarter-phase system by the proper distribution of coils on two transformer cores. Moreover, all of these may be connected in series, and leads from their junction points may be connected to the segments of a synchronously driven commutator. Commutation may then be accomplished at various loads in identically the same manner as in a direct-current generator —that is, by shifting the brushes forward to such an extent that the short-circuited coil has induced in it the e.m.f. necessary to reverse the current. Commutation at constant load and frequency should be as perfect as it is in the direct-current generator.

The short-circuiting of a coil by the brushes affects the wave-forms of the continuous e.m.f. and of the transformer flux. The e.m.f. is lowered slightly by the fact that for the period under the brush one coil is short-circuited and those between this coil and the position of commutation at no-load are reversed. The transformer flux is also sharply reduced by the current in the short-circuited turns if the period of short-circuit is too long. These conditions may not be sufficient to have a prohibitive effect on either the primary or the secondary currents; when they are sufficient they can be lessened by increasing the number of phases, because by increasing the number of phases the e.m.f. per phase producing current in the short-circuited coil is also diminished.

The only irregularities that can occur in the wave of flux oscillating in the uniform and independent magnetic circuits of the transformers are those of low value due to hysteresis and those due to short-circuit at commutation. The latter may be diminished by finding the proper length of time for short-circuit and by increasing the number of phases. Such an arrangement if operable would, therefore, avoid the use of the compensating winding of the panchahuteur, and would be simpler and less expensive. These characteristics are possessed by the simpler arrangement of Rowland and that of Hutin and Leblanc. Each of them requires only a small rotating part and low driving power. The only losses are in the transformers and in the two sets of brushes. The regulation and efficiency of such a machine should, therefore, be good.

APPARATUS.

The energy available for the experiments was obtained at 220 volts, two-phase and 60 cycles. The smaller the number of phases, the greater the voltage between commutation segments and the greater the consequent short-circuit current in the coil under the brush. In a 12-phase system the fluctuations in the continuous voltage are very pronounced, as already indicated, and by adopting 12 phases and 60 cycles it would appear as though very rigorous conditions of performance were imposed. Sixty cycles requires a much shorter period of commutation and either greater speed or a larger commutator with a greater number of segments than does 25 cycles. It was, therefore, decided to transform the available 60-cycle quarter-phase into 12-phase, and investigate the performance of commutation to direct currents.

The apparatus was constructed for the transformation of 5 kw from 200 volts quarter-phase to 110 volts continuous. This arrangement involved two transformers, each of 2.5-kw rating with secondaries suitably interconnected to give a symmetrical 12-phase system of e.m.fs. of proper value. They were of the core type with a wire space 14 in. long on each leg. The cross-section was cruciform and had an area of 10 sq. in. The induction was chosen in the neighborhood of 4000 lines per centimeter. This arrangement gives as a convenient number of primary turns to form the proper ratios 288, with 0.695 volt per turn. In deducing the number of secondary turns necessary it is to be noted that the effective e.m.f. on the brushes is obtained by their following the maximum of the secondary alternating e.m.f. around the closed circuit as in the converter. If in the general expression for the total e.m.f. between any two opposite points in the closed secondary winding:

$$\sum_{k=O}^{k=\frac{n-2}{2}} E \sin\left(B - \frac{2k\pi}{n}\right) \qquad (4)$$

there be substituted the values of k and n for 12 phases, there is obtained for the instant $t - O$ $E_{dc} = E\left(\sin\frac{\pi}{6} + \sin\frac{\pi}{3} + \sin\frac{\pi}{2} + \sin\frac{2\pi}{3} + \sin\frac{5\pi}{6}\right) = 3.73\,E$. This value is the minimum of E_{dc} and its variation is about 3.5 per cent. Taking the minimum value of the continuous e.m.f. as 110 volts the maximum value of the e.m.f. per phase of the 12-phase secondary system is 29.5 volts. The average value of E_{dc} is 3.82 E or about 112.7 volts.

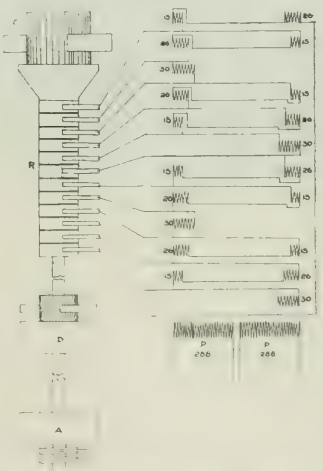


FIG. 1. INTERCONNECTIONS TO COMMUTATOR

The method of determining the number of turns on each transformer for the successive phases is well known.[3] In the present case the several phases were formed from independent windings. The secondary turns on each transformer for each phase are as follows:

Phase.	Turns on No. 1	Turns on No. 2
2	26	1
4	15	4
3	4	30
6	7	—
5	30	—
1	26	—
12	26	—15

The coils containing 26 turns have about 0.1 per cent too many. The negative sign indicates that the coils are connected

[3] Steinmetz, "Alternating Current Phenomena," Chapter XXXVI

in the reverse direction. These pairs of coils are connected in series, as indicated in Fig. 1, and between successive pairs 12 leads are taken to an equal number of brushes and collector rings. The coils are so arranged that the two legs on a transformer always have the same number of ampere-turns similarly arranged, and the primary is wound in two layers on each leg with 72 turns per layer. As calculated, the copper loss per transformer is 2.74 per cent, the iron loss 2.6 per cent, the full-load efficiency 94.7 per cent.

Each collector ring is connected to four equidistant bars in a 48-part commutator. This number of segments for the commutator was chosen so as to reduce the speed to that of an available eight-pole, single-phase synchronous motor. To this motor there was directly coupled a direct-current generator which could also be used as a starting motor. The eight-pole motor makes one-fourth of a revolution for each cycle, which fact necessitates four times as many commutator segments as

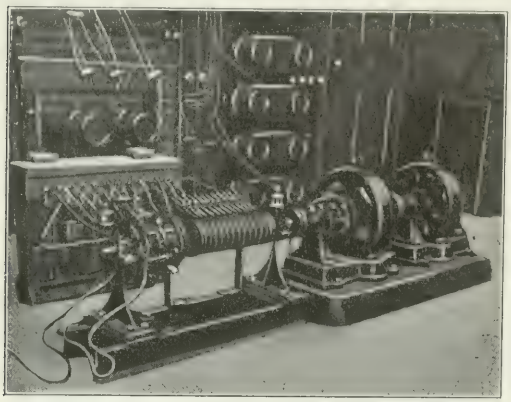


FIG. 2.—GENERAL VIEW OF SYNCHRONOUSLY-DRIVEN COMMUTATOR.

there are phases. The direct current is collected by eight carbon brushes, each ⅜ in. × ⅞ in. in section. The commutator is 6 in. in diameter and has a collecting surface 4 in. wide. With the exception of the commutator the entire construction was carried out in the shops of the Physical Laboratory of the Johns Hopkins University. Fig. 2 shows the general arrangement of the several parts of the apparatus.

PERFORMANCE.

The rotating part is brought up to speed by the direct-current machine used as a motor, and the single-phase motor is then synchronized. When running in synchronism the transformer primary circuits may be closed and the proper position of commutation may then be found by adjusting the brushes for minimum sparking. On loading the direct-current side, the brush position for sparkless commutation shifts forward. The amount of the brush shift is practically proportional to the amount of direct-current output, and from no-load to full-load is about 4 deg. of arc, or about 0.2 in. on the commutator. A low value for this quantity is objectionable as it renders commutation sensitive to dissymmetries of commutator construction and relative spacing of brushes, and also to oscillations of the rotating part about the position of true synchronism. In the present apparatus the low value is due to the small number of phases. It was also found that the width of six commutation segments taken at various portions of the circumference varied as much as 1/16 in. The frequency variation was sometimes as great as 3 per cent. In spite of these facts, the operation at constant load for any value up to full load was very satisfactory. At 25 per cent overload the sparking would prevent continuous service. In this region the required variation of the brush lead is less than the variations in the symmetry of the apparatus. In the region of one-half load, variations of about one-third full-load are possible with fixed brushes.

REGULATION AND EFFICIENCY.

Data of regulation and efficiency were obtained for the transformers with the rotating part of the machine and also for the transformers alone. The readings are given in Table I.

The change in the continuous e.m.f. from full-load to no-load was from 110.0 to 122.7 volts, 12.7 volts, or 9.7 per cent. In the transformers alone the rise was from 86.5 to 88.5 volts, 2 volts, or 2.26 per cent (Fig. 3). The efficiency of the transformers at full-load was found experimentally to equal 94.0 per cent. The calculated value given above is 94.7 per cent. This must be considered very fair agreement, and indicates that there are no abnormal losses in the magnetic or copper circuits and that the balance of e.m.fs. in the closed secondary circuit is nearly perfect. The loss in the brushes and rotating part increases with the load and varies from 2.5 per cent at 4 amp direct current to 8.0 per cent at 41.2 amp, or full load.

The single-phase secondary e.m.f. given in equation (2) may also be written

$$E_{ac} = \frac{E}{\sin\frac{\pi}{n}} \sin\left(\beta - \frac{n-2\pi}{2n}\right)$$

The continuous e.m.f. is given by the same expression if, as before, all values of the sine are considered positive. This

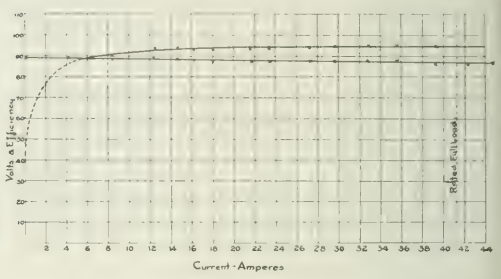


FIG. 3.—REGULATION AND EFFICIENCY OF THE TRANSFORMERS.

means that the continuous e.m.f. is made up of a series of crests of sine waves. The sine is a maximum for $B - \frac{n-2}{2n}\pi = \frac{\pi}{2}$, or $B = \pi - \frac{\pi}{n}$. For this value of B, $E_{ac} = 3.86\,E$. This is then also the maximum value of the continuous e.m.f. The minimum evidently occurs at $B = \pi$ and is $3.73\,E$. The average value of a sine wave between $\frac{\pi}{2}$ and $\frac{\pi}{2} + \frac{\pi}{12} = 0.993$ times the maximum value $= 3.83\,E$. This is the average value of E_{dc}. The output of the transformers is, therefore, taken as the product of the effective value of the single-phase e.m.f. and the direct current, multiplied by $0.993\sqrt{2}$. This is the value used in Table I, column 9.

TABLE I.

Input.			Output.				Volts		Per cent loss in
Volts.	Amp.	Kw.	Volts.	Amp	Kw.	Eff.	trans.	Kw.	Eff. trans.	brushes.
112.6	"	"	125.5	0	0	0	127.3	0	0	0
112.2	1.37	.600	123.8	4.1	.507	84.5	127.2	.522	87.0	2.5
112.0	2.67	1.195	122.0	8.4	1.024	85.9	126.1	1.060	88.8	2.9
111.5	3.78	1.686	120.1	12.43	1.498	88.9	125.7	1.562	92.7	3.8
111.5	4.42	1.971	119.5	14.67	1.752	89.0	125.4	1.840	93.4	4.4
112.2	4.93	2.213	119.0	16.28	1.938	87.6	125.8	2.047	92.3	4.7
110.8	5.44	2.410	117.1	17.98	2.105	87.5	124.1	2.234	92.7	5.2
111.1	6.50	2.886	117.1	21.50	2.517	87.1	124.1	2.670	92.5	5.4
110.1	6.95	3.086	115.2	23.35	2.690	87.2	122.8	2.867	92.9	5.7
110.3	8.10	3.567	114.2	27.22	3.112	87.3	122.3	3.333	93.5	6.2
109.9	8.70	3.821	113.3	29.60	3.355	87.7	122.0	3.612	94.5	6.8
109.6	9.63	4.220	112.6	32.7	3.680	87.3	121.7	3.979	94.4	7.1
109.4	10.53	4.615	110.6	35.7	3.961	86.1	121.6	4.340	94.2	7.9
109.2	11.63	5.070	110.5	39.3	4.340	85.7	120.7	4.740	93.6	7.9
109.2	12.80	5.590	109.7	42.3	4.640	83.0	120.2	5.085	91.1	8.3

The first column of Table I gives one-half the value of the primary voltage. The second column gives the current in one phase of the primary. The input given in column 3 is then determined as four times the product of this current and the voltage given in column 1. To test the accuracy of this method

all values of the sine being considered positive because negative parts of the wave are reversed with reference to the brushes by the method of connection. As B varies from O to $2\pi/n$, from $2\pi/n$ to $4\pi/n$, etc., the value of the continuous e.m.f. passes from a minimum to a maximum and back again to a minimum. The smaller the number of phases, the greater the value of $2\pi/n$ and hence the greater the fluctuations. Since there is one maximum for every $2\pi/n$th part of a cycle, there are as many direct-current maxima per cycle as there are phases. As the number of phases is increased, the difference between the maxima and the minima is decreased and it is possible to obtain direct current as uniform as may be desired by increasing the number of phases. The difference between maximum and minimum when 12 phases are used is about 3.5 per cent; for 24 phases it decreases to less than 1 per cent.

Any number (n) of phases of e.m.f. may be obtained from a quarter-phase system by the proper distribution of coils on two transformer cores. Moreover, all of these may be connected in series, and leads from their junction points may be connected to the segments of a synchronously driven commutator. Commutation may then be accomplished at various loads in identically the same manner as in a direct-current generator —that is, by shifting the brushes forward to such an extent that the short-circuited coil has induced in it the e.m.f. necessary to reverse the current. Commutation at constant load and frequency should be as perfect as it is in the direct-current generator.

The short-circuiting of a coil by the brushes affects the wave-forms of the continuous e.m.f. and of the transformer flux. The e.m.f. is lowered slightly by the fact that for the period under the brush one coil is short-circuited and those between this coil and the position of commutation at no-load are reversed. The transformer flux is also sharply reduced by the current in the short-circuited turns if the period of short-circuit is too long. These conditions may not be sufficient to have a prohibitive effect on either the primary or the secondary currents; when they are sufficient they can be lessened by increasing the number of phases, because by increasing the number of phases the e.m.f. per phase producing current in the short-circuited coil is also diminished.

The only irregularities that can occur in the wave of flux oscillating in the uniform and independent magnetic circuits of the transformers are those of low value due to hysteresis and those due to short-circuit at commutation. The latter may be diminished by finding the proper length of time for short-circuit and by increasing the number of phases. Such an arrangement if operable would, therefore, avoid the use of the compensating winding of the panchahuteur, and would be simpler and less expensive. These characteristics are possessed by the simpler arrangement of Rowland and that of Hutin and Leblanc. Each of them requires only a small rotating part and low driving power. The only losses are in the transformers and in the two sets of brushes. The regulation and efficiency of such a machine should, therefore, be good.

APPARATUS.

The energy available for the experiments was obtained at 220 volts, two-phase and 60 cycles. The smaller the number of phases, the greater the voltage between commutation segments and the greater the consequent short-circuit current in the coil under the brush. In a 12-phase system the fluctuations in the continuous voltage are very pronounced, as already indicated, and by adopting 12 phases and 60 cycles it would appear as though very rigorous conditions of performance were imposed. Sixty cycles requires a much shorter period of commutation and either greater speed or a larger commutator with a greater number of segments than does 25 cycles. It was, therefore, decided to transform the available 60-cycle quarter-phase into 12-phase, and investigate the performance of commutation to direct currents.

The apparatus was constructed for the transformation of 5 kw from 200 volts quarter phase to 110 volts continuous. This arrangement involved two transformers, each of 2.5 kw rating with secondaries suitably interconnected to give a symmetrical 12-phase system of e.m.fs. of proper value. They were of the core type with a wire space 14 in. long on each leg. The cross-section was cruciform and had an area of 10 sq. in. The induction was chosen in the neighborhood of 4000 lines per centimeter. This arrangement gives as a convenient number of primary turns to form the proper ratios 288, with 0.695 volt per turn. In deducing the number of secondary turns necessary it is to be noted that the effective e.m.f. on the brushes is obtained by their following the maximum of the secondary alternating e.m.f. around the closed circuit as in the converter. If in the general expression for the total e.m.f. between any two opposite points in the closed secondary winding:

$$k = \frac{n-2}{2}$$

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there be substituted the values of k and n for 12 phases, there is obtained for the instant $t = O$ $E_{dc} = E\left(\sin\frac{\pi}{6} + \sin\frac{\pi}{3} + \sin\frac{\pi}{2} + \sin\frac{2\pi}{3} + \sin\frac{5\pi}{6}\right) = 3.73\,E$. This value is the minimum of E_{dc} and its variation is about 3.5 per cent. Taking the minimum value of the continuous e.m.f. as 110 volts the maximum value of the e.m.f. per phase of the 12-phase secondary system is 29.5 volts. The average value of E_{dc} is 3.82 E or about 112.7 volts.

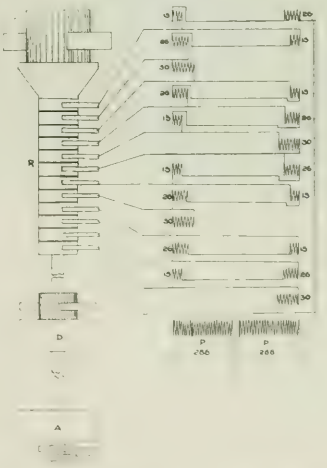


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The method of determining the number of turns on each transformer for the successive phases is well known.[3] In the present case the several phases were formed from independent windings. The secondary turns on each transformer for each phase are as follows:

Phase	Turns on No.	Turns on No.
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[illegible] "Alternating Current Phenomena," Chapter XXXVI

in the reverse direction. These pairs of coils are connected in series, as indicated in Fig. 1, and between successive pairs 12 leads are taken to an equal number of brushes and collector rings. The coils are so arranged that the two legs on a transformer always have the same number of ampere-turns similarly arranged, and the primary is wound in two layers on each leg with 72 turns per layer. As calculated, the copper loss per transformer is 2.74 per cent, the iron loss 2.6 per cent, the full-load efficiency 94.7 per cent.

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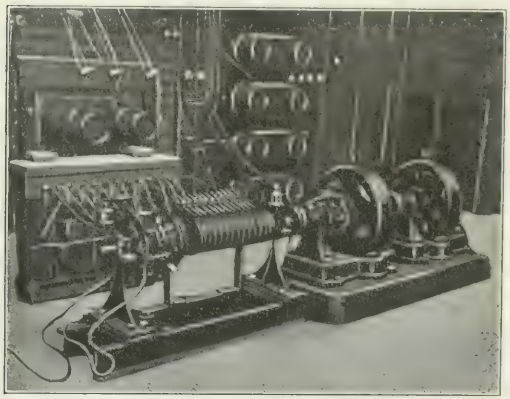


FIG. 2.—GENERAL VIEW OF SYNCHRONOUSLY-DRIVEN COMMUTATOR.

there are phases. The direct current is collected by eight carbon brushes, each ⅜ in. x ⅞ in. in section. The commutator is 6 in. in diameter and has a collecting surface 4 in. wide. With the exception of the commutator the entire construction was carried out in the shops of the Physical Laboratory of the Johns Hopkins University. Fig. 2 shows the general arrangement of the several parts of the apparatus.

PERFORMANCE.

The rotating part is brought up to speed by the direct-current machine used as a motor, and the single-phase motor is then synchronized. When running in synchronism the transformer primary circuits may be closed and the proper position of commutation may then be found by adjusting the brushes for minimum sparking. On loading the direct-current side, the brush position for sparkless commutation shifts forward. The amount of the brush shift is practically proportional to the amount of direct-current output, and from no-load to full-load is about 4 deg. of arc, or about 0.2 in. on the commutator. A low value for this quantity is objectionable as it renders commutation sensitive to dissymmetries of commutator construction and relative spacing of brushes, and also to oscillations of the rotating part about the position of true synchronism. In the present apparatus the low value is due to the small number of phases. It was also found that the width of six commutation segments taken at various portions of the circumference varied as much as 1/16 in. The frequency variation was sometimes as great as 3 per cent. In spite of these facts, the operation at constant load for any value up to full load was very satisfactory. At 25 per cent overload the sparking would prevent continuous service. In this region the required variation of the brush lead is less than the variations in the symmetry of the apparatus. In the region of one-half load, variations of about one-third full-load are possible with fixed brushes.

REGULATION AND EFFICIENCY.

Data of regulation and efficiency were obtained for the transformers with the rotating part of the machine and also for the transformers alone. The readings are given in Table I.

The change in the continuous e.m.f. from full-load to no-load was from 110.0 to 122.7 volts, 12.7 volts, or 9.7 per cent. In the transformers alone the rise was from 86.5 to 88.5 volts, 2 volts, or 2.26 per cent (Fig. 3). The efficiency of the transformers at full-load was found experimentally to equal 94.0 per cent. The calculated value given above is 94.7 per cent. This must be considered very fair agreement, and indicates that there are no abnormal losses in the magnetic or copper circuits and that the balance of e.m.fs. in the closed secondary circuit is nearly perfect. The loss in the brushes and rotating part increases with the load and varies from 2.5 per cent at 4 amp direct current to 8.0 per cent at 41.2 amp, or full load.

The single-phase secondary e.m.f. given in equation (2) may also be written

$$E_{ac} = \frac{E}{\sin\frac{\pi}{n}} \sin\left(B - \frac{n-2}{2n}\pi\right)$$

The continuous e.m.f. is given by the same expression if, as before, all values of the sine are considered positive. This

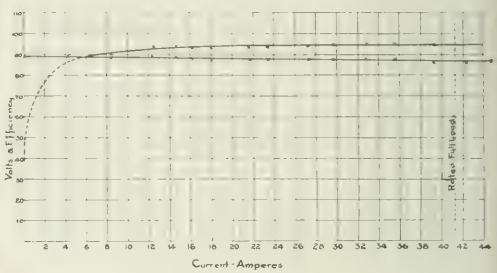


FIG. 3.—REGULATION AND EFFICIENCY OF THE TRANSFORMERS.

means that the continuous e.m.f. is made up of a series of crests of sine waves. The sine is a maximum for $B - \frac{n-2}{2n}\pi = \frac{\pi}{2}$, or $B = \pi - \frac{\pi}{n}$. For this value of B, $E_{ac} = 3.86\,E$. This is then also the maximum value of the continuous e.m.f. The minimum evidently occurs at $B = \pi$ and is $3.73\,E$. The average value of a sine wave between $\frac{\pi}{2}$ and $\frac{\pi}{2} + \frac{\pi}{12} = 0.993$ times the maximum value $= 3.83\,E$. This is the average value of E_{dc}. The output of the transformers is, therefore, taken as the product of the effective value of the single-phase e.m.f. and the direct current, multiplied by $0.993\sqrt{2}$. This is the value used in Table I, column 9.

TABLE I.

Input. Volts.	Input. Amp.	Input. Kw.	Output. Volts.	Output. Amp.	Output. Kw.	Eff.	Volts trans.	Kw.	Eff. trans.	Per cent loss in brushes.
112.6	"	"	125.5	0	"	0	127.3	0	0	0
112.2	1.37	.600	123 8	4 1	507	84.5	127.2	.522	87.0	2.5
112.0	2.67	1.195	122.0	8 4	1.024	85.9	126.1	1.060	88.8	2.9
111.5	3.78	1.686	120.1	12.43	1.498	88.9	125.7	1.562	92.7	3.8
111.5	4.42	1.971	119.5	14.67	1.752	89.0	125.4	1.840	93.4	4.4
112.2	4.93	2.213	119.0	16.28	1 938	87.6	125.8	2.047	92.3	4.7
110.8	5.44	2.410	117.1	17.98	2.105	87.5	124.1	2.234	92.7	5.2
111.1	6.50	2.886	117.1	21.50	2.517	87.1	124.1	2.670	92.5	5.4
110.1	6.95	3.086	115.2	23.35	2.690	87.2	122.8	2.867	92.9	5.7
110.3	8.10	3.567	114.2	27.22	3.112	87.3	122.3	3.333	93.5	6.2
109.9	8.70	3.821	113.3	29.60	3.355	87.7	122 0	3.612	94.5	6.8
109.6	9.63	4.220	112.6	32.7	3.680	87.3	121.7	3 979	94.4	7.1
109.4	10.53	4.615	110.6	35.7	3.961	86.1	121.6	4.340	94.2	7.9
109.2	11.03	5.070	110 5	39.3	4.340	85.7	120.7	4.740	93.6	7.9
109.2	12.80	5.590	109.7	42.3	4.640	83.0	120.2	5.085	91.1	8.3

The first column of Table I gives one-half the value of the primary voltage. The second column gives the current in one phase of the primary. The input given in column 3 is then determined as four times the product of this current and the voltage given in column 1. To test the accuracy of this method

he input was measured also by means of a wattmeter that had reviously been calibrated in terms of the other instruments. he results agreed to within the limit of experimental error—or example, volt-amperes = 0.525 and wattmeter reading = 0.529 kw. The next three columns give voltage, current and he power output on the direct-current side. The total effiiency of transformation given in column 7 is then the ratio f output to input as given in columns 6 and 3. Columns 8 nd 9 give the voltage at the transformer secondaries, and their utput is obtained as described above. The efficiency of the ransformers, given in column 10, is the ratio of the output as btained to the input. The per cent loss in the brushes and the otating part was taken as the difference between the total effiiency of conversion and that of the transformers. With inreasing load the efficiency of the transformers increases, that f the rotating part decreases, and more rapidly, so that a ombination of the two forms a curve with a maximum of 89 er cent at 14 amp direct current—one-third load (see Fig. 4).

With driving power included (0.35 kw = 7 per cent), the otal efficiency of the apparatus varies from 74 per cent at 0.1 oad to 79 per cent at full-load. As indicated below, the loss n the direct-current brushes at full-load is about 6 per cent, nore than half of which may be attributed to mechanical imerfections. The power for driving a commutator and collec-

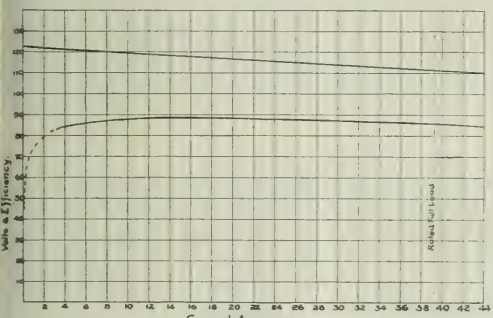


FIG. 4.—REGULATION AND EFFICIENCY PRIMARY OF TRANSFORMERS TO DIRECT-CURRENT BRUSHES, DRIVING POWER NOT INCLUDED.

tor rings capable of delivering 500 kw at 500 volts should not exceed 10 kw, or 2 per cent. With apparatus of this larger rating, therefore, and remembering the higher efficiency of the larger transformers, it is probable that efficiency values in the neighborhood of 90 per cent would be obtainable.

The drop in the voltage in the carbon brushes and contact with the commutator was measured for various values of output. The results are given in Table II. At full-load the drop at this point is about 6 per cent. The values of ohms per square inch, given in the last column, are uniformly more than twice as great as those readily obtainable in direct-current generators. The excess is due in large measure to mechanical vibration and other structural imperfections, and the consequent slight chattering of the brushes.

TABLE II.

Voltmeter readings.	Current.	Volt amperes.	Contact resistance of four brushes in ohms.	Ohms per sq. in.
1.2	4.2	5.1	.286	.220
1.7	8.6	14.6	.196	.151
2.3	12.6	29.0	.183	.141
2.5	16.5	41.2	.152	.117
2.7	24.1	65.1	.111	.085
2.8	28.1	78.6	.100	.076
3.2	31.9	102.0	.100	.076
3.4	33.6	117.6	.098	.075
3.4	37.4	127.1	.091	.070
3.4	41.0	138.6	.083	.064
3.5	43.6	152.3	.078	.060

In the set of curves, Fig. 5, No. 1 is the percentage drop in the voltage in the transformers proper; No. 2 that due to the shift of the brushes, and No. 3 that due to the resistance of the brushes and to the contact resistance between the carbon brushes and the commutator. No. 4 represents the total drop in voltage. The drop due to the brush shift is observed experimentally by placing on the commutator two search brushes, one in the position of commutation at no-load, the other following the carbon brush.

COMMUTATION.

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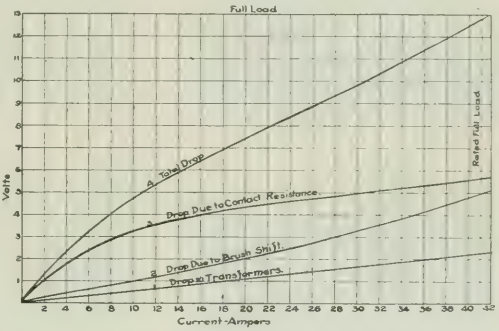


FIG. 5.—DISTRIBUTION OF TOTAL DROP IN ELECTROMOTIVE FORCE.

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(a) By mechanical braking actuated by output current.

(b) By loading the direct-current generator.

(c) By variation of the field of the synchronous motor.

(d) By varying the phase of the e.m.f. applied to the synchronous motor.

(e) By varying the position in space of the resultant motor field.

2. Leaving angular position of rotating part fixed.

(a) By collecting the direct current by means of split brushes with reactance coils between the halves.

(b) By inducing an e.m.f. in the n-phase leads by means of commutating poles.

In applying the several methods of retarding the rotating part no attempt was made to construct the actuating mechanism by which the several influences may be made to vary with the amount of direct-current output. Automatic means of applying methods (c), (d) and (e) would offer no difficulty, and the principal aim of the experiments was a determination of the available influence which may be brought into play.

Methods 1 (a) and 1 (b) retard the rotating part by increasing the load on the motor. They thus consume power; they

were tried only for the purpose of determining whether automatic commutation is feasible by any method causing the necessary change in the angular relation of the armature and the field pole. Both methods worked admirably, no difficulty being found in adjusting the friction or generator loads for commutation of all loads within the rating of the apparatus.

In method 1 (c) it is suggested to take advantage of the distortion of the weakened field of a synchronous motor by armature reaction, and the consequent angular displacement of the armature. The motor as used was run at its normal impressed e.m.f., but at one-half its normal speed, thus necessitating a highly saturated field. For this reason attempts to apply this method were not found successful. Method 1 (d) was tried as follows:

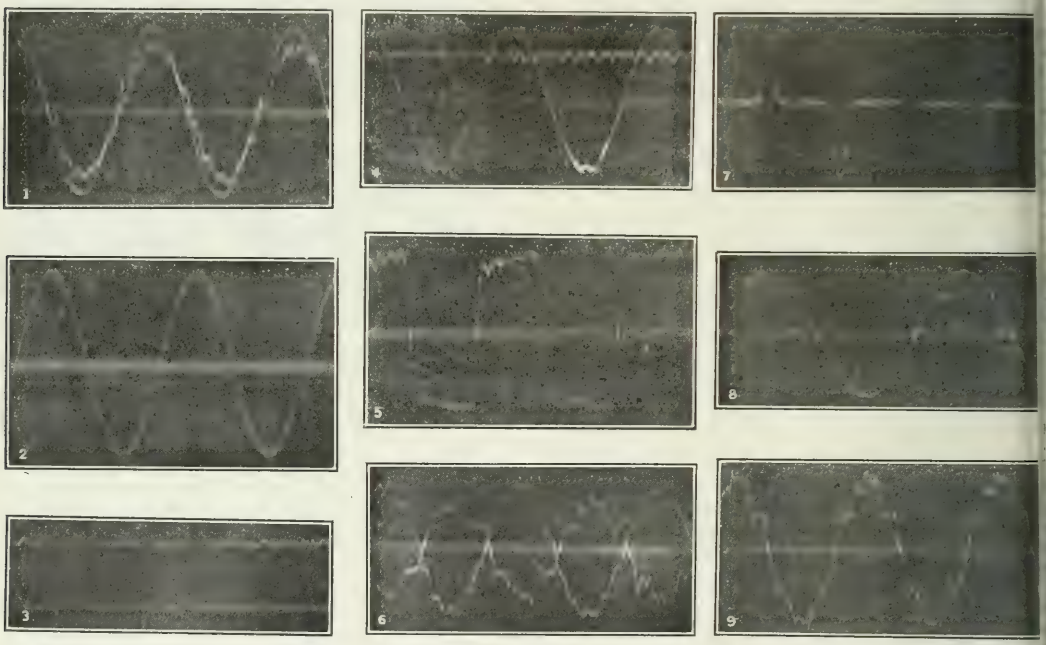
By inserting in the motor armature circuit a second variable e.m.f. differing in phase by 90 deg., a combination of the two will give any desired change in the phase of the impressed e.m.f. and a consequent change in the angular position of the rotating part. The motor received energy from one phase of the quarter-phase supply system. A transformer, the primary [illegible] size, scale and position of the auxiliary pole and the number of turns on it. This method was not tried.

Method 2 (a) was tried with several combinations of split

TABLE III.

[illegible]	[illegible] degrees	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
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[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

brush with resistance and reactance. No improvement over the conditions with solid brushes could be noted; the same brush lead was necessary and an oscillograph record showed



FIGS. 6 TO 14.—OSCILLOGRAPHS

of which was excited from the other phase, had its secondary with a variable number of turns in series with the motor armature. The change in phase was then obtained by varying the number of turns included from the secondary. Any desired change can be obtained. Table III gives one series of readings showing the angular shift resulting from different values of voltage impressed from the second phase. Adjustment for any value of the load was possible by this method. A change from no-load to 30 amp, with the accompanying insertion of voltage, resulted in considerable hunting and sparking, lasting, however, for only a few seconds.

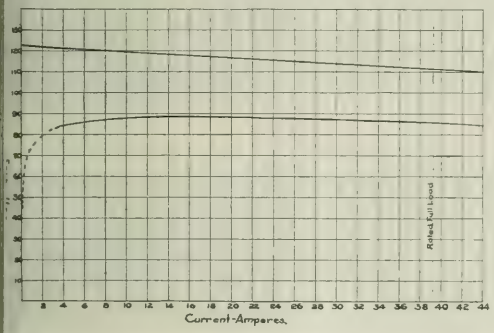
The change in angular position of the rotating part may probably be best accomplished through method 1 (e), that is, by means of auxiliary field-poles, excited by the direct-current output. By this means the resultant magnetic field may be made to shift in such a way that for any value of the load the armature will be in the proper place for commutation. This result can readily be obtained by automatically adjusting the that it had no evident effect on the distortion of transformer flux.

As the load increases so does the counter e.m.f. required to reverse the current in the coil that is commutated. If this e.m.f. could be introduced from some external source, the usual brush shift would not be necessary. This result may be accomplished by means of commutating poles. A pair of such poles excited by the direct-current output were rotated synchronously in proper relation to a series of coils, one in each of the 12 phases. Several modifications were tried without any promising results. The limitations of space on the revolving element prevented a thorough investigation of this method, which is apparently a possible one.

WAVE FORMS.

With a view to obtaining a more intimate knowledge of the performance and to studying the influence of the number of phases on commutation, a number of oscillographs of the

ie input was measured also by means of a wattmeter that had reviously been calibrated in terms of the other instruments. he results agreed to within the limit of experimental error—or example, volt-amperes = 0.525 and wattmeter reading = 0.529 kw. The next three columns give voltage, current and ie power output on the direct-current side. The total efficiency of transformation given in column 7 is then the ratio f output to input as given in columns 6 and 3. Columns 8 nd 9 give the voltage at the transformer secondaries, and their itput is obtained as described above. The efficiency of the ansformers, given in column 10, is the ratio of the output as btained to the input. The per cent loss in the brushes and the otating part was taken as the difference between the total efficiency of conversion and that of the transformers. With increasing load the efficiency of the transformers increases, that f the rotating part decreases, and more rapidly, so that a ombination of the two forms a curve with a maximum of 89 er cent at 14 amp direct current—one-third load (see Fig. 4). With driving power included (0.35 kw = 7 per cent), the tal efficiency of the apparatus varies from 74 per cent at 0.1 ad to 79 per cent at full-load. As indicated below, the loss the direct-current brushes at full-load is about 6 per cent, ore than half of which may be attributed to mechanical imerfections. The power for driving a commutator and collec-



IG. 4.—REGULATION AND EFFICIENCY PRIMARY OF TRANSFORMERS TO DIRECT-CURRENT BRUSHES, DRIVING POWER NOT INCLUDED.

or rings capable of delivering 500 kw at 500 volts should not xceed 10 kw, or 2 per cent. With apparatus of this larger ating, therefore, and remembering the higher efficiency of the rger transformers, it is probable that efficiency values in the eighborhood of 90 per cent would be obtainable.

The drop in the voltage in the carbon brushes and contact ith the commutator was measured for various values of outut. The results are given in Table II. At full-load the drop t this point is about 6 per cent. The values of ohms per quare inch, given in the last column, are uniformly more than wice as great as those readily obtainable in direct-current genrators. The excess is due in large measure to mechanical ibration and other structural imperfections, and the consequent light chattering of the brushes.

TABLE II

oltmeter eadings.	Current.	Volt-amperes.	Contact resistance of four brushes in ohms.	Ohms per sq. in.
1.2	4.2	5.1	.286	.220
1.7	8.6	14.6	.196	.151
2.3	12.6	29.0	.183	.141
2.5	16.5	41.2	.152	.117
2.7	24.4	73.5	.111	.085
2.8	28.1	78.6	.100	.076
3.2	31.9	102.0	.100	.076
3.4	34.6	117.6	.098	.075
3.4	37.4	127.1	.091	.070
3.4	41.0	138.6	.083	.064
3.5	43.6	152.3	.078	.060

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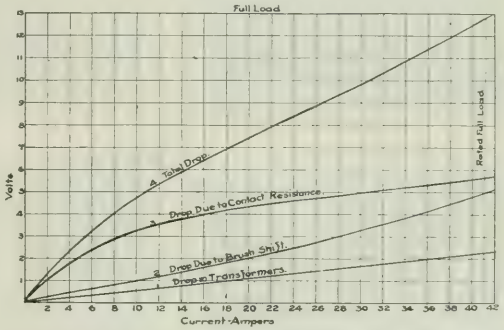


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arious alternating-current and direct-current quantities were ken. Some of these are shown in the accompanying figures: No. 1, transformer primary impressed e.m.f. and current at ull-load; No. 2, alternating e.m.f. between two opposite points f the closed circuit of the 12 secondary phases, at no-load; o. 3, continuous e.m.f. at no-load; No. 4, continuous e.m.f. nd resultant secondary e.m.f. at opposite points of closed cir- uit, full-load; No. 5, current in closed transformer secondary rcuit at full load; No. 6, transformer primary current and rimary counter e.m.f. at full load; No. 7, current in one col- ctor ring; No. 8, primary counter e.m.f. at no-load; No. 9, rimary counter e.m.f. full-load.

The irregularities of the curve of primary current, as shown n oscillograms Nos. 1 and 6—the smoother curve—are seen to e the same as the number of phases in the secondary system. hey are caused primarily by the succession of sharp changes n the number of secondary amp-turns. The secondary cur- ent has an approximately constant positive and negative value qual to one-half the continuous current. The number of sec- ndary turns on each transformer, however, passes through a ycle of values during each alternating cycle, as may be under- tood from Fig. 1. Superimposed on this effect are those due o the period of short-circuit of a phase-winding by the direct- urrent brushes, and to the shifting forward of the brushes.

The effects of short-circuit by the brushes on the resultant lternating secondary e.m.f. may be seen in oscillogram No. 4.

The effect of the fluctuating continuous current on the trans- ormer secondary current is seen in oscillogram No. 5.

The primary counter e.m.f. at no-load should be a smooth urve. The oscillogram for this counter e.m.f. as taken from a est coil on one core is shown as No. 8. The small kinks in his curve indicate the unsymmetrical spacing of the commuta- tor segments. The contact between the brush and the segment does not occur at a uniform time-displacement throughout the cycle.

The primary counter e.m.f. at full-load is badly distorted; the principal cause is the fact that when the brushes are shifted forward a portion of the secondary turns are carrying a reversed current, thereby causing a sharp change in the value of the magnetic induction. In addition, there are the effects of the irregular resultant of secondary and primary amp-turns, and of short-circuit in the coil under the brush. The magnetizing component of the primary current is, therefore, also distorted. The effect on the total primary current is not great, however—see oscillogram No. 6—since the power component corresponding to the secondary output greatly exceeds the magnetizing component.

CONCLUSIONS.

The performance of the experimental apparatus indicates that the commercial possibilities of the principle are greater than have generally been supposed. The distortion of the primary current with as few as 12 phases is not prohibitive. The current distortion and conditions of commutation would be further improved at lower frequency by the use of a greater number of phases in the secondary system. The rotating element should have a small amount of inertia so as to follow quickly all possible changes of frequency. Commutation is satisfactory at constant load. Automatic adjustment of the conditions of commutation is possible, although sharp changes of load or frequency will be accompanied by more or less serious sparking of short duration. With increasing number of phases the cost and weight would be lessened and the performance would be improved by keeping the commutator fixed and rotating the brushes.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

"Human Interest" in Central-Station Work.

The first (April) issue of *The Edison Round Table*, published in Chicago by the Commonwealth Edison Branch of the National Electric Light Association, has made its appearance, and it amply justifies the forecast of it recently appearing in these columns, being a bright and attractive illustrated magazine of 48 pages. Mr. R. F. Schuchardt, the editor, and his associates are entitled to congratulations. One interesting feature in "The Oracle" department is a forecast of the station equipment necessary for the company's business in 1920. The present generating equipment is about 150,000 kw, and the estimates for 1920 range from 500,000 kw to 1,500,000 kw. The latter estimate was made by Mr. W. L. Abbott, who has staked a dinner on the accuracy of his prediction.

A Diplomatic Complaint.

A central station in one of the Central States recently received a communication from a customer, a lawyer, which read as follows:

"Herewith enclosed I hand you check for $4.72 in payment of my electric light account with you. Your men were here the other day to test my meter, and possibly their test will have disclosed to you that this meter has been developing a wonderful burst of speed. With no evening work, with my office closed the latter part of the day a considerable portion of the time this winter, with only three electric lamps ever lighted, my little meter up in the dark closet has worked faithfully for you and apparently annihilated twice as many kilowatts as the meter I had last winter could do with six lights working full time. This is not meant in a spirit of complaint, but I feel that in a monopoly such as yours ability of such a high order should not be overlooked, and that the sphere of usefulness of my little meter to your concern should be enlarged. I will be perfectly satisfied with a less ambitious one, and if you will only place the other where the number of lamps used are considerably in excess of mine, I am sure the exchange will be satisfactory to you from the dividend-paying standpoint."

Flatiron Advertisements.

The Pacific Electric Heating Company, Ontario, Cal., has instituted a comprehensive advertising campaign to further the introduction of electric heating apparatus. *Collier's Weekly* of April 10 contains a full-page announcement relating to electric flatirons, and similar space will be taken in *Everybody's, Munsey's,* the *Century* and *McClure's*. A circular has been sent to central stations and supply dealers on the Slope advising the addition of local color to this national campaign by advertising in local papers, the circular being accompanied with copy for advertisements and an offer to supply cuts. It is suggested that if newspapers are not used, the advertisements be mounted on a piece of cardboard and displayed in the window, or a window display made beginning April 8 or 9 and lasting several days, calling attention to the fact that the dealer has the electric flatiron that is being advertised in *Collier's Weekly* and the leading magazines. An expert ironer from a laundry using one of the irons in a nicely decorated window is also advised, or the placing of a little bench in the window and having an employee of the repair department to work there, taking apart the iron and showing how it is made, and then showing how quickly the iron heats up and how it retains its heat. Burnt impressions with the iron may also be made on heavy blotting paper or heavy tag board. An offer is made of a full supply of printed matter to all interested in the sale and use of the iron.

Some Lessons on Meter Complaints from Paris, Ill.

The City Gas & Electric Company, of Paris, Ill., of which Mr. William T. Clark is manager, recently went through an experience a knowledge of which may be helpful to many central-station companies where meter complaints are plentiful. One of the newspapers of Paris began a systematic campaign against the accuracy of the company's meters and left no stone unturned to create a feeling of dissatisfaction and suspicion among consumers. As a result of this agitation the City Council appropriated $300 to engage Mr. Edward E. Winters, of New York, as consulting engineer, to test meters submitted by complaining customers, and in view of the charges that had been made against the company about inaccurate meters, the company was only too glad to have such an investigation started. The Council investigating committee scoured the town for complaining customers, both gas and electric, and advertised in the papers for them. The complaints did not come in very rapidly, but finally the committee succeeded in getting 27 electric consumers to say that they were not satisfied with the registration of the meters on their premises.

Mr. Winters carried on his tests with an indicating wattmeter, checked by a precision wattmeter at the University of Illinois. The meters were tested in place on the consumers' premises. The results were about as would be expected by anyone having a knowledge of the general characteristics of electric meters. Of the 27 meters tested only four were found fast under light or heavy load. Of these four fast meters two were fast on light load and two on heavy load. Of the 23 which were found slow the inaccuracy ranged all the way from 80 per cent down. The most inaccurate of the fast meters was 4.22 per cent fast on heavy load and 7.11 per cent slow on light load. This investigation, of course, effectually discredited all the talk about meters being fast.

The company has a method of testing meters in the presence of consumers when complaints are made that differs from the methods commonly used by other companies. Instead of testing the meter on the consumer's premises by turning on and off lamps of known consumption and showing him that the registration is about what would be expected from the rating of the lamps, the meter is brought into the company's office and placed in circuit with a Thomson portable testing meter. The manager then takes up the matter personally with the consumer in the office and the meter is tested in comparison with the portable testing meter.

Mr. Clark says that this proves more satisfactory and convincing to the consumer than a test with lamps, though general experience is to the contrary. The company handles its gas-meter business the same way, bringing gas meters in to test with a prover in which the number of cubic feet of gas is measured directly in a small gas holder. Meters complained of are brought in for test because it is easier and takes less time for the manager to take up these matters with the consumer at the office than to visit the premises.

Boiler-Room Routine of Rockford Electric Company.

The Rockford Electric Company, at its main power plant in Rockford, under the management of Mr. F. H. Golding, has inaugurated a system of operation in the boiler-room which is intended to hold up boiler load factors and keep boilers operated at best economy. The plant contains 3150 rated horse-power in nine boilers of 350 hp each. These boilers, as here illustrated, are equipped with Jones underfeed stokers. In the main boiler feed-pipe is inserted a Venturi meter. This meter indicates the rate of flow in number of pounds of water passing per hour on a large dial and also records it on a recording chart. This is in plain view in the boiler-room, where is can be easily seen at any time by the fireman and water-tender. The rule is established that the number of boilers in operation mu be kept small enough so that the water used per boiler p hour is not below 12,300 lb. The normal rating of the boil using 30 lb. per hp-hour demands 10,500 lb. per hour, so that is expected that the boilers will be worked always at conside ably above their rated load. The 12,300 lb. is the minimu limit, so that there are times when a boiler is evaporating co siderably more than this. For example, if four boilers were operation, a fifth would not be cut in until the rate of wat consumption arrived at a point where the cutting in of the fif



BOILER ROOM, ROCKFORD ELECTRIC COMPANY.

boiler would not lower the rate below 12,300 lb. per boil per hour.

The water-tender is directly responsible for the feeding c water to boilers, the number of boilers in use and the contr of the air supply. The water-tender on each shift reports t the chief boiler-man, who is assistant to the chief enginee The chief boiler-man takes the records of the Venturi wat meter each day and compares them with the kw-hour output.

There is a Sarco CO_2 recorder in the boiler-room which autc matically makes seven registrations of per cent of carbon d oxide per hour. This is connected to different boilers on di ferent days, and as the average conditions on all boilers are ke uniform, the firemen are governed by the indications fro the boilers to which the instrument is connected in operatin the remaining boilers in service at that time. There is co siderable rivalry between the different shifts of firemen t maintain a good record. The company is burning coal fro the Southern Illinois field and the percentage of CO_2 run from 10 to 11, which is considered the best record obtainabl with this kind of coal.

The firemen work three shifts. There are three firemen o two of the shifts and four firemen on the third shift, with on ash-man and two boiler-cleaners and repair men.

The water required per kw-hour in this plant averages abou 35 lb. for all-day operation. These boilers supply a mixe equipment of slow-speed compound-condensing engines an 500-kw steam turbines with barometric condensers.

Low-Voltage Tungsten Sign Lamps in Denver.

As is generally known, the Denver Gas & Electric Company under the direction of Mr. H. L. Doherty, makes extensive us of sign lighting and outdoor illumination. It not only supplie a great deal of energy for this purpose to its customers, bu makes a profuse use of this form of advertising to advance it own business. Its office building, situated at the corner o

venteenth and Tremont Streets, is made striking at night by e use of attractive decorative lighting without and display hting within. About 600 lamps are studded in arches between e first and second floors of the building and also in a line cornice lights above, serving to illuminate the exterior. A rge roof sign is used for public notices of various kinds, and further feature is an arch over Seventeenth Street carrying veral hundred incandescent lamps. The general appearance night of the company's office building is shown in the accompnying illustration (Fig. 2).

Recently the company has effected a great saving in energy using tungsten lamps for the small arches and the cornice

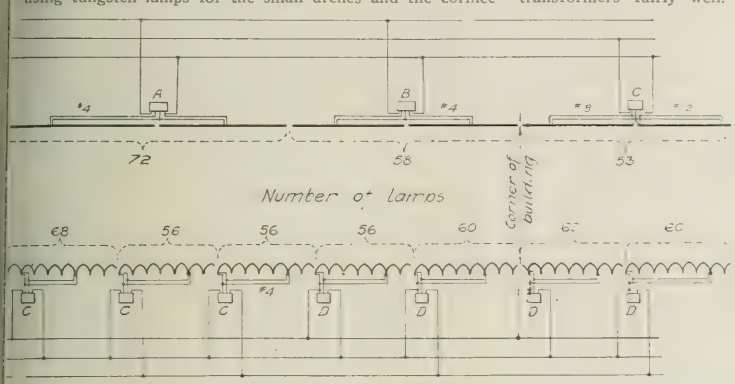


FIG. 1.—WIRING DIAGRAM.

ghting. Both the new lamps and the old ones are rated at cp, but the old carbon lamps consume 20 watts each and the ew tungsten lamps only 5 watts each. This results in a sav-ng, at the lamp, of 75 per cent in energy, and nearly all the nergy so saved can be usefully applied to other sign lighting n flat rates. Bryan-Marsh lamps are used in the new tungsten



FIG. 2.—EXTERIOR LIGHTING WITH TUNGSTEN LAMPS.

installation. There are 416 lamps in the arches and 183 in the cornice. They were operated in the original installation at 108 volts from alternating-current, 60-cycle mains.

In order to use the small tungsten sign lamps it was necessary to reduce the voltage at the lamps in a ratio of 10 to 1, and to supply this low-voltage energy at a number of points on the lighting circuits in order to keep the distribution loss and drop as small as possible. This required the use of a number of small transformers, and low-voltage transformers made by the Enterprise Electric Company, of Warren, Ohio, and the Kuhlman Electric Company, Elkhart, Ind., are used. Eight ¼-kw, step-down, 108-volt transformers, having a 10-to-1 ratio at full load, were ordered for the arches, and two 1/3-kw, 216-volt transformers, having a 10-to-1 ratio and an additional tap giving 20-to-1 ratio at full lead, were ordered for the cornice. In Fig. 1 *A* and *B* are 1/3-kw, 216-volt auto-transformers, 10-to-1 ratio, with 20-to-1 tap. *C* and *D* are ¼-kw, 108-volt transformers with 10-to-1 ratio. The circuits are fused on the primary side. The signs are wired with No. 12 wire.

From the layout of the lighting circuits it was found advisable to use but seven of the ¼-kw transformers on the arches. The eighth, as well as the two 1/3-kw transformers, was placed on the roof. This arrangement balanced the load on the various transformers fairly well. The sign itself was wired with No. 12 wire, which was not sufficiently large to carry the energy required with permissible drop, and this necessitated the use of No. 4 feeders tapped in as shown in the accompanying wiring diagram (Fig. 1). The transformers which feed the lamps on the arches are placed at about every seventh arch and mounted directly on the building. They are quite inconspicuous. It was found that the total variation in voltage on the low-voltage circuits was about 10 per cent, but this produced no noticeable difference in the candle-power or color of the lamps. The transformer efficiency is about 92 per cent. The average consumption, figured from the service switch, was about 7.05 watts per lamp, including transformer and line losses, but without taking into account the power factor.

During the progress of the installation the sign was at one time illuminated partly by carbon lamps and partly by tungsten lamps. In this situation the quantity of light given out by the two kinds of lamps was not noticeably different, but the contrast between the white of the tungsten and the yellow of the carbon lamps was striking. Directly in front of the tungsten lamps the effect was not quite so good, due to their low end-on candle-power, but from a slight angle the tungsten lamps make a fine appearance.

Taking all factors into consideration, the consumption of electricity is reduced to about one-third the former amount by this change. The general appearance of the arches and cornice has been improved, and the only thing which yet remains to be demonstrated by actual experience is the relative renewal cost of these lamps compared to the old carbon lamps. It is believed that the useful life of both types of lamps is about the same—that is, about 2000 hours.

Electric Heating Discussed at Chicago Club.

"Electric Heating Devices" was the subject discussed at the weekly luncheon of the Electric Club, of Chicago, on April 7. Mr. E. L. Callahan, of the General Electric Company, was the principal speaker. He made an earnest plea for the co-operation of all engaged in the electrical industries in "boosting" the heating branch of the business. During the last five years there has been a great change in the attitude of the public toward electric heating. It is now an important branch of the industry, and 15 concerns or more are making electric-heating apparatus. The possibilities of electric heating and cooking add to the attractiveness of electric service, and houses should be wired so that all forms of electrical conveniences may be installed. The desirability of foresight of this character should be impressed upon architects. Central-station companies should advocate electric heating because it makes use of the generating capacity and distribution systems of their stations at times when they are lightly loaded.

Mr. Callahan discussed briefly the varied character of the

devices used for electric heating, beginning with lamp-socket devices, which are particularly attractive to the consumer because no additional wiring is required. Then there are power-circuit devices, which should commend themselves particularly to central-station companies. The industrial field for electric heating introduces another class of devices. Here the possibilities are very great, and they have only begun to be appreciated. There is also a commercial use for electric heating. For instance, all boxes, barrels and cases shipped by manufacturers and dealers must be marked in some way. Why is it not entirely feasible to do this marking by means of electric branding irons? The fireless cooker promises to extend greatly the field of electric cooking in the household by bringing the cost within the means of persons in moderate circumstances. Already firmly established, electric heating is sure to be very widely extended in the future, and many devices not yet conceived will be used in its application.

Mr. F. J. Holmes, president of the Vulcan Electric Heating Company, of Chicago, pointed out that, particularly in the industrial applications, electric heating is not only very convenient, but actually results in a saving in operating cost. He spoke particularly of the electric soldering iron, and cited the case of a lantern factory where a good saving was made over the old gasoline torch, at the same time increasing the quantity and quality of the output. He also spoke of curling-irons in hair-dressing establishments, and said that in many industrial applications the saving that can be effected by the use of electric heat is really surprising.

Mr. Leonard Kebler, president of the Ward Leonard Electric Company, of Bronxville, N. Y., laid stress on the reliability of present-day electric heating devices. He said that the tools and appliances of this description which are now available have practically an indefinite life. This great point of reliability achieved, the manufacturers are now giving particular attention to securing greater economy in operating cost.

Mr. Harold Almert, of Chicago, lately manager of the Wichita (Kansas) Gas, Electric Light & Power Company, discussed the subject from the viewpoint of the central-station man. He said that in Wichita, where natural gas is available at 27 cents per 1000 ft., it was naturally a pretty difficult proposition to introduce electric heating and cooking. Nevertheless, the modern method is so convenient and attractive that there will always be found many users who will prefer it even if the cost be somewhat greater. Thus, the question of introducing these devices rests largely with the sales organization. It is of great importance to get the devices out among the public, and it is quite essential to find the right way of marketing them. Mr. Almert related some of his experiences in Wichita in this direction and pointed out that heating devices are especially valuable in increasing the demand from customers already connected and at the same time improving the load factor of the station.

Mr. George B. Johnson, of the Commonwealth Edison Company, Chicago, was called on and briefly referred to the remarkable flatiron campaign, under his direction, by which his company put out 10,000 electric flatirons between Dec. 15, 1908, and March 15, 1909. This achievement was briefly outlined in the issue of April 8. Mr. Johnson also made the interesting statement that the Commonwealth Edison Company has heating appliances, with a total rating of 18,000 kw, connected to its system. He remarked that the company had had success in putting devices of this character out on trial.

The last speaker was Mr. H. F. Holland, of the Pacific Electric Heating Company, of Chicago, who referred briefly to the advantages of the electric flatiron.

Holyoke's Municipal Lighting Finances.

By Glenn Marston.

Holyoke, Mass., has owned its municipal lighting plant for six years and has reduced the rates for gas and electric light several times during that period. Meanwhile the tax rate has advanced from $16 to $17.40. A small proportion of the increase, 43 cents, is due to the increased State tax, but the remainder appears from the official records to be due entirely to the increased financial burden imposed upon the city by the purchase of the lighting plants.

There is no city which has been so persistently held up as an example of the success of municipal ownership in the United States as Holyoke. It is managed by one of the most efficient operating men in the country, Mr. W. H. Snow, who has tried in every way to keep politics out of the management of the property, with the result that the service is excellent and the rates are low. An inquiry into these rates, however, shows that they are far from sufficient to meet the legitimate charges against the plant.

If the accounting of the lighting plants was conducted on even the same basis as the accounts of another municipal department, the Holyoke water works, there would be a deficit instead of the surplus of $54,930.90, as is shown on page 76 of the annual report for 1907. An example of the peculiar methods of reporting expenditures is that relating to bonds. The above surplus is shown after operating expenses, including bond interest, are taken care of, but in the whole report of the lighting department the word "bonds" does not appear. One must turn from page 76 to a folded insert bearing no page number, 256 pages further along in the municipal register, to find the city's appropriation for the payment of gas and electric bonds.

One would be inclined to call this deceptive accounting if it were not for the emphatic assurance of several officials in Holyoke that there was no intention to deceive; but it is difficult to understand why such a huge expenditure as the payment of maturing bonds, which are, of course, a direct charge against the plants, should be omitted—not even mentioned in any way—from the report. While the Mayor of Holyoke, in answer to an inquiry regarding the profits of the plant, stated that the plants showed a profit of $54,930.90, he afterward amended the statement by saying that the profits were $16,517.61. This admission shows that the Mayor himself must have been misled by the lighting department's report, for it is hard to believe that he would be a party to wilful deception in this regard.

It is difficult to understand why the city water works is compelled to pay taxes while the lighting department does not. If there is justice in making the water department pay its share toward the maintenance of the city government, and there manifestly is, why is the lighting department favored? Can it be the discrimination is due to the fact that the Mayor's profit of $16,517.61 (reduced from $54,930.90) would be wiped out and supplanted by a deficit? The taxes on the lighting plant, figured on the same basis as those of the water department, would be over $19,000. These taxes would, of course, be paid if the plants were owned by a private company. Apparently it is to avoid a deficit that the lighting department is not taxed.

From these figures it is evident that there would be a loss on the plant if even the charges recognized by other departments of the same city were made against the plant. No account is taken of the absurdly inadequate depreciation figure. The city auditor's own figures, incidentally, show an income for the lighting department of $323,706.18, while he shows expenditures and appropriations amounting to $356,319.84. This does not tally well with the reported profit of over $54,000. It will be noticed that there is a slight discrepancy between the income report of the auditor and that made by the lighting department. This is because the municipal year does not correspond with the 12 months covered by the lighting report.

The question of depreciation is always a difficult one—it is necessarily a matter of guesswork to some extent—but in the case of Holyoke there can be no doubt that the depreciation account is far too small. An allowance of 3 per cent is made for depreciation, while the officials themselves admit that all of the original electric plant left after six years consists of two waterwheels and one old-style Edison dynamo. A depreciation of 3 per cent assumes that the plant will last over 30 years. As practically all of it has been scrapped in six years, the depreciation rate should be nearly five times what it is. Depreciation

the gas works has been by no means as rapid, but it is safe assume that it has been considerably in excess of 5 per cent. suming 5 per cent for the gas plant and 15 per cent for e electric plant, the depreciation account would be something e $100,000 instead of $29,275.23. This one item alone would t up a good deal more than the reported profit of over 4,000.

The annual report for 1908 shows that the profits have been terially reduced because of a reduction in rates made effctive a year ago. While the "profit" for 1908 is only 0,965.57, the report again ignores the question of bonds, hough additional bonds were issued during the year for enewals and extensions," constituting an official admission at the depreciation account does not cover the actual wear d tear on the plant. This brings the annual appropriation for nds up to $41,100. The report says: "At the station, exnsive additions and alterations have been in progress during e year . . . $160,000 was appropriated to the department for is work and the wisdom of the move has already been own." Not one word to the effect that this appropriation as made from the proceeds of additional bond sales. The ly intimation that the department has anything to do with nds is an item of bond premiums mentioned once on page 9 d once on page 12. Regardless of the additional burden aced upon the taxpayers by the bonds issued last year, the port calmly states that it makes a profit of over $30,000. The ficit this year must be even larger than it was last year, as e report omits all items that were formerly omitted, while the ported "profit" is considerably smaller, yet there is no indiation that the existing state of affairs will be remedied.

It is easy to see why Holyoke is enjoying low rates for ectricity and reasonable rates for gas when the city continues issue more and more bonds to meet depreciation and conruction that could be taken care of by the huge "profits" of e plant if these profits really existed. When a plant pays taxes, has no sinking fund, and relies on the generosity of e taxpayers for the greater part of its depreciation account would be strange, indeed, if good management—and Mr. ow is a good manager—could not show a profit. The relavely small proportion of the population using gas and elecicity appears to benefit by low rates, but in the meantime xes are going up, and the annual appropriation from the city easury for the payment of gas and electric bonds is inreasing.

The New York Edison Company and Its Relation to the Electric Automobile Business.

By Norman G. Meade.

In New York city freight and delivery transportation has een a serious problem, but with the advent of electric comercial vehicles a great many difficulties have been overcome. he same characteristics apply to these conveyances as are ound in all other systems of electric propulsion. Nothing can e easier to understand than the power plant of an electric agon. There is no complication of parts, no delicate mechanm to wear out rapidly or to get out of adjustment and reuire an expert to make necessary repairs.

Many classes of delivery service involve long-distance runs ith intermittent stops, while many more call for a large numer of short trips. In either case it is generally unwise to wait or the regular delivery system with its scheduled routes and low service. The frequency of sudden and unexpected deands often warrants the adoption by a commercial firm of a pecial delivery equipment that will always be ready to make rompt deliveries at the request of customers.

The New York Edison Company was one of the first centralation companies to appreciate and take advantage of electric ehicles, and it has not only strongly recommended their use or pleasure and business purposes, but it is now one of the largest users of electric wagons and trucks in this city. The company maintains 12 passenger conveyances, 36 delivery wagons, three 2½-ton and 3-ton trucks, and five 5-ton trucks. The garage is located at Forty-first Street and First Avenue, where a complete repair shop and all the necessary facilities for overhauling and repairing batteries and vehicles—in fact, everything that goes to make up an entire automobile establishment—is found. A small garage is also maintained at 546 Pearl Street for light repairing and charging.

Thirteen of the electric delivery wagons are used for the incandescent-lamp delivery service. Lamp renewals are made by these wagons on requests from customers who write or telephone for them. These orders are routed by a night clerk who assigns about 60 orders to each wagon. In addition to serving lamps upon request, the lamp wagons call periodically every two or three months on every customer using incandescent lamps.

For the accommodation of electric vehicle users the New York Edison Company has established 20 charging stations in various parts of the city, where batteries can be recharged at a nominal rate of 10 cents per kw-hour. An order, signed by the owner or the chaffeur, and showing the meter readings before and after charging, filled in by the operator at the station, is forwarded to the general offices of the company. This arrangement is a great convenience to automobilists who are at some distance from a garage, as they can recharge without wasting time in a return trip for that purpose.

Through the columns of *The Edison Monthly* and advertising literature the New York Edison Company will illustrate and



LOADED LAMP WAGONS AT FORTY-FIRST STREET STOREHOUSE.

describe various types of electric automobiles and accessories and give general suggestions for economical and convenient operation and maintenance. The automobile engineer of the company endeavors to enlist the co-operation of various automobile companies to increase the sale and use of electric automobiles, and personally solicits large business houses using horse-drawn wagons to introduce the electric machines. In addition the engineer visits those already using "electrics" to ascertain if they are giving satisfaction. It is often found that through misapprehension much more current for charging is used than is necessary, or that the vehicles are not handled as economically as is possible. These difficulties the engineer tries to adjust to the satisfaction of the customer.

There are many large users of automobiles in New York on the Edison service. The New York Transportation Company alone has in operation 250 electric taxicabs. The Adams Express Company uses 55 1-ton and 2-ton trucks, and there are a number of other companies using many commercial vehicles driven by electricity.

The New York Edison Company has a special automobile and storage-battery contract under which current is sold at 6 cents per kw-hour, subject to a discount of ½ cent per kw-hour for a monthly consumption of 3000 kw-hours, up to 3 cents per kw-hour for a monthly consumption of 50,000 kw-hours. This contract is subject to the restriction that energy shall not be

used without the written consent of the company between the hours of 4 p. m. and 9 p. m. during the months of November, December, January and February.

A very convenient folder is issued by the New York Transportation Company, giving a list of charging stations in New York City and its environs, with a map showing their locations in Manhattan and the Bronx.

Some figures showing the performances of the New York Edison Company's 2000-lb. delivery wagons are interesting. The month of January, 1909, shows the following:

Average number of days each wagon worked	26
Average mileage of days each wagon	795
Average kilowatt consumption, charging	618.7
Average daily mileage	19.5
Average daily kilowatt consumption, charging	23.8

It will be seen by these figures that the average cost of energy per mile, figured at 3½ cents per kw-hour, is but 4.3 cents.

It is interesting to note in conclusion that there are more than 4000 electric vehicles in use in New York, which represents more than are in all the other large Eastern cities put together.

INTERIOR WIRING AND ILLUMINATION

Louisiana Electricians' Licensing Law.

By T. S. McLoughlin.

Louisiana by its 1908 State law licensing electricians has plunged the entire fraternity in New Orleans into problems of interpretation and enforcement which it is expected will eventually result in a bona fide test of its constitutionality within six months, before the Supreme Court. The preamble of Act 178 confines its provisions to cities of more than 50,000 inhabitants, and makes its terms apply to "the licensing of persons, firms and corporations conducting or managing a business for installing any wires or electric apparatus to convey electrical current, for light, heat or power, and to prevent the doing of such work by persons, firms or corporations, other than those licensed in accordance with the provisions of this act."

As New Orleans is the only city of the State of over 50,000 inhabitants, the operation of a State law is thus confined to that city alone. The board of examiners and supervisors who confer licenses has been appointed by the Governor and is actively at work. It is composed of four electrical contractors and a union labor representative, who is also its secretary. The act prescribes that they shall be practical electricians, be appointed upon nominations made by the oldest electrical contractors' association in the city and the International Brotherhood of Electrical Workers, respectively, and shall serve two years. The commissioner of police and public buildings and the fire marshal recommend two one-year men, and these four select a fifth, also serving for one year, from established electrical engineers. There are few men in New Orleans—in fact, none—who practice electrical engineering exclusively and independently, a condition of affairs due principally to the not uncommon reluctance of professional architects to reduce their own fees by the employment of either mechanical engineers or electrical specialists, and particularly the latter.

The board meets at least once a month, and conducts an examination of candidates for the term of "Master Electrician," and issues a license to the firm or corporation the applicant represents, which is also a certification of the applicant's ability. Besides passing the examination, a final requirement is a $2,500 bond to afford recourse for the real party at interest or owner for a year from date of installation against loss or damage by reason of work done or material furnished being below the standard of the National Electrical Code. This is where the insurance interest is written into the law, as a proper certificate from a legally authorized underwriter's inspector cancels the bond liability on any job or contract. A previous legislative act created the Louisiana Fire Prevention Bureau, as well as the office of the marshal, and its inspectors will be recognized as clothed with the necessary "legal" authority.

Members of the board take the oath of State officers. Revenues must go to the maintenance of the board. Neither the per diem allowance of $5 per member for actual service, nor the secretary's salary, to be fixed by the board, can become a charge against the State or State treasury. No salary is at present enjoyed by the secretary, who is the International Brotherhood nominee.

The method of examination is patterned after civil-service rules. At present 20 questions, valuation of five points each, are selected from 200 prepared by the board, sealed and kept in a box ceremoniously brought from a safety deposit box for each examination. So difficult has it been to get suitable questions that the board has withheld from public scrutiny the questions already used, fearing that similar or identical questions may become necessary for future use when those formulated have been exhausted. Applicants must be 21 years of age. A preliminary requirement is that satisfactory evidence must be furnished the board of three years' experience as a master electrician, or its practical equivalent, such as a journeyman might offer. Experience does not figure in the examination itself, which a percentage of 70 is required.

Supplied with writing materials, in the presence of a quorum of the examiners, they struggle through the questions in three hours. Motor questions and problems on wire sizes under given conditions are frequently included. A member of the board is emphatic in his statement that the questions are invariably based upon Code requirements. Text-books or outside assistance is denied, and papers are signed with numbers instead of names. They are now kept on file and an applicant may review his own paper, after the result has been announced for his own satisfaction.

Under this system another class—numerically it has been as few as one and as many as six—might draw a set of questions all the same in kind or as varied as the classes of work or the departments of the Code. Persons upon whose ability a license has been issued as master electrician carry with them from one employer to another their qualification, but the board must pass upon the new employer's right to undertake the work permitted under the act to licensees. This will probably be met by treating the case as a renewal or transfer, and the new licensee will be charged the $10 fee accordingly each time a transfer is made. "Once a master electrician always a master electrician;" so several men will probably get steady jobs. The usual provision for revocation for cause of a license appears in the law, with provision that due hearing be given.

A few candidates paid $50 before succeeding and a few have failed and given up entirely, thus losing their entrance fee of $25. There are now 27 licensees, including the three large jobbing houses, two leading fixture houses, a St. Louis contractor who has recently established an office here, a number of small contractors both in and out of the association, and the four members of the board, who are contractors. Some of the latter had their superintendents or firm members qualify as master electricians.

An estimate by the writer of receipts and expenses, necessarily uncertain in the newness of the law, is as follows:

FROM JANUARY, 1909 TO JANUARY, 1911.

RECEIPTS.

First year, 50 licenses, at $25 each	$1,2
Second year, 50 renewals, at $10 each	5
Second year, 12 new licenses, at $25 each	3
Total	$2,0

EXPENSES.

First year, per diem expenses five members for 15 meetings	$3
First year, stationery and sundry expenses	1
Attorney's retainer	1
Secretary's salary, at $25 per month	3
Second year, same as first year	9
Total	$1,9

The New Orleans Electrical Contractors' Association, aided by organized labor as represented by the local union of the International Brotherhood of Electrical Workers, had the la

assed on their representations. The electrical contractors had a previous session attempted to secure legislation without result. The association will, therefore, support the law, and as newly created master electricians immediately become ardent advocates of enforcement, it will not be friendless in the face of such opposition as may develop. Meanwhile, a carpenter who undertook electrical work has been remanded under $500 bond to a higher court by a committing magistrate for taking a contract without a license and doing work after warning. Another case against a grocer's clerk who did some electrical work for his employer is yet to come up. Affidavits have been made against violators by both board members and licensed contractors.

The following sections are remarkable in their exemption of light and power companies and their provisions for punishment not only of the unlicensed contractor, but of workmen who take employment except under licensed or excepted concerns. Isolated-plant electricians are also excused.

"Section 13. Be it further enacted, etc., Nothing in this act shall be so construed as to prevent any person from doing or performing any of the kinds of work enumerated in Section five (5) of this act, when such work is performed under the direction and supervision of a duly licensed master electrician, but no work, other than minor electric repairs for the maintenance of established plants, shall be performed excepting under such direction and supervision of a duly licensed master electrician, and the said licensed master electrician shall be responsible for any and all work so done under his direction and supervision. This shall be construed as exempting lighting companies and electric railway companies and the department of police and public buildings of the city of New Orleans from the provisions of this act in so far as the maintenance and installation of their equipment, pole-line, services and meters are concerned.

"Section 14. Be it further enacted, etc., Any person, firm or corporation or any member of such firm or corporation, who shall practice or engage, or continue, in the work of a master electrician, as defined in Section five (5) of this act, without having complied with all the provisions of this act, and any person not licensed as a master electrician who shall do or perform any such work except under the direction of a master electrician, or who shall violate any of the provisions of this act, shall be guilty of a misdemeanor and upon conviction thereof, shall be sentenced to pay a fine of not less than twenty-five dollars ($25), nor more than five hundred dollars ($500), or to an imprisonment not exceeding ninety (90) days, or both, in the discretion of the court."

The definition and privileges of a master electrician are set forth as follows:

"Section 5. Be it further enacted, etc., The term 'master electrician' as used in this act shall be so defined as to include any and all persons, firms and corporations engaged in the business of, or holding themselves out to the public as engaged in the business of installing, erecting or repairing, or contracting to install, erect or repair electric wires or conductors to be used for the transmission of electric current for electric light, heat or power purposes, or moldings, ducts, raceways or conduits, together with fittings for same, for the reception or protection of such wires or conductors, or to electrically connect electric wires or conductors together, or to any electrical machinery, apparatus, device or fixtures to be used for electric light, heat or power purposes. A license of 'master electrician' issued or granted under, and in accordance with the provisions of this act, shall entitle any such person, firm or corporation so licensed to engage in the business of," etc.

A list of the questions for one examination is given below:

1. Describe some method of making a satisfactory support in conductors in vertical conduit risers.

2. What is the rule as to the circuit connecting ground detectors, pilot lights and potential transformers on switchboards?

3. In cases where dampers in theaters are released by electric devices, what is the rule as to the circuits?

4. When a ground wire is connected to gas pipe system on house side of meter what additional precaution should be taken?

5. What is the maximum voltage between conductors in same fixtures?

6. What is the rule for sockets in damp or wet places, and how shall they be installed when not on fixtures?

7. Give brief description of material and construction of cabinets; for "K and T" work; for conduit system.

8. Would you use the same size of rubber-covered wire for wiring a 1-hp, 110-volt, direct-current motor as for a 1-hp, 220-volt direct-current motor. If not give size for both cases.

9. State the rule to be followed in starting and stopping motors.

10. What devices, protective or controlling, are required to be installed in wiring for motors?

11. What size rubber-covered wires should be used to feed 15-hp, 110-volt direct-current motor of 75 per cent efficiency at 25 per cent overload?

12. What sort of wiring is required from switchboard on theater stage to border lights, and how it may be run in accordance with the National Code?

13. What size alternating-current motor may be installed without compensator?

14. Describe the care that should be given to the brushes to keep them in good condition.

15. How should service be arranged in wiring for both light and power for direct current?

16. When can canopies on fixtures be insulated?

17. What is the rule for the type of insulation on wires in theater border-lights and footlights, and is this rule mandatory?

18. What is the ruling for installing wires passing through timbers at the bottom of plastered partitions?

19. What does the term theater mean in so far as rules and regulations of the National Code are concerned?

20. Give a formula to find circular mils when voltage, amperage, distance and actual volts lost are shown.

Photometric Units.

A rather vigorous discussion has been going on in the columns of the *Illuminating Engineer* (London) regarding the use of the term "lux," especially as regards the unit of intensity involved, whether "candle" or "hefner." Now "lux" is one of the terms peculiar to illumination for which there seems to be a real call, so that a general definition of it is rather important. "Lux" at present is universally used with the meter as unit distance, but the intensity implied may be either candle or hefner, and occasionally German writers use kerze when they really mean hefner. With the coming adoption of a standard candle unit in France, Great Britain and the United States, "lux" as used in these three countries will mean one and the same thing. It would then seem advisable for German writers to call their unit the hefner-lux or to adopt the lux accepted elsewhere. "Lux" unqualified ought to mean practically what it implied when Professor Blondel brought the term into his tentative series of light units in 1893. These units, whether adopted in whole or in part, are logical and systematic, and there is no valid excuse for going outside this excellent list in establishing a proper nomenclature for illuminating values. The proposed international unit being practically identical with the bougie-decimale greatly simplifies the issue.

Historically, "meter-kerze" antedates "meter-hefner," and the former should therefore be considered to mean what it originally implied, i. e., the lux with the candle as basis. The same reasoning should apply to the "lumen," the only other illuminating unit yet badly needed. "Lumen" was also established by Professor Blondel as part of his 1893 system, and ought to be used only in its original sense. Its use with the hefner as unit of intensity, unless so specifically qualified, seems to be quite unjustifiable from any point of view. Everyone respects the value of the hefner lamp as a concrete thing, but that is no reason for applying it tacitly as unit intensity in terms that

really mean something else. One important matter should be again here referred to, the undesirability of generally using "lux" and "lumen" prior to the official action that will give them a definite value. It will now be only a short time before such action will be taken, and then one can comfortably go ahead with the knowledge that the terms will mean the same thing everywhere. The hefner units, if so characterized, will merely be slightly inconvenient but will do no particular harm. Whether it is advisable at present to take over the whole Blondel list of units is another matter. So far as need demands, they will doubtless meet the requirements, yet as in the case of the metric system itself, subsidiary names are likely to drop out of sight unless the things that they imply meet long-felt wants. This matter will take care of itself in due season. "Hefner" has come into general use only in Germany, and its implication unspecified in "lux" and "lumen" is as improper as it would be to use "foot-pound" with the tacit understanding that the pound meant was really half a kilogram. The present mix-up reminds one of the time when Siemens units were confused with ohms and the weber disputed ground with the ampere. These conflicts were only temporary, but while they lasted they were annoying. At present the one thing needful to avoid confusion is extra care in writing to avoid ambiguous terms, and a united effort, at the earliest practicable moment, to establish in regular usage the few vital terms for which there is frequent use.

New Telephone Patents.

INSTRUMENTS AND APPARATUS.

One of the most vulnerable parts of the flexible connecting cords used at switchboards is at the base of the plug, where the cord takes a more or less abrupt turn when it is put into use. This result is attributable to the horizontal position of the plug as it stands in the jack. To overcome the difficulty Mr. E. T. Banes, of Philadelphia, has patented a slightly flexible rubber bushing, which is secured in the bore of the plug and which surrounds the cord tightly. Such a bushing will tend to reduce the abruptness of the turn in the cord and will hold this away from the conducting metal part.

A receiver forms the subject of a patent granted to Mr. A. H. Nicholson, of Wendover, England. In this receiver use is made of a wide span U-shaped magnet, each pole of which is short, and carries an inwardly projecting cup for supporting the diaphragms. One diaphragm is carried on each cup, the two standing in parallel planes a short distance apart. A ring carrying the earpiece closes in this space, by being slipped over the two cups. Within the ring is a diaphragm in the center of which is supported the receiver bobbin or coil, with its core poles confronting the diaphragms immediately opposite the polarizing poles. The diaphragm is thinned toward the side of the ring carrying the earpiece, so that an aperture is left toward each diaphragm.

An antiseptic attachment has been jointly patented by A. W. Lyda, of Pittsburgh, Pa., and E. C. Robinson, of Lowellville, Ohio. The device consists of a metal cap, similar to a watch-case cover, which contains the antiseptic absorbent in it. It is supported by a hinge to a clamping ring which encircles the lip of the mouthpiece. A pendant hook attached to the ring forms an auxiliary receiver support.

SWITCHBOARD CIRCUIT.

In two-wire common-battery systems of the Dunbar type it has been customary to arrange the cut-off relay so that it disconnects the line-relay circuits when it operates to connect to the jack circuits. Mr. W. W. Dean has patented a modification of this arrangement whereby the line relay is placed on the line side of cut-off relay contacts and thus as the cut-off relay operates it leaves the line-relay in the talking circuits. To offset this disadvantage the cut-off relay, through its contacts, puts a short-circuit around the line-relay. The patent for this arrangement has been assigned to the Kellogg Switchboard & Supply Company.

CALL DISTRIBUTING SYSTEM.

Call-distributing systems require a combination of automatic and manual switching. Thus, a call originated by a subscriber is under his control sent into an automatic switch, which picks up a telephone line not busy and extends the call to a manual operator for completion. It will be seen that a number of lines far less than the number of subscribers served is needed between the automatic and manual devices. With such systems there should be some way for the calling party to signal the manual operator directly without "knocking down" his connection at the automatic switch. It is with a view to accomplishing this result that Mr. S. H. Browne, of Pittsburgh, has invented a retarding relay device, which he has described in a patent assigned to the American Telegraph & Telephone Company. The control of the automatic switch lies in a relay, the return movement of whose armature toward the "knock-down" position is retarded by a train of gears and escapement. Now if the caller wishes to signal, he vibrates his hook slowly, thereby affecting the supervisory lamps of the manual board. He does not "knock down" his switch, because before the "knock-down" relay can get to its backstop the relay is re-energized by the use of the hook. The "knock-down" takes place upon a long depression of the hook.

DUPLEX SYSTEM.

A duplex system for sending two non-interfering messages simultaneously over the same wires is described in a patent assigned to the General Electric Company by its inventor, Mr. M. C. A. Latour, of Paris, France. The two telephone currents are superimposed upon a high-frequency alternating current, too high to affect the human ear. One-half of each wave is then blotted out with a mercury-vapor arc rectifier. At the receiving end a rectifier is also used to refuse all currents not of proper polarity. It will thus be seen that by the use of two such outfits upon the same line wires, with rectifiers properly poled, one station may work upon the positive half-waves, the other using the negative half-waves.

TRANSMITTERS AND ATTACHMENTS.

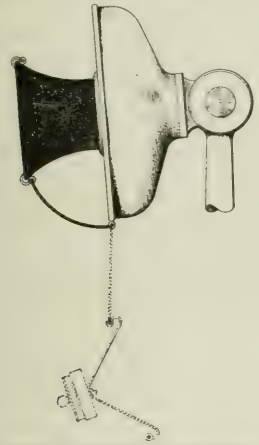
The solid back transmitter has always been distinguished by the stationary microphone cup carrying the stationary electrode in its base and the movable electrode attached to the diaphragm, which is supported upon the cup by means of an auxiliary diaphragm. In recent years a different arrangement has been used—that is, the inverted solid back, wherein the carbon cup is associated with the movable electrode and diaphragm, while the rear electrode is held stationary, the auxiliary diaphragm extending from it to the moving cup. Besides these two, there is a third type wherein both electrodes are connected to the microphone cup by means of auxiliary diaphragms; one electrode is secured to the main diaphragm and the other to the bridge, the microphone cup floating, so to speak, on the auxiliary diaphragms. Mr. H. P. Clausen, of Chicago, has obtained a patent for such a transmitter wherein an initial strain is given to the auxiliary diaphragms by either pushing the electrodes together or pulling them apart more than the normal distance. Mr. Clausen has assigned his patent to the American Electric Telephone Company.

Mr. C. Adams-Randall, of New York City, has obtained a patent for a very different type of transmitter. He uses a felt disk in one face of which is pressed a channel having a more or less complicated shape, with a view to increasing its length. At each end of the channel is a terminal electrode to which the transmitter electric circuit is attached. The diaphragm, preferably non-conducting, lies against the face of the felt, thereby sealing the channel, which latter has, of course, previously been filled with carbon granules. It will be seen that the resistance through the carbon from electrode to electrode is varied by means of the lateral pressure exerted by the diaphragm upon the granules in their channel.

It has been the practice for many years to make transmitter

mouthpieces of hard rubber, electrose, or other similar opaque and black compounds. However, Mr. W. Gibson, of Danbury, Conn., employs glass as the substance for the mouthpieces, and, as it is expensive and rather impracticable to form suitable threads upon the glass, he has designed a metal nipple, adapted to screw into the transmitter face. The nipple has a cylindrical portion beyond the threads, upon which the glass mouthpiece may be forced with sufficient friction to maintain it in place.

In the accompanying illustration is shown a disinfecting attachment, designed by Mr. M. A. Dohney, of Chicago. When



DOHNEY TELEPHONE DISINFECTOR.

it is desired to use the transmitter the wire clips are sprung and the disinfector is allowed to hang clear.

Another idea for a transmitter disinfector is that of Mr. G. M. Scroggs, of New Orleans. Mr. Scroggs provides a perforated metal lining for the mouthpiece, having a turned-back flange carrying spring clips which engage the insulating mouthpiece. The perforated lining is wrapped with a coating of absorbent, saturated with disinfectant, and over this is another metal layer which is secured by being screwed into the flange piece. The whole device, thus built up, fits the mouthpiece.

Mr. A. A. Williams, of Chicago, has also patented a transmitter disinfecting device. His device consists of a number of false mouthpieces of paper, telescoped together. The outer one is of a shape to fit the inside of the transmitter mouthpiece and the edges of all are turned back over the mouthpiece and clamped in position by means of a spring ring. Whenever it is desired to change the lining the ring spring is opened slightly and one of the layers of paper, the innermost, is pulled off and the ring is allowed to snap back into place to hold the remaining layers in position.

SWITCHBOARD TEST CIRCUIT.

For switchboard "busy" tests it has been the custom for a long time to use a tertiary winding on the operators' induction coil. This tertiary winding has usually been associated with the tip of the plug through an auxiliary contact of a relay, key, etc., so arranged that the tertiary is connected to the cord only during the period of test, before the cord is inserted in a jack. Mr. C. S. Winston, of Chicago, recently patented and assigned to the Kellogg Switchboard & Supply Company another arrangement wherein the tertiary winding is permanently connected between a grounded battery and a point in the operator's set, midway between the receiver and the induction coil secondary. The connection of this grounded test circuit is at a point which approximates a neutral point and, therefore, it has a minimum distributing effect.

RECEIVERS.

It has been well recognized for a long time that in many instances partially deaf persons can hear with the telephone receiver very readily. This is the case when the affection of the ear is one of the drums or middle ear, the inner ear being in good condition. The excitation of the inner ear is supposed to be through the bones of the skull, due to vibrations impressed from the body of the receiver in its contact with the head. In order to make this action more perfect, Mr. James Dickson, of Cleveland, Ohio, has devised a receiver with this end especially in view. He has mounted on the ear-cap, integral therewith, a boss terminating in a spherical surface, with a smaller hemisphere arising from its middle. When such a receiver is used the boss can be placed immediately in front of the ear in such a way as to make a very good contact with the skull, thereby compressing tightly the interlying tissues of the face.

Another improvement in receivers has been patented by Mr. A. Rector, of New York City, the patent being assigned to the Helpaphone Company. This improvement comprises an extension body piece for inserting in an ordinary receiver between the normal ear-cap and the body proper. A web extends across one end of the extension piece, designed to clamp the diaphragm and to provide the usual narrow air space. A tube of the same diameter as the normal cap-aperture extends from the air-space to the ear-cap. The ear-cap screws down upon the extension, its aperture registering with the tube. It is claimed that this device improves the quality of the received sound.

AN IMPROVED DESK STAND.

Many of the desk-stand or portable telephones now manufactured have a cylindrical upright, near the top of which is the hook-switch lever, while in the base are the switch springs with a more or less complicated linkage between. A patent issued to Mr. A. H. Weiss, of Evanston, Ill., and assigned to the Kellogg Company, describes such a stand with the linkage having a toggle action. The main switch spring requires a vertical displacement for its action. The hook lever has a long bent arm extending down within the tubular upright, and pivoted on its lower end is a second link which extends to the main spring of the switch. The depression of the hook causes the lever in the linkage to straighten. This action lengthens out the linkage, thereby driving down the spring before it.

MISCELLANEOUS DEVICES.

A key-type switchboard, using no cords, is described in a patent granted to Mr. F. W. Wood, of Newport News, Va. Banks of keys are so arranged that each vertical row of levers corresponds to a single line, while each horizontal row corresponds to a different cord pair. The arrangement of circuits is such that the main battery supply is in series with the supervisory signal, and when a connection has been effected, each telephone line of the connection is bridged from the ends of this combination circuit. In other words, the supervisory signal coil serves as a retardation coil in the battery feed circuit. The claims of the patent deal principally with this arrangement of circuit combined with the use of the non-inductive shunt about the supervisory signal coil.

A message-registering system forms the subject of a patent granted to Messrs. V. D. Greene and K. W. Fort, of Chicago. This system is adapted solely to automatic exchanges. It is so arranged that the subscriber must register a count before his selective apparatus will perform its functions in selecting the desired party. The arrangement is a mechanical one, the counter push being so associated mechanically with the dial mechanism that the latter will not start until after a call has been registered. As is well known, the use of distributed inductances to overcome capacity was brought to a practical solution through the inventions of Dr. Pupin. However, his inductance coils distributed along the circuit are provided with cores normally demagnetized, or practically so. A different arrangement is described by Mr. I. Kitsee, of Philadelphia, who distributes inductances along the line to improve transmission, but magnetizes the cores inductively by means of permanent polarizing magnets associated therewith.

Messrs. W. F. Wagner, of Detroit, and W. E. Shiels, of Toledo, are the joint inventors of a party-line lock-out system. The apparatus is so arranged that as soon as the receiver comes

out the hook at any station, and the operator answers, the relays operate at all stations to lock out all other stations on the line. If the desired party be on the same line as the calling party a push at the calling station must be operated to unlock the line until such time as the desired party answers.

Letters to the Editors.

Compulsory Working of Patents.

To the Editors of Electrical World:

Sirs:—Referring to the recommendation of Mr. Barkelew in your issue of March 18 concerning the compulsory working of patents, it appears to the writer that such a law would favor, not inventors, but manufacturers, who would wait until a patent was void and then avail themselves of it without cost. Such a law would be counter to American progress, since many of our best inventions have come from men of small means. As conditions now are, it is far more difficult to interest capital or manufacturers to exploit a new device than to invent and patent it, to say nothing of interesting the consumer. The nation would lose by a law making practically hopeless the case of the inventor of small or moderate means—a law also at variance with American principles. Inventors as a class are not duly paid for their services to the nation, nor are their services duly recognized except in rare cases, when public sentiment has accidentally been touched. In the end it would be more profitable to the consumer and to the nation to provide a law paying for inventions and seeing that they are worked.

Blue Mound, Mo. Edwin J. Elsas.

[Our correspondent evidently overlooked the bearing of the suggestion of Mr. Barkelew, which had in view the clearing of the field of protective and other paper patents which, it has been claimed, are gradually depriving the independent inventor of any incentive to invent owing to the manner in which such patents control some of the arts.—Eds.]

Valuation of Public-Utility Properties.

To the Editors of Electrical World:

Sirs:—I have read with considerable interest Mr. W. H. Winslow's letter in your issue of March 25, and I believe that he has brought out the point of difference much clearer than before.

Two quotations will serve to show wherein the difference lies. Mr. Winslow, in his letter, states: "It is well known that most new ventures in the public-utility line have all they can do to get enough money to cover actual cash requirements during the early years of their operation, and to take the position that a depreciation reserve which cannot be laid aside then shall not be made up later, is certainly unfair and unjust." In the summary of the Supreme Court decision, published in your issue of Feb. 11, the court states: "If, however, a company fails to perform this plain duty and to exact sufficient returns to keep the investment unimpaired, whether this is the result of unwarranted dividends upon over-issues of securities or of omission to exact prices for the output, the fault is its own. The court could not undertake to correct such past errors of management." Or, in other words, one party says: "Let the dead past bury its dead," while the other says, "Let extra profits in the future make up for past losses." This seems to be the real point of divergence of opinion, and it does not take a deep student of such affairs to see that it makes a lot of difference with the way in which the accounts may be kept.

The reasoning of the Supreme Court is given quite clearly in the article above referred to and I shall not try to add anything to it here. I would, however, like to justify, from the standpoint of the Supreme Court, the correctness of my statements with regard to the accounts.

The first case, as corrected by Mr. Winslow, is that of a partly depreciated plant which is bought and at the same time a certain amount of cash is invested which, with its interest accumulations, will, at the time of the plant's replacement, equal the amount of depreciation at the time of purchase. There are two factors to be considered here. It is probably assumed that the purchaser receives dividends on the total investment, including the price paid for the plant and the cash laid aside. At the time of replacement the accumulated interest of the cash investment is available in addition to the two sums named above. Whether this increase in assets, which thus makes up for past losses, is permissible depends upon the view taken with regard to the first proposition. There is another factor to be considered, however, in that a considerable amount of cash has been actually invested.

With regard to the fluctuation in the value of the service with the bank balance, I believe that Mr. Winslow has misunderstood me. With the same capitalization, say, initial cost of plant, and the same rates, the company with cash assets bringing in interest can pay higher dividends than the company without cash assets. With the same capitalization and same dividends the company with cash assets would have *lower rates* for current. One way of stating this is that the total earnings should fluctuate with the total assets.

With regard to charging double depreciation in order to build a new plant at the proper time, the propriety of this also depends on one's interpretation of the fundamental proposition. Of course, if it were not allowable to wipe out past losses, neither would such double depreciation be permissible. A curtailment of dividends or new issue of securities or both would be required.

I wish to add that I have not overlooked Mr. Winslow's basis of "reproductive value." It appeals to me, however, as a statement to be proved rather than as an axiom from which to work.

West Lynn, Mass. F. E. Haskell.

Uniform System of Accounting.

To the Editors of Electrical World:

Sirs:—The Public Service Commission uniform system account called "general amortization—electric" provides for a monthly charge to cover wear and tear, obsolescence and inadequacy, in which charge are included the amounts charged in the month to the various repair accounts in electric operating expenses. The rule adopted by this company for determining the amount of such charge is as follows: Multiply one cent (0.01) by the number of kw-hours sold. This rule is based on the following facts, opinions, estimates and considerations:

(A) The 10 years of this company's experience is too short a period to be of service in determining the average amount of annual reserve necessary for the equipment owned. The real amount may be determined only upon retirement of the equipment from service.

(B) The average amount necessary will change from time to time, being affected by many variables, including changes in the design, efficiency and cost of equipment obtainable, the rate of growth of business, the extent of use of equipment and other operating conditions.

(C) The many competitive sources of light, heat and power in every community must, in the long run, be the determining factor in fixing the value to the consumer of gas or electric service, and the natural laws of supply and demand be the controlling influence in regulating the rates for business actually done. The purpose of the entry being to accumulate prior to the retirement of the equipment from service a total amount of credit sufficient to offset the depreciation in value of such equipment, the rate of accumulation should be such as may best serve the common interests of the owners of the property and the community served, due regard being given to the reasonableness of cost of operation, to the return on capital necessary to attract the same, and to the rates paid by consumers for service. The amount of the charge each month should be determined by the managers of the companies, subject to the

limitations only that at no time shall the total charges amount to less than the total repair and replacement costs, nor shall any charge be made when the accumulated balance in "accrued amortization of capital" account exceeds 50 per cent of the book value of the total capital (all kinds) in service.

(D) Under present conditions the rate of amortization named for this company is expected to provide for the actual cost of usual monthly repairs and up-keep expenses and add something to the reserve accumulated for the occasional extraordinary replacements and withdrawal from service of equipment.

The gross earnings of this company are between $100,000 and $200,000, consequently we fall within the class of those having gross operating revenues amounting to less than $500,000 (condensed scheme). We have not felt that any help was needed in applying the system, insofar as it is applicable. The introduction of the system involved with us simply a lot of labor and expense and some temporary delay in getting out our reports. The trouble we experience follows the introduction of the system and, summed up briefly, consists in the fact that the accounts, both capital and income, are so subdivided as to make it necessary to estimate a very large portion of the entries. As a result, our knowledge, both of our investment and of our operating expenses, will be less than in the past and our records as a basis for accurate calculation far from satisfactory.

New York. Accountant.

Tungsten-Lamp Rates.

To the Editors of Electrical World:

Sirs:—We have read with interest the article in your issue of March 18 relating to the plan adopted by the Hartford Electric Light Company to sell energy for tungsten lamps on a candle-power rather than on a watt basis. In this connection we call your attention to section 3 of the enclosed copy of the franchise which the City Council of Richmond recently granted. It became apparent to us after installing about 1000 tungsten lamps that in small cities where the field is limited and only a few large consumers are to be found, it is impossible to make up reduced revenue with new business. The reduction in the bills of the Government Building and of hotels amounted to more than we could hope to make up by adding 50 residences, and even if we should succeed in securing the 50 new residence customers the matter of additional investment costs had to be reckoned with. We could not increase our rates to meet the situation because our franchise would not permit this. We therefore went before the City Council and secured the franchise referred to, in which the maximum rate is specified in candle-power, with the *most efficient* incandescent lamp used as a basis for computing the cost per 100 cp per hour.

The difficulty that will confront a great many central stations in changing to the candle-power basis will be that rate limits fixed by franchises are expressed in kw-hours.

It might be of interest for us to state that the city of Richmond, Ky., last September, contracted with us to furnish 120 60-watt multiple tungsten lamps on the streets to replace this number of gas lamps. These lamps were installed during October, and while some have not yet been renewed, others of the first installation had an unsatisfactory life. Since the first renewal, however, better results have been obtained, and it now appears that the installation will be a success. The illumination is much better than was secured from the gas lamps. The City Council is very proud of the installation, as it believes it is one of the first of its kind in the country.

Richmond, Ky. L. B. Herrington,
President, Richmond Electric & Power Company.

[The section of the franchise to which reference is made reads as follows: "That the purchaser of this franchise or privilege, or any successor, transferee, or assignee of such purchaser shall not charge for electricity for any purpose a rate which will make the cost of electric light to any citizen of Richmond using more than $1 worth of electricity, per month, with the most efficient incandescent lamps, more than 3½ cents per 100 cp per hour."—Eds.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Enclosed Motors for Mines.—S. A. Simon.—An abstract of a paper read before the Glasgow Section of the (British) Inst. Elec. Eng. The author discusses the safeguards that should be adopted to minimize the danger from electrically ignited explosions in coal mines. In gassy situations, under certain specified

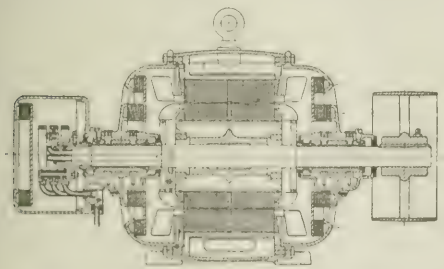


Fig. 1.—Mine Motor with Plate Protection.

conditions, total enclosure of motors, switches, etc., is required by the mine regulations. The author discussed what protection is advisable in other parts of the mine, expressing himself generally in favor of "plate protection" instead of complete enclosure. From the observed fact that slits or gaps of not more than 0.5 mm (0.02 in.) width and about 50 mm (2 in.) depth are not sources of danger, a form of "plate protection" was devised which embraces all the advantages of gauze without its defects. It possesses mechanical strength, permits of ventilation, prevents an explosion by cooling the issuing gases and is not damaged by after-burning should this phenomenon take place. It consists of a series of plate, usually ½ mm thick and 50 mm deep, placed side by side, at a distance of ½ mm from one another in openings of the motor or apparatus casing. These plates are usually in the form of rings or hollow squares, but they can be any shape or size. Any number can be used, according to the amount of ventilation required, and the protection secured is independent of the position of the point of ignition, of the relative volume of the containing vessel to the area of opening and of the composition of the gas. A drawing of such a motor is given in Fig. 1. In an editorial note on the paper, the design of this motor case is said to be "extremely ingenious, and the author's claim that it offers a considerable advantage over gauze protection seems well founded, but the best solution of the problem appears to be to enclose the motor entirely and build the cases and covers strong enough to withstand an internal pressure of at least 200 lb. per square inch."—Lond. *Elec. Eng'ing*, March 25.

Flywheel Generators.—J. Rayal.—The author first discusses the general uses of flywheel generators for direct current, and then describes a 2500-kw machine of this kind, built by a German company for a British concern to supply energy at 250 volts for lamps and motors. It is driven by a steam engine at a speed of 85 r.p.m. The rotor weighs 56,000 kg (56 tons).

The machine is satisfactory with respect to both efficiency and rise of temperature.—*La Lumière Elec.*, March 20.

Lamps and Lighting.

Low-Voltage Metallic-Filament Lamps.—O. Brandt.—An illustrated article on the use of low-voltage metallic-filament lamps, and especially osram lamps, for automobiles and yachts, etc. The comparison is made between the cost of operation of a 16-hp, low-voltage, carbon lamp with a useful life of 500 hours and an analogous osram lamp. The ratio of the cost of energy in the two cases is 2.75 to 1. The Zeppelin airship on its recent trip was lighted at night with 8-cp osram lamps. —*Zeit. f. Beleucht.*, March 10.

Metallic-Filament Lamp.—A note on a recent British patent of T. McKenna (19,118, 1908; March 18, 1909). To prevent the filaments from sticking to the metal supporting hooks, the latter are coated with a lower oxide of tantalum or niobium. The iron or nickel hooks are dipped in colloidal tantalic or niobic acid, dried, and then heated to about 1300 deg. C. in hydrogen to convert the coating into the required oxide.—Lond. *Elec. Eng'ing*, March 25.

Lighting with Tungsten Lamps.—J. S. Codman.—Some notes on the lighting of a clothing store in which 68 arc lamps were replaced by 185 100-watt tungsten lamps equipped with prismatic reflectors, and the saving in energy consumption in the different rooms varied from 34 per cent to 62 per cent. Illuminating tests were made with a Sharp-Miller photometer. Some details of the tests are given.—*Illum. Eng.*, March.

Generation, Transmission and Distribution.

Electric Winding in Mines.—An illustrated description of the equipment of the Clausthal Government mines in Germany. At the Ottilia mine the Ward Leonard system is used in connection with a battery. The winding engine is fitted with a Koepe pulley, on the shaft of which is keyed the armature of the main shunt motor. The field winding of the latter is fed with current at constant voltage, being connected to a constant-voltage generator *A* driven by a special motor. This arrangement is shown in Fig. 2. The generator e.m.f. can be varied from zero to 500 volts by altering the regulating resistance in the field winding. This resistance being operated from the driving handle it follows that each position of the rheostat corresponds to a definite speed of the winding motor. The battery used with this set consists of 242 cells with a normal charging current of 108 amp, the discharge current being 220 amp. This battery is employed for the purpose of smoothing down the peaks in the load curve, and is connected with the system and a booster as shown in the diagram. This allows energy to be taken from the battery during heavy loads, while when the load is light the battery is charged. The depth of the mine shaft is nearly 1900 ft. (570 m), the normal load ¾ ton

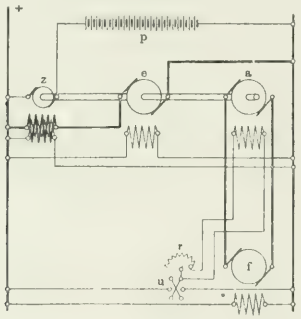


FIG. 2.—DIAGRAM OF ELECTRICAL WINDING GEAR.

(750 kg), and the usual working speed 12.2 ft. (3.7 m) per minute. The control platform of this winding engine is fitted with suitable instruments, including a tachometer and a tachograph, as well as a gage for showing the air pressure for working the brake. The compressed pressure is produced by means of a small direct-current motor. The compressed-air brake is used only for bringing the cage to rest, and for holding it in position another brake can be operated either by the driver or by the depth indicator, when the bank is overrun. It also comes into operation if a given speed is exceeded, and this depends only upon the position of the control handle. This apparatus is capable of dealing with 300 tons (300,000 kg) during a 10-hour shift, the journey being made in 54 seconds.—Lond. *Electrician*, March 26.

Electric Motors in Cotton Mills.—W. Hoult.—A paper read before the Liverpool University Engineering Society, on electric driving in cotton mills. A small three-phase motor to each loom is the most satisfactory arrangement, as the looms can then be run at a considerably higher speed, which naturally increases their production. The threads, moreover, do not break so often and the cloth has a more regular appearance, obtaining a better price than cloth woven from engine-driven looms. The author strongly advocated the individual drive for all machinery in weaving sheds and spinning mills, with the exception of mules and possibly carding engines. A discussion followed the reading of the paper, chiefly on the relative advantages of induction motors as compared with direct-current machines for this class of drive, "it being generally conceded that the combination of three-phase turbo-generator and induction-motor drives had great advantages, this system also enabling the repulsion motor to be used to the fullest advantage for the ring frames."—Lond. *Electrician*, March 19.

Traction.

London Tramways.—J. H. Rider.—The first part of an illustrated paper read before the (British) Inst. Elec. Eng. A description is given of the development of the London Council Tramways undertaking, and of the equipment of the Greenwich generating station. The engine-room contains at present four vertical horizontal reciprocating engines, coupled to alternators of 3500-kw rating at a power factor of 0.55. Two additional turbo-alternators of the same rating are also in course of erection. The total normal rating of the station is, therefore, 34,000 kw, but as each set is capable of dealing with an overload of 25 per cent, the station can, on emergency, be worked up to 42,500 kw. Allowing one reciprocating and one turbine set as reserves, the maximum working load may be taken at 30,000 kw. —Lond. *Electrician*, March 26.

Electric Tramways in Brazil.—An illustrated description of the system of electric tramways in Para. The total length of track constructed for electric working is 55,060 m (33 miles), of which 26,000 m (16 miles) of single track are laid in paved streets, and 21,600 m (13 miles) in unpaved streets, all with girder rails. Sleeper construction was employed throughout the whole of the work, with rails of 90 lb. to 96 lb. per yard (45 kg to 48 kg per meter), thermit joined, on paved streets. On unpaved streets continuous joints were employed. The power plant contains three 400-kw, direct-current traction generators, and two 2000-volt, 50-cycle, single-phase generators for lighting. —Lond. *Electrical Review*, March 26.

Electric Traction on Railways.—P. Dawson.—A continuation of his long, illustrated serial. In the present installment he discusses the method of fire protection of the cars and the systems of wiring.—Lond. *Electrician*, March 26.

Installations, Systems and Appliances.

Contacts in Electrical Apparatus.—G. J. Meyer.—The conclusion of his paper on contacts in electric apparatus. The change of the contact resistance due to a film of air, etc., is shown in Fig. 3. The abscissas represent the pressure of the two contact surfaces upon each other in atmospheres. The ordinates represent the contact resistance in milliohms per square centimeter. The three curves refer to brass contacts. Curve I shows the contact in air, while curve II shows the increase of resistance after the apparatus had been laying in a factory with suction-gas plant, the increase of resistance being due to a film of gas. Curve III gives the resistance immediately after the contact had been slightly treated with vaseline. The author describes a series of experiments which he has made

with various apparatus like cell switches, etc., and discusses the so-called fatigue of contacts which results when the elasticity limit is exceeded so that the pressure is reduced and the resistance and temperature are increased. In the discussion which followed, Schortau remarked that aluminum contacts always

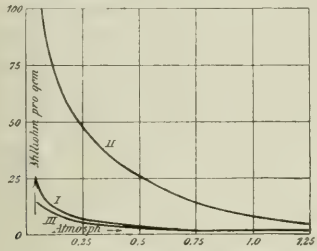


FIG. 3.—CONTACT RESISTANCES.

show an increase of contact resistance after a short period of use.—*Elek. Zeit.*, March 25.

Electric Installation in a Department Store.—A description of the electric equipment of a large department store in London. Energy is taken from the St. Marylebone Borough Council's 2 × 240-volt, direct-curent mains, from which nine service cables are brought into the building. Thirty-six-lamp and 20-motor circuits are controlled from a main board in the lowest basement. All of the cables are run in solid-drawn screwed conduit embedded in the concrete walls and floors. About 280 arc lamps and 6000 incandescent lamps are employed, a special feature being the concealed window lighting with osram lamps. The applications of motors comprise a group of nine electric lifts and several motors driving fans, pumps, air-compressors, and other machinery. A very complete system of fire protection, with automatic fire-extinguisher apparatus, has been installed. Another novelty is the use of the lamp call signals for the heads of different departments.—Lond. *Elec. Eng'ing*, March 25.

Electric Energy from Wind.—A description of a wind-driven generating plant of English manufacture suitable for supplying energy both for lamps and motors in isolated districts. A storage battery is, of course, included in the installation, and relay switches for automatically controlling the pressure of the generator are provided. The load on the wheel is increased as the speed, and consequently the power, increases. The plant consists of a 16-ft. (4.8 m) diameter wind turbine on a steel tower 50 ft. (15 m) high. The generator is of 2-kw rating and has a speed variation from 800 r.p.m. to 1600 r.p.m. The storage battery is charged whenever the wind attains a speed of six miles (10 km) per hour. The plant running at the works is capable of producing about 1500 kw-hours per year with the conditions of the winds such as obtain in London at the height of 50 ft. (15 m), but, by running the tower higher, better results would be obtained. On some parts of the coast the wind power available is from three to four times as great as that in London.—Lond. *Electrician* and *Elec. Review*, March 26 (illustrated); Lond. *Elec. Eng'ing*, March 25.

Electricity on Board Ship.—A. P. Chalkley.—An illustrated paper read before the New Castle Section of the (British) Inst. Elec. Eng. The author discusses the reasons for the adoption of low pressures for distribution on board ships, and then describes typical arrangements of switchboards. The various uses and applications of electricity for motive power are considered, and finally the application of electric motors for the propulsion of ships.—Lond. *Electrician*, March 26.

Prevention of Accidents.—A set of proposed regulations for the prevention of accidents in electric installations. The regulations were worked out in co-operation with iron and steel men, mining engineers, chemical engineers, etc., by a committee of the German Association of Electrical Engineers.—*Elek. Zeit.*, March 25.

Electrochemistry and Batteries.

Iron Reduction in Electric Furnace.—F. F. Cargano.—In Italy, where the acid industry is well developed, there are very large pyrite residues, containing some 50 per cent of metallic iron. The author shows that under the particular local conditions the electric furnace is superior to the blast furnace for extracting the iron and describes his large-scale experiments in this line. He also emphasizes some special possibilities of the electric furnace for the production of pig iron and alloys of iron with silicon, etc.—*Electrochem. and Met. Ind.*, April.

Progress in Electrochemistry.—F. M. Perkin.—A concise summary of advances made during the last year in industrial electrochemistry and electrometallurgy.—Lond. *Electrician*, March 26.

Units, Measurements and Instruments.

British Physical National Laboratory.—An abstract of the annual report for the year 1908. It is noted that recent intercomparisons of resistance standards of the Laboratory, the Reichsanstalt, and the Bureau of Standards at Washington give identical values for the high-resistance coils, which the values assigned to the unit coils differ by not more than 1 part in 100,000. The number of tests made in the Physical Department was 14,153, of which 300 were electrical measurements, 1615 related to "electrotechnics" and 779 to photometry. In regard to general electrical measurements the experiments in connection with high-oscillation frequencies will be continued. It is proposed to construct additional coils for the standard wave meter so as to extend its range considerably in both directions, and for the same purpose to make another small air condenser of constant value. The preparations for experiments with Poulsen arc lamps are practically complete, and it is hoped that the work may be commenced very shortly. The large aluminum-disk air condenser will be completed, and it is proposed to build another glass-plate condenser to give additional range of frequency. Other methods of measuring high frequency will be considered. In continuation of the work on inductances, it is hoped to complete the marble variable mutual inductance, and to make a fixed secondary standard. The construction of a large self-inductance coil of low resistance, and in sections, is also proposed. Improvements are under consideration in the methods and apparatus for determining the constants of telephone inductance. These will include the completion of the high-frequency alternator. It is hoped also to make an investigation of the methods of measuring effective resistance, which is of great importance in telephone work. Among other work in contemplation may be mentioned the investigation of new methods of measuring small alternating-current iron losses and constants of transformers. The work on transformers will involve the construction of a variable mutual inductance from 0.001 up to 1 microhenry. It is intended to investigate thoroughly the accuracy with which it is possible to standardize lamps exhibiting small differences in the color of the light they emit. Details of tests are now arranged with the Reichsanstalt with the object of defining, if possible, with greater precision the ratio between the hefner and pentane units. In connection with the tests on new resistance alloys, and also on various samples of an alloy used for making resistors for use in the Laboratory, it has been found that the temperature-resistance coefficient varies considerably with different samples of the same alloy and also with different sizes of wires of the same batch of material. Some preliminary tests have been made, and it is proposed to investigate the discrepancies fully. An abstract of the report of the director, R. T. Glazebrook, is also given.—Lond. *Electrician*, March 26.

Photometry Standards.—In the report of the Director of the (British) National Physical Laboratory for 1908 it is stated that the photometry tests substantiate the reliability of the 10-cp pentane lamp of Harcourt as the primary standard of candle-power. Progress has been made in the establishment of two sets of standard lamps of a higher efficiency, and therefore of whiter light than those commonly used for electric sub-standards. These run at 3.5 watts and 3.1 watts per candle respectively, and have been carefully aged before standardization. Graphitized carbon filament lamps have been found valuable for this purpose. Efforts are being made to obtain satisfactory metallic-filament lamps to give further steps down to 1.5 watts

per candle. In this way it is hoped that in the near future reliable standards may be issued to those concerned with the photometry of metallic-filament lamps. Reference is made to the paper read by Dr. Glazebrook at the British Association in Dublin, explaining differences in humidity measurements as calculated from ventilated and unventilated hygrometers. Some valuable intercomparisons of light standards have been made with the National Laboratories of France and the United States of America. In February Dr. Rosa, of the Bureau of Standards, Washington, brought over a set of standardized electric lamps for intercomparison of candle-power units. The result of the measurement showed the Bureau of Standards unit to be 1.6 per cent greater than that of the N. P. L. Some of the lamps were brought over again in October and the same value obtained for the difference between the two laboratories. At the same time M. Laporte, of the Laboratoire Central at Paris, brought some standard lamps for comparison with the N. P. L. standards, and results were obtained which showed that within the limits of experimental error the units of the two laboratories may be said to be in agreement.—Lond. *Electrician*, March 26.

Two-hundred-thousand-Volt Voltmeter with Compressed-Air Insulation.—E. A. Watson.—A description of a high-tension voltmeter for which compressed air was adopted for insulation instead of oil because of the somewhat unsatisfactory behavior of oil under high direct-current pressure. In the instrument illustrated in Fig. 4, which is intended to read up to 200,000 volts, an air pressure of 200 lb. per square inch (14 kg per square centimeter) is employed. Joints are made with rings of composition sheeting placed in grooves in such a manner that they cannot squeeze out. All joints at terminals, etc., are made self-sealing, and the air pressure can be maintained for long periods without any appreciable drop. In order to avoid brush discharges the moving member *A* is built of copper sheet beaten on a former of such shape that no sharp edges are presented, the construction being evident from the illustration. By appropriate shaping of this and the fixed member *B*, the deflection is caused to be nearly proportional to the pressure, and a fairly uniform scale is obtained. The clearance between the fixed and the moving members increases with the pressure, and for the maximum, deflection is about 2 cm (0.8 in.). The dielectric strength of the compressed air employed (at 200 lb. per square inch) is about 400,000 volts per centimeter (1,000,000 volts per inch). As can be seen from the illustration, a mirror *E* is attached to a steel shaft *C* on which the moving part is mounted. A lamp throws a beam of light through the glass window in the case onto the mirror, which reflects it onto a scale *F* not shown in the drawing. The torque on the moving part is considerable, and acts against a coiled spring *D* of heavy piano wire.—Lond. *Electrician*, March 26, and *Elec. Eng'ing*, March 25.



FIG. 4.—VOLTMETER FOR 200,000 VOLTS.

High-Tension Voltmeter.—A note on an electromagnetic voltmeter used in the (British) National Physical Laboratory for direct measurement of pressures up to 100,000 volts. The apparatus consists of a 500-volt large-dial voltmeter, taking 0.02 amp for full deflection and capable of being used to an accuracy of 2 parts in 1000. In series with this are 18 resistors, having a total resistance of 5 megohms, the whole being capable of connection across the 100,000-volt mains, and dissipating in all 2 kw. By special arrangement of high-tension multipoint switches, sections of the resistor are short-circuited, thereby giving various ranges from 500 volts to 20,000 volts. For higher ranges than this the ratios are changed by special contact pieces across the boxes.—Lond. *Electrician*, March 26.

Comparison of Mutual Inductance and Resistance.—A. Campbell.—A standard mutual inductance has been constructed for the (British) National Physical Laboratory, its value calculated from the dimensions being 10.0178 millihenries. It forms an extremely accurate standard, against which both mutual and self-inductances can readily be tested. In addition to this it affords a means of ascertaining the resistance of resistors in absolute measure, and thus evaluating the ohm. The comparison of resistance with mutual inductance can be made very simply and directly by the use of two-phase alternating currents as follows: In Fig. 5 *M* is the mutual inductor (a small fraction of it being adjustable) and *R* the resistor; and *A* cos *pt* and *B* sin *pt* are currents in time-quadrature. For example, from a two-phase alternator or a phase-splitting device, let *G* be a vibration galvanometer tuned to frequency *n*, where $p = 2\pi n$. When the galvanometer shows no deflection, the e.m.f. introduced into its circuit is zero at every instant, and $R = pM \times A/B$. This arrangement gives a direct comparison between *R* and *M* when *p* and *A*/*B* are known. By observing the speed of the alternator, *p* is found, while the ratio of *A* to *B* is obtained by means of the electrostatic voltmeter *V*, which is put alternately across the resistors of equal resistances, r_1 and r_2, or by a differential electrodynamometer. In practice *A* is made very nearly equal to *B*. The condition of balance is arrived at by alternating *R*, *M* or *p* until the galvanometer deflection becomes zero, accurate time-quadrature being maintained by adjusting the self-inductance l_2. For example, if $A = B$, for $M = 10$ millihenries and $R = 5$ ohms, the necessary frequency is about 80 cycles per second. The results obtained have been encouraging and appear to indicate that the method is susceptible of high accuracy. The National Physical Laboratory intends to make a determination of the ohm by this method during the coming year.—Lond. *Electrician*, March 26.

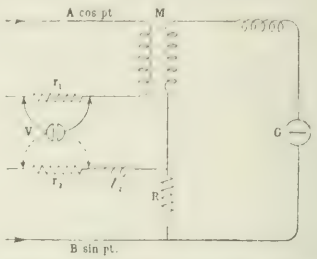


FIG. 5.—MUTUAL INDUCTANCE AND RESISTANCE.

Electrolytic Meter.—A note on a recent British patent of W. M. Mordey and G. C. Fricker (3995, 1908; March 18, 1909). Polarization, which causes serious errors in shunted meters working on light loads, is compensated for by inserting a resistor with a high temperature-resistance coefficient in series with the meter. This resistor is heated by its own current or by heat produced by resistance in the main circuit, so that the current through the cell at heavy loads is decreased in the same proportion as it is decreased at light loads by polarization.—Lond. *Elec. Eng'ing*, March 25.

Wavemeter.—In the annual report of the Director of the (British) National Physical Laboratory it is mentioned that a standard wavemeter has been constructed, consisting of an air condenser of variable capacity, a set of self-inductance coils, and a thermal-ammeter. In order to obtain an absolute calibration of the wavemeter, the frequencies of the oscillations with which it was tested were determined by including a spark-gap in the main oscillation circuit (to which the wavemeter was loosely coupled), and photographing the spark trains by the help of a rotating mirror. The mirror was concave (200 cm = 80 in. radius) and was mounted in a special long camera. It turned on a vertical axis and was rotated by a small motor, the speed being observed and controlled by the help of a commutator on the shaft connected to a condenser, bridge, and galvanometer for Maxwell's method. The application of a small

brake enabled the galvanometer light-spot to be held at zero, and hence the speed could be kept at a known and constant value. From measurements of the distance from spark to spark in the wave trains, the speed of the mirror, and the distance from the mirror to the plate, the frequency was deduced. Observations were made over a range from $n = 300{,}000$ to 1,000,000 periods per second (wave lengths 1000 m to 300 m) and the results were compared with those obtained by calculation from the capacities and inductances of the wavemeter, which had been measured at ordinary frequencies, a small correction (less than 1 in 1000) for distributed capacities being made by means of Glazebrook and Lodge's formula. The results show good agreement and indicate that in a single layer coil of well-stranded wire, of the types used, there can be very little variation in the effective self-inductance over a range of frequency up to at least 1,000,000 periods per second.—Lond. *Electrician*, March 26.

Testing Transformers.—E. KRAUS.—A paper on the methods used by the Siemens & Halske Company for testing electric meters both for direct and alternating current. For testing alternating-current meters a transformer of the design shown in Fig. 6 is employed. The points *M* and *N* are connected to supply network. The number of turns in circuit between *A* and *B* is regulated roughly by means of the two sliding con-

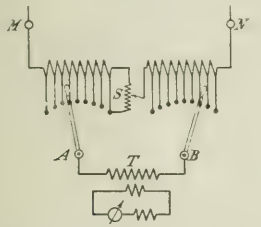


FIG. 6.—TESTING TRANSFORMERS.

tacts *A* and *B*, and more accurately by means of the sliding contact *S*. The main current coil of the meter under test is connected to the points *A* and *B*.—*Elek. u. Masch.*, Vol. 26, 1908, page 71; abstracted in *Elek. Zeit.*, March 25.

Weston Standard Cell.—In the report of the Director of the (British) National Physical Laboratory for 1908 it is mentioned that more than 100 Weston normal cells of various forms have been set up during the year, and these, together with a large number of older cells, have been intercompared from time to time. The depolarizer still continues to receive attention, and the constancy of the voltage of the cell over long periods of time has been stated by Hulett to be a function of the quantity of free acid present in the cell. The quantity of free acid in the N. P. L. cells must be exceedingly small. The majority of the cells contain mercurous sulphate precipitated chemically, and, after washing, the sulphate thus prepared is probably as free from acid as the salt prepared by other methods. Observations have also been made on cells kept in a state of continual pendular motion for six weeks, the velocity of the ends of the limbs of the *H* vessel being about 20 m (66 ft.) per minute. The object was not to test the cathode system alone, but to test the general effect of agitation on the cells. Six cells were employed, and the depth of paste was varied from 0.5 cm to 8 cm (0.2 in. to 3.2 in.). The agitation did not appear to accelerate any action tending to lower the e.m.f., for in one case only did the voltage fall by so much as 1 part in 100,000.—Lond. *Electrician*, March 26.

Telegraphy, Telephony and Signals.

Telephone Receiver Impedance.—R. T. WELLS.—Rayleigh and Wien have examined telephones with regard to their current sensibility by measuring the least current that would produce audible sound at different frequencies, and Austin with regard to the volt sensibility by measuring the least impressed electromotive force that would produce audible sound at different frequencies. A curve of either sort can be converted into one of the other if the impedance of the telephone at the different frequencies is known. Fig. 7 shows the results of the author's determination of resistance, inductance and impedance for dif-

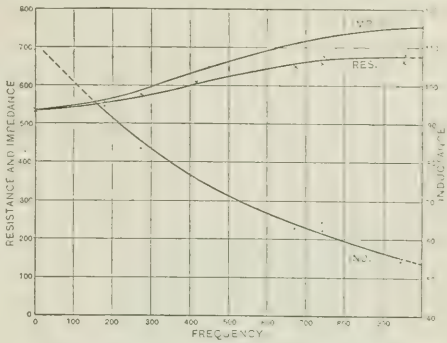


FIG. 7.—RESISTANCE, INDUCTANCE AND IMPEDANCE CURVES.

ferent frequencies for one of a pair of head telephones made for use as a wireless telegraph receiver. Its direct-current resistance was 531.6 ohms.—*Phys. Rev.*, March.

Compressed-Air Insulation in Wireless Telegraphy.—C. C. MONCKTON.—With reference to a recent paper on the dielectric strength of compressed air, the author discusses the use of compressed air in the spark transmitters of wireless telegraph installations for the purpose of increasing the range of the apparatus. It permits higher potentials to be used with the same gap, and for a given potential. The smaller gap, and consequently lower resistance when compressed air is used, reduces the damping effect.—Lond. *Elec. Eng'ing*, March 25.

Hungary and Austria.—W. MAURER.—Statistical notes on the telegraph and telephone service in Hungary in 1907.—*Elek. u. Masch.* (Vienna), Feb. 21. The effect of the new telephone tariff in Austria is discussed by H. von Hellrigl. The results have been rather unfavorable from the financial standpoint. The number of messages transmitted has decreased. While the number of telephone connections has increased, the increase is mainly in party, for which a very low rate is charged.—*Elek. u. Masch.* (Vienna), March 21.

Miscellaneous.

Electrical Industries in 1908.—GLIER.—A review of the principal commercial developments in the German electrical industries during the last year. The export trade of Germany, England and the United States is discussed, the supply of copper and the drop of the copper price; the proposed tax on electricity in Germany; the present conditions of electric traction on railways in different countries; the possibility of higher efficiency in generating electrical energy. Statistical tables are finally given of dividends paid by German electrical companies and of stock quotations during the last 10 years.—*Elec. Zeit.*, March 25.

Electricity in Horticulture.—A note stating that considerable advantages have been made in the applications of electric energy in market-gardening operations at Bitten, near Evesham, where J. E. Newman, who is specializing in this branch with Lodge apparatus, has succeeded in obtaining very promising results with lettuce and strawberries in blocks of glass houses planted with these crops. Three houses of the latter crop are devoted to the experiment, two electrified and one non-electrified. The practice of applying electricity to growing crops is gaining favor, and a Scottish landowner has just decided to put a 23-acre plant on one of his farms. It is intended to form a syndicate to work the system, and Sir Oliver Lodge is said to take a keen interest in this development.—Lond. *Electrician*, March 26.

Electric Welding.—An electric welding plant has been installed in a London wheelwright's shop for welding tires. The jaws of the welding machine are water-cooled, and about 65 hp is taken for 2.5 minutes during the operation of welding.—Lond. *Elec. Eng'ing*, March 25.

BOOK REVIEWS.

Jahrbuch der Drahtlosen Telegraphie und Telephonie. First Quarter volume. Dr. Gustav Eichhorn. Leipzig: S. Hirzel. 184 pages, illustrated. Price, 20 marks per volume.

This volume is No. 1 of a proposed series of quarterlies devoted to the progress of wireless telegraphy and telephony, commencing with the year 1907. The first part contains papers by F. Braun on "Directed Wireless Telegraphy"; by H. Th. Simon on "Undamped Electric Waves"; by J. A. Fleming on "Recent Developments in Electric-Wave Telegraphy," and several other well-known workers in this branch of applied science. Some of the papers are mathematical in character, while others are descriptive. Among the latter are illustrated descriptions of the recently erected wireless stations of Germany at Nauen and of Denmark at Lyngby. The range of the Nauen station is stated to be about 3000 km overseas and 1350 km overland with St. Petersburg, Russia. A 25-kw alternating-current generator is installed. There is appended a very full bibliography of literature on the subject. The publication promises to be a valuable reference book of wireless telegraph literature.

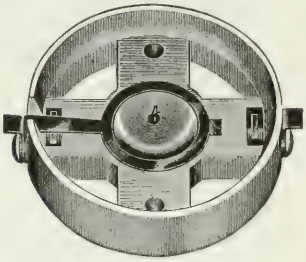
Elektrochemie. By Dr. Heinrich Danneel. Leipzig: C. J. Göshen. 158 pages, 26 illustrations. Price, 0.80 mark.

This little volume is an elementary text-book on electrochemistry from the standpoint of the student in technical schools and colleges. It is divided into three chapters. The first deals with electrical measurements and electrolytic constants. The second discusses the processes of electrolytic conduction, and the third treats of the electrochemistry of solutions. The description is clear and well adapted to a student's reading. The presentation is that of an electrochemist as distinguished from that of an electrochemical engineer. The book is well adapted to the use of laboratory students.

NEW APPARATUS AND APPLIANCES

Thermostat for Alarms.

A thermostat which is applicable for fire-alarm circuits, temperature regulators, hot-bearing alarms, etc., is illustrated herewith. The device is made by the Copenhagen Automatic Fire Alarm Company, of Sheboygan, Wis., and consists of a copper disk and a concave silver plate or diaphragm, the two when hermetically sealed forming a capsule about the size of a dime, mounted on a small porcelain base with the necessary electrical connections. In the capsule is a liquid which at a certain fixed



THERMOSTAT.

temperature forces the silver diaphragm with a positive snap from concave to convex, thereby closing the electric circuit. When the temperature is reduced again, the diaphragm snaps back to its original concave form. Ordinarily the device is used in connection with an annunciator so that the seat of trouble is quickly located. The thermostat is set to operate at a temperature of from 10 deg. to 20 deg. above the maximum normal temperature of the room in which it is placed.

Tubelite.

A new type of reflector for illuminating show-windows, showcases, etc., has been brought out by I. P. Frink, New York. The reflector occupies only 2¼ in. space, and can be made in any



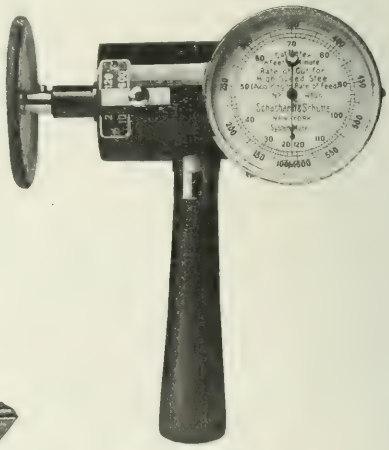
TUBELITE.

length up to 10 ft., without seams, and finished in any color desired. Another feature is that standard-base tubular lamps are used, which lamps can be purchased in any electrical supply store; and should a lamp burn out, there will be only a 6-in. unlighted space. Illuminations from 8 to 64 candle-feet can be obtained, according to the lamps used. The new reflector has been given the trade name "Tubelite."

Cut Meters for Machine Tools.

The accompanying illustration shows a new "Cut Meter" recently placed on the market by Schuchardt & Schutte, 90 West Street, New York, known as the "Cito," and built on the lines of the tachometers made by this firm. The indicating mechanism is actuated by accurately balanced centrifugal weights, and the readings are correct in any position. As the readings do not depend on magnetic action, these instruments, it is claimed by the makers, remain accurate under all shop conditions, and are not affected by the magnetic fields present in shops equipped with electric power. They also indicate with the work running in either direction.

The standard range of the "Cito" meters is from 20 ft. to 600 ft. per minute, arranged in two scales, the first scale being



CUT METER.

from 20 ft. to 120 ft. per minute, and the second range from 100 to 600 ft. per minute. Either range is thrown into action by moving the thumb slide on the face up or down to the de-

ired range. The shell or case is made of aluminum, which educes the weight to approximately 10½ oz. The handle can ie unscrewed, which makes it conveniently portable. With ach instrument a rubber tip is also furnished for recording evolution of shafts up to 900 r.p.m. When used as a tach- ometer a formula is furnished for converting the scale reading n feet to the equivalent in revolutions per minute. The meter s put up in a leather case with an extra tier for the measuring lisk.

Large General Electric Warehouse.

The General Electric Company is about to remove its ware- ouse in Chicago from 434 East Illinois Street to the large Pugh terminal warehouse extending from 462 to 582 on the ame street. Here the company will have 10 floors and about 10,000 sq. ft. of floor space. The lease is for 15 years, with he privilege of getting more space in the immense building as required. The space occupied in the old warehouse was 78,000 sq. ft., and in addition an extra 15,000 sq. ft. was leased. In he space which has just been leased the company will carry a large stock of the lighter forms of electrical apparatus, such as motors, lamps, meters, transformers and the like. Here also will be the Chicago repair shops. The company will abandon its old steam plant and operate the shops by electric motors supplied with energy from the mains of the Com- monwealth Edison Company. The warehouse is located near he proposed outer harbor on Lake Michigan, and by lighterage s connected with all the railroads entering Chicago. The Gen- eral Electric Company also possesses large warehouses in Phila- delphia and San Francisco, but it is believed that the one in Chicago is larger than either of these.

Transformer for Low-Voltage Circuits.

The Kuhlman Electric Company, of Elkhart, Ind., has brought out a line of transformers ranging in rating from ¼ kw to 1 kw and designed primarily for feeding energy to low- voltage tungsten lamps on electric signs. The primary winding is designed for standard low-potential circuits of 110 volts and 220 volts, the ratio of transformation being 10 to 1 and 20 to 1,



TRANSFORMER FOR LOW-VOLTAGE LAMPS.

respectively. A galvanized sheet-metal case houses a core-type transformer with auto-coil windings protected by insulating compound. The accompanying data are applicable to the line of transformers mentioned:

Rating, kw.	Core loss, watts.	Copper loss, watts.	Efficiency, per cent.	Temperature rise, deg. C.	Weight, lb.
¼	14	6½	92	60	24
½	14	8½	93.6	40	27
¾	24	11	94	40	37
¼	26	13	95	35	44
1	29	18½	95.6	38	50

The drop is compensated for in the windings and normal sec- ondary voltage is said to be maintained at full load. The tem- perature rise was calculated by the increase of resistance method after the transformers had been under full load for eight hours. Other apparatus coming within their range can, of course, be used in connection with the transformers.

Portable Suction Cleaner.

The accompanying illustrations show the details of the aspira- tor made by the Portable Air-Suction Cleaner Company, of New York City. The apparatus consists of three bellows driven through pinion, gear and shaft by a 1/6-hp General Electric motor of either the direct-current or alternating-current type. The bellows exhaust from a common chamber communicating

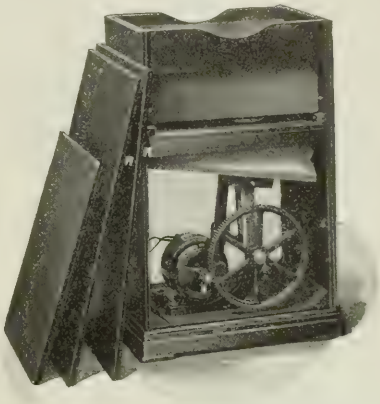


FIG. 1.—PORTABLE SUCTION CLEANER.

with a tin dirt receptacle, the suction pipe being protected by a cloth screen wound around a wire guard which suffices to keep dust from passing into the bellows. The dirt receptacle is removable so that the accumulations are easily disposed of. The entire equipment is housed in a polished-wood cabinet with removable sides and top, as shown; proper connections being



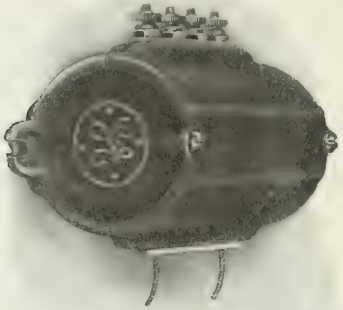
FIG. 2.—[illegible]

provided for the suction hose and for the wires feeding elec- trical energy to the motor. The apparatus is mounted on ball- bearing casters, so that it can be easily moved from place to place, and the necessary electricity can be taken from any con- venient lamp socket.

Transformer for Bell-Ringing Circuit.

The General Electric Company, Schenectady, N. Y., has recently placed on the market a transformer for ringing electric bells. This has a low-voltage secondary winding with taps giving 6, 12 or 18 volts when the primary is connected to the ordinary 110-volt lighting circuit. The transformer will operate on circuits ranging in e.m.f. from 100 to 130 volts at the usual lighting frequencies.

The entire transformer is so small that it may be held in the hand, and is designed in such a manner that a continuous

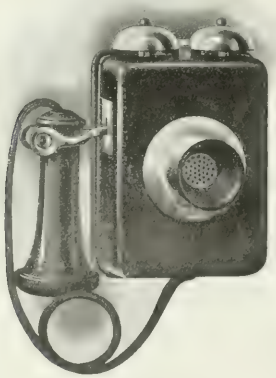


TRANSFORMER FOR BELL-RINGING CIRCUIT.

short-circuit on the secondary will do no damage either to the transformer or adjacent circuits. The core and coils are placed in a small metal box with lugs or feet attached for convenience in fastening to the wall or ceiling. A screwdriver is the only tool needed for installing the transformer, after which it is said to require no attention whatever; this is in strong contrast to the ordinary primary battery. The transformer may also be used to advantage for operating buzzers, spark-coils, burglar-alarms, miniature lamps, door-locks, gas-lighting and annunciator systems.

All-Metal Telephone.

The Connecticut Telephone & Electric Company, of Meriden, Conn., has recently placed on the market a new type of all-metal telephone to be used in connection with its hotel, apartment and



ALL-METAL TELEPHONE.

two-line interior telephone system. This telephone is designed, of course, principally for battery call service, but it can also be arranged for common-battery exchange service. The instrument is equipped throughout with the very best long-distance parts and all cord and line connections are made inside the case. The telephone is finished in black enamel with nickel trimmings.

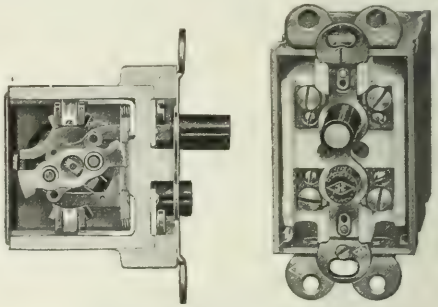
Lubrication by Pure Mineral Grease.

A practical test of the economy of pure mineral grease in electric railway work is stated to be under way on the Providence & Fall River Interurban Road, the object being to demonstrate the superiority of the lubricant in question, Keystone grease, manufactured by the Keystone Lubricating Company, of Philadelphia. A car having a new two-motor equipment, geared for about 25 miles per hour, was supplied with lubricants consisting of 25-lb. Keystone motor grease for the motor and axle bearings at one end, and an equal weight of the ordinary stock grease that has hitherto been in use by the road for these bearings at the other end. The car was then put into regular service. A recent report on the test stated that the entire 25 lb. of the ordinary grease and two-thirds of a second charge of 25 lb. of the same were used, whereas less than one-third of the original charge of Keystone grease had been consumed.

Installing Switches in Damp Walls.

The following communication has been received from the Hart Manufacturing Company, Hartford, Conn.:

"On page 826 of the issue of April 1 is an article in which the statement is made that when push-button switches are installed in wet plastered walls, 'they are subjected to a hardship



FIGS. 1 AND 2.—DAMP-PROOF PUSH-BUTTON SWITCH.

that they are little fitted to overcome.' This statement is in error if applied to any 'Diamond H' switches in use, all of which are constructed to withstand dampness, both at the time of installation and for years afterward. Dampness does not terminate at the completion of a building, but remains in the walls for some months afterward and is absorbed during every damp spell. As a consequence, a switch not constructed to withstand dampness will have a short and unsatisfactory life. 'Diamond H' switches, installed as far back as 1898-9, are today working properly and, in fact, no installation of 'Diamond H' switches has ever been replaced for the reason stated.

"The article further says that where switches have been installed in wet walls and lasted for years, it was because they were made of 'all-cast parts,' which type required 'a man with a muscular thumb' to operate them. 'Diamond H' switches have never been made with cast parts or heavier mechanism than at present, and at all times could be operated with ease by anyone not affected with paralysis. As to the necessity of a special construction to enable a switch to be wired before the rough plastering is completed, this advantage exists only in theory, as 'Diamond H' push-button switches are so constructed that the mechanism is entirely enclosed by the porcelain base, making it impossible for plaster or foreign substances of any description to get into the working parts. This construction is found only in 'Diamond H' push-button switches, and in the article referred to their particular merits were overlooked."

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

There has been no improvement in the conditions of trade during the past week, although the tone continues to be very hopeful, and business men seem to be encouraged as to the immediate future. To sum up the situation of the early spring trade, it would be fair to say that it has been rather disappointing than otherwise. Commercially and industrially the return to normal conditions has been much more tardy than was anticipated at the beginning of the year. In the retail line business has been fair, and as a whole has been better than for the same period in 1908, but has been far behind that of 1907 and some of the years that immediately preceded it. The Easter trade was generally good throughout the North and West, was an average in the East and rather poor in the Southwest and Texas, where local conditions militated against it. The recent orders that have been received by wholesalers and jobbers have been very light, and continue to be merely of the filling in or emergency class. There seems to be no fixed determination on the part of outside merchants to lay in stocks for the future. There has been some business done in agricultural implements, in fertilizers and in all commodities that are strictly for farm use. This, however, is merely the seasonable business that is to be expected at planting time. The more favorable weather has increased to some extent the building business and trade in lumber, paints and kindred materials which enter into construction. While it is too early for the crop reports to cut much figure in trade conditions, the only Government report that has been made is rather discouraging, as it shows that the winter wheat crop is below the average, and indicates that the yield will be short. The iron, steel and coke trades are very quiet. There is little buying in pig iron, and, outside of structural material, very few orders are being placed for finished products. The condition of the coal trade is unsettled, owing to wage scale complications affecting the anthracite properties. While it is not likely that there will be any strike, as the miners appear to be unwilling to bring about such a condition, it seems evident that an agreement will not be reached very soon. The passage of the tariff bill through the House means little that is definite to trade, as it is the general opinion that it will be materially amended in the Senate. It is encouraging, however, to business men that the new measure has progressed thus far, and it leads to the hope that the final determination of the tariff matter will be speedy. One indication of returning confidence in general business conditions is the sudden activity in the diamond and precious stone market. The import of jewels for the month of March were nine times as large as they were for the same month a year ago, and the importers declare that there is more inquiry for diamonds at this time than there has been for the past 18 months. This is mentioned because there are many people who believe that the diamond trade is a barometer of the general commercial sentiment. Diamonds are not bought when the general feeling of business men is one of depression. Collections continue to be only fair, in spite of the easy money market. Business failures for the week ended April 8 were 227, against 204 of the previous week, 258 for the same week in 1908, 104 in 1907, 161 in 1906 and 196 in 1905.

THE COPPER MARKET.

The immediate feature of the copper market is the report of the Copper Producers' Association which was made public April 12. This report shows that the stock of marketable copper on hand in the United States March 1, according to the previous report, was 173,284,248 lb.; that the production of marketable copper from domestic mines and imports during the month of March was 117,058,661 lb.; that the deliveries of marketable copper for export and consumption during the month were 108,063,007 lb., leaving on hand April 1 a surplus of 182,279,902 lb. This indicates an increase during the month of 8,995,654 lb., which is very much smaller than had been anticipated. The discrepancies between these figures and the figures of outside statisticians are mostly in the deliveries for export and consumption. The reports of the United States Custom House show that there were exported during the month of March 46,645,760 lb., which would indicate domestic takings of 61,417,247 lb. It is claimed, however, that the exports were practically 10,000,000 lb. greater than were shown in the Government figures. If this claim is correct, the takings for domestic consumption amounted to about 51,500,000 lb., which is a very considerable increase over the average for the first two months of the current year. It is estimated that the average takings since Jan. 1, have been about 36,000,000 lb., and, as it is well known that the users of copper are not any more actively employed at the present time than they have been during the earlier months of the year, it is evident, if the figures given out by the association are correct, that stocks have accumulated in consumers' hands. If this is the case, the reduction in the ratio of increase of the surplus in the hands of producers is offset by the increase in the hands of consumers. It makes little difference to the market where the surplus is carried so long as the surplus continues to grow. During the past week the market has been extremely dull, owing to the fact that domestic buying amounted to practically nothing, and that the London market was closed for three business days. Prices have remained unchanged, and there seems to be little evidence of any pressure on the part of either producers or selling agencies to make sales. So far as is known, no material concessions have been made from quoted prices. Exports have been quite liberal since the first of April, averaging about 1000 tons a day. Up to and including April 8 the total exports had amounted to 7234 tons. Quotations on the Metal Exchange April 12 were:

Lake	13⅞ @ 13
Electrolytic	12⅝ @ 12⅝
Casting	12⅜ @ 12⅛

London prices April 8 were as follows:

	Noon. £	s	d	Close. £	s	d
Standard copper, spot	57	0	0			
Standard copper, futures	57	13	6			
Market		Easy				
Sales of spot				200 tons		
Sales of futures				500 tons		

Extreme fluctuations for this year:

	Highest.			Lowest.		
Standard						
Lake	14.55			12.55		
Electrolytic	14.25			12.12½		
Casting	14.12½			12.00		
London, spot	£64	2	6	£54	12	6
London, futures	64	17	6	55	10	0
London, best selected	67	15	0	59	0	0

PROPOSED INCREASE IN CARBON TARIFF.—The new tariff bill as reported by the Finance Committee of the United States Senate provides that electric light carbons shall pay a duty of $7 per thousand feet. This is not only an increase in duty over the rate of 35 per cent ad valorem, which was the provision of the Payne bill that passed the House last week, but is an increase also over the present rate of duty of $0 per thousand pieces, as provided in the Dingley bill. Under the Dingley law the importation of carbons was never a revenue-producing business. The average return to the Government on this account was between $100,000 and $125,000 per year. At a matter of fact, the $9 per thousand rate practically prevented the competition of imported carbons with the American manufacture. This was true in spite of the fact that importers brought in the majority of their carbons in double lengths, and in some instances in triple lengths, in order to avoid the high duty. The main item, which has been imported, are the carbons for enclosed arc lamps. In use these run 9½, 10 and 12 in. in length, and the consumption of the latter length is about 70 per cent of the total. By importing in 24-in. lengths, and cutting in two pieces, and by importing in 28½-in. lengths and cutting in three pieces, the importers have been able to reduce their duty to about $4 per thousand carbons. This makes no allowance for breakage, which increases as the length of the

carbons increases, nor for the expense of cutting. Owing to the difficulty of making straight carbons in these unusual lengths, only three firms in Germany have been able to supply them. If the bill proposed by the Senate committee becomes a law, it will mean that the duty upon these enclosed arc carbons will be increased from an average of $4 or $4.50 per thousand to $7 per thousand of 12-in. carbons. The result of the law will be that the duty on enclosed arc carbons, of which there are, roughly estimated, 40,000,000 or 50,000,000 used in the United States every year, 5,000,000 to 7,000,000 of which are imported, will be increased from the present rate from 40 to 50 per cent. This does not appear in the provisions of the bill, because 90 per cent of all the imports of those carbons have been in extra lengths. Comparing the present bill with the Dingley law it would seem that there has been a reduction of 20 cents per thousand; the insertion of the word "feet," however, practically amounts to an increase of the duty as stated above. But few enclosed arc carbons have been imported in 12-in. or less lengths, so that but few of the importers have paid the full duty on regular lamp lengths. There has been no importation of carbons for the ordinary open arc lamps. These are pressed carbons and can, it is asserted, be made to sell for from $5 to $8 per thousand. The $9 duty has, therefore, been absolutely prohibitive. Carbons for enclosed arcs have been sold in this country under the present protection at from $20 to $26 per thousand. The increase in duty will mean an increase in this price, and the central stations which have public lighting contracts will be directly affected. In the flaming-arc business, which has recently been developing rapidly, the new law means also a large increase over the present rates. The increase, however, will not be so great as it would have been on some of the high-class carbons under the 35 per cent provision of the Payne law. Flaming-arc carbons are quoted in pairs for the reason that the positive and negative carbons have different values; on this account they are sold in pairs, and quotations and duty are all considered in pairs. Of the importations within the past few months about 65 per cent of the flaming-arc carbons have been in the 24-in. or 600-mm lengths, and 35 per cent in the 16-in. or 400-mm lengths. The percentage of the longer lengths is constantly increasing, from the fact that there is a greater demand for longer burning lamps. A thousand pairs of carbons of the 24-in. length have heretofore paid a duty of $18. It is estimated that under the Payne law provision of 35 per cent ad valorem, these carbons would have to pay a duty of $24.85, and under the provisions of the Senate bill they would pay a duty at the rate of $7 per thousand feet or $28, as a thousand pairs of 24-in. carbons would measure 4000 lin. ft. The duty on 1000 pairs of 16-in. carbons under the present law has been $18; under the Payne law at 35 per cent ad valorum it would have been about $16.80, and under the provisions of the proposed Senate bill it will be about $18.66. In others words, the Senate bill increases the duty on all flaming-arc carbons that are imported, because there is none which comes in shorter than the 16-in. length. To figure the matter down a little more closely, the importers now pay upon 24-in. carbons $9 duty upon 24,000 in., or 2000 ft. Under the proposed Senate bill they would pay upon this same shipment $14, as the new rate is $7 per thousand feet. On 16-in. carbons the importers now pay $9 for every 16,000 in. As 16,000 in. is 1333 ft. the importer will pay, if the Senate bill, of $7 per thousand ft., becomes a law, $9.33 for the same import. The importers claim that if the Senate law becomes effective it will materially curtail their business, and will, in consequence, add to the present price of carbons, thereby affecting the operating cost of every central station which does lighting. They also claim that the substitute offered by the Senate for the Payne bill is directly opposite to the weight of testimony that was given upon the question of carbon manufacture before the Ways and Means Committee of the House. Speaking of the present situation, Hugo Reisinger, who imports the largest proportion of foreign carbons used in this country, has this to say: "We understand that this proposed increase of duty which the Senate bill offers, is directly the result of political influence. Myron T. Herrick, ex-Governor of Ohio, and a very influential politician, is one of the vice-presidents of the carbon trust. It is probably not necessary to say more than this in regard to the Senate provision. Under the present law the percentage of imports has only been from 10 to 15 per cent of the total of carbons used. This shows that the carbon trust has been able to sell 85 or 90 per cent of all of the carbons, and these have sold at what I consider an exorbitant profit. Carbons for standard enclosed arc lamps, according to my estimates, do not cost the trust more than $8 per thousand to manufacture. They are sold at from $20 to $24 per thousand according to the size of the orders, and this enables the trust to pay dividends upon an excessive capitalization. We maintain that the imported article is superior in quality to the domestic manufacture, but that the enormous duty has made it almost impossible for the foreign articles to compete. If this proposed law is enacted it will be even more difficult for the importer to compete with the National Carbon Company. In his testimony before the Ways and Means Committee, the secretary of the National Carbon Company admitted that it had absolute control of the carbon trade, and that it was therefore practically a trust. I think it is up to the central station managers of the United States to get busy and prevent the enactment of this Senate law. When it comes down to the last analysis, the central station man is the one who pays the excessive price. Of course, the tax payers and the public eventually pay, but it is upon the central station men that the burden will fall most heavily. It is difficult to make the legislators understand the effect of the introduction of the words 'per thousand feet.' This is really the catch phrase of the entire paragraph on carbons. If the central station men wish to prevent the passage of this law they should write to their Senators at once."

IMPORTANT WATER-POWER DEVELOPMENT IN IDAHO AND MONTANA.—The Northern Idaho & Montana Power Company, organized under the laws of Delaware, with authorized capital stock of $6,500,000, divided into $2,500,000 preferred and $4,000,000 common stock, and an authorized bond issue of $10,000,000, is operating electrical properties in eastern Washington, northern Idaho and western Montana. It owns a number of electrical public-service utilities, and is now distributing electric light and power, and it proposes to develop several water powers. The water powers which it now controls are capable of development in excess of 100,000 hp at minimum flow. They are on the Big Fork River, Moyie River and Pend o'Reille River, formerly called Clark's Fork of the Columbia River. Plants are operated at Newport, Wash.; Sand Point, Idaho; Polson, Mont., and Kalispell, Mont., and the company is negotiating for others. The company is entirely financed and is a going concern. It hopes ultimately to be one of the largest hydro-electric power concerns in the Northwest and in further ing it own interests it will also be an important agency in developing the country. The company was promoted and financed by H. M. Byllesby & Company, engineers, and Howard, Simmons & Company, bankers, of Chicago. Mr. Otto E. Osthoff, vice-president of H. M. Byllesby & Company, has just returned from an extended visit to the territory in which the company will operate. The largest of the existing water-power plants is that of Kalispell, where generating machinery having a rating of 1500 hp is now in operation, the ultimate rating of the present station being 8000 hp.

ELECTRICAL APPARATUS FOR SEWAGE PLANT.—Messrs. Dixon & Smith, engineers, Wright Building, St. Louis, Mo., will act as consulting engineers to revise the plans for the East St. Louis sewage pumping plant. The plant will consist of seven centrifugal pumps operated by gas engines, the total capacity being 1800 hp. A small electric plant will be installed to operate the crane, valves and accessories. The main building is 136 ft. x 38 ft. Bids will be asked for in about 10 days by the engineers for O. T. Dunlap & Company, who have the contract for installing this work.

TELEPHONE GROWTH IN ALBERTA.—There is rapid development in the construction of telephone lines in the Province of Alberta under the direction of the department of public works. It is estimated that within the present year there will be 800 miles of new telephone lines constructed. The mileage constructed last year amounted to this much, and the demands are as urgent at the present time as they were at the beginning of 1908. If all the demands could be granted there would probably be 3,000 miles constructed during the year.

NORTHWESTERN RAILWAY ELECTRIFICATION.—The Northern Pacific Railway Company is conducting preliminary investigations looking to the electrification of the greater part of its Montana division. It is said that negotiations are already pending with the Madison River Power Company for furnishing energy for the operation. It is also said that the St. Paul Railroad has decided to electrify its Montana division and is only awaiting the development of the extensive power project at Great Falls, Mont.

MIETZ OIL ENGINES.—August Mietz, 128-138 Mott reet, New York, has put in operation at the municipal water rks of Newburyport, Mass., a pumping engine which is imed to have made a record for economy hard to beat. The gine is a horizontal Mietz & Weiss 40-hp oil engine and is erated night and day. The report of the engineer at the ation shows that the engine consumes 25 pints of oil (Gulf fining Company) per hour, which has been purchased deliv-ed at the station at 2¾ cents per gallon. In other words, the el cost of the plant is about 8½ cents per hour, or a little re than $2 per day of 24 hours. The pump lifts 14,000 gal. water under 150 ft. head for every gallon of oil consumed. e August Mietz Company has also recently sold a number its oil engines for service in connection with electrical in-allations. J. Ogden Armour has purchased for his estate at elody Station, near Chicago, two 90-hp four-cylinder oil en-nes, direct connected to 60-kw Sprague generators, and one -hp engine connected to a 25-kw generator. This installa-n is to be used for furnishing power, running pumps and oviding current for lights. The two heavier engines are plicated to provide for emergencies and to take care of extra avy loads. The Armour Packing Company has also recently rchased six 50-hp oil engines for use in its fertilizer plants various towns in Florida.

NEW YORK AND BROOKLYN BRIDGE SUBWAY OOP.—Construction on the Manhattan end of the Brooklyn bway loop is progressing rapidly, and it is promised that the rk will be completed within a few months. It has been held at the Brooklyn Bridge terminal by the city's delay in adopt-g plans for its municipal building. Other parts of the line, wever, have progressed with rapidity. So far, however, there s been no bidder for the operation of the road when it is mpleted. It is thought that the Bradley-Gafney-Steers Com-ny will ask for the right to operate the new subway if it is anted its franchise down the east side, for which application s been filed with the Public Service Commission. The Brook-n side of the loop system, that is, the road through the Flat-ish Avenue extension to the new Manhattan Bridge, has ver been taken up by the city, and no arrangements have been ade for any construction in that section. For this reason the ublic Service Commission has taken the ground that to ask r operating bids at this time would mean that the Brooklyn apid Transit would be debarred from bidding.

ALUMINUM DEVELOPMENT IN GREAT BRITAIN.—he British Aluminum Company has put in operation its plant Kinlochleven, on which more than $5,000,000 has already en spent, having been able to begin the production of alum-um at the new plant six months earlier than was at first nticipated. The extra haste in completing this plant was due the dissolution, last September, of the aluminum pool. The eaking up of this combine resulted in a decrease in aluminum ices from $1,000 a ton, which prevailed to in 1907, to about 00 a ton. This makes it necessary for the company to rely on increased sales in order to make a profit. It is expected at the present plant will produce, eventually, 30,000,000 lb. of uminum annually. The company will issue $1,200,000 of nds for one of its subsidiaries and will increase its own bond ue from $500,000 to $5,500,000.

NEW HAVEN RAILROAD ELECTRIFICATION.—At a eeting of the board of directors of the New York, New Haven Hartford Railroad Company on April 9 the plans for the ectrification of the division between Stamford, Conn., and ew Haven were thoroughly discussed, but action was indefi-itely postponed. Owing to the large expense which the work ould entail, it was decided to defer taking the matter up until ne normal earnings of the road had been restored. The pres-nt power plant at Coscob, Conn., is sufficiently well located to andle the operation of this district, but its size would have o be materially increased. It is said that the estimates for ne proposed electrification and increase in generating equip-ent amount to about $15,000,000.

66,000-VOLT WINNIPEG POWER DEVELOPMENT.—Work has been commenced on clearing the right of way for ne transmission line of the new Winnipeg electrical power evelopment. This is 100 ft. wide and the total length of the ne to Point du Bois is 75.5 miles. Rapid progress is being ade on the two large cofferdams at the latter place. Con-racts have been let to the Locke Insulator Manufacturing ompany, of Victor, N. Y., for the line and special insulators, he estimated cost of which is $14,638. A small contract has been also awarded to the Stuart Machinery Company, of Winnipeg, for a machine shop equipment. The engineers for the work are Messrs. Smith, Kerry & Chace.

EXTENSION FOR MILLIKEN BROTHERS.—Judge Holt, of the Federal Court of New York, has granted an extension of 60 days to the receivership of Milliken Brothers, the structural steel concern. The application of the receivers shows that the steel trade is in a very demoralized condition. The low prices and sharp competition have brought about a condition of affairs which the receivers say is worse than at any time since the receivership began. The receivers announce that the company has been awarded the contract for the iron work on the immense building of Gimbel Brothers at Sixth Avenue and Thirty-second Street, in New York.

TRACTION BRAKES FOR BROOKLYN RAPID TRANSIT.—President Edwin W. Winter, of the Brooklyn Rapid Transit Company, has notified the Public Service Commission that he has made a contract with the Westinghouse Traction Brake Company for the installation of its system of traction brakes upon the elevated lines in Brooklyn. This action comes as the result of an investigation undertaken about a year ago by the Public Service Commission on the subject of brakes on the Brooklyn Rapid Transit elevated lines, as the commission was of the opinion that the safety of the public demanded a change in the system of brakes.

NEW OAKLAND, CAL., ELECTRICAL PLANT.—The Central Oakland Light & Power Company has been incorporated with a capital stock of $1,250,000, and will at once begin work on a plant to supply electric light, power and steam heat in Oakland. Among the incorporators is Mr. A. N. Hunt, who built the great Spreckels San Francisco electric lighting plant.

JERSEY ROADS BUY NEW EQUIPMENT.—The Public Service Railway Company, with headquarters at Newark, N. J., has recently purchased from the General Electric Company 6500 kw in rotary converters and 3500 kw in transformers. Switchboard equipment was also purchased. The company also purchased one 2000-kw turbo-generator for its Camden station.

BOGOTA ELECTRICAL PLANT.—A consular report from Bogota, Colombia, states that a hydro-electric plant to supply electric light and power to Bogota is under consideration. The city offers $25,000 per annum for lighting its streets, the cost of the street lighting installation being estimated at $89,000.

Financial Intelligence.

THE WEEK IN WALL STREET.

After the Easter holiday the New York stock market returned to business with an accession of activity, and with higher prices. The tone of the market has been so strong for several weeks that, although there have been temporary recessions, a permanent advance has been generally anticipated. For this reason, the majority of the people who deal in stocks regularly were willing to go on their holidays long of shares. There was no evidence that accounts were closed out immediately preceding the holiday. When the market opened on April 12 there was some uncertainty, owing to the fact that Easter Monday is a holiday in London, and there was no line for traders to go by from the transatlantic market. Almost immediately, however, a buying movement set in, and during the day considerable advances were recorded on almost every one of the active stocks. Atlantic Coast Line and Louisville & Nashville were especially strong. This was due to reports that were circulated that the earnings of these companies had so rapidly increased that it would be almost impossible to avoid an increase in the rates of dividends. The general sentiment in the stock market is very optimistic. This is not due to any actual increase in commercial business, but owing to the fact that in all lines there is a belief that normal business will be reached within a very short period. It is now expected that the tariff will be finally settled within a few weeks, and this will establish a basis upon which summer and fall commercial transactions can be made. The railroads are already reporting marked increases in their net earnings, and, while the industrial companies are not as yet very busy, the general sentiment among their managers is that it will only be a short time until orders will be almost overwhelming. The money market continues to be very easy, funds are in good demand, and the banks have plenty of cash ready to lend on every reasonable proposition. Call rates on April 12 were [illegible] per cent, and the paper was [illegible] per cent. The quotations in the table are those of the close April 12

NEW YORK.

	Apr. 3.	Apr. 12.	Shares sold.		Apr. 3.	Apr. 12.	Shares sold.
All.-Ch. . . .	15*	15	400	Int.-Met., pfd..	43⅝	43¾	49,300
All.-Ch., pfd...	47⅛	47⅛	2,000	Mackay Cos...	74¼	76	7,150
Amal. Cop . .	77⅛	78⅛	93,800	MackayCos.,pfd.	71	74	1,500
Am. D. T. ...	29*	29½	— —	Manhattan Elev.	141*	145*	100
Am. Loc. . . .	50	55⅛	6,900	Met. St. Ry....	25	22*	300
Am. Loc., pfd..	114½*	114⅜	— —	N.Y. & N.J.Tel.	119½	122	300
Am. Tel. & Cbl.	76*	70	14	Steel, com.....	51½	52¼	363,238
Am. T. & T....	134⅞	137½	79,183	Steel, pfd....	113⅞	115	19,877
B. R. T.....	77⅜	77⅛	65,930	W. U. T.....	67	69½	8,000
Gen. Elec.	159⅜	159¾	12,375	West'h., com..	84½	84¼	11,800
Int.-Met., com..	14⅞	14⅜	15,075	West'h., pfd...	115*	120	480

PHILADELPHIA.

	Apr. 3.	Apr. 12.	Shares sold.		Apr. 3.	Apr. 12.	Shares sold.
Am. Rys.	46	46*	———	Phila. Elec. ...	11¾	12⅛	—
Elec. Co. of A.	12½*	12½	———	Phila. R. T....	29⅞	30¾	———
Elec. Stor. B'ty.	44¾	45	———	Phila. Traction	92½*	92½	———
E. S. B'ty, pfd.	49*	49*	———	Union Traction.	55⅜	57	— —

CHICAGO.

	Apr. 3.	Apr. 12.	Shares sold.		Apr. 3.	Apr. 12.	Shares sold.
Chi. City Ry...	187*	180*	———	Chi. Tel. Co...	133*	133	———
Chi. Rys., Ser.1.	110*	110	— —	Met. El., com..	19*	19*	———
Chi. Rys., Ser.2.	41*	40⅛	— —	Nat'nal Carbon.	84	85½	— —
Com. Edison....	112⅜	112⅜	———	Nat. Carb., pfd.	119*	120*	———
Chi. Subways...	27½*	27½*	— —				

BOSTON.

	Apr. 3.	Apr. 12.	Shares sold.		Apr. 3.	Apr. 12.	Shares sold.
Am. Tel. & Tel.	137⅛	137¾	— —	Mex. Tel.	3	2¾*	———
Cum. Tel.....	128*	130	— —	Mex. Tel., pfd.	6*	6*	———
Edison El. Ill..	258¼	260	— —	N. E. Tel.	132½	134½	— —
Gen. Elec.	160	160	— —	W. Tel & Tel..	7*	9½	———
Mass. Elec. Ry.	14¾	14¼	———	W. T. & T., pfd	75⅞	83¾	———
Mass. E. R., pfd	72¼	72¼	— —				

*Last price quoted.
Shares sold are for four days, April 5 to April 8.

DIVIDENDS.

Albany Home Telephone Company, quarterly, 1 per cent, payable April 20.

American Light & Traction Company, preferred, quarterly, 1½ per cent; common, quarterly, 2 per cent, both payable May 1.

Cape Breton Electric Company, Ltd., preferred, semi-annual, 3 per cent, payable May 1.

Columbus (Ohio) Railway Company, preferred, quarterly, 1¼ per cent, payable May 1.

East St. Louis & Suburban Company, preferred, quarterly, 1¼ per cent, payable May 1.

Edison Electric Illuminating Company, Boston, quarterly, 2½ per cent, payable May 10.

Electric Bond & Share Company, preferred, quarterly, 1¼ per cent, payable May 1.

Electrical Securities Corporation, preferred, semi-annual, 2½ per cent, payable May 1.

Milwaukee Electric Railway & Light Company, preferred, quarterly, 1½ per cent, payable April 30.

Montreal Street Railway Company, quarterly, 2½ per cent, payable May 1.

People's Gas Light & Coke Company, Chicago, quarterly, 1¾ per cent, payable May 25.

Twin City Rapid Transit Company, Minneapolis, common, quarterly, 1¼ per cent, payable May 15.

HUDSON RIVER POWER COMPANIES.—A comprehensive reorganization plan for the Hudson River Power Companies, which comprise eight separate incorporations, has practically been agreed upon by the various bondholders' committees, which have been working on the matter. The probabilities are that the properties will be bought in at foreclosure sale and turned over to one central organization. Application has been made by the Hooper committee for the foreclosure of the mortgages on the Hudson River Electric Power Company, the Hudson River Water Power Company and the Hudson River Electric Company. These three companies hold $9,202,000 of the entire $11,010,500 outstanding bonds of the entire eight companies. The request for foreclosure on the other five companies will probably be made at once. In the reorganization there will necessarily be a considerable scaling down of the present bond issues. The actual value of the physical properties as estimated by Stone & Webster, not including the rights of way, is $6,234,000, which is nearly $5,000,000 less than the amount of bonds outstanding. The Hudson River Companies will undoubtedly require a considerable amount of new money to put the properties into successful operation. Additional transmission lines will have to be constructed to link together the isolated plants in order to make a successful working unit of the entire system.

RAILWAY PROMOTERS REFUND.—Thomas F. Ryan, P. A. B. Widener, Thomas Dolan and the estates of William C. Whitney and William L. Elkins have paid back to the Metropolitan Securities Company the sum of $992,212. This is the amount which the promoters of the Metropolitan system paid to Anthony N. Brady "for distribution" at the time of the purchase of the Wall and Cortlandt Street Ferries Railway Company. Of this amount $245,681 was repaid by the Whitney estate, which was the amount Mr. Whitney originally received. The suit brought by the Metropolitan Securities Company has been discontinued. The fact that this large amount had been paid to the promoters was brought to light through an investigation of the Public Service Commission.

NEW YORK CAN BUILD NEW SUBWAYS.—According to the report of General Benjamin F. Tracy, who was appointed by the Supreme Court last June as a referee to investigate the condition of New York City's public debt with view to ascertaining whether additional bonds could be issued to pay for new subways, the city's debt limit has not yet been reached by $106,205,714. General Tracy's report makes all the deduction which he considers necessary from the city's bonded issues, and in his opinion the margin is as above indicated. The report is made in connection with an injunction proceeding against the building of the Fourth Avenue Subway in Brooklyn. The case will be carried to the Court of Appeals.

SIXTH AVENUE RAILROAD COMPANY.—President Frank Curtiss, of the Sixth Avenue Railroad Company of New York City, has sent a notice to the stockholders informing them that the regular dividends of the company will be deferred. This is done, it is said, on account of the unsettled state of traction affairs on Manhattan. The Sixth Avenue Railroad was leased in 1892 to the Houston, West Street & Pavonia Ferry Company for 800 years at a rental equivalent to 7 per cent on its stock. The Pavonia Company was taken over by the Metropolitan Street Railway Company, and the Sixth Avenue has therefore been a portion of the Metropolitan system. It is not stated that the company has shown any decrease in business, but the dividends are suspended until the complications are cleared away.

WASHINGTON RAILWAY & ELECTRIC COMPANY.—The gross earnings of the Washington Railway & Electric Company for the year 1908 were $3,720,573, as compared with $3,385,748 the previous year. The net earnings of the company after making deductions which were applied to subsidiaries amounted to $616,057, which equals 5 per cent upon the preferred stock and almost 3 per cent upon the common stock.

THE MACKAY COMPANIES.—It is stated by an official of the Mackay Companies that the earnings at the present time are sufficient to warrant an increase in the dividend on the common stock from 4 to 5 per cent. It is not likely, however, that such an increase will be ordered, from the simple fact that the management, which has always been very conservative, prefers to further increase the surplus fund.

WESTINGHOUSE NOTES ARRANGED FOR.—Robert Mather, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, is said to have made satisfactory arrangements in his recent trip abroad to take care of the $3,000,000 short-term notes of the company which were placed in Paris in 1907. These notes were issued shortly before the panic. In order to devote his entire time to the Westinghouse company, Mr. Mather has resigned from the presidency of the Rock Island company.

TRACTION PROFITS FOR CHICAGO.—The city of Chicago was paid more than $1,300,000 last week as a result of its partnership with the Chicago City Railway Company and the Chicago Railways Company. This money represents 55 per cent of the net earnings of the two surface lines during the fiscal year which ended Jan. 31, 1909.

MAY MAKE AN OFFER FOR STEINWAY TUNNEL.—It is said the Interborough Rapid Transit Company is preparing to make a new offer to the city for a franchise for operating the Steinway tunnel. President Theodore P. Shonts says that his company is willing to carry passengers from Queens Borough and give free transfers to the subway system.

DENVER CITY TRAMWAY BONDS.—Clark, Dodge & Company, New York, and E. W. Clark & Company, Philadelphia, are offering to the public $1,848,000 5 per cent first and refunding sinking fund mortgage bonds of the Denver City Tramway Company. The bonds are due Nov. 1, 1933. They are offered at 95 and interest.

INTERNATIONAL SMELTING & REFINING COMPANY.—The $10,000,000 of stock to be issued by the International Smelting & Refining Company was so heavily oversubscribed that in some instances subscribers had to be cut down 75 per cent, and many applications were ignored entirely. The rush for this stock was particularly eager on account of the fact that the subscribers to this issue will hereafter have the right to subscribe to the $40,000,000 additional stock which is authorized in the company's incorporation. It is semi-officially announced that the company will go on a semi-annual dividend basis in May or June of this year, and that the earnings of the company for the current year will be close to $1,000,000, or 10 per cent on the issue of stock, all of which will be derived from the Raritan Refining Works. The company has made a contract for securing the site for its new smelter, which will be built at the mouth of Pine Canyon, Tooele County, Utah. The structural steel for its construction has already been ordered, and it is promised that work will be pushed to a very speedy completion.

NORTH MOUNT VERNON LINE SOLD.—The only railroad owned by the New York City Railway Company was sold at auction at White Plains on April 8. The line was the old North Mount Vernon Railway, which was 1.57 miles long, and owned two cars, which were so badly in need of repairs that they could not be operated. The line was sold under order of the court by the receiver of the New York City Railway Company. It was bought in by John Johnston, of Brooklyn, for $500, which covered the franchise, tracks, wires, poles and other property, and the purchaser is also liable for $25,000 in franchise taxes and assessments, which he agreed to pay. Mr. Johnston declined to make any announcement as to his purpose in buying the road, but it is presumed it is for some of the other Bronx properties, as the line is only available as a connecting link.

AMERICAN GAS & ELECTRIC COMPANY.—The earnings of the American Gas & Electric Company have been rapidly gaining within the past few months. For the three months which ended Feb. 28 the surplus earnings were $96,210; this is at the rate of 15.39 per cent per annum on the common stock after dividends of 6 per cent had been paid on the preferred. It is stated that within the past year the total number of customers of the sub-companies has increased more than 20 per cent. The company recently has been pursuing the policy of expansion and acquisition. It has taken over the Forest City (Pa.) Electric Company and also the Lackawanna Valley Electric Light & Power Company, of Carbondale, Pa.

AMERICAN LIGHT & TRACTION COMPANY.—At the meeting of the directors of the American Light & Traction Company, April 7, the regular quarterly dividends were declared, and the board confirmed the action of the executive committee in voting to pay on Nov. 1 an extra stock dividend of 10 per cent to holders of the common stock. This was the first meeting of the new board of directors, and Emerson McMillan, formerly president of the company, was elected to the newly created position of chairman of the board. A. P. Lathrop was elected president, and J. M. McCarthy was chosen vice-president and treasurer. Marion McMillan was also elected vice-president and assistant secretary.

TRI-CITY RAILWAY & LIGHT COMPANY.—The annual report of the Tri-City Railway & Light Company, Davenport, Iowa, for the year 1908 shows gross earnings of $1,819,077, an increase of $36,721 over the previous year. Speaking of the condition of the company, Joseph F. Porter, the president, says that while the gross earnings only show an increase of 2.06 per cent, the net earnings, owing to improvements, increased efficiency and economies, have increased 15.35 per cent. The surplus at the end of the year was sufficient to pay a 6 per cent dividend on the preferred stock, leaving a balance of $93,119, which was equal to more than 1 per cent on the common stock.

NEW YORK & QUEENS ELECTRIC LIGHT & POWER.—The directors of the New York & Queens Electric Light & Power Company have made a proposition to the stockholders providing for an issue of $1,500,000 in bonds, to provide for further extensions and improvements. It is said that the future development and growth of the Borough of Queens demand these extensions. The majority of the stockholders have already given their consent. There is also a proposition before the stockholders to place a general and refunding mortgage on the property and franchises to the amount of $25,000,000, which will bear 5 per cent.

HUDSON COMPANIES DIRECTORS.—The board of directors of the Hudson Companies, holding company for the Hudson & Manhattan Railroad Company, have elected Dumont Clark, president of the American Exchange National Bank; A. A. Tilney, connected with the firm of Harvey Fisk & Sons, and Charles Francis Adams 2d, of Boston, Mass., directors to succeed Gardner M. Lane, Cornelius Vanderbilt and Andrew Friedman, who recently resigned from the board on account of their connection with the Interborough Rapid Transit Company. All three of the new directors are well known in the financial world.

MICHIGAN-LAKE SUPERIOR POWER COMPANY.—More than 99 per cent of the first mortgage bonds of the Michigan-Lake Superior Power Company have been deposited with the bondholders' reorganization committee, but no steps have been taken looking toward foreclosure proceedings. The bondholders have been waiting until the company's right to divert water from the main channel into its private canal have been fully established. It is believed that this will be accomplished by the provisions of the recently adopted River and Harbor bill.

GENERAL RAILWAY SIGNAL COMPANY.—The annual report of the General Railway Signal Company for 1908 shows that the business of the company for the year was only about 40 per cent of that done in 1907. The net earnings were only $47,344, and after paying interest charges and depreciation, there was a deficit of $19,103. Not including the current business of 1908, the company reports that it has now on hand contracts aggregating $1,100,000, and the officials declare that there has recently been a revival of activity in their orders.

LONDON UNDERGROUND ELECTRIC.—The report for the month of February of the Underground Electric Railways of London shows an increase in net earnings of more than $30,000. For some months past the gross receipts of the company have been very satisfactorily increased, while the expenses have been curtailed a small amount. The net earnings for the first two months of the present year have been about $200,000.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Dallas Combined Companies:					
February, 1909	$91,688	[illegible]	$36,635		[illegible]
February, 1908	84,135	[illegible]	[illegible]		[illegible]
Galveston-Houston Electric Company:					
February, 1909	82,552	53,388	29,164		[illegible]
February, 1908	74,711	48,[illegible]	26,462		6,048
General Railway Signal Company:					
Year 1908	260,661	213,316	47,344	$66,447	19,103*
Year 1907	1,[illegible]07	[illegible]	[illegible]	[illegible]	[illegible]*
Kansas City Railway & Light Company:					
February, 1909	[illegible]	841,637	222,181	[illegible]	[illegible]
February, 1908	464,118	[illegible]	251,390	[illegible]	[illegible]
Minneapolis General Electric Company:					
February, 1909	98,189	36,047	62,142		20,614
February, 1908	84,583	[illegible]	48,661		17,649
Northern Texas Electric Company:					
February, 1909	[illegible]	[illegible]	[illegible]		17,380
February, 1908	[illegible]	[illegible]	[illegible]		[illegible]
Seattle Electric Company:					
February, 1909	379,691	230,038	[illegible]		[illegible]
February, 1908	347,618	220,250	127,368		[illegible]
Tri-City Railway & Light Company (Davenport, Iowa):					
Year 1908	1,819,077	[illegible]	[illegible]	[illegible]	[illegible]
Year 1907	[illegible]	[illegible]	[illegible]	308,443	251,621
Washington Railway & Electric Company:					
Year 1908	[illegible]	1,856,171	[illegible]	[illegible]	724,436
Year 1907	[illegible]	1,748,752	1,636,996	[illegible]	$72,121

*Deficit.

GENERAL NEWS

Construction News.

BELLEVILLE, ARK.—A telephone company has recently been organized in Belleville to construct a telephone system and will erect about 40 miles of line. W. G. Page is president and J. W. Wilson manager of the company.

CARLISLE, ARK.—The Carlisle Rice Mill Company has awarded the contract for its proposed power plant for rice mili to the Southern Engine & Boiler Works, of Jackson, Tenn., which includes a 400-hp Corliss engine, high-pressure boilers, pumps, automatic engine and lighting plant.

EUREKA SPRINGS, ARK.—It is reported that the Cassville & Western Railway Company is planning to develop the water power of White River to be utilized to generate electricity for lamps and motors.

MAMMOTH SPRINGS, ARK.—Frank Hill, of Memphis, has accepted the franchise offered by the City Council and will establish an electric light plant, work on which will begin at once.

GILROY, CAL.—The City Council, it is said, has decided to advertise for bids to furnish the city with electricity to operate the municipal electric light system for a term of five years. The municipal electric light plant has not proven a profitable investment, and it has been decided that the city can purchase electricity cheaper than it can be generated at the municipal plant.

NEEDLES, CAL.—The Needles Light & Power Company has applied to the Town Council for an extension of one year in time in which to complete its plant, the extension to date from July 27, 1909.

OAKLAND, CAL.—The Board of Supervisors has granted the Home Telephone Company, of Alameda County, a 50-year franchise for the extension of its telephone system to any part of the county, in return for which the company is to pay $2,500 and furnish the county with 20 telephones free of charge.

RED BLUFF, CAL.—Notice of appropriation of 12,000 cu. in. of water in Mill Creek has been filed by Smith Crowder.

REDDING, CAL.—Notice of appropriation of 100,000 cu. in. of water in the Sacramento River has been filed by A. L. Leonard, of Red Bluff. It is understood that the appropriation is made in the interest of the Iron Canyon irrigation project.

SACRAMENTO, CAL.—The Great Western Power Company has made preparations for the construction of an extensive distributing system, in the island district of the Sacramento and San Joaquin rivers, between Sacramento and Stockton, from the main tower line at New Hope, to supply electricity for lamps and motors to the farmers on the reclaimed land.

SAN FRANCISCO, CAL.—The promoters of the proposed Stockton street car line will apply to the Board of Supervisors for an additional franchise to operate its cars from the junction of Bay and East streets to the Presidio. The new company also proposes to apply to the Harbor Commissioners for permission to operate a street railway on East Street from the junction of Bay Street to the Ferry Building. Frank D. Stringham represents the promoters.

CRESCENT BEACH, CONN.—The incorporation committee of the State Legislature has voted to report favorably on the application of Cruttenden Brothers, of Norwich, Conn., to incorporate as the Crescent Beach Power & Water Company for the purpose of supplying electricity and water to the cottages at Crescent Beach and Sound View.

JEWETT CITY, CONN.—The Legislature has passed the bill authorizing the Borough of Jewett City to furnish electricity outside of the borough limits.

THOMPSONVILLE, CONN.—Announcement has been made by the Northern Connecticut Light & Power Company that the price of electricity for lamps in Hazardville, Enfield and Thompsonville, beginning June 1, will be reduced from 18 cents to 15 cents per kw-hour, with a discount of 10 per cent on bills paid before the 10th of the month, which will reduce the price to 13½ cents per kw-hour, making the rate the same as in Windsor Locks.

WASHINGTON, D. C.—Bids will be received until April 30 by James Knox Taylor, supervising architect, Washington, D. C., for bronze railings and lamp standards for the east front of the Treasury Building, Washington, D. C.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 27 to furnish at the navy yards and naval stations the following supplies: Brooklyn, N. Y., or Mare Island, Cal., Schedule 1089—65,000 ft. solid double braided wire. Brooklyn, N. Y., Schedule 1099—Four 300-kw turbo-generating sets. Schedule 1103—Electrically driven reversible two-speed deck winch. New Orleans, La., Schedule 1110—Panel board and distribution cabinet, cable, wire, etc.; panel board connections, steel conduit, etc. Applications for proposals should designate the schedule

JACKSON, GA.—The Central Georgia Power Company, of Macon, Ga., is contemplating extending its transmission lines to Jackson to furnish electricity for lamps and motors. W. J. Massee is president of the company.

TALLADEGA, GA.—The City Council has granted the Alabama Power Development Company a perpetual franchise in this city, removing the provision in its present franchise limiting its service in Talladega to the hydro-electric plant at Jackson Shoals, and permitting the company to supply electricity generated either by steam or water power. The company agrees to erect a high-tension transmission line immediately from the Anniston plant and eventually to connect the system with its proposed plant at Little River Falls in Cherokee County, where it is estimated that 20,000 hp can be developed. The Jackson Shoals plant, where about 300 hp at present is available, will be further developed and a dam built some distance below the present dam. The plans of the company call for an expenditure of about $3,000,000, of which $300,000 will be spent immediately. The construction of an electric railway connecting Talladega, Anniston and Gadsden is included in the project.

LUCILLE, IDAHO.—Surveys are being made of the property of the United Placer Company, located on the Salmon River near Lucille. The company proposes to develop the water power and install an electric plant and pumping station.

OROFINO, IDAHO.—The Orofino Electric Company is reported to have filed on additional water rights in Orofino Creek.

POCATELLO, IDAHO.—The Bear Lake Power Company will construct a new power house and install new equipment this spring. The Bannock Engineering Company, of Pocatello, will have charge of the engineering work.

CLAYTON, ILL.—The capital stock of the Clayton Farmers' Union Telephone Company has been increased from $1,000 to $2,500.

PETERSBURG, ILL.—The proprietors of the Petersburg electric light plant are planning to change the system from single-phase, 125 cycles to the three-phase, 60 cycles, which will require the installation of a 150 or 200 hp engine and a 150 or 200 kw alternator. R. H. Abbott is president and manager.

COLUMBUS, IND.—The Central Indiana Lighting Company has secured a site on White River, where it will erect a new power plant.

CRAWFORDSVILLE, IND.—The Home Telephone Company is in the market for material to construct two miles of conduits and for new leads and cables. The company will also install a new switchboard in its new exchange building now being erected.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company has awarded the contract for the construction of a concrete dam in Fall Creek at Northwestern Avenue to Henry Maag & Company for $10,200.

LINTON, IND.—Local capitalists are contemplating the purchase of the municipal light plant, and if secured will buy a coal mine near and erect a large electric light plant, with a view of furnishing electricity to neighboring towns. They also propose to build electric railways to and in the coal fields and to Martinsville.

PORTLAND, IND.—The City Council, in order to facilitate collection of service bills, is offering a discount of 2 cents per kw-hour on all bills paid on or before the 15th of each month. Those who do not pay by the 25th are to be disconnected without notice. The new rate is 11 cents per kw-hour for the first 9 kw; 10 to 29, inclusive, 10 cents; 30 to 59 kw, inclusive, 9 cents; 60 kw and over, 8 cents. Rates for electricity for motors will be 10 cents per kw for the first 10 kw; for each additional kw, to and including 199, 7 cents; 200 to 399 kw, inclusive, 7 cents; 400 to 599 kw, inclusive, 6½ cents; 600 kw or more, 6 cents.

RICHMOND, IND.—Robert Ashe has been granted a franchise by the County Commissioners to erect transmission lines from this city to Liberty, to supply electricity to the latter place.

RUSHVILLE, IND.—Bids will be received until May 14 by the city of Rushville for furnishing engine, piping, alternating-current generator and exciter to be installed in the municipal electric light plant. Plans and specifications are on file at the office of S. G. Gregg, city clerk, and A. T. Mahin, superintendent of the municipal electric light plant. Harvey M. Cowing is mayor.

VINCENNES, IND.—Bids will be received until June 8 for lighting the streets of the city for a term of 10 years with 200 arc lamps of 2000 cp, with an all-night and every-night service. The contract is to take effect from April 29, 1910.

DANBURY, IA.—Plans are being considered to install a municipal electric light plant in Danbury to cost about $7,000.

MARSHALLTOWN, IA.—Plans are being made by the Iowa Telephone Association for the construction of a new automatic telephone system in Marshalltown, which will involve an expenditure of about $150,000. The wires are to be placed in underground conduits.

SIOUX CITY, IA.—The Sioux City Service Company has filed amendments to its charter, increasing the capital stock from $25,000 to $2,000,000.

FORT LEAVENWORTH, KAN.—Bids will be received by Captain William D. Davis, quartermaster, until May 10 for construction of addition to engineer's barracks, building No. 45, at Fort Leavenworth, and for making additions to the heating and electric lighting system. Full information and blank forms of proposal furnished on application at the above office, where plans and specifications may be seen; also in the offices of the chief quartermasters at Chicago, Ill.; Omaha, Neb., and Denver, Col.; depot quartermasters at Philadelphia, Pa., and St. Louis, Mo.; quartermasters at Columbus Barracks, Ohio, and Master Builders' Exchange, Kansas City, Mo.

FORT SCOTT, KAN.—The Fort Scott Gas & Electric Company has been reorganized and proposes to rebuild its power plant and improve the electric lighting system.

LAWRENCE, KAN.—The City Council has granted franchises to two separate railway companies to operate street car lines in Lawrence: one to C. C. Sullivan, representing capitalists from Dayton, Ohio, to operate railway in Lawrence, and Whitsed Laming was granted a franchise to operate an interurban railway through the town.

WATHENA, KAN.—The proposition to issue bonds for the construction of an electric light plant will be submitted to the vote of the people.

WINFIELD, KAN.—The Missouri & Kansas Telephone Company is contemplating the reconstruction of the telephone system in Winfield. All the wires in the business section of the city will be placed underground.

HARLAN, KY.—The capital stock of the Harlan Telephone Company has been increased from $2,500 to $4,100.

MILTON, KY.—An effort is being made among the farmers of Trimble County to organize a rural telephone company. It is expected that the local company will start with about 300 subscribers.

SANDY SPRING, MD.—It is reported that the Kensington Railway Company is preparing to construct an extension of its railway from Kensington to Sandy Spring, a distance of about four miles. An issue of $50,000 in bonds is contemplated to build the extension. Charles F. Brooke is president, and Allan Farquhar treasurer of the company, both of Sandy Spring.

BOSTON, MASS.—Superintendent Emerson, of the Street Department, has recommended that the city enter into a 10-year contract with the Edison Electric Illuminating Company for the same service that is now furnished by the company. By the terms of the new contract it is estimated that the cost of the service will be approximately $300,000 per year, about $75,000 less than the city now pays. The contract also provides for substituting the new magnetite lamp for the lamp now in use. The contract with the Edison company expired March 20, and the city has since been paying the rates that were in force under the old contract. Mayor Hibbard has signed the contract with the Edison Electric Illuminating Company for lighting the city for a term of five years for $380,000 per year. The contract was made with the understanding that it can be changed for a 10-year contract any time within the next six months. The present contract saves the city $55,000 per year.

DEDHAM, MASS.—The citizens have voted to make a contract with the Edison Electric Illuminating Company for lighting the streets of the city for a term of 10 years at a cost of $9,016 per year.

ESSEX, MASS.—It is reported that a large addition is to be built to the power station at Essex Falls. The plant furnishes power for the Boston & Northern Street Railway.

FALL RIVER, MASS.—The Fall River Electric Light Company is making arrangements to extend its underground system and has applied to the Board of Aldermen for permission to place underground conduits on several streets in the city.

LEYDEN, MASS.—An effort is being made to have the Greenfield Electric Light & Power Company extend its transmission lines to Leyden.

MARLBORO, MASS.—We are informed that W. G. Webber has purchased the interest of W. H. Emery in the Marlboro Electric Company. Mr. Emery has resigned his position as treasurer and manager of the company; Edward C. Mason has been elected treasurer, and C. S. Davis general manger. The business of the company will continue as heretofore. W. G. Webber is president.

SPENCER, MASS.—The Spencer Gas Company has submitted a proposition to the committee on street lights offering to furnish 40-cp tungsten lamps at $18 per lamp per year and arc lamps at $75 each per year. It also offered a sliding scale on the tungsten lamp, reducing the above prices somewhat on a five-year contract.

STERLING, MASS.—The Selectmen have decided to grant the Connecticut River Power & Transmission Company a franchise to erect its transmission lines over the highways in the town, in return for which the company agrees to furnish electricity at the rate of 2½ cents per kw-hour, delivered to the center of the town. As yet the town is not ready to make use of the privilege.

UXBRIDGE, MASS.—The Uxbridge & Northbridge Electric Company is making arrangements to change its entire plant from single-phase to three-phase, and will soon install a new generator in the near future. A. G. Sias is superintendent.

WEST BOYLSTON, MASS.—Arrangements are being made by the Marlboro Electric Light Company to install the street lighting system in West Boylston, which will consist of 125 tungsten lamps.

WORCESTER, MASS.—The subcommittee of the joint standing committee on public buildings, appointed to investigate and report on the advisability of installing a municipal lighting plant in the basement of the city hall to furnish electricity for lighting the building, the plaza and part of the common, has reported against the proposition.

FLINT, MICH.—The Oak Park Power Company is planning to install a new generating unit in its plant.

HOUGHTON, MICH.—The City Council is reported to be considering the question of establishing a municipal electric light plant.

TWO HARBORS, MICH.—Preliminary steps have been taken for the organization of the Lake County Rural Telephone Company. Arrangements will be made with the Duluth & Iron Range Telephone Company for long-distance connections. E. E. Cavalin is secretary of the temporary organization.

CHISHOLM, MINN.—The Meseba Telephone Company is planning to install a new telephone exchange in Chisholm.

FERGUS FALLS, MINN.—At an election held April 6 the citizens voted to issue $5,000 in bonds, the proceeds to be used for extensions to the municipal electric light system.

WADENA, MINN.—The Village Council is making arrangements to establish a 24-hour service in connection with the municipal electric light plant.

MACON, MISS.—On April 6 the citizens voted to issue $20,000 in bonds for improvements to the municipal electric light plant. The proceeds will be used to install an additional electric generating unit and motor-driven pumps. The construction of a high-tension transmission line to Brooksville is also contemplated to supply that town with electricity. G. B. Baskerville, Jr., is superintendent.

CLARKSBURG, MO.—Plans are being considered to install an electric light plant in this town. Charles Knirnschild, of Clarksburg, is interested in the project.

CRYSTAL CITY, MO.—The Pittsburg Plate Glass Company has purchased a new motor generator set for its plant in this city. The company is planning to add considerable new equipment during the coming summer.

EAST ST. LOUIS, MO.—Surveys have been completed by the Wood River, East Alton & Bunker Hill Traction Company and rights of way and franchises secured for its proposed electric railway from Wood River to East Alton and Litchfield, a distance of 30 miles. It has not yet been decided when contracts will be awarded. J. T. Rudisell is president and general manager.

HELENA, MONT.—The Hauser Lake Dam, located near Helena, owned by the Helena Power & Transmission Company, is reported to have been washed out again, causing a loss of about $250,000.

LINCOLN, NEB.—Extensive improvements are contemplated by the Automatic Telephone Company to its system during this coming summer, which will involve an expenditure of about $200,000, of which $100,000 will be used to erect long-distance lines. An addition will be built to the main exchange building, and a branch exchange will be erected at Twentieth and Cherry streets.

SOUTH OMAHA, NEB.—Bids will be received by John J. Gillin, city clerk, until April 19 for furnishing electric or gas lamps and maintenance for the same for a term of 5 or 10 years, beginning Oct. 26, 1909; also for lighting the city hall, jail building and all other public buildings and places.

VALENTINE, NEB.—It is reported that C. H. Cornell, who owns water rights on the Niobrara River, is planning to develop the same, to be utilized to generate electricity.

MANHATTAN, NEV.—The contract for the erection of the transmission lines to Round Mountain and Manhattan is reported to have been awarded to Hill & Carpenter for $11,000.

ALLENHURST, N. J.—The Senate has passed the bill allowing the Borough of Allenhurst to sell its municipal electric light plant.

CAPE MAY, N. J.—The Cape May Light & Power Company has applied to the County Board of Freeholders for permission to erect transmission lines on the county roads to Erma, Burleigh, Rio Grande, Green Creek and to the Five Mile Beach resorts.

ORANGE, N. J.—The City Council has authorized City Engineer Fred T. Crane to secure estimates of the cost of installing a municipal electric light plant and to report at the next meeting of the Council.

TRENTON, N. J.—The Senate has passed the bill authorizing the Boards of County Freeholders to contract for the lighting of highways across meadow lands to seaside resorts.

BATH, N. Y.—The Bath Electric & Gas Light Company has decided to re-establish a day service for both lamps and motors, beginning May 1. The service was discontinued four years ago and has been the main issue between the electric light company and the Village Trustees relative to renewing the street lighting contract and to the sale of the property of the Citizens' Electric Service Company, which has tried for two years to get into competition to secure the street lighting contract, but failed with the present company.

BROOKLYN, N. Y.—It is proposed to construct a loop connection at the South Elevated Station, Rockaway Parkway and Glenmore Avenue, in connection with the construction of the proposed elevated railway from the Brighton Beach line at the Brooklyn Union Elevated Railroad at Avenue U, E. Avenue Q and Flatbush Avenue, Brooklyn, three miles in length. Two cars will be operated. Electricity for operating the cars

will be rented from the Brooklyn Rapid Transit Company. J. S. Sadler, of Carlisle, Pa., is president, and J. C. Langdon, 180 Montague Street, Brooklyn, secretary of the company.

BUFFALO, N. Y.—The plant of A. Nowak & Son, Buffalo, which was destroyed by fire last fall, is being rebuilt at a cost of about $100,000. The entire plant will be operated by electricity generated by Niagara power.

BUFFALO, N. Y.—The Board of Aldermen has adopted the resolution authorizing Commissioner Ward to draw plans and advertise for three electrically driven pumps for the new water-works system; two of 20,000,000-gal. capacity and one of 25,000,000 gal.

CHARLOTTE, N. Y.—The contract for the new cable towers to be erected on each side of the harbor at Charlotte has been awarded to the Seneca Engineering Company, of Montour Falls, N. Y. The towers will be 167 ft. in height and are to be completed by May 20.

ELMIRA, N. Y.—Arrangements are being made by the Thatcher Manufacturing Company to install a new generator in the power plant of its agriculture implement factory.

GOUVERNEUR, N. Y.—Plans are being considered for the development of the South Edwards water power by wealthy mill owners and lumbermen of Gouverneur and Watertown. An option has been secured on the property. The power will probably be utilized to operate a large pulp and paper mill and the surplus transmitted to Harrisville, Edwards and other towns for lamps and motors.

NEW YORK, N. Y.—At a special meeting of the Great Eastern Telephone Company, held recently, the capital stock of the company was increased from $1,000,000 to $50,000,000.

NEW YORK, N. Y.—Bids will be received until April 19 by C. B. J. Snyder, superintendent school buildings, Department of Education, for installing electric equipment, in addition to and alterations, in Public School No. 87, on Washington Avenue, between Pulaski and Lafayette streets, Middle Village, Borough of Queens.

OGDENSBURG, N. Y.—The directors of the New York & Ontario Power Company have authorized the sale of $1,850,000 in bonds, the proceeds to be used for developing water power at Waddington, N. Y. The company owns all power rights between Waddington and Crapser's Island, which is estimated capable of developing 30,000 hp. It is proposed to replace the present dam with a concrete dam. The cost of the entire plant and equipment is estimated at $2,000,000. The company holds the right to sell electricity in both United States and Canada, and will furnish electrical energy to operate the new Norwood & St. Lawrence Railroad.

ONEIDA, N. Y.—Preparations are being made by the Madison County Gas & Electric Company for a general overhauling of its plant and lines, which will involve an expenditure of about $25,000.

PATCHOGUE, N. Y.—The Patchogue Electric Light Company has filed an amendment to its charter increasing its capital stock from $40,000 to $70,000. E. E. Hawkins is president of the company and H. S. Conklin, secretary.

RAYBROOK, N. Y.—Governor Hughes has signed the bill appropriating $307,300 for an additional pavilion, power house, new reservoir and other improvements at the State Hospital for the Treatment of Incipient Tuberculosis at Raybrook.

TALCVILLE, N. Y.—The board of directors of the Uniform Fibrous Talc Company has decided to build the new mills of the company on the Freeman farm, in Talcville, near the mines. A concrete dam will be built and a power house erected to generate electricity, which will be transmitted to the mills, about 1¼ miles distant. The entire plant will be operated by electricity, including the machinery at the mines. Connell & Connell, of New York, N. Y., are the architects. F. W. Sybel is president.

ELIZABETH CITY, N. C.—Arrangements are being made by the Elizabeth City & Albemarle Electric Railway Company for the construction of its proposed electric railway from Elizabeth City to Albemarle Sound, a distance of about 14 miles. D. G. Wilson, of Weeksville, N. C., is interested in the enterprise.

GOLDSBORO, N. C.—The Goldsboro Traction Company has nearly completed a 2½-mile street railway in Goldsboro. Plans are now being considered for the immediate extension of the railway to Swan Springs and White Hall, a distance of 16 miles. E. T. Oliver, of Raleigh, N. C., is president and general manager.

KING, N. C.—The Quickstep Telephone Company is making arrangements to improve and extend its service and will erect telephone lines from King to Danbury, Rural Hall and Donnaha.

MIDDLESEX, N. C.—Preparations are being made by W. W. Lannon to install an electric light plant in Middlesex. Power for operating the system will be obtained from the mill, two miles distant.

SALISBURY, N. C.—The Southern Power Company, of Charlotte, N. C., has completed plans to erect a large transformer station at Salisbury, at a cost of $50,000. For further information address F. D. Sampson.

THOMASVILLE, N. C.—The right-of-way into Thomasville has been secured by the Southern Power Company for transmission lines already built to Lexington, a short distance away. A transformer station will also be erected here.

WASHINGTON, N. C.—We are informed that the Washington Investment Company is making arrangements to commence work at once on its proposed electric street railway in Washington, which will extend to Suburban Park at Washington Heights. A power station and repair shop will be erected at Washington Heights. W. E. Jones is president and general manager.

FARGO, N. D.—It is reported that the City Council will employ an electrical engineer to prepare estimates of cost for a municipal electric light plant.

GRAND FORKS, N. D.—The Board of Regents of the North Dakota University has awarded the contract for the construction of the new power house to Melby & Standahl, of Grand Forks, and for the erection of the 125-ft. concrete smokestack to Alphons Custodis, of Chicago, Ill.

LANSFORD, N. D.—The Farmers' Telephone Company is planning to make extensions to its system, which will require the erection of about 30 miles of line.

BRIDGEPORT, OHIO.—The Village Council will receive bids until June 1 for street lighting for a term of 10 years. The village has a population of over 4000 inhabitants. For further information address R. T. Michener, village clerk.

CLEVELAND, OHIO.—The Cleveland Worsted Mills Company is reported to have awarded a contract to the Allis-Chalmers Company for a 1500-kw generating unit for its power plant.

CLEVELAND, OHIO.—The County Building Commission has decided to ask for bids for furnishing light, power and heat for the county court house on a five-year contract. The Cleveland Engineering Company is preparing plans for a power plant to cost $150,000. The commission is asking for bids, with a view to deciding whether it will be cheaper to purchase the service or install a plant in the county court house.

COLUMBUS, OHIO.—Arrangements have been completed by the Orr Felt & Blanket Company for the erection of a felt and blanket mill. The mill will be operated by electricity, which will be generated by the company's own plant.

COLUMBUS, OHIO.—Bids will be received by the Board of Public Service, City Hall, Columbus, Ohio, until April 21 for furnishing labor and materials for construction and erection of additional machinery at the municipal electric light plant as follows: Item 1—One high-pressure condensing steam turbine capable of driving a direct-connected generator with a rating of 2000 kw under normal load conditions; one 2000 kw alternator. Item 2—One 2000-kw surface condenser and accessories. Item 3—Additional switchboard in accordance with the specifications on file in the office of the Board of Public Service. Bidders may submit propositions on each of the above items separately, or any number thereof, or on the whole, but if on the whole, or more than one, the amounts bid on each item must be separate. Edward W. Hirsch is secretary.

NILES, OHIO.—The Board of Public Service is considering the question of abandoning the city plant and procuring electricity for operating the municipal electric system from the Hydro-Electric Company at Warren, Ohio.

PAINESVILLE, OHIO.—The City Council has decided to install additional equipment in the present municipal electric plant to enable the plant to furnish electricity for small manufacturing concerns until the new plant can be installed. The new equipment will include one direct-connected 250-kw generator, to cost $4,300; one 300-hp engine, $3,000; switchboard, $300; piping and feed-water heater, $1,000; foundations for engines, $500; one boiler set, $1,500; transformers and wire, $1,500, and addition to building, $1,100, making a total of $13,500. The city is also considering the question of operating the water-works pumps by electricity. W. N. Collister is superintendent of the municipal electric plant.

HOBART, OKLA.—The Oklahoma Midland Electric Railway Company would like to communicate with contractors with a view of awarding a contract for construction of three miles of track. H. H. Hoover is president.

SPIRO, OKLA.—Plans and estimates are being prepared for an electric light and water system in Spiro to cost about $40,000.

TISHOMINGO, OKLA.—It is understood that Dr. S. W. Skillern proposes to develop the water power of Pennington Creek Falls, which will be utilized to generate electricity to operate the proposed electric railway from Oklahoma City to Dallas, Tex.

COQUILLE, ORE.—The City Council has granted the Coquille Mill & Mercantile Company a franchise to construct and operate an electric light and power plant and electric railway in Coquille.

HOOD RIVER, ORE.—A 50-year light and power franchise has been granted to the Watt Development Company.

PORTLAND, ORE.—Plans of D. E. Keasey for the construction of an electric railway, with loops from Twenty-third and Washington streets to Parkside, have been approved by the County Court and County Commissioners. The proposed extension will cost about $20,000, and when finished it is understood that the line will be taken over by the Portland Railway, Light & Power Company.

ST. HELENS, ORE.—The St. Helens Lumber Company has awarded the contract for the construction of its power plant to the Northwest Bridge Company, of Portland, Ore.

CANONSBURG, PA.—The power plant of the Greek coal mine, owned by John M. Greek, was destroyed by fire April 8, causing a loss of about $13,000.

CANONSBURG, PA.—The Washington Electric Light & Power Company, of Washington, Pa., has purchased nearly all of the stock of the Canonsburg Electric Light, Heat & Power Company. The new owners contemplate improvements to the plant, which will be operated until the transmission line is extended from the plant in Washington. A 24-hour service will be established when connections have been made with the Washington plant.

CARLISLE, PA.—The contract for the construction of the Cumberland Electric Railway from Carlisle to Newville, a distance of 12 miles, has been awarded to the Carlisle Construction Company. The cost of the road is estimated at $300,000.

HAZLETON, PA.—Preparations are being made by Jeremiah Woodring & Company for the installation of a new electrical unit in their power plant, which is said to be the forerunner of important extensions to the plant.

LEBANON, PA.—The Ona & Lebanon Rural Telephone Company has applied for a charter. The directors are: H. D. Wengart, Anson Wentling, Christian Wengart, A. H. Hetrick, and others.

PITTSBURGH, PA.—The Wisconsin Engine Company, of Corliss, Wis., has secured the contract for two single and two cross-compound engines to be connected to Western Electric generators with a total rating of 2400 kw in the Oliver power plant at Pittsburgh.

WASHINGTON, PA.—Plans have been completed by the Wellsburg & Bethany Street Railway Company for the construction of its railway from Bethany to Avella, a distance of seven miles.

ANDERSON, S. C.—Contracts for additional machinery to be installed in the Gluck Mills, Anderson, have been awarded by Robert E. Ligon, president, to Howard & Bullough American Machine Company, Pawtucket, R. I., and for electrical power equipment to the General Electric Company, Schenectady, N. Y.

GAFFNEY, S. C.—The Gaffney Manufacturing Company is making extensive improvements to its mill, which will be equipped to be operated by electricity.

GREENVILLE, S. C.—Plans are being made by L. M. Hubbard for the construction of an electric railway from Greenville to Paris Mountain, a distance of about seven miles. The residents of Greenville have raised a bonus of $30,000. L. M. Hubbard, with associates from Chicago, Ill., will finance the project.

BRYAN, TEX.—It is reported that J. T. Maloney, mayor, has offered for himself and associates to construct an electric railway between Bryan and College for a bonus of $10,000. A committee has been appointed to raise the fund. G. S. Parker is chairman of the committee.

HOUSTON, TEX.—The Citizens' Telephone Company has been placed in the hands of a receiver on petition of H. E. Huntington, a bondholder. It is stated that the receivership is preliminary to a reorganization of the independent system in Texas.

MOUNT PLEASANT, TEX.—Plans are being made to form a stock company for the purpose of constructing an interurban electric railway between Mount Pleasant and Red Mineral Springs. J. V. Moore, W. H. Seay and R. F. Lindsay were appointed as a committee to solicit subscriptions.

SAN ANTONIO, TEX.—It is stated that the San Antonio Gas & Electric Company has purchased the first unit for its new steam power station, consisting of a 2000-kw, General Electric, horizontal steam turbine, and three 500-hp Stirling boilers. W. B. Tuttle is vice-president and general manager.

SNYDER, TEX.—R. F. Brumback has been granted a franchise to install an electric light and power plant in Snyder.

EUREKA, UTAH.—Plans are being made by the East Tintic Development Company to place its plant in operation. A pipe line is being laid and an electric plant with sufficient output to supply 50 lamps will be installed at once.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company has commenced work on the rebuilding of the State Street-Murray line, at an estimated cost of $40,00; when completed the Murray end of the line will be extended to Bingham Junction, a distance of 4½ miles, with a branch to Sandy, from a point about half way between Murray and Sandy.

MONTPELIER, VT.—The Consolidated Lighting Company has entered into a contract with the Selectmen of the town of Barre for furnishing electricity for lighting the town for the coming year. The contract includes the villages of South Barre, East Barre, Websterville and Graniteville, and will require 323 incandescent lamps besides the arc lamps.

EDINBURG, VA.—The Valley Builders' Supply Company is considering the question of installing an electric light plant in Edinburg. J. C. Hutcheson is president.

RICHMOND, VA.—Bids will be received at the office of the city electrician, City Hall, Richmond, Va., until April 27 for furnishing material and labor required for the construction and equipment of an electric light plant, including construction of dams, raceways, foundations and other concrete work, rock excavation, radial brick chimney, turbines, intake gates and gear, trash racks, electric generators, steam turbines, exciters, switchboards, regulators, electric wiring, boilers, steam and water piping, railways, pumps, condensers, lamps and other accessories. Plans, specifications, proposal forms and form of contract may be seen at the above office and at the office of E. W. Trafford, consulting engineer, Chamber of Commerce Building, Richmond, Va. Proposals must be made upon forms supplied by the city. E. D. Richardson is chairman of committee on electricity.

BELLEVUE, WASH.—Application has been made to the Board of County Commissioners by D. C. Conover and E. P. Moran for a franchise to construct an electric railway over a portion of the county roads between Bellevue, on the east shore of Lake Washington, and a point on the west shore of Lake Sammamish, a distance of about 6½ miles. A franchise is also asked for a branch line from Medina Landing on Lake Washington, a distance of two miles, and also a branch line 1½ miles long on the west line of the railway.

BELLINGHAM, WASH.—Preparations are being made by the Cascade Valley Railway Company for the construction of an electric power plant on the Skagit River, seven miles above Marblemount.

ENTAIT, WASH.—The capital stock of the Entait Power Company has been increased from $50,000 to $200,000. The company is building a large plant, dam, canal and power house on the Entait River. Contracts have been placed for a large share of the output of the proposed plant. The company also contemplates furnishing electricity in Wenatchee.

GENEVA, WASH.—The Whatcom County Railway & Light Company is extending its transmission lines from Bellingham to Geneva.

NORTH YAKIMA, WASH.—The Yakima Valley Transportation Company has applied for a franchise to construct an electric railway on the roads of the Fruitvale district, and if granted the company will construct two railways, each three miles in length.

OAKVILLE, WASH.—S. K. Bowes and S. A. Wells have applied for a franchise to furnish electricity for lamps and motors.

PROSSER, WASH.—The Prosser Power Company is contemplating the construction of an entire new generating plant, two miles east of Prosser. The plant will be equipped with two units of 500 hp each. The company has taken over the water works system and franchises and electric light and power department of the Prosser Falls Land & Power Company, also the machine shop operated in connection with the plants. Edwin F. Benson is president; John Chisholm, vice-president, and Harry C. Benson, secretary, of the company.

SEATTLE, WASH.—The City Council has passed an ordinance providing for a system of cluster lamps on Broad Street.

SEATTLE, WASH.—It is reported that the Seattle-Tacoma Power Company contemplates extensive improvements to the Snoqualmie Falls plant and will increase the output to 30,000 hp.

WASHOUGAL, WASH.—Plans are being made by Cottrell & Son for the construction of a dam on the Washougal River, which will develop 1,000 hp. The dam will be located about 2½ miles from Washougal and will furnish power to generate electricity, which will be transmitted to Washougal and Camas, where franchises have already been secured to operate electric systems.

HUNTINGTON, W. VA.—The Ohio Valley Electric Railway Company is reported to have secured from the Chesapeake & Ohio Railway Company 38 miles of abandoned road between Barbourville and St. Albans, and will also construct 20 miles of new railway to provide a route between Huntington and Charleston, W. Va. W. C. Sproul, of Chester, Pa., president of the Kanawha Valley Traction Company, is interested in the project.

GREEN BAY, WIS.—The C. Killman Company's new planing mill has been completed. The mill will be equipped for electric motor drive.

HARTFORD, WIS.—Plans are being made by the Allenton-Kohlsville Telephone Company to construct about 20 miles of new telephone line during this season and also to rebuild part of its old lines.

HARTFORD, WIS.—Preparations are being made by the Hartford Canning Company to double the output of its plant and install new machinery to be electrically driven.

LA CROSSE, WIS.—The proposition to issue bonds for the construction of a municipal electric light plant will be voted upon at the April election.

MADISON, WIS.—The Interstate Power Company is making arrangements to furnish electricity in the lead and zinc districts to operate the mines, and is now placing contracts to furnish power.

MILWAUKEE, WIS.—It is reported that the Kopmeier Motor Car Company is planning to install an electric generator and will equip its plant throughout for electric motor drive.

RICE LAKE, WIS.—The Rice Lake & Northwestern Telephone Company and the Barron County Telephone Company are planning to extend their telephone lines this spring to take in several smaller towns.

WAUTOMA, WIS.—The Neshkora Electric Light Company, of Neshkora, has submitted a proposition to furnish electricity in Wautoma.

LARAMIE, WYO.—The Southern Wyoming Power Company has commenced work on the construction of the new electric light plant.

LOVELL, WYO.—The Rocky Mountain Bell Telephone Company has decided to sell its 13-mile line connecting Lovell with its main system to the Colony Telephone Company. The new owners expect to install new exchanges in Lovell and Cowley and propose to connect with Garland, Ralston, Penrose and Powell.

WINNIPEG, MAN., CAN.—We have been advised that two contracts have been awarded recently in connection with the Winnipeg power development at Point du Bois. The contract for line insulators was awarded to the Locke Insulator Manufacturing Company, of Victor, N. Y.; to the

Stuart Machinery Company, a contract for machineshop equipment, for $1,[illegible]. Work has commenced on clearing the right of way for the transmission line, which will be 75.5 miles in length.

OTTAWA, ONT., CAN.—The Ottawa Electric Railway Company is planning to construct extensions to its system during the coming summer, and will also rebuild several of its lines with heavier rails.

PORT ARTHUR, ONT., CAN.—Bids will be received by the Railway Commissioners for material required to complete the double track of the Port Arthur & Fort William Electric Railway to the Fort William boundary. About 20 miles of new track will be added to the railway during 1909. N. C. Pilcher, of Port Arthur, is general manager.

MONTREAL, QUE., CAN.—The Montreal & Southern Counties Railway Company, which proposes to construct an electric railway between McGill Street and several communities on the South Shore, it is said, will soon award contracts for electrical equipment for its proposed railway. Announcement has been made that work will soon commence on the construction of its substation and car barns at St. Lambert, Que.

MEXICO CITY, MEX.—The Veyan, Jean & Company are installing a large hydro-electric plant for the purpose of furnishing electricity in Mexico City. The company is building a canal from the Alameda River, from which power will be obtained to operate the plant.

QUERETARO, MEX.—The Compania Hydro-Electrica Queretana is planning to erect another dam on the San Juan River in the State of Queretaro to furnish additional power to operate its hydro-electric plant.

SALINAS, MEX.—The Compania Salinas de Mexico is equipping its large salt refining plant at Salinas, to be operated by electricity, which will be furnished from the plant of the Benito Juarez Mines Company.

SANTA ROSALIA, MEX.—The Compania Productora de Hielo y Electricidad is installing an electric light plant in Santa Rosalia.

New Industrial Companies.

THE AMERICAN STEAM APPLIANCE COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $5,000, by George S. Andres, M. K. Andres and Walter A. Weisner. The company proposes to manufacture machinery, engines and boilers.

THE DELTA ELECTRIC & MANUFACTURING COMPANY, of Chicago, Ill., has been chartered with a capital stock of $5,000 to manufacture screw-in grounding devices and other electrical appliances. The incorporators are: Weldell P. Slayton, Harry E. Kiester and Frank L. Belknap.

THE DUPLEX NON-ARCING TROLLEY COMPANY, of New York, N. Y., has been chartered, with a capital stock of $2,000,000, to manufacture electric trolleys and mechanical devices. The incorporators are Arthur Olney and Frederick J. Ryan, of Providence, R. I., and Walter R. Lee, of New York, N. Y.

THE ELLIOTT FURNACE APPLIANCE COMPANY, of New York, N. Y., has been chartered, with a capital stock of $100,000, for the purpose of manufacturing and installing machinery, boilers and fuel economizers. The incorporators are Thaddeus V. Elliott, William F. Marsh and Frank Martin, all of Brooklyn, N. Y.

THE ECONOMY LIGHT COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $100,000, by S. L. Shaeffer, W. V. Tyler, F. S. Abraham and S. J. Shaeffer, of Chicago, Ill. The company proposes to manufacture appliances for furnishing light and heat.

THE NATIONAL DICTOGRAPH COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $1,000,000, by a syndicate which has purchased from the General Acoustic Company, 1265 Broadway, New York, N. Y., exclusive rights, to manufacture and sell the dictograph. K. M. Turner will be president of the new company.

THE STEPHENS ENGINEERING COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $50,000, to do a general engineering and contracting business, by Claude D. Stephens, Alton C. Stephan and Isaac Thompson, Jr.

THE TERNELLE ELECTRICAL COMPANY, of Portland, Maine, has been chartered for the purpose of dealing in all kinds of electrical apparatus. The company is capitalized at $200,000, and the officers are: Frederick P. Lewis, president, and Bion Bradbury, Jr., treasurer, both of Portland.

THE WESTCHESTER ELECTRIC SUPPLY COMPANY, of White Plains, N. Y., has been incorporated, with a capital stock of $2,500, by Irving W. Austin, of White Plains, N. Y.; Edward P. Barrett, Katonah, N. Y., and Rutherford B. Washburn, of White Plains, N. Y.

New Incorporations.

MONTGOMERY, ALA.—The Lewis Creek Railroad Company has been incorporated with a capital stock of $30,000 to construct a railway 40 miles in length, connecting Toinette and Skidder in Washington County. The incorporators are: S. R. R., H. W. and G. E. Cochrane, of Tuscaloosa, Ala.

FRESNO, CAL.—The Sierra Power Company has filed articles of incorporation for the purpose of developing the water power of the San Joaquin River, to be utilized to generate electricity. The company is capitalized at $100,000, and the incorporators are: C. K. Kirby, Jr., of Fowler; John W. McLaughlin, of Fresno; C. K. Kirby, Jr., of Fresno; F. W. Kirby, of Fowler, and D. C. McLaughlin, of Fresno.

RIVERSIDE, CAL.—The Corona Union Telephone & Telegraph Company, capitalized at $25,000, has been incorporated by J. G. Jameson, E. J. Genereaux, C. M. Scoville, G. E. Snidecor, W. L. Prizer, W. L. Peelerf and D. Lord, all of Corona.

SAN FRANCISCO, CAL.—The South River Electric Company, capitalized at $[illegible], has been incorporated by D. C. Degarrett, E. C. Hegler, S. Harris, C. M. Lindsay, W. P. Swart, A. V. Massey and Carl Senn.

SAN FRANCISCO, CAL.—The San Benito Light & Power Company has been incorporated, with a capital stock of $250,000 and the following directors: Charles W. Waller, Perry M. Reeves, of San Francisco; Thomas P. Pheby, Jr., of Oakland; H. H. Pitts, of San Mateo, and H. M. Wright, of Berkeley. The company proposes to generate and sell gas and electricity and to control a gas plant in Hollister.

CHICAGO, ILL.—The Oxford Junction Light, Power & Mill Company has been incorporated with a capital stock of $50,000 to operate a heat, light, power and milling plant. The incorporators are: W. C. Hill, A. Brothman, H. C. Smith and J. A. Swanson, all of Chicago, Ill.

HOLLAND, IND.—Party line No. 30, connected to the Holland Exchange, has filed articles of incorporation. Henry Welmeyer, Fred. Kuck, Christ. Ring and Fred. Satkamp are directors.

KOKOMO, IND.—The John R. Goyer Telephone Company has filed articles of incorporation. John R. Goyer, O. A. Clark and Joseph Hessler are directors.

WEBSTER CITY, IA.—The Air Line Telephone Company has been organized for the purpose of constructing telephone lines into Independence and Beliraburgs townships. Irving Lasher is secretary.

BANGOR, MAINE.—The Winooski Valley Power Company has been incorporated with a capital stock of $100,000 to generate and furnish electricity and gas, etc. The officers of the company are: J. Wilson, president, and L. B. Miller, treasurer, both of Bangor, Maine.

LINCOLNVILLE, MAINE.—Articles of incorporation have been filed for the Lincolnville Water Power Company, with a capital stock of $100,000. The company proposes to furnish electricity for lamps and motors in the towns of Lincolnville and Northport; also to engage in the manufacture of lumber and wood products. The officers are: E. H. Coleman, president, and J. P. Cilley, treasurer.

DETROIT, MICH.—The Leland Light & Power Company has been incorporated, with a capital stock of $30,000, by Charles S. and M. H. Abbott, of Detroit, and others.

KANSAS CITY, MO.—Articles of incorporation have been filed for the Blue Valley Traction Company by U. S. Epperson, J. M. Lowe, E. M. Sweetman, C. C. Carver and others. The company is capitalized at $300,000 and proposes to construct an electric railway from Raytown to Kansas City, a distance of 10 miles.

HELENA, MONT.—The Montana Rapid Transit Company has been incorporated with a capital stock of $5,000,000 for the purpose of constructing an electric railway from Helena to Butte, a distance of 72 miles. The officers are: Joseph K. Toole, president; H. G. Pickett, vice-president, and E. C. Day, secretary.

FULTON, N. Y.—Articles of incorporation have been filed for the Niagara-Oswego Power Company for the purpose of furnishing electricity for lamps and motors in Fulton. The company will have offices and a transformer station in this city, and in addition to furnishing electricity generated by Niagara power it will also purchase electrical energy developed by the Oswego River. The company will soon make application to the City Council for a franchise. The officers of the company are: S. B. Storer, of Syracuse, president; M. S. Powell, of Fulton, vice-president and general manager; E. M. White, of Phoenix, secretary and treasurer.

HENDERSONVILLE, N. C.—The Green River Power Company has been chartered with a capital stock of $100,000 by U. S. Staton, of Hendersonville; J. M. Torrence, of Waynesville, N. C., and W. A. Mauney, of Kings Mountain, N. C.

ATWATER, OHIO.—The Atwater Telephone Company has been organized, with a capital stock of $10,000, by H. S. Wilson and Frank Robison, of Palmyra; W. E. Craig, of Milton; S. W. Wilson, of Atwater, and H. L. Beatty, of Ravenna.

JOSEPH, ORE.—The Wallowa Lake Light & Power Company has been incorporated with a capital stock of $15,000 by J. H. Dobbin, Aaron Wade, L. B. Caviness, L. Knapper and Albert Warsweiler. The company has purchased a site for its power plant. Water will be piped from the lake, securing a fall of 147 ft., capable of developing about 3000 hp. The company proposes to supply Joseph, Enterprise and the ranches of Alder, Slope and Prairie Creek with electricity for lamps and motors.

PORTLAND, ORE.—Articles of incorporation have been filed for the Oregon Light & Power Company, with a capital stock of $2,000,000, by H. H. Riddell, A. McMurphey and N. L. Bailey. The company proposes to erect a hydro-electric plant on Eagle Creek in the Cascade Mountains and transmit electricity to Portland. The cost of the power plant, equipment and transmission lines is estimated at about $1,000,000.

TOPTON, PA.—The Inter-County Electric Railway Company has been incorporated, with a capital stock of $250,000, for the purpose of con-

structing a high-speed electric railway between Lyons and Allentown, a distance of 21 miles. The directors are: Maxwell H. Bochow, of Topton, president; George F. Souwers, Bateman Saddington, Joshua H. Fisher and Fred R. Perry.

HOUSTON, TEX.—The Brown-Woods Electric Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: D. Russell Brown, D. F. Woods, Russell Stapp and Frank C. Jones.

SOUTH ROYALTON, VT.—The South Royalton Power Company has filed articles of incorporation with the Secretary of State for the purpose of furnishing electricity in Royalton and South Royalton for lamps and motors and other purposes. The incorporators are: A. Curtis Fletcher, Ruth L. Howe and Robert B. Keltie, of Boston, Mass.; James G. Harvey, of White River Junction, and G. S. Edson, of West Lebanon.

CHARLES CITY, VA.—The Charles City Telephone Company has been incorporated and the following officers elected: H. S. Saunders, president; J. M. Bell, secretary, and L. M. Nance, treasurer.

CARP, ONT., CAN.—The Monk Rural Telephone Company has been organized with a capital stock of $30,000 and the following named officers: Robert Richardson, president; J. W. McElroy, vice-president; G. H. Groves, secretary and treasurer. The company will take over Monk rural telephone plant and will enlarge the system, making extensions to several towns, which will require the erection of 120 miles of wire.

Legal.

FALLEN ELECTRIC LIGHT WIRE AS EVIDENCE OF NEGLIGENCE.—In a recent action brought in Maryland to recover damages for an injury to a small boy received by coming in contact with an electric light wire while passing along a public avenue, it was held by the Court of Appeals of that State that the fact that the electric wire fell down into the street was sufficient evidence of negligence on the part of the company to allow the case to go to the jury. Walter vs. Baltimore Electric Company et. al, Court of Appeals of Md., 71 Atl. Rep., 953.

MOVING BUILDING UNDER ELECTRIC LIGHT WIRES.—The plaintiff in an action recently brought against an electric lighting company in New Hampshire was a carpenter, who had been injured by contact with one of the company's wires while assisting in the moving of a small house through the streets of Portsmouth. One of the men engaged on the work had telephoned to the superintendent of the street railway company and the latter sent a lineman, who worked for the street railway company as well as for the defendant, to take charge of the work of getting the building under the wires. It appeared that the wires were uninsulated and that the defendant had no license to place its wires across the street at the point where the accident occurred. The evidence also tended to show that the condition of the wires was dangerous, that the defendant was guilty of negligence in their construction and maintenance. Notwithstanding this, a verdict in favor of the plaintiff was set aside and a new trial ordered for the reason that it did not appear from the evidence that the superintendent of the street railway company had authority to direct the lineman to take charge of the work. Clough vs. Rickingham County Light & Power Company, Supreme Court of New Hampshire, 71 Atl., 223.

Personal.

MR. WILLIAM JENKS, of Woonsocket, R. I., has accepted the position as manager of the Bristol County Gas & Electric Company, at Bristol, R. I.

MR. D. B. RUSHMORE, of the General Electric Company, delivered a lecture April 2 before the Pittsfield A. I. E. E. Section on the application of electricity to steel mills.

MR. FRANK T. CLARKE, of the engineering department of the Commonwealth Edison Company, Chicago, has resigned to accept a position with the Pacific Gas & Electric Company, of San Francisco.

MR. T. E. DIBBINS, who has been manager of the supply department of the Pacific Coast office of the General Electric Company, has been promoted to be assistant Pacific Coast manager for that company, with headquarters at San Francisco.

HON. CHARLES ALGERNON PARSONS, inventor of the type of steam turbine that bears his name, is on a visit of 10 days to this country. He is accompanied by Mr. S. F. Prest, one of the directors of the Parsons Marine Turbine Company.

MR. A. J. FAULDER, formerly engineering assistant with the New York & New Jersey Telephone Company, has been appointed inspector of light and power in the Borough of Richmond under the Department of Water Supply, Gas and Electricity, New York City.

MR. GEORGE TAYLOR, for the past three years connected with the testing and construction department of the General Electric Company at Schenectady, has lately resigned to become a partner in the Taylor Machinery Company, 8 Oliver Street, Boston, Mass.

DR. RICHARD C. MACLAURIN, the new president of the Massachusetts Institute of Technology, will formally assume office June 7, with appropriate ceremonies, in Symphony Hall, Boston. A general reunion of the Institute graduates and many social events in the nature of celebrations are planned at this time.

MR. TURE N. STEEN, the Swedish electrical and mechanical engineer, who has been visiting this country for the past month, has returned home. His address in Stockholm is 4 Dalagatan, where he will be glad to receive inquiries and advices as to the introduction of electrical and mechanical inventions and appliances into Sweden. He is in command of capital for manufacturing purposes.

MR. FRANK N. BOYER, assistant manager of the Chicago office of the General Electric Company, who, accompanied by Mrs. Boyer, has been making an extended sojourn on the Pacific Coast and in the Hawaiian Islands for health and recreation, is on his way back to Chicago, where he is expected about May 1. Mr. Boyer's friends will be pleased to know that he reports that he never felt better in his life.

MR. WILLIAM A. BAEHR has opened an office as consulting engineer at 1943 Commercial National Bank Building, Chicago. Mr. Baehr was chief engineer of the Laclede Gas Light Company, of St. Louis, from 1903 to 1907. Before that he was with the Denver Gas & Electric Company, and he has built electric plants in Memphis, Tenn.; Beloit, Wis., and elsewhere. In addition to his engineering practice, Mr. Baehr will represent in Chicago Messrs. Bartlett, Hayward & Company, of Baltimore, Md.

MESSRS. L. B. MARKS AND J. E. WOODWELL, consulting engineers, Terminal Building, New York City, have just moved to larger offices in the same building. The firm and its associates cover broadly the field of mechanical, electrical and illuminating engineering and now have under way the preparation of plans and specifications for the equipment of a large number of buildings. The firm is also retained for special engineering services by several manufacturing companies in the electrical and illuminating line.

MR. FRANK F. KINNEY, acting head of the testing department of the Commonwealth Edison Company, Chicago, has resigned to become general manager of the Chicago Electric Meter Company, which manufactures, among other devices, a printing attachment for watt-hour meters invented by Mr. Kinney. During his service with the central-station company Mr. Kinney paid particular attention to the improvement of meters. Mr. E. O. Schweitzer has been appointed head of the testing department of the Commonwealth Company, with Mr. W. A. Durgin as first assistant.

MR. GEORGE W. WELLS, who for the past two years has been superintendent of the mechanical department of the West Penn properties, Connellsville, Pa., has resigned to represent the H. W. Johns-Manville Company as manager of its electrical department in New Orleans. Mr. Wells is a native of Boston and was for a number of years with the General Electric Company, having taken a shop course at its Lynn works and afterward having served in the engineering and sales departments. At a later date he became connected with the Stone & Webster Corporation and was manager of the electric lighting and street railway systems in Tampa, Fla.

Obituary.

MR. AARON K. STILES died from heart disease at his winter home, at Lajolla, Cal., on March 31. Twenty-five years ago Mr. Stiles was one of the conspicuous figures in the electrical manufacturing industry in the United States. His claim to distinction, in an electrical sense, rests chiefly on the fact that he had the foresight to recognize the great practical inventive ability of the late Mr. Chas. J. Van Depoele. Mr. Stiles financed Mr. Van Depoele, and thus played an important part in the introduction of electric lighting and electric railways in this country. Mr. Stiles was born in Canada, although of American parents, in 1834. He located in Chicago in 1859, and removed to Sycamore, De Kalb County, Ill., in 1862. He was county clerk of De Kalb County from 1853 to 1854, and was prominent in Republican politics. About 1873 he became interested in the barbed wire fence business, owning half of the Kellogg barbed wire patents, under which the manufacture was carried on. In this business he realized a fortune. Becoming interested in the work of Van Depoele, Mr. Stiles assisted the inventor to form the Van Depoele Electric Light Company, in Chicago, about 1882. Subsequently Mr. Stiles became the president and principal owner of this company, and he pushed the electrical business with great vigor, for he was an ardent, energetic man, with much confidence in his own judgment. It is said that this company established the first electric arc lights in Chicago and was second only to the Brush Company in making such machines in the United States. At first, in 1884, the Van Depoele Company used electric motors for driving machinery in its shop. Mr. Van Depoele was firmly convinced that the electric railway was practicable, and in 1883, backed by Mr. Stiles, he built the first trolley car. In 1884 the company was reorganized as the Van Depoele Electric Manufacturing Company, and it exhibited



A. K. STILES

an electric railway in operation at the Toronto Exposition of 1883. Here the underrunning trolley was used for the first time. Mr. Stiles maintained that the credit for this invention was his, the idea coming to him in passing a cooper shop that something like an oak barrel stave might be attached to the top of the car, maintaining contact with the overhead wire by pressing against it at the upper end of the stave. Mr. Van Depoele recognized the merit of the idea, and it is said that from this crude conception the underrunning trolley, practically as in use to-day, was developed by the great inventor whose name it bears. In 1888, when the Van Depoele patents were purchased by the Thomson-Houston Electric Company, the Van Depoele Company had equipped about 14 electric railways. At this time Mr. Stiles retired to Streator, Ill., and for 15 years he and his sons were owners of the Streator Gas & Light Company, selling out about two years ago. Thereafter Mr. Stiles invested largely in ranch lands in Montana. His wife died eight years ago, and he is survived by two sons and a daughter—William A. Stiles, Chicago; Everell D. Stiles, Miles City, Mont., and Mrs. John E. Brower, Grand Rapids, Mich.

MR. HERBERT D. SCRIBNER, Pacific Coast manager for the Allis-Chalmers Company, committed suicide in his offices in San Francisco on April 3. His act was brought on by severe and prolonged illness. Mr. Scribner was one of the best known and popular electrical men on the Pacific Coast. He went to the coast about 20 years ago at the age of 23 and was engaged in the construction of the first electric railway of that section, at Seattle. Afterward he was associated with Howard C. Holmes, of San Francisco, in building electrical lines at Stockton, Cal.; Tacoma, Wash; Vancouver, B. C., and between Oakland and Hayward, Cal. He was the San Francisco manager of the Westinghouse Electric & Manufacturing Company for many years, leaving that company to accept the management for the coast of the Allis-Chalmers Company. He leaves a widow and three children at his home in Alameda.

Trade Publications.

RECORDING GAGES for pressures and vacuums are described and listed in catalog No. 102 of the Bristol Company, Waterbury, Conn.

ENCLOSED FUSES of the refillable type are illustrated, listed and described in a booklet issued by the Crescent Company, 103 West Adams Street, Chicago, Ill.

SECTION SWITCHES.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4654 devoted to section switches rated at 200, 400, 600 and 1200 amp.

PHOSPHOR BRONZE.—Price List No. 24 of the Phosphor Bronze Smelting Company, 2200 Washington Avenue, Philadelphia, deals with phosphor bronze alloys in ingots and castings, rods, wires, ropes, sheets and plates.

ELECTRIC HARDENING FURNACES.—Bulletin No. 4655 of the General Electric Company, Schenectady, N. Y., gives a detailed description of an electric furnace for use in connection with tempering and annealing.

FANS.—Catalog No. 70 of the Robbins & Myers Company, Springfield, Ohio, is an artistic publication, giving much information concerning "Standard" ceiling, desk, bracket oscillating and exhaust fans for both direct-current and alternating-current circuits.

MOTOR-STARTING DEVICES.—Pamphlet No. 3768, of the General Electric Company, Schenectady, N. Y., contains a comprehensive list of motor speed-controlling devices and both automatic and non-automatic starters. Each device is illustrated and briefly described.

TANTALUM LAMPS.—Booklet No. 3737 of the General Electric Company, Schenectady, N. Y., states the advantages to be derived from the use of tantalum lamps for the illumination of railroad cars, and contains a reference to the steam turbo-generator outfit designed for use in connection with the illuminating system on trains.

NERNST LAMP FIXTURES.—The Nernst Lamp Company, Pittsbugh, Pa., has issued an advance bulletin devoted to chandeliers and ornamental fixtures for Nernst lamps. A complete price list is given of all of the fixtures, many of which are of new design. Lamps for both direct-current and alternating-current circuits are listed.

INSULATION.—The John C. Dolph Company, 153 West Avenue, Long Island City, New York, has issued an American edition of its catalog on insulation specialties, which is also printed in French, German, Italian and Spanish. The specialties include varnish compounds for use with armature and field coils and dynamos and transformer core plates.

STEAM TURBINES.—The Kerr Turbine Company, Wellville, N. Y., has issued as Bulletin No. 8 a well-illustrated description of the Kerr steam turbine. This turbine utilizes the principle of the Pelton water wheel; it is of the multiple bucket and nozzle impulse type. Illustrations are given of turbines directly connected to generators, pumps and ventilating fans.

EXTENSION DIFFUSERS.—The General Electric Company, Schenectady, N. Y., in Folder No. 3761, entitled "Extension Diffusers," describes a diffuser for use in connection with incandescent lamps designed to meet the demand for an incandescent lamp fixture, embodying æsthetic as well as the scientific principles required for certain high-grade incandescent lighting. These diffusers are especially recommended for store lighting.

DIRECT-CURRENT MOTORS.—The Robbins & Myers Company, Springfield, Ohio, has issued as "Standard Motor Book" No. 71, an illustrated catalog covering its complete line of direct-current motors and generators and special types of motors. The regular line of motors range in rating from 0.033 hp to 15.0 hp, while special motors are built for all services to which motors can be put.

BELL-RINGING TRANSFORMERS.—In Folder No. 3765 the General Electric Company, Schenectady, N. Y., illustrates and describes a small transformer for use in connection with the operation of electric call bells. The idea in the use of the transformer is the elimination of the usual battery for this purpose and the utilizing of energy from the lighting circuit. The transformer will operate on voltages ranging from 100 to 130 at the usual lighting frequency.

CURTIS TURBINE GENERATOR.—A handsome publication devoted to the Curtis turbo-generator has recently been issued by the General Electric Company under the number 4653. This bulletin is elaborate as to details of construction, containing interior views and cross-sections of various parts of turbine and generator. It describes large and small turbines of vertical and horizontal types, and contains illustrations of numerous representative Curtis turbine installations.

Business Notes.

JOHN F. ZERBEY, JR., electrical constructor, has opened an office at Fourth and Arch Streets, Pottsville, Pa.

KATES & COMPANY.—Kates & Bok, exporters of machinery and supplies, 79 Wall Street, New York, have changed their firm name to Kates & Company.

MR. F. F. FOWLE, consulting electrical and telephone engineer, Chicago, has moved his office from Room 736, Marquette Building, to Room 937 in the same building.

THE BUCKEYE ENGINE COMPANY, Salem, Ohio, announces the appointment of Mr. Louis Bendit as Kansas City sales manager, and of Mr. J. R. Detweiler, district manager, Wichita, Kan.

NEW FLAME ARC LAMP.—The Excello Arc Lamp Co., New York, is introducing the new "Duplex" Excello arc lamp to the trade. This lamp has recently been the subject of favorable articles in foreign technical journals.

COPPER-CLAD STEEL WIRE.—The Duplex Metals Company, Philadelphia, has been informed that the only wire that stood up in the Northwest during the great sleet and wind storm of early March was its copper-clad steel wire.

THE INTERNATIONAL ELECTRICAL CORPORATION is preparing to open a factory in Portland, Maine, for the manufacture of storage batteries. The company states that it has the right to manufacture and sell in this country the Ternelle battery, an Italian invention, which has been in successful operation in Italy for a number of years.

MR. JOHN W. FREEMAN has been appointed manager of the Sprague Electric Company's Pittsburgh office to succeed Mr. F. W. Barry, who recently resigned. Mr. Freeman has been associated with the Pittsburgh office for some time and is fitted by training and experience to give efficient attention to the Sprague company's business in that territory.

DOSSERT & COMPANY, New York, report the receipt of large orders for solderless cable taps ranging in size from 6 to 500,000 circ. mils and for various types of lugs from the Buick Motor Company, Flint, Mich.; Edison Electric Illuminating Company, Brooklyn; General Electric Company; Southern Wisconsin Power Company; Electric Appliance Company, and E. C. Tibbals & Company, of Brooklyn.

MR. FRANK WELLS HALL has been appointed manager of the Philadelphia office of the Sprague Electric Company. Mr. Hall was formerly connected with the Sprague Electric Company, both in the New York and Chicago offices in engineering and sales capacities. His knowledge of the Sprague Electric products, combined with his wide circle of acquaintances and his extensive business and engineering experience, will undoubtedly win for him a large clientèle in his new territory. Mr. Hall assumes his new duties April 15, 1909.

FACTORY FLAMING-ARCS.—The Stave Electrical Company has recently received an order for approximately 100 Stave flaming-arc lamps from the Weston-Mott Automobile Company, of Flint, Mich. These lamps are being used throughout the different departments of the factory. The adoption of an installation of Stave flaming-arc lamps has resulted in all-around economy in operation and has made the Weston-Mott shops one of the best lighted in the country. The clear orange color and even distribution of the light have also increased the efficiency of the staff, and several other automobile concerns are now considering the installation of Stave flaming lamps.

THE DUNTLEY MANUFACTURING COMPANY, of 305 Dearborn Street, Chicago, Ill., incorporated under the laws of Delaware with a capital stock of $500,000, has announced its permanent organization. The company, which manufactures vacuum cleaners, gasoline-electric handcars and calculating machines, has been in operation sixty days, is operating a plant in Chicago and has four other factories at other points under contract. Mr. Duntley was formerly president of the Chicago Pneumatic Tool Company. The officers of the company are: J. W. Duntley, president; A. W. Maconochie, vice-president; F. A. Rautenberg, secretary, and Eugene McComas, treasurer.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 6, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

916,994. ELECTRIC HEATER; G. W. Carpenter, J. Rasmussen and F. B. McCrosky, Ontario, Cal. App. filed April 16, 1908. An electric heater having a body portion with rounded grooves in its upper face and cores disposed in said grooves, the cores having flat upper faces and rounded surfaces, thus confining the heat near the bottom of the plate.

917,000. RHEOSTAT; L. S. Chapman, Schenectady, N. Y. App. filed June 24, 1909. A pair of circuit arms are yieldingly held together, the arms being moved together to a predetermined position and one arm continuing its movement, together with a latch which prevents the return of arm from the predetermined position until the other arm returns and trips the latch.

917,003. SEMAPHORE SIGNAL; A. G. Clark, Schenectady, N. Y. App. filed July 31, 1908. An electric motor semaphore signal in which a gear wheel drives the signal from the motor and in which the arm is locked to the gear wheel in one direction and unlocked when the gear wheel returns, thus preventing the signal from moving to danger to clear except when driven by the motor.

917,011. PRINTING TELEGRAPH; A. C. Crehore, Yonkers, N. Y. App. filed Jan. 16, 1905. A series of magnets at the receiving station are actuated by a typewriter at the sending station and operate the keys of the typewriter at the receiving station. Improvement on the prior system of the same patentee.

917,017. MAGNETIC DEVICE FOR TELEPHONE SYSTEMS; W. W. Dean, Chicago, Ill. App. filed Jan. 6, 1904. Common battery telephone system in which the number of individual apparatus and contacts are reduced to one set. The magnets of the heretofore separate relays are included in a single structure and provided with a single set of contacts.

917,018. ELECTRICAL APPARATUS AND METHOD OF MANUFACTURING AND OPERATING THE SAME; J. T. H. Dempster, Schenectady, N. Y. App. filed Aug. 23, 1904. A condenser is placed in a fluid insulating bath of oil under pressure which causes the air in the dielectric to be taken up by the oil.

917,023. MOTOR-CONTROLLING DEVICE; G. H. Dorgeloh, Schenectady, N. Y. App. filed June 24, 1908. A starting rheostat, an auxiliary resistance, an electromagnet connecting said resistance in parallel with the motor armature during a portion of the movement of the rheostat and excluding the auxiliary resistance during the remainder of the movement.

917,025. ELECTRIC SWITCH; W. Drake and L. C. Hatch, Black Earth, Wis. App. filed Jan. 21, 1907. Cut-outs for fuse boards for telephone switches comprising a plurality of contacts, a switch blade supported on links at each end and a handle for giving the blade a movement.

917,031. INSULATOR FOR HIGH TENSION TRANSMISSION LINES; C. E. Eveleth, Schenectady, N. Y. App. filed Sept. 3, 1908. For electric railways which employ a catenary system of suspension of the working conductor, to avoid breakage of insulators by wanton throwing of stones. Introduces breakage lines in the petticoat of the insulator so as to limit the breakage to the outer portions thereof.

917,040. ELECTRIC TRANSFORMER FURNACE; O. Frick, Saltsjobaden, Sweden. App. filed March 2, 1904. The mass to be heated is on an annular hearth and acted upon by induction from a primary coil.

917,041. CARBON FEEDING DEVICE FOR ARC LAMPS; R. Fritz, West Hoboken, N. J. App. filed Feb. 28, 1908. An electric arc lamp with an automatic intermittent feed of electrodes, including a star wheel engaging the carbon near the electrode, the carbon descending by gravity.

917,047. SECONDARY ELECTRIC CLOCK; P. G. Giroud, New York, N. Y. App. filed Nov. 15, 1907. For advancing the hands of a clock step by step and holding them in position against displacement. Details.

917,053. ELECTRIC HEATER; R. L. Hailey, New York, N. Y. App. filed June 11, 1908. A smoothing iron in which the bottom plate is heated electrically by means of a single layer of resistance wire. A thin sheet of insulation is interposed between the wire and the plate.

917,061. FIRE ALARM SIGNAL SYSTEM; B. B. Hatch, Boston, Mass. App. filed July 15, 1908. Means for automatically indicating that the battery or batteries are out of order, the system being a closed circuit one with an alarm bell so arranged that the failure of the battery, etc., gives an alarm.

917,064. VENTILATING SUPPORT FOR ARMATURE TEETH; T. Hibbard, Minneapolis, Minn. App. filed Nov. 17, 1905. The ventilating support is applied between the laminas composing the armature and the end plates and consists of a plurality of U-shaped pieces of metal or teeth.

917,069. CLAMPING EAR FOR TROLLEY WIRES; R. L. Hoffman, Schenectady, N. Y. App. filed Oct. 8, 1907. A clamping ear for suspending the trolley wire, comprising two jaws, each having an elevated shoulder at one side with means for forcing down the shoulders so as to clamp the wire, by turning a nut.

917,070. IMPELLING DEVICE FOR CIRCULATING SYSTEMS; E. P. Holly, Roxbury, Mass. App. filed March 23, 1904. For securing circulation of ammonia, etc., by means of a motor driven electrically. Makes use of a plurality of motors driving a screw to feed the liquid, and throws in one motor when the other stops.

917,095. SPONGE INDICATING AND ALARM DEVICE; F. Mersfelder, Sr., Canal Dover, Ohio. App. filed April 25, 1908. Gives an alarm when the baker dough has risen the right amount.

917,099. ELECTRIC ARC LAMP; R. Monasch, Berlin, Germany. App. filed Feb. 20, 1908. Means for starting a lamp by heating the arcing point by means of an auxiliary arc.

917,103. WIRELESS TELEGRAPHY; I. Morgas, Wilkesbarre, Pa. App. filed Oct. 7, 1905. Produces different spark frequencies without using interrupters. Inserts inductance in the primary circuit of an oscillatory system by pressing a key.

917,104. MAGNETIC WAVE DETECTOR; I. Morgas, Wilkesbarre, Pa. App. filed Sept. 29, 1908. A stationary magnet and a coil of conducting magnetic material rotating in the field of the magnet, together with means for rotating the coil and for conducting oscillations through the coil, the oscillations being rendered manifest by an inductive apparatus.

917,130. METER; W. H. Pratt, Lynn, Mass. App. filed May 4, 1904. An integrating watt meter in which an electric motor drives the wheel and permanent magnets act as a brake. The field coil is a ribbon wound on edge and the armature is spherical.

917,137. ILLUMINATING DEVICE; C. A. Robinson, Sitton, Colo. App. filed June 20, 1908. Two hollow spheres carry cone-shaped reflectors, in each of which an electric light is secured. They are arranged one above the other on transverse axes and rotated.

917,138. MAGNETIC WEDGE; C. Robinson, Schenectady, N. Y. App. filed Jan. 8, 1907. For retaining wedges closing the slots in the armature, consisting of a bar composed of metal (steel) having an inner layer of non-magnetic material.

917,145. ELECTRICAL SIGN RECEPTACLE; F. J. Russell, New York, N. Y. App. filed Dec. 11, 1907. An electrical receptacle for signs, receiving the sockets of incandescent lamps. It is made in two pieces of telescopically and adjustably related members.

917,147. ARC LAMP; R. H. Read, Schenectady, N. Y. App. filed Aug. 23, 1906. Means for starting arc lamps with titanium electrodes, comprising a clutch for raising the upper electrode, a shunt around the arc and a circuit closer in the shunt adapted to be closed by the clutch when the upper electrode drops.

917,159. FILAMENT FOR ELECTRIC INCANDESCENT LAMPS; John Johannes Schilling, Halensee, Germany. App. filed Dec. 24, 1906. The process of producing a metallic filament for lamps which consist in mixing finely powdered metal and heating the mixture.

917,163. WIRE SUPPORT; J. F. Scott, Highland Park, Ill. App. filed Nov. 5, 1906. For supporting trolley wires in which a pair of depending hooks interlock with the span wire and an abutment engages the wire between the hooks and holds them in interlocked position.

917,176. METHOD OF RECOVERING METALS; W. O. Snelling, Pittsburgh, Pa. App. filed Sept. 18, 1908. For getting tin from cassiterite by arranging it in contact with an electrode in an electrolyte capable of liberating hydrogen and passing a current through it.

917,181. SINGLE-PHASE ALTERNATOR; C. P. Steinmetz, Schenectady, N. Y. App. filed June 10, 1907. A synchronous single-phase alternator having a polyphase armature winding and a single-phase external circuit connected to one phase of the winding and a reactive winding connected to another phase of the winding.

917,183. MOTOR-CONTROLLING DEVICE; J. P. Tarbox, Washington, D. C. App. filed June 30, 1908. A starting resistance, a controlling member therefor, a solenoid in circuit with the motor which shifts the member as the motor current varies, an operating member having a bias to starting position latched to the controlling member, a no-voltage magnet and means for unlatching the members and releasing the controlling member when the operating member engages the magnet.

917,187. ELECTRICAL MEASURING INSTRUMENT; E. Thomson, Swampscott, Mass. App. filed Nov. 13, 1908. Comprises a support on two coils suspended from the support together with means for supplying current to the coils and indicating means for showing the movement between the coils.

917,188. DYNAMO ELECTRIC MACHINE; L. A. Tirrill, Lynn, Mass. App. filed Nov. 19, 1904. An electric automobile motor with most of its parts of standard size, and having auxiliary heads secured to the ends of the annular field rings.

917,189. SYSTEM OF MOTOR CONTROL; J. F. Tritle, Schenectady, N. Y. App. filed July 1, 1908. For two or more locomotives driven by induction motors in parallel, which are started by switches and whose speed is controlled by liquid rheostats in the secondary circuits of the motors.

917,190. MOTOR-CONTROL SYSTEM; J. F. Tritle, Schenectady, N. Y. App. filed Nov. 14, 1908. Particularly for induction motors in which a plurality of motors drive a common load and in which the short-circuiting switches for the several motors are closed automatically in succession.

917,195. ELECTRIC OVEN; T. Van Aller, Schenectady, N. Y. App. filed May 28, 1906. For heating the air and for cooking. Provides a stove within the heater.

917,197. TRAMWAY POINT; E. Veevers and G. H. Butterworth, Liverpool, England. App. filed April 11, 1908. Closes the switch by means of an electromagnetic apparatus without compelling the driver to leave the car.

917,200. ELECTRODE FOR SEARCHLIGHTS; H. Viertel, Charlottenburg, Germany. App. filed Oct. 25, 1907. Arranges the electrodes so that they converge and the positive electrode is made oval or rectangular so as to form a flat burning surface instead of a crater, thus improving the distribution of light.

917,207. INSULATOR; A Weber, Jr., Schenectady, N. Y. App. filed July 21, 1905. An insulator in two parts, each part cylindrical. Details.

917,209. SWITCH FOR ELECTRIC CIRCUITS; E. B. Wedmore, Rugby, England. App. filed Oct. 16, 1906. Switch for controlling circuit of electrically measuring instruments, the switch having a low contact resistance, provides means for tightening the brushes into close relation with the contacts.

917,212. ENVELOPE FOR VAPOR ELECTRIC CONDUCTORS; E. Weintraub, Schenectady, N. Y. App. filed June 15, 1903. Provides an exhausted outer envelope. The tube [illegible] the mercury vapor.

917,[illegible]. RINGER FOR TELEPHONE SYSTEMS; K. W[illegible], Schenectady, N. Y. App. filed Feb. 6, 1908. For harmonic selective signaling in which the armature is [illegible] at one end which avoids the motion of the armature, thereby avoiding the [illegible].

917,[illegible]. MOTOR CONTROL SYSTEM; H. E. W[illegible], Schenectady, N. Y. App. filed Aug. [illegible]. For electric systems [illegible] wherein the current [illegible] the motors is [illegible] by a generator driven by an oil or gas engine. The control of the motors is semi-automatic.

917,223. BRUSH HOLDER; E. R. Whitney, Lynn, Mass. App. filed June 24, 1904. A helical spring presses the brush against the segments, and the brush-carrying member is prevented from moving into contact with the segments by a stop.

917,224. INDUCTION MOTOR; J. B. Wiard, Lynn, Mass. App. filed Feb. 20, 1906. An induction motor having a laminated motor body provided with tunnels with switch contacts within the tunnels, thus controlling the resistance of the motor winding. The switch is worked by a push button passing through the bearing of the shaft.

917,229. RECEPTACLE FOR INCANDESCENT LAMPS; H. C. Wirt, Schenectady, N. Y. App. filed Feb. 27, 1906. Sockets for incandescent lamps used for indicating the presence or absence of currents on switchboards. A fuse is arranged in the socket. Details.

917,235. AUTOMATIC FIRE ALARM BOX; H. Anderson, Haddonfield, N. J. App. filed Oct. 6, 1908. A motor, an alarm mechanism having two contact members and means operated by the motor during the operation of the alarm for separating the contacts and breaking the motor circuit, together with means for locking the contact member in disengaged position.

917,238. CANOPY INSULATOR; E. E. Bechtold, Chicago, Ill. App. filed July 19, 1907. A shell-like canopy insulator having an external annular bead and an insulating strip between the bead and canopy and the base.

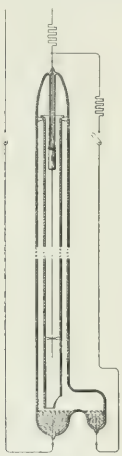
917,241. APPARATUS FOR ELECTRIC HEATING DEVICES; F. Boling, Frankfort-on-the-Main, Germany. App. filed Nov. 5, 1908. Improvement on 617,375. A mica strip is arranged in a suitable casing with a filler sheet metal surrounding the elements so as to increase the radiating capacity and thereby the load capacity.

917,263. TELEGRAPH REPEATER; C. E. Davies, Ottawa, Ont., Can. App. filed March 11, 1908. Reduces the number of instruments by making and breaking the main line by moving armatures which also make and break the local circuits.

917,272. DRY BATTERY; C. D. Enochs, La Crosse, Wis. App. filed May 26, 1906. A thin shell has an inner coat of water-proof material, the electrode being united with the shell. The carbon electrode is in the center of the shell as usual.

917,325. RECEPTACLE OR THE LIKE FOR CONDUITS; G. A. Lutz and C. C. Sibley, New York, N. Y. App. filed Oct. 26, 1905. For supporting rosettes having in combination a conduit provided with grooves and a base engaging the grooves of the conduit.

917,326. MEANS FOR HOLDING RECEPTACLES AND THE LIKE TO CONDUITS; G. A. Lutz, New York, N. Y. App. filed Feb. 23, 1907. Improvement on 834,839. A conduit has an open, trough-like mouth. The sockets can be adjustably secured to the trough. Details.



917,212.—Envelope for Vapor Electric Conductors.



917,500.—Undergrooved Trolley Wire.

917,327. BASE FOR SUPPORTING SWITCHES AND THE LIKE UPON CONDUITS; Mr. G. A. Lutz, New York, N. Y. App. filed Feb. 23, 1907. The conduit has an open, trough-like mouth and rotary switches can be secured to the conduit by means of screws. Details.

917,328. OUTLET OR JUNCTION BOX; G. A. Lutz, Plainfield, N. J. App. filed July 23, 1908. The conduit has a box operatively associated therewith and a cap having depending walls to overlap the box walls, the cap being provided with means to engage the walls of the conduit and retain it in position.

917,342. JUNCTION-BOX COUPLING; E. S. Morrell, Philadelphia, Pa. App. filed July 24, 1908. A coupling for attaching pipe conduits to junction boxes by means of a screw-threaded sleeve and nut, without threading the conduit pipe.

917,348. WALL SWITCH; W. J. Newton, Lynbrook, N. Y. App. filed July 21, 1908. Improvement on 702,989. Details.

917,367. MASSAGE INSTRUMENT; J. W. Scott and D. Tibbals, Granite City, N. Y. App. filed May 13, 1908. An induction coil in the handle supplies a shocking current to the massage roller.

917,372. MEANS FOR ATTACHING ELECTRIC LAMP SOCKETS; W. S. Stapley, Bridgeport, Conn. App. filed Oct. 1, 1908. A simple means for attaching sockets to the fixtures, the pipe being provided with a flange and screw threaded to receive the nut, between which nut and flange the cap of the lamp socket is secured.

917,396. CAR TROLLEY; A. Zaccaria and A. Belvedere, Uniontown, Pa. App. filed June 9, 1908. Prevents the trolley from jumping by providing arms which embrace the trolley wire. Details.

917,445. TROLLEY; A. S. Janin, New York, N. Y. App. filed Dec. 30, 1907. The trolley consists of a collapsible diamond-shaped frame operated by a spring and compressed air.

917,471. INDUCTION MOTOR; E. Mattman, Norwood, Ohio. App. filed March 13, 1906. Improvement in the means for securing the short-circuiting rings of squirrel-cage rotors in position.

917,500. UNDERGROOVED TROLLEY WIRE; Louis Steinberger, New York, N. Y. App. filed Nov. 23, 1903. The trolley wire has a longitudinal flexible member, the member being provided on opposite sides with webs which are wider than the body, so as to provide a contact face which is protected from the action of the weather and has a plurality of bearing surfaces.

917,501. THIRD-RAIL INSULATOR; L. Steinberger, New York, N. Y. App. filed June 5, 1907. The third-rail is mounted upon insulators having a metallic plate provided centrally with an opening, a bolt extending across the plate, a roller encircling the bolt, the roller engaging the rail and allowing play between the plate and the roller.

917,504. ELECTRIC HEATING APPARATUS; G. Teuber, Laasphe, Germany. App. filed Sept. 4, 1907. A flat spiral pancake-shaped heater of particular construction with a particular insulating paste.

917,510. DYNAMO-ELECTRIC MACHINE; A. H. Wouters, Norwood, Ohio. The rotor of a turbo alternator has its parts firmly held in place by means of bolts and wedges of special construction.

917,535. BRUSH HOLDER; A. J. Brown, Norwood, Ohio. App. filed July 30, 1906. Does away with the long, spiral spring in the brush holder by making use of a spring-pressed finger having at its free end a screw engaging the brush which may be adjusted to maintain the finger in the proper position for different lengths of brush.

917,541. ELECTRIC SWITCHING DEVICE FOR RAILWAYS; R. V. Cheatham, Louisville, Ky. App. filed June 25, 1907. A trolley pan having parallel flat strips with flat bottoms inclined at an angle to the horizontal and deflecting blocks over bars, which latter are attached to the pan.

917,542. SWITCH CONSTRUCTION; H. W. Cheney, Norwood, Ohio. App. filed Aug. 25, 1905. Reduces the sparking and provides means for adjusting the core of the tripping magnet. The switch operates by means of a toggle and links. Details.

917,548. COUPLING FOR ELECTRIC CONDUCTORS; A. H. Conway, Mason City, Ia. App. filed May 3, 1907. A two-part coupling detachably connected by screw threads and each having a drop of insulation carrying the contacts.

917,556. TROLLEY; C. A. Dean, Homestead, Pa. App. filed July 13, 1908. A trolley with means for preventing the wheel from jumping. Special construction of arms which embrace the trolley wire.

917,560. DRY-BATTERY CELL; W. S. Doe, Jersey City, N. J. App. filed May 11, 1908. A reservoir is made of zinc, sealed in the top of the battery and insulated from the carbon electrode, it being in contact with the enclosing electrode and containing an exciting fluid.

917,564. SWITCH; W. C. Dunn, Logansport, Ind. App. filed May 22, 1908. The switch is operated by a magnet, the circuit of which is controlled from the car.

917,574. DETECTING DEVICE FOR WIRELESS TELEGRAPHY; Reginald A. Fessenden, Brant Rock, Mass. App. filed March 26, 1907. The receiver comprises a conducting liquid and a conducting body projecting thereinto with means for supporting the body so as to balance it against the frictional stress of liquid, together with an indicator.

917,632. RAILWAY SIGNALING MEANS; R. J. Marshall, Newcastle-upon-Tyne, and W. H. Penman, Gateshead-upon-Tyne, England. App. filed April 18, 1908. For indicating to the driver of a train the condition of the various line signals, especially in foggy weather by actuating a signal in the cab. Details.

917,633. TELEPHONE TRANSMITTER; C. T. Mason, Sumter, S. C. App. filed April 27, 1908. A sound-receiving diaphragm removable and replaceable with a new one without changing the adjustment of other parts. The improvement is in telephone transmitters provided with a cell containing carbon particles.

917,700. RHEOSTAT; P. H. Zimmer, Schenectady, N. Y. App. filed Nov. 16, 1905. For use with small shunt-wound motors, in which both the starting and the regulating mechanisms are operated by a single handle, and a no-voltage release magnet holds the parts in running position.

917,703. ELECTRIC RAILWAY SIGNAL; W. J. Ashley, Denver, Col. App. filed May 11, 1908. Gives a signal when the rail is displaced by flood or fire, by closing an electric light circuit provided with lamps which show to the passengers on the train, as well as to the engine man, that the rail has shifted.

917,707. PROCESS OF MAKING CARBID OR CARBID-CONTAINING ELECTRODES; Henry S. Blackmore, Mount Vernon, N. Y. App. filed April 6, 1907. The process of making a composite carbid electrode, which consists in mixing the metal carbid with a solid hydrocarbon—carbon-yielding substance and exposing to heat.

917,714. TROLLEY POLE SUPPORTING AND CUSHIONING MEANS; S. C. Cooper and W. M. Austin, Johnstown, N. Y. App. filed May 3, 1907. A trolley-pole supporting and cushioning mechanism in which a spring and a pneumatic- or fluid-operated piston control the movement of the trolley wheel.

917,961. FIELD SPOOL FOR ELECTRIC MOTORS; E. H. Anderson, Schenectady, N. Y. App. filed Jan. 11, 1904. Prevents flashing at the commutator of direct-current motors by splitting the metal spools on which the insulated wires are wound for the field.

917,975. PULL SOCKET; J. R. Byrne, Schenectady, N. Y. App. filed Aug. 1, 1905. One pull turns on the lamp and the next turns it off. Provides a tumbler and spring construction and special design for the purpose.

917,981. PARALLEL OPERATION OF ROTARY CONVERTERS AND STORAGE BATTERIES; E. J. Berg, Schenectady, N. Y. App. filed Sept. 13, 1907. The rotary converter has a shunt and series winding and also an auxiliary field winding excited by a series-excited booster.

917,982. VOLTAGE REGULATOR; E. J. Berg, Schenectady, N. Y. App. filed May 12, 1908. Improvement in the well-known Tirrill volt regulator in which the exciter circuit, in addition to the regulator named, has an automatic booster set provided with a differentially wound motor which drives the booster generator.

917,983. REGULATING DEVICE FOR ALTERNATING-CURRENT CIRCUITS; S. R. Bergman, Lynn, Mass. App. filed June 14, 1905. In connection with the fixed primary and secondary windings, employs relatively movable primary and secondary windings in series with the first named and all in a common magnet circuit.

917,985. CONDUIT THREADING MACHINE; H. W. Boddy, Woodbury, N. J. App. filed Dec. 9, 1907. The conduit has a longitudinal passage and the machine has a smooth driving surface adapted to fit in between the diagonal corners of the conduit.

917,988. SYSTEM OF DISTRIBUTION; W. S. Bralley, Schenectady, N. Y. App. filed May 11, 1906. Sectionalized distribution system provided with automatic switches for connecting the sections together so as to utilize them in the most efficient manner.

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The Proposed New International Candle.

We are glad to learn that good progress is being reported in the direction of securing an official international candle, through the work of the National Physical Laboratories and the International Electrotechnical Commission. It will be remembered that various countries have maintained national standards of luminous intensity, through the medium of certain hydrocarbon-oxygen flames under definite specifications. England had originally a sperm candle flame, and more recently has adopted a standard flame of pentane gas. France has a standard colza-oil flame called the Carcel. Germany has a standard amyl-acetate flame, called the Hefner. This country has depended upon the pentane flame in its gas industry, but has relied upon incandescent-lamp secondary standards in its electric lighting, the incandescent lamps being standardized to the assumed value of the English candle. Incandescent lamps cannot be predetermined in luminous intensity with the requisite precision for standard purposes. No set of specifications for the preparation of an incandescent lamp has enabled us, as yet, to assign the luminous intensity of the lamp in advance. The lamp will vary in intensity between fairly wide limits. But a batch of well-constructed incandescent lamps, seasoned by being operated for, say, 50 hours at rated voltage, may be calibrated with considerable precision by photometric comparison with some standard luminous source of the same color, and will then preserve that calibration for a long period, if operated only occasionally for short intervals. Moreover, it has been demonstrated that the probable error of photometric comparisons between different seasoned incandescent lamps of the same color is markedly smaller than similar photometric comparisons between flames. In other words, incandescent lamps are not adapted for primary standards of intensity, but they are well adapted for preserving any assigned standardization. In the hands of skilled observers, with accurate voltmeters, they are good custodians of luminous intensity.

In view of the differences between the various national candles, the Bureau of Standards, supported by the American Institute of Electrical Engineers, the Illuminating Engineering Society and the American Gas Institute, has sought to bring about an international unification of the candle, through the medium of a stock of seasoned incandescent lamps. The bureau ascertained by taking over a batch of such lamps to Europe that the difference between the luminous intensities of the standard candle in England, France and America was only a small amount, and that if an agreement could be reached by these countries, an international candle could be arrived at which might be maintained in future by mutual exchange and intercomparison of standard incandescent lamps. At the council meeting of the International Electrotechnical Commission, held in London, last October, the French committee brought up the question of a proposed international candle. No action

was taken at the time, but the matter was left for further consideration by the various national committees. Since that time, however, considerable progress has been made. The British committee has taken the matter up with the official co-operation of the gas industry in Great Britain, and has issued a report recommending to all the other national committees a proposed international candle which shall be equal to a pentane candle for England, to a bougie decimale for France, to an American candle for the United States, and to 10/9 of a Hefner. It can hardly be expected that Germany would give up the Hefner standard, which she has maintained so long; but at least Germany would gain the advantage of having a simple numerical relation between her Hefner candle and the international candle of other countries.

The American Institute of Electrical Engineers, the American committee of the International Electrotechnical Commission, the Illuminating Engineering Society and the American Gas Institute have all agreed to the Bureau of Standard's entering into this international arrangement, although the plan is more onerous on America than upon any of the other subscribing countries, because it involves lowering the standard candlepower of America as maintained by the bureau to the extent of 1.6 per cent. A 16-cp lamp on the old basis will thus become a lamp of 16.256 international candles, a difference which is immaterial in the commercial branches of the lighting industry, but will be distinctly appreciable in the standard photometric laboratories of the country. France already has the bougie decimale, and needs no change. England can effect the change without any difficulty by a slight modification of the pentane specifications with regard to the measurement of water vapor in the atmosphere of the photometric laboratory. It is earnestly to be hoped that the international candle may be adopted by all of the countries interested. We should then have only two luminous standard intensities instead of half a dozen. That is, we should have the international candle and the Hefner, which is 90 per cent of the former. We expect to hear shortly that the International Electrotechnical Commission has reached a satisfactory agreement upon the matter.

Commutation Phenomena.

Although thousands of dynamos are in daily use employing commutators, and although the commutator is now an old and time-honored device, yet there is always much to be learned from an investigation of the properties and behavior of a commutator, for, while the commutator is a very simple affair superficially, it is a most complex device in detail. The article by Mr. Carlton L. Kennedy, on page 971, presents some interesting elementary features concerning the behavior of a commutator. It is pointed out that if the coil under commutation were inductanceless, the rise of current through the leading segment would have a uniform gradient uphill, while the fall of current in the trailing segment would have a similar uniform gradient downhill. Inductance tends to alter the gradient in one way and inserting resistance in the material of the brush adds another modification. The tendency under load is to force a considerable current density into the edge of the trailing segment just before breaking contact. If this current density rises high enough, and persists long enough, the metal in the segment will be vaporized with a vicious green spark; whereas if the final current on letting go is kept down to a certain limit and if the time during which this limit acts is sufficiently reduced, the spark at rupture will not be hot enough to erode the commutator segment materially. There will probably be visible sparking, but it will be of the carbon-arc type and not of the copper-arc type.

Joint Pole Lines.

The description printed elsewhere of the joint pole line system inaugurated in Los Angeles points a moral which it would be well to read. Joint occupancy of pole lines is common enough, but the systematic arrangements carried out in Los Angeles have an exceptional measure of importance. When several electric companies for various service are operating in a city, the question of pole locations becomes very troublesome. Underground distribution, desirable as it is, in most places is quite prohibitive in cost. To enforce it generally would imply depriving part of the community of the benefits of electric service entirely, or permitting them to have it only at very high prices. Granted the need of making provision for overhead service, it seems that the Los Angeles plan should be followed whenever it is possible. One line of well-located and well-set poles can give service more cheaply and effectively than the usual tangle to be found in the streets, and there is no serious objection to its use. The general installation of such a system would free many a city from what has become a really serious burden. The chief difficulty is to get the various companies to undertake harmonious action. As a rule, they are wanting in harmony, each striving to throw all the expense upon the others. Perhaps the only influence that can be made generally effective is a choice between agreement on a joint pole scheme and going underground. Generally, the telephone and telegraph companies are first in the field, and their lines never really well built at the beginning, are commonly in bad shape by the time other electric services are well established. Consequently it is impracticable to arrange for joint use and there the matter drops.

In Los Angeles the establishment of proper overhead service seems to have been taken up very thoroughly and systematically. A joint pole committee has affairs well in hand with the intent of clearing the streets outside the established underground district of all unnecessary poles. The joint use of over 10,000 poles, established within about two years, is evidence enough of the committee's activity. The immediate value of the work is shown in the practical cessation of the complaints that would certainly have forced the construction of much additional underground work had they not been thus stilled. More than this, the united service can be more cheaply and effectively carried out than any set of independent schemes, and probably with less danger of interference between the several sets of wires. At least this advantage can be secured, that the several circuits shall occupy positions with respect to each other that shall make the chance of interference a minimum. And in new construction the work can be done more thoroughly and safely than in any attempt to mix new construction with old. Risk from crossing of wires comes chiefly from bad workmanship, and when all the companies interested unite in the building, the merest self-interest will take care of the matter of safe

construction. A first-class pole line, while never exactly ornamental, can at least be made comparatively unobjectionable, and is in every case preferable to several bad pole lines. Los Angeles is a city that has been very progressive in electrical matters. It has, if we remember correctly, quite the largest consumption of electrical energy per capita of any city in the country, and inferentially, in the world. Its solution of the pole-line problem was needed and seems to be a very happy one. Whether it would work out as well elsewhere, in a severer climate, remains to be seen. Fifteen-thousand-volt transmission wires and telephone wires on the same pole line form a combination that would worry the average city electrician during a sleet storm. Yet with proper construction it is probably safer than if the lines were scattered over the territory without any system, as is usually the case. We shall hope to see the Los Angeles plan copied elsewhere, for the tangled pole lines of most cities in this country are altogether objectionable.

Torque Relations in Induction Motors.

As is well known, the starting torque of a polyphase induction motor is proportional to the power dissipated in the secondary circuit under starting conditions, and is equal directly thereto when expressed in so-called "synchronous watts." It follows, therefore, that the starting torque may be increased by any method that will increase the secondary losses at standstill, such as increasing the resistance without decreasing the current appreciably, or increasing the current without changing the resistance. The present issue contains an article by Mr. M. Berthold outlining the changes in design proportions that affect the torque relations, and an article by Dr. A. S. McAllister discussing the effect upon the torque of changing the secondary resistance of a motor without altering the design proportions.

Mr. Berthold shows to what extent the various operating characteristics of the motor depend upon the performance at starting. Thus, a motor that possesses a low power factor and a high torque at standstill requires a large current at start, but operates with high efficiency and good speed regulation. The article by Dr. McAllister deals with a diagram which represents the complete performance of an induction motor throughout all ranges of speed and changes of the resistance of the secondary. The diagram is based on the fact that, of the total power delivered by the primary, the part not absorbed in the secondary resistance is transmitted to the rotor for mechanical work, the latter power being received at unity power factor. Thus, the primary quantities depend solely upon the power delivered by the primary, and are unaffected by the relative subdivisions of the power into electrical loss and mechanical work after it reaches the secondary. The ratio of the secondary loss to the secondary input is the rotor slip, which alone is varied by the change in the relative values of the subdivisions. These facts have long been known, but it is convenient to have them represented in the simple rectangular diagram described in this issue.

Water-Powers in Scandinavia.

Recent numbers of *Engineering* (London) contain a most interesting and striking account of the great work that is being carried on in Norway and Sweden in the development of the hydraulic resources for electrical transmission. The Scandinavian peninsula with its large mountainous area is rich in water-powers, making up in head what is lacking in flow, there being no rivers of considerable size. It is a thing to be noted, by the way, that most of the world's hydraulic power is furnished by the smaller rivers. The total available water-power of the two kingdoms reaches about 9,000,000 hp, of which only about 10 per cent is yet developed or being developed. Neither country is conspicuous for large manufactures, and one of the most striking things about the recent hydraulic work is that no inconsiderable part of it is intended for the fixation of atmospheric nitrogen, which must now be recognized as an actual process of no uncertain commercial value. Plants for the nitrate trade having a capacity of more than a quarter of a million horse-power are now under construction, and more are being projected. It is a curious thing that American engineers and investors should not have considered seriously this nitrate process, which furnishes an almost ideal supplementary source of load to take up the power not utilized for regular transmission service. As unfortunately is becoming usual of recent years, we are lagging in this technical development, which has been advanced to a practical stage abroad. When a great concern like the Badische Analin und Soda Fabric develops, as it has done, 70,000 electrical horse-power in a single plant for nitrate making, it is high time for Americans to wake up from their happy dream of manufacturing standardization and take notice.

This particular plant is at Tya in southwestern Norway, and it is especially notable as being not only the seat of one of the highest utilized falls in the world, but as showing a beautiful example of high-head storage. The total head above the Pelton wheels is 3288 ft., and the calculated loss by friction in the tunnels and pike lines is 218 ft., leaving an effective head of 3070 ft. The Tya head is, we believe, the second highest utilized fall in the world. The Tya River, like most mountain streams, is very variable, but Lake Tym, at an altitude of 3550 ft. above the sea, together with a small chain of neighboring lakes, is to be utilized for storage, giving at the enormous head available capacity enough to equalize the flow for at least an entire season. The smaller lakes are of enough capacity for summer regulation, and in winter Lake Tym itself, some 15 km long and with high, rocky banks, will give the required capacity. This Tya plant is the first of any size to work all-the-year-round storage, which, at the enormous head available, becomes not only easy but economical. The cost of the whole plant, including all constructions, amounts to about $2,500,000, or less than $40 per horse-power. With this low investment the power for the nitrate works will be on a thoroughly economical basis. There are numerous opportunities for high-head work in Norway, and two other plants, each of about 150,000 hp at about 1000-ft. head, are coming along soon, one being already under construction. It is worth noting that one of the large Swedish plants now under way is intended to furnish power for electrifying a section of the Swedish State Railway, following up the experiments on electric traction reported last year. None of the Scandinavian plants seems to show sensational developments in high voltage or long transmissions, although Stockholm is to be supplied over an 85-mile line presently. But of business-like activity there is an astonishing amount.

East Boston 80-Cent Gas Bill Defeated.

The Massachusetts House has defeated the East Boston 80-cent gas bill on a vote of 91 to 77, with 14 pairs. Speaker Walker took the floor to ask the membership to reconsider the previous passing of the bill to be engrossed. He argued that the State regulation of public-service corporations by commissions would be greatly weakened by the bill and showed that State regulation has been successful in Massachusetts for 40 years.

Speaker Walker further urged that the commissions as expert bodies are the proper authorities, rather than the Legislature, to determine questions of rates of lighting, railway, telephone, gas and telegraph companies.

"No one is going to invest money in these enterprises if the Legislature may at any time step in and by fixing an arbitrary price take away the return on the investment," said the Speaker. "The proposed legislation is a blow at the stability and development of our public utilities, and consequently a blow at the prosperity of Massachusetts."

Under the natural course of events questions of this character come before the Gas and Electric Light Commission for adjudication.

Internal Combustion Engineers' Association.

The Internal Combustion Engineers' Association, organized last year, has already done much toward forwarding its objects through a study of the question of uniform commercial rating for internal combustion engines. A committee, of which Mr. J. C. Miller is chairman, was appointed to take up this subject, and has made a preliminary report dealing with several of its bearings.

The subject is being considered under six heads, as follows: 1. Should a rating be based on the actual brake horse-power the engine will deliver using specified fuel, running at specified r.p.m., and located approximately at sea level? 2. Should this rating be as near as practicable to the load the engine will carry when giving the highest fuel economy? 3. Or, should the rating be determined by making it a definite percentage less than the maximum brake horse-power when running regardless of fuel economy? 4. What should be the percentage in Nos. 2 and 3? 5. As it is impracticable to make two or more engines exactly alike, and improbable that identical results would be reached in separate tests of individual engines, in testing to determine if engines are accurately rated, should an allowance be made not exceeding a definite limit? 6. What should this limit be in percentage of rated horse-power?

The committee considers that it would not be at all difficult to find two engines, both of them rated by their respective builders at 50 hp, one of which would carry a maximum load of less than 40 hp, and the other a load of over 90 hp. In view of this condition it believes there is no work that the association can do that would be more beneficial to all concerned than to endeavor to establish a uniform commercial rating. As to the above questions, the committee gives an affirmative answer to 1, 2, 3 and 5, but withholds its opinion as to 4 and 6, and desires further data of tests in order to pass upon these. It makes a suggestion that the rating should be 15 per cent less than the maximum output, and that an engine should be capable of carrying not less than 10 per cent and not more than 25 per cent overload.

The constitution of the association, adopted Jan. 8, provides that active members shall be confined to those whose connection with internal combustion engineering shall be either as operating engineer, superintendent or chief engineer, erecting engineer, designing engineer or consulting engineer who has recommended and installed internal-combustion engines. It is provided that the work of the association shall be carried on by committee, and three permanent technical committees are specified, as follows:

A committee on operation, which shall make investigations as to the reliability and efficiency of apparatus, and methods of operating, and which shall call the attention of owners and operators to their plants when running below the average in either of these respects, and, on request, shall make suggestions tending toward improvement. Another committee has for its work the making of investigations relating to the design, material and construction of internal combustion motors and accessories, and formulating recommendations of these points. A third committee has for its subject the investigation of different fuels under varying conditions.

The officers of the association are as follows: President, Mr. Homer R. Linn; vice-president, Mr. I. J. Bent; treasurer, Mr. I. J. Babcock; secretary, Mr. Walter A. Sittig, 61 Ward Street, Chicago, Ill.

Mexican Notes.

It is announced that the Compania de Tranvias, Luz y Fuerza, which owns the electric light and power system at Guadalajara, will soon begin the construction of transmission lines from one of its generating plants to the mining districts of Etzatlan and Hostotipaquilla for the purpose of supplying mines and mills in those two localities with power. Some time ago Manuel Cuesta entered into contracts to provide power for a number of mining companies operating in the two districts named. Mr. Cuesta had planned to erect a large hydro-electric plant on the Santiago River near Guadalajara for generating the necessary power as well as to give him power for operating large electrical pumps for irrigation works which he had arranged to establish adjacent to Lake Chapala. Mr. Cuesta has transferred his concessions and contracts to the Compania de Tranvias, Luz y Fuerza, which will proceed to carry out his plans as rapidly as possible.

The City of Mexico is to be connected with Puebla by an electric railway, which will be built by the same Canadian interests who now own the stock of the Mexico Tramway Company and the Mexico Light & Power Company. The system of the Mexico Tramway Company covers Mexico City and a part of the Federal District. The Mexico Light & Power Company has already expended $40,000,000 gold in erection of a great hydro-electric plant at Necaxa and in extending its light and power system to Mexico and other places in its territory. The survey for the proposed electric line to Puebla is being made under the direction of Mr. A. V. Nesbitt, chief engineer of the Mexico Light & Power Company. The distance between Mexico City and Puebla is about 160 miles. Two routes are being surveyed and whichever one is deemed the most feasible will be adopted. One of the routes runs close to Popocatepetl and Ixtaccihuatl volcanoes.

The report has been current recently that the Mexican Government is planning to obtain a controlling interest in the electric light and power plant and street-railway system of Mexico City and the Federal District. This report is based largely on the fact that the Government recently refused to grant an American syndicate a concession for the establishment of a competing electric light and power plant for this city.

The same interests that are in control of the Mexico Tramway Company and the Mexico Light & Power Company recently acquired the timber-land holdings and large lumber mills of Col. W. C. Greene and associates in the State of Chihuahua and are making a survey for a line of railroad to connect that property with Juarez, Mexico. These same interests are preparing to install a great hydro-electric plant in the State of Chihuahua.

Electrification of Chicago Railroad Terminals

In his annual message to the Chicago City Council, presented April 12, Mayor Busse had this to say of the proposed electrification of railroad terminals in Chicago: "The electrification of railroad terminals remains an important and unsolved problem. We have not been standing still, but we have not made as much progress as many of us would like. We are in

about the same position in relation to this problem as we are to that of harbor development and subway construction." The Mayor said that one railroad (evidently referring to the Illinois Central) is committed to the policy of electrification. Legislation pending in Springfield, intended to give cities specific authority to require the electrification of railroad terminals, will, if passed, assist the city in the solution of this problem.

New Substations in Chicago.

Three combination substations, to be used partly for the railway service and partly for the general light and power service of the Commonwealth Edison Company, are under construction by that company in the southern part of Chicago. In all of them the incoming current is 20,000 volts and 25 cycles, the substation apparatus being of standard type. All of the new substation buildings have a street frontage of 75 ft. One, to serve Grand Crossing, is at 7675 South Chicago Avenue. Here there will be two 1000-kw standard railway rotaries. In the Roseland substation, at 10847 Michigan Avenue, there will also be two 1000-kw standard railway rotaries, with the addition of two 500-kw frequency-changing motor-generators for the general work of the Edison company, changing frequency from 25 to 60 cycles. At the South Chicago substation, 9347 South Chicago Avenue, there will be two 1000-kw railway rotaries and two 1000-kw frequency changers. In addition to these substations now under construction, real estate has been purchased for a new step-down transforming substation to be located at 904-906 South Troy Street, near West Twenty-second Street and Kedzie Avenue, on the West Side.

Niagara Ice Jam.

Up to last Sunday the ice jam in the Niagara Gorge was little changed. Down near the mouth of the river, at Fort Niagara, the ice showed a tendency to break away, but opposite Lewiston and for miles down stream the channel was full from shore to shore, though the height of the ice was not so great as in the early stages of the pack. The tracks of the Gorge Railroad were still under ice for miles. Investigation reveals many poles destroyed and long stretches of wire down. The condition of the roadbed could not accurately be determined up to Sunday, but the management is very hopeful. Despite this, there is every indication that the road has been seriously injured.

Above Lewiston, toward the Devil's Hole and Whirlpool, the ice has been breaking away. From the falls to the Whirlpool Rapids the jam was still solid, and up near the Horseshoe, where the station of the Ontario Power Company is located, the conditions frequently underwent changes. Now and then there would be a backing up of the water and ice, causing new fears, but the river would quietly settle back to normal level, demonstrating a local condition, caused no doubt by ice conditions further down stream. The Ontario Power Company has seen the necessity of issuing a second statement, as follows:

"The high water, exceeding by 12 ft. that of which there is any record or any report in the past, was reached about 1:30 a. m., Saturday, April 10. It was about 382 ft. or 383 ft., normal being 343 ft. The water began to recede within an hour or so, and had fallen about 35 ft. by 9 or 10 o'clock in the morning. Since that time there has been no water in the power house. Several hundred tons of ice were left on the power-house floor and were shoveled out through the windows as fast as possible, but it being difficult to obtain workmen on Easter Sunday this work was not completed until about midnight Sunday.

"The damage to the machinery will probably not exceed $100,000, if as much, exclusive of the high-grade lubricating oil. Some idea can be gained of the magnitude of the works when the fact is realized that under normal conditions about 100 bbl. of such lubricating oil are in constant use on the various bearings.

"The cleaning of the machines began about noon on Saturday and was continued night and day until finished, about 36 hours later. A large force of expert mechanics was necessary in order to do this properly. The drying out of the exciters was begun 10 hours after the flood was at its height, and the drying of the generators began on Sunday afternoon and is still in progress. This work requires the greatest care and it is necessary to bring expert workmen from Hamilton, Pittsburgh and other places in order that it should be done properly. The Westinghouse Company has kindly given the services of its chief expert on insulation, Mr. Reynders, who will remain to give his advice until the work is finished. This work is being done as rapidly as possible, but it cannot be unduly hastened, and when completed the generators will be in the same perfect condition as when they originally came from the factory.

"The company appreciates the forbearance which has been shown by such of its customers as have been cut off from their usual supply of power, and asks for a continuance of it for a few days longer, when everything will be restored to normal conditions. Meanwhile, through the courtesy and neighborly spirit shown by the Electrical Development Company and the Canadian Niagara Power Company, the company has obtained enough power to keep in service all the public-service corporations depending upon its power, both in Canada and the United States.

"All danger of further interruption is now past. A great quantity of ice has been coming down the river for the last 24 hours, but it finds its way under the ice pack in the lower river and there has been no considerable rise in the river. The windows and doors of the power house have been stoutly barricaded to a height greater than that reached by the flood of Friday night, so that if there should be another extreme rise in the river, which is not anticipated, it would create no trouble."

Lockport suffered severely from the results of the Niagara jam, nearly every mill in the manufacturing district being shut down. An attempt was made to obtain power from two large generators of the Niagara Development Company, but the demand overtaxed the capacity of one of these machines, which was put out of service. One large manufacturing plant which uses electricity entirely has a rebate clause which gives damages of $170 per day from the power company if it fails to supply power.

Senate Tariff Bill.

So far as concerns the electrical industry, the changes of most interest made in the Payne tariff bill by amendment in the Senate relate to the duty on arc-light carbons and on electrical machinery and apparatus. As noted last week, the Senate bill changed the duty on arc-light carbons from 35 per cent ad valorem to $7 per thousand feet, the present duty being $9 per thousand carbons. The effect of this change through the wording employed is to increase the tax from the present or Dingley rate by 50 per cent to 60 per cent on flaming-arc and some grades of enclosed-arc carbons.

As to electrical machinery and apparatus, the Senate bill cancels these items in paragraph 194 of the House bill, where they were made subject to a duty of 30 per cent; this cancellation restores the duty to the former rate of 45 per cent by bringing these manufactures under the provisions of an omnibus clause. The duty on steam engines and machine tools, however, remains as fixed by the House, at 30 per cent ad valorem, a reduction from the present rate of 45 per cent. The duty on iron and steel wire smaller than No. 16 is increased by the Senate from ½ cent to ¾ cent per pound. Insulated wire remains at the present rate of 45 per cent ad valorem. Telephone and telegraph line poles remain at the rate fixed in the House, namely, 10 per cent, the present duty being 20 per cent. The duty on red lead is increased by the Senate from 2⅛ cents per pound to 2⅞ cents per pound, and the duty on litharge from 2¼ cents per pound to 2¾ cents per pound. Tantalum, titanium and tungsten metals are enumerated in the Senate bill, the duty

being fixed at 25 per cent. The duty on antimony has been increased to 1½ cents per pound from ¾ of a cent per pound in the Payne bill, which latter made no change in the present rate.

In the Senate bill the entire section of the House bill relating to discriminations with respect to patents has been cancelled. This section was criticized as in contravention to principles laid down by the International Patent Conference which were accepted by our Government.

Hearing on Minimum Meter Charge at Boston.

The Massachusetts Gas and Electric Light Commission, as noted in the issue of April 15, gave a continued hearing at its offices in Boston on April 13 on the petition of Joseph J. Leonard and others that the minimum meter charge of $1 per month by the Boston Edison Company should be reduced or eliminated. Mr. J. W. Cowles, superintendent of the meter department, was called as a witness and submitted, with Mr. L. N. Wallace, auditor of the company, the following items of expense which the company has to meet in the maintenance of meters on the premises of small consumers:

YEARLY ITEMS IN METER EXPENSES

Interest and depreciation, 6 and 14 per cent	$2.79
Testing and repairing	.77
Cost of reading meter	.42
Lamp depreciation and losses; 10 lamps, carbon, at 16 cents, 20 per cent	.32
Expenses per bill rendered, or substantially per meter:	
Accounting	.66
Billing	.75
Collecting	.88
Cashier's department	.15
Postage	.36
Stationery	.15
Total per meter per year	$7.25

The above is exclusive of 40 kw-hours consumed in the armature of the meter per year, and of any portion of the fixed charges and general expenses of the company.

Mr. Cowles figured the cost of a small meter at $12 in the Edison company's stockroom, and allows $1.50 as the cost of installing it, including transportation to the consumer's premises, erection and adjustment. He estimated the life of an average small meter at about seven years, which might possibly be extended two or three years under the most favorable conditions. Advances in the art, however, are causing many meters to be replaced before they are given up through wear and tear. The average cost of testing and repairing all meters for the calendar year 1908 was $1.10 per meter. The expense of reading-taken was the average for the system, although the location of smaller meters in less accessible places tends to raise the cost of reading compared with large instruments through the relative increase in the time required per meter. The test and repair expenses were reached by careful analysis of department expenses on meters of the small class. A routine test is made yearly of all meters. About 25,000 meters are now located on the company's system. The smaller consumers require approximately 10,000 to 12,000 meters. Four large meters can be tested per man per day or 16 small meters, under the most favorable conditions. A single tester does the work up to and including the 15-amp size of meter. The materials used in repairs include jewels, top bearings, brushes and crocus cloth. With 25,000 customers in a territory of over 400 sq. miles the company's losses in revenue are only 0.4 per cent.

Mr. Wallace explained the estimates of cost per bill rendered, which are, substantially, the average of all meters for the year ending June 30, 1908. The company then had 23,890 meters installed and sent out 23,086 bills. He stated that collection actually costs about $2 per year for the small consumer per meter, because while 50 per cent of the customers pay without solicitation and 25 per cent with a little urging, 25 per cent pay "by extraction," and impose a large proportion of the collecting expense through the necessary hiring of collectors and their transportation through the territory. No supervision was included in the accounting expenses as submitted to the board.

Secretary L. S. Wrightington, of the Boston Consolidated Gas Company, testified that there were 3500 meters on his system that passed no gas for 11 months in the year ending June 30, 1907. When a meter charge of $6 per year was imposed over 6000 more meters were removed than in the year before. The meter charge is designed to raise some revenue from an otherwise unprofitable customer.

Concluding for the Edison company, Counsel Everett W. Burdett stated that he had shown the cost of meter maintenance to be at least $7.25 per year; that current charges and general expenses, as well as a proportion of the company's fixed costs, should be added to bring the expense to at least $14 per year. The current charge at marketable rates alone is $4.80, and finally, if the meter maintenance did not cost the company a cent, there ought to be a minimum charge as a matter of protection to the central station. It is not only the right and privilege, but the legal duty of the company to see that no body or class of customers is getting its product at less than cost or without contributing the proper proportion to the profits of the corporation. Some one must pay the cost of meter maintenance in the company's rates. Mr. Burdett contended finally that this meter charge should be sustained in the interests of good management, live investment, economy and the proper apportionment of charges and profits among customers. The board took the case under advisement.

Missouri Electric Light Convention.

The third convention of the Missouri Electric, Gas, Street Railway and Water Association was held at the Colonial Hotel, Springfield, Mo., April 15, 16 and 17.

The first session opened with an address of welcome by the Mayor of Springfield and a response by President William B. Hays, of Poplar Bluff.

President Hays, in his presidential address, made a brief review of the history of the association. It was organized in St. Louis, Oct. 21, 1907, with 20 members. One convention had been held since then, in April, 1908. The membership is now 50. The remainder of this session was taken up with business matters.

Thursday afternoon the session was opened by a paper on "Insurance on Public-Service Plants," by Mr. C. W. Hough, general manager of the Consolidated Light, Power & Ice Company, of Joplin. Mr. Hough and Judge David D. Hoag, secretary of that company, are organizing an insurance exchange for electric light and power stations to be conducted along the lines of a mutual company and similar to the insurance exchange existing among ice manufacturers. Insurance to the amount of $400,000 has been subscribed and policies will be issued when the amount has reached $1,000,000. The cost of insurance is to be equal to the actual losses paid members plus 25 per cent for conducting the business. An abstract of Mr. Hough's paper and the discussion will appear in a later issue. Several members testified to the saving in cost of insurance which the ice manufacturers' insurance exchange has effected. A considerable number of electric light companies represented also manufacture ice.

Mr. Paul M. Loewe, of the Moberly Gas & Electric Company, read a paper on "Tungsten Lamps from a Central-Station Manager's Standpoint." He and the speakers following him were enthusiastic about the effect of the tungsten lamp on the business, and the driving out of gasoline-lighting plants. Abstracts of this paper will appear in a later issue.

In the evening the members were taken in a special car to the power plant of the Springfield traction and lighting systems and then to see the special tungsten street lighting just put in on the principal business street of North Springfield.

Friday morning Mr. C. W. Hough, of Joplin, read a paper on "Equitable Rate Making." This paper gave a valuable analysis of central-station investment and operating cost figures derived from the United States Census and showed their application to the Doherty readiness-to-serve methods of charging. The rate

question was thoroughly discussed, as it usually is when it comes up in convention. The paper and discussion brought out many valuable points, and will be abstracted in a future issue.

Friday afternoon Prof. H. B. Shaw, dean of the Engineering School of the University of Missouri, Columbia, Mo., presented a paper on "The Value of an Engineering Experiment Station." He called attention to the importance of an increase in knowledge of the conservation of our natural resources and to some of the specific subjects which might be investigated with profit by an engineering experiment station in Missouri. The State Legislature has been asked to appropriate $10,000 for such a station at Missouri University, following the example set by Illinois and Iowa.

Mr. P. A. Bertrand, of Jefferson City, praised the University of Illinois experiment station and the work done by it.

A paper written by Mr. O. Wiemer, of the Wagner Electric Manufacturing Company, on "Some New Features of High-Tension Transmission" was read, Mr. Wiemer not being present. This took the form of notes on a trip recently made among some of the high-tension transmission plants west of the Rockies, and told of the work of the Telluride Power Company in Utah and of its institute at Olmsted, near Provo. Here employees of the company receive instruction in subjects relating to high-tension transmission. A laboratory and a library are maintained. Among the institute's experimental apparatus was a horn lightning arrester employing an air blast created by a blower to extinguish the arc. A testing transformer has been recently built for 150,000 volts with one terminal grounded to the case and the other led out through a single bushing. He referred briefly to the work of other companies and noted the increase in the use of steel-tower transmission lines for important work.

At the executive session which followed, the rules were changed so as to admit water companies and the name was changed to the Missouri Electric, Gas, Street Railway & Water Association.

Friday evening the supply men present tendered a banquet to the central-station men at the Colonial Hotel.

In the afternoon the convention party was taken in automobiles by Springfield citizens to the Country Club and return, thus giving them a chance to see the city.

At the Saturday morning session three papers were read and discussed: "Office System and Accounting," by Mr. N. J. Cunningham, of the Springfield Gas & Electric Company; "Keeping Operating Records," by Mr. P. A. Bertrand, of the Jefferson City Light, Heat & Power Company, and "Operation of Steam Boilers with Chain Grate Stokers," by Mr. T. E. Gannett, of St. Louis.

The following officers were elected for the ensuing year: President, Mr. W. K. Bixby, Springfield; first vice-president, Mr. R. Irvine, Marshall; second vice-president, Mr. F. E. Murray, Louisiana; third vice-president, Mr. P. A. Bertrand, Jefferson City; secretary-treasurer, Mr. C. L. Clary, Sikeston.

The next convention of the association will be held in Jefferson City on April 14, 15 and 16, 1910.

Industrial Education.

A special meeting of the American Institute of Electrical Engineers was held under the auspices of the Educational Committee in New York on April 16. Prof. Herman Schneider, dean of the College of Engineering of the University of Cincinnati, read a paper entitled "Fundamental Principles of Industrial Education." The author showed that any attempt to put schools that teach trades into the public school system would result in a tremendous expenditure of money for skilled teachers and for equipment which is not commercially productive, while any attempt to put in a few of the trades would afford only a slight solution of the problem. Under present conditions most of the children who leave the public schools go at once into the industries or stores, and there is no connection whatever between school and shop. The children go to work not because they want to, but because they have to become little bread-winners. Here, then, are many children working in some capacity, and a series of public schools carried on only for those who are fortunate enough to be able to continue in their school work. Since the public school system is the only organized institution capable of dealing with all these children at work, and since the children are also learning a trade and earning money sufficient for their simple wants, it seems that the only complete solution of the problem is a system of co-operation between the schools and the factories for efficiency training and civic training of the young people after they have found their work.

The fundamental principle of the co-operative system lies in the teaching of the practical side only in a shop or store under actual commercial conditions, and the teaching of the science underlying the technique only by skilled instructors.

At Fitchburg, Mass., the co-operative system is a part of the public-school system. The students are divided into two groups which alternate every week. That is to say, this week one-half of the students are in the day school and one-half are in the factories. Next Monday morning these groups will change, and those who are in the school this week will go to the shops, and those who are in the shops this week will go to the school. Since the public school becomes a part of the apprenticeship system, it has a voice in the organization of the apprentice course in the shop.

Professor Schneider described also the shop co-ordination method of operation as applied at the University of Cincinnati. This plan was outlined in our issues for May 18, 1907, and July 11, 1908.

DISCUSSION.

Mr. Harry Barker called attention to the fact that the interweaving of industrial training with high-school work in many cases would produce skilled workmen at the expense of a great reduction in the number of educated engineers. That is to say, at the end of the course in high-school and industrial training the student is unprepared to enter an engineering college and he will be inclined to undertake life work at once without having received any real education.

Mr. A. D. Dean stated that the courses of instruction in the public schools, which were designed for earlier condition, should be altered to conform to conditions as they exist to-day. Beyond doubt industrial training should be introduced, and the best results can be obtained by conducting the industrial work in connection with the public school system. Although the establishment of industrial courses meets with opposition in certain localities, the fact remains that more than 30 places in New York State have taken steps tending toward the introduction of industrial training in the high-school courses. Mr. Dean said that the co-operative scheme described by Professor Schneider is excellent provided the high-school teachers are permitted to make suggestions concerning the outside work and the employers are allowed to recommend needed changes in the high-school studies.

Mr. Franklin Phillips reported the results of compilations made by the New Jersey Commission of Industrial Education which show that, although it costs only $42 per year to train each student, yet the average wage of the graduates at the age of 45 has risen to $60 per week as compared with $20 per week for the skilled mechanic.

Mr. C. R. Dooley outlined the work done by the Casino Technical Night School at East Pittsburgh, Pa. This school, which is located in the center of the Westinghouse industries, is giving instruction to about 300 students at the present time.

Mr. C. E. Dounton said that the plan of giving special instruction to the student apprentices in the factory of the Westinghouse Electric & Manufacturing Company had proved far preferable to the older arrangement of placing the apprentices under the regular shop foremen.

Prof. W. S. Franklin expressed the opinion that the present system of public school training is fundamentally wrong in many features and should be completely revised to meet present-day requirements.

Prof. J. P. Jackson and that the best plan for training college students along industrial lines is to have each student spend one year in the shops between the junior and senior college years, and after graduation spend another period in the shops for further perfection and development of the student's practical ability.

Prof. S. W. Ashe outlined the training of employees as carried on by the electric lighting companies in New York, Brooklyn and Boston.

Mr. C. F. Scott remarked that under present conditions of civilization it is essential for each person to be taught both how to think and how to do; both the mind and the hands must be trained.

Dr. C. P. Steinmetz said that industrial and engineering training should supplement educational work, but should not be introduced as a substitute therefor. A person who has learned merely a trade or a profession cannot be considered as educated. The courses should be so arranged that a student acquires an education while learning a trade or profession.

Written contributions to the discussion were received from President C. S. Howe, of the Case School of Applied Science; President A. C. Humphreys, of Stevens Institute of Technology; Professors D. C. Jackson and V. Karapetoff and Messrs. O. A. Kenyon, W. S. Atkinson, G. M. Basford and R. W. Pope. Both President Ferguson and Professor Morris, chairman of the education committee, were unable to be present. Vice-president J. G. White presided.

The Gary Electrical Plant.

Much has been written about the size and novel features of the electrical equipment of the new "Steel City" of the Indiana Steel Company at Gary, Ind. However, the subject is so large that the various features of the extensive equipment still afford ample material for study, while the plant will acquire added interest as extensions are made.

Mr. B. R. Shover, electrical engineer for the Indiana Steel Company, delivered an illustrated lecture on "The Electrical Equipment of the Gary Steel Plant" before a joint meeting of the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers at the rooms of the latter in Chicago on Friday evening, April 16. It will be recalled that Mr. Shover presented an interesting paper on this subject before the Institute on March 12 last. In his Chicago lecture he covered much the same ground, of course, but nevertheless several new and interesting points were brought out during the evening, some of which are set forth in this brief report. The attendance was said to be the largest at any meeting in the Western Society's rooms. Mr. W. B. Jackson, chairman of the Electrical Section of the Western Society, presided. Mr. Shover's address was illustrated by a number of lantern-slide pictures, and his remarks were largely explanatory of the various views.

It is only three years since the civil engineers began to lay out the city of Gary on the sand dunes at the southern end of Lake Michigan. Since then a great steel-making establishment has been built, and around it an important industrial community. Some idea of the extent of the mills may be gained from the statement that 68,000 tons of structural steel have been used in construction work.

The plant is electrically operated as far as possible, and in the part of it now completed there are installed 110 electric traveling cranes, with an aggregate lifting capacity of 3812 tons. The direct-current motors installed have an aggregate rating of 22,025 hp, while the 440-volt alternating-current motors have a rating of 5312 hp all told, and the corresponding figure for 6600-volt alternating-current motors is 27,000 hp. Thus the total rating of all the motors installed in the steel mills of Gary is no less than 54,337 hp. About an equal rating in horse-power will be required for the operation of that part of the plant now under construction, and still more for parts which are at present being designed.

Overhead construction is used for distributing electricity throughout the plant, and 350 tons of conducting-line cable are used on 31,000 ft. of transmission line. The main feature of the Gary plant is the use of electric power wherever it was considered it would give the best results. On Jan. 17, 1909, the mills turned out the first steel rail ever rolled by electric drive. Another characteristic of the plant is the utilization of blast-furnace gas to operate gas engines for blowers and for driving generators in the electric power station. Mr. Shover said that up to the present time the experience with gas engines had been satisfactory.

One interesting feature is that the entire system of distribution is laid out on a double-pole line; every circuit is duplicated. In ordinary operation the two sides are run in multiple, but in case of accident one pole line can be cut out and the men can work on it in safety as a dead pole line.

The plant is of impressive magnitude, and it may be noted that the line of gas engines in the power house is a quarter of a mile long. All electrical apparatus is remote-controlled, and in this system of control one notable feature is a 10,000-amp circuit-breaker specially designed for the plant. Every tower of the pole line is grounded, and as nearly as possible in all other ways perfect "ground" conditions have been attained.

In planning the steel mills as a whole, the chief experimenting has been done in the electrical line, and here there has been a large amount of pioneer work; the steel-making machinery itself, while of the most modern type, does not differ a great deal from the most modern steel plants elsewhere. The plant has this advantage, however, that it was laid out in its entirety as a very large installation; therefore it could be planned intelligently as a whole to attain the most economical production of steel products. A large proportion of the electric motors used are direct current, but Mr. Shover said that it is probable that a greater proportion will be for alternating current in the future, as he believes that much of the work can be done more satisfactorily and at a less cost by alternating current.

Gary is the possessor of the largest rail mill in the world, and the only one entirely operated by electricity. Mr. Shover devoted much of his time to describing the electrical equipment of this mill. It is in this mill that the enormous alternating-current motors are used to drive the main rolls. Here are six induction motors having a combined rating of 24,000 hp made up of three 2000-hp motors and three 6000-hp machines, turning at different speeds, according to the work they have to perform. Automatic control is used exclusively on the tables throughout the mill, and eight operators can turn out 2000 tons of finished rail daily. The motors are placed in a distinct building separated by a brick wall from the rail mill. The motor house, therefore, has practically all the facilities for operating and inspecting the machinery as is the case in a very large power house.

It will give some idea of the size of the 6000-hp motors to note that the "oil cellar" in the main bearing of one of them holds six barrels of oil. When the alternating-current supply is cut off from one of the 6000-hp motors, it takes it an hour and 37 minutes to stop running, and the 2000-hp machine, turning out at higher speed, will take even a longer time to come to rest. To prevent this waste of time in shutting down, an electric brake has been arranged by turning direct current at 250 volts into one phase of the winding through an external resistance.

Very elaborate calculations were necessary to determine the character of the load on this rail mill. It was computed that the combined load on the mill would fluctuate from 4300 hp to 19,000 hp, and in practice these calculations were shown to be not far out of the way. The average load of the mill is about 12,000 hp.

In the discussion, Mr. James Lyman, engineer for the Western district of the General Electric Company, spoke of the great advances made in processes of steel manufacture in the last 20 years. This progress is to be seen not only in the grade of steel and machinery for producing it, but in the personnel of the engineering force. Gary will stand as a great monument to the manufacture of steel, first in the utilization of the blast

furnace gas produced and, second, in driving practically all steel-making machinery by electric motors. It is estimated that the blast furnaces will furnish about 25 per cent more gas than is necessary to operate all machinery. However, experiments are now under way to make it possible to use electricity in producing steel by using the electric arc in electric furnaces of that type. If these experiments are successful the remaining 25 per cent of the gas from the blast furnaces and also the gas from the coke ovens, when erected, will be used.

Mr. J. M. S. Waring, district engineer in Chicago for the Electric Storage Battery Company, described, with the aid of diagrams which he drew on the blackboard, the original three-section, split-pole rotary converter used for connecting the stor age battery at the Gary plant to the alternating-current system. He also described the two-section rotary and touched briefly on the exciter for automatically varying the auxiliary field of the rotary. The battery installation at Gary consists of two batteries in parallel, each consisting of 125 cells. The combined rating of the two batteries is about 17,000 amp for 20 minutes.

Following Mr. Waring, Mr. W. L. Abbott announced that an invitation had been received from General Superintendent Gleason, of the Indiana Steel Company, asking the combined societies to visit Gary on April 24. This invitation was accepted with cordial thanks. Mr. Abbott remarked that the interest in the joint meetings of the two bodies was so great that there is little doubt that the practice of holding these joint meetings will be continued in the future. At his request a census was taken of the society affiliations of those present. Those in attendance belonging to the American Institute numbered 93 and to the Western Society, 28. Of these gentlemen, 18 are members of both societies. The vote, however, did not indicate faithfully the total number of those present, for as the hour had grown rather late, some of those who were in attendance earlier in the evening had gone home.

In answer to questions, Mr. Shover said that compressed air is used for starting the gas engines. He said further that overhead distribution was used rather than underground because much of the plant was laid out before the transmission problem was seriously considered. The cost to tunnel at that stage of the work would have been prohibitive.

Earlier in the evening Mr. Shover remarked that one engineer had criticized the Gary plant as the "commercial crime of the age." Later someone asked him what this expression meant. Mr. Shover answered that it has been asserted that the blast-furnace gas could be burned under steam boilers and a steam-turbine plant put in that would occupy much less space, cost less and be more reliable in operation than the gas engines. This opinion, however, is purely conjecture, and Mr. Shover does not appear to subscribe to it. Mr. Henderson remarked that since the probable date of this criticism the price of gas engines has decreased from 25 to 30 per cent, and therefore much of its force has been lost.

Mr. C. T. Henderson, of the Cutler-Hammer Manufacturing Company, Milwaukee, gave an interesting offhand description, with explanatory diagram on the blackboard, of the 10,000-amp circuit-breaker used in the remote-control system at Gary. This circuit-breaker is the largest solenoid breaker ever made. Mr. Henderson also spoke briefly on the subject of automatic control in general.

Presentation of the John Fritz Medal to Mr. Charles T. Porter.

The ceremony in connection with the presentation of the John Fritz medal to Mr. Charles T. Porter for his work in advancing the knowledge of steam engineering and in improvements in engine construction, which was held in the Engineering Societies Building, New York, on April 13, was presided over by Mr. Henry B. Towne, the chairman of the board of award. Addresses were delivered by representatives of the four national engineering societies.

Dean W. F. M. Goss, of the University of Illinois, member of the A. S. M. E. and the A. I. E. E., outlined the condition of civilization prior to the invention of the steam engine, and showed to what extent modern civilization is indebted to the steam engine.

The actual presentation of the medal and diploma was made by Mr. E. Gybbon Spilsbury, chairman of the board of 1908-9 by which the award was made, after Mr. Porter had been introduced by Mr. Jesse M. Smith, president of the A. S. M. E. A letter of appreciation was received from Mr. John Fritz, who was unable to be present.

Prof. F. R. Hutton, of Columbia University, honorary secretary of the A. S. M. E., said that the modern steam engine owes to Mr. Porter the first vision of the advantages of high rotative speed, the recognition and solution of the problems encountered by reason of the high speed, and the invention of one form of steam condenser and two forms of speed governors. The address of Professor Hutton closed with a tribute to Prof. Chas. B. Richards, associated with Mr. Porter's early work of designing, and to Mr. John F. Allen, who had conceived many details of the first high-speed engine which Mr. Porter combined into an harmonious whole.

Mr. Robert W. Hunt, member of the A. S. C. E., the A. I. M. E. and past-president of the A. S. M. E., discussed the advances made in the operation of steel mills by the introduction of the high-speed steam engine.

Mr. Frank J. Sprague, member of the A. S. C. E., A. S. M. E. and past-president of the A. I. E. E., remarked that the only high-speed engines shown at the French Exhibition in 1881 were two Porter-Allen machines driving electric generators. Mr. Porter constructed the historic Edison lighting station at Pearl Street, New York, which contained the first directly coupled engine-driven generators.

Mr. Porter is the fifth recipient of the John Fritz medal, which was established in 1902. The awards have been made annually since 1905, when Lord Kelvin received the first medal. The other medals were given to Mr. George Westinghouse, Prof. Alex. Graham Bell and Mr. Thomas A. Edison.

April Meeting of the New York Section, I. E. S.

The New York Section of the Illuminating Engineering Society held a meeting on April 15, at which time papers were presented by Mr. Norman Macbeth and Mr. Alfred A. Wohlauer.

Mr. Macbeth outlined the operating characteristics of the small-mantle incandescent gas lamp, which, he stated, is a worthy competitor of the tungsten electric lamp for residence lighting. In developing the incandescent gas lamp much attention has been paid to its mechanical strength, which is covered by the chemicals employed. The decrease of the candle-power of the lamp in service also depends largely upon the composition of the material used on the mantle. Mr. Macbeth said that the reduction in candle-power of the small-mantle lamp is about 30 per cent in 1000 hours of use.

Mr. Wohlauer discussed the calculation and design of illumination. He showed why it is proper to multiply the square feet to be illuminated by the illumination in foot-candles in order to determine the lumens to be produced by the lighting units, and explained the factors to be employed in finding the candle-power of the lamps from the value of the required lumens. Mr. Wohlauer described a form of paper ruled in both rectangular and polar co-ordinates, which allows one to plot a polar candle-power curve and to determine from this curve the mean spherical candle-power immediately from certain straight lines shown as the rectangular co-ordinates on the same diagram. The rulings are based on the fact that the superficial area of any zone of the solid of revolution of the polar curve about its central axis varies directly with the product of the polar vector and the sine of the angle between the vector and the central axis; hence when the vector itself represents the mean candle-power over the superficial area, the line

drawn from the extremity of this vector perpendicularly to the central axis shows the total lumens throughout the zone selected, a proper scale being chosen.

In reply to a question by Mr. V. R. Lansingh as to the tests to which gas lamps are subjected, Mr. Macbeth said that the gas industry has not as yet adopted any standard of excellence such as that by which electric lamps are judged. He expressed the opinion that the industry would benefit greatly by following the practice common in the testing of electric lamps.

Mr. P. S. Millar called attention to the fact that all reported performances of gas lamps are based upon tests made at the laboratory, where the conditions and adjustments are under perfect control and differ enormously from the unfavorable conditions and lack of care to which the lamps are subjected in actual service. Moreover, the reported candle-power of gas lamps is always the maximum obtained in any one direction when the lamps are first placed in operation and before they have deteriorated. Even under the most favorable operating conditions, such as in street lighting where the gas company adjusts the lamps, the actual specific output is not more than 60 per cent of the value claimed for the lamps.

In reply to Mr. Millar, Mr. Macbeth stated that in the electric lighting industry the reported specific consumption is based on laboratory measurements, while during service the lamps are operated under much less favorable conditions.

Mr. J. S. Codman expressed his appreciation of the great convenience of the method of calculation employed with the paper described by Mr. Wohlauer, but said that it is unnecessary to use special paper for the purpose because the values of the lumens can be scaled from the ordinary polar co-ordinate paper upon which candle-power curves are ordinarily plotted. Mr. Wohlauer showed, however, that the paper with double ruling is advantageous in removing any doubt as to the value to be assigned to each scale since the polar rulings in each case correspond to the rectangular rulings in the ratio of one to one.

The secretary, Mr. A. J. Marshall, announced that the joint meeting with the Municipal Art Society will be held at 8:15 p. m. on May 6, in the Twenty-second Regiment Armory, on Columbus Avenue and Sixty-seventh Street. At this meeting Mr. E. L. Elliott will deliver an illustrated lecture of a non-technical nature on "Art in Public Lighting."

American Electrochemical Society.

At the fifteenth general meeting of the American Electrochemical Society, to be held at Niagara Falls, Canada, on May 6, 7 and 8, the first two sessions will be devoted to the discussion of electrometallurgy of iron and steel, concerning which papers will be read by Messrs. Paul Girod, A. Kjellin, E. Stassano, R. Catini, R. Turnbull, C. A. Keller, H. D. Hibbard, F. A. J. FitzGerald, G. Gin, P. M. Bennie and J. W. Richards. Papers will also be read by Mr. C. A. Hansen on "Furnace Electrode Losses"; Mr. Carl Hering on "The Working Limit in Electrical Furnaces Due to the 'Pinch' Phenomenon"; Dr. E. F. Northrup on "A New Type of Ammeter for the Accurate Measurement of Alternating Currents Above 1000 Amp."

The presidential address will be delivered by retiring President E. G. Acheson, the title being "The Electrochemist and the Conservation of Our Natural Resources." Other subjects to be discussed are: "Addition Agents in Electrolytic Plating Baths," by Mr. E. F. Kern; "Electrolytic Precipitation of Lead and Zinc as Affected by the Addition of Certain Organic Compounds," by Messrs. S. A. Tucker and E. G. Thomssen; "Electro-Deposition of Some Metals from Acetone Solution," by Messrs. H. E. Patten and W. R. Mott; "The Deposition of Aluminum from Aqueous Solutions, Using Rotating Cathodes," by Messrs. S. A. Tucker and E. G. Thomssen; "The Electro-Deposition of Platinum," by Mr. W. J. McCaughey; "Electrolytic Production of White Lead and Colors," by Mr. John A. Yunck; "The Electromotive Force of Cadmium Amalgams," by Mr. G. A. Hulett; "Thermodynamics of the Weston Standard Cell," by Mr. G. A. Hulett. "The Electrolytic Reduction of Nitric Acid," by Messrs. H. E. Patten and W. J. McCaughey; "The Probable Electric Nature of Chemical Energy," by Mr. A. H. Patterson; "Bakelite and Its Electrical and Electrochemical Applications," by Mr. L. H. Backeland; "A Graphite Cathode Dish," by Mr. J. W. Turrentine; "Relative Efficiency of the Arc and Resistance Furnace for the Manufacture of Calcium Carbide," by Messrs. S. A. Tucker, W. A. Alexander and H. K. Hudson; "Some Physical Properties of Silicon," by Mr. C. I. Zimmerman; "Magnetic Tests on Some Iron Alloys," by Mr. C. F. Burgess; "Further Experiments with Calcium Alloys as Reducing Agents," by Messrs. O. P. Watts and E. R. Suhm; "Electrochemical Methods of Soil Analysis," by Mr. F. K. Cameron; "A Modified Oxy-Hydrogen Gas Coulometer," by Mr. J. W. Turrentine; "Rapid Electrochemical Analysis," by Messrs. L. S. Palmer and R. C. Palmer, and "The Corrosion of Iron," by Mr. W. H. Walker.

The headquarters of the society will be the Clifton Hotel, on the Canadian side, where all of the sessions will be held.

Signaling and Other Electrical Problems in Railroad Work.

While the announced subject of the discussion following the weekly luncheon of the Electric Club, of Chicago, on April 14, was "Railway Signal Practice," the topics brought up covered a rather wider range. The principal speaker was Mr. A. G. Shaver, signal engineer of the Chicago, Rock Island & Pacific Railway. He said that railroad signaling may be divided into two branches—block signals and interlocking apparatus. He took his auditors on an imaginary trip on the Twentieth Century Limited train from Chicago to New York and described the various systems of signaling encountered. These embrace electrical, mechanical and electro-gas systems, the latter electrically controlled but operated by the explosive power of carbonic-acid gas. In addition, the train, at various points in its journey, is operated by low-pressure pneumatic and combined high-pressure pneumatic and electromagnetic systems; then there is manually controlled apparatus and finally the problems encountered in the electric zone in New York City and just north of it.

The rails of the tracks are used for electric train signaling. In the case of electrical train operation by direct current, alternating current is used in the rails for signaling. If the train operation is by alternating current, then the signaling may be accomplished by alternating current having a different frequency. However, this subject of alternating-current railway signaling is really "in its infancy," and methods are being greatly improved year by year. In relation to the signaling system in the electric zone of New York City, the speaker said that he had been told that the signaling apparatus used here cost $1,250,000, and that the signaling problems to be solved in this electrification were really more intricate than those involved in the application of electricity to the movement of the trains. It is a great undertaking to electrify railroad terminals in large cities, said Mr. Shaver. The new system introduces great complications in signaling, and this is especially true where two or more roads use one set of tracks.

Discussing briefly the subject of telephone train dispatching, by request, Mr. Shaver said that this system is working satisfactorily so far as he knew. The operating of trains is facilitated by the use of the telephone rather than the telegraph. For one thing, trained operators are not necessary; at a remote passenger siding, for example, the conductor of the train can put himself in touch with the train dispatcher at division headquarters by telephone; no telegraph operator is needed. It is hard to get good men to handle train orders, and the speaker thought that by the use of the telephone possibly women could be obtained to do this work, for he considers women to be especially reliable. Another advantage of the telephone over the

telegraph is that by its use a greater number of orders can be transmitted over a wire circuit in a given space of time, thereby greatly increasing the capacity of the system—a feature of especial value during periods of heavy traffic.

An increasing use is made in train signaling of automatic devices to provide safeguards to meet the delinquency of the human element, according to Mr. Shaver. But, after all, good, intelligent, well-trained men or women are the best safeguards which any system of signaling can have. Railroad men generally are not greatly impressed with signals designed to be operated in locomotive cabs. However, it is possible that some form of wireless apparatus may prove to have merit when applied in this way.

There was discussion of the recent action of the organization of trainmen in Chicago designed to oppose the proposed law giving municipalities in Illinois the power to compel electrification of railroad terminals within their limits. Some of the members were in favor of this bill as being a step toward the undoubted advantages of electrification; others were opposed to it as placing undue power over public-service corporations in the hands of municipalities, fearing that it would create a bad precedent. No action was taken by the club.

Among those taking part in the discussion were Mr. Leich, of the Cracraft-Leich Electric Company, Genoa, Ill.; Mr. O. T. Lademan, Railway Telephone & Electric Company; Messrs. Max W. Zabel, Perry R. Boole and W. S. Taussig. Mr. A. J. Farrelly, signal engineer of the Chicago & Northwestern Railway, told of the great advances made in railway signaling in the last 20 years. He also commented on the advantages of the telephone in train dispatching.

New York Public Service Commission News.

The bills amending the Public Service law of New York, which were referred to in our last issue, were adopted by the lower branch of the Legislature, April 19, with the amendments reported by the committee. These amendments do not in any material point change the original intention of the bills. One of the amendments deals with the terms "control" and "controlling," and furnishes a definition of these words. The definition says that "control" means the holding of any property of a public service corporation so that such holding may affect the use or operation of such property or the holding of ownership of the majority of the stock of such corporation. This latter provision refers not only to the holding company but to a single person or to a syndicate of persons. Under the proposed amendment also the Public Service Commission is authorized to fix commutation and school rates, or interchangeable mileage over railroads and street railways, except for one continuous ride which is wholly within a city of the first class. Another amendment provides that in addition to the purposes for which stocks and bonds may be issued now, such securities may be put out with the approval of the commission for the reimbursing of money actually expended for permanent improvements. The sections referring to gas and electric corporations were so amended as to comply with the sections referring to railway corporations. The fight for and against the bills was made very active in Albany, members of the commission being on hand to advocate their passage and the public service corporations being represented by counsel. Joseph H. Choate, former Ambassador to Great Britain, was the leading speaker in behalf of the traction lines of New York City. His argument that the lines were already handicapped in the performance of their duty by too much commission regulation has been answered in a public letter signed by the secretary of the Public Service Commission of the First District.

At a conference between a select committee of the New York Board of Estimate, the Borough Presidents and the Public Service Commission last week it was determined to proceed at once with plans for the construction of the Fourth Avenue subway line in Brooklyn. The first step will be to secure the consent of the property owners. Contracts have already been let for a portion of the work, but it is not likely that work will be commenced in the immediate future, as there is still a great deal of wrangling over the details. A fresh impetus has been given to the project by the report of General Tracy indicating that the city had a sufficient margin in its debt limit to undertake the work.

The Interborough Rapid Transit Company has already put into operation an experimental train of eight cars which have side doors in the center. This was in compliance with the Public Service Commission's order which said that a train should be ready for trial before May 1.

Spring Meeting of American Society of Mechanical Engineers.

The American Society of Mechanical Engineers will hold its spring meeting in Washington, D. C., May 4-7. Professional sessions will be held at which papers on the conveying of materials, gas-power engineering, steam turbines, the specific volume of saturated steam, oil-well pumping and various other subjects will be discussed. At the reception, which will be held in the New Willard Hotel, an address of welcome will be made by the Hon. B. F. Macfarland, president of the Board of District Commissioners, with a response by Mr. Jesse M. Smith, president of the society. During the convention President Taft will hold a reception for the members at the White House. The War Department will give a special exhibition drill of the United States troops at Fort Myer, to which the members and guests will be invited. At the same time, if the conditions are favorable, an ascension of a dirigible balloon will be made and probably also that of an aeroplane.

An address will be given by Rear-Admiral Geo. W. Melville (retired), past-president of the society, and former engineer-in-chief of the navy, the subject being "The Engineer in the Navy." This evening will be made the occasion for the presentation to the National Gallery of a portrait of Rear-Admiral Melville presented by friends and admirers. It will be received for the National Gallery by Dr. C. D. Walcott, secretary of the Smithsonian Institution. F. H. Newall, director of the Reclamation Service, will deliver an illustrated address on "Home Making in the Arid Regions." Trips will be made to various points of interest about the city and a number of pleasurable excursions have been planned. Among the papers to be presented are the following: "A New Transmission Dynamometer," by Prof. Wm. H. Kenerson; "Operating System for a Small Producer Gas Power Plant," by Mr. C. W. Obert; "A Method of Improving the Efficiency of Gas Engines," by Mr. T. E. Butterfield; "Small Steam Turbines," by Mr. Geo. A. Orrok.

Graduate Study at the Massachusetts Institute of Technology.

In the recent report of Acting-President Arthur A. Noyes, of the Massachusetts Institute of Technology, particular emphasis is placed on the advanced instruction of graduate students. Dr. Noyes points to the fuller provision now made at the institute for advanced study leading to the higher degrees of master of science, doctor of philosophy and doctor of engineering as one of the most important developments of the year. These courses are described in a bulletin entitled "Advanced Study and Research" which has been issued by the institute.

Another important movement which also supports the cause of advanced study at the Institute of Technology has been the establishment of the new Research Laboratory of Applied Chemistry in which opportunities are afforded for research assistants and advanced students to execute investigations of chemical problems which are of interest to manufacturers. This research laboratory co-operates with the Research Laboratory of Physical Chemistry which has been supported by the Institute of Technology for some years. It is expected that a

Research Laboratory of Applied Electricity may soon be established. During the present institute year graduate students received the advantage of $5,100 in awards for fellowships and graduate scholarships. Another factor of importance for graduate students is the institute library, the accessions to which aggregated 4563 items for the year 1908.

The students now at the Institute of Technology who are graduates of the courses of this or other institutions aggregate 215, and these come from 91 different colleges and universities. The largest number from any one institution besides the Institute of Technology is 16. Many of these students are taking under-graduate engineering work in the institute classes. Others are pursuing the advanced or graduate instructions. Among the total student body, 46 States and Territories, besides the District of Columbia, the Philippine Islands, Porto Rico and the Canal Zone, are represented; 30 foreign countries are also represented.

Electric Railway Convention Committee at Denver.

The committee of the American Street and Interurban Railway Association, appointed to investigate the advantages of various Western cities for the convention of the association next fall, left Chicago Saturday evening, April 17, for Denver, where it arrived an April 19 and is making its headquarters at the Brown-Palace Hotel. The members of the committee taking part in the trip are: Messrs. John I. Beggs, president Milwaukee Electric Railway & Light Company; E. C. Foster, first vice-president New Orleans Railway & Light Company; A. E. Lang, president Toledo Railways & Light Company, and B. V. Swenson, secretary American Street and Interurban Railway Association. Hon. James F. Shaw, president of the Boston & Worcester Electric Companies, expected to be a member of the party, but important duties in connection with the Massachusetts Senate, of which he is a member, at the last moment prevented his going. The American Street and Interurban Railway Manufacturers' Association also appointed a committee which is accompanying the committee of the Railway Association. The gentlemen composing this committee are: President Joseph R. Ellicott, of the Westinghouse Traction Brake Company, New York; Vice-President Charles C. Peirce, manager railway department, General Electric Company, Boston; Mr. James H. McGraw, president McGraw Publishing Company, New York; Mr. E. M. Williams, manager street railway sales department, Sherwin-Williams Company, Cleveland, and Secretary George Keegan, New York City.

It will be recalled that at the last meeting of the association the selection of a convention city was left to the executive committee and that at a meeting of the committee, which was held in New York, Jan. 28 to 30, it was decided that the convention should be held in some city west of the Mississippi River. Subsequently it was decided to visit several cities west of the Mississippi River before the final decision should be reached. Denver is the first city to be visited.

Local Section of Mechanical Engineers to Be Formed in Boston.

A meeting of about 150 representative mechanical engineers was held at the Edison Building, Boston, on Friday evening, April 16, for the purpose of forming a local section of the American Society of Mechanical Engineers. President Smith and Secretary Rice, of the national organization, addressed the meeting, and among the other speakers were Mr. F. R. Low, chairman of the Gas Power Section, and Mr. H. F. Bryant, vice-president of the Boston Society of Civil Engineers. A committee consisting of Prof. Ira N. Hollis, of Harvard University; Prof. Edward T. Miller, of the Massachusetts Institute of Technology; Mr. Charles T. Main, consulting engineer, of Boston; Mr. Irving E. Moultrop, of the Edison Electric Illuminating Company, Boston, and Mr. Joseph H. Libby, of Stone & Webster, Boston, was appointed to arrange for future meetings and adopt plans for the development of the local section. The movement began with an inquiry from a committee of the Boston Society of Civil Engineers as to the expediency of forming a mechanical as well as an existing sanitary section of that organization. It was found that only a small proportion of the local mechanical experts are members of the Civil Engineers Society, and it was decided to form a local section of the national mechanical organization following the lines of the Boston A. I. E. E. Section. It is estimated that there are about 350 mechanical engineers in the vicinity of Boston who will be interested in the new section.

U. S. Government Wireless Stations.

The United Wireless Telegraph Company has compiled the following list of 57 wireless telegraph stations maintained by the U. S. Government. The list is revised to April 15, 1909. A similar list of stations on American ships, including war vessels, contains 96 entries:

Ft. Levett, Me.	Ft. Monroe, Va.	North Head, Wash.
Cape Elizabeth, Me.	Beaufort, N. C.	Tatoosh Is., Wash.
Portsmouth, N. H.	Charleston, S. C.	Nome, Alaska.
Boston, Mass.	St. Augustine, Fla.	Cordova, Alaska.
Cape Cod, Mass.	Jupiter Inlet, Fla.	Circle City, Alaska.
Ft. Andrews, Mass.	Pensacola, Fla.	Fairbanks, Alaska.
Newport, R. I.	Key West, Fla.	Wrangell, Alaska.
Fire Island, N. Y.	New Orleans, La.	Sitka, Alaska.
Navy Yard, N. Y.	Guantanamo, Cuba.	Ft. Egbert, Alaska.
Ft. Totten, N. Y.	San Juan, Porto Rico.	St. Michaels, Alaska.
Ft. Wright, N. Y.	Culebra, W. I.	Ft. Gibbon, Alaska.
Ft. Wood, N. Y.	Colon, Panama.	Petersburg, Alaska.
Ft. Hancock, N. J.	Farallone Is., Cal.	Circle City, Alaska.
Phifadelphia, Pa.	Mare Island, Cal.	Zamboanga, P. I.
Cape Henlopen, Del.	Pt. Arguello, Cal.	Cavite, P. I.
Washington, D. C.	Table Bluff, Cal.	Island of Guam.
Annapolis, Md.	Point Loma, Cal.	Jolo, P. I.
Cape Henry, Va.	Puget Sound, Wash.	Oahu, Hawaii.
Norfolk, Va.	Cape Blanco, Ore.	Malalong, P. I.

Central-Station Relations with the Contractor.

At the meeting of the Brooklyn (N. Y.) Kilowatt Club on April 12 at the Brooklyn Edison clubrooms an address on electrical development was delivered by Mr. T. C. Martin, editor of *Electrical World*. There was a large gathering and the chair was taken by Mr. George Weiderman, president of the club and a leading Brooklyn contractor. Mr. Martin submitted the table herewith as evidence of the fact that the central-station industry of the country was still far from being properly developed, and showed as a matter of fact that telephony derived a larger income from the public, the isolated plant business in each field probably offsetting so as to leave the "public utility" figures a fair comparison.

Beginning of 1908.	Investment or capital.	Number of plants or companies.	Earnings.	Net income before dividends.	Total number of employees.
Electric light	$996,613,622	4,714	$175,642,338	$41,445,427	47,632
Electric railways..	3,774,772,096	1,236	429,744,254	40,340,286	221,429
Telephony	814,616,004	22,971	184,461,747	43,659,442	144,169
Telegraphs	220,293,575	25	51,583,868	10,704,255	28,034
	$5,806,295,297	58,946	$841,432,207	$136,149,410	441,264

Mr. Martin pointed out and described many recent plans of development, and laid special emphasis on the desirability of closer harmony and co-operation between the central station and the contractor throughout the country. The average central-station earnings per capita ought to be at least $5.

After the address there was a discussion of possible co-operation in Brooklyn between company and contractors, as had been suggested, along the line of the company financing certain contracts entered into by the local contractors and receiving payment therefor on the instalment plan; also of the matter of a possible set of standard specifications for house wiring. Definite action was postponed until another meeting.

At its next session the Kilowatt Club will take up the rules and regulations of the Brooklyn Edison system concerning installations and service, with a view to arriving at a set of requirements that will give greater satisfaction to all parties concerned.

CURRENT NEWS AND NOTES.

ARKANSAS PUBLIC UTILITIES CONVENTION.—The Arkansas Association of Public Utilities Operators will hold its convention at Hot Springs, May 13, 14 and 15, 1909.

NO CONNECTICUT PUBLIC SERVICE COMMISSION.—The committee of the Connecticut State Legislature having cognizance has reported unanimously against a bill before it to create a public utilities commission.

WORLD'S FAIR FOR BOSTON SUGGESTED FOR 1920.—A movement has been started in Boston to arrange plans for a World's Fair in 1920 to celebrate the 300th anniversary of the landing of the Pilgrim Fathers on Plymouth Rock.

ELECTRIC SOLDERING IRONS FOR NAVY YARDS.—The United States Navy Department in a schedule of electrical supplies, for which bids will be opened May 4, includes 54 electrical soldering irons for the Philadelphia Navy Yard.

SIOUX RAPIDS WATER-POWER RIGHTS.—A member of the Canadian Government has stated that he has information from Washington that the United States proposes to acquire absolute control of all the water rights along the Sioux Rapids.

GAS-PRODUCER TESTS.—A series of gas-producer tests are being made in the mechanical engineering laboratory of the University of Illinois under the general direction of Mr. C. M. Garland, instructor in the laboratory, assisted by Mr. A. P. Kratz, graduate student.

BELGIAN TECHNICAL BIBLIOGRAPHY.—The Société Belge des Ingenieurs et Industriels has announced the coming publication of a monthly bulletin giving notices of new technical books and the more important articles in the technical and engineering press of the world.

GERMAN PATENT TREATY.—The Senate Foreign Relations Committee has authorized a favorable report on the patent treaty with Germany. It is believed that a ratification of the agreement with Germany will be followed by patent treaties with other European countries.

JAMESTOWN MUNICIPAL PLANT.—The municipal lighting commission of Jamestown, N. Y., has reduced the commercial lighting rates, which formerly averaged 6 cents per kw-hour. The new rates are graded from 5 cents per kw-hour to 3½ cents for all above 30,000 kw-hours per month.

STANDARDIZING TELEPHONE RATES AND METHODS.—A meeting of the International Telephone Traffic Commission, at which were represented more than 2000 telephone companies, was held in Philadelphia last week, when the subjects of standardizing rates and adjusting methods were discussed.

"THE LADY OF THE DYNAMOS."—With this title Henry Holt & Company, publishers, have issued a novel, written by Adele Marie Shaw and Carmelita Beckwith, in which an electrical engineer is the hero. Carmelita Beckwith is also the author of a clever story, privately printed several years ago, entitled "Motoritis," being the autobiography of a dynamo.

TELEPHONE MAINTENANCE FUND.—Dating from Jan. 1, of this year, the Cuyahoga Telephone Company, of Cleveland, Ohio, will set apart 23 per cent of the gross earnings for purposes of improvements, replacements and depreciation of the plant. Heavy losses from storms, fires or other accidents will thus be provided for. It is estimated that the fund will yield $30,000 in excess of the expenditures for the present year. This money will be invested in bonds of the company or other securities that may be handled by Ohio savings banks. The amount will thus increase from year to year, barring extraordinary needs, and the company will be in a position to take care of its affairs at all times.

INSPECTION TRIP TO GARY.—On the invitation of Mr. Gleason, general superintendent of the steel mills of the Indiana Steel Company at Gary, Ind., the Chicago Section of the American Institute of Electrical Engineers and the Electrical Section of the Western Society of Engineers, of Chicago, will visit the plant at Gary in a body on April 24. The party will leave Chicago on the Lake Shore train leaving La Salle Street station at 10:45 a. m. Luncheon will be taken at Gary, and after inspecting the electrical equipment the party will return to Chicago in the evening.

"ELECTRIC LIGHT SPECIAL."—The special N. E. L. A. convention train over the Pennsylvania Railroad from Chicago to Atlantic City has been named the "Electric Light Special." It will leave the Union Station, Chicago, as a second section of the 18-hour "Pennsylvania Special" on May 30 at 3 p. m., arriving in Atlantic City about noon on May 31. It is expected that the Pittsburgh delegation will take this train. The train will go through Pittsburgh at 1 a. m. on May 31, but an extra sleeper will be attached there, and this car will be ready for occupancy at 10 p. m. on May 30.

CANADIAN WATER-POWERS.—Mr. R. E. Young, superintendent of the Dominion railway lands, in a recent statement to a legislative committee estimated the total horse-power known to be available in Canada at 25,682,907, distributed as follows: 17,075,939 in Quebec; 3,129,168 in Ontario, exclusive of Niagara Falls; 2,000,000 in British Columbia; 1,000,000 in Alberta; 600,000 in Northwest Territories; 504,900 in Manitoba; 500,000 in Saskatchewan; 54,700 in Yukon; 150,000 in New Brunswick, and 54,000 in Nova Scotia. Mr. Young endorses a prediction that owing to their great water-powers Ontario and Quebec would in time become the manufacturing centers of North America.

NEW YORK CENTRAL ELECTRIC POWER ASSOCIATION.—The employees of the New York Central & Hudson River Railroad Company occupied in the maintenance, operation and construction of the electric zone a year ago formed the Electric Power Association of the New York Central & Hudson River Railroad Company. Lectures and discussions by the members on topics of especial interest to the different departments are features of the monthly meetings. A question box is open to members. After a year of pronounced success the association had a social gathering of its members on April 20 at the Railroad Men's Building, Forty-fifth Street and Madison Avenue. At the next educational meeting, which will be held during the week beginning April 26, Mr. C. H. Quereau, superintendent of electrical equipment, will address the society on the subject of "Electrification of Steam Railroads."

NEW ELECTRICAL HARDENING FURNACE.—In a paper before the Faraday Society (England) Messrs. E. Sabersky and E. Adler described a new electrical hardening furnace built by the Allgemeine Elektricitäts-Gesellschaft, and consisting of a fireclay crucible containing a bath of metallic salts. By means of the electric current these salts are melted and kept at a temperature which can be made to reach any value up to, say, 1400 deg. C. For working this furnace alternating current of a voltage not exceeding 70 is used, and by means of a transformer fitted with regulator and switchboard, the supply voltage is lowered to this value. The hardening process consists of heating up the steel to a temperature above the critical point line, and a subsequent rapid cooling down. The authors claimed that the operating cost of the new electrical furnace on the basis of equal output works out lower than that of gas-fired muffle or bath furnaces. In reply to a question it was stated that no action of the fused salts on steel had been noticed, and that the furnace could be started up in 30 minutes.

MICHIGAN HYDRO-ELECTRIC DEVELOPMENT.—In a report to the Legislature of Michigan by a special committee it is stated that in the State there are hydro-electric plants aggregating 251,000 hp, and there is a possibility of the additional development of 300,000 hp.

ARGENTINE INTERNATIONAL RAILWAY EXPOSITION.—An international exhibition of railways and land transport will be held at Buenos Ayres, Argentine Republic, May 25 to Nov. 25, 1910. One of the features of the affair will be an international department for the exhibition of electric railway apparatus and material.

LIGHT AND THE EYE.—At a meeting of the New York Academy of Sciences, to be held in room 407, Schermerhorn Hall, Columbia University, New York City, at 4 p. m. on April 26, papers will be presented by Prof. S. W. Ashe on "Reactions of the Pupil to Color," Mr. David E. Rice on "Studies in Visual Acuity" and Mr. J. Carlton Bell on "Studies in Stereoscopy."

PENNSYLVANIA FREIGHT TROLLEY BILL.—Much interest has been shown in two bills now before the Pennsylvania Legislature, one of which permits electric railway freight and the other confers exchange provisions between steam and electric roads. It is reported that the large electric railway systems favor the bills, as well as the Pennsylvania Railroad. Under their provisions freight deliveries can be made in cities at night over electric lines.

ANOTHER "COLD-MOTOR" FIASCO.—As noted in these columns some months ago, the citizens of an Indiana town, officially and non-officially, enthusiastically endorsed and financed an invention known as a continuous water-power motor, the output of energy from which was claimed to exceed vastly the input. A newspaper dispatch records the latest phase—the disappearance of the inventor, and excited citizens called upon to meet liabilities of $50,000.

PROTEST AGAINST ELECTRIFICATION.—The operatives working at the terminals of the Chicago railroads have organized and sent a delegation to Springfield to protest to the Legislature against the passage of a bill providing for the electrification of all terminals in Illinois. The workmen base their objection to electrification on the alleged increase in danger to switchmen and trackmen. It is intimated at Springfield that the real backing of this protest is the railroad companies themselves.

ELECTRIC LAMP USED TO HEAT INCUBATORS.—A correspondent writes that on a large farm considerable difficulty was experienced with oil-lamp heated incubators, as many of the chicks died from the effects of the foul air if the attendant was not careful to remove them immediately after they were hatched. This trouble was practically eliminated by substituting an incandescent lamp, which maintained an even temperature of 102 deg. Fahr., required less attention from the operator, and entirely did away with all smell and smoke in the brooder-room, besides greatly reducing the chances of a fire.

MUNICIPAL ELECTRIC WORK IN CHICAGO.—Mayor Busse, of Chicago, in his annual message presented to the City Council on April 12, says that while the expenditures of the local Department of Electricity have grown materially, the efficiency of the department has increased in greater proportion. Thus, the number of arc lamps operated per employee in 1903 was 37.42, while in 1908 this figure had risen to 49.01. The average cost in salaries and wages of operating municipal street arc lamps in 1903 was $24.26 per lamp, whereas in 1908 this amount had dropped to $22.54. Turning to the inspections of electrical construction, Mayor Busse declared that in 1903 the number of inspections made by each electrical inspector was only 1143, while in 1908 the corresponding figure had risen to 2364. He added that the amount earned for the Department of Electricity per electrical inspector had been doubled in five years.

BASEBALL PLAYING AT NIGHT.—Again it is proposed to light baseball parks by electricity so that the great national pastime may be carried on after dark. From Cincinnati it is reported that the towers for the arc lamps to be used to light the National League ball park are already in position, and it is said that the experiment will also be tried in the National League ball park at Pittsburgh and in the new American League ball park in Chicago, which will be fitted up next year. In Cincinnati a separate company has been formed to introduce the evening amusements, and Mr. Herrmann, the "baseball magnate" of that city, is reported to have said that it will be easy to see the ball as far as it can be hit or thrown at League Park when the new electric-lighting equipment is in operation. It is proposed to "put on" all kinds of attractions, such as track meets and Marathon races, at the Cincinnati park in the evening, as well as ball games.

CONSOLIDATION OF CHICAGO STREET RAILWAYS URGED.—Discussing the proposed subway for street-railway traffic in Chicago, Mayor F. A. Busse, in his recent annual message, praised the work of the local transportation committee of the City Council in preparing the elaborate report on subways previously summarized in the pages of the *Electrical World*. He said that he regarded this report as one of the most important pieces of work undertaken during his administration. In the Mayor's judgment, however, the ultimate solution of the traction problem in Chicago must come through consolidation of the existing traction companies and the operation of their lines as one complete system. This will bring about the proper co-ordination of transportation routes. "None of us," said Mr. Busse, "can better serve the interests of the people of Chicago than by doing everything that lies within our power to bring about unification of our transportation service at the earliest possible date."

A REPORTER'S IDEA OF AN ALTERNATOR.—A Western newspaper prints the following description of a revolving-field alternator recently installed in its town: "The generators are of the latest pattern manufactured, and are altogether the reverse in plan from the original idea of generating electric current. Instead of generating the current by friction on copper commutators and carbon brushes, the electric current is generated through wave currents, and there is no friction of any kind whatever. The main generator is composed of a field of wires on a wheel 16 ft. in diameter. On the outside of this there is a stationary armature composed of copper wire, with an air space between the two. The field is magnetized with the direct-current generator and passes from the field in wave currents into the generator; thence through the main wires to the switchboard. It is on the same plan as picking up a small piece of steel with a common magnet, such as boys play with."

PROPOSED POWER DEVELOPMENT ON THE DESPLAINES RIVER.—Arguments were heard by the Supreme Court of the State of Illinois in Springfield, Ill., on April 15 in the case of the State of Illinois against the Economy Light & Power Company, of Joliet. The State seeks to restrain the company from developing the power of the Desplaines River at Dresden Heights, near the junction of the Desplaines and Kankakee rivers, to form the Illinois River. The case was taken under advisement by the court. It was brought before the Supreme Court on an appeal from the Circuit Court in Chicago, which ruled in favor of the company on the ground that the river is not navigable and that the company's power rights at Dresden Heights are fully sanctioned by law. The Desplaines River would form a part of the proposed deep-water way from the Lakes to the Gulf, and it is for this reason that the State is opposing the proposed power development.

Sioux Falls Hydro-Electric Development.

SIOUX FALLS is an enterprising city of about 16,000 inhabitants on the Sioux River, in South Dakota. The river has a considerable fall at this point, and quite recently the Sioux Falls Light & Power Company purchased the necessary water rights and erected a compact, modern hydro-electric plant of considerable engineering interest. The plant is located within the city limits, which enabled the water-power to be developed without step-up or step-down transforming stations or transmission lines. A dam was constructed with a maximum height of 8 ft. and approximately 600 ft. of spillway; the available head may be further increased by the addition of flashboards 36 in. high. By the construction of about 2000 ft. of retaining wall, the water was backed up, flooding an area of 16 acres. This, in addition to an upper pool having an area of 17 acres, gives a large storage capacity.

The intake and spillway, which were built during the summer of 1907, consist of a monolithic structure of concrete designed to take care of the flood and ice conditions of the Big Sioux River, which has an average flow at this point of 250 cu. ft. per second. To avoid ice troubles, the intake was designed for the slow movement of water, and all water is compelled to flow under an arch before reaching the racks, so that ice may be intercepted. The penstock, which is 680 ft. long and 7 ft. in diameter, is made of ¼-in. steel plate and has three expansion joints spaced about 180 ft apart. A water-regulating tower, 16 ft. in diameter and 62 ft. high, is placed about 25 ft. from the power house. The penstock ends in this regulating tower, and there is a steel pipe 9 ft. in diameter leading from the tower to the waterwheels in the power house. A 54-in. Ludlow gate valve is used in front of each turbine. The ratio of the area of the regulating tower to that of the penstock is about 5 to 1. This arrangement avoids all serious fluctuations due to variations in load. The company operates an electric railway as one of its utilities, and during the heaviest fluctuation in load which has yet been experienced, due to snow blockades on this railway, the maximum variation in the water level in the standpipe was only 18 in.

The power station was built during the spring and summer of 1908, and the whole plant was put in commission about Oct. 1, 1908. The power house is an attractive building with granite walls, steel trusses and a tile roof. It is 46 ft. x 92 ft. in ground dimensions and 55 ft. high, including a reinforced concrete basement. It is designed to accommodate four 500-kw turbo-generators, a 50-kw motor-driven exciter, a 50-kw turbine-driven exciter and two 150-kw railway motor-generator sets. Three of the main generating units are now installed. They are three-phase, 60-cycle, 2300-volt machines turning at 300 r.p.m. The turbines are at present operated on a 60-ft. head, but the plant is so designed that it can be operated on an 80-ft. head if future conditions should so demand.

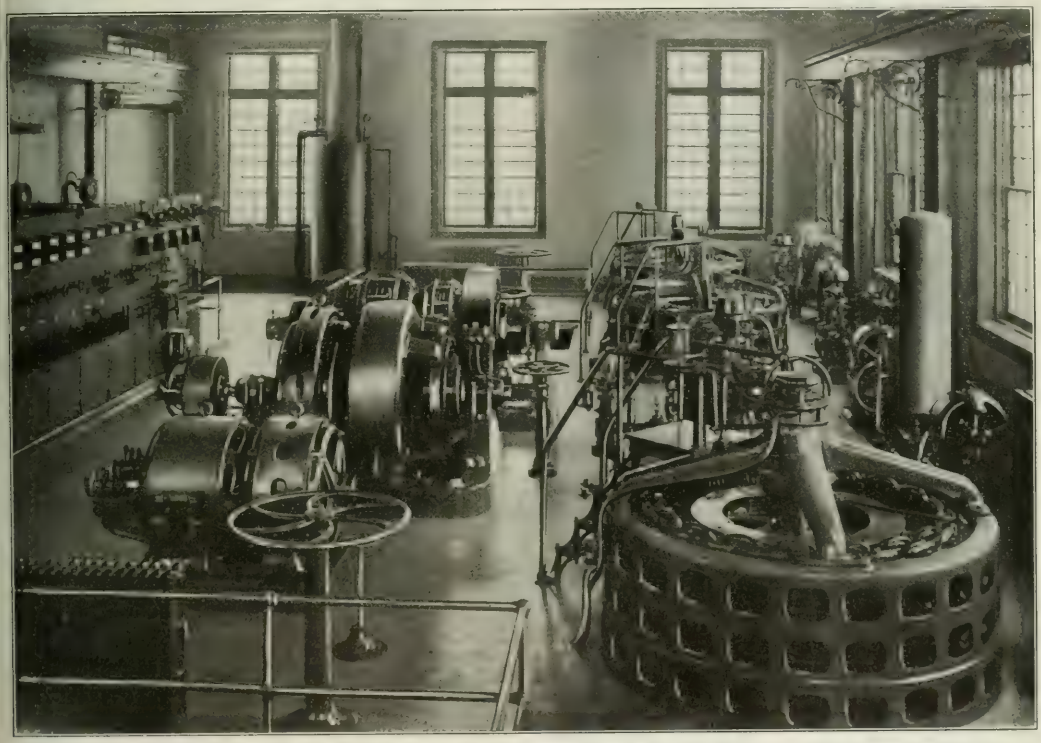


FIG. 1 – VIEW OF INTERIOR OF SIOUX FALLS HYDRO-ELECTRIC POWER STATION

The upper floor of concrete is supported on steel beams resting upon steel columns and concrete piers and carries the three main generators, exciters, governors, motor-generator sets, oil-pressure system, switchboard and other electrical apparatus. The gate-valve stands, by-pass valve stands and a small boiler for heating purposes are also on this floor. The portion of the floor carrying the generators is supported by thick concrete walls forming partitions separating the turbines. An intermediate floor carries the thrust bearings and regulating cylinders. The basement floor carries the turbines, penstocks and gates. The penstock is supported on concrete piers resting upon the floor and has a branch connection to the gate valve of each turbine. That part of the floor supporting the turbine and discharge casing is reinforced by heavy I-beams. Provision is made for installing long draft tubes which will extend down in long radius bends and will be supported by piers on bedrock.

Ways are built just outside the foundations in the tailrace for stop logs, with a space between for filling with sand bags, etc.

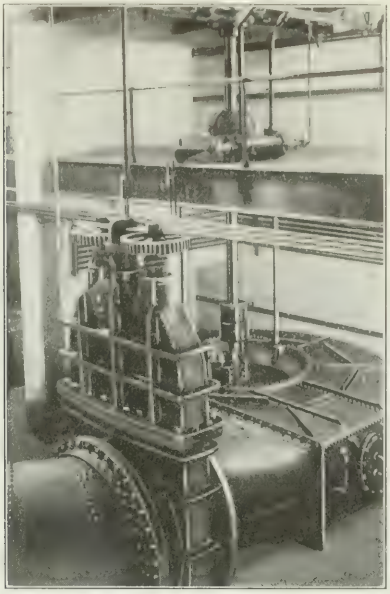


FIG. 2.—GATE VALVE.

so that the draft-tube pits may be unwatered for examination.

Space was allowed in the design of the building for the installation of another main unit of the same size as the three

When the cofferdams are removed the effective head will be increased by about 10 ft. The thrust bearings are of the oil bath, salt contained type, consisting of a cast-iron thrust block which is locked on the shaft by means of a heavy key and thread. This block turns in an oil bath on the surface of a cast-iron base ring. The turbines, which are of the reaction type, are built with spiral casings which are said to add to the efficiency of the



FIG. 3.—VIEW OF INTAKE, GATES, SPILLWAY AND WALLS OF DAM.

unit as a whole. Self-oiling, babbitted steady bearings of heavy construction are placed on top of the turbine crown plates and another babbitted steady bearing is carried on the bed plates supporting the thrust bearings. The generator shafts, which are coupled to the turbine shafts above the thrust bearings, also are supplied with two steady bearings, one of which is carried by the generator stator at the upper end of the shaft, and the other by the spider supported from the generator base

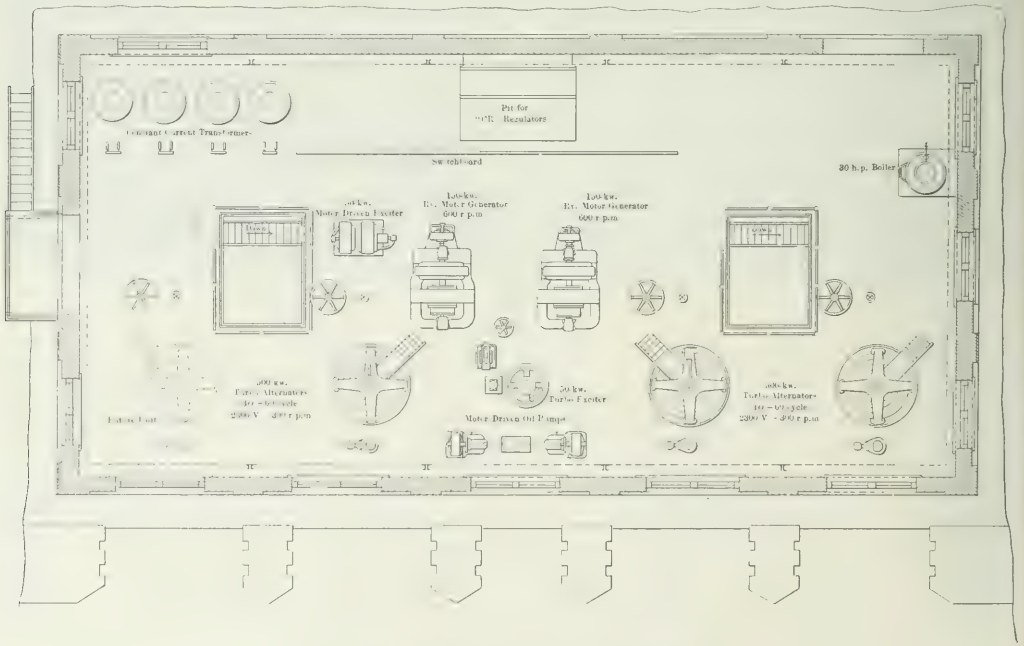


FIG. 4.—FLOOR PLAN OF NEW POWER HOUSE.

now installed. The turbines are at present equipped with short steel draft tubes which will be extended as mentioned above.

ring. The gates are of the swivel type operated through regulating shafts and connections.

The governors supplied with the turbines are of the oil-pressure type. Oil under pressure is delivered to a receiving tank by a motor-operated rotary pump. From the tank the oil is transmitted to a regulating cylinder containing a piston, which is connected through a rod and short link direct to the regulating shaft. The oil acting on either side of the piston causes it to operate the gates in accordance with the changes in load. The governor proper is driven from the turbine shaft by means of a belt. It consists of a stand upon which are mounted the flyballs, floating lever, compensating dash pot, synchronizing attachment and relay device. The governor head used is very sensitive.

The exciter turbine is of the vertical, single-reaction type, enclosed in a plate-steel spiral casing and is of the same general design and construction as the main turbines. It is designed for 100 hp under a 60-ft. head and is direct-connected to a 50-kw, 125-volt, compound-wound generator. This set is large enough to furnish all the excitation for the main generators. The motor-generator exciter set is made up of an Allis-Chalmers 125-volt generator, direct-connected to a three-phase, 60-cycle induction motor, and will be used to excite the main generators

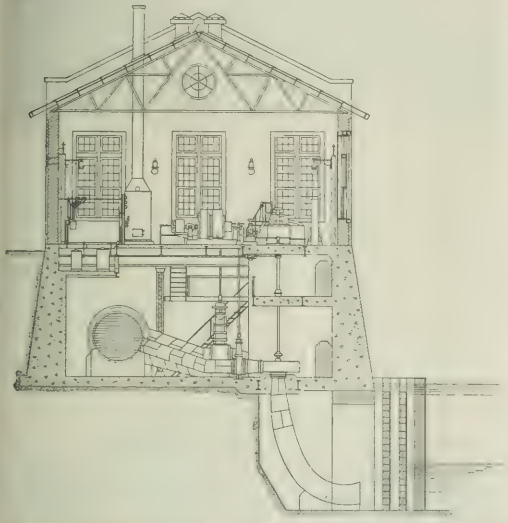


FIG. 5.—CROSS-SECTION OF NEW POWER HOUSE, THROUGH EXCITER COMPARTMENT.

in case it may be desired to shut down the turbine-driven unit.

A 12-ton, hand-operated, Whiting traveling crane is installed in the generator-room. The main generating equipment was supplied by the Allis-Chalmers Company. One of the motor-generator sets is from the General Electric Company and the other from the Crocker-Wheeler Company, both being driven by 2300-volt synchronous motors. The first-mentioned is of the two-bearing type, and excitation is supplied by a 4-kw, 125-volt, direct-connected Crocker-Wheeler generator. The direct-current generator of the General Electric set is a 600-volt railway machine. The submerged-tube steam boiler, used for heating purposes, was furnished by the Kewanee Boiler Company.

The main operating floor of the power house is 20 ft. above the basement, where the turbines are located. The switchboard is about 38 ft. long and is placed 7 ft. away from the wall. It is made up of 18 black-slate panels with General Electric controlling apparatus. Back of the switchboard on the wall are the lightning arresters, separate arresters being provided for the single-phase lines and for the three-phase lines. At one side of the switchboard are located four constant-current transformers with their individual controlling panels. The outgoing lines consist of four three-phase, 2300-volt lines and six single-phase, 2300-volt lines passing through porcelain tubes in the wall and thence to the pole line.

From this plant the company supplies electricity to operate the street-railway system, and also energy for factories, business houses and private residences. The company also has a street-lighting contract. Its line construction is very good. Sometimes severe climatic conditions are encountered. During last February a snowfall of 25 in. was reported in one night, and during the following day only two blocks of street railway line could be operated. In the face of this severe test the company lost only two poles, and there was no interruption of the distribution of energy from the plant.

The Sioux Falls Light & Power Company owns land on both sides of the Big Sioux River. It has two dams and two hydro-electric power plants with the necessary water rights and a steam auxiliary plant. The officers of the company are as follows: President, Mr. E. W. Coughran, Sioux Falls; vice-president, Mr. W. G. Haley, Sioux City; treasurer, Mr. G. B. Caldwell, Chicago; secretary, Mr. Fred H. Read, and superintendent, Mr. Arthur Huntington, both of Sioux Falls, S. D. The plant was designed by H. M. Byllesby & Company, engineers, Chicago, under the immediate supervision of Mr. O. E. Osthoff, vice-president and chief engineer.

Joint Pole Lines in Los Angeles.

By J. E. Macdonald

Everybody who has visited Southern California during the last decade has no doubt marveled at the wonderful development and growth of this section. Los Angeles has more than tripled its population in that period, and suburban towns have arisen as by magic under the stimulating influence of the finest suburban trolley system in the world. The demand for utilities, such as light and telephone, has increased in even a greater proportion, and the operating companies have been taxed to meet the eager demand for their service.

In the city of Los Angeles are two telephone companies, three lighting companies and four electric railway systems, all of which are operating independently and have immense distributing systems and branches to many of the outlying towns and cities within a radius of 100 miles of this Southwestern metropolis. Such rapid development was accompanied to a marked degree by the "pole nuisance," which is now being overcome.

The Joint Pole Committee of Los Angeles is a committee of representatives of the various utility companies, and has for its object the elimination of all unnecessary poles outside of the regular conduit districts established by city ordinance. The Pacific Electric Railway Company, Pacific Light & Power Company, the Los Angeles Railway Company, the Edison Electric Company, the Los Angles Gas & Electric Company, the Los Angeles Pacific Company, the Pacific Telephone & Telegraph Company and the Home Telephone & Telegraph Company are actively engaged in this commendable work, as well as a number of outside or subsidiary companies, which participate to a lesser degree. The committee has an organization operating in a measure independently from any of the parent companies, but under the jurisdiction of the authorized members selected by the various companies interested. Combinations are arranged for and recorded through the secretary, who handles the details and provides for an equitable settlement on all combinations. The committee was organized for active work Feb. 1, 1907, and during the two years to date has accomplished a great deal toward bettering local conditions. During this period combinations have been made on over 10,000 poles in and around the city of Los Angeles, thus eliminating a much larger number of poles which would have been otherwise necessary.

Los Angeles is a city covering a very large area. An extension to outlying sections of the conduit district would be impracticable under the favorable rates given to patrons of the utility companies, and the "Joint Pole" proposition has solved this otherwise vexing problem. Popular agitation with reference to the companies' poles has almost ceased entirely since the adoption of this co-operative method, and has helped the companies themselves in making construction better and cheaper, while promoting harmony among the operating officials of the



FIG. 1.—A CONGESTED OVERHEAD SYSTEM



FIG. 2.—AN INTERESTING COMBINATION



FIG. 3.—THE OLD METHOD



FIG. 4.—THE NEW METHOD



FIG. 5.—A COMBINATION CORNER.



FIG. 6.—FIVE COMPANIES USE ONE LINE OF POLES.

JOINT POLE LINES IN LOS ANGELES

various companies whose business interests must be in direct opposition.

The committee, through the secretary, relieves the companies of all details relating to joint construction, and maintains with each company at an extremely low cost a duplicate file of all combination work.

In recording combinations a map is made showing the exact location of the poles, each pole having a reference number which corresponds to the house or street number at that particular location. These maps or supplements, when approved, are filed in a regular vertical street index, prints being furnished all members of the committee. In addition, an index card is prepared which gives an exact copy of the information contained in the schedule shown on the map. These cards are filed in a company index, which is arranged to show the various owners and applicants in combinations. In addition to this, each supplement when approved receives its consecutive number which offers an additional check for reference purposes only. Among other details which the committee handles successfully is keeping the companies advised of changes in street lines or other public improvements which may affect the various pole lines.

Referring to the accompanying illustrations, Fig. 1 shows a congested condition on a street to be widened, when all lines will go on combination poles. The poles of Fig. 2 carry three 15,000-volt, three-phase circuits; 2200-volt primaries with 440-volt, 220-volt and 110-volt secondaries; 6000-volt series street-lighting circuits; 500-volt railway feeder and a railway-telephone circuit. Fig. 3 shows the poles of five companies set on private property—the old way—and Fig. 4 is a view of a line on private property carrying the circuits of two telephone and one lighting company. Fig. 5 shows a combination corner; the combination line 2½ miles along the avenue and 1½ miles along an intersecting street. Fig. 6 is a combination line carrying the circuits of five companies.

The Effect of the Starting Characteristics Upon the Operation of an Induction Motor.

By M. Berthold.

THE induction motor has been treated in the past by several authors, more recently especially with regard to the predetermination of the magnetic leakage. The purpose of the present article is to consider briefly in a general way some of the factors of influence in the starting and operating performance with particular reference to the polyphase squirrel-cage type of machine.

The well-known circle diagram which will be used in the treatment below in its simple form exhibits all of the performance characteristics of the motor clearly and they can therefore

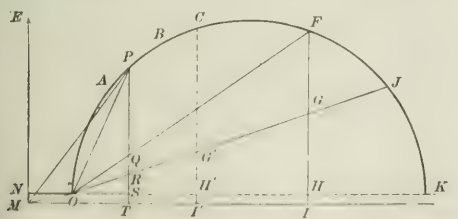


Fig. 1 Simple circular current locus of an induction motor

easily be followed. This diagram has been fully discussed in the pages of the *Electrical World*. Special reference is made to an article in the issue for May 26, 1906, by Dr. A. S. McAllister, dealing with the simple circle diagram in which the various quantities determining the motor characteristics are explained. This diagram is reproduced herewith as Fig. 1.

Before entering upon the discussion of the starting performance, the usual definition of the starting torque may well be considered. The actual torque exerted by the rotor at starting is usually expressed in per cent of the synchronous torque—that is, the torque which the motor would have when developing its full-load rating if it were running at the synchronous speed; this torque is smaller than the so-called running torque. The ratio of the synchronous torque to the running torque is accurately shown in the circle diagram by the relative length of PQ and PR, assuming P to be the point on the circle at which full-load exists. In the same diagram the starting torque is represented by the length FG. The ratio of the starting torque to the synchronous torque, represented by the lengths shown in the circle diagram, is seen to be the ratio of the secondary power dissipated as heat at the moment of starting to the watt output of the motor under load.

In the following table is given a list of symbols which will be used below:

W_o = no-load watt input.
W_l = watt output of motor at full load.
W_i = watt input of motor at full load.
W_k = watt input of motor at starting.
I_1 = primary current at full load.
Ik_1 = primary current at starting.
I_2 = secondary current at full load.
Ik_2 = secondary current at starting.
S = slip at full load in per cent.
L_p = total primary losses.
I_o = primary current at no load.
Ik_i = ideal primary current at starting.
r_1 = primary resistance.
r_2 = secondary resistance.
$\cos\Theta$ = power factor at full load.
$\cos\Theta_k$ = power factor at starting.
$\cos\Theta_o$ = power factor at no load.
η = efficiency.

The secondary copper loss can be expressed as

$$I_2^2 r_2 = (W_i - L_p)\frac{S}{100} \qquad (1)$$

When both sides of equation (1) are multiplied by $\left(\frac{I_{k2}}{I_2}\right)^2$ and divided by W_l, there is obtained

$$\frac{I_{k2}^2 r_2}{W_l} = \frac{(W_i - L_p)}{W_l} \cdot \frac{S}{100} \cdot \left(\frac{I_{k2}}{I_2}\right)^2$$

The left side of the last equation represents the ratio of the secondary power lost at starting to the full-load watt output of the motor. The value of $\frac{(W_i - L_p)}{W_l}$ is

$$\frac{\text{sec. input}}{\text{sec. output}} = \frac{100}{\text{sec. eff.}} = \frac{100}{100 - S}$$

Hence the starting torque in per cent of the synchronous torque has the value

$$\frac{S}{100 - S} \cdot S \cdot \left(\frac{I_{k2}}{I_2}\right)^2 \qquad (2)$$

For comparisons and for practical considerations the relations of expression (2) are best shown by Fig. 2.

Starting Performance.

A disadvantage of the polyphase squirrel-cage induction motor when compared with other types of motors is found in its poorer starting performance. It is of interest, therefore, to investigate the possibility of obtaining a high starting torque and to consider the factors determining such condition. In the second part of this article will be shown the influence of these factors upon the operating performance.

The starting torque of a motor can be varied by changing the secondary resistance—that is, by changing the slip for each value of torque. By this procedure the leakage and consequently the circular current locus remains the same. With the increase of the torque the watt input of the motor at starting is increased and the starting current is slightly reduced; how-

ever, the power factor at starting is increased, although the efficiency under load and the maximum possible output are decreased.

In a new design, therefore, for general reasons it is not desirable to exceed a certain value of the slip, and hence the only alternative is to increase the starting current to the extent illustrated in Fig. 2. The increase of the starting current is

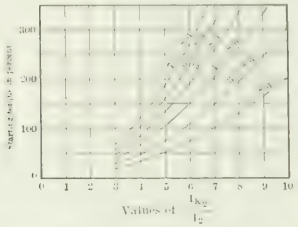


FIG. 2 STARTING TORQUE FOR VARIOUS DESIGN PROPORTIONS.

obtained by reducing the resistance and reactance of the motor circuits.

When designing induction motors one must keep in mind the fact that when attempting to change the performance prevailing, for instance, at starting, the performance at another condition is changed in consequence thereof.

The condition existing at starting is represented by the circle diagram of Fig. 1, where *MF* and *OF* are the primary and secondary currents in value and phase relation. The line *OJ* separates the primary and secondary copper losses. The starting torque and the maximum running torque are represented by *FG* and *CG'*. Fig. 1 thus shows the quantities in which one is most interested.

A relatively high torque at starting could be obtained by making *FG* nearly equal, or equal, to *CG'*. The ratio of the two quantities has obviously a predominant influence upon the performance of the motor between "no load" and "standstill," as the diagram plainly shows.

With respect to a good operating performance and a high torque, or—what is of greater moment—a good starting performance in general, it will be found necessary to design the squirrel-cage induction motor with low impedance in the circuits; that is, cos Θ_k will be large. Merely a high torque may be obtained, of course, when cos Θ_k is small; however, the starting current must necessarily then be very large, as will be shown later.

As mentioned above, the slip under load is fixed by the values I_2 and r_2. In all cases the primary resistance may then be relatively small so as to obtain a high starting torque.

For motors designed with a large value of cos Θ_k, the entire performance from "no load" to "standstill" may be developed within the first quadrant of the circle, Fig. 1. The maximum possible watt input occurs then at starting.

A further inspection of the circle diagram shows that the maximum output occurs at *B*. It is evident that this output is directly depending upon the value of cos Θ_k. At present a maximum output of approximately 200 per cent of normal seems universally to be accepted as the rule. This proportion with general good operating performance keeps the starting current within a reasonable limit. Therefore a correct predetermination of the starting current is important.

The starting current depends largely upon the magnetic leakage reactance of the coils. In determining the leakage reactance three leakage fluxes must be considered:

1. The leakage flux across the slots of the stator and the rotor.

For a given main flux this leakage is decreased by increasing the number of slots per pole per phase, provided the ratio of slot-depth to slot-width does not change.

2. The leakage across opposing tooth-tips.

Obviously this leakage varies with the relative position of the stator and the rotor teeth, and would be a maximum for wide open slots and a small number of slots. The variation of the leakage reactance for different rotor positions varies the starting current slightly; however, the starting torque is varied even more. The use of partially closed slots and a large number of slots in either the stator or the rotor decreases this variation. This change generally leads to deep and narrow slots, particularly in the rotor; it would thus increase the slot leakage and it usually causes additional iron losses by the increased frequency of pulsation in the teeth and gap surface, which facts prohibit the use of such modifications for obtaining uniform starting torque.

3. The leakage flux around the winding of the stator and the rotor coils.

For a full-pitch winding the length of the winding-head of the coils is approximately from 40 to 50 per cent greater than the pole-pitch. It is evident that the leakage flux, to some extent, is governed by the number of poles, the diameter at the gap and the style of the winding. In most cases, however, a reduction in the length of the winding-head by the use of a fractional-pitch winding reduces the leakage reactance; moreover, by using a winding with two coils per slot when cording

TABLE OF CHARACTERISTIC DATA.

Motor No.			1			2			3			4			5	
Number of poles			6			4			4			4			6	
Number of phases			3			3			3			3			3	
Number of cycles			60			60			60			25			60	
No load	I_0 in % of I_1		34.2			31			33			40			39.5	
	W_0 in % of W_1		3.83			4.55			4.82			6.55			6.43	
	Cosθ_0		.086			.202			.211			.255			.126	
Starting performance	W_k in % of W_1		318			448			63			168			377	
	Cosθ_k		.482			.595			.787			.823			.34	
	Actual maxim. start torq. in % of synchr. torq.		155			220			250			275			250	
	Values from circle diagr. ratio $I_{k_1}:I_1=$		5.03			5.84			6.18			7.1			8.85	
	" $I_{k_2}:I_2=$		5.81			6.46			6.72			7.35			10.15	
	% slip at full load = S.		4.8			5			5			5			2.3	
	Load condition	η	cos θ	cos $\theta \times \eta$	η	cos θ	cos $\theta \times \eta$	η	cos θ	cos $\theta \times \eta$	η	cos θ	cos $\theta \times \eta$	η	cos θ	cos $\theta \times \eta$
Operating performance	25%	.854	.545	.465	.755	.643	.486	.787	.584	.46	.665	.547	.374	.795	.53	.422
	50%	.89	.765	.681	.838	.823	.69	.872	.78	.68	.782	.743	.581	.877	.737	.646
	75%	.885	.85	.752	.853	.887	.756	.868	.872	.757	.802	.84	.673	.901	.834	.751
	100%	.874	.879	.768	.85	.915	.778	.857	.908	.778	.804	.888	.714	.91	.879	.80
	125%	.858	.893	.767	.835	.926	.773	.833	.925	.77	.789	.915	.722	.915	.904	.827
	For max. output	.667	.82	.538	.61	.864	.526	.57	.896	.541	.527	.925	.488	.725	.79	.573
	% load at max. cos$\Theta \times \eta$		110%			100%			110%			125%			175%	
Max. output in % of normal			206			223			221			223			394	
Max. power-factor			.894			.93			.934			.938			.925	
% load at max. pow.-factor			140			140			160			190			200	
$\sigma = \frac{I_0}{I_{k_1}}$			.0581			.0417			.0362			.0314			.042	
$\frac{I_0}{I_{k_2}}$			.0677			.053			.0545			.0634			.0452	

the winding, the leakage reactance can be reduced because of the elimination of part of the total leakage in those slots where the current in the two coils is opposite in direction. Fractional-pitch windings have been fully considered by authors* with special reference to the induction motor, and need not be discussed here.

OPERATING PERFORMANCE.

Induction motors of the squirrel-cage type, in standard sizes at least, should have a good operating and starting performance. All of the factors of importance for good starting performance and their influence upon the characteristics at no-load and during operation are best illustrated by a table giving the complete performance data of a number of polyphase squirrel-cage induction motors. Five motors have been selected for this purpose.

The test results have been compared with the equivalent values of power factor and efficiency at the various load conditions as derived from the circle diagram. The discrepancies are small and may be attributed to observational errors due to either method; there have been selected for the present comparison the data derived from the circle diagram, as given in the accompanying table.

The first four machines compared are relatively small motors, while the fifth and last is a large motor selected because of the special features of large overload capacity and good operating performance. The starting torque of the last motor, while high, is not of considerable importance in actual service, because the motor starts with light load. In comparison with the other motors it has a low power factor and watt consumption and a relatively high torque.

For each motor there is given the ratio of the magnetizing current to the ideal starting current, which is nearly equal to Heyland's leakage factor; quite frequently the ratio of the induction motor's idle current to the actual starting current is used, which is also given for comparison. This value, however, is without meaning unless the power factor at starting is stated in connection therewith. The no-load data are given in order to show some of the variations frequently encountered in motor performance or directly depending upon the general characteristic.

In conclusion, the general considerations relating to the starting and operating performance may be summarized as follows:

The starting torque depends principally upon two factors, namely, the secondary resistance and the starting current. When affecting an increase of the starting torque by an increase of the secondary resistance, the efficiency under load and maximum output are decreased.

When affecting an increase of the starting torque by an increase of the starting current in the case of a new design, the maximum output may remain the same or may be increased and the slip at full load at the same time may be decreased; the efficiency then depends upon the power factor at starting.

Within small variations of the power factor at starting, on the basis of equal maximum outputs and no-load characteristics, the influence of the power factor at starting upon the operating performance may be outlined as follows:

For high power factor at starting the light-load efficiency is relatively high and the power factor at normal load is low; at overload the efficiency is low and the power factor is high.

For low power factor at starting the light-load efficiency and power factor under full load are not appreciably altered; at overload the efficiency is high and the power factor is low.

For a small variation of the power factor at starting and a corresponding increase of the starting current, the starting performance may be materially improved without appreciably altering the efficiencies within the commercial working range of the motor.

Standard polyphase squirrel-cage induction motors of small and medium sizes may well be designed for larger power factor at starting where good starting and operating performance is essential. In larger sizes, however, where relatively high starting torque is not of practical importance and where the best operating performance is the predominant factor, the power factor at starting may be relatively small.

*C. A. Adams, W. K. Cabot and G. A. Irving. *Proceedings* A. I. E. E., June, 1909.

Torque and Speed Relations in Polyphase Induction Motors.

By A. S. McAllister.

In view of numerous articles that have recently appeared in discussion of the starting characteristics of polyphase induction motors, it is believed that a single diagram for showing the interrelations of the primary and secondary quantities as affected by the change in secondary resistance and speed will prove of interest at this time.

As is well known, the most convenient method for representing the electrical characteristics of the induction motor is one involving the simple circular current locus plotted to polar co-ordinates. Such a diagram is shown herewith, the various quantities there represented being properly indicated. This diagram is based on measurements made upon a 440-volt, three-phase 6-pole, 60-cycle induction motor, having a synchronous no-load loss of 1120 watts, a primary resistance of 0.96 ohm, and a secondary resistance of either 0.5 ohm or 5.0 ohms—expressed in "equivalent single-phase" values.

At this point it may be well to recall that the diameter of the circular current locus is equal to the primary electromotive force divided by the sum of the primary and secondary magnetic leakage reactances, and is independent, in all respects, of the resistances of the two circuits. After having located the synchronous no-load point O on the circular current locus, and determined any other point, such as the starting point F, the complete locus can be drawn; all of the primary and secondary quantities can then be determined with extreme simplicity. At some point, such as P, along the current locus the distance MP is the primary current, of which PT is the power component, and TM the wattless component. PT is the power input (to proper scale); PQ is the output, and the ratio of PQ to PT is the efficiency. PR is the primary output, or the total secondary input; it is also equal to the rotor torque—to proper scale. QR is the secondary copper loss; $QR \div PR$ is the slip, while $PQ \div PR$ is the speed with synchronism as unity.

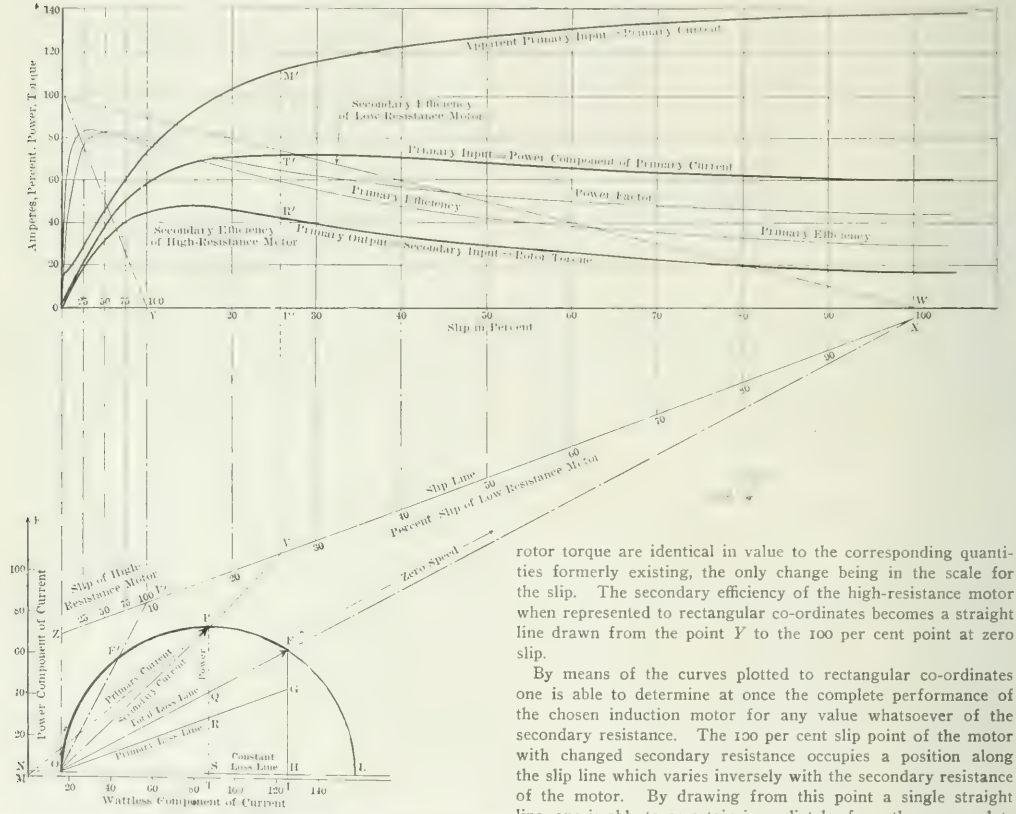
For many purposes, particularly for the demonstration given below, it is convenient to represent the speed directly on the diagram. This representation possesses the maximum of simplicity because it involves the use of merely an additional straight line drawn parallel to the primary loss line ORG; such a line is shown at ZVX, the synchronous speed—zero slip—point Z being vertically above O. The zero speed—100 per cent slip—point would be located at the intersection of this line with the total loss line OQF, at some point such as X. If, through any point on the current locus, such as P, there be drawn a straight line passing through the point O, the intersection with the speed line—or rather the slip line—at a point such as V, shows the slip in per cent of synchronism by the length ZV; that is to say, the distance ZV bears to the total length of the "slip line" the ratio of the slip to the full synchronous speed. At some other point on the current locus, such as F', the slip would have the value indicated by the intersection of the extension of the line OF' shown on the diagram as 10 per cent.

The proof of the accuracy of the above method of representing the slip was given by Mr. H. C. Specht in the issue of the *Electrical World and Engineer* for Feb. 25, 1905, and need not here be repeated.

By drawing from the point O various straight lines to selected points along the slip line at different chosen values of the slip, it is possible to ascertain directly the power component of the primary current, the wattless component of the primary current, the total losses of the motor, the torque, the efficiency, etc. It is convenient to represent the last-mentioned quantities to rectangular co-ordinates with the slip in per cent

as abscissa, as has been done in the accompanying illustration. The method of plotting the curves is indicated on the diagram. However, it may be well to mention that at any point along the slip line, such as V, the corresponding distance $P'M'$ is the primary current PM. The distance $P'T'$ is the power component of the current, PT, while $P'R'$ is the secondary input PR. The ratio of $P'T'$ *to* $P'M'$ is the power factor, while the ratio of $P'R'$ *to* $P'T'$ is the primary efficiency. The secondary efficiency, being equal to the speed in per cent of synchronism, can be represented by a straight line drawn from the point W to the 100 per cent ordinate value at zero slip. The product of the primary and the secondary efficiencies gives the efficiency of the motor, while the product of the secondary efficiency and the secondary input gives the output of the motor.

Special attention is directed to the change of the torque with



CHARACTERISTICS OF A POLYPHASE INDUCTION MOTOR PLOTTED TO RECTANGULAR AND TO POLAR CO-ORDINATES.

variation in the speed of the rotor. The torque of the low-resistance motor has a certain low value at starting, increases to the maximum at about 85 per cent of full-load speed, and then decreases rapidly as the speed increases to synchronism. It is evident that if a motor possessing the characteristics here shown were connected directly to the supply circuits with the rotor stationary, the machine would take a large value of current and yet would produce only a small starting torque. If the operating conditions were such as to demand a large torque at starting, the particular motor chosen would be incapable of complying with the requirements. However, it is possible to cause the motor to exert its maximum torque at any chosen speed merely by giving the proper value to the resistance of the secondary.

For the purpose of investigating the effect of varying the secondary resistance the accompanying diagram possesses many advantageous features. In explanation of this statement let it be assumed that the secondary resistance is increased to 10 times its former value. The only change necessary is that involved in so altering the scale along the slip line that the value which was previously 10 now becomes 100. Zero speed —100 per cent slip—is now represented along the slip line by the point V'. Moreover, the former curves plotted to rectangular co-ordinates for the low-resistance motor to represent the apparent primary input, the real primary input, the primary output, the secondary input, rotor torque, primary efficiency, and the power factor are identical with the curves to be plotted for the high-resistance motor. That is to say, when the resistance of the secondary is changed from its former value the primary current, secondary current, primary efficiency, power factor and rotor torque are identical in value to the corresponding quantities formerly existing, the only change being in the scale for the slip. The secondary efficiency of the high-resistance motor when represented to rectangular co-ordinates becomes a straight line drawn from the point Y to the 100 per cent point at zero slip.

By means of the curves plotted to rectangular co-ordinates one is able to determine at once the complete performance of the chosen induction motor for any value whatsoever of the secondary resistance. The 100 per cent slip point of the motor with changed secondary resistance occupies a position along the slip line which varies inversely with the secondary resistance of the motor. By drawing from this point a single straight line, one is able to ascertain immediately, from the curves plotted to rectangular co-ordinates, the primary current, the primary input, the primary output, primary efficiency, secondary input, rotor torque, power factor, secondary efficiency, the efficiency of the motor, and the output of the motor for any chosen value of the speed in per cent of synchronism.

The diagram plotted to rectangular co-ordinates shows in a striking manner the well-known fact that when a polyphase induction motor is subjected to a certain torque the effect of changing the secondary resistance is to vary the slip directly therewith without altering in any respect the primary current, the power factor, the input, the primary efficiency and the secondary input. Thus a polyphase induction motor of the slip-ring type could be accelerated from rest and brought to full-load speed under full-load torque while maintaining, and not exceeding, full-load input and full-load primary current, the power factor remaining constant. Under these conditions the secondary resistance would have a value varying directly with the slip of the rotor from synchronous speed.

Commutation Phenomena.

By Carlton L. Kennedy.

It is probable that in practice commutation in direct-current machinery is actually effected almost entirely by the resistance of the brush contact. Although the e.m.f. induced in the coil at the instant it is short-circuited by the brush, due to the coil not being in the exact neutral spot at that instant, has a great influence upon the shape of the current curve during commutation, and may materially aid or oppose good commutation, still the actual bringing of the current to its correct value in the armature coil at the last instant before the commutator bar passes out from under the brush is probably always actually effected by the brush-contact resistance.

In order to arrive at a clear understanding of just what happens when the coil is short-circuited by the brush, consider first the infrequent case where the brush is exactly upon the neutral spot on the commutator. In this case, if there were no inductance in the coil the current would divide between the two bars to which the coil is connected in exact proportion to the contact resistances between the bars and the brush spanning them, neglecting, of course, the effect of the resistance of the coil itself, which is usually so small as to be negligible. Since the area of the brush contact with any particular commutator bar, and therefore its resistance, would constantly change as the bar passed under the brush, the rate of change of current, $\frac{di}{dt}$, will be a constant quantity, and may be represented by a straight line whose slope is $\frac{di}{dt}$ as shown at $A\,D\,B$ in Fig. 1, where abscissas represent time and ordinates current. This straight line evidently represents the case of equal potential drop between the brush and both of the bars connected to the commutated coil, since the current density at the surface of each bar is the same.

All practical armature coils, however, being wound upon an iron core do possess considerable inductance. In order that the strength of the current in a circuit containing inductance may change, it is necessary to introduce an e.m.f. into the circuit, in which case the e.m.f. is represented by the equation $E = L\frac{di}{dt}$. It therefore follows that the rate of change of current is $\frac{di}{dt} = \frac{E}{L}$. The e.m.f. necessary to cause this change of current in the commutated coil is introduced by the fact that the inductance of the coil causes the current to lag behind the values it would otherwise assume. Therefore the current density, and with it the voltage drop, between the leading commutator bar and the brush rapidly become greater than that between the brush and the training bar. The difference between these two drops is the e.m.f. which produces the change in current in the coil. The current in this case follows a curve similar to $A\,E\,B$ in Fig. 1. In practically all cases, however, the brush is not set upon the neutral point when the dynamo is under load, on account of the field distortion. In this case the coil itself generates an e.m.f. which, added algebraically to the difference in the drops between the two bars, gives a new current curve. Assuming that this voltage is constant, a curve will result similar to $A\,F\,B$.

These curves were drawn under the assumption of constant contact resistivity between the brush and commutator at various densities.

An analysis of this simple diagram furnishes a good deal of information in regard to what is happening during commutation.

When the brush covers one bar or less, the area between the brush and one bar is decreasing constantly at the same time that the area between the brush and the other bar is increasing. The triangle lying below the straight line $A\,D\,B$ may be taken to represent the area between the brush and the bar passing out from under it, and the triangle lying above the straight line to represent the area between the brush and the other bar. Then at any instant of time, such as $O\,C$, an ordinate will give these instantaneous areas, $C\,D$ and $D\,G$, on the same scale that $O\,A$ is the total area.

Since the straight line $A\,D\,B$ represents the case of uniform current density, the actual current density at any instant for either of the curves may be determined by erecting an ordinate at some time point, such as at C. Then $C\,E$ or $C\,F$ will represent the actual current density between the brush and the bar passing out from under it, on the same scale that $C\,D$ represents the average density. Thus, if the average current density $C\,D$ is 30 amp per square inch, $C\,E$ would represent a density of about 45 amp per square inch, and $C\,F$ about 60 amp per square inch. Also $G\,E$ and $G\,F$ represent the current density between the brush and the trailing bar, if $G\,D$ represents the average density. Thus in Fig. 1, at the point E, the leading bar is carrying about 60 per cent of the total current while at F the leading bar is carrying about 85 per cent of the total current, notwithstanding the fact that the contact area $C\,D$ is only 0.4 of the total area.

The slope of the curve at any point is, of course, $\frac{di}{dt}$, and since the reactive voltage is $L\frac{di}{dt}$, it follows that the slope of the curve is everywhere proportional to the instantaneous reactive voltage.

In the actual plotting of these curves, two peculiar facts become apparent. The first of these is that whatever values be chosen for inductance, current and time of commutation, the curve will always end at point B. Commutation should, therefore, theoretically always be perfect under any conditions where

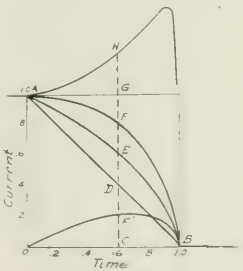


FIG. 1.—CURRENT CURVES.

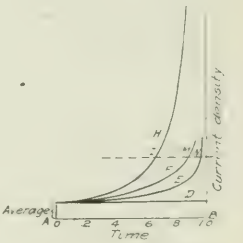


FIG. 2.—CURRENT DENSITIES.

the brush and commutator make good mechanical contact. What then does cause sparking? This question is answered by the other peculiar fact before mentioned. As the curve approaches B, $\frac{di}{dt}$ assumes greater and greater values, until at B, $\frac{di}{dt}$ approaches infinity—that is, the current curve becomes vertical just at B. Therefore, since $D\,C$, the area of the brush contact, decreases faster than $E\,C$, the current density, $\frac{EC}{DC}$ also rapidly becomes greater, and at B also approaches infinity. This is what might be expected, since E, which is a function of the current density, must always equal $L\frac{di}{dt}$.

Now it is a well-known fact that when the current density between a carbon brush and a commutator exceeds a certain value, the carbon becomes incandescent, due to the heat produced. The actual cause of sparking is then probably this sudden increase in current density just as the bar passes out from under the brush; the carbon, and often the copper of the commutator, becomes vaporized, thus furnishing a conducting path for the current for a short interval after the bar leaves the brush, and hence an arc results. Since it has been shown that the current density at the last instant always approaches infinity, it might be supposed that sparking would therefore always occur. That such is not the case is doubtless due to the fact that under conditions of good commutation the ex-

cessive density lasts for only an exceedingly short interval of time, 0.00001 second. As a certain lapse of time is always required to increase the temperature of a body appreciably, the brush has not time to become incandescent, and perfect commutation results.

It has often been observed that fine white sparks are not particularly injurious to the commutator, while when the sparks assume a greenish hue, the commutator is rapidly injured. The difference in the causes producing these two effects may be seen by referring to Fig. 2. Here abscissas represent time as before, while ordinates represent the ratio $\frac{LC}{DC}$ and $\frac{I \cdot C}{DC}$ of Fig. 1, which is, of course, the current density for the curves F and E. If it is assumed that BP is the current density at which incandescence occurs, it will readily be seen that this density lasts for a much shorter interval of time for the curve E than for the curve F. Now, if the interval of time necessary for the brush to become incandescent were just equal to NP, the edge of the brush would be vaporized at P for a very short instant each time a bar passed out from under the brush, and the fine white sparks above mentioned would be seen. However, since the heat conductivity of copper is much greater than that of carbon, the copper absorbs the heat more rapidly than the carbon, and it does not become perceptibly vaporized. The only effect on the commutator in this case is a somewhat more rapid wear than would otherwise occur, while it still retains its polished surface.

When the conditions are such as are represented in the curve F, the interval of time during which the excessive current density continues is much greater than for the curve E. The copper cannot then absorb all of the heat produced, and part of it is vaporized, forming the greenish sparks which are well known to indicate rapid destruction of the commutator.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Another Street Lighted with Arches in Grand Rapids.

Frequent mention has been made in these columns of the scheme of lighting business streets with arches of incandescent lamps, which originated in Columbus, Ohio, and has been adopted for a number of the more prominent streets of Grand Rapids, Mich. The idea seems to be spreading rapidly in Grand Rapids and other Michigan cities. On April 7 the Business Men's Association of Division Street, Grand Rapids, celebrated the beginning of arch lighting in that street with a banquet at the Herkimer Café. The Division Street public celebration was held Saturday, April 10. Merchants advertised special sales for that day, decorated the store fronts, trimmed the show windows and did everything possible to attract a crowd to Division Street on Saturday evening to convince people that merchandise could be bought as cheap on that street as anywhere else in the city.

Tungsten Lamps Increase Revenue in Denver.

Mr. C. N. Stannard, secretary of the Denver Gas & Electric Company, reports that his company has not thus far suffered any loss in revenue from the use of tungsten lamps, but in many installations has enjoyed increased revenue. In explanation of this statement it may be well to explain the situation in Denver in the fall of 1908. The company had not been actively pushing the tungsten lamp previous to that time. Some of the contractors and supply dealers in the city were beginning to get them into large installations with the argument that they would save the consumer money. In such cases the contractor would, of course, install lamps of lower wattage and decrease the consumer's bills without increase in illumination. The company met this situation by putting its representatives to work introducing these lamps among consumers on the basis of increased illumination rather than reduced consumption. The results have been as outlined by Mr. Stannard.

Special Window-Lighting Proposition at Fitchburg.

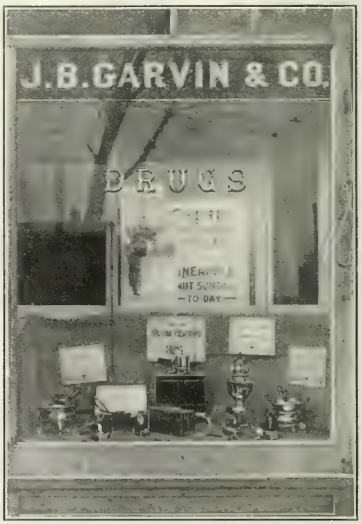
The Fitchburg Gas & Electric Company has made a special tungsten-lamp proposition to the merchants of the city for window illumination, quoting rates which include free renewals for this class of business. The proposition was made public at a recent meeting of the Board of Trade and Merchants' Association. The company's rates, as given below, apply per lamp per month for window service, the hours being from dusk until 10 p. m., except Saturdays, when the service extends to midnight.

Candle-power.	Rate per month.
20	$0.50
32	.65
48	.95
80	1.50
200	3.65

Each customer is to provide his own wiring, according to the requirements of the company. The lamps are to be turned off by the company's patrolman.

Renting Show-Window Space by Denver Gas & Electric Company.

The accompanying illustration of a show window in the drug store of J. B. Garvin & Company, in Denver, illustrates a point in central-station practice which will doubtless interest other companies. The Denver Gas & Electric Company gives the merchant free window lighting for two of his windows in exchange for the space given the company in one window.



A DENVER WINDOW RENTED BY COMPANY.

The merchant is pleased with the arrangement and the company has sold a large number of irons and other appliances through the use of this window. The store also serves as a headquarters for the company's representatives. The use of this window was first made for a display of electric irons with a notice telling of the 30-days' free trial offer. This worked out so successfully that the company gradually added electrical appliances until the exhibits comprised those shown in the illustration.

The Salesman and the Sales Manager.

Some interesting computations were given in a paper read before the Chicago branch of the National Sales Managers' Association, on April 8, by Mr. C. A. S. Howlett, district sales manager in Chicago of the Western Electric Company. Assuming that a traveling salesman is paid $150 a month, the speaker showed that this amount, with $200 a month for expenses, amounted in a year to $4,200, or, capitalized on a 5 per cent basis, $84,000. Thus, if a sales manager has 100 men under him he is virtually directing the equivalent of $8,400,000 of capital. From this it follows that the training of salesmen is a subject of great importance. Methods should be adopted for decreasing the number of changes in the selling force, and the training of salesmen to make them efficient, rather than constantly discharging unsatisfactory men in the hope of finding better ones, means a distinct saving in money in a large establishment.

In the training of salesmen the characteristics to be taken into consideration are willingness, reliability, aggressiveness, ability to suggest and initiative. A system of reports could be developed by giving to each salesman a monthly percentage mark in each of the characteristics mentioned, considering 100 as perfect. By adding these percentages together and dividing them by five an average percentage could be obtained for each man, and his numerical rank in order of usefulness could thereby be determined. This system gives an opportunity for training salesmen in those particular qualifications in which they are weak. If the markings show improvement from month to month they will indicate also that the efficiency of the sales manager has increased, for it is evident that if no progress is shown in the percentage markings the sales manager has been wasting his time in this direction. As a check on this system of marking by percentages the figures may be compared with the relative and actual value of the salesman's sales for his company.

A salesman receiving $300 a month will cost, assuming $340 monthly expenses, $7,680 a year. Capitalized at 5 per cent this will amount to $153,600. Assuming that a 10 per cent net return on this capital is satisfactory it then becomes this man's duty to earn a net profit of $15,360 a year. Adding $7,680 for direct expenses would make the total net profit the salesman would be expected to produce $23,040. If the profit on his goods averaged 20 per cent it would be necessary for this particular salesman to do a yearly business of $115,200. If, by proper direction, the efficiency of all the salesmen, viewed from a profit-return viewpoint, could be increased 10 per cent, or $8,400 a year, this increase would certainly justify giving the percentage system a thorough trial.

Comparison of Gas Arcs, Flame Arcs and Series Tungsten Arches for Business-District Street-Lighting.

By H. W. Hillman.

A year or more ago a street in Grand Rapids, Mich., 1800 ft. long, was lighted by merchants with series-tungsten lamps suspended on arches about 100 ft. apart. The merchants on this particular street were especially well satisfied with the illumination from every viewpoint. On another street, in connection with which new illumination was being considered, the merchants wanted to see a display of gas arcs before deciding upon the series-tungsten system. Accordingly poles were set about 50 ft. apart, staggered on either side of the street. Two gas lamps were installed on each pole. Inverted mantles were used, and the outer globe of the arc suspended at the top. The illumination was good when compared with the old method of lighting, but the volume of light and the perfect distribution secured by the tungsten arches gave evidence of the marked superiority of the tungsten arches over the gas arcs.

When the subject of cost was investigated it was found that for the number of gas arcs required to produce an illumination effect anywhere near equal to that of the series-tungsten system, the bid for gas lighting was nearly twice as much as for the series-tungsten lighting.

Before the trial was finished, and during the cold-weather season, the outer globes from the gas arcs were continually dropping on the street, causing uncomplimentary comments.

There seems to be no gossip about the introduction of gas arches across the street. It is questionable whether gas arcs could be suspended over the streets in the form of an arch, or whether there is any method of gas lighting which will compete with the series-tungsten arches, considering distribution, volume of light and appearance.

Considering particularly the point of distribution of light, the writer agrees with the opinion of Dr. Louis Bell in a recent lecture to the effect that light for streets should be suspended over the street and not concentrated on posts along the side. I believe this opinion is entertained by the best illuminating engineers. The tungsten arches represent a system quite in harmony with the above, while the distribution from gas arcs is not, and the results of the tests prove the inability of the gas arcs to distribute the light as well as the tungsten arches. The tungsten lamps are installed with reflectors above each individual lamp and are located only 6 ft. apart across the street. Therefore the pavement below is beautifully illuminated, and the arches are sufficiently near together to give a brilliant illumination between each one of them.

I have recently seen, in another city, a merchants' district illuminated with short burning-flame arcs. There were two arcs suspended in front of each store, regardless of frontage, the small and large front being treated alike. The street was not more than 55 ft. wide, and the lamps were suspended not higher than 18 ft. A great volume of illumination was exhibited, greater perhaps than has been used in any street heretofore. There would seem to be no question whatever about the volume of light furnished, except that the street might be considered over-illuminated.

From the standpoint of distribution, however, Dr. Bell's point again becomes important. The distribution of light is not greatly improved over the gas arcs, nor can it be expected to be unless the flame arcs extend out over the center of the street. The tungsten arches, therefore, are superior to the flame arcs in respect to distribution.

As to attendance, the flame arcs are short-burning; they need attention every day and trimmers must come with their step-ladders and carbons to place the lamps in condition to burn another night. This practice was long ago abandoned when the short-burning open arcs were replaced by long-burning enclosed arcs, and as regards attendance the short-burning flame arcs represent a step backward.

Considering the cost of operating, the long life of the series-tungsten lamps makes the renewal cost very low. The energy used per 100 ft. of street is slightly more than 1 kw—in fact, 14 lamps consume 75 watts each, or 1050 watts. Two or three times this amount of energy is, therefore, required to operate the arrangement of flame arcs before referred to.

The cost of carbons, the cost of labor and the current consumed by the flame arcs make operating expensive compared with the tungsten arches. If, therefore, the cost of operating the tungsten is much lower than the short-burning flame arcs, the tendency will be to promote and extend the system of lighting business districts with the series tungsten arches.

The proof of this statement is being brought home to us

when we consider the many cities and towns which have already installed the new arch system. There are three large cities in Michigan, other than Detroit and Grand Rapids, which are about to install the tungsten arches on their main streets. This represents a start in each one of these cities which will result in the gradual extension of the system upon all the important business district streets.

Finally, the tungsten-arch system sets a pace for the gas companies that is exceedingly difficult to follow, and this is the character of business which central stations should push aggressively, offering the path of least resistance for new business.

It is likewise true that the attention of all the merchants is more than ever attracted to the tungsten lamps by reason of the streets being thus illuminated, and considerable advertising for the multiple-tungsten lamps is thereby gained.

A member of our "city beautiful" committee recently made a trip East and upon his return advised the writer that he saw a main street in one of the cities illuminated with flaming arcs, but felt that this system did not compare favorably with the tungsten-arch system. The attitude of the committee in regard to arches, referring particularly to attractiveness in appearance, is that they greatly admire the beauty of the illumination at night; that it is a source of much favorable comment, and the appearance of the arches in the daytime is not objectionable.

On April 1 was completed the installation of 18 new arches with tungsten lamps on Division Street, Grand Rapids. Such a keen interest in this system of lighting is being taken by the Business Men's Association that a banquet was held on that date celebrating a new era of illumination in this particular section of the city. When merchants thus enthuse over street lighting it is a compliment to illuminating engineering and further emphasizes the superiority of a lighting system to attract such favorable attention.

Automobiles in Cleveland.

According to the records of the Cleveland Automobile Club there are now over 4000 automobiles of all kinds and makes in use in the city of Cleveland. Of this number between 1000 and 1200 are said to be electric vehicles, and the number is rapidly increasing.

Cleveland is among the pioneers in the development of the electric vehicle. The Baker Motor Vehicle Company has been engaged in the manufacture of these machines for a number of years. The first product of its factory was in the form of a small runabout, with a limited mileage capacity and used very largely by ladies for shopping and calling purposes. However, the capacity of the batteries has been greatly increased since then, and bodies of all kinds are now used. While the truck business has not been taken up to any considerable extent, the company has produced this kind of a vehicle for its own use and has found it a success. The usefulness of the machines can be limited only by the possible mileage that they will make without recharging. Within the past two or three years the Rauch & Lang Carriage Company has produced some very elegant vehicles in the form of stanhopes and coupés. It also now has a seven-passenger vehicle on the market, this being rather larger than the styles heretofore offered. The Cuyahoga Motor Car Company has recently completed a car which, on a test run on Clifton Boulevard, in Cleveland, made 149 miles at a speed of 12.5 miles an hour on one discharge of the batteries. The temperature at the time was 29 deg. Fahr., and the last seven hours the machine carried two men. Several other tests, including hill climbing, have been satisfactorily made.

The convenience in handling the electric vehicle and the ease and simplicity in operation appeal to men who prefer to give their thoughts to other things than driving their cars. Several agents handling both gasoline and electric machines have expressed the opinion that the latter will forge ahead more rapidly than ever from this time forth. Their expressions are based upon the fact that gasoline machines have been discarded by many and electrics purchased instead. Cost of maintenance and "boarding" also has much to do with the matter. The ordinary electric cars used in Cleveland have run 80 miles on level roads or streets at a speed of about 13 miles an hour with one charging of the batteries, but grades, poor paving, imperfect or worn batteries and mechanical parts all come in to militate against the maximum possible mileage. The style of the body used also has much to do with the power required because of resistance of the wind. The mileage may be said to vary from 45 to 70 under all conditions.

The Cleveland Electric Illuminating Company has made no special rate either to private or public garages for the energy used in charging batteries. When called upon its engineers work out plans to give the most economical and satisfactory service, and then see that the equipment is properly set and connected. The company does not handle the charging sets at all, this being left to the agencies selling the machines. Some of these sell mercury-arc sets and install them free in private garages, but in the case of garage equipment, the purchase is made direct from the manufacturer.

Usually the rectifiers are placed upon ordinary house circuits for private garages, and the charge made at 115 volts is 5 cents per kw-hour. In case higher voltage is desired, requiring a separate circuit, the cost is 6¼ cents per kw-hour. If the capacity of the house circuit is sufficient, the rectifier set is



FIFTH AUTOMOBILE SIGN IN CLEVELAND

simply connected to it, but if found necessary the circuit is carried to the rectifier and the house lights then taken from it. This plan does not necessitate much change, as the wires are all taken from the rear of the lots in any event.

Garages in the business section of the city, as well as the selling agencies which maintain repair shops, secure energy for charging purposes from the 115-volt direct-current power circuits, using the ordinary rheostats for resistance in controlling the charge. The cost of energy to them depends upon the number of hours per day used. In this manner the central station endeavors to keep its load factor high. No soliciting is done by the company for this business, as most of it comes without effort. Neither has it been found necessary to make any inducements in the way of rates to those who own machines, nor to the garages.

In the districts of the city where only alternating-current energy is furnished the problem presents more difficulties to garage owners who cater to the electric business, and who as yet have not got into the charging end of the business upon as satisfactory a basis as exists in some other cities. Some use motor-generator sets, some generate their own energy with gas-engine outfits and some secure direct current from private plants in the neighborhood. The subject of rectifier equipment is, however, now occupying the attention of all who are not in position to secure direct current.

The Cuyahoga Motor Car Company, Euclid Avenue and 105th Street, which has been operating with a motor-generator set, recently ordered a Westinghouse rectifier set. It will be operated on a 230-volt circuit at 40 amp, and six 28-cell cars may be charged at one time at a 20-amp rate, with three cars in series. Or two 40-cell cars may be charged in series at the same rate. It is estimated that the rectifiers will enable the owners of the garage to realize a much higher efficiency from the energy purchased.

The Buckeye Garage Company, Euclid Avenue and Fifty-fifth Street, receives direct current at 120 volts from a private station in the neighborhood and charges through rheostats, six of them being located on as many pillars at intervals on the large floor space. The resistance in this case was designed by the managers and consists of two pieces of asbestos-covered gas pipe joined at one end and wound with common fence-wire. The windings of the two sides are connected at the connecting end of the pipe, and the amount of resistance needed is regulated by connecting the two sides at any point desired with a piece of wire with bent ends to hook over the pipes. This has rubber insulation in the middle so that it may be handled. Other apparatus introduced in this garage has enabled the management to reduce considerably the cost of charging. The management believes that there is waste in charging machines in series and danger also of overcharging, because all machines are not fully discharged when placed in the circuit.

The Chisholm-Phillips Automobilium Company, Euclid Avenue and Fifty-fifth Street, also receives its energy from a private station at 120 volts, the voltage being reduced by a Leonard-Bundy rheostat where the cables enter the building. An advantage claimed for this rheostat is that heavy currents will not damage it and batteries may be discharged as well as charged through it. A case on the wall above contains two double-knife switches, fuses and an ammeter from which the amperage on each of two lines may be ascertained. Each line has three plugs located in convenient places from which machines of various battery capacity may be charged. The company has a generator direct-connected to an engine using natural gas for furnishing energy at night for lights, signs and charging. The cost from this plant is about 1½ cents per kw-hour. Because of the small amount of current used in the daytime, it is more economical to buy it.

The Wingle Motor Car Company, on Hough Avenue, has a mercury-arc rectifier plant in operation, but owing to the fact that the apparatus was purchased when it was first placed on the market the system is somewhat complicated. However, it has served its purpose in maintaining economical operation and insuring satisfactory service to patrons. The Baker Motor Vehicle Company also operates a 15-hp generator from which two rectifiers are supplied for charging its heavy trucks. Storage batteries take care of the excess and supply energy when the plant is shut down.

The early rectifier sets were fitted for either 110-volt or 220-volt circuits and this caused much trouble in the installation as special circuits often were necessary. Engineers of the Cleveland Electric Illuminating Company within a short time suggested such changes as would fit the sets for either voltage or to a voltage higher even than the latter. This was called the Cleveland type by the General Electric Company, and for a time a higher cost price was attached than for the original outfit. Later this was reduced and the manufacture of this type became general. They have been very satisfactory as operated on the various circuits maintained by the local company.

An estimate places the number of private garages fitted with rectifiers at about 300, although it has been impossible to arrive at the exact number. No special records are kept by the local light and power company, as the rates do not differ from those for other purposes and the energy is measured on meters in ordinary use whether on house or power circuits. While the garages are doing a large business, it will be seen that the charging done in the private garages is an important item and will probably become more so, especially in the more pretentious homes, where men are already employed for other purposes. The machines may be charged during the night without care, as the rectifier is automatically cut out when the charge approaches the maximum capacity.

Public garages differ somewhat in their methods of charging customers for "boarding" cars. One of the large concerns in the business district, which is also a large sales agency as well, makes a flat charge of $25 per month, and this includes charging the batteries, washing, such minor repairs as may be found necessary and two deliveries a day. Two other large garages, one in the East End and the other about half-way between the business section and the eastern city limits, make use of a graded rate, according to the number of cells and the size of the cars, as follows: 14-cell cars, $22.50 per month; coupés, $25 per month; broughams, $30 per month. The service consists of housing, flushing, washing, charging and minor repairs, with the necessary number of deliveries. As these garages are both in the residence district, most of the charging may be done at night. Many of the cars are used for theater and party purposes, and it is rather late before they are run into the garages, but provision is made for this by getting cars standing on the floor charged and out of the way before the late rush. The rate for single charges for ordinary machines is 50 cents, although most of the garage men say that there is little profit at this figure. They do the work in the hope of securing other business on which the profit is greater.

Garage managers realize that the growth of their business depends upon the service owners are able to secure from their cars, and to that end they are endeavoring to teach them how to handle their cars, protect the batteries and maintain them at the lowest cost. This is often discouraging work, however, as it has been found that the average owner does not take readily to learning his machine and wants to use it to suit his convenience, whatever the result may be. It is believed that, as the use of electrics becomes more general, owners and operators will exercise greater care in this respect.

Of the nine or ten automobile factories in Cleveland, two are engaged in the manufacture of electrics and a garage company is just entering the manufacturing business. Columbus has one company manufacturing electric machines of all styles, and a company was incorporated recently in Toledo to enter the field. Five or six outside companies maintain salesrooms in the city and some of the larger agencies handle both gas and electric cars. An idea of the effort that will be made to push the electric car business may be gained from the fact that agents believe the business is just assuming its rightful place now and that the future will see a rapid growth. This, of course, will mean more perfect facilities for caring for cars on the part of the garage people and an increase in their business.

With stanhope, coupé, brougham and cab bodies the electric machine now combines greater mileage possibilities and increased simplicity of operation. A wider range of use has thus been attained, which insures a more general sale to people who have heretofore hesitated because of the limitations imposed. It is believed that the cost of maintenance is smaller than with gasoline cars and that the operation is not only more convenient, but safer. The electric is a general family car, while the gasoline or steam machine requires the service of a chauffeur or some one well acquainted with its mechanism. The electric is pre-eminently the theater, shopping and calling car, and it is now serving more satisfactorily for business purposes than any other.

Extensive advertising in the newspapers is done by all the manufacturers and all the agencies in the city, but one of the most effective and novel pieces of electric sign work for that purpose has been produced by the A. & W. Electric Sign Company, of Cleveland. It was placed on the side of a building on the west side of the Public Square, where it could be seen from both Euclid Avenue and Superior Street and by the thousands who go to the square in the evening to board the cars for their homes. The sign consists of a huge automobile, outlined by 4-cp lamps, set against a painted background representing a street scene. By means of a complicated flasher made by the sign company the wheels are given the appearance of revolving rapidly, while dust arises behind the flying machine and the ladies' veils wave in the air. The effect, both in the case of the dust and the moving veils, is secured by means of 2-cp lamps operated by the flasher. As will be seen, there are also street lights and a brilliant headlight on the machine. The horn is blown at regular intervals under the control of the flasher. Over 1200 lamps are used in the sign, and current is secured

from the Cleveland Electric Illuminating Company. It is owned by the A. & W. Electric Sign Company and the three advertisers mentioned on it pay in equal parts for the publicity, each thus reducing his expenses. The Stevens-Duryea car is handled by the Chisholm-Phillips Automobilium Company, whose name appears at the right-hand end of the sign, but does not show in the cut. The outside dimensions of the sign, including the street scene in the background, are 24 ft. x 50 ft.

INTERIOR WIRING AND ILLUMINATION

Illumination at Southern Electrical and Industrial Exposition.

The accompanying illustration gives a view of the Louisville Exposition looking toward the main entrance, and indicates the plan of the illumination, a description of which appeared on page 899 of the issue of last week. The vaporous-looking globe beyond the tower is the handless electric clock, the dial of which is 25 ft. in diameter while the pendulum is 35 ft. long. A description in detail of the clock appears on page 848 of the issue dated April 8.



GENERAL VIEW OF LOUISVILLE EXPOSITION.

Self-Contained Electric Table Lamp.

For years a substitute for the fitful light of burning candles on dining-room candelabra has been lacking, especially in hotels. The objection raised against the electric candelabrum is that it necessitates the presence of wires on the tables or the piercing of tables and linens when the lamps are fed from receptacles in the floor. In either case, however, the electric lamp lacks the portability of the candlestick, so that where tables have to be moved from time to time so as to vary the dining-room arrangement, the task of feeding the lamps with flexible cords is not an easy one. On the other hand, the hotel men have always recognized the danger and shortcomings of the candlestick, and while many have substituted electric candelabra for candles, they have ever been on the lookout for something better. Mr. F. A. Muschenheim, of the Hotel Astor, New York, has succeeded in designing an electric lamp which possesses all the desirable features of the candlestick as to portability, with many other advantages not possessed by other forms of table lamps.



FIG. 1.—SELF-CONTAINED ELECTRIC TABLE LAMP.

The complete lamp consists of a single storage cell placed within a silver containing vessel and equipped with three miniature tungsten lamps and a suitable switch for placing them in and out of circuit. The battery stores sufficient energy to keep the lamps aglow for 14 hours. Fitting neatly over the stand is a shallow glass dish containing cut flowers and water. The former are supported by a cast-glass disk with numerous holes into which the flower stems, etc., project. The lamp thus serves as a flower vase as well, and the effect of the light passing through the glass and water and playing around the flowers and leaves is very pretty indeed. That softness of glow which mellows and enriches the countenance and which, with dreamy music and subdued voices, is so essential to the atmosphere of the feast,

is not lacking. The lamp is much lower than either the candlestick or the electric candelabrum and does not hide the faces

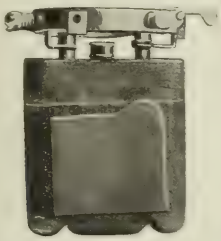


FIG. 2.—STORAGE BATTERY AND LAMPS.

of persons seated on the opposite side of the table, which is a great advantage. Its effect is somewhat similar to that of a

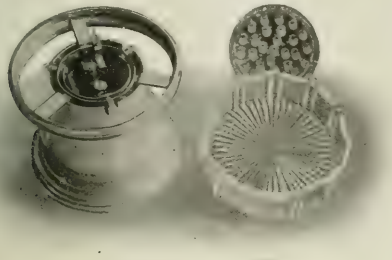


FIG. 3.—PARTS OF LAMP OUTFIT.

small electric fountain which appeals to both the sense of sight and smell. The features of the lamp are clearly illustrated in the engravings.

Illumination Measurements in Street Lighting.

An important paper in the last number of the *Transactions* of the Illuminating Engineering Society by Mr. W. C. Allen, is unusual in containing the results of a rather elaborate series of illumination tests made upon the street. Such tests are instructive but not always convincing, as the discussion upon this paper clearly shows. Results obtained in illumination are, of course, factors not only of the particular illuminants used, but also of their location, height above the street, reflecting system, if any, and various other things which have to do not only with the illuminant as such, but with the particular use which is being made of it. The practicability of measurement of illumination upon the street as a measure of general lighting depends perhaps more upon the environment than upon the lamp itself. In the simplest possible case of lights uniformly distributed over the center of a comparatively narrow street clear of trees and other obstructions, one can measure the illumination at various points very comfortably; and in comparing two such streets lighted by different illuminants, such measurements will give a fairly good idea of the relative effects and the cost of obtaining them. When, however, one deals with a wide street lighted by lamps along the two curbs, and particularly if there is obstruction by trees, one finds it very troublesome to gain from the measurements such data as will enable the results to be compared with those obtained in another wide street with another arrangement of lamps and trees. It is hard to obtain a proper average value of the illumination without a great multiplicity of measurements, and there is as yet no definite agreement as to the proper measure for the lighting of a street, when areas and not mere distances from the lamps are considered. The class of streets first discussed, narrow and clear ones, forms the simplest possible case of street lighting, and even in this there is no general agreement as to the significance of average illumination.

In view of the recommendation of the National Electric Light Association with respect to selling illumination rather than light, the lack of any convention as to the evaluation of that illumination is a quite serious matter. We commented somewhat severely upon this action at the time of its passage and we earnestly hope that at its next meeting the National Electric Light Association will either rescind its action, or if it cannot bring itself to do that, lay down some principles by which the effective lighting of two streets can be compared on the basis of their illumination measurements. Experience has shown that street measurements of light in general are of a rather unsatisfactory character and involve a very large amount of labor compared with the results obtained. The common street illuminants are subject to considerable fluctuations, the arcs varying in light with the length and position of the arc itself, while the gas lamps vary quite as widely from changes of pressure, the effect of drafts and the like. Moreover, the actual measurements of illumination under such circumstances have not a very high degree of precision, since the instruments are used under unfavorable conditions, and particularly in most streets are required to measure illuminations so low as to involve considerable technical difficulties. If our streets were lighted brilliantly, as abroad, and with the illuminants near enough together to give a fair degree of uniformity, the illumination measurements would be very much easier than they are. When one undertakes to measure the light on a street furnished by arcs 400 ft. to 500 ft. apart, the net result is apt to be very little better than an educated guess, owing to the fact that in a large part of the readings the illumination is almost negligibly small, and the reduction to an average of bright lighting near the lamps and next to none between them, is something of a farce. Suppose now that a lighting company undertook to sell, and a city to buy, illumination, what common ground of understanding is there upon which they could meet in their measurements with sufficient certainty to justify the application of the method to a contract involving $200,000 or $300,000 per year? If there is such a common ground it is high time to mark it out. In a case of this sort, even the unavoidable errors of photometry on the street would involve differences of thousands of dollars in the annual payment. Even the specification by candle-power of the illuminants would hardly involve bigger chances of dispute, and this specification has, we hope, been so thoroughly discredited since the Colorado Springs controversy that it will never appear again in a municipal contract.

When cities undertake to do real lighting on their streets some of the difficulties in measuring it will vanish; but few cities are willing to spend the amount necessary to get first-class lighting, even with all modern resources of street illumination. By far the safest basis for a municipal lighting contract is one for service with a particular specified illuminant, of which the properties in producing results can be tried out in advance. Such a service contract has at least the merit of being definite, of providing for the use of certain specified things, which can be verified at any time, and of thus avoiding the disputes likely to arise from so uncertain a thing as the measurement of the illumination on the streets. It is far easier to see that a given type of lamp actually gives ample and well-distributed lighting than it is to determine with a precision even moderately great, what that illumination really is. It makes a vast difference, for instance, in illumination measurements whether the trees are bare and snow is on the ground, and whether the trees are in full leaf and the ground bare. Lighting which would meet the required standard at the one season might well fail to do it at the other. By all means let us have illumination measurements such as are given in Mr. Allen's paper as a matter of general information and as affording when obtained in sufficient quantity a somewhat useful guide in planning results; but unless one is hunting for trouble in the way of litigation, it is safer to base contracts upon something which admits of simpler and readier determination than foot-candles upon the average city street.

New Telephone Patents.

TRANSMITTER ATTACHMENT.

In using the telephone it frequently becomes necessary to block off the transmitter from conversation in its vicinity not meant for the ears of the distant party. Mr. R. L. Woodward, of Jersey City, has invented and patented for this purpose a special device embodied in a short tube adapted to mount between the transmitter and its mouth-piece. The extension tube carries a diaphragm hinged at its bottom and normally held by a spring in a position to close the sound passage. A thumb-piece on the outside provides the means for depressing the diaphragm to open the sound passage. In its fully depressed position the diaphragm latches itself until released by a backward pressure on the thumb-piece.

TESTING CIRCUIT.

For common-battery, two-wire multiple switchboards a great variety of circuit arrangements has been patented. The latest of these is one invented by Mr. W. W. Dean, the patent being assigned to the Kellogg Switchboard & Supply Company. As usual, the tip of the connecting plug serves as a test contact, being connected to the testing relay through auxiliary contacts upon the listening key and the supervisory relays of the particular cord-pair used. However, in this case, the tip circuit is not looped through one of the relays. Instead of this the ground is connected to the tip strand only when one of the supervisory relays is operated, and thus it is clear at the time of test so that there are no false indications. The other supervisory relay serves through its auxiliary contacts to sever the test circuit as soon as operated.

EXCHANGE-CIRCUIT SYSTEM.

Mr. G. Babcock, of Rochester, N. Y., has patented an exchange-circuit system wherein the line limbs are used in parallel for transmission currents, and in series for received currents. The transmitter current passes out through repeating coils over the wires to the middle point of the receiver winding. Here it is tapped off to ground through the transmitter. The two repeating or induction coils at the central office co-operate in sending out voice currents to the distant station.

SELECTIVE SYSTEM.

A rather novel step-by-step system of signaling is the invention of Mr. W. E. Zabst, of Portage, Wis. There is a stepping device at each station which drives a disk that blocks the bell clapper except when a notch in it comes into position. The notches have different relative angular positions at all stations. All disks move in unison and a pointer indicates at each the position of all. When a station is desired, the caller starts all disks moving, and when his pointer indicates the desired station, he knows its notch is in the proper position for ringing.

MARINE-TYPE SWITCHBOARD.

A switchboard especially for use in marine service where all of the parts are exposed to moisture has been invented by Mr. E. A. Graham, of London, England. The switchboard is especially designed to be moisture-proof. The line and supervisory lamps are placed behind water-proof windows and the jacks are so arranged behind their bushings as to provide against the admission of moisture. The cords are wound on spring rollers, included within the casing, so that they are not exposed to the air. The apparatus for one line, including relays, jack and lamps, is mounted in a self-contained unit adapted to be placed within the casing.

RECEIVER SUPPORT.

A receiver support forms the subject of a patent granted to Mr. F. S. Weyrs, of Philadelphia. The support consists of a linkage adapted to be clamped to the base of a desk-stand set, which linkage carries a clamp for holding the usual hand-receiver. Normally the center line of the receiver is parallel to that of the transmitter, in which position the linkage so acts on the hook-switch as to depress it. When the receiver is brought around into position to meet the ear of a user, the linkage releases the hook-switch, thereby permitting it to arise.

Letters to the Editors.

The Electric Vehicle in Pasadena, Cal.

To the Editors of Electrical World:

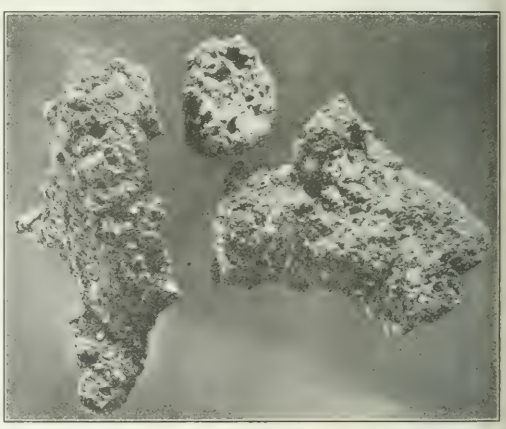
Sirs:—I notice in your issue of April 1, in an article on page 806 under the heading "The Electric Automobile at Rockford, Ill.," the statement that Rockford holds the record for the largest number of electric automobiles per 1000 of population of any city in the United States. The population is assumed at 50,000 and the number of electric vehicles is stated to be 130, or 2.6 per 1000 population. I beg to call your attention to the fact that in Pasadena, Cal., with a population of about 15,000, there are owned about 200 electric automobiles. This would make the proportion about 13 automobiles for every 1000 population.

San Francisco, Cal. R. B. Daggett.

The Effect of a High-Voltage Arc.

To the Editors of Electrical World:

Sirs:—During one of the coldest nights of February the 30,000-volt transmission line between Spier Falls and Glens Falls, N. Y., snapped off at a place where there is short dip on Mt. Gregor. Only one wire of the three broke; this swung to the ground and produced an arc, which caused the telephone wires at the power house to be burned off. Two of the wires



EARTH FUSED BY A HIGH-TENSION ARC.

remaining intact, the service was continued for some time as single-phase to Glens Falls. When the break was located the ground was found to be charred in a peculiar way, resembling the radiating roots of a stump. Each "root" was distinct and showed a conglomerate mass of fused stone and earth, out of which most of the earth had been evaporated, leaving a coherent charred mass. The accompanying illustration shows the general form of the "roots."

Spier Falls, N. Y. J. Rowland Nowell.

Snow Loads on Transmission Lines.

To the Editors of Electrical World:

Sirs:—Referring to the article "Snow Loads on Transmission Lines," by Mr. Max M. Collbohm, in your issue of March 25, I wish to call attention to the fact that, according to the

experience of the telephone companies in Wisconsin, and particularly in the Southern section, the greatest damage to wires and pole lines was done before the temperature had dropped to zero, and also before the wind had reached any great velocity. The storm damage was greatest before early morning on Jan. 29.

According to the January Climatological Report for Wisconsin section, the maximum temperature registered at Madison was 31 deg. above zero and minimum 1 deg. above zero; at Watertown, maximum 30 deg. above zero and minimum 25 deg. above zero. The minimum temperature of 1 deg. above zero was not reached until the evening of the 29th, after the greatest damage had been done.

Samples of sleet-covered wire examined in the vicinity of Madison, Watertown and Milwaukee weighed 2 lb. per lineal foot for samples of approximately 2.75 in. in diameter. The wire from which these samples were taken was a steel wire 0.08 in. in diameter.

Milwaukee, Wis. W. R. McGovern.

Even Harmonics in Alternating-Current Circuits.

To the Editors of Electrical World:

Sirs:—In your issue for March 25 you comment editorially on Dr. Steinmetz's article on "Even Harmonics in Alternating-Current Circuits," calling attention to one case of unsymmetrical e.m.f. wave in which there are even harmonics.

There is another case of even harmonics which seems to me of considerable importance, and this not a transient phenomena, but the steady condition after the transient phenomena have

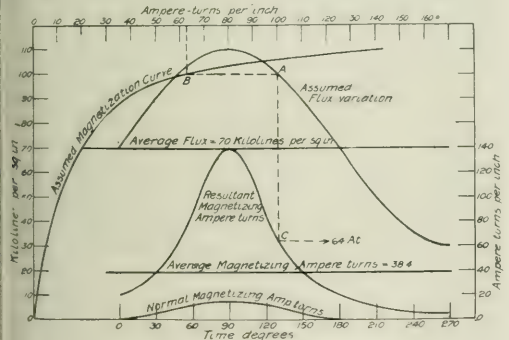


FIG. 1.—EXCITATION CHARACTERISTICS.

disappeared. It is the magnetizing current of transformers connected through a rotary to a three-wire direct-current system, the neutral of which is derived from the star point on the low-tension side of the transformers. This occurs, of course, only when several single-phase transformers are used and the direct-current m.m.fs. in any one core are unbalanced.

In the outline given below the assumption is made of a three-phase synchronous converter receiving energy from three single-phase transformers whose primaries are connected in delta and secondaries in star, the neutral wire of the direct-current system being joined to the neutral point on the star-connected secondaries.

Evidently when a sinusoidal e.m.f. is impressed upon the primary of a transformer the core flux must have a sinusoidal rate of change of value. In the case chosen the secondary current is composed of a certain unidirectional value plus a harmonic current depending upon the load and excitation of the converter. The primary current is composed of two parts, namely, the load and the magnetizing components. The load component of the primary current balances the secondary load amp-turns and hence is sinusoidal. However, it seems to me that the magnetizing component contains even harmonics owing to the saturation of core, which tends to make a peaked mag-

netizing current when the flux is being increased above the mean value and a flat-topped wave when the flux is being decreased below the mean value.

In Fig. 1 there is assumed a magnetization curve and a harmonic curve of flux, the average value of which is 70,000 maxwells per square inch. For any given point, say A at 130 deg., the flux is 100 kilo-lines per square inch, and the value of the exciting amp-turns per inch is 64. In a similar manner the curve of resultant magnetizing amp-turns per inch is determined. The average value of this curve or the secondary direct-current component is 38.4 amp-turns per inch. The alternating-current component supplied by the primary is the difference between the total and direct-current magnetizing amp-turns per inch. The root mean square value of the alternating-current magnetizing amp-turns per inch is 41.7. The root mean square value of the normal magnetizing current, as shown for one alternation, is 5.18 amp-turns per inch. If this is 2.2 per cent of the rated full-load amperes, the alternating-current magnetizing amp-turns per inch for the assumed case is 18.1 per cent and the direct-current component 38.4 amp-turns per inch is 16.3 per cent of the rated full load amperes. This value

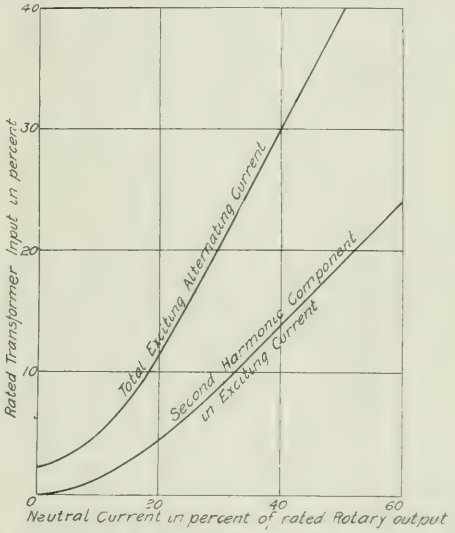


FIG. 2.—RELATION OF SECOND HARMONIC TO TOTAL EXCITING CURRENT.

corresponds to a direct current in the neutral of 27.3 per cent of the rated full-load rotary current. The two halves of the alternating-current wave are plainly different and can be readily analyzed for second harmonic.

The curves of Fig. 2 show the total magnetizing current and second harmonic component thereof in percentage of the rated full-load transformer current as plotted against neutral current in percentage of the rated full-load current of the rotary. The curve is plotted from the following table:

PERCENTAGE OF RATING.

Magnetizing Current	2.2	2.3	2.6	3.1	3.9	5.0	8	18.1	41.8	114
Second Harmonic...	1	2	4	7	1.4	2.7	7.6	20.2	...	
Neutral Current....	1.4	3.4	5.0	7.3	10.6	15.4	27.3	94	95	

The values for the curve were calculated from the formula,

$$I_{\text{neutral}} = V_2 \left(\text{Direct-current excitation} \over \text{Rated rotary current} \right) \left(\text{Efficiency} \over \text{Rated transformer amp.} \right)$$

The following constants were assumed: Efficiency of transformation, 85 per cent. Rating of transformers, 1/0.85 of the rating of the rotary. Normal flux density, 40,000 lines per square inch (6200 gausses). Normal magnetizing current, 2.2 per cent of rated full-load current. The following magnetization curve was used:

B in kilolines per sq. in.	10	60	80	90	100	110	120	
H in amp-turns per in.	7.5	14.5	27.5	38.5	63	140	330	

Finally, the two additional assumptions were made, that the flow in the direct-current neutral divides substantially equally between the different transformers, and that the hysteresis loss is negligible. This latter assumption is unjustifiable, but I have no data as to unsymmetrical hysteresis loops at present. However, it will not affect the fact that the second harmonic component will be very large.

The fact to which I wish to direct particular attention is that the magnetizing current in certain cases—for example, when the unbalancing reaches 30 per cent—may reach about 20 per cent of normal current and the second harmonic about 10 per cent of normal current.

ITHACA, N. Y. JOHN F. H. DOUGLAS.

To the Editors of Electrical World:

SIRS:—I have read with much interest the discussion of my note on the origin of even harmonics in alternating-current systems by Prof. G. W. Patterson and Dr. M. G. Lloyd in the issue of April 8.

In the early days of electrical engineering, when our knowledge of alternating-current phenomena was still very incomplete, most of the energy of investigators was spent on the consideration of these, and the terms frequency, wave-shape, harmonics, etc., became familiar to us as applied to alternating waves—that is, waves in which the successive halves have the same amplitude or intensity. On the other hand, oscillating waves in which the successive waves gradually decrease in intensity were practically unexplored, with the exception of some brilliant lecture experiments of Prof. Elihu Thomson and M. Nikola Tesla. Our increasing knowledge of alternating waves, and especially the rapidly increasing industrial importance of oscillating waves, led to their extensive study in recent years, and then it was immediately recognized that the terms frequency, wave-lengths, wave-shape, harmonics, etc., have the same meaning and equal importance with respect to oscillating and alternating currents. For instance, resonance phenomena occur in the same manner, except that with oscillating waves, as transient phenomena, the total energy of the wave is limited and thereby enters as a factor in the phenomenon. The nomenclature of waves is therefore now applied to such transient waves in the same manner as to alternating waves; and Messrs. Patterson and Lloyd when discussing wireless telegraphy probably have used the terms frequency, wave-length, and possibly wave-shape and harmonics many times, when discussing transient waves, in which successive waves decrease in intensity. With the only exception, I believe, of Dr. Fessenden's system, which uses very high frequency alternators, all of the systems of wireless telegraphy use the oscillating currents of condenser discharges, which do not involve harmonic waves in the meaning of Professor Patterson's discussion.

That the application of the terms frequency, wave-length, wave-shape and harmonics to oscillating waves is not an extension of the nomenclature, but the legitimate meaning of the term is realized when we consider the derivation of the term "harmonics." It is taken from the art of music, and with few exceptions—as the pipe organ—most musical instruments, such as the piano, the tuning fork, etc., give waves which gradually decrease in intensity—that is, they are transient or oscillating, and not alternating waves. If, therefore, long before electrical engineering existed, the laws of wave motions, frequencies, the effect of wave shape ("Klangfarbe"-Helmholtz), the phenomena of resonance with the fundamental and the higher harmonics, etc., were studied in connection with the tuning fork, it appears obvious that the terminology of the wave motions of the transient waves of the tuning fork is fully as justified in the discussion of transient electric waves as of alternating waves.

Mathematically, a wave motion is represented by the product of a Fourier series into a non-periodic and gradually decreasing term, which is unity with alternating waves. In the discussion of the action of *wave* motion, such as resonance phenomena, only the former term comes into consideration. In general, the non-periodic term is constant for all harmonics,* and is an exponential function; sometimes, however, as in the case of the starting currents of transformers, it is more complex, and is different for the different harmonics. Its physical origin in this case is found in the shape of the hysteresis cycle, and the origin of the even harmonics resides in the unsymmetrical shape of this cycle when performed between limits of magnetic density which are not equal and opposite.

Resolution into a Fourier series requires a full wave; the use of the numerical values of one-half wave only is, therefore, not permissible, except where it is known beforehand that even harmonics are absent, so that the numerical values of the second half-wave are identical with those of the first half-wave.

The last paragraph of Dr. Lloyd's discussion is a misunderstanding of what I meant with respect to being in phase. If two waves have the same frequency and the same wave shape, their phase difference may be counted between their zero values, or between their maxima, or any other corresponding points. If two waves have the same frequency, but different wave shape, their phase difference, as defined by the A. I. E. E. Standardization Rules, is the phase difference of their equivalent sine waves.

If, however, two waves have different frequencies, their phase difference is usually different according to whether it is counted as the angle between their zero values or their maximum values, etc. No definite agreement yet exists as to whether the phase difference between two waves of different frequency, the angle between their zero values should be considered—as Dr. Lloyd interpreted my statement—or the angle between their maximum values or with waves of different wave-shape, between the maximum values of their equivalent sine waves, as I applied it. It appears to me preferable, however, to define as the phase difference the angle between the maximum values of the waves, since in electrical engineering the relative position of the waves at the maximum value is of far more importance than that at the zero value, as evidenced by the frequent use of such terms as "peaked wave," "flat-topped wave," etc.; the terms "wave with flat zero," "wave with sharp zero," which refer to the relation of the harmonics at the zero point, are hardly ever used. It is, therefore, desirable to use the term "phase difference" as applying to the maximum values of the waves, and I applied it in this meaning in my note. However, I believe that I may not have always thus used it myself.

SCHENECTADY, N. Y. CHARLES P. STEINMETZ.

* Steinmetz, "Transient Electric Phenomena," Section IV.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Mercury-Vapor Rectifier.—G. SCHULZE.—An account of an investigation, made in the German Reichsanstalt, of two mercury-vapor rectifiers of the Westinghouse company, one for single-phase and the other for three-phase currents. The author gives the formulas to be used in measuring the different currents in the single-phase rectifier, with hot-wire or dynamometric instruments. For both types of rectifiers, oscillographic curves were taken of the alternating current, the pulsating direct current and of the voltage. The three-phase rectifier was tested as to life, efficiency and the best conditions for charging storage batteries. The rectifier which was tested for life operated

for 1040 hours and during this time it was connected 39 times to the circuit; it furnished 1490 kw-hours at 155 volts, direct current. While on circuit over night, it lost its vacuum and became useless. It is probable that a crack developed at one of the points where the electrodes were fused in the glass. The above figure for life, however, was found for only one single rectifier and should, therefore, not be taken as an average. A second rectifier of the same type has been working so far for 2250 hours, being 96 times connected to the circuit, and is still in excellent condition. By careful meter readings it was found that the loss in the rectifier averaged 7.2 per cent. This does not include the small loss in the induction coil. One of the three-phase rectifiers was subjected to an overload of 50 per cent for one hour without producing any detrimental results.—*Elek. Zeit.*, April 1.

Air-Gap Reluctances.—R. Livingstone.—A communication giving a convenient diagram (Fig. 1) for finding the correction coefficient k for calculating air-gap reluctances. Two curves are given. One is based on the formula of Carter; the other on

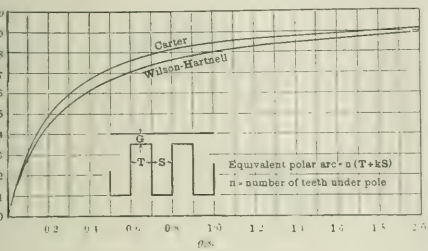


FIG. 1.—AIR-GAP RELUCTANCES.

the formula of Hartnell. Since Carter's formula is based on the assumption of negligible pole-face curvature and infinite permeability in the teeth, the real value of k is always somewhat less than the value given by Carter's curve.—Lond. *Electrician*, April 2.

Cooling Transformers.—F. Emde.—To aid the cooling of transformer coils, Pichler inserts circular metallic plates between successive coils. The object of these plates, which extend beyond the outer surface of the coils, is to carry away the heat generated in the coils. Kohler calculated the flow of the heat by an approximate mathematical method. The present author solves the same problem by an exact method, and arrives at simple formulas suitable for practical applications.—*Elek. u. Masch.* (Vienna), Feb. 21.

Lamps and Lighting.

Comparative Tests of Incandescent Lamps.—K. Satori.—The author discusses some of the results obtained in the Vienna lamp-testing laboratories of the Association of Austrian Central Stations. The effect of the increase or decrease of voltage above or below the normal value upon the candle-power, consumption of watts, and life is shown in Fig. 2. The drawn-out curve refers to carbon lamps, the curve consisting of dashes refers to "metallic-filament lamps" (probably tungsten lamps) and the curve consisting of dashes and dots to graphitized-carbon lamps. All of the curves give changes in per cent of the normal values. It has been proposed to estimate the normal life of a lamp by making a short-time test at a voltage 20 per cent above the normal. For this purpose a coefficient is used by which the actual life found at the increased voltage is to be multiplied to get the normal life. However, the author has found by extended investigations that this coefficient varies between very wide limits (for instance, between 38 and 123) for different lamps of the same type. At the above testing laboratories use is not made of this method of testing. If such tests are to be made it would be preferable to test the lamp at a voltage 10 per cent above the normal. According to the author, all new advances in electric lighting are due to the use of selective radiation. The superiority of metallic-filament lamps over carbon lamps is said to be essentially due to selective radiation and not to higher temperature of the filament. The phenomenon of "overheating" of metallic-filament lamps in the first moment when the circuit is closed results in the early destruction of the metallic filament in all cases where the lamp is very often switched on and off. For instance, for

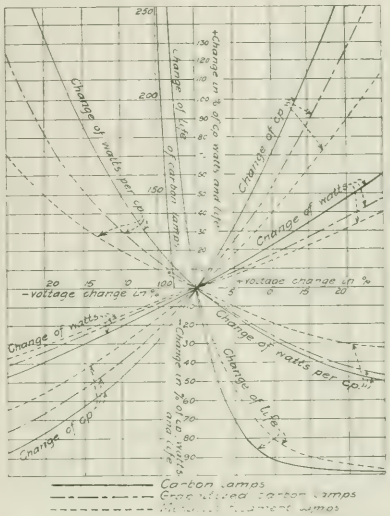


FIG. 2.—COMPARATIVE TESTS OF INCANDESCENT LAMPS.

advertising purposes in which the lamps are light and dark at periodical intervals, metallic-filament lamps are wholly unsuitable. The modern practice of paying more attention to the mean spherical candle-power represents a decided advance.—*Elek. u. Masch.* (Vienna), March 7.

Restarting of Carbon Arc.—J. A. Pollock, E. M. Wellisch and A. B. B. Ranclaud.—In connection with the restarting of carbon arc, without movements of the electrodes, when the circuit is opened and reclosed, the relation between the potential difference established between the electrodes at the moment of the remaking of the connections, and the maximum time of interruption of the circuit within which the arc will reform has been investigated for cases differing as to the relative positions of the electrodes before the opening of the circuit, and as to the direction of the potential difference after the reclose of the connections. The problem is that of the change from a non-luminous to a luminous discharge in air at normal pressure of which an explanation in the case where negative electricity flows from a hot to a cool electrode has been given in a previous paper. In the present experiments both electrodes are at a high temperature and the conditions of the change are complicated by the presence, at the moment of reclosing the circuit, of ions at the anode surface as well as near that of the cathode. In some of the cases examined the relations show a critical characteristic, but sufficient data are not available to enable an explanation of this result to be given.—*Phil. Mag.*, April.

Illumination.—H. Edler.—A description of a simple graphical method for determining the illumination of a horizontal surface from lamps above, whatever may be the form of the polar candle-power diagram, but, of course, the diagram must be known. The method is almost completely graphical and there is very little calculation necessary. In the discussion which followed, Kohler pointed out that it is possible to use the same method for solving the reverse problem; namely, to find the polar candle-power diagram of the source of light required to give a desired distribution of illumination on a horizontal surface.—*Elek. u. Masch.* (Vienna), March 28.

Graphitized Carbon Filament.—A note on a recent British

patent (14,805, 1908, March 25, 1909) of the British Thomson-Houston Company for an improvement in the manufacture of graphitized-carbon filaments. The process of making the so-called "metallized" filament consists in firing the base filament to drive out impurities, flashing the fired filament in benzine vapor so as to deposit a graphite skin, and finally firing the resulting composite filament to harden the skin. It has been found that this last step causes the skin to separate from the core, and the present patent is for an intermediate step between the first firing and the flashing, in order to roughen the surface of the core. The roughening is done by flashing the filament in air for a fraction of a second. In the next step the deposited material fills up the pits of the roughened core, thus preventing relative movement between the core and the skin. The life and strength of the filament are considerably increased.—Lond. *Elec. Eng'ing*, April 1.

Incandescent-Lamp Globe.—A note on a recent British patent of J. Kremenezky (18,278, 1908; March 25, 1909). The glass disk of the carrier is made appreciably smaller in diameter than the bulb neck, which is made wide to admit of a wide filament frame. The covering flames from the blowpipes of the sealing-in machine are caused to act on the neck just above the disk so that the softened glass of the neck fuses onto the disk. This arrangement enables carrier disks of small diameter to be used, even when the diameter of the filament frame is large.—Lond. *Elec. Eng'ing*, April 1.

Photometry.—E. W. Weinbeer.—The conclusion of his article on the determination of the mean hemispherical and the mean spherical candle-power of lamps. The author discusses various graphical methods and his own slide-rule for the same purpose.—*Elek. Anz.*, March 11.

Search Lantern.—A fully illustrated description of a search lantern for coast defense. It has a metallic mirror with a diameter of 6 ft. 6 in. The lantern is operated electrically from a distance. When the electrodes in use are burned out, the lamp can be replaced in a few seconds by a reserve lamp fitted with fresh electrodes.—Lond. *Eng'ing*, March 19.

Generation, Transmission and Distribution.

Water-Power in Sweden and Norway.—There are available in Sweden about 4,000,000 hp and in Norway about 5,000,000 hp, of which 400,000 hp and 500,000 hp, respectively, have been or are being developed. Descriptions are given of five typical plants in Sweden and Norway, their hydraulic and electric equipment and cost of development per electrical horse-power as follows:

	Turbine hp.	Feet head.	Cost per electric hp.
Jossefors	1,800	26	$70
Frykfors	4,000	27	64
Yngeredsfors	8,250	60	38
Vamafors	75,000	86	26
Tva	73,000	3,290	36

The last two plants will be used for the fixation of atmospheric nitrogen.—Lond. *Eng'ing*, March 12 and 19.

Transmission of Energy by Ropes.—E. Kenyon.—An illustrated paper read before the South Wales Institute of Engineers. The author first compares the advantages of the continuous or American rope system and the undivided or English rope system. He says that the continuous or "American" rope system—namely, that of winding one long rope as many times around the driving and driven pulleys as there are grooves to fill and carrying it across the whole width of both by means of a "sliding" jockey pulley sustained at the required angle—may possess certain advantages under special conditions, as, for instance, the driving of paper-making machinery by a series of expanding rope pulleys so arranged as to permit a variation at the driving line of about 4 in. in their respective diameters. However, under the ordinary conditions governing energy transmission, the comparative imperfections of the method are so pronounced that numerous installations have been transformed to multiple ropes, with beneficial results. He then takes up in detail various mechanical problems of rope driving. As to cotton versus manila, he says that cotton, though more expensive, is greatly preferable. As to four-strand ropes versus three-strand ropes, the latter have the advantage. The most serviceable lubricant for ropes is compounded from saponified tallow, wax and plumbago, which becomes hard like domestic soap.—Lond. *Eng'ing*, March 12 and 19.

Air in Steam Condensers.—D. B. Morison.—A note on a paper read before the Liverpool Engineering Society, in which the author emphasizes the great importance of keeping air out of a steam condenser if the highest fuel economy is to be attained either with reciprocating or turbine machinery. Ordinary fresh water, he stated, contains 3½ per cent of air measured by volume, but the condenser steam withdrawn from a condenser by a water-pump contains only from 0.5 to 1.0 per cent of its volume, a proportion which is raised to 2 per cent when it is withdrawn by an air-pump. If this water is not sprayed or otherwise violently agitated, but allowed to flow into a feed tank, and pumped thence by a float-controlled pump, the degree of aeration is not appreciably increased, so that when it is afterward passed through a feed-heater, the liberation of air is almost nil. In actual practice, however, large volumes of air are often liberated in the feed-heater, but this air has been forced into the water as it passed through the common ram-pump and none of it is in solution in the water as it enters this pump. In modern steamships there is either a float-controlled feed-pump or an air-collecting feed-heater so that the air which actually enters the boiler is too little to have any appreciable effect on the efficiency of the condenser. The air found in the latter enters, therefore, by leakage partly through the glands on the low-pressure cylinder, but when the auxiliaries exhaust into the condenser the air thus entering is very largely augmented. By proper care the air leakage can be cut down to such an extent that the opening of an air-hole 1/16 in. in diameter into a well-designed condenser will not affect the vacuum attained, the reserve output of the air-pump being sufficient to deal with this amount of leakage.—Lond. *Eng'ing*, March 12.

Condenser.—T. Pausert.—An illustrated description of the fundamental principles of the condenser of Maurice Leblanc and its development for the practice by the Westinghouse Company, with special reference to steam-turbine practice.—*La Revue Elec.*, March 15.

Centrifugal Pumps.—A. Barbezat.—The first part of an illustrated article in which the author proposes to give data for the calculation of centrifugal pumps. In the present instalment he discusses several cases of an apparently paradoxical behavior of such pumps.—*La Lumière Elec.*, March 27.

Traction.

London.—J. H. Rider.—The conclusion of his article on the electric system of the London County Council Tramways. The present instalment contains particulars of the method of transmitting and transforming the electrical energy. The substations contain apparatus of various types, and mention is made of the trouble experienced owing to the breakdown of stator coils of the induction motor-generators at the instant of switching onto the busbars. The breakdown was found to be largely due to the construction and winding of the coils; particulars are given of the type of coil which has proved most satisfactory. Mention is also made of the system dealing with faults on the conductor rails.—Lond. *Electrician*, April 2.

Track Brakes.—H. M. Sayers.—An article in which the author compares and discusses the tests recorded in the brake reports of the two tramway associations, on track-brake blocks of different materials, and shows that, while the question needs further investigation in certain indicated directions, practical experience and the test results taken together support the general use of wooden blocks for the control of speed on steep gradients. Serrated cast-iron blocks are hopeful, and may supersede wooden blocks, if they do as well on greasy as on wet rails. The removal or prevention of grease on rails is most important.—Lond. *Elec. Eng'ing*, April 1.

Overhead Construction.—An illustrated article giving drawings and an abstract of the specifications for the complete details of overhead construction which have been adopted by the Connecticut Company. These standards are being applied

on all 500-volt direct-current lines, both for new construction and renewals.—*Elec. Railway Journal*, April 3.

Electric Haulage on Canals.—Henry.—An illustrated review of the different systems in practical use.—*Industrie Elec.*, March 25.

Installations, Systems and Appliances.

Booster System.—Stirm.—In the Pirani booster system, the battery is brought into action by changes of the current even when the voltage changes only slightly. The author has modified the Pirani system by inserting iron resistors in hydrogen-filled tubes (like the ballast resistor of the Nernst lamp) in various branches of the circuit. The arrangement is shown in Fig. 3, where *g* is the Pirani exciter of the booster *h* driven by the motor *i*. The excitation windings *a* and *b* act in opposite directions. For mean values of the load they just counterbalance each other, so that there is no excitation, and the voltage at the terminals of the booster *h* is zero. If the load in the network increases beyond the average, the action of *a* is stronger than that of *b*, and a voltage is produced at the terminals of *h* in a direction to discharge the battery. If the load in the network decreases below the average, the action of *b* is stronger than that of *a*, and the voltage at the terminals of *h* is in a direction to charge the battery. If an iron resistor *d* is inserted in series with *a* and in shunt with *s*, the additional discharge voltage is limited. On the other hand, an iron resistor *e* in series with *b* limits the charge voltage. If both *d* and *e* are inserted simultaneously, both the charge voltage and the discharge voltage are limited, but in a different degree. If the intention is to reduce the additional voltage uniformly, after it has manifested itself strongly for a short time, an iron resistor *f* is inserted in the excitation circuit of *h*.—*Elek. Zeit.*, April 1.

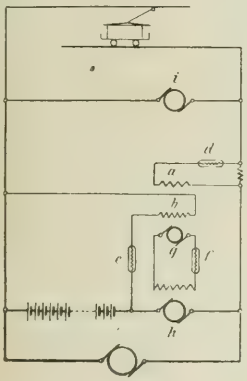


FIG. 3.—BOOSTER SYSTEM.

Storage Batteries for Three-Phase Systems.—A. Loewit.—The author compares the cost of operation in a steam-driven electric lighting plant for some 1600 arc lamps with a pure three-phase system and with a three-phase system provided with storage batteries. In spite of the higher first cost and of the losses in converter and battery, the latter system is found to be the cheaper one.—*Elek. u. Masch.* (Vienna), March 7.

Hungary.—W. Mauer.—The author gives a list of 56 new central stations which have been opened in Hungary since January, 1906. The date of opening, the system used and the date of equipment are also given.—*Elek. u. Masch.* (Vienna), March 7.

Heating of Resistors.—C. Richter.—A mathematical paper giving a method of calculating the final temperature which a resistor assumes when it is subjected to a varying load of a given load time curve.—*Elek. u. Masch.* (Vienna), March 21.

Rheostats.—An illustrated description of woven-wire rheostats, for special use in theaters and cinematograph exhibitions.—Lond. *Electrician*, April 2.

Wires, Wiring and Conduits.

Wiring.—An article pointing out that the electric central stations of England are at present in a rather unfavorable condition. The advance of the metallic-filament lamp has reduced the amount of energy for lighting and the rate of new connections has not yet increased to the extent hoped for, chiefly for the reason that there is still the same lump sum to be paid for wiring. It is thought that conditions will even grow worse, because the gas people are not standing still and the metallic-filament lamp will also be improved. Two remedies are discussed. The first is that the central stations "must be put on a proper commercial basis, and probably this will be brought about by necessity. Unbusinesslike councillors and sleepy directors will be forced to see that the primary object of their undertakings is to obtain business, not to reduce works costs. The engineer must give precedence to the salesman and up-to-date methods must be employed." The rational method of charging for electricity should be worked out by commercial men. The proper solution of the wiring problem would be the second remedy. At present wood-casing and steel-barrel are the two chief systems used in England. It is thought that the Continental system known as "surface flexibles" will receive a certain amount of adoption. Another recent system is Kalkos, which is a system of draw-through conduits. The conduits or fittings are made of tinned brass, and the system is the slip-joint one, but perfect continuity is obtained by soldering the joints at the fittings and sockets. The ideal system remains still to be invented—a flexible system of wire and casing combined, inexpensive, reliable and durable.—Lond. *Electrician*, April 2.

Electrophysics and Magnetism.

Effective Resistance and Inductance of a Concentric Main.—A. Russell.—A highly mathematical paper on the effective resistance and inductance of a concentric main for varying frequencies and methods of computing Kelvin's "ber and bei" and allied functions. The author first gives the general solution of the problem and then simplifies the results for particular cases, giving also a numerical example.—*Phil. Mag.*, April.

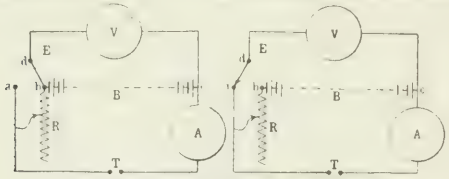
Thunderstorm Electricity.—G. C. Simpson and C. T. R. Wilson.—Two papers on the theory of thunderstorm electricity. Wilson has put forward a theory to account for the electrical phenomenon connected with thunderstorms based on his well-known experiments on the condensation of water vapor from supersaturated air upon negative ions. Simpson raises some objections against this theory and claims that it is not sufficient to explain all of the facts. Wilson replies that he has never regarded condensation on the ions as in itself a sufficient cause for the strong electrical fields of thunderstorms. If, however, there be assumed the occurrence of supersaturation in the atmosphere, condensation on the negative ions is likely to be of importance in connection with the production of precipitation, and as tending to cause a preponderance of negatively charged rain to be carried down to earth.—*Phil. Mag.*, April.

Radiology.—P. Lenard.—A "radiological institute" will be opened at the University of Heidelberg. It will be devoted to scientific researches on Roentgen rays, Becquerel rays, ultra-red and ultraviolet radiation, radioactivity, phosphorescence, photo-electricity, etc. Practical applications, especially in medicine, will also be considered. The radiological institute will be under the same director as the physical institute of the university. The equipment of the institute with apparatus, etc., will be entirely up to date. Besides the regular members and assistants, others will be permitted to participate in the work of the institute, which is to be carried out according to a systematic plan.—*Phys. Zeit.*, March 15.

Units, Measurements and Instruments.

Laboratory Switchboard.—A description of a small switchboard in a private laboratory. The general arrangement of the connections is shown in Figs. 4 and 5, one of the terminals *C* of the battery *B* being connected through an ammeter *A* to one of the two main terminals *T*, while the other is con-

noted through one of the contacts *a* of a two-way switch *b* to the resistance coils of a rheostat *R*. The voltmeter *T* in position, Fig. 4, measures the voltage at the terminals of the battery, while in position Fig. 5 it measures the voltage at *T* for a given battery grouping, which can be varied at will by the rheostat. By altering the position of the switch *E*, the voltage at the battery terminals can be tested as often as desired without interrupting the supply at *T*. The battery is connected to a mercury-distribution board of the usual type, shown at *B*, Fig. 6, the connections, of stiff copper wire, being designed so as to allow of rapid disconnection or connection



FIGS. 4 AND 5.—DIAGRAM OF CONNECTIONS.

of the cells with the board, without interrupting the supply and without the risk of short-circuit. The mercury-switch panel is placed under a hinged glass cover, thereby providing an effective protection from dust, so that, even after two years' working, the surface of the mercury, although tarnished, is free from scum. Fig. 6 shows eight cells connected in two parallel groups of four in series. The testing of each cell singly is rapidly performed by connecting all of the mercury cups on one side, and shifting one connecting piece from cup to cup on the other side, the voltage being taken in each position. The ammeter *A* and the voltmeter *B* are both of the movable-coil type and both have two ranges, the former from 0 to 1 amp and from 0 to 5 amp; the latter from 0 to 18 volts and from 0 to 3 volts. The connections are shown at *A* and *V*, respectively, *m m* being the moving coils. The ammeter can be readily switched on either range by a two-way switch *C*, the instrument being therefore always in circuit. A three-way switch *D*, which is used for the voltmeter, is arranged so that a spring keeps it on the first contact, which corresponds to the open-circuit position, and brings it back on that contact as soon as it is let go. The next contact is the 18-volt range contact; the last, the 3-volt range contact, so that it is impos-

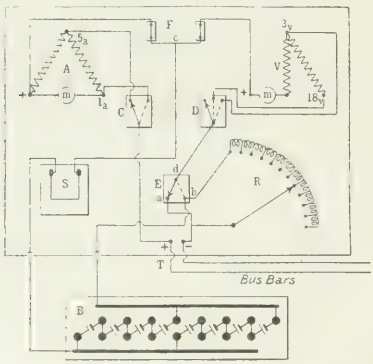


FIG. 6.—DIAGRAM OF CONNECTIONS.

sible to switch the whole battery to the 3-volt range by accident and so bend the pointer. It is also impossible to leave the voltmeter in circuit by neglect. Further protection is given by two fuses *F*, one on the circuit of each instrument. A spring-release, single-pole switch *S* closes the circuit.—Lond. *Elec. Eng'ing*, April 1.

Five-Hundred-Thousand-Volt Testing Plant.—F. W. C. BRECHT.—An illustrated description of a 500,000-volt plant for testing apparatus for wireless telegraphy and for ozonizing, with special reference to the method of wiring and the insulators employed.—*Elek. Anz.*, March 11 and 18.

Telegraphy, Telephony and Signals.

Seeing into the Distance.—A. KNOTHE.—An illustrated description of a method of seeing into the distance based on the change of resistance of selenium by illumination. The transmitter is shown at the left and the receiver at the right of Fig. 7. *C* is a camera, the picture in which is to be transmitted. *B* are series of batteries; the ends of the two wires

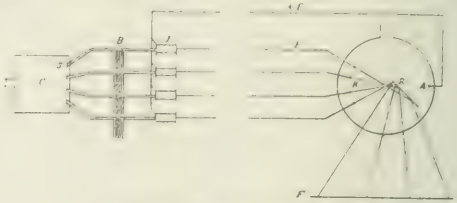


FIG. 7.—DIAGRAM OF APPARATUS.

from each battery are bridged by a piece of selenium *S*. The circuit is open in the dark, but is closed when *S* is lighted. When it is closed the induction coil *J* is set in operation and electricity is transmitted over the line to the receiving station. At the other end a discharge is produced in a Roentgen tube and this is observed on the screen *F* as the point of light. The different negative wires in the receiving station are arranged as shown in the illustration and form the cathode *K* of the Roentgen tube. *R* is a reflector. To each piece of selenium *S* at the transmitting station there corresponds, therefore, one single point on the screen *F* at the receiving station, and this point is more or less lighted in accordance with the illumination of the corresponding selenium piece *S*. The picture in the camera *C* is therefore reproduced on the screen *F*; the whole picture being made up of a great many points. Each of these points needs one selenium cell, one battery, one inductance coil and one transmitting line. To get a fairly satisfactory picture the arrangement will, therefore, be exceedingly complicated and expensive. It is evident that the author has not tried it in practice.—*Elek. Anz.*, March 25.

Directed Wireless Telegraphy.—F. KIEBITZ.—An illustrated report on a series of experiments made with wireless telegraphy in a certain direction at the German Government's telegraph experiment station.—*Verh. Deutsche Phys. Ges.*, 10, No. 23, 1908; translated in abstract, with illustrations, in Lond. *Electrician*, April 2.

Miscellaneous.

Show-Rooms.—An article entitled "The Innocent Abroad in Some Electricity Supply Showrooms." The establishment of showrooms by English electric central stations, where various electrical apparatus can be inspected and where the prospective consumer can obtain information regarding the use of electricity for all purposes, is doubtless a step in the right direction. However, the results arising from these exhibits have not always been successful. The present article is written by a "would-be-consumer" who lately visited these showrooms in quest of information, but concealed his engineering identity. He has endeavored to discover whether these places do adequately supply proper information, and the result is not altogether encouraging. The writer complains of "cautious salesmen, lukewarm arguments" and varied experiences.—Lond. *Electrician*, April 2.

Darwin.—The whole issue is devoted to the memory of Charles Robert Darwin. There are papers by H. F. Osborn on the life and works of Darwin; by C. F. Cox on the individuality of Darwin; by J. J. Stevenson on Darwin and geology; by H. C. Bumpus on Darwin and zoology; by T. H. Morgan "For Darwin"; by W. M. Wheeler on predarwinian and postdarwinian biology; by R. M. Wenley on the halo of a hundred years; by A. R. Wallace on the origin of the theory of natural selection; and by Sir Joseph Hooker on the first presentation of

the theory of natural selection. The issue contains a large number of excellent portraits.—*Pop. Science Monthly*, April.

McGill University.—J. Dalemont.—An illustrated account of the methods of teaching engineering subjects at McGill University in Montreal.—*La Lumière Elec.*, March 20.

BOOK REVIEWS.

Widerstands-Bestimmungen. By Fritz Hoppe. Leipzig: Johann Ambrosius Barth. 100 pages, 120 illustrations. Price, 4 marks.

The author of this volume has collected the various methods of measuring electrical resistance in actual practice and has presented their principles and mode of operation in a manner adapted to the needs of the student of electrical engineering. The work covers the measurement of resistance in electrical machines and apparatus, the measurement of insulation resistance and also the determination of temperatures by means of resistance measurements. There is also a brief chapter on the localization of faults in cable conductors by electrical resistance measurements. The work is elementary in character, but clear and easily understood.

Who Makes What. A Book of Reference for Buyers. New York: Daniel T. Mallett. 368 pages. Price, $1.

This is a directory of the hardware trade issued from the office of the *Hardware Dealers' Magazine*. The matter is divided into five sections, as follows: Hardware wholesalers and jobbers, classified by States and towns, with some information as to the business history and specialties of each firm; directory of manufacturers; directory of products; directory of important foreign hardware firms; directory of New York City hardware export houses. The directory of foreign firms is in the form of letters from U. S. consular officers in reply to an inquiry on the subject. The work should be very useful to all who have occasion to make considerable purchases of hardware, this term including a great range of staple manufactures in the metals.

Les Récents Progrès du Système Metrique. By Ch. Ed. Guillaume. Paris: Gauthier-Villars. 94 pages.

This very interesting report on recent progress of the metric system contains some very important matter of international interest. Meter bars rechecked by comparison are reported as showing deviations of the order of 1 part in 10,000,000. Kilogramme masses rechecked by comparison are reported as showing deviations of the order of 1 part in 100,000,000. The wavelength of the red line in the cadmium spectrum has been found to be 0.643847 micron by two sets of observers within about 1 part in 10,000,000.

The laws in force in the different civilized countries on the subject of the metric system are enumerated and compared. In Europe, England and Russia are the only two countries in which the metric system has not yet been rendered compulsory by law, and in Russia it is compulsory in Finland, and is much used in all parts. The volume contains a number of tables and formulas useful to the physicist and to the technologist.

Les Merveilles de L'Electrochemie. By Emile Guarini. Paris: Dunod & E. Pinat. 168 pages, 99 illustrations. Price, 5 francs.

In the introduction the author calls attention to the wonderful water-power of his country, Peru, so that it is presumed that this book represents an attempt to acquaint the Peruvians with the possibilities of electrochemistry as a factor in the development of this power. Indeed, no other excuse can be found for such a publication. In the brief space of these 150 pages the author attempts to give a complete treatise on the theory and practice of the subject, or at least to give considerable theory as to the electrolytic cell and the effect of heat, combined with the practical side as in the manufacture of steel and refining of metals. The attention given to each subject is no measure of its importance in the practical world. For instance, in the metallurgy of iron there are 24 cuts of the Stessano and Harmet furnaces and one induction and one Héroult furnace. A whole chapter is devoted to the artificial production of the diamond and the Hall aluminum process is but mentioned, not described. Even the matter compiled from other sources is carelessly done, our own Tucker being disguised as Trucker and our Bancroft as Baucroft. It is hardly a book that will appeal to the electrochemist as a work of reference, even if for no other reason than that the thousand and one facts it contains are hidden away without an index, and the classification is so poorly done that the table of contents is useless. The print and cuts are very much blurred from the very poor quality of paper used in the make-up of the book.

NEW APPARATUS AND APPLIANCES

Electrical Laboratory Equipment of the City of Philadelphia.

The electrical department of every large city has occasion to purchase and pass on a great quantity and large variety of electrical materials, which makes it important that it be provided with well-equipped laboratories for measuring and testing such materials. The city of Philadelphia is in advance of most of the other cities of this country in this respect, having recently provided an excellently equipped laboratory for this purpose.

A little consideration of the electrical interests of any large city emphasizes the importance of such a laboratory. In Philadelphia the lighting problem of the City Hall alone is a very large one. The exterior of this impressive building is well and tastefully lighted by clusters of incandescent lamps, shielded by opaque globes, which are mounted on decorated bronze pillars. The 500-ft. tower is encircled at its top by a rim of powerful arc lights that may be seen at a distance of 20 miles, while at a slightly lower elevation is placed an enormous clock which is lighted so well by banks of small lamps that the time may be read at night some two or three miles away. In addition to this the Electrical Bureau has charge of the entire street lighting of the city, which extends east and west about eight miles and north and south 12 miles.

The extensive fire-alarm and police telegraph and telephone system is also under the charge of this bureau. The central station of this system is in the City Hall, where are centered some 1800 wires, by means of which the police and fire departments are in communication with all parts of the city.

The effective lighting of the City Hall, as well as the excellent condition of all of the electrical work, is due to the energy and progressiveness of the chief of the Electrical Bureau, Mr. James F. McLaughlin, and to him also is due the equipment of the electrical laboratory. The instruments of this laboratory may be classified as follows:

Photometric Apparatus.

This apparatus consists of a three-meter photometer with a complete equipment of accessory apparatus for measuring the candle-power of incandescent lamps. The three-meter photometer is provided with a direct-reading scale and with a Lummer-Brodhun photometer screen. It is also equipped with a universal rotator which makes it possible to measure the candle-power of incandescent lamps when rotating in any plane with

reference to the line of sight. With this apparatus distribution curves can also be readily determined for any style of lamp.

Ammeter and Voltmeter Standardization Apparatus.

This equipment comprises a complete installation for the accurate measurement of direct-current e.m.fs. from a very small fraction of a volt up to 1500 volts and for the measurement of currents from a milliampere to 300 amp. In Fig. 1 the instruments are shown ready for a test. They are a potentiometer (which measures e.m.fs. from the lowest up to 15 volts), a volt box or multiplier for extending the range up to 1500 volts, a set of standard low resistances for measuring current, a Weston standard cell and a wall D'Arsonval galvanometer.

Laboratory Cable-Testing Apparatus.

This equipment is shown in Fig. 2 and contains all of the necessary instruments for measuring the capacity, insulation and conductor resistance of cables. Capacity is measured by the ballistic-throw method and insulation by the direct-deflection method, as is customary in the laboratories of cable-manufacturing plants. The instruments are a high-sensibility galvanometer, a lamp and scale, standard 1/10 megohm, standard 1/3 microfarad condenser, Ayrton shunt, Kempe key, battery and galvanometer reversing switches, short-circuit key and other keys and switches for interchanging connections. The particular form of galvanometer used has been found very

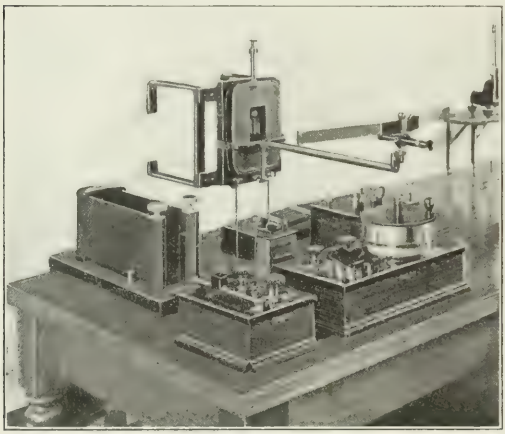


FIG. 1.—LABORATORY CABLE-TESTING APPARATUS

satisfactory for this class of work on account of its quickness of action and accessibility of its parts combined with its high sensibility. The lamp-stand and scale is 1 m long and is of the type in which the scale is read by reflection from a mirror. This type is much more satisfactory than that requiring the light to come through a translucent scale, as the spot is equally visible whether the observer be directly behind it or not. It will be noted from the illustration that the grouping and arranging of the instruments provide the best possible insulation and, at the same time, connections that are perfectly obvious. The instruments are all mounted on a polished hard-rubber plate. The binding posts and many of the parts of the instruments are mounted on petticoat-insulated pillars. Connections between the instruments are made by means of heavy nickel-plated wires, stiff enough to hold their shape and to be run in the air, which insures perfect insulation.

The arrangement of switches, etc., is one which has been found most satisfactory from the operator's standpoint. To interchange connections from capacity to insulation tests, it is only necessary to throw a few double-throw switches.

To the right of the insulation- and capacity-testing set is a five-dial Wheatstone bridge for resistance measurements from a small fraction of an ohm to a few megohms. The dial construction of this bridge makes it exceedingly convenient to use without any sacrifice of accuracy due to poor contacts. The galvanometer, lamp and scale and Ayrton shunt of the insulation- and capacity-testing set are so arranged that they may be used with the Wheatstone bridge.

Portable Cable-Testing Apparatus.

The above-described insulation-testing set can be used only for testing cables which can be either brought into the laboratory or connected to it by means of other wires. There are frequently occasions to make tests on cables where this is not possible, and therefore an equipment of portable testing appa-

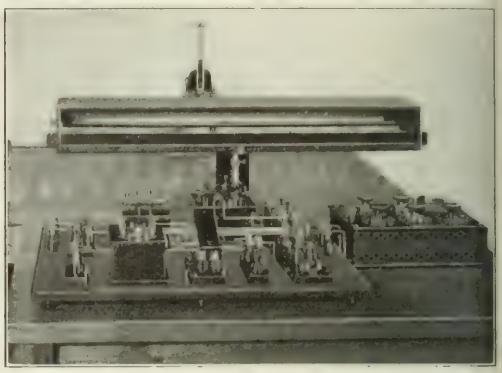


FIG. 2.—PORTABLE CABLE-TESTING APPARATUS.

ratus is also provided. The instruments are shown in Fig. 3.

Beginning from the left to the right, these are (1) a dial decade portable testing set for measuring conductor resistance and locating faults by means of the Murray and Varley loop tests. (2) A fault-finder for making the same measurements. This instrument is particularly adapted for measuring faults in cables where wires are in pairs, as in telephone cables, and is so simply arranged that linemen without technical education can readily learn to do excellent work with it. It is also an excellent instrument for locating opens. (3) A portable telescope galvanometer—an instrument with which insulation resistance may be tested up to 200 megohms. For its range of measurement it is a remarkably light and convenient piece of apparatus. (4) A bridge for locating faults in power cables and other cables of large cross-section, and it will be noted from the illustration that it is provided with large extension cables and large clamps, by means of which errors due to connecting leads and imperfect contacts are eliminated. On account of the large cross-section in the class of cables for which this bridge is intended, it is very important to avoid these errors. (5) A high-sensibility galvanometer, mounted on a tripod for street use.

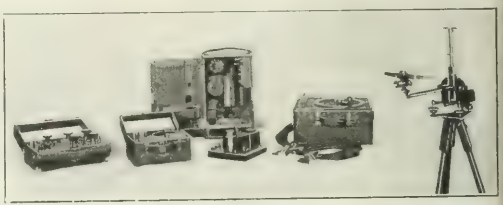


FIG. 3.—APPARATUS FOR INSULATION AND CAPACITY TESTS.

In combination with the 100,000 ohm box, Ayrton shunt and standard condenser, which are shown in the carrying case in the back of Fig. 3, this instrument is used for insulation and capacity tests. The galvanometer is provided with a special device to minimize the influence of vibrations, which is so successful that it is practicable to use the instrument even in places where the ground is in continual vibration, due to heavy traffic, etc.

All of the instrumental equipment of the laboratory was supplied by the Leeds & Northrup Company, of Philadelphia.

General Electric Exhibit at Alaska-Yukon-Pacific Exposition.

The General Electric Company's exhibit at the Alaska-Yukon-Pacific Exposition will cover a floor space of 1400 sq. ft. in Machinery Hall and will consist mainly of various supplies, together with some larger apparatus of particular interest to that section of the country, such as mine locomotives, mine hoist equipment, electric air drills, etc. The small-material exhibit will include a display of domestic applications of small motors, arc and incandescent-lighting apparatus and supplies, heating devices, oil switches, circuit-breakers, rectifiers and other devices of general interest. The booth will be given an artistic Dutch treatment throughout and will, in addition to open floor space for the heavier materials, consist of two rooms. One of these rooms will be used for the complete display and demonstration purposes of cooking and heating devices, and the other as a room for the reception of daily visitors.

Paterson (N. J.) Street Illumination.

Following the lead of Newark, N. J., Paterson business men recently formed an association for the purpose of stimulating trade, and one of the means adopted to this end was the special lighting of Main Street. Flaming-arc lamps were selected for this purpose, but owing to the numerous overhead wires, including trolley wires, and the fact that the authorities would allow no more poles to be put up, it was necessary to mount the lamps and outriggers on the buildings. Owing to the different heights, and different architectural features of the



PATERSON STREET ILLUMINATION.

buildings, it was impossible to get uniform height and distance in placing the lamps. Nevertheless, the effect is highly satisfactory from every standpoint. Fox Bros. & Company, New York, supplied the entire installation, doing all the wiring and other work, and furnished the "Polar" 20-hour, 3000-cp. flaming arc lamps employed.

Automatic Draft Control for Steam Boilers.

The accompanying illustrations show an equipment for automatically controlling the draft of a boiler furnace installed by the Green Fuel Economizer Company, Matteawan, N. Y., for the Atlantic City Sewerage Company. The equipment supplies and regulates the draft for 400 hp of boilers, the fuel for which is No. 2 buckwheat coal. Referring to Fig. 2, the controller, located near the forced-draft fan, admits water pressure to a line of ¼ in. pipe running to an actuator which operates a damper in the chimney flue. A second controller admits water pressure to a actuator or damper motor which operates louvre dampers in the discharge pipe of the fan. This same controller admits water pressure to a diaphragm or piston valve which controls the admission of steam to the engine and slows down the engine driving the fan at the same time that the fan outlet is

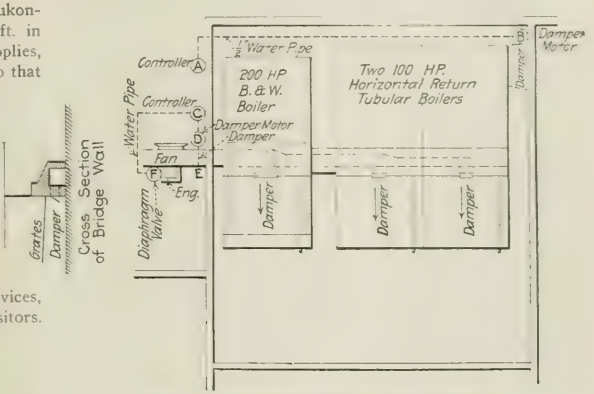


FIG. 1.—PLAN OF AUTOMATIC DRAFT CONTROL.

throttled. By controlling the speed of the fan a considerable economy in steam for driving is effected. The chimney-flue damper is arranged to close a trifle earlier than the fan dampers so as to avoid the possibility of any gas being forced out through the fire-doors by the operation of the blast fan.

The arrangement by which the air is carried from the blast fan through a brick conduit under the bridge walls to the separate furnace is apparent from the illustration. Each outlet is supplied with an independent hand-operated damper, the purpose of which is to make up for any differences in resistance of flues and air-passages between the different boilers. For instance, the draft induced by the chimney in the uptake of the nearest boiler might be 0.3 in. and in the one farthest away only 0.1 in. In the same way the pressure from the fan might vary from boiler to boiler, but all of these differences can be adjusted by the independent dampers in the ash-pits,

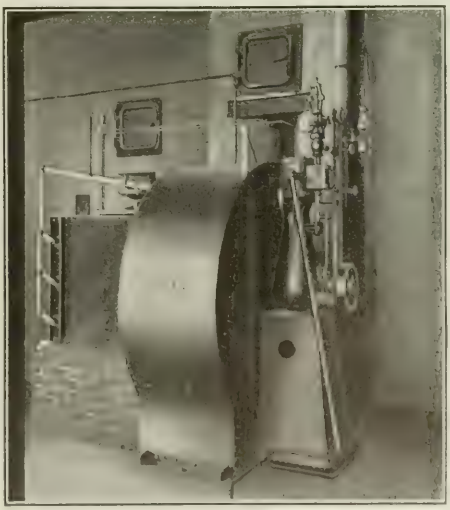


FIG. 2.—ENTIRE ANTHRACITE PLANT.

which also provide for working any one boiler more rapidly than the others, as desired. It is said that the equipment is capable of holding the steam pressure constant within 2 lb. per square inch.

Transformer for Moving-Picture Arc Lamps.

The problem of supplying low-voltage alternating current to moving-picture arc lamps from commercial supply circuits has several solutions, such as in the use of a rheostat or a choke coil in series with the arc, a compensator or auto-transformer connected across the line with low-voltage taps, or a transformer with a low-voltage secondary. It is well known that there is a large waste of energy in a series rheostat, depending, of course, upon the voltage of the supply circuit. Many lighting companies require the use of 220 volts for moving-picture work in order to avoid heavily loading one side of a three-wire system. This increases the losses considerably in circuits where a resistance or a reactive device is used for reducing the voltage.

Reducing voltage by the use of a choke coil or an auto-transformer introduces reactance into the circuit, resulting in a large current at low power factor being taken from the system, thereby affecting the voltage of the lighting circuit.

In order to meet the demand for a device that would be free from the above-noted and other objectionable features, the General Electric Company has recently placed on the market a special transformer for moving-picture work. This transformer, known as the "Economy Arc," has a low-voltage secondary winding with three taps giving 30, 40 or 50 amp in the arc circuit. This method of regulating the curent adapts the transformer to a number of varying conditions such as result from different densities of films and different distances between lamp and screen. The fact that with this device there is no direct electrical connection between the lamp and the supply circuit is also noteworthy.



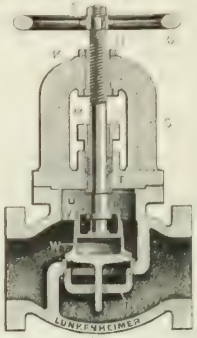
TRANSFORMER FOR MOVING PICTURE ARC LAMPS.

The transformer is so designed that with the secondary on short circuit, the primary current will not rise to an excessively high value. The temperature rise being low, the transformer is very cool-running and its introduction to the circuit increases the reactance but little. Low operating temperature means much to the lamp operator who has very little room for his apparatus and must necessarily be in close proximity to the regulating device.

The dimensions of the entire device, which includes the transformer and regulating switch and connections, are as follows: Height over switch handle, 16 in.; floor space, 13 in. x 16¼ in.; weight, approximately 85 lb.

Non-Return Boiler Stop Valve.

The necessity for a reliable non-return stop valve on each boiler when several are operated together is now generally recognized, and in some countries their installation is required by law. When several boilers are connected to a common header it is evident that if a tube is blown out or a fitting is ruptured the steam from the battery of boilers will rush into the header and discharge through the boiler which is disabled. The difficulty of closing a stop valve in the event of such an accident is apparent. The Lunkenheimer Company, Cincinnati, Ohio, has designed a non-return boiler stop valve which is claimed to overcome this danger entirely. This valve, the operation of which will be appreciated from the accompanying illustration, is intended to be placed between the boiler and header. When placed on a boiler the valve prevents steam being turned

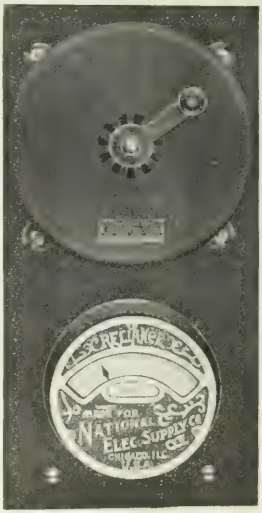


NON-RETURN STOP VALVE.

into it when it has been cut out for cleaning or repairs, for the reason that the valve cannot be opened by hand. It can, however, be closed by hand, as can any other stop valve.

Charging Set for Ignition Batteries.

The National Electric Supply Company, of Chicago, is marketing a battery-charging set which is designed to charge one or more ignition batteries from a 115-volt service line. The outfit consists of a 9-in. rheostat and a permanent magnet ammeter mounted on a slab of ½-in. asbestos wood 20 in. long by 10 in. wide. It is compact and of attractive appearance, and is much more simple and easy of adjustment than the old method of charging by the insertion of lamps in the circuit. The ammeter is of 10-amp capacity and has the evenly divided scale of the permanent magnet instrument, while the extremely fine control afforded by the rheostat enables the operator to set the current



RHEOSTAT AND AMMETER FOR CHARGING SET.

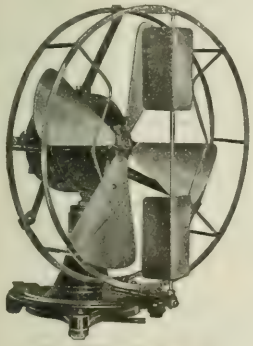
exactly at the desired rate of charge. The rheostat is of such resistance that with only one battery on charge a minimum current of 2 amp may be obtained, while the maximum capacity of the rheostat is 5 amp.

Combined Oscillating-Rotating Fan Motor.

During the past two seasons an increasing demand has developed for the oscillating type of fan and the indications are that this type will be quite generally used during the coming season. The Central Electric Company, Chicago, Ill., has, with the co-operation of a well-equipped factory, developed a line of fans of this type for which a number of advantages and successful features are claimed. The motors represent the latest approved engineering and factory practice, are self-oiling, self-aligning and embody all the best features of modern construction. In addition to the qualities of the ordinary oscillating fans, they possess the ability to move backward and forward through any desired angle, or can be converted into stationary fans by simple adjustment. A view of one of these fans is given below.

A Screw-in Grounding Device.

The illustration herewith shows a new grounding device intended to afford a non-inductive ground, such as is secured by burying a copper plate in the earth. This device is screwed into the ground in the same manner as a guy anchor and is used for grounding telephone and telegraph wires, railway signal apparatus, lightning-protective devices, transformer secondaries and in other cases where a low-resistance, non-inductive ground is necessary. The screw point is made of cast iron, copper-coated, and when completely oxidized still affords a good ground path. This ground can be installed where it is not permissible



OSCILLATING-ROTATING FAN.



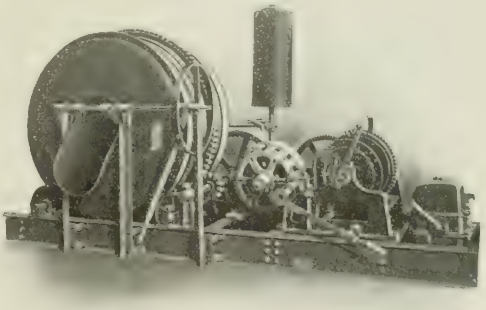
SCREW-IN GROUNDING DEVICE.

to dig a hole, and can be placed in position in from 15 to 20 minutes at comparatively low cost. After being screwed into the ground it requires no further attention, beyond the connection of the necessary exterior wire. If desired, the screw point can be made of copper. A wrench, 6 ft. 6 in. in length, is attached to the upper end of the ground, and 5-ft. extensions may be added to the wrench, making it possible to sink the screw point until it is in permanent contact with moist earth. The connecting wire of the ground is of pure copper and, as stated before, the screw point itself is usually an iron casting, copper-plated. This copper-plating not only insures a perfectly soldered connection between the wire lead and the casting, but also increases the life of the casting. A packing of charcoal is not required to retain moisture, as the point is screwed down to permanently moist earth. This device is made by the Delta Electric & Manufacturing Company, of Chicago.

Motor-Driven Concrete Mixer in Record Performance.

One of the most noteworthy buildings of reinforced concrete construction that has been erected in the West is being built for the Sacramento Hotel Company, Sacramento, Cal. This building is designed to provide in a substantial manner for catering to the demands of a capital city which also entertains large conventions. In planning for the construction of this large building the Ransome Concrete Company, of San Francisco, which is the general contractor, took pains to install an equipment which would be thoroughly reliable and durable, and also insure the rapid handling of materials. The principal element of the plant, the concrete mixer and hoisting machine, was especially designed for the Ransome Concrete Company by C. G. Meyers, of Norman B. Livermore & Company, San Francisco, Cal., to meet the requirements of heavy, continuous service. As shown in the illustration below, the concrete machine consists of a special combination Ransome concrete mixer mounted on a 10-in. steel I-beam frame. On the end opposite the mixer is mounted a Mead-Morrison single-drum hoist. Both mixer and hoist are arranged to be driven directly through gearing by a 30-hp Westinghouse alternating-current motor operating at 850 r.p.m. on 220-volt, 60-cycle, three-phase current and equipped with the necessary auto-starter. The mixer is provided with a Ransome patent water-measuring device and measuring hopper. The hoist is used in operating the Ransome concrete hoist-bucket. The whole arrangement forms a compact machine, the steel frame giving great stability to the outfit.

The mixer was set up in its permanent location in the basement under the sidewalk and retained in that location until all the concrete had been deposited in the building. Crushed rock and gravel were brought to the site by teams and dumped into large material bins from which the material was fed by a belt conveyor to a large charging hopper mounted above the mixer.



MOTOR-DRIVEN CONCRETE MIXER.

After mixing, the green concrete was hauled by means of Ransome concrete carts to the molds.

That the arrangement as installed was an efficient one is well demonstrated by a record made Sept. 3, 1908, when the company placed 381 cu. yd. of concrete in 8¾ hours. This involved the mixing of 315 cu. yd. of rock, 158 cu. yd. of sand and 572 barrels of cement—a total of 551 cu. yd. of loose, dry material which weighed in the aggregate 1,427,000 lb. The addition to this dry material of 460 barrels of water brings the actual weight of material handled to 1,547,600 lb. All of this material was hoisted a height of 15 ft. and dumped into a bin fitted with two Ransome concrete bin gates. From here it was distributed to the forms, using 10 concrete carts as carriers.

The maximum haul for placing this concrete was 225 ft., the average haul 150 ft. By average haul is meant the distance which the material had to be carted, the round trip being twice that distance. In doing this work but 10 men were used in wheeling the 10 carts, each man handling his cart alone and working the full day, so that the average amount of material placed by each during the day weighed over 75 tons.

Norman B. Livermore & Company recently secured a contract from the State for two similar concrete-mixing and hoisting outfits to be used in the construction of the California State Prison, at San Quentin.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Reports from trade during the past week show some improvement in retail business, and some additional orders for fall and winter delivery received by wholesalers and jobbers. Women's wear, cottons, woolens and notions are the leaders in this trade improvement. Weather conditions have been adverse, owing to the fact that over a great section of the country it has been unseasonably cold. This has had its effect upon the crop prospects and has delayed seeding in many territories. Winter wheat has not progressed as well as it was hoped for, and the planting of the spring wheat crop has been so delayed that the yield will probably be curtailed. Throughout the South there is a more confident feeling, and purchases are more liberal, owing to the higher price of cotton. In industrial lines there has been a trifle more business in pig iron and structural material; in fact, these branches of the industry almost entirely cover the improvement. Pig-iron sales have been made amounting to 50,000 or 60,000 tons, mostly taken by agricultural implement makers. Structural material has been in very excellent demand, especially for railway work, and 35,000 tons of steel rails were reported as having been sold during the past week. Prices have been extremely low, and in many instances, it is claimed, below the profit margin. There is still considerable talk of a reduction on rails to $24, but as yet no such cut has been made. The extremely high prices for wheat in Chicago have demoralized the grain business and have practically paralyzed the flour trade. Collections have been better during the week, owing to the more liberal sales by retailers. Business failures for the week ended April 15 were 201, against 227 of the previous week, 261 in 1908, 167 in 1907, 167 in 1906 and 183 in 1905.

THE COPPER MARKET.

During the past week the actual buying of copper has been light for both the domestic and foreign accounts and prices have in consequence evinced a tendency to sag. Speculation in standard warrants has been less active and the advances recorded during the latter part of March have been practically lost. Exports are heavy, but of course represent deals that were made some days in advance. The statistical position of the copper market continues to be in favor of lower prices, in spite of the fact that the figures of the Copper Producers' Association indicated a very small increase in the surplus stock during March. It is not improper to say that these figures do not inspire confidence in the market. It is generally conceded now that the takings by domestic consumers during March were something like 51,000,000 lb. or at the rate of 612,000,000 lb. per year. It is thoroughly understood, however, that this is a figure which is in no way warranted by the present condition of the manufacturing industry, and the conclusion is inevitable that consumers must have been laying up stocks against future orders and not filling immediate needs. Like the buying of the speculators, such buying does not reduce copper stocks. It simply means a transfer of ownership, not a melting of copper. Such sales, such shiftings of the actual position of copper, may serve to keep up prices or to encourage dealers, but they do not lessen the growing accumulations of unused copper. As long as the production of the mines is from 30,000,000 to 40,000,000 lb. per month greater than the consumption of the melting pots the copper surplus grows, and no amount of juggling of figures will alter the conditions. Sales, as stated before, have been light during the past week, but there has been little evidence of price concessions. Material concessions would probably have stimulated buying, for it is generally understood that there are a number of bargain hunters watching the market. Exports from Atlantic ports for the present month, including April 19, were 17,397 tons. Quotations on the Metal Exchange April 19 are given in the accompanying table.

Lake	12¾ @ 13
Electrolytic	12½ @ 12⅝
Casting	12¼ @ 12½

London prices were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	57 10 0	57 5 0
Standard copper, futures	57 18 0	58 0 0
Market	Steady	Firm
Sales of spot		300 tons
Sales of futures		1,000 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14 5s	12 5s
Electrolytic	14 2s	12 12½
Casting	14 12½	12 0s
London, spot	£64 2 6	£54 12 6
London, future	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

LONG ISLAND RAILROAD ELECTRIC CONTRACTS.—The Long Island Railroad has recently placed a number of important contracts for equipment and rolling stock preparatory to carrying out during the spring and summer the electrification of several of its branch lines. The company proposes to build two additional tracks between Winfield and Jamaica, a distance of eight miles; to construct a two-mile, two-track connection between the main line and the Montauk division; to build a freight connection between its Montauk division and the freight yards at Long Island City, a distance of one-half mile, and to build the proposed cross-island trolley from its railroad station at Huntington to Amityville, a distance of 18 miles. Contracts for the material for this work have all been awarded. In connection with the construction of these lines there will follow the development of the company's power transmission system, and substations will be built at Huntington, Farmingdale and Winfield, all of which will be supplied with power from the main station of the company in Long Island City. The apparatus for these substations has been purchased. In addition the Long Island Railroad has contracted for the reconstruction of 50 miles of its main line for third-rail operations. Motor equipments for 50 cars have already been ordered from the Westinghouse Company, and the company expects to contract within the next 60 days for 125 steel motor cars, complete.

WESTERN ELECTRIC BUSINESS EXTENDING.—The business of the Western Electric Company for the month of March made a better showing than for any preceding month in the present year, and better than for any month in the previous fiscal year, which ended Nov. 30, 1908. The March sales were at the rate of $48,000,000 per year, and the rate for the four months of the fiscal year averaged at about $45,000,000 per year. The principal direction of business is in the line of telephone apparatus. There has been steady improvement in such sales, not only to the Bell companies but to outside telephone companies. The sales to independent companies are 50 per cent bigger than at the same time a year ago. The Western Electric Company is still increasing the number of its employees, having added about 2000 since the beginning of its fiscal year. It is now employing nearly 17,000 workmen.

ELECTRICAL CONSTRUCTION.—Among the items printed under CONSTRUCTION NEWS last week and in the present issue, are announcements of proposed new plants or considerable extensions of present plants at Prosser, Wash.; Petersburg, Ill.; Columbus, Ohio; Mammoth Springs, Ark.; Lucile, Idaho; Clarkesburg, Mo.; Richmond, Va.; Eureka Springs, Ark.; Tishomingo, Okla.; Talladega, Ga.; Painesville, Ohio; Macon, Miss.; Batesville, Ark.; Calvert, Tex.; Oneida, N. Y.; Fort Worth, Tex.; Louisville, Ky.; Oregon, Ill.; Iron River, Mich., and Denver, Colo.

MOTOR-DRIVEN PRINTING PLANT.—One of the oldest and largest printing establishments in the State of Texas, that of Clarke & Courts, Galveston, has just completed the electrification of its drives. The order for 21 motors recently placed with the Birmingham office of the Crocker-Wheeler Company makes a total of 61 of these motors in the plant.

FIGHT TO BE MADE ON CARBON TARIFF.—The importers of carbons for arc lights are organized for a determined fight against the proposed tariff of $7 per 1000 ft., as is provided in the Aldrich bill. A meeting was held April 15 by prominent importers, in order to form some sort of an organization to take up this question and inform the legislators at Washington of the conditions of the trade, and protest against the hardships which the proposed tariff will impose. Hugo Reisinger, who is the largest importer of carbons in the United States, was represented at the meeting, as were also L. E. Frorup & Company, the German-American Electric Company, the Stave Electrical Company, the Beck Flaming Lamp Company and Fox Brothers & Company. It was determined at the meeting that a campaign of education should be carried on among the central-station men of the country, showing exactly what would be the result of the proposed change in the tariff. Such a change would be especially a hardship upon the users of flaming-arc carbons, and it is these that are ta be interested particularly. At the present time all carbons imported pay a duty of $9 per thousand pieces. In the case of enclosed-arc carbons, which are the largest part of the imports, this high duty is partially offset by the importation of 24-in. and 28½-in. lengths, which are cut in this country. This reduces the average ot about $4 per thousand when all of the various lengths imported are considered. To impose a duty of $7 per 1000 ft. will, of course, prevent the importation in longer lengths than are used in the lamps, and will amount to an increase in almost every class of carbons imported. At the present time flaming-arc carbons are paying a duty of $18 per thousand pairs, and this duty is the same whether the carbons are 16 in. or 24 in. long. As no flaming-arc carbons are imported of a shorter length than 16 in. the Aldrich bill would increase the duty on all of them.

LARGE CHICAGO ISOLATED PLANT.—Workmen are now engaged in tearing down the old Victoria Hotel on the corner of Michigan Avenue and Van Buren Street in Chicago. On this site will be erected a 20-story office building, to be known as the McCormick Building, the ground floor being occupied by a prominent firm of jewelers. The building will extend 101 ft. on Michigan Avenue and 172 ft. on Van Buren Street. It will be wired for 7500 16-cp incandescent electric lamps and 120 hp in electric motors, used to drive pumps of various descriptions, an air-compressor, a dumb-waiter and for other machinery. There will be five passenger elevators, and in all probability these will be of the electric type. To supply electricity for light and power a private plant will be erected in the sub-basement. This will consist of three generating units, two of 50 kw each and one of 100 kw. Direct current at 240 volts will be generated, and the dynamos will be direct-connected to four-valve steam engines, supplied with steam from a boiler plant in the building. The switchboard will be provided with a complete equipment of instruments and controlling devices. The three-wire, 120-240-volt system will be used, with Simplex wire and Hart or Diamond H switches. The meter panels will be of a special type. The building will have two wire shafts, each containing three sets of risers, each set consisting of three cables. For wiring purposes each floor is divided in half, and six of these half floors will be on each set of risers. The wiring is especially laid out so that any desired metering arrangement made necessary by subdivision of space for tenants can be arranged. Holabird & Roche are the architects for this building, and the George A. Fuller Company (which will award the electrical contracts) is the general contractor.

GERMANS MAY MAKE CARBONS IN AMERICA.—Hugo Reisinger, the principal importer of carbons for arc lamps in this country, and representative of some of the most important manufacturers in Germany, both of flaming-arc and enclosed-arc carbons, announces that if the new schedules of tariff which is proposed in the Aldrich bill becomes a law he will establish a factory for the manufacture of carbons in this country, which will be backed by German capital to any amount that is necessary, and which will manufacture the same carbons that are now imported from Germany. He says that such a factory can be established in this country to compete in the carbon business, and that the result of such competition will be the practical cutting in half of the present prices charged for carbons to consumers. Mr. Reisinger says that there is plenty of money available for this purpose just as soon as it is determined that the present high rates of duty will be maintained, or that an increase is to be adopted. He says: "I know that such a factory in this country would speedily bring the carbon trust to terms, and that the consumer would get all the benefit. We would have the advantage of a thoroughly modern, compact plant, and we would not have to pay dividends on inflated capital."

LARGE ELECTRICALLY DRIVEN RAILROAD SHOPS.—One of the largest jobs of construction work in which electricity plays a part now under way in the Southwest is the building of the locomotive- and car-repair shops of the St. Louis & San Francisco Railroad Company, commonly known as the 'Frisco System, at Springfield, Mo. Here a force of from 700 to 900 men is engaged in erecting the seven main buildings of the shops, which will have initial capacity for caring for 25 locomotives, although ultimately designed to be a 90-pit shop. The shops will be electrically operated throughout, although only a portion of the machines will have individual drive. In all about 100 electric motors will be needed. The power house is a separate building, with an initial boiler capacity of 2000 hp, but laid out for an ultimate capacity of 3200 hp. At first two 500-kw Westinghouse turbo-alternators will be installed, as well as a 300-kw rotary converter to furnish direct current for the direct-current motors, which will be used where variable speed is required. It is expected that these shops will be ready for service some time during the coming summer. The Arnold Company, of Chicago, is the designer and constructor of these shops, the work being under the direct supervision of Mr. P. L. Battey, chief engineer of the railway shop department of the Arnold Company.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY.—At a special meeting of the board of directors of the Standard Electric Accumulator Company last week the following officers were elected for the ensuing year: President, Thomas Nelson, Jr.; vice-president, James W. Johnson; secretary and treasurer, C. de Waal.

Financial Intelligence.

THE WEEK IN WALL STREET.

During the past week the Wall Street stock market has been less active than it was before the Easter holidays, and was decidedly irregular. In the opening session, immediately after the holidays, there was quite an advance, then profit taking began, and many issues which had been pushed forward dropped back several points. For the remainder of the week profit taking was continuously in evidence, and, while there were some supporting orders, there has been at no time any particular strength in buying, and at no time any particular disposition to sell the market as a short proposition. The con-

NEW YORK.

	Apr. 12.	Apr. 19.	Shares Sold.		Apr. 12.	Apr. 19.	Shares Sold.
All.-Ch.	15	16	5,100	Int.-Met., pfd.	43¼	44½	38,430
All.-Ch., pfd.	47¾	49⅞	2,075	Mackay Cos.	78	76*	2,800
Amal. Cop.	78⅜	76¼	143,075	Mackay Cos., pfd.	74	72½*	950
Am. D. T.	29½	29*	——	Manhattan Elev.	145*	145¼*	1,780
Am. Loc.	55⅛	54⅛	6,800	Met. St. Ry.	22*	22½	400
Am. Loc., pfd.	114⅞	114	300	N. Y. & N. J. Tel.	122	123	100
Am. Tel. & Cbl.	76	76*	100	Steel, com.	52½	52⅛	481,952
Am. T. & T.	137½	137¼	70,860	Steel, pfd.	115	114½	10,203
B. R. T.	77½	76⅞	41,705	W. U. T.	69½	70	10,450
Gen. Elec.	159¾	159½	4,402	West'h., com.	84¼	83	1,300
Int.-Met., com.	14⅞	15¼	15,950	West'h., pfd.	120	120	200

PHILADELPHIA.

	Apr. 12.	Apr. 19.	Shares Sold.		Apr. 12.	Apr. 19.	Shares Sold.
Am. Rys.	46*	46*	——	Phila. Elec.	12⅝	12	——
Elec. Co. of N.	12½	12½	——	Phila. R. T.	85½	85½	——
Elec. Stor. B'ty	45	45*	——	Phila. Traction.	92	93	——
E. S. B'ty, pfd.	40*	40*	——	Union Traction.	57	57⅛	——

CHICAGO.

	Apr. 12.	Apr. 19.	Shares Sold.		Apr. 12.	Apr. 19.	Shares Sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	133	133½	——
Chi. Rys., Ser 1	120*	120*	——	Met. El., com.	19*	17½*	——
Chi. Rys., Ser. 2.	40⅛	40	——	Nat'nal Carbon.	85*	85*	——
Com. Edison.	142½	144	——	Nat. Carb., pfd.	120*	120*	——
Chi. Subways.	27½	26	——				

BOSTON.

	Apr. 12.	Apr. 19.	Shares Sold.		Apr. 12.	Apr. 19.	Shares Sold.
Am. Tel. & Tel.	134¾	135*	——	Mass. Elec.	20¾*	20¾	——
Com. Tel.	13	13*	——	Mass. El., pfd.	60*	60*	——
Edison El. Ill.	260	260	——	N. E. Tel.	134	133*	——
Gen. Elec.	156	156	——	W. Tel. & Tel.	9½*	9	——
Mass. Elec. Rys.	11¼	11¼*	——	W. L. & P., pfd.	85*	85*	——
Mass. El. R., pfd.	50	50	——				

*Last price quoted.
Shares sold during the week April 12 to April 19.

dition of the steel business has been more encouraging than at any time within the past year, and this has helped the general sentiment. On the other hand, the excessive prices for wheat in Chicago have done much to demoralize the general trading element. Neither of these, however, has had more than a passing influence upon the market. Taken as a whole, the condition is one in which all traders are waiting, but are confident. It is the general opinion in Wall Street that the tide has changed for the better, and that the days of depression are practically over. It is also the general opinion that the advances which may be looked for in the stock market have been largely discounted. In other words, the opinion is that stocks have been pushed considerably beyond the point where the immediate earnings of the companies will warrant. There is no doubt that dividends will be increased in many cases, but it is a question whether or not the prices of stocks have not already been advanced to anticipate such increases. This, of course, has been largely encouraged by the long continued cheap money market. It has been no trouble, for many months, to place bonds that had any sort of good backing, and it has been no trouble to get all the money that was necessary to carry any stock investments that a trader might desire. Money continues to be as easy as ever, indicative of the fact that actual business has not completely resumed, but trading is nothing like as active as the money quotations would seem to indicate. Rates quoted on April 19 were, call 1¾ @ 2 per cent, 90-day paper 2½ per cent. The quotations in the table are those of the close April 19.

DIVIDENDS.

American District Telegraph Company, quarterly, 1 per cent, payable April 22.

American Gas & Electric Company, preferred, quarterly, 1½ per cent, payable May 1.

Commonwealth Edison Company, Chicago, quarterly, 1½ per cent, payable May 1.

Edison Electric Illuminating Company, of Brockton, Mass., semi-annual, 3½ per cent, payable May 1.

Grand Rapids Railway Company, preferred, quarterly, 1¾ per cent, payable May 1.

Havana Electric Railway Company, preferred, quarterly, 1½ per cent; common, quarterly, 1 per cent, both payable May 15.

Houghton County (Mich.) Electric Light Company, preferred, semi-annual, 3 per cent; common, semi-annual, 2½ per cent, both payable May 1.

International Steam Pump Company, preferred, quarterly, 1½ per cent, payable May 1.

Michigan State Telephone Company, preferred and common, 1½ per cent each, payable, common June 1, preferred Aug. 2.

Mexico Tramways Company, quarterly, 1½ per cent, payable May 1.

United Electric Securities Company, Boston, preferred, semi-annual, 3½ per cent, payable May 1.

STANISLAUS ELECTRIC POWER COMPANY.—A sale has been ordered by the United States Court, at San Francisco, of the property of the Stanislaus Electric Power Company, Stanislaus Railway Company, the Tuolumne Water Power Company and the Union Construction Company, for May 10. These companies were placed in the hands of receivers several weeks ago, as already published in these columns. This action was taken, and the present sale is for the purpose of completing a deal by which the Stanislaus water-power properties will come into the possession of the United Railways interests, of San Francisco. It is presumed that the United Railways Investment Company, which is the holding company organized by the railway company for the purpose of taking over the Stanislaus properties, will be the only bidder at the sale.

CENTRAL CROSSTOWN PROTECTIVE COMMITTEE.—The holders of the $2,490,000 notes of the Central Crosstown Railroad Company, of New York, which mature May 1, have formed a protective committee to look after their interests. These notes are guaranteed by the Metropolitan Street Railway Company, under the terms of the lease, but as a portion of the lease has been already abrogated and as the Metropolitan receivers have no means of meeting the payment, there is some uncertainty as to the status of the noteholders. The committee, of which Cornelius C. Cuyler is chairman, has asked that the notes be deposited with the United States Mortgage & Trust Company, of New York, or the City Trust Company, of Boston.

UNITED RAILWAYS, OF BALTIMORE.—The annual report of the United Railways Electric Company, of Baltimore, shows only a surplus of $93,771 for 1908 which could be made applicable to dividends. This is less than ½ of 1 per cent on the stock and entirely disregards the interest coupons on the income bonds which are being funded until December, 1910. The report is not altogether gloomy, however, from the fact that during the year there was spent on improvements and rehabilitation something like 13 per cent of the gross receipts. The balance sheet of the company shows total assets of $75,858,717 and a funded debt of $54,745,000. The floating debts amount to almost $6,000,000.

BLACKSTONE VALLEY CONSOLIDATION.—An act has been introduced in the Rhode Island Legislature providing for the incorporation of the Blackstone Valley Gas & Electric Company which, if the present plans are carried out, will result in the consolidation of all the lighting plants in the northern section of Rhode Island and the adjacent corner of Massachusetts. The company has already been incorporated under the laws of Maine and has been doing business through the subsidiary concerns it is now proposed to merge. The principal companies affected are the Pawtucket Gas Company, Pawtucket Electric Company, Woonsocket Gas Company and Woonsocket Electric Machine & Power Company.

WATERTOWN LIGHT & POWER COMPANY.—The Public Service Commission of the Second District of New York has authorized the new Watertown Light & Power Company to issue $455,000 of its common stock in place of the stock of the Watertown Gas Light Company and the old Watertown Light & Power Company. This is a feature of the merging of the two properties. The new company is also authorized to execute a consolidated mortgage upon its plants of $2,000,000 to secure $1,557,500 of 5 per cent 50-year bonds and to retire the bonds of the Watertown Gas Light Company and the old Watertown Light & Power Company.

WASHINGTON WATER-POWER COMPANY.—Moffat & White and Lee, Higginson & Company are offering to the public an issue of $4,000,000 5 per cent bonds of the Washington Water-Power Company, Spokane, Wash. The proceeds of these bonds will be used for refunding purposes and to make improvements and extensions. After the total issue of bonds amounts to $6,000,000 the company is prohibited from issuing in any one year more than 50 per cent of the amount spent in improvements. There is a sinking fund provision of 2 per cent for the purchase of the bonds at not more than 110. The net earnings of the company amount to four times the interest charges.

PHILADELPHIA ELECTRIC COMPANY.—After meeting its heavy fixed charges, the Philadelphia Electric Company, which practically controls the electric light and power facilities of Philadelphia, was able to increase its dividends on the capital stock from $499,935 to $711,068. The company also declared a stock dividend of $999,510. According to the income account, contained in the annual report, the gross earnings for the year were $5,244,963. The total surplus was $2,390,528, and it was out of this surplus that the stock dividend was created.

NO WESTERN UNION DEAL.—The officials of the Western Union Telegraph Comapny vigorously denied last week a rumor that was current in Wall Street that negotiations were in progress looking to the absorption of the company by the American Telephone & Telegraph Company. President Clowry said that the report was absolutely untrue, and that he had never heard of any proposition looking toward such a deal having been made. The officials of the American company were also positive in denying the rumor.

KENTUCKY INTERURBAN TRACTION SYSTEM.—Incorporation papers have been filed with the Secretary of State at Kentucky for the formation of the Cincinnati, Louisville, Lexington & Maysville Traction Company, with an authorized capital stock of $10,000,000. The system as proposed will be about 250 miles long, and will serve a number of towns which have no railroad facilities. The limits of the territory covered will be those of the cities named in the company's title.

BINGHAMTON RAILWAY COMPANY.—The report for the year 1908 of the Binghamton Railway Company shows gross earnings of $327,273, an increase of almost $40,000, and net earnings of $141,708. There was a surplus after paying all charges and regular dividends of $10,352.

BOSTON ELEVATED CONSOLIDATION VOTED FOR.—At a meeting of the shareholders of the West End Street Railway Company, of Boston, a resolution was adopted, by an overwhelming vote, petitioning the Legislature for permission to consolidate with the Boston Elevated Railway Company. The terms of the resolution provide that dividends on both the first and second preferred elevated stock shall be at the rate of 8 per cent from the date of consolidation, and that Elevated first and second preferred shall be received in exchange for the preferred and common stock of the West End Street Railway Company. These are the terms which have heretofore been agreed upon by the directors of the two companies.

NEW YORK & ONTARIO POWER BONDS.—The New York & Ontario Power Company, of Ogdensburg, N. Y., has ordered the sale of $1,850,000 bonds, the proceeds of which are to be used for the development of water-power at Waddington, N. Y. The company owns all the water-power rights in the St. Lawrence River between Waddington and Cropser's Island. It is said that there is a 12-ft. head capable of developing 30,000 hp. It is planned to build a 600-ft. concrete dam and the total cost of this and equipping the power station is figured at $2,000,000. The company has the right to sell in both this country and Canada and will furnish energy for the Norwood & St. Lawrence Railroad.

CUYAHOGA TELEPHONE ISSUES NOTES.—The directors of the Cuyahoga Telephone Company have authorized the sale of $300,000 short-time collateral notes to McLoud & Pulliam and Otis & Hough, with the proceeds of which the floating debt will be paid and a new branch exchange built on East Eighty-first Street, near Hough Avenue. About $100,000 will be expended for the exchange, which will accommodate 7000 subscribers. This is badly needed, as the company has been compelled to refuse 1000 orders that could not be cared for on the east side of the city recently. The exchange building will be two stories in height, and the intention is to have it ready for operation by Jan. 1.

UNITED ELECTRIC SERVICE CORPORATION.—The Board of Estimate of New York has granted a franchise to the United Electric Service Corporation to establish an electric wire system in the city for messenger, burglar and fire-alarm service. The company is not allowed to use its wires for telephone purposes. It is said that several prominent politicians are interested in the proposition and that it is intended to be a competitor of the American District Telegraph Company. The company is to pay to the city $1,200 as a minimum yearly rental for the first five years of the franchise, $2,500 for the second five years and $4,500 for the remaining five years of the charter's existence.

NEW YORK EDISON COMPANY'S REPORT.—According to the report made by the New York Edison Company to the Public Service Commission, First District, the earnings of the company from the sale of energy for the six months which ended Dec. 31, 1908, amounted to $7,231,000, and the operating expenses for the same period were $4,644,000. The net income, after deducting bond interest and all collateral expenses, amounted to $1,191,000, which was less than the 3 per cent dividends paid in that period. The final surplus account at the end of the year was $12,849,000. During the six months the number of consumers increased 6649 and the number of meters 6359.

LANYON ZINC COMPANY FAILURE.—Upon the application of Alton B. Parker, acting in behalf of the Trust Company of America, trustee of the bondholders, a receiver has been appointed at Iola, Kans., for the Lanyon Zinc Company, which is one of the largest smelting works in the country. J. O. Rodgers, president of the company, was named as receiver. The petitioners declare that there are still outstanding $1,783,000 of the company's bonds, on which there has been a default of interest amounting to $483,000, part of which has been due since 1905. It is said that the Lanyon Zinc Company controls over 40 per cent of the entire zinc output of the world.

LIGHTING MERGER IN WESTERN PENNSYLVANIA.—The stockholders of the Citizens' Light, Heat & Power Company and the Consumers' Gas Company, of Johnstown, Pa., have voted to merge those concerns with the Johnstown Fuel Supply Company. The promoter of this combination is Emmet Queen, of Pittsburgh. A new company will be formed to take over the merged business which will be known as the Citizens' Light, Heat & Power Company. The new company will have a capital of $2,000,000 of preferred and $1,000,000 of common stock. It is expected to start in business about July 1.

CENTRAL INDIANA LIGHTING COMPANY.—According to statements sent out by the Central Indiana Lighting Company, a subsidiary of the National Light, Heat & Power Company, of New York, the earnings for last year in Alexandria, Fairmount, Bloomington and Columbus were $103,966.72. The operating expenses amounted to $74,775.36, leaving the net earnings $29,221.36. The interest on bonds for last year amounted to $28,583.27. This makes the surplus earnings for the four plants only $638.09. The company operates a street-car line in Columbus in addition to a lighting plant.

BIG WESTERN POWER COMPANY TO SELL RIGHTS.—It is said in Denver that a special meeting of the Telluride Power Company has been called for May 4, for the purpose of authorizing the directors to sell the lease and water rights of the company. This company has a capitalization of $20,000,000, and a projected capacity of more than 100,000 hp. The company is owned and controlled by Cleveland and St. Louis capitalists, and has built up a system of up-to-date power plants in Colorado, Utah and Idaho.

INDIANA INCORPORATION.—Westinghouse, Church, Kerr & Company have complied with the foreign corporation law of Indiana by filing the necessary papers with the Secretary of State and have received a certificate of authority to do business in Indiana. The capital to be invested in the States is stated to be $40,000. The company will do a general designing and construction engineering business with offices at 611 Newton Claypool Building, Indianapolis.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Light & Traction Company					
Quarter ended March 31, 1909	$848,032	$26,023	$822,009	$373,582	448,426
Quarter ended March 31, 1908	659,003	12,000	647,093	314,953	332,140
American Telephone & Telegraph Company:					
March, 1909	1,238,001	237,881	1,000,190	666,230	333,963
March, 1908	1,130,112	184,976	945,166	647,640	297,526
Bell Telephone Operating Companies:					
Two months ended Feb. 28, 1909	21,269,800	15,681,200	5,588,600	1,184,600	4,404,000
Two months ended Feb. 29, 1908	20,068,400	14,700,000	5,379,200	1,299,800	4,079,400
Binghamton (N. Y.) Railway Company:					
Year 1908	327,273	185,565	141,708	106,982	34,726
Year 1907	287,561	174,376	113,185	98,284	14,901
Coney Island & Brooklyn Railroad Company:					
Year ended June 30, 1908	1,557,157	1,308,656	248,801	248,003	798
Year ended June 30, 1909	1,621,574	1,287,120	334,450	253,450	81,045
Honolulu Rapid Transit & Land Company:					
Year 1908	187,114	106,656	80,458	05,458	82,403
Year 1907	187,133	87,025	100,008	100,008	72,413
Long Island Railroad Company:					
Year 1908	9,818,141	7,267,235	2,550,906	2,756,642	*276,088
Year 1907	10,135,307	8,526,584	1,603,823	1,462,695	*858,828
Philadelphia Electric Company:					
Year 1908	5,211,903	4,285,301	959,602	459,189	500,413
Year 1907	1,981,[illegible]	4,075,001	[illegible]	500,836	409,413
United Railways of St. Louis:					
March, 1908	900,[illegible]	[illegible]	[illegible]	[illegible]	80,543
March, 1907	870,[illegible]	[illegible]	[illegible]	[illegible]	66,483
Washington Water Power Company (Spokane):					
Year 1908	2,911,[illegible]	[illegible]	1,111,353	[illegible]	580,430
Year 1907	[illegible]	1,262,610	[illegible]	[illegible]	[illegible]

*Deficit.

GENERAL NEWS

Construction News.

CAMP HILL, ALA.—The citizens have voted to issue $10,000 in bonds, the proceeds to be used for the construction of an electric light plant.

COLUMBIANA, ALA.—J. R. White, city treasurer, writes that at present there is no light or power plant in the village, but expects that one will be installed soon.

FORT PAYNE, ALA.—Plans are being considered for the erection of a hydro-electric plant on Wills Creek, for which surveys are now being made. E. C. Drew, of Monroe, La., is interested in the project.

BATESVILLE, ARK.—Arrangements are being made to install a 250-hp Corliss engine and generator in the municipal electric light and water plant, at a cost of about $6,000.

EARL, ARK.—The capital stock of the Earl & Tyronza Telephone & Telegraph Company has been increased from $10,000 to $32,000.

LITTLE ROCK, ARK.—Plans are being considered by L. L. Whitcomb to establish a power plant in West Little Rock.

AUBURN, CAL.—The promoters of the Annie Laurie and Alameda group of mines, located on the North Fork of the American River, about six miles from Colfax, are making arrangements to install a 150-hp electric power plant on the property for the purpose of developing the mines at once.

CHICO, CAL.—The Bay Counties Power Company is contemplating the erection of a transmission line from Hamilton City to connect with the transmission line on the west side.

CHICO, CAL.—Only one bid was received by the City Trustees for the franchise applied for by Frank C. Wilson, representing the Sierra Electric Power Company for the distribution of electricity in Chico, which was submitted by the above company. The franchise was sold for $80.

CORNING, CAL.—The Northern Electric Power Company is making arrangements to increase its supply of electrical energy in Corning and surrounding country from 2000 to 6000 hp. The increase is made to meet the demand for electricity for pumping purposes throughout the Maywood Colony. The company is rebuilding its old lines and erecting new transmission lines throughout the town.

FORT BRAGG, CAL.—The Fort Bragg Electric Light Company has decided to enlarge its electric light plant and will install a 750-kw generator and steam turbine during the summer. The company will also erect another transmission line from Fort Bragg to Mendocino to improve the service.

LEMOORE, CAL.—The City Council is considering the question of granting a franchise to the San Joaquin Light & Power Company, of Fresno, Cal., to furnish electricity in this city, and also the sale of the municipal electric light plant to the company in connection with the deal. The Council has authorized the city attorney to draw up a resolution for the sale of the plant and to allow the company to enter the city without a franchise.

LOS ANGELES, CAL.—The Kern River Mining & Power Company proposes to construct a dam this summer below the Kern River Power Company to furnish power to generate electricity to operate a stamp mill which the company is to build.

PALO ALTO, CAL.—The City Council is considering the question of issuing bonds to the amount of $57,000, the proceeds to be used for extensions and improvements to the municipal electric light and water works systems, the erection of garbage crematory, fire alarm system, etc.

PLACERVILLE, CAL.—The Hodens Mining & Electric Company is making arrangements to start the preliminary work on the development of its properties at Fairplay. The company contemplates the construction of a large electric power plant on the Cosumnes River. R. D. Caldwell is superintendent.

SAN FRANCISCO, CAL.—District Judge Van Fleet, of the United States Circuit Court, has ordered the sale of the properties of the Stanislaus Electric Power Company and the Tuolumne Water Power Company to be sold to the highest bidder at the county court house at Sonora, Cal., May 10, to satisfy the mortgage of the Knickerbocker company.

SAN JOSE, CAL.—Bids will be received by the State Department of Engineering, State Capitol, Sacramento, Cal., until April 24 for construction of State Normal School Building, as follows: First—Building complete, excluding power house and plant. Second—Building complete, except auditorium part, but including power house and plant complete. Third—Building complete, except auditorium part. Fourth—Power house and plant complete. Plans and specifications may be seen at the State Normal School, San Jose, Cal., or at the State Engineering Department, Sacramento, Cal. N. Ellery is State engineer.

SANTA BARBARA, CAL.—Application has been made to the Board of Supervisors by S. A. Moss for a franchise to operate an electric railway between Manzanita station, near Mill Valley Junction, to a point above Coyote Creek.

VALLEJO, CAL.—Bids will be received until May 4 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the Navy Yard, Mare Island, Cal., a 40-ton, four-motor, electric, overhead traveling crane as per schedule 1104.

DENVER, COL.—The Northern Colorado Power Company has decided to make extensions to its distributing system in the Longmont-Greeley district for the purpose of furnishing electricity to farmers in that district for pumping. The cost of the work is estimated at $150,000. W. J. Parker is president and George Best, secretary.

DENVER, COL.—A special meeting of the stockholders of the Telluride Power Company has been called for May 4, it is said, for the purpose of authorizing the directors to sell or lease its water rights. The company has built up a system of 11 power plants in Colorado, Utah and Idaho, and will ultimately have a combined output of more than 125,000 hp. The company owns four plants in Colorado and six in Utah and Idaho, and has just installed the units in a plant 135 miles north of Salt Lake City, which has an output of 20,000 hp. Its transmission lines are now erected to Salt Lake City. The plant will ultimately develop 80,000 hp.

DENVER, COL.—The large electric power plant of the Central Colorado Power Company, located at Shoshone, near Glenwood Springs, is nearing completion and will soon furnish electricity in Denver. The company has awarded the contract for the erection of a substation near Denver to Charles J. Sheely, which will cost about $50,000. The Denver Gas & Electric Company will distribute all the power furnished in this city by the company. It is expected to have the plant completed by June 1.

DURANGO, COL.—The property of the Animas Power & Water Company was purchased April 1 by W. N. Vaile, of Denver, for $750,000 for the bondholders. The company will be reorganized, with a capital stock of $1,000,000 and bond issue of $4,000,000. S. Z. Mitchell is at the head of the reorganization committee. The company has a 4,000-hp plant and supplies electricity in Silverton and surrounding towns and to mining properties located in that district.

HOLLY, COL.—The City Council has authorized the purchase of machinery and equipment for a municipal electric light plant to cost about $10,000, contracts for which have already been placed.

DANIELSON, CONN.—The Quinnebaug Company has installed an electric generator in its mill to furnish electricity to operate its new spinning frames.

GLASTONBURY, CONN.—The Senate has passed the bill amending the charter of the Glastonbury Power Company permitting it to lease the plant of the Manchester Light & Power Company.

WATERBURY, CONN.—Announcement has been made by B. S. Burrell, business manager of the Connecticut Company, of a reduction in the price of electricity for electric signs. The rate will be $1.80 per year for each 4-cp lamp in the sign to burn for five hours each night.

WATERBURY, CONN.—The Business Men's Association is considering a proposition to install additional lamps on Grand Street from Bank Street to the new depot. The proposal involves the erection of poles and installation of underground conduits by the association, the subsequent cost of maintenance to be paid by the city.

WOODSTOCK, CONN.—The Putnam Light & Power Company, of Putnam, Conn., has applied to the Selectmen for a charter to supply electricity in the town for lamps. The company now furnishes electricity for power purposes in Woodstock, but has no charter to do business, and under the present arrangements the company's rights can be revoked by giving a notice of 30 days.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 27 to furnish at the navy yard and naval stations as follows: Washington, D. C., Schedule 1133—electrical-driven plate-bending roll, etc. Also until May 11 as follows: Brooklyn, N. Y., Schedule 1136—7275 lb. soft-rolled sheet copper, etc. Applications for proposals should designate the number desired by number.

QUINCY, FLA.—The citizens will vote April 27 on the proposition to issue $9,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant. B. A. Puckett is superintendent water and light plant.

SARASOTA, FLA.—H. P. Porter and associates have been granted a franchise by the City Council to construct and operate an electric light plant.

ALBANY, GA.—A company has been organized at Albany under the name of the Albany Cotton Mills and proposes to erect a mill and install 10,000 spindles, 300 looms and a 400-hp power plant for steam or electric drive. The company is capitalized at $250,000. W. W. Pace is president of the company and John A. Betjeman, treasurer.

ATLANTA, GA.—We are informed that plans are being made by the Atlanta Northeastern Railroad Company to commence work on its proposed railway connecting Atlanta, Roswell, Alpharette and Cumming,

during the coming summer. The road will be about 47 miles in length and will be used for both freight and passenger service. Steam will be used for freight, and it is probable that either electricity or gasoline motors will be used for passenger service. J. L. Murphy is secretary.

CEDARTOWN, GA.—The Board of Water & Light Commissioners has awarded contracts for equipment for the municipal electric light and water plant, which includes a 150-hp Erie Ball, cross-compound engine direct connected to a 105-kw, three-phase, 60-cycle, 2300-volt Crocker-Wheeler generator, which will double the output of the plant. W. T. Hardy is superintendent.

COLUMBUS, GA.—The plant of the Perkins Hosiery Mills will be enlarged. The company now operates 5000 spindles and 250 knitting machines, driven by electricity.

LA GRANGE, GA.—Contracts have been awarded for the installation of the power plant for Unity Cotton Mills No. 2, which is now being erected in La Grange. Fuller E. Callaway is interested in the project.

MANCHESTER, GA.—Contracts have been awarded for the power plant of the Manchester Cotton Mills now under construction in this place. Fuller E. Callaway is interested in the enterprise.

CHICAGO, ILL.—The Local Telephone Company has increased its capital stock from $10,000 to $60,000. The main office of the company has been changed from Martinton to Chicago.

CHICAGO, ILL.—Bids will be received by William Carroll, city electrician, at his office, 76 Fifth Avenue, Chicago, Ill., until April 24, for furnishing the Department of Electricity, City of Chicago, with 2,060,000, more or less, arc-lamp electrodes, in accordance with specifications on file in the above office and in approximately the following quantities: 1,400,000 14-in. x 5/6-in. copper-coated electrodes; 150,000 12-in. x 1/2-in. copper-coated electrodes; 45,000 10-in. x 1/2-in. (plain) forced electrodes; 45,000 12-in. x 5/6-in. (plain) forced electrodes; 180,000 12-in. x .510-in. to .520-in. cored electrodes; 180,000 12-in. x .510-in. to .520-in. solid high-grade electrodes; 60,000 12-in. x .510-in. solid high-grade electrodes, special gage. Proposals must be made out upon blanks furnished by the city electrician.

DEKALB, ILL.—The DeKalb Midland Railway Company expects to commence work on the construction of its proposed electric railway from DeKalb to Sandwich about July 1. Electricity for operating the road will be purchased. John F. Pearce, of Chicago, is president.

EAST ST. LOUIS, ILL.—The City Council has granted the Consumers' Electric Light, Heat & Power Company another 90 days to erect its plant and transmission system preparatory to supplying electricity for lamps and motors in East St. Louis. Under the terms of the franchise the company was to have its plant ready for service April 13.

KANKAKEE, ILL.—The capital stock of the Kankakee Electric Railway Company has been increased from $100,000 to $200,000.

KEWANEE, ILL.—The Galesburg & Kewanee Electric Railway Company is reported to be making plans for extending its railway from Galva to Galesburg, Ill. R. H. Hayward is general manager.

OREGON, ILL.—Arrangements are being made to enlarge and improve the plant of the Oregon Electric & Power Company, which will involve an expenditure of about $100,000. The plant was purchased some time ago by A. M. Searles, of Chicago, Ill.

BRAZIL, IND.—The Citizens' Telephone Company and the Bell Telephone Company have been consolidated and hereafter operates as one system. The Citizens company will take over the property of the Bell company in this city and county, the consideration being $100,000. While the management of the company and system remains with the local people it is understood the Bell company obtains a toll line station and will get a large share of the toll business from the patrons of the local system.

HAMMOND, IND.—The Calumet Traction Company, which was recently incorporated to construct an electric railway from Hammond to East Chicago, North Calumet and Center, has changed its name to that of the Indiana & Chicago Traction Company. W. J. Riley, of East Chicago, is secretary.

INDIANAPOLIS, IND.—The Board of Public Works has granted the Indianapolis Telephone Company permission to construct a conduit system and set poles in streets and alleys to extend its system throughout the Irvington territory, where a new exchange building will be erected.

INDIANAPOLIS, IND.—The Board of Public Works has awarded the contract for the construction of the new city hall building to the Westlake Construction Company, of St Louis, Mo., for $510,000. The bids for electric wiring were rejected. New specifications will be prepared immediately for heating and electrical work. Rubush & Hunter are the architects.

LOGANSPORT, IND.—Plans are being considered for the construction of an electric railway about 60 miles in length. Application will soon be made to the city council for the franchise, which will be known as the Logansport & Bass Lake & Lagro Electric Company. James C. Fletcher, Jesse W. Lacy, Peter Hendricks, Henry C. Schneider and C. H. Peter are interested in the enterprise.

NEW CASTLE, IND.—Plans and specifications are being prepared for the completion of the Indianapolis, Newcastle & Toledo Electric Railway, bids for the construction of which will be received about May 1. The Union Trust Company of Indianapolis is trustee for the company. The trustees are petitioned the Superior Court to permit the issue of receivers' certificates and extending $400,000 to pay for the work.

WARSAW, IND.—Negotiations are under way for the purchase of the rights of the Huntington & Goshen Railway by J. J. Burns and others, of Chicago, Ill., which were recently purchased by J. P. Dolan, of Syracuse, at sheriff's sale. This route will form a connecting link for electric railway service between Fort Wayne and Chicago by way of South Bend.

SILVER CITY, IA.—The Mills County Telephone Company has been absorbed by the Independent company, of Council Bluffs. The new company will improve the present lines and also proposes to make large extensions in toll lines.

SPIRIT LAKE, IA.—The Midland Telephone Company contemplates building a new exchange in Spirit Lake.

UNION, IA.—The Union Electric Light Company is reported to have awarded a contract for the installation of its plant to the Minneapolis Steel & Machinery Company, of Minneapolis, Minn. Contracts have also been awarded for the erection of the distribution system.

FT. RILEY, KAN.—The contract for extension to the lighting system at Fort Riley has been awarded to R. L. Sparks, Long Building, Kansas City, Mo., for $5,600. Captain W. M. Whitman is constructing quartermaster.

GLASCO, KAN.—The question of establishing an electric light plant and water works system in Glasco is under consideration.

BELLEVUE, KY.—The city is advertising for bids for a 10-year franchise to erect an electric plant and transmission system to furnish electricity for lamps and motors in Bellevue. Under the terms of the ordinance the plant is to be in operation not later than Sept. 1, 1909, and within one year to have its system installed to furnish electrical service in all parts of the city, which is now served by the Union Light, Heat & Power Company. George Trunnel, Jr., is city clerk.

GLASGOW, KY.—The capital stock of the Glasgow Telephone Company has been increased from $10,000 to $25,000.

LOUISVILLE, KY.—Arrangements are being made by B. F. Avery & Company, 150 Main Street, Louisville, for the construction of an entire new plant. A power plant will be installed, the equipment of which will include boilers and engines to supply 700 hp, automatic sprinkler system, electrical and other equipment. Plans and specifications are being prepared by George M. Brill, Marquette Building, Chicago, Ill.

HAGERSTOWN, MD.—The Hagerstown Silk Company is planning to erect an addition to its mill and will require special silk machinery, electric motors, wiring, transmission equipment, etc. The present plant is operated by electricity.

ATTLEBORO, MASS.—It is reported that John Joyce, of Andover, Mass., who is prominently connected with electric light corporations throughout Massachusetts, has purchased a large block of stock of the Attleboro Steam & Electric Company. Mr. Joyce will assume control of the plant in the near future. Associated with him is Vincent Goldthwaite, of Wellesley, Mass., who will have active management of the company.

AYER, MASS.—The town of Ayer and the Massachusetts Lighting Company have finally come to an agreement, whereby the company is to furnish electricity for lighting the town. Under the terms of the contract the company is to furnish 125 street lamps at an annual cost of $2,350. The streets of the town have been lighted by gasoline since last October.

BOSTON, MASS.—Mayor Hibbard has not yet signed the contract with the Edison Electric Illuminating Company for lighting the city for five years as reported in the issue of April 15. The Mayor has decided to consult with experts before signing the contract. Under the new contract the rate for arc lamps will be $103.51, of which there are 3183. The present price is $124.10.

NORTH DANA, MASS.—The citizens have voted to appropriate $800 for street lighting. The electric light plant, which is owned by Mr. Mason, is expected to be ready to put in operation in about 10 days.

PEABODY, MASS.—At the annual town meeting held April 13 the citizens voted to appropriate $58,000 to enlarge the municipal electric light plant.

PITTSFIELD, MASS.—The Berkshire Street Railway Company has petitioned the Massachusetts State Railroad Commission for permission to issue $248,000 in bonds, the proceeds to be used to retire outstanding obligations and for the construction of an extension at Cheshire Harbor, for bridge repairs and reconstruction near Farnham Station, Cheshire.

PITTSFIELD, MASS.—The Pittsfield Electric Company has notified the City Council that the arc lamps in the section of the city where underground wires are to be placed would cost $99 each per year, which is $[illegible] more than the present price. If the [illegible] are all underground it will cost the city $1,300 additional for street lamps.

STOUGHTON, MASS. [illegible] of Brockton, has filed a petition with the Board of Selectmen asking for [illegible]

WINCHESTER, MASS.—The special committee appointed by the town to investigate the question of lighting the streets by electricity has reported in favor of making a contract with the Lynnfield Electric Company of Reading, Mass., for a term of [illegible] term or yearly contract.

CADILLAC, MICH.—The Western Michigan Power Company has purchased 1050 acres of land for flowage rights along the Manistee River, in Greenwood and Liberty townships, in Wexford County.

DETROIT, MICH.—The Michigan Central Railroad Company has placed orders with the General Electric Company, Schenectady, N. Y., for six electric locomotives to be used to operate its trains through the tunnel under the Detroit River at Detroit. Electricity for operating the trains will be supplied by the Detroit Edison Company. The railroad company will erect a substation near the tunnel on the Detroit side of the river. It is expected to have the tunnel ready for operation about Dec. 1, 1900.

HILLSDALE, MICH.—The citizens have voted against the proposition to issue $10,000 in bonds, the proceeds to be used to enlarge the municipal electric light plant. The plant is now badly overloaded, and unless additional equipment is installed the plant will not be able to meet the demands made upon it during the winter season. It is expected that a special election will be held, when the bond issue will be again submitted to the people.

IRON RIVER, MICH.—Plans and specifications are being prepared by the Menominee Range Power & Development Company for the construction of a dam and electric power plant at Saunders at a cost of about $20,000. I. W. Byers, of Iron River, is attorney for the company.

ANOKA, MINN.—Plans have been prepared by William Pierce Cowles, engineer, Minneapolis, Minn., for the construction of an electric light plant and water works system in Anoka.

FERGUS FALLS, MINN.—The Northwest Telephone Company is planning extensive improvements to its system in Fergus Falls, which will involve an expenditure of about $43,000 and will include the installation of a new switchboard, underground conduit, aerial cable work and other equipment.

MINNEAPOLIS, MINN.—At a joint meeting of the Linden Hills and Harriet Heights Improvement associations, held April 1, it was voted to drop plans to organize a local company, provided the Minneapolis General Electric Company would furnish the service. A committee was also appointed to see what the company would do in regard to the extension of the Bryant Avenue car line across the foot of Lake Harriet.

MERIDIAN, MISS.—Contracts have been awarded by the Alden Knitting Mills, of New Orleans, for the construction of buildings for the Meridian mill to the Rubush-Dabbs Construction Company, of Meridian. The plant will be known as the Priscilla Mill, capitalized at $30,000, and will be operated by electricity.

CALIFORNIA, MO.—A. W. Carver, of Neosho, Mo., has been granted a franchise to operate an electric light plant in California. It is said that the local plant will be purchased and improvements made to the system.

PATTONSBURG, MO.—The proposition to establish an electric light plant in Pattonsburg will be submitted to a vote of the people at an election to be held soon.

BIG TIMBER, MONT.—Bids will be received by the Boulder Telephone Company until May for the reconstruction of 34 miles of the East & Main Boulder Telephone Company's line.

OMAHA, NEB.—We are informed that the Nebraska Traction & Power Company expects to have its proposed electric railway from Omaha through South Omaha, Ralston to Pappillion in operation within 30 days. Electricity for operating the railway will be purchased from the Omaha Electric Light & Power Company, which will be transmitted to Ralston, where a substation will be built. W. W. Crist is general manager.

HOBOKEN, N. J.—Bids will be received until April 28 for terms of one, two and five years, for furnishing electric arc, gas, hydro-carbon or other lamps for the city of Hoboken, according to the specifications on file in the office of the city clerk. James H. Londrigan is city clerk.

JERSEY CITY, N. J.—Plans are being made by the Business Men's Association for lighting Monticello Avenue from Communipaw to Fairview. It is proposed to erect arches for lamps along the street.

LONG BRANCH, N. J.—Consumers of electricity for lamps residing between Monmouth Beach and Lower Moor have been notified that the service will be discontinued on and after April 26. Owing to a recent order of the court, the Consolidated Gas Company, which is furnishing the service, must remove its wires from the New Jersey Central Railroad Company's poles. In order to furnish the service the company will have to secure a new right of way.

NEWARK, N. J.—The Market Street Merchants' Improvement Association has notified the Board of Works of the acceptance of the city's terms upon which a contract for the illumination of Market Street with flaming arc lamps may be made. The plan submitted by the board provides for the maintenance of 58 lamps between Pierson's Alley and the Pennsylvania Railroad at a cost of $300 per lamp per year, the Merchants' Association to pay the city the difference between that rate and the $70 rate paid for the type of lamp now in use.

PERTH AMBOY, N. J.—It is reported that the merchants on Smith Street, between State and High Streets, have decided to install a small electric light plant to supply electricity to light the stores in the block and for 20 street flaming arc lamps which will soon be installed. A committee composed of Harold L. Hall, C. A. Sexton, Henry McCullough, William O'Donnell and John K. Sheehy has been appointed to make arrangements to install the plant.

DEMING, N. M.—The Deming Ice & Electric Company is planning extensions to its system, with a view of furnishing electricity to the farmers in this vicinity for lamps and motors.

FORT BAYARD, N. M.—Sealed proposals will be received until May 8 by Capt. S. P. Vestal, constructing quartermaster, U. S. A., for electric wiring in three double sets of captains' quarters, nurses' quarters, laundry building and medical storehouse at this post.

LAS VEGAS, N. M.—The plant and holdings of the Las Vegas Railway & Power Company have been purchased by Dr. J. M. Cunningham, president of the San Miguel National Bank, for $65,000 at master's sale. The sale was a result of foreclosure proceedings brought against the company by the Trust Company of St. Louis County, trustee, to satisfy a mortgage of $313,000. It is understood that Dr. Cunningham and associates of the original Las Vegas Light & Fuel Company are associated with the United States Light & Traction Company, of Denver, Col., in the purchase of the property.

ALBANY, N. Y.—The Senate has advanced to the third reading the bill appropriating $450,000 for a new lighting and heating plant for the capitol.

AUBURN, N. Y.—Plans are being considered by the New York, Auburn & Lansing Railroad Company for the erection of a power plant on Fall Creek on the Ithaca end of its railway.

BALDWINSVILLE, N. Y.—The Board of Village Trustees is reported to be considering the question of establishing a municipal electric light plant. For further information address Joseph Hines, president.

BELMONT, N. Y.—A 20-year franchise has been granted to J. B. Murray to furnish electricity to light the streets of Belmont.

BROOKLYN, N. Y.—The contract for condensing equipment and piping for a 1000-kw alternator at the New York navy yard has been awarded to the Walworth Manufacturing Company, of Boston, Mass., for about $10,923.

BUFFALO, N. Y.—Bids will be received by the Board of Trustees of the city and county hall until May 1 for furnishing and installing an electric power plant, including steam engines, generators, switchboards, a complete system of interior wiring, chandeliers, lamps, etc., in the city and county hall. Plans and specifications are on file and may be seen at the office of the superintendent of the building. Carl T. Chester is secretary.

CLIFTON PARK, N. Y.—The Public Service Commission, Second District, has granted the Dwass Electric Company permission to construct a power plant at Clifton Park under a franchise given by the Round Lake Association. The company is authorized to issue $20,000 in capital stock.

CORINTH, N. Y.—The Public Service Commission, Second District, has granted the Corinth Electric Light & Power Company permission to purchase from Warren Curtis, Jr., the power station, dam and franchises for an electric light plant for the village of Corinth. The company is also authorized to issue capital stock to the amount of $25,000.

LESTERSHIRE, N. Y.—The Board of Trustees has abandoned the project to install a municipal electric light plant and has entered into a contract with the Binghamton Light, Heat & Power Company for a term of five years. The company is to furnish arc lamps as follows: For the first year the lamps will cost $80 each per year; second year, $75; third year, $70; fourth year, $65, and the fifth year, $62.50. The price of incandescent lamps has been reduced to $20 per lamp per year for the entire term of the contract.

MALONE, N. Y.—Work has commenced on the construction of the proposed electric railway between Malone, Westville, Fort Covington and Dundee, Que., a distance of 20 miles. A power plant will be built three miles north of Malone. J. H. Scott is president and general manager.

ONEIDA, N. Y.—The Madison County Gas & Electric Company contemplates improvements to its plant which will involve an expenditure of about $25,000.

ROCHESTER, N. Y.—The project to construct the Genesee & Orleans Electric Railway from Batavia to Oak Orchard Harbor on Lake Ontario, via Albion, 30 miles in length, has been revived by George W. Mische, of Rochester, N. Y., with a view of commencing construction work this summer. The road will be standard gauge and will be operated by electricity generated by Niagara power.

SYRACUSE, N. Y.—The Rochester, Syracuse & Eastern Railroad Company has awarded the contract for the construction of its proposed railway from a point between Jordan and Memphis to Lakeland to I. A. Hodge & Company, of Syracuse.

WATERTOWN, N. Y.—The Public Service Commission, Second District, has authorized the Watertown Light & Power Company to issue its common stock of par value of $455,000 in place of the capital stock of the Watertown Gas Light Company and the Watertown Light & Power Company, which were recently consolidated. The new company is authorized to execute and deliver a $2,000,000 mortgage upon its plants and to issue bonds to the amount of $1,557,500.

ASHEVILLE, N. C.—A franchise has been granted to George E. Ladshaw, Gabriel Cannon and A. L. White, all of Spartansburg, S. C., for the construction and operation of a power plant at Potts Shoals, on Green River, located about seven miles from Hendersonville. The offices of the company will be located at Hendersonville. The company will furnish electricity for all purposes.

CHARLOTTE, N. C.—A franchise to construct an electric railway in Concord and Cabarus County has been granted to David Barry, of Amherst, Mass., and James W. Barry.

HICKORY, N. C.—W are informed that preparations are being made by the Hickory Railway Company to commence work on the construction of its proposed electric railway within the next two months. Plans are under way for the construction of a hydro-electric plant on the Catawba River. The proposed railway will connect Catawba Springs, Newton, Brookford, Hildebran and Cliffs. M. E. Thorton, of Hickory, is president and general manager.

JONESBORO, N. C.—The Leeco Cotton Mill Company has been organized and has acquired the mill of the Clark Manufacturing Company, equipped with 100 looms. The company contemplates increasing the output of the mill by one-third and adopting electricity for motive power. D. E. McIver, of Sanford, N. C., is president, and J. R. Jones, of Jonesboro, treasurer.

WASHINGTON, N. C.—R. W. Marshall & Company, of the Traction Engineering Company, of New York, N. Y., is reported to have secured the contract for the construction of the electric power plant for the proposed electric railway, of which F. R. Massey is general manager. Rodman & Rodman, of Washington, represents the holding and construction company.

FARGO, N. D.—At an election held April 4 the citizens voted in favor of municipal ownership of the lighting and water systems.

CADIZ, OHIO.—The Wheeling, Cadiz & Tuscarawas Traction Company will award contracts about May 15 for the construction of its proposed electric railway, which is to connect Uhrichsville and Wheeling, W. Va., a distance of 55 miles. A. E. Townsend, of Cadiz, is president and general manager.

CINCINNATI, OHIO.—The Springfield, Wilmington & Cincinnati Railway Company has drawn a mortgage in favor of the Carnegie Trust Company, of New York, N. Y., to secure an issue of $5,000,000 in bonds, the proceeds to be used to purchase a right of way from Springfield to Norwood, and to construct an electric railway and terminals. B. M. Barr is president of the company and H. D. Emerson, secretary.

CLEVELAND, OHIO.—The Cleveland Subway Company has changed its name to the Cleveland Underground Rapid Transit Company and has asked for franchises which will enable it to connect the present Broadway station of the Nickel Plate Railway with the central part of the city and within the site of the proposed new union station for steam roads.

COLUMBUS, OHIO.—It is reported that the Hocking Valley Railroad Company is contemplating equipping the Puritan Railroad to be operated by electricity and extending the electric car service between Wellston and Hamden, Ohio.

DAYTON, OHIO.—The City Railway Company is planning to rebuild its Fifth Street line from the river bridge to the Pennsylvania Railroad on National Avenue.

DEFIANCE, OHIO.—H. H. Parsons, of East Aurora, N. Y., was the successful bidder for the property of the Peoples' Gas & Electric Company, of this city, at receiver's sale April 15, the consideration being $81,475, which is two-thirds of the appraisement. The property consists of an electric generating plant and gas plant, together with several residences. Mr. Parsons represented a group of bondholders in the purchase. The company has received a new franchise and will spend about $35,000 in improvements on the plants.

RICHWOOD, OHIO.—An election will be held on May 10 to vote on the proposition to issue $15,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

RICHWOOD, OHIO.—R. W. Lent, secretary and manager of the Richwood Light, Heat & Power Company, writes that should the company secure a new contract for street lighting it would install new machinery and practically rebuild its plant.

AMARILLO, OKLA.—The Amarillo Water, Light & Power Company is planning to install a 400-hp gas producer and gas engine in its plant.

EUGENE, ORE.—A company has been incorporated, with a capital stock of $300,000, to construct an electric power plant on the McKenzie River at Hayden Bridge. F. L. Chambers is interested in the project.

PORTLAND, ORE.—The Western Oregon Trust Company has petitioned the County Commissioners for a franchise to construct an electric railway on the Barnes Road, extending from the present terminus.

PORTLAND, ORE.—The Oregon Electric Railway Company, it is reported, is planning to make improvements to its system this year, which will involve an expenditure of about $200,000. The company is also contemplating extensions to its system. The length of the proposed extensions is about 90 miles. G. W. Talbot is general manager.

SELMA, ORE.—A rural telephone company has been organized to erect a telephone line from Deer Creek to Grants Pass. E. F. Hathaway is president of the company.

CHESTER, PA.—The City Council is reported to have decided to light the streets of Upper Darby Township.

CLARION, PA.—Preliminary surveys are being made for the proposed electric railway to connect Clarion, Sligo, Rimersburg and East Brady, which is to be built by the Clarion & East Brady Electric Railway Company.

DONORA, PA.—A charter authorizing the extension of the Donora-Eldora Street Railway to Webster, West Newton, West Elizabeth and Monogahela has been filed in the office of the recorder.

GROVE CITY, PA.—We are informed that the Slippery Rock & Grove City Electric Railway Company will be prepared to let contracts about July 15 for the construction of its electric railway between Slippery Rock and Grove City, a distance of about nine miles. The power station will be located near Grove City. The company will furnish electricity for lamps to the State Normal School and also in Slippery Rock. J. L. Lovejoy is president.

MONTOURSVILLE, PA.—Negotiations have been concluded by A. L. Scholl, J. Harry Spencer and Dr. F. L. Moyer, of Montoursville, for the purchase of the Montoursville passenger railway and the property of the Montoursville Electric Light, Heat & Power Company, owned by the Railways Company General, of New York, N. Y. The new owners will assume active control of the companies on May 1.

PERKASIE, PA.—A telephone company has been organized in Bedminster Township to construct a telephone line to Deep Run and other places. The officers are: W. S. Nichols, president; Joseph Diehl, secretary, and John H. Nickel, treasurer.

STEELTON, PA.—The Pennsylvania Steel Company is building an addition to its main steel foundry, the equipment of which will include one 50-ton and one 30-ton electric traveling crane, new core ovens and annealing furnaces, etc.

CENTRAL FALLS, R. I.—E. H. Barnes & Company, of New York, N. Y., are reported to have purchased a site on High Street, where they will erect a large plant for weaving silk. Contracts have been awarded for the construction of the building and power house, which calls for an expenditure of more than $100,000.

ARLINGTON, S. D.—It is reported that the Lake Preston Milling Company contemplates the installation of an electric light plant and will supply electricity to light the city.

MADISON, S. D.—At an election to be held soon the proposition to issue $16,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant, will be submitted to the people.

ERWIN, TENN.—Plans are being prepared by Toney & Kirkpatrick for the development of water property.

GREENVILLE, TENN.—P. C. Ottinger is reported to be interested in a project to construct a hydro-electric light plant on the French Broad River.

HUMBOLDT, TENN.—The Missouri, Tennesee & Georgia Railroad Company has again taken up the project to construct an electric railway from Humboldt to Dyersburg, a distance of 35 miles. A power station and repair shop will be located at Humboldt. The company will also furnish electricity for lamps and motors. I. H. Dungan, of Humboldt, is president and general manager.

NASHVILLE, TENN.—Lee Guggenheim, who has purchased the Crocker Springs, has submitted a proposition to the property owners along the route offering to construct an electric railway from Nashville to Crocker Springs, along White's Creek pike, providing the citizens will donate the right of way for the entire distance and subscribe to $30,000 of capital stock. The proposed road will be 12 miles in length and will connect with the Nashville Street Railway at the intersection of White's Creek and Dickerson pikes.

AUSTIN, TEX.—The Galveston-Houston Electric Railway Company has filed an amendment to its charter increasing its capital stock from $3,000,000 to $3,500,000.

BROWNWOOD, TEX.—The plant of the Brownwood Electric Company was destroyed by fire April 10.

CALVERT, TEX.—The Calvert Water, Ice & Electric Light Company has engaged Louis Block, consulting engineer, 45 East Forty-second Street, New York, N. Y., to prepare plans for its proposed electric light plant. The equipment will include two water tube boilers, three generators direct connected to engine, two 75 kw and one 25 kw. The company will also install a 25-ton ice plant.

DENISON, TEX.—Preparations are being made by the Grayson County Telephone Company to enlarge and improve its local system.

EL PASO, TEX.—We are advised that the El Paso & Fort Hancock Railway Company is making preliminary arrangements for the construction of its proposed electric railway from El Paso to Fabens, a distance of 32 miles. The section extending from El Paso to Ysleta will be built first. The company will soon file incorporation papers. C. N. Bassett is president of the company and W. Cooley, treasurer, both of El Paso.

EL PASO, TEX.—Plans are being made by the El Paso Electric Railway Company for extensive improvements and extensions to its system this year which will involve an expenditure of about $450,000. The plans call for an extension of the present power plant at a cost of about $300,000 and will include the installation of a 2250-hp steam turbine with auxiliaries and condensers and increase the output of the plant from 3300 hp to 5500 hp.

PLATONIA, TEX.—[illegible] in a project to install an electric light plant.

FORT WORTH, TEX.—The Fort Worth Light & Power Company contemplates extending its transmission lines to Glenwood, Polytechnic Heights and Sycamore Heights to furnish electricity for lamps. J. C. [illegible] is [illegible]

FORT WORTH, TEX.—The citizens have voted to issue $50,000 in bonds, the proceeds to be used for improvements to the municipal electric light plant, including the installation of about 500 additional arc lamps.

GAINESVILLE, TEX.—It is reported that the Commercial Club, of Gainesville, has decided to accept the proposition to construct a street railway in Gainesville submitted by capitalists. A committee, composed of J. T. Edwards, W. McKenzie, R. R. Bell and S. M. King, has been appointed to complete arrangements for the proposed railway. Gasoline electric cars will be used.

BRATTLEBORO, VT.—The Connecticut River Power Company is contemplating furnishing electricity generated at its plant at Vernon, Vt., in Worcester, Mass., for manufacturing purposes. The company has already made arrangements to supply electricity in Gardner, Fitchburg, Leominster, Clinton and other places. The transmission lines have already been erected as far as Clinton, Mass.

ACCOMAC, VA.—It is reported that A. J. Liliston, of Accomac, contemplates the installation of an electric light plant in connection with his sawmill. F. E. Reudiger is engineer.

BRISTOL, VA.—The City Council is reported to be considering the question of installing a municipal electric light and power plant.

ELKTON, VA.—W. H. Marshall, it is said, contemplates the installation of an electric light plant with sufficient output to supply from 400 to 600 lamps, to be operated by steam or water power.

BRISTOL, VA.-TENN.—Theodore Swann is interested in a project to supply electricity in Bristol for power purposes. Mr. Swann, it is said, has secured options on power sites and rights of way and has secured franchises in the twin Bristols and has also placed contracts for furnishing electricity for lamps and motors to the amount of $80,000 per year.

CHEHALIS, WASH.—The Twin City Light & Power Company has been granted a franchise by the City Council to construct and operate an electric railway in Chehalis.

PROSSER, WASH.—The farmers of the Rattlesnake country have organized what is to be known as the Rattlesnake branch of the Benton Independent Telephone Company. The company is planning to erect about 25 miles of telephone line this spring. Arthur Rothrock is president.

SEATTLE, WASH.—Steam that has been going to waste in the city incinerator plant at the south end of Lake Union is now being utilized to generate electricity. One 250-hp generator has been installed, which furnishes electricity for lighting the incinerating plant, operating and lighting the city asphalt plant and driving a 1,000,000-gal. pump recently installed in the incinerating plant. Plans are being considered to furnish electricity for lamps to nearby buildings.

WENATCHEE, WASH.—Plans are being made by the Farmers Telephone & Telegraph Company for extensive improvements to the local service, which will involve an expenditure of about $15,000.

PENNSBORO, W. VA.—The Consolidated Electric Company, of Pittsburgh, Pa., has applied to the Council for a franchise to establish an electric light and power plant in Pennsboro. J. E. Cunningham is recorder.

WESTON, W. VA.—George I. Keener, who was recently granted a franchise to operate an electric railway between Weston and Bendale, has applied to the City Council for a franchise in Weston. It is proposed to build a power station in Weston.

ALLENTOWN, WIS.—The stockholders of the Allentown-Kohlsville Telephone Company have decided to increase the capital stock of the company from $5,000 to $15,000.

SPARTA, WIS.—Plans have been prepared by Jacob Cloos, engineer, Milwaukee, Wis., for an electric light plant, to cost $10,000, and for a combined water and light plant, $18,000.

FORT YELLOWSTONE, WYO.—The contract for the installation of the power plant at this post has been awarded to the D'Olier Engineering Company, of Philadelphia, Pa., for $45,889. Lieut. G. C. Smith is constructing quartermaster.

CALGARY, ALB., CAN.—The Province of Alberta has received petitions for the construction of approximately 3000 miles of telephone line during the present year and plans have been accepted for some 900 miles of line. In addition to the rural lines a trunk system will be built from Medicine Hat to Taber, a distance of 90 miles, and an additional wire will be strung on the circuit connecting Calgary, Edmonton and Fort Saskatchewan.

NELSON, B. C., CAN.—G. C. Hodge has submitted an offer to the City Council to construct the proposed telephone line to Salmo.

NELSON, B. C., CAN.—It is proposed to build a telephone line from Nelson to Salmo, permission having been obtained from the Great Northern Railway for use of its telephone poles for $5 per pole per annum.

VANCOUVER, B. C., CAN.—The Great Northern Aluminum Company, Montreal, Que., has been awarded a contract by the British Columbia Electric Railway Company for the supply of 390 miles of aluminum wire for the transmission of electricity for $45,000.

WINNIPEG, MAN., CAN.—Contracts have been awarded by the Board of Control for furnishing and installing one turbine pump, with a capacity of 1,000,000 gal. per 24 hours, and one 150-hp motor to the Northern Electric & Manufacturing Company, for $11,000. H. W. Rattan is city engineer.

WINNIPEG, MAN., CAN.—During the present year the Manitoba Government, it is said, will spend some $800,000 on improving and extending its telephone system. According to a statement made by one of the commissioners $470,000 will be spent on material and $330,000 on labor. The work will be divided up as follows: Underground and aerial work in Winnipeg, $160,000, two new exchanges and switchboards in Winnipeg, $110,000, rural and farmers' lines, $270,000; alterations and additions to exchanges, $104,000; extensions to long-distance lines, $156,000. Tenders will be called for the various supplies from time to time as they are required.

WINNIPEG, MAN., CAN.—At the annual meeting of the Winnipeg Electric Railway Company it was decided to issue $1,500,000 in new stock, the proceeds to be used for extensions and improvements.

BERLIN, ONT., CAN.—The citizens voted April 12 in favor of the by-law to raise $40,000 for the hydro-electric power project.

DUNNVILLE, ONT., CAN.—The by-law to grant a bonus to the Dunnville, Wellandport & Beamsville Electric Railroad was defeated by the ratepayers.

HAMILTON, ONT., CAN.—The Court of Appeals has reversed the judgment of Judge Snider fixing the price to be charged the city by the Cataract Power Company at $85 per lamp, $15 less than the city had been paying, and ordering a refund to the city of $16,000. The court ordered all the evidence to be reheard.

LONDON, ONT., CAN.—The London & Northwestern Railway Company, which proposes to construct an electric railway from London to Sarnia, has applied to the Ontario Legislature for a charter. The proposed railway will be about 114 miles in length.

NEW HAMBURG, ONT., CAN.—The ratepayers voted in favor of granting a bonus to the People's Electric Railway Company.

NEWTONVILLE, ONT., CAN.—An independent telephone company has been organized to connect Orono and Newtonville. The officers are: W. H. Reid, president; Andrew Sharpe, vice-president, and Moses Cowan, secretary and treasurer.

ST. MARY'S, ONT., CAN.—The township of Osborne has voted to grant a bonus to the St. Mary's & Western Ontario Railway to the extent of $20,000.

TILSONBURG, ONT., CAN.—The Tilbury Telephone Company will at once order the necessary supplies for the proposed telephone system so as to have 35 miles of the line in operation by July.

MONTREAL, QUE., CAN.—T. M. Kirkwood, of Toronto, is interested in a project to construct an electric railway from Toronto to Quebec.

CONDIE, SASK., CAN.—The Condie Rural Telephone Company is completing arrangements for the construction of a rural telephone system. For further information address N. Henderson, secretary.

PRINCE ALBERT, SASK., CAN.—The city has decided to develop water power at Coal Falls, 26 miles south of here. It is estimated that 10,000 hp can be developed. For further information address F. W. Halliday.

Company Elections.

AURORA, ILL.—At the annual meeting of the Western United Gas & Electric Company the following officers were elected: I. C. Copley, president; R. N. Strohm, vice-president and treasurer; Frederick Bennett, secretary, and H. L. Rice, general manager.

VINCENNES, IND.—At the annual meeting of the Vincennes Light & Power Company the following named officers were elected: E. M. Deane, president; M. S. Rooney, vice-president; F. G. Deane, secretary, and R. E. Preble, treasurer.

LOWVILLE, N. Y.—At the annual meeting of the Lowville Electric Light Company the following officers were elected for the ensuing year: C. D. Moore, president; C. S. Mereness, vice-president; Henry A. Petrie, secretary and treasurer, and Charles W. Harrison, superintendent.

NEW YORK, N. Y.—At a meeting of the board of directors of the Hudson Companies, the holding company of the Hudson & Manhattan Railroad Company, Dumont Clarke, A. A. Tilney, of New York, N. Y., and Charles Francis Adams, of Boston, Mass., were elected directors to succeed Gardiner M. Lane, Cornelius Vanderbilt and Andrew Freedman.

DELPHOS, OHIO.—At the annual meeting of the Delphos Electric Light & Power Company the following-named officers were elected: T. P. Linn, of Columbus, president; Henry Gumble, of Columbus, secretary, and C. W. Post, of Gordon, treasurer and general manager.

HOOD RIVER, ORE.—The Valley Electric Railway Company, which is promoting an electric railway out of the west side of the valley into the Mt. Hood County, has been organized by electing the following-named officers: E. T. Folts, president; A. M. Kelly, vice-president, and H. B. Langille, secretary.

FREDERICKSBURG, VA.—The Fredericksburg Electric Company has been organized by the election of the following-named officers: R. M. Van Dorn, president; C. W. Jones, vice-president; Alvin T. Embrey, secretary and treasurer.

FREDERICKSBURG, VA.—The Electric Generating Company has been organized and the following officers elected: E. J. Smith, president; Isaac Hirch, vice-president; Alvin T. Embrey, secretary and treasurer.

SPOKANE, WASH.—At the annual meeting of the Washington Water Power Company, held recently, the following named officers were elected: Henry M. Richards, president; D. L. Huntington, first vice-president and manager; H. L. Bleecker, secretary; H. E. Perks, treasurer, and D. C. Douglass, assistant treasurer.

New Industrial Companies.

THE AMERICAN REVERSIBLE MOTOR COMPANY, of Boston, Mass., has filed articles of incorporation, with a capital stock of $50,000, for the purpose of manufacturing and selling engines and machinery of all kinds. A. C. Day, of Saugus, Mass., is president, and G. M. Power, of Boston, Mass., treasurer.

C. N. CADY COMPANY, of Canastota, N. Y., has been chartered with a capital stock of $60,000 for the purpose of manufacturing motors, engines, machines, etc., by Charles N. Cady, George B. Cady, Jr., and Minnie A. Cady, all of Canastota, N. Y.

THE CENTRAL ENGINEERING & SPECIALTY COMPANY, of Wheeling, W. Va., has been chartered with a capital stock of $5,000 by H. E. Hohman, George E. Carle, A. A. Doan and C. H. Isreal. The company proposes to deal in electrical apparatus.

THE COMBINATION ENGINE POWER COMPANY, of Boston, Mass., has been chartered, with a capital stock of $100,000, for the purpose of manufacturing and installing machinery, boilers and fuel economizers. are: James L. Arnold, of Manchester, president, and George B. Clark, of Boston, treasurer and clerk.

THE DIXON CABLE SYSTEM, of Jersey City, N. J., has been chartered by H. O. Coughlan, B. S. Mantz and J. E. Turner, all of Jersey City, N. J. The company is capitalized at $300,000, and proposes to manufacture electrical or other contrivances for telegraph or telephones.

THE ECONOMICAL SMOKE CONSUMER COMPANY, of Chicago, Ill., has filed articles of incorporation, with a capital stock of $50,000, for the purpose of manufacturing furnace doors and smoke consumers. The incorporators are C. O. Gervais, T. Prouix and P. R. Fraser, of Chicago, Ill.

THE ELECTRICAL APPARATUS COMPANY, of Chicago, Ill., has been chartered with a capital stock of $4,500 by G. W. Berthold, Herman Horstman and Edward E. Berthold. The company proposes to manufacture and deal in electrical machinery and appliances.

THE EXCELSIOR INSULATED WIRE COMPANY, of Newark, N. J., has been incorporated with a capital stock of $100,000 to manufacture insulating materials. The incorporators are: Franklin S. Randall, of Hoboken, N. J.; Joseph H. Strange, of South Orange, N. J., and Baxter Morton, of New York, N. Y.

THE FRICK COMPANY, of Chicago, Ill., has filed articles of incorporation, with a capital stock of $1,000,000, for the purpose of dealing in machinery and boilers.

THE INDEX SIGN COMPANY, of New York, N. Y., has been incorporated with a capital stock of $20,000 by George E. Moray and John B. Coyle, both of New York, N. Y. The company proposes to do a general electrical contracting business.

THE INTERNATIONAL POWER GENERATOR COMPANY, of Wilmington, Del., has been chartered with a capital stock of $150,000 by E. E. McWhiney, of Philadelphia, Pa.; S. Moor, of Lima, Pa., and Harry W. Davis, of Wilmington, Del.

MAGNETIC LOCOMOTIVE COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $100,000, by Frank B. Tinker, Ward S. Perry and John R. Markle. The company proposes to manufacture electrical devices and machinery.

THE METROPOLIS ENGINEERING COMPANY, of Jamaica, N. Y., has been chartered, with a capital stock of $20,000, by Oscar Erlandsen, of New York, N. Y.; Charles W. Smith, of Brooklyn, N. Y., and Thomas W. Baldwin, of New York, N. Y. The company proposes to do a general engineering and contracting business.

THE MODERN ENGINEERING COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $100,000 by F. M. Shive, S. E. Roberson and H. W. Davis, of Wilmington, Del.

THE NEW ENGLAND DYNA-BATTERY COMPANY, of Boston, Mass., has been chartered with a capital stock of $50,000 to manufacture electrical machinery of all kinds. F. S. Ashley, of New York, N. Y., is president of the company, and J. H. Ladd, Jr., of Watertown, treasurer.

ODDIE & STAFFORD, of New York, N. Y., have been incorporated, with a capital stock of $12,000, as engineers, architects, builders and contractors, by Harold H. Oddie, of New York, N. Y.; Joseph L. Stafford, of Brooklyn, N. Y., and Myron S. Falk, of New York, N. Y.

THE REPPELL ELECTRIC COMPANY, of Kansas City, Mo., has filed articles of incorporation with a capital stock of $10,000 for the purpose of doing a general electrical business. The incorporators are L. C. Reppell, John W. German and C. W. Lovett.

W. M. SHEEHAN & COMPANY, of New York, N. Y., have been incorporated by William M. Sheehan, Frank C. Joutras and Edward F. McAviney, all of New York, N. Y. The company is capitalized at $50,000 and proposes to do contracting and electrical work.

THE SHELDON ELECTRIC COMPANY, of Chicago, Ill., has been chartered with a capital stock of $100,000 by Gentry Shelton, A. J. Crowley and Charles M. Haft. The company proposes to manufacture electrical apparatus.

THE SLOANE MOTOR COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $35,000, to manufacture motors and accessories, by A. W. Baer, William W. Sloane and Donald M. Carter.

THE STANDARD LIGHTING APPLIANCE COMPANY, of Hoboken, N. J., has been chartered with a capital stock of $100,000 by H. M. Browne, F. W. Mills, E. J. Forhan, all of New York, N. Y. The company proposes to manufacture lighting appliances.

THE TRENTON ENGINE COMPANY, of Trenton, N. J., has been incorporated with a capital stock of $125,000 by Charles A. Comp, Charles H. English, of Trenton, and William P. Cubberly, of Robbinsville, N. Y.

THE UNITED METER IMPROVEMENT COMPANY, of Wilmington, Del., has filed articles of incorporation with a capital stock of $25,000. The incorporators are: F. M. Shive, S. E. Roberson, Harry W. Davis, of Wilmington, Del.

THE VACUUM SPECIALTY COMPANY, of New York, N. Y., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing vacuum apparatus, machinery, heating and cooling apparatus. The incorporators are: H. C. Messimer, J. M. Clement, of New York, N. Y., and H. G. Welch, of Paterson, N. J.

New Incorporations.

HEBER, ARK.—Articles of incorporation have been filed for the Heber Light & Power Company by A. N. Hilger, W. L. Burt, John M. Covey and others. The company is capitalized at $10,000.

CALHAN, COL.—The Mountain View Telephone Company has been organized at Mountain View and will connect the Farmers' Mutual Telephone Company at Calhan and Ramah. The officers of the company are: B. Hale, president; J. W. Baker, vice-president, and F. S. Turner, secretary.

MOUNT VERNON, GA.—The Mount Vernon Telephone Company has been organized to construct a local telephone system by L. L. Jennings, G. W. Dodson, C. P. McGuire, J. L. McClure, L. Terry and J. I. Terry.

WASHINGTON, GA.—The Washington Telephone Company has been incorporated with a capital stock of $15,000 by Marie Fitzpatrick, T. M. Fitzpatrick, W. Quinn and others. The company will operate the system already established and will expend about $5,000 for improvements.

KANKAKEE, ILL.—The Danville, Crescent & Kankakee Traction Company has been incorporated with a capital stock of $10,000 for the purpose of constructing an electric railway from Danville to Crescent City and thence to Kankakee. The incorporators are: E. E. Mayers, George H. Clark, Louis Schwer, F. J. Nassles, Henry R. Voight and others, all of Crescent City.

MONMOUTH, ILL.—The Searles Power Company has been incorporated by J. F. Searles, H. J. Fischer and Nels Jenssen. The company is capitalized at $20,000 and proposes to operate power plants.

INDIANAPOLIS, IND.—The Chicago, Bay Shore & Gary Railway Company has filed articles of incorporation with a capital stock of $10,000. The directors are: Louis M. Erb, E. Goyeski, V. C. Corbitt and W. Knox Haynes.

KOKOMO, IND.—The Stahl-Goyer Telephone Company has been incorporated to build and operate a system of telephone exchanges and telephones in Howard County. George A. Stahl, George H. Beeker and Newton Keyton are directors.

FRANKFORT, KY.—Articles of incorporation have been filed for the Cincinnati, Louisville, Lexington & Maysville Traction Company. The company is capitalized at $10,000,000 and proposes to construct an electric railway, which will consist of two trunk lines, one to connect Cincinnati and Lexington and the other Maysville and Louisville. The railway will be about 250 miles in length. The officers are: W. T. S. Blackburn, of Dry Ridge, Ky., president; J. Glastock, of Williamstown, Ky., vice-president; John McCoy, of Dry Ridge, secretary, and Kate Martin, treasurer.

EATON RAPIDS, MICH.—The Sunfield Co-operative Telephone Company has been organized, with a capital stock of $10,000 and the following named officers: Charles M. Ralston, president; W. E. McClelland, secretary, and C. N. Town, treasurer.

MENAHGA, MINN.—The Menahga Western Telephone Company has been organized to build a telephone system, including 52 miles of lines. A. O. Richardson is secretary.

MEDFORD, MONT.—The Rocklin Telephone Company has been incorporated with a capital stock of $2,000 by G. W. Moore and others.

GLENS FALLS, N. Y.—The Citizens Electric Power Company has been incorporated with a capital stock of $50,000 by James H. Crase, of Johnstown, N. Y., Theodore D. Crase, of Sands Hill, N. Y., and J. Ward Russell, of Glens Falls, N. Y. The company proposes to furnish gas and electricity for lamps, heat and motors.

DANVILLE, N. C.—The Providence Telephone Company has been incorporated, with a capital stock of $2,000. Post office address, Danville, R. F. D. No. 5.

HIGH POINT, N. C.—The Prospect Telephone Company has been chartered by R. F. Mendenhall, J. P. Suck, J. L. Newton and others.

NEWHOME, N. D.—The Sykeston & Newhome Telephone Company has been organized to construct a telephone line to connect Newhome and Sykeston, a distance of 10 miles.

WOODWARD, OKLA.—The East Indian Creek Telephone Company has been incorporated with a capital stock of $1,000 by D. E. Nelson, of Mutual; P. C. Renfrew, W. F. Clevis and E. L. Layton, all of Woodward.

UNION CITY, PA.—Articles of incorporation have been filed for the Erie & Union Railroad Company, with a capital stock of $250,000. The company proposes to construct an electric railway from Union City to the Erie waterfront at the junction of Mill Creek and Lake Erie. The directors are: William J. Smith, of Titusville, Pa., president; Jesse L. Strauss, of New York, N. Y.; Cornelius M. Sexton, of South Orange, N. J.; Charles E. Wellborn, of Weston, N. J.; S. Grumbine, E. Egbert and B. E. Currie, of Titusville, Pa.

INTERCOURSE, PA.—The Intercourse Telephone Company has been organized, with the following named officers: W. J. Caldwell, president; John M. Beam, vice-president, and H. H. Klinger, secretary. The company proposes to construct and operate a telephone system in Leacock Township.

NASHVILLE, TENN.—The Home Telephone Company, of Cannon and DeKalb Counties, has been incorporated, with a capital stock of $2,000, by W. R. Estes, T. B. Clark, L. E. Barges, John H. Melton, and others.

NASHVILLE, TENN.—The Mutual Home Telephone Company, of Smith County, has filed articles of incorporation with the Secretary of State, with a capital stock of $1,000. The incorporators are: G. W. McDonald, G. W. Cornwell, J. C. Hesson, and others.

CORN HILL, TEX.—Articles of incorporation have been filed for the Corn Hill & Gravis Telephone Company, with a capital stock of $3,000, by T. A. Crumlers, V. A. Harvill, B. A. Condar, and others.

MANTI, UTAH.—The West Side Telephone Company has been incorporated, with a capital stock of $3,000, and the following named officers: Thomas H. Pratt, president; John Dewsnip, vice-president; W. B. Hamilton, secretary and manager, and Joseph W. Blake, treasurer.

BENTONVILLE, VA.—The Warren County Farmers' Telephone Company has been chartered with a capital stock of $5,000 and the following officers: R. T. Morrison, president; R. A. Tristoe, secretary.

CLAREMONT, VA.—The Harrison Telephone Company has been incorporated with a capital stock of $5,000. The officers are: W. C. Webb, of Burrowsville, Va., president; W. W. Rich, vice-president; E. F. Harrison, secretary and treasurer, both of Claremont.

DISPUTANTA, VA.—Articles of incorporation have been filed for the Disputanta Telephone Company with a capital stock of $5,000. The officers are: Thomas Temple, president; A. N. Cooks, vice-president, and J. A. Hobbs, secretary and treasurer.

GRUNDY, VA.—The State Telephone Company has been incorporated to construct a telephone line from Grundy to Blackey. S. Dennis, president, and W. E. Williams, secretary and treasurer.

GRUNDY, VA.—The Grundy Raven Telephone Company has been incorporated to construct a telephone line from Grundy to Blackey. S. R. Hurley is president; E. E. Smith, secretary and treasurer.

SOUTH HILL, VA.—The South Hill Telephone Company has been formed, with a capital stock of $2,000, and the following named officers: R. E. Yancey, president; J. H. Wall, vice-president, and N. G. Smith, secretary and treasurer.

HUNTERS, WASH.—The Southwest Telephone Company has been formed and the following officers elected: D. M. Glasgow, president; A. F. Trumley, vice-president; A. W. Holt, secretary and treasurer.

RAYMOND, WASH.—The Willapa Harbor Telephone Company has filed articles of incorporation, with a capital stock of $30,000. The incorporators are: W. W. Canon, C. S. Gilchrist, F. B. Hubbard, of Centralia, Wash.; J. L. Myers, of South Bend, Wash., and H. W. McPhail, of Raymond, Wash.

SEATTLE, WASH.—The Seattle Home Telephone Company has filed articles of incorporation, with a capital stock of $500,000. The incorporators are: Samuel Hill, Hervey Lindley, E. A. Stuart, M. H. Arnold and W. G. Collins.

SPOKANE, WASH.—The Orchard Avenue Water & Power Company has been incorporated with a capital stock of $1,000 by C. M. Specks and others.

CURRAN, WIS.—The Curran Farmers' Telephone Company has been incorporated, with a capital stock of $2,500, by D. A. Stolts and others. Post office address, Luxembourg, R. F. D. No. 3.

GRAND RAPIDS, WIS.—The Grand Rapids Street Railway Company has been incorporated with a capital stock of $125,000 by G. F. Steele, F. J. Wood, George L. Williams and others.

HORICON, WIS.—The Horicon Telephone Company has been incorporated with a capital stock of $[illegible] by Gustav A. Zeuske, Frank Rodenbeck and Ferdinand Laches.

MADISON, WIS.—Articles of incorporation have been filed for the Interstate Light & Power Company, with a capital stock of $1,000, by A. R. Case, Warren M. Fox, and others. The company proposes to erect electric light and power plants, gas and heating plants and water works systems in Grant, La Fayette, Iowa and Dane Counties.

PLOVER, WIS.—Articles of incorporation have been filed for the Plover Telephone Company, with a capital stock of $1,050 by W. L. Hartwell, F. L. Taylor, and S. B. Bell.

BRANDON, MAN., CAN.—The Municipal Light, Heat & Power Company has been incorporated with a capital of $50,000. The incorporators are: G. Edgar Knechtel and Violet Knechtel, both of Winnipeg, Man.; M. B. Jackson and W. A. Thompson, Hamiota, Man., and W. C. Fraser, of Hamiota.

ROSEWOOD, MAN., CAN.—The Rosewood Rural Telephone Company has been organized here with the following officers: T. F. Morris, president; William Norman, vice-president; Charles Claydon, treasurer; W. C. Morris, secretary; G. Claydon, manager.

WILMER, SASK, CAN.—The Wilmer Rural Telephone Company has been organized with the following named officers: T. M. Leggat, president; Sanford McNeil, vice-president, and Thomas Larkin, secretary and treasurer.

Legal.

RECEIVER APPOINTED FOR LIGHT COMPANY.—J. E. Springfield has been appointed receiver of the Water, Light & Gas Company, of Hutchinson, Kan., by Judge Pollock. The apointment was made on an application of Mason, Lewis & Company, of Chicago, Ill., bond brokers. The liabilities are given as $200,000.

CITY OF FORT WAYNE SUES TRACTION AND TELEPHONE COMPANY FOR TAXES.—The city attorney of Fort Wayne, Ind., has brought suit against the Fort Wayne & Wabash Valley Traction Company and the Home Telephone Company for the back taxes due on account of the special poll tax of $1 for each pole. The companies resist payment on the ground that the city has become joint users of the poles and in the case of the traction company has also entered into competition with it for commercial lighting and power.

NECESSITY OF EQUIPPING TELEPHONE WITH ADEQUATE LIGHTNING ARRESTERS.—A verdict for $1,000 against a telephone company, for personal injuries received from a bolt of lightning entering the plaintiff's house by means of the defendant's telephone wire, has been affirmed by the Court of Civil Appeals of Texas. The plaintiff was passing through the room where the telephone was placed, when a flash of lightning appeared on the telephone in the form of a ball of fire. An explosion immediately followed and the plaintiff was burned and received other injuries. The suit was based upon a charge of negligence on the part of the telephone company in failing to provide and install in connection with its telephone at the residence of plaintiff a proper device for arresting lightning. The specific negligence charged was that the company failed to make a ground connection with its arrester. Southern Telegraph & Telephone Company vs. Evans, Court of Civil Appeals of Texas, 116 S. W., 418.

INJURY TO LINEMAN BY PARTING OF SPLICE ON MESSENGER WIRE.—The plaintiff was employed by the defendant company as a lineman in the erection of a new telephone line. His particular duties were to climb a pole, attach himself to the messenger wire, by means of a safety strap, and to propel himself along it for the purpose of attaching loops or hooks. While engaged in this work, the cable on which he was suspended in mid-air parted at a splice about halfway between the poles and the plaintiff fell to the ground, sustaining more or less serious injuries. The plaintiff, in company with a fellow employee, had made the splice which parted. The only claim of negligence appeared to be that the defendant had changed the method of splicing from a three-clamp splice to a two-clamp splice, and that it had permitted its foreman to direct that the splice should be made between the poles instead of at or near a pole; it being claimed that the strain would be greater at the intermediate point than at or near one of the poles. The Appellate Court, in reversing a verdict in favor of the plaintiff, said: "The law does not make an employer an insurer. It calls upon an employee to use his own intelligence in carrying out the details of the work in which he is engaged. The work in which the plaintiff was engaged was obviously a dangerous one. He knew that his safety depended upon the splice. He knew this just as well as the master could have known it. He knew the added danger, if there was added danger, in making the splice midway between the poles; and he was likewise as competent to judge as any other man, exercising reasonable care, as to the security of the two-clamp splice." Tweed vs. Hudson River Telephone Company, New York Supreme Court, 114 N. Y., Supp. 607.

Personal.

MR. BERNARD E. SUNNY, president of the Chicago Telephone Company, has been elected vice-president of the Commercial Club of Chicago.

PROF. W. L. PUFFER has been engaged by Mayor Hibbard, of Boston, to inquire into the merits of the five-year contract that it is proposed to make for the city with the Edison Electric Illuminating Company.

MR. F. A. KREHBIEL, for a number of years mechanical engineer for The Arnold Company, Chicago, is now manager of the Fuel Engineering Company, of Chicago.

MR. GEORGE WESTINGHOUSE.—Press dispatches from Germany announce the visit to Berlin of Mr. George Westinghouse in connection with his enterprises in the Empire.

MR. E. P. FEATHERSTONEHAUGH, B.Sc., a graduate of McGill University, Montreal, Que., has been appointed professor of electricity at Manitoba University, Winnipeg, Man.

MR. E. McCAULEY has resigned as manager of the Avoca Electric Light & Power Company, of Avoca, Ia., to accept a position in Seattle, Wash. Mr. Frank Glaze has been appointed to fill the vacancy.

MR. WILHELM WECHMANN, of Berlin, chief electrical and mechanical engineer of the Royal Prussian Railroad, is in this country for the purpose of studying the American practice on railroad electrification with reference to the single-phase system.

MR. W. H. CONYNGHAM, of Wilkes-Barre, Pa., has been appointed president of the Wilkes-Barre Gas & Electric Company, to succeed Mr. R. L. Faust, resigned. Mr. Faust is still a director of the company and retains his place on the executive committee.

MR. JOHN F. GILCHRIST, assistant to the president of the Commonwealth Edison Company, has been elected secretary of the Industrial Club of Chicago—an organization of influential business men which deals with the larger topics of political and commercial advancement, as improvement of jury service and the consular representation of the United States.

MR. PUTNAM A. BATES, consulting electrical engineer, is removing his office to the new United States Express Building, 2 Rector Street, New York City, where on the top floor facing south and southeast he will have quarters three times larger than the old offices on Broadway. Mr. Bates has not only kept his staff together during the period of depression, but has enlarged it and has increased the number of departments of work covered. He finds the outlook excellent and has now several important commissions on hand.

MR. HENRY DOCKER JACKSON, consulting engineer, 88 Broad Street, Boston, Mass., has recently completed a report for Mr. J. J. Scott, Boston, Mass., who represented possible stockholders in the Marion Gas Light Company, of Marion, Mass., with reference to the possibilities of the Marion Gas Light Company supplying light and power to the towns of Wareham and Marion, Mass. This report covers fully the cost of the installation, the possible income to be derived and a careful study of the contract between the Marion Gas Company and the company desiring to supply power.

MR. WILLIAM HENRY KELLER has opened an office in Charleston, W. Va., as consulting electrical engineer in mining practice and equipment. Mr. Keller, after leaving Cornell, where he followed the mechanical-electrical engineering course, went with the Ottawa (Kans.) Electric Light & Power Company as engineer and assistant superintendent, and later enlarged his experience with the Pennsylvania Railroad Company, Westmoreland Coal Company, and People's Coal Company, Brownsville, Pa., in the varied capacities of lineman, wireman, lamptrimmer, draughtsman, crane inspector, machinery inspector, foreman of inspectors, and engineer of machinery in charge of railroad car shops. During Mr. Keller's subsequent employment by the Webster Coal & Coke Company, and the Pennsylvania, Beech Creek & Eastern Coal & Coke Company, as outside superintendent and, later, electrical engineer, at Ehrenfeld, Pa., he had charge of one of the first alternating-current equipments installed for mine work. Later he was employed as chief electrician at the Sayre Shops of the Lehigh Valley Railroad Company, and, until Feb. 28 of this year, as chief electrician of the New River Collieries Company, Thurmond and Prince, W. Va. In addition to his general consulting practice, Mr. Keller will undertake the periodic inspection of electrical equipment in mines.

MR. WARD S. ARNOLD, who is widely known among electric railway engineers and contractors, has accepted a position to further the electric-railway interests of the Westinghouse Electric & Manufacturing Company in the Middle West, and also the steam-turbine sales of the Westinghouse Machine Company. Mr. Arnold will make his headquarters in Chicago, but he will also assist the Minneapolis, Kansas City, St. Louis, Cincinnati, New Orleans and Dallas offices of the Westinghouse Electric & Manufacturing Company in railway work. Mr. Arnold, who is a brother of Mr. B. J. Arnold, the consulting engineer, and Messrs. W. L. and R. G. Arnold, of The Arnold Company, has been connected with the General Electric Company, the Stanley Electric Manufacturing Company and the Bullock Electric Manufacturing Company, always in the railway field. Since 1904 he has been engaged in the contracting business with Mr. George Townsend, formerly of Townsend, Reed & Company, of Indianapolis. During the last five years Messrs. Arnold and Townsend have built, among other electric roads, the Indianapolis & Western, now a part of the Terre Haute, Indianapolis & Eastern, and the Niles-St. Joseph (Mich.) extension of the South Bend & Southern Michigan Railway Company. Mr. Arnold is familiar with all branches of electric-railway building, including engineering, construction and financing, and he cannot fail to prove a valuable man for the Westinghouse interests.

MR. PHILIP G. GOSSLER, vice-president of the J. G. White Company, is resigning his active connection with that corporation and from June 1 will be associated with the well-known banking house of A. B. Leach & Company in a special consulting and administrative capacity. This marks a distinctly new departure in the relations between financial houses and engineers, in that it places with the financial interests as a member of their own organization an engineer capable of passing authoritatively on all the engineering questions that come up in connection with the acquisition, development and operation of public utility properties. Mr. Gossler, ever since his graduation from the Pennsylvania State College in 1890, has been actively engaged in the fields of electric lighting, power and traction, and has made a most enviable reputation. At the beginning of his career, connected with the Edison General Electric Company, he joined the staff, soon after, of the United Electric Light & Power Company, of New York City, and took up central-station work. In 1895 he went to Montreal, where he became general superintendent and electrical engineer of the Royal Electric Company, whose remarkable growth is one of the features of the electrical industries on this continent, especially with regard to the utilization of water-power, long-distance transmission and original methods of selling energy. While in Canada Mr. Gossler was president of the Canadian Electrical Association, and contributed during the period a number of important papers and discussions to engineering bodies. Since his connection with the J. G. White Company he has been actively engaged in consolidating and directing a number of electrical companies. Mr. Gossler will continue his connection with the J. G. White Company and with these various properties, as director, etc. The esteem and affection in which he is held by his present associates is attested by the complimentary dinner given him this week by the officers and staff of the White company.

Obituary.

MAJOR LEWIS FREDERICK RICE, who since 1890 had been assistant engineer and architect for the American Bell Telephone Company, died at his home at Brookline, Mass., April 13. Major Rice was 70 years of age. He was a graduate of the Rensselaer Polytechnic Institute and served on the Brookline water works as construction engineer, and later on the Troy & Greenfield road. He served in the civil war and then became assistant engineer for the Reading & Columbia Railroad and later engineer of the St. Louis water works.

DR. FRANK L. TUFTS, adjunct professor of physics at Columbia University, was killed on April 15 by coming in contact with an arc-lamp circuit which he was testing in Bayonne, N. J. He was alone at the time so that explanations as to the immediate cause of his death are mere conjectures. Professor Tufts was granted the degree of B.S. by Antioch College in 1891; A.B. by Harvard University in 1894; A.M. by Columbia in 1896 and Ph.D. by Columbia in 1897. He was appointed tutor in physics at Columbia in 1898; was promoted to an instructorship in 1903 and became adjunct professor in 1905. He leaves a widow and a son about one year of age.

MR. JOHN CHAMBERLIN FISH, well known to the electrical industry as president of the National Electric Lamp Association and of the Shelby Electric Company, passed away suddenly on Friday, April 16, after an illness of only four days. Mr. Fish, who was born in Sheldon, Vt., on April 14, 1864, moved to Ohio at an early age and secured his education in the public schools of Akron and Shelby, eventually graduating from Kenyon College at Gambier. He first became identified with the electrical business when he organized in 1896 the Shelby Electric Company, which owes its success to his ability and determination of character. At a later date he also became president of the National Electric Lamp Association, the formation of which was greatly due to his efforts. Mr. Fish was an extremely public-spirited man and for the past 20 years had exerted a great part of his activity in the building up of Shelby, Ohio, the city in which he resided. It was due to him that many manufacturing concerns located there. Mr. Fish at the time of his death, aside from being interested in the electrical business was president of the following companies: The Shelby Printing Company, the Shelby Water Company, the Ohio Seamless Tube Company and the Auto Call System Company, as well as vice-president of the Shelby Telephone Company and a director in the [illegible] being located in Shelby. Aside from endeavoring to benefit his place of residence in business ways, Mr. Fish also devoted a great deal of his time to the intellectual side, being president of the Board of Education. Mr. Fish was [illegible] and was president of the Central Club, of Shelby, and the Shelby Business Men's Association. He is survived by a widow and [illegible] Delbert R., Dorothy Gertrude and John C., and by his mother and one sister, with whom every one who has met Mr. Fish sympathizes in their affliction.



J. C. FISH.

Trade Publications.

METAL HOSE for water, air, oil and gasoline are listed in a booklet issued by the American Metal Hose Company, 173 Lafayette Street, New York.

FLEXIBLE CONDUIT for electric wiring is described in a folder issued by the American Circular Loom Company, International Trust Building, Boston, Mass.

PYROMETERS.—Combination indicating and recording units for electric pyrometers are briefly treated in a folder issued by the Bristol Company, Waterbury, Conn.

METAL MOLDING for electric light wiring is listed and described in an illustrated booklet issued by the National Metal Molding Company, Fulton Building, Pittsburgh, Pa.

EXPANDED METAL for use with concrete is explained in booklets being distributed by the Northwestern Expanded Metal Company, 930 Old Colony Building, Chicago, Ill.

STEAM CONDENSER.—Catalog 5, section B, of the Schutte & Koerting Company, is devoted to steam condensers of the multi-jet type, which operate without air pumps.

PIPE CLAMPS.—Bulletin No. 15 of the H. Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, is an illustrated price list devoted to pipe and conduit clamps.

STORAGE BATTERIES.—The Gould Storage Battery Company, 341 Fifth Avenue, New York, has issued a neatly printed bulletin devoted to storage batteries in isolated lighting plants.

LIFTING MAGNETS, designed from loads of from 600 to 1500 lb., are described in a bulletin of the Lincoln Electric Company, Thirty-eighth Street and Kelley Avenue, Cleveland, Ohio.

METAL MOLDING.—The American Circular Loom Company, International Trust Building, Boston, Mass., has issued an illustrated descriptive price-list dealing with metal molding.

PUMPS.—Bulletin E. P. No. 3 of the Du Bois Iron Works, Du Bois, Pa., is devoted to motor-driven, engine-driven and belt-driven pumps ranging in rating from 25 to 1000 gal. per min.

ELECTROPLATING GENERATORS for currents of from 100 to 5000 amp are discussed in a bulletin of the Lincoln Electric Company, Thirty-eighth Street and Kelley Avenue, Cleveland, Ohio.

TUNGSTEN FIXTURES are illustrated and listed in a supplement to Catalogue 15A of the Dale Company, Ninth Avenue and Hudson Street, New York. The designs shown are artistic and attractive.

ANNEALING AND HARDENING FURNACES for brass, copper, steel, iron, aluminum, gold, silver and other metals are described in Bulletin No. 2 of the Rockwell Company, 50 Church Street, New York.

COAL-HANDLING APPARATUS, including mast and gaff fittings, automatic railways, chutes, screens, tubs, blocks and ropes, are described in Pamphlet No. 094 of the C. W. Hunt Company, 45 Broadway, New York.

PANELBOARDS.—The Electric Manufacturing Company, 926 Lafayette Street, New Orleans, La., has issued an illustrated price-list devoted to panels, cabinets, steel boxes, switchboards, switches and electric distribution specialties.

ELECTRIC CLOCKS.—The Industrial Instrument Company, Foxboro, Mass., has issued bulletin No. 22, giving description and illustrations of master clocks and secondary clocks for electric time systems in industrial plants.

BUSHINGS of the porcelain-lined type designed to provide a durable hard and smooth surface for conduit outlets are listed and described in bulletin No. 12 of the H. Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, N. Y.

STEAM SPECIALTIES, including feed-water regulators, steam-operated traps, steam-pump governors, water gages and gage cocks, are illustrated and described in a 16-page booklet of the Williams Gauge Company, Pittsburgh, Pa.

ELECTRIC CARRIAGES, including runabouts, stanhopes, victorias, coupés, surreys, broughams and landaulettes, are well illustrated and described in a handsome catalog published by the Rauch & Lang Carriage Company, Cleveland, Ohio.

ALTERNATORS.—The Lincoln Electric Company, Thirty-eighth Street and Kelley Avenue, Cleveland, Ohio, has issued a bulletin dealing with alternating-current generators rated at from 12 kw to 90 kw for single-phase and polyphase service.

HIGH-VOLTAGE OUTDOOR SWITCHES.—The Kelman Electric & Manufacturing Company, 612 North Main Street, Los Angeles, Cal., has issued bulletin No. 5 devoted to a self-contained outdoor switching unit for a 30,000-volt system.

WIRING SUPPLIES.—Catalogue No. 21 of George Heineman & Co., Philadelphia, is a loose-leaved publication illustrating, listing and briefly describing wiring supplies, including rosettes, receptacles, sockets, attachment plugs, cut-outs, switches and switchboxes.

LIGHTING SPECIALTIES.—The Crescent Company, 103 West Adams Street, Chicago, Ill., has issued an illustrated price-list of electric lighting specialties, including outlet boxes, clusters, soldering compounds, lamp guards, lamp-coloring fluids, and lamp removers.

METROPOLITAN FAN MOTORS.—The Metropolitan Electrical Supply Company, of Chicago, has issued a special fan-motor catalog. All of the standard forms are shown, but particular attention is given to the improved oscillating fan which they are introducing.

CONTROLLERS.—Publication No. 3768 of the General Electric Company, Schenectady, N. Y., contains complete price-lists, with illustrations and brief description, of numerous lines of starting and speed-controlling devices. All of the devices shown are of the rheostatic type.

SWITCHBOARD INSTRUMENTS, including voltmeters, ammeters and wattmeters for direct-current and alternating-current circuits are described in bulletin No. 14D of the Keystone Electrical Instrument Company, Ninth Street and Montgomery Avenue, Philadelphia.

ELECTRICAL SUPPLIES, including fans, generators, motors, lamps, cables, insulators, sockets, plugs, switches, fuses, shades, lighting fixtures, telephones and heating devices, are illustrated and listed in publication No. X102 of Veritys, Ltd., 31 King Street, London, W. C., England.

ELEVATORS.—The Otis Elevator Company, Yonkers, N. Y., has issued a booklet entitled "World's Wonders," which contains illustrations of the ancient and modern wonders of the world. Among the latter are the skyscrapers in New York which have been made possible by electric elevators.

INTERURBAN RAILWAYS.—The Allis-Chalmers Company, Milwaukee, Wis., has issued bulletin No. 1058 giving well-arranged technical descriptions of the equipments of the Winona (Ind.) Interurban Railway Company and of the Indianapolis, Crawfordsville & Western Traction Company.

INDUCTION MOTORS for 25 cycles and 60 cycles, rated at from 0.5 hp to 200 hp, are listed and described in a bulletin of the Lincoln Electric Company, Thirty-eighth Street and Kelley Avenue, Cleveland, Ohio. These motors are of the squirrel-cage type, designed for two-phase and three-phase service.

TUNGSTEN LAMPS, with filaments arranged similarly to the filaments in tantalum lamps, are treated in a bulletin issued by Verity's, Ltd., 32 King Street, Covent Garden, London, W. C., England. The bulletin also contains descriptions of auto-transformers for lowering the voltage impressed upon the lamps.

DIRECT-CURRENT MOTORS for grinding and buffing machines, rated at from 0.125 hp to 10 hp are listed and briefly described in a folder issued by the Lamb Electric Company, 3 Canal Street, Grand Rapids, Mich. Motors rated at from 0.25 hp to 15 hp are discussed in a separate folder of the same company.

ECONOMIZERS in the boiler plants of steel mills are described in Bulletin No. 163 of the B. F. Sturtevant Company, Hyde Park, Mass. Bulletin No. 161 of the same company deals with economizers in the plants of various textile mills. Each of the economizer equipments is fully illustrated and described in detail.

DIRECT-CURRENT GENERATORS of the engine type, rated at from 12 kw to 850 kw, are discussed in Bulletin No. 1059 of the Allis-Chalmers Company, Milwaukee, Wis. The bulletin contains illustrations of installations where these machines may be seen in operation. The various parts are also shown separately.

ENCLOSED FUSES.—The Central Electric Co., Chicago, is distributing a new circular entitled, "A Little Fuse History," which, in addition to calling attention to the history of fuse development, also emphasizes the fact that the present prices are extremely low. The circulars are entitled, "Buy While the Buying's Good."

TELEPHONES.—Pamphlet No. 13 of the Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., gives good description of magneto telephones for electric interurban and steam railway dispatching systems. Pamphlet No. 14 deals with compact series and bridging dry-battery wall telephones and two-piece portable desk telephones.

DIRECT-CURRENT MOTORS AND GENERATORS.—The Lincoln Electric Company, Thirty-eighth Street and Kelley Avenue, Cleveland, Ohio, has issued a catalogue dealing with direct-current motors and generators rated at from 0.15 hp to 7.5 kw. A separate catalogue of the same company describes and lists motors and generators rated at from 4.5 hp to 100 kw.

WIRELESS CLUSTERS of detachable and regular types are listed and briefly described in Catalogue 15B supplement of the Dale Company, Ninth Avenue and Hudson Street, New York. The detachable clusters are so constructed that the bases may be connected in place at the proper time, while the bodies, shades, lamps, etc., can be installed after the mechanics have left the building.

FITTINGS.—The Sprague Electric Company, 527 West Thirty-fourth Street, New York, is sending out catalog No. 424 describing its various types of conduit, conductors, boxes, fittings, etc. Among the newer types may be mentioned the single-strip flexible-steel conduit which is designed especially for fireproof construction. Special mention is also made of the multilet box, which is one box with many uses.

PLUNGER MAGNETS.—The Lincoln Electric Company, Thirty-eighth Street and Kelley Avenue, Cleveland, Ohio, has issued a bulletin dealing with solenoids for single-phase, polyphase and direct-current circuits. List-prices are given on alternating-current solenoids designed for pulls of from 100 to 500 lb. and for strokes of from 1 in. to 8 in., and for direct-current solenoids giving pulls of from 200 to 600 lb., with strokes of from 4 in. to 12 in.

NEW TYPE ON SIGN.—The Wehrle Company, Newark, O., has issued a pamphlet describing the new type of sign, known as the "Reflecto," which embodies an interesting application of the principles of light reflection. The letters of the sign are traced by the faces of disks cut in the sheet metal forming the front; the disks, however, are not entirely separated from the sheet, remaining attached at two diametrically opposite points. Each disk is bent at such an angle toward the lamp or lamps within the sign that it reflects outward the light therefrom, being for this purpose covered with aluminum foil.

WATER WHEELS.—A 116-page publication, issued by the Pelton Water Wheel Company, San Francisco, Cal., as its 1909 catalogue, is in reality a well-prepared technical discussion of hydro-electric developments in which impulse wheels are employed. The catalogue, which is of text-book or reference-book nature, gives an excellent outline of the engineering features of hydraulic equipments and contains a list of companies using Pelton wheel. More than 12,000 of these wheels, having an aggregate rating of 1,325,000 hp, are now in use in various parts of the world. The wheels are now running under heads as high as 2150 ft.

Business Notes.

THE STANDARD ELECTRIC ACCUMULATOR COMPANY has moved to 91-93 Mercer Street, New York.

MR. CHARLES F. JOHNSON, Cleveland, O., has entered the electrical machinery field and will buy and sell new, rebuilt and second-hand machinery by a mail-order system which he has found very successful in conducting a similar line of business.

THE DALE COMPANY, Ninth Avenue and Hudson Street, New York, manufacturers of lighting fixtures, etc., has recently added 10,000 sq. ft. to its floor area and has purchased considerable equipment in order to possess proper facilities for handling its increased business.

THE NATIONAL MACHINERY & WRECKING CO., Cleveland, O., has just issued a special bargain list, together with prices on second-hand alternating and direct-current generators of 50 to 600 k.w. capacity, Corliss and automatic engines, motors, extra armatures and leather belting.

CROCKER-WHEELER MOTORS FOR STEEL MILL.—The Carnegie Steel Company has added to the 1550 hp in Crocker-Wheeler motors in its Duquesne plant by the purchase of three more Crocker-Wheeler motors of the same type, specially designed for rolling-mill work, aggregating 225 hp.

MUENZEL GAS ENGINE PLANT.—The Union Electric Power Co., Union, Iowa, has ordered from the Minneapolis Steel & Machinery Co. a 55-hp. Muenzel producer gas engine and gas producer, which will be installed in its new electric light plant. The engine will be belted to two generators.

THE SHELTON ELECTRIC COMPANY, Chicago, has opened a large and commodious establishment at 105 West Forty-second Street, New York City. This was necessitated owing to the increased demand for its product and in order to take care of its export trade. An interesting exhibit of vibrators, centrifuge and other electrical appliances has been arranged in the offices.

UTICA DROP FORGE & TOOL COMPANY TO MARKET ITS OWN PRODUCT.—The Utica Drop Forge & Tool Company, of Utica, N. Y., has, dating from the first of April, 1909, sold its own product direct to the trade. This company claims to be the largest nipper and plier factory in the world, having more than an acre of area under roof, and uses a mile of industrial railroad upon its premises in carrying its product from department to department. Its plant is new, the old plant having been destroyed by fire about two years ago, and is along the most modern and improved lines for heat, light, air and sanitation and for the economical and rapid handling of the product.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED April 13, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

917,749. CIRCUIT CONTROLLER; S. Cabot, Brookline, Mass. App. filed Nov. 10, 1908. For controlling the circuits in wireless telegraphy, being serially connected in a sonorous circuit and having a plurality of sets of serially subdivided electrodes arranged on a drum with power operated means for creating relative movement between them.

917,760. SWITCH; G. W. Hart, Hartford, Conn. App. filed Nov. 2, 1907. After the circuit is completed it is magnetically kept closed and then quickly broken, by means of an electrically actuated main circuit switch and a pilot switch.

917,778. MEANS FOR STARTING ARC LAMPS; G. M. Little, Pittsburg, Pa. App. filed May 6, 1907. The electrodes are brought into and out of engagement with each other to remove the fused slag by means of an electromagnet, acting independently of the feeding mechanism.

917,785. INSULATING SUPPORT FOR HIGH-TENSION CONDUCTORS; R. D. Mershon, New York, N. Y. App. filed May 21, 1907. A substitute for the old style insulators by combining a number of longitudinal insulating units in a frame work so arranged that the mechanical strains are resisted by tensional and compressive strains in the units.

917,787. PROCESS OF MAKING STORAGE-BATTERY PLATES; W. Morrison, Chicago, Ill. App. filed Jan. 12, 1905. Process of preparing a paste which consists in mixing soft lead and an oxide of lead, reducing to a paste and adding a liquid preparation of water, acetone, sulphate of ammonia and acetic acid.

917,794. TRANSFORMER SYSTEM; K. C. Randall, Edgewood Park, Pa. App. filed July 6, 1908. Means of automatically determining the order in which the primary terminals of the transformer are connected and disconnected from the supply circuit. A group of transformers, transforming three-phase into two-phase which is controlled by electrically operated switches governing the connection between them and the three-phase circuit and a manually operated switch governing the electrically operated switches and determining the above order.

917,795. ELECTROLYTIC CELL; J. H. Reid, Newark, N. J. App. filed Dec. 28, 1908. Minimizes skin friction and makes a uniform deposit of the metal by arranging the electrodes concentrically, rotating them in opposite directions, circulating the electrolyte between them, taking out the electrolyte and regenerating and resupplying it.

917,796. ELECTRIC FURNACE; J. H. Reid, Newark, N. J. App. filed Dec. 28, 1908. Furnace for refining ore containing silica in which a treating table is used formed of a plurality of converging electrodes and resistance elements having perforations through which the melted metal may drop, together with a scraper for spreading the metal on the table.

917,806. ELECTRIC MOTOR; R. Siegfried, Pittsburg, Pa. App. filed May 25, 1906. A direct current motor with readily accessible brushes and with a field magnet frame that is open at the commutator and provided with brush supporting tube.

917,830. SIGNALING SYSTEM FOR RAILWAYS; M. W. Zabel, Chicago, Ill. App. filed April 13, 1907. The track is divided in a series of locks with a selective signal receiving device at a signal station, and electric means connected with the track to selectively operate the signal to indicate various positions of the trains on the track.

917,847. SELF-CENTERING FIXTURE STUD; J. L. Corey, Indianapolis, Ind. App. filed Dec. 24, 1907. The studs for electric light fixtures are provided with a universal joint so as to permit them to be adjusted in the correct position from the wall after they have been knocked out of place.

917,858. CONTROLLER FRAME; H. W. Forslund, Chicago, Ill. App. filed Dec. 14, 1906. Electric hoist for elevators in which the controller frame is provided with inculating supports for the controller and with means for clamping the controller supports within the frame.

917,867. ARC LAMP; W. G. Housekeeper, Wilkinsburg, Pa. App. filed July 9, 1906. For reestablishing arcs in lamps with electrodes, one iron and the other titanium oxide, by means of an electromagnet whose circuit is controlled by an arm attached to the electrode.

917,868. SYSTEM OF CONTROL; H. D. James, Pittsburg, Pa. App. filed June 2, 1905. In combination with a supply circuit and motor, of switches for establishing the motor armature circuits for forward and back rotation and relay switches, for preventing interruption of the field magnet circuit.

917,875. METHOD OF MAKING ELECTRODES; E. W. Jungner, Kneippbaden, Sweden. App. filed June 23, 1906. The method of making electrodes which consists in electrolizing a plate of magnetic metal in a bath of semi-solid substance, then removing the substance and subjecting the plate to a charging current in a suitable electrolyte.

917,897. AUTOMATIC CONTROLLING MECHANISM FOR FLUID PRESSURE SYSTEM; W. J. Richards, Milwaukee, Wis. App. filed July 15, 1908. For air compressors driven by electric motors. Includes step by step mechanism connected with the motor with means for rendering it inoperative and means operated by the motor for rendering it operative, thus cutting out the starting resistance step by step.

917,898. CONTACTOR COMMUTATOR FOR DYNAMO ELECTRIC MACHINES; H. R. Rivers-Moore & J. McL. Donald, London, Eng. App. filed Oct. 5, 1907. The contact doors are moved relatively slowly against the collector segments and suddenly released to effect a rapid break.

917,916. TIME RELAY FOR SELECTIVE SIGNALING; H. A. Watson, Kendallsville, Ind. App. filed March 26, 1908. Selective ringing means for party telephones, by means of a manually opened switch and retarding mechanism therefor actuated by a relay.

917,964. BRUSH HOLDER; A. Rae, McKeesport, Pa. App. filed Oct. 12, 1908. A brush holder having a base, a head, links connecting the base and head with means for maintaining a commutating contact with the base and head and means for regulating the spring pressure between the base and head as to vary the pressure of the brush upon the commutator.

918,013. PAPER FEED MECHANISM; G. S. Conger and C. Pearce, New York, N. Y. App. filed Dec. 27, 1906. A positive paper feed for printing telegraphs, consisting of a [illegible] automatically locked to the shaft.

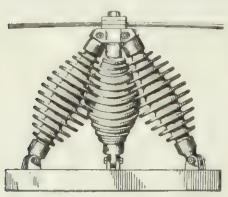
918,085. CIRCUIT CONTROLLING DEVICE; R. B. Pegram, Washington, D. C. App. filed July 3, 1906. A circuit controller for controlling arc lamps, consisting of a [illegible] comprising a clock and cam [illegible] by the clock and a [illegible] electromagnet means to establish or interrupt the circuit.

918,088. GARMENT HOOK; H. Poppertt, Buffalo, N. Y. App. filed Jan. 16, 1900. A garment hook which rings an alarm when the garment is removed by unauthorized persons.

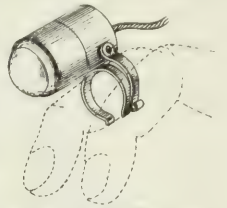
918,102. SOCKET FOR INCANDESCENT LAMPS; W. C. Tregoning, Cleveland, Ohio. App. filed June 26, 1908. A socket for lamps having two oppositely arranged insulating disks having flat sided contact members mounted thereon and a rotatable ratchet pressing them together laterally.

918,119. ELECTRIC FIXTURE; W. J. Boemper, Rutherford, N. J. App. filed Oct. 4, 1907. A base box for snap switches adapted to straddle the molding and of insulating material. Details.

918,127. INSULATOR; W. G. Clark, New York, N. Y. App. filed July 27, 1908. An insulator which holds the wire so it cannot be-



917,785.—Insulating Support for High-Tension Conductors.



918,181—Electric Flash Light Attachment

come loose by means of a wire receiving slot; a restricted opening leading thereto and suitable shoulders. The wire is held in by a key.

918,164. ALARM APPARATUS; W. H. Kirnan, Bayonne, N. J. App. filed Dec. 21, 1908. For fire alarm boxes to prevent interference between two or more signal transmitters in series. Includes a closed circuit signal wheel, a non-interfering magnet having an armature and a controller connected to the armature actuated by the wheel which controls contacts in series with the magnet.

918,181. ELECTRIC FLASH-LIGHT ATTACHMENT; F. Meadows, Berkeley, Cal. App. filed March 29, 1907. A flash light which can be attached to the finger of the user.

918,199. POLARIZED RELAY; P. Ribbe, Halensee, near Berlin, Germany. App. filed Jan. 28, 1909. A polarized relay for currents of micro-voltage or micro-amperage. Makes use of a permanent magnet with field coils and a rectangular frame carrying the armature of superposed plates of soft iron.

918,202. INCANDESCENT LAMP CLUSTER; F. Schwartz and L. Kleinmann, New York, N. Y. App. filed Feb. 26, 1908. A lamp cluster having a block and a rotatable stem carrying contact plate, so arranged that the lights may be turned on in groups of one, two or more lights.

918,208. TRANSMITTING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed Dec. 23, 1905. A wireless transmitter appuratus to avoid sparking at the telegraph key by means of inductive resistances of different magnitudes connected in the circuit and an inductive resistance and a key adapted to close the circuit in parallel to one of the resistances.

918,221. STORAGE BATTERY GRID; W. M. Thayer, Hartford, Conn. App. filed April 17, 1908. A storage battery rib formed of a number of bars with flanged ends parallel with each other so as to form pockets between them. The active member consists of a plural number of rods inserted axially into the pockets.

918,223. ELECTRICAL FUSE; W. H. Tidmarsh, Elgin, Ill. App. filed May 31, 1907. Details in fuse construction to permit readily replacing them.

918,254. ARRANGEMENT OF WINDINGS FOR ELECTROMAGNETIC CLUTCHES; H. Ast, Vienna, Austria-Hungary. App. filed Dec. 26, 1908. An electromagnet clutch in which the wires are provided with an insulating envelope making them air-tight and moisture-tight, and preventing the admission of gases.

918,255. ANTENNA FOR WIRELESS TELEGRAPHY; H. E. Athearn, Brooklyn, N. Y. App. filed May 23, 1908. Antenna for wireless made up of a plurality of loops extending horizontally between the upright poles and lying in a vertical plane between them.

918,256. HERTZIAN WAVE METER; C. D. Babcock, New York, N. Y. App. filed May 27, 1908. Consists of a condenser composed of a pair of concentric metal cylinders adjustable longitudinally with relation to each other, provided with a spirally wound inductance and wave measuring scale.

918,257. STATIC CONDENSER; C. D. Babcock, New York, N. Y. App. filed June 30, 1908. The dieletric of a condenser is provided with an insulating flange extending at right angles to the insulating surface.

918,262. METHOD OF FORMING JUNCTION AND FEEDING POINTS IN ELECTRICAL AERIAL DISTRIBUTION SYSTEMS; H. Behrend, Sudene, near Berlin, Germany. App. filed May 21, 1908. Masts are provided for carrying several groups of feeders and the junction points are simplified by joining two conductors of like polarity together with two safety devices between them and arranging the trains of conductors of like polarity in different planes.

918,269. PROCESS FOR PRODUCING METALS; H. S. Blackmore, Mount Vernon, N. Y. App. filed Sept. 24, 1907. Consists in exposing a substance containing a metal and oxygen capable of reacting with a carbid to yield metal to electrolysis at the same time employing an anode containing calcium carbide.

918,278. AUTOMATIC ELECTRIC FIRE AND HEAT ALARM; J. W. Butterworth, Richmond, near Auckland, New Zealand. App. filed Feb. 24, 1908. An automatic alarm in which a short tube containing a thermostatic fluid also carries contact wires, the circuit being closed by the expansion of the fluid.

918,287. TROLLEY DEVICE FOR ELECTRIC CARS; W. A. Crawford-Frost, Baltimore, Md. App. filed Oct. 13, 1908. A trolley wheel support having an L-shaped pole urged upwardly by a spring and provided with a guide.

918,291. KEYBOARD TRANSMITTER FOR MORSE AND OTHER TELEGRAPHIC CODES; P. B. Delany, South Orange, N. J. App. filed July 10, 1903. When a key is depressed devices are operated which automatically effect the transmission of dots and dashes.

918,292. TELEGRAPHY; P. B. Delany, South Orange, N. J. App. filed May 22, 1905. An electrochemical telegraph in which the capacity on the line is used to complete the signals.

918,293. TELEGRAPHY; P. B. Delany, South Orange, N. J. App. filed May 24, 1905. The transmission of dot signals is effected by the combined use of two or more electromagnet devices, the first one when the key is depressed closing the circuit to be charged and the last one breaking the circuit.

918,294. AUTODOT-TRANSMITTER; P. B. Delany, South Orange, N. J. App. filed June 21, 1906. A loosely mounted sliding impact weight is set into motion by the armature lever to make the dots.

918,306. METHOD OF WIRELESS SIGNALING; R. A. Fessenden, Brant Rock, Mass. App. filed July 1, 1907. A method of wireless signaling employing the apparatus of 918,307 below, eliminating disturbing impulses by generating waves of a definite frequency in groups of a group frequency of 250 per second, but within the limits of audibility and receiving the same with an indicator unresponsive to the group frequency.

918,307. APPARATUS FOR WIRELESS SIGNALING; R. A. Fessenden, Brant Rock, Mass. App. filed Aug. 25, 1908. Avoiding atmospheric disturbances by providing a generator sending out waves of a definite frequency higher than 250 per second and breaking them up into trains which succeed each other at a frequency above the normal frequency used for alternating-current work. The attention of the hearer is concentrated on the higher notes, so that the low noises made by atmospheric disturbances do not affect him.

918,322. TELEGRAPH SYSTEM; G. E. Hines, New York, N. Y. App. filed July 30, 1908. A duplex telegraph which can also be used as a quadruplex. Uses two sources of current, one for sending induced impulses and the other for sending continuous current impulses.

918,330. SYSTEM OF INSULATION FOR HIGH VOLTAGE ELECTRIC CONDUCTORS; F. M. Locke, Victor, N. Y. App. filed Apr. 9, 1907. A series of petticoat insulators is arranged in series between the supports and tie pieces connect insulators and supports and exert compression strains upon them.

918,353. SWITCH; L. H. Moulthrop, Bridgeport, Conn. App. filed Sept. 10, 1908. A double push button switch of particular construction.

918,370. APPARATUS FOR THE ELECTROLYTIC DECOMPOSITION OF ALKALI CHLORID SOLUTIONS BY MEANS OF MERCURY CATHODES; J. J. Rink, Copenhagen, Denmark. App. filed May 4, 1908. An improved apparatus for treating alkali chlorid. Makes use of two separate concentration cycles so that the amalgam next the cathode is separated from the anodes by a diaphragm and each portion connected with a concentration receptacle.

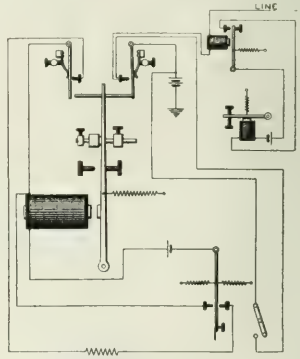
918,377. TROLLEY GUARD; G. W. Sandiford, Mobile, Ala. App. filed Oct. 5, 1908. A guard for trolley wires, the pole having a slotted opening in which is mounted a spring pressed rack carrying the wheel.

918,402. CONTROLLER FOR ELECTRICALLY DRIVEN AUTOMOBILES; A. Vorreiter, Berlin, Germany. App. filed April 23, 1907. Details in a drum controller for automobiles.

918,413. BURGLAR ALARM; W. T. Anderson, Jr., Tarentum, Pa. App. filed April 29, 1908. A burglar alarm connected to a trap plate which is placed upon the stair of the stairway.

918,417. AUTOMATIC ALTERNATING-CURRENT CONTACT APPARATUS; C. E. L. Brown, Roemerburg, Baden, Switzerland. App. filed August 27, 1906. For operating an electro-magnetic circuit breaker by means of an induction device which by reason of the return current is actuated to close a local circuit containing the electro-magnetically operated switch.

918,419. PROCESS FOR PRODUCING CARBIDS; Remo Catani, Rome, Italy. App. filed Jan. 15, 1906. The process of making calcium



918,294—Autodot Transmitter.

carbide compounds consisting in coating the carbon with slacked lime and placing it and the lime into an electric furnace.

918,434. SWITCH; G. Gaglio and L. Villani, Milan, Italy. App. filed Nov. 2, 1907. An electric time switch operating mechanism of the type wherein a sand glass is used to bring the devices into circuit closing position.

918,439. ELECTRIC PROCESS FOR GASSING THREADS; G. Gin and V. Courtecuisse, Lille, France. App. filed Sept. 11, 1907. For singeing waste projecting from threads by means of electrically heated surfaces in the presence of excess of oxygen.

918,477. INCANDESCENT LAMP SOCKET; F. E. Seeley, Bridgeport, Conn. App. filed April 21, 1908. Has a rotary spindle carrying a contact comprising an external conducting band, a shell within the same and an interposed insulating envelope.

918,489. AUTOMATIC SWITCH FOR LIGHT AND POWER CIRCUITS AND THE LIKE; P. H. McCormack, New York, N. Y. App. filed March 17, 1908. A plurality of switches, each controlling a lamp, etc., which can be thrown in successively. The work done by a solenoid.



"Tungstolite" Fixture.

"Tungstolite" Fixture

OKONITE IT NEVER DISAPPOINTS

The 3- or 4-light *moderate-priced*, high-efficiency Cluster Fixture is especially adapted for store, office and shop lighting.

A convenient feature is that each fixture is packed in an individual box. This method of packing makes it unnecessary to repack each fixture when desiring to reforward shipment. Why waste time unpacking fixtures and take chances of breakage, when the Tungstolite Method insures against these troubles?

"OPALUX" Reflectors

A comparison of these modern reflectors with the older forms will convince the most skeptical that "Opalux Light" is pointing a way toward better illumination.

Aside from this fact, Opalux will soon pay for itself by elimination of broken Tungsten Lamps. Every time a reflector is removed for cleaning there is a danger of lamp breakage. Opalux Shades simply need dusting, and do not require washing.

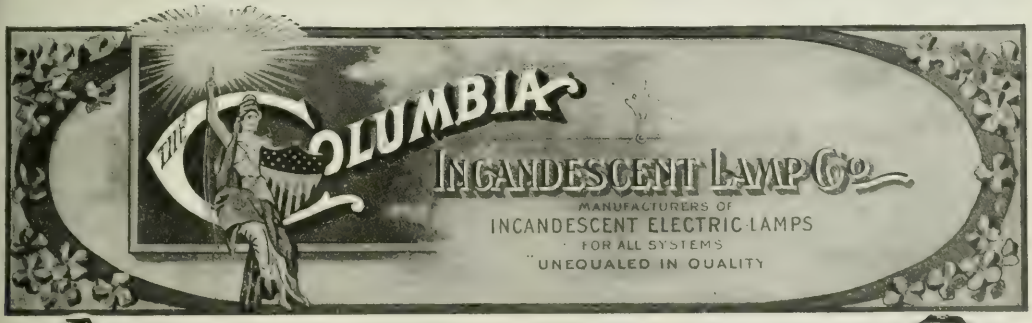
Complete engineering data will be forwarded upon request.


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Central Electric Company,

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Columbia Carbon Filament Lamps, all types
Columbia Tungsten Lamps, all types
Columbia Gem Lamps, all types
Columbia Tantalum Lamp,
both regular and meridian types
40-Watt Tungsten Lamp
with standard Edison base



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BOSTON, 130 Purchase Street
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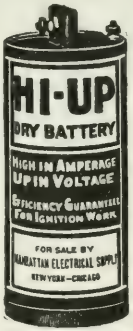
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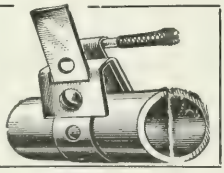
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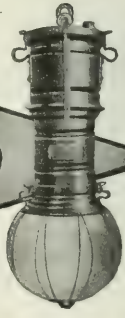
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The General Electric Report.

Elsewhere in this issue is given an abstract of the annual report of the General Electric Company for 1908-9. Always a document of great importance, the report this year has a special value as showing how far the depression in business affected electrical industries broadly, by placing in comparison with the figures of the boom period of 1906-7-8 those following the collapse. It appears that the orders received by the company in 1908 were only 70 per cent in value of those for each of the two preceding years and the shipments were only 60 per cent. To take the exact figures, the sales billed in 1908-9 were only $44,540,676, while in 1907-8 they were no less than $70,977,168 and in 1907 they were $60,071,883. These are indeed sharp declines, but it appears that 1908-9 was after all the best year if we leave out the tremendously active boom epoch, with its dangerous extremes of high prices and low profits. As a matter of fact, the General Electric Company with its smaller business and lower prices last year came very nearly meeting its dividends out of regular profits and made but a slight charge on surplus, which to-day is over $16,000,000, while the company is carrying a large cash balance that it hopes now, says President Coffin, "will be profitably used." There is no reason in sight why next year should not see any and all of the peaks of the past overtopped, yet on a more stable basis of prosperity because of the increase in population and wealth and the growing use of electrical energy and apparatus.

The engineering report of Vice-President Rice is quite encouraging in its references to new work, larger types, forward lines of experiment and a widened contact with general industry. He notes the 10,000-hp induction motors for Gary, the 12 new locomotives for the New York Central, the 14,000-kw turbines for Chicago, the new vertical rotaries of 2500 kw, all evidences of the truth that dull and depressed times are not without their stimulus and often come as a blessing in disguise. The only use of standards in electricity is as points of new departure; and here is every evidence that this great typical electrical enterprise is progressive and ever alert to newer opportunities of development.

The Iowa Convention.

The Iowa Electrical Association last week held another of its notably successful annual conventions. The success of this association lies in the well-balanced character of its programs, which are confined to subjects of immediate interest to the large number of small companies of which the association is composed. Exhibits are always a drawing card to small central-station men, as well as large, and the Iowa and Ohio associations owe part of their success to the provisions which have been made for exhibits for several years past. These State associations have been in a general way following the experience of the larger national associations in finding the unsatisfactory features of parlor exhibits scattered through a

hotel. At the last two Iowa conventions ample exhibit space was provided free of charge, leaving to the supply men only the expense of providing an exhibit which, while not expected to be large, was nevertheless ample in the case of most of the new appliances in which central-station men are interested.

As concerns the work of the association aside from the exhibit feature, it is gratifying to note that the committee on "Facts and Factors," as shown by Mr. Austin Burt's report, has been much more successful in its efforts than in previous years and presented a compilation of data from 26 Iowa stations. This report took the general form which has been used of late in some of the central-station statistics presented in these columns. The comparison of these fundamental data of central-station business cannot fail to suggest to enterprising members of the association where improvements can be made in their own business. Consideration of various methods of increasing day load took up a considerable proportion of the time at the convention. The tungsten lamp, which was a novelty a year ago, has apparently become well settled in the business as a great aid not only in competing with private gasoline plants, but in securing additional consumers of all kinds. To judge from the testimony of those at the convention, the fears of revenue reduction by the coming of the tungsten lamps were absolutely unfounded. The lamp has had the opposite effect, as the broad-minded men of the industry predicted. If there is a central station which has allowed tungsten lamps to cut or reduce the total revenue, it must certainly be due to indifference and inactivity. To the progressive plants it has meant increase in every case. A brief running report of the convention is given in this issue, and abstracts of the papers and discussions will appear in later issues.

Methods of Computing Mean Spherical Candle-Power from Polar Curves of Candle-Power.

There are two known ways of deriving the mean spherical intensity of a luminous source from the polar curve of mean intensity in elevation. One is by some graphical method. The other is by some method of arithmetical computation, with or without a slide rule. Of graphical methods there are at least two in general use. Of arithmetical methods there are several, but they differ very little from one another. The *Elektrotechnik und Maschinenbau* contains an arithmetical method, noticed in the Digest, which is a slight modification of a well-known plan. It divides the polar curve into equal angular zones, takes the horizontal components of the intensities in these zones, finds their arithmetical mean and multiplies this by $\pi/2$ to arrive at the mean hemispherical candle-power. If the method were new it would be well worth discussing at length; but it deserves to be better and more generally known to illuminating engineers.

Determination of the Location of a Wireless Sending Station.

It will be remembered that on the occasion of the collision between the *Republic* and the *Florida* off Nantucket Island, about three months ago, in which the former sustained injuries that caused her to founder soon afterward, the rescuing steamer *Baltic* received the general wireless alarm when only 65 nautical miles westward of the scene of accident. Nevertheless, owing to the dense fog which prevailed at the time, the *Baltic* had great difficulty in finding the sinking vessel, although constantly in receipt of aerograms from her. If the bearings of the *Republic* could have been determined from the *Baltic* when the alarm signal came in, the latter vessel might have been able to cover the intervening distance in four hours. It actually took 12 hours of steaming over a zigzag course of some 200 nautical miles before the sinking steamer was reached, and even this might not have been possible had not the accident occurred in fairly shallow water on a steady gradient of sea bottom, so that the soundings from the drifting *Republic*, reported wirelessly from time to time, served as an additional guide to the searching ship. The incident shows how difficult it is to form an estimate of the whereabouts of a wireless signaling station from which messages are being steadily received.

A plan which has been suggested for the orientation of incoming signals is to erect a composite antenna of, say, four vertical wires, at the four corners of a square base, and compare the strengths of the signals received from different pairs of these four taken in regular succession. Such a structure does not, however, lend itself to the form and rigging of a steamer. It is also possible to use two vertical antennas, one, say, near the foremast, and one near the mainmast, connect them in series through receiving apparatus midway, and compare the strengths of the incoming signals as the vessel is swung in a circle. There should be two maxima and two minima of intensity, from which the bearing of the sending station might be estimated. But swinging a ship is a process that takes time, which may be ill spared for such purposes. Another plan for use in such a case is suggested by Herr Bela Gati in his article on page 1026. He proposes that the strength of the incoming signals be measured on a suitable type of barretter receiver. According to the observations of Duddell, the strength of received current, everything else remaining the same, is inversely as the distance from the sending station, at least up to a distance at which the observations terminated. Since the power of the incoming signals is proportional to the square of the received current, this leads to the conclusion that the power of the signals varies inversely as the square of the distance. If, then, the strength of the outgoing signals is maintained constant, and the strength of the incoming signals is measured from time to time as the receiving ship moves along, the direction of the sending ship can be deduced within certain limits. For instance, if the signals get weaker, the ship is proceeding in the wrong direction, and if they fail to get stronger, the line of advance must be across the line connecting the two vessels.

It is theoretically possible, as the article points out, to make two runs on courses of defined length and direction, and from the three received current strengths at the beginning and end of the runs, as well as the intermediate turning point, to compute the distance of the sending station from the location at the end of the runs. But it is not even necessary to make a computation. The same result can be attained graphically. The first run $A\,B$ may be laid off on the chart in length and direction and, with center A, a circle may be drawn with a radius equal to n/i_a, where n is any convenient number and i_a the received current at A. Similarly with center B, another circle can be drawn with radius n/i_b. The two circles will mutually intersect at two points. By repeating the operation

with new arbitrarily assigned values for n, similar pairs of intersection points may be obtained in a few minutes without any calculation. The locus of all such points will be an ellipse having its major axis upon the line of the course prolonged at one or the other end. The ellipse also intersects the course perpendicularly. The sending station will theoretically lie somewhere on this ellipse, if no drifting has occurred during the run. If now the course be changed at B along a line BC on the chart, a similar set of intersecting pairs of circles can be drawn from the centers B and C as before, and the elliptical locus of these intersections can be arrived at graphically after a few trials. The sending station will then lie theoretically at one of the two intersections of these locus ellipses, and it will be easy to see which junction is the position sought because, in general, one position only is a possible one in view of the three received current strengths i_a, i_b and i_c. For the greatest precision, the two courses AB and BC should in general have the same length and be mutually perpendicular. It is much easier to lay out such a plan of operations comfortably on paper with the courses laid down on the chart in advance and the sending station sending signals at convenience and on schedule time than in foggy weather, on a rolling ship, with the sending station in imminent peril of sinking, and all officers under a great tension. Nevertheless, the plan seems capable of service to some extent at least.

Some Fallacies of Street Lighting.

We greatly regret to observe that the ghost of candle-power contracts, supposed to have been safely laid at Colorado Springs, is still walking. The National Electric Light Association, which ought from bitter experience to know better, is in part responsible by reason of the extraordinary illumination proposition it put through at a recent convention, a resolution that should have been entitled "An Act to Promote Misunderstandings and Litigation." This aside, one finds in N. E. L. A. reports, even at this late day, ratings of street arcs as of 1200-cp or of 2000-cp ratings which by the layman are taken as descriptive and made the basis of assumed equality in the comparison of the prices charged for street service. We wish there could be permanent cessation of such foolishness and that street lights could be sold for what they are and not on the basis of ratings known to be erroneous. In the earlier days of arc lighting a 2000-cp arc meant just one thing—an open direct-current arc taking 9.5 amp to 10 amp and 45 volts to 50 volts at the lamp. It therefore created no confusion to have an erroneous candle-power rating, since the buyer knew very early in the game that the rating was a humbug. At the present time, however, one can find in the tabulated data published from various sources direct-current, open arcs as above, direct-current enclosed arcs at anywhere from 5 amp to 6.6 amp, alternating enclosed arcs at 6 amp to 7.5 amp and even 300-watt magnetite and 250-watt titanium arcs all posing as of 2000 cp. It would take the wisdom of the serpent to assign the real candle-powers to such a collection, but all of them are enormously below the rating and they vary among themselves by 100 per cent or more whether one reckons candle-power or effective illumination.

Hence any attempt to reckon the comparative prices charged for arc lights in various cities from data based on rated candle-power is mischievous and misleading. One city may use 5 amp, direct-current, enclosed arcs and another 9.6 amp. open arcs, one a 6-amp, alternating arc and another a 7.5-amp of similar sort, all through careless precedent rated at 2000 cp and burning the same number of hours per year. Their values for street-lighting purposes vary over a range of more than 100 per cent, and without an exact knowledge of the characteristics of each type, comparisons of prices charged mean nothing at all. To a large extent the central stations are responsible for the continuance of the old ratings, and if those thus offending were the sole victims of the resulting misunderstandings, it would merely be making the punishment fit the crime. Unhappily, the innocent suffer for the sins of the guilty in such matters. The only safe and honest policy in selling street lighting is to sell what is actually delivered; i.e., service for a specified time and under specified conditions with a known illuminant which is satisfactory to the customer. In this way one can avoid what is perhaps the most impracticable and silly stunt that ever entered into the litigious mind to conceive—the measurement of arc lights *in situ*. If an arc must be measured for light, take it down and put it into a sphere photometer and burn it under standard conditions long enough to get a fair average performance. Even so it is no easy job to check the candle-power with any fair degree of precision—such precision, for instance, as would be required if payments for service were made rigorously proportional to candle-power.

Another common fallacy is in attaching undue value to small units. It is, of course, demonstrable that one can by proper distribution get more uniform illumination from small than from large units. Properly planned lighting with small units can be made very effective indeed. But the mere substitution of small lamps for large without holding up equality of energy, or for that matter luminous flux, hurts the case of the small unit. One cannot under any ordinary conditions obtain equality of cost and retain equality of light. For instance, one may replace an arc lamp by three 60-cp incandescents without change of price and will doubtless get a higher minimum illumination by the change; but to get the same flux of light available on the street one would have to install five or six incandescents instead of three. Subdivision of units increases the cost of service, and if equally good lighting is required one must watch carefully lest it also increase the total costs. A question of degree enters the case, in that a street really well lighted by arcs cannot at usual prices be equally well lighted by incandescents at the same price, while a very badly lighted street may often be improved with positive economy by the same substitution. For instance, to light a street up to the London idea of proper light as recently expressed by Mr. Voysey—namely, 0.1 foot-candle measured on a horizontal plane 4 ft above the pavement—by the use of incandescents would be a rather expensive matter, while in Sculch City, Ark., lighted by 6.6-amp alternating arcs spaced 40 rods apart one could safely bet on the advantages of small units. A degree of common sense has to be applied to these things. Sculch City pays perhaps $65 per year for its arcs, but it gets scant value in service as compared with cities that require first-class installation under ground. One cannot safely go into theoretical comparisons in street lighting and should stick very closely to the actual facts if he proposes to obtain results of any practical importance. Theory is all right and extremely valuable in its proper place. It cannot [illegible] and still lead to useful results.

Annual Report of General Electric Company.

The annual report of the General Electric Company has been issued under date of April 22, and covers the operation of the company for the year ending Jan. 31. The following is a comparison of the sales billed and orders received for the past four years:

Years, ending Jan. 31.	Sales billed.	Orders received.
1906	$43,140,992	$50,044,272
1907	60,071,883	60,483,659
1908	70,977,168	59,301,940
1909	44,540,676	42,186,917

The profits of the company for the past year (including $35,918 for securities sold and $1,453,942 from royalties, dividends, interest, etc.), and after deducting all patents, general and miscellaneous expenses, fixed charges, allowances for depreciation and losses, and writing off $1,524,295 from factory plants, were $4,802,250. After meeting dividend payments there was a deficit of $411,773 which was charged to the surplus account. This latter account footed to $16,192,062 on Jan. 31, 1909.

The report states the year of 1908 was marked by severe and continued depression in the business of the company. The value of orders received during the year was only 70 per cent of that for each of the two previous years, and shipments to customers only 63 per cent of the shipments for 1907. The great and sudden shrinkage in the business has, because of the difficulty in reducing expenses, resulted in great increases in the ratio cost of selling prices, with a corresponding decrease in the percentage of profits. It is stated, however, that since the close of the year these conditions have improved, and the outlook for the ensuing year is said to be encouraging. Notwithstanding the smaller amount of business, the total number of separate orders and contracts received was 248,384 as compared with 236,864 for the preceding year, an increase of 11,520. The average value per order, however, was 30 per cent less. During the year there was expended in acquiring patents, for licenses under patents, and in patent litigation, $929,109, which amount was charged to profit and loss. During the past year the plan of decentralization is stated to have been continued with satisfactory results. Each line of apparatus, such as switchboards, induction motors, steam turbines, meters and transformers, has been placed in its respective separate building or factory. Each group is supplied with a special set of engineers, manufacturing staff and clerical force, with a separate factory accounting system.

The total floor space of factories on Jan. 31 was 7,000,000 sq. ft., and the number of employees, 23,300. Among the buildings completed during the year was one with 142,000 sq. ft. floor space at Schenectady for the manufacture of wiring devices; a building of 99,000 sq. ft. floor space at Lynn, for the production of meters and instruments; an iron foundry of 59,000 sq. ft. floor space at Pittsfield, and buildings of 92,870 sq. ft. for lamp works. Work has been resumed on a building of 71,000 sq. ft. at Pittsfield, to be used as carpenter and pattern shops, and for pattern storage.

Vice-President E. W. Rice, Jr., in his report states that experience in the use of the high electric pressures of from 60,000 to 100,000 volts, needed for the economical distribution of electricity over very long distances, has been so satisfactory that higher pressures up to 150,000 volts are being considered in pending propositions. In this connection, it is stated that the sales of transformers of 60,000 volts and over in 1908 were nearly double those in 1907. Many improvements have been made in switches for the control of high-tension circuits, and there have designed and placed in commercial operation switches capable of controlling 110,000 volts, which is the highest voltage now in practical operation.

Two 14,000-kw turbines, placed in operation in Chicago, and two in New York, have proved satisfactory in every respect, and orders for additional units of the same size have been received. The company engineers have completed the design of a number of turbine generators for operation by low-pressure or exhaust steam. The economic value of these machines is based upon the fact that steam turbines are much more efficient than steam engines in the lower range of steam pressures between atmospheric pressure and a good vacuum. Turbines of this character have been designed up to 500-kw capacity, and it is expected that they will, by utilizing the exhaust steam from one of the existing engines, increase the capacity of the combined unit more than 40 per cent with a substantial reduction in coal consumption. The Curtis steam turbine has been adapted to the driving of centrifugal pumps and the city of San Francisco has purchased eight 750-hp and four 600-hp turbine pumps for a high-pressure water system. This is the first important application of steam turbines to this class of service.

The new type of commutating pole railway motor has, it is stated, proved most satisfactory in practical operation and large numbers have been sold. Several new sizes have been developed during the year. The 1200-volt railway system has been further perfected and the installations already made have proved an unqualified success. The vertical type of rotary converters of our design has continued to give satisfaction and many additional installations have been made during the past year. They are of particular value because of the saving in space afforded by the compactness of design. A number of these vertical rotaries is being built of 2500 kw capacity, which are the largest rotaries ever constructed. An especially interesting application of electricity is exemplified in an order received during the past year for the complete electrical equipment of two power stations and an electric transmission plant furnishing power and light for the construction of the dam at Gatun, Isthmus of Panama. The order includes 12 special electric locomotives and a number of special motors required for this work.

Publicity Work of the Public Service Corporation.

An interesting publicity campaign has recently been begun by the Public Service Corporation of New Jersey with a series of advertisements appearing not only in the Newark papers, but in as many as 25 dailies that are published in 12 different cities. Mr. J. L. O'Toole, head of the company's publicity department, informs us that with its railway service, electric lighting and gas it reaches and caters to the necessities of more than 150 separate municipalities in 11 counties of the State; its chief territory being virtually, as is well known, the northern portion of New Jersey.

In some of the recent work of this kind, companies have deemed it necessary to take a full page, but none of the "ads" of the Public Service Corporation now referred to is so large. Their standard size seems to be about 10 in. long by 4½ in. wide, and in that space the company manages to say a number of interesting and pertinent things, which are admirably directed toward enlisting the good-will and appreciation of the community addressed. The fact is set forth that the corporation has already spent more than $30,000,000 in the improvement of its properties, which means, of course, improvement to no less an extent in the facilities given. It has increased its electric lighting and railway generating capacity from 47,700 kw in 1903 to 102,900 kw in 1908, with 15 power plants and 14 substations. It has added 860 cars of the most modern type, extended its 5-cent fare zones, increased its transfer privileges, put into effect a 10-cent base rate for electrical energy, whereas many customers formerly paid as much as 18 or 20 cents; and it has increased its gas mains from 1335 miles in 1903 to 2037 miles in 1908, also making dollar gas almost universally available throughout its territory. It furnishes electrical energy for business places and residences in 138 cities and towns; trolley service in 118 and gas in 113.

These are impressive figures. The corporation has no less than 675 miles of electric track in 10 counties, with 88 separate lines of cars, and about 1400 cars in steady operation, making a distance of 108,506 miles daily. Last year it gave 294,110,602 rides, so that it carried the entire population of the State 137

times over. At some points the traffic is very dense. Over one crossing in Newark, 534 cars an hour pass during the evening rush—nine every minute, or a headway of barely seven seconds. These little facts escape attention generally, but it is remarked: "Public Service is not finding fault with the 'hurry-up habit.' Nor does it possess the ability to change it. Reasonable men, it hopes, will appreciate the difficulties it has to contend with. Unreasonable men—well, it's pretty hard for anybody to satisfy unreasonable men." Data are also issued as to the transfers at no fewer than 230 points.

Week by week these statements come out, each conveying in some form an idea of the great work the corporation is doing. Nor is the inference favorable to the company always left to implication. The various points are made very frankly and incisively, and one passage may here be quoted from a comment on the fact that troubles and delays must be inevitable with such a vast amount of business: "We are not finding fault with honest criticism. On the contrary when just criticism is offered in a spirit of fairness we will welcome it and try to profit by it, but we do not think we should be measured by the standard of the irresponsible critic who puts surmise forth for facts, lets prejudice supplant judgment, or permits a plain grouch to take the place of reason." So far, no cuts or diagrams have been used, and no large type. It is all plain, quiet speech with a brief heading that sums up the topics discussed.

The Convention of the Iowa Electrical Association.

The Iowa Electrical Association held its annual convention at Cedar Rapids, April 21 and 22. The registration of central-station men was nearly 100, while the guests and supply men brought the total registration over 200. This does not include the registration at the Iowa Street & Interurban Railway Association convention, which was held April 22 and 23. The local arrangements were along the lines followed by this association for several years past, with some improvements. The supply men were given free space for exhibits, and the exhibits were convenient to the convention hall. The American Auditorium Building was used for this purpose, the auditorium proper being occupied by the exhibits and the convention sessions being held in one of the committee rooms. The arrangement was such that it brought out an electrical show of no mean proportions.

This common-sense method of handling the exhibit problem undoubtedly brings out many central-station men who would not otherwise come because the absence of exorbitant charges for exhibit space brings more exhibits. Incidentally, the local central-station company, of course, profits indirectly by the publicity given to electrical matters and the throwing open of this exhibit to the general public.

The first session was called to order Wednesday morning by President L. D. Mathes, of Dubuque. The address of Mayor J. T. Carmody welcoming the association to Cedar Rapids was responded to by Mr. F. J. Hanlon, of Mason City. President L. D. Mathes in his address called attention to the revolution that had been going on in electric lighting the past 12 months because of the tungsten lamp. He then referred to the trend of public sentiment mentioned by President Carson last year toward all kinds of legislation affecting public-service companies.

This is in many cases the result of the making of an issue by professional politicians upon which to get into office. Many of the bills introduced into the Iowa Legislature regarding public-service corporations were of such an origin. He was glad to say, however, that all these efforts were defeated and none of the injurious measures passed. He regarded this as a proof of the fair mindedness of most of the men in the State Assembly. It had been charged that a powerful lobby was being maintained at Des Moines by the public-service companies. Mr. Mathes characterized this emphatically as "buncombe." Representations of these interests, it is true, went to Des Moines and were heard on the proposed bills, as they had a perfect right to be. They certainly would have been lacking in alertness were they to let such legislation go through because of indifference and failure to adequately present their side of the case.

One of the important issues which has been brought up is that of a public-service commission. In this connection Mr. Mathes remarked that it was surprising how many electric lighting company men have but little conception of the public-utility commission problem and have given but little thought to its possible effect on their business. Mr. Mathes thought that the past year had been one of reasonable prosperity to the industry and that it was recovering well from the effect of general contraction of business.

Mr. Austin Burt, as "Facts and Factors" committee of the association, then made a very interesting and valuable report. Mr. Burt in preparation of this report had compared central-station facts and factors from 26 Iowa stations of various sizes. The form of report was identical with that recently used by the *Electrical World*, to which Mr. Burt made acknowledgment. The table of Mr. Burt's report, which will be given in a later issue, covers stations operating in towns of 1100 to 85,000 population.

Mr. J. G. Boyd, "Statesman" for Iowa of the Sons of Jove, was accorded the floor for a few minutes to speak on that



PRESIDENT ELECT O. E. BROWNELL.

organization. Mr. Boyd said a few words about the objects of the order and said that it was proposed and desired to form a branch in Iowa. He announced that a rejuvenation would be held the following evening.

Mr. O. E. Brownell, of Lake City, opened a discussion on portable vacuum cleaners by reading a paper on that subject. From the discussion it appears that a number of central stations are stirring up interest in vacuum cleaning in their respective communities in order to popularize electric service and increase the day load. The discussion of this subject occupied the rest of the first morning's session.

Wednesday afternoon was opened with the report of the committee on grounded secondaries. In the absence of Mr. Thomas Sloss, of Cedar Rapids, chairman of this committee, Prof. F. A. Fish, of Ames, another member of this committee, read the report. This report stated that the committee had not been able to carry on the tests on the efficiency of various types of ground in Iowa soil which had been hoped for a year ago. However, the State engineering experiment station at Ames might be able to take up some of the work with a general appropriation the coming year. The committee's report quoted at length from the A. I. E. E. *Transactions* paper by Hayden, Vol. XXVII, No. 3, giving results of tests on iron-pipe grounds. A letter from Dr. C. P. Steinmetz on grounding of secondaries was also embodied in the report. After some discussion on

methods of grounding, it was voted to continue the committee for another year to investigate this subject more thoroughly if possible.

Mrs. L. D. Mathes, of Dubuque, read a paper on "The Application of Electricity in the Modern Home," accompanied by demonstrations of meat roasting in an electric oven. This paper, which went very fully into some of the domestic processes in which electricity can be applied, was followed by a short explanation by Miss Jennie Michel, of Dubuque, a domestic-science expert, who gave some technical points regarding the use of the electric oven in roasting. In connection with this demonstration, the Steckline fireless cooker, designed by Mrs. Mathes and Mr. Steckline, of the Union Electric Company, of Dubuque, was shown. This is a well-insulated oven construction, employing for heat a 7-in. disk stove placed inside.

A general discussion of introduction of electric cooking followed, from which it appeared that complete electric cooking outfits are not making much progress, but that a large number of small cooking devices are being placed on central-station lines. Following this discussion a very hearty vote of thanks was given Mrs. Mathes for appearing before the convention with her wealth of information on domestic science subjects electrically applied.

Mr. Thomas Ferris, of Osage, discussed in a paper the effect of the tungsten lamp on central-station revenues. He thought in general the effect had been good. This, of course, was a fruitful source of discussion in which some figures on the life of tungsten street lamps at Cedar Falls were given by Mr. J. P. Jones. The whole trend of the discussion was that central-station revenues had not been reduced by the coming of the tungsten lamps, but that a very important weapon for putting gasoline lighting plants out of business had been put in the hands of central-station men.

The convention then took up the subject of ornamental curb-line illumination, upon which Mr. D. F. Fradette, contract agent of the Des Moines Electric Company, gave a short paper. This paper reviewed curb-line illumination in a number of cities, finally describing that in use on the business streets of Des Moines.

Wednesday evening a reception was held at Hotel Montrose, the headquarters, where opportunity was given to meet the members of the Commercial Club of Cedar Rapids. The courtesies of this club were extended to all convention visitors registered. After the reception the exhibits were again visited by many members.

Thursday morning session was opened with a paper by Mr. A. Harrison, of Nevada, on "Twenty-Four Hour Service in a Town of 2500 People and Methods Adopted to Increase Daylight Load." While admitting that local conditions alter cases, Mr. Harrison expressed the opinion that conditions are generally very similar in most Iowa towns, and that in such towns a population of over 2000 is sufficient to support daylight operation. While there is not much manufacturing, there is other load in the shape of water pumping and miscellaneous small motors that can be picked up. He then described the various schemes successfully used in working up a day load in a town of 2500 population. This was followed by an experience meeting in which various members told of their success in starting day circuits in small towns.

Mr. M. P. Ellis, of the Holophane Company, presented a paper entitled "Aid of Prismatic Reflectors to High-Efficiency Units." This paper brought out some discussion on the cleaning and maintenance of lamps and reflectors by central-station companies to prevent discredit to electric service.

A discussion on the progress in the introduction of heating units by central-station companies was led by Messrs. E. L. Callahan, heating specialist of the General Electric Company, and H. T. Holland, Chicago manager of the Pacific Electric Heating Company. This discussion was largely on methods of best introducing some of the better-known electric heating devices. The question of the desirability of electric heating load has come to be taken for granted, because it usually means additional revenue without additional investment. Methods of handling rates for heating appliances were also discussed.

At the closing session on Thursday afternoon Mr. J. B. Lindl, of Dubuque, told "The Story of a Successful Sign Campaign, with Facts and Figures." This gave the results of a very short and successful campaign for the introduction of electric signs at Dubuque, which was successful after several years of unsuccessful effort and considerable money had been expended. This also brought out a good discussion.

Mr. E. M. Sterns, of Humboldt, gave a short paper on "Selling Electrical Domestic Appliances in a Small Town." He described efforts to work up day-load revenue in a town of 2000 population in which the chief possible source of such revenue was from domestic appliances.

"The Importance of Close Inspection of Customers' Installations" was the subject upon which discussion was opened by Mr. W. J. Greene, of Cedar Rapids. This took up the importance of reducing fire risks and other hazards by inspection of the wiring in buildings connected. It was brought out that while such inspection may fall to a municipal or insurance inspector, the company may have to make inspections in self-defense, especially if there is no other inspection provided. Two cases of death caused by ungrounded secondaries were brought out.

Mr. L. D. Mathes spoke a few moments on the importance of a broad-gage policy in dealing with customers. This is especially important in dispelling the popular dislike of public-service corporations which has been due to the indifference of some such large corporations to complaints of consumers. Mr. Mathes said that this burden of criticism had been thrown on smaller companies because of the indifference of some of the larger companies, particularly in the East. This is now a matter of past history, but it takes this impression of the public a long time to wear off.

At this stage of the proceedings, Mr. George S. Carson, on behalf of the convention, presented President Mathes with a handsome watch-fob in recognition of his unusually able efforts and successful accomplishments as president of the association this year. President Mathes' remarks on various subjects as they came up for discussion not only served to bring out the best that was in the convention, but were in themselves very instructive and helpful. That his efforts had not been lacking during the year was shown by the excellent program presented.

The convention then went into executive session and elected the following officers for the ensuing year: President, Mr. O. E. Brownell, of Lake City; vice-president, Mr. Thomas Crawford, of Clinton; secretary, Mr. W. N. Keiser, of Des Moines; treasurer, Mr. W. A. Mall, of Belle Plaine. Executive committee: Messrs. A. L. Dodd, of Charles City; Edward Reavy, of Davenport, and Gus Lundgren, of Cherokee. The next meeting is to be held at Sioux City, at a date to be fixed by the executive committee.

The convention was indebted to the Cedar Rapids & Iowa City Railway & Light Company and the Cedar Rapids & Marion City Railway Company for a theater party Thursday evening and also for an automobile ride given to the ladies of the convention on Thursday.

Mr. O. E. Brownell, president-elect of the association, is the proprietor of the electric light plant at Lake City, Ia., which he has owned for five years. His election as president of the association well illustrates the important part the small companies play in the Iowa Electrical Association, and the way in which it caters to their needs and is supported by them. Mr. Brownell was born and brought up at Winterset, Ia., and received a common-school education. He is 38 years old, and his experience in the electric lighting business dates back 17 years, when he began work at the old water-power station in Des Moines. Much of his early training was received in the employ of the Des Moines Edison Company. Prior to his purchase of the Lake City plant he was chief engineer of the State hospital at Mount Pleasant, Ia.

Abstracts of the more important papers and discussions will appear in later issues.

The Niagara Ice Jam.

The dangers from the Niagara ice jam became so pronounced st week that Collector of Customs John A. Merritt, of the ort of Niagara Falls, called upon the U. S. War Department instruct its engineers at Buffalo to make an examination to e if they could afford relief. This national department did othing, and President Sanford White, of the village of Lewis-n, wired Governor Hughes to suggest a plan of relief. This sulted in the State Department of Public Works taking up the estion, and within a few hours Assistant Superintendent unze was on the scene. He at once determined to employ namite to break the jam. Two tons of this explosive were rried from Buffalo to Fort Niagara by night, wagons carry-g it across country, and last Thursday morning the work of acing the dynamite began. By noon all was ready for the st blast. During that afternoon other blasts were fired, but nightfall the results did not appear to be much, so far as acturing the jam was concerned, but Friday morning it was ith rejoicing that it was observed the water had settled back. his recession of the water continued until the river was about rmal, and on Saturday the ice began to break away at the outh of the river and at various places toward Lewiston. On nday the channel opened still more, and then it was realized at the dynamiting at the mouth of the river had broken the m so that the river was resuming its normal flow into Lake ntario. With these conditions established, the fears of the ople of the locality were much allayed.

During the latter part of last week the ice fell away to a nsiderable extent about the power house of the Ontario Power mpany, but the ice jam between the upper steel arch and the hirlpool rapids was still fast at the opening of the week, this retch of ice being in front of the station of the Niagara Falls ydraulic Power & Manufacturing Company. When this report as written, the Ontario Power Company had not yet succeeded getting its machines in operation, but the force employed was boring hard with hope that successful results would be shortly rthcoming. Two of the towers supporting the aluminum bles that transmit power from this station across the river idway between the Falls and Lewiston for delivery to the iagara, Lockport & Ontario Power Company have been ocked down by the ice.

When the water first receded in the gorge, the Gorge Rail-ay Company was quick to set men at work clearing the line, it owing to high water coming again, operations had to be spended temporarily until after the effects of the blasting ere known. If no further trouble is experienced from ice id water, hundreds of men will be at work this week clearing way the deposited mass of ice and bringing the road out its chaotic condition in order that repairs may be made revious to the influx of summer visitors. All transportation cilities along the river have been taxed by sightseers, the iagara Falls Park & River Railway, Canadian side, finding self a dividend proposition in what may be termed winter me, much to its surprise.

Proposed Limitation of Sale of Sanitary District Power.

Mr. B. F. Kleeman, who represents one of the southern dis-icts of Chicago in the lower house of the Illinois Legislature, as introduced a bill in that Assembly to limit the power of the anitary District of Chicago in supplying electricity generated y the water-power of the Drainage Canal. The purpose of this mendment to the laws under which the Sanitary District oper-es is to make it mandatory on that body to sell, or offer to sell, e electricity generated to municipal bodies within the Sanitary istrict or adjacent to the main channel of the canal for the rpose of street lighting or for the operation of pumping plants machinery used for municipal purposes or in the public rvice. It is provided, however, that before the electrical ergy is sold notice shall be given to the mayors, aldermen or other competent officials of municipal corporations affected, that a certain amount of electrical energy is offered for sale and that this energy can be purchased at a certain price per horse-power, which shall not exceed the cost of production. If the municipalities decline to purchase the power within 60 days from the last publication of the notice, then the power, or the surplus which is not purchased by the municipalities, may be disposed of to any other person or corporation upon such terms as may be accepted by the Sanitary District. It is intended by this proposed law to give the municipal bodies the refusal of the power before it is offered to private consumers. The bill has been referred to the drainage and waterways committee.

Mr. Kleeman contends that inasmuch as this electrical energy is the result of the investment of the taxpayers' money, the taxpayers in the various municipalities affected (of which Chicago, of course, is the principal one) should have the benefit of the use of the electricity at cost for the purpose of street lighting, which is badly needed, or for other municipal service.

Accounting Section at the National Electric Light Association Convention.

In speaking of the plans which have been made for the sectional meetings for accountants at the convention of the National Electric Light Association, to be held at Atlantic City, N. J., on June 1 to 4, H. M. Edwards, auditor, New York Edison Company, and chairman of the Committee on Uniform Accounting, said:

"Sectional meetings for accountants as a feature of National Electric Light Association conventions were inaugurated at the Chicago meeting last year. At that time the interest was centered largely around the proposed classification of accounts which the Public Service Commissions of New York were considering, and hence the single session at Chicago was devoted largely to that subject and especially to the bearing of the proposed system of accounts on the question of depreciation.

"At the Atlantic City meeting this year there will be delivered six papers on live subjects, each of which affects the daily routine of the accounting department of every member company. The papers are written by experts, men who have reached high positions in the official staffs of their respective corporations. Surely such a program must interest accountants and, it would seem, should induce the management of every company to see that its accounting department is represented at these meetings.

"Much has been said and written of the value of association and of the beneficial and broadening effect on the minds of those in attendance at conventions. These benefits should appeal particularly to accountants, who, by the very nature of their duties, become conservative and find that their horizon is too apt to be bound by the walls of their own offices. The corrective to this condition is association with their fellows and the opportunity for discussion and comparison which such association affords. The association has now provided the opportunity, and it behooves the accountants to take advantage of it.

"The accounting committee is very desirous of a large attendance and will do all in its power to make the meetings attractive, to see that the delegates become acquainted, and to give to everyone an opportunity to state his problems and, if possible, to find their solution."

The accounting section will hold meetings all day Thursday and on Friday morning. The following papers will be presented: "Branch Office Accounting," by Mr. E. J. Allegaert, auditor, Public Service Corporation of New Jersey; "Customers' Accounts," by Mr. L. A. Wallace, auditor, Edison Electric Illuminating Company of Boston; "Pay-Roll Problems," by Mr. W. W. Freeman, cashier, New York Edison Company; "Care and Handling of Supplies," by Mr. J. L. Bailey, treasurer, Consolidated Gas, Electric Light & Power Company, Baltimore; "Cost Accounting," by Mr. H. R. Kern, auditor, Philadelphia Electric Company; "Depreciation," by Mr. G. E. Claflin, United Electric Securities Company.

Electrical Distribution in Chicago.

Mr. H. B. Gear, general inspector of the Commonwealth Edison Company, Chicago, was the speaker at the luncheon of the Electric Club, of Chicago, on April 21. Mr. Gear's subject was "Distribution of Electric Light and Power in Chicago," and as he has made a thorough study of this subject and introduced a number of improvements in this class of work, his address was valuable and instructive.

Mr. Gear outlined the nature and extent of the transmission system of the Chicago company, mentioning the total mileage of over 300 in the 9000-volt, three-conductor, 25-cycle cable, and pointing out that a voltage of 20,000 has been adopted for the zone outside of a 10-mile radius from the generating station. About half of the energy delivered over the 9000-volt system is sold wholesale to the electric railways in and about Chicago. The remainder is delivered to light and power customers through 32 substations, 24 of which deliver direct current and eight deliver alternating current. Twenty-one of the direct-current substations convert the 25-cycle energy by means of rotaries and three are battery substations exclusively. There are 20 storage batteries, with a total rating of 18,000 kw at the one-hour rate, to protect the direct-current systems, which had a maximum load in December, 1908, of 38,000 kw.

Six of the eight alternating-current substations convert 25-cycle energy to 60 cycles by motor generators. These carried a load of 18,000 kw in December, 1908. The other two are straight transformer stations, taking their energy from the frequency-changing substations. The 60-cycle electricity is distributed to all customers outside the direct-current territory by means of four-wire, three-phase feeders at 2300 volts, phase to neutral, and 4000 volts between phases. Lighting and single-phase power are connected from one phase to neutral and three-phase power transformers are Y-connected, so that standard 2200-volt transformers are used throughout.

Single-phase motors are required from customers up to 5 hp, and larger ones are in use in a few cases when three-phase is not available. No three-phase service is given for less than 5 hp on account of the excessive cost of transformers and meters. Lighting installations less than 25 lights are connected two-wire at 115 volts. Larger lighting installations are connected three-wire at 115-230 volts. These voltages are the same on the alternating-current and direct-current systems.

All new underground lines have been constructed on the conduit and cable system for several years. Underground services enter buildings under sidewalks in business sections and at back or front lot lines in residence sections. The customer bears the expense of the lawn service and makes the decision as to whether it shall be underground or overhead.

Ultimately the company will have no poles on the streets of Chicago. Underground conduits will be used in the streets with overhead distribution from pole lines through the alleys between the streets to customers' premises. Chicago is fortunate in having numerous alleys, as it enables this convenient and economical system of distribution to be carried out to the mutual advantage of the public and the public-utility companies.

There are about 35,000 poles in the company's distribution system in Chicago, principally in alleys, as explained. Of this number, about 25,000 are occupied jointly with telephone, telegraph or railway companies. In nearly all cases there is but one pole line in an alley, as this makes it much safer and more convenient to have the service connections on both sides of the alley than would be the case if there were two pole lines. The number of accidents from broken or crossed wires is remarkably small. The electric light wires are on the upper crossarms with the telephone wires beneath, and there is a clear space of 5 ft. between the two sets of wires.

Answering questions, Mr. Gear said that it is not the policy of the company to extend the direct-current area, as with the present excellent performance of alternating-current motors, nearly every useful application of electricity can be served by alternating current. There is no two-phase service regularly in use anywhere on the company's system of distribution. A few alternating-current motors are operated on 440-volt circuit but the company does not supply standard transformers for th voltage.

Mr. C. A. S. Howlett, president of the club, presided at th meeting and took part in the discussion, as did also Messr F. J. Postel, James R. Deane, Frank L. Perry and others. M B. E. Sunny, president of the Chicago Telephone Compan had been announced to address the club on April 21 on "Ch cago Charter Bills," but he was suddenly called from the cit It is possible that Mr. Sunny may talk on this subject at o of the club's luncheons at a later date.

New Electrical Musical Instrument.

On the evening of April 27, in Symphony Hall, Boston, new electrical musical instrument, called the "Choralcelo," w formally presented to the musical world. This instrume which is the result of many years of inventive application the part of Messrs. Melvin L. Severy and George B. Sincla of Boston, is claimed to make possible an ideal of music beauty hitherto unrealized, particularly in a stringed devic In previous instruments the musical note has been produc by some abrupt and more or less intrusive mechanism. A viol string, for example, is vibrated by a resined bow, with th result that many of the overtones are killed by the contact the bow with the string, and so on through the musical a The result has been that pure musical tones are not produc by ordinary musical instruments. In the choralcelo, on t contrary, it is claimed that, for the first time, the music of stringed instrument is produced with no physical or materi contact with the strings. In this instrument the vibrations a produced by an electromagnetic influence, leaving the strin free to pulsate from end to end with all the overtones whi naturally belong to them.

While the instrument gives out rich, full tones representi a remarkable range in tonal and instrumental values, it scarcely larger than an ordinary upright piano, and the ope ating mechanism is both simple and compact. An interesti feature of the music of the choralcelo is that the harmo floods the auditorium without appearing to come from any pa ticular direction. By the introduction of suitable contacts at t keys the loudness of the sounds is electrically controlled, varyi with little effort on the part of the performer from crashi chords to delicate harmonies. In the instruments thus f shown the piano-action has been left in the case, and one of t most interesting effects created has been by the simultaneo playing of the piano and electromagnetic operation.

The Symphony Hall program included alternate numbers the choralcelo and by a band composed of about half t members of the famous Boston Symphony Orchestra, co ducted by Gustav Strube. Although the choralcelo gives o a volume of sound sufficient to fill a large hall, the applicati of electricity in its mechanism is so simple and direct that t current consumption at the full musical output is only abo 6 amp at 110 volts.

Pittsburgh A. I. E. E. Meeting.

The regular monthly meeting of the Pittsburgh Sectio A. I. E. E., was held in Carnegie Institute April 13, pr ceded by the usual dinner at the University Club. Mr. Edgar Reed, chairman, presided. The subject of the eveni was "Repairing Live Lines While in Service," which was co sidered in a paper prepared by Mr. J. S. Jenks, assisted Mr. W. H. Acker, both of the West Penn Railways Compa Mr. Jenks showed by means of a large number of lante slides the system together with the tools which he and assistants have developed on their 25,000-volt lines in order avoid the necessity for linemen to come in contact with t line conductors, and showed how completely equipped po could be stripped of all wires and crossarms, and the insu

..., crossarms and conductors replaced without interrupting circuit. The paper excited a lively interest among the ... of engineers present, which included representative men ... all the large electrical companies and public-service cor... ations in the territory. The discussion was participated in ... Messrs. H. N. Muller, D. E. Burke, W. H. Acker, N. W. S...rer, A. J. Glenn, F. F. Espenschied, O. M. Jorstad, H. A. C...derwood, Graham Bright, R. A. L. Snyder and Bertrand P. R...ve.

The next meeting of the section will be held on May 11, w...n a paper on electric lighting will be presented by Mr. C. E. S...phens, of the Westinghouse Electric & Manufacturing Com...y.

Massachusetts Legislative Notes.

A notable victory was secured by Speaker Walker, of the H...use of Representatives, during the past week in the killing o... the East Boston 80-cent gas bill after it had reached an a...anced stage in the legislative calendar. Although the m...sure itself appeared harmless on its face, it would have s...ously injured the policy of the State with respect to the s...ervision of public service corporations by trained com...sions had it been passed. Even if the Governor had vetoed t... bill it would have been an expression of little confidence in... he work of the Gas and Electric Light Commission, on the p... t of the Legislature, although for 20 years this board has ...ne a reputation for impartial dealing and has repeatedly s...wn itself qualified to deal with problems of rate-making. A... Massachusetts is thoroughly conservative in its regulation o... public utilities, it is a source of general gratification that t... House rescinded its action on the bill after the injury to i...estors and the discouragement to industrial conditions in t... State which were entailed had been made plain by the ...aker.

The joint committee on ways and means has reported favor...y on a bill to provide for an investigation of the water re...rces of the State, and the bill has been given a second read... in the House.

The bill to authorize the Heath Telephone Company to sell ...ck privately has passed the House to be engrossed and has ...n sent up to the Senate for concurrence.

The electric lighting consolidation bill providing for the ...orption of the electrical business and equipment of gas ...panies by central stations has been given a third reading in t... House. It is probable that this bill will pass at this session. ...l it is understood that the purchase of several of the suburban ...ctric properties by the Boston Edison Company will be ...ught promptly before the Gas and Electric Commission for ...roval if the bill becomes law.

The Senate has given a first reading to the adverse report of t... committee on Mercantile Affairs on the Reidy bill relative t... telegrams transferred from one company to another.

The Dean bill on the taxation of foreign telephone and tele...ph companies has been killed by the two houses in con...rence.

The bill to permit the Connecticut River Transmission Com...y to build lines over certain lands of the State on approval ... the Metropolitan Water and Sewerage Board has been re...rred to the committee on metropolitan affairs.

The report of the committee on taxation against the Reynolds ... for legislation seeking the taxation of telephone and tele...ph companies has been accepted by the Senate.

New York Public Service Commission News.

Both branches of the New York General Assembly have now ...sed what is known as the Travis-Robinson bill which amends ... rapid transit act so as to permit the building of additional ...ways in New York City with private capital. The bill is ...w ready to be sent to the Mayor for his approval. It pro...les that the Public Service Commission, with the approval of the Board of Estimate and Apportionment, may grant a franchise to a private corporation and that the railroad shall be built at the expense of the holder of the franchise. The right of the city is reserved to terminate the franchise after 10 years on specified notice and to buy the property at a sum not exceeding the actual cost of the plant, with 15 per cent added for engineering expenses. The bill also provides for the building of rapid transit roads to be owned by the city at public expense and gives the commission and board of estimate the power to determine whether all or any portion of the expense of construction shall be assessed upon the property benefited by the improvement.

No action has yet been taken in the Assembly upon the Travis-Lee constitutional amendment removing the cost of self-supporting subways from computation in the city's debt limit. In the Senate the bill amending the public service law, which was passed last week by the Assembly, was placed upon the calendar, but objection was made to advancing it out of its regular order and putting it upon its passage. The bill may be lost for lack of interest on the part of the senators.

At the public hearing before the Public Service Commission upon the application of the Hudson & Manhattan Railroad Company for a franchise to run a subway under Sixth Avenue to the Grand Central Station the only objection that was made came from Everett P. Wheeler, who represented certain holders of traction securities and who asked that the commission look more closely into the financing of the project. The attorney for the Interborough Rapid Transit asked that a provision be incorporated in the franchise prohibiting the McAdoo system from extending its station at Forty-second Street and Fourth Avenue further north than the middle line of the former street. There now seems to be little doubt that the franchise will be granted.

The executive committee of the Washington Square Association, of which Thomas F. Ryan, largely interested in the Metropolitan system, and F. W. Whitredge, receiver of the Third Avenue Railroad Company, are members, has filed a protest with the Public Service Commission objecting to the proposed double-tracked subway of the Hudson & Manhattan Railroad under Ninth Street from Sixth Avenue to Fourth Avenue. The protest is based on the possible injury to property in the neighborhood and suggests that as the McAdoo system will tap the present subway at Forty-second Street, it is unnecessary to build the Ninth Street spur. In connection with this protest it was made known that already the excavations for this line had been completed about halfway of the block between Sixth Avenue and Fifth Avenue. It was also practically given out that the McAdoo Company had no intention of abandoning this work, but expected to take it up as soon as the proposed line to the Grand Central Station has been completed. The company already has the necessary franchise for this branch.

The Public Service Commission of the First District of New York has held a hearing on the application of the Pelham Park Railroad Company and the City Island Railroad Company to issue $100,000 of bonds for refunding purposes and for the construction of a monorail line between Bartow Station on the New Haven Railroad and City Island. The refunding portion of the new bonds will amount to $55,000, and the balance will be spent for the construction of the monorail system.

At the "Rapid Transit" dinner, given by the Reform Club of New York City, April 26, Milo R. Maltbie, member of the Public Service Commission for the First District, outlined the position of the commission with regard to profit-sharing between the city and transit corporations. "The rapid transit policy of the commission," he said, "contemplates a sharing of all profits above a certain fixed minimum. According to the amendments to the law proposed by the commission [illegible] be deducted from income operating expenses, taxes, payments to reserve and [illegible] and a [illegible] must be [illegible] to be [illegible] to be divided equally between the company and the city. In other words, if the company were able to [illegible] one year after paying all charges except interest and dividends

and if the agreement fixed 5 per cent as the limit, the city would get 2 per cent and the company would get 2 per cent, the latter as an extra dividend to its stockholders. If only 7 per cent were earned the city would get 1 per cent and the company 1 per cent, or 6 per cent in all." All the funds received by the city from such sources are to go toward paying interest and sinking fund charges upon municipal bonds issued to build and equip rapid transit lines.

Meeting of New England Section of Illuminating Engineering Society.

The regular monthly meeting of the New England Section of the Illuminating Engineering Society was held at the Edison Building, Boston, on April 20. The speaker was Mr. L. D. Gibbs, assistant advertising manager of the Edison Electric Illuminating Company, of Boston, his subject being "Store Window and Sign Lighting." Mr. Gibbs sketched the development of illumination for mercantile establishments from the earliest days of oil lamps and gas down to recent times, and pointed out that much of the poor lighting of the past was due to the failure to realize that intelligibility, legibility and artistic effect do not necessarily follow the unrestricted or undirected use of a large quantity of light. A light may be more of an obstruction to trade than otherwise if it is not installed according to correct principles. The illuminating engineer is perhaps handicapped because he is generally restricted to a close association with some commercial interest, but he is fortunate, on the other hand, to practice in a field where there is clearly a demand for his skill in progressive establishments. That the clientèle is receptive augurs well for the future of the illuminating engineer. The business man is in general looking for novelty, and this quality may easily be secured by lighting effects.

Mr. Gibbs then emphasized the importance of avoiding harmful physiological effects in store or sign lighting. Particularly in window illumination should it be realized that people prefer to look at displays from inconspicuous positions. Too much light outside the window tends to drive passers-by across the street, perhaps to return to the original side again after the offending glare has been passed. Merchants hire high-salaried men for their window decoration and the possibilities should be doubled with proper illumination. The merchant wants something dignified and yet attractive. Illuminating engineers should co-operate with sign builders, for there is room for improvement here. It might pay a merchant to keep two sizes of lights for use, the larger with darker goods and the smaller with lighter ones. Different sizes would work in well with different color schemes in the windows. A large number of lantern slides of representative window illumination were shown, with the object of bringing out the good and bad points of practice, and particularly to illustrate the importance of the comfort of the spectator. Outline lighting is a better feature in window work than outside illumination. It is a poor policy to repel the passerby by improperly distributed or too much light.

A brief discussion followed the address. Dr. Louis Bell emphasized the importance of designing signs for legibility at greater distances and urged the value of complete concealment and proper direction in window illumination. The distance at which signs can be read is often absurdly small in proportion to the size of the sign and the amount of current used. Too few units and too small letters tend to produce blurring of signs at short distances, and the separation of the letters or their component lamps should be carefully considered. It is a good plan to get away from the spot-light effect. The point was also brought out that when a central station advertises electricity by an electric sign there should be some means of directing the inquirer to the company, installed on the sign itself. To print "Electricity is Cheaper; Wire Up!" is well, but the company's name should also be included.

Carbon Primary Cell.

Mr. Ernst Waldeman Jungner, the Swedish electrochemis best known by his early work with the nickel-iron storage ba tery, has in recent years been engaged in finding a solution the old problem of the carbon primary cell, and in a pate granted to him April 20, he describes a cell of this type. Th electrolyte is concentrated sulphuric acid with certain additio to be mentioned below. The anode is amorphous carbon, whi the cathode consists of graphite, unattackable by the electroly and in such a form as to be capable of absorbing atmospher air. The simple reaction intended is the oxidation of the anod amorphous carbon by means of the atmospheric oxygen supplie to the cathode. The function of the electrolyte is simply t permit the transfer of oxygen from the cathode to the anod In this respect the cell is, therefore, of the "oxygen-lift" typ like the Edison or Jungner nickel-iron battery. But in th present case the anode carbon is gradually consumed, whi the graphite cathode remains intact. The electrical energy therefore produced at the expense of the carbon which forms th anode, and oxygen from atmosphere. The use of concentrate sulphuric acid instead of dilute acid is important, but has th disadvantage of high electrical resistance. Jungner, therefor makes additions to the acid to increase the conductivity and the same time render it easier for the electrolyte to abso oxygen from the cathode or atmosphere and deliver it to th anode. Such additions are nitrogen oxide gases NO, N_2O NO_2, or chlorine compounds of such gases, etc. The cell co struction is not as simple as the intended reaction, and the is the further complication that the electrolyte must be heate But Jungner claims that in his cell he utilizes 50 per cent the combustion energy of carbon, which, of course, is an eff ciency many times higher than can be obtained with the stea engine.

Electricity in a Modern Biscuit Factory.

Electricity furnishes the motive power for the largest biscu factory in New England, which was recently completed Boston by the Austin Biscuit Company at a cost of $1,500,0 The plant is the most complete cracker establishment in th world, the building, which is of reinforced concrete and bric costing nearly $900,000. The factory is located at the corner Causeway and Washington Streets, and is six stories in heigh 330 ft. long and 107 ft. wide, with 1000 windows in the plan The company manufactures 101 varieties of biscuit, and wh completed to the designs of the owners its capacity will 8,000,000 crackers in nine hours. Electricity is supplied to th plant from the company's installation in the basement of th factory. This means of driving the machinery and lighting th establishment was chosen on account of its cleanliness, efficien and convenience.

The power plant consists of four 100-hp return tubular Rob Mumford boilers operated at 125 lb. steam pressure, and thr electric generating units aggregating 425-kw capacity. The are a Harrisburg horizontal high-speed 260-r.p.m. engine dire connected to a 75-kw generator; a Harris-Corliss horizont 150-r.p.m. engine direct coupled to a 150-kw generator, and engine of the latter make direct connected to a 200-kw 15 r.p.m. generator. All the generators and most of the motors the plant were supplied by the Boston office of the Westin house Electric & Manufacturing Company. The generators a wound for 220 and 110 volts direct current, the higher potenti being used throughout the factory for power service and th lower for light distribution. The distribution for the differe floors is measured and controlled at a large switchboard the basement and iron conduit carries the cables to the cente of supply at the different floor levels, whence smaller condu runs to individual motors.

On top of the building are two electric signs advertisi "Sunshine Biscuit," one on the roof and the other on the corn of the building so as to be visible from all elevated trai

which pass the structure. There are 1155 incandescent lamps in the two signs, 4-cp lamps in the middle of the sign, 8-cp on the border, and 16-cp on the sinuous flashing portion. The sign flashers are each driven by a ½-hp, 220-volt General Electric motor.

A cold storage equipment has also been installed. This is steam driven with the exception of a propeller used to agitate the brine in the ice tank. The propeller is driven by a 5-hp, 1600-r.p.m., 220-volt General Electric motor. There are two cold storage rooms kept at 30 deg. and 15 deg. Fahr. respectively, and the company manufactures its own ice. Four Otis electric freight elevators of a capacity of three tons each are installed, each driven by a 30-hp, 220-volt motor. A special feature of the elevator service is the installation of annunciator locks at the different floors.

The first use of electricity in the processes of the factory is on the sixth floor, where flour and other ingredients are mixed in motor-driven machinery. The tubs of dough are rolled under steel knives mounted in frames, and the dough is churned by these knives until it is ready to be set aside to rise. In the mixing room are a 30-hp, 1100-r.p.m. motor belted to two three-spindle mixers; a 30-hp motor belted to three-barrel mixers, and a 13-hp, 1350-r.p.m. motor driving three-barrel mixers, one at a time. The motors are all mounted on platforms suspended from the ceiling, with their starting boxes close at hand. On the same floor and extending to the floor below for firing are 28 ovens, 16 of which weigh 400 tons apiece, some being of the Ferris wheel type and others of the English endless-belt type, 45 ft. long. In the American division of the baking room are 12 motors of 13-hp capacity each, and each motor drives by group method one rotary oven, one cracker machine, one break for rolling dough, and one conveyor running to the fourth floor. In the English department the company has introduced machinery which has never before been used in America, operated by two 25-hp, 1150-r.p.m. motors, one motor being held in reserve. There are three cracker machines, two ovens and three breakers in this division. The rolling and flouring of the dough, the kneading, salting, cutting and stamping are all handled by these machines. Each of the larger ovens consumes half a ton of coal per day. The output of the men in this portion of the plant is about 10 times that in the days of hand labor.

In the packing department, on the fourth floor, a number of motors are used to expedite the process. The biscuits are brought down to this floor on patent chain carriers driven by the motors on the sixth floor. The cartons in which the biscuits are packed are made on elevated platforms and are carried to the packers by small conveyors, there being seven of the latter, driven by two 2.5-hp, 1500-r.p.m. motors. A special feature in connection with the bringing down of the biscuits from the upper floor is the cooling of the recently cooked product by 30-in. fans as the conveyors pass a given point in the packing department. These crisping blowers are each direct driven at 1500 r.p.m. by 2-hp motors. In this department there are also a 13-hp, 1350-r.p.m. motor driving a cracker meal grinder by belting, and a 60-in. fan driven by another 13-hp motor. This fan is used to exhaust air from a drying room where icing goods are kept for a short time, the motor being located outside the room to secure the necessary cooling operation.

On the third floor of the plant is the dipping department, where fancy goods of the iced varieties are given their necessary coatings by machinery. Here are six marshmallow kettles operated in connection with two icing goods trolleys by a 13-hp motor. The goods which are iced or frosted are not handled in the process but are carried along the room by a spindle conveyor for drying. The icing machine, two cake-cutting machines and two icing tables are driven by another 13-hp motor. On the second floor are two buffers and three nailing machines driven by a 13-hp motor, the company making all its wooden and tin boxes. A machine shop is also located on this floor and the various lathes, grinders, saws and other tools are run by a 30-hp motor, which is also connected by line shafting and belting to drive a sugar-bolting machine.

The new building and its equipment were planned by Mr. J. Schull Loose, of Kansas City, a director of the company. The chief engineer of the plant is Mr. W. F. Sayles.

Central-Station Revenue and Cost in Massachusetts.

In the analysis of central-station operations the practice of individual companies is interesting from the standpoint of the specific problem and its solution, while the combined results of many stations' operation throw a clear light upon the general tendencies of the industry. To study the revenue and cost of operation of the central stations in a whole State may be instructive to a considerable degree, even though such total figures represent no single plant that is in service. The recently published report of the Massachusetts Gas and Electric Light Commission for the year ending June 30, 1908, presents some significant total figures for the operations of all the companies in that period. Table I gives the distribution of income for the central stations of the State as made up from the following items:

TABLE I.

Income of all Massachusetts Central Stations, 1908.

Commercial arc-light service by contract	$90,302.64
Commercial incandescent service by contract	137,136.47
Commercial arc and incandescent service by meter	6,092,317.51
Public arc light service	1,479,422.30
Public incandescent service	488,581.54
Electric power	1,825,729.34
Energy to other companies	237,433.19
Rent of motors	4,093.83
Rent of fixtures	14,795.59
Rent of meters	5,460.60
Steam-heating revenue	26,367.58
Total revenue from operation	$10,401,550.49

The companies earned approximately $630,000 more in 1908 than in 1907, and of this increase $400,000 was a gain in lighting business by meter rates. There was a decrease of approximately $29,000 in the flat-rate business compared with 1907, which indicates that the net new business in lighting by meter rates was about $370,000, or a gain of 6.5 per cent on the total meter lighting business of 1907. This was a gratifying indication of the progress of electric illumination in a year of depressed business. The sale of power was the second largest single source of revenue, the gain for power sales in 1907 being over $200,000, or 12.5 per cent. The percentage rate of increase of the power business was, therefore, approximately double that of the lighting business, but the total gain in revenue was less in the power field, on account of the lower rates prevailing for motor service. The total public-lighting service, arc and incandescent, slightly exceeded the revenue from power. In comparison with 1907 there was a gain in revenue from incandescent street lighting and a loss from the arc street-lighting service. As some of the public-lighting revenue probably is derived from municipal buildings, it is difficult to assign definite figures to the tendency toward more incandescent street lighting. The steam-heating business of the Massachusetts central stations was only $26,367 in 1908, about $11,300 less than in 1907.

Table II, on page 1016, shows the expenses of all the private companies of the State for the fiscal year 1908.

The largest single expense item was fuel, which was $160,000 larger than in 1907. Taxes came next, amounting to over $722,000. For every 3 cents paid in dividends the companies paid practically 1 cent into the public treasury in the form of taxes. About 12 per cent of the total expenses were due to taxation. It is significant that neither station wages, plant repairs, line repairs, lamps nor general salaries were as high as the item of taxes. There was a decrease of $14,000 in taxes compared with 1907. Station wages were about $70,000 greater in 1908 than in 1907. The reliability of electrical machinery as compared with steam equipment is indicated by the relative proportion of repairs, which was maintained in 1908 as well as in 1907.

The companies purchased about $2,000 less in carbons in 1908 than in 1907, indicating a slow advance of incandescent street lighting. The purchases of incandescent lamps increased about

20 per cent in 1908 compared with 1907, or by about $50,000. The companies spent approximately $63,000 more in 1908 for line maintenance. The total operating expenses increased $500,000 in 1908. Meter, lamp and motor repairs were $18,000 lower in 1908. The item of globes was reduced in 1908, indicating the losing hold of the arc lamp in street illumination.

TABLE II.

Expenses of all Massachusetts Central Stations (private companies), 1908.

Coal or other fuel	$1,348,844.91
Rental of real estate used for plant	101,285.81
Oil and waste	35,527.68
Water	57,598.55
Wages at station	679,238.95
Station repairs	43,505.85
Steam plant repairs	135,695.75
Electric plant repairs	89,866.35
Apparatus and machinery	48,413.51
Energy bought	230,412.09
Wages of meter men, collectors, clerical labor	286,654.88
Repairs and renewals to lines	549,659.96
Repairs and renewals to meters, lamps, motors	149,624.23
Distribution tools and appliances	94,294.11
Carbons	68,966.56
Incandescent lamps	299,291.52
Globes	3,926.30
Directors' allowances	14,171.22
Salaries of officers	225,902.51
General salaries	430,156.20
Rent of offices, if separate from plant	29,013.25
General office expenses	258,259.42
Taxes	722,154.68
Insurance	149,696.27
Law expenses	61,134.19
Claims	3,417.93
Bad debts	38,930.10
Incidental expenses	11,671.22
Total	$6,145,599.80
Other Charges.	
Interest	$389,143.48
Dividends	2,019,933.50
Depreciation	299,182.11
Sundries	834,822.76
Total	$3,543,081.85

Low expenses and claims were exceedingly moderate, in comparison with the troubles which street-railway corporations sustain.

As a whole, these figures indicate that conditions in the Massachusetts central-station field are thoroughly satisfactory.

Technical Welfare Work.

By Sydney W. Ashe.

Three years ago the Edison Illuminating Company of Brooklyn instituted a series of lectures on electrical engineering for their employees, of which the writer was given charge. This idea has since developed into an extensive system of educational work, now being carried on by the New York Edison Company, the Edison Illuminating Company of Boston, as well as its originator, the Edison Illuminating Company of Brooklyn. After three years' experience in this work it seems appropriate now to ask whether the undertaking has been a success, and if so, wherein have the various companies benefited. It is hardly necessary to go into the mechanics of this work as the details have been given from time to time in the various issues of the *Electrical World*.[1] The remarks of the writer will therefore be confined to the latter question. Increased loyalty of the men to their respective companies has been the first great benefit of this work. The personal interest of the various managements in their men has created a very kindly spirit and a feeling of pride in the home company. The men have felt that an effort was being made to raise their technical standard so that they could advance and in time occupy positions which now have to be filled by outside talent. The question may be asked as to whether the work would not in time serve to make the men discontented, whether they would not feel as they had attended all of the lectures in a season that they should immediately be promoted to general manager of the company. While it is true that a little knowledge is sometimes a dangerous thing, the results show that a little knowledge in this case has served more to whet the appetites of the men and make them realize their own limitations. They have become more earnest, more ambitious, more inquiring, less mechanical in their work, read the technical papers more, keep the librarians busy, have purchased many technical books and have kept themselves exceedingly busy.

The men have learned how to handle their apparatus in a more intelligent way, a slight mistake owing to ignorance of intelligent handling of apparatus often resulting in expense which would be far greater than the annual expense of the whole lecture course. In every lecture the particular points of danger in the handling of apparatus have been emphasized as most accidents are caused either by negligence or lack of realization of the full extent of the dangers which are always present, the possibilities of fatalities being thereby lessened. By having a better knowledge of things the men know better how to handle apparatus, and to locate trouble. As the time element is so important a factor in time of emergency in the lighting field, it is evident how very important is this characteristic of being able to analyze things quickly. Where such extensive educational opportunities exist the men are more contented and there is less of a tendency to shift to other companies, or, in other words, there is more of a spirit of "once an Edison man always an Edison man." The men also get a better idea of the whole of which they are a part.

These courses have usually been given in co-operation with the benefit associations of the various companies and have served to strengthen these associations, resulting in increased membership. For instance, in Boston a slight fee has been charged for the whole lecture course, as follows: $1 if the applicant is a member of the company and a member of the benefit association; $2 if he is a member of the company, but not a member of the benefit association, and $3 if he is not a regular employee, but a member of an affiliated wiring company. This method has increased somewhat the membership of the benefit association, has limited the attendance to those most interested, has served to flatten the attendance curve and has resulted in raising about $500 toward the expense of the course.

A very successful feature of this year's work in Brooklyn was the introduction of the supplementary talks given by the department heads and assistants at the lectures. These talks were limited to 20 minutes so as to relieve the department head of the burden and responsibility of preparing a lecture. The result of this system has been very gratifying, as it did much toward creating confidence in the men and also created a friendly competition between departments. It is rather interesting in this connection to note that the success of the meetings of the Brooklyn section of the National Electric Light Association has been due in no small measure to the co-operation of the men who gave the supplementary talks at the lectures. Fully two-thirds of the papers presented at these meetings and the discussions of these papers were owing to the men who had previously co-operated at the weekly lectures.

The enthusiasm of the lecture committee of the New York Edison Company was so great at the close of last year's course that they undertook to lay out and give this year an elaborate laboratory course in conjunction with the lectures. This course involved a very large amount of labor on the part of the lecture committee, but it has been quite successful.

The benefits of the educational work also extend to the lecturer in charge. He comes into close contact with men and with commercial practice and is very quickly relieved of the frills and hobbies that are too often characteristic of teachers. The success of each individual course requires careful planning, close study of conditions and human nature, the ability to keep creating something new, the keeping of close watch on new developments in the art and an immense amount of patience. Where the instructor is associated with a technical institution the same methods can be brought into the classroom. The result is wholesome and is what our technical institutions need.

Care must be taken with this work not to overdo it or its many benefits will quickly disappear. When with the meetings of various engineering societies and two or three evenings a week of educational work, it reaches a point where a man is at work each evening and feels that he is neglecting his duty if he does not keep up this pace, it is time to give the whole

[1] *Electrical World*, March 16, 1908.

latter a rest. However, this result can be avoided by limiting the educational work to one or two evenings per week, and then, if there are men who feel that they do not obtain sufficient benefit, they should be encouraged to attend some of the evening courses in our technical institutions.

The writer feels that the above work has done much to awaken the men and arouse their enthusiasm, has been a good asset for the various companies and has been a valuable experience for himself.

Automatic Thermo-Electric Control.

A patent was issued to Mr. H. Ward Leonard on March 3 relating to the automatic control of the energy supplied to an electrically heated tool. The patent states that if an electrically heated flatiron be used to iron damp goods as rapidly as possible, the iron becomes chilled, or if this difficulty be overcome by increasing the watts, then when the iron is idle it is likely to become destructively overheated. What is needed is a wide variation of the current, automatically controlled as needed to maintain a definite temperature irrespective of whether the iron is idle or is being worked to the limit.

The invention provides in the flatiron, in addition to the heating wire, an auxiliary controlling resistance of nickel or other material whose resistance responds immediately to a change of temperature. This change of resistance affects an exterior automatic, magnetically controlled switch in series with the controlling resistance, and the automatic switch, thus made responsive to a change in the temperature of the flatiron, is caused to vary the heating current as required. Thus in practice as soon as the iron is worked to the limit, this exterior automatic switch cuts out the exterior controlling resistance and causes the iron to take, say, three or four times as much energy as when it was idle. When the iron is set aside and tends to heat up under this very large working current, the automatic switch immediately inserts the resistance needed to prevent the iron from becoming overheated.

CURRENT NEWS AND NOTES.

OKLAHOMA ELECTRIC LIGHT, RAILWAY AND GAS ASSOCIATION will hold its third annual convention at Oklahoma City, May 18-20, 1909. Mr. Galen Crow, Guthrie, is secretary.

TELEPHONE DIRECTORS' MEETING OPENED WITH PRAYER.—The Charles City Telephone Company, of Virginia, has its directors' meetings opened with prayer, a minister being summoned for that purpose.

ELECTRICAL MACHINE DESIGN.—At a meeting of the New York Electrical Society, to be held in the Engineering Societies Building, on April 29 at 8 p. m., Mr. B. A. Behrend will deliver an illustrated lecture on "The Design and Characteristics of Modern Electrical Machinery."

MRS. TAFT PURCHASES ELECTRIC VEHICLE.—Mrs. W. H. Taft, who is an enthusiastic automobilist, has purchased an electric vehicle which she will operate herself. It is stated that Mrs. Taft desired to operate one of the large White House gasoline cars, but that this wish did not meet with the approval of President Taft.

VIENNA TRACKLESS TROLLEY.—A consular report gives some details of a trackless trolley line in Vienna extending 1.37 miles through a narrow street with high grades, which was placed in operation last November. The line is double in order that the vehicles coming and going may pass without interruption. The total cost of the plant was $11,253, and it is estimated that the line will fall short of meeting expenses the first year.

JAPANESE LIGHT AND POWER STATISTICS.—According to a consular report the total electric-light and power-generating capacity in Japan at the end of 1908 was 86,606 kw, an increase of 12,090 kw over 1907. Of this capacity 54,550 kw was generated by steam, 31,951 kw by water-power and 105 kw by gas engines. Last year the Tokyo Electric Light Company began taking power from Katsura, 47 miles distant, the voltage being 55,000.

SORTING CIGARS BY TUNGSTEN LIGHT.—A new use for the tungsten incandescent lamp is pointed out in the daily-newspaper advertisements of the Commonwealth Edison Company, of Chicago. It takes keen eyesight to sort cigars at the factory into "dark," "medium" and "light," and hitherto, it is said, this work has been possible only by daylight. Recently sorting by the light of tungsten lamps has been tried, and it is declared that the experiment was entirely successful, thus demonstrating the color value of the light from tungsten lamps.

TELEGRAPH COMPANIES AND OPERATING IN "FUTURES."—A bill has been introduced in the Legislature of the State of Illinois to prevent the sale or attempted sale of breadstuffs or provisions not actually owned by the person selling or agreeing to sell. This measure is intended, evidently, to suppress gambling in "futures" on the Chicago Board of Trade. One feature of the proposed law is that telegraph and telephone companies are made liable to a fine of not less than $1,000 or more than $10,000 for transmitting messages to aid in the sales prohibited in the proposed law.

DOMESTIC FLAMING-ARC CARBONS.—In our issue of April 8 a note on the carbon tariff situation included the statement that there are no indications that the manufacture of flaming-arc carbons will be undertaken in this country. Later it was learned that the manufacture of this grade of carbons had been started by a certain factory, and in recurring to the subject in the following issue in connection with the Senate tariff bill, a statement in regard to the domestic manufacture of flaming-arc carbons was modified accordingly. We are now informed by another carbon manufacturing company that it has been making flaming-arc carbons for about a year.

GOVERNMENT TELEPHONY IN SASKATCHEWAN.—After many premature announcements the Saskatchewan Government has finally purchased the system of the Bell Telephone Company in that province. The price paid was $367,000 in cash and there is yet due the province some $10,000 in unearned rentals. The system consists of 469.4 miles of long-distance lines with 13 exchanges. The transfer will be made at midnight, April 30-May 1. This was the last mileage the Bell company owned in Canada between the Great Lakes and the Pacific Coast, and press dispatches state the Ontario Government will shortly consider the purchase of the company's system in that province.

NINE-HOUR LAW FOR TELEGRAPH OPERATORS UPHELD.—Judge K. M. Landis, of the United States District Court in Chicago, has upheld the "hours of labor" law and decided that the Atchison, Topeka & Santa Fé Railroad violated the law with respect to telegraph operators in a case brought before him. The Government charged the railroad with employing telegraph operators at Corwith, Ill., over a longer period than 9 hours out of the 24. While it is true the operators were only engaged for nine hours in actual work, they were employed in broken shifts of 12 hours each. The argument of the defense was that the law means that no operator should be on duty more than 9 hours in the 24, but Judge Landis was of the opinion that the meaning of the law is that an operator cannot be on duty for more than the period of nine hours and that this starts when he begins work and ends when he is finally dismissed for the day.

ELECTRIC LOCOMOTIVES AND FOREST RESERVATION.—Legislation has been introduced into the New Brunswick Parliament providing that all railways running through the timber reserves must be equipped solely with electric locomotives.

TELEPHONE MUNICIPAL OWNERSHIP.—The Manitoba Government Telephone Commission has issued a notice to the effect that in future linemen and cablemen will work 10 hours per day instead of 9 hours as previously. No advance in salary will be given excepting to those paid by the hour.

HEATING VALUE OF COAL.—The U. S. Geological Survey, Washington, has issued a bulletin giving the results of the Government's purchase of coal under the heat value specification. The editor, Mr. John Shober Burrows, the engineer in charge of this part of the fuel problem, sets forth the advantages of the method of purchasing fuel on the heat-unit basis, and shows how successful the method has been in buying fuel for the Government.

INDIANA INDEPENDENT TELEPHONE ASSOCIATION.—The first quarterly meeting of the members of the Indiana Independent Telephone Association for district No. 2, composed of officials and managers, was held in Indianapolis, April 23. Questions of local interest were considered and delegates elected to the annual meeting at Indianapolis in May. Officers were elected as follows: Vice-president, Mr. Wm. L. Moellering; secretary and treasurer, Mr. Martin Umbalk.

WIRELESS IN JAPAN.—According to a consular report nearly all Japanese steamships on foreign lines are furnished with wireless telegraphy. In the navy all ships, from battleships down to torpedo-boat destroyers, are equipped with wireless telegraphy, and the wireless telephone was successfully used at the grand naval review off Kobe last autumn. The wireless telephone is being developed in the communication department and in the navy. The Teishinsho system of wireless telegraphy used has been developed in Japan and is stated to differ from the Marconi and De Forest systems.

CHICAGO-SOUTH BEND ELECTRIC RAILWAY.—The new Chicago, Lake Shore & South Bend Railway is being extensively advertised in the daily newspapers of Chicago. This railroad connects at Pullman with the Illinois Central Railroad, and six limited trains daily (except Sunday) leave Randolph Street, Chicago, for South Bend, Ind., 90 miles distant, which they reach in less than three hours. The new company says that it has the most modern and finest coaches ever put into service on any electric railway in the United States. Furthermore, it is declared that its trains make faster time than is made on any other electric railway in the world.

TELEPHONE RATES IN JAMESTOWN, N. Y.—The Home Telephone Company, of Jamestown, N. Y., by John H. Wright, general manager, has petitioned the Common Council of that city for authority to increase its rates. The present rates range from $14 per annum for the four-party line residence service, to $30 for single-line business service and are fixed by ordinance. The company petitions for a new schedule of rates ranging from $16 to $36 respectively. It is said that the cost of the plant was $286,015, while the net revenue for the year 1908 was only $14,415. Allowing 6 per cent interest on the cost of the plant and 3½ per cent for depreciation there would be a total fixed charge of $27,174. Deducting from this amount the net earnings would leave a net annual deficit of $12,758. The plant was constructed for a total capacity of 2000 subscribers' lines and there are now connected to it 2600 instruments, which has resulted in congested lines and impaired service; but to provide the extensions necessary the stockholders must be assured of a reasonable interest on the additional capital required. The Bell Telephone Company operating the same field is unrestricted as to rates. The present owners of the company are not the ones who originally built the plant. Mr. Wright says that the company "was organized on foreign capital and by men who had no previous knowledge of the telephone business, which, in a measure, accounts for the low rates agreed upon between the promoters and the city in granting the franchise."

PROPOSED RATE REDUCTION IN COLUMBUS, OHIO.—The committee of the Columbus, Ohio, City Council last week reported in favor of an ordinance which will make the maximum net rate for electric lighting in the city 6 cents per kw-hour. This action was taken in the face of protests from officers of the Columbus Railway & Light Company that energy cannot be furnished at that figure and that already there is a waiting list of about 1000 people to whom service cannot be furnished at the present rate of 7 cents, because the company cannot put in the connections and equipment at that rate. Vice-president E. K. Stewart stated after the meeting that the company cannot accept the proposed new ordinance and that it would not be legal for it to do so in the face of the fact that energy would have to be furnished at a loss to the stockholders.

FILIAL DEVOTION OF THE YOUNGER BIDWELL.—A rather pathetic sequel to the recent litigation in Chicago relating to the alleged "cold motor" of Benson Bidwell and his son, Charles E. Bidwell, has been made pubic. The Bidwells were recently convicted for operating a "confidence game" by promoting the sale of stock in a company to manufacture a "cold" electric motor for which fraudulent claims were made. The father, over 70 years of age, was sentenced to serve from 1 to 10 years in the penitentiary, but on the showing that he was a physical wreck and would probably die if subjected to long confinement, Judge Chetlain has vacated the original sentence and ordered the elder Bidwell to serve only 10 days in the county jail for petty larceny. This action was taken partly owing to the devotion of the son, who had an appeal pending staying the execution of his own sentence. In consideration of the leniency shown to his father, the younger Bidwell agreed to withdraw his own appeal, surrender his remaining rights and go forthwith to Joliet Penitentiary for an indeterminate sentence. This offer of a son to save a father was accepted on April 14.

BOYS INSPECT CHICAGO CENTRAL-STATION PLANTS.—One of the commendable enterprises undertaken by the Chicago Association of Commerce is an occasional excursion to industrial plants of interest in and near Chicago for sons of members. Thus the rising generation is shown in a very practical manner some of the principal props which underlie the commercial importance of Chicago. On April 17 there was an inspection trip of this character to the Quarry Street and Fisk Street generating plants of the Commonwealth Edison Company. About 340 youths and young men 14 years and over were included in the lively party. The boys were taken in special chartered street cars to the Quarry Street power house, and after viewing that they were ferried across the South Branch of the Chicago River to the Fisk Street plant, which was duly inspected in its turn. Luncheon was served in the boiler-room at Fisk Street and after a photograph had been taken of the merry "bunch" the boys dispersed to their homes. The party was in charge of Messrs. W. R. Humphrey, William A. Gibson, George E. Plumbe and William Hudson Harper for the Association of Commerce, and Mr. W. L. Abbott, chief operating engineer of the Commonwealth Edison Company, did the honors for his company. The officials of the Association of Commerce were greatly pleased at the careful arrangements made for the reception of their boys and also for the hospitality shown by the Edison Company. It is safe to say that this aggregation of young men from families of influence will have a much better conception of the importance of the electrical service of Chicago than before taking this visit.

Central Heating and Lighting Plant for the United States Military Academy.

By Henry C. Meyer, Jr.

DURING the past few years Congress has appropriated $7,500,000 for the enlargement and improvement of the United States Military Academy at West Point, N. Y., made necessary by an increase in the Corps of Cadets. After an architectural competition had been held, Messrs. Cram, Goodhue & Ferguson, of Boston, Mass., were selected as the architects for the undertaking, with Messrs. Olmsted Brothers, of Brookline, Mass., associated with them in the landscape work. The general plans of the work were completed and many of the contracts awarded during the superintendency of Brig.-Gen. Albert L. Mills, whose successor, Col Hugh L. Scott, has since directed the preparation and approval of plans and the carrying on of the work.

The plans finally approved by the Secretary of War contemplated the erection of a new cadet headquarters, cadet barracks, hotel, academy building, administration building, chapel, bachelor officers' quarters, 35 officers' quarters, cavalry and artillery stables and barracks, quartermaster's storehouse, quarters for the superintendent and staff, riding hall, power house and other buildings of lesser importance.

While some at West Point seemed inclined toward a central plant for supplying steam as well as electricity to all of the buildings, this idea was abandoned as it was believed that all of the distributing steam pipes should be placed in tunnels of sufficient size to permit inspection and repairs to be made. As the buildings at the extreme north and south end of the post were separated by a distance of over two miles steam distribution through tunnels was out of the question. It was, therefore, decided to restrict the distribution of steam to the buildings bordering upon the parade and to those lying south of the parade as far as the hotel. The only large building not served would be the cavalry and artillery stables and barracks at the south end of the post, the quartermaster's stores and other smaller buildings to the north, and these will be taken care of by separate plants.

The consulting engineer was instructed to design a plant capable of supplying sufficient steam to warm and ventilate the large buildings of the central group then proposed and of furnishing electricity for all purposes for the entire post; to construct a power house of sufficient size to permit the installation of such boilers and electrical generating apparatus to take care of the demands should the Corps of Cadets be increased to 1200, and to provide storage capacity in the power plant for 4500 tons of anthracite coal. This was desired so that coal could be delivered when the Hudson River is opened to navigation and at a time when freezing weather would not interfere with coal handling. So large a storage capacity also reduced the opportunity for strikes to affect the operation of the plant. A study of the situation, based upon the plans for buildings then proposed, seemed to indicate that about 3000 hp would be required for warming and ventilating the buildings and supplying hot water for bathing purposes, with a possible increase of 600 hp required by the increase in the corps mentioned. The probable maximum electrical load seemed to be about 1200 kw for the buildings immediately contemplated and about 200 kw additional for the increase.

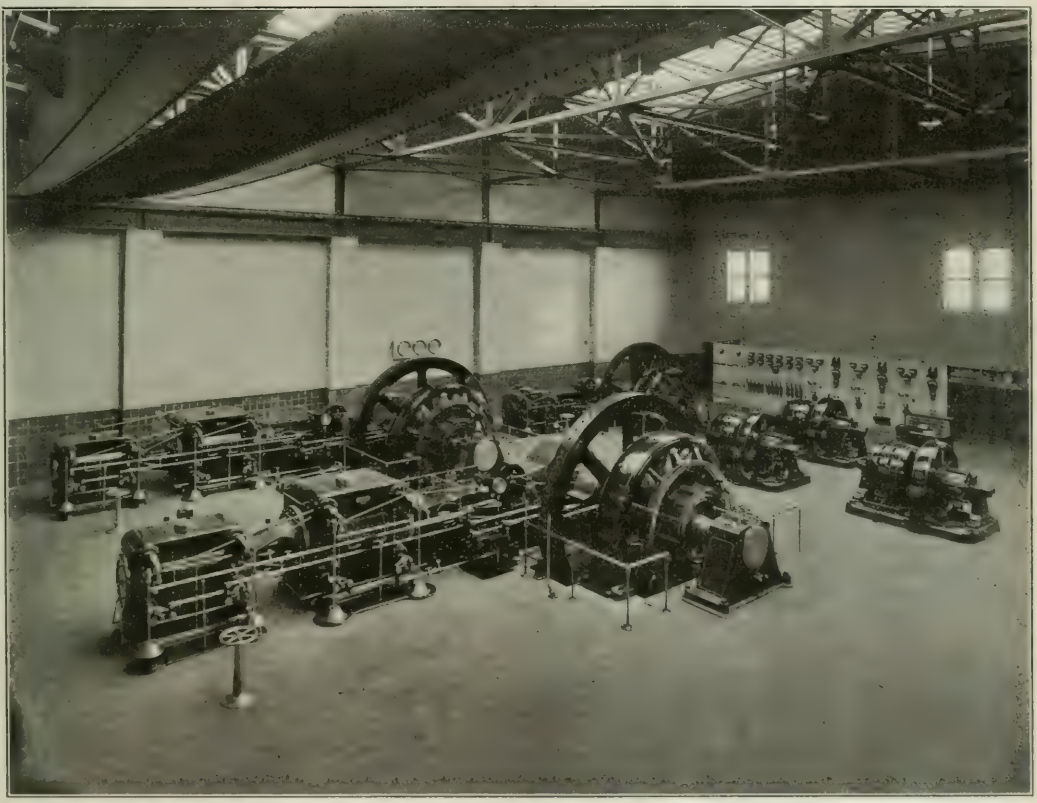


FIG. 1.—GENERATOR-ROOM IN POWER PLANT AT WEST POINT MILITARY ACADEMY.

After considering a number of possible sites, it was finally

decided to blast out a pocket in the rocks over the southern entrance to the railroad tunnel and there locate the power house; to conceal the chimney in the tower of a riding hall soon to be built, and to provide means for the mechanical handling of coal either from rail or water delivery, and for the disposal of ashes in a manner that would not be objectionable in so prominent a location. The natural contour of the rock at the site selected, and the desire to depress the roof line of the building so as not to cut off the view of the imposing south front of the riding hall, led to the adoption of a somewhat unusual arrangement of the building. Rock was found at a short distance below the grade at the railroad siding of such a character as properly to support a masonry structure on which it was intended to run the cars for the delivery of coal. This same structure carries a tower for the storage of ashes. The boiler house extends north and south, and contains a boiler-room on the main floor, with basement extending under the front of the boiler-room only. The coal bunker above is a large box-like structure 148 ft. long, 57 ft. wide between column centers and about 21 ft. 6 in. deep on the clear. A tower on one of the corners of the boiler-room contains the elevator for raising coal, and this tower is connected to the ash tower by two masonry walls roofed over to form an enclosure for the belt that conveys the coal from the cars up a steep incline to the base of the elevator. The engine-room has a basement beneath and a tower at the corner of the room provides the principal means of access between the engine and boiler-rooms, also space for the chief engineer's office, and locker and bath-rooms for the operating force.

The building is faced with natural rock quarried at West Point and arranged as random-coursed ashlar and the style is Gothic to harmonize with the other buildings. The coal bunker, roof trusses and floor systems are carried on steel columns resting on heavy cast-iron bases, and the outer walls do not carry any load other than their own weight. As the coal bunker was planned to contain 4500 tons of coal, the design of the steel work was somewhat out of the ordinary, particularly as each interior column had to carry part of the weight of the boilers. The maximum load on any column was 304 tons. The floor of the bunker consisted of heavy steel beams framed into the girders and supporting a concrete floor of varying thickness and laid so as to drain to the middle point of each bay. On account of the heat given off by the boilers expansion joints were provided for in the beam and girder construction, and the concrete floor was laid in squares the size of the bays with an open joint between, which was afterward filled with oakum and pitch. The side and end walls of the bunker consisted of beams framed into girders at the top and bottom with concrete walls laid between. The plans for the steel work were prepared by Joseph H. Wallace & Company. The engine-room has a floor of Welsh quarry tile, which is dark red in color and non-absorbent. The side walls have a wainscot about 5 ft. high of a very dark-green Rookwood tile. Above is the face brick, which is Kittanning non-absorbent and a light buff in color. The roof trusses and traveling crane are painted a dark green and the color scheme is very pleasing.

BOILERS.

The boiler plant at the present time contains four Babcock & Wilcox boilers, each containing about 4400 ft. of heating surface with tubes arranged 21 sections wide and 10 tubes high. The boilers are of the usual forged-steel construction. The grates are of the Treadkill type, with 87 ft. under each boiler, giving a ratio of heating to grate surface of 50 to 1, an unusual one with small-size anthracite coal, but permissible in this case as mechanical draft is available when needed. The boilers are suspended by straps around the drums from horizontal channels carried by the building columns and the spacing of the columns is such that two columns are located between each battery of two boilers requiring that the boilers in each battery be spaced sufficiently to prevent the heat of the furnace from affecting the columns. To save space the usual 17-in. side wall was reduced to 13 in. opposite the column and vertical cast-iron channels bolted to the wall to secure an air space. The spaces in front of the columns and between the ends were closed by iron plates secured to the flange of the channel and the bull-nosed brick laid to finish against the plate and thus present a proper appearance. The feed pipe is on the level of the boiler drums, and the feed valve has an extension spindle extending to the wheel-hand high above the boiler-room floor.

The chimney, which will be later inclosed by the tower of the riding hall, is of the Custodis radial-brick type with an inner core 10 ft. inside diameter at the top and 140 ft. above the grates. The chimney contains an inside ladder, also lightning rods connected by a copper cable with an extension run down to the river and there connected to a submerged copper plate. As the free exhaust from the engines at the power-house roof would be objectionable, it is discharged at the top of the chimney through a 16-in. cast-iron flanged pipe run up inside of the chimney and stayed to it in such a manner that the pipe can expand easily. As the chimney was limited in height by architectural considerations, and is not high enough to obtain sufficient draft to burn low-grade coal to run the boilers at their rating, a mechanical-draft plant was installed. The plant consists of two Sturtevant fans and engines, each fan furnishing 55,000 cu. ft. of air per minute at a pressure of 2½ in. of water. Both blowers and engines are located on a mezzanine floor, and each blower discharges downward through an iron duct into a masonry duct below the boiler-room floor level and extending across the boilers in the rear of the bridge wall. Connections lead to the ash pit, and they have the usual dampers operated by levers extending through the fronts of the boilers. The fans are controlled by a Foster regulator actuated by the boiler pressure.

Each boiler is connected by a smoke connection of steel plate put together with angles to the bottom of the main smoke flue, which is supported by beams from the building columns. The flue has a concrete floor, brick side walls and double rowlock brick arches sprung between transverse I-beams for a top. Expansion joints are provided in the flue. The smoke flue is provided with a pair of dampers close to the chimney. They are of cast iron heavily ribbed and suspended from the steel floor-beams of the coal bunker by several links of a chain with a turnbuckle for vertical adjustment, the chain tending to make them operate more easily. The damper is fitted with a Locke damper regulator. This is not used when the fans are in operation.

COAL AND ASH HANDLING.

Means are only provided at the present time for the mechanical handling of coal delivered by rail, but the system is designed with the idea of taking care of coal by water at any time that it might be desired so to receive it. As the facilities for switching cars at West Point are somewhat limited it was decided to arrange for the unloading of four 50-ton hopper-bottom cars without shifting and two tracks were arranged for so that two cars could be run in on each side of a belt conveyor, and slightly above it, so that a gravity discharge could be obtained through chutes onto the belt. Two of the cars can be run under the large tower and there is space for two others outside of the tower. The belt runs from beneath the unloading platform upward at an angle of about 23 deg. to the base of the tower at the southeast corner of the building, and there discharges into the boot of an elevator which raises the coal to a point above the top of the bunker. The coal is then spouted onto a transverse belt conveyor extending across the south end of the boiler house. This discharges into a bunker below or onto either one of two longitudinal belts, which deliver through automatic trippers into any part of the bunker beneath them. The first conveyor and the transverse conveyor are each 18 in. in width and the longitudinal conveyors are each 16 in. wide. The specifications required that the system handle 60 tons of 2240 lb. each per hour. The conveyor has upon test considerably exceeded this requirement. The elevator buckets are connected by a two-stand, drop-forged chain with malleable-iron bucket attachment with heavy steel pins. The elevator is enclosed in a casing of heavy steel

plates put together with angles at all corners and joints. To prevent the elevator from falling and jamming in case of breakage, the pins are extended into a channel on the inside of the casing made of a pair of angles. The conveying system is operated by three Westinghouse motors, one driving the lower conveyor, one driving the elevator and the transverse conveyor and one driving the two longitudinal conveyors. The motors are of the enclosed type, and the starting boxes are enclosed in dust-proof iron boxes. An electrical connection is run from each starting box inside of the switch to a pilot lamp on a



FIG. 2.—REAR VIEW OF ALTERNATING-CURRENT SWITCHBOARD.

board in the boiler-room. This board also contains an automatic circuit-breaker in the main feed supplying all of the motors. The solenoid of the breaker is connected by wires to push buttons at various parts of the conveying system so that an attendant can, by pushing a button, stop the operation of the entire coal-handling plant when necessary. The motion of the shaking chutes regulating the delivery of coal from any car to the lower belt is controlled by a wheel on a shaft extending up through the platform on which the cars are located. The conveying system was supplied by the Robbins Conveying Belt Company.

Coal is discharged from the bunkers to the boiler-room floor by numerous chutes at points convenient for firing. As the bottom of the coal-bunker floor is flat, to give maximum storage capacity, similar chutes are provided at the rear of the boilers and arranged to dump into Hunt standard charging cars so that the coal may be carried on tracks to the front of the boilers. The chutes have a valve at the bottom and also a sliding gate just below the bunker-room floor level.

The ash pits have a deep hopper bottom so arranged with chutes that the ashes may be drawn out into industrial cars and run through the boiler room basement and on the roof of the conveyor incline over an ash hopper that will be constructed at a later date in the upper part of the tower so that ashes may be discharged into railroad cars for removal. At the present time the ashes are being used for filling in and are being discharged through a temporary opening in the side wall of the power house.

ENGINES.

The conditions existing led to the adoption of direct current at 240 volts for both lamps and motors and for alternating current at 2200 volts for the extreme north and south end of the post. It was decided to install at the present time two 400-kw and one 200-kw direct-current generators, each of the former driven by a tandem-compound Corliss engine and the latter by a simple Corliss engine. Motor-generators are used to obtain the alternating current. As part of the exhaust steam from the engines could be used for heating during the winter months and as the river is 60 ft. below the engine-room level, the use of condensers was not considered advisable. The Providence Engineering Works were awarded the contract for the engines. The specifications called for a normal working pressure of 130 lb. at the throttle, but which might be increased to 150 lb. when considerable back-pressure was placed upon the engines during the heating season. The speed was limited to 100 r.p.m., and the engines were to be capable of running at 50 per cent overload for short intervals. The compound engines are each provided with a large reheating receiver containing 0.6 sq. ft. of reheating surface in brass pipes per rated horsepower of the engine. The simple engine has its cylinder steam jacketed in both heads only and the compound engines have high- and low-pressure cylinders jacketed in a similar manner. All of the engine piping is below the engine-room floor and the main throttle valve and the valve in the exhaust pipe are operated by floor stands. After erection the engines were subjected to a rigid test by Mr. George H. Barrus. The



FIG. 3.—REAR OF DIRECT-CURRENT SWITCHBOARD.

builders guaranteed that the steam consumption of each compound engine would not exceed 19 lb. of steam per ihp with a steam pressure of not less than 130 lb. at the throttle and 1 lb. back-pressure in the exhaust pipe. The friction load of each compound engine was guaranteed not to exceed [illegible] per cent of the rated load, taken at 600 hp. The steam consumption of the simple engine was not to exceed 23 lb. per ihp per hour when the engine is developing from 275 hp to 325 hp with a steam pressure not less than 130 lb. at the throttle valve and 1 lb. back-pressure at the exhaust valve. The friction load of

the simple engine was not to exceed 4½ per cent of the rated load, taken at 300 hp.

The tests showed that the steam consumption of the compound engine was 3.5 per cent better than the guarantee and the simple engine 8.8 per cent better, and that the friction of the compound engine and simple engine was within the limit guaranteed.

PIPING.

The piping in the power house consists of a system of pipes conveying steam to the engines and pumps and also to the high-pressure line run through tunnels to the various buildings. The exhaust steam from all engines and pumps is run through a grease extractor and pipes are provided for conveying exhaust steam for warming buildings adjacent to the power house, the exhaust steam being carried as far as the Academy Building. Means are provided for supplementing the exhaust steam by live steam direct from the boilers through reducing valves and reducing valves are also used to lower the steam pressure on the direct lines of the buildings from the usual boiler pressure of 135 lb. to from 80 lb. to 100 lb. for the tunnel system. Fig. 2 shows the arrangement of the piping in the power house. During the heating season the exhaust steam passes through the 16-in. line through the basement of the engine-room to the entrance of the steam tunnel and as it rises to the tunnel, connection is made with the high-pressure lines which supply steam direct from the boilers through Foster reducing valves to supplement the exhaust steam when it is insufficient in quantity to warm the buildings connected to the exhaust heating system. All points at which steam might collect in the high-pressure system, the reheating receivers on the compound engines and the steam jackets on engine cylinders, the separators and steam-supply pipes are all connected to the Holly gravity-return system. The condensation that occurs in the various buildings connected to the central plant is returned to the power house by Bundy pumping traps. The feed-water pumps are of Worthington manufacture and the heater is of the Wainwright type.

All high-pressure steam pipes in the power house and in the tunnel system 2 in. in diameter and over are provided with extra heavy flanged fittings and with extra heavy flanges for connecting the piping. In all of this piping, 5 in. in diameter and over, the Rockwood type of joint, sometimes called the Van Stone joint, with rolled-steel flanges, made by the Latrobe Steel Company, is used. All of this work and the pipe bends were manufactured by the M. W. Kellogg Company for the Thompson-Starrett Company, which firm had the contract for all piping work in the power house and tunnels.

ELECTRICAL EQUIPMENT.

A preliminary load curve that was constructed, based upon the size and probable use of electricity for lamps, motors, etc., was similar in character to that in a city-lighting plant, but with a smaller demand for current. While the greater portion of the load consists of lamps, a considerable number of elevators are to be used in the buildings comprising the central group, all of which are located within a short distance of the power house. The Cadet Mess Hall contains a most elaborately equipped kitchen and bake shop, and a large number of motors are used for dish-washing, bread-making, food preparing and other purposes. The large building that will be erected for the Quartermaster's Department will be fitted with all kinds of machinery, which is to be electrically driven by motors, in many instances of variable speed.

Practically all of the buildings on the grounds requiring energy for motors are within 2700 ft. of the power-house site. The large group of buildings at the south end of the grounds, about 8000 ft. from the power house, comprising the cavalry and artillery barracks, had an estimated wired load of 75 kw in incandescent lamps. The Soldiers' Hospital is located at the extreme north end of the reservation, and it is intended to erect at this point a large group of small houses for soldiers. All of these buildings, as well as the various groups of officers' quarters, require energy for lamps only.

Before a decision was reached as to the kind of distributing system best suited to the conditions, two systems were considered. The difficulty of obtaining a balance in a three-wire system and the desire to use direct current as far as it could be used with economy, led finally to the adoption of a 250-volt, two-wire system, and it was found that this could be used to supply energy to about 75 per cent of the total expected load without great expense. To take care of the balance and to supply street lighting it was decided to use motor-generators delivering 60-cycle, single-phase current at 2200 volts to supply energy to buildings at the extreme north and south ends of the grounds and for supplying the series street-lighting system through tub transformers.

The load curve indicated that the maximum lighting load for the buildings supplied with direct current amounted to 925 kw for lamps and 120 kw for motors, with a maximum of 250 kw for alternating-current lighting with 90 kw for series street lighting. All of the projected buildings have not yet been completed. At the present time there is installed two 400-kw and one 200-kw generators, the former driven by tandem-compound Corliss engines and the latter by a simple Corliss engine, all made by the Providence Engineering Works. The normal full-load voltage of all generators is 250 volts, but means are provided for varying the voltage within reasonable limits. Each generator was designed to over-compound 10 volts from no load to full load to compensate for the drop in the feeder system, but this may be reduced to various lesser amounts of over-compounding by means of a special series field shunt.

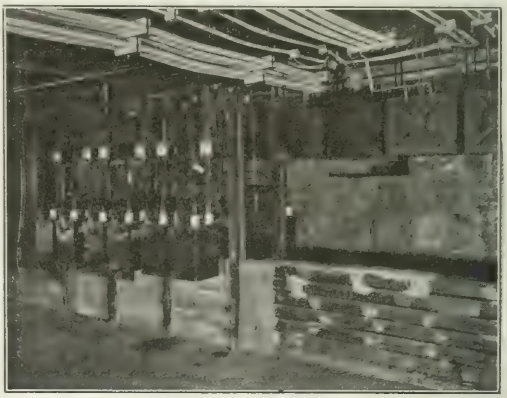


FIG. 4.—SWITCHES AND CONTROLLERS IN BASEMENT UNDER SWITCHBOARD.

Three motor-generator sets have been installed. The generators have a normal load of 125 kw with a single-phase, alternating e.m.f. of 2400 volts at a speed of 600 r.p.m. Means are provided for varying the fields of the motors should the speed tend to change due to any change in the direct-current e.m.f. The motor-generators are, of course, arranged to operate in parallel. All electrical apparatus in the power house was supplied by the General Electric Company.

The generators and motors are connected to the switchboard by fireproofed rubber-covered cables hung in porcelain insulator racks supported from the basement ceiling. The alternating- and direct-current sections of the switchboard are separated by a wrought-iron grille. The direct-current buses extend from the generator panels to the right through a direct-current station panel to the feeder panels, and to the left through an alternating-current station panel to the motor-generator panels. The 2200-volt, alternating-current feeder panels are to the left of the motor-generator panels with the series street lighting panels on the extreme left. The 2200-volt feeder buses and oil switches with transformers are located in the basement directly under the board. Whenever it is necessary to add another pair of motor-generator panels or

nother direct-current generator panel it can be done by removing as much of the iron grille as is necessary, the grille being so constructed that one, two or three panels may be added and still place the doorway midway between the sections of the board.

The direct-current distributing system comprises an extensive system of feeders, the outer terminals of the feeders being looped together by mains, and it is the intention to keep the mains at approximately constant voltage throughout their length. Pressure wires are run back to the power house from the junctions of feeders and mains and a sliding voltmeter switch is provided on the station desk for reading the voltage at the junctions. There is a double set of positive feeder buses with a negative feeder bus. The positive leg of each feed, being connected to the middle point of a single-pole, double-throw switch, may be thrown on to either positive bus as required. By means of this arrangement and double-throw, generator main switches the generators may be run at slightly different voltages, one connected to the high-voltage and the other to the low-voltage bus, and each feeder may be thrown to the high-voltage or the low-voltage bus, as may be desired, in order to maintain equality of voltage at the mains and to compensate for unequal drop in different feeders.

The switchboard is of blue Vermont marble and consists of 21 panels of a total length of about 67 ft. The generator panels contain double-pole main switches, field switches, voltmeter switch, single-pole circuit-breaker, ammeter and rheostat wheel. A pilot lamp is placed on each board and this is wired on the generator leads inside of the main switch and circuit-breaker so that there will be light on the board when the generator is running even though the circuit-breaker might open.

The direct-current station panel contains two station-type voltmeters on a swinging bracket, one station ammeter and two kw-hour meters, one for the high and one for the low-voltage bus. The two voltmeters on this panel are connected to the pressure wires in two feeders, one running to a nearby junction and one to a remote junction so the switchboard operator may see at a glance if equality of voltage in the mains is being maintained.

The direct-current feeder panels contain the double-throw switches and an ammeter in one leg of each feeder. Each leg of each feeder connects to the board through a composition open link fuse of sufficient capacity to open only when the feeder is dangerously overloaded, and then only when the overload is of a continuous nature. These fuses are mounted on a soapstone slab supported free from the board and protected with flame guards.

The alternating-current station panel contains a differential

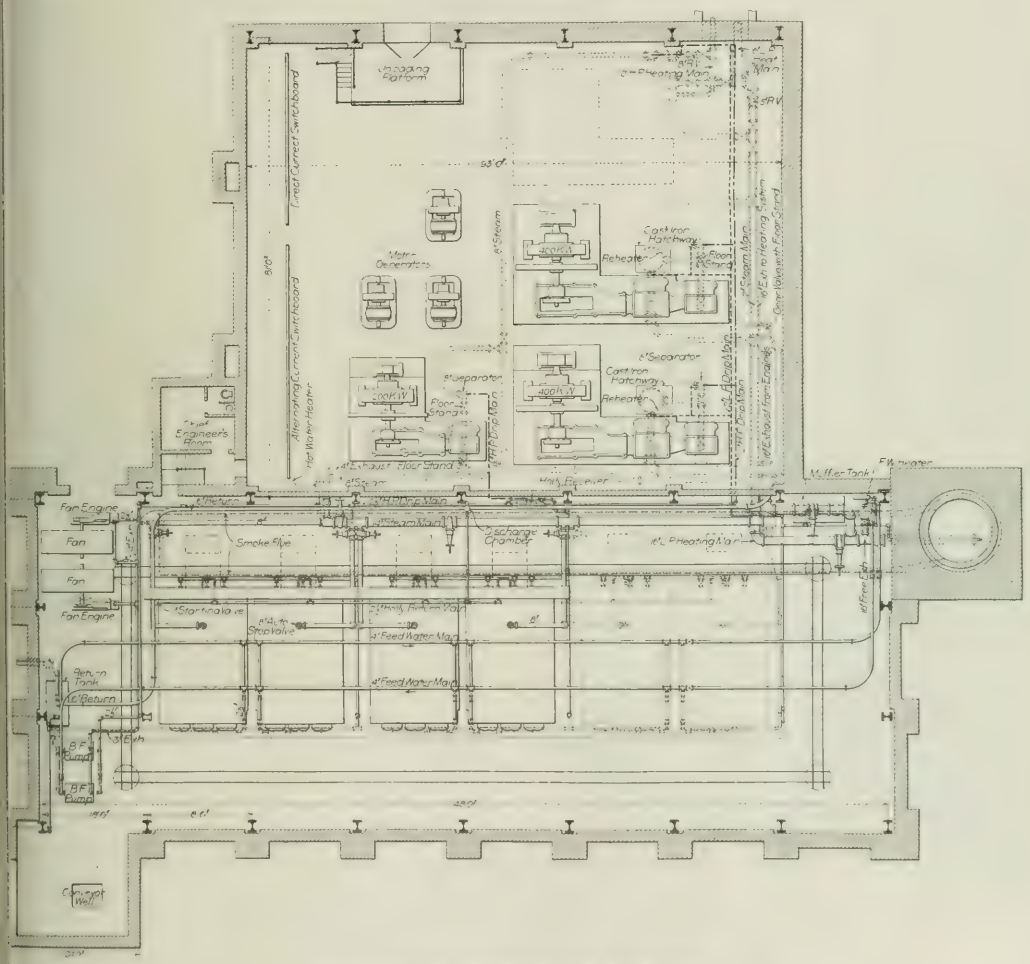


FIG. 5.—PLAN VIEW OF GENERATOR AND BOILER ROOMS

galvanometer and one station-type voltmeter, both on a swinging bracket, either being used in paralleling the generators. There are also rotary switches for the station galvanometer and voltmeter and a double-pole plug voltmeter switch for connecting the bus coil of the galvanometer to either the positive high-voltage bus or the positive low-voltage bus. The energy for the motor-generator and the station lamps, which are controlled from the station panel, is recorded by a kw-hour meter on this panel.

The motor section of the motor-generator panels contains a double-pole circuit-breaker interlocked with the corresponding alternating-current generator switch, field-circuit ammeter, main switch, starting rheostat with a five-stop multiple-interlocked starting switch with no voltage release, while the generator section contains voltmeter, ammeter, a frequency indicator, a field-switch rheostat and combined single-phase oil switch and automatic circuit-breaker with auxiliary tripping coil operated by the motor circuit-breaker. The generators are paralleled by a synchronizing lamp and by a voltmeter connected across the lamp terminals. The feeder panels contain ammeters, plug switches for ground detector readings, and the operating mechanism of the combined oil switches and circuit-breakers. The street-lighting panels contain an ammeter and ammeter jack, and plug switches for each circuit. Explosive high-tension fuses are placed behind the board in each circuit.

The system of distribution is by an underground cable system with rubber-insulated, lead-covered cables manufactured by the Okonite Company. The work of drawing in the cables was done by Messrs. Johnston Livingston, Jr., & Company, under the direction of the cable makers, who also furnished splicers for the work.

All direct-current cables are single-conductor, lead covered; all alternating-current cables, except transformer leads, are of the duplex type in a single lead sheath. Each leg of a direct-current feeder was made up with two potential leads or pressure wires in the outer layer of strands, each pressure wire being No. 15 covered with an insulating wall of such a thickness that the space occupied by each lead with its insulation is equal to the space occupied by a single strand of the cable. One of the leads in each cable is used as a testing lead when necessary or in case of breakdown of the other lead.

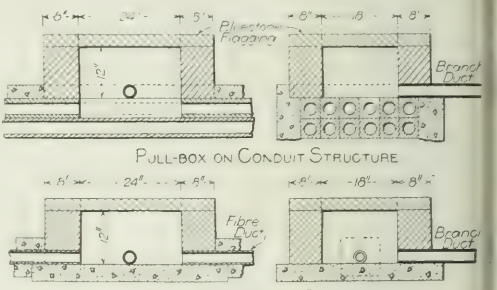
At the present time 11 direct-current feeders have been installed and each leg terminates in a water-tight junction box in a manhole, where connection is made to the corresponding leg of the main and to such buildings as may be served from the manhole. The positive and negative are separate throughout, there being separate positive and negative junction boxes. A drawing of a typical box is given. These were made in four standard sizes with connections for three, five, seven and nine cables. The boxes were designed especially for this work and are believed to possess some points of interest, one being the comparatively small amount of space required inside of the box. The cables enter through water-tight stuffing boxes, the stuffing boxes being made to answer for any size of cable by means of a brass ring and a brass gland, each of which has a hole the proper size for the cable that is to pass through it. The ring acts as a seat for the packing beneath the gland. The entering cable terminates in a flat lug which is bolted to one end of a copper block, to the other end of which a composition link fuse is bolted and serves as a connection between the feeder terminals and the box bus. The bus is mounted on a soapstone seat and composition link fuses serve to make connection between the bus and the copper blocks to which the main and house branch terminals are bolted in a manner similar to the connection at the feeder block. The pressure wires are connected to the bus through a plug fuse cut-out. The junction boxes are provided with rubber gaskets and heavy bronze nuts and bolts for securing the cover in place. The junction boxes were made by Messrs. Russell & Stoll, of New York, in accordance with the writer's specifications.

The alternating-current house-lighting system consists of 2200-volt, duplex conductors connecting through single-pole cut-outs to transformers located in a few instances in manholes and in most cases in vaults forming part of the building supplied. In the case of the different groups of officers' quarters, one transformer serves a number of buildings. The greater portion of the secondary distribution consists of a 120-240-volt three-wire system and in the case of the officers' quarters, which are small residences, a three-wire service is brought into each building to a three-pole cut-out and the two-wire distribution in the different quarters are connected alternately to the different sides of the three-wire main so as to obtain proper balance.

The alternating-current junction boxes are also waterproof and are of usual construction. They are of the single-pole type provided with enclosed fuses and they are equipped with water-tight stuffing boxes with a brass nozzle for the entering cable, the lead sheath of the cable being wiped to the nozzle. Alternating-current junction boxes are used as transformer cut-outs only. The secondary transformer leads are wiped directly to the low-tension mains. The service connections to buildings are wiped directly to the low-tension mains, where there are any, or to the transformer secondary leads in the absence of mains.

Cut-outs are placed on all service connections inside of each building at a point close to where the wires enter the building. The cut-outs are of the Sachs type and contain fuses that are disconnected by opening the box cover. These cut-outs are used for the direct-current work and for most of the alternating-current distribution.

During the erection of the power house the tungsten lamp made its appearance and as the prospect of its success seemed



PULL-BOX ON CONDUIT STRUCTURE

PULL-BOX IN FIBRE CONDUIT

FIG. 6.—DETAILS OF DISTRIBUTION BOXES.

to be assured, arrangements were made in the cable contract and in the wiring of buildings supplied with direct current for changing over to a 120-240 three-wire system, in case such a change seemed advisable. For this reason three-pole service cut-outs were installed. If this change is ever made a single conductor, neutral main may be pulled into the conduit system to which neutral leads from the various buildings may be connected. The system is so arranged that a few neutral conductors will have to be run from this neutral main to the power house, where a single neutral feeder panel can be installed together with the necessary operating panel for balancers.

When the question of street lighting was first considered the several methods then in general use were discussed and various forms of lamp-posts for both arc and incandescent lamps were examined. The board of officers to whom the matter was referred objected to the use of arc lamps at the Military Academy, and when the usual form of incandescent lamp-post was shown to the architects, the objection was made that a lamp-post bearing a resemblance to a shepherd's crook was entirely out of place at a school for training soldiers. The architects were very desirous of using the old-fashioned lantern of Gothic design with iron corners and top. The writer held that the lamp should be supported in a pendant position and the iron top was designed to take the same type of lamp holder and socket that is used for series incandescent work. The holder is screwed into a tapped casting in the upper part of the lantern and the lamp-socket slips into the holder and is held by means of the usual contact clips. The cables pass

through the post and divide upon entering the lantern, continuing up in diagonal corners of the lantern and connecting to the terminals on the lamp-holder. As the cables have an insulating wall of 6/32 in. thick and this is covered with a triple layer of braid, care had to be taken in concealing the cable and designing the parts of the post so that the cable could be easily pulled in and connected. It would have been practically impossible to have used this lamp-post without ground glass in the lantern, the use of which was suggested to the writer by Mr. V. R. Lansingh. With plain glass, which was tried, the broad black shadows cast by the four iron corners of the lantern and by the base made the lighting very unsatisfactory. With ground glass, however, the shadows, even those around the base of the lamp-post, entirely disappeared. A further advantage of the ground glass lies in the fact that the high intrinsic brilliancy of the filament is entirely avoided.

SUBWAY SYSTEM.

The distribution of electricity is entirely by an underground subway system consisting mainly of single clay ducts with brick manholes, with branches from manholes to buildings and from manholes to street lamp-posts when the post is near enough to the manhole to make this method advisable. Where lamp-posts, along the line of the clay duct subways, are not close to manholes, a pull box, as shown in Fig. 6, was constructed. One duct in the upper layer of ducts opens into the pull box and a branch connection of fiber is run to the base of the lamp-post. In streets or roads through which the main subway does not extend the street lamps are fed from cables run through a single-fiber duct laid in a concrete envelope with pull boxes opposite the lamp-posts. Some of the roads are bounded on the east side with stone walls and in some instances the street lamps are located upon the walls. The cables for posts so located are run in wrought-iron pipe hung beneath the projection of the wall coping on the east or far side of the wall so as to be invisible. The conduit sections for this work terminated in cast-iron pull boxes set in the wall with door and branch conduit extending into the base of the post. The total amount of clay conduit installed was about 85,000 duct-feet with 83 manholes and 142 pull boxes.

The contract was a flexible one in that it called for unit prices per foot of conduit for various numbers of ducts; for unit prices on different types of manholes; for excavation in earth to various depths; for excavation in rock; for brickwork, concrete and manhole covers, so that there could be changes in location and reasonable changes in quantities as the work progressed without affecting the unit prices bid.

The ducts were 3-in. standard clay conduit laid in cement mortar with a concrete envelope on the top, bottom and sides, with the top not less than 2 ft. 6 in. below the surface. All manholes are drained by a hole in the floor covered with a perforated iron plate. The manholes are in most cases either connected to the sewer or in cases where the slope of the ground permitted by a drain run to the surface. Great care was taken to lay the ducts so that the conduit sections are without pockets and drain toward the manholes. Grade stakes were used except where the pitch was so sharp as not to require them.

The fiber ducts for the street lighting were 2½ in. American conduit laid on a bed of concrete and afterward enclosed on the top and sides with a concrete envelope not less than 2 in. thick. Mr. P. H. Porcheron acted as inspector of the work for the Government and the Russell Contracting Company, of New York, was the contractor. The writer, who was appointed by the War Department as consulting engineer of the power plant, street illumination and steam distribution, wishes to acknowledge his indebtedness to Mr. Philip Torchio, to Mr. Geo. A. Orrok and to Mr. J. D. Whittlesey for many valuable suggestions during the preparation of plans for the work; also to the writer's assistants in the work of preparing plans and specifications, especially to Mr. Bassett Jones, Jr., on electrical work, to Mr. K. A. Nylen on piping and steam engineering, and to Mr. J. J. Ruckes for the power house, tunnel and other work

Effect of a Severe Sleet Storm in the Mohawk Valley.

On Feb. 18 the central part of New York was visited by a severe sleet storm which swept down the Mohawk Valley. There were no signs of the storm at Syracuse; but farther east, at Canastota, the northeastern portion of the upper petticoat of the high-tension insulators on the transmission lines appeared to be covered with sleet, although the wires themselves were singularly free. Between Canastota and Utica the sleet was heavy and many trees had limbs broken and some telephone wires were down. In Utica the wires were covered with a thin film of ice, but no great damage was reported. In the little town of Frankfort the telephone wires were all heavily coated and sagged to a depth of 8 ft. to 10 ft. on 100-ft. spans; and between the town and Ilion the telephone wires were down in several places. Some of the wires that were still on the poles were badly stretched and short-circuited. The sleet

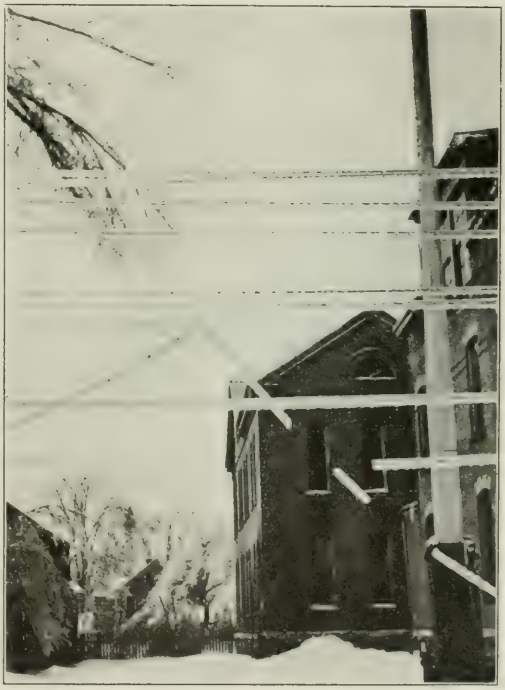


FIG. 1.—TELEPHONE WIRES COVERED WITH SLEET.

had not broken or fallen from the wires, although a 20-mile wind was blowing all morning. As might have been expected, the trolley wires did not appear to have suffered much injury.

Between Ilion and Herkimer conditions were very bad. Cross-arms were broken, pole tops were snapped off and the wires stripped completely between the poles that were left standing. In the city of Herkimer there was scarcely a tree without some broken limbs. The streets were covered with limbs and a mass of wires. Men and teams were kept busy clearing the wreckage, and nearly all the wires of both telephone companies and the electric light company were put out of service. At about 10 o'clock the temperature began to rise and this, with the action of the wind, caused much of the sleet to fall. There were many instances of the tenacity with which sleet hangs to the wires; the best of these was probably shown by the mass of wires hanging loose from the cross-arms of the poles. These had probably fallen 25 ft. or go it and yet the

sleet had not been broken on the wires. The Independent Telephone Company's wires were almost totally destroyed. Its poles, being still rather new, were left standing, but the wires were stripped from them. The Bell Telephone Company suffered even worse, as its poles were older and more heavily laden, but a large force of men were out repairing the work as fast as possible.

On Mohawk Street one pole line carrying four 10-pin cross-arms and one 150-pair telephone cable was broken down for a distance of 1200 ft., and the cable in falling on the wires of the trolley company was so badly burned as to be unfit for use. The poles were broken in various places, some close to the ground and some near the tops of the poles. In one instance a telephone pole about 50 ft. long was found to be broken in three parts.

The trolley lines of the Utica & Mohawk Valley Railway Company at this point were also put out of service, due probably to the falling of the Bell telephone lines rather than to the effect of the sleet on the trolley wires. The wires of the high-tension line of the Utica & Mohawk Valley Railway Company in Ilion and Mohawk did not seem to be injured by the sleet, although the insulators were still coated with ice at noon on Feb. 10.

Two pieces of ice, one taken from a 350,000-circ. mil cable and one from a No. 10 telephone wire, were weighed. Both

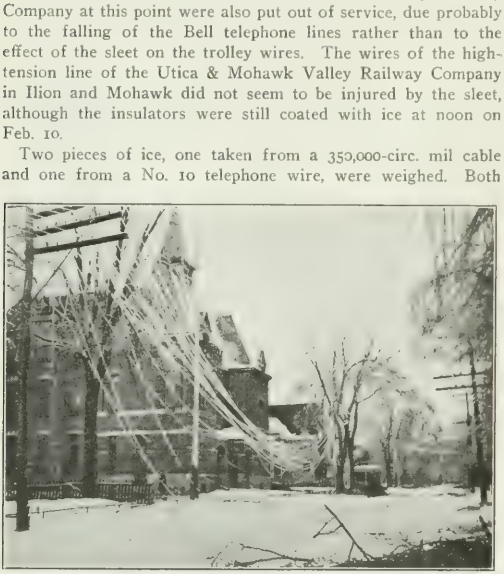


FIG. 2.—TELEPHONE WIRES ON 125 FT. SPAN AFTER SLEET STORM.

wires seemed to be coated with a thickness of ice about the same and the coating was on the under side. The piece of ice from the No. 10 telephone wire weighed ¾ lb. and was 10 in. long, making a uniform weight of 0.9 lb. per lineal foot. The piece from the cable weighed 1½ lb. and was 14 in. long, making a weight of 1.28 lb. to the foot. These were not exceptional specimens, but were a fair average of the general conditions. Some of the limbs broken from sound elm trees were as large as 12 in. in diameter. There were many places where pieces of the ice were completely broken away from the feed wires on one span and still remained intact on the adjacent spans.

Determination of the Distance and Direction of a Sending Station by Barretter Measurement.

By Béla Gati.

In the collision of the *Florida* and the *Republic* the value of the wireless telegraph for marine service received signal proof. Nevertheless, although the *Baltic, Lucania, La Lorraine, Furnessia* and *Seneca* were equipped with wireless telegraph, without the praiseworthy devotion to duty of Operator Binns, aid for the passengers of the *Republic* would doubtless have arrived too late, and in another similar case a like devotion might not have such a happy consequence. It, therefore, would be most desirable if, by means of automatic signals, a sinking ship could give notice of its distance and direction to other vessels. In case of the telegraph operator having sustained injury a sailor could then signal, say, the letter *t* at regular intervals, and this would quite suffice to determine the distance and direction of the imperiled ship. The writer here refers only to the case of a rescuing ship with an ordinary antenna, and excludes the case of a ship equipped with so-called directive antennæ.

According to Duddell's rule, the distance between a transmitter and receiver, multiplied by the strength of the incoming current, is a constant. This rule was proved by Duddell for considerable distances, but also applies to shorter distances.[1] If, for instance, this constant were 10,000 km-microamperes, then at 50 km the current would be 200 microamperes; at 47 km, 212.7 microamperes, and at 43 km, 188.6 microamperes. These values can be measured conveniently with the pointer galvanometer of a Gati barretter-measuring set.

For example, the rescuing ship—say, the *Baltic*—finds the incoming current to be 200 microamperes, and if after the run of 3 km on its original course the current is again found to be 200 microamperes, the *Baltic* knows that she is not nearing the *Republic*. Now, if the vessel changes to a course perpendicular to the former one, and after 3 km gets 212.7 microamperes, it will be known that she is on the right course, and that the distance is 47 km. One can always determine the distance of the imperiled ship by two measurements made on different courses with the aid of some calculations. It is not even necessary to know the constant. If the sinking ship does not emit waves constantly, the measures must be repeatedly made.

It is extremely desirable for wireless stations to apply the Duddell rule, particularly since the constant gives an indication of the efficiency of the station transmissions. Although damping measurements, as stated by Hahnsmann,[2] have only received recognition since 1906, and the proposed constant measurement has not as yet been put into practical use, it nevertheless seems to the writer that measurements of the kind suggested should be compulsorily exacted in the interest of humanity.

[1] Béla Gati, *Physikalische Zeitschrift*, 8, p. 080.
[2] Walter Hahnsmann, *Jahrbuch* der drahtlosen Telegraphie, 1909, p. 294.

Tests of Watt-hour Meters.

The New York City Public Service Commission has printed a report prepared by Dr. Cary T. Hutchinson on tests of direct- and alternating-current watt-hour meters of the type used on central-station circuits in New York City. Sections of the report give the theory of the several classes of meters and the methods and conditions of test, as well as a brief description of each of the numerous types tested.

DIRECT-CURRENT WATT-HOUR METERS.

The report states that all direct-current meters submitted were Thomson watt-hour meters made by the General Electric Company, 17 types of which were tested. The conclusion from the tests is that any meter properly constructed in accordance with the design of any of these types will, when in good condition, register accurately within the limits specified below. It is added that this recommendation is based on what may be reasonably demanded of a modern direct-current energy meter, as summarized in the following outline specification. The range of load and voltage called for is considerably in excess of the variations which ordinarily arise under service conditions, these wide limits being chosen to get a measurable difference in registration, and at the same time to indicate the maximum error that might arise under extreme conditions of operation; the limits of error in registration specified refer to the tests made under laboratory conditions, where the meter can be carefully mounted and adjusted and every precaution taken to secure high accuracy in the measurement of the various quantities involved.

In regard to the adjustment of the meter at full load and

light load, particular attention is called to the fact that in a number of the meters there is a marked shifting from day to day of these two supposedly fixed points on the registration curve (in some cases as much as 2 per cent), the meter being left untouched in the laboratory, subject to no outside influence except slight variations in the room temperature. To determine just what causes these variations would require a prolonged investigation; they are, however, probably due to temperature effects. In making comparative tests under various conditions, therefore, frequent determinations of the accuracy of registration at these two points should be made and the proper correction allowed for any change that may occur, particularly if the tests extend over a considerable period. Following are the specifications submitted:

Mechanical Construction.

Material and workmanship to be first-class in every particular, all fixed parts to be securely held in their proper position, moving element to be as light as possible consistent with proper strength and all bearing surfaces to be designed to reduce friction to the minimum.

Accuracy of Adjustment.

Meter to be capable of adjustment to register with an error of less than 1 per cent the true value of energy supplied through the meter at rated voltage and at either rated current or 10 per cent of rated current.

Accuracy of Registration Under Various Conditions of Load and Voltage.

After the meter has been adjusted as above specified, it shall register with an error of less than 2 per cent the true value of the energy supplied through it at rated voltage at any current from 10 per cent of rated current to 150 per cent of rated current; the error in registration at 5 per cent of rated current and at rated voltage shall not be greater than 7.5 per cent; the change in the accuracy of registration for a 10 per cent change in voltage either above or below normal shall not exceed 3 per cent at rated current or 5 per cent at 10 per cent of rated current.

Accuracy of Three-Wire Meters.

The change in the accuracy of registration of a three-wire meter when either one of the current coils is cut out of circuit shall not exceed 3 per cent for rated current through the remaining coil.

Effect of Change in Temperature.

The change in registration of the meter when the temperature of the room in which it is installed rises from 50 deg. Fahr. to 100 deg. Fahr. shall not be more than 5 per cent at rated voltage at either rated current or 10 per cent of rated current.

Effect of Temporary Overloads.

A temporary overload (three seconds) of 300 per cent of rated current applied five consecutive times shall not cause a permanent change of registration at rated voltage and rated current of more than 2.5 per cent for meters having a rated current capacity of less than 600 amp, or of more than 5 per cent for meters of larger capacity; the permanent change in registration at 10 per cent of rated current and rated voltage, due to such overloading, shall in no case exceed 5 per cent.

Loss in Current Coils.

For meters rated at 50 amp or less the total loss in the current coils at rated load shall not be more than 1 per cent of the total power supplied; for larger meters this loss shall not exceed *two-tenths of 1 per cent.* (0.2 per cent).

It is stated that this specification covers only those characteristics of the meter which may affect the accuracy of registration from the consumer's point of view—that is, a meter which fulfills the above specifications will, when properly installed and correctly adjusted, show no tendency to over-register, within the limits specified, under normal conditions of operation. There are, however, a number of other points which affect the excellence of an energy meter; namely, the friction of the moving element, the power lost in friction, in the potential circuit, and in the disk, the speed of the meter, the driving torque, the weight of the moving element, the ratio of driving torque to weight, and the ratio of driving torque to frictional torque. These data have been determined for all meters submitted, and in general it may be stated that it is desirable that a meter have the least possible friction, small loss in potential coil, high ratio of driving torque to weight, and high ratio of driving torque to frictional torque.

The following points regarding the design and use of the Thomson wattmeter are added:

The internal connections of a Thomson meter are such that the losses in the meter are borne in part by the supply company and in part by the consumer; the former stands the losses in the potential circuit, disk, and frictional resistance, the latter pays for the loss in the current coils. Consequently, from the consumer's point of view, the loss in the current coils only is of importance.

A heavy overload, such as a short circuit in the installation supplied through the meter, may cause a considerable weakening of the permanent magnets, and thus cause the meter to run fast. No attempt, however, was made to determine the effect of overloads greater than 300 per cent of full load, as it is always possible to protect a meter from heavier overloads by installing proper fuses or circuit breakers. If the meter is not so protected the consumer should be warned that a heavy short circuit may make his meter run considerably fast, and a readjustment of its speed after such a heavy overload should be requested. It should be noted, however, that the later designs of the Thomson meter are much less affected by overloads than the earlier types, as the magnets are so designed and are so arranged with reference to the current coils as to reduce this effect to a minimum.

The magnetic field produced by other instruments or wiring in the vicinity of a watt-hour meter may affect the registration to a considerable extent; particularly when the meter is installed on a switchboard on which are located busbars carrying heavy currents; the result may be either an over-registration or an under-registration, depending on the direction of the stray fields. By adjusting the meter after it is installed the effect of any constant stray field can be compensated for, but accurate registration is impossible when these effects are large and variable.

A watt-hour meter should always be installed in such a manner as to reduce mechanical vibrations to a minimum, as the friction of the meter is largely affected by such variations, which may cause the meter to run continuously or to "creep" when no energy is being supplied through it.

ALTERNATING-CURRENT WATT-HOUR METER.

Twenty-four types of alternating-current meters, representing 11 manufacturers, were tested. Of these 13 complied with the specifications given below. Concerning those which failed to meet these specifications, it is stated that with one exception all are of early design and no longer manufactured. In regard to commutator watt-hour meters, tests of this type indicate that they are only suitable for measuring energy supplied at a power factor of practically 100 per cent. Following are the specifications for alternating-current watt-hour meters:

General.

In the case of a three-wire single-phase meter, the limits of error specified, unless otherwise stated, refer to tests made with the two current coils connected in series and rated voltage applied to the potential circuit. In the case of a polyphase meter the limits of error specified, unless otherwise stated, refer to tests made with single-phase current, with both current coils of the meter in series and the two potential circuits in parallel and connected to a single-phase source of pressure.

Mechanical Construction.

Material and workmanship to be first class in every particular, all fixed parts to be securely held in their proper position, moving element to be as light as possible consistent with proper strength and all bearing surfaces to be designed to reduce friction to the minimum.

Accuracy of Adjustment.

Single-phase meters to be capable of adjustment to register with an error of less than 1 per cent the true value of energy supplied through the meter at rated voltage and frequency and

100 per cent power factor, at either rated current or 10 per cent of rated current. Each element of a three-phase meter to be capable of independent adjustment so that the meter will register on a single-phase circuit with an error of less than 1 per cent the true value of the energy supplied at normal frequency and 100 per cent power factor through either element alone, for either rated current or 10 per cent of rated current through that element, with normal single-phase voltage applied to both elements.

Accuracy of Registration Under Various Conditions of Load and Voltage.

After the meter has been adjusted as above specified it shall register with an error of less than 2 per cent the true value of the energy supplied through it at rated voltage, frequency and 100 per cent power factor at any current from 10 per cent of rated current to 100 per cent of rated current; the error in registration under the same conditions at 5 per cent rated current and 150 per cent rated current shall not be greater than 2.5 per cent; the change in the accuracy of registration at rated frequency and 100 per cent power factor for a 10 per cent change in voltage either above or below normal, shall not exceed 1 per cent at either rated current or at 10 per cent of rated current.

Effect of Change in Frequency and Power Factor.

A change in the power factor of the load supplied through the meter at normal voltage and frequency from 100 per cent to 50 per cent lagging shall not cause an increase in the speed of the meter at rated watts of more than 2 per cent, or a decrease of more than 4 per cent, and shall not cause an increase or decrease of speed at 10 per cent of rated watts of more than 4 per cent. A change of 10 per cent in the frequency of the current supplied through the meter at normal voltage and 100 per cent power factor shall not cause a change in the accuracy of registration at either rated current or 10 per cent of rated current of more than 2 per cent. A change of 10 per cent in the frequency of the current together with a change in the power factor from 100 per cent to 75 per cent lagging, the voltage being held at its rated value, shall not change the speed of the meter at either rated watts or 10 per cent of rated watts more than 4 per cent.

Accuracy of Three-Wire Single-Phase Meters.

The change in the accuracy of a three-wire single-phase meter at rated voltage, frequency and 100 per cent power factor, when either one of the current coils is cut out of circuit shall not exceed 2 per cent for rated current through the remaining coil.

Accuracy of Polyphase Meters.

A polyphase meter when adjusted on single-phase current as described above shall also register on a polyphase circuit at rated voltage and frequency within 1 per cent of the same accuracy shown on the single-phase test, both at 10 per cent rated current and at rated current at both 100 per cent power factor and 50 per cent power factor

Effect of Change in Temperature.

The change in registration of the meter when the temperature of the room in which it is installed rises from 50 deg. Fahr. to 100 deg. Fahr. shall not be more than 4 per cent at rated voltage at either rated current or 10 per cent of rated current.

Effect of Temporary Overloads.

A temporary overload (three seconds), of 300 per cent of rated current applied five consecutive times shall not cause a permanent change of registration at rated voltage at either rated current or 10 per cent of rated current of more than 1 per cent.

Loss in Current Coils.

The total loss in the current coils of the meter at rated current shall not exceed *five-tenths of 1 per cent* (0.5 per cent) of the rated watts of the meter.

As in the case of the direct-current meters, this specification covers only those characteristics of the meter which may affect the accuracy of registration unfavorably to the consumer. The following points regarding the design and use of alternating-current watt-hour meter should also be noted:

The internal connections of these meters are such that the losses in the current coils of the meter are borne by the consumer; the other losses are borne by the company.

A heavy overload, such as a short-circuit in the installation supplied through the meter, may weaken the magnets and thus cause the meter to run fast, but the effect of such overloads on alternating-current meters is as a rule not as great as with direct-current meters.

Unidirectional stray magnetic fields of constant magnitude have no effect on the registration of an alternating-current meter; fluctuating stray fields or fields due to alternating-current circuits in the vicinity of the meter may, however, affect its registration. By adjusting the meter after it is installed the effect of any such field of constant magnitude can be eliminated, but accurate registration is impossible when such stray fields are large and variable.

Care should be taken to install the meter in a manner to reduce mechanical vibrations to a minimum; the final adjustment of the speed at 10 per cent and 100 per cent rated current should be made after the meter is installed and connected, taking the voltage and current for this purpose from the supply mains.

On account of the high reactance of the potential circuit of an induction meter, together with the fact that the coils in this circuit are wound on iron cores, the effective value of the current flowing in this circuit for a given impressed voltage will depend upon the shape of the pressure wave; consequently the torque, and therefore the speed, for a given load supplied through the meter will be a function of this wave shape. In case the pressure on a given circuit is supplied from different generators at various times, the effect of the maximum variation in wave form on the accuracy of the meter should be determined, and no meter should be allowed on this circuit which is appreciably affected by such variations. If the pressure on the circuit has a constant wave form, even though it may not be a true sine wave, then, by adjusting the meter after it is installed, using for this purpose the pressure on the supply circuit, the particular form of this wave will be immaterial, provided the accuracy of the standard with which the service meter is compared is not affected by wave-form variations. In the case of a polyphase meter, each element should be adjusted to read correctly when connected to the particular phase on which it is to operate.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

The Electric Vehicle Situation in Buffalo, N. Y.

By Geo. J. Kirchgasser.

The first year of the 20th century saw the first vehicles made in Buffalo using electricity for motive power, and since then, due to the steady advance made in mechanical construction, batteries and motors, the number of electric carriages, delivery wagons and trucks has increased yearly. To watch the Adams Express Company's electric wagons hurrying about the city, especially in the downtown districts, one cannot but realize their efficiency for this kind of work. They are driven up at a good speed, the parcel delivered, and are swiftly away again. Turning, stopping and starting can all be done much quicker than with a horse or with a gasoline automobile. Even for heavy trucks the advantage of electric power is being recognized, as the increasing number of this type in use shows.

There are approximately 400 electric automobiles used in Buffalo, about 350 of these being pleasure carriages, and the

remainder delivery wagons and trucks. The Adams Express Company has 20 1-ton trucks. The National Battery Company has one 5-ton, one 1½-ton and one 1000-lb. truck, besides five electric sight-seeing cars, which are run in the summer season. The Arctic Ice Company, Heinz Company, of Pittsburgh, and a number of other concerns use electric automobiles for business purposes.

Buffalo claims 340 miles of asphalt-paved streets, with no grades or hills to speak of, so that conditions are favorable to the use of electric vehicles. There are three public garages in the city; one connected with the National Battery Company; the Babcock garage, and a new one recently opened. The National Battery Company's garage is located on Massachusetts Avenue not far from the west side residential section. Besides a large garage used exclusively for electric automobiles, the concern manufactures a general line of storage batteries and others of a special type used in connection with a system of car lighting. The electricity for the whole plant is received from the Cataract Power & Conduit Company at 2200 volts. Rotary converters are used for charging. This garage is in the hands of a competent expert, Mr. W. P. Babcock. Between 65 and 75 carriages are usually kept here and 30 can be charged at one time. The rate for charging, storing, washing and delivery is $30 per month. An extra fee is charged for washing out the batteries. Close watch is kept of the batteries and a card system used, so that if a car has not been used the batteries are not charged, as Mr. Babcock claims that the active material is loosened and dropped to the bottom of the cell if the batteries are charged too frequently when only a small amount of the charge has been taken out. Of course, if the carriage is standing idle for some time, charging at intervals livens up the batteries. As the whole plant uses electricity, the cost per month for energy used by the garage can only be approximated at from $60 to $70.

The Babcock garage is connected with the Babcock Electric Carriage Company, and is located near the corner of West Utica Street and Elmwood Avenue in the residential section of the city. This garage does not use central-station energy. The electricity here is generated at 110 volts, gas engines being the prime movers. The cost of charging cannot be ascertained, as electricity is used throughout the factory. The number of vehicles boarded here is about 85, 40 being charged at one time.

The charge made for storage, washing, charging and delivery is $30, and the other conditions are about the same as at the National garage. The Babcock company at one time attempted making contracts, guaranteeing to maintain the batteries in good shape, to make all ordinary repairs, besides the storing and charging of the vehicle, etc., for one year at a certain figure, but abandoned the plan after a short time.

The third garage, located at Pennsylvania and Fargo avenues, has just been opened and at present boards less than 20 vehicles. This garage also controls the Buffalo agency for the Waverly cars.

All the trucks are charged at private garages with isolated plants, as are also a great many carriages. The Buffalo General Electric Company supplies energy to 36 private garages having mercury-arc rectifiers, 19 of which have been installed within the last year. The 30-amp rectifier is used in all cases except one, and all are connected to the alternating-current mains at 220 volts. The Buffalo General Electric Company has received no complaints in regard to the rectifiers. There is, though, a tendency for owners to charge too frequently, as some people plug in their batteries after every trip no matter how short the trip. The rate of 6 cents per kw-hour is made to these consumers on a guarantee of $50 per year. No restriction is made as to time of charging, the consumer being at liberty to use the energy at any time.

The Rapid Building of Power Load.

Mr. R. B. Boyce, manager of the Southeast Missouri Ice, Light & Power Company, of Charleston, Mo., has done some rapid work in building up power load in that town. Charleston is a small town in which day service was started in August, 1908. By April, 1909, 60 hp in motors had been connected. The motors range in size from 1 hp to 25 hp.

An Experiment with Flat-Rate Residence Lighting at Marshall, Mo.

The Marshall Light, Heat & Power Company, of Marshall, Mo., of which Mr. R. J. Irvine is manager, is trying an experiment with flat-rate lighting for small cottages that will be watched with much interest. The rate is $1 per month for four 25-watt tungsten lamps, 20 cents additional for each lamp up to seven, and 15 cents additional for each lamp more than seven. This flat rate is made on the condition that the customer uses only tungsten lamps. These lamps are sold to the customer at list price. It is explained to the customer that wasteful or unnecessary use of electricity also means unnecessary cost of lamp renewals to him. It is the idea that with tungsten lamps at the present high price there will be sufficient inducement to the consumer to turn lamps off when they are not needed so that waste of electricity will be prevented.

The company has had this arrangement in force about three months, and has secured 92 such customers in a town of about 6000 population. The flat rate undoubtedly appeals to many owners of small houses as a meter rate does not, because it is known that the bills cannot be in excess of the stipulated amount. The company reserves the right to install meters at any time if the contract is being abused by the installation of larger candle-power lamps than those contracted for, or by the use of carbon-filament lamps. The plan is considered by the company as partially an experiment and partially an entering wedge for regular meter customers. It certainly appears from the number of such customers connected in a short time that the plan is popular and works well as a means of getting service introduced among a large number of consumers. At the same time there is no expense for meters.

Conference on New Accounting System in Wisconsin.

At an important joint meeting of the Wisconsin Electric & Interurban Railway Association, the Fox River Valley Gas & Electric Association and the Northwestern Electrical Association, held at Sheboygan, Wis., on April 12 and 13, the new accounting system prescribed by the Railroad Commission of Wisconsin was discussed. About 50 representatives of operating companies were present, and Mr. Ernest Gonzenbach, of Sheboygan, president of the Northwestern Electrical Association, presided. During the convention the visitors inspected the plant of the Sheboygan Light, Power & Railway Company, the gas-engine-driven generating station at Port Washington of the Milwaukee Northern Railway and the plant of a coal-loading and sorting company.

"The Practical Application of the New Accounting System" was the title of a paper presented by Mr. George Allison, of the Wisconsin Electric Railway Company and the Eastern Wisconsin Railway & Light Company. Mr. Allison distributed copies of the schedule of accounts which he had arranged under the new classification for the use of the companies with which he is connected. Mr. C. N. Duffy, of Milwaukee, said at the conclusion of this paper that he was pleased to learn that Mr. Allison had found the accounting system prescribed by the commission so well adapted for the use of his companies. Mr. Duffy thought that the public-service companies of Wisconsin were fortunate in having such a good commission, and further that the system of accounts presented was easily adaptable for large or small utilities.

Mr. A. D. Alt, manager of the Mondovi Electric Light Company, said that he had not yet adopted the new accounting system because there were several questions still pending with the commission. His plant is an offshoot of a flour mill which

obtained its power from a hydraulic plant and also from an auxiliary steam plant. Both methods of generating power were used as conditions demanded, and the milling and lighting employees are engaged in both kinds of work with no very definite demarkation. In this case it was difficult to see how to apportion the power costs so that the accounting system prescribed by the commission might be followed for the lighting plant.

Mr. Alt said, in relation to the methods of testing electric meters prescribed by the commission, that inasmuch as his company had but a small number of meters the expense for testing as prescribed was a hardship. Heretofore the meters had been tested at the factory, but the commission did not approve of this method on account of the possibility of damage during shipment, and Mr. Alt asked for suggestions as to how a small company could economically meet the commission's order, which said that meters must be tested on the premises—not at the factory or at the company's workshop. The commission also had said that there was no master meter for direct current that was sufficiently reliable.

Mr. Duffy said that in his view it was the purpose of the commission to obtain as clearly as possible cost figures for the generation of power by gas, steam and water, and he thought that such figures should be given by the companies willingly because of their value for comparison by the commission. He suggested that Mr. Alt ascertain the total cost of generating power for both the mill and the lighting plant and then apportion, according to the best possible estimate, the electric current consumed and lost in distribution.

Mr. Irving P. Lord, of Waupaca, said that the situation in his city resembled that described by Mr. Alt. In Waupaca the company obtains its power from a hydraulic plant and also from a steam auxiliary. In addition, there are both railway and lighting departments, but as the power requirements are fairly evenly divided, the charges for fuel, labor and general maintenance are apportioned one-half to the railway department and one-half to the lighting department.

There was considerable discussion of the subject of the proper way of accounting in the case of small motors, too small to have a separate meter, connected to lighting circuits. It might cost from $10 to $15 to install a meter for a small fan, for example, whereas it would be much more economical and practical to connect this motor to the lighting circuit. Mr. Lord remarked that he has 20 small motors connected to his system, the largest 7½ hp, and with the exception of a few all are provided with separate meters. Mr. A. Westermeyer, of Sheboygan, remarked that under the present system of accounting in that city the income from small motors on lighting circuits goes into lighting sales.

Mr. J. O. Posson, manager of the municipal plant at Algoma, said that the local authorities which had charge of the operation of the plant were studying the system of accounts laid down by the Railroad Commission, but in the past had not called for a separation for power accounts between the lighting and city water departments. Heretofore one man had done all the testing of meters by using a master meter kept at the plant. The city could hardly afford to send out men to test the customers' meters in place, and had asked the Wisconsin Railroad Commission to send a representative to Algoma to study the local conditions so that a ruling might be made.

Mr. V. E. Extrom, superintendent Electric, Water & Telephone Company, Tomahawk, Wis., said that the plant at Tomahawk was operated by water power, with a steam reserve, and the steam reserve was used either for running a sawmill or lighting the town. The company divided its charges for the operation of the steam plant on the basis of the current required for lighting purposes. Mr. Allison, in answer to a question, said that it was the office practice of his companies to pass all accounts through one voucher journal and then recapitulate at the end of the month by using a distribution sheet and taking the distribution direct from the voucher.

Mr. B. G. Broad, of the Milwaukee Northern Railway, presented a paper entitled "Methods of Changing from the Old to the New." This paper was largely devoted to railway work.

A paper of Mr. Halford Erickson, of the commission, on "The New Accounting System," was then read by the author. Mr. William J. Hagenah, of the accounting division of the commission, was then introduced, and he said that the classification of accounts which has been prescribed is the result of careful study of the systems in use in Wisconsin and also in other States. It is admitted that a great many of the items appearing in the forms of the commission have never been a part of the records of public utilities in Wisconsin. The effort has been to prepare a classification which shall suit the different utilities without establishing a precedent.

The classification is divided into two major groups, Class A and Class B, permitting comparison between accounts used in the smaller companies and the more detailed accounts of the larger companies. A feature of the classification is the accounting for all power used, whether generated, rented or purchased. Power is produced by two or three methods, and in some cases all of these methods are used by one company. The power account in the classification is divided into the different methods of power generation, as hydraulic, gas or steam generation. Then there is the possible cost of power that is purchased, and if each company will keep an accurate record of these various items, the question of power accounting may be settled. It would be manifestly unfair to compare the cost of steam power with that generated by hydraulic means. The same is true of gas-driven plants. These costs should be made public for the benefit of the patrons of each particular company. They can be determined in no other way than by separation of accounts, and when this is done the commission can determine whether the basis of sale is just to the public. In the case of hydraulic utilities transmission, transformation and (if necessary) storage-battery accounts are also included. When the cost of gas-power production is compared with the cost of steam-power production at the steam-power plant, it is necessary that the cost in each case shall equal the worth at each point. Consequently, the cost of hydraulic power would be the cost of the steam power at the place where it is being delivered.

There was some question of dividing expense accounts in Class A classification into two classes, as municipal distribution or contract lighting and commercial consumption. But it was decided that it would be better to keep only one set of accounts on this subject, and from the entries an analysis could be made by which the commercial lighting feature could be distinguished.

Treating of the undistributed accounts in the list in the second, or Class B, classifications, Mr. Hagenah requested that those companies preferring to distribute or itemize certain accounts indicate in each case the account into which the items have been distributed in order that the analysis of the commission may be facilitated. Depreciation has been provided for in a general way, but the commission has been unable to prescribe an exact percentage. However, depreciation is constantly going on, and it is desired that the physical and financial standing of each utility be known. This can be provided for by making actual reduction from revenue or gross earnings and making a fictitious book entry in the nature of an open or unadjusted account. Taxes are to be treated as an operating expense.

Mr. Hagenah was asked a number of questions in relation to the case of the flour mill and electric light plant, previously mentioned. He said that proper account should be kept as to the cost of operating, and should show whether the actual or primary use of the service was for the benefit of the mill or the electric light plant. In either case the total cost of generation and the kw-hours produced should be kept. Then at the end of the month there should be a careful analysis of the cost of producing this current and a proper apportionment made between the electric light plant and the mill. In relation to the subject of testing electric meters for small plants, Mr. Erickson said that the commission has established certain standards and that the decisions in relation to these contain practically everything that has been determined in relation to this subject. These decisions may be had from the commission on application.

Discussing the question of classification of electric light earnings, Mr. Hagenah said that the largest average amount of cur-

rent used, either for lighting or power, will determine whether the consumer is to be classed as a commercial-lighting or commercial-power consumer. All depends upon the proportion of current used by the consumer for lighting purposes and for power purposes. Where some current is used by the people of the house for small electric heating devices, such as flatirons, curling-irons, heater, etc., the classification would be that of electric lighting, probably. If, however, besides the lighting considerable power is used, as in the case of sewing-machines in tailor shops or "sweatshops" in residences, then the consumer may be classified as a power consumer as well as a lighting consumer, and separate meters should be installed to register the amount of current used in each case. The moment a motor of any kind uses the major portion of the current delivered to a customer, that customer should be classified as a commercial-power consumer. One reason why this classification is made is because of the difference in rates offered for power and lighting. Mr. Gonzenbach said that it was going to be a difficult matter in many cases to decide whether a consumer should be classified under lighting or power. Mr. Hagenah admitted that there might be cases where it would be difficult to draw the line, and in some instances the decision would perhaps have to be left to the auditor in making out his reports.

Mr. Erickson said that the commission is not going to require any impossible things of the utility companies. It is not intended to enforce any rules which are going to cause hardship or create any unnecessary burden on the State or its utilities. Mr. Gonzenbach said that the public-utility men had had enough experience with the Railroad Commission of Wisconsin to know that they would be fairly treated.

Answering Mr. Duffy in relation to classification where one company operates both electric light and railway service, Mr. Hagenah said that the station reports usually show the detailed cost of the current generated and that the railway should be charged with its proportion and the electrical department in like manner. Detailed costs of each distribution will follow.

Mr. Erickson explained that it is the intention of the commission simply to have a system of accounting under which detailed and definite reports can be made to it. Companies may subdivide these accounts to suit their own convenience. If desirable, one of the commission's accounts may be divided into two or three others, but they must not be subdivided so that they cannot be combined properly when the company makes its report to the commission.

In relation to the making of rates, Mr. Gunn said that the rates of his company start at 12 cents a kw-hour for lighting and 8 cents a kw-hour for power. The discount is arranged in such a way that those who use power during the day get the benefit of a very material reduction. This brings the rate down as low as 3 cents per kw-hour for large consumers. On this subject Mr. Erickson said that it is the intention to make rates that are equitable both to the utilities and to the various classes of consumers, providing for the lowering of rates as the cost of production decreases, so that the business of the plant will not be seriously affected by such action. The basis of rate-making should be the operating expenses of the plant; otherwise rate-making will be largely an estimate.

Further explaining his position, Mr. Erickson said: "The fixed expense—and there is a clearly defined fixed expense in all service—should be a service rate. It should be a charge upon the consumer because it is a fixed expense in connection with the installation. Having fixed a service rate for the consumer, you should have a specified rate added to it which should be computed upon the amount consumed per month. There are some particular objections to this form of rate. There are users of electricity who, if you were to charge them all you really should, would not take your service. Consequently, you must make some arrangement so that your rate will appeal to them and induce them to accept the service. You must take something from your fixed expense and add it to the variable expense; therefore, when you add the two together you will get a rate unit which, while it takes away the lower rate for the long-hour users, and makes it a trifle higher for them, will lower the rate somewhat to the short-hour user." Mr. Erickson said later: "Of course, the maximum-demand system of making rates is not correct. You know from experience what is the maximum demand for each class of consumer, and estimates on that demand are not absolutely correct, but they are not so far out of the way as to create an injustice."

Mr. Erickson remarked that in many schedules of electric light companies department stores are given a very good rate. They are, however, really very costly customers, because they use all their lights for a short time only. Mr. Duffy remarked that a store having a 500-light installation might use it six hours and another store having 3000 lamps installed might use them only one hour. To this Mr. Erickson replied that it would be manifestly unjust to charge them both the same rate. Continuing, he said: "In treating installations of this kind you must adjust your rate schedules. We are up against questions like that every day, and it is perhaps a thing that is troubling us more than anything else in our work. It is a question which has to be worked out and is in a way 'up to' all of us. The department store having a 3000-lamp installation takes a greater proportion of the demand than the 500-lamp installation. Now if you will proportion that charge upon the basis of the demand, will you not make the store with a 3000-lamp installation pay its proportion?"

Mr. Duffy pointed out that if this principle was applied to a man's residence his increase in rate would be from 25 to 50 per cent. He asked if it would not be a justifiable discrimination if an arbitrary rate were made so that the price to this man should not be raised. Answering this, Mr. Erickson said that some arbitrary adjustment may have to be made, but it will have to be done with a great deal of discretion so as not to establish a precedent.

Central-Station Facts and Factors.

In dealing with central-station matters the editorial policy of the *Electrical World* for years past has been to present to central-station men as much essential and fundamental information regarding the financial and engineering conduct of the central-station business as has been made available by editorial visits to such companies and by various public reports made by them. In the belief that a systematic tabulation of certain instructive items concerning the results being attained by central-station companies would be of interest and value, a collection has been made of information covering a certain set of items, these items having been formulated after consultation with various central-station men. The first tabulation of such information is given herewith. It is the intention to continue these tables from time to time as information is collected from more companies. The editors will be glad to receive such information from any of its central-station readers. Company names will not be published in any case, as they are not essential to comparisons of this kind. The companies are designated by numbers only.

The general items covering kilowatt station rating and population of districts served are given only for the purpose of affording an idea as to the size of the company. The other items are grouped under two general heads: (a) utilization of investment and apapratus; and (b) development of territory served. The items under utilization and investment of apparatus are intended to show to what extent the apparatus installed is being utilized to produce revenue and also how well the money invested is being used. Those items pertaining to development of territory served indicate to the manager and financier whether the territory served is very much underdeveloped as regards central-station service, or whether a saturation point is being reached which would call for very cautious investment in extensions and enlargements.

Taking up the items one by one, the "total investment per kilowatt of station rating" represents the outstanding funded liabilities in the shape of bonds, stock and similar securities per kilowatt of station equipment. If this figure is low, it does

not necessarily mean true economy in construction or a good present physical condition of the property. An excessive figure, however, is not to be looked upon favorably, as it indicates that the plant has heavy interest obligations. In some cases this figure is low, as the plant has been allowed to deteriorate to a point where complete rebuilding will soon be necessary. Sometimes, especially in the case of the smaller plants, the figure is low because extensions and improvements have been paid for out of earnings and are not represented by bonds and stock. In general, a plant which has been continuously maintained at a high state of efficiency has more investment per kilowatt than some less efficient and depreciated plant, this higher investment being justified by the earning power brought about by the better condition.

The item of "gross yearly income per kilowatt of station equipment" is one of the most instructive on the list and indicates whether a company is building up its load in such a way as to get the most profit out of every kilowatt of equipment. It also indicates whether the system of rates is such as to secure proper returns. Plants having considerable non-peak load are, of course, among those which show the highest yearly earnings per kilowatt of equipment.

The item "gross yearly income per $100 invested" shows the percentage of investment appearing in yearly gross earnings and to some extent indicates what percentage of net income on the investment may be earned with proper economical operation. "Yearly operating expenses per $100 invested" also gives an insight into the net earnings. "Average income per consumer" indicates whether the consumers are using energy in large or small quantities, or both, and whether there are large contracts to bring up the general average. "Total connected load in kilowatts per kilowatt of station equipment" indicates by comparison the diversity of the load obtained by various companies—that is, one company may have a character of load which calls for a larger station equipment per kilowatt connected than would another. This diversity factor is important in determining rates.

"The kw-hours sold or accounted for per 100 kw-hours generated" will depend on the thoroughness of meter testing, the size of transformers, the line losses and character of the load, whether almost entirely peak load or distributed over 24 hours.

The items on transformer capacity indicate whether an unnecessarily large capacity in transformers has been installed, practice differing considerably in this respect. The item "Kilowatt station rating per employee, all departments," by comparison shows whether the company is employing a greater or less number of men than the average for a given output. The "yearly load factor," which is obtained by dividing the average load for the year by the maximum peak load of the year, shows how fully the plant equipment is being utilized. A low load factor usually goes hand in hand with a low gross yearly income per kilowatt. It indicates that more use might be made of existing apparatus by cultivating the load for periods when the lighting peak is not on.

The purpose of the items under "development of territory served" has already been indicated. All these items based on population are open to the criticism that in most cases the population is not exactly known. A question is also likely to come up as to the territory actually served. The company may have a franchise over an entire town and yet serve only two-thirds of it. Furthermore, the interval from one census to another always gives rise to wild guessing. Nevertheless, these items based on population, applied with judgment, are of value as indicating the extent to which the business has been worked in different towns.

The criticism may also be made that figures based on the kilowatts of station rating are unfair to the companies which have had the wisdom to install considerable reserve machinery, whereas other companies have no reserve whatever during the December peak load. This criticism is just, but probably no better basis for comparison than station equipment can be devised. The majority of large companies have a reserve, either in the shape of an extra unit or in the overload capacity of existing units during the December peak. Probably the majority of small companies do not have such reserve, the breaking down of one unit involving either some interruption to service

TABLE OF CENTRAL-STATION FACTS AND FACTORS.

	1	2	3	4	5	6	7
A General Information.							
Number of company	9	1	2	3	4	5	6
Kw rating of stations	100 to 120,000	1,800	119,250	2,000	565	300	240	850
Total population of district served	1,500 to 2,400,000	30,000	2,400,000	25,000	10,000	4,000	1,500	10,000
B Investment and Apparatus.								
Total investment per kw of station equipment	$60 to $600	$333	$420*	$375*	$133	$800*	$62.50*	$82*
Gross yearly income per kw of station equipment	$40 to $139	$58	$79	$80.75	$69	$122*	$48	$63
Gross yearly income per $100 invested	$18 to $79	$17.40	$18.75	$21	$51	$14.40	$77	$79
Per cent of gross yearly income spent for operation (including everything but interest and depreciation)	39% up	47.6%*	62.4%*	39%	53%	60%	39%	39%
Yearly operating expenses per $100 invested	$13 up	$8.28	$13.60	$8.60	$27	$14.76	$30	$32
Average income per consumer	$30 to $118	$59.80	$118	$83	$7		$31	$37
Total connected load in kw per kw of station equipment	up to 3.34	2.34	1.17		.94		2.2	2.6
Connected kw load in lamps per kw of station equipment	up to 2.50	1.11			.87		1.54	1.44
Connected kw load in motors per kw of station equipment	0 to 1.00	1.12			1.01		0.37	0.84
Connected kw load in heating apparatus per kw of station equipment	0 to .067	0.11					0.10	0.32
Kw-hours sold or accounted for per 100 kw-hours generated	30 to 85	81						74.0
Kw transformer equipment per kw of alternating-current station equipment	to	1.03	.78					
Kw transformer equipment per kw of connected load	to .92	1.43	1.1					
Kw transformer equipment per kw connected in residence districts	0.5 to 1.1		1.1					
Kw station rating per employee, all departments	30 to 700	94	47					
Yearly load factor (average load divided by maximum)	15 to 44%	32%	39.6%	13%	17%*	44.2%		30%
C Development of Territory Served.								
Gross yearly income per capita of population	up to $8.55	$4.00	$3.90	$6.40	$3.90	$7.35*	$8.50	$5.51
Investment per capita	$22 down	$23	$22	$30	$7.46	$30	$10	$6.95
Watts station rating per capita	up to 160	56	49	80	56	60	160	85
Number of consumers per 100 of population	up to 2.8	2.8	3.3	8.8	2.8		2.8	14.8
Number of residence consumers per 100 of population		2.3	1.9	7.2				10.4

*See notes in body of article.

or very low voltage. The only other basis of comparison of this kind which can be taken would be the maximum yearly load in kilowatts, but, as is well known, this maximum varies within certain limits in a surprising way from year to year, and would probably be even more unsatisfactory than kilowatt station equipment as a basis for comparison, as it would be as unfair to the company with a large reserve equipment as would the basis of station rating.

Column No. 0 on the table does not refer to any company, but gives approximately maximum and minimum figures on the various items which have been obtained from various sources. These maximum and minimum figures do not necessarily refer to companies whose statistics are given in the table, but are selected from statistics gathered from various sources. They are intended to be only approximate, and cover electric investment only, so that in cases where a company operates a steam or hot-water heating system in connection with its station the figures would not apply.

Column No. 1 gives data from a station in first-class physical condition in a manufacturing town. It is equipped with steam turbines, and, as shown in the table, has a large connected motor load, the motor load being practically equal to the connected lighting load. The yearly income is low in proportion to the investment, but the operation is economical and the equipment is in a stable condition which will call for no expensive reconstruction in the immediate future, but rather extensions of the existing plant. The gross yearly income per capita of population is above the average, and this is due to motor load rather than to lighting load, as is shown by the small number of consumers per 100 of population, which indicates that the residence-lighting business has not been extensively worked.

Column No. 2 contains statistics from a very large station, carrying on a great diversity of central-station business and also carrying a street-railway load. Half of the output goes to street railways. Were it not for this fact, the investment per kilowatt of station equipment would probably be in excess of $420. If all the station output were distributed for miscellaneous motor and lighting purposes, the necessary investment in distributing lines and substations would increase the investment per kilowatt of station equipment. As a general proposition, the larger the city the higher the investment per kilowatt and the lower the gross yearly income per $100 invested. It is therefore only by the economies possible in the operation of a large station that the latter is able to pay as well as a smaller plant, the investment per unit or rating being usually much higher. The figure given for this station on "connected load per kilowatt of station equipment" does not include the street-railway load. Otherwise the figure on connected load would probably be almost double what it is. The alternating-current distribution system of this company has connected 3.34 kw for each kilowatt of alternating-current substation equipment. The percentage of gross income spent for operation in the case of this company includes depreciation, which is not included in this item given for the other companies in the table. This accounts for the high percentage of operating expenses in a large company, which would be expected to operate very economically. It is also notable that the kilowatt station equipment per employee in all departments is not materially less in the case of a company like this than in the case of smaller companies. The yearly load factor given includes both the railway and lighting loads. The yearly load factor on this company's regular central-station business is about 31.4 per cent.

In column No. 3 are given the returns of a steam-turbine plant, having also a small hot-water heating load. This plant is in first-class condition. The investment figures given include the cost of the hot-water heating system and the figures on earnings include those from the hot-water heating. The notable points about this station are the high yearly load factor and the low operating costs brought about largely as a result of this fact. This load factor is the result of securing a lot of motor business which does not operate during peak-load hours.

Column No. 4 relates to a plant in which the investment per kilowatt is notably low because part of the construction was paid for out of earnings rather than by security issues. This low investment makes the gross yearly income high per $100 invested. A notable point about this plant is that the connected motor load slightly exceeds the connected lamp load. The yearly load factor in the case of this plant was obtained by assuming that the maximum load of the year equals the output of the plant, as the actual peak load of the year was not at hand. If the plant has considerable reserve equipment, the yearly load factor is, of course, better. It is seldom, however, that a good yearly load factor is found in a plant of this size.

Data of a station also operating a hot-water heating system are given in column No. 5. The high investment is accounted for by this fact. The earnings include those from the sale of electricity and hot-water heating. The gross yearly income per kilowatt of station equipment from the sale of electricity is $100 and that from heating $22. The yearly load factor of this plant is also remarkably high because of the extensive motor load which this company has worked up. The number of residence consumers per 100 of population, representing 1 consumer for every 10, is also higher than usual. Figures on this company indicate that it has developed its field to a point much higher than the average, both in motor and residence business.

In column No. 6 are given the returns of a remarkably small plant which has attracted attention all over the country on account of the high gross earnings per capita of population, amounting to $8.50 per year. In this town about 80 per cent of the buildings are reported to be wired. The low investment represented by stock is accounted for by the fact that since the original stock issue all extensions have been paid for from the earnings, thus keeping down the stock liabilities of the company, although the plant probably cost at least double the amount represented by the stock. The low cost of operation is partially due to the use of natural gas in gas engines. Much of the construction in connection with this plant is not of a very permanent character, which also tends to keep the investment down. The "watts station capacity per capita" of population is high, and would be expected as the number of customers per 100 of population is 25.

The station to which the figures in column No. 7 apply is operated entirely by water-power located a short distance outside the city. In this case the investment per kilowatt of equipment is low because bonds have been retired with money obtained from net earnings

INTERIOR WIRING AND ILLUMINATION

Street Illumination by Arches in Fort Wayne.

In order to attract retail business, property-owners and business men of Columbia Street, Fort Wayne, Ind., have formed an organization to erect a number of arches to support electric lights on that portion of Columbia Street between Clinton and Harrison Streets. The committee, of which William Dreier is a member, has been appointed to look into the matter of the number of arches and their exact location and cost. Possibly the plant will be extended to include the approaching streets from the south and from Bloomingdale and Lakeside for a short distance.

Arc Lamp Electrode.

A patent issued March 30 to Freidrich Kalkner, of Nuremburg, Germany, describes an arc lamp carbon arrangement which consists in the use of a negative carbon relatively much smaller than the positive carbon and having a metallic casing. It is said that in practice it has been found that a smaller negative

carbon increases both the yield of light and the steadiness of the arc. On the other hand, the greater resistance of the very small carbon, if used bare, would cause it to become red hot along its entire length, and it would, of course, be rapidly destroyed. To obviate this latter difficulty, the slender negative carbon rod, which has a cross-section of only one-sixth that of the positive carbon, is covered with a casing of very thin copper; this casing is liquified at a distance of about 1 in. from the arc, the melted copper falls away in drops, and the metallic fumes do not pass into the arc. This small electrode can be used either in a horizontal arrangement or at an obtuse angle to the large carbon.

More Tungsten Arches in Grand Rapids.

The system of lighting business streets by means of arches of tungsten lamps, supported by span wires from building to building, continues to be extended in Grand Rapids through the efforts of various merchants' associations and the Grand Rapids-Muskegon Power Company. A contract has just been closed for lighting Ionia Street to the Union Depot with 16 arches. At this rate it will not be long until the entire business district of Grand Rapids, as well as some suburban business streets, will be lighted in this way. The Merchants' Association of Worcester, Mass., is giving consideration to a similar scheme of lighting.

Schoolroom Illumination in Boston.

A lecture on the artificial illumination of schoolrooms was given at the Harvard Medical School, Boston, on April 18, by Dr. Myles Standish, professor of ophthalmology at Dartmouth and Harvard. From the point of view of the specialist the speaker touched upon the difficulties of adequately illuminating 40 to 60 desks from fixtures, unless the objectionable and costly expedient of providing each individual desk with a separate light is undertaken.

It was pointed out that more attention should be paid to the decoration of the room, the present fashion of giving schoolrooms a dark tone being disadvantageous. The best color for the walls is a pale yellow-green, nearly white. In modern schoolrooms the windows usually occupy one-fifth of the wall space. The best shades are hand-painted gray-green. The desks and other furnishings in the room should be of light-colored wood.

In Germany and elsewhere there is a system of indirect illumination whereby the light source is entirely screened from below and reflected from the ceiling and upper part of the walls. Such a method lacks one important factor of daylight, namely, shadows; and if attempted with incandescent lamps requires a maximum of expense to produce a comfortable sense of sufficient illumination. A widely extended experience has shown that while indirect illumination may be satisfactory for halls it is not suited for schoolrooms. The Boston school committee has rejected indirect illumination. After a series of experiments with incandescent lamps it was determined that a distribution of the lighting sources through the room was desirable, and that bare lamps without shades should not be used. It was found that most of the shades on the market confined the illumination to a relatively small area directly beneath the fixture, and that others transmitted the light and diffused it widely, but were undesirable because of the facets, which became multiple sources of brilliant illumination. When the committee finally experimented with the Zalinsky shade it was found that sufficient light passed through it to properly illuminate the ceiling and upper parts of the room, but that the greater proportion of the light was reflected downward at such an angle that the direct illumination was surprisingly great. The committee also determined that in most cities the cost of electricity, with a proper choice of lamps, is not so much greater than the cost of gas as to be prohibitive.

Preservative Treatment of Line Poles.

In the report on line poles purchased in 1907, compiled by the U. S. Bureau of Census, in co-operation with the U. S. Forest Service, and issued as publication No. 9 of "Forest Products," it is stated that the use of preservatives superficially applied has grown very rapidly during the last few years. Among the substances used are creosote, tar, tar oil, asphalt, crude petroleum, and various patented preparations. This manner of applying the preservative has the advantage of simplicity and cheapness, and for many conditions has proved valuable, adding considerably to the life of the pole. This process should not, however, be regarded as a substitute for the more efficient impregnation of the wood with the preservative.

Impregnation is usually effected by means of pressure pumps, the timber being placed in strong retorts hermetically closed. Recently, however, what is known as the "open-tank" or "non-pressure" process has been developed, whereby atmospheric pressure is employed to drive the preservative into the wood by a simple alternate heating and cooling of the pole in the treating liquid. The poles may be placed upright in the tank, so that only the butt is impregnated, since this is the part most liable to decay and hence most in need of treatment. The advantages of this method lie in the decreased cost of the apparatus required and the very considerable saving of preservatives.

Extensive experiments have fully demonstrated the practicability of the open-tank process for many conditions. In a test recently conducted in southern California, about 1800 poles were treated by various preservatives, and careful records will be kept of their comparative durability.

A 40-ft. Southern pine pole with a 7-in. top contains about 25 cu. ft. Assuming an absorption of 8 lb. of creosote per cubic foot of timber, or 23½ gal. per pole, with the cost of creosote at 10 cents a gallon, the preservative will cost $2.35 per pole. Allowing 50 cents for labor and seasoning charges, the total cost of treating the entire 40-ft. pole will be $2.85.

In California the standard 40-ft. Western yellow pine pole contains about 26 cu. ft., and creosote costs there about 20 cents per gallon. The actual cost, therefore, of treating the entire length of the pole will be about $5.40. If, however, only the butt of the pole is impregnated, only about 6 gal. of oil and preservative will be required, and the total cost will be reduced to about $1.52 per pole. The prices quoted do not include profit.

Building Up Load at Rockford, Ill.

The Rockford Electric Company has been doing some very active work in the building up of its load since the American Gas & Electric Company took hold of the property in 1907. Most of this development has been made under the management of Mr. F. H. Golding, formerly assistant manager of the Dayton Lighting Company, who assumed the management of the Rockford Electric Company in the fall of 1907. At that time the company was just beginning to give electric service in the outlying districts of the city. Formerly there was only a direct-current distribution system covering the downtown district and certain residence streets.

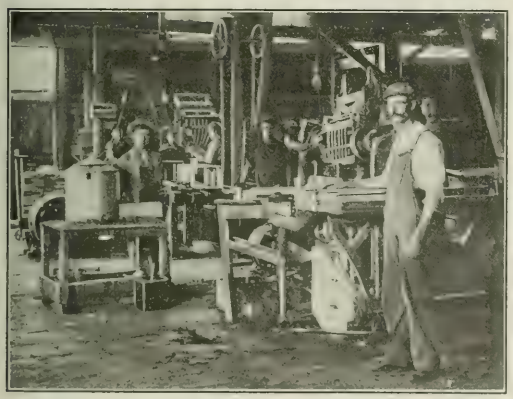
Rockford is a city which offers exceptional opportunities to a central-station company for building up a motor load among manufacturers. There are 350 factories of various kinds in Rockford, some of them very large. Rockford has sometimes been called the "Lowell of the West" on account of the large factories which were years ago attracted to its water-power. The water-power, however, is very limited and nearly all of the factories are operating with steam. These factories are said to employ in the neighborhood of 11,000 persons. The city has 26 furniture factories, 17 machine-tool plants, 4 immense knitting plants, 1 farm-implement factory, covering 25 acres, and a malleable-iron works covering 15 acres.

The Rockford Electric Company originally operated on water-

power, but soon outgrew this until its generating plants in Rockford now contain 600-kw in water-driven machinery and 4700-kw in steam-driven machinery. The last two steam units installed were 500-kw turbines. The company has for some time carried all of the electric railway load of the city and interurban lines centering in Rockford. The central-station generating system is, therefore, of a size where highly economical machinery can be used from now on, and the company is in a position to solicit the motor business of the large manufacturers, as well as that of the small.

At the time the American Gas & Electric Company took control in May, 1907, the company had 1369 consumers. In February, 1909, the number had increased to 2667. In May, 1907, the connected lighting load was 1500 kw, or the equivalent of 30,000 50-watt lamps. In February, 1909, the load had increased to 3000 kw.

The connected horse-power in motors shows a similar proportion of increase. In May, 1907, the connected motor load was 1720 hp. In February, 1909, it was 3300. During the time of this increase the direct-current distributing system was being reduced in area, but the connected load on the direct-current system was being increased, so that the direct-current load remained about the same as before the restriction of territory. As far as the generating plant is concerned, therefore, the alternating-current machinery has taken most of the increase. The



INTERIOR OF PLANT OF THE GREEN LUMBER COMPANY, SHOWING ELECTRICALLY HEATED GLUE-POT.

connected load of the company in December, 1908, was a total of 5200 kw, not including the street and interurban railway systems or the city arc lamps. The maximum load, exclusive of these systems, was 2595 kw. The load factor on the generating stations, including the railway and street-lighting loads, for the year 1908 was 38 per cent.

The W. F. & John Barnes Company's machine-tool plant is being rearranged by degrees so as to use electric motors exclusively. At present, 67-hp in motors is connected at this plant, and also a lighting load of 141 5-amp arc lamps and 286 16-cp incandescent lamps. In the knotting machinery factory of the Barber-Coleman Company, 200 hp in motors is connected. In the large wood-working plant of the Green Lumber Company 240 hp is connected. An interesting feature of this plant is the 25-gal. glue-pot seen at the left of the accompanying illustration. This glue-pot consists of the ordinary outer and inner receptacles used in glue-pots, the water in the outer receptacle being kept hot by means of a 2300-watt Simplex immersion coil.

Energy is sold on a readiness-to-serve or Doherty rate, consisting of a fixed charge of $1 per month per horse-power connected, plus 3 cents per kw-hour for energy used, with a sliding scale for large consumers. A readiness-to-serve rate is also used in connection with lighting, the consumer being given the option between this and a sliding scale, ranging from 13 1/3 cents to 8 cents per kw-hour, with 10 per cent discount, the sliding scale being based on a minimum guarantee per month for each rate. The lighting readiness-to-serve rate is $1.80 per year per 16-cp connected, plus $12 per year consumers charge, plus energy at 4 cents per kw-hour. The fixed charge per month of the readiness-to-serve rate is based on the candle-power and not on the wattage of the lamp.

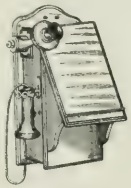
In soliciting for business there is one man who devotes his attention to motors, one to residence lighting and steam heat. There are two men working on commercial or business district lighting, one having the business district on the west side and the other the two business districts on the east side of the river.

The company runs two advertisements per week in each of the two weekly papers. The writing of advertisements is divided up among the soliciting force, each solicitor writing an equal number of advertisements per week.

New Telephone Patents.

WALL TELEPHONE SET.

A new idea in the design of telephone wall sets, as patented by Mr. R. Hansen, of Sioux City, Ia., is shown in the accompanying illustration. There seems to be considerable merit in this arrangement of parts, as it will be seen that the face of the user is to one side of the writing shelf and, therefore, he is



HANSEN SUBSTATION TELEPHONE SET.

better able to see what is being written. The filler piece between the shelf and the face of the set proper carries the ringer, the gongs being downward beneath this filler. The whole face and shelf of the set is hinged so that it may be swung out to expose the working parts.

TRANSMITTER.

While it has been customary to support the microphonic button of solid-back type transmitters by means of a rear stud extending through a solid bridge, the button may, if desired, be supported by a clamp about its body. Such a transmitter is that for which a patent has been granted to Mr. Hansen. He has provided the bridge with a central aperture of size just to take the cylindrical microphone button casing. Slits run longitudinally of the bridge from this central aperture, terminating in circular enlargements. This forms a spring, or flexible clamp, the button being held by tightening this clamp by means of set screws running transversely through the bridge. The advantage of this method of supporting the button by means of a clamp about its cylindrical body is that it permits of insulated electrode contact studs from both faces of the button. At the same time the enlargements at the ends of the slits provide for the insertion of insulating bushings for supporting the transmitter terminals, conductors extending from these terminals to contact studs.

CALL-REGISTERING SYSTEM.

With an idea of automatically recording calls attempted in the absence of a subscriber, Mr. R. D. Lamson, of New York City, has invented a telephone recording apparatus in the nature of the usual telegraphic or fire-alarm recorder and adapted to be connected to a telephone line in such a manner that anyone calling and receiving a "Don't answer" may forward the proper signals, recorded upon a tape, to indicate the time at which the call was made and also the number and exchange of the calling subscriber. The problem, of course, is largely one of adapting the control mechanism of the telegraph recorder so that it will be responsive to currents designed for it and yet not be responsive to other currents upon the telephone line required for the usual purposes.

Letters to the Editors.

Valuation of Public Utilities Properties.

To the Editors of Electrical World:

Sirs:—I have been interested in your discussions of the recent decision of the U. S. Supreme Court in the Knoxville, Tenn., water case, particularly your editorial of Feb. 11, 1909, Mr. Winslow's letters of Feb. 25 and March 25, and Mr. Haskell's letter of March 18.

The valuation of the plants and properties of public utility companies is growing in importance, not only in view of their occasional purchase by municipalities, but more particularly on account of the growing tendency toward their regulation, and the fixing of equitable rates, by duly constituted legal authorities. It is important, therefore, that sound ideas upon these questions should prevail.

I do not agree with Mr. Winslow as to the unfairness of recent court decisions and other precedents. In my judgment both the public and the utilities generally are to be congratulated upon the progress that is being made toward fair and intelligent views of these very complicated matters.

Mr. Winslow's principal contention is that rates based upon present value of plant—which means reproductive cost less depreciation—are unfair to the utilities, and must eventually bankrupt them. In his judgment rates are properly a function of reproductive value. He also contends that the worth of any given service to the user is independent of the value or age of the plant rendering it. Another contention is that most utilities have a hard time meeting expenses in their earlier years, and to maintain a depreciation account then is a serious handicap.

As to the first argument, I have pointed out elsewhere that the authorities were practically unanimous against this view. It has everywhere been held that the value to be considered in rate making is the present value. As to Mr. Winslow's second point, service from a new and up-to-date plant always commands better prices than from an old and worn-out one, just as a new house will bring more rent than an exactly similar, though older one. Passing this by, however, is it true that the consumer should pay the same rate irrespective of the value of the plant rendering the service?

In this connection it should be remembered that the tendency of the day is to base such rates, not upon the worth of the service to the consumer—for that is an extremely variable and intangible matter—but upon the cost of rendering that service. There is justice in this for the reason that the public is in a sense a partner in the enterprise to the extent at least of the franchises which have been given. The utilities are the agents of the public in rendering a service which is necessarily monopolistic in its character.

In ascertaining the cost of rendering the service the value of the plant is important in that it forms the basis for computing the annual fixed charges, namely, the interest and the increment to sinking fund to cover the depreciation of the plant. The value at any date is found by deducting from the cost of the plant—original or reproductive—the amount which has accrued in the depreciation account by annual payments and interest, up to that date. Let us consider a number of different methods of computing fixed charges:

1. Where the depreciation account is started at the beginning of the plant's service and is continued uniformly throughout its entire life.

2. Where that account is not started for some years after the plant begins service. This may be considered in two ways: *a*. When it is begun reasonably early; and *b*, say, midway of the life of the plant, a plan which Mr. Winslow seems to favor.

3. A readjustment on the basis of reduced value of plant: *a*, about midway of its life; and *b*, say, every five years.

Let us take a plant costing $600,000, and having an assumed life of 50 years. This is, of course, much longer than the life of an ordinary electric plant, and is even somewhat beyond that of the average waterworks, although perhaps not much too great in the case of the best modern systems. Assume interest on capital investment to be 6 per cent, and that the annual increment to sinking fund is compounded at 3½ per cent interest.

Under Plan 1 the annual credit to sinking fund would be a sum which, compounded as above, would amount to $600,000 in the assumed life of the plant. This would be accomplished by an annual depreciation charge of 0.763 per cent. Adding interest, the total fixed charge becomes 6.763 per cent on $600,000, or $40,578 per year.

If the starting of the sinking fund is deferred for, say, 10 years (Plan 2*a*), then the fixed charges during that period would be only the $36,000 interest, but the plant would have to earn in the remaining 40 years the entire $600,000, which would require an annual credit to sinking fund of 1.183 per cent. At the end of the 10-year period there would be a sudden addition to fixed charges of $7,098, making a total of $43,098 for the rest of the plant's life.

If, however, no depreciation fund has been maintained at all during the first half of the plant's life (Plan 2*b*), then the fixed charge during that period would—as before—be the interest only, $36,000. During the remaining 25 years, however, the entire $600,000 must be earned, which would require an annual charge of 2.567 per cent, or $15,402, making the total $51,402.

Plan 3*a* involves a readjustment of rates about midway of the life of the plant, which in the case of a waterworks may be assumed at about 25 years. This is reasonably close to the time when many such franchises expire. Assuming the plant to have maintained a sinking fund for depreciation in accordance with Plan 1, it would have accumulated at the end of 25 years approximately $200,000. Deducting this from the original cost of $600,000—which for our present purposes may also be taken to represent the cost of reproduction—leaves $400,000 as the present value of the plant. As the remaining $400,000 must, however, be earned in the remaining 25 years' life, there must be an annual charge for sinking fund of 2.567 per cent, a total of 8.567 per cent, or $34,268. It is this reduction of $6,310, under Plan 1, to which Mr. Winslow objects.

Under Plan 3*b* the readjustment is made every five years, as has been proposed in some municipal plants where the sinking fund is devoted to paying off bonds at regular intervals. To thus retire the entire $600,000 in 50 years would require $60,000 every five years, to provide which there would have to be assigned to the sinking fund each year 1.865 per cent, or $11,190, the same to be compounded annually at 3½ per cent. During the first five-year period, therefore, the fixed charges would be interest, $36,000; depreciation, $11,190; total, $47,190. As the bonded indebtedness would decrease by $60,000 every year, the interest charge would fall $3,600 to correspond. The amount thus earned for fixed charges would therefore vary from the above $47,190 during the first five years, down to $14,790 during the last period, as shown in the following table:

Period.	Value of plant as indicated by outstanding bonds.	Fixed Charges. Interest.	Depreciation.	Total.
1st 5 years	$600,000	$36,000	$11,190	$47,190
2d 5 years	540,000	32,400	11,190	43,590
3d 5 years	480,000	28,800	11,190	39,990
4th 5 years	420,000	25,200	11,190	36,390
5th 5 years	360,000	21,600	11,190	32,790
6th 5 years	300,000	18,000	11,190	29,190
7th 5 years	240,000	14,400	11,190	25,590
8th 5 years	180,000	10,800	11,190	21,990
9th 5 years	120,000	7,200	11,190	18,390
Last 5 years	60,000	3,600	11,190	14,790

If the bonds must be retired in a shorter period—say, 20 years, as is sometimes required—the fixed charges would be much larger during the earlier periods.

If the bonds must be paid off at regular intervals, and the depreciation account kept up as an additional and separate matter, as seems to be required by law in some municipal plants, then there must be in addition to the fixed charges of Plan 3*b* a further depreciation charge as per Plan 1. It is needless to say that such an arrangement involves such high rates for service as to be practically prohibitory.

These plans differ widely as to the amount of fixed charges which the plant should earn, and to secure which rates must

be adjusted. Plan 1 has much to commend it, but might be criticised from the company's standpoint as requiring a depreciation account from the beginning, which it might not be possible to maintain, but which it might readily earn later—even in increased amount—as the business develops. It may be also criticised from the standpoint of the public in that it maintains the full interest charge throughout the life of the plant, when the total might be reduced by using the depreciation fund to retire the bonded indebtedness, thus stopping 6 per cent interest instead of letting the fund grow at 3½ per cent.

Plan *2a*, which seems to carry out the Wisconsin and Cincinnati ideas, and to that extent meets Mr. Winslow's criticism, has, however, the serious objection that it is adjusted but once, and then involves a sudden increase of nearly 20 per cent.

Plan *2b* is open to the same objection, but to a much greater degree, the sudden increase being $15,402; in addition to which the interest on the full value of the plant must continue. Furthermore, rates fixed on this basis increase the value of the property 50 per cent.

Plan *3a*, the one most generally followed, has the sanction of the best authorities. The entire $200,000 which has accumulated in the sinking fund is charged off, and a new one started, based on the then value of the plant, $400,000, and the depreciation is fixed at a sum which will return that amount at the end of the life of the plant. It will be noted that this arrangement effects an annual saving of more than $6,000 over Plan 1. It is, of course, true that on this basis the owners will not have in hand at the end of the plant's life the $600,000 necessary for its reproduction; but if the difference of $200,000 had accrued in the sinking fund at the beginning of the new period, it could have been paid back to the stockholders then, or used for retiring bonds. The additional $200,000 needed when the plant must be replaced is in the nature of betterments, and could very properly be met with new capital. This, of course, would then involve making a fresh start according to Plan 1, and a corresponding revision of rates.

Plan *3b* appears to have no advantages other than a constantly lowering of fixed charges which would permit a corresponding reduction of rates. As this, however, calls for large earnings during the earlier years of the plant's life and reduced earnings later, it is exactly the opposite to the usual experience of such plants. Furthermore, such a plan would involve a great increase of fixed charges, and of rates to correspond, when it became necessary to rebuild the system.

On the whole, I am inclined to think that Plan *3a* is as near an equitable solution of this vexed problem as can be reached. It already has the sanction of the best authorities, and permits that reasonable reduction of rates which seems to be demanded by the trend of the times and which is usually warranted by increased business, and better and more economical facilities.

St. Louis, Mo. William H. Bryan

Patent Reform.

To the Editors of Electrical World:

Sirs:—The need of reform in the patent laws is constantly forcing itself on public attention, as is indicated by the discussion of the subject in your columns and elsewhere. That in the progress of events an intricate system of abuses has grown up admits of little doubt. The remedies, however, are not quite easy to apply, without so radical a change of procedure as to amount to a complete revolution in present practice. The fundamental intent of the patent law is found in its direct authorization in the Constitution itself. The clear intent of this authorization was to encourage the useful arts by granting temporary monopoly to inventors. This beneficent purpose is carried out by the existing statutes only insofar as they operate to secure such a monopoly. On the face of every patent issued are the following words: "Now, therefore, these letters patent are to grant unto the said (A. B.) his heirs or assigns for the term of 17 years from the (.....) day of (.....), (.....), the exclusive right to make, use and vend the said invention throughout the United States and the Territories thereof." On its very face the thing granted is not only the right but the exclusive right to "make, use and vend" the invention described in the letters-patent; and insofar as the patent laws fail in this they fail of the purpose for which they were authorized in the Constitution. Whatever the original conditions may have been, it is now only too obvious that the inventor actually receives very little more than a slight presumption of right in the subsequent litigation Even the right to make the very thing described in the patent is not his unless he can establish it against all comers in a series of suits that may last the full term of this patent.

A very brilliant patent lawyer, winner of many a hard fought suit, recently delivered an address on the protection afforded by the law to secret processes, and made it extremely clear that within the range of things that can properly be held as trade secrets, the rights of ownership will be rigorously upheld by the courts, in such cases the procedure to secure protection being on the whole less cumbersome than in suits under the patent laws. It is the custom to blame patent attorneys for many of the abuses that exist, but in fact these have grown up so gradually that they cannot be charged to any one class or influence. Besides all this, the Patent Office is being now used in ways that certainly could not have been foreseen by the founders of the system.

The fundamental presumption unquestionably was that the thing patented would be made, used and sold. That patents should be obtained for the purpose of preventing this object was a thing evidently not considered. There were no trusts a century since, exhausting their ingenuity in devices to prevent competition—no great companies maintaining patent departments bigger than the whole staff of the Patent Office in the earlier days. Any changes made now in the statutes or rules must contemplate not only protection for the legitimate rights of the inventor, but the securing to the public the benefits of his invention. If they fail in this they fail in the very object for which the patent system was authorized: "to promote the progress of science and useful arts." For their progress is not promoted by making it easy to tie up improvements for 17 years. The ways of the large interests in the Patent Office are familiar. For each patented thing made, used and sold there are a dozen or a score of patents secured which block the way to all lines of improvement. Some of them are doubtless taken out in good faith as improvements and laid on the shelf for one reason or another. Others are merely dogs in the manger, useless in themselves, but holding the way for ferocious attacks when the real improvement comes along. For the protection of the rights of the public the laws should be so modified as to compel the owner of a patent, in Down East parlance, to "fish, cut bait or go ashore" within a reasonable time.

Adequate remedies for complicated ills are never easy to prescribe. In the present case, however, some of the ills can be definitely located in the Patent Office practice, and can be reached without the use of drastic remedies. One of the most serious things in the system is the granting of too many broad patents—broad at least in the verbal scope of the claims so that their limitations can only be discovered after wearisome litigation. It is very common to find attached to a definite and comparatively simply specification, claims which when rigorously read upon it are fair enough but may in turn cover many things besides, and which may years later be made the basis of suits only to be decided by a long and costly fight in the courts. In theory such claims are supposed not to be allowed, but in practice they are exceedingly common. If the inventor were compelled to stand closely by his actual invention so that its scope should be clearly defined in the claims and not permitted to go beyond the perfectly definite statement of the specification, litigation would be greatly decreased. This reform can be put into effect by any clear-headed and forceful Commissioner of Patents who has an adequate force of assistants put at his disposal by Congress. It implies merely a more thorough search into the state of the art and a determination

to hold the language of the claims hard down to the thing actually invented. As things now are it is frequently possible to dodge an obvious reference by mere verbal juggling, perhaps securing in the end what is apparently a basic pattern carrying with it the presumption of broad validity.

Of radical changes in the patent laws many have been proposed, based commonly on provisions in some of the foreign patent systems. Provision for compulsory working, with forfeiture in unworked patents after a comparatively brief time, is a favorite scheme of reform. In certain cases the desired results might perhaps be attained, but upon the whole we see small chance of accomplishing much in this way. Many foreign countries have compulsory working laws which actually do not mean much, and in particular they would not remedy some of our most crying evils. They would not, for instance, deter large companies from going through the motions of working, while they would almost inevitably wreck the inventor of small means if the provisions of the law were anything but farcical. The strategic patterns owned by trusts are valued not for the inventions as such, but for their possible hold and restraint on the business.

A few thousand dollars spent in going through the form of working can be well afforded for this purpose, while the independent inventor would generally go to the wall, especially if his pattern covered intricate machinery. A suggestion made by Mr. Isaac L. Rice in the abstract of his *Forum* paper printed in your columns is based on a provisional grant for six months during which the patent is subject to attack. If it survives this period of litigation it is to be held valid. This device looks pretty fair—more promising than it really is. For in the first place the big interests would make a point of fighting everything that looked promising, thereby generally wearing down the inventor by the heavy costs. And second, if the patent stood fire successfully, infringers would have to be sued, as is now the case, the only gain to the patentee being that infringers would be estopped from invoking the defenses that allege invalidity. The exact scope of the patent would still remain to be determined. A more useful thing, of which Mr. Rice makes mention, would be a compulsory license law, able on the one hand to protect organized industry from disaster, and on the other to insure some return to the patentee in cases where he now gets nothing but a lawsuit. But in order to make such a law effective the patent must be so difficult to invalidate that would-be infringers would be discouraged.

Back of all legal reforms must lie such rigorous action in the Patent Office as would give the patent not only a presumption of validity but practical certainty, within the limits of its specification. The statute should be so modified that the office can say to the inventor: "This thing which you have patented is yours to make, use and vend and no action shall lie against you so long as you stick to your specifications. You are found, however, to have made, not a complete original invention, but a patentable improvement on the devices of A, B and C, which were cited against you, and you must demand licenses of them if you wish to manufacture." The preliminary publication suggested by Mr. Rice will then be reduced to a device for getting overlooked references before the office, the commissioner to have final jurisdiction with liberty to hear counsel and summon experts in his own behalf if he desires. If licensing is made easy it will not pay to risk infringements.

The general procedure suggested might be modified in various ways, but essentially it would cover the following points: First, the search would be made thorough enough to disclose clear ground of infringement as between patents in the prior art and the thing shown and described in the applicant's specification. Instead of being allowed to dodge citation by mere verbal changes in claims, the applicant would have either to amend his case so as to be absolutely clear of them in fact or take a patent merely for his improvement, issued as specifically subject to the cited patents. Second, after issuance of provisional protection a public opportunity to bring to the attention of the office any patents which should have been cited, merely for the information of the Patent Office, which would then reopen its inquiry and continue its action. The commissioner might receive briefs from interested parties and call experts for his own information, if necessary, but should have final authority to pass on the scope of patents cited—just as he does now within the limits of the present practice. Third, the final issue of the patent either cleared entirely by specific limitation or directly subject to broader patents—in either case carrying the right to make, use and vend the thing shown and described undisturbed, having when necessary secured license from the owners of controlling patents. Fourth, a compulsory license law to insure getting such license.

The result of this would be to give a patentee a clearly defined right to manufacture under his patent, and to stop infringement suits save against absolute pirates, who would have no standing in court. If anyone tried to dodge a patent by trivial modifications, he should have no standing unless he had faced the Patent Office with it and settled his rights. The expense of such procedure as here suggested would be somewhat higher than at present, but far less than the present fees plus almost inevitable litigation. The chief things to be determined by the courts would be the value of license rights, and the bulk of the tedious legislation now common would be avoided. Best of all, there would be little use in taking dog-in-the-manger patents under which licenses could be demanded.

NEW YORK. INVENTOR.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Centrifugal Coupling.—J. FISCHER-HINNEN.—Polyphase induction motors with squirrel-cage secondaries have the disadvantage of a low starting torque and a high starting current. These disadvantages may be overcome by starting the motors without load and automatically coupling them when a certain speed is reached. The coupling of the author, in which use is made of the centrifugal force, is shown in Fig. 1. As shown in the diagram, two leather strips are fixed to the periphery of the inner half of the couple. By means of centrifugal force these leather strips are pressed against the inner periphery of the outer half of the coupling and by the resulting friction, the outer half is carried along. For higher speeds, the weight of the two leather strips is generally sufficient to produce the necessary friction. For low speeds a sheet of lead or iron is placed between the two leather strips in order to increase the friction. At normal speed the slip remains below 0.3 per cent. A special property of this coupling is that it is not necessary to avoid small eccentricities of the two machines coupled together.

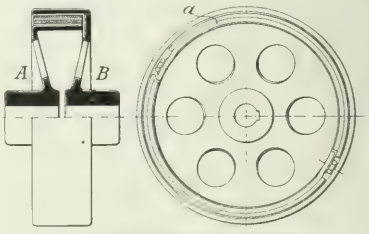


FIG. 1. DIAGRAM OF COUPLING.

The coupling is also particularly suitable for single-phase motors.—*Elek. Zeit.*, March 25 and April 10.

Effect of Damping Coils.—I. Doery.—A theoretical note on the action of damping coils on pole-wheels of alternators operating in parallel. The damping coil has two functions. The first is to decrease the oscillations due to the forced oscillations of the prime mover and to the reaction of the generators. The second is to dampen the effect of sudden outside changes, like the change of the pressure in steam boilers, or a change of the chemical composition of the gas with gas engines, etc. The author deals especially with the second effect, with special reference to a former paper of Rosenberg.—*Elek. u. Masch.* (Vienna), April 4.

Losses in Induction Motors.—O. S. Brabstad and A. Fraenckel.—An illustrated translation in abstract of their recent German paper on an investigation and calculation of the "additional iron losses" in induction motors.—Lond. *Electrician*, April 2.

Lamps and Lighting.

Two-hundred-Volt Tantalum Lamp.—The 200-volt to 250-volt tantalum lamp has been placed on the market in England in 32-cp and 50-cp sizes, at a retail price of $1.25 each. The 32-cp lamps can be supplied in two types, "consuming 1.7 watts per British candle and 2.2 watts per British candle, respectively, the former at voltages from 200 to 250 and the latter only at from 200 volts to 230 volts." (The life of the two types is not stated.) The 1.7-watt lamps are 5 9/16 in. long and 2½ in. in

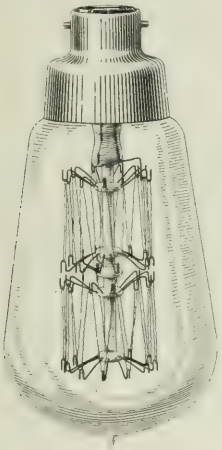


Fig. 2.—32-cp, 200-volt tantalum lamp.

diameter, and the 2.2-watt lamps are 5 13/16 in. long and 2 15/16 in. in diameter. The 50-cp lamps are supplied only for the lower specific power consumption (1.7 watts per candle), and have the larger-sized bulb—5 13/16 in. long over the cap and 2 15/16 in. in diameter. The 32-cp, 1.7-watt lamps are recommended for use on direct-current circuits alone, whereas the 50-cp, 1.7-watt lamps and 32-cp, 2.2-watt lamps may be used on either direct-current or alternating-current circuits. The difference from the ordinary tantalum lamp is that the 200-volt lamp contains two filaments wound upon two sets of supporting arms instead of one, as shown in Fig. 2.—Lond. *Elec. Eng'ing*, April 8.

Metallic Filaments.—A note on a recent British patent of W. B. Coolidge, for the manufacture of metallic filaments (17,620, 1908; April 1, 1909). In the manufacture of filaments of tungsten and similar refractory metals, the squirted filament is cut into lengths, coiled and then baked in a vacuum or hydrogen chamber to remove the binding material. After this treatment the individual filaments are raised to a high temperature by sending current through them, in order to remove the last traces of the binder and to sinter the filament together. A difficulty in this last process was the fact that the filaments could not be connected in parallel, as some would take too much current and burn away, while others at the same pressure would not be properly sintered. To enable a large number of filaments to be sintered simultaneously the present invention provides for the use of a separate resistor with a high positive temperature-resistance coefficient, such as iron wire enclosed in a bulb filled with hydrogen, in series with each filament. The pressure can then be raised until every filament is properly sintered as a low-resistance filament will be prevented from taking too much current by the rise in resistance of the corresponding iron resistor.—Lond. *Elec. Eng'ing*, April 8.

Supports for Metallic Filaments.—A note on a recent patent of Siemens & Halske Company (21,385, 1908; March 25, 1909). Tungsten filaments are in some cases fused to the metal supports, which are then made of nickel or iron coated with copper. The nickel or iron forms an alloy with the tungsten at the point of fusion, and the copper is added to prevent trouble owing to the fusibility of the alloy when only nickel or iron is used. When the filaments are cemented only to the supports, or merely looped round the ends, it has been customary to employ supports of copper, as this metal does not retain occluded gases. According to the present invention, such copper supports are constructed with a core of steel to prevent them from softening with the heat and thereby becoming permanently deformed.—Lond. *Elec. Eng'ing*, April 1.

Incandescent Lamps.—G. Loring.—An illustrated Franklin Institute paper describing the procedure in manufacturing carbon-filament lamps and tungsten lamps.—*Jour. Franklin Inst.*, Apri[1].

Arc Lamp.—An illustrated note on the "Rebofa" flame-arc lamp, made by a British company. The electrodes are superimposed one above the other, the bottom electrode being the positive. The arc voltage is 30, so that six lamps may be connected in series for 200 volts. The electrodes are fed together by gravity, the top one being weighted.—Lond. *Electrician*, April 9.

Mean Hemispherical Candle-Power.—J. K. Sumec.—A brief illustrated article on the simplest methods for determining the mean hemispherical candle-power from the polar candle-power curve. If this curve is given, the mean hemispherical candle-power equals the arithmetical mean of the abscissas of those points of the curve which correspond to 10 deg., 20 deg., 30 deg., etc., below the horizontal, multiplied by $\pi/2$. (The right angle may, of course, be divided into any other number of equal parts instead of 10 deg.)—*Elek. und Masch.* (Vienna), April 4.

Generation, Transmission and Distribution.

Dalmatia.—H. Tenesel.—The conclusion of his profusely illustrated article in which a sketch is given of the development of the water-power of the Kerka River, in Dalmatia. The Manojlovac plant has a rating of 24,000 hp. Three-phase currents are used at 3000 volts and transmitted to a distance of 35 km (21 miles) for operation of 32 calcium-carbide furnaces.—*Elek. Zeit.*, March 25.

Electric Cranes.—H. H. Broughton.—A continuation of his long serial. In the present instalment the author deals with the design and construction of the mechanical equipment of cranes. The mechanism required for effecting the usual crane motions is treated in four sections. The first section relates to lifting mechanism. The article opens with a short discussion on the determination of the size of motor, and a simple expression is given suitable for most ordinary types of jib and overhead traveling cranes. Then follow notes on wire ropes, flat-link chains, the gear ratio, spur-and-worm gears, shafting, barrels, blocks and hooks, mechanical brakes, limit switches and the "free-barrel" system. Lifting magnets and safety tongs are also described.—Lond. *Electrician*, April 9.

Traction.

Surface-Contact System Abandoned.—The London County Council has decided to abandon the use of the "G.B." surface-contact system in the Mile-End Road. The highways committee stated the reasons for this action in a long report, which was adopted by the Council at about 4:30 in the morning, toward the close of an all-night sitting. In the course of the discussion, Mr. W. Thompson, who was chairman of the high

ways committee, at the time the adoption of the "G.B." system was decided upon, expressed the opinion that the surface-contact system is to be the system of the future and that the "G.B." system had been "done to death by slanderous doings." The chief troubles experienced were due to the contact studs becoming alive from leaking of current, especially when the streets were wet and dirty. Some means of preventing this, however, have been recommended by Mordey. It has finally been decided to adopt the conduit system in that section where the overhead trolley cannot be used.—Lond. *Elec. Eng'ing*, April 8.

Melbourne.—An account of the report of C. Merz on the proposed electrification of the suburban railways of Melbourne, Australia. The following systems were compared: Unprotected and protected low-tension and high-tension third-rail systems, high-tension direct-current trolley system, three-phase system and single-phase system. The choice was narrowed down to a comparison of the unprotected third-rail, the protected third-rail and the single-phase overhead systems. Calculations showed that a protected third-rail system at 800 volts has many advantages over the unprotected system at a lower voltage, from both financial and operating points of view. It was further found that under Melbourne conditions the third-rail direct-current system shows a saving compared with the single-phase system. Concerning the power station, it is recommended that the prime movers be steam turbines supplied with superheated steam by water-tube boilers. The e.m.f. at the alternators is to be 12,000 volts; the switchgear is to be situated in a separate building, where the attendants are undisturbed by the noise of machinery or of accidents, and an elaborate telephone system is to connect the switchroom with each generating unit and with the substations. —Lond. *Elec. Review*, April 9.

Signal for Motormen.—All tramways in Liverpool are to be equipped with an automatic device by which a signal indi-

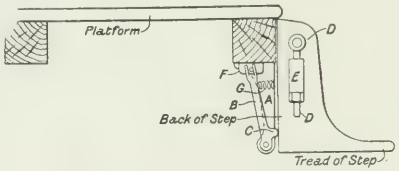


FIG. 3.—AUTOMATIC FOOT-BOARD SIGNAL.

cation is given automatically to the driver of a tramcar whenever a passenger attempts to board or alight from a car. The action of the device depends upon a contact being closed by the weight of the passenger as he places his foot on the step. The arrangement is shown in Fig. 3. At the back of the step a bracket *A* is fixed to the underside of the platform, projecting downward as far as the tread. Attached to the lower end of this bracket is a lever *B* having a projection *C* near the fulcrum against which the back of the step abuts. The step is hung on trunnions from adjustable hangers *D* passing through lugs *E* attached to the side frames and placed well back, allowing of slight swinging motion. When weight is applied to the tread this motion is communicated through the point *C* to the lever *B*, the top end of which is forked, and operates by a spring *C*. The circuit closed in this way lights a small lamp or operates the indicator placed on the top of the controller before the motorman.—Lond. *Elec. Eng'ing*, April 8.

Car Wiring.—An article on fire risks in heavy car wiring and control. The anonymous author points out the great objections from the fire-risk point of view in most of the systems at present for wiring railway motor-cars. Steel tubing is frequently used for protection, but there is much to be said against it. The author states that a far better result is obtained by the use of grooved slabs of asbestos slate. This system is used on the (London) Metropolitan Railway, but does not appear to have been adopted elsewhere to any great extent. In control apparatus preference is given to placing the whole of the apparatus in a fireproof compartment. Finally, it is suggested that aluminum might be used with advantage to a much larger extent than at present in car construction.—Lond. *Electrician*, April 9.

Installations, Systems and Appliances.

Electricity for Farms.—W. Siebert.—The author discusses the question whether direct current or three-phase currents are preferable for small electricity works in agricultural districts. Since motive power is the chief requirement and three-phase induction motors are of ideal simplicity, the three-phase system is preferred, especially as such small plants may be considered as possible substations of future large three-phase transmission systems. To store energy a battery may be provided with a synchronous converter. Parallel operation of the three-phase machines may be avoided by providing a special circuit for each machine and making provision so that any circuit may be connected to any machine. This system has proved quite successful on shipboard for ratings between 200 kw and 250 kw.—*Elek. Zeit.*, April 8.

Italy.—An article on the development of the electrical industry in Italy, giving general notes on large water-power stations, electric tramways and railways, and electric lighting plants, with special reference to the reasons why the German electrical companies have so far been predominant in Italy.—*L'Industrie Elec.*, March 25.

Tariff and Central-Station Economy.—Norberg-Schultz.—An illustrated description and abstract of his recent German paper in which the author endeavors to trace the effect of lowering the price per kw-hour. From curves relating to various stations he concludes that there is a critical price per unit below which the receipts per year based on the kilowatt of maximum demand fall off rapidly. The article has already been abstracted in the Digest.—Lond. *Electrician*, April 9.

Wires, Wiring and Conduits.

House Wiring—An illustrated description of a system of house wiring recently introduced by a British company. It involves the use of either of two systems, called the "stannos" and the "kuhlos." Kuhlos wires are made by wrapping plain or tinned brass or copper sheets around ordinary rubber-insulated conductors, the casing being finished off by bending

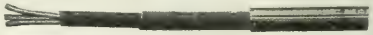


FIG. 4.—KUHLOS WIRE.

over to a longitudinal seam that projects somewhat from what is otherwise a smooth tube in close contact with the insulation. Continuity fittings and special wood blocks are provided. This system, which has been tried for some little time in Germany, affords a very inexpensive method of wiring with ordinary accessories, provided surface work alone is desired and the location is dry. A kuhlos wire is shown in Fig. 4. A feature of the wiring is the simple method adopted for fixing. Small clips, one of which is shown in Fig. 5, are nailed to the wall and then bent round the cable, as seen in Fig. 6. The cables can thus be rapidly fixed in position, and the cost of labor is reduced to a minimum. The clips are made in three sizes, for taking one, two or three wires, respectively. The cable can be bent by hand, so that bends, elbows, etc., are unnecessary. The



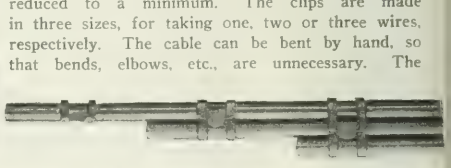


FIG. 5.—BUCKLE CLIP FOR ONE WIRE. FIG. 6. WIRES FIXED WITH BUCKLE CLIPS.

stannos system is in principle the same as the kuhlos system just described, the wires being encased in tinned copper. This latter consists of a sheet of tinned copper, lapped twice round the cable, the second lapping being soldered thoroughly to the first. The cable is absolutely water-tight and can there

fore be used in any situation. Two features are its great flexibility and the ease with which the metal casing can be removed for the purpose of baring the insulation. Owing to their small diameter (a 3/20 stannos wire is only 0.196 in. diameter), the wires are particularly suitable for locations where value is attached to neat appearance. In order to ensure continuity, special continuity fixtures are provided. These fixtures comprise back-plate, spring-plate or clamp, and special wood block. The metallic parts are made of sherardized steel, so that it is impossible for rust or verdigris to form and so cause the contacts to fail. It is claimed by the British company which has introduced this system that the stannos can easily be installed at less than $2.50 per point, including a carbon lamp. The kuhlos system is even cheaper, although not so pleasing.—Lond. *Electrician*, April 9.

Electrophysics and Magnetism.

Frictional Electricity.—M. Owen.—An account of experiments the object of which was to obtain curves showing the electricity charge produced as a function of the work expended in friction. Specimens of ebonite and glass were rubbed on a slate wheel, the axle of which was connected to earth. In some of the experiments the rim of the wheel was covered with a band of copper. Measurements made with specimens of different widths showed that the charge produced by a given amount of frictional work was almost exactly proportional to the width of the specimen, except in the case of very small amounts of work. The curves show that with a sufficient amount of frictional work the charge produced reaches a constant maximum value; that this maximum is independent of the pressure applied during the rubbing, but that the maximum is reached with a smaller quantity of work the greater the pressure. The view generally held as to frictional electricity is that due to Helmholtz, namely, that it is of the nature of contact electricity, the frictional work being expended in bringing the surfaces into closer contact. This view appears to be borne out by the observation that after a number of preliminary rubs the maximum deflection may be obtained with quite a small amount of frictional work, an amount much less than that required to give the maximum charge with the first rub. During the three or four hours' rest it might be supposed that the surface of the specimen goes through a process of slow elastic recovery of its original uneven form, or that during this time the surface becomes tarnished by the atmosphere, so that after this period the first contact is not a good one. However, in no case, whether after recent rubs or not, did mere contact of the wheel and specimen without rubbing produce even the slightest evidence of charge on the specimen.—*Phil. Mag.*, April.

Crystal Rectifiers.—G. W. Pierce.—An account of an investigation of crystal rectifiers for electric currents and electric oscillations. In the present paper the author deals with carborundum, molybdenite, anatase and brookite. The rectification is conditioned on the localization of the energy of the circuit at the high-resistance boundary between the two different classes of conductors, the crystal and the metallic electrode. Such a localization of energy at the boundary of the two conductors is favorable to the production of electrolytic polarization, if electrolytic polarization may exist in solids, and is also favorable to the production of a thermo-e.m.f., either of which might result in rectification. However, some experiments of the author appear to indicate that neither electrolysis nor thermoelectricity plays an important part in the phenomenon.—*Phys. Review*, March.

Theory of Radiation.—A. Einstein and J. Weiss.—Two highly theoretical papers. Einstein discusses critically some important fundamental points in the modern radiation theory. He endeavors to show that the Jeans-Lorentz radiation law is a necessary consequence of the statistical theory of heat; but he agrees with Planck that the above law is not in agreement with the facts. He then endeavors to show that Planck's radiation theory contains a certain intrinsic imperfection on account of not sufficiently defining the conception of probability. He then shows how it is possible, by modifying the foundations of Planck's theory, to reach the same results as Planck's with absolute strictness. J. Weiss gives a brief derivation of Planck's radiation law and shows why Jeans' argumentation, when translating simply the formulas of the gas theory to the electromagnetic parameters, leads to wrong results.—*Phys. Zeit.*, March 15.

Properties of Matter.—J. J. Thomson.—An account of his concluding three lectures before the Royal Institution, in London, on the properties of matter. The author discusses gravity, elasticity and surface tension.—Lond. *Electrician*, April 9.

Units, Measurements and Instruments.

Weston Cell.—F. A. Wolff.—An abstract of an American Physical Society paper in which the author deals with the value of the Weston cell obtained immediately after it is completed by bringing the mercury into contact with the paste, and furnishes a crucial test of the theory regarding the equilibrium conditions in the cell recently advanced by Hulett. The behavior to be expected on the theory proposed by Hulett was not found, so that it may be concluded that the assumption of accelerated hydrolysis at a mercury surface does not apply to the Weston cell as ordinarily set up.—*Phys. Review*, April.

Thermoelectric Couples.—W. W. Coblentz.—An abstract of an American Physical Society paper on the thermoelectric behavior of tungsten and tantalum. Further improvement in the construction of thermopiles must come through the reduction of the heat capacity of the junctions. Tantalum is obtainable in fine wires; it is pliable and does not oxidize readily at ordinary temperatures, and hence, suggests itself as a substitute for iron (steel) in connection with constantan. Observations were made on the thermoelectric force of couples made of copper-tantalum and copper-tungsten, the temperature range being from —180 deg. C. to +300 deg. C. The results show that throughout the range investigated the thermoelectric force of the copper-tantalum couple is about 4.1 microvolts per degree, which is one-tenth that of a copper-constantan couple. The thermal e.m.f. curve of tungsten-copper is rather unusual in that its inversion temperature occurs at about 40 deg. C. For temperatures below —100 deg. C. the thermoelectric force is about 3.8 microvolts per degree, while above +200 deg. C. the thermoelectric force is about 4.5 microvolts per degree. In each couple the direction of the current is the same as that in a copper-constantan couple.—*Phys. Review*, April.

Moving-Coil Galvanometer.—A. Zeleny and O. Hovda.—An account of an experimental investigation of the temperature coefficients of the moving-coil galvanometer. The moving-coil galvanometer has three temperature coefficients: one each for current, potential and ballistic measurements. On account of magnetic hysteresis and other disturbing causes it was found impossible to determine the values of these coefficients for an individual instrument with as high a degree of precision as it is possible to read deflections or throws. The values of the coefficients for different galvanometers of the same construction and materials are found to differ considerably, so that only approximate values can be given for any type of the instrument.—*Phys. Review*, April.

Alternating-Current Meter.—An official announcement of the Reichsanstalt by which induction meters for single-phase current and for three-phase currents, with a balanced load, are admitted for calibration. The constructions of the meters are described and illustrated.—*Elek. Zeit.*, March 25.

Tests of Steel.—B. O. Peirce.—An article describing a long series of determinations of the permeabilities of normal brands of compressed steel, Bessemer steel and Norway iron, in the form of ½-in. rods, over a wide range of excitation, and considering especially a method of measurement in a massive yoke in the region from $H = 400$ to $H = 2500$, which lies above the limits of most permeameter observations and below those of the isthmus method.—*Am. Jour. of Science*, April.

Telegraphy, Telephony and Signals.

Effect of Daylight on Wireless Telegraphy.—Mosler. Marconi has found that wireless messages can be transmitted to much greater distances at night than during the day. He believed that the smaller effect during the day was due to sunlight

dissipating the negative charge of the antenna of the transmitting station. The present author has measured the damping effect of the antenna at different times of the year and at different hours of the day, and has found that the damping effect is the same during day and night. He has further found that for transmitting messages to distances of 300 km (180 miles) the energy arriving at the receiving station is exactly the same during day and night. Marconi's observation cannot be explained, therefore, by a photoelectric effect of sunlight on the transmitting antenna. It must be assumed that in the long-distance transmission experiments from the Poldhu station the radiation was propagated in high altitudes of the air, and the final cause of Marconi's observation must be found in ionization.—*Elek. Zeit.*, April 1.

Miscellaneous.

British Patent Law.—Delivering a judgment in an appeal against a decision of the Comptroller-General of Patents, revoking a patent under the new British patent act, Justice Parker discussed what, in his opinion, was the intention of the legislature under the revocation clause, and also criticized the rules under which applications for revocations have to be made. His view as to the desirability of alteration in the present procedure is opposed to that expressed by the Comptroller. While the patent in question is not an electrical one, the following remarks of the judge (who had also to do with the recent Bremer arc-lamp patent revocation) are of general interest. In his opinion, it was wrong for the applicant not to be compelled to give evidence and satisfactory reasons for applying for the revocation of a patent. At present the patentee would be forced to disclose valuable information, the possession of which might be the precise object of the applicant, who, having obtained it, could withdraw his application for revocation. It allowed competitors, or intending competitors, to obtain particulars of the patentee's business which they otherwise could not obtain. Therefore, every applicant should be forced to give some *prima facie* evidence that his statement was correct. Reasonable protection should be given to the patentees; even a common informer had to make out some case requiring an answer, and it was obviously wrong that an applicant for a revocation of a patent should be freed from this obligation. Referring again to the Bremer case, Justice Parker stated he had come to the conclusion that both parties in an appeal must be compelled to rely upon the case which they placed before the Comptroller. In other words, he would not allow extra evidence to be called. He allowed this procedure in the Bremer case owing to the fact that he himself had not fully considered this point and felt that the patentees in that action might be in the same position.—Lond. *Elec. Eng'ing*, April 1.

Carbon-Tungsten Steels.—An account of the quite extended discussion which followed the recent paper of T. Swinden on the magnetic properties of a series of carbon-tungsten steels. J. W. Ullet said that manufacturers of telephone apparatus find that the question of the permanence of magnets is a very important one. Careful investigations have shown that a gradual drop in the strength of a receiver magnet makes a very considerable difference in the efficacy of the receiver. One speaker had referred to the excellent results obtaind by sparking magnetos of high-class construction, such as the Simms-Bosch. Ullet was not quite sure that the efficacy of these instruments is due entirely to the strength of the magnets. The excellent accuracy of the work is a more important factor. In reply to a question of McWilliam, Swinden said that he had not yet found either carbon or carbon-tungsten which was non-magnetic. The only reason which would lead one to the belief that a purely austentic steel would be non-magnetic (assuming that such a steel could be obtained) are that (1) the magnetic strength decreases as austenite appears and (2) the "artificial" austenite produced in nickel and manganese steels, which resemble very closely the austenitic constituent of quenched high-carbon steels, is practically non-magnetic. With regard to the maximum permanence value with a carbon content of only 0.5 per cent C, this is due to the permanence being a resultant effect of coercive force and remanent intensity. Although the higher (6 per cent) tungsten steel is now preferred in practice, it is possible that by judicial treatment the 3 per cent steel can be made to compete.—Lond. *Electrician*, April 2.

Argentina.—A statistical article on electrical imports to Argentina during 1907. Among countries exporting electrical machinery, etc., to Argentina, Germany is first, England second and the United States third. The chief items imported are wires and cables.—*Elek. Zeit.*, March 25.

BOOK REVIEW.

VECTORS AND VECTOR DIAGRAMS APPLIED TO THE ALTERNATING-CURRENT CIRCUITS. By William Cramp and Chas. F. Smith. New York; Longmans, Green & Company. 252 pages, 114 illustrations. Price, $2.50.

The title of this volume is quite misleading because it deals more largely with algebraic and symbolic, than with the graphic, representation of the relations in alternating-current circuits, while in four of the 10 chapters there are fewer vector diagrams than the average writer would use in treating the subjects covered, namely, self-induction and mutual induction, the transformer, motors of the induction type and alternating-current commutator motors. The remaining six chapters deal with vectors and with locus diagrams, but the diagrams actually shown have been used for interpreting certain equations rather than for showing physical relations directly. The book may be considered as giving a mathematical treatment of the more prominent electromagnetic phenomena with the aid of vectors, the uses of which are explained, and as such should be of value as a textbook for electrical engineering students.

NEW APPARATUS AND APPLIANCES

Boulton Shops of the Richmond, Fredericksburg & Potomac Railroad Company.

An excellent example of the change from steam to electric drive is furnished by the Boulton shops of the Richmond, Fredericksburg & Potomac Railroad Company, at Richmond, Va., familiarly known as the "Washington-Richmond Line," as it runs from Washington, D. C., to Richmond, Va. The maintenance of the rolling stock and the manufacture of both freight and passenger cars are carried on at these shops. A three-phase, 220-volt, 60-cycle system of distribution is employed with constant-speed induction motors.

The original electrification was begun about six years ago by the installation of a 75 kw belted generator, which was used only for lighting purposes, and about one year later a 125-kw Westinghouse generator was added to supply power for the machine shop. This is in use at present and is driven by a Ball engine of 225 hp direct-connected to the generator. Upon the erection of a new planing mill it was necessary to replace the 75-kw generator by one of 150 kw to drive the wood-working machines. This latter generator is direct-connected to a Ball engine of 250 hp. The generators are excited from a 17½-kw, 125-volt, direct-current Westinghouse generator driven by a Troy upright engine. The larger generating unit and the exciter are shown in Fig. 1. Steam is supplied from two locomotive-type boilers at 125-lb. pressure. The switchboard represents standard Westinghouse practice for low-tension, three-phase, alternating-current circuits.

The entire electrical equipment was installed by the local

operating force of the company under the direct supervision of Mr. W. F. Kapp, superintendent of shops and machinery. From the time of the original installation no interference whatever has been experienced by the failure of any of the power-plant equipment or the motors. The only interruption of service which has occurred has been the occasional blowing of a fuse when some one of the motors was started improperly.

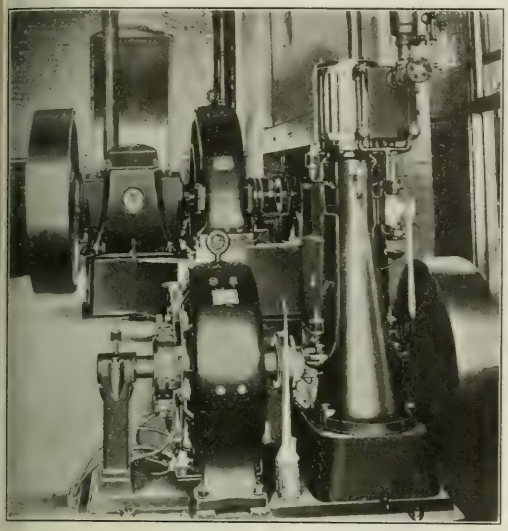


FIG. 1.—GENERATOR AND EXCITER.

The machine-shop equipment is particularly well arranged both with respect to the machines and the driving motors and the natural lighting facilities. Several of the individually driven machine tools are shown herewith, clearly indicating the convenience of the motor drive as well as the general cleanliness of the shop, as a result of the elimination of a large part of the belts. The table on page 1044 shows the different equipments used in the shops, including the wood working department, the machine shop, the wheel mounting shop and the blacksmith shop. In addition to the equipment shown in the table should be mentioned a storehouse elevator, operated by a 10-hp induction motor, and a Sturtevant fan in the punch shop for use in connection with the heating system, driven by a 10-hp motor. The heating of the paint shop is done by a 50-in. fan and heater coils, which are located in the roof trusses, the fan being operated by a 7½-hp motor.

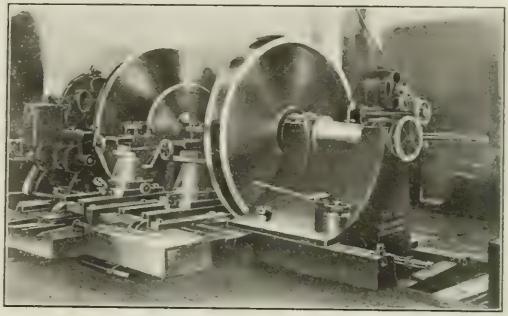


FIG. 3.—DRIVING-WHEEL LATHE—90 IN.

In connection with the installation of the 40-hp motor driving the two boring mills, the wheel press and the double-head axle lathe in the wheel-mounting shop, it should be noted that the original intention was to drive the entire machine-shop equipment from this one motor, but circumstances allowed such a regrouping of the tools that this motor became available for its present work. It has ample capacity to allow considerable expansion in this department when such proves to be necessary.

In the machine shops the line shafts of the group drives present an unusual feature in the high speed at which they run. Standard practice usually gives a maximum line-shaft speed of approximately 200 r.p.m., but here one shaft runs at 400 r.p.m and the other three at 300 r.p.m. No trouble whatever has resulted from these unusual speeds.

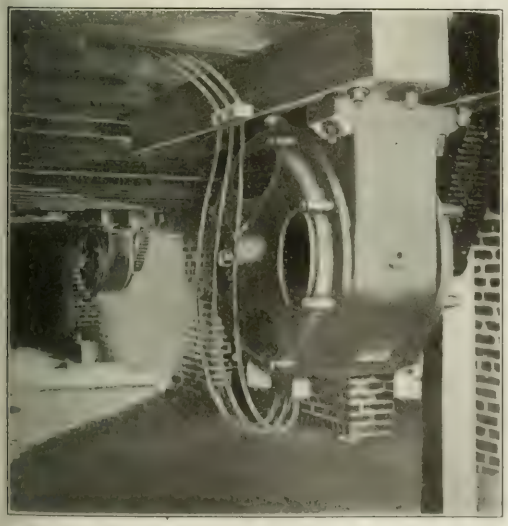


FIG. 2.—MOTORS ON UNDER SIDE OF FLOOR OF PLANING MILL.

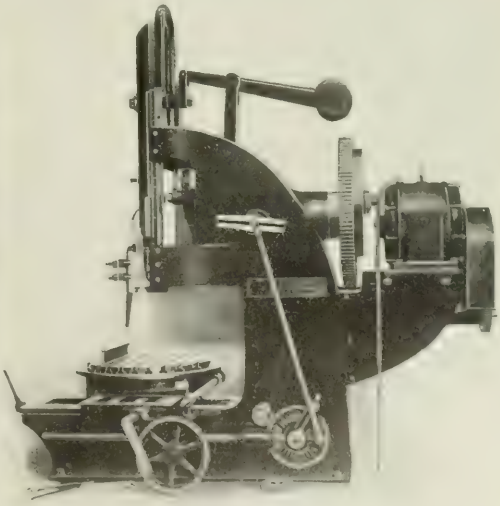


FIG. 4.—SLOTTER.

The planing mill is especially interesting owing to the manner of mounting the motors. In the extension of the shop plant it became necessary to fill in a considerable depth the ground

on which the planing mill is situated in order to bring the floor level up to a grade. It was decided not to fill in the space immediately beneath the building, but to leave this portion in the shape of a basement, utilizing the space to mount the motors and such shafting as are necessary to operate the various machines. The motors are suspended from the lower side of the floor beams and connected to the machines or shafting which they operate by means of a flexible chain; the method of support is clearly shown in Fig. 2.

This solution of the motor-drive question has resulted in a planing mill which is practically free of obstructions with the exception of the tools themselves and such material as may be in process of manufacture, the only motors above the floor

BOULTON SHOP EQUIPMENT OF RICHMOND, FREDERICKSBURG & POTOMAC RAILROAD.

Driven Machine Kind	Size	Manufacturer	Motor H.P.	Drive	Location
Planer	36"x11'	Niles Bement Pd	7½	Individual	Machine shop.
Driv'g wh'l lathe	90"	Niles	20	"	"
			3	"	"
Shaper	24"	Bement Miles Co	7½	"	"
Boring mill, horiz		Niles	5	"	"
Planer					
Wheel press			10	Group	"
Drill press					
Boring mill	44"				
Lathe	35"		15	"	"
Lathe	24"				
Guide grinder					
Lathe	43"				
Lathe	24"				
Turret lathe	13"		10	"	"
Drill press					
Emery grinder					
3 lathes	24"		5	"	"
Punch and shear, 2 bolt threaders		Hilles & Jones	7½	"	Blacksmith shop.
Grindstone					
Bolt header	1¼"				
Drill press	34"		10	"	"
Pipe threader	4"				
2 tool grinders			3	"	Tool room.
Fan	30"	Sturtevant.	3	Individual	Blacksmith shop.
2 boring mills	44"				
Double head axle lathe					
Wheel press	250 tons		40	Group	Wh'l m't'g shop
Tool grinder	24"				
Flue tumbler	200 flues		10	Individual	

PLANING-MILL EQUIPMENT IN RICHMOND, FREDERICKSBURG & POTOMAC SHOPS.

Woodworking Tools Kind	Size	Manufacturer	Motor H.P.	Drive
Bandsaw	42"	Fay & Egan	7½	Individual.
Car sill tenoner and gainer	12"	" "	7½	"
Cut-off saw	40"	Greenlee	15	"
Four-side molder	10"		20	"
Double cabinet-makers' saw	24"	Greenlee	15	"
Universal planer	12"x30"	S. A. Woods	40	"
Jointer	24"			
Double-head shaper				
Lathe	20"		20	Group.
Sash sticker				
Jig saw				
3 tool grinders				

being the one on a traversing-bed planer, as illustrated, which is driven by a 10-hp Westinghouse induction motor mounted directly on the machine; and one above the floor line driving the fans which take care of the shavings, this being situated in the roof trusses. The blast and exhaust pipes drop from the trusses directly to the machines which they serve.

The refuse from the machines is collected by means of a 50-in. fan and driven to the boiler-room where it is consumed by means of a second 50-in. fan. Both fans are driven by a 40-hp induction motor.

The entire electrical installment was made with Westinghouse Electric & Manufacturing Company apparatus.

Screw Guy Anchor for Pole Lines.

There are many conditions met with in the construction of electric light, telephone and street-railway pole lines that call for ingenuity on the part of the man in charge in obtaining suitable anchorages to counteract side strains on the line. W. N. Matthews & Brother, St. Louis, Mo., claim that by means of the Matthews guy anchor many otherwise impossible situations may be overcome, owing to the fact that it may be screwed into the ground without digging, and that it will hold very great strains. Fig. 1 shows one of nine poles in a curve in an important feeder line owned by the Union Electric Light & Power Company, of St. Louis, running along Broadway past Calvary Cemetery. The pole line is located just inside of where the curbstone will be located when the street is finally paved. There is a cinder sidewalk between the pole line and the fence shown in the picture. This line had to be anchored, but as authority could not be obtained from the owners of the cemetery to put "deadmen" in their grounds, ways and means had to be devised for overcoming the difficulty involved, and to



FIG. 1.—ANCHORED POLE ON A CURVE.

obtain an anchorage that would not interfere with pedestrians. The method by which this obstacle was overcome is shown in the illustrations. An arm was built out from the pole about 12 ft. above the ground. The guy wire was brought out to the end of it and then secured in a vertical position to an 8-in. anchor, which was screwed down to the eye alongside of the fence posts. It can readily be seen that under these conditions it would have been impracticable to put in a deadman or any other form of anchorage depending on a solid bank of earth for its support. Fig. 2 shows a crew of the Union Electric Light & Power Company installing a 6-in. guy anchor at an angle which brings it under a granitoid sidewalk. If a deadman had been used in this case, it would have been necessary to take



FIG. 2.—PUTTING GUY ANCHOR IN PLACE.

up two squares of granitoid to dig the necessary hole, and the cost would have been excessive. The electric light company has used a number of these anchors in St. Louis for dead-ending leads going through alleys. All of the alleys are paved with brick on top of concrete, and it has been found very economical to use anchors of the type described because it is only necessary to remove 8 in. to 12 in. of brick and concrete until the solid ground is reached, and then screw the anchor to place. Where it is necessary to obtain the permission of

property owners for the installation of an anchorage in their lawns, it is not difficult to get them to consent to the use of an anchor that does not require the digging of a hole and whose installation does not disturb the property in which it is installed. The anchor can also be used to advantage in low-lying ground that is covered with 2 ft. or 3 ft. of water or marsh, as it can be screwed down into the solid ground beneath and a good permanent anchorage obtained without the necessity of constructing a box to keep out the water and silt before a hole could be obtained to bury a deadman.

New Keystone Switchboard Instruments.

Some new round-pattern switchboard instruments have recently been put on the market by the Keystone Electrical Instrument Company, of Philadelphia, one of which is illustrated herewith. These are designed for both alternating- and direct-current measurements, and have, it is claimed, some very desirable features embodied in their construction. They are very strongly built and will, it is claimed, stand the worst kind of abuse without injury; 100 per cent overload can be applied at the instrument terminals without bending the needle or permanently injuring the movement. All parts are generously proportioned and a powerful torque is produced without introducing temperature errors or increasing the current consumption of the instrument. The opening in the instrument case over the scale is large so as to admit plenty of light, thus facilitating readings at a distance. The scale markings also are clear and distinct.



ROUND PATTERN SWITCHBOARD INSTRUMENT.

In the opinion of many engineers an instrument void of all useless ornamentation harmonizes better with the other equipment in a modern switchboard, so for this reason these new instruments show merely a border and the necessary lettering. The standard finish is dead black, but any other style of finish is supplied when requested.

New Appliances at Iowa Convention.

The exhibits made at the convention of the Iowa Electrical Association and the Iowa Street & Interurban Railway Association, at Cedar Rapids, were so extensive as to comprise a good-sized electrical show. The American Auditorium was rented by the association and the entire main auditorium room was offered to exhibitors and completely occupied by them free of expense for exhibit space. The original plan was to hold the convention in the center of the auditorium with the exhibits around the walls, but the requests for space were so numerous that the entire floor was taken up finally and the convention sessions held in an adjoining room. The plan is one which was much appreciated by the supply men, many of whom made exhibits when they otherwise would not have done so. The plan of renting parlor space in hotels at State conventions has never been very satisfactory, because of the high prices charged and the out-of-the-way location of many of the rooms in the average hotel. In the following paragraphs it will be impossible on account of lack of space to mention all of the exhibits, but attention will be called to some of the newer appliances which have not been on the market long and which are, therefore, of special interest to central-station men who wish to keep posted on the latest appliances.

The Pacific Electric Heating Company exhibited in the booth of J. B. Terry & Company, local Cedar Rapids dealers, some of the new "hot-point" irons, which have an automatic attachment whereby the plug is thrown out and the iron disconnected when a certain temperature is reached. This automatic protection, which not only reduces the fire risk, but prevents waste of energy when the iron is forgotten with the energy turned on, has proved so popular that factory facilities have been taxed to supply it.

The Railway Specialty & Supply Company, of Chicago, exhibited a vacuum-cleaning machine made by Hanlon & Wilson. The outfit exhibited had a ½-hp motor belted to a rotary pump. It is of a size convenient for movement from one room to another or from house to house.

The Fort Wayne Electric Works, in the way of new appliances, exhibited its "Compensarc," which is a kind of transformer for reducing the voltage from 110 volts to that required by the arc of a moving-picture apparatus. It can be connected for a 14-amp, 40-amp or 60-amp arc.

The Duncan Electric Manufacturing Company had on exhibition its new portable recording watt-hour meter for use in testing consumers' meters. This has a push-button pointer resetting appliance whereby the pointers can be returned to zero at any time for convenience in starting a test from zero. This instrument also has a dial switch for quickly changing from 110 volts to 220 volts or from 5 amp to 40 amp maximum capacity, which is a great improvement in speed over the old plug method.

The Central Electric Company had the only exhibit of 5-watt, 4-cp, 10-volt tungsten sign lamps. These were on a sign operated from a Central Electric step-down transformer reducing from 110 volts to 11 volts. A new Central Electric time-switch, which sells at a very reasonable price, was also shown. On this time-switch a common alarm clock trips a trigger operating a common rotary snap switch. The "Central" vibrator was another new specialty shown, as was also a remote-controlled switch for 25-amp capacity. These remote-controlled swithes obviate the necessity of running heavy main feeders long distances where the point of control has to be some distance from the natural course of the wires from the service entrance of the building. The high-tension drop-out strand protector which, when placed at each end of any span, will completely disconnect any span in which a break should occur, has been recently brought out in copper, and at the Iowa convention was also shown in aluminum for use with aluminum transmission lines. Other new specialties were the "tungstometer," a small instrument for measuring the wattage of tungsten lamps; "Opalux" white reflectors for tungsten lamps and Pelouze electric irons, which are of unusually high efficiency.

The new General Electric flatiron, regarding which announcement was very recently made, was exhibited for the first time. The heating, or resistance, metal in this iron consists of a single layer of flat metal stamped from a sheet in zigzag form. This is placed between mica sheets and is clamped between the bottom of the iron and another piece of iron above the resistor which acts to supply heat storage. Between the top of the iron and the heat-storage piece is an air space, which acts as a non-conductor of heat to prevent unnecessary loss by radiation from the top of the iron. The notable feature of this heating element is that a resistance metal has been found which is of such high specific resistance that only one layer need be used. This layer can be placed between thin mica sheets so that the heat passes readily into the iron above and below, thus providing for conductivity of heat away from the resistance metal, this being necessary to prevent the destruction of the resistance metal in any heating element. The new iron has also another important improvement in the terminal which makes it impossible to attach the plug to the iron incorrectly,

of in the former types. This should materially assist in eliminating cord and terminal troubles, which have been common. A transformer employing a new shape of core and a new alloy steel which reduces core losses were a part of the General Electric exhibit. A mercury-vapor rectifier set for electric automobile charging was also shown.

The Westinghouse Electric & Manufacturing Company has recently brought out a new toaster which has some strong points. It consists of a flat Hadaway heating unit placed horizontally. To make toast, a wire netting is placed over this unit to bring the toast a short distance from the metal of the unit. The toaster can also be used as a stove or griddle by placing over it a flat iron plate instead of the wire netting. The device has a handle which can be used for moving the toaster when it is hot, or can be pulled out and used as a toast or griddle-cake turner. The legs are removable and have smooth bottoms which will not scratch polished tables. The new Type S transformer, with low core loss, employing the new steel and the new form of core, was shown. The Westinghouse portable recording watt-hour meter for testing and calibration of consumers' meters has been improved by substituting a rotary switch for the plugs formerly used to connect the meter for different current-carrying capacities. It has been found that these plugs are likely to get lost, so that this rotating switch has been provided. The switch also gives a much more rapid means of changing the meter to carry different loads. A chocolate-heater for candy factories was one of the recent electric heating appliances much appreciated by local candy men who visited the exhibit.

The Federal Electric Company displayed several new types of tungsten clusters.

The General Compressed Air & Vacuum Cleaning Company, of St. Louis, which has been in the vacuum-cleaning business for a number of years, making large machines, now manufactures a small machine employing a ½-hp motor. This machine is of such weight and size that it is easily moved about a house by one person.

New Lake Steamer Brilliantly Illuminated.

Chief among the novel and interesting features of the new steel lake and ocean steamer *United States*, which goes into commission this month on Lake Michigan, is its electrical equipment. In addition to the regular lighting, the steamer bears an immense shield decorated with red, white and blue lamps; a large skeleton star outlined with electric lights and a huge double-face electric sign reading "United States." This sign will flash the name of the vessel first on one side and then on the other. The crowning feature, however, is the electrical flag erected on the stern. This is constructed entirely of metal and is studded with red, white and blue electric lights which are arranged



STEAMER "UNITED STATES."

with a flasher giving the effect of a waving flag. To see the Stars and Stripes waving at night miles out on the lake will be, to say the least, an unusual sight. The flag, star, name-sign and shield are connected with festoons in the three colors extending from the masts. All of the electrical features were manufactured in the shops of the Federal Electric Company, Chicago.

Each of the 46 staterooms of the steamer bears the name of one of the States of the Union; special panels between the staterooms display the portraits of the present Governors of the States, and there is a gigantic wooden map of the United States made up of blocks of wood gathered one from each of the States of the Union, kiln-dried and then highly polished to show their natural grain. Each block is carved in the exact geographical shape of the State from which it came, so that when put together they form a complete map of the nation. The walls of the cabin are filled with oil paintings portraying the most striking events of our sea history.

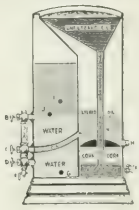
The *United States* is 215 ft. in length, 40 ft. beam and to the top of the bridge measures 56 ft. It is equipped with the most complete wireless telegraph apparatus to be had in this country.

Phantom Loads for Testing Alternating-Current Meters.

A portable loading device for alternating-current meters, shown below, has recently been placed on the market by H. J. Blakeslee, of Syracuse, N. Y., which is especially serviceable for central-station meter departments. The apparatus consists of a shunt transformer with low-voltage secondary and current-controlling arrangement. In use, the current coils of the meter under test and the standard are supplied from the transformer secondary and the potential coils are connected as normally. When a test of a meter is made in this manner, by exciting the current coils from a separate low-voltage source, an artificial load is created which is only apparent, and the load indicated by the instruments does not actually exist. Three requirements are said to have received particular attention in the design of the device. In order to insure that when in use the instruments shall be operating under conditions which are equivalent to those of a normal test and all objections as to power factor and varying or abnormal wave forms eliminated, a shunt transformer is used with constant-core magnetization, and a regulating resistance is used only in the secondary. To provide wide range and accurate adjustment of current, the resistance is arranged so that although nothing smaller than No. 4 wire is used, any current value from zero to the maximum can be obtained. The instrument has been made singularly compact; that rated at 150 amp having dimensions of 5 in. x 5 in. x 4 in., which permits it to be readily placed in one corner of an inspector's grip.

Oil Filter.

The accompanying illustration shows the details of an oil filter manufactured by the Kosmic Oil Filter Company, of Easton, Pa. Several advantages are claimed for the arrangement shown. Clarification takes place from below upward, and not by filtration from above, downward. The filter is divided into two compartments, enabling one compartment to be cleaned without interfering with the other. By regulating the valve which controls the flow of oil from one compartment to the



OIL FILTER.



PORTABLE LOADING DEVICE.

other, the degree of purity can be seen as the oil passes through the water in the gage glass, and the process can be regulated to the purity of the oil desired. Unfiltered oil is poured in the top over a screen *A*, and passing down is constrained to pass upward again through the cork and screen. The oil then passes over the connection shown and up through the glass filled with water, and out into the storage chamber. The clean oil may

be drawn off through the cock *I*. Before the filter is ready for operation water is poured into it until it emerges at the cock *J*. When it is desired to clean the filter, the valve *C* is closed and the oil drawn off from the spigot *F*. Hot water is then poured in the top of the filter and the interior rinsed out well. By opening the spigot *F* and removing the cap *H*, water and dirt may readily pass out. This operation may be repeated several times if necessary, when the spigot *F* may be closed and the cap *H* replaced. The filter is then again ready for use. Any water contained in the oil may be drawn off from time to time through the spigot *F*. The filter is built in two sizes, one capable of filtering from 20 gal. to 40 gal. in 24 hours and the other large enough to filter 10 gal. to 20 gal. in 24 hours.

Chicago Electric Washer and Wringer.

One of the most pleasing characteristics of the electrical advancement of the twentieth century is the new and varied applications of electric motors by which the drudgery of household work is lifted from the shoulders of women. Washing machines and wringers, for instance, are now successfully operated, and their use promises to rob "wash-day" of its terrors. The Hurley Machine Company, of Chicago, manufacturer of the "Thor Electric" washing machine, has introduced a new



ELECTRIC WASHER AND WRINGER.

and simple type, which it calls the "Chicago" electric washer and wringer. This outfit is illustrated herewith. A small motor is attached under the washtub so that it may be connected by belt-drive either to the washing machine or the wringer, as shown in the picture. Electricity may be obtained through a plug attached to any lamp socket, and either alternating- or direct-current motors may be used. The combination is strong and compact, with few parts to get out of order. The tub is built of cypress, said to be the best wood obtainable for this purpose, and it has a corrugated bottom and sides, giving it a washboard surface. The cover is made double, so that it will not warp, and it is so constructed that it may be raised at any time without turning off the power. All that is necessary is to partially fill the machine with soapsuds, place the clothes in it and turn on the current. The new machine is introduced as a practical, low-priced piece of apparatus, and the company offers to put it in for free trial. The wringer furnished with the machine is specially devised for this use, and can be started or stopped by the touch of a button.

Ampere-Hour Meter.

The accompanying illustrations show two types of amp-hour meter recently brought out by the Sangamo Electric Company, of Springfield, Ill. While such a meter is especially serviceable for electric vehicles, train-lighting equipments, central-station batteries, and was, in fact, designed primarily for use in connection with storage batteries, it is applicable for a number of other uses. One use to which it has been adapted since its introduction is in connection with electroplating operations, the meter being calibrated to read in quantities of metal deposited instead of amp-hours. Fundamentally, the meter does not differ from the well-known Sangamo direct- and alternating-current mercury, motor-type watt-hour meters. In these meters a copper-disk armature is immersed in mercury contained in a mercury cup or chamber so constructed as to prevent spilling or escape of mercury in any position in which the meter is placed. Contacts are embedded in the walls of the mercury chamber so that current may be led in and out through the mercury and the armature. When the current passes across the magnetic field, a stress is exerted upon the conductor carrying the current tending to displace it.

In the service type of meter shown herewith it will be noticed that the tips of the poles of the mercury chamber are attached to the poles of a large energizing magnet. The armature immersed in the mercury is subjected to a powerful field on each side of the center. The magnet takes the place of the potential-energizing coil and field used in the standard type of Sangamo direct-current meter. When the current passes through the armature and across the two field coils, a rotative effect or torque is exerted upon the armature which varies with the current passing, the fields remaining constant. Like the watt-hour meter, the amp-hour meter is operated with current shunts. The standard meter without shunt is rated at 10 amp. and in this size the entire line current passes through the arma-

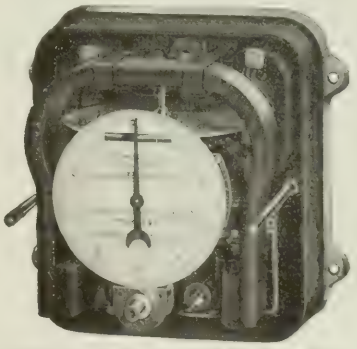


FIG. 1. "AUTO" TYPE, WITH CASE REMOVED.

ture, the meter being capable of taking an overload of 100 per cent. In larger sizes the armature is shunted; the shunt across the main binding posts of the meter being placed inside the meter up to 100 amp, and external to the meter in larger sizes. The meter is said to be remarkably accurate, owing to a special arrangement of armature, damping disk and permanent magnet. The recording train and dial differs from that in the watt-hour meter, the purpose of the dial being to show at any time by the position of a single pointer the condition of the battery with which the meter is connected. As the pointer will rotate backward on charge at exactly the same rate that it rotates forward on discharge, it acts as an indicator to show when a battery is fully recharged for partial or complete discharge. Thus, if the meter indicates a discharge of 60 per cent of the total rated capacity, the charging current would be kept on until the hand had rotated backward to zero and also for a point beyond an additional amount, which could readily be determined by experience or by obtaining data from the battery-makers as to the proper percentage to allow in recharging for internal loss in the

battery during discharge. If the hand has been carried past zero in recharging, it is desirable to have it reset at zero preliminary to starting out with the batteries fully charged. To provide for this the instrument is equipped with a resetting device located just below the recording train. The device is

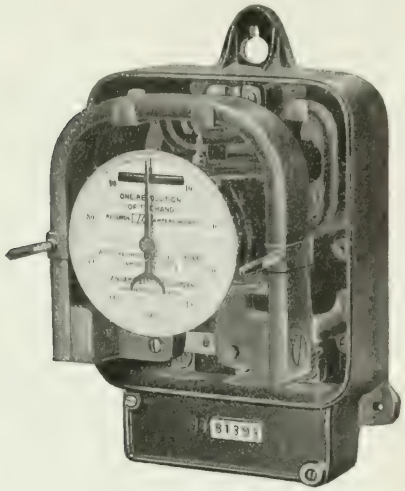


FIG. 2.—SERVICE TYPE METER, WITH CASE REMOVED.

similar to the pendant set of a watch, and is fitted with a detachable key. By pushing in the key and turning slightly the hand can be brought to zero from any position without disturbing the mechanism of the meter or the train. For vehicle work the instrument possesses many advantages. An automatic cut-off attachment is fitted to the meter and any amount of recharge can be determined, the pointer set for this, and upon the completion of its revolution, or partial revolution, when the battery is in a fully charged condition, the circuit will be automatically opened. This is effected by placing an insulated contact point at the zero on the dial and taking the auxiliary circuit out through a pair of extra binding posts on the meter, operating a relay-battery circuit to open a switch in the charging circuit.

Indirect Lighting from Fixtures for a Large Auditorium.

To accommodate banquets, balls, concerts and the like, the South Shore Country Club, of Chicago, is erecting a large auditorium, 120 ft. x 90 ft. Marshall & Fox are the architects, and, early in the making of the plans, they decided to use some system of indirect lighting for this auditorium, considering arc lamps and the cove system, but finally deciding to use the "I-Comfort" fixtures. These fixtures consist of inverted silver-plated glass reflectors, containing in this case 100-watt tungsten lamps, the light from which is reflected from the ceiling, while the lamps themselves are not visible, so that there is general illumination without glare or eye strain. The central portion of the South Shore auditorium will be lighted by three large, handsome chandeliers, each containing 23 of the inverted fixture units. In addition there will be 28 separate fixtures of this type suspended in the promenade of the auditorium surrounding the central portion. The hall is treated in ivory and red, with a paneled ceiling, and it is anticipated that an excellent lighting effect will be obtained. The consumption of electrical energy will be the same as that planned for direct illumination, while the cost of the fixtures will be $850, as compared with $1,500 for the direct-lighting planned. It is said that this auditorium will be the first large hall or assembly room of this character west of Washington to be lighted in this manner.

New Type of Outlet Box.

There are many kinds of outlet boxes on the market, and the tendency now is to simplify them so that jobbers and contractors will not be obliged to carry a large variety of stock



FIG. 1.—KNOCKOUT BOX.

to meet the demands. To this end the Sprague Electric Company has placed on the market a box to which the name "Multilet" has been given, because it signifies the aim of the manu-

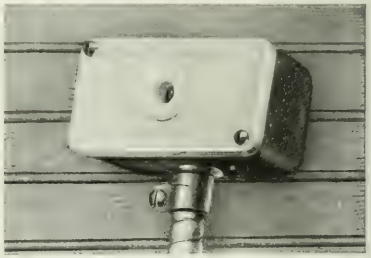


FIG. 2.—WIRE PORCELAIN COVER.

facturer—one box for many purposes. The box, which is shown in Fig. 1, is of the knockout type and made of stamped steel; it has one outlet in each end, one in the bottom, one in one

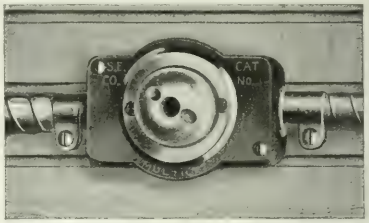


FIG. 3.—FLOOR RECEPTACLE COVER.

side and two in the other. The box is made in two sizes and has a set of covers for each size, which enable any necessary combination to be made for use with rigid conduit, Greenfield

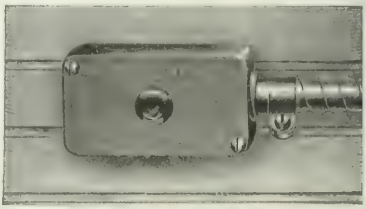


FIG. 4.—PENDANT COVER.

flexible steel conduit, or Greenfield flexible steel-armored conductors. This makes it unnecessary for the dealer to handle

a variety of boxes and also enables the wireman to complete his work without expensive delays caused by inability to find just what he needs. It is not necessary to wait for special fittings for special work, and the new box insures uniform and safe installation. The box accommodates standard fittings,

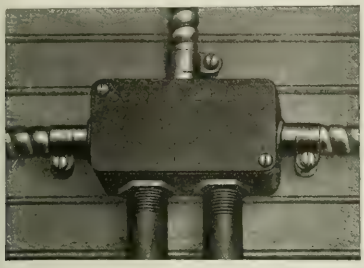


FIG. 5.—CLOSED COVER, WITH CONDUIT KNOCKOUT.

such as receptacles, rosettes, etc., in addition to snap switches for both surface and concealed work. Boxes and covers, with the exception of porcelain covers, are made in galvanized and in black enameled finish. Figs. 2, 3, 4 and 5 show "Multilet" covers.

Portable Motor for Family Use.

The accompanying illustration shows a portable motor brought out by the Steiner Manufacturing Company, of St. Louis, Mo., and intended for family use. The outfit comprises a portable stand mounted on ball-bearing castors fitted with a 1/6-hp motor of either the direct-current or alternating-current type for driving sewing-machines, washing-machines, wringers, ice-cream freezers, meat-choppers, coffee-mills, buffers, grinders and other household appliances, the idea being to employ the same motor for a variety of purposes. The height of the motor from the floor is adjustable within limits by means of a hand-wheel, as shown in the engraving, and the machine is



PORTABLE MOTOR FOR FAMILY USE.

entirely enclosed so as to preclude the possibility of danger to children or others who might not be over-careful of their movements in the vicinity of the apparatus. In addition to the shaft, the motor is equipped with a cone pulley in steps of 2 in., 3 in. and 4 in., and is belted to a special gear of pulleys of the same size so that three speeds are obtainable with a constant-speed motor. The gear, which is made of bronze metal and steel, is also enclosed. The company markets a line of household utensils especially adapted for use in connection with the motor.

Meeting of the Technical Publicity Association.

The annual meeting of the Technical Publicity Association, which was held April 8, marked the fourth year of its existence. The reports of the secretary and treasurer indicated that the association is in a healthful condition financially, and that the membership is constantly increasing. The association now numbers among its members the advertising men connected with the largest machinery manufacturing and allied industries of the country.

The report of the circulation committee showed that the association has on file reports from several hundred of the leading technical publications in the United States and Canada, which have been of considerable value to the members and are being constantly referred to. The reports of the committee on publicity, receptions and entertainments showed good work being accomplished in these lines. The election of officers for the ensuing year resulted in but few changes. The following officers were elected:

President, Mr. C. S. Redfield; first vice-president, Mr. C. N. Manfred; second vice-president, Mr. O. C. Harn; secretary, Mr. H. H. Kress; treasurer, Mr. H. M. Davis. Additional members of executive committee and directors: Messrs. Rodman Gilder and C. W. Beaver.

The subject of the meeting was "Trade Paper Copy," and a number of advertisements of the various members clipped from the trade papers were projected on a screen by means of a stereopticon, and were then criticized by the various speakers. Mr. Walter B. Snow, publicity engineer, Boston, on "The Text Matter"; Mr. Fred L. Dion, of the Willetts Press, New York, on "Typography," and Mr. George Leland Hunter, New York, on "Balance and Proportion in Display." Prizes of gold-mounted fountain pens were presented for the advertisements considered best as to text, typography and illustrations. Among others who contributed to the interesting topic of the evening were Mr. George French, editor of *Profitable Advertising*, and Mr. St. Elmo Lewis, advertising manager of the Burroughs Adding Machine Company, Detroit, Mich.

New Nernst Chandelier.

The Nernst Lamp Company has added to the designs of Westinghouse Nernst chandeliers the box-type renaissance chandelier shown in the accompanying illustration. The design



NEW NERNST CHANDELIER.

is massive and substantial, and its middle portion is larger than the round-type renaissance design previously brought out. This gives the fixture a more compact appearance and adds to the artistic effect when the lamps are not burning. It is made for 66, 88, 110 and 132-watt lamps.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Hope for the future rather than present improvement is the best that can be said of trade conditions during the past week. There has been a little more business done in wholesale lines for next fall and winter delivery, but most of the business for immediate shipment is of the filling-in character, and is very spotted. Retail trade has been retarded to some extent on account of the cold and wet weather in many sections of the country. This also has done something to interfere with the prospects of the coming crops. The break in the unusually high prices of wheat and of cotton has stimulated some buying, but even this is unimportant. Taken as a whole, the tariff uncertainty, the backward weather and crop conditions are a bar to the activity of trade and also of industry. The underlying feeling, however, is that these restrictions will be removed very speedily, and that we may look for improvement during the summer, and heavy business in the fall. In industrial lines, pig iron has been more active, but there has been some falling off in orders for finished materials. It is said that electrical apparatus and agricultural implements are showing some improvement, and that cast iron pipe and heating apparatus have also developed some activity. Building is fairly active all over the country, and the number of permits that are being issued indicate that there will be a large business in this line during the summer. Collections show very little change, but are classed as only fair. Money, however, is easy, and financial troubles are not important. Businesss failures, for the week ended April 22, were 247, against 201 the previous week; 254 for the same week of last year; 157 in 1907; 177 in 1906, and 193 in 1905.

THE COPPER MARKET.

There has been little vitality to the copper market during the past week, and few sales have been made either for export or for domestic consumption. Prices have been fairly well maintained in view of the small demand, and there seems to be little disposition on the part of the producers to make concessions. American consumers have confined their purchases to a few small lots for early delivery, but it is reported that there have been some inquiries for fairly large amounts for May and June delivery. So far as reported, no sales of this character have been made. It is stated that some electrolytic, for spot delivery, has been recently sold as low as 12½ cents. The majority of sales, however, have been made between 12⅝ and 12¾, and this is especially true when delivery is to be made within 30 days. Production continues at about the same ratio as has been recorded during the past few months, and the domestic consumption will be considerably smaller than that reported in March. On the other hand, the actual exports of copper for April will probably be larger than for any month within the past year. These exports, of course, reflect sales that were made in March and are not immediate takings. There will be an addition to the surplus supply, which will probably be considerably larger than that reported by the Copper Producers' Association for March. Exports so far for the month, up to and including April 26, have been 23,523 tons. Quotations on the metal exchange April 26 were:

Lake	12⅝ @ 13
Electrolytic	12⅝ @ 12⅝
Castings	12⅝ @ 12½

The London market April 26 was as follows:

	Noon. £ s d	Close. £ s d
Standard copper, spot	57 12 6	57 12 6
Standard copper, future	58 7 6	58 7 6
Market	Firm.	Quiet.
Sales of spot		700 tons
Sales of futures		1,500 tons

Extreme fluctuations for this year

	Highest.	Lowest.
Standard		
Cake	14	12.55
Electrolytic	14	12.62½
Casting	14	12.50
Lake, spot	£64 2 6	£53 12 6
London, futures	64 17 6	53 10 0
London, best selected		

TARIFF ON ARC-LIGHT CARBONS.—In speaking of the tariff on carbon situation and the controversy to which it has given rise, a representative of one of the largest American factories objected to some of the statements repeated in these columns bearing on the subject. "We have been producing flaming-arc carbons for considerably more than a year," he said, "and are selling them in quantities to dealers and the largest consumers in the United States right along. I might say further that if the buyers of these carbons will compare the prices that are made to-day with the prices they paid for the same kind of carbons before we began to manufacture them I am sure they will agree that it is the competition of American manufacturers that regulates the prices of the imported carbons more than the tariff. This is only a repetition of the experience of carbon users in this country which occurred at the time enclosed arc carbons were first produced here. A comparison of the prices made by the importers before these carbons were made in America with the present rate on the same grade of carbons will further verify my contention that the consumer would be paying a great deal more for carbons to-day were it not for the competition of the American manufacturers. A casual investigation of the market will prove that the importers' prices are kept about on a level with those of the American manufacturers. If they are so anxious to reduce this basis, it seems to me that they have plenty of leeway to do so without waiting for a reduction of the tariff. In their testimony before the Ways and Means Committee they stated that ½ x 12-in. solid enclosed arc carbons cost them in the neighborhood of $14 per thousand, freight and duty paid to New York, including the cost of cutting double and triple lengths to standard lengths. Consumers are familiar with the fact that the importers sell these carbons at an average of about $25 per thousand, so I believe they will agree with the statement I have just made that the tariff does not necessarily regulate the prices of the imported, as it is quite clear that the importers could at any time greatly reduce their prices and still have a handsome profit if they cared to do so. The rate of 70 cents per hundred feet proposed by the Senate Finance Committee would not permit any advance in the selling prices of carbons for enclosed lamps, flaming-arc lamps and moving picture lamps, or any other high-grade carbons, despite the statements by the importers to the contrary; and even if the duty were placed at a still higher rate which might permit an increase, no such action is contemplated by my company, as it would be contrary to its policy of reducing prices when the cost of manufacture permits, this being evidenced by the reduction recently made by it in prices on dry batteries. Comparatively speaking, the rate of duty proposed by the Senate bill is no higher than that in force in Germany and France, the countries from which the importers get their supply of carbons; and without entering into a discussion of the principles of a protective tariff, I am confident the American consumer will enjoy lower prices on carbons if they have the benefit of American competition than they would if the importers had the field alone."

EXHIBIT FOR SEATTLE EXPOSITION.—The General Electric Company shipped last week three carloads of material to Seattle, Wash., as an exhibit in the Alaska-Yukon-Pacific Exposition. Almost every class of apparatus is included in the display, from heavy mining machinery and electric locomotives to the latest household appliances. The General Electric Company has furnished the equipment for the exposition buildings, which does not include generating machinery as the energy for the exposition is purchased from the local power company.

THE McCORD ENGINEERING COMPANY has been organized in Atlanta, Ga., carrying on a general contracting business in electrical, mechanical and civil engineering. The company has equipped a complete electrical testing laboratory and repair shop and will have an efficient force of workmen to send out on all classes of electrical repairs. The company is composed of Messrs. J. L. McCord, W. P. McCord and C. M. McCord, with offices at 101 South Forsyth Street and shops at 2 Nelson Street.

WESTINGHOUSE BUSINESS CONTINUES TO IMPROVE.—The improvement in the business of the Westinghouse Machine Company's shops at East Pittsburgh continues to be encouraging. Since April 1 quite a number of orders for steam turbines, steam engines and gas engines have been booked and the record for the first two weeks of the month shows a considerable increase over the same period of March. Among the contracts particularly worth mentioning which the company has lately received is an order from the City Electric Company, of San Francisco, for a 15,000-hp steam turbine. This will be the most powerful steam turbine installed west of the Mississippi, its power capacity being about equal to 10 of the largest-size express railway locomotives. This company has already installed three Westinghouse steam turbines of a smaller size. The East Pittsburgh shops are also turning out at present on order from the city of Detroit a 3000-hp steam turbine, and another of the same size is going to the Nichols Copper Company, of Laurel Hill, L. I., while the Saginaw & Flint Railroad Company, of Michigan, has contracted for an 1150-hp turbine, and the Alaska Treadwell Gold Mining Company, of San Francisco, has ordered two 1000-hp machines of the same type.

THE SHELTON ELECTRIC COMPANY, of Chicago, manufacturer of electric vibrators and hair-driers, has increased its capital stock to $100,000, and will remove its headquarters to New York on May 1. Attractive quarters have been secured at 105 West Forty-second Street, and here much more space will be available than in the Chicago office, which will be continued at 35 Randolph Street. The company expects to make a decided increase in its business by this change. It will soon bring out a new electric hair-drier, which is said to embody many improvements. The officers of the Shelton Electric Company are: President, W. G. Shelton; vice-president, L. C. Shelton; secretary, A. J. Crowley.

TO BUILD HIGH-SPEED ROAD IN TEXAS.—The Stone & Webster Engineering Corporation has contracted for the design, construction and equipment of an interurban electric railway between the cities of Galveston and Houston, Tex. The distance is about 50 miles and the road will be designed for high-speed operation. The engineering work includes the final surveys, determination of right-of-way, design of bridge structures, the working out of the most economical car schedules and the selection of types of rolling stock best adapted to the conditions. The contract includes the design and construction of the power station, transmission lines and substations.

NEW MEXICO HYDRO-ELECTRIC DEVELOPMENT.—Powell Stackhouse, Jr., and associates, who operate large coal mines at Carthage, New Mexico, are preparing to install a large central electric power plant there. Transmission lines will be built from this plant to El Paso, Silver City, Deming and Albuquerque. The power that will be generated at this plant, in addition to being used by various kinds of industrial enterprises, will be available for the operation of pumping plants for irrigation works in the valleys of the several different streams which the transmission lines will reach.

COPPER IN CENTRAL AFRICA.—The holdings of the Tanganyika Concessions company, a British corporation, in British Central Africa are said to be the most extensive and richest copper properties ever discovered. W. G. Perkins, formerly superintendent of the Steptoe Smelting & Mining Company, together with Alan McCormack and P. K. Horner, of the same property, have been engaged to develop the proposition. They will leave in a few weeks for Africa. It is claimed that these new copper mines will be able to produce the metal cheaper than any others in the world.

NEW YORK TELEPHONE COMPANY EXPANDING.—During the past week the New York Telephone Company has purchased the property at Nos. 18 to 30 on Lispenard Street, and from No. 18 to No. 26, inclusive, on Walker Street. The entire plot contains about 21,000 sq. ft., and it is understood that the telephone company intends to erect thereon a high office building in which will be grouped several of the company's exchanges. The exact plans for the building have not yet been given out.

OIL BURNING LOCOMOTIVES THROUGH THE FORESTS.—Both the New York Central and the Delaware & Hudson railroads have informed the Public Service Commission of the Second District of New York that they will at once equip their locomotives running through the forest preserves of the State for oil burning. This is in acceptance of an order, recently issued, intended to prevent forest fires.

ALLIS-CHALMERS COMPANY.—One of the most important sales recently made by the Allis-Chalmers Company is that of three 5000-kw steam turbines to the Interstate Railways Company for installation in the power house of the United Traction Company at Reading, Pa.

Financial Intelligence.

THE WEEK IN WALL STREET.

During the past week the stock market in Wall Street, while it has been reasonably active, has been rather uncertain as to its tendency. Generally speaking, there is an optimistic feeling and prices are inclined to be somewhat higher. On the other hand, there are a great many opinions expressed that the present prices of stocks have fully discounted the developments that may be expected within the next six months in industrial and commercial business. This difference of opinion, of course, occasions some trading. It is undeniable that within the past two or three weeks there has been quite a lot of profit taking, both by the small stockholders and by large interests; if it had not been for this the upward movement of the market would have been unchecked. Whether the principal traders have reinvested at lower levels or not it would be hard to determine; it is sufficient to say that there seems to be fully as much interest displayed on the buying side of the market as on the selling side. Such a condition as this, if the tariff matter was settled, and other disturbing influences were removed, would make a very active market, probably without any great amount of price change. The condition of the money market is such that trading and speculation are very distinctly encouraged. Money is easy, and bond issues are rapidly absorbed. This was demonstrated last week when the $18,000,000 issue of the St. Louis & San Francisco Railroad was taken up without creating any flurry in the Street, and when the $5,000,000 new issue of the Corn Products Refining Company found immediate acceptance. The ease and facility with which corporate enterprises are now able to secure money is almost unprecedented in the history of Wall Street. The proposed financing of the Chicago, Burlington & Quincy, which will involve the placing of $65,000,000 of new refunding bonds, is generally accepted as an undertaking that will meet with no serious obstacles. The modification of the Public Service Commission's terms for the Erie bond issue has done much to strengthen the securities of that road. These modifications are practically all that was asked by the management of the company. Call money on April 26 was 1½@2 per cent, while 90-day loans were made at 2¾@3 per cent. The quotations in the table are those of the close, April 26.

NEW YORK

	Apr. 19	Apr. 26	Shares Sold.		Apr. 19	Apr. 26.	Shares Sold.
All.-Ch.	16	15½	34,300	Int Met., pfd.	44½	44¾	45,225
All.-Ch. pfd.	49	49⅝	31,050	Mackay	76*	78*	5,000
Amal. Cop.	76½	76⅝	100,100	Mackay Cos. pfd.	72½*	73*	2,300
Am. D. T.	29*	29*		Manhattan Elev.	143½*	144½*	100
Am. Loc.	53*	53*	1,200	Met. St. Ry.	25½	26	1,800
Am. Loc. pfd.	114	114	200	N. Y. & N. J. Tel.	123*	124*	100
Am. Tel. & Cbl.	76*	76*		Steel, com.	52¾	53	128,900
Am. T. & T.	132¾	130½	128,725	Steel, pfd.	113½	114½	3,850
B. R. T.	76⅛	76	22,885	W. U.	68	68	3,000
Gen. Elec.	169	168½	1,000	West'h. com.	82	82½*	4,000
Int. Met. com.	15⅜	15⅝	26,700	West'h. pfd.	110*	110*	600

PHILADELPHIA.

	Apr. 19.	Apr. 26.	Shares Sold.		Apr. 19	Apr. 26.	Shares Sold.
Am. Rys.	1...	1...		Phila. Elec.	...	...	...
Phila. Co. of A.	12¼*	12¼*		Phila. R. T.	...	...	...
Phila. Suburb. Ry.	1...	1...		Phila. Traction.	93	92*	...
U. G. Elec.	14[illegible]	14[illegible]		Union Traction.	...	...	...

CHICAGO.

	Apr. 19	Apr. 26.	Shares Sold.		Apr. 19	Apr. 26.	Shares Sold.
[illegible]	...	...	...	[illegible]	...	...	...
[illegible]	...	...	...	[illegible]	...	...	...
[illegible]	...	...	...	[illegible]	...	...	...
[illegible]	...	...	...	[illegible]	...	...	...
[illegible]	...	...	...	[illegible]	...	...	...

BOSTON

	Apr. 19	Apr. 26.	Shares Sold.		Apr. 19	Apr. 26.	Shares Sold.
[illegible]	...	...	...	[illegible]	...	...	...

DIVIDENDS

The J. G. Brill Company, preferred, quarterly, 1¾ per cent, payable May 1.

Connecticut Railway & Lighting Company, preferred and common, quarterly, 1 per cent each, payable May 15.

Helena (Mont.) Light & Railway Company, preferred, quarterly, 1¼ per cent, payable May 1.

Montreal Light, Heat & Power Company, quarterly, 1½ per cent, payable May 15.

Municipal Gas Company, Albany, N. Y., quarterly, 2½ per cent, payable May 1.

National Carbon Company, preferred, quarterly, 1¾ per cent, payable May 15.

Ohio Traction Company, Cincinnati, preferred, quarterly, 1¼ per cent, payable May 1.

West Pennsylvania Railways Company, Pittsburgh, preferred, quarterly, 1¼ per cent, payable May 1.

HUDSON & MANHATTAN STOCKHOLDERS.—The publication of a list of the 20 largest stockholders of the Hudson & Manhattan Railroad Company, according to the books on June 30, 1908, has created some surprise. The particular feature that has caused the most comment in financial circles, is the fact that J. P. Morgan & Company at that time owned 6666 shares of the preferred stock, and interests affiliated with that firm many times that number of shares. The largest stockholder was, of course, the Hudson Companies, and the next largest Simpson, Thatcher & Bartlett. Mr. W. G. McAdoo, president of the company, is credited with having 32 shares. The publication of the Morgan interest in the company has given rise to gossip as to the possibility of an ultimate connection between the McAdoo system and the Brooklyn Rapid Transit. Such a connection, however, is as yet a mere conjecture.

THIRD AVENUE RAILROAD EARNINGS.—According to a report made by Receiver F. W. Whitridge, the earnings of the Third Avenue Railroad Company have increased $500,000 in the year which ended March 31. Mr. Whitridge places the increased number of fares received in that time at approximately 10,000,000. He attributes a large proportion of this gain to the use of the pay-as-you-enter fare boxes. He says that the company has received a very much larger percentage of the fares than it did formerly, not because of the dishonesty of some employees so much as to the fact that every person now pays. He also attributes the increase in patronage to the better service which the company is giving on account of the improvements in equipment which have been made. He says that the first three days after the transfer system was stopped the road lost 60,000 passengers per day, but that it has gradually regained them.

UNITED STATES LIGHT & HEATING COMPANY.—Formal announcement of the consolidation of car-heating properties, which was noted in detail in the issue of April 1, has been made by the Edwin Hawley syndicate, which promoted the merger. No additional facts concerning the organization were made in the official announcement. The new company, the United States Light & Heating Company, has been organized under the laws of Maine and will take over the Bliss Electric Car Lighting Company, which is owned by the Cutler-Hammer Company, the National Battery Company, of Buffalo, and the United States Light & Heating Company, of New Jersey. W. H. Silverthorn, president of the Railway Steel Spring Company, is president of the new organization and the board of directors includes the names of a number of men well known in railroad and financial circles. The capital of the new company will be $17,500,000.

GENERAL ELECTRIC OFFICIAL REPORT.—The annual report of the General Electric Company for the fiscal year which ended Jan. 31, 1909, has just been issued. A digest of the report will be found on page 1008 of this issue. It shows that the total sales billed for the year were $44,540,676. The company reports that at the present time its sales are at a rate of about $8,000,000 per year better than they were two months ago. It is stated that at present the rate of business is about $52,000,000 per annum. The improvement seems to be general in all departments. Small equipment has shown better development than have the orders for street railway apparatus and for large installations. The company is still carrying its enormous cash balance, its annual report showing that on Jan. 31 there was more than $22,233,671 in cash on hand.

MASSACHUSETTS LIGHTING CONSOLIDATION.—A special meeting of the stockholders of the Boston Edison Illuminating Company will be held to authorize the purchase of the property of the following corporations used in the business of generating and furnishing electricity for light and power: Chelsea Gas Light Company, Boston Consolidated Gas Company, Newton & Watertown Gas Light Company, Waltham Gas Light Company and the Lexington Gas & Electric Company. If these purchases are authorized by the stockholders, steps will be taken at once to fix terms and conditions under which the properties will be operated.

WEST VIRGINIA TELEPHONE LINES SOLD.—The property and lines of the Consolidated Telephone Company, of Fairmont, W. Va., consisting of all of the independent systems in Marion, Harrison, Taylor, Upshur, Randolph, Tucker, Preston and a part of Monongalia counties have been sold to Z. F. Robertson. Mr. Robertson is said to represent New York and Chicago capitalists who will reorganize these properties into one company, and form a link in the chain of independent telephone companies which are now being developed in the Central West.

VINCENNES TRACTION COMPANY SOLD.—The Vincennes Traction & Light Company has sold its entire property, including the street railway system, to capitalists from Louisville, Ky., who will at once reorganize the company and improve the system. S. A. Culbertson is president of the new company; S. S. Bush, vice-president, and Attilla Cox, secretary and treasurer. The traction lines will be extended, new car barns constructed and probably a new power installation purchased. The plans of the new company have not yet been given out.

SAO PAULO TRAMWAY, LIGHT & POWER COMPANY.—Negotiations are pending for the purchase of the Gas Company of Sao Paulo, Brazil, by the Sao Paulo Tramway, Light & Power Company. If negotiations are successfully carried through, it is intended to arrange the capital of the gas company by retiring the present common stock, and to issue new common and preferred stock of the purchasing company therefor. This would provide a return of about 11 per cent on the present stock.

SEATTLE ELECTRIC COMPANY BONDS.—Lee, Higginson & Company have sold $1,600,000 Seattle Electric Company first mortgage 20-year, 5 per cent bonds. These bonds are part of an authorized issue of $5,000,000. and were offered at 98½ and interest. The bonds are a direct obligation of the Seattle Electric Company, and are secured by a first mortgage on the interurban railway between Seattle and Everett. The bonds were almost immediately taken by the public after the offer was made.

THE NORTH AMERICAN COMPANY.—It is said that negotiations are under way for the sale of the Laclede Gas Light Company, of St. Louis, owned by the North American Company, to the American Light & Traction Company. This matter will be considered at the next meeting of the directors, which will probably be held this week.

CAMDEN & TRENTON RAILWAY COMPANY REORGANIZATION.—A committee representing the bondholders of the Camden & Trenton Railway Company has signed an agreement under which that company will be reorganized. The new company will be known as the Riverside Traction Company, and will have an authorized bond issue of $1,500,000; preferred stock of $400,000, and an authorized common stock of $1,100,000.

CONNECTICUT RIVER WATER POWER.—A project has recently been formulated at Littleton, N. H., for the construction of three large dams on the Connecticut River, involving an investment of about $6,000,000, which, it is stated, will be furnished by Chicago capitalists. It is believed that this project will develop more than 5,000 hp between the towns of Dalton, Mass., and Monroe, N. H.

SAN DIEGO LIGHT BONDS SOLD.—N. W. Harris & Company, of New York, have purchased from the San Diego (Cal.) Consolidated Gas & Electric Company $1,600,000 first mortgage 5 per cent bonds. This company operates the entire gas, electric light, heat and power business of the city of San Diego, and the bonds will probably be offered to the public at an early date.

INDEPENDENT TELEPHONE CONTROL CHANGES.—Portland, Ore., and Seattle capitalists have secured control of the stock of several independent telephone companies in the Pacific Northwest from the National Securities Company, of Los Angeles. The deal means the transfer of stock in the independent companies valued at about $750,000. A syndicate composed of Sam Hill, Hervey Lindley, E. A. Stuart, W. G. Collins and M. A. Arnold, of Seattle, and William M. Ladd, P. L. Willis, W. F. Burrell, F. H. Page and I. N. Fleischner, of Portland, has purchased the entire stock holdings of the National Securities Company in the three independent telephone companies in Oregon and Washington. This constitutes between 40 and 50 per cent of stock of the Home Telephone Company, of Portland, the Home Telephone Company, of Puget Sound, and the Northwestern Long Distance Telephone Company, of Portland. Over 50 per cent of the stock of the long-distance company has been taken over. Arrangements have been made for the expenditure of $200,000 on improvements to the Portland plant, and engineers are now drawing up the plans. It is announced that this will be followed by a further outlay of $500,000 within the coming year. A large amount is also to be expended in Tacoma on immediate betterments to the Puget Sound company's plant.

ALASKAN COPPER MINES SOLD.—One of the largest copper deals made in recent years has been effected by the purchase of control of the Alaska Copper & Coal Company, which is commonly known as the Bonanza Mines, by the Guggenheim interests and J. P. Morgan & Company. These purchasers have formed what is known as the Alaska Syndicate and have taken over the holdings in the mines which were controlled by Norman Shultz and his associates. It is said that the price paid was between $2,000,000 and $3,000,000 less than was offered for the same property several years ago. These mines are said by experts to be the richest copper properties that have yet been opened. It is claimed that the new syndicate will be able to produce copper at less than 6 cents per pound. The Copper River Railroad, which is being built by the Morgan and Guggenheim syndicate, will run to the mines in about a year. This railroad is necessary for the development of the properties. The ore will be shipped by the company's own boats, connecting with the railroad at Cordova. It will probably be smelted at the Tacoma smelters of the American Smelting & Refining Company. It is also stated that a copper-wire plant may be built at Tacoma.

ELEVATED RAILWAY EXTENSION IN CHICAGO SUBURBS.—It is said that the Chicago & Oak Park Elevated Railroad will be extended from Harlem Avenue, the western limit of Oak Park, to Elmhurst, Ill., as a result of the recent municipal election in River Forest, in which the question was an issue. The new trustees are believed to favor the extension, and the president of the elevated railroad company says that the ordinance will be introduced immediately and passed. The extension will be four miles long. It will be another link in the proposed Chicago & Elgin Electric Railroad, by which it is planned to reach the Fox River Valley from Chicago.

LAKE SUPERIOR CORPORATION.—The Lake Superior Corporation has closed the sale of about $1,000,000 of its preferred first mortgage collateral bonds, and $2,000,000 of the Lake Superior Iron & Steel Company's 6 per cent notes. The price paid for the bonds, it is said, was about 80. These sales will give the Lake Superior Corporation $2,500,000 in cash as a working basis for doing business, and for payment of bank loans.

WILLIAMS, McCONNELL & COLEMAN is the name of a firm just formed to take over the business of Eglinton, Hammond & Andrews, brokers and dealers in investment securities. The firm will devote especial attention to the securities of electrical companies and public service corporations. The members of the firm are George Williams, H. F. McConnell and L. G. Coleman. The office is at 60 Wall Street.

NEW JERSEY PUBLIC SERVICE CORPORATION.—Notice has been given by the Public Service Corporation, of New Jersey that, pursuant to the provisions of the indenture securing its $6,250,000 convertible gold bonds which mature the first of next November, the holders may between April 15 and May 1 present the same for conversion into an equal amount of the stock of the company at par.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Birmingham (Ala.) Railway, Light & Power Company:					
March, 1909	$181,818	$114,203	$67,614	$44,787	$22,826
March, 1908	177,003	112,686	64,317	42,863	21,453
Calumet & South Chicago Railway Company:					
Year ended Jan. 31, 1909	839,296	578,910	260,386	.....	.....
Year ended Dec. 31, 1908	875,016	606,512	268,504	.....	.....
Cape Breton Electric Company, Limited, Sidney, C. B.:					
February, 1909	15,891	11,559	4,332	3,996	335
February, 1908	18,024	11,827	6,196	4,038	2,158
Chicago Railways Company:					
Year ended Jan. 31, 1909	11,037,071	7,725,950	3,311,121	.....	.....
Year ended Jan. 31, 1908	10,560,571	7,392,400	3,168,172	.....	.....
Edison Electric Illuminating Company, Brockton, Mass.:					
February, 1909	23,416	12,633	10,782	2,761	8,021
February, 1908	18,604	10,819	7,784	1,839	5,945
Edison Electric Illuminating Company, Brooklyn:					
March, 1909	289,298	143,674	145,623	82,619	63,003
March, 1908	272,157	133,646	138,510	80,260	58,249
Guanajuato Power & Electric Company:					
Year 1908	463,974	110,761	353,214	114,428	238,786
Year 1907	394,189	88,758	305,431	101,848	203,582
Houghton County (Mich.) Electric Light Company:					
February, 1909	24,303	10,643	12,826	3,382	9,443
February, 1908	21,909	9,800	12,109	3,180	8,929
Knoxville (Tenn.) Railway & Light Company:					
March, 1909	47,130	24,158	22,972	11,483	11,488
March, 1908	46,521	23,251	23,270	11,623	11,647
Little Rock (Ark.) Railway & Electric Company:					
March, 1909	56,586	27,548	29,040	11,023	18,117
March, 1908	50,552	28,226	28,326	8,190	20,136
Lowell (Mass.) Electric Light Corporation:					
February, 1909	29,553	16,495	13,058	3,641	9,416
February, 1908	28,906	16,014	12,891	4,333	8,557
Memphis Street Railway Company:					
March, 1909	133,151	84,512	48,639	35,480	13,159
March, 1908	128,887	83,705	45,182	34,836	10,346
Minneapolis General Electric Company:					
February, 1909	96,589	36,046	60,142	30,528	29,614
February, 1908	84,583	35,922	48,661	31,041	17,649
Montreal Street Railway Company:					
March, 1909	298,527	206,832	91,895	35,994	55,901
March, 1908	288,674	202,389	86,284	38,118	48,166
New Orleans Railway & Light Company:					
Year 1908	5,068,198	3,004,915	2,137,283	1,060,880	1,076,403
Year 1907	5,001,730	3,287,712	2,223,707	1,477,784	746,012
Northern Ohio Traction & Light Company:					
March, 1909	130,523	86,720	43,803	43,803	0
March, 1908	139,639	90,253	48,386	43,953	4,433
Oneida Railway Company:					
Quarter ended Dec. 31, 1908	83,928	56,911	27,018		
Quarter ended Dec. 31, 1907	68,433	46,823	21,610		
Puget Sound Electric Railway & Subsidiary Companies:					
February, 1909	128,111	91,488	36,623	40,405	3,782
February, 1908	117,531	70,887	46,644	43,144	3,500
Toledo Railways & Light Company:					
March, 1909	213,760	118,961	94,799	62,134	32,665
March, 1908	231,128	114,879	87,304	68,808	18,408
United States Telephone Company, Fostoria, Ohio:					
Year 1908	411,819	213,830	206,989	107,880	108,856
Year 1907	413,973	193,212	220,766	107,800	108,966

GENERAL NEWS

Construction News.

RECTOR, ARK.—The Rector Cooperative Telephone Company has increased its capital stock from $5,000 to $15,000.

HOLLISTER, CAL.—Bids will be received by the Board of Supervisors until May 17 for the franchise for a transmission line, for which application was made by William Palmtag.

RED BLUFF, CAL.—The Sierra Electric Power Company has secured a franchise from the Board of Supervisors to erect a transmission line from its plant of Battle Creek through the county. The company bid in the franchise which was sold April 6 for $60. Frank C. Wilson is secretary.

REDDING, CAL.—A large alfalfa meal plant is to be installed at Alberta, about nine miles south of Red Bluff. The plant will be operated by electricity, which will be furnished by the Northern California Power Company.

STOCKTON, CAL.—Preparations are being made by the San Joaquin Valley Electric Railway Company for the construction of its proposed electric railway to connect Stockton, Modesto, Riverbank and intervening towns. The railway will be 44 miles long. Arrangements have not yet been made for securing electricity for operating the cars. G. O. Broadhurst, of Stockton, is chief engineer; Morris L. Brackett, of Stockton, and Metropolitan Life Building, New York, N. Y., vice president.

TEHAMA, CAL.—Application has been made to the Board of Town Trustees by J. J. Worthington for a franchise to construct and operate an electric railway on D, E and Second Streets in Tehama.

VALLEJO, CAL.—Preparations are being made by the San Francisco, Vallejo & Napa Valley Electric Railroad Company to extend its railway from St. Helena to Calistoga, for which rights of way are now being secured. It is proposed to eventually extend the road into Lake County.

VISALIA, CAL.—The Visalia Electric Railroad Company is said to be willing to construct a railway to Woodlake district, connecting with the Naranjo district, provided the right of way can be secured without cost to the company. The cost of the railway is estimated at $200,000. J. H. Crossett is superintendent of the company.

RIFLE, COL.—Plans are being prepared by the Rifle Light, Heat & Power Company for the construction of a power plant to cost from $45,000 to $50,000, bids for construction of which will be received about June 1. O'Brian & Tomlinson, Nassau Building, Denver, Col., are the engineers; W. J. Le Rossignol is secretary.

HARTFORD, CONN.—The Senate has passed the bills authorizing the Standard Electric Company to issue bonds; incorporating the Crescent Beach Power & Water Company, the North Brandford Light, Water & Power Company, and amending the charter of the Lebanon Street Railway Company.

AMERICUS, GA.—Plans are being prepared for the construction of a municipal electric light plant in connection with the water-works system, the cost of which is estimated at $20,000.

AUGUSTA, GA.—Investigations are being made by Lamar Lyndon, of Dunbar & Lyndon, consulting engineers, 2 Rector Street, New York, N. Y., with a view of making extensive water power developments on the Saluda River, Lexington County, S. C. It is stated that James U. Jackson and other Northern capitalists are interested in the project.

COLUMBUS, GA.—The Perkins Hosiery Mills has awarded the contract for the erection of a two-story building to John H. Lowe, of Atlanta, Ga. The equipment of the building will include 8000 spindles, 24 cards and accompanying textile equipment, to be operated by electrical power. An additional engine of from 350 to 400 hp will be installed.

COLUMBUS, GA.—The city of Columbus, the Board of Trade and the Consumers' Association have filed a complaint with the State Railroad Commission against the Columbus Railroad Company and the Gas Light Company, of this city, alleging excessive charges for electric and gas service. The prices for electrical service are as follows: Arc lamps, $60 per lamp per year; incandescent lamps, $24 each, and 15 cents per kw-hour to consumers for lamps, decreasing to six cents for power purposes. As electricity is generated by water power, and coal is cheap, the petitioners think the prices should be materially reduced, and have asked the Railroad Commission to fix the prices as follows: Arc lamps, $40 each per year; incandescent, $15 each; electricity to the city for lamps and motors, 6 cents per kw-hour; to private consumers, 7 cents per kw-hour, with a discount of 10 per cent.

LA GRANGE, GA.—Contracts have been awarded for power plants for additions to the Unity Cotton Mills, of La Grange, and the Manchester Cotton Mills at Manchester, Ga., as follows: For engines of about 800 hp and 1000 hp to Hooven-Owens-Rentschler Company, of Hamilton, Ohio; for engine-driven exciter sets to the Harrisburg Foundry & Machine Company; to the General Electric Company, of Schenectady, N. Y., for generators; Dean Brothers Steam Pump Works, Indianapolis, Ind., for pumping and condensing machinery, and R. D. Cole Manufacturing Company, of Newnan, Ga., for [illegible] tank. D. Fulk, E. Calaway, of La Grange, is president of the [illegible] Company.

MOUNTAINTOWN, GA.—Application has been filed in the Superior Court by William M. Scott, E. W. Watkins, Sr., and E. W. Watkins, Jr., for a charter for the Coosawattee & Mountaintown Rivers Power & Improvement Company. The company proposes to develop the water power on the above rivers, erect a generating electricity, to be transmitted to neighboring towns. The company will be capitalized at $50,000.

VALDOSTA, GA.—The citizens have voted to issue $50,000 in bonds for the construction of an electric light plant in connection with the water-works system; and for extension to the water-works system, sewers and streets.

WRIGHTSVILLE, GA.—John W. Jordan, of Wrightsville, Ga., writes that he has a contract for a combined water works and electric light plant to be equipped with an 80-kw, 2300-volt, 60-cycle alternator, one 100-hp engine, one 125-hp boiler, heater and feed pump, one fire pump and air compressor, and also transformer for about 1200 lamps, and would like to receive prices on the above machinery.

TWIN FALLS, IDAHO.—Surveys are being made for the proposed electric railway from Twin Falls to the site selected for the new steel bridge across the Snake River Canyon, just below the Shoshone Falls. R. S. Cockburn is engineer.

BELLEVILLE, ILL.—A mortgage for $600,000 has been filed in the recorder's office by the St. Louis & St. Libory Railroad Company to secure an issue of bonds, the proceeds to be used to construct and equip a railway to extend from the Mississippi River through St. Clair County to St. Libory. Edward L. Thomas, of St. Louis, Mo., is president of the company.

CAIRO, ILL.—The Cairo Electric & Traction Company is constructing a power house in Cairo which will supply electricity for lamps in this city and for operating the cars of the Cairo & St. Louis Railway Company. The equipment will include three 400-hp Sterling boilers, which are now being installed; one 500-kw, 2300-volt, three-phase, Curtis turbine; one 750-kw, 600-volt, direct-current generator set, and a 300-kw motor generator set. The company will also repair and improve the present railway lines and equipment. The construction of an interurban railway nine miles long, connecting Cairo, Mound City and Moundsville is now under construction.

CHICAGO, ILL.—Arrangements are being made to extend the Oak Park Elevated Railroad from Harlem Avenue to Elmhurst, a distance of four miles.

WINNETKA, ILL.—Bids will be received by F. E. Herdman, manager of the municipal electric light plant and water-works system, until May 4 for two water-tube boilers, each with a rating of 200 hp, to be erected complete with all steam attachments in the municipal plant; also for boilers of 250 hp. Bids will also be received at the same time for two mechanical stokers of 200 hp each to be erected and operated in connection with the water-tube boilers; also for stokers of 250 hp.

BRAZIL, IND.—The controlling interest of the Brazil Electric Company has been purchased by a syndicate, of which F. M. Fauvre, of Indianapolis, Ind., is at the head. It is proposed to furnish electricity for lamps and motors to cities between Indianapolis and Terre Haute. The local plant has an output of about 1000 hp, which it is understood will be increased to 1500 hp by next fall to supply electrical service in this city and also in Greencastle. The company is also erecting a temporary plant in West Terre Haute to supply electricity in that city and surrounding territory. The plant will have an output of about 450 hp and is to be completed by the first of June, but later the output of the plant will be greatly increased. The company has about 1000 acres of coal lands in Vigo County, directly bordering Terre Haute, which will supply fuel for plants.

CRAIGVILLE, IND.—David and Andrew Worling have purchased the Craigville Telephone Company's plant. William Pennison, of Fort Wayne, has been employed to superintend the improvements, including extensions and new equipment to be made by the new owners.

EVANSVILLE, IND.—Bids will be received by the Board of Water Works until May 3 for the installation of an electric crane.

HUNTINGTON, IND.—The City Council has authorized the advertisement for bids for two new boilers and a dynamo for the municipal electric light plant. The new equipment will furnish electricity for 123 new street lamps. The city contemplates rebuilding and re-equipping the entire lighting system eventually.

LINTON, IND.—A spirited contest is on for the purchase of the local municipal electric light plant, now under lease to private parties. A syndicate headed by Mr. Ellis has offered $23,000 for the plant and a franchise. Mr. Ellis promises to dismantle the present power house and build a larger power plant about a mile distant, located at the mouth of a coal mine, and give a 24-hour service. On the other hand, Mr. Heath, of Chicago, is representing a company that will submit a proposition to the Council for the purchase of the plant under an agreement to reconstruct and re-equip the plant.

PRINCETON, IND.—The Princeton Independent Telephone Company is in the market for poles, wire and other material for the construction of a telephone line from Princeton to Owensville.

ROCHESTER, IND.—The capital stock of the Rochester Electric Light & Power Company has been increased from $50,000 to $150,000. John E. Beyer is president.

SOUTH BEND, IND.—The Manufacturers' Utility Company is planning to erect water and electric power plants along the St. Joseph River, for the purpose of furnishing electrical and water power to manufacturers. R. U. Miller, John Thomas and August Nelson are directors.

VINCENNES, IND.—The holdings of B. G. Hadnut and associates in the Vincennes Traction & Light Company have been purchased by S. S. Bush and S. A. Culbertson, of Louisville, Ky., and others, who are interested in the Rome Railway & Light Company, Rome, Ga.; the Pascagoula Street Railway & Light Company, Scranton, Miss., and the Jackson Railway & Light Company, Jackson, Tenn. The new officers of the Vincennes Traction & Light Company are as follows: S. A. Culbertson, president; S. S. Bush, vice-president and general manager, and Attilla Cox, secretary and treasurer.

VINCENNES, IND.—Bids will be received by the Board of Public Works until June 8 for lighting the streets, alleys and other public places in the city for a term of 10 years with 260 arc lamps of 2000 cp. In addition to furnishing the arc lamps specified, the contractor is to erect and have ready for use on April 29, 1910, not less than 220 incandescent lamps of 16 cp. The contractor is also to bid on furnishing electricity for lighting the public buildings. C. L. V. Tucker is clerk of the board.

DYERSVILLE, IA.—The Luxemburg & Millville Telephone Company is making arrangements to install its telephone system.

IOWA CITY, IA.—Plans are being made for the construction of a new electric light plant in Iowa City, for which a franchise has been secured. Franklin Benjamin, of Galesburg, Ill., is interested in the project.

LAWTON, IA.—The Lawton Telephone Company has made application for permission to increase its capital stock from $2,000 to $9,000.

FORT SCOTT, KAN.—Preparations are being made by the Fort Scott Gas & Electric Company to commence work on extensions and improvements to its system, which will involve an expenditure of about $30,000. F. D. Martin is manager.

HIAWATHA, KAN.—The North East Kansas Telephone Company has increased its capital stock to $20,000. F. M. Pearl is president.

LAWRENCE, KAN.—J. D. Bowersock has awarded a contract to the Allis-Chalmers Company, of Milwaukee, Wis., for a 250-kw electric generator. Mr. Bowersock contemplates installing a 750-kw generator if granted a franchise for a street railway system.

WATHENA, KAN.—The citizens have voted to issue $7,000 in bonds for the construction of an electric light plant.

BIDDEFORD, MAINE.—The York Light & Heat Company is making arrangements to erect a transmission line to Furness Rocks.

BRUNSWICK, MAINE.—The flume in connection with the plant of the Brunswick Electric Light & Power Company has been washed away by the flood putting the plant out of commission. The company is furnishing electricity through its auxiliary steam station. Electrical energy for operating the arc-lighting system is furnished from Cabot Mill station. Repairs cannot be made to the plant until the water subsides.

BALTIMORE, MD.—Proposals will be received by the Board of Awards until May 5 for furnishing the Electrical Commission with 1,000,000 ft., more or less, of vitrified tile conduit; 200,000 ft. of special duct pipe, including bends, according to specifications issued by the chief engineer of the commission. Samples of vitrified tile conduit and special duct pipe and bends must be submitted at least five days before the date of the opening of the bids. For specifications and further information apply to Charles I. Phelps, chief engineer.

BERLIN, MD.—Bids will be received by the Mayor and the Council until May 4 for furnishing and installing material and machinery for a gas producing power plant. Specifications and blue-prints will be issued upon application to the Mayor and Council.

CAMBRIDGE, MD.—The Peninsula Traction Company, which proposes to construct a system of electric railways through the Eastern Shore counties is making plans to have part of its system in operation by fall. The present plans of the company contemplate the construction of an electric railway from Claiborne to Ocean City, passing through St. Michaels, Easton, Hurlock, Vienna, Salisbury, and Berlin. Another railway will extend from Cambridge through East Newmarket, with a branch to Secretary, crossing the main line at Hurlock, thence to Federalsburg, to the Maryland line and to Seaford, Del. The road will be 120 miles long and will cost about $2,500,000. The McKay Engineering Company, of Baltimore, Md., has charge of the work for the company. The main power house will be located at Cambridge. Four substations will be erected along the line as follows: One between Easton and Hurlock, one at Vienna, one at Hebron and another at Berlin. John H. Rogers, of Cambridge, and F. Hayward Hearn, of Easton, Md., are reported to be among those interested in the project.

HAGERSTOWN, MD.—Water ought in the month at the Antietam Creek, the site of the old Antietam Iron Works, before Shepherdstown have been purchased by Pennsylvania capitalists. It is said that an electric light and power plant will be erected to furnish electricity to operate an electric railway over the Antietam battlefield.

BERNARDSTON, MASS.—The citizens are considering the question of lighting the village by electricity. G. W. Lawrence, treasurer of the Greenfield Electric Light & Power Company, has submitted a proposition offering to furnish the service provided sufficient business is guaranteed to pay the company to extend its transmission lines to the town.

BOSTON, MASS.—A special meeting of the stockholders of the Edison Electric Illuminating Company, of Boston, will be held April 29 to vote on the proposition to authorize the purchase of the electric lighting property of the following companies: Chelsea Gas Company, Boston Consolidated Gas Company, Newton & Watertown Gas Light Company, Waltham Gas Light Company and the Lexington Gas & Electric Company.

DUDLEY, MASS.—The citizens have voted to authorize the Selectmen to make a five-year contract with the Webster Gas & Electric Company for lighting the streets of the town.

ERVING, MASS.—The question of lighting the town by electricity is under consideration.

GARDNER, MASS.—It is understood that the Connecticut River Power Company, which has purchased the plant of the Gardner Electric Light Company, will not formally take over the plant, but will have a working agreement whereby the former company will furnish electricity to operate the plant. All motors now in use will be replaced by 60-cycle machines. H. H. Taylor is superintendent.

STOCKBRIDGE, MASS.—The Selectmen have granted the Stockbridge Lighting Company permission to extend its transmission lines through Goodrich Street; also other locations in Stockbridge and Glendale; in all about 30 lamps will be added to the street lighting system. The company contemplates extending its system to Interlaken in the near future.

STOUGHTON, MASS.—It is reported that the Edison Electric Illuminating Company, of Brockton, Mass., will acquire the plant and holdings of the Stoughton Gas & Electric Company.

WESTFIELD, MASS.—The citizens have voted in favor of the proposition to appropriate $25,000 for increasing the output of the municipal electric light plant. An additional generator and engine will be installed.

ANN ARBOR, MICH.—The Michigan & Ohio Railway Company has applied to the City Council for a franchise through the city. The company proposes to construct an electric railway between Toledo and Ann Arbor, which will probably be extended to Whitmore Lake and Lakeland.

FLINT, MICH.—Extensive improvements are contemplated by the Oak Park Power Company to its power plant, which will include the installation of six boilers, two turbines, switchboard, gas plant, pumps, stokers, etc. Contracts have already been placed for the above equipment. H. Dalton is secretary and manager.

IRONWOOD, MICH.—Work has commenced by the Twin City General Electric Company on the proposed extension of its street railway system from Ironwood to Bessemer, Ramsey and Wakefield, and also on the Jessieville extension. H. F. Pearce is general superintendent.

MANISTEE, MICH.—The Board of Supervisors is considering the question of granting a franchise to the Manistee County Electric Company to develop the water power of the Manistee River.

ALBERT LEA, MINN.—The Albert Lea Light & Power Company has commenced work on improvements to its electric light and gas systems, which will involve an expenditure of from $65,000 to $75,000. The equipment will include a 700-hp steam turbine, switchboard, installation of alternating-current system in the residential district, and extension of gas mains.

FERGUS FALLS, MINN.—The citizens have voted to issue $5,000 in bonds for extension to the electric lighting system.

HAWLEY, MINN.—The citizens have voted in favor of lighting the village by electricity.

ST. PAUL, MINN.—The capital stock of the Stevens County Telephone Company has been increased from $15,000 to $40,000.

WARREN, MINN.—Bids will be received until May 11 for a 125-hp internal furnace boiler for 160 lb. working pressure. Plans and specifications are on file at the city recorder's office. W. R. Haney is superintendent of water and light department.

COLUMBUS, MISS.—The Tombigbee Cotton Mills, the Columbus Underwear Mills and the Columbus Comfort Factory, of this city, it is reported will [illegible] the three mills.

HATTIESBURG, MISS.—Contracts have been awarded by the Hattiesburg Traction Company for the construction of a new power plant and the [illegible] the Electrical Installation of Chicago, Ill. The company owns the present light and power plant. The work will involve an expenditure of [illegible]

MT. OLIVE, MISS.—The [illegible]

EL DORADO SPRINGS, [illegible]

RICHWOOD, MO.—[illegible]

SEDALIA, MO.—Bids will be received by the City Council for lighting the streets and public places of the city for a term of 10 years from Nov. 1, 1909, with magnetite arc lamps. J. L. Babcock is president of the Council.

CENTRAL CITY, NEB.—The question of establishing a municipal electric light plant is under consideration and will probably be submitted to a vote of the people.

DILLON, NEB.—The citizens have voted in favor of the proposition to issue bonds for the construction of a municipal electric light plant.

LINCOLN, NEB.—The Omaha, Lincoln & Beatrice Railway Company is erecting a distributing station, at a cost of about $4,500, at Bethany Heights to supply the town with electricity for lamps and motors.

LONG PINE, NEB.—S. H. Kyner is contemplating installing electrical equipment in his mill to light the village.

TABLE ROCK, NEB.—Preliminary arrangements are being made for the organization of the Table Rock Electric Light Company, which proposes to furnish electricity in Table Rock. Electricity for operating the system will be transmitted from the plant of O. A. Cooper & Son, of Humboldt, eight miles distant. The company will be capitalized at $6,500. Dr. E. L. McCrea was elected temporary chairman, and C. J. Wood as secretary.

WESTERN, NEB.—The citizens at a recent election voted to issue bonds for the establishment of a municipal electric light plant.

GOLDFIELD, NEV.—A company which will be known as the Chafey Mines has been organized to take over the famous Black Hole Mine. The company is planning to make several improvements, including the installation of another stamp mill, a power plant and a tramway from the mine to the mill sites.

EAST TILTON, N. H.—The Village Improvement Society is considering the question of lighting the town by electricity, and has appointed a committee to circulate a petition to have the Selectmen to call a town meeting for the purpose of forming a precinct to be lighted.

KEENE, N. H.—The Keene Gas & Electric Company is erecting a transmission line from the Ralston Street power station to the power house of the electric railway in South Keene. A motor is also being installed in the South Keene station.

LACONIA, N. H.—The State Legislature has passed a bill to light Endicott Rock and the bridge connecting it with the mainland by electricity.

LITTLETON, N. H.—It is reported that Chicago capitalists are interested in a project for the development of water power on the Connecticut River, involving an expenditure of between $5,000,000 and $6,000,000. The plan provides for the construction of three dams, one of which would be 160 ft. high, to be located at Lower Waterford, Vt., Monroe and Dalton, with a separate power plant in each town. C. E. Everett, Carl A. Ross, A. Danville, all of Chicago, Ill., and F. H. Gilbert, of New York, N. Y., are among the party making investigations.

MANCHESTER, N. H.—The State Legislature has given the Amoskeag Manufacturing Company authority to construct a dam below Goff's Falls and to lay cables and erect transmission lines for the transmission of electricity to the company's mills.

MANCHESTER, N. H.—The City Council has passed the ordinance authorizing the Mayor and committee on lighting to execute a contract with the Manchester Traction, Light & Power Company to furnish electricity for the 10 arches erected across Elm Street for ornamental lighting. Under the terms of the contract the company agrees to furnish electricity for the lamps in the arches at the rate of 6 cents per kw-hour, and 16 cents for each 16-cp lamp the company may furnish for the arches.

WOODSTOCK, N. H.—The citizens on May 11 will vote on the proposition to install a municipal electric light and power plant, using the dam of the Woodstock Lumber Company across the Pemigewasset River to furnish power to operate the plant. The cost of the plant is estimated at $14,000. L. F. Parker is chairman of town committee, and Arthur W. Dudley of Manchester, N. H., is engineer.

BRIDGETON, N. J.—The City Council has appointed a committee to investigate the question of establishing a municipal electric light plant.

TRENTON, N. J.—Negotiations have been closed whereby Charles R. Le Compte, Harry J. Terwilliger, Ernest Le Compte, Nicholas MacDonald, of Lakewood, N. J.; James H. Butcher, J. Arthur Butcher, of Ardena, and Captain R. A. Clark, of Point Pleasant, N. J., have taken over the property and franchises of the Trenton, Lakewood & Atlantic Railway. About four miles of the railway has been built between Point Pleasant and Lakewood. It is said that the new company will complete the railway at once between Point Pleasant and Lakewood and extend it to Trenton, via Allentown.

SANTA FE, N. M.—The application of Ernest Fischer, of Cimarron, N. M., for diversion of the waters of Pecos River and Holy Ghost Creek, 30 miles east of Santa Fe, for power purposes has been approved by Vernon L. Sullivan, territorial engineer. It is proposed to erect a power plant just below the mouth of the Macho, where 4500 hp will be developed to supply electricity in Albuquerque, Santa Fé and Las Vegas. A 5-ft. pipe line six miles in length, besides the cement-lined ditches, is included in the project. The cost of the entire work is estimated at about $450,000.

BUFFALO, N. Y.—On the ground that no definite data is at hand as to the probable cost of lighting the city and county hall with electricity, Mayor Adam has vetoed the ordinance of the Common Council calling for a bond issue of $17,000 for the purpose of paying the city's half of the expense of installing an electric light plant in the building.

GENEVA, N. Y.—The Common Council has directed the Board of Public Works to prepare and submit plans for a municipal conduit and pole system for the distribution of electricity in Geneva, with estimates of cost.

MONTICELLO, N. Y.—The Village Board has granted a franchise to the Ulster Lake Company, of Ellenville, N. Y., to erect transmission lines and furnish electricity in Monticello. The company claims that it can furnish electricity for 25 per cent less than is now being paid for the service. Dwight Devine & Sons are interested in the Ulster Lake Company.

NEW YORK, N. Y.—Bids will be received until May 3 by C. B. J Snyder, superintendent of school buildings, Department of Education, for completing and finishing the installation of electric equipment in new Public School No. 89, Elmhurst, Borough of Queens, in accordance with the original plans and specifications of contract awarded to L. F. Benn, which has been declared abandoned.

NICHOLLVILLE, N. Y.—A 300-kw generator will be installed in the plant of the Nicholvville Electric Light Company, which was recently damaged by fire. The water wheels were not damaged.

PORT JERVIS, N. Y.—The incorporation of the Port Jervis Light & Power Company is said to be part of the plan of the bondholders' committee to organize two companies to take over the public service properties in this city, which were recently sold at a foreclosure sale. The Port Jervis Light & Power Company will furnish gas and electric service, and a company to be known as the Port Jervis Traction Company is being organized to operate the street railway. The new companies will take over the securities of the present company and will apply to the Public Service Commission for permission to issue stock.

SHELDRAKE, N. Y.—The power house, heating plant and pumping station at the Sheldrake Springs Sanitarium was totally destroyed by fire on April 20, causing a loss of about $10,000. It is said that the plant will be rebuilt immediately.

SOUTHOLD, N. Y.—Application has been made to the Town Board by John E. Root, George W. Reeves, Frederick E. Lewis, George F. Stackpole and J. Madison Wells for permission to construct and operate a street railway from Riverhead through Southold to Orient Point.

WARREN, N. Y.—The Warren County Traction Company has filed a mortgage in favor of the Banker's Corporation, of Reading, Pa., for $500,000. The company is planning to extend its railway from Youngsville to Warren.

BEAUFORT, N. C.—The contract for machinery and distributing system for the municipal electric light plant has been awarded to E. A. O'Bryan, Wilmington, N. C.; inside wiring is to be done by H. W. Westbrook, Mt. Olive, N. C. Richard Rice is Mayor.

CHARLOTTE, N. C.—Work has commenced on grading the railway for the Burgraham Interurban Company, which will connect Burlington, Graham and Haw River. The Southern Power & Traction Company, recently chartered, and which has secured franchises in Burlington, Graham, Reidsville, Wentworth and other towns, is being promoted by the same parties who are engaged in the construction of the above road.

WAKE FOREST, N. C.—The citizens have voted to issue $15,000 in bonds, the proceeds to be used for the construction of an electric light plant for the college and city.

GRAND FORKS, N. D.—The County Board of Commissioners has granted the Grand Forks Street Railway Company a franchise to construct a railway to the fair grounds and the cemetery.

NORTON, N. D.—The Norton Telephone Company has increased its capital stock from $10,000 to $30,000.

BELLEFONTAINE, OHIO.—The capital stock of the Logan County Farmers' Telephone Company has been increased from $5,000 to $15,000.

COLUMBUS, OHIO.—Proposals will be received at the office of the Board of Trustees, of the Ohio State University, Columbus, Ohio, until May 10, for furnishing materials and erection of an addition to the power house at the State University, in accordance with plans and specifications prepared by Herbert Edwards, of Columbus, Ohio. Plans can be seen at the above office or at the office of the architect. Carl E. Stees is secretary of the board.

DEFIANCE, OHIO.—The new owners of the plant of the People's Gas & Electric Company have submitted a proposition to the City Council offering to expend $50,000 in rebuilding the plant if granted a new franchise and lighting contract.

LIMA, OHIO.—Bids will be received by the Board of Public Service for lighting the streets of the city until May 13. The bids received Feb. 20 were rejected. A. W. Thomas is clerk of the board.

PATASKALA, OHIO.—The capital stock of the Pataskala Farmers' Telephone Company has been increased from $30,000 to $50,000.

SPRINGFIELD, OHIO.—It is reported that John L. Zimmerman, president of the Springfield Light, Heat & Power Company, and other officers are negotiating for the purchase of a site for a power house.

SPRINGFIELD, OHIO.—We are asked to announce the fact that the People's Light, Heat & Power Company ceased to exist after Oct. 1, 1908, and its property is now owned and operated by the Springfield Light, Heat & Power Company. The last named company also absorbed the plant and holdings of the Home Lighting, Power & Heating Company, of Springfield. A. N. Cope is general superintendent.

TOLEDO, OHIO.—Bids will be received at the office of the Board of Public Service until May 22 for furnishing and erecting two duplicate electric generators with a rating of 100 kw each; also for two vertical, three-cylinder producer gas engines direct connected to the above generators, together with the necessary piping, tools, etc. Bids will also be received for switchboard consisting of three main panels and three subpanels, together with all instruments, switches, electric cables, etc. The above machinery and equipment is to be erected in the low-service pumping station on the grounds of the filtration plant of the city of Toledo. Copies of the plan showing the location of the machinery and the gas main in the low-service pumping station, also copies of the specifications, forms of proposals, forms of bonds, and form of contract can be secured on and after May 1 on application to the chief engineer of the Board of Public Service, Valentine Building, Toledo, Ohio, upon deposit of $10, which will be returned upon return of said plans, specifications in good order, before June 1, 1909. Bidders must use printed forms, as none other will be received. George W. Tonson is president of the Board.

XENIA, OHIO.—The County Commissioners have granted a franchise to Thomas L. Ferneding, for the construction of an electric railway between Xenia and Dayton. The franchise will be transferred to the Dayton, Springfield & Xenia Southern Traction Company, incorporated last winter, which proposes to extend the railway to Washington, C. H.

ZANESVILLE, OHIO.—Plans are being considered to reorganize the Central Valley Light & Power Company for the purpose of constructing an electric railway between this city and McConnellsville to connect with the Parkersburg-Marietta railway, which is now being extended up the Muskingum from Marietta, and which will ultimately be extended to McConnellsville. The charter of the Center Valley Company, which originally provided for the construction of a power house, will have to be amended to secure the privilege of building the railway. Rufus C. Barton is one of the directors.

EL RENO, OKLA.—It is reported that the Oklahoma City Chamber of Commerce has agreed to raise the sum of $50,000 for the El Reno Interurban Railway, which proposes to construct an interurban electric railway between Oklahoma City and El Reno, a distance of 25.5 miles. It is said that the company will commence work as soon as the $50,000 has been raised. Henry Schaefer, of El Reno, is president.

SAPULPA, OKLA.—At the coming election the citizens will vote on the proposition to issue $40,000 in bonds, the proceeds to be used for the construction of an electric light plant and water works system.

JOSEPH, ORE.—Having secured a 30-year franchise from the City Council, the St. Joseph Electric Light & Power Company contemplates increasing the output of its plant. The plant is to be operated by water power.

PORTLAND, ORE.—The City Council has granted the Portland Railway, Light & Power Company a blanket franchise to construct and operate several new lines, spurs and switches in this city.

BLOOMSBURG, PA.—It is stated that the Columbia Power, Light & Railways Company will place contracts at once for the erection of a 23,000-volt, three-phase transmission line, 25 miles in length, with about 2000 kw of transformers, lightning arresters, etc. The company will also install a 500-hp hydraulic turbine, a 300-kw generator to supply electricity for railway service and a 200-kw belted generator with switchboard, etc. B. O. Ellis is general manager.

CALIFORNIA, PA.—Application will be made on May 10 for a charter for the California & Centerville Street Railway Company, which proposes to construct a street railway from California to Centerville. M. H. Francis, W. J. Weaver, H. C. Drum, Harris Booker and Joseph McLain are interested in the project.

FINLEYVILLE, PA.—The Finleyville Southern Street Railway Company will apply for a charter to construct an electric railway from Finleyville to Bentleyville, a distance of 14 miles. A. H. Anderson, S. C. Wilson, F. M. Hayden, T. M. Hayden, J. E. Hayden, and H. B. Hayden are interested in the enterprise.

GLASSPORT, PA.—Work will commence within 30 days on the proposed electric railway to be constructed by the Jefferson & Wilson Street Railway Company and the Peters Creek Street Railway Company, which will connect Glassport and Clairton. The railway will be about five miles in length and will cost approximately $300,000. It is expected to have the road completed by Dec. 1, 1909. W. G. Wilson, of Dravosburg, Pa., is president, and W. G. Wermer, secretary.

PITTSBURGH, PA.—Application has been made to the Governor for a charter for the Rapid Transit Subway Company, which proposes to construct and operate an underground passenger railway in Pittsburg. F. W. Mueller, W. E. Kusen, Paul H. Mueller, of Pittsburg, are the applicants.

PORTSMOUTH, R. I.—Application has been made by Henry C. Anthony, David J. White and John L. Borden to the Legislature for an act to incorporate the Portsmouth Electric Company for the purpose of furnishing electricity for heat, lamps and motors in the towns of Portsmouth and Middletown.

SUNBURY, PA.—The Sunbury & Northumberland Electric Railway Company contemplates the purchase of two second-hand rotary converters, of 125-kw and 175-kw, respectively, for [illegible] current.

PROVIDENCE, R. I.—The New York, New Haven & Hartford Railroad Company is erecting a large interlocking tower on Promenade Street. The cost of the electrical equipment is estimated at $7,000. Electricity for operating the station can be taken from four sources: From power house of the Providence, Warren & Bristol Railroad, Warren; the power plant at the Providence station, one of the power houses in the city and the storage batteries. It is expected to have the tower ready for service during the coming summer.

GEORGETOWN, S. C.—The Georgetown Railway & Light Company, recently incorporated, has purchased the plant and holdings of the Georgetown Electric Company and contemplates the construction of a local street railway system during the coming summer, for which a franchise has already been secured. H. C. Case is president.

SALUDA, S. C.—It is reported that Ladshaw, White & Cameron are planning to erect a power plant on Green River, about three miles from Saluda, which will furnish 50,000 hp. Three large dams will be constructed.

LITTLEBEND, S. D.—A telephone company has been organized to construct a telephone line to Onida. W. E. Jenkins, of Okobojo, is secretary.

MADISON, S. D.—The citizens on April 20 voted to issue $16,000 in bonds, the proceeds to be used for improvements to the electric light plant. William Rae is city auditor.

GREENVILLE, TENN.—P. C. Ottinger writes that he is not interested in the construction of a hydro-electric plant on the French River, as reported in the issue of April 22. Mr. Ottinger is reported to be interested in a proposed electric railway to connect Newport and Greenville.

LEXINGTON, TENN.—The City Council is considering the question of installing a municipal electric light plant and water-works system, for which estimates of cost will soon be asked.

MINERAL WELLS, TEX.—The street railway and lighting properties, known as the Mineral Wells Electric System, were sold recently at auction to D. T. Bomar, of Bomar & Bomar, of Fort Worth, Tex., for $75,000. The property consists of about six miles of street railway, an electric lighting plant, and a 30-ton ice plant. The system is not in operation and no definite plans have been made for resumption of business.

ROCKDALE, TEX.—The Rockdale-Florence Interurban Railway Company, it is reported, contemplates the construction of a power plant. H. C. Meyer is president.

SAN ANTONIO, TEX.—The Southwestern Telephone Company, it is said, will make extensive improvements to its local system, which will involve an expenditure of about $300,000, of which $50,000 will be used to erect a new exchange.

SNYDER, TEX.—The contract for the construction of an electric light plant has been awarded to Messrs. Brumbach & Couch, of Cleburne, Tex.

GREENVILLE, TEX.—The J. W. Maxey Company, of Houston, Tex., has been awarded the contract for engineering work on the Greenville electric light plant, for $60,000. W. A. Frazer is city clerk.

TAFT, TEX.—Arrangements are being made for the construction of an electric light plant, plans for which are being prepared by Alfred Giles, of San Antonio, Tex.

LA SAL, UTAH.—The La Sal Mountain Telephone & Electric Company has increased its capital stock from $15,000 to $50,000.

BETHEL, VT.—The power plant of the Bethel Electric Light & Power Company has been put out of commission owing to the upper raceway having been damaged by the floods, which will take several weeks to repair. Electricity for business places is furnished from the steam power plant of the Gaysville Electric Company, of Bethel, Vt.

ESSEX JUNCTION, VT.—The Burlington Electric Light & Power Company contemplates extending its transmission line from Essex Junction to Butler's, a distance of two miles.

COLFAX, WASH.—The County Commissioners have awarded the contract for the electric light plant for the county court house to Fairbanks, Morse & Company, of Spokane, Wash., for $1,420. The equipment will include a 9-hp gasoline engine, dynamo and storage battery.

EVERETT, WASH.—The Everett & Tacoma Railway Company, it is stated, has made surveys and secured practically all the right of way for its proposed electric railway from Everett to Snohomish, Issaquah, Seattle and Tacoma, a distance of 110 miles. It is understood that the road has been financed and that contracts for construction will be let about the first of June. O. E. Crossman is president, and E. Colburn, of Snohomish, is chief engineer.

NORTH YAKIMA, WASH.—It is reported that plans are being made by the Yakima Valley Transportation Co. to extend its railway into the Moxee Country.

SEATTLE, WASH.—E. L. Blaine has made application to the County Commissioners for a franchise to construct and operate an electric railway between [illegible]

SOUTH BEND, WASH.—The County Commissioners have granted a franchise to the Ilwaco General Electric Company, to erect transmission lines and construct an electric railway from Ilwaco to Stackpole Harbor on Willapa Bay, a distance of 20 miles. The company proposes to furnish electricity for lamps in Ilwaco and Long Beach and to operate an electric railway between Ilwaco and Stackpole Harbor.

SPOKANE, WASH.—The Panhandle Electric Railway & Power Company has filed amendments to its charter, which provide for the con-

[illegible] the railway from Priest River, Idaho, to Priest Lake. Connecting the two is the Canadian line, a railway from Spokane to Priest River is also proposed.

SPOKANE, WASH.—Albert M. Dexter, president of the Oregon Electric Railway Company, has had Puget Sound capitalists investigate a bond issue of $3,000,000, the proceeds of which will be used to construct a railway from Nighthawk to a point near the head of the navigation on the Columbia River, a distance of about 75 miles. The railway will be extended east of Spokane and west of Seattle. The entire system will include more than 500 miles.

VANCOUVER, WASH.—An electric power plant is being installed in the sawmill of the Pittock & Leadbetter Lumber Company, the equipment of which will include a 315-hp McEwen tandem compound engine, a 250-kw generator; steam for operating the plant will be furnished from the boilers of the sawmill. The company will furnish electricity to operate the cars of the Vancouver Traction Company, which at present purchases electrical energy for its system from the Portland Railway, Light & Power Company of Portland, Ore.

WASHGOUAL, WASH.—We are informed that work will begin on construction on the proposed dam of Washgoual River to be erected by Cottrell & Son in July. The dam will be located about 2½ miles from Washgoual. The cost of the plant is estimated at $10,000.

CABIN CREEK, W. VA.—C. K. McDermott, of Charleston, W. Va., is reported to be interested in a project to construct an electric railway to connect Cabin Creek and Boomer, W. Va.

GRAFTON, W. VA.—At the annual meeting of the Grafton Traction Company it was decided to extend the railway system to Flemington, a distance of 10 miles.

MARTINSBURG, W. VA.—The Tuscarora Valley Traction Company has applied for a franchise to construct and operate an electric railway to connect Hedgesville, Darkesville and other points. J. C. Anderson, of Norfolk, Va., is interested in the project.

WELLSBURG, W. VA.—Plans have been completed by the Wellsburg, Bethany & Washington Traction Company for an extension to its railway from Bethany to and across the State Line to Avella.

CAMPBELLSPORT, WIS.—The citizens are considering the question of purchasing the electric light plant owned by the Campbellsport Electric Light & Power Company, and operating it as a municipal enterprise. It is understood that the present owners are willing to sell the plant.

CUMBERLAND, WIS.—The capital stock of the McKinley Telephone Company has been increased from $500 to $10,000 and the headquarters of the company have been transferred from McKinley to Cumberland.

JEFFERSON, WIS.—The Copeland & Ryder Company is making preparations to install an electric power plant.

MILWAUKEE, WIS.—Plans are being made by the Pabst Brewing Company to commence work at once on the construction of a power plant at Cold Spring Avenue and Thirteenth Street at an estimated cost of $19,000.

SUSSEX, WIS.—The Lisbon Telephone Company has increased its capital stock from $720 to $5,000.

VICTORIA, B. C., CAN.—Financial arrangements have been completed for the development proposed by the Stav Lake Power Company and an announcement has been made that the company will be in a position to deliver 10,000 hp before the end of 1910. William McNeil is secretary.

WINNIPEG, MAN., CAN.—It is reported that the Great Falls Power Company is planning to develop the water power of the Winnipeg River and erect a power plant with an output of 180,000 hp. The canal, it is said, will cost $1,000,000. H. M. Byllesby, of Chicago, Ill., is reported interested in the enterprise.

WINNIPEG, MAN., CAN.—The Saskatchewan government has purchased the Bell telephone system in that province, consisting of the long-distance lines, local exchanges and equipment, and will take over the system May 1. The government already has a telephone system under construction.

LISTOWELL, ONT., CAN.—The citizens have voted in favor of the by-law to light the streets of the town by electricity with 265 lamps.

NEW HAMBURG, ONT., CAN.—The Metropolitan Railway Company, it is reported, contemplates constructing a railway which will extend from Stratford to Guelph.

NEW HAMBURG, ONT., CAN.—The town has decided to purchase $20,000 in capital stock of the People's Railway Company, which is capitalized at $1,000,000. Other municipalities will be asked to take stock in the company.

WINDSOR, ONT., CAN.—According to estimates it will cost the city from $125,000 to $130,000 to build a distributing station and transmission lines for Niagara power. The price for electricity from the Hydro-Electric Power Commission in amounts less than 5000 hp delivered at Windsor is $38 per hp per year, which, with the cost of the distributing system, would make the cost about $45 per hp per year.

LUMSDEN, SASK., CAN.—Arthur Anslow will receive tenders until May 8 for all work in connection with the construction of a system for the Wascana Rural Telephone Company.

SALTSCOATS, SASK., CAN.—Plans are being made by the Saltscoats [illegible] Company to erect about [illegible] miles of telephone line this season.

Company Elections.

OLEAN, COL.—At the annual meeting of the Olean Electric Power & Light Company the following named officers were elected: A. Phinney, president and manager; C. F. Sayles, vice-president; and G. Crosby, secretary.

KANSAS CITY, MO.—At [illegible] meeting of the directors of the Blue Valley Traction Company the following named officers were elected: M. M. Sweetman, president; C. W. German, secretary, and J. M. Lewis, treasurer.

HUNTINGTON, [illegible].—At the annual meeting of the Huntington Light & Power Company the following officers were elected: Henry S. Brush, president; William J. Matheson, vice-president, and [illegible] Cordes, secretary and manager.

New Industrial Companies.

THE CONTINENTAL ROYAL PHONE & PHONOGRAM COMPANY, of Kittery, Maine, has filed articles of incorporation with a capital stock of $5,000,000 for the purpose of manufacturing telephone and telegraph instruments. A. H. Peavey is president; G. E. Burnham, treasurer, and E. J. Burnham, clerk, all of Kittery, Maine.

THE ELECTRIC MANUFACTURING COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $25,000 by H. B. McGraw, M. C. Russ, W. P. Dunlany, K. B. Britton and C. A. Black.

THE EMPIRE VACUUM COMPANY, of New York, N. Y., has filed articles of incorporation with the Secretary of State, with a capital stock of $300,000, to manufacture vacuum cleaning apparatus. The incorporators are: George A. Kues, Frederick S. Bon and Charles W. Place.

THE FISHER DRILLING & ENGINEERING COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $15,000, by Hamilton Anderson, F. Fassett Briggs and Louis F. Goldman, all of New York, N. Y. The company proposes to do a mechanical engineering business.

FITZGERALD & BENNIE LABORATORIES, of Niagara Falls, N. Y., has been incorporated, with a capital stock of $25,000, as consulting chemical and metallurgical laboratory. The incorporators are: Francis A. J. Fitzgerald, P. McNiven, B. and Delos R. Miller, all of Niagara Falls, N. Y.

THE GARNY-MEHSERLE MACHINE & AUTO COMPANY, of Rochester, N. Y., has been incorporated with a capital stock of $2,000 by George Garny, Theresa Garney, Henry Mehserle and Katherine Mehserle, all of Rochester. The company proposes to manufacture motors, engines, etc., cars and vehicles.

THE GEORGIA TIE & LUMPER COMPANY, of Matteawan, N. Y., has been chartered, with a capital stock of $250,000, by John B. Ecleston, of New York, N. Y.; Samuel C. Ecleston and Arthur A. Mitchell, of West New Brighton, N. Y. The company proposes to manufacture railroad ties, poles and cross-arms for railroads, electric light companies and others.

THE INTERSTATE RAILWAY & STEAMSHIP SUPPLY COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $20,000, to manufacture engines, boilers, machinery, boats, electric motors and dynamos. The incorporators are: Thomas F. Fallon, William Hyland and Matthew M. Feely, all of New York, N. Y.

THE JEWEL ELECTRIC COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $15,000, to manufacture electrical supplies by Robert J. Phillips, Miles C. St. John and Milo C. Diller.

THE JOHN J. GIBSON COMPANY, of Buffalo, N. Y., has been incorporated, with a capital stock of $20,000, by Joseph N. Gregory, E. G. Thompson and George Roughhead, Jr., all of Buffalo, N. Y. The company proposes to manufacture motors, engines, machines, cars, automobiles, etc.

THE LIGHTNING ELECTRIC ACCESSORIES COMPANY, of Chicago, Ill., has been incorporated by Messrs. Hornstein and Fisher, Fort Dearborn Building, Chicago. The company is capitalized at $2,500 and proposes to manufacture automobile and electric accessories.

THE McLEER ELECTRIC & MANUFACTURING COMPANY, of Brooklyn, N. Y., has been incorporated by Charles B. McLeer, Joseph McLeer, Jr., and Edward McLeer, Jr., all of Brooklyn, N. Y. The company is capitalized at $20,000 and proposes to do general contracting and electrical work.

THE STANDARD CHEMICAL COMPANY, of Bayonne, N. J., has been chartered with a capital stock of $100,000 for the purpose of manufacturing materials pertaining to insulation. The incorporators are: Philip S. Smith, of Philadelphia, Pa.; Dorris Whipple and Charles H. Toping, of New York, N. Y.

THE STOUGHTON-FOLKINS COMPANY, of Portland, Maine, has filed articles of incorporation, with a capital stock of $10,000, for the purpose of manufacturing motors, engines and vehicles. M. S. Folkins is president, and P. T. Stoughton, clerk and treasurer, both of Portland, Maine.

THE WESTERN MANUFACTURING COMPANY, of Newark, N. J., has been incorporated with a capital stock of $125,000 by Christian H. Weston, Daniel W. Applegate, Burton L. R. Hunt, of Newark, N. J.

The company proposes to do a mechanical and electrical engineering business.

THE WILBUR-ROSS LIGHT & CHEMICAL COMPANY, of Wilmington, Del., has been chartered, with a capital stock of $25,000, by F. M. Shive, S. E. Roberson and Harry W. Davis, of Wilmington, Del.

New Incorporations.

RAUM, ARK.—The Northern Arkansas & Missouri Valley Telephone Company has been organized and the following-named officers elected: A. Winkle, president; W. O. Fox, secretary, and T. J. Davis, treasurer.

BAKERSFIELD, CAL.—The Farmers' Mutual Telephone Company has been chartered, with a capital stock of $4,000, by W. W. Frazier, R. S. Ashe, D. Hirschfield, Milo G. McKee and James Herod.

GLENDALE, CAL.—Articles of incorporation have been filed for the Glendale & Eagle Rock Railway Company to construct a railway 2½ miles in length, to be operated by electricity or gasoline. The company is capitalized at $25,000 and the directors are: E. D. Goode, R. E. Goode and George Benson.

RED BLUFF, CAL.—Articles of incorporation have been filed with the county recorder for the Sierra Electric Company. The directors of the company are F. E. Horton, of Berkeley, Cal.; B. F. Woolmer, T. C. Warren and Boyd L. Wilson, of Oakland, Cal. The capital stock is placed at $2,000,000.

RED BLUFF, CAL.—The Tehama Power Company has filed articles of incorporation with a capital stock of $10,000,000, and will develop a water power on Mill Creek in Tehama County. The directors are: Luke McDonald, of Redding; L. A. McIntosh, of Chico, Cal.; R. S. Kitrick, of Oroville, Cal.; J. E. Frick, of San Francisco, and Leon Ely.

BRANFORD, CONN.—The Senate has passed the resolution incorporating the North Branford Light, Water & Power Company. The incorporators are: Joseph P. Manning, Charles H. Nichols, of New Haven, Conn.; Louis A. Fisk, Charles S. Bradley, of Branford; Robert O. Eaton, of North Haven, Conn.; Alfred D. Rose, of North Branford; J. Henry Roraback, of North Canaan, Conn., and Theodore H. Macdonald, of New Haven, Conn. The company is given the privilege to take water from the Twin Lakes, in North Branford, the Branford River and West River and tributaries.

GAINESVILLE, GA.—The New Bridge Telephone Company has been organized to construct a telephone line 12 miles in length. Claud L. Thompson is president, and W. L. Awtry, secretary and treasurer.

CHICAGO, ILL.—The Kendall County Telephone Company has been incorporated, with a capital stock of $25,000, by Lester Coffeen, F. W. Henckman and George T. Rogers.

CHICAGO, ILL.—The Northern Illinois Gas & Electric Company has been chartered, with a capital stock of $2,500, by E. J. Kloss, E. A. Munger and L. D. Condee. The company proposes to operate electric light plants.

EAST ST. LOUIS, ILL.—The St. Louis & Chester Railway Company has been incorporated with a capital stock of $100,000 to construct and operate a railway from East St. Louis to Chester, Ill. The incorporators are: R. Steeber, E. W. Ziegenhein and R. A. Slack, of East St. Louis.

GOLDEN, ILL.—Articles of incorporation have been filed for the Golden Farmers' Telephone Company, with a capital stock of $2,500, by Philip Cain, Scott Najor and C. G. Buss.

LOVINGTON, ILL.—The Farmers & Merchants' Telephone Company, of Moultrie County, has been incorporated, with a capital stock of $30,000, by W. O. Neff, E. O. Hood and A. E. Hanson.

OTTAWA, ILL.—Articles of incorporation have been filed for the United Telephone Company, of Ottawa. The company is capitalized at $120,000, and the incorporators are A. C. Schoch, Henry W. Johnson and Vincent J. Johnson, all of Ottawa.

STONE CHURCH, ILL.—The Northwestern Telephone Company has been chartered with a capital stock of $840 by H. B. Dorschen, Louis Lammers and Victor Grattendick.

YORKVILLE, ILL.—The Kendal County Telephone Company has been chartered with a capital stock of $25,000 by W. Lester Coffeen, F. W. Henckesman and George T. Rogers.

BUSHY PRAIRIE, IND.—The Farmers' Mutual Telephone Company has been incorporated to build a system in Bushy Prairie and throughout Lagrange County. Arthur K. Hammond, E. W. Ernsberger and Fred Seaborn are directors.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the Pretty Prairie Telephone Company, of Lagrange County. The company is capitalized at $3,000, and the incorporators are: E. G. Smeltzly, H. C. Plank, M. L. Houser, Amos Long and D. M. Plank.

MOORES HILL, IND.—The Moores Hill Telephone Company has been incorporated, with a capital stock of $150. The directors are M. C. Nulford, M. E. Bigney, S. J. Houston, John F. Givan and George W. Canfield.

MASON CITY, IA.—The Portland Heights Telephone Company has been incorporated, with a capital stock of $[illegible]. R. E. Pedrick is president and treasurer.

OAKLAND, IA.—The Morgan & Oakland Township Telephone Company has been organized. The officers are: O. C. Sime, president; S. H. Russ, vice-president; Ole Sevick, secretary, and H. J. Iverson, treasurer.

WYOMING, IA.—The Wyoming Telephone Company has been chartered, with a capital stock of $30,000, by Otto Wettstein, Jr., W. D. Waggoner and J. J. Luneman.

MONTICELLO, MAINE.—The Monticello Electric Company has been organized with a capital stock of $5,000 for the purpose of generating electricity for light, heat and power purposes. The officers of the company are: Guy C. Fletcher, president; H. L. Hurd, treasurer, both of Monticello.

BARRYTON, MICH.—The Barryton Rural Telephone Company has been incorporated, with a capital stock of $1,000.

EAGLE LAKE, MINN.—The Midway Telephone Company has been incorporated, with a capital stock of $6,000. M. Bernardus is secretary and treasurer.

WEST CONCORD, MINN.—Articles of incorporation have been filed for the West Concord Telephone Company, with a capital stock of $15,000, by W. T. Schmidt, F. F. Clifford, J. G. McCarthy, E. E. Harrison and H. H. Orcutt.

HINSDALE, MONT.—Articles of incorporation have been filed for the Farmers' Telephone Company, of Hinsdale, with a capital stock of $20,000.

McLEOD, MONT.—The Maine Boulder Telephone Company has been incorporated, with a capital stock of $2,000.

O'NEILL, NEB.—The Michigan Telephone Company has been formed to build a telephone line to connect with Grattan and O'Neill, about 20 miles in length. M. P. Sullivan is president; J. D. Kelley, vice-president; P. C. Kelley, secretary, and Jacob Hirsch, treasurer.

ELY, NEV.—The Spring Valley Telephone Company has been incorporated by Henry C. Nicholson, Joseph Stevens and Eugene Giles.

RENO, NEV.—The Lander County Power & Light Company has been incorporated, with a capital stock of $200,000. The company proposes to construct and maintain electric light and power plants and to operate telegraph and telephone lines in the State of Nevada.

LAKEWOOD, N. J.—Articles of incorporation have been filed for the Lakewood & Seashore Railroad Company with a capital stock of $300,000, by Chas. R. Le Compte, of Lakewood, N. J.; Jas. H. Butcher, of Ardena; Ernest LeCompte, Harry J. Terwilliger, Nicholas MacDonald, all of Lakewood; and Frederick A. Clark, of Point Pleasant, N. J. The new company has purchased the property and rights of the Trenton, Lakewood & Atlantic Railroad Company, and proposes to construct an electric railway from Lakewood to Point Pleasant, a distance of 10 miles.

PORT JERVIS, N. Y.—The Port Jervis Light & Power Company has been incorporated, with a capital stock of $300,000, for the purpose of generating gas and electricity for lamps, heat and motors. The incorporators are J. E. Daily, J. D. Crowell and R. C. Maroney, of New York, N. Y.

WILTON, N. D.—The Grass Lake Mutual Telephone Company has been organized and the following officers elected: G. A. Hubbell, secretary; Oscar Backman, treasurer, and Gabriel Thor, general manager.

COLUMBUS, OHIO.—The Defiance, Napoleon & Wauseon Railway Company has filed articles of incorporation with a capital stock of $1,000 to construct and operate a railway between Wauseon and Defiance, the motive power to be steam, electricity or other power.

GILMORE, OHIO.—The Farmers' Mutual Telephone Company has been incorporated with a capital stock of $2,000 by A. Parker, D. Galbraith, Aaron Parker, W. F. Roberts and T. J. McCue.

MAGNOLIA, OHIO.—The Farmers' Tri-County Telephone Company, of this place, has been incorporated with a capital stock of $5,000 by R. R. Elson, J. H. Meitzler, M. J. Cooper, W. H. Maddrell and F. M. Randells.

NEWARK, OHIO.—The Somerset Telephone Company has been incorporated by Edward Kibler, Harry Swisher, C. E. Hollander, R. S. Hunter and R. W. Smith. The capital stock is $25,000.

CLINTON, OKLA.—The Clinton Street Railway Company has been incorporated with a capital stock of $50,000 to construct a street railway in Clinton, 10 miles in length. The directors are: C. W. Goodwin, R. O. Hunt, M. L. Holcombe, Charles H. Lamb, E. N. Tittsworth, A. N. Curry, E. A. Humphrey, and B. A. Little, of Clinton, and H. Smith, of Arapahoe, Okla. The Clinton Railroad Construction has also been chartered by the same parties.

McARTHUR (P. O. HAMMON), OKLA.—The McArthur Telephone Company has been chartered with a capital stock of $[illegible]. The directors are Henry Black, John Rogers and C. H. Godfrey, all of Texmo.

Personal.

MR. H. H. BARNES, JR., gave a lecture April 16 before the Pittsfield A. I. E. E. branch on "Electric Transportation Facilities in New York City." The lecture was illustrated with lantern slides.

MR. HENRY FLOY has been retained as consulting engineer by the St. Louis Smelting & Refining Company in the design and construction of a large extension to the company's plant at Collinsville, Ill.

MR. HAROLD ALMERT, the consulting and central station engineer of Chicago, has been visiting New York during the past week, in connection with various personal matters, and has returned to the West.

MR. W. CURRY TURPIN has resigned as superintendent of the Auburn Light, Heat & Power Company, to accept a position as electrical engineer with the New York Public Service Commission, First District.

MR. JEAN BART BALCOMB has resigned from the Lake Construction Company in order to take up practice as consulting engineer, with offices at 184 La Salle Street, Chicago. Mr. Balcomb will make a specialty of hydraulic and hydroelectric work.

MR. EDMUND LANG, for many years connected with the Wheeler Condenser & Engineering Company and other engineering companies, has been appointed to undertake some special work in shop organization for the Crocker-Wheeler Company, Ampere, N. J.

MR. E. O. GOCHICOA has resigned as superintendent of the Sultepec (Mex.) Electric Light & Power Company, and after a visit to some of the larger electrical works of this country will establish the firm of Gochicoa, Ohlhauser & Company, with headquarters at Toluca, Mex.

MR. DEWITT V. MOORE, vice-president of the Moore-Mansfield Construction Company, of Indianapolis, has been elected a director of the American Society of Engineering Contractors. This is a new organization recently formed in New York for the advancement of engineering knowledge and contracting practice and the maintenance of high professional standards among its members.

MR. W. B. POTTER, engineer of the railway department of the General Electric Company, is now fully recovered from his recent illness and operation, due to unusual effort and fatigue incurred during his long trip over the Pacific Slope, investigating power and traction conditions there. Mr. Potter has been under private treatment in New York City, but is now convalescent and resuming work, much to the pleasure of a host of friends.

MR. A. T. MACDONALD, the indefatigable secretary of the late Louisville Electrical Exposition, was the recipient at the close of the show of a silver service presented by the officers and exhibitors. The presentation was made after a mock trial in which Mr. Macdonald was condemned to hard labor in Louisville for the rest of his life. President Kieskers and Treasurer Beckman also received silver services in recognition of their services.

MR. CHARLES J. RUSSELL will represent the Philadelphia Electric Company at the seventh International Congress of Applied Electricity. The congress will be held in London, May 25 to June 2, and after the adjournment Mr. Russell will visit various plants in England, France, Germany and Switzerland, investigating the various industrial applications of electricity, with special regard to electrochemical and electrometallurgical processes.

PROF. WILLIAM C. BAUER has been appointed professor of electrical engineering in the new College of Engineering of Northwestern University at Evanston, Ill. Professor Bauer was born in Cincinnati in 1873 and was graduated from the University of Cincinnati in 1896. He specialized in physics, engineering and chemistry, and for a year was instructor in civil engineering in his Alma Mater after graduation. He was then employed by the Bullock Electric Manufacturing Company, and thereafter went to the Baker University at Baldwin, Kan., where from 1897 to 1908 he was professor of physics and chemistry. From 1899 to 1902 he was magnetic observer in charge of the Baldwin Magnetic Observatory of the United States Coast and Geodetic Survey. He installed the electric light plant for Baldwin University and also later the central steam-heating plant, as well as the municipal electric lighting plant for the city of Baldwin, of which he was superintendent for one year. In 1905 he was a post-graduate student in the University of Chicago, and since 1908 he has been professor of physics and electrical engineering in the University of Denver. He is a member of the American Chemical Society, the American Association for the Advancement of Science and the Kansas Academy of Science and has the honorary degree, awarded by Baker University, of Sc. D.

PROFESSOR L. A. HERDT, who for the past 10 years has been connected with the electrical department of McGill University, has been appointed head of this department in place of Dr. R. B. Owens, who has resigned. Professor Herdt pursued studies in mechanical and electrical engineering at McGill University, receiving the degree of Master of Engineering in 1894. He then studied at the Laboratoire Central d'Electricité, Paris, and at the Electrotechnical Institute, Montefiore, Belgium, receiving the degree of E. E. from the latter. After some years of practice in France and Canada Professor Herdt was appointed lecturer and afterward assistant professor of electrical engineering at McGill University. Since 1907 he has served as an associate professor of electrical engineering. Professor Herdt is a frequent contributor to the technical press on electrical subjects. He was a delegate from Canada to the meeting of the International Electrotechnical Commission at London in June, 1907. He has been active in the affairs of the Canadian Society of Civil Engineers, being a member of council and chairman of the electrical section. He is also a member of the American Institute of Electrical Engineers and an "Officier d'Academie" of France. Professor Herdt has carried on a great deal of research work, and his services as consulting engineer are much sought after. He is at present a member of the board of consulting engineers engaged on hydroelectric works for the city of Winnipeg, Man.

Trade Publications.

PRESSURE GAGES are outlined in a folder issued by the Industrial Instrument Company, Foxboro, Mass.

RAILWAY SIGNALS using the same means of indication by night as by day are described in a neat bulletin issued by the World Signal Company, Phillipsburg, Pa.

FANS.—The Pettingell-Andrews Company, Pearl Street and Atlantic Avenue, Boston, has issued a neat booklet in which are listed and described fans for desk, wall, ceiling, bracket and telephone-booth uses.

ICE-BREAKER.—The Harrison Safety Boiler Works have issued a pamphlet devoted to the Creasey ice-breaker, which is shown in a large number of illustrations, including one of an electrically driven combined breaker and ice-cream freezer. A section of the pamphlet with the title "Ice-Users' Handbook" contains information on freezing ice-cream, cold-storage temperature, specific heats, etc.

EXHAUST FANS driven by direct-current motors are described in bulletin No. 112 of the Crocker-Wheeler Company, Ampere, N. J. These fans are used for ventilating factories, offices, stores, schools, churches, hotels, restaurants and, in fact, wherever automatic ventilation is required. They are also used for drying lumber, hides, textiles and other materials requiring similar treatment.

DIRECTLY COUPLED DIRECT-CURRENT MOTORS are described in bulletin No. 113 of the Crocker-Wheeler Company, Ampere, N. J. These motors are used on lathes, hoists, bloom shears, big rolls and ammonia compressers. All important features of construction are clearly explained and are illustrated with photographs that give details of construction and others showing the motors installed for actual service.

SEARCH-LANTERNS.—The General Electric Company, Schenectady, N. Y., has issued bulletin No. 4657 devoted to the subject of search-lanterns for commercial use. This publication contains illustrations and descriptions of projectors of various types and sizes and goes more or less into detail. The use of projectors in connection with advertising purposes is constantly increasing and this bulletin will be found of special interest along this line.

ELECTRICITY IN BREWERY.—The advantages that can be obtained from the use of electric motors in breweries are well discussed in bulletin No. 111 of the Crocker-Wheeler Company, Ampere, N. J. This bulletin describes what is said to be the only brewery in the world in which all of the malt-handling machinery is electrically controlled from one place, namely, the plant of Peter Doelger, First Avenue and Fifty-fifth Street, New York.

TELEPHONE LINE INSULATING TRANSFORMER.—Booklet No. 3770 issued by the General Electric Company describes a piece of apparatus known as a telephone line insulating transformer designed to safeguard the users of telephones from the dangers of high voltage and to improve the telephone service by removing the ordinary small ground-gap carbon arrester from direct connection with the line. The booklet contains illustrations of the apparatus and its method of installation.

PORTABLE SERIES TRANSFORMERS.—In bulletin No. 4656 of the General Electric Company, Schenectady, N. Y., is described a series transformer for use in connection with the measurement of large values of current. These transformers are made in two forms—one contains both primary and secondary coils; the other contains only the secondary coil, the primary being composed of one or more turns of the cable carrying the current to be measured. They may be used on circuits the potential of which does not exceed 2500 volts. The transformers are portable and are provided with carrying handles.

Business Notes.

THE PARKER ELECTRIC COMPANY will, after May 1, have its offices in the Singer Building Tower, 149 Broadway, New York.

THE CLARK ELECTRIC & MANUFACTURING COMPANY will move its offices, May 1, to the Singer Building Tower, 149 Broadway, New York.

THE COLUMBIA METAL BOX COMPANY, 1941 Park Avenue, New York, has purchased the panel and switchboard department of the F. A. La Roche Company.

FRAZER & SALE, LTD., forwarding agents in the Oriental trade, have removed their offices from 63-65 Wall Street to the Hudson Terminal Building, 50 Church Street, New York.

MR. H. M. HIRSCHBERG, president of the Excello Arc Lamp Company, New York, sailed for Europe Saturday, April 24, on a short business trip to England and Germany, but will return in time to attend the electric light convention at Atlantic City on June 1.

THE DU BOIS IRON WORKS, Du Bois, Pa., has appointed Mr. James L. Kimball its New England representative, with offices at 53 State Street, Boston, Mass.; also the James F. Marshall Company, 608 Chestnut Street, Philadelphia, as general sales managers for Eastern Pennsylvania, Delaware and the southern half of New Jersey.

PELTON TURBINES FOR SCHAGHTICOKE GENERAL ELECTRIC PLANT.—The Pelton Water Wheel Company supplied the four

5000-hp Francis turbines used in the Schaghticoke hydro-electric station which generates electrical energy for the General Electric Schenectady works. The Pelton company also supplied the speed governors.

THE PLYMOUTH (MASS.) ELECTRIC LIGHT COMPANY'S power plant was damaged by fire on April 26, causing a loss of about $50,000. The generators and switchboard equipment sustained most of the loss, the injury to the building itself being comparatively slight. The company supplies Plymouth, Duxbury and Kingston with service and rushed emergency connections to get part of the system in operation on the evening of the fire.

THE INTERNATIONAL ELECTRIC METER COMPANY, of Chicago, has moved into new quarters at 110-112 North Sheldon Street. In its new factory the company has considerably more room than in the old location at 330 West Randolph Street, and it is now in position to take care of its increased business. The conditions for the manufacture of instruments in the new location are of the best, with ample provision for light and air, and the company announces that it is now better equipped than ever before to meet its customers' requirements.

PLANIGRAPH.—Messrs. Spon & Chamberlain, 123 Liberty Street, New York, are publishing the Herrick "planigraph," an instrument designed for quickly solving problems in copper conductors for electric circuits. It consists of a chart with four marginal shifting scales, one set for the calculation of branch circuits, one for mains and feeders, the third for railway circuits and the fourth for long-distance circuits. Any problems involving amount of energy, distance to be carried, volts, drop and size of wire required are readily solved.

THE CRESCENT COMPANY, 103 West Adams Street, Chicago, announces that it has taken the agency for the Dickinson Manufacturing Company, of Springfield, Mass., which makes a specialty of molded insulation, including composition and mica weatherproof sockets, socket bushings, composition socket rings, telephone receivers, receiver shells, mouthpieces, switch handles and socket keys. Recently it has developed an entirely new composition, known as "Gummon," which has a very high insulation resistance, and in addition is heatproof, oilproof, acid-proof and waterproof. This material is especially adapted for high-tension work, strain insulators and small parts where it is necessary to mold metallic pieces into the insulation

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 20, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

918,493. MULTIPLE SWITCH STARTER; T. E. Barnum, Milwaukee, Wis. App. filed May 20, 1907. A plurality of hand operating switches to control the motor resistance; the retaining magnet for holding the switch closed is controlled by a heat operated device when the resistance is left in circuit for longer than a predetermined period.

918,498. REVOLVING FIELD MAGNET STRUCTURE; B. A. Behrend, Norwood, Ohio. App. filed June 8, 1907. For field magnets driven at high speeds by turbine generators in which a polygonal core is used of high magnetic permeability having extensions for supporting it, all of one solid integral mass and field poles secured thereto.

918,499. FIELD MAGNET; B. A. Behrend, Norwood, Ohio. App. filed May 14, 1907. Revolving field magnets for dynamos used when driven by high speed turbines. Provides side supports for the windings and means passing into the pole pieces and between the windings for retaining the supports in position.

918,500. SEAL FOR ARC-LIGHT ELECTRODES; Edward R. Berry, Lynn, Mass. App. filed Sept. 28, 1908. The seal consists of a mass of electrode material and adhesive substance.

918,501. CONDUCTOR; G. W. Bolton, Jr., Detroit, Mich. App. filed Oct. 15, 1907. The conductor tip or clip is an open loop having contacting portions in a plane and another portion in a different plane.

918,513. PANEL CONSTRUCTION FOR SWITCHBOARDS; A. F. Dixon, New York, N. Y. App. filed April 25, 1908. For automatic telephone exchanges; having shallow grooves in its face with narrow strips of metal edgewise in the grooves having ears at intervals adapted to be engaged by contact brushes. Insulating material is flowed over the board into the grooves and hardened.

918,533. SPROCKET SUPPORT FOR ELECTRIC SAD IRONS; M. Griswold, Jr., Erie, Pa. App. filed May 6, 1908. The handle has at one end a hook and the iron has a plug on which the socket is detachably mounted.

918,535. ELECTRIC RESISTANCE UNIT OR ELEMENT; W. S. Hadaway, Jr., East Orange, N. J. App. filed June 15, 1908. A conducting ribbon with a plurality of slots on opposite edges, unequally spaced to locally increase the resistance.

918,537. TRAIN POSITION INDICATOR; O. Halvorsen, Schenectady, N. Y. App. filed March 23, 1908. For giving the position and rate of speed of trains. A series of electrical impulses are produced on the car which are received selectively so that they may be received on another car or at a station.

918,539. AUTOMATIC BLOCK SIGNAL SYSTEM; S. H. Harrington, New York, N. Y. App. filed Dec. 6, 1902. A signal with hydraulic means to operate it, the latter being controlled by a train.

918,540. RAILWAY SIGNALING DEVICE; S. H. Harrington, New York, N. Y. App. filed March 7, 1905. A block signal in which the circuits are independent of the rails and are carried by guy wires from suitable posts.

918,547. RESISTANCE UNIT; H. E. Heath, Lynn, Mass. App. filed Mar. 7, 1907. A resistance tube comprising similarly shaped strips of asbestos and conducting material spirally wound so as to overlap.

918,561. ALTERNATING-CURRENT SHUNT MOTOR; M. C. A. Latour, New York, N. Y. App. filed Aug. 17, 1907. An alternating-current motor of the commutating type, having means for supplying to the exciting winding of the motor shunt and series excitations, both dephased from the armature current of the motor.

918,566. TELEPHONE SYSTEM; R. H. Manson, Elyria, Ohio. App. filed April 18, 1905. Means for preventing a subscriber from ringing through the cord circuit at the exchange and operating the bell on the connected line circuit.

918,578. ELECTRIC REGULATOR; M. Moskowitz, New York, N. Y. App. filed March 1, 1905. Comprises a steadily burning lamp, magnets for actuating them, a dash pot and plunger, a cross arm connecting the links, the cross arm being connected to the dash pot.

918,594. DYNAMO ELECTRIC MACHINE; F. D. Priest, Schenectady, N. Y. App. filed Feb. 14, 1907. The armature, made up of laminæ carried directly on the shaft of the armature without the intervention of a sleeve.

918,596. MEANS FOR PROTECTING SUBMERGED MOTORS; H. G. Reist, Schenectady, N. Y. App. filed Feb. 4, 1907. The motor is arranged in an air-tight casing which forms a diving bell for the motor. Compressed air may be forced into the casing so as to expel the water when the motor is operated.

918,608. MULTIPLE SWITCH STARTER; L. L. Tatum, Norwood, Ohio. App. filed May 20, 1907. A plurality of hand operative switches control a resistance and an arrangement is provided whereby the operator must close each switch in a predetermined time after the preceding switch is closed or all the switches will open.

918,609. MULTIPLE SWITCH STARTER; L. L. Tatum, Norwood, Ohio. App. filed Jan. 11, 1909. A plurality of hand operated switches control the resistance, and a retaining device holds them closed. A plurality of devices, one operated by each switch, control the retaining device to open the switches unless each switch is closed within a predetermined time after the preceding one.

918,617. ELECTRIC CONNECTOR; J. J. Walsh, Yonkers, N. Y. App. filed May 1, 1907. For connecting mains with branch lines, by means of clamps which clamp around the wire and the branch line. Details.

918,618. WIRELESS TELEGRAPH RECEIVER; W. M. Way, Austin, Tex. App. filed March 7, 1908. A cup or holder carries a crystalline detector. The cup is rotatable on a vertical axis and an adjustable screw contacts with the crystal.

918,623. ELECTROLYTE FOR PRIMARY BATTERIES; J. W. Whitcomb, Corunna, Mich. App. filed Nov. 27, 1907. May be used with dry or wet batteries and consists of potassium bichromate with other ingredients.

918,627. BURGLAR ALARM AND SIGNAL SYSTEM; G. M. Willis, Chicago, Ill. App. filed Dec. 11, 1906. Details in the construction of a burglar alarm system using alternating current and alternating-current devices actuated thereby.

918,638. CONTROLLER; T. Von Zweigbergk, Preston, England. App. filed Sept. 14, 1907. For railway service, comprising a reversing barrel and contact fingers with mechanism arranged to hold the barrel in various longitudinal positions with reference to the fingers whereby different motors may be cut out.

918,649. ACID-PROOF TANK FOR THE ELECTROLYTIC REFINING OF METALS; A. G. Betts, Troy, N. Y. App. filed Dec. 6, 1906. A tank in which the walls consist of cement with solidified sulphur in the pores.

918,650. ELECTROLYTIC PROCESS; A. G. Betts, Troy, N. Y. App. filed Dec. 23, 1908. The process of producing oxidizing compounds which consists in electrolyzing a solution of a halogen compound with a suitable anode and a cathode of magnesium.

918,654. LAMP SOCKET; J. R. Byrne, Schenectady, N. Y. App. filed July 5, 1907. Key sockets in which a yoke is insulated from the lamp contact, having a bent end in which a bearing aperture is formed, a spring-pressed plunger therein and a key for actuating the plunger.

918,660. INTERCOMMUNICATING TRUNKING SYSTEM; E. R. Corwin, Chicago, Ill. App. filed May 9, 1908. An intercommunicating system for trunking between magneto exchanges and intercommunicating telephone systems. Makes use of a repeating coil inductively connecting one of the local lines with the trunk lines.

918,681. CIRCUIT-BREAKER; K. Kuhlmann, Berlin-Pankow, Germany. App. filed Aug. 16, 1907. Operates after a predetermined time. A controlling member for the circuit responds with a predetermined time lag to variations of current and is locked by a re-

918,682. SWITCHBOARD SIGNAL; O. M. Leich, Rochester, N. Y. App. filed July 29, 1907. A combined operator's and signaling key, so arranged that after the signal has been actuated it is restored to its concealed position by a movement of the key.

CONTROL OF ALTERNATING-CURRENT MOTORS. H. Maxwell, Schenectady, N. Y. App. filed Feb. 14, 1906. In combi-

by step.

918,690. ALTERNATING-CURRENT MOTOR; M. Milch, Schenectady, N. Y. App. filed Dec. 2, 1907. [illegible] verse rotation respectively with means for disconnecting one set [illegible] circuit to provide a

918,699. KNIFE SWITCH HANDLE; C. D. Pratt, Brooklyn, assignor to [illegible] App. filed Dec. 21, 1908. A knife switch handle comprising a stop and a screw therefor.

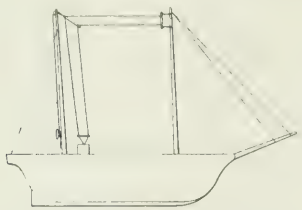
918,[illegible]. ELECTRIC HEATING DEVICE; P. C. Chase, Upland, Cal. App. filed July 3, 1905. A portable electric water heater which

may be immersed in a vessel containing water consisting of a plurality of coil-carrying plates. Details.

918,747. ELECTRICALLY OPERATED STOVE; H. Heitzberg and M. J. Wohl, New York, N. Y. App. filed Aug. 1, 1907. An electrically operated stove having a plurality of heating coils with different electrical resistances confined between flat heat-absorbing members.

918,748. ELECTRICALLY HEATED TOOL; H. Heitzberg and M. J. Wohl, New York, N. Y. App. filed Nov. 14, 1907. An electrical resistance, a clamping member provided with a projection and a wedge co-operating with the clamping member, and arranged in the heating chamber so as to produce ventilating spaces.

918,761. TROLLEY WIRE SUSPENDER; J. Mayer, Rutherford, N. J. App. filed Dec. 21, 1907. A hanger comprising a flexible resilient bar, clips connecting the wire in the bar along its length, the cross section of the bar decreasing from the center toward each end.



919,115—Antenna for Wireless Telegraph Systems.

918,810. SPRING AND EQUALIZER SYSTEM FOR ELECTRIC LOCOMOTIVES; W. E. Woodard, Schenectady, N. Y. App. filed Sept. 19, 1908. A spring equalizer system for electric locomotives acting both in a horizontal and a vertical plane in which the side pressure is transmitted to the track through two or more wheels.

918,828. SPRING AND EQUALIZER SYSTEM FOR ELECTRIC LOCOMOTIVES; W. Dalton and W. F. Woodard, Schenectady, N. Y. App. filed Sept. 19, 1909. See 918,910.

918,831. SECONDARY BATTERY; E. C. Ekstromer and M. Ekstromer, Boston, Mass. App. filed May 13, 1907. The active element is of high dialytic power, being an albuminoid from which a portion of the nitrogen and hydrogen has been removed.

918,832. STORAGE BATTERY; E. C. and M. Ekstromer, Boston and Quincy, Mass. App. filed Aug. 1, 1907. The base is provided with ribs forming two series of pockets which receive active material from the plates, so as to avoid danger of short circuiting.

918,844. MEANS FOR CONNECTING CIRCUIT WIRES TO ELECTRIC MOTORS; A. L. Goldschmidt, New York, N. Y. App. filed Aug. 30, 1906. Provides a conduit like a gas pipe in which the wires are carried.

918,845. SWITCHBOARD; A. L. Goldschmidt, New York, N. Y. App. filed July 3, 1908. A plurality of tiers of busbars, each tier terminating short of the set beneath, a base with holes opposite the ends of the tiers, fuses in the holes to connect the busbars with the tiers, and conductors connected to the fuses.

918,852. TELEPHONY; R. C. M. Hastings and T. Matheny, Athens, Ohio. App. filed June 15, 1907. A lockout and selective system for party lines in which the selective means are arranged in series on an all-metal circuit, the latter being grounded at central and at the opposite end of the line during the selective operating and unlocking of the receiver hook.

918,854. LEVER-CONTROLLED SWITCH; M. Hoffman, Berlin, Germany. App. filed Feb. 2, 1907. A lever-controlled switch in which the speed of the brush may be regulated and in which a flexible brush is pivotally connected to the lever and its operation controlled by a cam which reduces the speed of the brush when the maximum pressure is produced.

918,861. ELECTRIC MOTOR; L. F. Johnson, Chicago, Ill. App. filed Sept. 22, 1904. The motor has field cores and an armature core in electrical connection with each other. The field winding is grounded on the field magnet and the armature magnet grounded on the armature core.

918,866. ELECTRIC TRANSMISSION OF INTELLIGENCE; I. Kitsee, Philadelphia, Pa. App. filed June 10, 1908. For transmission of alternating or varying currents by means of a line comprising conductively independent conductors arranged in inductive relation, and associated conductor in an inductive relation with the said conductors and an earth connection for the associated conductors.

918,891. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed Nov. 30, 1908. The block of insulating material has a transverse opening for the receipt of a fuse case with flanges on two opposite sides and a vertical web, extending across and below the bottom thereof.

918,905. INSULATOR; B. A. Pond, Boston, Mass. App. filed Sept. 5, 1908. An insulator having in combination a holder, a bushing formed of insulating material in two parts held by the holder, and an element between the abutting surfaces of the parts.

918,921. WELDING APPARATUS; W. Siebenmorgen, Westfield, N. J. App. filed Feb. 23, 1907. An electric welding apparatus having two relatively movable terminals for drawing an arc, a resistance in the circuit, a shunt around the arc, and automatic means for decreasing the resistance as the current in the shunt rises.

918,950. PROCESS OF REDUCING METAL; H. S. Blackmore, Mount Vernon, N. Y. App. filed March 5, 1909. The process of reducing metal which consists in electrolyzing a substance containing metal, oxygen and fluorine, with an anode containing calcium acetylid.

918,955. TELEPHONE SYSTEM; C. F. Bradburn, Ontario, Canada. App. filed Jan. 20, 1908. A bi-circuit system in which communication is established by a selecting apparatus having a primary and secondary mechanism, the selecting circuit normally without current and actuated by current brought into circuit by the movement of the primary mechanism. The latter consists of a dial and pointer with contact studs.

918,969. INSULATING-BUSHING FOR ELECTRICAL SERVICE-BOXES; R. C. Cole, West Hartford, Conn. App. filed Dec. 11, 1908. Fuse boxes in which the insulating bushings are fastened within the apertures in the walls of the boxes.

919,009. ATTACHMENT FOR CURRENT COLLECTOR WHEELS; L. R. Hecker, Philadelphia, Pa. App. filed July 13, 1907. A plug of insulating material provides means for mounting a brush in contact with the trolley wheel from which a wire leads to a third rail.

919,010. GALVANIC CELL; W. L. Heim, Kane, Pa. App. filed Feb. 28, 1908. A dry galvanic cell having one of its electrodes insulated to prevent deterioration by action of the electrolyte, the insulation being removable by an application of heat.

919,022. CARBON CONSUMING GALVANIC CELL; E. W. Jungner, Kneippbaden, Germany. App. filed June 27, 1906. An anode of amorphous carbon, a cathode insoluble in the electrolyte and a depolariser of atmospheric air.

919,069. LIGHTNING ARRESTER OR LINE DISCONNECTOR; J. W. Pedigo, Chariton, Iowa. App. filed June 23, 1908. For telephones in which a pair of suitably shaped contact members connect the wires with a lightning arrester. Details.

919,078. MANUFACTURE OF SENSITIVE CELLS; P. Ribbe, Halensee, Near Berlin, Germany. App. filed Jan. 28, 1909. Selenium cells having parallel conductors covered with selenium in the shape of hairlines, by providing a plate of insulating material with parallel hair-like grooves rubbing on graphite powder, depositing electric conductors in the grooves, then covering the face of the plate with a thin layer of selenium.

919,081. AUTOMATIC MAIL SLOT ALARM; L. M. Robinson, Matteawan, N. Y. App. filed Dec. 11, 1909. For mail boxes, to give an alarm when the mail matter is put through the slot by the postman.

919,089. LEVER CHECK FOR ELECTRIC CONTROLLERS; J. Thomas, New York, N. Y. App. filed Jan. 27, 1909. Means for checking the controller lever so as to prevent sudden rotation by means of an arm and pawl, with a slot receiving the pawl on a reverse movement of the spindle.

919,113. TELEPHONE APPARATUS; C. Adams-Randall, New York, N. Y. App. filed July 28, 1906. A telephone transmitter useful for short and long distance work by controlling the current energy at the transmitter and regulating the amount of current carried thereby.

919,115. ANTENNA FOR WIRELESS TELEGRAPH SYSTEMS; C. D. Babcock, New York, N. Y. App. filed Jan. 24, 1906. For use on shipboard. By locating the horizontal portion in a vertical plane there is less swinging than if the spreaders *D* and *H* were horizontal.

919,137. OSCILLOGRAPH; J. T. Dempster, Schenectady, N. Y. App. filed Feb. 14, 1908. For projecting on a screen the curve of the current or voltage. A magnet produces the primary field and the secondary vibratory member produces the secondary field and vibrates about two axes perpendicular to each other.

919,165. ELECTRIC SMELTING FURNACE; H. C. Harrison, Easton, Pa. App. filed May 4, 1908. A furnace of the arc type employing polyphase currents for smelting, with a plurality of arc electrodes in a row.

919,171. DEVICE FOR PROTECTING END BEARINGS; W. B. Hodge, Glenside, Pa. App. filed April 8, 1907. For protecting end bearings in measuring instruments of the permanent magnet type. Removes the pivots from engagement with the bearing in shipping by a lever and trigger mechanism.

919,179. ALARM; J. S. Jones, Spokane, Wash. App. filed Oct. 16, 1907. A spring-pressed plug tends to close the circuit and is restrained by a cord which, when it burns, allows the plug to close the circuit and ring a bell.

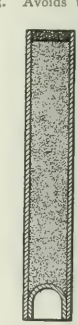
919,203. DYNAMO VENTILATOR; D. R. McCullough, Pocatello, Idaho. App. filed April 16, 1908. A casing surrounds the dynamo and an exhaust fan driven by the dynamo shaft provides the ventilation.

919,263. TROLLEY HARP; L. J. Tetlow, Holyoke, Mass. App. filed Nov. 14, 1908. A trolley harp in which the contact springs carrying the current are easily removable and replaceable.

919,264. GAS OR VAPOR CIRCUIT BREAKER; P. H. Thomas, Montclair, N. J. App. filed April 25, 1905. Avoids the formation



918,547—Resistance Unit.



918,500—Seal for Arc Light Electrodes.

of an arc by breaking the circuit between surfaces in an exhausted chamber. The circuit closer is mercury and the circuit is broken by breaking the mercury into two parts.

919,267. SYSTEM OF ELECTRICAL DISTRIBUTION; W. A. Turbayne, Lancaster, N. Y. App. filed Oct. 30, 1903. For a system in which the supply voltage varies, particularly in incandescent lighting systems using storage batteries. Switches in a series of end cells.

919,279. AIR DEFLECTOR FOR DYNAMO ELECTRIC MACHINES; F. W. Young, East Orange, N. J. App. filed Dec. 6, 1907. Combination with the motor having radial poles and windings of deflectors near one end of each of the passages between the motor windings which block the passages.

12,943. (REISSUE.) TELEPHONE EXCHANGE SYSTEM; E. Land, Chicago, Ill. App. filed Aug. 9, 1906. Semi-automatic telephone system, using a central operator. Uses no flexible cords, but a trunk selecting switch at the central office.

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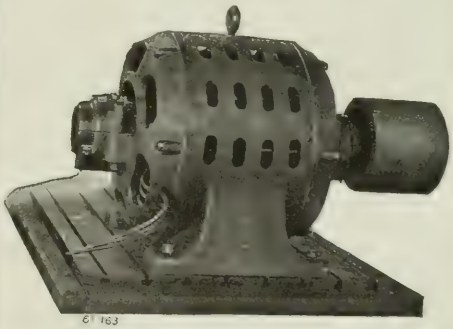
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Electric Automobiles.

A census is being taken of the central stations of the country by *Electrical World* as to the extent of their development of, or interest in, electric automobiles as a field of current consumption and as a branch of electrical industry that self-interest should prompt central-station managers to encourage. The blank forms to be filled up with data have only been out a few days, but we are surprised and pleased to be able to state that we have already received a little over 1000 returns. A much larger percentage has gone into the matter than is generally supposed. When more returns are in, we shall digest and publish the information; and, meantime, we would earnestly request our central-station friends to fill up the schedules promptly or express their views on the subject and forward immediately to this office in the return-stamped envelope provided.

The Boston Lighting Situation.

As our readers are already aware, Boston has been the scene during the past few months of interesting and somewhat sensational experiments on the improvement of street lighting, experiments carried on both by the Edison Electric Illuminating Company, which was getting ready to renew its lighting contract with the city, and by the Consolidated Gas Company in an endeavor to make a last stand against the invasion of improved illuminants. As a general rule, local controversies between gas and electric-lighting companies over the street lighting contract involve no broad issues, but in this instance the struggle which has just been closed by the awarding of the lighting contract to the Edison Company has been somewhat unusual, and involves technical matters of so general an interest as to make the situation of far more than local importance.

Up to the present time Boston has been lighted under contract between the city and the Edison Electric Illuminating Company by direct-current series enclosed arcs of the type devised by the late Mr. Gilbert, of the Boston Electric Light Company, the arcs taking about 500 watts at 6.7 amp. These lamps are equipped with clear outer and clear inner globes, and have been decidedly the most powerful enclosed arcs used for street service in this country, being customarily worked at a consumption of energy larger than that applied to similar lamps elsewhere. For the last year or two, as we have frequently pointed out, the tendency abroad has been strong toward the use of flaming or luminous arcs for street lighting, with a consequent great increase of the available light on the street; and it has been clearly evident that the enclosed arcs in common use in this country would sooner or later have to be displaced by the more efficient type. Understanding this fully, the Boston Edison Company prepared to take the initiative and to introduce high-efficiency arcs on a large scale at the time of the renewal of its contract with the city. It therefore caused to be made a very exhaustive investigation of street lighting abroad, obtained a large number of samples of foreign and American

lamps, and instituted a careful investigation of their suitability for street lighting.

Meanwhile, the gas company taking alarm at the inroads of tungsten street lamps upon its Welsbach service, determined to carry the war into Africa, and sent representatives abroad who imported a number of double inverted mantle Graetzin street lamps, working at the ordinary gas pressure, and also a large and flamboyant example of "press" gas lamp. It obtained permission to put out the former on an experimental section of street, and hoisted the latter in front of its own office. Meanwhile the Electric Company swung out a circuit of 6.6-amp magnetite arcs equipped with the latest type of luminous electrodes, and in addition, illuminated Copley Square and one or two other important locations with huge flaming arcs of unprecedented power, the results naturally being extremely striking. Up to this point the competition had been along dignified lines, but when it became evident that the exhibit of street gas lamps was a failure, and that the contract would inevitably go to the Electric Company, the controversy entered in an acute stage. The Boston papers for the last two weeks have been full of promiscuous abuse, first of the proposed installation of street lighting, and second, of the Mayor and other city officials. The row culminated when the contract was awarded to the Electric Company on the basis of the magnetite and flame arcs. The magnetite arcs in question were accepted by the city at the price of $103.54 per year each, which for a lamp having more than double the illuminating power of any street lamp ever regularly used before for public lighting in this country, is a remarkably low figure. For the few Gilbert arcs which are to remain for the present, the price was brought down to $92.31 per year, while for the few flaming arcs installed in large public places, the price figured was $156.27. Each of these lamps replaces three ordinary arcs. The contract was for five years, and the attacks made on it have seemed to be based, not upon any doubt as to the quality of the service nor seriously upon any question of price, which latter for the illuminants furnished will be recognized as low by anyone competent to judge.

The extraordinary feature of the situation and the one which most calls for comment is that, at the present time, in face of the technical facts which ought to be well known, any portion of the public should be found willing to advocate the reversion to gas for street lighting in place of luminous arcs and tungsten series lamps as now used. In point of fact, while the Graetzin street lamps on which the Gas Company intended to rest its case were rated by the makers at 250 cp and were loudly advertised as of that capacity, they were actually found to give on the street barely over 100 cp at an angle of, say, 25 deg. below the horizontal. They were repeatedly tested by Professor Puffer, the expert called in by the city for guidance in making its new contract, by the Electrical Testing Laboratories, and by various private observers, and always with the concurrent result that the candle-power they gave was less than half that which they were alleged to give. In a precisely similar manner the huge "press" gas lamp, which flared in front of the Gas Company's office and which was heralded as of 4500 cp, was tested by various independent authorities and uniformly found between 2000 cp and 2400 cp. The disclosure of this grossly incorrect rating naturally discouraged the city from wasting any further time in experimenting with gas, and doubtless contributed to the prompt settling of the controversy. Under the new contract Boston will be equipped with by far the most powerful lights ever used in America for public lighting; and inasmuch as the old spacing of the arcs is to be retained and the new lamps are to be placed for the most part 25 ft. above the pavement instead of 19 at present, the result will necessarily be a brilliancy of illumination which is for once something like that which a first-class city owes to its citizens. We hope it will be the opening of similar changes for the better all over ernment of Boston is to be congratulated on being first in line the country. The time is ripe for the change and the city govdespite the efforts of a misguided element to block progress and to revert to methods nowhere strikingly successful and generally discredited.

An Unfavorable Experience with Metallic-Filament Lamps.

The description in an article printed elsewhere by Mr. Warren H. Miller of his persistent struggles to use high-efficiency lamps in a big oil plant is a highly interesting, if somewhat discouraging, tale of woe. In brief, Mr. Miller's experience shows wholesale destruction of both tantalum and tungsten lamps when exposed to rough handling and vibration. His plant was operating at 25 cycles, and one might therefore confidently have predicted any amount of trouble in trying to use tantalum lamps which fault and get brittle after a very short time under such conditions. They will often run to a long life even on alternating current, if not subject to rough usage, but are in a condition that ensures breaking at some one of the scores or hundred of faults under any kind of shock. One may therefore dismiss the tantalum matter merely as an experiment which perhaps was worth trying, although presumably foredoomed to failure. The experience with tungsten lamps, however, was altogether more important, and one cannot help feeling that here Mr. Miller really played in rather hard luck, and as he went into it rather early, may have suffered from some bad batches of lamps, not yet fully eliminated from manufacture.

To sum up the economic results, of 1726 tungsten lamps placed in service between Oct. 2 and Jan. 26 last, only 389 were burning on April 2. Of this group it is worth noting that the 60-watt size seems to have shown the best results, although the dates and nature of the situations may have had some influence here. Of 550 60-watt lamps, 215 survived, while of 540 25-watt lamps only 30 pulled through. The 100-watt and 40-watt lamps did only fairly well, while of four 250-watt lamps purchased at $4.87 each, two were broken when received and one departed this life the first night of service, and the survivor was stolen in a few days. This $19.48 worth of experience seems to have sufficed Mr. Miller on this particular size. Now, if Mr. Miller's luck were unique, one would have little to suggest save more care, but others who have used tungsten lamps in rough industrial works have had similar troubles, though usually in less degree. The great efficiency of tungsten lamps, with their consequent large saving of current, is a temptation to their use even under difficult conditions, and many have taken the chance, so that it is little wonder that results have now and then been bad. It is undeniable that the tungsten filament as now made for ordinary voltage is brittle and liable to fracture on very small provocation. On the whole, however, it is getting better as time goes on, and, if rumor is correct, new processes are becoming available which may result soon in the production of a tungsten filament of great tenacity. It is to be hoped that this goods news is true, and that the makers of tungsten lamps will

be unable to hold back the process successfully, a step which commercial interests might urge.

In any event, it is pertinent to inquire whether anything can really be done with high-efficiency lamps under such circumstances as Mr. Miller describes. Of course, he found the graphitized-filament lamps all right as to life, but these cannot be taken seriously as of high efficiency in the sense of tantalum and tungsten lamps. It should in the first place be possible with the present resources in the way of reflectors to locate most of the lamps where they will not be actually hit by careless workmen. That precaution would remove one prolific source of damage. Next, the cleaning of the lamps when necessary should be in charge of some definite person, and the lamps should be lighted when cleaned. Finally, there should be systematic efforts at cushioned supports for the lamps. We believe that it is perfectly possible to develop a socket so supported as to cushion the lamps from shocks in a very complete manner. With lamps placed mostly out of reach on soft supports, shocks from vibration need not much be feared, and this gets rid of a constant source of mischief. In spite of the fragility of the ordinary tungsten filament, we believe that it is practicable to reduce very much the danger of breakage, so that industrial plants can get the benefit of the resulting economy. Then as a last resort, one can come down to the use of 50-volt to 60-volt tungsten lamps with special transformers. It seems to be thoroughly demonstrated that these low-voltage lamps are much stronger and of far longer average life than those for standard voltages, and their use involves little extra trouble, especially in installations already wired for carbon lamps. In spite of Mr. Miller's rather discouraging results, we do not believe the industrial plant is cut off from the benefits of tungsten lamps by the fragility of the filaments. One must treat a lamp according to its characteristics, and if it be intrinsically fragile one must take advantage of every device that will help in safe installation. Even the tantalum lamp, tender as it is under alternating current, could be cushioned so as to increase its life, and the tungsten lamp, particularly at low voltage, can certainly be made thoroughly available.

The Testing of Live Cables.

A paper has recently been read before the Dublin section of the British Institution of Electrical Engineers by Mr. R. G. Allen on "Testing the Insulation Resistance of Live Cables on Direct-Current Systems." The paper describes methods suitable for measuring the insulation resistance of mains, submains or house-wiring systems, when the lamps or motors are cut off, but when the full working pressure of, say, 440 volts is applied. The advantage of such testing methods is that they are conducted under service conditions and without the necessity either of cutting the tested mains off the system or of carrying about a testing battery. In low-tension, direct-current distributing systems the insulation of the various conductors is of importance when the neutral is ungrounded. At any moment a ground coming on one side of the system may change the pressures on the insulation of the system. If, for example, the system is running with a balance of distributed leakage, the neutral conductor will be at zero, or ground potential, the positive conductor will be at, say, 120 volts positive, and the negative conductor will be similarly at 120 volts negative potential. Should now a heavy ground come on the negative side of the system, the potential of that side will suddenly be brought to zero, the potential of the neutral to 120 volts positive and the potential of the positive to 240 volts positive. In this manner a sudden change of grounding from one side of the system to the other will throw the pressure from one set of conductors to another in a manner that is likely to give rise to sudden faults and leakages in house wiring, at times, perhaps, when no person may be at hand to notice and protect them.

In low-tension, direct-current systems operated with grounded neutral, the pressure on the neutral conductor throughout the system is always zero, that on the positive will always be 120 volts plus, and that on the negative 120 volts minus. If a ground breaks out on either outside system, it will immediately determine a rush of current through the same. Inside a building, the ground will produce a current rush to cut out the faulty wire through the melting of a fuse. In a street main the ground will probably produce a current rush sufficiently violent to burn off the ground. The insulation resistance of house wiring in such a system will be worth measuring from year to year as a matter of inspection, and the insulation of positive or of negative mains, at regular intervals, will be worth recording as a matter of inspection routine; but the importance of frequent insulation tests is usually very small. In high-tension, alternating-current cable systems the case is different. Except in the unusual case of sudden mechanical injury, these cables ordinarily break down electrically after undergoing a fairly steady depreciation. The fall is generally preceded by a steady decline. It becomes important, therefore, to keep constant watch for such decline, in order to remove the faulty cable from service before breakdown occurs. When breakdown takes place, it may entail surges of potential in the system sufficient to create new defects in cables that might otherwise have carried their pressure indefinitely. Leakage indicators are, therefore, frequently installed on high-tension feeder cables at their switchboard terminals. These indicators are frequently electrostatic devices arranged to point to safety if the potentials of the conductors in the cable are equally remote from ground, but to point to danger if the potentials become unbalanced and dissymmetrical. Such insulation tests are, therefore, continuously maintained on the live conductors, without entailing any considerable expense, and without involving any loss of power in the process.

The Efficiency of Light Production.

A recent paper before the London Physical Society by Dr. Drysdale takes up the possibilities of efficient production of light by true black-body radiation, the result being based on Wren's law in connection with the experimental results of Kurlbaum and others. The essential point of the investigation is the limited possibility of high efficiency from illuminants of pure incandescence. This has, of course, often been recognized as a matter of practice. By utilizing Féry's results, Dr. Drysdale finds 0.075 watt per candle-power as the theoretical so-called "mechanical equivalent of light" on the incandescent basis. This is fairly in accord with similar estimates and as a practical matter is not particularly encouraging, since the temperature indicated for maximum luminous efficiency runs to about 6500 deg C.—i. e., somewhere in the vicinity of solar temperature. Since no known substance is available for incandescence at anything remotely resembling this figure, the chance of improvement in any great degree would seem to be somewhat remote so long as incandescence of black bodies is concerned. In passing beyond 2000 deg. C., however, the efficiency rises very rapidly, as witness experiments with tungsten lamps at very abnormal voltage. Results with the electric arc are, of

course, rather inconclusive, the light production being much interfered with by the usual construction of the apparatus and only a part of the energy being available for incandescence even at the maximum crater temperature. The color values of the best incandescent lamps show how far their efficiency falls below that of the luminous crater, and the intrinsic brilliancy tells the same story. In the arc itself the difference between the phenomena at the two electrodes is a clear indication of the limitations of present apparatus. Even the most powerful carbon arc of the intensive type falls very far short of giving light at anything like theoretical efficiency.

It seems quite clear then that the greatest chance for improvement lies in such selective radiation as is given by incandescent gases and vapors, in, for instance, the luminous arcs. As a matter of experiment, the most efficient of the flame arcs can be driven to an efficiency within easy hailing distance of the black-body maximum, though at the cost of ill-balanced color. The great problem for such illuminants is to balance the color as well as may be without too great loss of efficiency. To be sure, in many cases—street lighting, for example—color within limits is a matter of minor importance, but, broadly, it cannot be neglected. Another line is indicated, even if only roughly, by Dr. Hyde's recent work on the variations of some incandescent metallic filaments from the "black-body" law. These variations are somewhat uncertain owing to the doubt about the real temperatures of the filaments, but they are nevertheless suggestive. On general theoretical principles it seems unlikely that any very great variations of such kind will be found save in connection with a condition of physical or chemical instability, so that the limitations of efficiency are rather likely to be found embarrassing. Selective radiation and selective absorption go hand in hand, and the latter rather implies destructive energy in one sense or another save perhaps in the case of fluorescent bodies, which seem to be quite outside the range of other properties required. As to incandescent gases by themselves, the outlook for efficiency is not very striking since the energy distribution of their spectra is not generally very favorable, as, for instance, in the case of helium. Beyond these one meets the vague range of possibilities furnished by the firefly, luminous bacteria and the like. This field is as yet practically unexplored, since almost nothing has been done in the direction of finding out the actual character of the radiation concerned. Until this is done one is quite in the dark as to the possible limitations of efficiency. The work of Langley is about the only basis even for a guess, and, to tell the truth, one cannot read his work on firefly light without a certain vague, although perhaps unjustified, feeling that it ought to be very carefully repeated. The spectrum he records bears too close a resemblance to an ordinary continuous spectrum of extremely low intensity for the similarity to pass unnoticed. Altogether, the outlook for anything very sensational in the way of chemical light can hardly be considered brilliant at the present moment. The best road to high efficiency seems to be via the flaming arc. Much can be done along this line, and a complete search among the metals and their refractory compounds should be made. In fact, it is being made in various places with some results that look fairly promising. In small light units one must for the present look to the improvement of the tungsten filament in the direction of a nearer approach to a stable wire, an improvement perhaps much nearer than is generally suspected.

The City Electrical.

When one reckons up all that has been done in the applications of electricity to human affairs and realizes the short span of years in which all the wonders have been accomplished, his bosom swells with pardonable pride if he does not think about the matter too long. Further contemplation is not altogether good for the soul, for soon there rise before the eyes very unwelcome visions of things that ought not to be—locomotives belching smoke and cinders along the byways of the city; hundreds of factory chimneys reeking with the fumes that only man of all creatures has really learned to tolerate; thousands of lesser filthy chimneys adding their mites to the noisome whole; sundry flickering gas lights in most of the dwelling places, and like as not, evil savored coal oil lamps and guttering candles. All these offend the sight and smell and bring a most unpleasant realization of the manifold things that electricity has not done to ameliorate human life. In spite of all the activity with which central-station work has been exploited it still is very far from filling its sphere. True enough, it has pretty nearly driven horse cars from the streets and it has replaced gas to a considerable extent among the larger consumers; it has replaced, too, some gas and steam engines in the smaller factories and has robbed the denatured alcohol industry of a few chafing dishes and curling tongs—but the bigger things that make for cleaner homes and streets and skies it has as yet been unable to touch in any effective way.

Why should not it enter this wider sphere and directly or indirectly get at the vital problems it contains? To begin with, why should not practically all the steam engines in urban territory be superseded by electric motors? Of the thousands of engines operated in any large city, nearly all would be economically replaceable by electric motors at quite possible prices for current. Is it not feasible to get them replaced by a sufficiently thorough campaign? More than this, if the usual urban regulations against smoke were really enforced, would not most of the steam engines have to go anyway? At present the central stations for the most part cannot reach far down enough in price to get all this business, yet with the opportunity to get it all, the matter of price would settle itself. Of course if the central station rates are regulated to petty things by ignorant supervisors not much can be done. Is not a problem of this sort, however, within the scope of civic leagues and other organizations that undertake municipal reforms? Should not their influence be thrown toward the abolition of the smoke nuisance by giving the central stations a helping hand in their campaign for better things? And why should not the same influences work for the prohibition of the steam locomotive in every large city as it has been prohibited in the New York terminals? Granted all this, there would still remain the huge heating problems. At present prices for electricity, electric heating on everything but a small scale is handicapped. If, however, vastly greater output were possible a price might be made that would very much widen the field.

When it comes to heating indeed, one may perhaps look for bigger usefulness than has ever yet been realized. Could one turn over to electricity all the lighting and the bulk of all the motive power, it should be possible to put out for the remaining work a fuel gas at a price that would make its use practicable on a very large scale indeed. Perhaps such may

be the future of the great gas industry—to work hand in hand with electricity to make a city what it ought to be. If it were feasible, as indeed it may be, to make the production of electricity co-ordinate with that of gas in the same works, it would be possible to clean up all the activities of a great city at once. One huge station, located where the prevailing winds would drive its smoke seaward or dissipate it, could be made adequate not only to furnish electricity but fuel gas, the one being in a sense the by-product of the other. A coke plant utilizing in changeable proportions its solid and gaseous products for motive power and for fuel gas, could be made to have a wonderful load factor and ought to turn out its joint products at figures hitherto unknown. With such a source of supply for all its needs, a city would become a new world. Fancy, for instance, New York or Chicago with the clear air of a country village! Yet such a change is not at all a dream impossible of realization unless one charges up failures to perverse human nature. Physically, the situation is an entirely possible one, and there are those now living who may survive to see it. It certainly is worth a struggle. Until such a condition is brought about he is reckless who thinks that electricity has even approached the bounds of its development.

Ground Return in Power Transmission Circuits.

It is recorded that Steinheil nearly a hundred years ago, in experimenting with his telegraph system, hit upon the idea of using the two iron rails of a railway track for the going and return conductors of a telegraph circuit. To his surprise and dismay, he found that the practical range of working in this manner was most limited. On following up the attempt with investigation, he found that the current leaked across from one rail to the other through the ground. This idea dawned on the experimenters of that time as a new conception, although in this age it is so familiar to our minds as to seem well-nigh intuitive. Steinheil won satisfaction, however, from his disappointment by making the ground return available, and by thus making a single telegraph wire the equivalent of the two conductors theretofore employed. Ever since the date of that discovery, the telegraph circuits all the world over have used ground return. There have been occasional troubles in making satisfactory ground, but, in general, the result has been all that could be wished.

On the advent of the electric lighting circuit of low potential an effort was made to get into the same boat with telegraphy, and to use the ground return. The attempt was, however, given up as impracticable after a few failures, owing to unduly large resistance in the ground circuits. The nearest approach to the use of the ground return in electric lighting distributing circuits is found on board some ships, where the steel hull of the vessel is used as a common return conductor, and in some three-wire systems whose neutrals, grounded in several places, may incidentally determine a small current flow through the earth. For all practical purposes, therefore, electric lighting has resigned all claim to the ground in distributing circuits. When telephone circuits were first introduced another endeavor was made to share with telegraphy in the benefits of the ground, in order to simplify the lines, and to carry but one wire to each subscriber. After years of vain struggle with electric disturbances of various kinds, the telephone had to give up the unequal contest, and to shelter itself by doubling its wires in all directions. Except for signaling and auxiliary purposes, telephone lines are now nearly all metallic circuits. On the arrival of the electric trolley circuit, once more the earth was laid under requisition for a return circuit, with the track rails aiding for what they might be worth. Here it was argued the drop of voltage in ground resistance was not of any great importance, and the saving in conductor would be most notable. After a few years, electrolytic troubles began to manifest themselves, in cities, to such an extent that at the present time good urban practice virtually disuses the ground return, and brings the current back to the central station almost wholly on ground cables, with the aid of elaborately bonded rails. Within the last few years the high-tension, alternating-current railway system has started on a new campaign of owning the earth, and again the telephone man and the telegraph man are up in arms with complaints of widespread electric disturbances on their circuits near its path.

In connection with the above question some interesting experiments have recently been published in *La Revue Electrique*, and were reported to the Electrical Congress of Marseilles last year. The experiments were made on the resistance of the ground to strong direct currents, both in France and in Switzerland. In the French experiments a direct current of 210 amp was led to ground, made of a number of cast-iron pipes passing into moist soil. It was found that the drop of pressure in the ground return was 360 volts, and that the resistivity of the soil appeared to be 6600 ohm-cm—that is, a centimeter cube of soil averaged 6600 ohms between any pair of opposed faces. In the Swiss experiments use was made of the Thury direct-current transmission system which runs from St. Maurice, at the Rhone Falls, to Lausanne on Lake Geneva. A direct current of 150 amp was carried between Bex and Lausanne over one of the transmission lines with ground return. The resistance of the ground at Bex was measured as 0.83 ohm, and that at Lausanne 0.7 ohm. Evidence is cited in the paper to show that the ground at Bex is limited to some extent by the neighboring Alpine ranges of fairly non-conducting material, so that the lines of equipotential on the ground surface due to the return flow are markedly distorted by these semi-insulating barriers.

The experiments confirm satisfactorily the existing theory of the part played by the earth's crust in the ground return circuit. According to this theory, the resistance of a good ground is mainly encountered within a comparatively short distance from the ground connection. Within a radius of the first 100 m some 90 per cent of the ground's resistance will have been encountered, and within a radius of the first kilometer, practically all of the resistance will have been passed. Consequently, it makes practically no difference whether two good grounds are 2 km or 2000 km apart, the resistance between them will be the same for all practical purposes. Incidentally, the experiments indicate that it may be possible in the future to learn something about the electrically conducting nature of deep-seated rocks by studying the distribution of electric potential on the ground's surface during the flow of powerful direct currents between ground plates widely separated. Such observations might perhaps entail geological deductions of some importance.

A. I. E. E. Annual Convention.

Following is the preliminary program of papers to be presented at the annual convention of the American Institute of Electrical Engineers, to be held at Hotel Frontenac, Thousand Islands, beginning Monday, June 28, 1909:

1. Some Considerations in Designing Heavy-Capacity Fuses, by Mr. L. W. Downes.

2. A Sketch of the Theory of the Adjustable-Speed, Single-Phase Shunt Induction Motor, by Mr. F. Creedy.

3. Calculation of the High Tension Line, by Mr. Percy H. Thomas.

4. Transmission paper, by Mr. W. S. Moody.

5. Effect of Frequency Upon the Cost of Alternators, by Mr. C. J. Fechheimer.

7. Two papers on high-tension transmission subjects, by Mr. R. D. Mershon.

8. The Reduction in Capacity of Induction Motors Due to Unbalancing in Voltage, by Messrs. S. B. Charters and W. A. Hillebrand.

9. The Heating of Induction Motors, by Mr. Alexander M. Gray.

10. Telephone paper, by Mr. J. J. Carty.

13. Three industrial power papers, by Mr. D. B. Rushmore.

15. The Resistance and Reactance of Armored Cables, by Mr. J. B. Whitehead.

17. Two educational papers, by Messrs. A. S. Langsdorf and H. J. Ryan.

18. Generation for 100,000 Cycles, by Mr. E. F. Alexanderson.

19. Repulsion Motors with Variable-Speed Shunt Characteristics, by Mr. E. F. Alexanderson.

20. Auxiliary Poles for Direct-Current Machines, by Mr. John N. Dodd.

21. The Thermal Convection from Thin Copper Wire Supported in Air, by Dr. A. E. Kennelly, Mr. C. A. Wright and Mr. J. S. Bylevelt.

23. Two papers by Comfort A. Adams.

24. Harmonics, Even and Odd, by Mr. J. B. Taylor.

25. Electric Measuring Devices, by Mr. L. T. Robinson.

Annual Convention of Southwestern Electrical & Gas Association.

The preliminary program of the fifth annual convention of the Southwestern Electrical & Gas Association, to be held at Dallas, Tex., May 20, 21 and 22, indicates that the meeting will be one of unusual interest. As in the case of several of the Western electrical associations, space for exhibits of apparatus will be supplied free of charge, the only expense to an exhibitor being for electrical energy, if any be used. Arrangements have been completed for special railroad convention rates.

An excellent entertainment program has been provided. On Thursday, the first day, there will be an automobile ride for visiting ladies, a luncheon at Lake Cliff for all attendants and in the evening a theater party. On Friday there will be a luncheon at the Country Club for ladies, and also an entertainment in the evening. On the same evening the Sons of Jove will provide an entertainment for all of the other sex in the form of a grand "Rejuvenation." On Saturday there will be visits to public-utility plants and other points of interest in Dallas. Following is a list of the papers to be presented:

"Producer Gas Plants for Small Central Stations," by Mr. W. B. Head, Stephenville; "Scope of Legal and Claim Departments and Their Relation to Each Other," by Mr. H. S. Cooper, Galveston; "Organization and Operation of a Claim Department," by Mr. W. C. Forbes, Ft. Worth; "Lamps for Residence Illumination: Their Characteristics and Comparative Economy of Operation," by Prof. Arthur Custis Scott, Austin; "Low-Pressure Turbines," by Fred M. Lege, Jr., Galveston; High-Pressure Gas Distribution for Commercial Purposes," by Mr. H. M. [illegible] Austin; "A Method of Determination of Total Sulphur in Gas," by Mr. L. B. Morehouse, San Antonio; "Preparation of Purifying Material, and the Purification of Gas," by Mr. Clark F. Farmer, Austin; "Economies That Can Be Made in the Operation of a Small Central Station," by Mr. Thos. Cook, Waxahachie.

Mr. D. G. Fisher, 300 Commerce St., Dallas, Tex., is acting secretary of the association.

Boston Street Lighting Situation.

Mayor Hibbard, of Boston, has signed a contract for the street lighting of the city for five years by the Edison Electric Illuminating Company, after exhaustive consideration of the relative possibilities of electricity and gas. The matter has been under investigation for many weeks and keen competition has been manifested between the Edison Company and the Boston Consolidated Gas Company. About 3500 lamps are involved, and the rate of payment by the city is $103.54 per lamp per year for magnetite arcs of 475 to 550 watts each (6.6 amp), and $92.39 per lamp per year for not exceeding 500 enclosed arcs of the so-called Gilbert type, 475-550 watts. These rates are on a basis of a fixed charge of $42 per lamp per year for the magnetites and $36 for the Gilberts. The running charge on the magnetites is figured at 1.75 cents per kw-hour and on the Gilberts at 1.6 cents per kw-hour. The Edison Company is to substitute magnetite lamps at not over 100 per week for the Gilberts. Rates are also quoted on 40-cp, 60-cp and 80-cp incandescent lamps at $19.35, $22.31 and $27.85 per year, according to the company's regular schedules. The total costs are based on 3828 hours per year burning. The contract contains a provision for arbitration of cost by the head of the electrical departments of Harvard University and the Massachusetts Institute of Technology, on request of either party. The duration of the contract may be extended to a period of 10 years by agreement of the parties. The contract amounts to about $350,000 per year.

As a result of various criticisms on the action of Mayor Hibbard in signing the street-lighting contract at the present time with the Boston Edison Company, the Mayor has made public the report of Superintendent of Streets Guy C. Emerson, showing in detail the reasons for the selection of electricity instead of gas. Mr. Emerson is an engineer of wide experience, and his recommendation in favor of the Edison Company was the result of an exhaustive investigation of the possibilities of both gas and electricity, including tests and cost comparisons over an extended field.

Mr. Emerson states that the previous contract for street lighting in Boston was made in 1894, for a five-year term, and in 1898 this contract was extended for 10 years. The original price for the so-called "Gilbert" or enclosed series arc under this contract was $127.75 per year. In 1906 this was reduced by arbitration provided for in the contract to $118.39. This last price is what the city has been paying up to the making of the new 1909 contract.

In his study of the problem Superintendent Emerson visited the various large cities along the Atlantic seaboard, collected information from both domestic and foreign sources, and called various persons into consultation. The results indicated that the tendency of the times is toward what might be termed spectacular lighting, or a more brilliant illumination for the streets. The Boston Edison Company offered to demonstrate any lamp, either of foreign or domestic manufacture. A number of lamps were submitted, from which the present General Electric flaming-arc and its 6.6-amp magnetite-arc lamp were selected as the basis of the new contract. The magnetite was regarded with special favor on account of the brilliancy of its light and the character of illumination given. The flaming-arc lamp was considered as a very valuable lamp for large open spaces, to be used in very limited numbers. In November, 1908, there were 24,189 magnetite lamps in operation in 80 cities and towns of the United States, and since then this number has been largely increased. Among the more prominent cities using these were: Baltimore, 1625; Fall River, 1000;

Toledo, 1800; Portland, Ore., 1725; Syracuse, 1500, and Worcester, Mass., 1000. These magnetites are lamps requiring but two-thirds the current of the lamp adopted for Boston, and of about one-third the illuminating power, being slightly superior in illuminating power to the Gilbert lamp used in Boston up to the present arrangement, but much more economical of current. The new Boston lamp is identical in material and construction with the above lamps, except in power. A number were tested in Boston street service, and in every case they fulfilled entirely the claims of their makers. As a result of improvements in the magnetite lamp, the city secured a price of $103.54 per lamp per year, based on 3828 hours burning, upon provision that all Gilbert lamps in excess of 500 should be replaced by magnetites. These magnetite lamps show by Mr. Emerson's tests about three times the candle-power in a given direction of the old Gilbert lamps. A price of $92.39 per lamp per year was made for the small number of Gilberts to be left. As this price took effect on April 1, and holds until the Edison Company can install the magnetite lamps, the city will receive great benefit from the reduction, the saving in April being estimated at over $8,300.

Mr. Emerson exhausted every avenue open in the attempt to find some form of competition with electricity for street lighting. Consultation with the Massachusetts Gas and Electric Light Commission, through the chairman, indicated that nothing was to be hoped for in the way of an appeal to force a lower price from the Edison Company. A thorough investigation was made of gas lighting in competition with electricity. Reports were gathered from various foreign sources, and several propositions were submitted by the Boston Consolidated Gas Company, notably for the installation of the so-called Graetzin low-pressure lamps and for high-pressure lamps in competition with the electric arc. An installation of Graetzin lamps was made in Commonwealth Avenue, and one high-pressure lamp was installed in front of the gas company's office on West Street. Frequent tests of the Graetzin lamp convinced Superintendent Emerson of its efficiency and its value as a possible competitor with the Welsbach low-pressure lamp; but its candle-power was found to be less than half the amount claimed by the gas company. Mr. Emerson finds that in general the city's Welsbach lamps, which are guaranteed for 60 cp. do not average much above 40 cp. It was also found that the Graetzin lamp was extremely susceptible to weather conditions. This lamp was therefore eliminated from consideration in connection with the contract. Superintendent Emerson's report states that the proposition of President Richards, of the Boston Consolidated Gas Company, dated April 5, for the installation of pressure lamps of the gas type is so vague regarding the character of the lamp as to be of little practical value, and verbal interviews with President Richards did not tend to throw more light on the subject. In regard to the statement of

STREET ARC LAMPS.

	Lamp and Watts	Hours per year	Price per year	Price per kw-hr
Boston	500-watt D. C.	3828	[illegible]	4.8
	6.6-amp. Magnetite		103.54	5.4
Fall River	4-amp. Magnetite	3900	91.28	5.3
Cambridge	425-watt A. C. Enc.	3900	90.00	5.4
Brooklyn	450-watt D. C. Enc.	4000	100.00	5.6
Brookline	500-watt A. C. Enc.	3828	124.10	6.2
Chelsea	425-watt A. C. Enc.	3828	100.00	6.2
Haverhill	450-watt D. C. Open	4000	100.00	5.8
Lawrence	450-watt D. C. Open	4000	90.00	5.
Lowell	500-watt A. C. Enc.	4000	100.00	5.
Lynn	500-watt A. C. Enc.	4000	94.90	4.7
New York	450-watt D. C. Enc.	3950	100.00	5.6
Pawtucket	425-watt A. C. Enc.	4000	112.50	5.6
Philadelphia	450-watt D. C. Open	4000	90.00	5.
Providence	450-watt D. C. Open	4000	[illegible]	5.
Worcester	450-watt D. C. Open	4000	164.00	8.1

Mr. Richards that "the ordinary type of gas street lamp" gives about 20 cp per cubic foot of gas, Superintendent Emerson replies that his tests show that the present Welsbach lamps give approximately 13 cp per cubic foot of gas, and the Graetzin lamps installed by Mr. Richards' company, less than 15 cp. Tests of the single high-pressure lamp installed on West Street show that the candle-power per cubic foot of gas is about 30, instead of 73, as Mr. Richards states. Mr. Emerson then states that the 80-cp tungsten lamp for $27.85 per year, which actually gives the rating attributed to it, is more powerful than the Graetzin lamp, and at a considerably lower price. Between Arlington and Berkeley Streets, Boston, 16 Graetzin lamps at $35 each gave a total candle-power by test at 20 deg. from the horizontal of 1600, at a cost of $560 per year, or 2.85 cp per year for $1. Five magnetite lamps, between Berkeley and Clarendon Streets, at $103.39 per year, gave a total of about 7500 cp at a cost of $515 per year, or 14.6 cp per year for $1.

Mr. Emerson concludes with a tabulated statement of the present cost of street lighting per kw-hour in a number of representative cities. An examination of the rates in large Eastern cities discloses the fact that nearly a uniform schedule exists, modified only by conditions such as the price of coal, labor, and the investment in underground construction. The table is shown herewith.

Hydro-Electric Development at Ox Bow Bend, Snake River.

The Idaho-Oregon Light & Power Company furnishes electricity to the cities of Boise, Emmett and Payette, Idaho. At Ox Bow Bend in the Snake River, 55 miles north of Huntington, Ore., where the topographical conditions are very favorable to water-power development, the company is building a hydro-electric generating plant, which is planned to produce electrical energy equivalent to 21,000 hp, measured at Boise, over 100 miles distant. The work of building the generating plant and hydraulic accessories is about half completed, and it is expected that the station will be ready for operation in about a year. The Arnold Company, Chicago, is doing the engineering, and J. G. White & Company, of New York, are doing the Ox Bow construction. Six per cent bonds amounting to $1,500,000 are offered for sale to defray the cost of power development. The net earnings of the company for the year 1908 are stated to have been $123,500.

Proposed Limitation of Sale of Sanitary District Power.

The Kleeman bill to compel the Sanitary District of Chicago to offer its electrical energy first to municipalities at cost, as previously outlined in these columns, is still pending in the Illinois Legislature and has aroused the active opposition of the Sanitary District trustees. By insinuation the Commonwealth Edison Company has been pointed to as one of the forces behind the bill, but Mr. Samuel Insull, president of that company, denies this charge vigorously, saying that he knows nothing at all about the Kleeman bill and that it is high time that the officials of the Sanitary District ceased to hold the Edison Company before the people as a bogey. Mr. Insull declares that the passage or the defeat of the bill means nothing to the Commonwealth Edison Company.

The Sanitary District trustees seem greatly exercised at the prospect of the passage of this bill, which is intended to give the municipalities along the Drainage Canal the refusal of the power at cost before it is offered to private consumers. Mr. Wallace G. Clark, one of the trustees, is reported by the Chicago *Daily Tribune* of April 28 as having made a bitter attack on the bill in an address delivered before the City Club of Chicago. According to the *Tribune*, Mr. Clark said, among other things: "We have had men murdered on our lines. Take our big transmission line where we have thrown the line dead in order to put in necessary repairs, we have found that there are agencies who have gone on down the line and thrown a chain over it, killing the men on that line. The Sanitary District has no labor troubles, so you can draw your own conclusions in this matter, the same as the trustees of the district do." Considerable unfavorable comment has been caused by the serious nature of these insinuations, and whatever may be the fate of the Kleeman bill, it is generally considered that there is no excuse for going to such extreme lengths in endeavoring to oppose it.

Long-Distance Operation of Waterworks.

Addressing the Chicago Association of Commerce recently, President R. R. McCormick, president of the Sanitary District trustees, made an interesting statement in relation to the utilization of electrical energy from the Drainage Canal hydro-electric power plant for the operation of municipal waterworks pumping stations. He said: "It was a hobby of mine, and I now concede that I was in error, that all the waterworks of Chicago should be operated by this same canal power, but it was pointed out by the city engineer in charge of the waterworks that in case of fire it would not be a safe thing to have the entire water supply dependent on one transmission line 30 miles long from Lockport, which might be destroyed by a tornado or by a violent lightning storm, or by mischief, thereby leaving Chicago at the mercy of the flames. So it has not been possible to attach the power house at Lockport with the pumping station in Chicago. I understand that a new station about to be erected will be partially equipped with electric power, so that part of it will be operated from Lockport and part of it by steam."

Pennsylvania Electric Locomotives.

A dispatch from Pittsburgh states that the East Pittsburgh shops of the Westinghouse Electric & Manufacturing Company have received orders to begin the construction of the first lot of electric locomotives which the Pennsylvania Railroad Company will operate in the tunnels of the New York terminals. It is understood that these locomotives will combine the most desirable features of electric locomotive design as determined by the tests conducted by the company with locomotives of different types on the West Jersey & Seashore and the Long Island Railroads, and by the manufacturers at East Pittsburgh, which tests are stated to have represented the expenditure of more than $500,000. It is understood that the locomotives will be the most powerful electric locomotives ever built and will be of the articulated type, each locomotive to consist of two units. Each unit will be equipped with one 2000-hp, direct-current motor mounted above the frames and connected to the wheels by connecting rods and side rods. The locomotives will be able to attain a speed of 90 miles per hour, and the first two to be built will be ready for test in the early fall. The present order will consist of 24 double units, but more will be required soon after the terminal station is opened.

Grounded Secondaries at Iowa Convention.

For several years past the Iowa Electric Association has had reports at its conventions on the grounding of secondary circuits. The importance and advisability of such grounding in order to protect lives of consumers had apparently been so well established that no discussion on this point was raised at the last two conventions, and attention was given exclusively to determining the best and most reliable form of grounding. The report of the committee this year, of which Mr. Thomas Sloss, of Cedar Rapids, was chairman, was made by Professor F. A. Fish, of Iowa State College, Ames, Ia., who said that it had not been possible to make tests on the resistance on different kinds of grounds during the past year. It was stated, however, that a part of the State engineering experiment station appropriation might be available for this the coming year.

The report contained an interesting letter from Dr. C. P. Steinmetz on the subject. Dr. Steinmetz stated that grounds for lightning arresters may safely have fairly high resistance if only the path to grounds is direct and free from inductance. For this purpose pipes driven in the ground may answer. On the other hand, grounds for secondary circuits must be of low resistance in order that the primary fuses may blow and disconnect the circuit when there is a cross between primary and secondary wires. He expressed the opinion that a buried cast-iron plate was better than a copper plate because the cast iron will be thicker and of longer life than the copper. Dr. Steinmetz strongly expressed his convictions that any electric circuit which is taken inside of houses should be grounded so as to prevent abnormally high voltages existing on the circuit, and this without regard to the normal voltage of the circuit.

Boston Edison Stockholders Ratify Purchase of Suburban Companies.

A meeting of the stockholders of the Edison Electric Illuminating Company of Boston was held on April 29, at which it was voted to purchase the locations and property of the Chelsea Gas Light Company, the Boston Consolidated Gas Company, the Newton & Watertown Gas Light Company, the Waltham Gas Light Company and the Lexington Gas & Electric Company. This purchase covers the electric business of the companies named, and does not contemplate the retention of the gas business of any company. The prices to be paid for the electric business of the several companies are: Boston Consolidated Gas Company, $1,300,000; Chelsea Gas Company, $350,000; Newton & Watertown Gas Light Company, $500,000; Waltham Gas Light Company, $600,000; Lexington Gas & Electric Company, $120,000; total, $2,870,000. President C. L. Edgar, of the Boston Edison Company, states that it is not the intention of the directors to issue any additional stock to pay for the properties for probably a year, as the company will have about $2,000,000 cash on hand early in May, with the final payment on the last issue of new stock offered to shareholders last winter. On Monday, May 3, the Edison company began to supply power to the Boston Suburban Electric Companies' street-railway lines under a 10-year contract recently made in connection with the transfer of the electric plant of the Waltham Gas organization to the Edison interests. About 700 hp will be required at first.

Niagara Power for Ontario Municipalities.

Definite steps looking to the distribution of electric power to the towns and cities of Ontario, between Toronto and Windsor, were taken on April 28, at a meeting of the Niagara Power Union in the city hall, Toronto, when a committee was appointed consisting of eight prominent representatives of the interested municipalities to tabulate the supplies needed by all the cities and obtain tenders on the whole from various companies. The committee was nominated by Mayor Stevely, of London. The members are: Comptroller H. C. Hocken, Toronto; Dr. Fred Guest, St. Thomas; Alderman D. A. Stewart, London; Mayor W. S. Dingman, Stratford; S. Carter, Guelph, and the officers of the union, namely, president, J. H. Fryer, Galt; secretary, J. W. Lyon, Guelph, and assistant secretary, H. L. Breithaupt, Berlin.

Thirty representatives from various municipalities in the Union were present. The feature of the morning session was an address by Hon. Adam Beck, familiarly known as the "Minister of Power," in which he quoted interesting figures regarding the work of the hydro-electric power commission. He stated its fighting days were over. The commission had been able not only to offer power to the municipalities within the first estimates, but to keep considerably under the estimated cost of the whole undertaking. He pointed out that whereas the original estimated cost of the transmission lines, transformer stations, etc., was $3,479,485, the commission had succeeded in reducing this figure by about half a million, the actual cost being $2,946,201. The commission engineers will be sent to Europe soon, said Mr. Beck, to procure information as to the best motors, lamps and other appliances, which information is to be used for the benefit of the municipalities. Among several things he predicted is a reduction of the electric light rate to 1½ cents per kw-hour and the establishment of a storage system at Dundas, Ont., probably, where power could be stored overnight to help over the difficulty of meeting the demand for power while the peak load is on.

Iowa Discussion on Tungsten Lamp Situation.

The Iowa Electric Association at its convention at Cedar Rapids, April 21 and 22, held a discussion on the central station and the tungsten lamp situation.

Mr. Thomas Ferris, of Osage, reviewed the situation in a paper on "Effect on Central-Station Revenue of the Introduction of the Tungsten Lamp." Mr. Ferris revived the various arguments brought up by pessimistic central-station men when the tungsten lamp was first talked of. These arguments pointed to a decreased revenue because of the higher efficiency of the tungsten lamps. Mr. Ferris, however, took no stock in such arguments and thought the effect of the tungsten lamp on the central-station business had been very good. It has increased business enough to make up for any small losses in revenue from existing consumers because it brings in new business not heretofore obtainable. He thought the advent of the lamp very timely and that it had saved central-station revenue from reduction by meeting competition. In the cases of companies which charge a higher kw-hour rate on small than on large amounts, the tungsten lamp may have the effect of causing the consumer who reduces his kw-hour consumption by the use of tungsten lamps to pay a higher kw-hour rate. Then if the central station takes on additional small consumers which pay the high rate, the effect of the tungsten lamp is to raise the average price received per kw-hour.

Mr. J. P. Jones in the discussion of this paper, presented some figures on the life of series-tungsten street lamps used at Cedar Falls. This company started to use tungsten street lamps the middle of last July. The average number of hours life of the lamps which had been burned out was 572. The average life of the lamps still in service not burned out was 952 hours. There are now 225 lamps in use.

President L. D. Mathes, of Dubuque, said that the central-station man could not ignore the tungsten lamp if he would. He suggested that possibly there is more danger of loss of revenue in small towns where there is not much possibility for new business than in larger cities where new consumers could be taken on to make up for reduction and revenue from old consumers.

Mr. George S. Carson, of Iowa City, did not agree with this suggestion because in his experience the tungsten lamps raised the standard of illumination and took business away from gasoline plants which could not be possibly reached otherwise. It has also tended to broaden the peak because satisfied consumers getting a lot for their money will burn the lamps four hours a day.

Mr. F. A. Lusk, of Ida Grove, said his company's revenue had not been cut by tungsten lamps. Merchants were getting more light for the same money.

Mr. Austin Burt, of Waterloo, thought that the tungsten lamp was having the effect of broadening the peak.

Mr. C. D. Jones, of Independence, said that tungsten-lamp installations were bringing on more customers and furthermore some residence consumers which formerly used kerosene for reading now used electric lights altogether and did away with kerosene reading lamps.

Mr. George S. Carson reported that at Washington he had put in one tungsten store-light installation in place of gasoline. All of the gasoline plants in town were gone.

Mr. H. C. Blackwell, of Davenport, reported that his company formerly had 1350 gas arcs, as the company conducts both gas and electric business. Since tungsten fixtures had been introduced, 269 gas arcs and 184 electric arcs had been displaced. Three hundred and sixty-four tungsten lamps had been put in. The net result had been an increase in gross revenues for the company and the wiping out of the expense of maintenance of the displaced gas and electric arcs which formerly fell on the company.

Mr. George S. Carson, of Iowa City, said that his company furnishes fixtures for tungsten lamps free in store lighting.

Mr. Gus Lundgren, of Cherokee, reported using tungsten lamps in stopping complaints of consumers in large halls. He puts in installations on trial. A contract for a private gasoline plant had recently been headed off by a trial installation of tungsten lamps.

The Pinch Interrupter.

At the meeting of the Armour Institute of Technology branch of the American Institute of Electrical Engineers on April 22 Mr. G. E. Marsh presented a paper on the Caldwell or Simon so-called electrolytic interrupter. In view of the fact that the "pinch" phenomenon, discovered by Mr. Carl Hering a couple of years ago and investigated by Mr. E. F. Northrup, is the principle on which the interrupter operates and that it does not depend upon electrochemical relations, it was given the name in the paper. The first part of the paper was confined to an exposition of the mathematical relations connecting the various quantities entering into the phenomenon, while the second portion dealt with the design and construction of an interrupter operating upon this principle and free from the defects usually inherent in various types of circuit-breaking devices.

The pinch phenomenon is defined as the contraction in the cross-sectional area of a liquid conductor when the current-density attains a certain value. When the current attains this value, dependent on the initial cross-section and material of the conductor, the contraction—the pinching effect—completely severs the conductor and opens the circuit. As the phenomenon is a function of the current strength and not of its direction of flow, either direct or alternating currents exhibit the effect. In the case of the supported fuse wires, enclosed types, the blowing is assisted by the contraction of the melted conductor and subsequent opening of the circuit due to the pinch effect.

This phenomenon may be ascribed to the tension of the magnetic lines of force encircling the conductor and to those existing within the boundary of the current-carrying material. By virtue of the forces directed radially inward, resulting in the reduction in cross-section of the conductor, there results a pressure directed along the axis of the conductor. If p is the liquid or hydrostatic pressure, a the cross-sectional area, i the current per unit area of the cross-section and K a constant, then $p = K a i^2$. If amperes, centimeters and gausses are the units in which the several quantities are chosen then K has the value of 10^{-5} approximately. In concluding this portion of his paper Mr. Marsh described and exhibited a pinch high-capacity ammeter made by Leeds & Northrup, of Philadelphia; a slightly modified interrupter playing the rôle of a circulating pump was also shown.

The requirements of a perfect interrupter were mentioned, and the merits and faults of the hammer, mercury, turbine, electrolytic and pinch types of interrupters were dwelt upon. The general superiority of the last-named type, or the Caldwell of improved design, on account of simplicity, reliability and zero cost of maintenance was maintained, and in this connection an apparatus of the kind considered was shown in operation. It was of the fixed-frequency type, having three fixed rates of interruption, namely, 50, 200 and 800 per second. An induction coil of original and efficient design was shown in operation with the interrupter.

In principle the apparatus consisted of a lead box with blackened copper vanes for radiating the heat and three glass tubes having small holes in the lower ends. A lead electrode is within each tube and connected to a switch, thus enabling any one of the three tubes (frequencies) to be used at will. The tubes are immersed a couple of inches in dilute sulphuric acid, contained in the box. The frequency of interruption varies inversely as the inductance in the circuit, the size of the hole in the tube and directly with the current density.

The successful operation demands a certain amount of inductance in the circuit. As the pinch phenomenon possesses a strongly marked capacity effect, no condenser is necessary when the interrupter is used with induction coils. This last-mentioned property of the apparatus may even result in a displacement of 80 deg. or more between current and emf.

Engineers Inspect Gary Steel Plant.

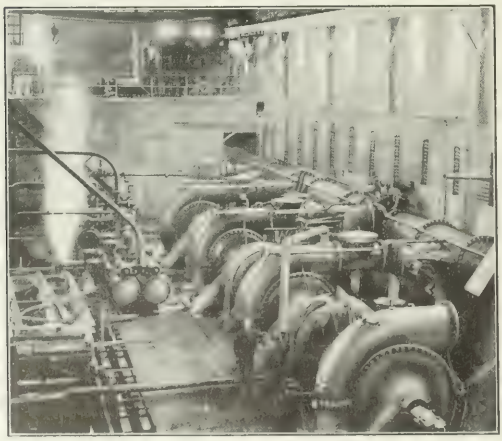
Accepting the kind invitation of the Indiana Steel Company, extended through Mr. Gleason, the general superintendent, 432 members of the Western Society of Engineers and the Chicago section of the American Institute of Electrical Engineers, visited Gary, Ind., on April 24 and inspected the new steel mills at that place which have been built in the last three years and around which has grown the city of Gary, with all modern improvements. So quickly have this city and plant sprung into being at the southern end of Lake Michigan, as the result of the combination of trained human intelligence and the expenditure of $40,000,000 in capital, that Gary is known as the "Magic City."

Mr. B. R. Shover, electrical engineer for the Indiana Steel Company, with a number of other representatives of the company's electrical staff, piloted the visitors over the extensive works, which cover about 2 sq. miles. The party was first taken to the gigantic electric ore unloaders by which the iron ore is taken from the great ore boats which bring it down from Lake Superior and dumped into stock piles or perhaps taken by conveyors directly to the blast furnaces. The gas from these blast furnaces is not allowed to waste, but after various purifying processes, is used to operate large gas engines which drive blowers or electric generators. Electric power is used throughout the entire works wherever possible, and in the power house, which is almost exactly 1000 ft. long, there are 17 2000-kw, 6600-volt, 25-cycle alternators, each direct connected to a 3000-hp gas engine.

After inspecting the apparatus to utilize the gas and the power house, the party passed to the open-hearth mill, which proved extremely interesting to all present. Here, too, electric motors are used almost exclusively in operating the charging machines and the great ladles and ingots. The rail mill, with its great 2000-hp and 6000-hp alternating-current motors, was also visited, and to many was the most fascinating part of the company's works. This mill is operated entirely by electricity, and eight operators are able to turn out 2000 tons of steel rail daily. The party returned to Chicago in the evening, after enjoying a most instructive and pleasant afternoon.

The Water Works of the Gary (Ind.) Steel Plant.

So much interest is being manifested in different parts of the country in electric pumping for city water works that many



GARY (IND.) WATER WORKS PLANT.

central-station companies figuring on this work will be interested in the accompanying illustration of the interior of the water-works pumping plant installed at the great steel mills of the Indiana Steel Company, at Gary, Ind. The electrical energy is supplied to this pumping station by two three-phase feeders carried on steel towers from the central generating plant of the company, which is driven by gas engines. The pumping station, as shown, contains four Platt turbine pumps, each direct-connected to an induction motor. Each pump has a capacity of 25,000,000 gal. of water per day, pumping against 100-ft. head. The pump speed is 500 r.p.m. Each feeder terminates in a bank of three 800-kv-amp transformers and each bank supplies two motors.

Side-Rod Single-Phase Locomotive.

A type of single-phase locomotive, designed to reduce the maintenance charges on rolling stock of this class, has been tested out at Schenectady, N. Y., by the General Electric Company and the American Locomotive Company, who jointly designed and built the machine. The distinguishing feature of the locomotive is the mounting of the motors on top of the frames and connecting them to the driving wheels, not through the usual gearing nor by pressing the armatures on the driving axles, but by rods and cranks. Two 800-hp, single-phase, 15-cycle motors will form the equipment of the locomotive, which is designed to develop a tractive effort of 30,000 lb. at a speed of 18 miles per

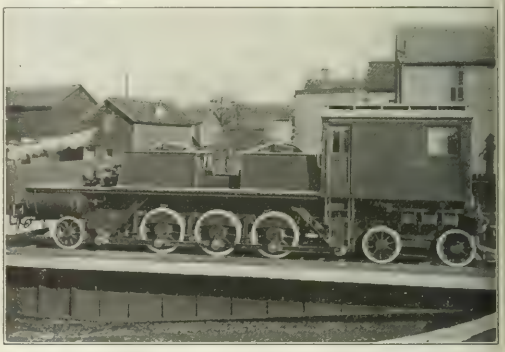


FIG. 1.—SIDE-ROD LOCOMOTIVE.

hour and to have a maximum speed of 50 miles per hour. The locomotive has been equipped temporarily with two 400-hp motors for testing purposes.

The frame and running gear are not unlike those of the steam locomotive. There are three pairs of 49-in. coupled driving wheels, a radial two-wheeled pony truck at one end and a four-wheeled bogie truck at the other end. The total wheelbase of the locomotive is 36 ft. 3 in., but the rigid wheelbase is only 10 ft., which permits rounding the sharpest curves. The total weight of the machine when fully equipped will be 250,000 lb., of which 162,000 lb. will be carried by the three driving axles. This gives a weight per driving axle much higher than that on either the New York Central or the New Haven electric locomotives, although slightly less than the maximum weight employed on high-speed steam locomotives.

The motors start as repulsion motors with short-circuited armatures, and as the speed increases are changed over to series repulsion motors, thus giving the motors high starting torque and eliminating running with short-circuited armatures. The starting tractive effort is about twice the running effort on the same input. The armatures are similar to those of an ordinary direct-current motor with equalizer rings. Multiple drum-type windings with the bars soldered directly to the commutator segments are employed, and the field winding is made up in two sections, the exciting and the inducing windings. The former has the same function as the field winding of an ordinary series motor, while the latter produces the high starting torque. By mounting the motors on top of the frame, extra large bearings may be employed, and the air-gap may be reduced to a minimum,

since there is no danger of the armature dropping on the pole pieces. The motors being carried on the frame of the locomotive and near the center, there are no severe shocks produced by dead weight on the axles, and the moment of inertia of the locomotive around its vertical axis is reduced to a minimum.

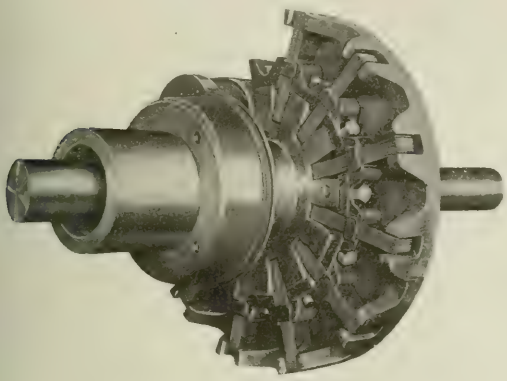
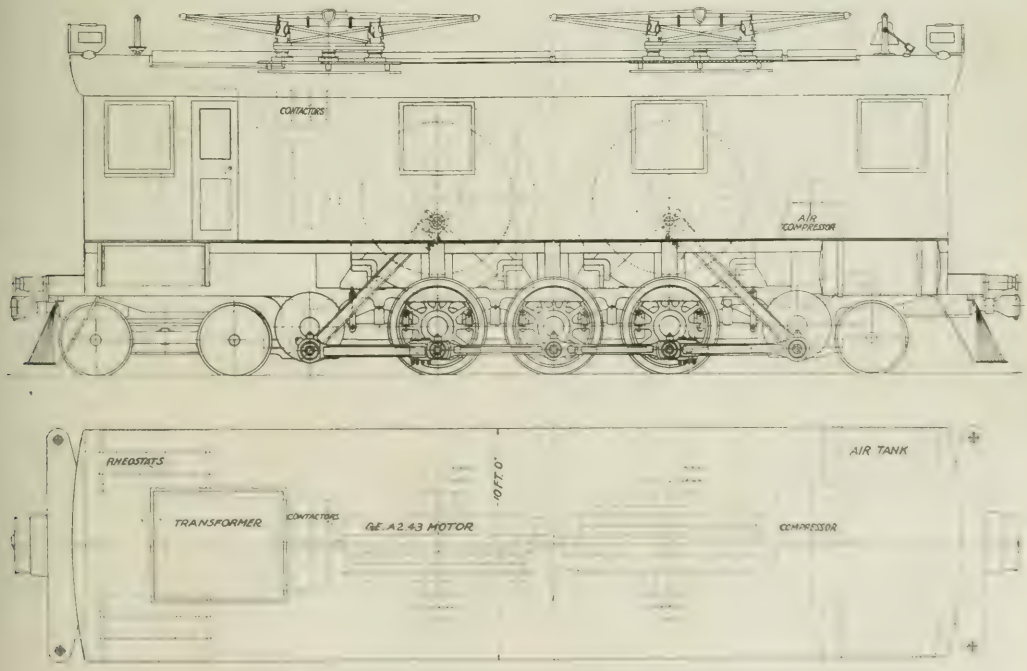


FIG. 2.—DETAILS OF FLEXIBLE COUPLING.

The arrangement of connecting rods between the motors and the driving wheels is illustrated in the engravings. Two jackshafts, 10 in. in diameter, and supported in bearings rigidly fixed in the locomotive frames, extend across the frames outside of the end driving wheels. Quartered crank arms are shrunk and keyed on both ends of these jackshafts and similar crank arms are attached with flexible couplings to both ends of each motor armature shaft. Inclined connecting rods extend from each motor crank arm to the corresponding jackshaft. To the same crank pins on the jackshafts are connected the driving-wheel side rods. For each revolution of the motor armatures, therefore, the driving wheels make one complete revolution and the motors revolve in exact unison, due to the mechanical connection through the driving-wheel side rods. The object of inserting the jackshaft as an intermediate connection between the motors on top of the frames and the wheels is to permit a horizontal drive between the spring-supported part of the locomotive and the driving wheels. This is necessary in order to provide for vertical play between the spring-supported part and the non-spring-supported wheels with a negligible variation in the distance between crank centers.

An interesting mechanical detail of the locomotive is the flexible coupling inserted between the motor armature shaft and the motor crank arm. The motor crank arm and its counterweight are formed in one piece, which is bored out to fit over an extension of the motor armature shaft. Just outside the armature bearing the armature shaft is enlarged in diameter, and notches are cut out to form seats for eight sets of radial leaf springs. On the inside surface of the crank-arm counterweight suitable notches are formed to seat the other end of the leaf springs. The sets of springs are fastened to the counterweight by bolted lugs which fit over the spring bands. The entire set of springs is designed to be of such strength as to carry the entire torque of the motor flexibly with an amount of deflection which will reduce the effect of the pulsating torque of a single-phase motor to a minimum.

The controller in the cab of the locomotive is mounted in the end over the bogie truck. Immediately back of the controller are mounted two transformers, and back of them the multiple-unit control switches. On the deck at the opposite end of the locomotive, over the pony truck, are mounted two air compressors for the braking system, and under the deck two large main reservoirs. This arrangement of auxiliary apparatus gives a good distribution of weight, and at the same time permits of easy access to all parts of the machine from the cab



FIGS. 3 AND 4.—ELEVATION AND PLAN VIEWS OF SIDE ROD LOCOMOTIVE.

Electricity at Meeting of National Association of Cotton Manufacturers.

At the meeting last week in Boston of the National Association of Cotton Manufacturers three papers having an electrical bearing were presented. Mr. A. Thatcher Holbrook, of Boston, discussed the lighting of large textile manufacturing areas, and brought out the advantages of the Nernst lamp for this service. Mr. Day Baker, manager of the Boston office of the General Vehicle Company, set forth the economies of the electric truck for inter-factory transportation, and Mr. T. E. Chappell, of New York, had for the subject of a paper the care of commutators, in which the advantages of commutator grinders were dwelt upon. An exhibition in connection with the meeting was held in the Mechanics Building, where a number of electrical manufacturers were represented.

Recent Developments in Chicago Telephone Service.

Reviewing the work of the Chicago Telephone Company under the franchise renewal ordinance of Nov. 6, 1907, Mr. Angus S. Hibbard, general manager of that company, gave some interesting facts in an address before the ways and means committee of the Chicago Association of Commerce on April 28. He pointed out that the requirements of this ordinance were in some particulars quite unusual and put upon the company a large amount of work. The Chicago exchange was made to embrace the entire city, which is a greater metropolitan area than that covered by any exchange in the country, and the system of rates provided by the ordinance was made co-extensive with these limits, making a telephone in the remotest corner of the city just as cheap as in the center of the loop district.

The inclusion of the small local exchanges in the outlying districts of the city, formerly connected by toll lines, has made it necessary to install thousands of miles of trunk lines in cables laid in underground conduits, connecting these districts with the city exchanges and with each other. One new exchange building, known as Lincoln, has been built and opened during the year at a cost of $180,000. Another exchange, to be known as Lawndale, is now under construction in the extreme western portion of the city. The company's toll building at 87 Franklin Street, forming an addition to its group of Main Office buildings, has been completed, and switchboards providing for the handling of messages in the territory immediately surrounding Chicago are now being installed in it at a cost of about $130,000.

The north shore underground toll cable has been completed and contains toll lines reaching all cities and towns along the lake shore to the north, and its extension by the long-distance company now reaches Racine and Milwaukee, making it one of the longest underground telephone cables now in operation in the world.

To accommodate the growth of business it is now necessary to install two and sometimes three separate telephone exchanges in one building. Believing in the future growth of the business districts in the southern part of and south of the loop, a property about 200 ft. north of Harrison Street on Federal Street has just been purchased. Upon this a fireproof building, costing with property about $500,000, is to be erected for the accommodation of the Harrison exchange and the new exchanges which will be required for the business of this portion of the city. The buildings now owned by the company in Chicago cover about 8½ acres and contain something more than 6,200,000 cu. ft. of space.

In spite of the continued depression in general business during the last two years, the applications for new service have been very numerous. When it is remembered that the telephone company cannot extend from the premises of a subscriber to a street or alley and tap a main, as is done in the case of gas, water or electric lighting companies, but must in each case provide for the subscriber's use a special circuit extending to the company's nearest exchange, limited to the subscriber alone or to a particular group of not more than four with which he may be associated, it will be seen that the plant requirements for telephone-exchange service are unusual. The lines of conduit and cables radiating from exchange offices must be pushed out in the new districts in advance of the requirements of subscribers if installations are to be made with reasonable promptness. If the engineers make a mistake and overestimate the probable needs of a particular district, unavailable and superfluous plant will be constructed; if they underestimate these requirements cables may be speedily filled and additional plant installations must be made to provide for the excess.

During the 16 months since the ordinance was passed the company has handled 59,044 "in" orders—i.e., orders upon which telephones were to be installed for city subscribers; 31,183 telephones have been ordered out; 50,541 telephones have been moved for subscribers moving from one location to another; 25,300 miscellaneous orders have been handled on account of changes in the class of service, rearrangement of service and other changes necessary to keep the lines and instruments of a subscriber in operation. This is a total of 168,068 orders for the period, or 399 for each working day. The wire plant of the company increased more than 90,000 miles during this period, reaching a total of 473,334 miles on April 1, 1909, of which 406,331 miles, or nearly 86 per cent, is contained in underground cables, leaving less than 24,000 miles of overhead wires in alley distributing lines or other locations in the entire city.

The company is now operating 31 separate exchanges in the city, of which 13 are in the so-called neighborhood exchanges located in the outlying districts. All of the company's larger exchanges are located in fireproof buildings, nearly all of which were constructed by the company for its exclusive use. The apparatus installed follows the approved standards, and there is a well-trained corps of employees, now numbering about 8100.

The injection of the flat rate into the schedule of rates at the time the ordinance was passed, against the protest of the company, was deplored by Mr. Hibbard. If one subscriber paying $125 a year insists upon using his telephone 50 or 100 times a day, he said, it must be evident that those who wish to communicate with him can do so only with great difficulty. Such a line may be found busy 10, 20 or more times before a single call can be completed to it. In the meantime the costs of operating, use of trunk lines and of operating machinery are necessarily involved in fruitless efforts. But this class of subscribers is not excessive in numbers. Out of the total of 181,533 telephones on Jan. 1 in Chicago only 9864 are of the so-called flat-rate business class.

Very nearly 90,000 telephones in Chicago were in residences, the total number being 86,546, as against 94,987 in places of business. As a comparison it may be mentioned that in New York there are about 79,000 telephones in residences out of a total of 254,000 stations. The number of exchange calls made in Chicago exceeds that of any other city.

At the subscriber's end too often calls are answered with delay because it is made the business of no one particular person to answer the telephone; some subscribers continue answering with the word "hello" or some other meaningless phrase rather than with the name of the person or firm, which latter answer avoids all delay. Subscribers' lines are burdened by useless or frivolous calls from or to employees who fail to realize that such use interferes directly and seriously with their employers' business. These difficulties are largely overcome by the introduction of private-branch exchanges with well-trained operators in charge, but it must always be true that first-class service calls for promptness and co-operation at the subscribers' end as well as in the exchange.

In its territory surrounding Chicago the company is operating about 50,000 telephones in 110 exchanges, and outside of this immediate territory connection is afforded with the long-distance lines. A recent and most careful search failed to find any city, town, village or hamlet containing as many as 200 inhabitants within 500 miles which did not have direct telephonic communication with Chicago.

"No one doubts," said Mr. Hibbard, "that the value of the

telephone in Chicago to-day, with nearly 200,000 instruments in service, is many times greater than when there were 5000 or 10,000. We do not know at what moment the service may represent its greatest value in reaching the residence of some subscriber having perhaps the cheapest form of service. This is equally true of the national system, and no subscriber can tell at what moment a message, coming a distance of 500 miles or 1000 miles, may represent a service whose value could scarcely be measured by its cost."

Massachusetts Legislative Notes.

The Senate has concurred with the House in the suspension of the rules to permit considering a petition with the bill of Noah Rankin for legislation to authorize the town of Erving to establish an electric light district, and has referred the bill to the Committee on Public Lighting. The Senate has accepted the report of the Committee on Public Lighting referring the Coughlin bill to the next Legislature. This bill is designed to regulate the price, quality and pressure of illuminating gas in Fall River. The bill to provide for an investigation of the water-power resources of the State has been passed and will shortly be laid before Governor Draper for his approval. The Senate has accepted the Committee on Public Lighting's reference to the next Legislature of the Reno bill to authorize gas companies to adopt the sliding scale system for the regulation of prices, dividends and wages. The House has also given this report a first reading. The House has accepted the same committee's reference to the next Legislature of the Hayes bill to reduce the price of gas in the Charlestown district of the city of Boston. Under suspension of the rules a bill to permit the Beverly Gas & Electric Company to do business in Topsfield has been introduced into the Senate, and has been referred to the Committee on Public Lighting. Governor Draper has signed the bill to allow the Heath Telephone Company to sell certain stock privately.

Design of Dynamo-electric Machinery.

Before the New York Electrical Society, at the Engineering Building on April 29, Mr. B. A. Behrend, advisory engineer of the Westinghouse Electric & Manufacturing Company, gave an extremely interesting address, illustrated by lantern slides, on the design and characteristics of modern dynamo-electric machinery. His treatment of the subject included a description of modern large generators; their principles of mechanical and electrical design; the difficulties to be overcome in securing high rotational speeds, and the various methods of overcoming them; the importance of regulation; methods of ventilation and muffling noise at high speeds, etc. The views showed various stages in building the largest and latest types of alternators, in the steam-turbine class, and illustrated very clearly the practices resorted to for cooling the parts and the manner in which the problem was dealt with of winding and securing the coils. Mr. Behrend was very frank in his treatment of the subject, and the address embodied a wealth of experience.

The discussion was opened by Mr. C. F. Scott, who traversed the general subject of dynamo evolution in a helpful way, and who was followed by Mr. C. O. Mailloux in a most striking review of the subject, going back to the beginning of the art in America. Mr. Mailloux narrated some very interesting experiences of his own in motor and dynamo design, and in doing expert work on early alternators, which were little understood and for which extravagant claims were made. His work included a motor to run a coal cutter in 1884, and a compound-wound machine, probably the first of its type. Mr. Mailloux spoke warmly of the work done by Hopkinson and the aid given by Dr. S. P. Thompson.

In spite of the wild storminess of the night, there was a good attendance and much enthusiasm. A long list of new members was elected, attesting the vitality of the society. Acting-President Beran was in the chair.

Art in Public Lighting.

At the Conference on City Planning and Municipal Art, being held in the Twenty-second Regiment Armory, New York City, under the auspices of the Municipal Art Society, the Depart-

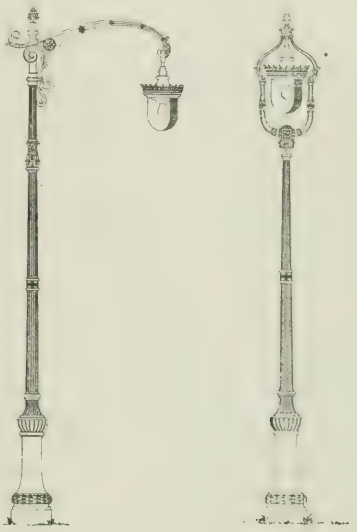


FIG. 1.—PROPOSED POSTS FOR TUNGSTEN STREET LIGHTING.

ment of Water Supply, Gas and Electricity and the New York Edison Company show by working exhibits what has been achieved in municipal art in the domain of public lighting. By means of lamp-posts and standards placed in a row, the transi-

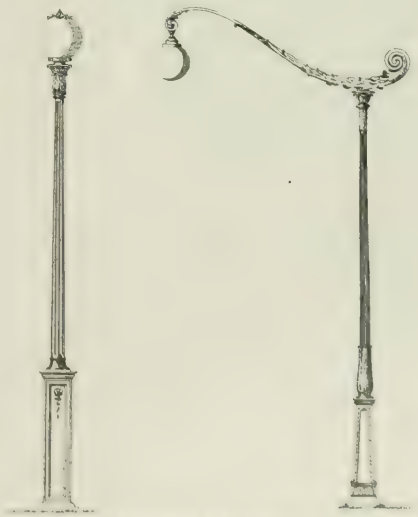


FIG. 2.—PROPOSED STANDARDS FOR TUNGSTEN PARK LIGHTING.

tion from the oil lamp of half a century ago to the tungsten standard and bishop's crook arc lamp-post of to-day is graphically shown. In addition, the New York Edison Company flanks this exhibit with numerous photographs of the various types of arc lamp-posts now used throughout the city, together with night views showing the illumination received from them. Not only are the practical aspects of civic improvement in all

branches displayed by means of models, drawings, etc., but the general raising of the standard of art as applied to public street lighting in New York as well. A feature of the lighting exhibit are four proposed standards for tungsten lamps illustrated on page 1073, and numerous colored sketches showing studies in many others. The designs have been submitted to the Municipal Art Commission for approval. The remodeled naphtha lamps formerly employed for park lighting and now adapted for incandescent tungsten lamps are also in evidence. In the entire street-lighting exhibit, the only one in which the actual apparatus is employed under operating conditions, the old and the new are shown side by side so that comparisons may be made not only of the increased efficiency of public lighting in New York, but also of the esthetic taste displayed in the design of the posts, two very important accomplishments overlooked by the majority of citizens and for which the public service corporations receive scant credit. The exhibition, which is free to the public, will be open afternoon and evening until May 8.

Hearing on Public Service Meter Specifications and Tests.

Two hearings were held on April 29 by the Public Service Commission of the First District on specifications proposed for watt-hour meters and with reference to discontinuing the use of certain types of watt-hour meters now in use which do not come up to the specifications. Representatives of all the electric lighting companies coming within the jurisdiction of the commission and also representatives of all the meter manufacturers interested were present, to discuss the report submitted on the subject by Dr. Cary T. Hutchinson, special consulting engineer of the commission. Mr. J. W. Lieb, Jr., of the New York Edison Company, who voiced the general opinion of the electric light companies, said that the latter were all in favor of a set of specifications which will cover the accepted types of meters and which will exclude improper measuring appliances or those which register in such a way as to be unfair to the consumer. The trouble, however, was that the proposed specifications seemed to be drawn up largely on the basis of the operation of the very latest and most approved types of instruments and that the application of the specifications would throw out 800,000 or more meters that are in use to-day in the United States, and giving satisfactory service.

In the matter of test, the lighting companies were agreed that a polyphase meter should be tested with both its potential circuits energized from a polyphase circuit, or under conditions which obtain in actual practice. In many of the suggested tests the watt rating of the meter has been specified rather than the ampere rating, with the result that a meter tested at rated watts with a power factor of 0.50 would carry a 100 per cent overload. Moreover, a meter on a lighting circuit would not be called upon to operate at so low a power factor, so that the limit was excessive and unusual. The specifications also call for tests with frequency variations as large as 10 per cent. It was suggested that this be changed to 5 per cent, as it is doubtful if stations could be operated under such conditions as to bring about so large a change in frequency. None of the companies objected to the discontinuance of a certain old type of alternating-current meter which registered 36 per cent slow; in fact very few of such meters are in use in New York City.

The representative of one of the lighting companies stated that his company had some 7000 meters which under the specifications would be excluded, although they are good meters, embodying all the latest improvements and register correctly. This would mean an investment of $75,000 which his company, with its tender income account, was not now prepared to make, especially in view of the fact that if the meters were tested under actual working conditions they would be found to be correct.

The manufacturing companies called attention to the fact that polyphase meters which were correct and acceptable under normal and operating conditions may be excluded under the abnormal conditions specified in the report of the expert for the commission. Variation in frequency inherently changes the power factor setting of alternating-current meters, and it is an abnormal thing to require a meter to vary 10 per cent in frequency and at the same time have a power factor of 75 per cent. A variation of 5 per cent in frequency would cover the conditions under which the meter will ever be called upon to operate. It was suggested that the accuracy of adjustment should be such that the meter would be capable of registering with an error of less than 1½ per cent and that the accuracy of registration under various conditions of load and voltage should be such that the meter would register with an error of not less than 3 per cent, the true value of the energy supplied through it at rated voltage at any current from 10 per cent of rated current, to 150 per cent of rated current.

It was pointed out that if the modifications suggested were made in the specifications all of the meters would be acceptable, except possibly the first induction meters placed on the market, which could not be expected to have the accuracy of the modern meter, seeing that it was designed prior to 1901; but even these meters were capable of adjustment and by closer maintenance would give good, average results. The tests showed that the use of this meter did not militate against the consumer but against the lighting company.

The hearing closed without indication as to final action on the specifications discussed.

New York Public Service Commission News.

The Triborough Railroad Company was incorporated in Albany last week, backed by the same interests that make up the Bradley-Gaffney-Steers Company. It is the purpose of this new company to apply to the Board of Estimate and the Public Service Commission for a franchise to build and operate a surface electric road from Fulton Street and Flatbush Avenue in Brooklyn over the new Manhattan Bridge to the intersection of Canal and Walker Street in Manhattan. It is said that the ultimate purpose of the new company is to branch out all over Brooklyn and become a rival of the Brooklyn Rapid Transit. A representative of the new company says that if the line is built, and the Bradley interests secure the franchise for the Lexington Avenue subway, free transfers will be given between the surface and subway lines. The nominal capital of the new company is $50,000, which, of course, would be increased if the franchise is granted.

The Legislature of New York adjourned last week without having adopted the bill which proposed to amend the Public Service Commission law by giving the commission the right to fix the rate for transfers and giving it supervision over telephone and telegraph companies. What is known as the Travis-Lee constitutional amendment which excludes self-supporting dock and subway bonds from computation in the city's debt limit was finally adopted by both branches of the Legislature and will be submitted to the people for ratification at the next general election. The Legislature also adopted what is known as the New York Central Eleventh Avenue bill. This measure practically repeals the Saxe law and provides that the New York Central shall be given the right to construct an elevated and subway line on Eleventh Avenue with the approval of the Board of Estimate and the Public Service Commission. The Coney Island 5-cent fare bill, which had passed the Senate, did not reach consideration in the Assembly.

At a hearing before Commissioner Milo R. Maltbie in a continuation of the investigation of the electric companies of New York City the companies filed reports of the meter tests, both on behalf of the companies and on complaints, which have been made within the last year and a half. Mr. Delos F. Wilcox, the chief of the bureau of franchises of the commission, filed a series of maps which he had prepared from the franchise documents filed by the various electric companies showing the limits of territory in which the various companies

have the right to supply energy. After these exhibits were filed, Henry J. Hemmens, counsel for the New York Edison Company, entered a protest, stating that the maps prepared by the commission which gave the Edison Company the right to supply energy on the Island of Manhattan and that portion of the Bronx west of the Bronx River, did not accord to the company all of the rights which it really possessed. He held that his company had the right to supply energy in any part of the Bronx, or, in other words, that its right extended to the full limit of the city of New York previous to Jan. 1, 1898. While his franchises were granted previous to the time that the portion of the Bronx east of the river was made a part of the city, the company holds that the rights they obtained for the city of New York cover the entire limits of the city prior to the combination which made Greater New York. Mr. Hemmens also expressed the opinion that the franchises granted by the Board of Electrical Control were invalid. This board, he thought, never had any authority to grant franchises. The commissioner then examined J. W. Lieb, Jr., associate general manager of the New York Edison Company, upon the question of stock ownership between the various companies that have practically amalgamated. It was shown that the United Electric Light & Power Company was the only one of the subsidiary companies in which there was an appreciable amount of outstanding stock, and even in this company the amount was small. It was also shown that at least 99 per cent of the stock of the New York Edison Company was owned by the Consolidated Gas Company.

Mr. Lieb also testified at a hearing on April 30 as to the distribution system of the Edison company. He explained the system of high-tension and low-tension feeder cables, and showed upon the maps how the voltage was reduced from 6600 to that of the low-tension system actually supplying consumers. Mr. Lieb also explained the various methods of street lighting and outlined the system under which the city is now paying for its street illumination.

Water-Power Development at Oregon, Ill.

The Oregon Power Company, of Oregon, Ill., successor to the Oregon Electric Light & Power Company, has been organized with a capital stock of $150,000 and an authorized bond issue of $200,000. Oregon is on the Rock River, between Rockford and Dixon, and the water-power available there has been utilized for a number of years. The new company will improve the water-power development, which is capable of supplying 1500 hp the year around. Electricity will be generated and sold in Oregon and in other nearby towns.

Three new Leffel turbine waterwheels, with Lombard governors, will be installed and they will drive a General Electric 600-kw, 60-cycle, three-phase, 2300-volt alternator turning at 200 r.p.m. The three turbines drive on the generator shaft and are arranged to be cut in or out by friction clutches. A second unit of three turbines and one generator of the same size will be placed in commission after the initial equipment is in operation. New switchboard equipment has been ordered, including Tirrill regulators. The water-power plant is reinforced by a steam plant of 500 hp, which will be doubled, new boilers and engines being needed.

A transmission line is being built from Oregon to Franklin Grove, 14 miles distant. The voltage of transmission is 13,200, and three Kuhlman step-up transformers of 200 kw each, placed in the generating station, will raise the generator voltage of 2300 to the line voltage. It is the intention, by the new additions and by rebuilding the old plant, to put the equipment of the new company in first-class condition throughout. Twenty-four-hour service will be given from the plant. Mr. A. M. Searles, of Chicago, who is an electrical man of long experience, is the general manager of the Oregon Power Company, and he is superintending the construction and installation of the new plant.

CURRENT NEWS AND NOTES.

HEADLIGHT REFERENDUM.—The railroad companies in South Dakota will take advantage of a clause in the State Constitution to have a referendum vote on a measure which recently passed the Legislature requiring locomotives to carry electric headlights of 1500 cp.

FIFTY ELECTRIC ELEVATORS FOR A DEPARTMENT STORE.—In a new department store being built in New York City for Gimbel Brothers, of Philadelphia, there will be 50 electric elevators. About 7000 people will be employed in the building, which was designed by the D. H. Burnham Company, of Chicago.

NAVAL LONG-DISTANCE WIRELESS.—Prior to awarding the final contract for the 3000-mile naval wireless telegraph system centering in Washington, a series of tests, lasting probably three months, will be carried on at Brant Rock, Mass. Lieut. Geo. C. Sweet will represent the Navy Department at these tests.

NEW YORK-CHICAGO WIRELESS.—Wireless communication was established on Sunday night by the United Wireless Telegraph Company between a station on the top of the Waldorf-Astoria Hotel, New York City, and one on top of the Auditorium Annex, Chicago. The New York *Times* has arranged for a Chicago news service with the operating company.

FLORIDA ELECTRICAL ASSOCIATION.—At a meeting held April 21-22 by Florida electric light men, at Orlando, a State Electrical Association was formed, and the following officers elected: President, Mr. H. A. Grant, Orlando; vice-president, Mr. W. H. Bostwick, Jacksonville; secretary and treasurer, Mr. G. F. Doig, Gainesville. Directors: Messrs. F. E. Fletcher, Tampa; C. H. Ellis, Tallahassee.

TELEPHONE RATES IN JAMESTOWN, N. Y.—By a vote of 7 to 5 the Common Council of Jamestown, N. Y., has granted the Home Telephone Company of that city permission to increase its rates as prayed for in the petition mentioned in the issue of April 29. The permission is conditioned on the payment of $3,000 by the company to the city in settlement of litigation relating to the payment of percentages on business done. There are also some other stipulations relating to installation of telephones and the payment of percentages in the future.

ELECTRICITY IN COAST DEFENCE.—At the regular monthly meeting of the Boston Section of the American Institute of Electrical Engineers, held in the auditorium of the Edison Building, Boston, April 21, with Dr. A. E. Kennelly in the chair, a paper was presented by Captain Clifton C. Carter, U. S. A., on "Mechanical and Electrical Engineering Problems and Practices Relating to Coast Defence." The talk was illustrated by lantern slides. On account of the military nature of the subject it was deemed best to withhold the matter discussed from publication.

A JOKE BY PRESIDENT ELIOT.—In referring to his promised list of books to occupy 3 ft. of shelf room and the reading of which would impart a liberal education, President Eliot, of Harvard, said that the compilation involves a difficult problem, in the solution of which he fears to make the error of the Bostonian who bought an electrical massage machine. The machine arrived in parts, and the Bostonian could not put it together. Finally he compared the parts with the invoice, and then, in high dudgeon, wired to the manufacturer: "Machine shipped most carelessly; 110 volts missing."

TELEPHONE REGULATION IN ILLINOIS.—Two bills have been introduced in the Illinois Legislature providing for the regulation of telephone rates in that State. They fix maximum rates for all localities which involve some material reductions from the present schedules, and require an interchangeable service between all of the companies located in the same territory.

NEW ENGLAND N. E. L. A. CONVENTION DELEGATION.—Very desirable arrangements have been completed for the transportation of the New England delegation to the June convention of the National Electric Light Association at Atlantic City, including reduction in fare and special cars. Mr. Charles H. Hodkinson, 70 State Street, Boston, is master of transportation for New England.

CONVENTION OF AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION.—The annual convention of the American Street & Interurban Street Railway Association will be held at Denver, Colo., Oct. 18, 19, 20, 21 and 22. Exhibits will be displayed in the new Denver Auditorium and adjacent space. Mr. B. V. Swenson, 29 West Thirty-ninth Street, New York City, is secretary of the association.

COLORADO CONVENTION.—The Colorado Electric Light, Power & Railway Association will probably hold its next annual convention in Denver in the week of Oct. 11-16. This is the week before the convention of the American Street & Interurban Railway Association and its affiliated bodies in Denver, and no doubt many members of the State association interested in railway work will arrange to attend the national electric railway convention of the following week.

SWINDLER USED MARCONI'S NAME.—New York detectives have recently arrested a man by the name of Horace G Robinson who, according to the police, has swindled confiding citizens in various parts of the country out of $1,500,000 by selling stock in bogus Marconi wireless companies. The system followed, so it is charged, was to travel over the country delivering lectures on the wonders of wireless and then taking subscriptions to the stock of mythical companies that he promised would bring in fabulous returns.

WIRELESS AT THE LOUISVILLE SHOW.—In an article in our issue dated April 15 on the Louisville electrical show it was stated that the wireless exhibit was not connected for demonstration at the opening of the show. We are informed by the Marconi company that this statement is in error, as both stations in the building were in working order at the opening of the show and remained in actual operation until the close, and that on the first day over 150 messages were transmitted from one station to another. The sets used were standard Marconi ship equipments.

ELECTRICITY IN AGRICULTURE.—Mr. William Low, of Balmakewan, Kincardineshire, Scotland, will experiment on a large scale with the application of electricity to agriculture. About 23 acres, divided in a number of fields, will be utilized for this purpose, each field including a non-electrified or controlled plot for the purpose of comparison. A network of wires will be run over the fields at a height of about 16 ft. from the ground. The poles will be put 200 ft. apart one way and 300 ft. another way. By means of transformers the voltage for the network will be raised to 100,000.

NEW USE OF THE X-RAYS.—In a lecture at Boston on April 26, Prof. Charles R. Cross, of the Massachusetts Institute of Technology, emphasized the widening scope of radiography. One of the latest applications considered was the use of the rays in detecting the presence of pearls in oysters, along the lines developed by Dr. Raphael Dubois, professor of physiology at the University of Lyons, France. Radiographs of 6000 oysters can be taken in one minute without injuring the shellfish and those containing no gems are put back into the sea. Others which contain small pearls are carefully kept in nurseries and allowed to develop.

FIRE ALARMS BY TELEPHONE.—In Chicago about 90 per cent of all the alarms of fire are sent to the fire department first by telephone and later, if there is a fire of any magnitude, by "pulling" a fire-alarm box. The Chicago Telephone Company sends monthly reports of these telephone fire calls to the chief of the fire department, and in general keeps in close touch with the department in the matter of transmitting alarms. During 1908 there were 8724 "fire calls" transmitted by telephone in Chicago, the number ranging from 522 in May to 1154 in August. During the same year there were 53,982 "police calls" by telephone, varying from 3505 in January to 5334 in September.

CENTRAL-STATION DIRECTORY.—The April half yearly edition of the *McGraw Electrical Directory,* isssued by the McGraw Publishing Company, is just out, and contains no less than 666 pages of closely printed data as to the industry. Every plant reporting is shown in full details of physical equipment, rates, officers, etc., and we are glad to say that the stations now failing to report are insignificant in number and in gross output or income. The total of stations brought to account in this country is 5264; in Canada 406; in Mexico 63, and in the West Indies 7, making a grand total of 5740. Of these no fewer than 3193 report themselves as carrying electrical supplies. The gain in plants over the last issue, six months ago, is 215 net. Fifteen States—California, Georgia, Illinois, Indiana, Iowa, Kansas, Massachusetts, Michigan, Minnesota, Missouri, New York, Ohio, Pennsylvania, Texas and Wisconsin—account for 3410 stations.

ELECTRIC CLUB OF CHICAGO.—At the weekly luncheon of the Electric Club of Chicago on April 28 Mr. D. W. Roper, assistant chief operating engineer of the Commonwealth Edison Company, gave a talk on "The Transmission and Distribution of Electricity for Light and Power in Large Cities." Among those taking part in the general discussion were Messrs. J. R. Deane, Guarantee Electric Company; William Carroll, city electrician; James Lyman, General Electric Company, and W. L. Abbott, Commonwealth Edison Company. Mr. Glenn Marston, of New York, spoke briefly, by invitation, on the subject of maintaining cordial relations between central stations and the public. Mr. C. A. S. Howlett, president of the club, who was in the chair, announced the appointment of a civic committee consisting of Messrs. F. J. Postel, chairman; J. R. Cravath, H. W. Young, J. G. Pomeroy, Stephen P. Gardner and W. R. Bonham.

ELECTRIFICATION OF STEAM RAILROADS.—At the April meeting of the Ithaca A. I. E. E. Section, Friday, April 23, Mr. Frank J. Sprague delivered an address on the subject of the electrification of steam railroads. In a comparison of direct-current and single-phase, alternating-current equipments, Mr. Sprague stated that the latter system had in some instances proved a disappointment on account of the lack of overload capacity of the single-phase type of motor. He showed that for cars of the same carrying capacity, operating at practically identical schedules, the cost of power at the generating station was the same for both systems. The weight of the single-phase equipment was, however, greater than the direct-current equipment for the same capacity, and owing to this greater weight the initial cost of motors and of car body and trucks is greater for the alternating-current system. In summing up his comparison of the two systems he declared that the direct-current system is preferable for the usual interurban or trunk-line railway for the following reasons: 1. Same or lower first cost. 2. Greater reliability. 3. Larger reserve capacity. 4. Lower total maintenance cost. 5. With increased frequency of stops a higher schedule.

System of the Lockport Light, Heat & Power Company.

THE Lockport Light, Heat & Power Company, of Lockport, N. Y., was formed a little over a year ago for the purpose of taking over the properties of the Lockport Gas & Electric Light Company and the Eeconomy Light, Fuel & Power Company. The formation of the company and the consolidation of the two old companies were made strictly in accordance with the terms of the decision of the Public Service Commission of the Second District of the State of New York. The Lockport Gas & Electric Light Company was organized over 50 years ago and for 30 years its sole business was the manufacture and sale of illuminating gas. About 27 years ago it bought out a small company which was then engaged in selling electricity on a limited scale and since then has carried on the business of selling electricity as well as gas. The company received energy for a time from the Niagara Falls Power Company, but in 1905 entered into a contract with the Niagara, Lockport & Ontario Power Company for energy at the rate of $10 per hp-year. The large switching station of the Niagara, Lockport & Ontario Power Company is just outside the city limits and the Lockport Gas & Electric Light Company was the first customer to be supplied with energy through this switching station from the station of the Ontario Power Company on the Canadian side of Niagara Falls.

The Economy Light, Fuel & Power Company was organized in 1905 to take over the local steam-heating business of the American District Steam Company. In this business there had been invested a large amount of money for a central steam-generating plant and an expensive distribution system. In 1905 the idea was conceived that the steam produced at a properly constructed central station could be utilized in producing electrical energy for lighting and power purposes and that the exhaust steam from the engines could be utilized for heating. Accordingly the company obtained a local franchise and prepared to enter the field of electric lighting. A lively warfare ensued between the two companies and the Lockport Gas & Electric Light Company began to engage in the business of supplying steam heat. Happily the price for electricity for motor circuits in Lockport was at that time lower than in any other city in the country and the price of energy for lighting circuits was lower than in perhaps 99 per cent of the other towns and cities of the country, so that while the rate for public arc lighting was reduced because of the competition for the contract, rate cutting was not indulged in for obvious reasons. It is significant, however, that a steam-driven station using exhaust steam for heating purposes was able to compete with a company selling Niagara energy, the rate for motor circuits ranging from 2 cents per kw-hour for the first 1000 kw-hours or less to 0.64 cent for energy in excess of 80,000 kw-hours, subject to a discount of 25 per cent for payment before the fifteenth of the next month. Energy in bulk was also sold under contract method of charging on the basis of peak demand at prices ranging from $18 to $22 per horse-power per year net.

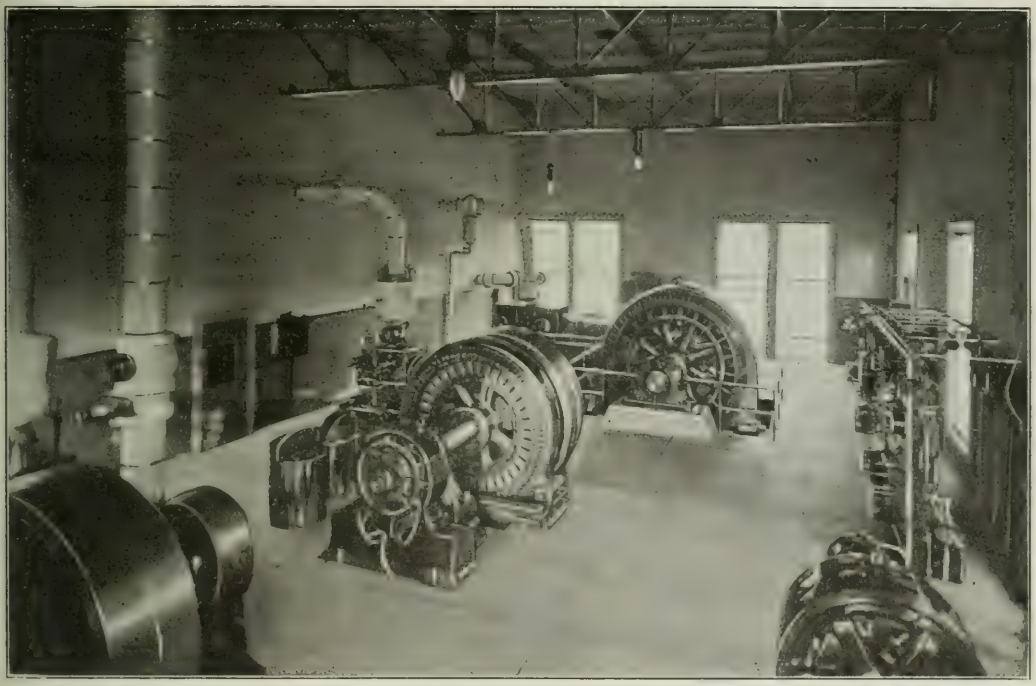


FIG. 1.—ELM STREET STATION OF THE LOCKPORT LIGHT, HEAT & POWER COMPANY.

ELM STREET GENERATING STATION.

The plant which was erected by the Economy Light, Fuel & Power Company on Elm Street consists of approximately 1800 hp of Heine and Stirling water-tube boilers which are operated under a steam pressure of 155 lb. At present there are installed one 600-kw, 2300-volt, 25-cycle, two-phase General Electric alternator, direct-connected to a 810-hp Ball engine; one 260-kw, 2250-volt, 60-cycle, three-phase Westinghouse alternator and one 190-kw alternator of similar output and make. The latter generators are direct-connected to Fleming four-valve, high-speed engines designed to operate during the heating season under a back pressure of from 6 lb. to 10 lb. Besides the direct-connected exciter sets there is a 30-hp motor-generator set provided, and to supply a limited amount of direct current a synchronous motor-generator set, rated at 85 kw, is installed. A 10-hp induction motor is connected to the shaft of the set and is used in starting it

The building is of steel construction, the foundations being of concrete and stone, the side walls of brick, and the front of the building of cut stone and pressed brick. A double roof is provided over the engine room, the inside roof being of book tile. The engine-room floor is of concrete and expanded



FIG. 2.—COAL-STORAGE EQUIPMENT IN REAR OF STATION

metal upon heavy steel I-beams. The engine foundations are built entirely of concrete and are of such depth that there is no vibration in the plant. The boiler-room floor is the same as the engine-room floor, but beneath the boiler-room floor is a tunnel, 9 ft. x 12 ft., through which coal is conveyed on an endless belt operating over rollers. The tunnel is also provided with a car and track for removing ashes by means of a hydraulic elevator which carries the ash-laden car to the track overhead, whence the ashes are deposited in a bin and removed by cart. The fuel purchased is mine run or lump bituminous coal, which is first screened and the smaller coal and dust burned under the boilers while the larger coal is sent to the gas plant owned by the company. The coal is dumped directly upon the crusher, which brings it to uniform size, the crusher discharging upon an endless belt carried through the tunnel to a link belt and bucket elevator. It is there carried up into a tower 78 ft. high and provided with large storage bins. These bins discharge coal into cars which are weighed and convey the coal to a second series of storage bins located over and just in front of the various boilers, chutes from the bins conveying the fuel to motor-driven Murphy automatic stokers and smoke consumers with which the plant is equipped.

Natural draft is used, there being two round brick stacks, one 5 ft. x 127 ft. and the other 7½ ft. x 155 ft. The roof over the boiler house is of concrete and expanded metal construction on steel trusses. Beneath the roof are located Green fuel economizers, which utilize the stack gases for the purpose of purifying and heating the water. There is also located in the plant three 20,000-gal. purifying tanks for water, the Tweedale system of purification being in use. In this alum and caustic soda are employed and by means of phenolphthale in the water is tested at frequent intervals. If the water in the test tube is deep pink, alum is added, and if no pink color is shown, caustic soda is added. A faint pink color indicates that the water has been properly treated. Back of the station is a large lot which is used as storage, and on which is carried about 2500 ton of fuel. Beneath this lot also are located tunnels in which are belt conveyors, which, when required, bring the coal to the elevators.

The station operates in parallel with the other station on Race Street, but is used only during the heating season and as a reserve during the summer season should the Niagara transmission line meet with any mishap. The distribution from this station throughout the business section of the city is through underground conduits of multiple duct type in which are located lead-covered cables. Energy is distributed through this underground system at 2200 volts. Subway transformers are used throughout the business section and aerial transformers in the manufacturing and residence districts. In the same underground system are also direct-current wires and low-tension current for commercial use. The switchboard is very complete in every detail, having all the usual instruments and including also Tirrill regulators, graphic recording meters, etc.

The company has between six and seven miles of underground steam mains supplying steam for heating to approximately 12,000,000 cu. ft. of space in residences, churches, schools, public buildings and business houses, the number of customers being about 500. The first underground steam construction was installed in 1876 and has since that time been extended every year. During the past seven or eight years the old construction was taken up and the present standardized type of construction, known as the improved Holly system, was put down under the direction of the contractor, the American District Steam Company. At the time of this reconstruction the mains were also increased in size with a view of their being operated in connection with the electric light and power plant. The exhaust steam due to the operation of the engines is fully utilized during the period from the last of September until about the first of June, for heating. The steam is sold strictly by meter, what is known as the Simplex condensation meter being used. The buildings are fitted in the ordinary way, either for one or two pipe steam or for the atmospheric system, or the steam is used to heat water through the use of the American District Steam Company's design of hot-water heaters, where hot-water

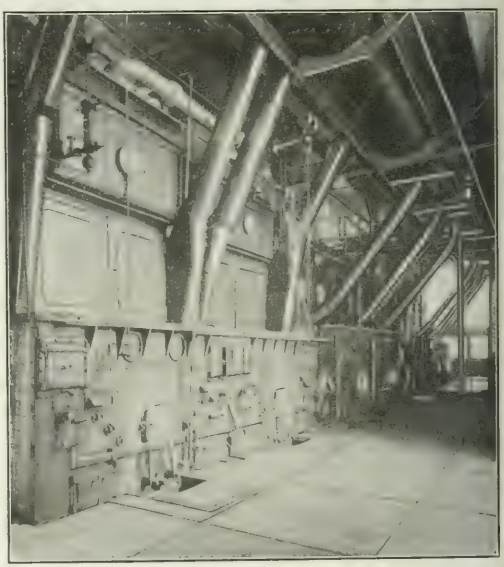


FIG. 3.—BOILER-ROOM OF ELM STREET STATION.

heating is desired in any building. Steam is also used in the heating of water for plunge or shower baths and for general domestic use in the same manner. The pressure carried in the underground mains ranges from 1 lb. to 7 lb., depending upon the outside temperature, wind velocity and humidity.

RACE STREET STATION.

The older station of the company is located on Race Street and the Erie Canal overlooking the famous locks. The site was formerly occupied by a flour mill and possesses the first right of any water not wanted in the canal. By by-passing the locks, a head of 51 ft. is available, to utilize which a 500-hp S. Morgan Smith wheel is installed. At present, while the work on the Barge Canal is under way, no water is available for power purposes. As a reserve to the water power there is a 550-hp Allis engine installed in the basement of the plant which is supplied with steam from two 300-hp Manning boilers fitted with flat grates for burning bituminous coal. A 96-ft. line shaft on the operating-room floor is belted to the engine and the shaft is also connected to the waterwheel through rope drive. The engine and waterwheel may be run together, the engine acting as the governor. Friction clutches are provided for the various belted units.

The present equipment in the station, belted to the shaft, comprises two 200-kw, 25-cycle, two-phase, 2200-volt alternators with belted exciters and four series arc machines. There are also two 200-kw, 25-cycle rotaries giving a 250-volt, direct-current service, the center of the transformers being tapped for the neutral, and a 750-kw frequency changer. The alternating-current side of the rotaries is provided with a Stillwell regulator and the rotaries are arranged to operate as synchronous motors, converters or both. They are provided with starting motors, and have friction clutches. One of the 25-cycle generators is used as a motor to drive the line shaft to which the arc machines are connected.

Energy from Niagara is received at this station through a transformer station on Transit Street, being brought underground in two lead-covered, paper-insulated, three phase cables 2000 ft long, made by the Standard Underground Cable Company, for 12,000 volt service. In the station on Race Street there are two 300-kw transformers stepping down the voltage from 11,000 to 2200 for local service. Last year the company purchased from the transmission company 9,561,256 kw-hours of energy. Connected to its lines are a number of manufacturing concerns using large amounts of energy.

The rates for energy for lighting range from 10 cents per kw-hour for the first 50 kw hours to 6 cents when over 400 kw-hours are consumed, less a 25 per cent discount. The rates for energy for motors are as already given elsewhere. The bulk-rate consumers must pay in accordance with the average of the highest one-minute peaks, as shown by a graphic recording wattmeter and are required to pay a minimum of 60 per cent of their maximum minute peak. The rate for gas is $1 net per 1000 cu. ft. and the rate for steam heat is 50 cents per 1000 lb of condensation less a discount of 15 per cent. The company advises its customers to use steam for heating, gas for cooking and electricity for lamps and motors. Mr. O. M. Diall is the general manager of the company.

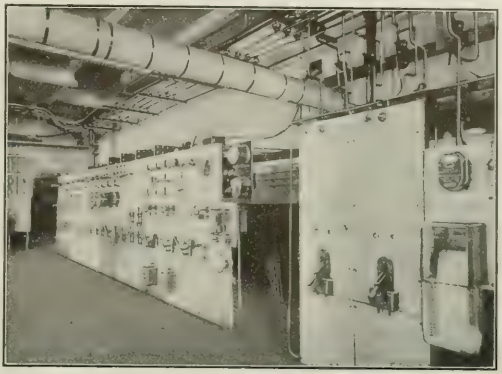


FIG. 5.—SWITCHBOARD IN RACE-STREET STATION.



FIG. 4.—GENERAL VIEW OF THE RACE STREET STATION OF THE LOCKPORT LIGHT, HEAT & POWER COMPANY.

The Electrical Equipment of the Gorham Manufacturing Company.

By C. E. Fairbanks.

THE electrical equipment of industrial plants varies within much greater limits as compared with each other than is ordinarily supposed on account of the considerable range in the demand, both as to quantity and type of current required in the various processes. In planning the electrical equipment—especially that for generating purposes—it is necessary to consider not only the lines of manufacture that the plant may be engaged in at present, but also any other branches that the concern may take up at some future day. This statement applied to the Gorham Manufacturing Company which, while having a world-wide reputation for its gold and silver products, has, within the last 10 years, established a reputation almost as extensive for its products in statuary bronze, architectural bronze and church ware. The extensive use of electricity in the various processes has been one of the means employed in obtaining the degree of refinement necessary in artistic work of these types.

In a concern as old as this one it has naturally followed that the development of the electrical art has involved constant substituting of more economical and refined equipment for what is regarded as unsuited for the present demands. This fact explains to some extent why part of the plant equipment requires direct current, whereas the remainder uses alternating current.

In order to provide facilities for handling its products in a completed form the Gorham company has completely equipped departments for photography, printing, paper boxes, cases and cabinets, etc., each of which has its special and varied requirements in the use of electricity.

All the buildings are of standard mill construction and are three stories high; most of them have basements, making a fourth story; those buildings not having basements are provided with a tunnel for piping, conduits, etc. Originally all of the motors and lamps were operated by direct current. However, when it became necessary to put up additional buildings and extend the operations of the plant, an alternating-current system was decided upon for distribution of energy to motors. The engine-driven shafting was changed to motor-driven with the single exception of the preparatory department, in which are located the heavy stamps and rolls. Three-phase induction motors were installed, and direct-current motors were removed as the opportunity permitted. Direct current is required, however, for quite a number of purposes other than for driving motors. This current is supplied by four 125-volt generators, three of which have a rating for 800 amp and the other for 300 amp. This latter generator and two of the former are directly connected to Harrisburg compound-condensing engines, whereas the other 800-amp machine is belt-connected to a countershaft operated by a 350-hp simple Corliss engine, which is used to drive the stamps in the preparatory-room, and is directly connected by 3-ft. bevel gears to the rolls. This generator was installed for the two-fold purpose of putting an additional load upon the engine and to care for any overloads that might occur on the Harrisburg engines. As this generator is operated in parallel with the others and is located at a point away from the generating plant where the switchboard is located, an indicator is used to show at the plant when the Corliss engine is being started or shut down, and also to show at the Corliss engine when a load has been put on or taken off this generator. A "Reversite" circuit-breaker is also provided at the switchboard for this machine.

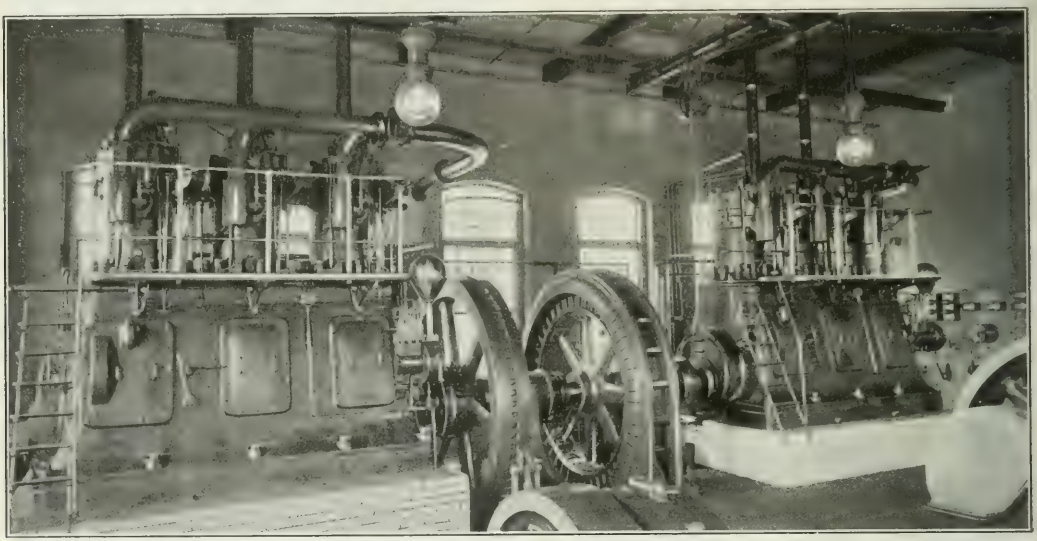


FIG. 1.—OIL ENGINES AND ALTERNATOR.

One of the most important users of direct current is the plating department in connection with gold and silver work; a total of 60 cells of storage battery are used for the tanks. The cells are grouped in weather-proofed housings on the roof. Switches are so grouped in the plating-room that any number of cells may be connected to the tanks as required to obtain the necessary voltage and amperage; a rheostat for each tank permits of further regulation. The cells are recharged at night directly from the 125-volt feeder through a regulating rheostat. The batteries for the electric automobiles, as well as the spark batteries for the gasoline cars, are also charged from these feeders. An automatic cut-out provides for any possible interruption of the supply. In the photo-etching rooms direct current is used for the Cooper Hewitt printing lamps, as well as for the electro-etching tanks. Another extensive user of this current is the department in which bottles and vases are first dipped into a metalicized solution previous to having silver deposited on them to any desired thickness; subsequently the design is outlined and the plating process is reversed, so that the surplus metal is cut away and the design remains entwined

about the glass. The printing lamps used in the photographic department are of the 28-amp direct-current type. Direct current is also required somewhat extensively in the assaying department and chemical laboratory. In all of the departments thus far named motor-generator sets are used to furnish

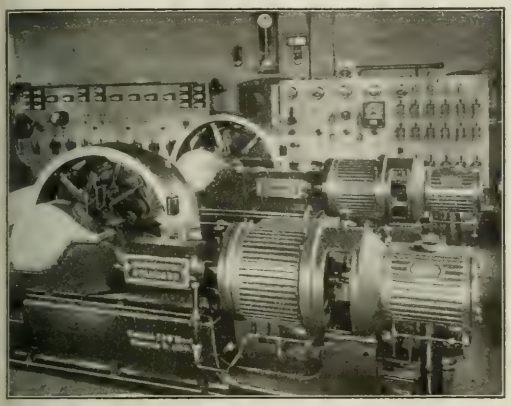


FIG. 2.—VIEW OF ONE END OF POWER PLANT, SHOWING SWITCHBOARDS AND ENGINES.

the current. These sets are driven at present by direct-current motors, as they were installed before the installation of the alternators. Numerous small direct-current motors, such as exhaust fans, desk fans, etc., as well as some of the larger direct-current motors up to 30 hp are in service for the reason that their operation is continuous for 16 hours per day and until the present plans are carried out alternating current is not available after 6 p. m.

The general lighting system for the buildings consists of 4900 incandescent lamps and about 100 arc lamps or tungsten clusters. These are operated from the direct-current system as these generators are in service 24 hours per day. The attached curve shows the demand throughout the average day. The night lamps are required by the watchmen and some of the motors that operate at night. The arc lamps are being replaced with clusters of tungsten lamps using from four to six 60-watt lamps per cluster. Not only does this arrangement give a more uniform candlepower, but the color value of the light is vastly superior around machinery, especially where oil is in evidence.

Tungsten lamps are used in circular arrangement to illuminate the dials of the tower clock; also in departments requiring a high grade of light, such as the engraving, shipping, accounting and display departments. The grounds are illuminated with arc lamps, but incandescent clusters are located at the corners of the buildings and on the bridge. The statuary-bronze building, which is 90 ft. x 200 ft., is lit by four flaming-arc lamps which replaced 12 enclosed arcs. Yellow rays have been found to penetrate the smoke and dust of the foundry much better than any other. Direct current is required in this building to operate the four motors on the 25-ton traveling crane.

At the present time there remains a total of only 200 hp in direct-current motors; this number will be much reduced as soon as additional contemplated alternating-current generators are installed.

The motors for the factory consist of 800 hp in induction motors of various ratings up to 40 hp. In the case of individual machines, such as pumps, planers, etc., the motors are directly connected, but in the case of shafting the greater proportion are chain-driven. The service is 550 volts, three-phase, 60 cycles, the energy being furnished by a General Electric alternator which is directly connected to a 500-hp Diesel oil engine.

The air compressors for this engine are motor-driven and are located in the pump building with other compressors. A 100-kw turbine outfit will shortly be placed to operate in parallel with this engine and to be used at night and other times when energy is required for overtime work—of which there is naturally considerable. At present the overtime is taken care of by energy furnished by the Narragansett Electric Company at a pressure of 2200 volts through three 75-kw transformers.

The switchboard has an indicating wattmeter and an overload-releasing oil switch for each set of feeders. A separate panel is provided for the Narragansett Company's service; besides the regular hand-operated oil switch there is a solenoid-actuated oil switch located in the transformer-room with a controlling switch on the panel above referred to. The circuit for this switch continues on to the alternator panel, so that the two systems may be thrown in parallel. A synchroscope is used for indicating synchronism. The switchboard is equipped with the usual watt-hour meter, power-factor meter, ammeter for each phase, etc. The alternator is excited by energy from the direct-current switchboard. For machinery requiring a variable speed use is made of variable-speed induction motors. The polishing-room has in service approximately 280 polishing heads, which are driven in groups of from 20 to 30 by 10 hp motors. A 40-hp motor directly connected to a double Sturtevant fan is used for the twofold purpose of drawing fresh

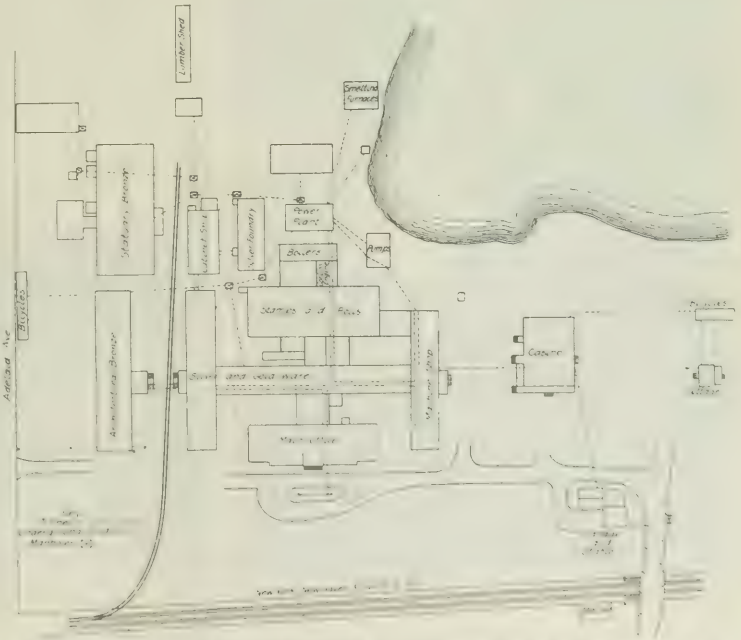


FIG. 3.—ARRANGEMENT OF BUILDINGS, GORHAM MANUFACTURING COMPANY, PROVIDENCE, R. I.

air into the room and carrying the dust from the polishing heads; this dust is strained and the silver is reclaimed. Induction motors are also used to drive the pressure blower employed for feeding oil into the silver and bronze melting furnaces. Besides this, air at 80 lb. is furinished for pneumatic

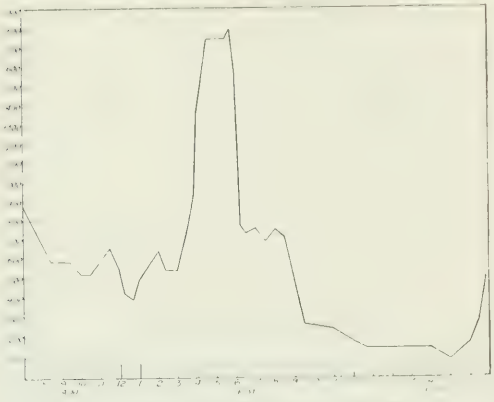


FIG. 4.—LOAD ON DIRECT CURRENT GENERATOR.

tools. Quite a number of portable electric drills, grinders and other types of small tools are in service. In the pattern and carpentry shops all sawdust and shavings are gathered by a motor-driven exhaust fan and delivered to the boiler-room. Steam for the engines, jet blowers, scrubbing tanks, etc., is

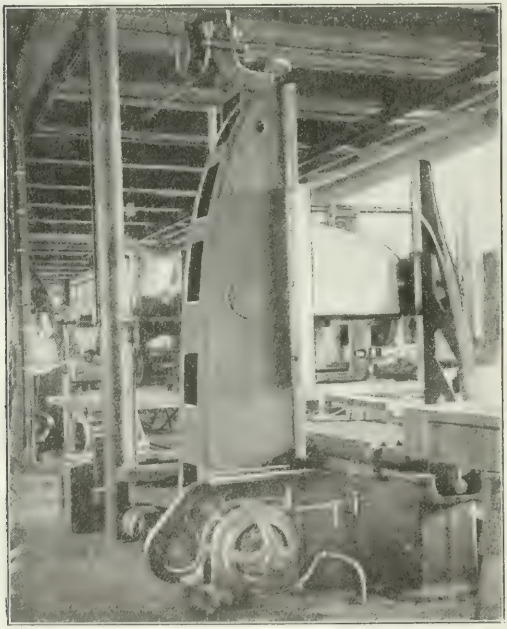


FIG. 5.—DIRECT CONNECTED OPEN SIDE PLANER.

furnished by a battery of six vertical Corliss boilers, which will shortly be replaced by Stirling boilers in a new boiler-house.

A card record is kept of all motors and generators of any size or type. The face side of the card gives all data regarding the machine, its location and what it is used for. The reverse side has space for tabulating any former history of the machine and all repairs made from time to time. The shop number assigned to a machine not only identifies the machine in the inventories, but also gives the location. For example, 2 C 19, means that the motor is on the second floor of building "C," and is No. 19. A map shows the location of No. 19 in the building and also in what department it is.

Not the least important of the electrical equipment is that for the time system, which is operated by a battery of 50 cells of storage battery. The time system includes 40 secondary clocks operated by a master clock, which is, in turn, synchronized with a tower clock. This master clock also operates the relays controlling the work gongs and time-check boxes. The former consists of 33 8-in. and 14-in. electro-mechanical single-stroke gongs located one in each department; these strike at the hours of 7, 12, 1 and 6. The same gongs are used in conjunction with the fire-alarm system; 30 stations are connected by cable to an annunciator, and when fire is recorded the alarm is sounded throughout the factory by striking the signal indicating the station; a trained fire-fighting force having reels, extinguishers and hose stations constitute a part of the working force. A double 18-in. x 10-in. x 12-in. Worthington pump is always ready for instant service. The check boxes are located at the entrances to the buildings and are connected with the various floors by tubes; an electro-mechanical movement operates these boxes each 15 minutes so that a new compartment is presented for the reception of checks. The master relay which controls these circuits is so connected to the one for the gongs that they operate in synchronism at the proper hours. This arrangement records the working time of between 2000 and 3000 persons.

The Casino building, in which are located dining- and lunch-rooms for men and women, has also spacious reading-rooms, shower baths, etc. This building is electrically equipped throughout with every convenience for the laundry, lighting, etc. At present the cooking is done on coal ranges.

The telephone service is furnished by 85 instruments connected to a Kellogg 100-line common-battery board, the energy for which is furnished by two banks of 11 "Chloride" cells.

Excepting the 2200-volt service mains which enter the grounds at the rear of the power plant all feeders, cables and wires are underground. To reach the buildings tile ducts are laid so as to radiate from the power plant, with manholes at proper points for the easy pulling of the cables and for the further purpose of diverting the ducts in other directions. The manhole heads are raised above the ground level about 4 in. so that in heavy rains no water will run inside; all ends of ducts

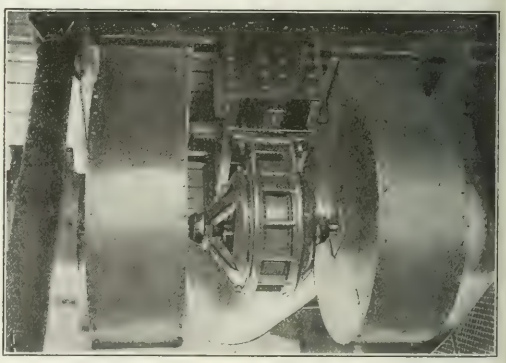


FIG. 6.—MOTOR DRIVEN EXHAUST FAN FOR THE POLISHING ROOM.

are sealed as a further preventive. The buildings have either a basement or a pipe tunnel and all cables and wires are carried in 3-in. piping laid on brackets in these tunnels. The motor and lamp wires are run open on the ceilings, but all wires on side walls and where they can be reached are in conduit. The time-system circuits are carried from the power plant, where are located the master clock and relays, through a 40-wire rubber-

insulated cable to a point at the center of the buildings; it is there terminated in a slate terminal box, and smaller cables of a similar nature ramify to sub-centers of distribution. The individual instruments are reached with No. 14 duplex wire. The telephone circuits are in lead-covered, paper-insulated cables. The major portion of the electric lamp wiring is on open porcelain cleats, although a considerable portion is placed in conduit. Weather-proof and moisture-proof switches and sockets are used in damp places, the gas house and places of a similar nature. All of the wiring is of rubber insulation with single-braid or double-braid covering, as conditions demand.

The mechanical equipment of this factory has many interesting features. It has been made to harmonize with the electrical equipment, so that there is a close relation between the two, and the motors carry three-fourths to full load all of the time, thus keeping the loading factor for the entire plant up to 80 per cent.

Electricity in Buffalo, N. Y.

By George J. Kirchgasser.

SINCE the introduction of energy from the hydro-electric plants at Niagara Falls, the employment of electricity for lamps and motors has increased wonderfully. Its increased use for motors has been most striking in recent years, the Cataract Power & Conduit Company now claiming to supply energy for almost 75 per cent of the manufacturing industries in Buffalo. According to recent rating, this company stands fifth in regard to kw-hour output; the Niagara Falls Power Company being first. Old industries in Buffalo are steadily changing from steam to electricity; new ones are equipped to use Niagara Falls energy, and a large number of individual motors for industrial purposes have been installed within the last four or five years, thus filling out the load curve during the regular working hours of the day. In 1903 and 1904 the curve indicated a low day load with the peak between 4:30 and 5:30 p. m. The use of small motors for various purposes and the introduction of household electric appliances have also helped to create a better load factor.

Electricity was first brought to Buffalo from Niagara Falls (Niagara Falls Power Company) about 12 years ago, the tension on the transmission lines then being 11,000 volts. In a short time the output of the plants was increased, the transmission voltage raised to 22,000, and by the latter part of 1904 nearly 25,000 hp was delivered at the Buffalo terminal station. Since then there has been a still greater percentage increase, energy now being delivered from plants on both American and Canadian sides of the Falls. In the American plant electricity is generated at a tension of 2200 volts and is stepped up to 22,000 volts, at which pressure it is delivered at the Buffalo terminal station "A," at Niagara and Ontario Streets. The alternators in the Canadian plant (Canadian Niagara Power Company) are wound for 11,000 volts, about 50,000 hp being available when the last bank of transformers is installed at the new terminal station "B," which is situated on the Niagara River at the junction of Front Avenue and Niagara Street. This station is only about 1½ miles from the business center of the city and about three miles nearer than terminal station "A." By running the transmission lines on the Canadian side, which is all open country and thinly populated, to directly opposite station "B," a voltage of 22,000, with its economical transmission and overhead construction, could be run to within a short distance from the heart of the city. Substations are fed by underground cables run in ducts at a voltage of 11,000, and the arrangement is such that energy can be delivered from both terminal stations or from either. The underground cable lines from station "A" are of a greater length and, therefore, more costly than those from terminal station "B," which has the more central location. The two power plants that supply Buffalo have an output of 155,000 hp at present.

As the first transmission lines were brought from the American Falls, the first terminal station had to be placed at the outskirts of the city because of the high voltage of the overhead system. When this station was equipped in 1900 there were seven 2250-kw transformers used to reduce the transmission voltage, which had been raised to 22,000 at the Falls, to 11,000 for distribution to the substations of the city. These transformers are of the oil-immersed, water-cooled type, and when installed were the largest in use. It was deemed preferable to use 11,000 as the voltage for underground cables and suffer the extra copper loss besides the 2 per cent in the transformers rather than use 22,000 volts for the underground transmission. This station's equipment proved sufficient up to 1905, when the increased load became an overload. Since the new terminal station was put in operation the load has been divided and is well taken care of.

The arrangement of this terminal station is very compact and simple. On one side are the incoming high-tension switchboards and on the other are the 11,000-volt distributing switchboards supplying the substations. There are three banks of transformers of 9000 kw each and a fourth bank nearly finished, making a total rating of about 50,000 hp. There are four three-phase, 22,000-volt, 25-cycle transmission lines entering on the high-tension side. The span across the Niagara River from Canada is one of the longest of its kind in the world, the distance being between 2100 ft. and 2200 ft. On each side of the river is a large steel tower, about 200 ft. high, which supports the wires. The great length of span causes a very great strain and some trouble has been experienced by the snapping of cables, due to extra weight of clinging sleet during the winter. The first three lines were of aluminum wire, and although each wire is counterweighted, sagging has occurred which at times allowed the wires to swing closer to each other and occasionally caused a display of fireworks out over the river. Three or four cables have snapped and were lost in the river. A bimetallic wire has been used on the fourth line, which has just been completed. This wire has an inner core of steel and an outer surface of copper, and, besides having a greater tensile strength, it is said to have other advantages over the aluminum wire

The Cataract Power & Conduit Company and the Buffalo General Electric Company employ four systems of alternating-current distribution, run overhead from substations at 2200 volts, which are divided as follows:

1. Single-phase, 60-cycle, operating at approximately 104 volts and 208 volts; 104 volts being used almost exclusively for lamps, the hp-rating of motors fed from this system being some fraction of 1.

2. Single-phase, 25-cycle, operating at approximately 110 volts and 220 volts for lamps and motors as on the 60-cycle system. As the motors used on these systems are small, no disturbance is caused to the voltage on starting. The largest motors are a 5-hp and a 15-hp, both of the Wagner type.

3. Three-phase, 25-cycle, operating at 220 volts and 440 volts for motors, rated at 2 hp or 3 hp.

4. Three-phase, 25-cycle, operating at 2200 volts. This is supplied and reduced in private transformer stations to voltages of 440, 220 or 110 for motors and lamps in factories, etc. There are also a number of large 2200-volt induction motors installed about the city, several being added recently. A better rate is the result of having current delivered on the premises of the consumer at 2200 volts.

The direct-current distribution systems are as follows:

1. The three-wire system, operating at approximately 110 volts and 220 volts for lamps and motors. For 110 volts the motors used are very small—¼ hp or less. This system is underground and supplies the down-town district, as it is well adapted for the congested sections and is economical in the amount of copper used.

2. Street arc lighting. This is at 6250 volts, constant current, being separated from all other systems and never used for inside service.

3. Five hundred-volt, for motors only. This is used for the large number of direct-current motors, the rating of which is

usually between 5 hp and 10 hp, though some are much larger and others are as small as 1 hp. As the induction motor in recent years has reached such a high standard, the number of direct-current motors installed on this system has decreased and alternating-current motors, both single and three-phase, are now being installed to a very great extent.

The Cataract Power & Conduit Company distributes the energy from the terminal stations to substations and supplies energy to large motor users and also for lamps in the remote sections of the city; the frequency of all the systems being 25-cycle. The primary function of this company is that of wholesale distributor of power.

The Buffalo General Electric Company gets its energy from Niagara Falls through the Cataract Power & Conduit Company's terminal stations and distributes it through the street arc system, the Edison three-wire system, the 500-volt direct-current system, and nearly all the alternating-current systems for lamps and motors in the city, both 25- and 60-cycle being used. Most of the residential sections are fed from 25-cycle circuits, and almost 25 per cent of the total load of incandescent lamps on the alternating-current circuits are operated at this frequency. In 1905 the rating of transformers operating on 25-cycle lighting circuits was about 20,000 lamps. As this number has increased since then this frequency must be thought satisfactory, except where a number of lamps, say, from 9 or 10 up, are placed short distances from each other. In this case very slight flickering is noticeable with ordinary carbon-filament lamps and marked flickering with tungstens. Where a large number can be seen at one time, the slight flicker of one, happening at the same time as each of the others, is discernible to the eye.

The Cataract Power & Conduit Company has four substations from which 25-cycle current is distributed at 2200 volts.

The Wilkeson Street substation adjoins the Buffalo General Electric Company's main substation and consists of an equipment of 30 250-kw air-blast transformers, making the total rating about 11,000 hp.

The equipment of the Babcock Street substation consists of 18 250-kw transformers, reducing from 11,000 volts to 2200 volts, and three 275-kw transformers reducing from 11,000 volts to 375 volts. These are also of the air-blast type and are in the same building with the Buffalo General Electric substation apparatus.

In the Ohio Street substation the rating of the transformers is about the same as at the Babcock station. This station supplies the southern part of the city.

At East Ferry Street the substation has been in operation only about two years. Alternating current is supplied for the east and northeast section of the city. The arrangement of apparatus is very simple, the high-tension switchboard being on one side and the low-tension distributing panels on the other; of four three-phase, 25-cycle circuits leaving the building overhead, one circuit belongs to the Buffalo General Electric Company. There are nine 300-kw transformers set in rows of three each, and a fourth row is soon to be added. These transformers are of the Westinghouse oil-immersed, water-cooled type, the temperature usually being about 40 deg. C. The outgoing lines are provided with choke coils and multi-gap lightning arresters.

The Buffalo General Electric Company has four substations, the main one being on Wilkeson Street, near the heart of the city, and supplied the entire Edison three-wire system up to a few years ago. Its equipment in detail is as follows: Six synchronous motor-generator sets are used to change the frequency from 25-cycle to 60-cycle for the lighting circuits. The alternators of these sets are rated at 200 kw and generate electricity at 2200 volts, 60-cycle, three-phase, while the synchronous motors are rated at 365 hp, and operate on 350-volt, three-phase, 25-cycle circuits. For the three-wire system there are five dynamos generating at 125 volts, with the following ratings: Two 250-kw machines direct-connected to one three-phase, 350-volt, 370-hp synchronous motor; two 333-kw machines direct-connected to a 1200-hp, three-phase induction motor. The fifth dynamo is of 100-kw capacity driven by an induction motor. Some of this direct current is also used for exciting the fields of the alternators and synchronous motors in the station. A storage battery is used to take up the fluctuations of the load on the Edison system and also to carry the peak.

All (almost 3000 hp) of the 500-volt direct current is generated at this station, except, of course, that used by the International Railway Company. There are three 600-kw and two 200-kw, 500-volt rotary converters used on this system. About 75 per cent of the street arc-lamp circuits are fed from this point. There are 26 Brush arc dynamos (6250 volts, 9.6 amp) located here, 200-hp, 350-volt synchronous motors being direct-connected, some to two and some to three generators.

The Main and Court Street station is built under the sidewalks of one of the busiest corners in Buffalo, and probably not more than one in 10,000 of the many people who pass over this station know of its existence. This subterranean station was fitted up to help out the Wilkeson Street station as the load on the three-wire system had increased to such an extent as to make necessary an increase in underground feeders from the latter station, which is three-quarters of a mile from some points of the business section. The equipment consists of three 186-kw, air-blast transformers reducing from 11,000 volts, together with the necessary oil switch and potential regulator. In addition there is a 500-kw rotary converter, which feeds into the three-wire system at 250 volts.

About two years ago a further increased load on the Edison system made it necessary to install another substation at Swan and Ellicott Streets to take care of the business section farthest away from the Wilkeson Street station. The equipment is also placed underground, and is similar to that in the Court Street substation except that there are two rotaries instead of one.

The Buffalo General Electric Company and the Cataract Power & Conduit Company have their substation equipment under one roof at the Babcock Street station. The Buffalo General Electric Company has one 250-kw transformer; four pairs of Brush street arc-lighting machines, each pair driven by a 200-hp, 350-volt synchronous motor; three motor-generator sets, the generators being rated at 200 kw, each operating at 2200 volts, 60 cycle, and the motors being 570-hp synchronous machines, operating on the 11,000-volt, 25-cycle system. For exciting the fields of the alternators and synchronous motors there are three motor-generator sets, the motors, two 30-hp and one 15-hp, being of the induction type and operating at 350 volts, 25-cycle; the generators are wound for 125 volts direct current. The 60-cycle alternating current from this station brings up the total for the city at this frequency to 1800 kw.

By employing synchronous motors at two substations, the Buffalo General Electric Company is able to keep the power factor of the system near unity. The synchronous motor is also practicable at 11,000 volts, while the induction motor is not, and constant speed is also assured regardless of drop in line voltage.

Four years ago the International Railway Company, of Buffalo, received from Niagara Falls about 7000 electrical hp. At the present time this company has a total equipment at its several substations capable of supplying between 20,000 hp and 25,000 hp of direct current at 500-550 volts. There are four substations, the main one being on Niagara Street within 100 ft. of the Cataract Power & Conduit Company's terminal station "B." Here there are two 1000-kw and one 400-kw rotary converters, three 750-kw, engine-driven, 500-550-volt, direct-current generators, and two 1500-kw, engine-driven alternators wound for 11,000 volts. These latter machines are used at peak load and in case of interruption of Niagara Falls circuits. The transformers are of the air-blast type and current at 11,000 volts is received from either terminal station "A" or "B" (that is from either the American or Canadian plant) or from both. This has bettered former conditions, when station "A" supplied all the electricity to the city. As a street railway load is liable to sudden fluctuation, the rotary converters are started on the alternating-current side. A large storage battery is also installed at this station.

The Virginia and Washington Street substation contains seven 1000-kw rotary converters and a large storage battery; at Seneca and Imson Streets there are three 400-kw and one

1000-kw rotary converters, and the Waldon Avenue station has five 400-kw rotary converters. These substations are located in different sections of the city so that each has a number of lines to take care of. Electricity at all substations is received through underground cables at 11,000 volts. Most all of the apparatus used in the substation of the Buffalo General Electric Company, the Cataract Power & Conduit Company and the International Railway Company is of General Electric manufacture, a small share being of Westinghouse make.

Another interesting illustration of the increased use of electricity may be seen in the three 1500-hp direct-connected motors and two-stage centrifugal pumps that have been installed at the pumping station of the Buffalo water works during the past four years. The first of these was put in use in 1905; the third has just been installed. There are three large air-blast transformers, one for each motor, and two small oil-cooled transformers for lighting and small motor circuits, reducing from 11,000 to 2200 volts and from 11,000 to 220 volts, respectively. The pumps are vertical, with the motors at the upper end of the shaft, and each is rated at 25,000,000 gal. per 24 hours. The efficiency of the transformers is claimed to be 98 per cent, of the motors 91 per cent, and of the pumps 80 per cent, making the combined efficiency 71.4 per cent. Pump No. 2 operated at an average of 22,200,000 gal. of water per 24 hours, for the latter part of November and the first half of December, 1908, or 128,580 lb. of water lifted per minute; as the head against which the pump works is about 192 ft., 750 hp represents the work done to the water. At the combined efficiency of 71.4 per cent, the electrical horse-power supplied by the Cataract Power & Conduit Company to the pumping station for pump No. 2 equals $750 \div 0.714 = 1050$, which is the average supplied for the month Nov. 15 to Dec. 15, 1908. These electrically driven pumps are more economical and take up so little room compared with the large, inefficient triple-expansion steam pumps which form part of the station equipment, and carry their load so readily, that it is not surprising that since the first installation in 1905 two more have been added.

A comparison might be made with a similar pump at the Duluth water works. Here a General Electric 1000-hp induction motor direct-connected to a two-stage vertical centrifugal pump has lately been installed, the capacity being 13,000,000 gal. per 24 hours against a head of 300 ft. If the combined efficiency is 73 per cent, as claimed, the horse-power which must be supplied is 937. At Buffalo 1228 hp is supplied for each pump when operating at the full capacity of 25,000,000 gal. For each 1,000,000 gal. pumped at the Duluth works $6.50 is paid, while in Buffalo the rate varies with the amount pumped per month. As the number of gallons pumped per day varies between 22,000,000 gal. and 24,500,000 gal., the total for each unit is between 650,000,000 gal. in the short months to 700,000,000 gal. for the others, so that a discount of 44.44 per cent is made on the rate of $9 per 1,000,000 gal. pumped. The actual rate, therefore, is $5. When the pumps operate at their full capacity of 25,000,000 gal. per day for 31 days per month, a discount of 50 per cent is made. The city's contract for pumps Nos. 1 and 2 expired on June 30, 1908, but although a new contract was not entered into, the Cataract Power & Conduit Company supplied the energy as before. A new contract will now be made for the three pumps.

Experience with High-Efficiency Lamps in Industrial Plants.

By Warren H. Miller.

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In one of the large industrial establishments of the country, containing some 45 buildings, besides numerous process tanks and stills, spread over several hundred acres of property, it was decided to use large gas engines as prime movers, and 25-cycle generators because of numerous advantages in paralleling and in motor drive. The problem of lighting this establishment with the least energy appeared to find a ready solution in clusters of tungsten and tantalum lamps, since they eliminated all carbon-renewal charges and all fire risks. To get some data on works street lighting with them, an experimental station of four poles, 80 ft. apart, in a straight line, was erected down the center of a very busy "yard" between the pipe shop and boiler shop. At a height of 35 ft. from the ground on the two end poles were hung two flaming-arc lamps, which were thus spaced 320 ft. centers. These had been tried out and found feasible on 25 cycles after numerous unsatisfactory experiences with the standard blue arc on the same frequency. The flaming arcs showed no perceptible flicker on outdoor service and their motor-driven mechanism proved steady and reliable on the low frequency. It might be mentioned in passing, however, that for indoor service, except for some such large building as a power house, they showed considerable flicker, due apparently to interference of the light reflected from the walls.

These two flaming arcs operated in series and took 12 amp. Tested against them were four clusters of 60-watt tungsten lamps, four lamps in a cluster, making 200 cp for each or 800 cp altogether. As the flaming arcs were rated at 3000 cp each, it was a great surprise to find that, for all practical working purposes, the tungsten clusters gave a far better light. This was due to the light distribution, which was quite brilliant under the flaming arcs, but, even at a height of 55 ft., was so poor midway between the lamps that no workman would handle either steel or pipe. The tungsten clusters gave a brilliant whitish-yellow light which was nowhere dim, owing to there being four of them on 80-ft. centers, against two flaming arcs on 320 ft. centers.

Further tests between two tantalum clusters of four 80-watt lamps and two tungsten clusters of four 60-watt lamps showed that the former gave much better distribution of light because the lamps were spread at an angle instead of hanging vertically in a close bunch. This latter arrangement renders nearly one-third of the glowing filament of little use, as its light is cut off by the adjacent lamps. To obviate this difficulty and yet retain the low power consumption of the tungsten filament, single street lamps were tried in place of the clusters, using the large 250-watt lamp costing about $4.87. Of four of these shipped to the plant two arrived with broken filaments, one went out the first night and the other was stolen out of the socket after a few days' service. Their use was decided against since every such accident would leave the spot in total darkness and lay off a gang of workmen temporarily.

The standard street lamps finally chosen consisted of four 60-watt tungsten weatherproof clusters made by the Federal Electric Company and screwed into Clinton street fixtures. These gave excellent light distribution and illumination when placed on alternate poles 18 ft. from the ground along the works streets, and spacing about 200 ft. centers. The tungsten lamps lasted better there than in many other places, but the percentage of breakage was quite high, one-fourth of all the lamps going out in the first few months. They are being replaced as they burn out with the more durable tantalum filament.

For lighting the manufacturing shops where the vibration is considerable, tantalum 80-watt lamps are used in four-lamp Harter slag-glass clusters with 16-in. white-enamel shades. These were spaced about 30 ft. centers, 12 ft. from the floor, and gave a brilliant white illumination that was in refreshing contrast to the blue-arc illumination usually used in such shops. They were installed 10 months ago and some of them are still in service, the shops having run night and day since starting. The majority of the lamps have been replaced once. In many cases the new lamp was a tungsten, as for all practical purposes they have been found to last quite as well burning on the side or at an angle as when perpendicular. The first lamp to undergo this test was a French tungsten, which was put in a machine-shop cluster on Aug. 6 last and was still burning on March 30.

These shop clusters were home-made and consisted of a steel outlet box with a 3-in. canopy cover, a ½-in. crowfoot, a 3-in. black iron canopy to slip ½-in. pipe and a stem of ½-in. galvaduct conduit into the end of which was screwed the Harter cluster, which has its own shade holder. The current consumption of each cluster was about 3 amp, and the total for

lighting all the shops, including all portables and machine drops was under 10 kw. This covered a boiler shop, 270 ft. x 125 ft.; machine shop, 110 ft. x 60 ft.; pipe shop, 80 ft. x 50 ft., and carpenter shop, 60 ft. x 50 ft. All machine and bench drops contained 20-cp Gem filament lamps. As for the alleged flicker on 25-cycle lamps it was absolutely indiscernible; indeed, all the lamps were fed temporarily from the exciter sets and later from 110-volt, 25-cycle transformers without anyone in the works being aware that any change had been made in the source of energy. Placed side by side, it was impossible for the most skeptical layman to tell which was which.

Many of the process buildings require absolutely fireproof marine installations and are wired with rigid conduit and marine fittings and fixtures. In these were installed 25-watt, 20-cp tungsten lamps and here the tungstens showed a somewhat lower percentage of breakage and had a long life. Where the fitting needed to be only vapor-proof, but not guarded, the Burnet Company's fixture was used. This takes a 40-watt tungsten, giving a larger lighting unit, and where installed on a secure fixture, such as the lower chord of a pump-house roof truss, shows good results. Lamps put in such places during last December are still burning and have practically no breakage reported against them. But where there is any chance of shocks or disturbance, such as wind storms shaking street clusters, and hammering vibrations being communicated through steel piping to the fixture, the breakage of tungsten lamps is so high as to preclude their use. Tantalum lamps are but little better where powerful vibrations can reach them. Out of 24 put in Harter clusters in the power-house roof trusses, seven broke the first night, and not over five of them are burning at present. But the worst destruction of tungsten lamps was in and around the process stills and tanks. Here general illumination was wanted and the fire risk precluded the use of arcs. As there was no place for poles or light lines, the iron platforms over the still benches were utilized. These were guarded by pipe hand railings and, at intervals of about 50 ft., the rail stanchions were carried up to form arches over the alleys. In the lower leg of one of the stanchions was put a 1½-in. Y rail-fitting, looking downward, and connected to the conduit tee in the ¾-in. galvaduct main of the lamp feed wires. A tee looking down was put in the center of the pipe arch or cross-piece, and a short length of No. 14 duplex wire was fished from there to the Y, where it entered the conduit.

Into the tee in the arch was screwed a Tidman hood with special 5-in. globe, making it capable of taking lamps up to the 100-watt tungsten size. The Tidman hood has a ½-in. thread to screw into stem or nipple, and a ⅜-in. nipple inside which takes a ⅜-in. key socket of any make so long as it permits the wires to be pulled through and fastened after the socket has been screwed on. This type of lighting fixture worked in well with the pipe railing around the process stills, making a strong and durable installation, and was used all over the plant.

When first installed a 100-watt tungsten lamp was put in each, but the slaughter among them was fearful, there being only 15 of them left burning after a few months' service. The filament is far too brittle. For instance: If a gang of pipe fitters in taking a piece of 12-in. pipe along the platform should set it down none too gently on either the railing or the iron floor itself every tungsten lamp within 50 ft. of the jar thus caused would be extinguished. The writer has even seen a pipe fitter set down a pair of 6-ft. tongs on the rail and put out the tungsten lamp in the next arch. A boilermaker's apprentice walking along the platform and beating a tune on the railing, boy-fashion, with a hand hammer would put out every tungsten lamp on the platform. The old carbon-filament lamp is not in the least affected by these trivial incidents, which are so common about a big industrial plant. Tantalum lamps were tried next and were but little better, 16 out of 100 being lost in less than two weeks. At present 50-cp metallic-filament lamps are being used and give no trouble.

The 20-cp metallic filament is the standard shop lamp of these works, there being about 1700 of them in service and only the ordinary shop percentage of breakage is reported. The complete installation of each shop "drop" includes a steel knockout box with cover which just passes a steel rosette bushing for armored cord. Inside is a Bryant rosette into which is secured the steel bushing. As many feet of the flexible armored cord are used as the case may require, and it terminates in a ⅛-in. steel-socket bushing which screws into a No. 1 Edison key socket. The lamp is furnished with a "neverbreak" lamp guard. The "Type E" cord costs only about $10 per 1000 more than the ordinary lamp cord, and is proof against being injured when stepped on, abraded with the cutting edge of a boiler plate, or frayed when yanked into a rough cylinder casting.

The Benjamin vapor-proof fitting consists of a cast-iron box, threaded in four lugs, containing a receptacle and provided with a metal holder like a preserve-jar top which is rigidly secured to the cast-iron box with screws and a rubber gasket. The globe, which is about 4 in. in diameter by 8 in. long, will take a 40-watt tungsten and screws down on a washer inside the preserve-jar top. This fitting is handy to install in a line of conduit, allowing junction from it in two directions and providing a brilliant lighting unit in itself.

The Burnet special marine box is of the same model as the standard marine fitting, except that the box and neck are of cast iron instead of brass, thus making it cheaper, although quite as serviceable. The question of portables involved getting, if possible, an armored cable that would be absolutely chemical proof, especially at the box and the fitting. There appeared to be nothing on the market that would prevent leakage between the armor and the insulation where both entered the fitting, so the standard marine cable was employed with marine portables. These have a bushing and rubber stuffing-box in the handle which absolutely prevents any leakage into the fitting.

It might be well to point out that certain types of flaming arcs with motor-driven feeding mechanism operated very smoothly on 25-cycles, whereas lamps with solenoid control were unsatisfactory on this frequency. The flicker due to the low frequency was not at all disagreeable out of doors, but inside of small buildings or near walls the light would hardly do to work by. In a large erecting shop and in a power house, 400 ft. long, three of them displaced 10 ordinary arcs each, and gave no annoyance from flicker. However, to avoid the high expense of flaming-arc carbons the clusters of incandescent lamps were used. These now hold four 50-cp metallized-filament lamps in place of the 60-watt tungstens originally installed, due to breakage caused by the street fixtures shaking in storms. On 200-ft. centers, 18 ft. from the ground, the illumination is very good and well distributed and requires from 2 amp to 3 amp per fixture. When this was written, of 112 sockets in these fixtures, 28 lamps are useless and 58 60-watt tungstens are burning out of the original 112 installed in January.

Looking over the reports of breakages since last October the tungsten-lamp sheet shows practically none left of such tungstens as were used to replace tantalums in the machine shop, boiler shop, two power houses, two boiler houses, pipe shop and carpenter shop. The tungstens only muster five lamps in all these places put together, while the tantalums in the clusters aggregate 76, some of them burning since May last. In the process buildings where the lamps are mostly mounted on brick walls in guarded marine fixtures the tungstens hold their own fairly well, 237 lamps being still burning, showing an average breakage of about 30 per cent of all the lamps installed in these places. Over 200 tungstens are charged to breakage in moving them from one socket to another. This positively cannot be permitted anywhere about industrial works with tungstens. When once the lamp has burned for a day or so the filament becomes so brittle that it is difficult to move it to another socket without breaking the filament even with the most careful handling. A "lamp famine" in any department thus becomes a calamity unless the new tungstens arrive in time. On 25 cycles the tantalums are quite as bad in this respect. In the brief but glorious history of the 24 tantalums which went into some clusters in the main power house, the reader will recollect that seven went out the first night.

In a month more only eight remained, and when these were ordered out to be used where there would be less vibration, the electrician returned from the roof trusses with the eight and found only one good one left when he reached the ground. It is, of course, due to the well-known faulting of the filament on alternating current, which is very bad on 60 cycles and 133 cycles and also comes in on 25 cycles. The table below of all sizes of tungsten lamps purchased between Oct. 2 and Jan.

TUNGSTEN LAMPS. PURCHASED BETWEEN OCT. 2 AND JAN. 26.

Size.	Number placed.	Number burning April 2.
100-watt	90	20
60-watt	550	215
40-watt	540	124
25-watt	540	30

TANTALUM LAMPS PURCHASED MARCH 17, 1909.

Size.	Number placed.	Number burning April 2.
80-watt	100	84
50-watt	200	179

26 may throw light on these lamps, as used in a large manufacturing establishment manned by several thousand clumsy, two-fisted mechanics.

Steam Consumption Tests of a 500-Kw Turbo-Generator Set.

By A. C. Scott.

The tests recorded below were made upon a 500-kw steam turbo-generator supplied by the Allis-Chalmers Company to the Water, Light and Power Commission of Austin, Texas.

The turbine is of the horizontal "reaction" type, having the revolving field core of the three-phase alternator connected thereto by means of a flexible coupling, which is intended to provide for slight inequalities in the wear of the bearings, to permit axial adjustment of the turbine, and to admit of differences in expansion.

The four bearings, two on the turbine and two on the alternator, are self-adjusting, with relatively large bearing surfaces, and are lubricated by a constant stream of oil flowing into the middle of each and out at the ends. The oil is maintained at a pressure of about 2 lb. per square inch to insure a sufficient

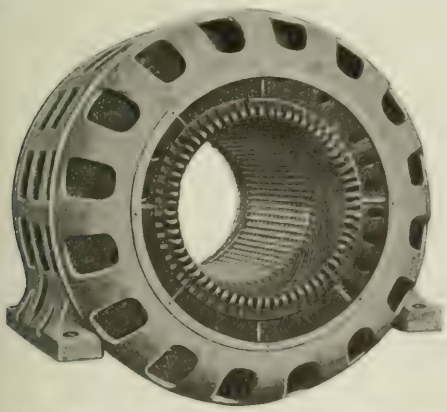


FIG. 1.—STATIONARY ARMATURE OF TURBO GENERATOR.

flow through the bearings by means of a rotary pump driven from the turbine shaft. This pump maintains an oil pressure of about 20 lb. per square inch for the control of the throttle valve by the governor, and this valve is decreased to the required pressure for the bearings by a reducing valve. The oil is circulated again and again through the bearings, being cooled by water after passing from the bearing before reaching it again. A noteworthy feature in this connection is the sectional brass oilers having glass sides, so that the stream of oil flowing into a bearing is visible at all times.

Where the shaft of the turbine passes out of the cylinder, the inward leakage of air or outward leakage of steam is prevented by glands which are kept tight by water packing and are therefore practically frictionless. A water pressure of about 10 lb. per square inch is maintained continuously, and the leakage passes through with the condenser discharge.

The gland water pressure in this particular plant is maintained by pipe connection with a tank 48 in. x 30 in. x 30 in. in size, located in the top of the boiler house, the pure water supply to which is controlled by a ball compression cock. Gages

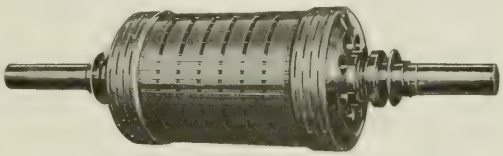


FIG. 2.—REVOLVING FIELD STRUCTURE OF TURBO ALTERNATOR.

on the turbine show the pressure at all times and readings are included in the following data under the term "gland" pressure.

The governor of the turbine is driven from the turbine shaft by cut gears running in an oil bath, at a speed ratio with respect to the turbine of 4:29. The governor operates the balanced throttle valve by means of an oil relay, and responds very satisfactorily to variations in load. It may be adjusted to change the speed of the turbine while in operation and thereby facilitate the synchronizing of the alternators and proper division of load.

An auxiliary governor is attached directly to the turbine shaft and rotates at the same speed. This governor is adjusted for a predetermined speed of the turbine, and should it reach a value far in excess of that, a valve is tripped which shuts off the steam and stops the turbine. A test of the safety governor was made, and is later described.

To provide for possible overloads that may be thrown upon the turbine, a by-pass steam valve which admits boiler pressure steam at a later stage in the turbine where the blades are larger, is actuated by the main governor whenever the load becomes abnormal. The "inlet" pressure gage readings appearing later on in the data on the test indicate the bypassing of steam on the heavy load.

The cylinder of the turbine is covered with insulating material and lagged with planished steel. The revolving field coils of the generator consist of flat copper placed in radial slots of the iron core. These coils are held in place by means of manganese-bronze wedges, the whole presenting a smooth surface cylinder (Fig. 1). Ventilation of the coils and core is accomplished by air being drawn in through openings parallel with the axis and discharged at the periphery. The ventilation of the ends of the coils is attained by allowing them to project beyond the ends of the core, they being held firmly in place against the stress of centrifugal force by means of nickel-steel rings. The stationary armature has numerous air ducts for ventilation of the laminated core and winding (Fig. 2).

The cool air is drawn in at the sides of the machine by means of fans which discharge it over the end connections of the armature coils into the base of the machine whence it passes through ventilating ducts in the core to an opening at the top of the cast-iron frame. The over-all length of turbine and generator is about 23 ft. 4 in.; width, 4 ft. 8 in.; height of highest point above floor line, 5 ft. 4 in., and total weight, 40,000 lb. The diameter of the steam pipe at throttle is 5 in., and of the circular exhaust opening 24 in.

The condenser in use with the machine tested is of the surface type, was built and furnished by the Henry R. Worthington Company, and consists of 2000 sq. ft. of cooling surface in the form of ½-in. copper pipes through which the circulating water is passed.

Two two-stage turbine pumps, driven by three-phase motors, pump the circulating water for all the condensers in the plant.

the inlet and outlet mains on the condenser for the turbine being each 10 in. in diameter.

The condenser discharge is pumped to the hot well by means of a motor-driven two-stage Worthington pump of about 3-hp full-load rating.

A Knowles rotative dry-vacuum pump is in use with the turbine, of dimensions 6 in. x 10 in. x 12 in.; piston rod, 1.25-in. diameter. The results concerning speed and steam consumption of this pump are considered later.

The exciter for the turbo-generator is an Allis-Chalmers machine, rated at 120 volts and 187 amp, directly connected to a 6-in. x 6-in. double-cylinder American Blower Company engine running at 512 r.p.m.

Since the tests were to be conducted at unity power factor load, it was decided to use a water rheostat for loading the generator. The size of the rheostat was calculated approximately by determining the heat units to be dissipated at 625 kw, which was 1¼ load for the machine. The box was made 8.5 ft. x 7 ft. x 2 ft., with a post in the middle, one at each of two corners, and one at the center of one end. The outer posts were connected to the middle one by wooden tracks which allowed each of the three electrodes used to be moved forward or backward along the bisectors of the angles of an equilateral triangle.

This arrangement permitted the load to be balanced easily and quickly. The electrodes used were ¼-in. boiler plate, of 12 in. x 12 in. size and for the ½-load test had to be raised nearly out of the water, causing the load to be a little unsteady. For each of the other tests, however, the load was readily maintained balanced and steady, and for the 1¼ load the plates were wholly immersed and a ¾-in. stream of cold water flowing into the box kept the water level constant at the top, with such satisfactory results as to leave nothing better for the work to be desired. Fig. 3 shows the appearance of this water rheostat while the test was going on.

Load (apparent, part of full-load)	0	2/4	3/4	4/4	5/4
Load, actual, kw	0	217.5	371.9	490.4	606.8
Pressure at throttle, lb	148.5	149.7	146.6	146.0	148.1
Steam quality, per cent	99.00	97.99	98.50	98.55	98.70
Steam per hour, lb	1583.1	5417.4	7968.0	9654.6	11888.2
Steam, lb. per kw-hour		24.9	21.4	19.7	19.6
Corrected consumption		24.0	20.67	18.5	18.4
Speed, r.p.m.	3614	3596	3579	3568	3565

An analysis of the heat units required for operation at five-

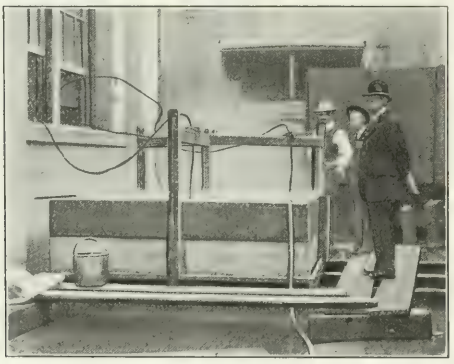


FIG. 3.—WATER RHEOSTAT.

quarters load shows that the total of 14,236,476 lb.-Fahr. units per hour used by the turbine and auxiliaries were distributed as follows:

Driving dry-vacuum pump	6,590 units	0.05	per cent
Removing condenser discharge	5,209 units	0.04	per cent
Circulating cooling water	18,592 units =	0.13	per cent
Steam at throttle	14,236,476 units =	105.07	per cent
Total	14,266,867 units	105.29	per cent
Returned by condenser	717,870 units =	5.29	per cent
Used by turbines and auxiliaries	13,548,997 units =	100.00	per cent
Delivered at the switchboard	2,068,221 units =	15.17	per cent

The change in speed from no load to full load was 1.3 per cent; when the main switch was opened under full-load the speed increased by 4.0 per cent and the e.m.f. by 25.4 per cent. At a constant speed and normal e.m.f., the speed regulation is 15 per cent. The temperature rise after operating for 1.5 hours at 1.25 full-load was only 26.7 deg. C. as measured at the air blast.

Tests of the unit were made at no-load, half-load, three-fourths load, full-load and five-quarters load. At no-load the steam pressure at the throttle was 148.5 lb. and the quality of steam 99 per cent. The condenser discharge was 2211.6 lb. per hour, of which 612.5 lb. was gland water. Thus, when connection is made for the quality, the consumption is found to be 1583.1 lb. per hour.

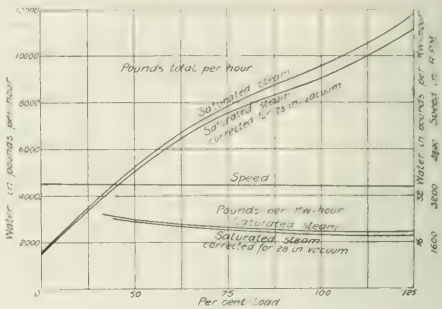


FIG. 4.—PERFORMANCE CURVES.

At one-half load the throttle pressure was 149.7 lb. and the average quality of steam 97.99 per cent. The actual load was 217.5 kw, the total corrected consumption being 5417.4 lb. per hour, or 24.9 lb. per kw-hour. The vacuum was 27.4 in.; for a vacuum of 28 in. the steam consumption would have been 24.0 lb. per kw-hour.

At three-quarters load the steam pressure was 146.6, the average quality of the steam 98.5 per cent, the vacuum 27.4 in., the load 371.9 kw. The steam consumption was 21.4 lb. per kw-hour, corresponding to 20.67 lb. per kw-hour with a 28-in. vacuum.

At full load the steam pressure was 146.0 lb., the quality 98.55 per cent, the vacuum 27.0 in., the real load 490.4 kw. The steam consumption was 19.7 lb. per kw-hour, or 18.5 lb. per kw-hour when corrected for 1-in. low vacuum.

At five-quarters load, the pressure was 148.1 lb., the quality 98.7 per cent, the vacuum 26.92 in., the real load 606.8 kw. The steam consumption was 19.6 lb. per kw-hour, corresponding to 18.4 lb. at a 28-in. vacuum.

These results are shown in Fig. 4 in order that they may be compared more readily.

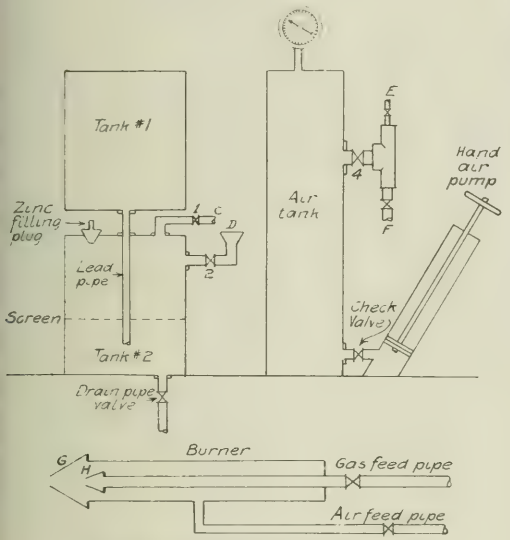
The Installation and Care of Storage Batteries.

By Omer F. Dubruiel.

IN setting up a storage battery care should be taken to have the battery-room light and dry, and the battery should be placed in a position that will allow each cell to be easily examined. The space above the battery must be sufficient to allow the plates to be taken out and put in again. If there are not enough windows for the admission of air artificial ventilation should be provided. Shafting, pipes or anything metallic situated over the battery should be covered or painted so that there may be no danger of any scale or rust falling into the cells. Windows through which the sun's rays may reach the cells should be painted white.

After a firm and level battery foundation has been prepared, the jars or tanks should be placed in position. If a few small glass jars are used they may be placed on shelves. Larger cells should be placed in sand trays and insulated by glass petti-

coat insulators. If the elements are in lead-lined tanks they should also be insulated with glass or porcelain petticoat insulators. After placing the jars or tanks in position, the elements are inserted. If glass jars are used, the hangers rest directly on the edges of the jars; and if lead-lined tanks are employed, the hangers rest on pieces of glass which are placed edgewise in each side of the tank. Before placing the elements in position, treated wood separators should be placed on the positive plates, two or more of the separators being used on each plate, the number being dependent on the size of the



FIGS. 1 AND 2.—DETAILS OF TANK AND BURNER.

element. All the hangers on the different plates should be of a uniform distance apart and no parts of opposite elements should be allowed to touch.

Small and moderate-size cells are provided with lead straps for connecting together with bolt connectors. These should be scraped bright and bolted up tightly, but not with too much force, as owing to the material used for making the bolts noncorrodible they are not as strong as iron ones. After the battery has been connected up several days, the bolts should be again tightened and painted with special asphaltum paint. The lead terminals should be permanently connected by "burning" them, but when this is not possible they should be soldered, mutton tallow being used as a flux. Under no circumstances should muriatic acid or soldering salts be used.

In burning the terminals the best flame to use is the hydrogen flame, as it may be used without any flux. For this a hydrogen generator is necessary and one may be made up as follows: Referring to Fig. 1, tanks Nos. 1 and 2 are lead lined and connected by a lead pipe. Tank No. 2 is fitted with a plug for zinc filling, and is also fitted with a pipe and valve connecting No. 1. In pipe *C*, on the side of the tank, a pipe, valve and funnel are arranged to allow the charging of diluted sulphuric acid. Tank No. 2 is also fitted with a drain pipe and valve. In order to charge the generator the plug is removed and pieces of zinc inserted. The zinc is held by the screen indicated by the dotted line. Then the dilute sulphuric acid is placed in the funnel *D* and valve No. 2 is opened (valve No. 1 and the drain valve being closed). The plug should be replaced and valve No. 2 closed when the sulphuric acid has risen to a height of 1½ in. above the zinc resting on the screen.

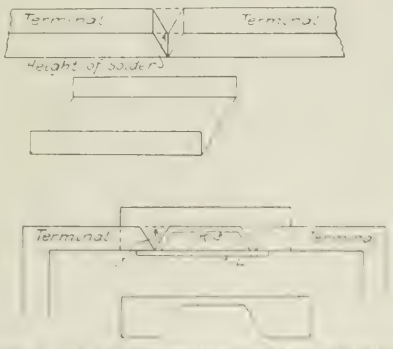
The acid attacks the zinc forming zinc sulphate and liberating hydrogen. As the gas is generated and fills the space above the acid in tank No. 2 the pressure of the gas upon the acid forces the latter up the lead pipe into the tank No. 1. When the gas is used the pressure drops and flows down the pipe and again comes in contact with the zinc and in this manner keeping a pressure of 2 lb. to 4 lb. per square inch. Fig. 1 also shows an air tank and hand air pump and gage.

Pressure is put on the air tank, and by means of a rubber hose, connections from valve *E* or *F* are brought to the burner, as shown in Fig. 2. When using air from the tank valve 4 should be opened and a connection made from *C*, Fig. 1, to the gas pipe in Fig. 2. Fig. 2 shows two leading-in pipes, one for gas and one for air; these have tips connected to them in order to get different size flames, the air and gas being regulated by valves. Fig. 3 shows how the ends of the terminals should be beveled besides being scraped clean and bright. A trough, as shown in Fig. 4, with an interior cross-section equal to the cell terminal, should be used, and by placing the two lugs into the trough and holding them in by means of clamps a chamber is formed into which molten solder may be run. When the cell terminal is of large size the terminal is usually connected to a busbar, as shown in Fig. 5, where *K* represents the busbar. A plate *L* is located under the busbar and terminals and a sheet-iron guard (Fig. 6) is placed as shown and held by a clamp. There are two pieces used, one on each side, and the molten solder is poured in to the height shown by the dotted line *J*. Each lug is treated in the same manner.

Pure lead should be used and the solder should be molten from the bar and allowed to drop in the chamber. At the same time the flame should be kept on the terminals so as to heat them to a point just below melting. The solder will then unite with the terminal and thus make a continuous piece of metal. Great care must be taken not to apply too much heat to the lugs when burning them to the busbar or the lugs will melt before the busbar is sufficiently hot, the latter requiring more heat than the lugs.

When using the burner an inner blue and well-defined flame is noticeable. The best results are usually obtained by holding the point of this blue flame on the surface of the work to be burned. When burning lugs a large flame should be employed, but when burning seams a small flame should be used. After the metal has cooled the clamps and troughs may be removed and the connection dressed for appearance.

Before filling the jars or tanks with the solution, all of the connections between the different cells of the battery and between the battery and the charging apparatus should be made so that there may be no delay in charging the battery immediately upon filling. The electrolyte should nearly fill the jar, and should in all cases cover the tops of the plates at least 1 in. The solution should be absolutely pure. If it is neces-



FIGS. 3, 4, 5 AND 6.—TERMINAL AND CLAMP DETAILS.

sary for the user to prepare his own solution, it can be made by using pure sulphuric acid, 66 deg. Baume, and distilled water, 1 part of acid to 5 parts of water by bulk. In mixing an earthenware or lead-lined receptacle should be used. The acid should be poured into the water, and not the reverse. The solution should be stirred with a wooden ladle and allowed to stand until it is cool, after which it is tested with a hydrometer.

the specific gravity should be 1.200, or 25 deg. Baume. If below 1.200 more acid should be added, and if above 1.200 sufficient water should be poured in to bring it to the correct density.

The charge must be commenced as soon as the cells are filling with solution. The battery should be charged at the rate equal to two-thirds of its normal or eight-hour charging rate, and the charge continued until the voltage of each cell is 2.6 volts, the reading being taken while the battery is being charged at the above rate. After the cells have reached the voltage specified, or higher, the charge should be continued until the specific gravity of each cell ceases to rise or has remained constant for at least three hours. This may happen after a battery has been charged for 30 hours or for 60 hours, depending on the type of plates used. If any cells do not show the proper rise in voltage, or do not gas freely, they should be examined for internal short-circuits. If there are any, they should be removed at once and the charge continued until all the cells indicate as above stated.

In charging in regular use the voltage need not reach as high a point as in the first charge except at stated intervals. Once each month the voltage of each cell should be brought up to 2.6 at normal rate, and all the cells made to gas. The tension of the charging circuit should be approximately 5 volts higher than the product of the number of cells multiplied by 2.6 in regular use. The battery should be charged at the normal, or eight-hour, rate if possible, although it is permissible to charge at a higher rate if absolutely necessary. The battery should be completely charged, but should not be habitually overcharged. If this is done, the life of the battery will be shortened and the electrolyte will evaporate rapidly, making it necessary to add water more frequently. If for any reason the battery is used only occasionally or the discharge is at a very slow rate, a weekly charge should be given to freshen it up. The amount of electricity supplied to the cell should exceed the previous discharge from 12 to 15 per cent in amp-hours.

When the cells are all in a normal condition, the maximum voltage and maximum specific gravity of the electrolyte are reached with the charging current constant at the normal rate, when no further rise or increase in either voltage or specific gravity is noticed during a period of one-half hour. In other words, if the charging has been continued for seven hours with a gradual rise in the voltage and specific gravity, and an additional half-hour of charging shows no further rise in either, the battery may be considered charged.

The voltage at the end of charge varies somewhat throughout the life of the battery, the age of the battery and the temperature of the solution having considerable influence upon the same. When a battery is new the voltage at the end of charge will generally be higher than 2.5 volts. As the age of the battery increases, the point at which it is fully charged will be somewhat lower, possibly as low as 2.40 volts per cell. If the charging current is at the highest rate, which should never be used except in cases of emergency, the final voltage will be about 0.05 volt per cell above that for the normal rate. With rates lower than the normal, the voltage at the end of charge will be somewhat less depending on the rate. For instance, if the cell is 2.50 volts at the normal rate, with 100 amp flowing, it will be 2.45 volts at three-fourths the normal rate or with 75 amp flowing. Changes in temperatures affect the final charging voltage by lowering the same when the temperature is above 70 deg. and by raising it when the temperature is below the normal. After a complete charge, and when the charging circuit is opened, the voltage will immediately fall off to approximately 2.15 volts. When the discharge is started it will fall to 2 volts. If the battery is not discharged at once, and is left on open circuit, the voltage will fall to 2.05 volts and remain there.

After the initial charge, and when the battery is regularly put to use, the specific gravity should be between 1.195 and 1.205 at normal temperature with the solution 1 in. above the tops of the plates. A slight and gradual loss of the acid from the electrolyte will be noticed. This is caused by a portion of it being carried off in the form of a spray. When this loss has become such that the highest reading that can be obtained is, say, 10 points below the standard, it should be regained by the addition of dilute acid instead of water. Before doing so one should be sure that the battery is completely charged and that the specific gravity has remained constant for some time. In adding acid to the cell, pure acid should not be used, but one having the same density as that fixed for the proper density of the acid in the cell. It is absolutely essential that the electrolyte should be free from impurities; ordinarily commercial acid should not be used unles it has been subjected to test.

When the battery has been completely charged, in addition to the voltage and specific gravity reaching its maximum, gas will be given off freely from all of the plates. The color of the positive plate should be dark brown, and the color of the negatives uniformly light slate or gray. If the body of the positive plates are of the proper color, no attention need be paid to the lodgment on the top of the plates of a fine white powder that may easily be brushed off. In fact, if the tops of the plates are of the same color as the body and no white powder is noticeable, it is an indication of an overcharge.

The limit of discharge is reached when the voltage has fallen to 1.75 per cell. In regular use it is not necessary to discharge to as low a point as this as it is always found best to have a reserve in case of emergency. After a battery has discharged it should be immediately recharged if possible; it should not be allowed to stand discharged more than an hour. In order to take the proper care of the battery, the attendant should be supplied with a portable low-reading voltmeter reading to 3 volts, but calibrated to 0.02 volt. Two or more hydrometers with scale reading from 1.150 to 1.250 and a portable lamp for inspecting the individual cells, except where wooden separators are employed, when a lamp is not necessary.

On many batteries it is found necessary to use end cells for the purpose of maintaining the voltage on discharge. These are arranged so that they may be successively cut into the circuit on discharge or cut out of the circuit when charged. It will always be found that some of the end cells are seldom used. In this case care should be taken not to overcharge them. They should be brought up to full voltage, the same as the main battery and then cut out. Cells that are not used at all should receive a complete charge once a week.

The amount of charge and discharge can be accurately determined from specific-gravity readings. If the specific gravity in the cell rises, it is unquestionably an indication that the charge is progressing.

It is important that each cell should be regularly inspected and a record made of the inspection. By so doing the chances of a cell becoming low or in a backward condition are reduced to a minimum. It is also essential to have a record to compare with previous ones. In case a cell gets into a low condition, and remains low through two consecutive records, it is a positive indication that something quite serious is causing the trouble. When inspecting a battery all of the plates should be examined. In addition to the examination of the cells with a lamp, and noting near the end of each charge whether all cells are gasing equally well, readings of the voltage and specific gravity of each cell should be taken once a week at the end of a prolonged charge and recorded in a book or in a proper form.

Open-circuit readings are of no value: all readings should be taken at the end of charge while the electricity is flowing. Occasionally readings are taken at other times, but the condition of the cell can be more accurately determined by readings taken at the end of charge. Care should be taken to watch the accumulation of sediment in the bottom of the tank or jar, to see that sediment does not reach the plates, thereby short-circuiting them and causing them to become unhealthy. The sediment should never be allowed to get near the plates. The accumulation is usually the highest under the middle of the plates. For that reason the sediment under all of the plates should be examined. If there is sufficient space provided at one end of the tank, the sediment may be raked out and scraped up. Aluminum scoops are used in lead-lined tanks and wooden scoops in glass jars. If this method of removing sediment is

impracticable owing to the limited space at the end of the tank or jar the sediment may be removed by first drawing off the electrolyte into clean vessels, then flushing the cells with water (the local supply may be used for this purpose). While the mud is being agitated from the flow of the water into the tank it should be either pumped or siphoned out of the cells. If there is not enough drop to use the siphon a pump may be used. After the cell is empty and cleaned, the electrolyte must be immediately restored or undue heating and drying of the plates will occur. The electrolyte should have a density equal to that fixed for the proper density of the solution in the cell. Before cleaning out the cells they should be fully charged.

There are several different causes for short-circuits. A short-circuit may arise through direct contact between adjacent plates; through some conducting material, such as a piece of lead, solder, spongy lead or oxide of lead sticking between the plates; through direct or indirect contact with the lining of the tank; through foreign particles getting into the cells, such as wood, straw, fibers, plaster, etc.; by the accumulation of sediment in the bottom of the jars or tanks; by the accumulation of lead dust on insulators that are not in a vertical position, and occasionally fine particles which are not noticeable at first may bridge across, growing larger, and become short-circuits.

It is of absolute importance for the satisfactory working of the cells that the positive and negative plates be insulated from one another completely. When a short-circuit is sufficiently large to allow the discharge of the cell to pass through the same, the elements will unquestionably get into an unhealthy condition. The cell may be low in voltage as well as in specific gravity and may refuse to gas. It is the duty of the attendant to examine the cells very carefully toward the end of the charge to make sure that all the cells gas simultaneously.

Any cell that does not gas as soon as the others should be examined at once. A portable incandescent lamp is indispensable for inspecting cells other than those fitted with wooden separators. If the cells are not very deep an ordinary incandescent lamp with a reflector on one side to protect the eyes from the light may be used. If the cell is deep it will be necessary to use a small flat lamp that will pass freely between the plates. It must first be ascertained whether all the spaces between the plates are clear. If there is no substance reaching across from plate to plate the insulators should be examined and placed in a vertical position. If the insulators become displaced or the hangers supporting the plates come in contact with one another this must be remedied by moving the insulators into proper position and spacing all the hangers equally. The examination and treatment of a cell which refuses to gas must not be discontinued until the desired gasing is obtained. The plates should not be unnecessarily disturbed; whenever necessary to remove particles adhering to the plates which are liable to cause short-circuit, a wooden or rubber strip should be passed between them.

The simplest method of bringing up cells showing a backward tendency is to give the whole battery an overcharge. If this does not bring up the low cells the latter should be prevented from discharging as much as the main battery. Where the cells are bolted together this can be readily accomplished by disconnecting the cell in question after a complete charge and letting it stand until the main battery is discharged, putting it into the circuit again prior to the next charge and repeating this treatment if necessary. Where the cells are lead-burned together it will be necessary to use an individual cell booster to bring them up. This consists of a small motor-driven generator of sufficient voltage to charge the cell. This machine can be charging the backward cell while the main battery is being discharged. Before putting a battery that has been in trouble into regular service again, care should be taken that all of the signs of a complete charge are present; that is, the potential and specific gravity should rise to the proper value, the plates should gas and have the normal color.

In case it is found necessary to discontinue the use of a battery for a period of six months or so it is advisable to take it entirely out of the service by drawing out the electrolyte. This may be done in the following manner: First, give the battery a complete charge, then siphon off the electrolyte into convenient receptacles, preferably carboys, making sure not to use carboys which have had other kinds of acid than sulphuric in them unless they have been thoroughly cleaned. As each cell is emptied of electrolyte it should be immediately refilled with water. The present method used is simply to allow the cells to stand in the water for a period of approximately 12 hours without discharging them while the water is in the cell, after which the water may be drawn off and the battery may stand until once more put in service. In putting a battery into service again it should be treated in the same manner as a new battery and care should be taken that the polarity of the charging source has not been changed in the meantime

Submerged Wire Rheostat.

By P. M. Brown

One very often requires rheostats capable of absorbing large amounts of energy for comparatively long periods, and the question of design has always proved more or less difficult as the little data obtainable were very vague and unreliable. The general method has been to cut and try; a process productive of much waste of time and money to say nothing of patience. On various occasions the writer made experiments with different sizes and types of rheostats, particularly with the immersed wire type, with the idea of finding some basis for calculation. The results may be summed up in the following formulas, which have proved very reliable. They apply only to immersed wire rheostats using ordinary galvanized-iron wire as a resistor. This type is the best for moderate voltages. It is very reliable; gives a steady load at practically unity power factor; is easily and cheaply built, and flexible enough, if a little ingenuity is exercised, to meet the most exacting requirements.

$$d = kI^{\frac{2}{3}} \qquad (1$$

$$l = \frac{d^2 \times E}{112 \times I} \qquad (2$$

where d = diameter of wire in mils.
I = current in wire in amperes.
E = e.m.f.
l = length of wire in feet.
112 = a constant = resistance in ohms per mil-foot
k = a constant having the following values: For tank or barrel rheostats $k = 3.25$ to 2.75. About 5 kw is all that should be dissipated in one barrel, using a plentiful supply of water. Where the rheostat is placed in a tailrace or river with a moderate flow $k = 2.75$ to 2.25. Where the rheostat is subjected to a rapid flow of water at low temperature $k = 2.25$ to 2.

A value of k as low as 1.85 has been used: but is not recommended. The rheostat took the form of a single wire strung zigzag across a rapidly flowing stream. The value of k is dependent upon the quantity of water and its temperature, and has a critical value for each condition where a slight increase of load will cause abrupt failure due doubtless to the formation of a gaseous envelope and consequent failure of the wire

The accompanying sketches and notes on a rheostat constructed for the acceptance tests of a 2000-kva, 2400-volt, three-phase, 25-cycle, hydro-electric unit may serve as an illustration. The requirements were to test the generator under a load of 2000-kva., 2400-volts unity power factor and under a load of 2500 kva, 2400-volts at a power factor of 80. In the waterwheel efficiency tests, an absolutely steady load, capable of variation from zero up to the full capacity of the turbines, some 3350 hp was necessary, and in the governor tests, a load capable of variation from zero to full capacity of turbines and allowing of abrupt changes of 50 per cent and 100 per cent of load.

It might be noted that the rheostatic load was not a success when used for the purpose of adjusting the governor, as it seemed to lack the cushioning flywheel effect of an ordinary power load and caused the governor to be too sluggish for

ordinary operation. However, that is a fault on the right side and one easily remedied.

The rheostat as shown was mounted on a raft and consisted of six racks of coils connected up into two independent star systems. The racks were held in place by two bolts and any one could be easily removed for examination or repair without disturbing the others or causing more than a few minutes' delay.

The calculations were as follows:

Maximum load = 2500 kw at 2400 volts; 603 amp per phase; 301.5 amp per phase per star system. E.m.f. to neutral = 1385 volts.

A value of $k = 2.45$ was selected, as the rheostat was to be moored in the tailrace in the full flow from the wheels.

Using formula (1), $d = 245 \times \sqrt[3]{301.5^2} = 110$ mils. No. 12 B. W. G. wire (109 mils) was the nearest size.

Using formula (23), the length of wire for this load per rack

$$l = (1385 \times 109^2) \div (112 \times 301.5) = 488 \text{ ft.}$$

For the full-load test on the generator, the current per phase = 482 amp at 2400 volts. The energy current in the 25 per cent overload test has the same value and was well within the capacity of the rheostat. The length of wire to absorb 2000 kw =

$$l = (1385 \times 109^2) \div (112 \times 241) = 610 \text{ ft.}$$

Each rack was wired with 10 coils of No. 12 B. W. G. galvanized-iron wire 61 ft. per coil or 112 turns on 1½-in. iron pipe. Coils were mounted on 1-in. x 1 5/16-in. porcelain knobs and tied with galvanized-iron wire. Leads of No. 4 B. & S. wire were brought out, through 6-in. porcelain tubes in the top of the rack, from the beginning of the first and the ends of the eighth and tenth coils, making the required two sections of 488 ft. and 610 ft. on each rack. All joints were carefully made and soldered and kept at least 6 in. under water. Care was taken to separate all coils at least 1 in. from the framework, and to moor the raft so as to expose all coils to a free flow of water; none being sheltered behind any portion of the framework. The generator tests were made with the full racks connected—two stars in parallel; the quadrature current in the 25 per cent overload test being supplied by a synchronous motor floating on the line.

For the waterwheel test, a single star was first used with full racks and a maximum load of 1000 kw. The second star was next paralleled and finally the taps from the eighth coils were joined to the neutrals, leaving eight coils per rack in service with a total capacity of the rheostat of 2500 kw at 2400 volts. Intermediate loads were obtained by field control.

The governor tests were made with the rheostat connected as in the last part of the turbine test. Control of the load was obtained by regulating the field. Half-load changes were made by opening and closing one leg of a three-phase oil circuit-breaker and minor variations by sudden swinging over the field rheostat.



FIG. 2.—RHEOSTAT IN TAILRACE.

With the three taps per rack and changing combinations from star to delta, the following balanced loads could be obtained: 500, 550, 660, 850, 1000, 1250, 1500, 1665, 1880, 2000, 2250 and 2500 kw at 2400 volts. If additional taps be brought out, almost any desired load may be had, though the above are sufficient for any test.

The rheostat was in constant service for over two weeks without any interruption and irregularly for nearly a year as an artificial load. When taken from the water last fall for the winter, it showed little or no deterioration except a little corrosion at the joints, due perhaps to electrolytic action between the copper leads and the zinc coating of the wire. The loads obtained came within 2 per cent of those calculated.

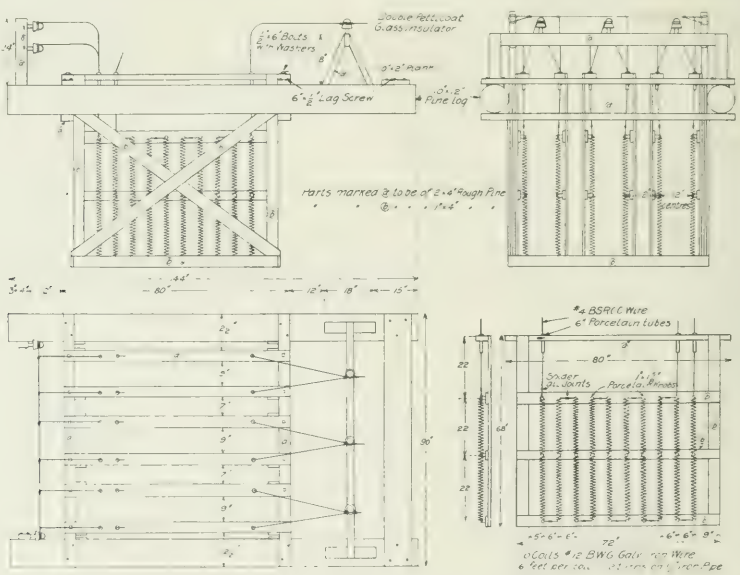


FIG. 1.—DETAILS OF IMMERSED WIRE RHEOSTAT.

Prime Movers for Small Central Stations.

Mr. T. L. Daniel, of the Minneapolis Steel & Machinery Company, presented a paper on this subject at the Minnesota Electrical Association convention at Minneapolis March 18 and 19. After referring jocosely to the confusion that is likely to exist in the purchaser's mind after the claims for all the different kinds of engines and turbines have been presented to him, he considered the relative merits of four types of prime movers, namely, the Corliss engine, high-speed engine, gas engine with producer gas, and steam turbine. His remarks applied particularly to plants of 500 kw and less.

The Corliss engine, being the oldest engine of the types considered, comes nearest to perfection, and is the best known among operating engineers. In this country it is still the standard for comparing economy, reliability and durability, the two latter qualities always being best with the slow speeds which are characteristic of the Corliss. Small clearance is a condition demanded by steam economy, and the long stroke of this engine, with its peculiar valve and short and direct ports, secure it more successfully than any other kind of reciprocating engine.

The high-speed engine is improving continually in the direction of simplicity and durability, and the manufacturers of really commendable machines seem to be catering to the demand for engines to operate where fuel is cheap or space is at a premium, or exhaust heating is required. The widely prevailing opinion relative to the low first cost of high-speed engines, the author says, is erroneous when one considers really first-class machines of the high-speed type, as they are not much lower in cost than the Corliss.

The producer-gas plant, he said, is particularly adapted to plants where fuel is high in cost or poor in quality, and water is bad or scarce. Its advantage lies in its unequaled economy of both fuel and water, ease of firing, especially with anthracite coal, safety and immunity from serious accidents resulting from careless operation, simplicity and smokeless combustion. Unfavorable to it are its high first cost and large floor space. To get reliability equal to the Corliss engine requires the best possible plant and a contract with the manufacturer to supply a competent operator.

The steam turbine has its field where space is valuable and foundations troublesome. The simplicity of the turbine itself and the absence of reciprocating parts has caused much comment. For plants under 500 kw, however, it is not clear that these properties are of any commercial value. The disadvantages are the uncertainty of repairs and depreciation, involving the possibility of serious damage to the turbine in consequence of some slight neglect; difficulty of securing experienced operators; the great amount of water required; condition of operation and first cost of plant required to give equal economy to the compound-condensing Corliss plant. A non-condensing turbine plant without superheater would cost much less than a steam Corliss plant. Its economy would about equal the high-speed engine, and its depreciation might be a serious matter because of erosion.

In discussing this paper the question was brought up as to the feasibility of adding a low-pressure turbine to operate condensing in a plant already equipped with simple reciprocating engines, thus adding to the output without increasing the boiler plant. It was stated that low-pressure turbines of small size were not feasible for plants under 500 kw.

Prof. George D. Shepardson, of the University of Minnesota, emphasized the desirability of forcing fires and running machinery at overload during the brief peak-load periods which occur each year. For example, the yearly peak in one central station with which he was familiar lasted only 60 hours per year. It was very desirable to keep down the investment on machinery needed to carry such a short peak.

Mr. Ludwig Kemper, of Albert Lea, said that from figures recently quoted a high-speed engine unit can be bought for 30 per cent less than any other kind of unit. The first cost of the steam turbine unit was lower than for a direct-connected Corliss. The amount of oil required for the turbine would also probably be less.

Another member brought up the question as to whether it would be desirable to operate a plant partly with producer-gas engines and partly with steam, having the new machinery of the producer-gas type and retaining the old steam-driven machinery. Mr. Daniel thought that this might be a good plan in some cases, changing the station over to producer-gas by degrees. In answer to a question as to the overload that can be carried by a gas engine, he stated this to be 10 to 25 per cent on engines as built by some makers.

Mr. B. W. Cowperthwait, of Faribault, expressed the opinion that if the gas engine were able to carry an overload of 10 to 25 per cent it would be underrated. The full-load rating of an engine is commonly considered to be its load when giving maximum economy. Mr. N. M. Argabrite, of Winona, said that the full-load rating of steam turbines is the point at which they give their best economy.

Mr. E. W. Erick, of South St. Paul, pointed out that while a steam engine or turbine will carry a load in excess of that at which it will give its maximum economy, this is not so with the gas engine. When the gas is being used in the most economical manner, with the best mixture in a gas engine, maximum load is obtained, and any load in excess of this will slow down the engine, so that the ability of the gas engine to carry load in excess of its rating is due to rating it below its point of best economy.

Mr. J. R. Cravath, of Chicago, called attention to the desirability in many cases of operating a mixed steam and gas-engine plant. In such an event the new gas-engine units could carry the all-day load at high economy and the steam units could be kept for reserve and to carry peak loads. This would keep the operating expenses low without unduly increasing the investment, as would have to be done if the prime movers were changed at once to gas engines.

Methods of Firing Cheap Grades of Bituminous Coal.

By Wm. Kavanagh.

There are six ways in which soft coal can be fired. These methods are known by the following names: Pancake, wedge or coking scoop, direct mixture, humpback and alternate. The pancake method of firing receives its name from the fact that the bed of coal is kept the same thickness all over the grate-bar surface, as shown in Fig. 1. The wedge or coking system may be employed in one of two ways, as shown in Figs. 2 and 3; the heavy end of the wedge being in the front or rear of the grate as shown. The scoop method of firing is illustrated in Fig. 5; the name scoop being applied because the fuel bed at the center of the furnace is thinnest and is gradually increased in depth as it approaches the furnace walls.

The direct mixture system of firing refers to that method where hard coal dust and soft coal are mixed in certain proportions and then fired either wet or dry according to the experience and ability of the fireman. The name humpback is



FIGS. 1 AND 2.—PANCAKE AND WEDGE FIRES.

given to that system of firing in which the fuel is carried high or deep at the center of the furnace and then tapers downward toward the bridge wall, furnace door and furnace walls, as shown in Figs. 4 and 6. The alternate method or system of firing derives its name from the way in which the hard and soft coals are fired in alternate layers; the different grades of coal being kept separate outside of the furnace door and each

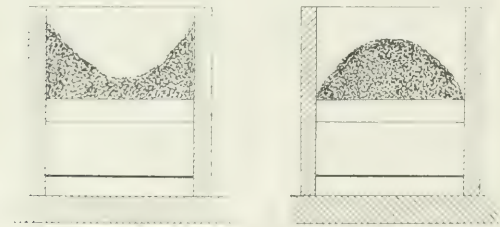
grade fired in regular order. With this method, the fire is first started with a heavy bed of soft coal and after this bed is well ignited, a thin layer of wet dust is spread evenly over the entire surface of the fuel bed. When the flame has appeared through this bed of hard coal dust, another layer of soft coal is spread over the incandescent bed of dust, and in this way the furnace is almost completely filled with the alter-



FIGS. 3 AND 4.—WEDGE AND HUMPBACK FIRES.

nate layers. After the furnace is nearly filled in the manner described, water is sprayed over the surface of the fuel, the furnace door closed and if the firing has been properly done no more coal will be needed during a run of five or six hours' duration, depending on the intensity of the draft and demand for steam. With natural draft this fire will last a long time, exceeding eight hours in some cases. Occasionally during the run a light sprinkling of water over the surface of the fuel will be found necessary partly to solidify the dust and delay rapid combustion. Should air holes appear they must be filled by first throwing one shovelful of soft coal over the air hole and on top of this a shovelful of wet dust. In this way the main body of the fire is maintained during the run. This method of firing is excellent where the plant operates continuously. Smoke formation is practically eliminated and the burning of soft coal can be practised where the most stringent anti-smoke laws are in effect. Occasionally during the run the slice bar may be inserted beneath the bed of incandescent fuel and the bed slightly lifted from the grate bars without allowing the bar to break through the upper surface of the fuel. This will add materially to combustion of the fuel. When the time arrives for a new fire to be built up, the old fire may be cleaned and enough live coal retained to start the fresh soft coal bed, when the firing can be continued as above explained. Very little clinker will be found in the furnace even with the use of the cheapest grades of coal and only a small amount of ash remains to be hauled from the furnace during the cleaning process.

Wetting fuel is wasteful from a theoretical standpoint; but practically it is known that if the dry dust of either hard or soft coal is used steam cannot be generated in sufficient quantities with ordinary natural draft. The most skilful firemen are unable to obtain practical results from the use of dry dust and hence it is common practice to sprinkle water on the dust employed. This causes it to cake, and afterward when subjected to heat the cakes thus formed coke and form themselves into lumps after the manner of a honeycomb. This honeycomb



FIGS. 5 AND 6.—SCOOP AND HUMPBACK FIRES.

formation is what the skilful fireman very much desires, and the small loss due to the wetting is offset by the gain due to the cheapness and quality of the fuel employed, and the fact that this cheap fuel can be thus profitably used. It is practically impossible to burn dry dust satisfactorily except by using some form of mechanical draft or by sprinkling it with water in the manner described.

The direct mixture system of firing is employed in numerous plants and a little experimenting with this system will determine what proportion of dust and soft coal is the most profitable to employ. With two barrows of dust and one barrow of soft coal, the mixing of these fuels can be automatically performed by dumping one barrow of dust, and on top of this one barrow of soft coal and then on top of the soft coal another barrow of dust; each barrow of fuel being sprinkled with water as it is dumped. If it is found the proportion of dust is too great one barrow of each may be used for the next trial and in this way one can determine which proportion is the most economical. Some years ago, hard coal dust was given away and in some cases carted to the boiler room for nothing; but now a load of dust costs from 50 cents to $1 in many cities in the East. The price of soft coal ranges from $3.50 to $4.50 per ton in the same sections, so that it will be evident the more dust burned the more economically steam is generated. Referring again to the direct mixture system, it will be found that some firemen can burn one barrow of dust mixed with one barrow of soft coal, while other firemen can only burn one barrow of dust to two barrows of soft coal. In general it will be found that a good fireman can burn three barrows of dust mixed with two barrows of soft coal on natural draft.

In the wedge or coking system of firing when the thickest end of the wedge is against the bridge wall, smoke formation is sure to occur; the thinnest end of the wedge near the furnace door admitting more air, becomes incandescent long before the fuel at the bridge wall is well ignited. Hence the smoke formed in the thickest portion of the bed passes out to the chimney without encountering any highly heated portion of the furnace. If the wedge formation is reversed, the thinnest end will be raised to a high temperature and the smoke formed near the furnace door must pass over or through this highly heated portion of the furnace near the bridge wall and, therefore, the smoke is consumed before it can appear as such in the stack or chimney. The hottest region of the furnace being furthest from the furnace door the rich gases are ignited and their complete combustion is assured. If a piece of pipe is inserted in the uptake or back connection in such a way as to permit the smoke to flow through it and out in the boiler room it will be found possible to burn the smoke by applying a torch to it. This experiment would indicate that gases rich in carbon were escaping to the stack without being consumed. Combustion of those gases should take place in the combustion chamber and the heat so evolved utilized in generating steam.

Pipe-Hangers—III.

By W. H. Wakeman.

IN the first issues of March and April, the writer illustrated quite a number of hangers applicable for various purposes, and in the present issue concludes the series with a description of 10 others.

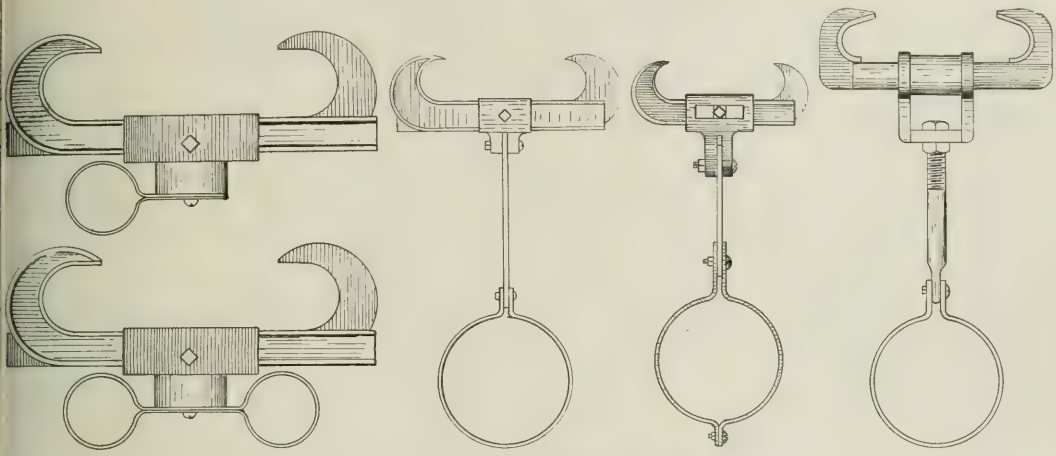
The hanger shown in Fig. 1 can be nicely adjusted to beams with flanges from 3 in. to 7 in. wide, as the straight shanks of the hooks are a sliding fit in the central part, and when in proper place they are fastened by the set screw shown. This device is for one pipe only, but that shown in Fig. 2 carries two, and in both cases they are close to the ceiling. It is not necessary to place the pipe parallel to the hanger, as the supporting rings are on a swivel, therefore, they can be turned at any desired angle.

Fig. 3 illustrates another girder hanger for pipes, the lower part of which consists of a bar or link of flat iron that can be coarsely or approximately adjusted by means of holes located a short distance apart. The ring or band can be sprung over the pipe, then brought together and held by a bolt. The device shown in Fig. 4 has a split band held together by a bolt at both top and bottom, hence it can be easily put on and removed from a pipe.

Fig. 5 shows a hanger fitted with a band made in one piece which is bolted to a nipple of any desired length. The upper end is threaded and fitted with two nuts, for the purpose of

locking the nipple firmly in place when the desired adjustment is secured.

A hanger with a band made in halves and bolted to a nipple is illustrated in Fig. 6. Another nipple is bolted to the clamps and a turnbuckle connects them as shown. This arrangement provides for an adjustment of several inches, and if the turnbuckle is a good fit on the nipples it will remain in place indefinitely, although the expansion and contraction due to heat and cold, shocks and jars caused by water-hammer in the pipes, and vibration in mills and shops resulting from the use of unbalanced pulleys, sometimes loosen pipe hangers and change the pitch of pipe lines given when they were hung.

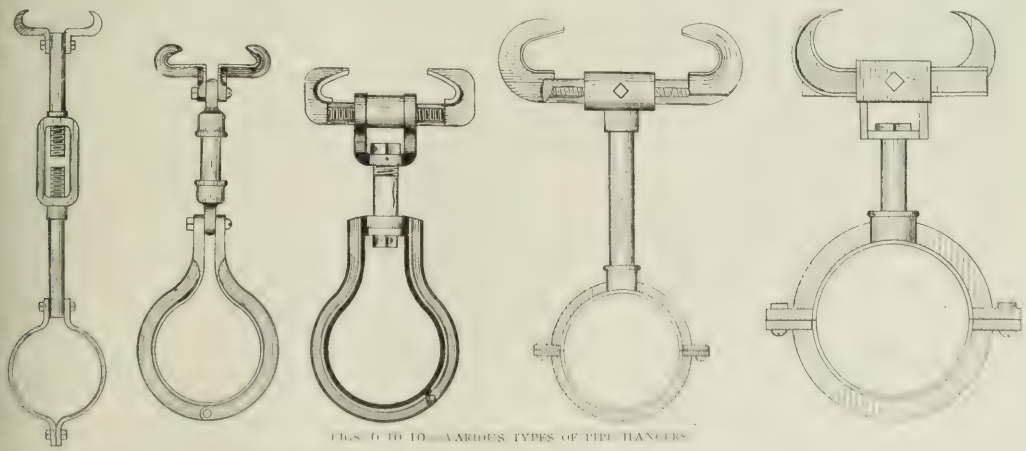


FIGS. 1 TO 5.—VARIOUS TYPES OF PIPE HANGERS.

The hanger shown in Fig. 7 has a hinged band that is very convenient. It is bolted to a socket and the clamps above are bolted to another. Between them is a pipe nipple, the length of which decides the "drop" of the hanger. With this exception the hanger is non-adjustable, provided both ends of the nipple are fitted with right-hand threads. Of course, it is possible to unclasp the band and turn the sockets in the required direction to secure the adjustment desired, but this does not really constitute an adjustable hanger in a strict sense of the word. If this is a right-and-left nipple with threads in the sockets to correspond, adjustments could be made at any time with a pipe wrench, as already described in connection with a previous illustration.

Fig. 8 illustrates a hanger fitted with a hinged band that locks around a nipple which carries a nut at either end, although no provision is made for locking the nipple in position. The nipple is made as near the desired length as practical, then final adjustments are made with these nuts. That shown in Fig. 9 carries a ring that is split horizontally, therefore it is easily disengaged from the pipe for adjustment to give proper pitch as follows: Suppose that after this hanger is put into position with the pipe in place, it is too low. The screws which hold the lower half of the ring should be removed, the set screw at the center of the clamp loosened and spread slightly, but not enough to release them from the girder, the upper half of the ring swung clear of the pipe and turned from right to left, or in the direction which tightens a nut that is fitted with a right-hand thread. The upper half of the ring should be dropped into place, the lower half secured in position, the clamps readjusted, and the job is done.

These directions are given in order that those who are not familiar with such work may understand what can be done with these appliances. However, the hanger shown in Fig. 10 is of superior design, although it appears similar to the preceding, for if the pipe is to be raised it is only necessary to turn the nut which appears directly under the clamps until the desired height is secured, which completes the job.



FIGS. 6 TO 10.—VARIOUS TYPES OF PIPE HANGERS.

When a new heating system is to be installed or one that is already in use remodeled, it is a good idea for one to devote the necessary time in careful consideration of what can be accomplished along the line of the pipe hangers rather than to adopt the first plan presented.

LETTERS ON PRACTICAL SUBJECTS

SMOOTHING ROUGH COMMUTATORS.

The electrician or engineer often has a badly behaving direct-current motor in the plant that causes trouble by sparking and flashing, rattling of the brushes and heating of the commutator simply because the segments are either rough or burned, or the whole surface is not true. The tendency to spark is greater with a motor exerting its full horse-power than when not working to its limits; and with a constant, heavy load, when the sparking does begin, the commutator suffers from the very start. Black stretches appear on the bars under the path of the brush contacts, while the brushes in turn are worn down extra rapidly by such roughness. A common remedy is the application of coarse and fine glass-paper fitted to a curved block. A daub or two of compound or oil completes the doctoring, but does not improve things much. Glass-paper will smooth the segments somewhat and leave a polish, but will not true the surface, and after a half hour of such treatment the brushes still clatter defiantly for all the commutator shines like new. To remove an armature to be trued in a lathe takes time that often cannot be spared. A truing device is very handy, but even that takes time to get it into operation. A very good remedy that does not take much time has been tried by the writer on many motors. A carborundum stone 7 in. long, 2 in. wide, 1 in. thick, of fine grain, should be procured and an arc

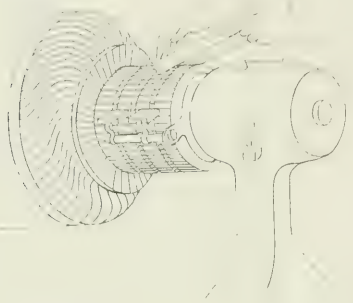


FIG. 1.—SMOOTHING ROUGHENED COMMUTATOR.



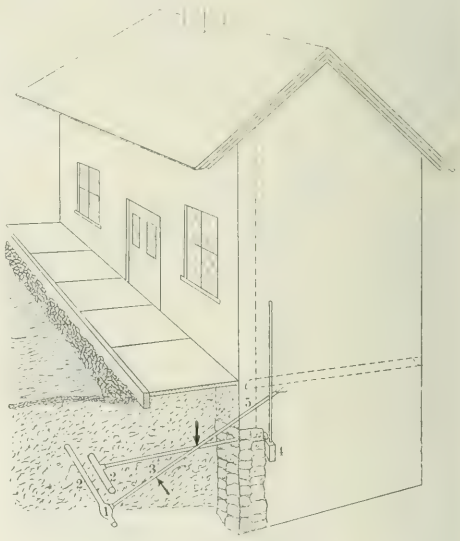
FIG. 2.—TRUING STONE.

cut out of the wide, flat surface at one end to fit or nearly fit the commutator. With the motor running with its usual load the near end of the stone should be held with one hand and with the other hand the cutting pressure on the commutator may be regulated. By moving the stone slowly across the bars it is prevented from cutting new grooves, and at the same time wears down the high bars and ridges evenly and rapidly. Next there should be applied to the surface a piece of clean, dry pumice stone. This should be moved across the bars with a light pressure at first till it receives a curved surface; as the commutator smoothens more pressure may be applied to produce a polish. Most any size commutator can be smoothed and polished without the use of glass-paper, file or truing device and without removing the armature. Of course, turning down in a lathe is the best when time will allow. The writer has applied a fine-grain carborundum stone and dry pumice stone to a score of motors about a large plant many times with excellent results, without truing even one in a lathe. In applying the stone a film of copper will collect on its cutting surface which should be scraped off occasionally. A clean surface of the pumice stone should always be applied to the commutator, and by means of clean waste the dust of cutting and polishing may be frequently removed from the commutator. The surface should first be trued with the carborundum and the pumice used to polish it.

POUGHKEEPSIE, N. Y. H. S. RICH.

A HUMMING GROUND.

A very peculiar incident was called to the writer's attention a short time ago, when a householder complained of a violent humming in the vicinity of his gas and electric meters, which had grown to be unbearable. It was at first felt that the humming must be due to the action of the 60-cycle alternating current in the loose laminations of the stator windings of the electric meter, but when the main switch was opened the noise continued as much as ever. When the gas meter was disconnected a fat spark was noticed at both the inlet and outlet of the meter when the latter was taken down, and the noise ceased at once. A voltmeter placed across the inlet and outlet to the gas meter gave a reading of 90 volts and a similar reading was obtained between the inlet and a steam pipe nearby. Upon further investigation an old and abandoned underground electric service was discovered alongside of the gas pipe. Not wishing to place insulating joints on the gas meter, the



HUMMING GROUND.

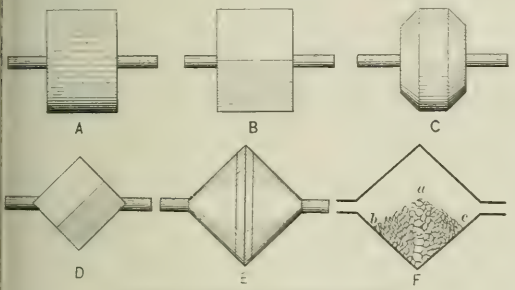
street was dug up and it was found that the gas and electric service pipes crossed and touched each other just outside the building line. There was a strong smell of gas and the ground was blackened. Evidently the gas main had been made porous by the action of the electricity from the grounded service and at the gas meter a drum effect resulted from the gaseous dielectric enclosed in the casing of the meter. Had the cross

been permitted to remain very much longer, a bad gas leak would have probably resulted. In the accompanying engraving the conditions are illustrated. Here 1 is the electric conduit, 2 the gas main, 3 the point where the pipes crossed, 4 the gas meter and 5 the abandoned service. In eliminating the trouble the service conduit was cut at the point where it left the junction box, the gas meter was replaced and when the main switch was again closed no sound was heard and no trouble has been found with the service since.

Newburgh, N. Y. A. P. Broadhead.

DEFECTIVE CONCRETE MIXING.

When the materials which enter into concrete for engine foundations or for other engineering structures are properly proportioned, there is found to be much less mixing required than when the sizes or grades are improperly proportioned. This applies to the cement proportion as well as to the amount of any size of sand or gravel which may enter into concrete. The proper amounts of each size or grade vary with the diameter



VARIOUS SHAPES OF CONCRETE MIXERS.

of the largest size of material used in the concrete, but no matter what the size of the largest material used, the mixing becomes harder as the proper proportion of sizes is departed from. When the dry concrete mixture is properly proportioned for maximum density the several sizes of material seem to fall into place naturally and with very little effort on the part of the mixer. But let the proportions be departed from to a considerable extent and great trouble is met with in obtaining a thorough mixture, and the material even seems to separate to a considerable extent upon the slightest provocation. Aside from the matter above noted, the writer desires to sound a word of caution to all users of concrete against certain forms of power mixers which are, or may be placed, in the market. The commercial forms of concrete mixers now in use consist of two types: the continuous mixing pug-mill or paddle machine and the cylinder, in which batches of concrete material are revolved until their ingredients are supposed to be thoroughly mixed. The pug-mill has no place as a mixer of dry materials for the reason that the volume in a given section of the machine must travel along in much the same condition as it was in when it entered the machine. That is, if a considerable volume of each grade of material be dropped in succession into the pug-mill the grades will necessarily come through in the same order that they entered the machine. It is impossible, in this machine, to mix a portion of material in one end of the machine with material in the other end. Thus the product of a pug-mill mixer is extremely likely to be made up of a string of differently constituted mixtures.

Undoubtedly the best concrete mixer is a revolving cylinder, the diameter of which is quite large in comparison with its length. To obtain the best results, the length should not be more than one-half the diameter of the cylinder, and the ends should be straight and at right angles to the shaft. Some mixers are made with conical or semi-conical ends. Such shapes are not capable of giving the best results in mixing material of various diameters. It is not necessary that the mixing case or vessel be circular. It may be square or rectangular, but it is essential, as will be hereinafter demonstrated, that the ends of the containing case at all times stand perpendicular to the axis about which the mixer revolves. Thus, a cubical case may be used to advantage, provided that it is so supported that its axis passes through the middle of two sides. But when the rectangular case is supported and revolved upon an axis which passes through diagonally opposite corners, then the device becomes a separator instead of a mixer. The accompanying illustration indicates several types of revolving mixers in common use. *A* represents the plain cylindrical mixer, one of the best forms made; *B* represents a square or rectangular mixer with the heads square with the shaft. A common form of mixer is shown at *C*, the corners of the cylinder having been removed. This is a defective form of mixer, as will be shown later. *D* is another bad form, and a very common one, too. This mixer is rectangular like the one shown at *B*, but it is supported and revolved upon an axis which passes through the corners instead of through the middle of two of the heads. The mixer shown at *D* is an innocent-appearing device and no one would suppose that this machine is more of a separator than a mixer, but such is the case. The coarse particles will go to the middle of the mixer and the finer materials will arrange themselves adjacent to each other according to their size. This seems strange, but it is easily proved as follows: Procure a couple of glass funnels, such as are used by druggists and chemists. Place a quantity of sand and gravel, of assorted sizes, in one of the funnels, then fasten them together, as shown, by means of a bit of adhesive plaster. Next, hold the funnels nearly horizontal and revolve them slowly a number of times. The gravel should roll and tumble across the funnels. After revolving the funnel a couple of dozen times it will be found upon examination that the coarse and fine material is arranged as shown at *F*, the coarse particles being found in the middle at *A*, while the fine particles are arranged on either side, as shown at *b* and *c*. The writer will offer no explanation as to why such a separation of sizes takes place. It is sufficient that the separation does take place. Square-ended concrete mixers should always be used, conical or diagonally mounted mixers avoided, if good results are desired. Above all, a properly proportioned mixture of coarse and fine material should be employed; the coarse or largest size being as large as possible up to 2½ in. in diameter. Then, the above conditions being filled, a fine quality of properly mixed and proportioned concrete will be the result.

Detroit, Mich. James Francis.

DETERMINING THE POWER REQUIRED.

An engineer who is largely interested in placing electric motors from the standpoint of the salesman, recently remarked during a conversation with the writer that it troubled him more than anything else to ascertain exactly the amount of power demanded by any machine. There was, he stated, no published tables of horse-powers actually consumed by machines of all kinds, although many random machines had been tabulated.



FIG. 1.—MEASURING THE CATENARY SAG.

He further stated that the great difference in the connection and operation of different machines of the same size and kind made tables prepared for certain conditions almost valueless under other and new conditions which were constantly being met with. In view of the above situation, it would be extremely convenient to be possessed of some means whereby the power which is actually being transmitted to a machine by the driving

belt may be measured during the usual working of the machine in question. In the May, 1908, issue the writer presented a letter to the effect that every driving belt was a dynamometer by means of which the power absorbed by any machine could be readily measured. The manner of measuring was to ascertain the drop or sag of the belt on both the driving and driven sides, then from a table of catenary constants and the weight of the belt per linear foot, and the distance apart of the point



FIG. 2. DETERMINING THE BELT PULL.

of suspension on each pulley, the exact amount of tension in each fold of the belt could be calculated.

It is evident from the behavior of a belt that the working side hangs at a much flatter catenary than does the idle or return side, and that the exact amount of sag must depend upon the distance apart of the points of support, the power pull and the weight of the belt per foot as above stated. The amount of sag may be readily measured by means of a couple of fingers or pointers which are erected so as just to touch the inside surfaces of each fold of the belt and to indicate in inches the average deflection at the points of the belt which shows the greatest deflection. This being done, either one of two methods may be followed to ascertain the pull on the belt in each fold. Fig. 1 illustrates the sag or catenary determination which merely calls for the locating of two pieces of board or metal upon adequate supports, as shown at *a* and *b*. Flexible-spring fingers are attached to each of these boards, the lower edges of which are located exactly in line with the pulley faces, as shown. While the belt is running, the spring fingers are deflected until they touch the belt while it is in its average running position. There will, of course, be more or less fluctuation to the belt, but the fingers being arranged to drift with the belt, and being very flexible, the average position of each belt-fold can be quite closely marked by the flexible fingers.

It is evident that with the belt at rest the amount of sag in the working and idle folds will be equal, but when the belt is working the deflection of the two folds will be unequal and the average amount of deflection of each fold is found as above described. The next step, after having found the deflection, is to determine the amount of pull on the belt necessary to cause the deflection noticed. To determine this point the belt is opened at *a*, Fig. 1, and clamps are attached to which are made fast the spring balances and turnbuckles *c* and *d*. It may be necessary to block securely the pulley around which the belt passes. The turnbuckles are then screwed up until the belt folds give exactly the amount of deflection noted by the flexible fingers while the belt was running. If there is any trouble experienced in blocking the shaft, the pull measuring may be done by screwing up both turnbuckles until the sag is just right at either *a* or *b*, and after the pull on the belt has been recorded for that leg the pull on the belt should be changed until the recorded sag for the other fold has been reached, when a reading may be taken on the spring balance through which that strain is passing.

It is possible to do this work with a single balance, which may be shifted from one fold to the other as required. But the erroneous method of determining both belt pulls from the same fold of belt by letting it down to the different deflections in succession should not be tried. The method will not give correct results for the following reason: The length of belt in fold *b* is greater than that in fold *a*, hence there is a considerable difference in tension in the belt, due to this cause alone. To obtain the actual strain, or belt pull, it must be actually weighed under the exact working conditions and this can only be done by weighing the pull of each fold in its proper place on the pulleys.

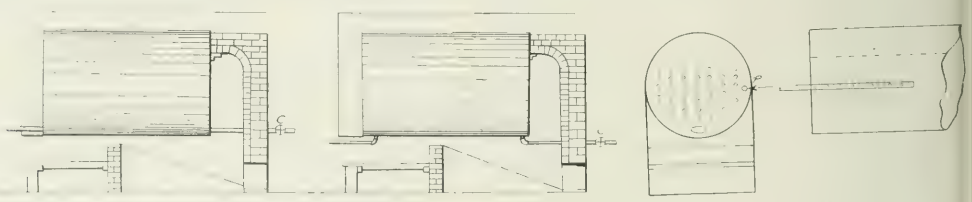
The other method of ascertaining the belt pull, and one which does not call for opening the belt, is to procure a narrow belt or wire cable of known weight to the foot and place this around the pulleys, as shown by Fig. 2, the working belt having been removed or run to one side a trifle to let the test belt or wire to be put in place. The pull on each fold of the wire is ascertained as before, then a table of constants, or a curve, is consulted which has been prepared for the particular weight of trial wire or belt used, from which table or curve the amounts of pull which would be given by a belt of the weight and length corresponding to the working belt in actual use may be found.

For small belts the first method would be preferable, but for large, wide belts, which would require a spring balance of great capacity, the second method would be better—or a modification of it. For instance, were the engineer to make the pull measurements with a known weight of belt, say, a 3-in. or a 4-in. belt, then a very simple table or chart would be required in order to obtain the actual belt pull from the trial figures obtained by measuring the pull of the belt of given width. The difference in pull, times the belt velocity in feet, divided by 33,000 will give the horse-power transmitted.

WILLOUGHBY, OHIO JAMES F. HOBART

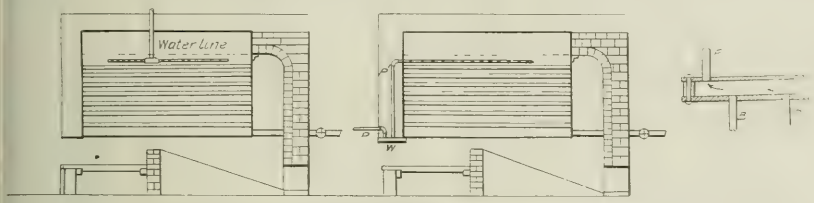
FEEDING AND BLOWING OFF A HORIZONTAL TUBULAR BOILER.

Fig. 1 is an illustration of a horizontal tubular boiler that receives its feed-water through a pipe tapped into the front or rear head. Formerly, the location of the feed pipe was never given any consideration. Any place was good enough so long as the pipefitter or boilermaker succeeded in placing the pipe close to the crown sheet so as to insure a speedy boiling of the water. That was the one idea. There was no thought given to the destructive effects of the cold or partly heated water on the crown sheet; the paramount idea was to get the cold water as close to the fire as possible. Fig. 2 represents what was at one time considered an improvement in the art of boiler feeding. Here the feed pipe was tapped in the shell or crown sheet directly over the fire, and hence the feed-water was closer to the fire than in the previous case; therefore, it was thought a better method was found for feeding boilers. At the present time, no boilermaker of any standing would sanction either of the above methods of feeding water to a horizontal tubular boiler or any other type of boiler. It was found by feeding water close to the crown sheet that the metal in the vicinity of the cold or partly heated feed-water entrance

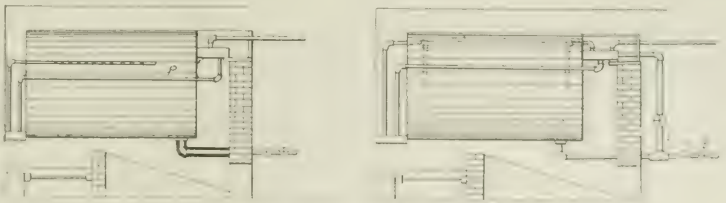


FIGS. 1 TO 4.—METHODS OF FEEDING TUBULAR BOILERS.

crystallized and leakage occurred around the feed pipe and shell. The crown sheet cracked, requiring patches and in some cases an entirely new firesheet was necessary; hence it was clear that both methods of boiler feeding mentioned were by no means the best. The first improvement that followed the above methods was to raise the feed-pipe connection and place it some distance up the tube sheet so as to permit the entering feed-water to mingle with the water already within the boiler, which was at a higher temperature. Fig. 3 shows this improvement. Here the feed pipe is tapped into the head or tube sheet about half-way up, as shown at *P*. The specific gravity of the water entering the boiler being a trifle greater than that of the water in the boiler, the entering water settled toward the crown sheet and in doing so mingled with the hotter water, thus lessening its gravity and giving it a tendency to move upward. Hence its impingement on the fire sheet is lessened thereby, increasing the longevity of the crown sheet. By extending the pipe *P* within the boiler and below the water line and allowing the feed water to flow through a series of small holes in the pipe, as shown in Fig. 4, the specific gravity of the feed-water is lessened and a mingling of the water at different temperatures more easily obtained; the feed-water being sprayed over a greater area. Fig. 5 shows the next improvement, which consists in having the feed pipe enter the top of the boiler and extend downward below the water line, teminating in a tee, as shown. The tee is fitted with two nipples that are open at their ends and perforated for their entire length. The portion of the feed pipe extending above the water line and in the steam space is subjected to the heat of the steam and hence the temperature of the feed-water is raised a certain amount before being scattered about or sprayed through the water already in the boiler. Fig. 6 shows the next step forward in supplying the boiler with feed-water. A water arch is substituted for the old-time brick or block arch; the water, after passing through the heater, being discharged into the water arch *W* through the pipe *P*, and after absorbing a certain quantity of heat in traversing the arch the water then enters the boiler through pipe P^1. Pipe P^1 is located below the water line and extends within the boiler a distance equal to three-fourths of the boiler length; the pipe being open at its end and perforated as in the previous cases. The substitution of the water arch not only elevated the temperature of the feed-water, but it also removed a serious defect in the boiler setting. The front arch, being previously constructed out of fire brick or baked blocks, was rapidly eaten away by the heat, requiring considerable repairs, the bricks falling down and admitting large quantities of cold air over the fire. Fig. 7 is a sectional view of a water arch built up out of boiler iron. The water enters the arch through the pipe *P*, then moves across the arch and out at P^1 as shown. The arch is provided with one or more handholes for the purpose of cleaning, and a blow-off pipe is also connected in the arch as shown at *B*. Sometimes the water arch is not constructed of boiler iron, a heavy header or series of pipes being used as a substitute. Fig. 8 illustrates the next step forward in the art of boiler feeding. It was found that the rear arch gave almost as much trouble as the front arch by reason of the lengthening and shortening of the boiler when subjected to heat, causing the brickwork to drop down or fall out of position. In order to overcome this difficulty a water arch was substituted for the rear brick arch and hence what is known as the double water arch, single-feed system came into existence. The feed-water from the heater enters the rear arch as indicated and after traversing the arch enters the front arch through pipe *P*. Thence the water flows to the boiler as shown by the piping. Pipe *P* need not occupy the position indicated. In connecting the two arches together it may be run in the upper flue or through the furnace, being raised sufficiently to protect it from injury by the fire tools. This method is preferable to running the pipe through a tube or outside of the wall. The double-arch, double-feed system with circulating pipe connected directly into the blow-off pipe as shown at *D*, is illustrated in Fig. 9. This system needs no further explanation, as it is somewhat similar to that described in Fig. 8, with the exception of the feed connection in the back and the circulating pipe in the blow-off to protect the latter from being burned or filled with scale. The rapid movement of the water through *D* prevents the destruction of the blow-off pipe, hence the blow-off need not be protected with asbestos as shown in Fig. 8. The same connection could be made to the blow-off in Fig. 8 providing the arch was tapped for the extra connection; the expense of making this connection being the only consideration. Referring to Figs. 1 and 2 the old style of connecting the blow-off pipe is shown. The pipe being unprotected its rapid destruction follows, there being no circulation to prevent the blow-off from becoming filled with sediment. The only way to prolong its life is to open the blow-off cock regularly night and morning in order to clean out whatever scale may have accumulated during the night and day run. With this style of blow-off connection, the best time to blow is in the morning before the steam pressure rises over 10 lb. or 15 lb. In some cases where the blow-off pipe is run over the top of the boiler it is necessary to blow with a much higher pressure. At the noon hour and after closing down at night the blow-off should be opened for a short time, at least in order to clear the pipe. The constant opening of the blow-off cock or valve, as shown at *C*, Figs. 1 and 2, insures a rapid destruction of the seat because the sediment, or a portion of it, will rest on the seat, making it necessary to use a wrench to close the valve tight. Sometimes it is impossible to close the valve or cock steam tight, owing to the lodgment of scale around and beneath the valve disk, no matter what size wrench is used; hence, the steam and water rushing through the small opening soon wear the seat and disk, forming a leaky blow-off cock or valve. This plan is good and is shown at *B* in Fig. 2. Here the blow-off pipe is fitted with two cocks or valves.



FIGS. 3, 6 AND 7.—FEED-WATER ARRANGEMENTS AND WATER ARCH



FIGS. 8 AND 9.—FEED-WATER AND BLOW-OFF

QUESTIONS AND ANSWERS

Please inform me whether a 33,000-volt transmission line will in any way interfere with wireless telegraphy? B. F. E.

There is no doubt that a 33,000-volt transmission line would affect to some extent a wireless telegraph station in its immediate neighborhood. However, the interference is doubtless negligible, because no cases of interference have been brought to our attention.

What effect does soda ash have on boiler feed water and what are its disadvantages? A. M.

The effect of soda ash on boiler feed water will depend on the impurities in the water. Ordinarily small quantities of the substance are used to change troublesome sulphate of lime to carbonate of lime which can be easily handled in a feed-water heater. If the use of straight soda ash results in priming and cutting of oil from the cylinders of engines, tannic acid may be introduced to destroy the alkalinity of the water. The objections to its use are that it works the joints of steam lines, causes foaming and saponifies the oil used for lubrication in the cylinders of engines.

What are the standard voltages used in mining operations? W. G.

There are no standard voltages for mining operations. The companies operate under mining laws which differ in the several States and which unfortunately have not kept pace with the application of electricity to mining conditions. In very many mines 250 volts is the highest tension used, while in others the three-wire system with grounded neutral using 550 volts between the outer wires is employed. Foreign mining experts requested to investigate conditions in mines by the U. S. Geological Survey recommend 650 volts, direct current, and 500 volts, alternating current, as limitations for the underground distribution of electricity in mines.

When using choke coils in connection with lightning arresters, where should they be connected? K. F. K.

Choke coils should preferably be placed in the leads from the transformers or generators and inside the switches. While but one set of arresters may be used on an incoming line to which a number of transformers is connected in a bank, a choke coil should be placed in the leads of each transformer. Ordinarily choke coils are used so that there is one arrester and one choke coil on each wire of an incoming line. It has been suggested that for the protection of generators of a certain voltage, choke coils of the next higher voltage rating be employed, since these have an increased number of turns and give a higher protection to the generator.

A 7½-hp, 220-volt, 25-cycle, induction motor is run on 40 cycles. The machine is continually hunting and sometimes stops. The rotor is of the squirrel-cage type and becomes quite hot when running under normal load. The bolts holding the conductor bars to the end rings are all good and tight, so that there is no trouble there. The speed of the motor also drops when the load is thrown on. The motor has four poles and 60 coils and runs on two-phase current. The thing which is puzzling is that only the rotor becomes hot. Could the change of frequency have anything to do with the hunting and heating, or is the trouble due to the construction of the machine? C. F. K.

When an induction motor normally designed for operation at 25 cycles is run at 40 cycles it is subjected to considerable increase in speed, and probably mechanical difficulties will be encountered on account of the increased speed. However, the machine should be able to carry full normal power load, although it could not ordinarily be subjected to as great torque as one operated under normal conditions. Hunting is almost unknown in the operation of induction motors. Whenever it does occur it can be attributed to some condition external to the motor itself. If the load fluctuates violently the machine is liable to hunt, moreover, if the generator speed is not constant the machine may seem to hunt. If the rotor winding of your squirrel-cage induction motor becomes warm during operation then it is evident that the machine is subjected to conditions quite different from those for which it was designed, independent entirely of the fact that the frequency has been changed from 25 cycles to 40 cycles.

If the neutral of the primary of a Y to Y-connected bank of transformers be grounded, does this tend to increase the electrical insulation stress between the high- and low-tension windings? Would it protect a delta-connected generator in case of a breakdown between the two windings? Kindly explain the following: In a star to delta system, if one leg of the delta is opened and short-circuited, the voltage of the transformers is increased 73 per cent, while the line voltage is increased 300 per cent. G. M.

The grounding of the neutral of a system has no effect upon the insulating stresses to which it is subjected under normal operation. Under normal conditions, the mechanical neutral point of a system tends to remain at the ground potential; however, if one of the wires becomes grounded the mechanical neutral point is shifted by 57.7 per cent of the delta voltage. It may safely be said that the insulating stresses will be reduced rather than increased when the neutral of the system is grounded. An answer to your other question is given in detail in the article by Mr. W. T. Ryan, which appeared in the December, 1908, number.

Can good regulation be obtained over a transmission line two miles long made of No. 4 copper wire and carrying 60 kw at either 125 or 133 cycles, single-phase, the voltage being 2200? What I desire to know is whether four miles of No. 4 copper wire will offer enough resistance to the 27 amp, at the above voltage and frequency, to cause surging in the line and thus make the voltage fluctuate so much that it would not be suitable for lighting purposes. W. H. G.

The resistance of No. 4 wire is about 0.25 ohm per 1000 ft., so that a transmission line two miles long would have a total resistance of somewhat over 5 ohm. A load of 60 kw at an e.m.f. of 2200 volts would require 27.3 amp. The loss in a 5-ohm line would be about 3.7 kw, or, roughly, 6 per cent. The reactance at from 125 cycles to 133 cycles would probably be about 8 per cent; the impedance, 10 per cent, and the voltage regulation at full load would probably be about 7 per cent. A regulation of this value should prove satisfactory, provided the equipment will permit of increasing the e.m.f. at the station, with an increase in load on the system. It might be well also for you to read the article appearing on page 36 of the January number in this connection.

We are operating a 133-cycle system, and it is proposed to change over to 60 cycles. Will it be practicable to operate the same transformers on 60 cycles? What effect will the change in frequency have on the voltage ratio of the transformers or on their performance? P. H. H.

The ratio of the primary and the secondary voltage of a transformer is in no wise affected by a change in the frequency. The ratio depends solely upon the number of turns. If, for example, there are 10 times as many turns in the primary coil as in the secondary coil, then the ratio of transformation is 10 to 1. When the frequency is changed, say, from 133 cycles to 60 cycles, the transformers can be operated at the original voltage with an increase in the iron loss, or they can be operated at a reduced voltage at the former value of iron loss. When a 133-cycle transformer is operated at 60 cycles it will be subjected to the original iron loss if the voltage is reduced to about 75 per cent of its former value; if, however, the voltage is given the same value as before the iron loss will be increased by about 60 per cent. The total losses in a transformer would be increased somewhat less than 30 per cent, and the temperature rise would be increased by slightly less than 30 per cent. It might be well for us to mention in this connection that it has been the practice of several of the manufacturing companies to build their transformers for operation at either 133 cycles or 60 cycles. The transformers are really 60-cycle units, and when operated at 133 cycles they are subjected to slightly decreased loss and decreased temperature rise.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

The Electric Vehicle Situation in Boston.

Within the past two months organized efforts to develop the use of electric vehicles on a larger scale than ever before have been vigorously pushed in Boston. Through the co-operation of the manufacturers and central-station interests active steps are being taken to popularize the electric vehicle for both commercial and pleasure service. On Feb. 25 a meeting was held at the Boston Athletic Association clubhouse at the call of General Superintendent W. H. Atkins, of the Edison Electric Illuminating Company of Boston, for the purpose of securing the co-operation of manufacturers, manufacturers' agents and representatives of the Edison company in the furtherance of electric automobile work. Mr. Frank J. Stone, New England manager of the Electric Storage Battery Company, who presided, discussed the possibilities of the electric vehicle in this territory, showing the accessibility of many natural advantages to the electric automobile through good roads and emphasizing the importance of suitable garage accommodations and an active interest in this business on the part of the central stations. The sphere of usefulness of the electric machine was fully discussed, and a committee was appointed to report plans for organization.

On March 11, at the Hotel Tuilleries, during the week of the Boston Automobile Show, about 50 gentlemen prominently interested in central-station and automobile matters met as a result of the previous work of the committee and, after a banquet, voted to form an organization to be known as the Electric Vehicle and Central-Station Association, to develop the possibilities of this field. Mr. Frank J. Stone was elected president of the new organization; Mr. L. R. Wallis, of the Boston Edison company, treasurer, and Mr. H. T. Sands, of the Malden Electric Company, secretary. Discussing the scope of the new association President Stone emphasized the value of this business to all interests concerned and showed that the annual energy consumption of the motor vehicle, ranging from 3600 kw-hours to 10,000 kw-hours per vehicle, is the kind of load which the central station can utilize to the utmost advantage. Mr. Stone said that all auxiliary interests are now in a better position that ever before to co-operate in developing this business. Improved facilities at garages are necessary, proper inspection and care need to be secured for vehicles in service; and public interest can be stimulated in the electric vehicle field. The first number of a monthly magazine devoted to this special work appeared last month as the organ of the association, called *The Electric Vehicle and Central Station*, published at 12 Pearl Street, Boston. Mr. Stone pointed out the usefulness of such a means of publicity, and following his address a paper was read by Mr. William P. Kennedy, consulting engineer, New York, on "The Present Status of the Electric Vehicle." He touched upon the importance of good engineering in the proper application of motor vehicles, and the resulting economies. Lack of skilled analysis has caused much difficulty in the past in situations where the purchaser has not secured the best results.

Mr. W. H. Atkins, general superintendent of the Boston Edison company, then emphasized the company's desire to co-operate with others in encouraging the use of the electric pleasure and commercial vehicles.

On March 19 Mr. Alexander Churchward, chief of the electrical vehicle motor department of the General Electric Company, at the Edison auditorium, Boston, spoke on "The Evolution and Possibilities of the Electric Vehicle for Commercial, Professional and Other Uses" during a regular meeting of the association. Mr. Churchward reviewed the development of the electric vehicle, presented characteristic curves of the automobile motor, and discussed the whole subject from the technical point of view.

On April 7, Mr. Day Baker, Boston manager of the General Vehicle Company, Long Island City, N. Y., gave a paper before the association on "The Practical Application of the Electric Vehicle." This paper showed in a most interesting way how the congestion in the streets of Boston can be reduced if the possibilities of the electric vehicle are utilized.

At present there is no doubt that the electric vehicle business in Boston is only a small part of the total automobile business, and many of the garage men have felt that there is little money in handling electric motor cars compared with the profits of the gasoline car in the garage. This is not the case in all the garages, but it is a fact that the profits on gasoline car repair work are often so high as to turn the interest of the garage manager away from the electric machine. There are at present between 150 and 200 commercial and pleasure electric vehicles in Greater Boston. The number is less than it would have been had it not been for the recent fire at the Park Square Garage, where several valuable electric, as well as many gasoline, machines were totally ruined. While the garage situation is somewhat unsatisfactory at the present writing, the movement under foot by the association is rapidly improving conditions. Among the principal garages which handle electric vehicles the following rates are representative:

Rate for charging transient cars, 10 cents per kw-hour; minimum charge, 50 cents.

Rate for doctor's runabout, always ready, including oiling and inspection, but not repairs, charging, 10 cents per kw-hour.

Monthly rate, charging small runabouts, excluding inspection, $15; including inspection and oiling, $18 to $20.

Garage storage charge, per month, $20.

Total rate on 1000-lb. delivery wagon, including storage, washing, polishing, inspection, oiling, minor repairs and charging, per month, $40.

Total rate as above on pleasure vehicles, $30 to $35.

There are a number of private garages now in Boston which utilize the mercury-arc rectifier to advantage on the regular motor rates of the Edison company, which bring the charging rate to from 12 cents to 6 cents or 7 cents per kw-hour according to the amount of energy demanded. These rates in a garage charging continuously a considerable number of machines will easily be cut in half, or reduced still lower.

It is expected that within three weeks a garage for the exclusive use of electric vehicles will be opened by Mr. N. Rommelfanger on Columbus Avenue. In the conduct of this garage a specialty will be made of the care of batteries, the employees will call for batteries and deliver them throughout a wide territory, suitably charged, and if desired, renovated. A considerable charging business of this character is now being carried on by Mr. Rommelfanger in rather limited quarters. The opening of this all-electric garage will doubtless be a decided stimulation to the electric automobile situation, as there is no establishment of the kind in New England at the present time. The Edison company at present has charging facilities at the following suburban points: Dedham, Natick, Somerville, East Boston, Woburn and South Framingham. The business is purely transient and the rate is 12 cents per kw-hour, with a minimum charge of 50 cents.

The Edison company at present has four electric vehicles, each of 1000-lb. rating. Two are delivery wagons for meters and lamps, one is an emergency repair wagon for underground work principally, and one is a pump wagon. Another 1000-lb. lamp wagon has just been purchased, and also a 3.5-ton construction wagon, motor driven, which will carry poles 26 ft. long. A special agent has been detailed in the sales department to give all of his time to the electric vehicle business, and the

company is making out accurate lists of the electric automobiles now in service, encouraging prospective users and purchasers, listing location of charging facilities and expanding the field that can be developed in commercial and pleasure-car service.

A recent exhibit of a Studebaker machine for pleasure service, with the estimates of its cost, in the exhibition department window of the company was described lately in this paper. A complete six-months' record of the cost of operation and service of this machine is given herewith through the courtesy of Mr. S. G. Thompson, of the Boston branch of the Studebaker company.

During the six months the vehicle traveled 3437 miles on 91 charges, making an average of 37.77 miles per charge of the battery. The total cost of energy for charging, at 7.5 cents per kw-hour, was $51.16. The mechanical repairs cost $10.16, the battery repairs $6 and tire repairs $42, making the total cost of operation $109.32. Painting cost $21.40, so that the total gross expense was $130.72. The average gross expense was 71.82 cents per day, or 3.8 cents per mile. Mr. Thompson obtained occasional daily runs of approximately 60 miles per charge with this machine under the most favorable conditions. At the present time this company is making active campaigns for commercial business on a large scale in connection with the larger Boston mercantile establishments, and a large number of pleasure vehicles of this type have been sold within the past few months.

In a recent interview, Mr. Hayden Eames, Boston manager of the Studebaker company, emphasized the great advantages of the electric vehicle for city service, pointing out the unsuitability of the gasoline car for congested streets. He pointed out that to drive a car weighing from 1.5 to 2 tons through crowded streets, stopping, starting, slacking pace and accelerating, to weave a way through the traffic, shifting gears once or twice in every block length, is to subject brakes and tires to severe stresses and it shows up in the annual repair bills in an appalling way. Unless the chauffeur is unusually careful the car will deteriorate 50 per cent in a year under such service. In such a case the electric car will pay for itself in the saving it effects in the depreciation of a heavy touring car. The greater flexibility of control of the electric car, its improved acceleration, cleanliness, absence of cranking, faster effective speed in the crowded streets, shorter wheel-base and simplicity of control all tend to make it pre-eminent for urban work. Through the installation of the mercury-arc rectifier the amount of energy used in charging has been reduced by 40 per cent compared with charging through a rheostat, and this device in the automatic style will enable a car to be maintained in a private garage at a cost of from $7 to $10 per month, including maintenance, renewal of batteries and cost of the charging energy. A considerable number of users of pleasure vehicles in the Boston suburban cities are now handling their own charging through the rectifier with the maximum of ease. Some of these are elderly ladies, who find the electric machine exactly adapted to their needs.

Among the larger garages which handle electric vehicles in Boston are the Motor Mart, on Park Square; N. Rommelfanger, Motor Mart; the White Garage, Newbury Street; the Dodge Motor Vehicle Company, maintaining over 125 electric cars; the Massachusetts Automobile Club (private, for members); Regent Garage, Hotel Beaconsfield, Brookline; Central Garage, Brookline; Chestnut Hill and Newton garages, with other charging points in the suburban territory. This phase of the business is still comparatively undeveloped in Boston, but with increasing use of the vehicles much more extensive and complete facilities will be offered.

Prominent recent purchasers of electric automobiles in Boston show the variety of uses to which these machines may be put. The National Shawmut Bank, the largest in New England, has a 1-ton special wagon for the carting of bullion and making of collections, delivery of payrolls, etc. This machine superseded three shifts of horses. The Paine Furniture Company has a 3-ton electric truck of General Vehicle manufacture which took the place of two two-horse furniture vans for suburban deliveries within the 15-mile radius of the city. The Boston office of the General Electric Company recently purchased a 2-ton truck, for delivery purposes, of General Vehicle make. The Walter Baker Chocolate Company has a large electric truck in use in its factory-yard and city-trip service, and there are several electric sight-seeing wagons in use in Boston. Several dry-goods firms are becoming interested in the electric delivery wagon, and the manufacturing companies are taking up the matter from the engineering point of view with the intention of specifying the equipment which will produce the best service for a given initial expenditure and maintenance cost.

Summing up the Boston situation, it is evident that the city is becoming thoroughly awakened to the importance and advantages of the electric vehicle. The formation of the new association and the establishment of the magazine are stirring up interest. In the co-operation of the various organizations concerned, with care to avoid the pitfalls of the past, there appears an assured and profitable expansion of motor-vehicle service in the New England capital.

Building Up a Decrepit Central Station.

What can be done toward rejuvenating a decrepit central-station plant is illustrated by the case of a small installation in Herrin, an Illinois coal-mining town of 7500 inhabitants. The plant having passed into the hands of a receiver, the management was changed and the methods modernized. The tungsten lamp was introduced and notwithstanding the lower consumption of electrical energy, the bills of almost all customers have increased through the use of more light, and complaints have greatly decreased. Last season 50 fans and 14 electric irons were sold, and there are present prospects for 25 fans and 100 irons. In 12 months the load of the station has increased 20 per cent and the income 50 per cent. A new 150-hp boiler has just been installed and another generating unit is under consideration. Preparations are being made to ground all secondaries. The matter of a power load has just been taken up and one motor already sold. Mr. Fred. W. Richard is president and general manager of the plant, and it is through his efforts that the success thus far achieved is due.

Meter-Reading and Billing Methods.

The discussion at the Missouri Electric Light Convention, April 17, brought out some points worth considering in connection with meter reading and the billing of consumers from the meter books. There was a strong sentiment among some of the members in favor of the plan of arranging consumers' ledgers in the same order as the meter-readers' books, these meter-book leaves being arranged by routes for the convenience of the meter readers. This arrangement of consumers' loose-leaf ledger accounts in the same order as the meter-readers' route books makes it possible to transfer a meter reading to the consumer's ledger with minimum loss of time in turning ledger leaves and with minimum possibility for mistakes or omissions. Practically the only argument that can be advanced against this method is that the company may not be using a loose-leaf consumers' ledger which permits of arranging consumers' accounts in any order desired. This is not a difficult matter to change. Of course, if the consumers' ledger accounts are kept in the order of the meter-reader's route, they must be indexed alphabetically so that an account can be quickly found. Referring to an index in this way, however, takes but little time, so that there is no doubt a net gain in time in the whole operation of billing and crediting by virtue of the time saved in billing. In a small company the bookkeeper will be so well acquainted with the routes that he will seldom refer to the index.

One company reported using a meter reader's book in which there is a coupon for each month. This coupon is removed

after the readings have been made each month so that the meter reader does not know what the previous month's reading was. This removes the temptation from the meter reader of guessing at a consumer's probable monthly consumption, and so not reading the meter at all. It is probable that sham work of this kind by the meter readers, together with mistakes in reading meters, is responsible for more complaints in large cities than central-station men have any idea of. It is guesswork of this kind that causes a consumer to be billed for as much when he has been away from home most of the month as when at home, and gives rise to well-founded suspicion as to the accuracy of a company's meters and methods.

Flat Rates Again.

The Missouri Electric Light Convention brought out arguments and reports as to experiments with flat rates which show that the use of flat rates by electric lighting companies is, under present conditions, not by any means likely to become as obsolete as appeared a few years ago. While it is true that there are many small companies serving a large majority of their customers on a flat-rate basis, nearly all progressive and well-managed companies have in the past 15 years got as far away from flat-rate practice as possible. Many have recollections of the size of the coal bill in flat-rate days and the sudden increase in net earnings brought about by the installation of meters. Nevertheless there are some things about flat rates in the present condition of the central-station industry which have set managers to thinking. For example, it was brought out by Mr. C. W. Hough, of Joplin, Mo., at the convention referred to that a certain central station operating under a flat-rate system of charging entirely was earning three times the gross revenue per kilowatt of station capacity that its up-to-date neighbors were enjoying. Now the investment in a central station being proportional to the capacity, any scheme which brings about high earnings per unit of capacity is worth serious consideration for the reason that fixed charges on investment ordinarily form so large a proportion of the cost of serving consumers. The average cost of fuel per kw-hour in the central stations of the country has been going down steadily for a number of years, and this fact in itself changes the situation as regards desirability of flat rates.

In favor of flat rates it is contended that about the only item of cost that is greatly influenced by the waste of electricity which inevitably follows the use of that system of charging is the item of fuel; and that if it is possible with flat rates to considerably increase the revenue per kilowatt of station capacity, the company with low fuel costs per kw-hour can afford to supply electricity for considerable wasteful use, rather than reduce its gross revenue by the use of meters. If fuel costs per kw-hour are very high, as is frequently the case with very small plants, waste of electricity is a much more serious item. It is unquestionable that hundreds of central stations have increased net revenues by the use of meters, which have stopped the waste of electricity and so reduced fuel bills. In some cases gross revenue has probably been increased by the installation of meters, and in other cases decreased, depending very much on the flat rates formerly in use. The greatest loss in flat rate lighting has usually been in residences where the flat rates were inadequate to cover the use and misuse of the service.

Another aspect of the flat-rate problem brought forward is that the cost of electric service to the consumer usually has to be higher than with meters in order to cover the production of a large amount of electricity which is wasted. This in itself tends to restrict the number of consumers so that the number connected per mile of street is likely to be much less in a flat-rate system than with meters. On the other hand, there are some consumers to whom a flat rate appeals more than a meter basis of charging. Many of these will pay a larger amount per year on a flat-rate contract than if placed on a meter basis. This fact, together with the gradually lowering fuel cost per kw-hour due to the use of more economical machinery and increasing development of water-power, will, it is believed by many, keep flat rates a live issue for many years. At the same time, if the company is desirous of obtaining the largest number of consumers per mile of main, it will have to be in a position to offer meter rates to those who wish to obtain the benefits of their own care and economy in the use of electricity.

It also appears from the Missouri discussion referred to that the much talked-of, but little tried, flat-rate cottage lighting with tungsten lamps is being given a trial. The rate charged is about 1 cent per watt connected per month, with the understanding that the consumer uses nothing but tungsten lamps. As long as the tungsten lamp remains high enough in price to induce consumers to save lamp renewals by turning off lamps when not needed, the plan should work very well if there is frequent inspection of consumers' installations to see that carbon lamps are not being substituted. The plan is at least valuable in getting electric light into cottages where people have been afraid of meter bills. Where installed under these conditions it is not likely to be taken out, even though the meter should be installed later as tungsten lamps become cheaper

Mutual Insurance by Central-Station Companies.

At the convention of the Missouri Electric, Gas, Street Railway and Water Association, on April 15, Mr. C. W. Hough, manager of the central-station properties in and near Joplin, outlined a plan of mutual insurance by central-station companies upon which it is proposed to issue policies as soon as $1,000,000 is subscribed. Insurance to the amount of $400,000 has already been pledged. In his paper Mr. Hough referred to the interest taken in central-station insurance by national and State associations. He gave the amount spent on premiums by traction and lighting companies in the United States as $2,974,000 per year for fire insurance.

It is proposed to form an electric insurance exchange similar to the ice manufacturers' insurance exchange in which members of the exchange pay their pro-rata cost of paying fire losses of members. The plan as carried out in the Ice Manufacturers' Exchange is for each company at the start to pay in an amount equal to the regular premium of the old-line companies on the same amount of insurance. Twenty-five per cent of the amount of the premium is to go for the running expenses of the exchange. Of the amount left after paying running expenses and fire losses of members, one-half is returned directly in cash to the members each year, the other half being kept as a reserve. As the reserve increases, the premiums can be lowered. It is proposed to have the management of the exchange in the hands of the advisory board, consisting of well-known representative men in the business from each State. The attorneys of this board which carry on the work of the exchange will be bonded to the advisory board. Policies at first are to be limited to $10,000 on one risk. As showing the amount of profit in the insurance business as carried on by the old-line companies, an investigation carried on by Mr. Davies, of the American Street & Interurban Railway Accountants' Association, showed that among the traction companies of America about $6,000,000 had been paid in by those companies which had made reports to Mr Davies. Of this, $4,376,000 went for profit and running expenses. The balance was paid in insurance losses.

In the discussion of Mr. Hough's paper, Mr. W. B. Hays, of Poplar Bluff, said that his company's membership in the ice manufacturers' insurance exchange had saved about 42 per cent in insurance. Mr. Hough said that a company might count on saving 40 to 50 per cent in the cost of insurance. Mr. R. J. Irvine, of the Marshall Light, Heat & Power Company, which is owned and controlled by the National Light, Heat & Power Company, said that on account of the unwarranted cost of fire insurance this company had cancelled insurance policies on its 31 properties and was carrying its own insurance. Mr. R. B. Boyce, of Charleston, testified to the saving in insurance effected by the ice manufacturers' exchange

Central-Station Facts and Factors from Iowa.

The accompanying table, which gives some central-station facts and factors collected from 26 Iowa central stations, was presented by Mr. Austin Burt, of Waterloo, Ia., at the convention of the Iowa Electrical Association, at Cedar Rapids, April 21 and 22. Mr. Burt has for some years been on the "Facts and Factors" committee of this association and this is the first extended report from Iowa central stations which he has presented. In offering these data Mr. Burt stated that the form of report used was one suggested by Mr. J. R. Cravath in the *Electrical World*, and recently used by him in a paper for the presentation of central-station data.

The table divides the central stations reporting into groups. The averages for each of these groups are given and also the grand average of all the stations reporting. The conditions indicated by the table are probably much better than would be revealed by a report covering all of the stations in the State, for the reason that those companies which have taken enough interest in the matter to report to the committee are aggressive enough to have worked up the business to a much more satisfactory condition than the general run of companies through the State. Some of the items in the table, Mr. Burt suggested, this line, and to judge from these data, as compared with the present table from Iowa, some of the Iowa stations reporting must have misunderstood some of the items and counted only the power stations in the items of "investment per kilowatt station capacity" and "station capacity per employee," thus giving as a result abnormally low investment and abnormally high station capacity per employee as compared with the other stations which included the total investment and the total number of employees.

Data for Rate Making.

Mr. C. W. Hough, of Joplin, Mo., presented a paper before the Missouri Electric, Gas, Street Railway and Water Association, at Springfield, Mo., April 16, on "Equitable Rate Making" in which he showed the method of arriving at the Doherty readiness-to-serve system of rates. He took for a basis some interesting figures which he derived from the United States central-station census figures of 1902.

Mr. Hough said that before deciding on a rate schedule for any central station, the cost should be carefully analyzed. The theory is that each customer should pay his proportion of ex-

STATION	Total Population	Station Capacity	Investment per Kilowatt Station Capacity	Gross Annual Income per Kilowatt Station Capacity	Gross Annual Income per $100.00 Invested	Ratio of Expense to Gross Income	Operating Expense per $100.00 Invested	Annual Income per Consumer	Total Connected Load per Kilowatt of Station Capacity	Lamp Load per Kilowatt of Station Capacity	Motor Load per Kilowatt of Station Capacity	Heating and Misc. Load per Kilowatt of Station Capacity	Ratio Transformers to Station Capacity	Station Capacity per Employee	Yearly Load Factor	Income per Capita	Investment per Capita	Station Capacity per Capita	Number of Consumers per 100 of Population
		K.W.	$	$	$	%	$	$	K.W.	K.W.	K.W.	K.W.	K.W.	K.W.	%	$	$	Watts	
A	1,100	45	244	81	33	80	26	26	.7	.7	.0	.0	1.2	23	32	3 30	10	41	12
B	1,200	50	370	93	25	75	19	39	2.5	2.4	1	.0		25	22	3 90	15	42	10
C	1,400	48	250	114	45	65	30	43						24	46	3 90	9	29	9
D	1,500	100	200	90	45	72	33	67	1.8	1.5	.2	1		25	21	6.00	13	67	9
E	1,500	60	192										1.0	29			8	40	7
F	1,500	60	200	88	44	76	33	29	1.5	1.3	.2			30		3 50	8	40	12
G	1,800	75	300	103	34	83	28	42	.6	.6	.0		1	19	50	4 30	13	42	10
H	2,000	120	208	70	34	36	12	37	1.7	1.7	0		1.7	40	47	4.20	13	60	11
I	2,000	53	260	111	43	81	34	27	1.1	1.1	0		1.1	27		2 90	7	27	11
J	2,000	60	133			64		25	.8	.8	0			30			4	30	
Average	1,600	67	236	94	38	70	27	37	1.07	1.01	06	01	1.0	27	36	4.06	10	42	10
K	2,200	75	292	137	47	62	29	40	2.8	2.3	4	.1	.7	37	91	4.00	10	34	12
L	2,500	80	187	69	37	73	26	40	1.3	1.3	.0			40	45	2.20	6	32	6
M	2,500	130	138			72		44	2.1	2.1	0	0					7	52	
N	2,700	110	218	94	43	79	34	36	1.5	1.0	.5	4	1.2	37	24	3.80	9	41	11
O	2,800	135	200	67	32	72	23	38	2.7	2.2	0	.5	.9	34	24	3.20	9	48	12
P	3,000	175	200	101	51	53	27	65	1.3	1.3	0	0	1.2	29	23	5 90	11	58	9
Q	3,000	150	167	67	40			33	1.2	1.2	0	0	D.C.	50		3.30	8	50	10
R	3,000	120	367	132	36	32	12	50	2.9	1.8	.8	3	1.3	40	25	5 30	15	40	10
Average	2,470	122	221	95	41	63	28	43	2.1	1.7	.6	.2	1.06	38	39	4.04	9.4	44	10
S	4,000	250	120	106	85	43	37	59	2.2	1.2	.9	.1	1.2	42	23	6.70	8	63	11
T	5,000	255	216	71	33	67	22	33	1.9	1.4	.3	.2	1.8	32	15	3.60	11	51	11
U	8,000	300	266	78	29	59	17	33	1.9	1.6	.3			38	21	3.00	10	38	9
Average	5,670	285	202	85	49	56	25	42	2.0	1.4	5	2	1.5	37	20	4.40	10	51	10
V	15,000	900	139	75	54	53	29	63	1.9	1.4	.5		.8	50	16	4 50	8	60	7
W	16,000	650		46		90		57	1.1	.7	4	.1	.8	93	29	1 90		41	3
Average	15,500	775	139	60	54	71	29	60	1.5	1.1	5	.1	.8	71	22	3.20		50	5
X	28,000	2,100	190	58	30	42	15	56	1.0	.9	.6	1	.8	233	30	4 30	14	75	8
Y	46,000	1,000	200	109	55	57	31	85	2.9	1.7	1.0	2	1.2	125	17	2.30	4	22	3
Z	85,000	3,250		99		54		97	2.8	1.6	1.1	.1	.4	427	24	3.80		41	4
Average	53,000	2,110	195	88	42	51	23	79	2.4	1.4	.9	1	.8	262	24	3.50	9	46	5
Grand Av'ge	9,411	401	220	900	45	65	47	46	1.8	1.4	.3	.1	1	0 3	3 2	3.93	9.0	4 4	9

were so far from the averages as to lead to some question as to whether proper methods were used in computing by the reporting companies.

In commenting upon this table in the discussion Mr. J. R. Cravath said that, contrary to the indications in the table, the investment per kilowatt station capacity for the larger companies is usually considerably larger than that for smaller companies. Mr. Burt explained that this low average for the larger companies in this table might be due to the small number which reported. Mr. L. D. Mathes said that the high ratio of investment to gross annual earnings indicated that operating a small central station in Iowa is not such a bonanza as some people seemed to believe.

The *Electrical World* has compiled considerable data along

pense and profits for the service rendered. The total cost to the consumer is not a simple item, but can be divided approximately into four parts, represented by a consumer's charge, a capacity charge, an output charge and profit.

Mr. Hough took as a basis of income and expense the statistics given by the last United States census report on the electrical industry. An analysis of the income and expense of all the purely electric private stations in the United States showed that of the gross income the total expense was 80 per cent and the surplus 20 per cent. The expense, which is 80 per cent of the gross income, is divided as shown on page 1105.

These items should now be distributed as correctly as possible into three items, consumer's charge, capacity charge and output charge. The consumer's charge should cover cost of

reading meters, making out bills, collecting, and all costs which vary with the number of customers. The capacity charge should cover bond interest, general salaries, general expense and all items of expense due to the capacity of the station. The output charge should cover operating supplies, fuel, oil,

	Per cent.		Per cent.
Interest on bonds	16.00	*Labor:*	
General expense:		Dynamo and switchboard men	1.98
Taxes	4.10	Linemen	3.85
Rents	1.95	Mechanics	1.20
Insurance	1.25	Lamp trimmers	2.25
Injuries and damages	.41	All others	2.75
	7.71		20.87
General salaries:		Rent of power	3.00
General officers	2.25	*Operating supplies:*	
Managers and superintendents	3.20	Fuel	15.50
Clerks	2.55	Freight	1.46
	8.00	Oil and waste	.95
Labor.		Incandescent lamps	2.20
Foremen	1.41	Carbons	1.40
Inspectors	.61	Arc globes	.23
Engineers	4.20	Miscellaneous supplies	2.68
Firemen	2.63		24.42

waste, engineers, firemen and all expense dependent upon the output of the station and profit.

The items previously analyzed would then be divided, approximately, as follows:

Item.	Consumer. per cent.	Capacity, per cent.	Output, per cent.
Surplus or profit	...	...	20
Interest on bonds	...	10	...
General expense	...	7.71	...
General salaries	2.55	5.45	...
Labor	2.25	2.75	4.20
Labor	.61	1.20	2.63
Labor	...	1.40	1.98
Labor	...	...	3.85
Rent of motors	...	...	3
Operating supplies	...	...	24.42
Total per cent. 100	5.41	34.51	60.08

Therefore, the total should be apportioned, approximately, as consumer's charge, 5 per cent; capacity charge, 35 per cent; output charge, 60 per cent, or a total of 100 per cent. The rate should then be such that the charges will be in this proportion. These proportions will vary with every plant and the figures are merely used as an illustration, for they represent the average results as shown by Government reports.

The output of the 80 private stations of Missouri for the year 1902 was 49,756,499 kw-hours, with a dynamo capacity of 27,714 kw, or a load-factor equivalent of 1800 hours' use per year or five hours' use per day.

The income from sale of energy was $2,098,622, which is equivalent to earnings of $76.50 per kw-capacity per year, or a net income per kw-hour of 4.2 cents; but as the lost and unaccounted-for current is approximately 30 per cent, the rate charged was 6 cents per kw-hour.

To determine a "readiness-to-serve" rate schedule equivalent to 6 cents per kw-hour the proportions previously determined were applied, giving a consumer's charge (5 per cent) of 0.3 cent; a capacity charge (35 per cent) of 2.1 cents, and an output charge (60 per cent) of 3.6 cents; total 6 cents.

The consumer's charge is usually fixed arbitrarily at $1 per customer per month. This can be lowered as the number of customers increases and the expense per customer decreases.

The "readiness-to-serve" or capacity charge is 2.1 cents per kw-hour for five hours' use per day, which is equivalent to $3.15 per month of 30 days per kilowatt of connected load. The "readiness-to-serve" charge is usually based on a 16-cp lamp equivalent. The readiness charge of $3.15 per kilowatt of connected load worked out would cover 20 16-cp lamps at approximately 15 cents each per month.

The kw-hour charge is 3.6 cents for all current used as registered by the meter.

As it is usual to allow a discount of 10 per cent from the gross bill for prompt payment, it is necessary to add this to the rate for output. This makes the rate 4 cents per kw-hour.

This rate schedule, as expressed to customers, will take the following form:

One dollar per month consumer's charge, plus 15 cents per 16-cp lamp or equivalent connected load, plus 4 cents per kw-hour for current used as registered by meter, less 10 per cent discount for payment by the tenth of the month.

On this rate schedule the rates per kw-hour for different hours use per day are as follows:

Hours per day.	Hours per month.	Cents.	Hours per day.	Hours per month.	Cents.
1	30	14.5	13	390	4.8
2	60	9.25	14	420	4.75
3	90	7.5	15	450	4.7
4	120	6.6	16	480	4.65
5	150	6.1	17	510	4.62
6	180	5.75	18	540	4.58
7	210	5.5	19	570	4.55
8	240	5.3	20	600	4.52
9	270	5.2	21	630	4.50
10	300	5.	22	660	4.47
11	330	4.9	23	690	4.45
12	360	4.87	24	720	4.44

This rate plotted as a curve shows at a glance that the short-hour customers automatically pay a higher rate and the long-hour customers a low rate, and that the longer the use each day the lower the rate. There are no overlapping points as in many of the discount and step rates.

From the foregoing any central station can take its own items of cost as a basis and work out a readiness-to-serve rate which will be approximately correct and will be equitable to the central station and to the consumer, as each consumer will automatically pay a rate per kw-hour proportional to the cost of serving that consumer. The readiness-to-serve rate will discriminate between the profitable and unprofitable customer, and has the advantage of making the bills more uniform throughout the year by lowering the winter bills and increasing the summer bills. The low rate per kw-hour will induce long-hour use of current for advertising purposes, show windows, signs, etc. The author, in conclusion, said that a trial of this rate system will convince any central-station manager that it is the most equitable and satisfactory system yet devised.

DISCUSSION.

Mr. Hough said in answer to questions in the discussion as to the percentage of electricity lost and unaccounted for that in the Doherty properties it averages 30 per cent. In Denver for the last two years the lost and unaccounted-for energy was 27 per cent, the losses being checked up and looked after more closely there than in the majority of central stations.

In reply to a question as to how many companies are using the Doherty readiness-to-serve rate prescribed in the paper, Mr. Hough said that it was in use in the 40 plants controlled by Doherty interests and in a number of others besides. In the case of power service, the readiness-to-serve charges could be made lower than in the case of lighting if the power load did not come on at the same time as the lighting load, because the lighting load would pay a part of the readiness-to-serve charges.

Mr. P. A. Bertrand, of Jefferson City, said that his company had adopted the Dow system used in Detroit for residence consumers. In this system the consumer is charged a high rate for a certain number of kw-hours per room without regard to the number of lamps connected. Electricity used over and above this amount is charged at a much lower rate. He pointed out that this is more likely to be satisfactory than counting the number and capacity of lamps installed, because this number might change from time to time.

Mr. J. R. Cravath, of Chicago, called attention to another strong point of the Dow system, namely, that it does not discourage residence consumers from putting in convenient lamps in closets, stairways and other places where they are infrequently used, but where they are counted against the consumer if the maximum demand is based on the actual connected load. The maximum demand estimated on the number of rooms in a

house is fully as likely to be correct as a count based on connected load, and does not penalize conveniences.

Mr. Hough said that the investment per kilowatt of capacity for central stations in Missouri was shown by the census to be $575. A new central-station system would cost about $200 per kilowatt of capacity. Prof. H. B. Shaw, of the University of Missouri, made the objection to the Doherty rate for residences that it would make the residence consumer's minimum bill so high that it would be considered prohibitive. He called attention to the fact that the United States census showed a yearly income of $76 per kilowatt of station capacity in Missouri, while the average for the United States was $70. Missouri stations, therefore, averaged above the country at large.

Mr. C. L. Clary, of Sikeston, said that in some cities where the Doherty rate has been used among residence consumers, the readiness-to-serve rate is based on but 30 or 40 per cent of the connected load in residences.

Mr. Hough called attention to some valuable figures averaged from 27,000 residence consumers of the Commonwealth Edison Company, Chicago, in the *Electrical World* of April 8, 1909. These figures showed the ratio of actual maximum demand (as measured by demand meters) to connected load. Figures of this kind, taken from actual experience, will greatly simplify the calculating of rates.

Mr. Bertrand said that the experience of the central-station company at Peoria, Ill., with which he had formerly been connected, was that the best financial returns are from the smaller and medium-sized residences. Such residences yield a higher revenue for a given maximum demand than do large residences. In other words, the revenue per dollar invested in lines and apparatus is higher.

Mr. Hough said that his company required a deposit of $5, which covers possible loss from unpaid bills. This deposit materially cuts down the losses from bad accounts. Taking up the question of flat rates, he called attention to the fact that in many cases the income per kilowatt connected on some of the old flat-rate systems was three times what it is now on a system employing meters throughout.

Mr. P. A. Bertrand said that in many cases customers would object less to paying a flat rate than to paying by meter, even though the total yearly charges might be less with the meter. The increase of bills during the winter months with the meter was a common source of complaint. Mr. W. B. Hays, of Poplar Bluff, said that his company increased its revenue $1,000 per month by the installation of meters. Mr. H. D. Hibbeler, of Washington, approved a flat rate for use in small cottages with tungsten lamps, the rate to be 25 cents per month for each 25-watt tungsten lamp. Mr. R. J. Irvine said that his company makes a residence rate similar to that outlined by Mr. Hibbeler. A flat rate helps to keep up the income in summer. Mr. Hough said that his company had just taken over the central station at Galena, Kan. In that station the income per kilowatt of demand is three times what it is in Joplin and other cities now controlled by the same company.

Mr. R. B. Boyce, of Charleston, said that his company had flat rates up to five years ago. At that time it only had five residence consumers. A flat rate is not favorable to residence business. In three years he had secured 100 residence consumers. He had adopted a rate similar to that used in New Bremen, Ohio. Under this rate an installation used only a quarter of an hour each day pays a very high rate. The rate is reduced the greater the length of time the connected installation is used, the reduction being made in small steps. One of his residence customers has put in a flat-rate controller, and by virtue of this his company counts the maximum demand for which this controller is set, instead of the maximum number of lamps connected.

Mr. P. M. Loewe said that the gross income was higher with flat rates, which his company formerly had, but that the net income was increased by the installation of meters. The meters were installed May 1, and generally resulted in a considerable reduction in the summer bills, the bill for the winter service being much higher.

INTERIOR WIRING AND ILLUMINATION

Ornamental Street Lighting at Des Moines, Iowa.

By P. B. Sawyer.

The tendency toward a change in the lighting of the business streets of cities has been productive of a number of varied kinds of installations of lamps, the variation depending upon the local condition and the public spirit of the city's merchants. The forms of lighting range from the temporary installation of festoons of incandescent lamps, which look well at night but are unsightly by day, to the premature installations of artistic systems for continued and efficient service. The best form is that which will give effective lighting, be permanent, and makes a good appearance at all times.



FIG. 1.—STANDARD.

The merchants of a number of the more progressive cities are considering, or are installing, these systems at the present time, and this question has been considered by the Commercial Club, of Des Moines, Ia., which has adopted a system now being installed under the direction and through the efforts of a subcommittee of that organization.

The post adopted (Fig. 1) is 13 ft. 7½ in. high over all, with four 1-ft. 9-in. arms. The light is supplied by five 100-watt tungsten lamps, enclosed in pale opalescent globes; the top globe is 12 in. in diameter and 2 in. larger than the four pendant ones. These posts are installed, under a city ordinance, on the outer edge of the sidewalk of the business streets (Figs. 2 and 3) in a uniform manner. The posts are set 56 ft. from center to center, starting at the street intersection at a point on the curbing opposite the outside property line. The posts are paid for by the owners of the abutting property at the rate of $85 per post, which is sufficient to cover the cost erected. The lighting service is covered by a separate agreement at the rate of $69.50 per post per annum, dusk-to-midnight service, which includes the first installation of tungsten lamps and globes and their renewals; also the painting of the post annually and ordinary maintenance, so long as the lighting agreement is in force. The posts are wired for multiple service, and are switched on and off by a patrolman, who looks after the sign as well. The Des Moines Electric Company acts as contractor in placing the poles and also furnishes the electrical energy.

A brief outline of the developments of the system may be of interest. Members of the Commercial Club who had public

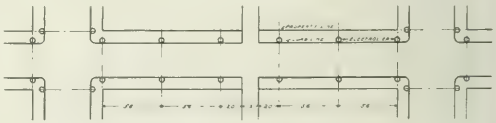


FIG. 2.—PLAN OF STREET LIGHTING.

spirit enough to realize the advantages of this form of lighting proposed at a regular club meeting the investigation of such a system. A subcommittee of the club was appointed and in proper time met and discussed the proposition and called in representatives of the lighting companies, asking for designs, prices, etc., which were obtained and presented at a later meeting. From a large number of ideas, the post (Fig. 1) was adopted and so was electric service. The club then succeeded

in having an ordinance passed by the City Council prohibiting the installation of any other design of post or system of lighting. This done, the next step was to get the system installed. A committee was appointed for each block from the merchants having business in that block. These committees were furnished with blank contract forms (for the installation of posts) which they circulated among their neighbors for signatures. When these were obtained the contracts were turned over to the electric light company, and the poles contracted for were installed. A solicitor then followed up these installations and obtained the lighting agreement. This method is working out quite smoothly and the merchants who are trying to hang back are given no rest by their neighbors until they have agreed to bear their proportion of the lighting scheme.

This system is now installed over approximately one-half mile of streets (Fig. 4) and the progress of the extension is very rapid. The first poles were erected in December, 1908, and the plan of the club is to complete the work in the next nine months. The design is highly ornamental both by day and by night and gives a good distribution of light; the merchants are well pleased and the system is a permanent improvement in the streets.

Des Moines is a growing city, having a population of about 85,000; is situated near the center of the State, and the lighting system is one of the many modern improvements now being made that will assist in making it a center of activity in the Middle West. Some interesting facts in central-station practice in Des Moines appeared in the March 11 issue.



FIGS. 3 AND 4.—WALNUT STREET, DES MOINES, BY DAY AND BY NIGHT

The Tungsten Lamp from a Central-Station Manager's Standpoint.

Mr. Paul M. Loewe, of the Moberly Gas & Electric Company, read a paper dealing with the benefits of the tungsten lamp to the central-station industry, at the convention of the Missouri Electric, Gas, Street Railway & Water Association, at Springfield, Mo., April 15.

A little over a year ago Mr. Loewe said that he received a case of 100-watt tungsten lamps from a manufacturer and a letter asking him to hold these lamps until a representative would call. When the representative came he had not only sold every lamp, making a guess at the price, but had put three gasoline plants out of commission. The tungsten lamp will not reduce the amount of energy used by consumers. As it is human nature to look for something for nothing, the consumer lets his lamps burn longer, talks of the fine light he has, tells his friends about it, and at the end of the month willingly pays as large a bill as ever.

If a company furnishes free carbon-lamp renewals, the removal of this burden is quite an item to the central station. The tungsten lamp will soon come down to a more conservative price. Mr. Loewe spoke in a very appreciative manner of the good work done by manufacturing companies in assisting central-station managers to work out practical problems of illumination as they come up, this service being performed free of charge. There are still people who use coal oil, and this is not always a case of poverty, but simply a case of staying in the same old rut. For the price at which energy is sold to-day, the laboring man can enjoy the luxury of electric light as well as the rich man.

Certain prospective customers when approached will always raise the objection that they cannot afford to pay as much as some neighbor who has very high bills. This is where the tungsten lamps get a customer. The central-station manager immediately uses the argument that with the new tungsten lamp such high bills are not necessary, and the prospect is induced to have his house wired. One of Mr. Loewe's customers was on the point of putting in a gasoline plant because his bills ran so high with the carbon-filament lamp. Just before the deal was closed, Mr. Loewe persuaded him to make a trial of tungsten lamps. This reduced his bill materially during the summer months, and there was no more kicking about the size of the bill.

COMPARISON OF TUNGSTEN AND GASOLINE LAMPS.

Mr. Lowe, in considering the case of a given room equipped with tungsten and gasoline lamps, allowing the same rated candle-power per square foot, said that no data would be of universal application, because the prices of gasoline and electric power (the latter especially) vary widely. He therefore computed the monthly cost of the two systems for a certain definite assumed case, that of a large room of ordinary finish and height equipped with:

1. Bowl-frosted tungsten units, rated at 100 watts and 80 horizonal cp, equipped with bowl reflectors.

2. Gasoline lamps equipped with chimney and mantle, burning at a gravity pressure of about 12 in. of water and using 2.2 gal. of oil per mantle per 100 hours.

The dimensions of the room were 40 ft. x 40 ft., and the area to be lighted was consequently 1600 sq. ft. One rated candle-power per 3 sq. ft. was used or a total of 533 cp, or seven 80-cp, 100-watt lamps. The following table gives the results:

	Tungsten.	Gasoline.
Hours burning per month	120	120
Horizontal candle-power of unit	80	30
Number of units	7	25
Assumed cost of energy per kw-hour, cents	5	10
Cost of supply per month	$8.40	$100.00
Monthly cost lamp renewals (800-hour basis)	1.05	
Cost of chimneys and mantles (renewed once in 100 hours)		1.40
Total monthly cost for illumination	9.45	112.00

A gasoline lamp of the kind described will average not over 30 horizontal cp and will consume per month of 120 hours 2.7 gal. per mantle. The light distribution is mainly horizontal owing to the absence of an efficient reflecting device. Mantle lamps, especially the upright type, are not well adapted to efficient reflectors owing to difficulty with respect to a fixed relation between the source of light and reflector; to the deterioration and darkening of mantles and chimneys; to the presence in some types of metal parts directly under the lamp, and to the

small incentive for development by reflector manufacturers along these lines.

It is a safe estimate that not more than 75 per cent as much useful light per rated candle-power is given by the upright-mantle gasoline lamp as by the tungsten, "useful light" meaning the light upon the working plane. This light is commonly taken at a height of 30 in. above the floor of the room.

DISCUSSION.

Mr. C. W. Hough, of Joplin, said that his company is operating two systems of series-tungsten street lighting. So far they had lost no lamps from burnouts, but had lost 30 lamps during an exceedingly severe wind storm. His company was competing with 25-cent natural gas with the aid of tungsten lamps.

Mr. Loewe said that the use of tungsten lamps had caused a reduction of about 75 per cent in the number of free carbon-lamp renewals required at Moberly. In 401 working days his company had put on 381 new consumers, many of them gained through the introduction of the tungsten lamp. (The population of Moberly is about 8000.)

Attention was called in the discussion to the recently inaugurated practice of the Union Electric Light & Power Company, of St. Louis, of selling tungsten lamps to consumers at 25 per cent below list price. It was claimed that the result of this practice has been that large wholesale merchants, who were central-station customers, in St. Louis would be requested by their customers over the State to purchase lamps for them and that these lamps were being purchased and shipped over the State to the detriment of the business of local supply dealers.

Mr. Fred L. Benson, of the General Electric Company, said that the Commonwealth Edison Company, in Chicago, although selling tungsten lamps below the listed price, prevented their use except on the company's lines by requiring one of the company's carbon or tungsten lamps in exchange for each tungsten lamp sold at a low price. Mr. Benson said that it seemed likely in the near future that some alloy of tungsten would be found which would be less fragile and which would make a tougher lamp filament, although at the expense of some loss of efficiency.

Mr. R. B. Boyce, of Charleston, spoke enthusiastically of the benefit his company had derived from the introduction of tungsten lamps. Six gasoline plants had been put out. In fact, he jocosely remarked that had it not been for the increased business brought about by the tungsten lamp he might not have had money enough to come to the convention.

Mr. Loewe said that he had noted in the *Electrical World* the co-operation that other central stations had secured with the contractors in their territory. He had gone to work accordingly on the same line. By all electrical interests working together in the town 14 out of 42 gasoline installations had been put out of business by the tungsten lamp.

Prof. H. B. Shaw, of the University of Missouri, said that the tungsten lamps tested so far at his laboratories had averaged below rated candle-power, the range being from 1.3 to 1.9 watts per mean horizontal candle.

Electric Sign and Display Work at Rockford, Ill.

The Rockford Electric Company, of Rockford, Ill., has been doing some good work under the management of Mr. F. H. Golding both in securing electric sign business and in producing attractive window displays in its own office windows. The



FIG. 1.—WEST STATE STREET, ROCKFORD.





FIGS. 2 AND 3.—ELECTRIC SIGN BY DAY AND BY NIGHT.

business centers of Rockford being scattered into three districts it is difficult to show by any one photograph the work that has



FIG. 4.—ELECTRIC SIGN.

been done in sign and display lighting. Fig. 1, however, shows one of the principal streets. The sign in the distance is about

a quarter of a mile away across the river. This distant sign, which is that of the Rockford Lumber & Fuel Company, is notable on account of its size; it is shown again in Figs. 2 and 3. It is 6 ft. high and 170 ft. long, and contains 300 lamps. Along



FIG. 5.—SIGNS OF ROCKFORD ELECTRIC COMPANY

the top of the sign are lamps in dense opal globes which serve to top off neatly the supporting posts of the sign. The lamps are of only 2 cp and yet the sign is very legible at a distance. In fact, its legibility is due to the fact that the letters are clean-



FIG. 6.—WINDOW EXHIBIT.

cut and the lamps are of low candle-power, so that there is no blurring effect.

About 75 per cent of the signs connected are on a flat rate and are turned on and off by the company's patrolman. There are 160 signs, with a total of 10,000 lamps connected, most of these lamps being of the 2-cp type. Fig. 4 shows one sign which is rather striking in effect. One of the company's own signs, on its property along the river bank, is shown in Fig. 5.

The company has two window exhibits in its own office window. These exhibits are changed frequently. In one is shown applications of motors to machine tools made in Rockford. Fig. 6 shows a window trimmed for a bedroom in order to exhibit all electric bedroom conveniences.

The company has begun to experiment with 4-cp, 10-volt, tungsten sign lamps, using a 110-volt to 11-volt transformer at the sign.

Letter to the Editors.

Grounded Secondaries.

To the Editors of Electrical World:

SIRS:—I wish to express my appreciation of the arguments by Mr. W. J. Canada in your first issue of April in favor of grounded secondaries, and of your editorial endorsement of the arguments. Why any element connected with the electric-lighting industry should oppose the grounding of the secondary is inexplicable, and it would be most interesting to know the motive of such opposition, which is in striking and most unfavorable contrast to the broad spirit shown by the underwriters in favoring, on humane grounds, a practice which they might, as possibly adverse to their monetary interest, join the National Electric Light Association in opposing. Mr. Canada states that the grounding of the secondary is now advocated by practically all engineering societies and by a majority of electric light and power companies, which latter statement is borne out by the result of his canvass on that subject. In view of this approval of the practice, and the willingness of the underwriters to accept it, one is naturally puzzled at the persistent though veiled opposition of the National Electric Light Association, which, moreover, thus far has apparently not deigned to offer any technical reasons for its attitude. The necessary corrective could be applied by the American Institute of Electrical Engineers, but while this body has formally placed itself in favor of grounding the secondary, it apparently hesitates to take any decisive action in the matter, as indicated by the failure, noted in your columns, of that body to represent its views at the recent meeting of the Underwriters' National Association, though entitled to membership in the committee which reported on the subject.

If there are any reasons against grounding the secondary sufficiently strong to counterbalance the safety to life through such grounding, they should be made public; in the absence of such a statement, the opposition to grounding appears entirely indispensable, and against the interest of the electric lighting industry.

CHICAGO, ILL. CHARLES S. DAWSON.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Alternators.—H. BRUHN.—A translation of his recent German paper on the e.m.fs. induced in the exciting winding of single-phase alternators. The author examines the reaction of the armature current on the field winding in a single-phase generator, and shows how the e.m.f. induced in the several turns depends on their position, which becomes of importance in machines having cylindrical rotors with distributed windings. The result of the investigation shows that, in addition to the e.m.f. which appears at the slip-rings, other e.m.fs. exist inside the winding. Although the latter pressures neutralize one another, and, therefore, set no pulsating currents in the exciting circuit, yet, owing to their possible magnitude, they may become dangerous to the insulation.—*Lond. Electrician*, April 16.

Automatic Speed Control of Motors.—A note on a recent British patent (7811, 1908: April 8, 1909) of Sir W. G. Armstrong, Whitworth & Company, Ltd., and F. Harlow. Motors, the speed of which is controlled by varying the field strength of the generator, are liable to stop if the torque is suddenly increased, and to prevent this result it is necessary to decrease the resistance in the generator field circuit. This is effected automatically by means of two rotating contacts, which, when they touch, short-circuit a portion of the field circuit resistance. One contact is on the motor shaft, and the other is fixed to a copper disk, driven by the motor through a spring coupling

the copper disk rotates in a magnetic field. Below a certain speed the contacts touch, but above this speed the braking effect produced by eddy-currents in the disk causes the disk to lag and the contacts to separate.—Lond. *Elec. Eng'ing*, April 15.

Synchronous Alternating-Current Motor.—F. B. Crocker and M. Arendt.—An article illustrated by numerous diagrams, giving an elementary explanation of the action of the synchronous single-phase alternating-current motor.—*Gen. Elec. Review*, May.

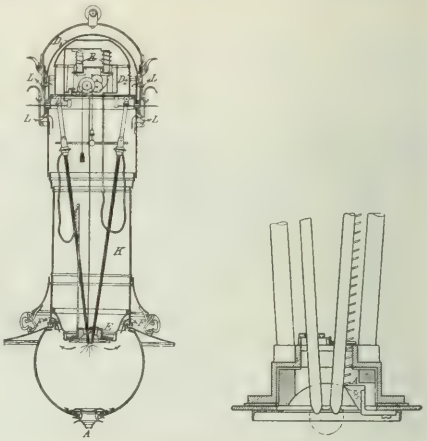
Polyphase Commutator Motors.—E. Roth.—The first part of a theoretical article in which the author develops a general vector diagram of polyphase commutator motors; it contains other well-known diagrams as special cases.—*La Lumière Elec.*, April 10

High-Speed Direct-Current Generator.—A note on a recent British patent (7327, 1908; April 1, 1909) for the field construction of high-speed direct-current dynamos of the British Thomson-Houston Company and F. H. Clough. The field system is constructed like the stator of an alternating-current induction motor, and is provided with shunt and series windings. the series coils occupying slots in the pole face between the slots containing the shunt winding. The armature has a fractional pitch winding, the demagnetizing conductors of which correspond in position with the magnetizing conductors of the stator-series winding. A flat neutral commutating zone, equal in width to the difference between the pitch of the armature winding and the space enclosed by the shunt winding, is obtained.—Lond. *Elec. Eng'ing*, April 8.

Lamps and Lighting.

New Standard of Candle-Power of Light.—W. A. Harwood.—An abstract of a paper read before the Manchester Section of the (British) Inst. Elec. Eng. The author proposes a "secondary" standard, which may be stamped once and for all with a given candle-power and will retain its value for an indefinite period, thus obviating the necessity of more than two sets of photometer readings. The new standard consists of the light emitted by a fixed area of an incandescent metal strip heated electrically. Of various metals tried pure platinum has proved most suitable for the purpose. The method of adjustment depends on the different absorbing qualities of black fluorspar and water for waves of heat and light. Of the total radiation emitted by a heated platinum strip, the percentage which is absorbed by black fluorspar is found to increase as the temperature of the strip is raised, while the percentage absorbed by water diminishes. As one particular temperature of the strip is raised these two percentages are equal and their equality fixes the conditions of the strip uniquely. In the actual apparatus two parts of the radiation from the strip pass through a plate of black fluorspar and a layer of water respectively, and fall on two sensitive thermopiles which are connected in opposition through a galvanometer. The adjustment consists in regulating the current so that the galvanometer deflection is zero. Up to the present the strip has been photometered against an incandescent lamp at constant voltage, with very satisfactory results.—Lond. *Electrician*, April 16.

Arc Lamps.—B. Monasch.—The first part of an illustrated paper read before the Hamburg Electrical Society on recent European direct-current arc-lamp practice. The enclosed arc lamp, which has found so much favor in the United States on account of the greatly reduced cost of attendance, has not found as much favor in Germany. It has been modified in Germany in order to increase the candle-power at the expense of the long life. This is done in the so-called "economy" arc lamp, which has only one single globe and thinner carbon electrodes than are used in enclosed-arc lamps. A 6-amp lamp with 7-mm electrodes and a clear globe has a mean lower hemispherical candle-power of 1100 hefner candles. A 5-amp lamp with 6-mm electrodes gives 725 candles. With an anode of 300 mm and a cathode of 100 mm, the life is about 22 hours. Bremer started a new era by using impregnated carbon electrodes. He also came back to the old idea of placing electrodes side by side, slightly inclined against the vertical. In order to get a perfect circulation and carry off the vapors, so as to avoid their deposition on the lamp globes the Allg. Elek. Ges. uses the arrangement shown in Fig. 1. The air enters at *A* and passes along the inner surface of the globe without disturbing the quiet burning of the arc. The vapors developed in the arc are carried off through the openings *F*. If any of the vapors should get into the upper space *K*, they are carried off through *L* into outside air. None of the vapors can get into the regulating mechanism. With this kind of ventilation, the loss of candle-power due to vapors deposited on the globe is less than 5 per cent in 18 hours. It is now possible to use three arc lamps with pure carbon electrodes in series across a 100-volt circuit without any serious resistance. Similarly it has recently become possible to connect three intensive flame-arc lamps in series across a 110-volt circuit or six such lamps across a 220-volt circuit. For this purpose special electrodes ("plania intensive triplex") are used. The author uses the name of "intensive" arc lamps for all lamps in which two electrodes are placed side by side so as to emit an intensive light perpendicularly downward. Beck was the first to devise an arc lamp without any regulating mechanism. Another arc lamp of this kind, designed by F. Janecek and built by the Allg. Elek. Ges., is shown in Fig. 2. A piece of sheet iron is inserted longitu-



FIGS. 1 AND 2.—ARC LAMPS

dinally in one of the electrodes. Teeth are cut out of this sheet, as shown in the illustration. The lowest tooth rests on the porcelain piece *A* and upholds the electrode. This iron tooth is subjected only to the radiating heat of the arc. Under this influence it gradually softens, bends and the electrode slides down until it is held by the next tooth and so on. The two electrodes are mechanically coupled together by something like a scissor coupling (not shown in the illustration). The arc is lighted by bringing the two electrodes in contact by a magnetic device. In order to protect a system of two such arcs in series at 110 volts against any variation of voltage, they are connected in series with an iron resistor in a hydrogen atmosphere, such as the Nernst lamp ballast. In general, arc lamps without a special regulating mechanism are liable to get out of order. Carbone uses two pure carbon electrodes side by side. According to the author, the most important technical advance in arc lamp design is due to Blondel, who uses carbon electrodes with relatively very thick impregnated cores. Such electrodes are made for white and yellow light and for 30 volts or 40 volts at the arc. In 110-volt networks, three lamps, each of 30 volts, can be used, in series with a resistor of small resistance, or two lamps of 40 volts each. This last type of lamp with electrodes giving white light is now being introduced on several of the largest streets of Berlin, to replace the old pure-carbon arcs. The author seems to have quite a favorable opinion of the Blondel arc lamp, and discusses how far the flame-arc lamp

with Blondel electrodes one above the other is better for street lighting than the intensive flame-arc lamp or other arc-lamp types. He thinks this lamp is especially favorable in competition with inverted incandescent gas lamps of high candle-power. The article is to be concluded.—*Elek. Zeit.*, April 15.

Disk-Arc Lamp.—An illustrated note on a new arc lamp of English make, in which the ordinary carbon rods are replaced by disks of carbon; these are controlled by a mechanism which feeds the carbons by the simultaneous rotation of both disks, so that the periphery of each disk is burned away uniformly. The arc is struck by separating the disks, the extent of movement being independent of the size of the disks. This type of lamp has very short over-all dimensions; a 10-amp lamp measuring not more than 20 in. over-all. The lamp can be used as a flame, enclosed, or open arc lamp, with suitable electrodes, and it is claimed will burn 50 per cent longer than any ordinary lamp. A magnetic field is employed to give stability to the arc. —Lond. *Electrical Review*, April 16.

Tungsten Lamp.—H. Schroeder.—A paper illustrated by diagrams showing the superiority of the tungsten series lamp over the carbon series lamp and the conditions under which the tungsten lamp is cheaper to operate than incandescent gas lamps.—*Gen. Elec. Review*, May.

Generation, Transmission and Distribution.

Small Water Falls.—H. J. S. Heather.—A paper read before the South African Association of Engineers on a convenient method of utilizing a series of small water falls. A power plant is erected at each fall, but only one is equipped with an ordinary synchronous generator, exciter and regulating switches, the others being equipped with non-synchronous induction generators. This arrangement results in a great saving of wages.—Lond. *Electrician*, April 16.

Small Gas Plant.—A. H. Gibson.—An abstract of a paper read before the Manchester Section of the (Brit.) Inst. Elec. Eng. The author tested the combined efficiency of a suction gas producer and gas engine capable of developing 24 hp. The fuel used throughout was gas coke containing 81.75 per cent of carbon and 1.19 per cent of hydrogen, and had a net calorific value of 12,635 lb.-Fahr. units per pound dry. The general conclusions to which the experiments led are as follows: The composition and calorific value of the gas vary greatly with the quantity of water vapor supplied to the vaporizer, as does the thermal efficiency of the producer, the latter attaining its maximum value, namely, 78.6 per cent, when the gas produced has its highest calorific value—that is, 127 lb.-Fahr. units per cubic foot at 32 deg. Fahr. under a pressure of 29.921 in. of mercury. The efficiency of the engine, however, falls off as the gas becomes richer, the reduction of thermal efficiency of the producer being accompanied by a reduction in the percentage of heat rejected to the jackets, and in an increase of the thermal efficiency of 26.9 per cent and a minimum efficiency of 22.8 per cent, based on the brake horse-power. The over-all thermal efficiency of the plant has a maximum value of 18.16 per cent based on the brake horse-power, this occurring with a slightly greater vapor supply than that (0.4 lb. per pound of dry fuel) giving the maximum producer efficiency.—Lond. *Electrician*, April 16.

Fuel Economy.—J. Izart.—The first parts of a long paper in which the author discusses the reasons of the great difference in specific fuel consumption obtained in various central stations. The necessity of paying more attention to the possibilities of improving the fuel consumption by continuous control of the operation and tests is pointed out. In the last installment the author gives an entropy diagram for saturated-steam and superheated-steam calculations.—*L'Industrie Elec.*, Feb. 25, March 25, April 10.

Motors in a Cotton Mill.—An illustrated description of the electric motor equipment of a large ring-doubling cotton mill in the Manchester district. Some particulars are given of the nature of the machinery to be driven and the motor switchgear, etc., employed. Energy is taken from the mains of the Manchester Corporation, and induction motors are used throughout.—Lond. *Elec. Eng'ing*, April 15.

Centrifugal Pumps.—A. Barbezat.—The conclusion of his paper on centrifugal pumps. The author gives diagrams which facilitate their predetermination and also gives examples of the use of his diagrams.—*La Lumière Elec.*, April 3.

Mine Fan.—An illustrated account of some tests of an electrically driven mine fan, showing an over-all efficiency of 76.6 per cent when taking about 400 hp.—Lond. *Elec. Eng'ing*, April 15.

Traction.

Overhead Conductors.—P. Dawson.—A continuation of his long and fully illustrated serial on electric traction on railways. In this installment the author first considers the many objections which have been raised against the use of the third-rail for main-line electrification, and then proceeds to discuss the use of overhead conductors, dividing the latter system into those where two overhead conductors per track are necessary and those where only one conductor per track is required. The construction of the overhead work is also considered in detail.—Lond. *Electrician*, April 16.

Installations, Systems and Appliances.

Russia.—C. Schmidt.—An article on central stations in Russian towns, with a relatively large area and a small and poor population. The author recommends in general the three-wire direct-current system with 440 volts between the outers. The kerosene lamp used in most cities for street lighting can be replaced without increasing the cost of operation by metallic-filament lamps. The author recommends the use of metallic-filament lamps of at least 50 cp at a height of about 5 m (16.5 ft.) above ground and at a distance of 40 m or 50 m (132 ft. or 165 ft.) from each other. In general two kerosene lamps are to be replaced by one metallic-filament lamp.—*Elek. Zeit.*, April 15.

Parallel Connection of Resistors.—P. Fehmers.—A description of a graphical method of determining the joint resistance of resistors connected in parallel. The method is thought to be specially suitable for calculating starting and braking rheostats. —*Elek. und Masch.* (Vienna), April 11.

Wires, Wiring and Conduits.

Paper for Cable Insulation.—C. Beadle and H. P. Stevens. —The first part of an article in which the authors point out that information at present available upon the desirable properties of paper from the insulating point of view is very meager. The authors attempt to fill this gap by giving the results of their experience in dealing with such papers from the chemical point of view. The composition of manila and other papers is briefly discussed. Tests to which papers should be subjected are considered, and a number of tables of results are given. The effect of the moisture is dealt with at some length, and the authors finally express their opinion on changes taking place when papers are in contact with the atmosphere and when they are protected from it. The paper is to be continued.—Lond. *Electrician*, April 16.

Transmission Line.—J. Liston.—A fully illustrated description of the 32,000-volt Schaghticoke-Schenectady transmission line of the Schenectady Power Company, which has a length of 21 miles.—*Gen. Elec. Review*, May.

Electrophysics and Magnetism.

Effect of Air Blast on Spark Discharge.—J. A. Fleming and H. W. Richardson.—An abstract of a paper read before the Physical Society of London on the effect of an air blast upon the spark discharge of a condenser charged by an induction coil or transformer. When an oscillatory discharge of a condenser takes place across the spark-gap in the usual manner by charging the condenser from an induction coil or transformer, the intermittent spark which takes place is a complex effect. It consists partly of a true condenser discharge and partly of an alternating-current arc due to the current coming directly from the induction coil or transformer. This arc discharge is a source of difficulty in making accurate quantitative measurements with electrical oscillations, and to produce a uniform oscillatory discharge this true arc discharge must be prevented or arrested. This can be done by a regulated air-blast pro-

duced in any convenient manner, thrown upon the spark-gap, provided that the spark-gap is small. As a proof of the advantages to be obtained from this arrangement a number of measurements were given of the decrement and spark-gap resistances of various circuits measured with the Fleming cymometer, with and without the air-blast upon the spark-gap. It was shown that the observations were more regular and the resonance more accurately delineated when the spark-gap was thus treated with an air-blast. The paper also described experiments made to investigate the effect of breaking up the spark-gap into smaller spark-gaps in series, both when the gaps were subjected to an air-blast and also without an air-blast. It was shown, up to a certain length of gap, about 2 mm in the case of this experiment, that the air-blast had a very decided effect in increasing the mean square value of the current, and also that a similar effect was produced by dividing up the spark-gap into smaller spark-gaps in series, provided that the total spark-gap was not increased beyond a certain limit. This increase appears to be due to the suppression of the arc discharge, as shown by the appearance of the image of the spark in a revolving mirror. With regard to the multiple spark-gaps, the general result, however, appears to be that beyond a small limit in length, about 3 mm, nothing is gained by breaking up the spark-gap into spark-gaps in series, or by subjecting the spark-gap to an air-blast.—Lond. *Electrician*, April 16; *Elec. Eng'ing*, April 15.

Effect of Electrolytes on Colloids.—E. F. Burton.—An account of an experimental investigation, the chief results of which are as follows: For a copper colloidal solution, the particles of which are positively charged (that is, move to the cathode), the influence of added electrolytes on the velocity of the particle has been determined. The electrolytes used were potassium ferrocyanide and aluminum sulphate. Evidence has been produced to show that it is the ion bearing a negative charge that is active in reducing the velocity. This power of the negative ion depends on the valency in a way analogous to the valency relations found by Picton and Linder, and by Hardy, for the coagulative power of ions. The discharging power of two negative ions of the same valency is the same. Observation on the coagulation produced in each case shows that the particles coagulate when they lose their charge.—*Phil. Mag.*, April.

Electricity in the Atmosphere.—M. Makower, Margaret White and E. Marsden.—An abstract of a paper on the electrical state of the upper atmosphere, read before the Manchester Section of the (Brit.) Inst. Elec. Eng. It contains the results of the investigations made during July and August, 1908. These were chiefly concerned with the measurement of the electric currents flowing from a kite down a wire by which it was attached to the winding machine. In the first experiments different lengths of wire were let out with the kite, detached from the winding machine, and the end of the wire attached to an ebonite insulator fixed to the ground. The kite was then connected to earth through a sensitive dead-beat galvanometer and the current measured. In these experiments the currents at considerable heights were so large that it was found necessary to reduce the sensitiveness of the galvanometer by shunting. The plan was therefore adopted in later experiments of using a portion of the kite wire when attached to the drum of the winding machine, which was earthed, as a shunt, and thus making use of the usual daily flights taking place at the Glossop Observatory. The mean currents obtained were as follows:

Height of kite above ground.	Current in amperes.
2,000 ft.	5×10^{-5}
4,000 ft.	13×10^{-5}
6,000 ft.	23×10^{-5}

The current at any fixed height varied considerably from day to day. There seemed, however, to be a fairly close connection between the current and wind velocity, the currents being great when the wind was high. A few experiments were made on the potential of the air at different heights, but no very reliable results were obtained, on account of the difficulty of satisfactorily insulating the apparatus owing to the high potentials to be measured.—Lond. *Electrician*, April 16.

Corpuscular Theory.—B. J. Spence.—An abstract of an American Physical Society paper on the number of free corpuscles per unit volume of the metals gold, platinum and silver. Drude has developed in his work on the optical properties of metals a theory of dispersion, based on the assumption that in the metals there exist two kinds of corpuscles, conducting and vibrating. The author simplifies somewhat Drude's equations and calculates the number of corpuscles for gold, silver and platinum.—*Phys. Review*, April.

Skin Effect.—W. E. Miller.—A second paper illustrated by many diagrams giving various formulas for calculating the skin effect. A numerical table is given for evaluating the different mathematical functions in these formulas.—*Gen. Elec. Review.*—May.

Electrochemistry and Batteries.

Artificial Graphite.—An illustrated description of the equipment of the works of the International Acheson Graphite Company, at Niagara Falls, with special reference to E. G. Acheson's recent inventions in the field of soft unctuous graphite.—*Electrochem. and Met. Industry*, May.

Carborundum and Silicon.—An illustrated description of advances made during the last years by the Carborundum Company, of Niagara Falls. Details are given of new applications of carborundum; of a new abrasive aloxite, produced as a by-product in making ferro-silicon; and of the production of metallic silicon by the processes of Tone.—*Electrochem. and Met. Industry*, May.

Electric Hardening Furnaces.—A. Sabersky and E. Adler.—An account of experiments with a furnace intended for hardening steel articles and employing an electrically fused salt bath. Figures of the cost of operation are given. —Lond. *Electrician*, April 10; *Electrochem. and Met. Industry*, May.

Experimental Electric Furnaces.—C. A. Hansen.—An illustrated description of the results obtained with a small experimental furnace of the Héroult type, giving details of construction, consumption of electrodes, power consumption, metallic losses, slags and quality of output.—*Electrochem. and Met. Industry*, May.

Ions.—G. Rosset.—A theoretical note on "the period of electrolytic vibration of ions" and its consequences.—*La Lumière Elec.*, April 10.

Units, Measurements and Instruments.

Integrating Photometer.—An illustrated description of an integrating photometer devised by H. Krüss. As shown in Fig. 3

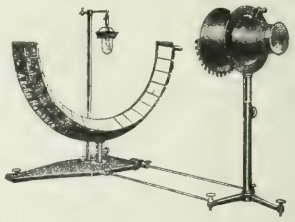


FIG. 3.—INTEGRATING PHOTOMETER.

it is quite similar to the instruments of Matthews. There is a half circle or a circle of mirrors *S* and the lamp to be tested is placed in the center of the circle. The light emitted from the lamp is reflected by each mirror and falls on the lens *O*. There

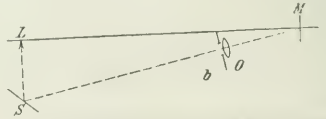


FIG. 4.—DIAGRAM SHOWING PRINCIPLE OF PHOTOMETER.

is a lens to each mirror. As shown in Fig. 4 there is a slit *b* before each lens *O* and the slit openings of the different lenses are adjusted according to the well-known cosine law. The light passing through the different lenses is focused at the point

N and there measured in any convenient way. As the slits *B* are adjustable it is possible to use only one lens by closing up the other slits to determine the polar curve of the lamp.—*Jour. f. Gasbel.*, Vol. LI, 1908, p. 597; abstracted in *Elek. Zeit.*, April 15.

Standard Resistors.—C. C. Paterson and E. H. Rayner.—An illustrated description of the construction of non-inductive water-cooled standard resistors for precision alternating-current measurements. The resistors described were designed to carry currents from 50 amp to 2000 amp, and range from 0.04 ohm to 0.001 ohm. As it was desired to obtain a voltage drop of two volts or more across the potential points, a considerable amount of power had to be dissipated, and water cooling had to be resorted to. The resistors are in the form of manganin tubes through which water circulates. It has been found that the smaller sizes can be loaded up to currents giving voltage drops more than double the above figure, without the temperature rise causing a change in resistance of more than 2 parts in 10,000. The watts per square centimeter, which are dissipated under the "maximum" load conditions, vary from 7½ to 12. An upper limit of 10 watts per square centimeter may be taken as an average value for the design of manganin tubes up to 1.5 mm thickness of wall. This corresponds to a current density of about 25 amp per square millimeter (16,000 amp per square inch) in tubes 0.3 mm thick. In the larger sizes an internal glass tube is provided so that the water only flows in the annular space between this and the outer manganin tube. Measurements have shown that the effect of the resistance of the water is unappreciable. Self-induction effects are avoided by leading the potential wires back along the resistors in such a way that the magnetic flux, which causes the back e.m.f. of self-induction in the resistor, will also give rise to a practically equal back e.m.f. in the lead of the potential circuit, and so neutralize the induction effect. In order to make this elimination more complete, and also to render the calculation of the inductance possible, it is necessary that the potential lead shall take the form of a closely fitting cylindrical sheath running the whole length of the tube and insulated from it at all points except at one end. In the tubes in question the thickness of this insulation is 0.2 mm.—Lond. *Electrician*, April 16.

Testing Cables.—H. Ohlson.—When testing short lengths of highly insulated wire with a D'Arsonval galvanometer of about 1000 ohms, and a universal shunt of 10,000 ohms set for a multiplying power of 1, in order to obtain the greatest sensitiveness, the movement of the coil is extremely sluggish, if the short-circuit key be closed during the test for the purpose of checking the instrument, zero. Further, on opening the key before the battery is applied there is a small deflection, although no charge may be in the cable core under test. Both

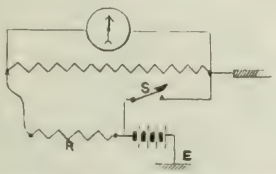


FIG. 5.—DIAGRAM OF CONNECTIONS FOR CABLE TEST

these troubles are due to the alteration of the permanent shunting of the galvanometer when the short-circuit key is opened or closed, the shunt being 10,000 ohms with key opened, and practically a short-circuit across the coil with key closed. Both disadvantages can be overcome by the insertion (Fig. 5) of a high resistance (100,000 ohms is convenient) at *R* between battery and traveling connection. Inserting a resistance in the galvanometer circuit, as is sometimes done, decreases the sensitiveness of the instrument considerably, but this arrangement does not affect it. This resistance is not required when capacity is being measured, as *S* remains open throughout the test, and it should always be removed unless the capacity is very small. For determining the constant of the galvanometer, *R* may either be cut out or added to the resistance in circuit. It is not necessary to use it when the multiplying power of the universal shunt is greater than about 5, as then the shunting of the galvanometer changes little with the short-circuiting at *S*.—Lond. *Elec. Review*, April 16.

Testing Insulation Resistance.—R. G. Allen.—A paper illustrated by many diagrams read before the Dublin Section of the (British) Inst. Elec. Eng., on testing the insulation resistance of live cables on direct-current systems.—Lond. *Elec. Review*, April 16.

High-Frequency Currents.—H. de Graffigny.—A description of a device for producing high-frequency currents for therapeutic purposes, and especially of a modification, due to J. Gourier, of the old apparatus of D'Arsonval and Oudin. This modification consists in supplementary shunt coil wound around the resonator coil and which impresses its effect on that of the resonator.—*La Lumière Elec*, April 3.

Analysis of Periodic Curves.—J. Fischer-Hinnen.—An illustrated description of an analytical and graphical method for the resolution of a periodic curve into its fundamental wave and higher harmonics. The method is claimed to be suitable for the use of electrical engineers not specially skilled in such work.—*Elek. und Masch.* (Vienna), April 11.

Telegraphy, Telephony and Signals.

Testing Wireless Telegraph Receivers.—J. A. Fleming and G. B. Dyke.—An abstract of a (London) Physical Society paper on the production of steady electrical oscillations in closed circuits, and a method of testing radiotelegraphic receivers. There is great difficulty in conducting comparative tests of receivers in actual radiotelegraphic stations, but owing to the small radiative property of closed circuits, it is practicable to use two such circuits, one as a transmitting station and the other as a receiving station, at a distance of a few hundred yards; this is practically equivalent to stations with open oscillators at very large distances. Methods were described for producing in one of the closed circuits extremely constant damped oscillations by means of an induction coil or transformer, a spark-gap on which a steady jet of air is allowed to impinge, and a suitable mercury break. The receiving circuit consists of a small circuit of insulated wire, which is pivoted in any such manner that it can be turned in any direction, the angular deviations with a condenser being measurable on scales. This circuit is joined in series with a condenser of variable capacity, and with the oscillation-detector to be tested. If the oscillation-detector is of the current-actuated type it is placed in series with the condenser; if of the potential-actuated type it is placed across the terminals of the condenser, being associated with a shunted cell and telephone if necessary, or with a telephone simply, if a magnetic detector is used. It is then possible to set this receiving circuit in such a position that it has no current induced in it by the oscillations in the transmitting circuit; but on turning it through a certain angle, sounds are heard in the telephone indicating the production of oscillations in the secondary circuit. The angle through which it is to be turned is a measure or indication of the sensitiveness of the detector.—Lond. *Elec. Eng'ing*, April 15.

Miscellaneous.

Lightning Discharge.—C. C. F. Monkton.—An illustrated description of an interesting case of a lightning discharge, showing a preference for a copper path rather than a course along an iron pipe of approximately equal ohmic resistance.—Lond. *Elec. Eng'ing*, April 15.

BOOK REVIEWS.

The Lady of the Dynamos. By Adele M. Shaw and Carmelita Beckwith. New York: Henry Holt & Company. 310 pages. Price, $1.50.

With its wealth of incidents, its dramatic changes of fortune, its great personalities, it is strange that the electrical art has not inspired more fiction. But the truth is, perhaps, that novel

writers have not yet had time to acquaint themselves with the new opportunities and are a little afraid of the new technique. We are glad to encourage the authors of the present sprightly and interesting volume with the suggestion that other parts of the field keen with episodes as worthy of their pens as those which here concern a young American electrical engineer installing a hydro-electric plant in the beautiful Island of Ceylon. Miss Shaw is well known as a fertile producer of admirable short stories, while Miss Beckwith has become well known in the journalism of electric light and power.

The narrative takes us from the selfish society life of New York direct into the green glooms and lights of tropical life, where the hero finds his "lady of the dynamo," and where by a strange twist of fate the other woman follows him. There is acute human interest in every page of the development, while the technical part relative to the plant, the dam and the power transmission is cleverly and briskly worked out. Possibly the authors have founded their story on fact; it is certainly true that in the enterprises of this kind that are now taking electrical engineers into so many remote parts of the world, an abundance of exciting adventures presents itself. We can heartily commend this swiftly moving story, with its fine local color, as one of the books for the coming summer months.

The Street Railway System of Metropolitan Boston. By A. E. Pinanski. New York: McGraw Publishing Company. 58 pages. Price, $1.

This book, which is printed in pamphlet form, deals with the development of the street railways, the franchises, the finances and present condition of the Boston railways and suggests methods for improving the service. It is evident that much care has been exerted to render the treatment accurate, and the author claims to have made use of 30 public documents, 33 monographs, 49 technical articles, 11 newspaper discussions and 16 contributions from private sources. The magnitude of the system discussed will be appreciated when it is known that the Boston elevated railway alone handles half as many passengers per year as all of the steam railroads in the United States combined carry in the same time. The merit of the discussion can be judged from the fact that for it the author was awarded the Baldwin Prize, offered by the National Municipal League for the year 1908, for the best essay dealing with the relation of the municipality to the transportation service.

The Copper Handbook. A manual of the copper industry of the world. Vol. VIII, 1908. Houghton, Mich.: Horace J. Stevens. 1500 pages. Price, $5.

The eighth annual edition of Mr. Stevens' compendium of the copper industry, covering the year 1908, contains 1500 pages and almost 50 per cent more matter than the previous edition. The principal portion of the book is devoted to a detailed description of the copper mines of the globe, details being given of no less than 6767 properties. Copper is considered under a great variety of heads in the preliminary chapters of the book, these giving, in non-technical language, a vast amount of information relating to the geology and mineralogy of copper and copper ores, with chapters devoted to mining, milling, smelting, leaching and refining, and yet other chapters treating of the history of the metal, brands, grades, substitutes and uses. The complete glossary of mining terms is reprinted from Vol. VII. The final chapter, devoted to statistics, is most complete and its authority has been recognized officially and by the copper trade. As usual, the "Copper Handbook" is exceedingly frank in its comments, and the descriptions of mining companies considered by the author to be dishonest are marked by the utmost limit of plain speaking.

NEW APPARATUS AND APPLIANCES

A Modern Hospital Power Plant in San Francisco.

By C. F. Braun.

Following the destruction of its old hospital building in the San Francisco disaster, the Southern Pacific Company immediately began plans for a new and larger institution. As a site, an entire block facing on the beautiful Golden Gate Park, was secured and in February, 1908, work was begun on what is now the most complete industrial hospital in the United States, a hospital capable of caring for over 250 patients. It may be interesting to the reader to know that this hospital is supported by the employees themselves, by a tax of 50 cents per month, levied on each employee, who in return is insured the best medical care and attendance in case of sickness or accident.

Heat, light, motive power and water are supplied by a very complete isolated plant, which it is the purpose of this article to describe. The power plant is located in a modern concrete and brick structure, in which utility and architectural beauty have been harmonized, and as is characteristic of the other parts of the institution, no expense has been spared to give the plant a finished and pleasing appearance. The boiler settings are of glazed brick, the engine-room floors of maroon tile and the engine finish is exceptionally fine, all exposed pipe and fittings being of finished brass.

Steam for the engine-generator units, for the Webster heating system and for hot-water service, is supplied by a battery of two 150-hp water-tube boilers, operating at 160-lb. pressure. California crude oil is the fuel used, the fuel-handling apparatus consisting of two 4.5-in. x 2.75-in. x 4-in. duplex steam-driven pumps, which draw oil from a 10,000-gal. storage tank outside the building footings, passing it through heater and strainer to the burners. The heating of the oil is accomplished by means of a small coil on the outside of which the oil-pump exhaust is allowed to pass. A set of 5.25-in. x 3.5-in. x 5-in. duplex steam-driven boiler-feed pumps, a set of 6-in. x 9-in. x 12-in. direct-acting vacuum pumps for the heating system, and a 400-hp Webster open heater complete the boiler-room equipment.

The stack is a part of and harmonizes with the rest of the building. It is 36 in. in diameter and 50 ft. high, the lower 20 ft. being lined with vitribestos tile.

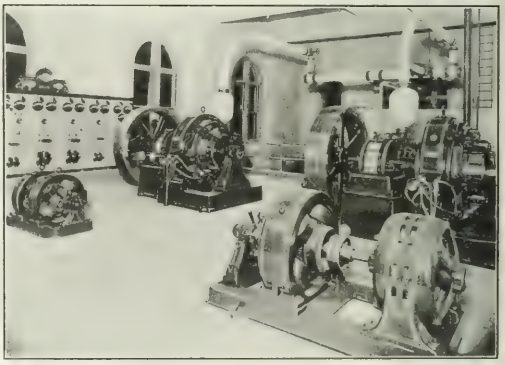


FIG. 1.—ENGINE ROOM OF HOSPITAL POWER PLANT.

All pipes from the boiler-room to the main building are led out through a 4-ft. x 8-ft. reinforced-concrete tunnel, which passes on a level from the boiler-room floor directly underneath the engine-room and thence to the buildings. The engine exhaust pipes are led into this tunnel, as are also all

drip pipes and all electric wiring to and from the generator-room.

In view of the demand for direct current by special apparatus and by elevators throughout the hospital it was decided to install a direct-current plant, the distribution to be on a three-wire system. High-efficiency, 125-volt lamps are used throughout, and elevator and other motors are operated at 250 volts.

The generating equipment is of special interest in that two-wire, 250-volt generators were used, unbalancing of the three-wire system being accomplished with a motor-generator balancing-set. With this arrangement exceptional regulation and results have been obtained.

The main generating equipment consists of two 75-kw, 250-volt, two-wire direct-current generators, each directly driven by a 120-hp simple automatic engine running at 275 r.p.m. A 30-kw, 250-volt, two-wire direct-current generator directly driven at 900 r.p.m. by a two-phase induction motor is provided as an auxiliary, the motor being connected to the local electric supply company's service mains. The series-field coils of the machines are adjusted for 10 per cent over-compounding. The voltage rise is proportioned to the load increase, making the compounding curve approximately a straight line.

The motor-generator balancing set, which is connected across the three-wire system, was designed to regulate within 2 volts with a maximum current in the neutral wire of 150 amp, but it

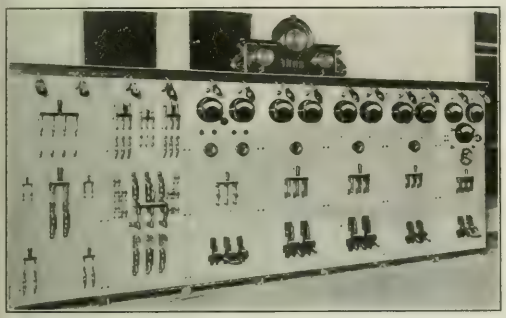


FIG. 2.—SWITCHBOARD IN HOSPITAL POWER PLANT.

will be seen later this figure has been surpassed. The connections for this balancing set are such that the shunt-field winding of each machine of the set receives energy from the opposite side of the system, this tending to raise the voltage on the low side. The series-field coils of each machine of the balancing set are in series with the armature of the opposite machine thereby compounding one machine with the armature current of the other. The arrangement is such that at each moment the machine acting as a generator is cumulatively compounded, while the machine acting as a motor is differentially compounded. The cumulative compounding on the generator tends to raise the voltage on the low side and the differential compounding of the motor tends to increase the speed. When running under unbalanced load the motor takes considerably more current than does the generator, and if it were compounded with its own current it would tend to flash over much sooner than when compounded with a smaller current of the generator; the generator being compounded with the larger motor current has a stronger tendency to hold the voltage up. Under test and without any movement of the brushes or rheostats this set showed the following regulations:

Current in neutral.	Volts, motor side.	Volts, generator side.
0	116.7	116.7
30	117.2	116.3
70	117.8	115.8
130	117.1	115.6
150	115.5	116.9

It is thus seen that the e.m.f. varies from normal by only 1 volt, or less than 1 per cent, this regulation being obtained through the entire range of the balancing set automatically and without any operation whatever of the rheostats. The machines reverse their functions, passing through zero to the opposite extreme with the same results. The writer believes that no three-wire machine can produce such satisfactory results. The balancing set has the additional advantage in that for long, continued unbalancing on the system the rheostat can be adjusted so that the voltages on the two sides of the system are exactly equal. The standard regulation guaranteed for three-wire generators is 2 per cent above and below normal. As far as service is concerned, then, the two-wire machines with balancer seem to be far preferable.

For operation the balancer set requires 7.5 amp, which represents its no-load loss. This loss, however, is offset by the greater efficiency in the two-wire generator over that of the three-wire machine, additional windage and friction in the three-wire machine bringing the efficiency of this type of machine to at least 2 per cent below that of the two-wire machine of equal rating. When the use of standard two-wire apparatus, simplified wiring and reduction of first cost are further considered, the superiority of the three-wire generator in any respect to an arrangement such as this, is not in the least apparent. The danger of violent short-circuiting encountered in "throwing in" some three-wire machines in parallel is also eliminated with the use of the balancer. The electrical machinery was built by the Electric Machinery Company, of Minneapolis, Minn.

The switchboard consists of seven panels, three generator panels, a panel for the induction motor, a balancer-set panel and two distributing panels, one lighting and one motor. The panels are of uniform size, 30 in. x 76 in., of a single piece of blue Vermont marble 2 in. thick.

On each generator panel are mounted a voltmeter, an ammeter, a double-pole plain overload circuit-breaker, the field-circuit rheostat and a three-pole knife switch, through the middle pole of which the equalizer load is connected to the equalizer bus.

On the motor panel are mounted an ammeter for each phase, a voltmeter with plugs and receptacles, a double-pole plain overload circuit-breaker, a triple-pole main switch and a large hand-wheel for operating the motor starter at the rear of the board.

On the balancer panel are mounted a differential ammeter, a differential voltmeter, a triple-pole plain overload circuit-breaker, two field rheostats, a triple-pole double-clip rheostatic starting switch, and also the ground-detector lamps of the system. The switching arrangement for the balancer set is very simple. The three-pole double-clip switch serves to start the balancer, cut-out resistance and connect the neutral, and is absolutely fool-proof.

All distributing switches on the lighting panel are of the double-throw type, the lower studs being connected to a separate set of buses that are joined to the local company's alternating-current mains. Thus light for the hospital is insured without running any machinery whatever in the plant. If, however, energy for the motors is required, the motor-generator set must be started. The institution is thus protected even in the case of entire shut-down of the steam plant.

Above the board and supported by ornamental copper work are mounted the engine-room clock and boiler steam gages.

All metal work on the board, including instruments, is copper-finished, and the board is in general keeping with the handsome appearance of the plant.

In view of the fact that all exhaust would be made use of in the steam and hot-water systems, a highly economical engine was not particularly desired, but rather a simple engine with good regulation and with few parts to give trouble. American Ball simple engines with 14-in. x 12-in. cylinders were installed.

To secure a good and sufficient water supply wells were sunk to a depth of about 100 ft. The water was found to be so exceedingly gritty that an air lift was determined upon as being superior to any form of plunger pump. A small 6-in. x 8-in. air compressor, driven by a 5-hp motor in the boiler-room, provides the air. The air-lift delivers the water to the

suction pipe of a 2 in. centrifugal pump driven by a 3 hp motor, which, in turn, forces the water to the large supply tank located on the roofs of the various main buildings. This arrangement has been found to be very satisfactory, the gritty water having no deleterious effects on the air-lift or pump-runner. The capacity of the pumping equipment is 7200 gal. of water per hour.

Great care has been exercised throughout to make the plant a model one. Mr. D. J. Patterson was supervising architect, and the Standard Engineering Company, power engineers, of San Francisco, installed the plant, the boilers, however, being supplied by the Parker Boiler Company.

Battery Charging Rheostats for Direct Current.

For use wherever a small storage battery is maintained, as in public and private garages, where only constant-voltage direct current is available, a storage-battery rheostat is now being sold by the Westinghouse Electric & Manufacturing Company. Some form of resistance must be employed since the voltage at the beginning of the charge is less than is required when the batteries are fully charged, and it is therefore necessary to reduce the voltage, usually by an adjustable series rheostat. The voltage applied to the battery should be raised gradually from the minimum value at the beginning to about 2.7 volts per cell at the end of the process. The illustration shows a type "DB" battery-charging rheostat for 40 to 44 cells, which is capable of carrying 50 amp on any position; other rheostats are supplied for the same current capacity to charge 10 to 14 cells from 110-volt to 120-volt circuit.

To select a charging rheostat for a given service, the circuit voltage, the minimum allowable battery voltage and the charging current in amperes must be known. The required rheostat resistance can then be computed as follows:

$$\text{Resistance of rheostat} = \frac{\text{circuit volts} - \text{battery volts}}{\text{amperes charging current}}$$

The battery voltage is the product of the number of cells in series and the volts per cell. For example, to charge a battery which has 36 cells connected in series, at a maximum rate of 7½ amp from a 110-volt circuit, the minimum voltage or the initial charging voltage being 2 volts per cell, the resistance in the rheostat would have to be as great as

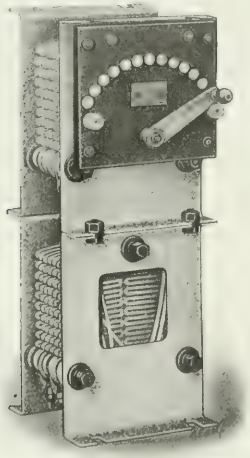
$$\frac{110 - 36 \times 2}{7.5} = 5.07 \text{ ohms approximately,}$$

and the standard rheostat with 5½ ohms resistance would be required.

Although these rheostats are rated as for 110 volts to 120 volts, it is possible to use them on higher voltages provided the resistance is great enough to keep the current within the maximum allowable amperage for the batteries, but, of course, the current capacity of the rheostat must not be exceeded.

These rheostats have a standard finish of black marine for the face-plate; the resistance grids are coated with aluminum paint, and the supporting frames are galvanized, making rusting impossible. The general appearance of the complete rheostat is such that it can be mounted near any switchboard without forming a displeasing contrast.

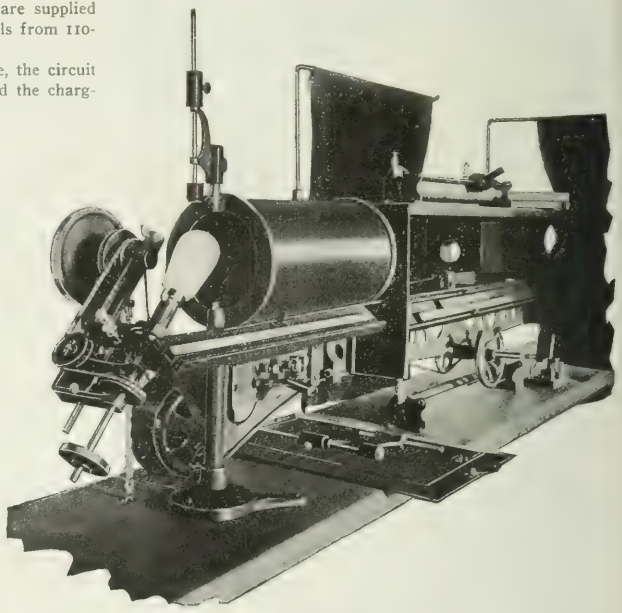
The resistance is of the grid type and is rigid, compact and substantial, insuring a long life if not abused. There are 13 steps by which the resistance can be adjusted, giving ample opportunity for maintaining the current at the correct value. The entire construction is particularly suited for operation by persons unfamiliar with electrical appliances.



BATTERY CHARGING RHEOSTAT.

Spherical Photometer.

The spherical photometer illustrated herewith is built by the Dwyer Machine Company, of Lynn, Mass. By its use end-on, angular, mean spherical and horizontal measurements can be taken, and its special features adapt it to the measurements of reflector lamps and the determination of the value of reflectors attached to lamps. The general construction of the instrument is shown in the engraving. The revolving mechanism consists of a mean spherical jig for rotating the lamp while in a vertical or horizontal position or at any intermediate angle. By means of an index wheel the lamp may be fixed at every 10 deg. The frame of the photometer is of cast iron machined to insure alignment and accuracy of distances. The bar consists of a V-track and the car is provided with wheels to match, to prevent wabbling and to keep the screen square with the rays of light. The bar is enclosed by planished iron hoods which cut out light from windows, doors, etc., from the screen. The interior surfaces of the instrument are lined with black velvet and large curtains protect the operator reading the screen so



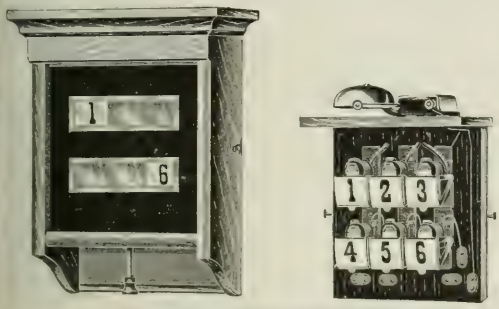
SPHERICAL PHOTOMETER.

that light from the end lamps shall not interfere with the accurate reading of the differences in the reflections on the screen. The car is controlled by a tiller wheel so located that its operation does not tire the arms. A foot treadle starts and stops the rotating socket, which may be driven by belt or by an independent motor. Binding posts and flexible connections are provided for voltmeter and ammeter, and by means of two rheostats, fine gradations of potential may be secured. The scales read directly in candle-power. Two sizes of instruments are made: a 60-in. size having a range of from 1 cp to 50 cp and a 72-in. size with a range of from 1 cp to 100 cp.

Drop Annunciator.

The increasing demand for a good, reliable annunciator, due to the erection of so many new modern office buildings, hotels and apartment houses has led Edwards & Company, Inc., to place on the market a new type of lock gravity-drop annunciator, known as "The Dixie." This type has the same fine cabinet work and finish which are characteristic of the Edwards annunciator, and in addition, has several new features. The well-known 8-B Lock gravity drop, which is positive in operation and thoroughly reliable, is supplied in this type as well as the standard bells and buzzers used on all Edwards annunciators.

The annunciator is in two parts, the back board and the case. On the back board (see Fig. 2) the bell, drops and connectors are mounted. When the annunciator is to be installed the case is unhooked and removed, there being no screws to take out or



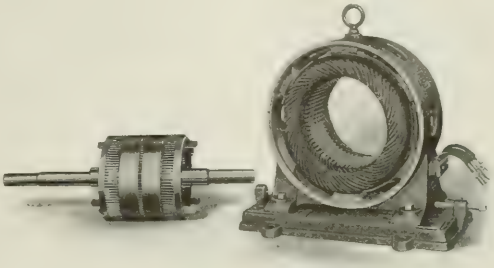
FIGS. 1 AND 2.—DROP ANNUNCIATOR.

replace, and the back board is screwed to the wall. Connections can be easily made, as the connectors are in plain view at the bottom of the back board, and it is not necessary to work through or between the drops. Since the bell is also on the back board, a test can be made while the case is off and the working parts exposed. When the work of installation is completed, the case is held in place by substantial hooks, thus protecting the instrument from dust or damage.

Another desirable feature of the annunciator is that the marking is printed on a paper board, which is slipped into the shutter, so that it can be easily changed when necessary. The indicators are large and very distinct, and as there are no indications in sight except when a call is made, any confusion as to what particular call was made is avoided. Only a small amount of current is required to operate these drops because of their simplicity and ease of operation.

Polyphase Induction Motor.

The accompanying illustration shows the stator and rotor of a polyphase motor which is typical of a line built by the Ideal Electric Manufacturing Company, of Mansfield, Ohio, for frequencies of 25, 30, 40 and 60 cycles and for tensions of 110, 220, 440, 550 volts and over. The design is characterized by massive frames, cast-iron end housings, amply proportioned phosphor bronze bearings, form-wound stator coils threaded into partially closed slots, and heavy shafts. The machines are designed to carry 25 per cent overloads for two hours without abnormal temperature rise, and 50 per cent overloads for short intervals. The motors are constructed for floor, wall or ceiling attachment. Standard belted motors are provided with rails for belt tightening, the rails serving as a support for the motor when used for wall or ceiling suspension as well as for ordinary

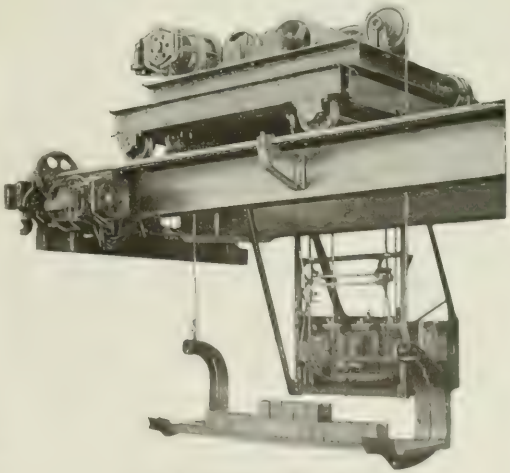


POLYPHASE INDUCTION MOTOR.

floor attachment. Motors larger than 7½ hp are provided with starters which reduce the pressure applied to the windings during the starting period. The starter comprises an auto-transformer and an oil-immersed controller for making the change from the starting to the running positions. In the small sizes for low-voltage motors, the auto-transformers and controllers are mounted together, but in the larger sizes each is mounted separately and both are immersed in oil.

Three-Motor Electric Traveling Scale Crane.

The accompanying illustration shows a new type of scale crane, designed and manufactured by the Whiting Foundry Equipment Company, Harvey, Ill. All movements are operated by electricity. The novel feature of this crane consists in the application of the scales for weighing material which are supported on trolley truck frame and carry the hoisting mechanism mounted on independent steel framework. The scale beams are in the cage suspended from the trolley and readings are taken and recorded by the operator. There are three beams: two scale beams with self-recording poises and one tare beam, en-



ELECTRIC TRAVELING SCALE CRANE.

abling scale weights to be determined of several different items of material with ease and accuracy. A simple movement of hand-lever transfers, when desired, all load from the knife edges of the scale to the trolley truck frame, and then operation is the same as with ordinary trolley. The former method of crane

weighing consisted of hanging a scale device on the hook. This required a special man to read, enter and calculate weights and deduct the tare, a process much more laborious than with the new arrangement, which also eliminates the liability of personal error. The scale device on the hook also occupied considerable head room, which was often a consideration of importance. An open-side platform is furnished, as shown, for carrying long pieces such as rods or bars. The design of this platform is made to suit the material to be handled. A crane of this type is most useful in loading material, checking invoiced weights, and in loading for shipment, for inventory, etc.

Developments in Bituminous Gas Producers.

For a number of years the Westinghouse Machine Company has been engaged in the development of a satisfactory form of producer suitable for gasifying the usual grades of bituminous fuels. The unusual difficulties encountered in the utilization of this kind of fuel have resulted in the trying out of many different types, both of the producer itself and of the necessary auxiliaries for producing clean gas. For the past year and a half, however, the company has been engaged in carrying out upon a commercial scale a producer plant which is now upon the market. These tests have not been conducted with a toy apparatus, but with a full-sized equipment of 175 hp, including a standard gas engine of about the same power, by means of which the actual power value of the gas produced and the over-all efficiency obtainable were determined without possibility of error.

The above-mentioned tests were brought to a conclusion on April 3, by drawing the fire in the producer after it had been in continuous operation on various loads and on various fuels for a year past, these 12 months having been devoted to tests of one to four weeks' duration, both 10 and 24 hours per day on standard fuels available for power purposes. These fuels included Pittsburgh slack and run-of-mine, lignites from northern Colorado, Texas and South America, as well as peat and other fuels from various parts of the country. During most of the tests the load on the equipment was maintained at full rating, although one special test of one month and a half duration was made to determine accurately the standby loss of the producer standing idle.

The drawing of this fire after one year's operation was made the occasion of a demonstration of the producer plant before Government officials and engineers from various parts of the country especially interested in bituminous gas practice. The fire was drawn without trouble or interruption, as large clinker formations were entirely absent, although the producer had, just previous to this occasion, been running on a full-load test for one month, using Pittsburgh coal. The lining of the producer was found to be practically intact and in quite good enough condition for continued operation for an unlimited period. A detailed examination of the piping leading from the producer house to the engine on test showed that during this long period of operation there had been no deposits of tar or lampblack. As a matter of fact, this piping had not been examined for about two years and a half of producer experimentation.

The most important feature of the demonstration was the entire absence of tar formed in the producer gas. A similar examination of the mixing and inlet valves of the engine used for the past year on this test showed practically no deposits of tar or lampblack, such as would interfere with the operation of the engine. The Westinghouse plant uses no tar extractors, as no tar is made; there is simply a static washer of small size in the place of the usual bulky coke scrubber. A rotary exhauster draws the gas from the fuel bed and delivers it to the engine at a definite pressure. No gas holder is used in this process, as the producer regulation is entirely automatic. The gas produced has a moderate heat value suitable for high compressions in the gas engine, and is uniform and clean, average samples showing not more than 00.2 to 0.03 grain per cubic foot in impurities. The ash is fairly clean, and analysis of samples from time to time shows that not more than 1 per cent to 3 per cent of the combustible in the coal escapes in the ash.

The various fuels which have been used in this producer on test have been gasified successfully and have run as high as 34 per cent moisture, 35 volatile and 15 per cent ash and 1½ per cent sulphur. The results of the tests show that with coal, such as Pittsburgh slack or run-of-mine, an over-all economy of 1.1 lb. per brake hp-hour can be secured, equivalent to a little over 0.9 lb. per hp-hour. Moreover the producer efficiency does not vary more than 10 per cent from full load on the plant to no load.

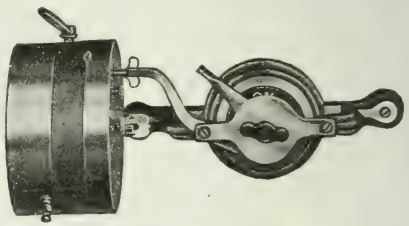
The results of this past year's tests have fully convinced the builders that the apparatus experimented with possesses unusual commercial value, and preparations are being made for extensive manufacture. A plant of this type has been in operation for over six months on Colorado lignite coal with equal success, as evidenced by an order recently placed with the Westinghouse Machine Company for a duplicate equipment.

Electric Time Switch.

The use of time switches is rapidly increasing as their various applications become generally known, and these conditions have created the demand for a simpler or less complicated device than has frequently been secured in the past. To meet the demand for a switch of reasonable price, having capacity up to and including 35 amp, the type shown herewith has been developed and is being marketed by the Central Electric Company, Chicago, Ill.

The switch mechanism is of the well-known double-pole type and so located as to be operated by means of a tripping mechanism controlled by a standard clock. To operate the device it is only necessary to close the switch and set the clock at any hour it is desired to have the switch opened. At this predetermined time the clock releases the locking toggle and the switch is instantly thrown open by a suitable controlling spring.

Time switches have been found especially useful in connection with the sale of energy on a flat-rate basis—that is, where lamps are to be switched on or off at definite hours on a fixed charge



ELECTRIC TIME SWITCH.

for current. Energy rent for tungsten lamps is being sold on this basis in many cities. In stores and apartment houses the use of time switches not only effect a great saving in energy used, but what is often more important, assures punctual service that attendants will not give. In small stores it often happens that everyone is busy at the time when the lights should be turned on. In apartment houses the halls are frequently dark through forgetfulness or absence of the janitor. With a time switch the lights are always on and off at the right time.

When show windows or signs are located near theaters or other places of amusement, it is very desirable to have them illuminated while the crowds are passing. The time switch can be set to turn the lights off at any desired time and makes a trip to the store unnecessary. The time switch can also be successfully used in public or private illuminating plants for controlling service at a flat rate during specified hours. There are many other situations where it can be used for convenience and profit as, for instance, in charging automobiles or storage batteries of any kind and in every place where the current should be turned on and off at definite hours.

Catenary Bridges for Electric Railways.

The accompanying illustrations show styles of catenary bridge construction used by the Syracuse, Lake Shore & Northern and



FIG. 1.—BRIDGE FOR DOUBLE-TRACK ROAD.

the Rochester, Syracuse & Eastern railroads. The bents of the bridge are 28 ft. center to center.

The bridges, which are placed 300 ft. apart, support a No. 4-0 grooved copper trolley wire by means of hangers suspended



FIG. 2.—BRIDGE USED WITH THREE-PHASE TRANSMISSION LINES.

from the catenary messenger wire at 30-ft. intervals. On the construction on the Syracuse, Lake Shore & Northern Railroad 7/16-in. strand steel messenger wire was employed, mounted

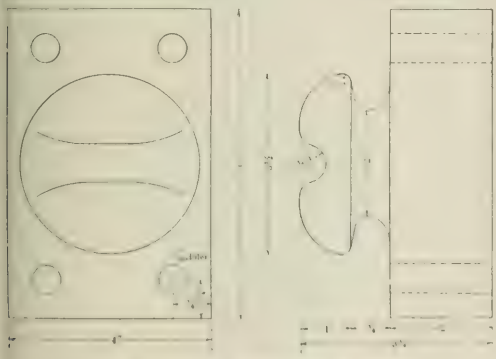


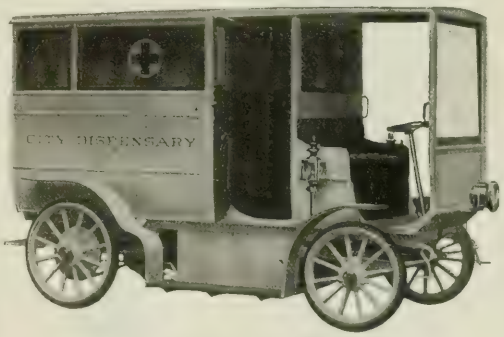
FIG. 3.—PORCELAIN INSULATING SADDLE

on porcelain-pin insulators attached to steel pins on the top member of the bridge. On the construction on the Rochester, Syracuse & Eastern Railroad it is proposed to use the two 500,000-circ. mil copper feeders as messengers, and thus eliminate the cost of the steel messengers. The copper messenger is to be carried on a porcelain saddle (Fig. 3) recently designed by Mr. Thomas H. Mather, chief engineer, and Mr. R. A. Dyer, Jr., electrical engineer of the railroad company. These saddles, which are to be furnished by the Ohio Brass Company, are to be lagged to a timber, which will be protected from decay by preservative compound, and are to be mounted on the tops of the catenary bridges. This timber provides additional insulation and is a safety precaution against grounding in case the insulator should break.

These bridges were designed to be comparable in price with the ordinary wooden-pole construction. It is said that the total cost of construction per mile of double track on the Syracuse, Lake Shore & Northern Railroad was $4,100, as compared with $3,325 for an equivalent wooden-pole construction. The elimination of the steel messenger will result in a saving of $400 per mile. These bridges were built by the Archbold-Brady Company, Syracuse, N. Y.

Waverly Electric Ambulance.

The Waverly Company, Indianapolis, has recently completed for the Indianapolis Board of Trade an electric ambulance, which is claimed by the makers to be the handsomest and most modern power-driven ambulance ever constructed. The dimensions of the new ambulance are as follows: Length, 14 ft. 1 in. over all; wheel-base, 8 ft. 1½ in.; length inside, 8 ft. 5 in;



ELECTRIC AMBULANCE.

width over all, 5 ft. 10 in.; width inside, 3 ft. 10 in.; height over all, 8 ft. 4 in.; height inside, 5 ft. 4 in.; height of sill, 32¾ in.; height of step, 19 in.

Special points of convenience are two side doors 23 in. wide near the front of the ambulance opening upon an open space of 18 in. x 3 ft. 10 in. in front of the stretchers for the use of the surgeon and attendants. Convenient to this space are electric-light buttons, an electric heater, special drawers for surgical instruments, and appliances for the control of folding seats and stretchers. The interior of the ambulance is handsomely finished in polished hard woods with russet leather curtains and upholstery. The exterior is painted in white enamel, with the words "City Dispensary" in blue letters on the side panels. In the glass of the center window on each side is displayed a large red cross on a white circle.

An exceptionally powerful motor has been provided, with large overload capacity, such as is used on commercial vehicles in heavy service. This is operated by a 42-cell, 13-plate battery, constructed for unusual mileage and speed, which last varies from 3 to 15 miles an hour in ordinary service, with a special emergency speed of 20 miles an hour. A four-speed controller, so designed as to enable the car to start and accelerate without shock, is an important feature of the equipment, and this with the noiselessness of the rotor, driving system and gear make this new construction an ideal piece of mechanism, considered either from the point of view of the operator or that of the patient.

Electrically Operated Valves.

In steam stations it is often desirable to operate a valve from a distance so that in cases of emergency it will not be necessary to approach a valve to shut it off. Also when large

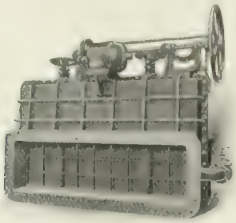
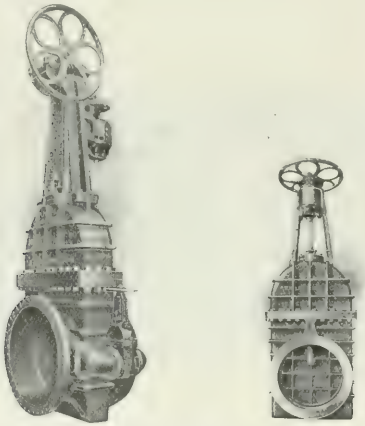


FIG. 1.—ELECTRICALLY OPERATED EXHAUST VALVE.

units are started and stopped with any frequency, motor-driven valves for large exhaust piping, for instance, will materially expedite matters. It is not uncommon, therefore, to find in



FIGS. 2 AND 3.—ELECTRICALLY OPERATED VALVES.

large steam stations electrically operated valves between the boilers and the steam header, or between sections of the header or between the header and engines. Where space is limited or where the locations are disagreeable or difficult of access, motor-operated valves are well adapted. In hydraulic stations where heavy construction obtains, so that the opening and closing of valves and sluice gates by hand would take not only considerable time, but labor as well, valves operated from the switchboard possess an added advantage besides that of being motor-operated. By means of tell-tale lamps the position of the valve can be indicated, and where the water is brought in a pipe line from a reservoir some distance away, the installation of electrically operated valves at the intake or at some intermediate point in the line is a safeguard against damage. The Chapman Valve Manufacturing Company, of Indian Orchard, Mass., builds a line of electrically operated valves for various purposes. The body, cap and plug are made of various materials as called for by standard construction, and the motors are specially designed for valve use. The direct-current motors have solid hand-hole covers to exclude dirt and moisture, and the alternating-current motors have solid heads. The windings are treated by immersion in hot asphaltum in vacuum and the bearings are of a special form requiring no lubrication whatever. The windings are designed to give the motor great starting torque with low speed. There are no contact devices to cut out the motor at the end of the travel of the valve. The plug is forced to its seat and the motor being then overloaded, the overload device on the controller releases and the circuit is broken. No external resistance is used in starting the motor. There is a lost motion, or "hammer-blow," device which allows the motor to bring the gears to speed, at which point the yoke nut receives a heavy "hammer blow," starting the plug from its seat. By the use of such a device a large motor is not required. Should it be desirable at any time to operate the valve by hand, the motor and gearing can be disconnected in a short while. The hand-wheel is fitted with a locking device by means of which it can be engaged with the yoke nut. The controller usually furnished is mounted on the wall or switchboard and has asbestos-lined cover and fiber barriers between segments. A tripping rod projects through the top and furnishes means for stopping the valve at positions intermediate between open and closed. The controller has but three positions and no resistance. In throwing the handle to the open position, for instance, it is held there without further attention until released by the tripping coil at the end of the travel of the valve, and is then brought to the off position by a strong centering spring.

Large Base Receptacles.

Pass & Seymour, Inc., of Solvay, N. Y., have brought out two new large base receptacles, especially suited for tungsten lamps and illustrated herewith. The mechanism of the key socket is of the company's double-pole construction and the socket is,

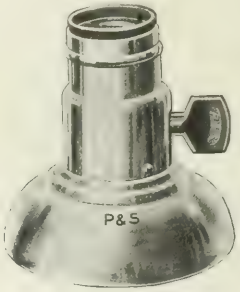


FIG. 1.—KEY RECEPTACLE.



FIG. 2.—KEYLESS RECEPTACLE.

moreover, provided with an insulated mandrel. The receptacles, which are of the key and keyless types, are fitted with large recessed bases to be used in concealed work, the base being thus

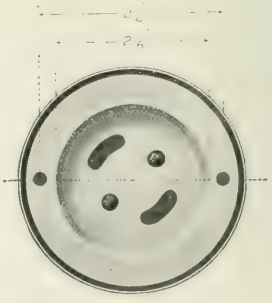


FIG. 3.—BOTTOM OF BASE.

made to take care of the end of the tubes or conduit projecting from the ceiling. The bottom of the base is 2½ in. between centers of screw holes, so the screws will properly engage the lath or joist.

New Cochrane Open Feed-Water Heater.

The accompanying illustration shows a new heater, just introduced by the Harrison Safety Boiler Works, Philadelphia, Pa. The heater possesses all the features of the well-known Cochrane heater—that is, it heats the water by direct, actual contact with the purified steam and provides for the retention of precipitated scale-forming matter on trays and in the filter, for the escape of air and gases and for the automatic admission of sufficient new water to make up the full amount of boiler feed.

The new feature consists of a specially designed separator which is large enough in volume to purify all the steam required for heating the boiler feed water and also to handle the entire amount of steam exhausted by the engines and pumps, so that the surplus can pass directly to the heating or drying system without further purification. Upon entering the separator the steam strikes a vertically ribbed baffle plate, such as is used in the oil separators attached to other Cochrane heaters; but after passing around the baffle plate, that part of the steam required for heating the feed supply is diverted into the heater proper while the surplus steam is passed to the heating system through the "steam stack" at the top of the separator. The arrangement of parts is such that the "preference" is into the heater, so that the feed-water will be heated up to the maximum temperature before steam passes to the heating system.



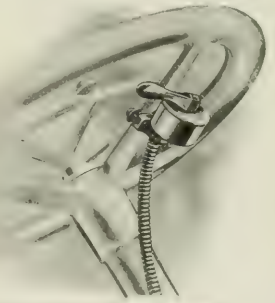
OPEN FEED-WATER HEATER

To provide for shutting the interior of the heater off from the steam piping—that is, to make it possible to open and clean the heater while the heating system continues in operation—a cut-out valve is placed in the opening between the heater and the separator, while a similar valve is placed between the overflow opening of the heater and the steam trap, even when the heater is cut out of service. The steam cut-out valve is of cylindrical semi-rotating type and is operated from the outside by means of a suitable lever.

This large separator with valves thus takes the place, it will be noted, not only of the separator on the ordinary open feed-water heater, but of one or more gate valves and tees, and an independent separator with trap and connections. The comparison in the accompanying illustration shows the least number of extra valves, fittings, separators, traps, etc., required by an ordinary heater and receiver to perform the functions of the new surplus exhaust and cut-out valve heater. In many installations much more complicated arrangements have been installed to perform this service. For installations where there is no necessity of cutting the heater out of service while exhaust steam is being supplied to the heating system, as where a plant is running during only a part of the 24 hours, the cut-out valves can be omitted, although they are recommended even in such cases, particularly when the heater is used in connection with a heating or drying system.

Automobile Steering-Wheel Switch.

The automobile steering-wheel switch shown herewith puts the ignition control under the right-hand of the driver and may be manipulated without the hand leaving the wheel. Four different positions are provided as follows: "Off," "Battery," "Magneto" and "Magneto and Battery together," for cars provided with two ignition systems, or may be used with a magneto or battery system alone. The device is only 1½ in. in diameter, is made entirely of brass and is dust and waterproof.



AUTOMOBILE STEERING-WHEEL SWITCH

It is fastened by a bracket under one of the arms of the steering wheel and the controlling lever may be removed, making the car safe from interference during the absence of the driver. Only two wires are used, which are encased in flexible brass tubing and connected to the battery and magneto. No other switches are necessary. The switch may be installed by anyone, and is so simple that disarrangement cannot occur. It is made by the Connecticut Telephone & Electric Company, Meriden, Conn.

Steel-Tape Cables.

In electrical construction work there appears to be an increasing demand for steel-tape cables to be laid underground directly in the earth without being encased in conduit. Lead-covered cable is used in various sizes, and this is encased by a spirally wound covering or protection of steel tape, the whole enclosed in a serving of jute. This type of cable is inexpensive to install and it is furnished in any length desired. A shallow, narrow trench is laid and the cable is placed within it, directly in the earth, from a cable reel. This system occupies a sort of midway position between overhead wires and the much more elaborate and expensive underground-duct system. No manholes are necessary. The steel-tape cables are particularly adapted for parks or country homes or in making service connections in cities from street mains to houses. In the last mentioned case the cable can be laid directly under the lawn, and a man with a spade can do the work of trenching, putting back the sod so that in a few days there will be no indication of the cable laid in the ground. Various sizes of cable of this type is made by the Simplex Electrical Company, of Boston.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

To sum up the trade conditions for the month of April, it is not going too far to assert that they were thoroughly disappointing. The net result has been a smaller retail trade than was anticipated, a hand-to-mouth jobbing business and a discouraging spring outlook for crops. The wide prevalence of unfavorable weather during the latter half of the month has done much to retard planting, and in many cases may seriously injure the coming season's yields. It has also acted as a deterrent upon all kinds of retail business. Farmers are not feeling optimistic, and are not buying with liberality. Wholesale jobbing trade for the month was better than for the same month last year, but very much smaller than had been looked for. In this circle, however, there is no lack of optimism, and it is generally believed that fall business, at least, will be entirely satisfactory. Reports of the leading industries during the past week are rather better than they have been. The low prices have evidently brought out a considerable number of orders and in the iron and steel trade, especially, there has been satisfactory buying. An announcement made during the week by the Carnegie company advancing prices on certain forms $1 per ton, on account of the fact that its shops had taken enough business to last for some months, was distinctly encouraging. It shows that one of the largest concerns in the country will be kept busy, even if the prices which it is receiving are not making the profits that were brought in by former figures. It must be a fact that other mills are in somewhat the same condition. Pig iron has also stiffened somewhat in price, and No. 2 foundry is quoted at $11.50 at Birmingham. Makers of malleable iron agricultural implements, stoves and tubes are also reasonably busy. It was also announced during the past week that the equipment companies had taken sufficient orders to keep their plants well employed during the entire summer. This is satisfactory in view of the fact that many other orders are known to be prepared and ready for placement. The building industry continues to be active, and it is evident that there will be very much more done in this line during the coming season than there was during 1908. The Chicago grain market continues to be disturbed, and prices for both wheat and corn are unusually high, apparently due to the light receipts rather than to speculative manipulation. Collections continue to be only fair, and business troubles are not unusually heavy. Failures for the week ended April 29 were 268, as against 247 for the previous week, 284 in the same week of 1908, 163 in 1907, 139 in 1906, and 193 in 1905.

THE COPPER MARKET.

The copper market during the past week has been in a more encouraging condition than it has been at any time during the past two months. This is not due to the fact that actual sales were heavier, but to the fact that there is more evidence that the consumers are taking orders, and that there are more inquiries for copper for May and June delivery. So far, buying by local melters has not been very heavy, but it is believed that it can be only a short time until round lots must be demanded. The takings for speculative purchases abroad were not so heavy as during the latter part of March, but actual exports of copper for April will be the largest for any month since June, 1908. The shipments from Atlantic ports during April were 29,007 tons, or, in round numbers, about 65,000,000 lb. It is estimated that domestic takings will amount to something like 40,000,000 lb., and as the production is figured at about 112,000,000 lb., the addition to the surplus will be only 7,000,000 lb., or less than the addition that was credited by the figures of the Copper Producers' Association for the month of March. Prices have shown no inclination to decline during the week, and sellers, as far as can be learned, have been making no concessions. The quotations for delivery in June or any subsequent month, are very rigidly adhered to, and it is doubtful if any large quantity could be purchased at the present figures for a distant delivery. The production of copper continues at almost record figures, although the April output will be several million pounds less than that of March; in fact, it is not believed that any other month in the near future will reach the 117,058,661 lb. record that was made in March. The larger number of orders being received in the steel industry are encouraging to the copper producers, and it is generally conceded that the consumption of copper follows closely the activity in the steel trade. Quotations on the Metal Exchange May 3 were:

Lake	12⅜ @ 12⅝
Electrolytic	12⅜ @ 12⅝
Casting	12⅛ @ 12⅜

The London prices May 3 were as follows:

	Noon £	s	d	Close £	s	d
Standard copper, spot	57	15	0	57	17	6
Standard copper, future	58	10	0	58	11	3
Market	Firm.			Firm		
Sales of spot				200 tons		
Sales of futures				1,400 tons		

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London last selected	67 15 0	59 0 0

TELEPHONE RATES REDUCED AT CLEVELAND.—The United States Telephone Company at Cleveland has announced that its schedule of rates is to be readjusted in such a manner as to make a substantial reduction to patrons of its lines. The officers of the company state that several hundred miles of new copper circuit have recently been completed in Ohio and that arrangements have been made for the construction of connecting trunk lines between the east and west, affording much greater capacity in every way, and that lower rates are to be offered to stimulate business. They deny that any plan had been made to take business from competing companies or to open any war between the Bell and the independent companies. James S. Brailey, Jr., president of the United States Telephone Company, said that he felt that his company would widen its scope of operations and extend its business by making a concession to users of the lines. The company has prepared to take care of any additional business that may come. Shortly after this announcement was made the Bell companies in Cleveland came out with special rates to various points over the country. Although they are irregular as to amount, the action of the companies indicates that competition will be close for a time. The following reductions in rates have been made by the Bell companies: Between Cleveland and Chicago, $1.25 to 75 cents; Cleveland and Cincinnati, $1.50 to $1.10; Cleveland and Detroit, 90 cents to 65 cents; Cleveland to Toledo, 60 cents to 45 cents; Cleveland and Dayton, $1.50 to $1.10. Between Pittsburgh and points named the following reductions have been made; Columbus, $1 to 75 cents; Toledo, $1.25 to 90 cents; Youngstown, 40 cents to 30 cents; Dayton, $1.50 to $1.10.

C. & C. ELECTRIC COMPANY'S SUCCESSOR.—Announcement is made that the Garwood Electric Company, a new organization, has secured the exclusive right to manufacture the dynamos, motors and other appliances which were formerly manufactured by the C. & C. Electric Company. The new company has already begun business, and it will use the same factory, with the same designs, patterns and tools, and with the same engineering staff and workmen as the old C. & C. Company. The C. & C. Company in its long career had, it is stated, put out 40,000 machines. The main office of the new organization will be at the works at Garwood, N. J., with branches at Company Building, Philadelphia. It is incorporated under the laws of New Jersey and is capitalized at $250,000.

JAPANESE ELECTRICAL MANUFACTURES.—According to a consular report the electric manufacturing industry of Japan made great strides in 1908, and was competing fairly successfully with foreign products. Generators up to 500 kw were built; also 200,000-volt, oil-immersed testing transformers and 50,000-volt to 150,000-volt insulators.

THE TARIFF ON PLATINUM.—Under the Dingley law not only crude platinum but all articles manufactured from platinum were admitted free of duty, with the exception of one or two metals which were discovered subsequent to the passage of the law, and which were not enumerated. Under the proposed new tariff law it has evidently been the intention to admit platinum and all of the metals in the platinum group free of duty, including platinum wire and scrap, but to charge 45 per cent ad valorem upon articles manufactured from platinum. The phraseology of the law is such, however, that some of the important dealers in platinum are fearful that it might be subject to a construction calling for a duty upon the metal itself. In order to have this matter cleared up Cyrus Osborn Baker, one of the most important importers and manufacturers of platinum in this country, has written a letter to a number of Senators and Representatives calling their attention to the danger of controversy if the law is adopted in its present form. Mr. Baker refers to it as an "error in phraseology, which if permitted to remain might give rise to endless controversy and litigation." He points out the wording of article No. 591, which appears under the heading of "Free List," and reads: "Iridium, osmium, palladium, rhodium and ruthenium and native combinations thereof with one another or with platinum." Also article No. 650, which reads: "Platinum, unmanufactured, or in ingots, bars, plates, sheets, wire or scrap." He then says: "It would seem that the intention is clearly to include platinum and the platinum group of metals, with all their alloys, on the free list, but the insertion of the word 'native' will certainly prove very confusing, as all metals of the group, always, when in commercial condition, contain one or more of the other metals in alloy, and by a strict interpretation might not be classified as a native combination." He also suggests that platinum sponge be included in the enumeration in article No. 650. Mr. Baker says that, as he has spent his life in the platinum manufacturing and refining industry, he believes that it is necessary to make the wording of the new act as simple and as complete as possible, and therefore suggests in place of both articles the following: "Platinum, iridium, rhodium, palladium, ruthenium, iridosmine, osmium, osmi-iridium, and any of these metals when combined or alloyed with each other. All or any of the enumerated metals or alloys, unmanufactured, or in ingots, bars, slabs, sheet, wire, sponge, or scrap." Speaking of the duty on platinum, Mr. Baker said: "If some appraiser should take it from the phraseology of the act as drawn, that platinum which contained a trace of some other metal was not a 'native combination,' and should thereupon assess a duty of 45 per cent ad valorem, it would practically destroy the platinum business in this country. As platinum is such a high-priced material, the handling of it requires a very large capital. If, for instance, we bring in a million dollars worth of platinum in a year, this would require a duty of $450,000; and, while I believe that the courts would finally hold that the collection of any such duty was not contemplated by the law, it would practically paralyze the industry to tie up that amount of money until we could get a decision. My suggestion is entirely for the purpose of making the law clear. As far as the duty is concerned, I do not particularly care one way or the other; I have made no protest against the 45 per cent ad valorem duty on manufactured articles, and I certainly did not advocate any such duty to protect the manufacturers in this country. While it is possible that under this rate of duty we might be able to push up our prices a trifle, I doubt if the protection would amount to anything to us, and it certainly would supply no revenue to the Government. I believe if the protection permitted us to advance our prices as much as 5 per cent we would have a large number of foreigners coming over here at once to manufacture platinum articles. We have been able to keep foreigners out, and to do more than 90 per cent of the business without any duty, and I do not see that the industry needs any protection." When asked about the platinum market, Mr. Baker said the demand had been a little more active, but that prices were not much advanced, ruling from $23 to $24 per oz.

CENTRAL GEORGIA POWER COMPANY.—Work upon the Central Georgia Power Company's plant, which is located at Capps and Lloyd Shoals, Ocmulgee River, in Butts County, Ga., has progressed so rapidly that it is now expected that the dam and the entire works will be completed by Jan. 1 next, and that the company will be ready to deliver its energy into Macon early in next year. This company was chartered under the general laws of Georgia in March, 1907, and undertook to develop a hydro-electric power system at the location named. The securities of the company have been placed upon the market, and it is understood that the financing has been successfully accomplished. The capital stock is $4,000,000 authorized, all of which, it is said, has been subscribed. There is to be an issue of $3,000,000 first mortgage bonds, and of this issue $2,500,000 have already been taken. The remaining $500,000 will be kept in the treasury for subsequent developments. These bonds bear 5 per cent. interest and are dated May 1, 1908. They are payable at the banking house of A. B. Leach & Company, 149 Broadway, New York. It is expected when the plant is completed that it will be able to deliver 18,000 hp. The Ocmulgee River at the site of the dam is 350 ft. wide, flowing through a hilly country. The plan contemplates a concrete and masonry dam 1452 ft. long on the crest, which will give an efficient working head of 100 ft., and will back the water up into a large reservoir, which will have a surface of 3600 acres. The water will descend through large steel feeder pipes, passing through the dam into the turbines, and thence into a tailrace. The installation so far embraces four 3000-kw turbines. Space for two additional ones of the same size is also provided in the power house. Two exciters of 250-kw direct current have also been provided. This equipment was purchased from the Westinghouse Electric & Manufacturing Company some months ago, and is now being shipped. From the transformers and switchboard the current will be carried at 60,000 volts by steel tower transmission lines to Macon and surrounding towns. Macon, which is 37 miles away, is a city of almost 60,000 population, and embraces among its industries four large cotton mills. There are many other industries in Macon which promise a good market for the energy which this company will offer for sale. The organization and ownership of the company are largely in the hands of Georgia capitalists. The president is W. Jordan Massee, who is president of the Macon Railway & Light Company. The other officials of the company are closely identified with the same traction concern.

SOUTHERN POWER COMPANY.—On April 30 the Southern Power Company of the Piedmont section on North Carolina opened its new plant at Rocky Creek on the Catawba River, which adds 40,000 hp to the capacity of the company. The company had already been delivering 55,000 hp from its plant at Great Falls which is located upon the same river. This company, which is a close corporation, belonging largely to the Duke family and other interests associated with the American Tobacco Company, is one of the most successful developments in the South. Its capitalization consists of an authorized issue of $6,000,000 preferred stock and $5,000,000 common stock. Of this issue $5,250,000 of the former and $4,000,000 of the latter have already been issued. The stock has, however, never been offered to the public, but has been taken by the interests which originated and are developing the company. It is probable that all of the preferred stock will be issued before the coming fall, as there is additional work in contemplation. The company is also building a new plant on the Broad River near Blacksburg, S. C., which is known as the Ninety-nine Island plant. It will be completed and ready for service about Jan. 1, 1910, and is expected to develop 20,000 hp. The transmission lines of the company, which are carried on steel towers, run for 110 miles, and distribute power over the entire Piedmont section. The current is carried at 100,000 volts on the main trunk line, and at a smaller voltage on branch lines. After the completion of the Blacksburg station the company has in contemplation three other plants at different locations, and expects ultimately to develop a total of 230,000 hp. The installation of the company at the Great Falls and Rocky Creek plants consists of eight 4000-kw Westinghouse generators. At the Ninety-nine Island plant there will be four or five generators of the same size and type installed. The officials of the company say that they have an ample market for all of the power they can generate, even with the increased capacity that is contemplated when the new plants are finished. Dr. Wm. Gill Wylie, of New York, is president of the company, B. N. Duke is first vice-president, and R. B. Arrington is secretary. The New York office of the company is at 111 Fifth Avenue.

ROCHESTER RAILWAY & LIGHT COMPANY.—Officials of the Rochester Railway & Light Company report that never before in the history of the company have there been received so many new contracts and applications for service. The principal increase was in residential lighting. There are many new residences being built in the city, and many of the old houses are being wired for electric lighting.

IMPROVEMENTS IN ATLANTIC CABLE SERVICE.—The plans of the Mackay Companies for improving its Atlantic cable service are very comprehensive, and if they are successful will add much to the efficiency of the lines. The company intends to connect two of its five cables directly with Newfoundland, thus giving to 40 per cent of its Atlantic mileage the benefit of a 30 per cent to 35 per cent increase in speed. It is claimed that the Newfoundland route possesses two very important advantages over any other route in that it almost equally divides the line between New York and England, making the two arms of the cable of almost equal length which permits the sending of messages at greatly increased speed. The second advantage is that the character of the ocean floor in this locality is such that thousands of dollars can be saved in repairs to cables. The Mackay Companies has also perfected an automatic relay system, by which a message passing through Newfoundland can be forwarded without the employment of an operator. It is claimed that the new route will result in a gain of at least 50 per cent over any existing system. An improvement has been shown in the earnings of the company during the last few months which is taken to mean that better times are in sight.

WORKING ON THE PENNSYLVANIA LOCOMOTIVES.—The Westinghouse Electric & Manufacturing Company has received orders at its East Pittsburgh shops to begin the construction of the first lot of electric locomotives which the Pennsylvania Railroad Company will operate in the tunnels of the New York terminals. These locomotives will be larger and more powerful than any ever heretofore constructed, each having a capacity of 5600 hp. They will be manufactured from designs made by George Gibbs, chief engineer of electric traction of the Pennsylvania Railroad Company. The mechanical parts will be made at the Altoona shops under the supervision of A. W. Gibbs and A. S. Vogt. These locomotives will be able to attain a speed of 90 miles an hour. The first lot the Westinghouse factory is to turn out consists of 24 double units of these giant locomotives, but it is understood that more will be needed soon after the terminal station is opened.

CROCKER-WHEELER COMPANY SALES.—Officials of the Crocker-Wheeler Company say that there has been recently a steady improvement in business and that inquiries are more numerous than at any time within the past 18 months. Among the large direct-current generators recently sold is one of 300 kw, 250 volts, to the Perry Fay Manufacturing Company, Elyria, Ohio, and one of 200 kw, 125 volts, to the Cleveland Provision Company, Cleveland, Ohio. There have been many sales of smaller generators ranging in size from 35 to 100 kw. A large order was placed by the Spanish-American Iron Company, Felton, Nipe Bay, Cuba, for 230-volt, direct-current motors aggregating 235 hp. Another sale of direct-current motors, which totaled 135 hp, was made to the Morgan Engineering Company, Alliance, Ohio.

NEW TUNGSTEN LAMP FACTORY.—The Heany Electric Company has recently been organized by interests connected with the General Motor Company, of Flint, Mich., for the manufacture of tungsten lamps. The company has been incorporated under the laws of Michigan with a capital stock of $150,000. A factory is being rapidly equipped in Flint which, it is promised, will be in operation within three months with a capacity of 5000 lamps per day which, it is expected, will be steadily enlarged. The filaments for these lamps will be furnished by the Heany Lamp Company, of York, Pa., with which the new company is affiliated. The general offices of the new concern will be located at Detroit.

WESTINGHOUSE MACHINE COMPANY BUSY.—The Westinghouse Machine Company has been able to record another very satisfactory month during April. During the month the company at East Pittsburgh received contracts averaging in the turbine department alone about one machine per day, some of them, like those for the San Francisco Electric Company, for 25,000 hp. Besides the turbine business, the demand for gas engines and reciprocating steam engines has also increased, while the new gas reducer, which the company recently brought out, has opened a line of inquiries that looks exceedingly promising.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction News last week and in the present issue are announcements of proposed new plants or considerable extensions of present plants at Rifle, Col.; Fort Scott, Kan.; Albert Lea, Minn.; Taft, Tex.; Table Rock, Neb.; Toledo, Ohio; Warren, Minn.; Winnetka, Ill.; Huntington, Ind.; Berlin, Md.; Columbus, Miss.; Chicago, Ill; Brooklyn, N. Y.; Bellefonte, Pa.; Quincy, Fla.; Newark, Ohio; Trenton, N. J.; Springfield, Mass.; Henderson, N. C.; Springfield, Ohio; Indianapolis, Ind.; Gouverneur, N. Y.; Boston, Mass.; Virginia, Minn.; Grand Forks, N. D.

BIG CONTRACT FOR UNDERGROUND CABLE.—The Standard Underground Cable Company, of Pittsburgh, has been awarded the contract for all of the high-tension lead enclosed cables that are to be used in connection with the new Pennsylvania Railroad terminal in New York City. These cables will extend from Long Island City to the Hackensack Meadows under both rivers and the Borough of Manhattan. The contract is one of the largest ever placed for underground cables and will amount to several hundred thousand feet. The contract calls for cables which are designed to carry 11,000 volts.

ALBEMARLE (N. C.) DEVELOPMENT COMPANY.—The prospects for an early completion of the electrical development on the Yadkin River, near Albemarle, are stated to be encouraging. A contract has been let to L. A. Moody for the erection of a stone and concrete dam across the river. This dam will be 160 ft. in length and will be 10 ft. high and 10 ft. at the base. The development is being engineered by the Albemarle Development Company, and according to J. C. Masters, one of the promoters, will represent an expenditure of $1,000,000.

ELEVATED RAILROAD TRAFFIC IN CHICAGO.—Daily average traffic on the South Side elevated road in Chicago in April, 1909, was 116,205 passengers, a decrease of 1.43 per cent compared with the corresponding figures for April, 1908. The North Side elevated company's average for April, 1909, was 117,574 passengers, an increase of 13.52 per cent compared with the corresponding month of last year. The two West Side elevated roads have not made public the figures of their daily traffic for April.

TO COMPLETE BLEWITT-FALLY HYDRO-ELECTRIC PLANT.—United States Judge J. C. Pritchard has issued an order returnable in chambers in Richmond, Va., May 8, to all parties interested to appear before him to show cause why the property of the Rockingham Power Company should not be sold under order of the court. It is anticipated that the court will order the sale, and that the development will be prosecuted on a large scale.

WIRELESS TELEPHONE RIGHTS.—Announcement has been made that the Radio Telephone Company, of New York, of which Lee De Forest is engineer, has acquired by purchase the exclusive license to manufacture, use and sell wireless telephone apparatus in the United States under the numerous patents owned by the Stone Telegraph & Telephone Company.

BIDS FOR ELECTRIC ELEVATOR.—Sealed proposals for an electric freight elevator, to be installed for the United States Marine Corps in Philadelphia, will be received until May 7 by Colonel F. L. Denny, U. S. M. C., U. S. Marine Corps Quartermaster Department, Washington, D. C.

NEW HAVEN TO CHANGE ITS STREET LAMPS.—The United Illuminating Company, of New Haven, has determined to put in for street lighting purposes 800 G. E. magnetite arc lamps. These are to replace open arc lamps heretofore in use.

Financial Intelligence.

THE WEEK IN WALL STREET.

The market in Wall Street during the past week has differed very little from the market of the past month. Stocks have as a general rule been strong, but advances in prices have been very insignificant, and in some instances there have been losses recorded. Trading has not been particularly active, averaging about 600,000 shares per day, and business has been very largely professional. On every advance in prices there have been evidences of profit taking, and on every reaction of prices there has been enough buying to furnish ample support. These things indicate that the market is practically one of speculative traders, who are taking narrow profits and making quick turns. The decision of the United States Supreme Court, on May 3, of

the commodities clause of the Hepburn law, was taken as a distinct victory for the coal owning roads and resulted in an immediate advance in Reading, and the other properties most affected. Beyond this there has been during the week no distinctive movement in any particular stocks. The stocks of the United States Steel Corporation have continued to be strong, and the common has shown a particular disposition to advance. This may be regarded as remarkable, in view of the fact that the report of the last quarter of the company was unfavorable as far as the quantity of business is concerned, and that it is known that the next quarter will reflect even smaller profits, although the business may be larger. The general opinion, however, is that industry must speedily awaken, and Wall Street traders are perfectly willing, when money is as cheap as it is at the present time, to anticipate the good times which are expected in the future. Copper stocks have kept remarkably strong in price, in view of the adverse statistical report from the copper market and the well-known scarcity of buying orders from domestic consumers. Traction stocks in Wall Street have been comparatively stronger than they were a few weeks ago, and Brooklyn Rapid Transit especially has shown its resistance to pressure by failure to record any considerable decline in the face of some adverse legislation at Albany. The disturbances in Turkey and the continuation of the tariff debate are both deterrent influences to an important advance, but they really seem to have but small effect in the Street. Bonds continue to be extremely strong, and any sort of an issue is well taken. In fact, there is no industry and no railroad that is hesitating about making improvements or extensions on account of its inability to place bonds. The big interests are simply waiting for the actual return of business to make extensions. Money continues to be easy, and the banks are overloaded with cash. Quotations May 3 were call 1¾ @ 2 per cent, and 90-day paper 2½ @ 2¾ per cent. The quotations in the table are those of the close May 3.

NEW YORK.

	Apr. 26.	May 3.	Shares Sold.		Apr. 26.	May 3.	Shares Sold.
All.-Ch.	15½	16⅛	3,065	Int.-Met., pfd.	44¾	47	62,400
All.-Ch., pfd.	49⅛	50½	7,300	Mackay Cos.	78½*	78¾	1,150
Amal. Cop.	76⅜	77⅜	97,405	Mackay Cos., pfd.	73½*	73¼	2,000
Am. D. T.	29*	29*	——	Manhattan Elev.	144¾*	143½*	11,295
Am. Loc.	54½	56	10,020	Met. St. Ry.	26	27½	200
Am. Loc., pfd.	114	115	820	N.Y. & N.J. Tel.	124*	125*	100
Am. Tel. & Cbl.	76*	76*	——	Steel, com.	53	56⅛	435,942
Am. T. & T.	139¾	141	42,016	Steel, pfd.	114¾	116¾	12,050
B. R. T.	77½	78⅜	95,450	W. U. T.	68½	75¼	26,450
Gen. Elec.	158¼	160	3,600	West'h., com.	81½*	83¼	9,450
Int.-Met., com.	15⅜	17⅛	43,591	West'h., pfd.	119*	120*	600

PHILADELPHIA.

	Apr. 26.	May 3.	Shares Sold.		Apr. 26.	May 3.	Shares Sold.
Am. Rys.	45½	46	——	Phila. Elec.	12	12	—
Elec. Co. of A.	12¾*	12¾	—	Phila. R. T.	35⅛	35½	——
Elec. Stor. B'ty	45¼*	45½	— —	Phila. Traction.	93*	94	— —
E. S. B'ty, pfd.	49*	49*	— —	Union Traction.	57¼	58⅛	——

CHICAGO.

	Apr. 26.	May 3.	Shares Sold.		Apr. 26.	May 3.	Shares Sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	133*	132½	——
Chi. Rys., Ser. 1	110*	109½*	—	Met. El., com.	19	19*	— —
Chi. Rys., Ser. 2	39	38½*	—	Nat'nal Carbon.	84	85	— —
Com. Edison.	114	114½	—	Nat. Carb., pfd.	120*	120*	——
Chi. Subways	25½	25½*	—				

BOSTON.

	Apr. 26.	May 3.	Shares Sold.		Apr. 26.	May 3	Shares Sold
Am. Tel. & Tel.	139	141	——	Mex. Tel.	2¾*	3	——
Cum. Tel.	131	131*	—	Mex. Tel., pfd.	6*	5⅞*	— —
Edison El. Ill.	258	253*	—	N. E. Tel.	132	132½	——
Gen. Elec.	158	158	—	W. Tel. & Tel.	9	11¾	—
Mass. Elec. Ry.	14¼*	14½	—	W. T. & T., pfd.	83	85	—
Mass. E. R., pfd.	72	72	—				

*Last price quoted.
Shares sold are for week April 26 to May 1.

DIVIDENDS.

Consolidated Gas Company, New York, quarterly, 1 per cent, payable May 18.

Electric Properties Company, New York, preferred, quarterly, 1½ per cent, payable May 19.

Otis Company, semi-annual, 5 per cent, payable May 1.

Tampa (Fla.) Electric Company, semi-annual, 3½ per cent, payable May 15.

NEW YORK & ONTARIO POWER COMPANY'S BOND AND STOCK AUTHORIZATION.—The New York Public Service Commission of the Second District has just issued the full text of its decision of Jan. 4, 1909, authorizing the New York & Ontario Power Company to issue $600,000 in stock and $1,850,000 in bonds in order to take over all rights and property connected with a proposed 10,000 hp hydro-electric development at Waddington, on the St. Lawrence River. It is stipulated that the stock shall be sold for cash only at full par value and that the bonds shall not be sold for less than 81 per cent of their par value—the applicants having stated they have succeeded in interesting capital on these terms. Only 17,400 hp will be developed initially, the estimated cost for this capacity being $2,100,000 and for the estimated gross annual charges $180,000. Evidence submitted tended to show that there is a reasonably assured market within the immediate vicinity of Waddington for the full output of the proposed plant.

BOSTON EDISON PURCHASES APPROVED.—A special meeting of the stockholders of the Edison Electric Illuminating Company, of Boston, was held April 30, for the purpose of approving the purchase of the location and property of several smaller companies. The stockholders voted to purchase the Chelsea Gas Light Company for $350,000; the Boston Consolidated Gas Company at $1,300,000; the Newton & Watertown Gas Light Company for $500,000; the Waltham Gas Light Company for $600,000, and the Lexington Gas & Electric Company for about $120,000. This requires a total of $2,870,000. and it is the intention of the directors to finance the deal temporarily, and in a year or so to increase the capital stock to take up the obligations which will be issued at this time. Another meeting will be held May 6 to hear reports from the smaller companies and from the Massachusetts Gas Commission.

TELEPHONE SECURITIES PRAISED AS AN INVESTMENT.—Edward B. Smith & Company, New York, and Thomas A. Biddle & Company, Philadelphia, have published a pamphlet giving the results of their study of the plants of the American Telephone & Telegraph Company from the standpoint of an investment proposition. The pamphlet sets forth the many advantages possessed by the securities of this company, specifying that they are yielding an excellent return, with prospect of advancement; that the status of the business in the world is fixed; that the securities represent dollar for dollar in expenditure; that the business represents one that is universal in use, and that it suffered less than almost any other business during the time of depression, and that it has always a ready market value either for sale or as collateral.

HUDSON RIVER WATER POWER COMPANY.—The receivers of the Hudson River Water Power Company have deposited with the Trust Company of America $125,000 with which to pay the semi-annual interest due last November on the company's $1,938,000, 5 per cent gold bonds. It is said that under the receivers the earnings have so improved that it is not only able to pay the November interest, but it is expected that in a short time the May 1 interest will be forthcoming. This is one of the seven subsidiary and allied companies of the Hudson River Electric Power Company, for which receivers were appointed last fall, after the failure of E. H. Gay & Company.

CINCINNATI TRACTION TERMINALS.—Cincinnati traction interests have recently formulated plans to control the traction terminal facilities in that city. These plans have been submitted to the various civic bodies asking for their support, and it is not believed that there will be any difficulty in securing the franchises desired. It is claimed that if the plan is worked out, it will mean much to the business interests of the city and the great interurban traffic which is now considerably scattered will be concentrated at a convenient point.

NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY.—The annual report of the New England Telephone & Telegraph Company shows that 16,737 stations were added during the past year, making a total of 241,508 in service December 31, when the report was made. Including sub-license stations the total number of stations was 304,986. The balance sheet of the company showed that the appraisal value of the entire property was $46,540,819, and that the total par value of the securities held is $38,939,850.

CALIFORNIA GAS & ELECTRIC BONDS.—J. P. Morgan & Company, the First National Bank and the National City Bank of New York have recently purchased $5,000,000 of unifying and refunding 4 per cent bonds of the California Gas & Electric Corporation. Lee, Higginson & Company, of Boston, are also associated with the purchase, and it is probable that the securities will shortly be offered to the public.

HUDSON RIVER TELEPHONE COMPANY SOLD.—The stockholders of the Hudson River Telephone Company have approved a plan for the sale of their property to the Central New York Telephone Company. The present Hudson River stockholders will receive $60 per share for their shares.

COMPETITION IN NEW YORK TELEPHONE SERVICE.—The Public Service Telephone Company, which has recently been incorporated at Albany, and which is backed by the Longacre Electric Light & Power Company, of New York City, it is stated will soon enter the telephone business in New York in competition with the New York Telephone Company. The organization of the new concern has been perfected by the election of John M. Shaw as president, and John A. L. Campbell as secretary. The board of directors includes George S. Graham, Clarence Simpson, R. Conklin, A. J. Wheeler, Jr., and Russell Robbins. The capital stock of the company is $10,000,000, one-half common and one-half preferred, and there is an authorized issue of $25,000,000 of bonds. Mr. Shaw, president of the company, makes the following statement as to its purpose: "The organization proposes to do a general telephone business in the city of New York, and it has taken a lease from the Longacre Electric Light & Power Company for a term of 999 years of a franchise which that company has, to do a telephone business. This franchise has been fought out through the courts, and finally settled in favor of the Longacre company. The franchise rights that we have leased are sufficient to enable our company to do business without any additional power conferred upon it by the city, and our company is willing to enter into any agreement with the city which is reasonable about the division of the receipts which should be paid to the municipality." It does not seem that this company is in any way connected with the Great Eastern Telephone Company, which recently increased its capital stock from $1,000,000 to $50,000,000, and which promises to enter the field in New York State. D. A. Reynolds, president of this latter company, says that his concern has ample franchises and capital to serve the entire city of New York, and that it will be connected with the affiliated Independent telephone lines throughout this State and the West. He is not, however, ready as yet to make any definite statement as to the plans of the company.

PREPARING TO FINANCE THE STANISLAUS DEAL.—Ernst Thalmann, president of the United Railways Investment Company, has sent a letter to the stockholders pointing out to them the important matters that will be taken up at the annual meeting to be held May 17. Chief of these is, of course, preparing the way for the purchase of the Stanislaus Electric Power Company's properties. The stockholders will be asked to authorize an increase in the capital stock of the Investment company of $10,000,000 of preferred stock, and to sanction the sale of $10,000,000 of the common stock of the United Railroads of San Francisco, which is now held in the treasury. This latter stock will be transferred eventually to the corporation to be organized, and controlled through ownership, for the purpose of taking over the Stanislaus property. The issue of $1,000,000 of the preferred stock and $1,000,000 of the new common is all that is contemplated at the present time, the balance to be held in the treasury for use when the deal is completed. In speaking of the necessity for taking over the Stanislaus plants, President Thalmann says that for some time past the operations of the United Railroads company have been hampered by lack of adequate electric power under its own control, and he believes that the control of the Stanislaus company, which includes the control of the Tuolumne Water Power Company, will furnish all the energy that the railways require.

AMERICAN LIGHT & TRACTION COMPANY.—The gains being made in the earnings of the operating companies that are controlled by the American Light & Traction Company show that the profits for the current year will run far ahead of the dividend requirements, even in the face of the recent increase in the rate. The statement for the first quarter of 1909 shows that there is an increase of $175,000 in the total earnings paid in by the 12 subsidiary companies over the amount paid in in 1908. At this rate, estimating the three succeeding quarters to be the same, the parent company would earn in 1909 a total of $3,300,000, or something like 32 per cent on the old common stock, after paying 6 per cent on the preferred. There will be put out on Nov. 1 a stock dividend amounting to $752,000, and this new stock will receive its first dividend in the subsequent February.

INTERNATIONAL SMELTING & REFINING COMPANY.—Although the original $10,000,000 of capital stock of the International Smelting & Refining Company has barely been paid in, the company has already accumulated a surplus of $300,000 from the operations of the Raritan Refining Works and the cash on hand amounts to $3,000,000. A portion of this surplus will be used to complete the new smelter in Utah, but it is estimated that there will be sufficient funds left to pay a dividend in June of 6 or 7 per cent on the capital stock. As soon as John D. Ryan returns from the West, which will be early in May, some announcement is expected concerning the company's plans for constructing new smelting and refining plants throughout the country.

LACLEDE GAS LIGHT COMPANY SOLD.—The negotiations which have been pending for some time, and by which the North American Company will sell to the American Light & Traction Company the Laclede Gas Light Company of St. Louis, have been practically completed, only the formal ratification by the stockholders of the companies remaining. The American Light & Traction Company will pay 93½ for the common stock of the Laclede company, but will buy none of the $2,500,000 preferred, which is owned by outside parties. The North American Company will receive between $7,000,000 and $8,000,000, and payment will be made partly in cash, partly in notes and partly in preferred and common shares of the American Light & Traction Company.

WALTHAM GAS COMPANY LIQUIDATED.—At a special meeting last week of the stockholders of the Waltham (Mass.) Gas Company it was decided to sell the electric business of the company to the Edison Electric Illuminating Company of Boston, for $600,000 and the gas business to the Newton & Watertown Gas & Electric Company for $500,000. As practically all of the capital stock of the Waltham company is owned by the Boston Suburban Electric Companies, it is this company that will profit by the transaction. Of the $1,100,000 received, $350,000 will be used to cancel notes outstanding, and the balance will be turned over to the Suburban company to take up the $324,700 capital stock that has been issued.

DEVELOPMENT AT HICKORY, N. C.—The construction of the proposed Hickory, N. C., railway will not be ready for consideration until the Water-Power Electric Company, of Hickory, has been financed for construction and is quite ready for operation. This proposition is now in shape and ready for intelligent presentation. Any one interested in that line can address the president, Colonel M. E. Thornton, at Hickory, N. C. The stock issue is $500,000, of which $240,000 is in the treasury, and the bonds will be $650,000, bearing 6 per cent interest, payable semi-annually. It is hoped to make a deal at once for the bonds, or a loan on a majority of the stock at 6 per cent for 12 months.

HAVANA TELEPHONE SYSTEM.—President Gomez, of the Cuban Republic, has issued a decree accepting the renunciation of its franchise by the Havana Telephone Company, and receiving, according to the terms of the contract, all the properties of the company which at the expiration of the contract revert to the State. The company is given a lease on the property for 18 years, under which it will pay a yearly rental of $24,375 for the first two years, and $150,000 yearly for the remainder of the period. The company expects to establish a thorough underground system which it is estimated will cost about $1,500,000.

CHICAGO-MILWAUKEE ELECTRIC COMPANY.—There are still several parties negotiating for the purchase of the Chicago-Milwaukee Electric Company. Representatives of a Toronto syndicate are in Chicago looking over the property, and may make an offer. George Mindeman, a Kansas City capitalist, is also on the ground and is negotiating for the purchase. Mr. Mindeman says that if the interests he represents secure the road it will be extended into other parts of Illinois and also in Wisconsin.

CUMBERLAND TELEPHONE & TELEGRAPH COMPANY.—The March statement of the Cumberland Telephone & Telegraph Company shows that it is sharing in the general prosperity which seems to be the rule with all licensees of the Bell system. The net receipts for the month were $185,045, which is at the rate of 11.28 per cent a year on the capital stock. Expenses are now averaging but 64 per cent of the gross receipts.

TRI-CITY RAILWAY & LIGHT COMPANY.—The report of the Tri-City Railway & Light Company, of Davenport, Iowa, for the quarter which ended March 31, shows gross earnings of $489,836 and net earnings of $206,886, which is a considerable gain over the same period last year. The surplus after paying dividends on the preferred stock was $38,904.

NORTH CAROLINA PUBLIC SERVICE COMPANY.—A new company recently organized under the laws of North Carolina, called the North Carolina Public Service Company, of Greensboro, will take over all the property and rights of the Greensboro Electric Company. This property includes the gas plant and distributing system, the electric light and power station and the transmission lines and the electric street railway covering the principal streets and operating 11½ miles of track. The new company has made a contract with the Southern Power Company for energy and the cost of fuel is so high it is not economical to operate the steam plant now in Greensboro. The capitalization of the North Carolina Public Service Company is $3,500,000 capital stock authorized and $3,500,000 5 per cent bonds. It is proposed to improve and extend the properties at once and to equip an interurban line to High Point. L. H. Hale is president, and Bird S. Coler, of New York, vice-president. The fiscal agents of the company are W. N. Coler & Company, 43 Cedar Street, New York.

RAILWAY SECURITIES SOLD AT AUCTION.—At the last weekly sale of securities at auction in New York, several large blocks of those issued by the Virginia Passenger & Power Company were disposed of. This is the company in which Frank J. Gould held a large interest and which has been in the hands of a receiver for the past five years. The sale included $648,000 of the consolidated 5 per cent bonds, class A, at 60; $475,000 of the same bonds, class C, at 90 and interest; 2,567 shares of the preferred stock, at $300 for the lot, and 856 shares of the common stock, at $100 for the lot. There were also sold $50,000 of the first mortgage bonds of the South Side Railway & Development Company, a subsidiary, at 90 and interest, and 6000 shares of the stock of the Richmond & Petersburg Electric Railway Company, another of the subsidiary concerns, at 25, and $500,000 of the latter's first mortgage 5 per cent bonds at 100 and interest.

BLACKSTONE VALLEY CONSOLIDATION DEFEATED.—The legislature of Rhode Island, on April 30, voted to indefinitely postpone the bill providing for the incorporation of the Blackstone Valley Gas & Electric Company. This was a bill through which Stone & Webster, owners of a majority of the stock in the Pawtucket Gas Company, Pawtucket Electric Company, Woonsocket Gas Company and Woonsocket Electric Machine & Power Company, sought to consolidate the holdings in one concern. The new company was also to have the right to purchase the Providence Gas Company and the Narragansett Electric Lighting Company. The Blackstone Valley Gas & Electric Company is already incorporated under the laws of Maine, but its subsidiary companies are doing business separately.

WASHINGTON WATER POWER COMPANY EARNINGS.—The gross earnings of the Washington Water Power Company for 1908 show an increase of $343,124 over the previous year, and are almost exactly double those of 1905. There has been an increase of 25 per cent in the number of incandescent lamps used, and everything else in the line of lighting has increased proportionately. The number of passengers carried on the traction system during the year was 10,520,942, an increase of about $2,300,000. Much of the success of this company is attributed to the blanket charter under which it operates. This confers the right to own and operate mills, canals, electric light and power plants, street railways, parks, dance halls, baths and almost anything else for which energy could be used.

ORGANIZATION OF A GREAT COPPER TRUST.—Financial circles during the past week have been regaled with many rumors to the effect that a great copper trust, representing all of the most prominent producing and consuming interests of the country, was in the process of formation. There does not seem to be any definite authority for such a story, further than the fact that there was recently a dinner at which representatives of these interests were present, and it was stated that some of the speakers referred to the advisability of an agreement that would regulate prices. It was suggested that an organization such as the Steel Corporation might be formed in the copper industry. In view of the widely diverging interests of the copper producers such an organization would be very difficult.

METROPOLITAN STREET RAILWAY SALE.—There will apparently be no litigation to interfere with the sale of the property of the Metropolitan Street Railway, as ordered on June 1. The property will be offered as an entirety at the court house door on that day, and the instructions of the court are that no bidder shall be recognized until he has deposited $100,000, in cash or a certified check, with the commissioner. It is now presumed that the Interborough Company has made arrangements to protect its interests in the property. No report has as yet been made by the reorganization committee or by Stone & Webster, who were employed to draft plans for the reorganization.

CHANGES IN U. S. TELEPHONE COMPANY'S BOARD.—Frank A. Davis, president of the Columbus Citizens' Telephone Company, and D. J. Cable, of Lima, Ohio, have been elected members of the board of directors of the United States Telephone Company, of Cleveland, H. B. Taylor and W. L. Carey having resigned to make room for them. The smaller companies of the State and the Ohio Independent Telephone Association will both have representation on the board through this action. A closer connection of this kind was desired both by the officers of the company and the members of the State organization, and it is believed that it will result in benefit to both.

ELECTRIC MERGER IN TOKIO.—News has just been received from Tokio, Japan, of the merger of the American General Electric Company, Shibaura Engineering Works and the Tokio Electric Company. The American General Electric is a large shareholder in the Tokio Electric Company, and the three concerns are principally in the business of manufacturing incandescent lamps.

MEXICAN TELEGRAPH COMPANY DIVIDEND.—The directors of the Mexican Telegraph Company have decided to issue 7,500 shares of new capital stock on June 1, to be distributed as a 25 per cent stock dividend to shareholders of record May 15. This new stock will participate in the regular July cash dividend.

REPORTS OF EARNINGS

	Gross earnings	Expenses	Net earnings	Charges.	Surplus.
Aurora, Elgin & Chicago Railroad Company					
March, 1909	$89,013	$60,349	$42,662	$28,764	$12,853
March, 1908	92,773	56,652	19,121		
Dallas (Tex.) Electric Corporation					
February, 1909	94,588		36,636		
February, 1908	81,68		26,336		
Detroit United Railway Company					
March, 1909	589,287		228,545		
March, 1908	529,256		190,042		
Electric Light & Power Company of Montreal, Ltd.					
February, 1909					
February, 1908					
General Electric Company					
Year ended Jan. 31, 1909	11,768,169		4,360,252		
Year ended Jan. 31, 1908	72,484,988		6,586,653		
Lake Shore Electric Railway System					
March, 1909	76,679				
March, 1908			26,146		
Manufacturers' Light & Heat Company of Pittsburg					
March, 1909			1,088,009	245,287	
March, 1908			910,461		
Metropolitan Electric Company					
Quarter ending March 31, 1909					
Quarter ending March 31, 1908				164,316	
Twin City Rapid Transit Company, Minneapolis					
March, 1909	541,936		262,629		
March, 1908					
United Gas Improvement Company, Philadelphia					
Year 1908				3,670,788	
Year 1907				3,663,136	

*Deficit.

GENERAL NEWS

Construction News.

BIRMINGHAM, ALA.—The Birmingham Railway, Light & Power Company has been granted a franchise to extend its North Highlands line a distance of about one and one-half miles.

PARKER, ARIZ.—Two franchises have been granted by the Board of Supervisors. One to T. M. Drennan, J. L. Curtis, Fred T. Bragonier, C. F. Shade and Le Roy Anderson for an electric power plant for a term of 25 years. The franchise calls for rights in Yuma County, especially in the town site of Parker. A telephone franchise was given to Henry Mitchell, the line to begin at the boundary of Maricopa County adjacent to the right-of-way of the Arizona & California Railroad, thence to Parker; also from Salome to Harqueholo.

LITTLE ROCK, ARK.—The contract for the construction of the power plant in connection with the union depot has been awarded to the Westinghouse, Church, Kerr & Company, New York, N. Y. The cost of the plant is estimated at $60,000 and is to be completed by Aug. 1. W. E. Strolbrand is engineer in charge of the work.

EUREKA, CAL.—It is reported that the Snow Mountain Power Company has placed a contract with the Allis-Chalmers Company, of Milwaukee, Wis., for a 4000-hp turbine to be direct connected to a three-phase, 60-cycle, 2300-volt alternating current generator and a 150-hp exciter set to be installed in its plant in this city.

MODESTO, CAL.—The Modesto Interurban Railway Company has awarded contracts for the grading of its proposed railway. The motive power has not yet been decided upon. T. K. Beard, of Modesto, is president, and W. A. Cooper, 1370 Franklin Street, Oakland, Cal., chief engineer.

MONTEREY, CAL.—Arrangements are being made by the Monterey County Gas & Electric Company for extensions and improvements to its system, which will include the installation of two new boilers and the construction of a transmission line to the Salinas; also to install a gas plant. The cost of the entire work is estimated at about $70,000.

NAPA, CAL.—Preliminary arrangements are being made by the San Francisco, Vallejo & Napa Railroad Company for extending its railway to Calistoga.

NEEDLES, CAL.—The Board of Supervisors has awarded B. L. Vaughn a franchise for the desert telephone line, for which he paid $50.

OAKLAND, CAL.—The Council is reported to be considering the question of appropriating $[illegible] for the erection of a power house at Magnolia and Twenty-fourth streets.

OAKLAND, CAL.—The Great Western Electric Power Company has awarded the contract for the construction of its substation on Matthew Street in Oakland to the Thompson Starrett Construction Company, of San Francisco, for $45,000.

ONTARIO, CAL.—Rights of way are being secured by the Ontario & San Antonio Heights Railway Company for its proposed electric railway between Uplands and Claremont, a distance of about six miles. The cost of the railway is estimated at from $150,000 to $175,000.

PASADENA, CAL.—Arrangements are being made to replace the present power house at Mt. Wilson with a concrete structure. Improvements will also be made in the equipment of the plant.

SACRAMENTO, CAL.—The City Trustees have granted the Central California Traction Company, of San Francisco, a franchise which provides that the Northern Electric Railway, the Vallejo & Northern Railway and two more railways shall be permitted to use the tracks the company proposes to lay on X and Eighth streets.

SAN BERNARDINO, CAL.—The directors of the Lytle Creek Power Company have decided to increase the output of the plant and make extensive extensions to the service in the residence section of this city. A bond issue to the amount of $300,000 will be voted to cover the cost of the work.

SAN FRANCISCO, CAL.—Plans are being prepared by Joseph David Atkins, of the Department of Public Buildings, Treasury Department, Washington, D. C., for the installation of a new auxiliary power plant in the San Francisco mint. The cost of the machinery is estimated at $40,000.

SAN JOSE, CAL.—The contract for the installation of power plant at the State Normal School at San Jose has been awarded to Rickon-Ehrhart Company, 1859 Geary Street, San Francisco, Cal., for $25,676.

SANTA ANA, CAL.—Negotiations have been completed for the construction of an electric railway between Santa Ana and Huntington Beach. The railway will be built by the Pacific Electric Railway Company, of Los Angeles.

SONORA, CAL.—Arrangements are being made to install new machinery in the Empire Mill. The electric plant will be removed to Cold Spring and an entirely new plant installed in the Empire Mill. G. W. Birmingham has charge of the work.

BOULDER, COL.—At the recent election the citizens voted in favor of the proposition to issue $[illegible] bonds for the construction of an electric light plant.

BLOOMFIELD, CONN.—At a special town meeting held recently the citizens voted to authorize the Selectmen to enter into a contract with the Hartford Electric Light Company for a term of five years at a cost not to exceed $600 per year. The company submitted a proposition offering to furnish 50 lamps of 60 cp at $18 per lamp per year.

GROTON, CONN.—The contract for furnishing electricity for lighting the new barracks at the navy yard has been awarded to the Groton municipal electric light plant. The transmission line will be extended from the Odd Fellows' Home at Fairview to the navy yard at an approximate cost of $1,000. The contract calls for about 200 lamps of 16 cp. It is expected that many of the private residences along the route will install electric lamps.

HARTFORD, CONN.—The Senate has passed the bill authorizing the Union Light & Power Company to do business in Avon, Canton and Burlington.

HAVANA, CUBA.—The Havana Telephone Company, whose contract with the Government expires next year, has surrendered its rights under this contract and has obtained a lease from the Government for 18 years, the company to pay $24,375 yearly for the first two years and $150,000 for the remainder of the contract. Messrs. Jarvis & Conklin are at the head of the company.

WILMINGTON, DEL.—The Wilmington Light & Telephone Company has been awarded the contract by the Board of Education to furnish electricity for lamps and motors for the various school buildings throughout the city.

WASHINGTON, D. C.—Work has commenced on the construction of the proposed electric railway of the Washington, Spa Springs & Gretta Railroad Company. The railway will extend from Washington to Bladensburg, Riverdale and Berwyn Heights, a distance of 10½ miles. S. S. Yoder, of Washington, D. C., is president, and C. D. Eldridge, electrical engineer.

QUINCY, FLA.—The citizens on April 27 voted to issue $9,000 in bonds for the construction of an electric light plant. Bids for construction of the plant will be received soon. George H. Palmer, of Quincy, is engineer.

TAMPA, FLA.—The Tampa Sulphur Springs Traction Company expects to place contracts within two weeks for the construction of three miles of track.

ATLANTA, GA.—The Georgia Railway & Electric Company has filed a mortgage of $20,000,000 in Fulton County in favor of the American Trust Company, of Boston, Mass., covering an issue of refunding bonds and providing funds for large improvements shortly. The State Railroad Commission has authorized the company to issue $1,200,000 in improvement bonds. The remainder will be used for improvements from time to time as the need may arise.

DOUGLASVILLE, GA.—The issue of $10,000 in bonds for a municipal electric lighting plant has been declared valid and has been approved in the circuit courts of Georgia. The plant will be completed as soon as possible.

ELLIJAY, GA.—The City Council is considering the question of issuing bonds for the construction of an electric light plant and water-works system, which will be submitted to the vote of the people.

FITZGERALD, GA.—Arrangements are being made by the Fitzgerald & Ocilla Electric Railway & Power Company for the construction of a power plant on Lake Beatrice to furnish electricity for lamps and for operating a 12-mile railway. C. A. Holtzendorf is general manager.

WAYCROSS, GA.—The Railroad Commission has adopted the report of Roland B. Hall, Jr., electrical engineer, sent by the commission to make investigations in regard to the differences which have arisen between the people and the Waycross Electric Light & Power Company, which will require the company to make improvements to its plant and service suggested in the report of Mr. Hall. The commission has declined to order any reduction in the rates charged by the company, as the report showed that the cost to the company for production of electricity at the switchboard was 6.75 cents per kw-hour, and that the average price received, after considering the loss in transmisssion, is about 7.04 cents. The present price of electricity to small consumers is 15 cents per kw-hour, running down to 7½ cents per kw-hour for electricity for motors.

HONOLULU, HAWAII.—It is reported that the Automatic Telephone Company has purchased the controlling interest of the Bell Telephone Company in Honolulu.

KELLOGG, IDAHO.—The Washington Water Power Company, of Spokane, Wash., has been granted a franchise to erect a transmission line through Kellogg.

VOLLMER, IDAHO.—It is reported that the Trustees have taken over the local electric light plant, and will expend about $4,000 for improvements.

CHICAGO, ILL.—Bids will be received by the city of Chicago until May 27 for furnishing general and detail drawings, tools, labor and materials to erect complete, ready for operation, in the Roseland pumping station, to be located at 104th Street and Stewart Avenue, two vertical,

triple expansion, condensing, self-contained, crank and flywheel pumping engines, each engine to have a rating of 25,000,000 U. S. gal. of water per 24 hours, and including a 25-ton electric crane, according to plans and specifications on file in the office of the Department of Public Works, Room 810, City Hall, Chicago. Proposals must be made out on blanks furnished by the above office. John J. Hanberg is Commissioner of Public Works.

CHICAGO, ILL.—Bids will be received until May 12 by I. J. Bryan, clerk of the Sanitary District of Chicago, at Room 1500, American Trust Building, Chicago, Ill., for furnishing and installing a direct-current, compound-wound generator, turbine water wheel unit, switchboard and wiring to electrical apparatus. Proposals may be made upon any or all of the following divisions: Divison A—Direct-current generator and rheostat; Division B—Switchboard panel and electrical wiring; Division C—Turbine water wheel unit. All proposals must be made upon blank forms furnished by the Sanitary District and in accordance with the plans, specifications and contract form on file in the office of the electrical engineer of the Sanitary District of Chicago at the above named office, and which can be obtained upon application therefor.

COLUMBIA, ILL.—The East St. Louis, Columbia & Waterloo Railway Company is making arrangements to commence work on the construction of its proposed electric railway, which will connect East St. Louis, Waterloo and intervening towns, 23 miles in length. The company proposes to furnish electricity for lamps. H. Reichenbach, of Columbia, is secretary and treasurer.

EAST ST. LOUIS, ILL.—The Citizens' Electric Light & Power Company is reported to have submitted a proposition to the merchants of East St. Louis offering to furnish electricity for the system of arches spanning the business streets, which has been in operation since May, 1908, free of cost, provided the merchants will make two-year contracts for their places of business, instead of the customary one-year contracts.

MURPHYSBORO, ILL.—The Murphysboro Street Railway Company has awarded the contract for furnishing poles, wires, cars, etc., for its proposed street car line to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.

ELKHART, IND.—The Lake Shore Railroad Company has made an appropriation for the immediate installation of telephones along its line between this city and Toledo, Ohio, for the purpose of dispatching trains by telephone.

INDIANAPOLIS, IND.—The Merchants' Heat & Light Company has procured a site in West Washington Street on the canal upon which to erect and equip a new plant to cost $300,000. It is the purpose of the company to extend its service northward.

NOBLESVILLE, IND.—The White River Light & Power Company, which is constructing a dam across White River, near this city, has disposed of $150,000 of bonds, which means the early completion of the plant. Work has been resumed and 30 days will be required to complete the dam. The generating plant is also nearly completed. The company will furnish electricity for lamps and motors and has several good contracts, including one interurban road.

SOUTH BEND, IND.—The South Bend Home Telephone Company has decided to make extensive improvements to its service in St. Joseph, which will involve an expenditure of about $30,000.

WARSAW, IND.—The City Council has granted the Wabash & Northern Traction Company a franchise to construct and operate an electric railway in Warsaw.

BLOOMFIELD, IA.—The Iowa Telephone (Bell) Company has purchased the local telephone plant for $75,000.

COUNCIL BLUFFS, IA.—Plans are being made by the Independent Telephone Company for improvements to the Mills County system, which will involve an expenditure of from $25,000 to $30,000.

HARTLEY, IA.—The municipal electric light plant has been completed and accepted by the Council. The machinery was installed by the Minneapolis Steel & Machinery Company.

MT. VERNON, IA.—We are informed that the Mt. Vernon Electric Light Company proposes to establish a 24-hour service soon.

BELLEVILLE, KAN.—The Belleville Independent Telephone Company is making improvements to its local plant and is preparing to build copper lines to Mahaska and to the Jewell County line. The cost of the work is estimated at $15,000.

CLAY CENTER, KAN.—Judge Pollock, of the Federal Court, has granted a temporary injunction forbidding the officers of the city of Clay Center from cutting down the poles or interfering with the operation of the electric light plant of the Clay Center Light & Power Company. The city, which owns and operates a municipal lighting plant, has refused to renew the franchise of the Clay Center Light & Power Company, which has been operating the old plant, and attempted to cut down the poles and remove the wires from the streets. The injunction was granted on the application of the Merrimac River Savings Bank of New Hampshire.

COFFEYVILLE, KAN.—The Stevens Electric Company, of the place, has been purchased by Collier & Clark Consolidated Company. The company will be operated under the same name at 114 West Eighth Street, Coffeyville. A. W. Collier is manager.

WINNSBORO, LA.—The Winnsboro Telephone Company is making arrangements to extend its telephone line from Winnsboro to Rayville.

BANGOR, MAINE.—A preliminary survey has been ordered by the Bangor Railway & Electric Company for the proposed extension to the Charleston division of its lines running from Bangor, which will eventually reach Waterville, 52 miles distant. John R. Graham is president.

RUMFORD, MAINE.—Bids will be received until May 8 by the Rumford Falls Power Company for completing the excavations, foundations, stone and concrete masonry, brick station, etc., of the hydro-electric development project started last year. Plans and specifications are on file in the engineer's office, Rumford.

BEVERLY, MASS.—The Selectmen of Topsfield have petitioned the Legislature to pass a bill granting the Beverly Gas & Electric Company permission to do business in Topsfield.

BOSTON, MASS.—The installation of a new electric lighting plant at East Boston is included among the improvements to be made by the Boston & Albany Railroad Company this year.

CLINTON, MASS.—The Connecticut River Transmission Company has applied to the Legislature for permission to erect its high-tension transmission lines over the State reservation of the Wachusset reservoir. The company proposes to extend its transmission line from Clinton to Worcester.

NEW BEDFORD, MASS.—The City Council has awarded the contract for the electrical work on the municipal office building to the Eastern Electrical Company, New Bedford, Mass., for $19,600.

NEW BEDFORD, MASS.—Contracts have been awarded by the New Bedford Cotton Company for the construction of its buildings to the B. F. Smith Company, of Pawtucket, R. I. The plans call for a power plant with an output of 1200 hp, contracts for which will be called for about June 1. Lockwood, Greene & Company, 93 Federal Street, Boston, Mass., are architects and engineers.

ORANGE, MASS.—The Orange Electric Light Company has applied to the State Gas and Electric Light Commissioners for authority to issue $155,000 additional capital stock, the proceeds to be used to pay outstanding indebtedness.

PLYMOUTH, MASS.—The plant of the Plymouth Electric Light Company was damaged by fire April 26, causing a loss of about $50,000. The generators, including a new 400-hp machine, were practically destroyed. The company has made arrangements to secure electricity from the plant of the Brockton & Plymouth Street Railway Company to operate its system. The company also furnishes electrical service in Duxbury and Kingston.

SPRINGFIELD, MASS.—The United Electric Light Company has purchased a site in Brightwood, where it proposes to erect a new substation to furnish electricity for motors. It is said that the company has already placed contracts for 300 hp among the manufacturers.

SPRINGFIELD, MASS.—Plans are being made for extensive improvements by the Springfield Street Railway Company to the local system and on the Westfield Railway, which will involve an expenditure of about $80,000. The work will include the laying of new tracks, wires and electrical equipment. New motors and electrical equipment will be purchased for the cars at a cost of about $25,000. About $40,000 will be expended on the Westfield line.

TOPSFIELD, MASS.—A petition is being circulated to be presented to the Legislature asking for permission to light the town by electricity, to be furnished by a company outside of the town.

BIG RAPIDS, MICH.—The Board of Supervisors of Mecosta County has declared the franchise of the Grand Rapids-Muskegon Power Company forfeited, and has instructed Attorney Barton to institute proceedings necessary to enforce the decision. This includes the Rogers dam, already constructed, as well as other dams contemplated in the franchise which expired by self limitation April 1. The franchise called for several dams, but only one was built.

DETROIT, MICH.—Bids will be received by the Police Commissioner of the city of Detroit, Mich., until May 10 for furnishing 20,000 ft., more or less, of underground cable for the police signal service, as per specifications, which can be secured on application to George A. Walters, secretary.

GLADSTONE, MICH.—The Board of Fire and Water Commissioners is planning to extend and improve the service of the municipal electric light plant and will install a 200-kw, three-phase, 2300-volt, 60-cycle generator and switchboard; construction of substation; 200-kw, 6600-volt to 2300-volt transformers; the construction of two miles of transmission line, and the reconstruction of present lines, changing arc lamps, meters and make other improvements, for which bids have already been received. J. D. Roberts is superintendent.

NILES, MICH.—The Indiana & Michigan Electric Company, which was recently granted a franchise to furnish electricity in Niles for manufacturing purposes, is erecting a substation in this city and will soon be ready to furnish electrical service. Power will be secured from the company's plants on the St. Joseph River at Buchanan and Berrien Springs.

HIBBING, MINN.—Plans are being made for the construction of a new power plant near Hibbing for the A. P. Stevens Iron Company. The plant is to be erected by the Power Equipment Company, of Minneapolis, and the equipment will include a producer gas engine, electric generator, pump, etc.

LUVERNE, MINN.—The Luverne Brick & Tile Company has installed a 150-kw electric generating unit in its plant.

VIRGINIA, MINN.—The Commodor Iron Mining Company, it is said, is planning to install a direct-current electric generating unit to be used for lamps and motors.

WHITE EARTH, MINN.—Plans are being made by the White Earth Telephone Company to extend its telephone lines to Wauburn, Ogema and Beaulieu.

MATHISTON, MISS.—W. J. Buckingham is reported to be interested in a project to install an electric light plant.

BRAYMER, MO.—The Central Telephone Company is preparing to erect a telephone line 19½ miles in length. W. H. North, R. D. No. 6, Northborne, Mo., is secretary of the company.

ANACONDA, MONT.—The Washoe Copper Company has purchased the plant and holdings of the Montana Electric Power & Mining Company, including all its water rights, power plants on Flint Creek and other property.

BOZEMAN, MONT.—The Gallatin Valley Electric Railway Company has awarded the contract for the construction of its proposed electric interurban railway between Bozeman and Salesville, 18 miles in length, to Westinghouse, Church, Kerr & Company, New York, N. Y. The company, it is said, will take over the Bozeman street railway system and will operate it in connection with the proposed interurban railway. The company is also contemplating the purchase of equipment for two substations. Charles B. Anderson is secretary of the company.

AUBURN, NEB.—The Auburn Electric Light & Power Company is planning to replace its wooden poles now in use with cement poles. Other improvements are also contemplated.

HOOPER, NEB.—The citizens are considering the question of installing a municipal electric light plant in connection with the water-works system.

PLAINVIEW, NEB.—The city, it is said, will grant a franchise to anyone who will intsall a plant in Plainview. For further information, address H. J. Nelson, city clerk.

LACONIA, N. H.—The Laconia Electric Lighting Company is considering the question of changing the street lighting system in Laconia.

MANCHESTER, N. H.—The Amoskeag Manufacturing Company has decided to locate its new power house north of the Jefferson mill. The equipment of the new power house will include 32 boilers of the Manning type with a rating of 150 hp each. The new power plant will furnish power for the whole northern division, eliminating the present plants at the Langdon, Jefferson and Amory mills.

WINCHESTER, N. H.—The town has awarded a contract to the Keene Gas & Electric Company to furnish electricity to light the streets of Winchester and Ashuelot. The contract is for a term of ten years and calls for 75 tungsten lamps of 40 cp.

HOBOKEN, N. J.—The Citizens' Light, Heat & Power Company, recently organized, has applied to the Common Council for a franchise in this city. The company agrees to enter into a contract to furnish the city with 285 arc lamps at $70 each per year. If a franchise is granted the company agrees to have its plant completed in a year.

TRENTON, N. J.—Plans are being prepared by Ford, Bacon & Davis, of New York, N. Y., for the construction of a new power plant for the Camden & Trenton Railway Company. At present the company secures electricity for operating its system from the Cinnaminson Electric Light, Power & Heating Company and the Bordentown Electric Light & Motor Company.

ALBANY, N. Y.—The Public Service Commission, Second District, has approved the franchise granted to the Municipal Gas Company, of Albany, by the Town Board of Bethlehem to erect transmission lines for the distribution of electricity for lamps, heat and motors on Delaware Avenue from the city line to the Five-Mile House, west of Delmar, and along adjacent streets intersecting and running parallel with Delaware Avenue in the villages of Elsmere, Delmar and Slingerlands in the town of Bethlehem.

BROOKLYN, N. Y.—Bids will be received by Bird S. Coler, borough president, Borough Hall, Brooklyn, N. Y., until May 26 for furnishing all labor and materials required for pumping engine and power plant for operating Gowanus flushing tunnel, Borough of Brooklyn. Blank forms and further information may be obtained and plans and drawings may be seen at the office of Bureau of Sewers, 215 Montague Street, Borough of Brooklyn.

FORT ANN, N. Y.—The Kanes Falls Electric Light Company is enlarging one of its dams to secure more power for its plant.

GOUVERNEUR, N. Y.—Preparations are being made by the Aldrich Paper Company, of Gouverneur, for the construction of a large steel flume at its talc mill at Emeryville. The company is also considering the question of the construction of an electric generating plant and transmission line to Natural Dam to supply electricity to the paper mill operated by the company in that place.

ITHACA, N. Y.—The Ithaca Street Railway Company is planning to commence work on the reconstruction of its system June 1, 1909. It is proposed to double-track the entire railway and rebuild the overhead system. The contract for insulators, etc., for the overhead work has been awarded to the Electric Service Supplies Company, Philadelphia, Pa.

JAMESTOWN, N. Y.—The annual report of the Municipal Light Commission gives the receipts of the municipal electric light plant for the year for lighting, both city and commercial, as $46,085, and the cost of maintaining the plant, including $6,486 for depreciation, $36,356, leaving a profit of $9,729. A substantial reduction in the price of electricity for lamps has been made.

LYONS, N. Y.—The Wayne County Electric Company has increased its rates to consumers of electricity in Lyons and Clyde from $1 to $1.25 per month [illegible] for payment before the [illegible] The charge for [illegible] motors has been advanced to $1 per month per horse-power with 40 per cent discount if paid by the 10th of the month.

NEW YORK, N. Y.—The contract for furnishing and installing electrical and mechanical equipment on piers according to contract No. 1150 was awarded to the Northeastern Construction Company, of New York, N. Y., for $745,000.

[illegible] which furnishes electricity for the local electric light and power system, was badly damaged April 20 owing to the washout of the Payne storage dam of the Witherbee-Sherman Power Company, located at Lincoln Pond. The company recently installed a large General Electric generator, which it is thought is ruined.

ALBERMARLE, N. C.—The Albermarle Development Company has awarded the contract for the construction of its dam to L. A. Moody, of Albermarle. The dam will furnish power to generate electricity for lamps and motors. J. C. Masters is president of the company.

CHARLOTTE, N. C.—It is reported that the Southern Power Company contemplates moving its headquarters from this city to another convenient point. This proposed action, it is stated, is the result of the adoption of an amendment to the city charter whereby the right, not only to regulate the service, but also the charges and rates of public or quasi public-service corporations, and to fix such rates, is vested in the Board of Aldermen. Local corporations of a public character, including telephone, power, lighting, etc., strenuously objected to the measure, which becomes effective May 6, 1909.

FAYETTEVILLE, N. C.—The Carolina Telephone & Telegraph Company has completed its lines to Selma, and a line to Wilson is under construction. Telephone lines from Selma to Welden will be built via Tarboro and other towns, and at Selma connections will be made with the American Telephone and Southern Bell companies.

HENDERSONVILLE, N. C.—The Green River Power Company, recently incorporated, with a capital stock of $100,000, proposes to develop a mountain water power, primarily to furnish electricity in Hendersonville, and also to furnish electrical power to a large cotton mill, which has been organized, and other manufacturing plants and for the proposed Hendersonville street railway system.

LEXINGTON, N. C.—The new Dacotah Cotton Mill, which will be equipped with 8640 spindles and 240 looms to start with, will be operated by electricity supplied by the Southern Power Company.

SILER CITY, N. C.—The Matthews Telephone Company has purchased the Pittsboro, N. C., telephone plant, and is making improvements to its entire system. A new switchboard has been purchased and the Pittsboro system will also be overhauled. The Matthews company owns several telephone lines extending out from Siler City and Pittsboro and a number of long-distance lines.

WAKE FOREST, N. C.—B. Parks Rucker, of Charlotte, N. C., engineer, will have charge of the construction of the municipal electric light plant, for which $15,000 in bonds was recently voted.

BATHGATE, N. D.—Bids will be received by Alexander Morrison, secretary, until May 10 for the construction of power house, tunnel and repairs to main building at the State Blind Asylum at Bathgate, N. D. Plans and specifications may be seen at the office of Joseph Bell DeRemer, architect, Grand Forks, N. D.; also at the Builders & Traders' Exchange, Grand Forks, N. D.; Fargo, N. D.; Minneapolis, Minn., and St. Paul, Minn., and at the office of the secretary at Bathgate, N. D.

ELLENDALE, N. D.—The contract for installing an electric light plant in the State School has been awarded to A. Paul for $3,200.

GRAND FORKS, N. D.—The Grand Forks Street Railway Company is making plans for improvements and extensions to its system, which will include the construction of 3½ miles of track, a new car barn and the installation of a 250-kw generator. Thomas D. Campbell is general manager.

ANTWERP, OHIO.—We are advised that A. A. Painter has purchased the local electric light plant owned by Henry Harris & Son.

CINCINNATI, OHIO.—The contract for furnishing and installing electrical equipment for power plant for the City Infirmary at Hartwell, Ohio, has been awarded to the General Electric Company, Cincinnati, Ohio. John J. Werner is clerk.

CINCINNATI, OHIO.—The Union Gas & Electric Company has submitted a proposition to the City Council for lighting Fountain Square. The company offers to erect and maintain 1600 4-cp, colored festooned electric lamps, to burn from dusk till midnight, 100 nights a year, for $2,166 per year; also for the maintenance of 38 magnetite arc lamps, to burn for five hours, for 100 nights, for $1,558, and for 12 magnetite arc lamps, to burn 3914 hours, for $1,790.

CINCINNATI, OHIO.—The Southwestern Ohio Traction Company has applied to the City Council for a franchise for an underground, elevated and surface railway, from Norwood into the heart of the city, with a branch leading from a point near Vance Street and Columbia Avenue to Carroll Street. If a franchise is granted, the company proposes eventually to operate a system embracing approximately 400 miles, extending half way across the State. The company plans to extend its system from Lebanon to Springfield, either by purchasing the railways now in operation or by the construction of an independent road. An extension [illegible] be built, [illegible] from Hillsboro or Blanchester to Columbus, and

when the final plans are consummated the company will have a direct and short line from Cincinnati to Dayton, Cincinnati to Springfield, and Cincinnati to Columbus, with branches to Hillsboro, Georgetown, Bethel and New Richmond and intermediate points. The railway will be operated by the third-rail system.

NATIONAL MILITARY HOME, OHIO.—Bids will be received by W. H. Ortt, treasurer, Central Branch, National Home, Disabled Volunteer Soldiers (P. O. address National Military Home, Ohio) until May 1 for repairs to engine, dynamos, motors, etc., in accordance with instructions and specifications, copies of which with blank proposals and other information can be secured upon application to W. H. Ortt, treasurer.

NEWARK, OHIO.—The Licking Light & Power Company is considering the question of installing a 500-kw gas engine unit.

NEW CARLISLE, OHIO.—The capital stock of the Springfield-New Carlisle Telephone Company has been increased from $20,000 to $40,000, the proceeds to be used for a new plant.

PIQUA, OHIO.—The plant of the Home Telephone Company, of this city, was recently destroyed by fire, causing a loss of about $40,000.

PLAIN CITY, OHIO.—At a recent election the proposition to issue bonds for improvements to the municipal electric light plant was defeated.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company has purchased a site on Buck Creek, west of Fountain Avenue, on which a new power plant will be erected. The plant, when completed, will involve an expenditure of about $200,000.

WEST MILTON, OHIO.—It is expected that the new electric light plant will be completed and in operation in about 30 days. The plant will be operated by water power and will have an output of about 165 hp. The cost of the entire system is estimated at about $10,000. L. A. Pearson is owner of the plant.

YOUNGSTOWN, OHIO.—It is understood that the new tube and skelp departments of the Republic Iron & Steel Company will be operated by electricity generated by furnace gas from the Haselton furnaces of the company.

YOUNGSTOWN, OHIO.—The Carnegie Steel Company is making plans to change the power of its plant from steam to electricity. The company is now installing four gas engines to be driven by furnace gas from the blast furnaces. Four new 2000-kw generators are also being installed in the plant, which will be driven by the gas engines. A storage battery is also used in connection with the plant.

MEDFORD, OKLA.—D. E. Stetler writes that the project of the Medford Ice, Light & Power Company to erect an electric plant in Medford has been abandoned, and states that there is a good opening for the establishment of an electric plant in the town.

MINCO, OKLA.—The contract for the construction of water works and electric light plant has been awarded to the Joplin Electric Construction & Supply Company, of Joplin, Mo., for $12,284. Burns & McDonnell, of Kansas City, Mo., are consulting engineers.

BUTTE FALLS, ORE.—Plans are being considered to erect a telephone line from Butte Falls to Eagle Point. B. H. Harris is interested in the enterprise.

EUGENE, ORE.—The Eugene-Pacific Electric Railway Company, recently formed for the purpose of constructing an electric railway from Eugene to Florence, is making surveys of the route and a report has been placed in the hands of capitalists for examination. The plans include the development of a water power to be used to generate electricity. All of the stock of the company is owned by the Lane County Asset Company. Frank E. Dunn, of Eugene, Ore., is president, and Lohman & Company, of San Francisco, Cal., are the engineers.

FOREST GROVE, ORE.—The United Railways Company has submitted a proposition to the Board of Trade offering to extend its railway from Portland to Forest Grove, providing this city will furnish a 10-acre tract about a mile north of the town for terminal and switching ground and the right of way.

PORTLAND, ORE.—The injunction brought against the city to restrain it from building a municipal electric light plant has been decided in favor of the city. Unless appealed, it is said that work will soon commence on construction of the plant, the cost of which is estimated at $130,000.

PORTLAND, ORE.—The Portland, Baker City & Butte Electric Railroad Company, which proposes to construct an electric railway from Portland to Baker City and thence to Butte, crossing the Warm Springs Indian reservation and Central Oregon, a distance of about 600 miles, has received permission from the Department of the Interior to make a survey of the reservation. It is proposed to erect a power plant with an output of 8000 hp in Portland, and additional power will be secured from the Wasco County Electric & Water Power Company's plant, located on the Deschutes River. The company is capitalized at $2,000,000 and a bond issue of $40,000,000 has been authorized. H. C. McAllister is president, and C. D. Charles, general manager.

RICHLAND, ORE.—[illegible] has been granted a franchise by the county court to erect a telephone line from Richland to Robinett.

SALEM, ORE.—The Mehama Telephone Company has filed a petition with the county court for a franchise to erect a [illegible] line in this county.

ALLENTOWN, PA.—The Interurban Electric Company [illegible] to construct an electric railway from Allentown to Bethlehem, Catasauqua, Whitehall and Coplay. Allentown [illegible] opposed to the City Council granting the franchise, and [illegible] the matter.

BELLEFONTE, PA.—Bids will be received by W. I. Isenberg, [illegible]ugh clerk, until June 1, for the construction of a complete electric power plant, including a concrete dam, races, water wheels, generator, reconstruction of power house building, transmission line, motor-driven pump, etc., in accordance with plans and specifications on file at the office of the city clerk, and at the offices of D. C. & William B. Jackson, 84 State Street, Boston, Mass. G. F. Musser is chairman.

BUTLER, PA.—The People's Telephone Company, of Butler, has increased its capital stock from $100,000 to $200,000.

PHILADELPHIA, PA.—Bids will be received by the Frankford Arsenal until May 26 for supplies for the year ending June 30, 1910, which will include steel, iron and copper tubing, electrical supplies, etc. Blanks can be had on application to the commanding officer.

PITTSBURGH, PA.—Surveys are being made for the Pittsburgh & Suburban Railroad Company for its proposed railway from Pittsburgh to Carnegie and Steubenville, a distance of about 40 miles. J. Toner Barr, 237 Fourth Avenue, Pittsburgh, Pa., is engineer.

PITTSBURGH, PA.—A bill has been presented to the City Council providing for the removal of all overhead wires and poles of the telegraph, telephone, electric and light companies from the streets of the city, the work to begin on or before July 1, 1909, and to be completed by July 1, 1913.

READING, PA.—The City Council has authorized the police committee of the council to advertise for bids for lighting the streets and city hall for a period of one, two, three, five or ten years.

SOUTHAMPTON, PA.—The Philadelphia Suburban Traction Company, of Philadelphia, Pa., contemplates the construction of an electric railway from Southampton to Hatboro. The company will soon make application for a charter. W. E. Watt, J. L. Crogan, H. C. Case, J. A. Bonnell and W. A. Merrick, of New Town, are interested in the company.

WASHINGTON, PA.—Application will be made on May 17 by C. B. Coldwell, J. W. McKay, M. J. Hosack, E. B. Hartman, Jr., and Roger Knox for a charter for the Washington-Marianna Street Railway Company to construct a street railway from Washington to South Strabane Township.

WAYNESBURG, PA.—Plans have been completed for the construction of a new electric traffic system, which will radiate in four directions from Waynesburg, with Washington, Wheeling, Uniontown and Morgantown as its terminals, work on which will begin about the middle of this month. The company will be known as the Waynesburg & Monongahela Street Railway Company, and its officers are: Peter Langsdorf, of McKeesport, Pa., president; W. J. Sheldon, of Waynesburg, vice-president; J. Carson Sheldon, of Buffalo, N. Y., secretary, and Charles O. Koehler, of McKeesport Pa., treasurer. The entire system will consist of about 100 miles of track of which 50 will be built this year.

WILKES-BARRE, PA.—Sealed proposals will be received by Fred H. Gates, city clerk, until May 20 for lighting certain streets of the city with electric arc lamps. Plans and specifications can be seen and blank forms obtained from the city clerk.

WOONSOCKET, R. I.—Preparations are being made by the Scotia Worsted Company for the construction of a new power house adjoining its mill on River Street. A 350-hp compound engine and new boilers will be installed.

CHESTER, S. C.—The Southern Power Company, which recently purchased the municipal electric plant, is overhauling the street lighting system, and expects to have the new system in operation soon. The company will also furnish electricity to industrial plants, etc. The Springstein and Eureka cotton mills have contracted for power to operate their plants, and the Wylie mills will use several hundred horse-power as supplementary to its plant.

LAURENS, S. C.—The Watts Cotton Mills have let the contract to the Piedmont Electric Company, of Anderson, to equip the mill to be operated by electricity. The company is changing its mill from steam to electric drive.

COVINGTON, TENN.—The Memphis, Covington & Northern Railway Company contemplates the construction of an electric railway to connect Memphis, Millington, Mumford and Covington. No definite plans have yet been made for securing power to operate the railway. G. B. Gillespie, of Covington, is president, and J. T. Garner, secretary and treasurer.

KNOXVILLE, TENN.—The county court has granted Charles Dawes a franchise to construct an electric railway from Knoxville to Bearden, with branches to Concord and Lyons View.

NASHVILLE, TENN.—[illegible] by the Nashville Railway & Light Company for a franchise to extend its tracks out Broadway and on the Hillsboro pike.

AUSTIN, TEX.—The Austin City Telephone Company was sold at auction April 6 to the Columbus Savings Bank & Trust Company (a Missouri corporation) for $63,000. The company has been in the hands [illegible]

GROVETON, TEX.—The capital stock of the Groveton Light & Ice Company has been increased from $20,000 to $25,000.

HOUSTON, TEX.—Stone & Webster Engineering Corporation, Boston, Mass., it is said, contemplates improvements to the power plant of the Houston Electric Company, which will involve an expenditure of $150,000 and will include the installation of an 800-kw unit, with two [illegible]

HUBBARD CITY, IA.—The Union Central Light & Ice Company writes that it would like to correspond with contractors with a view of making improvements to its plant, the contractor taking bonds of the company in payment of the work, for which $100,000 6 per cent bonds will be issued. In addition to the bonds, the bonuses from the four surrounding towns will be turned over to the contractor. The work will include the construction of a new power house, new ice machinery and transmission lines to four surrounding towns. W. A. Bass is president of the company.

STAMFORD, TEX.—The Stamford Street Railway Company has been organized to construct a street railway in Stamford which is to extend to the College Heights addition. The railway will be five miles in length. L. M. McArthur, of Stamford, is chief engineer.

TAFT, TEX.—The Coleman-Fulton Pasture Company is making arrangements to install an electric light plant in connection with its ice and cold-storage plants. The plant will have sufficient output to supply electricity for 1000 lamps and to operate both plants. Joseph F. Green is secretary and superintendent.

TRINITY, TEX.—It is reported that A. R. McDonald will establish an electric light plant in Trinity.

ST. GEORGE, UTAH.—A company has been organized to construct and operate an electric power plant in St. George. The company is capitalized at $20,350. The officers are: A. H. Ensign, president; George Z. Edwards, vice-president; R. J. Evans, secretary and treasurer, and B. E. Slosson, manager.

DAYTON, VA.—The Silver Lake Improvement Company contemplates the construction of a hydro-electric plant. W. D. Heatwole is president.

DAYTON, VA.—At an election to be held May 12 the citizens will vote on the proposition to issue $20,000 in bonds, the proceeds to be used for extensions to the municipal electric light plant and sewer system.

POCAHONTAS, VA.—The power, fan and boiler houses and machine shops of the Big Vein Coal Company was destroyed by fire April 20, causing a loss of $25,000.

ANATONE, WASH.—The Anatone Water & Light Company has been granted a franchise to operate in Anatone.

COLFAX, WASH.—The Commissioners have revoked the franchise granted to the Whitman Railroad & Power Company to construct and operate an electric railway between Colfax and Palouse. The franchise was granted five years ago and the company has failed to comply with the terms.

COLVILLE, WASH.—The Pacific States Telephone Company, it is stated, has appropriated $85,000 for improvements to its system in Stevens County.

SEATTLE, WASH.—The contract for furnishing electricity to operate the county rock crusher at Kapowsin has been awarded to the Puget Sound Power Company, at 2½ cents per kw-hour.

SPOKANE, WASH.—The Spokane & Inland Empire Railroad is planning to install a transformer in Steptoe to furnish electricity for lamps.

SPOKANE, WASH.—The Big Bend Light & Power Company is erecting a transmission line from Whitefish, Mont., to Kalispell, Mont., a distance of 18 miles, where it will connect with system of the Kootenai Valley Power Company. The company is now operating a steam plant in Whitefish and expects to have the transmission line completed by August, when the system will be changed over. W. C. Styver is president.

SPOKANE, WASH.—The Spokane & Inland Empire Railroad Company has applied to the City Council for a franchise to extend its system to Rockwood Boulevard, Lincoln Heights and Allendale. The company proposes to use iron poles and electric lamps will be placed on the poles, which will be maintained by the company. This is done voluntarily and is not a requirement of the franchise.

SPOKANE, WASH.—J. C. Ralston, city engineer, has submitted his report in regard to the construction of a municipal electric light plant. Mr. Ralston states that the cost of the plant would be $2,800,000, including the cost of the site, which would be $300,000. He also states that the use of the power at the up-river pumping station was not feasible. He does not advise the city to go to the expense of installing a plant, as he considers that the present company furnishing the service has the ideal situation, centrally located.

WASHOUGAL, WASH.—The contract for the installation of an electric plant has been awarded to the Pacific Electric Engineering Company, of Portland, Ore. The company will be known as the Western Light & Power Company. It is expected to have the plant in operation by Sept. 1. C. W. Cottrell is interested in the enterprise.

WENATCHEE, WASH.—Jay L. Holmes and others have filed a notice of appropriation of 25,000 cu. in. of water in the Icicle River, to be utilized to generate electricity. One of the objects in view is the erection of a large greenhouse to be heated by electricity.

JANESVILLE, WIS.—The Wisconsin Carriage Company is preparing plans for the construction of a new plant to be operated with electric motors.

MILWAUKEE, WIS.—The new plant of the Davis Manufacturing Company, which will be operated by electricity, is nearly completed.

MILWAUKEE, WIS.—The Milwaukee Western Electric Railway Company has recently awarded the contract for financing and construction of its proposed electric railway, 30 miles in length, to W. D. Chapman, of Akron, Ohio. The railway will connect Milwaukee and Beaver Dam and intervening towns. A branch line will extend from Sussex to Waukesha.

RICE LAKE, WIS.—Plans are being considered by the Red Cedar Electric Power Company for enlarging its plant.

STOUGHTON, WIS.—Plans are being made by the Mandt Wagon Company to change its plant to be operated by motor drive.

SUPERIOR, WIS.—The Northern Pacific Railroad Company is said to be making plans to construct new ore docks along the harbor front and to operate the machinery by electricity, which will be supplied from the power plant of the Great Northern Power Company.

WAUSAU, WIS.—The Marathon Paper Mills Company is advertising for bids for the construction of a new plant. The company has awarded a contract for power and electrical equipment to the Allis-Chalmers Company, of Milwaukee, Wis.

VICTORIA, B. C., CAN.—The Board of Aldermen is considering the question of securing electricity from the British Columbia Electric Company to supply additional lamps for the present, instead of making extensions to the municipal plant this year as planned, which would require an expenditure of about $20,000. It is estimated that the company can provide street lamps at $38 each per year, which will save the city about $10,000 per year.

MINIOTA, MAN., CAN.—The Miniota Municipality is making preparations for the construction of a rural telephone system. For further information address Reeve Gerrand, Miniota, Man.

LISTOWELL, ONT., CAN.—The citizens on April 19 voted to install a municipal electric light plant to cost $12,500 for both street and commercial lighting. The old arc-lamp equipment will be sold and tungsten lamps will be installed for street lighting.

PORT ARTHUR, ONT., CAN.—The Street Railway Commissioners have decided to call for tenders for four pay-as-you-enter cars. For further information address J. J. Carrick.

TORONTO, ONT., CAN.—The city of Toronto will soon call for bids for laying of underground conduit. Specifications can be secured on application to the Electrical Department, City Hall, Toronto.

WELLANDPORT, ONT., CAN.—The Dunnville, Wellandport & Beamsville Electric Railway Company is advertising for bids for grading for its proposed electric railway, which will connect Dunnville, Wellandport and Beamsville. The company has decided to purchase electricity to operate the road. James A. Ross, of Wellandport, is treasurer.

QUEBEC, QUE., CAN.—It is reported that the controlling interest of the Quebec Railway, Light & Power Company has passed into the hands of a syndicate, which is desirous of extending the railway to Murray Bay, a distance of 56 miles. The railway will start from St. Joachim and will cost about $2,000,000.

NORTH BATTLEFORD, SASK., CAN.—The proposition to issue $75,000 in bonds, the proceeds to be used for the installation of an electric light plant, water works and sewer system, will be submitted to a vote of the people.

NORTH BATTLEFORD, SASK., CAN.—Willis Chipman, civil engineer, of Toronto, Ont., has been retained to prepare plans for a municipal electric lighting system in North Battleford.

MEXICO CITY, MEX.—Augusta Pellet has filed a petition for a concession of water rights in the Vado or Tequesquipan rivers in the State of Mexico, to be utilized for the generation of electricity.

Company Elections.

NAPA, CAL.—At the annual meeting of the Vallejo, Benicia & Napa Valley Railroad Company the following named officers were elected: W. T. Botsford, president; E. Z. Hennessey, vice-president; John T. York, secretary.

HOBOKEN, N. J.—The Citizens' Light, Heat & Power Company has been organized by the election of the following-named officers: Anthony J. Volk, president; Frank Cordts, vice-president; Henry Lohmann, Jr., secretary, and John F. O'Hara, treasurer.

UTICA, N. Y.—At the annual meeting of the Utica Gas & Electric Company the following officers were elected: Anthony N. Brady, president; William E. Lewis, vice-president; M. Jesse Brayton, secretary; George H. Stack, treasurer, and C. A. Greenidge, general manager of the electric department.

New Industrial Companies.

THE AMERICAN OIL ENGINE COMPANY, of Portland, Maine, has filed articles of incorporation with a capital stock of $500,000 for the purpose of manufacturing and dealing in engines, tools, etc. C. E. Eaton is president, and T. L. Croteau, treasurer, both of Portland, Maine. The company, it is said, will take over the business of the International Oil Engine Company, of Danielson, Conn., which manufacturers stationary, marine and automobile engines.

THE B. & L. ELECTRICAL CONTRACTORS, of Brooklyn, N. Y., have been chartered with a capital stock of $5,000 by Julius A. Bychower, Pauline Bychower and A. Charles Teplitz, all of Brooklyn, N. Y. The company proposes to do electrical work.

EDWARD JOY, of Syracuse, N. Y., has filed articles of incorporation with the Secretary of State for the purpose of carrying on the business of contracting electrician, plumbing, steam- and hot-water heating business. The incorporators are: E. Joy, E. F. Joy and P. R. Joy, all of Syracuse, N. Y.

THE ELECTRIC SUPPLY COMPANY, of Richmond, Va., has been chartered, with a capital stock of $10,000, to conduct an electric supply business. F. J. Whybrow is president.

THE ERD MOTOR COMPANY, of Saginaw, Mich., has been incorporated with a capital stock of $22,000 by John G. Erd, Henry S. Erd and William J. Passolt.

EUREKA VIBRATOR COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $25,000 for the purpose of manufacturing and selling vibratory or electrical devices and novelties. The incorporators are: F. R. Muenzenberger, W. Muenzenberger and K. T. Muenzenberger, of New York, N. Y.

THE FIDELITY ENGINEERING & INSPECTING COMPANY, of Albany, N. Y., has been incorporated with a capital stock of $2,000 by Wallace Greenlach, Manning Boulevard, Edward J. Wheeler, of Albany, N. Y., and Albert B. Hager, of Albany, N. Y. The company proposes to do a general engineering, inspecting and testing business.

THE IDEAL POST COMPANY, of Portland, Ind., has incorporated to establish and equip a plant for the manufacture of concrete telephone and telegraph poles, together with the necessary apparatus for setting such poles. H. H. Gilmore, B. G. Arthur and M. C. Gaunt are directors.

THE INDEPENDENT ELECTRICAL COMPANY, of Salt Lake City, Utah, has been incorporated with a capital stock of $20,000 for the purpose of dealing in electrical supplies. The officers of the company are: Nephi L. Morris, president; Heber C. Iverson, vice-president; Eugene Chandler, treasurer, and L. J. Haddock, secretary.

THE KEYSTONE ENGINEERING COMPANY, of Wilmington, Del., has been chartered with a capital stock of $100,000 by W. B. Affleck, W. C. Hardy and R. R. Adams, of Philadelphia, Pa.

THE LINCOLN ELECTRIC COMPANY, of Hammondsport, N. Y., has been incorporated with a capital stock of $75,000 by W. B. Putney, Jr., R. Kelly, of New York, N. Y., and W. H. Griffin, of Matawan, N. J. The company proposes to manufacture electric batteries, instruments and supplies.

THE McCORD ENGINEERING COMPANY, of Atlanta, Ga., has been incorporated by J. L., W. P. and C. M. McCord. The company proposes to do a general electrical, mechanical and civil engineering and contracting business.

THE NATIONAL BURGLAR ALARM COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000. The company proposes to manufacture, erect and operate burglar alarms and warning instruments. The incorporators are: Frank L. Smiley, Bernard C. McKenna and Scudder J. Wooley, all of New York, N. Y.

THE NEW ENGLAND ENGINE COMPANY, of Augusta, Maine, has been chartered with a capital stock of $200,000 to manufacture engines, dynamos, tools, etc. R. S. Buzzell is president, and E. J. Pike, treasurer, both of Augusta, Maine.

THE PAGES' AEROPLANE RAILWAY COMPANY, of Brooklyn, N. Y., has been chartered with a capital stock of $100,000 by C. H. Pages, E. D. Kenyon, of Brooklyn, N. Y., and W. W. Heroy, of Bronx. The company proposes to manufacture cars, railway, tramway or aeroplanic, for passengers and freight and for amusement, toys, etc.

THE TRIPLE MOTOR TRUCK COMPANY, of Owosso, Mich., has been chartered with a capital stock of $340,000. F. O. Page, formerly of the Reliance Motor Company, is at the head of the new company.

THE UNION ELECTRIC MANUFACTURING COMPANY, of Pekin, Ill., has been incorporated with a capital stock of $6,000 by George H. Glass, George A. Vint and James W. Barrett. The company proposes to manufacture and deal in electrical tools, machinery and appliances.

New Incorporations.

DENVER, COL.—The South Platte Power Company has been chartered, with a capital stock of $50,000, by W. J. McConnell, Charles L. Barthen and Edwin J. Moore, of Denver, Col.

DENVER, COL.—The San Luis Valley Water & Power Company has been incorporated, with a capital stock of $1,000,000, by Fred G. Moffat, Gerald Hughes, H. A. Smith, George Bierbauer, H. G. Lunt and Franklin E. Brooks.

WILMINGTON, DEL.—Articles of incorporation have been filed for the Ambridge Heat, Light & Power Company with a capital stock of $150,000 by F. A. Heberlin, E. G. Schöll and I. R. Myers, of Ambridge, Pa.

MIAMI, FLA.—The Miami Electric Light & Power Company has been incorporated with a capital stock of $[illegible] to supply electricity for lamps, heat and motors in Miami, Fla. The incorporators are: J. R. Parrott, H. S. Jennison, A. V. S. Smith, of Jacksonville, Fla.; J. N. McConigle, of Miami, Fla., and C. D. Boice, of Jersey City, N. J.

ATLANTA, GA.—Articles of incorporation have been filed for the Coosawattee & Mountaintown Rivers Power & Improvement Company, with a capital stock of $50,000, with the privilege of increasing it to $500,000, by William M. Scott, E. W. Watkins, Jr., and E. W. Watkins, Sr. The company owns water power properties in Gilmer County and proposes to construct a hydro-electric plant, developing about 4000 hp for transmission. Hall Brothers, of Atlanta, Ga., are engineers in charge of the work.

PINEORA, GA.—The Effingham Telephone Company has been chartered, with a capital of $5,000 with privilege to increase it to $50,000. The company proposes at present to take over several lines running into Pineora.

BOISE, IDAHO.—The Northern Idaho & Montana Power Company has filed articles of incorporation with a capital stock of $3,000.

MONTEZUMA, IA.—The Montezuma Electric Light, Power & Heating Company has been incorporated with a capital stock of $6,000.

NEW SHARON, IA.—The New Sharon Public Utility Company has been chartered, with a capital stock of $50,000, by W. J. Nicholson and others. The company proposes to construct and maintain telephone, electric and gas plants, etc.

BRIDGEWATER CENTER, MAINE.—The Bridgewater Electric Light & Water Company has been organized and the following named officers elected: J. H. Farley, president; J. C. Burtt, treasurer, and E. B. Morton, clerk. It is said that the company will commence work at once on construction of a substation and distributing system in Bridgewater.

HINSDALE, N. H.—The Hinsdale Power & Mills Company has filed articles of incorporation with the Secretary of State, with a capital stock of $40,000.

ELIZABETH, N. J.—The Mutual District Telegraph & Messenger Company has been incorporated with a capital stock of $100,000 by J. A. McClary, of Rahway, N. J.; G. W. Blanchard, H. W. Pope, of New York, N. Y.; W. B. Moorewood, of Elizabeth; H. L. Benedict, of Union, N. J., and E. K. Summerwell, of East Orange, N. J. The company proposes to operate telegraph and telephone lines.

JERSEY CITY, N. J.—The Interstate Light & Power Company has been chartered with a capital stock of $750,000 by H. O. Coughlin, S. A. Anderson and J. R. Turner, of Jersey City, N. J. The company proposes to generate and distribute electricity for light, heat and motors.

Legal.

SALE OF ROCKINGHAM POWER COMPANY.—United States Judge J. C. Pritchard has issued an order returnable in chambers in Richmond, Va., May 8, to all parties interested to appear before him in the aforesaid city to show cause why the property of the Rockingham Power Company, of Rockingham, N. C., should not be sold under order of the court. It is generally reported that the court will order the sale and that the developement will be further prosecuted on a large scale to complete the Blewitt-Falls hydro-electric plant.

DEATH OF CHILD BY CONTACT WITH ELECTRIC LIGHT WIRE.—Where it reasonably may be said that an ordinarily careful and prudent person observing the highest degree of care would anticipate that persons in the exercise of lawful right might be brought into contact with wires carrying powerful currents of electricity, the law charges the owner of such wires to insulate them and to maintain them in a proper state of repair. This broad principle found application in a recent Missouri case. The case was one where a small boy, playing upon the roof of the tenement in which he lived with a ball, which rolled off the roof into the yard below, crawled to the edge of the roof to see if he could locate the lost toy. In doing so he seized the metal edge of the roof and his forehead came in contact with an electric light wire belonging to the defendant company, at a point where the insulation had been worn off, causing his death. After the jury had been instructed by the court that it should find in favor of the plaintiff, unless the defendant company established that the child was killed by his own negligence, and "not by the negligence of the defendant," a verdict was given against the company. On appeal, this was reversed for the reason that the instruction was erroneous. The burden was upon the plaintiff to the end of the trial to show that the negligence of the defendant caused the injury, and a defense was made out by the company upon its proving that the negligence of the boy contributed to the accident. Day vs. Consolidated Light, Power & Ice Company, Kansas City Court of Appeals, 117 S. W., 81.

DUTY OF ELECTRIC LIGHT COMPANY AS TO WIRES NOT OWNED BY IT.—The Kentucky Court of Appeals, in a case where a person had been killed by taking hold of an electric light wire which had fallen to the street, and which was used by the defendant company for the transmission of electricity, [illegible] it was not [illegible] by the company, expressed the following opinion as to the duty of the company under the circumstances: "The company could not escape its responsibility to the deceased through the public, even if using an agent or servant's deadly force as an electric current of such high voltage upon insecure lines of wire, where the public might reasonably be expected. No more could it dispense with the duty of inspecting the wires, from time to time, to see that they were securely fastened and properly insulated, although the lines were not owned by it. When it used the lines it was its duty to see to their proper and safe condition. This duty was not discharged by the exercise of ordinary care, but required the highest degree of care to keep them safe. If the wire broke because of the storm of Sunday morning (the injury occurred late Sunday afternoon), and the

company did not know that it was broken, and could not in the exercise of that degree of care exacted of it by the law have discovered it then it would not be negligent in failing to discover it; but, having knowledge of the manner in which the wires were strung, the length of time they had been exposed and in use, and that the insulation was off much of the wire, whether then it was negligent in failing to inspect and discover the break, from whatever cause it may have occurred, for more than 12 hours in the daytime, is a question for the jury." Lewis, Administrator v. Bowling Green Gaslight Co., Court of Appeals of Kentucky, 115 S. W. Rep. 728.

Personal.

MR. W. A. WINFIELD has been appointed manager of the Eastern Telephone Company, with headquarters at Halifax, N. S.

MR. WILLIS CHIPMAN, of Toronto, Can., has been commissioned by the town of North Battleford, Saskatchewan, to prepare plans for a municipal lighting plant.

PROFESSOR MORGAN BROOKS, of the department of electrical engineering of the University of Illinois, has been granted a leave of absence for the purpose of foreign travel and study during the coming academic year.

MR. KEMPSTER B. MILLER, of Chicago, is making a short trip to California, where his firm of McMeen & Miller has extensive telephone work under way. Mr. Miller will combine both business and pleasure during his brief stay.

MR. M. L. KOHLER, of Philadelphia, was elected president of the Chicago Mica Company, of Valparaiso, Ind., at a meeting of the directors held in Chicago on April 14. Mr. Kohler succeeds Mr. F. N. Boyer, resigned. Mr. E. H. Heilstedt was re-elected secretary-treasurer.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company, of Chicago, has returned to his desk after a short trip to London, whence he returned rested and refreshed. Mr. Insull arrived in New York on April 23 and took up his duties in Chicago on April 26.

MR. F. N. BOYER, assistant manager of the Chicago office of the General Electric Company, has returned from a visit to Southern California and Honolulu, where he spent eight months in search of health. The many friends of Mr. Boyer will be pleased to learn that he has fully recovered his health.

MR. GEORGE B. TRIPP, of Colorado Springs, who has recently made a trip East, says that the business outlook in Colorado and throughout the mountain States is very encouraging, and that the general feeling is distinctly one of cheerfulness. Mr. Tripp is general manager of the Colorado Springs Electric Company, the Colorado Springs Gas Company and the Pikes Peak Hydro-Electric Company.

MR. J. INGLES MATTHIAS has resigned as general manager of the Licking Light & Power Company, Newark, Ohio, to take effect July 1, 1909, on which date he will leave for Wilmington, Del., for a rest in the country near that city before returning to active work. Mr. Matthias had a hard struggle in placing the Newark property on a paying basis, but at last succeeded, and now seeks a new field.

MR. A. W. ZAHM, who has been traveling for the Northwestern Electric Equipment Company, of St. Paul, Minn., on May 1 resumes the management of the People's Gas & Electric Company, of Mason City, Ia., which position he held for a number of years before his connection with the Northwestern company. Mr. Zahm is an ex-president of the Iowa Electrical Association and very well known among Iowa central-station men.

MR. J. D. A. CROSS, who has been representing the General Electric Company, with headquarters at Des Moines, Ia., is to become manager of the electric heating appliance department at the Chicago office of the General Electric Company, to fill the vacancy caused by the resignation of Mr. E. L. Callahan, who will take charge of new business departments of central-station companies controlled by H. M. Byllesby & Company on June 1.

MR. WALTER GOLL, manager of the Chicago office of the Fort Wayne Electric Works, who has been one of the most popular members of the electrical fraternity in Chicago, has removed to Madison, Wis., having charge of the general sales organization and factory work of the Northern Electrical Manufacturing Company, now controlled by the Fort Wayne Electric Works. For the present Mr. Goll retains the managership of the Chicago office, but Mr. A. L. Pond, who has been appointed assistant manager of that office and who is well fitted by ability and experience to handle the business, will be in immediate charge in Chicago. Mr. Goll will make occasional trips between Madison and Chicago, making his headquarters in the former city.

MR. RICHARD T. LAFFIN has become associated with the Stone & Webster Management Association in connection with the Seattle Electric Company and other Puget Sound railway and lighting properties. Mr. Laffin was for many years connected with the Boston Elevated Railway, and was later general manager of the Worcester Consolidated Street Railway. He resigned from the latter position to become vice-president and general manager of the Manila Electric Railroad, and spent about four years in the Philippines in establishing and organizing the property, having only recently returned to this country.

COL. W. B. WILSON, the well-known historian of the telegraph in the [illegible] of the Pennsylvania Railroad with which he has been connected for 54 years, has just retired under the pension rules of the company, in which he became a telegraph operator at the age of 16. On May 4, 1861, he was taken to Washington by President Scott, of the Pennsylvania Railroad, and made manager of the military telegraph office in the War Department, where he served for 24 months. His services have been recognized from time to time by Congress and other bodies, and he has been elected more than once president of the Old Time Telegraphers' Association and of the U. S. Military Telegraph Corps' Association. In addition to his excellent literary work in the electrical field, Col. Wilson has written a history of the great railroad which is the only continuous narrative extant of the growth of the system.

MR. E. L. CALLAHAN, who has been for the past three and a half years in charge of the sale of electric heating appliances for the General Electric Company, with headquarters in Chicago, has resigned, to take charge of the new business departments of the various electric light, railway and gas properties controlled by H. M. Byllesby & Company, Chicago. Mr. Callahan, who is very well known throughout the Central States for his excellent work in the promotion of electric heating among the central-station companies, is 34 years of age and was graduated from the Case School of Applied Science, Cleveland, in the class of 1900. For three years he was assistant manager of the Simplex Electric Heating Company, and for two and a half years was manager of the Prometheus Electric Company. Previous to entering the electrical field he was with Westinghouse, Church, Kerr & Company in connection with the electrification of the Pennsylvania tunnel. In his new position he will have direction of the new business campaigns of 12 companies. His experience of the past few years in assisting central stations to build up heating appliance loads and his notable success in this work have fitted him admirably for this recent promotion.



MR. B. R. SHOVER, electrical engineer of the Indiana Steel Company, was born on Feb. 13, 1867, at Dublin, Ind. His high school training was obtained in Indianapolis, and his college education at the Rose Polytechnic Institute, from which he was graduated in 1890. Mr. Shover was employed successively by the following companies: Nevens Electric Heating Company, Indianapolis, Ind.; Richmond City Railway Company, Richmond, Ind.; Seashore Electric Railway Company, Asbury Park, N. J.; Asbury Park Electric Light & Power Company, Asbury Park, N. J.; Youngstown Street Railway Company, Youngstown, Ohio; Carnegie Steel Company, Youngstown, Ohio, and the Indiana Steel Company, Gary, Ind. Mr. Shover has made a special study of electric-motor applications in steel mills, including the requirements of the various mill processes and the characteristics of the electric motors which permit them to meet such requirements. It was his knowledge and experience along these lines that caused him to be selected for his present position as electrical engineer of the Indiana Steel Company. Upon him fell the task of selecting the electrical equipment for the steel mills at Gary, and rearranging the mills so that they could be driven most advantageously by means of electric motors. The successful operation of these mills represents the most important advance made in steel mills and motor applications within many years.



Obituary.

DR. F. B. MANDEVILLE died in Newark, N. J., April 26. He was one of the organizers of the old Schuyler Electric Light Company in Newark, which is now one of the constituent companies of the Public Service Corporation, and was its first vice-president and afterward president. Deceased was born in 1850.

MR. ALMON H. DEMRICK, electrical engineer of the United States Reclamation Service, Salt River Project, Roosevelt, Ariz., was drowned May 3 in the sluicing tunnel, 600 ft. long, cut through a mountain at one end of the Roosevelt storage reservoir. While in the tunnel with Mr. A. L. Harris, a civil engineer, a gate was inadvertently opened, thereby admitting water under 90 ft. head; Mr. Harris was swept through the tunnel without loss of life. Mr. Demrick, who formerly lived in Detroit,

was 56 years old. He had been with the project about six years and among other work had built a 65-mile electric transmission line through the mountains from Roosevelt to Phoenix. He was an associate member of the American Institute of Electrical Engineers.

MR. RALPH SCOTT, of the Scott Electrical Company, of Newark, N. J., died at his home in that city last week following an operation for appendicitis. Mr. Scott was born 26 years ago in Bradford, England, and brought to this country by his parents when a child. His academic education was received at Wilkes-Barre, Pa., where for a time he was an instructor at the New Century School in Wilkes-Barre. Mr. Scott went to Newark about two and a half years ago, where he founded the Scott Electrical Company, taking up, among other things, the manufacture of flaming-arc lamps. A lamp of this type made for the Lackawanna Hoboken terminal was of enormous size, the globe being 6 ft. in diameter.

MR. JAMES JONES, SR., formerly of Pearce & Jones and J. Jones & Son, died April 26 from pneumonia, at the age of 77, having been born in Birmingham, England, Sept. 20, 1832. Becoming interested in electricity when a young man, he came to New York City in the belief that he would there find better opportunities for advancement in that branch, and obtained employment with Chester & Company. For about 25 years he was a partner in the firm of Pearce & Jones, manufacturers of telegraph, telephone and fire-alarm apparatus. Later, with his son, he established the firm of J. Jones & Son, which for many years did a general electrical supply business, and was succeeded by Jones & Gross, in which firm the son, Mr. James Jones, Jr., is now partner.

Trade Publications.

CENTRAL ELECTRIC CIRCULARS.—The Central Electric Company, Chicago, Ill., has issued a new circular describing the Badger portable electric lamp, for which a number of advantages are claimed. Another circular describes new types of lightning arresters for high and low-tension direct and alternating current, and a 16-page circular is devoted to luminous and air radiators.

Business Notes.

MURALT & COMPANY have opened a branch office in the Temple Court Building, corner Bay and Richmond Streets, Toronto, Ontario. Mr. J. Engh, who has been prominently connected with this company for many years, will be in charge as manager.

MR. H. B. LOGAN, president of Dossert & Company, of New York, who is making an extended trip throughout the West, reports that he has concluded arrangements with Messrs. Otis & Squires, 155 New Montgomery Street, San Francisco, to act as Pacific Coast managers for Dossert & Company. Messrs. Otis & Squires will carry in stock a complete line of Dossert solderless connectors, cable taps and terminals.

THE CHICAGO ELECTRIC METER COMPANY, which was organized one year ago to manufacture the Chicago printing attachment for watt-hour meters, has removed its office and temporary shop from 121 La Salle Street to more spacious quarters at 281 West Van Buren Street, Chicago. Here, with largely increased facilities, the company will be able to supply the growing demand for its devices, which are coming into extended use in the sale of electricity for industrial purposes. Mr. F. F. Kinney is the general manager of the Chicago Electric Meter Company.

WESTINGHOUSE RAILWAY LINE MATERIAL CONTRACTS.—The Westinghouse Electric & Manufacturing Company has received a contract from the Falkenau Electrical Construction Company, of Chicago, engineers for the Salt Lake & Ogden Railway Company, covering direct suspension line material for the 37 miles of electrification of the present steam road between Salt Lake City and Ogden. A contract has also been closed covering the line material for the Gallatin Valley Electric Railway Company, of Bozeman, Mont., for 18 miles of new line; and an order entered from the Long Island Railroad covering 12 miles of low-voltage catenary construction.

INDEPENDENT ELECTRIC MACHINERY COMPANY.—Mr. John E. Launder, who has been associated with the B-R Electric & Telephone Manufacturing Company, of Kansas City, Mo., for the past eight years as purchasing agent and later as city sales manager, has resigned, to associate himself with the Independent Electric Machinery Company, having purchased an active interest in that corporation. The officers of the latter company are now: E. R. Royer, president; R. B. Coleman, vice-president, and J. E. Launder, secretary and treasurer. This company is now located in its own building, at 318-320 South Boulevard, where it has double the former stock and four times the former floor space. A full line of new generators, motors and transformers will be carried, besides the usual stock of second-hand generators, motors and transformers. The repair shop will also be a special feature of benefit to the Southwest trade.

ALLIS-CHALMERS PACIFIC COAST OFFICES.—The Los Angeles office of Allis-Chalmers Company has been moved from the Citizens' National Bank Building to larger and more convenient quarters at 129 East Fifth Street. The constantly increasing demand for the company's products on the Pacific Coast has compelled this change and necessitated an increase in the selling force, particularly in the steam and mining lines. Mr. J. F. Perry is district manager of the company at this office, and Mr. E. H. Knepper, formerly with Ingersoll-Rand Company, has become identified with Allis-Chalmers Company's Los Angeles office in the capacity of salesman. The increased demand for mining and crushing machinery, steam and electrical apparatus, hydraulic turbines, gas engines and steam turbines has also necessitated a larger selling force at the San Francisco office of Allis-Chalmers Company at 599 Mission Street.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Lloyd Lyon, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West 39th St., New York. Next meeting, Hot Springs, Va., May 24-27, 1909.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, Niagara Falls, Canada, May 6, 7 and 8, 1909.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, Little Rock, Ark. Next meeting, Hot Springs, Ark., May 13, 14 and 15, 1909.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, 557 Frick Building Annex, Pittsburgh, Pa. Next meeting, June, 1909.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago. Next meeting, Detroit, June 23, 24 and 25, 1909.

AMERICAN STREET & INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia.

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, John S. Corning, Boston Electric Railway Company, Boston.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York.

ASSOCIATION OF CAR LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad Electrical Department, Chicago. Next meeting, Chicago, Oct. 7, 8 and 9, 1909.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, S. E. Mumford, Detroit, Mich.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

CENTRAL ELECTRIC RAILWAYS ASSOCIATION. Secretary, A. L. Neereamer, Indianapolis, Ind.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, September, 1909.

EASTERN STATES INDEPENDENT TELEPHONE ASSOCIATION OF PENNSYLVANIA, NEW JERSEY, MARYLAND AND DELAWARE. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

ELECTRIC CLUB, CHICAGO. Secretary, W. S. Taussig, 204 Dearborn St., Chicago. Meets every Wednesday noon at Chicago Automobile Club.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, jr., 500 Fifth Ave., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second Tuesday, January, April, July and October.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meetings, San Francisco, second Thursday in each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, 29 West 39th St., New York.

Illinois State Electric Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, P. S. Millar, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, J. W. Fluckner, 503 Fifth Ave., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., 1909.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

International Independent Telephone Association. Secretary, A. C. Davis.

Iowa Electrical Association. Secretary, W. N. Keiser, Des Moines, Ia.

Iowa Independent Telephone Association. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia.

Iowa Street & Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., October, 1909.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meetings, second Tuesday in October, each year.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. C. Marshall, Port Huron, Mich.

Minnesota Electrical Association. Secretary-Treasurer, Ludwig Kemper, Albert Lea, Minn.

Mississippi Electric Association. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss. Next meeting, Jackson, Miss., June 15, 1909.

Missouri Electric, Gas, Street Railway & Water Association. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, Jefferson City, Mo., April 14, 15 and 16, 1910.

Missouri Independent Telephone Association. Secretary, G. W. Schweer, Windsor, Mo.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electric Light Association. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York. Next meeting, Atlantic City, N. J., first week in June, 1909.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

National Electrical Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

National Electrical Trades Association. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next meeting, Boston, Mass., June 10, 1909.

Nebraska Electrical Association. Secretary, William Bradford, Lincoln, Neb.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New Orleans Electrical Contractors' Association. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings second and fourth Tuesday of each month.

New York Electrical Society. Secretary, G. H. Guy, 33 West 39th St., New York.

New York State Independent Telephone Association. Secretary, R. M. Eaton, Niagara Falls, N. Y.

Northwest Electric Light & Power Association. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, Seattle, September, 1909.

Northwestern Electrical Association. Secretary, John S. Allen, Lake Geneva, Wis. Next meeting, Milwaukee, January, 1910.

Ohio Electric Light Association. Secretary, D. L. Gaskill, Greenville, Ohio.

Ohio Independent Telephone Association. Secretary, Ralph Reamer, Columbus, Ohio.

Ohio Society of Mechanical, Electrical & Steam Engineers. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Canton, Ohio, May 21 and 22, 1909.

Oklahoma Electric Light, Railway & Gas Association. Secretary, Galen Crow, Guthrie, Okla.

Old Time Telegraphers' & Historical Association. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburg, Pa., 1909.

Pacific Coast Electric Automobile Association. Secretary, J. T. Halloran, 604 Mission St., San Francisco, Cal. Next meeting, Oakland, Cal., February, 1910.

Pennsylvania Electric Association. Secretary, E. L. Smith, Towanda, Pa.

Pennsylvania Street Railway Association. Secretary, Charles H. Smith, Lebanon, Pa.

Pike's Peak Polytechnic Society. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

Society for the Promotion of Engineering Education. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

Society of Wireless Telegraph Engineers. Secretary, C. E. Russell, Boston, Mass. Monthly meetings, fourth Monday of each month.

South Dakota Independent Telephone Association. Secretary, E. R. Buck, Hudson, S. D.

Southwestern Electrical & Gas Association. Secretary, J. A. Myler, Jr., 609 Juanita Building, Dallas, Tex. Next meeting, Dallas, Tex., May, 1909.

Street Railway Association of the State of New York. Secretary, J. H. Pardee, care of J. G. White & Co., New York.

Vermont & New Hampshire Independent Telephone Association. Secretary, E. B. Seeley, St. Johnsbury, Vt.

Vermont Electrical Association. Secretary, A. B. Marsden, Manchester, Vt.

Underwriters' National Electrical Association. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass.

Western Association of Electrical Inspectors. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., October, 1909.

Western Society of Engineers. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

Wisconsin Electric & Interurban Railway Association. Secretary, Dudley Montgomery, Madison, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 27, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

919,302. MOTOR-CONTROL SYSTEM; A. H. Armstrong, Schenectady, N. Y. App. filed July 21, 1906. For electric railways in which an induction motor acts as a braking generator by interposing between the motor and the source a motor-generator, the motor field of which is excited by alternating current, and then varying the frequency in accordance with variations in the speed of the braking generator.

919,338. TRANSFORMER; J. J. Frank, Schenectady, N. Y. App. filed Dec. 17, 1907. Of the core type for polyphase circuits in which primary and secondary windings surround certain of the legs of the core and suitable connections connect on current sources of various phases.

919,[illegible]. CLEANING AND HEATING DEVICE; A. B. Herrick, Cleveland, Ohio. App. filed Nov. 25, 1904. For clamping and heating a rail bond in which a flexible conductor is flexed and a high resistance medium is mounted on the free end.

919,364. HEATING SYSTEM; H. Lemp and W. G. Fisher, Lynn, Mass. App. filed Nov. 17, 1906. For electric locomotives in which a tubular heating coil has a current of electricity flowing through the walls and means for forcing liquid into the interior of the coil.

919,365. HEATING SYSTEM; H. Lemp, Lynn, Mass. App. filed July 1, 1908. For heating railway cars where electricity supplies the heat in which a boiler has a heating coil, the latter supplied with electric current and a meter controls the current.

919,366. HEATING SYSTEM; H. Lemp, Lynn, Mass. App. filed July 2, 1908. For electric locomotives; in which the heater has a coil with electricity flowing through the walls thereof to heat a liquid contained therein.

919,381. ELECTRIC GLOW LAMP; H. Remane, E. Hurwitz, Berlin, and E. Gottschalk, Charlottenburg, Germany. App. filed July 18, 1907. For tungsten filaments attached to the melted ends of support parts, the latter containing an alloy of copper and nickel, which produces a fused joint that will not break.

919,384. TELEPHONE SWITCHBOARD CABLE; W. L. Runzel, Chicago, Ill. App. filed March 8, 1907. Consists of a plurality of cable units with their axes in a plane, an inclosing sheath, the opposite walls of the sheath sewed together and a separator through which the stitches pass.

919,385. BURGLAR ALARM FOR SUIT CASES, SATCHELS, ETC.; A. T. Ruthven, Topeka, Kan. App. filed Jan. 14, 1908. When the satchel is picked up a movable circuit-maker closes an alarm circuit.

919,386. INSULATOR; F. Schaub, Jersey City, N. J. App. filed Jan. 11, 1908. Has a base with a removable cap, with curved grooves in the parts to receive the wire.

919,394. TELEPHONE JACK BOX; J. B. Taylor and W. S. Bralley, Schenectady, N. Y. App. filed Aug. 14, 1908. Portable telephone set with flexible conductor and jacks for the train crews of electric railways, with a protective device connected with the line only when the jack is inserted in the box.

919,402. ELECTRICAL HEATING APPARATUS; W. E. Trumpler, Zurich, Switzerland. App. filed Feb. 25, 1907. A woven fabric with the woof of textile and the warp of heating wires.

919,403. APPARATUS FOR PRODUCTION OF OZONE; A. Vosmaer, Philadelphia, Pa. App. filed Oct. 22, 1907. A casing through which the air passes and a plurality of units in the casing each consisting of a rod having a tubular discharger. Details.

919,409. CLEAR-OUT SYSTEM FOR TELEPHONE SWITCHBOARDS; K. Weman and T. S. Hemenway, Buffalo, N. Y. App. filed May 29, 1908. To prevent ringing other parties when the disconnect signal is given by means of an electromagnet of high resistance connected across the cord circuit, a signal coil of lower resistance connectable across the cord circuit and a switch controlled by the magnet for connecting the signal coil across the circuit.

919,411. ELECTRICAL APPARATUS FOR WORKING PLANING MACHINES AND OTHER RECIPROCATING TOOLS; A. D. Williamson, Sheffield, England. App. filed Dec. 11, 1908. For producing a slow cutting stroke and quick return by means of a reversible variable speed electric motor and suitable switches.

919,423. LOCK SWITCH FOR ELECTRIC METERS; William S. Cord, Oceanpark, and H. F. Heywood, Los Angeles, Cal. App. filed Sept. 16, 1908. The current can be locked on or off by means within the meter casing. A switch is within the case and a fixed part on the meter and a key locks the switch to the fixed part in either closed or open position of the switch.

919,445. OZONIZER; A. Lohman, Philadelphia, Pa. App. filed Jan. 20, 1909. With micanite dielectrics. The ozonizer has a casing divided into a water chamber and end air chambers and a micanite dielectric is arranged in the tube which communicates with the air chambers.

919,449. TROLLEY; J. T. Minahan, Philadelphia, Pa. App. filed Oct. 27, 1908. A trolley guard to steer the wheel onto the wire and provided with an auxiliary wheel to contact with the wire when the trolley is almost horizontal.

919,450. THREE-POSITION SIGNAL; W. V. Moak, Schenectady, N. Y. App. filed Sept. 25, 1908. An electric motor with a member driven thereby and means for clutching the member to the semaphore arm to drive it from danger to caution with an electrical magnet controlling the member whose strength is increased above normal for stopping the arm before it reaches danger position in moving from clear to caution.

919,457. GALVANIC CELL; H. P. R. L. Porscke, Hamburg, Germany. App. filed July 15, 1907. Chlorid of iron is the depolarizer mixed with an acid of the arabin group.

919,458. FIELD POLE FOR DYNAMO-ELECTRIC MACHINES; H. Poth, Brooklyn, N. Y. App. filed March 9, 1906. For doing away with the cross magnetizing effect of the armature. By providing a pole piece secured to the leading horn side with an air space between itself and the pole and iron paths bridging the air space.

919,460. ELECTRICAL CLUTCH MACHINE; W. T. Price, Buffalo, N. Y. App. filed Nov. 20, 1907. An induction type of clutch having a field magnet, a motor of magnetic material covered with electrical conducting material and revolubly mounted with respect to the magnet.

919,463. ELECTRIC CONTROLLING MEANS; C. S. Reno, Cincinnati, Ohio. App. filed Dec. 12, 1907. A source of energy, a translating device, compensating windings and a controlling switch having protective devices.

919,472. ELECTRICAL SWITCH; T. W. Sanford, Chicago, Ill. App. filed July 24, 1908. A two-push button switch actuated by a spring, each plunger carrying the push button having an abutment flange and two stops rigid with the switchblade carrying member to engage the flange.

919,473. COMBINED SWITCH AND CUTOUT; H. R. Sargent, Schenectady, N. Y. App. filed Dec. 1, 1902. For street car lighting, having a rotary switch and inclosed fused contacts.

919,474. INCANDESCENT LAMP; H. R. Sargent, Schenectady, N. Y. App. filed Aug. 1, 1904. A socket having an insulating base with a central chamber and side recesses and divided into sections.

919,480. ELECTRIC HEATER; G. E. Stevens, Lynn, Mass. App. filed Nov. 29, 1907. For heating air, particularly for foot warmers, comprising a box with a perforated ornamented top and an electric heater distributing heat throughout the area of the top.

919,491. AUTOMATIC DRINKING APPARATUS FOR ELECTRICAL CIRCUITS; L. O. Surles, Atlanta, Ga. App. filed June 30, 1906. For automatic trunking between exchanges. Details.

919,495. INDICATOR AND ADVERTISER; C. H. Townsend, Berkeley, Cal. App. filed Dec. 23, 1907. A display sign driven by an electric motor.

919,510. EDGEWISE WINDING MACHINE; J. J. Wood, Fort Wayne, Ind. App. filed Oct. 3, 1907. A rotary support for carrying ribbon coil-reels.

919,511. DYNAMO-ELECTRIC MACHINE; J. J. Wood, Fort Wayne, Ind. App. filed Nov. 22, 1907. For the fields of dynamo-electric machines to avoid the danger of centrifugal force in which the spider has pole pieces having indentations and retaining rings to engage the indentations to clamp the pole pieces to the spider.

919,514. ELECTRIC MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Jan. 15, 1908. Electric motor of the commutator type for direct and alternating currents, to be [illegible] The field coils are connected to the armature [illegible] current and a portion of the coils produce a commutating field for alternating-current operation.

919,516. PANEL BOARD FOR ELECTRIC POWER DISTRIBUTION; M. E. Ames, Chicago, Ill. App. filed Oct. 21, 1908. A number of users are supplied from a single source and the supply is metered.

919,519. TELEPHONE CUTOUT AND LIGHTNING ARRESTER; W. E. Ashby, Chariton, Ia. App. filed Feb. 18, 1908. A plurality of telephones can be connected through the cutout with the same circuit of line wires. The lightning arrester includes two pairs of combs.

919,523. ELECTRIC MOTOR; R. E. Barker, Lynn, Mass. App. filed Oct. 14, 1907. Single-phase induction motor with a single centrifugal device with connections to a controlling switch and clutch to automatically operate both .

919,524. INDUCTION MOTOR; H. L. Barnholdt, Pittsfield, Mass. App. filed Oct. 31, 1907. Squirrel-cage motor in which the end rings are split with means for closing the split portions automatcially by centrifugal force when at speed.

919,527. INDUCTION MOTOR; S. R. Bergman, Lynn, Mass. App. filed Oct. 21, 1905. Squirrel-cage motor with two windings, one of low and the other of high resistance, one for starting and the other for use at speed.

919,535. AUTOMATICALLY OPERATED ELECTRIC SWITCH; J. C. Calhoun, Holland, Mich. App. filed Sept. 17, 1906. A rock shaft carrying two contacts with mercury cups into which the contacts alternately dip.

919,537. INDUCTION MOTOR CONTROL; F. E. Case, Schenectady, N. Y. App. filed July 8, 1908. Adds impedances in the primary circuit with short circuiting switches to cut them in and out as the several sections of the secondary impedances are short circuited.

919,547. DYNAMO-ELECTRIC MACHINE; W. F. Dawson, Rugby, England. App. filed July 15, 1908. Current-collecting and short-circuiting devices for induction motors with coil-wound motors.

919,563. SUBMERGED FUSE; C. E. Eveleth, Schenectady, N. Y. App. filed May 4, 1905. A tank, a liquid therein, a fuse in the liquid, and a baffle plate providing a tank, with apertures through which the fuse passes.

919,569. LIGHTNING ARRESTER; W. Gifford, Traverse City, Mich. App. filed March 25, 1908. A bank of high-resistance conductors each in series with an air gap.

919,571. CLAMPING EAR FOR TROLLEY WIRES; F. Guillot, Schenectady N. Y. App. filed Oct. 10, 1907. The ear comprises two jaws which slide in a holder in which they have a bearing so that when spread apart by a wedge the lower edges engage the sides of the trolley wire.

919,573. CONTROL OF RAILWAY APPARATUS; L. A. Hawkins, Schnectady, N. Y. App. filed July 16, 1908. Track switches, driven by electric motors, with a magnetic clutch for connecting the motor to the switch.

919,575. RHEOSTAT; H. E. Heath, Lynn, Mass. App. filed Aug. 4, 1905. A resistance unit of cast silicon provided with a contacting terminal.

919,577. RAIL BOND; G. H. Hill, Schenectady, N. Y. App. filed Dec. 19, 1907. A laminated body, a sheet metal cap enclosing an end and having a perforated base and a rib integral with the base and extending between two of the laminations.

919,578. RELAY; G. H. Hill, Schenectady, N. Y. App. filed Sept. 28, 1908. A relay for railway work in which when the relay is tipped over by accident a ball comes out of a cup and moves the armature to the position to which it is normally moved by gravity.

919,584. VAPOR ELECTRIC DEVICE; P. A. Huguenin, Paris, France. App. filed Nov. 21, 1907. A mercury vapor device, inclined and pivoted, with a solenoid to move the device to the opposite side of the horizontal and a cutout for the solenoid.

919,593. DENTAL ENGINE; M. Kelly, Hammond, Ind. App. filed April 25, 1908. Means for attaching an electric engine to a suspended cable and for connecting the tool with the motor.

919,604. DYNAMO-ELECTRIC MACHINE; H. Lippelt, Lynn, Mass. App. filed Feb. 3, 1908. Has a multipolar field, an open coil armature, the field magnet having main poles unevenly spaced with respect to the armature, and having shunt and series windings, together with series wound auxiliary commutating poles occupying the spaces.

919,626. COLLECTOR RING; J. E. Noeggerath, Schenectady, N. Y. App. filed Nov. 26, 1907. For acyclic generators run at high speeds in which a collector shell carries collector rings having feet with elastic tapering side portions, so that expansion of the rings does not produce undue strains.

919,633. DISTRIBUTION SYSTEM; F. W. Peek, Jr., Schenectady, N. Y. App. filed Dec. 14, 1908. For distributing the load on generators having regulators of the Tirrill type. The voltage regulator contains a differentially wound magnet, one winding varying with the voltage of its own generator and the other with the load on the other generator.

919,646. TRANSMITTER FOR IMPULSE-DRIVEN CLOCK SYSTEMS; F. M. Schmidt, Brooklyn, N. Y. App. filed Nov. 5, 1908. For synchronizing clock systems controlling secondary clock from a master clock. Details.

919,647. FEED AND POSITIVE LOCK FOR CLOCK TRAINS; F. M. Schmidt, Brooklyn, N. Y. App. filed Nov. 5, 1908. For moving clock trains step by step. Details.

919,662. REGISTER FOR TELEPHONES. W. O. Weissich, San Francisco, Cal. App. filed Dec. 29, 1906. For registering calls and the tolls due in which a plunger is operated by the subscriber, a lock prevents the movement thereof, a magnet releases the lock, the magnet being controlled by central.

919,670. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed Aug. 3, 1906. Uses both alternating and direct currents and a converter for transforming either kind to the other. Controls the division of the load between two sources of alternating current independent of any changes of speed of the rotary converter.

919,672. SOLENOID; C. J. Anderson, Chicago, Ill. App. filed Oct. 16, 1908. Avoids the humming noise produced when the alternating-

919,[illegible]. ELECTRICALLY HEATED DRINKING GLASS; [illegible] Cahill, St. James, N. Y. App. filed Nov. 23, 1908. A drinking glass [illegible]

919,[illegible]. INDIVIDUAL PROTECTOR; [illegible] filed June 10, 1908. A fuse for telephones, having an iron core and [illegible] through the [illegible] the body at the base.

919,702. FIRE ALARM BOX ATTACHMENT; E. A. [illegible], Mt. Royal, and H. Keyser, Baltimore, Md. App. filed June 16, 1908. Arranged to permit actuating the alarm by automatically applying a handcuff to the operator, which can only be unlocked by a key carried by the fireman.

919,724. ELECTROLYTIC METER; G. Hookham and S. H. Holden, Birmingham, England. App. filed June 1, 1908. The meter has a storage cell and an anode capable of absorbing the gas, together with a measuring tube.

919,734. ELECTRIC FUSE CASE; T. E. Murray, New York, N. Y. App. filed Sept. 28, 1908. A tubular fuse case with a disk-shaped cover, with means for locking the cover in place.

919,763. TROLLEY WIRE SUPPORT; J. W. Porter, Chicago, Ill. App. filed Nov. 16, 1907. Separable clamping members clutch the trolley wire and are provided with tongues and slots forming the securing and locking means instead of bolts.

919,790. SECONDARY ELECTRIC CLOCK; J. Steiger and J. Besancon, La Chauz-De-Fonds, Switzerland. App. filed July 7, 1908. A rotary electric motor has a lost motion connection with the pallet actuating the hand operating wheel.

919,803. MAXIMUM TRACTION TRUCK; W. S. Adams, Philadelphia, Pa. App. filed June 20, 1908. Improvements in trucks for cars.

919,811. ELECTRICAL SWITCH; H. A. Beynon, Chicago, Ill. App. filed May 11, 1907. For automatically switching on an electric light for bookkeepers in which the switch is closed by a platform on which the bookkeeper stands.

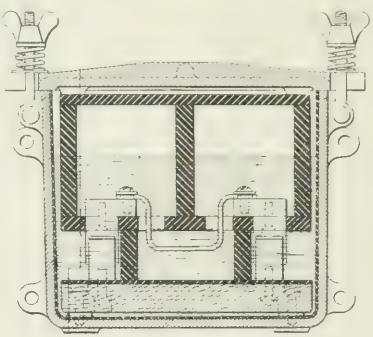
919,812. TELEPHONE APPARATUS; C. E. Bilton, Bridgeport, Conn. App. filed July 28, 1908. A telephone case of sheet metal having a back plate with cars and the central portion of the front stamped outward to form a pocket to receive a diaphragm.

919,821. INCANDESCENT ELECTRIC LIGHT; W. J. Carpenter and T. F. McDermott, Providence, R. I. App. filed Aug. 16, 1907. Improvement in the bulb and socket for electric lights. Details.

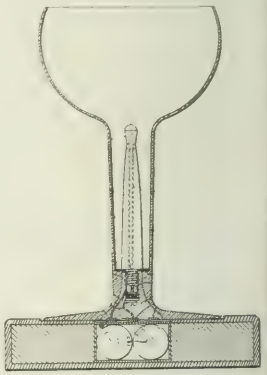
919,830. TERMINAL FOR ELECTRIC CABLES; C. W. Davis, Edgeworth, Pa. App. filed June 5, 1907. A terminal having a plug and a case, said plug consisting of a core and a surrounding body of insulating material in moisture-tight contact therewith and having a flaring leakage preventing petticoat.



919,423—Lock Switch for Electric Meters.



919,363—Submerged Fuse.



919,691—Electrically Illuminated Drinking Glass.

919,843. ELECTRIC HEATER; W. C. Fish, Lynn, Mass. App. filed Jan. 13, 1906. A heating base for receiving various utensils having a smooth tapering surface into which the receptacles fit.

919,862. SQUIRREL-CAGE ROTOR FOR ELECTRIC MOTORS; E. Heitmann, Montclair, N. J. App. filed July 15, 1908. The core is laminated and the conductor bars have transverse slots with coils engaging the slots and electrically connecting the bars.

919,900. PRIMARY ELECTRIC BATTERY; G. A. Lutz, Plainfield, N. J. App. filed Dec. 12, 1908. The depolarizer is a plate of cupric oxide, the positive electrode is zinc. An insulating block supports a frame which carries the depolarizing plate.

919,908. ELECTRICAL RESISTANCE DEVICE; H. S. Martin, Liverpool, England. App. filed July 13, 1908. A compression resistance body consisting of a mixture of mica in the form of scales with powdered graphite and sand.

919,940. OUTLET FIXTURE FOR CONDUITS; H. T. Paiste, Philadelphia, Pa. App. filed March 18, 1908. A fixture consisting of a hollow structure having a plurality of openings, a lamp socket mounted over one of said openings, another opening having its inner end threaded and its outer portion unthreaded, a conduit engaging the unthreaded portion.

919,968. TROLLEY WHEEL BEARING; A. C. Sloan, Salamanca, N. Y. App. filed Aug. 28, 1908. A lubricating device surrounds the axle which is made tubular to receive the device.

919,994. ELECTRIC SWITCH; G. Wright, Pittsfield, Mass. App. filed Aug. 3, 1905. Automatically indicates the different positions of the switch. The indicator is mechanically connected with the locking mechanism for the switch to show when the switch is opened.

919,996. ELECTRIC SIGNALING SYSTEM; S. M. Young and F. Townsend, New York, N. Y. App. filed Sept. 2, 1908. Automatic block system for electric railways supplied with high-frequency, alternating current connected at intervals across the rails.

919,998. STARTING RHEOSTAT; P. H. Zimmer, Schenectady, N. Y. App. filed Dec. 26, 1907. A starting rheostat comprising a resistance varying arm, a plurality of independently actuated switches in series therewith, and means whereby said switches are closed by an initial movement of said arm.

920,005. PLUG FUSE; H. U. Badeau and F. P. Poole, Bridgeport, Conn. App. filed Dec. 19, 1908. A cup-shaped porcelain body with terminals and within it a flat fuse strip having a reduced cross section for the melting point.

921,024. ELECTRIC CLOCK; E. E. Clement, Washington, D. C. App. filed Dec. 2, 1908. Avoids the use of moving parts upon the dial.

[illegible] minutes with means for operating each device in chronometric order.

920,030. SWITCH SIGNAL; R. B. Cunningham, Chicago, Ill. App. filed Oct. 8, 1908. A railroad track switch having an alarm bell which rings when the switch is open.

920,032. ELECTRIC SWITCH; C. W. Denny, Middletown, Ohio. App. filed Aug. 3, 1908. For starting alternating motors. A double-throw switch having a plurality of switch blades with a protective device for overloads.

920,034. TELEGRAPHIC TRANSMITTER; P. Dinger, Cleveland, Ohio. App. filed July 25, 1907. The main vibrator has a fixed weight with a stem and contact adjusting device connected with the key under spring tension so as to impart acceleration to the vibrator for making sharp dots.

920,036. RELAY; F. L. Dodgson, Buffalo, N. Y. App. filed Nov. 3, 1908. A polarized relay for railway signaling having permanent magnets surrounding the three sides of the pole piece so that the magnetic effect of all poles tends to rotate them in the same direction.

920,040. SINGLE-PHASE MOTOR; F. Eichberg, Berlin, Germany. App. filed May 22, 1909. Of the commutator type having an inducing winding on the stator and an armature winding with commutator. Main brushes short circuit the rotor on the line of magnetization of the inducing winding, and exciting brushes magnetize at an angle to said line with means for introducing into the circuit of the main brushes a shunt voltage assisting the voltage produced by the inducing winding.

920,043. TELEPHONE PARTY LINE SWITCHING APPARATUS; A. J. Farmer, Detroit, Mich. App. filed April 19, 1905. For selectively connecting and calling the station, effecting the proper sequence of signals at the exchange, and automatically restoring the selective apparatus. A controlling magnet and armature is controlled by a relay which is in multiple with its actuated contact, and a normally open contact and a contact closed only during the movement of the armature are provided for the purpose.

920,045. TIME-LIMIT CIRCUIT BREAKER; W. Fellenberg, Charlottenburg, Germany. App. filed Aug. 29, 1907. Opens in circuit after an abnormal current has persisted for a predetermined length of time by means of thermostatic strips.

920,052. TURBO-GENERATOR; B. H. Hamilton and W. E. Ver Planck, Lynn, Mass. App. filed April 19, 1907. The turbine and dynamo have a casing permitting circulation of air and discharging the air over the current-collecting devices.

920,073. APPLICATION AND DISTRIBUTION OF ELECTRIC MOTIVE POWER, PARTICULARLY FOR USE IN STARTING MACHINERY AND FOR SIMILAR PURPOSES; G. W. Mascord, London, England. App. filed April 9, 1906. An electric motor has a slow-speed positive clutch and a high speed between the motor and the driven shaft with hand means for operating the clutches.

920,078. ELECTRICAL FURNACE; H. Nathusius, Friedenshutte, near Morgenroth, Germany. App. filed Aug. 25, 1908. For refining steel by means of a hearth, a cover having slots, electrodes guided by the slots and additional electrodes passing the current through the material on the hearth.

920,084. RECORDING INSTRUMENT; W. H. Pratt, Lynn, Mass. App. filed Aug. 10, 1907. The movable coil is mounted on a stretched wire with two flexible filaments for sustaining its weight.

920,097. NEUTRALIZING INDUCTIVE DISTURBANCES; J. B. Taylor, Schenectady, N. Y. App. filed Nov. 20, 1907. For avoiding induction by electric railways on telephone lines by means of a transformer having one coil in series with the conductor carrying the inducing current, the other coil being inserted with the other conductor and a resistance in circuit with said last-named coil.

920,103. BATTERY CHARGING APPARATUS; F. E. Case, Schenectady, N. Y. App. filed Nov. 25, 1908. Automatic means for connecting and disconnecting the battery from its source, together with means operative when the battery is disconnected for interrupting the operation of the automatically operated switch.

12,946 (REISSUE). PREPARATION OF THE INDIGO VAT EMPLOYED IN DYEING; Henri Chaumat, Paris, France. App. filed Oct. 8, 1908. Electrolytic process in which the bath of alkaline salt is protected from air and in which the cathode consists of powdered indigo blue mixed with graphite.

12,947 (REISSUE). STARTER FOR ELECTRIC MOTORS; W. C. O'Brien, Baltimore, Md. App. filed March 24, 1909. Two solenoids control a plurality of switch levers.

12,950 (REISSUE). ELECTROMAGNETIC TRACTION DEVICE AND EMERGENCY BRAKE; C. A. Wells, Chicago, Ill. App. filed Sept. 27, 1906. Increases the traction between the wheels and the rails by magnetizing the wheels and using a magnetizable shoe which may be thrown into contact with the rail.

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The Export Trade.

The dullness that has marked the electrical export trade for so many months is evidenced again in the figures for March just to hand. The revival of foreign demand does not yet show itself as one would hope; but the consolation, if such it can be called, is that in almost every other branch of American mechanical production the same lack of good purchasing power abroad is seen in smaller totals. Cars, locomotives, builders' hardware, scientific instruments, clocks, sewing machines, woodworking machinery, pipe, musical instruments, jewelry—all come up with shrunken figures for the month or the nine months; and in reality there is more comfort to be found in the electrical items than in many of the others.

The electrical apparatus and instruments shipped abroad during March reached a value of $681,083 as compared with $444,542 in March, 1908, which is a cheering gain; but the total for the nine months was only $4,449,914 as compared with $5,281,944. There is plenty of leeway to make up. The value of heavy electrical machinery for March was $579,499 as compared with $600,636 in the previous year—a very slight difference. But for the whole period of nine months the total was only $4,813,096 as compared with $6,800,048, a very sharp decline. With regard to electrical instruments the loss is general, but chiefly in Brazil and Japan; while in electrical machinery it has occurred heavily in Mexico and Japan. The detailed tables prove the lessened consumption all over the globe, due to the universal dullness about which doubt long since ceased. All that can be hoped for is the early return of world-wide prosperity—but it should be foreseen by a keen search for markets.

Temperature Limits in Electrical Machinery.

The factor which determines the permissible output from large stationary transformers is the temperature beyond which the insulation will be injured or the core will begin to "age," rather than the efficiency or the voltage-regulation of the apparatus. In order to permit such transformers to be used economically, it is necessary to provide some means for carrying away the heat from the points at which it is generated within the transformers, at a rate greater than the natural circulation of the surrounding air would afford, and hence artificial cooling must be resorted to. In certain forms of revolving machinery it is found that before the maximum permissible temperature is reached, certain other limits, such as commutation, efficiency, regulation, etc., are encountered, so that it is necessary to arrange for artificial cooling. However, in most types of alternating-current machines, in many types of direct-current machines and in practically all machines when designed with a view to removing other limits, the maximum continuous load is determined by the permissible temperature rise, and the output rating can be increased by providing means for cooling the machines

Only in relatively recent years has really effective artificial cooling been used with revolving machines, and even at the present day many of the ancient methods of indirect cooling are employed. The placing of ventilating ducts in the cores of an armature is somewhat more effective than leaving air spaces in a self-cooling transformer, but it is not comparable to the artificial-cooling methods commonly employed with transformers to-day. Only in totally enclosed high-speed turbo-generators equipped with ventilating fans is the cooling by air circulation as effective as that used with air-blast transformers. The advantage to be gained by using forced draft in cooling even the smaller sizes of motors and generators are discussed in detail in an article by Mr. Alex. Churchward in this issue. This article deals with a subject to which designers, manufacturers and users of electrical machinery will in the future give much more attention than in the past .

Location of Faults in Cables.

The ordinary method of localizing electrically a slight ground in a telegraph or telephone cable conductor is to select another wire, which is in good electrical condition, have it connected at the distant station with the faulty conductor so as to form a loop with a single fault, and then to obtain a Wheatstone-bridge balance on this loop between the resistances to the fault from the two ends of the loop. Such a test is called a loop-test, and according to the particular variety of Wheatstone bridge used, either a Murray or a Varley loop-test. As a variant of the method, in the case of telephone-pair cables, each pair of wires in the cable may be looped at the far end of the cable, and the observer at the home end can then select a good pair to go along with the faulty pair. He then connects one end of the good pair to one end of the bad pair, and so establishes a final loop that has a total length of four times the length of the cable. The only advantage of this arrangement is that if all the distant couplings have been made originally, no attention is required at the distant end of the cable and the tester at the home end can make or unmake any loop at leisure and at will.

The precision of a loop test is known to be very high when conditions are favorable. The most favorable conditions are a high resistance per mile of the cable conductors, a low resistance in the fault, a total length in the loop not more than, say, a mile or two, a high normal insulation in the conductors, a high insulation in the good wire of the loop, uniformity in the diameter of the cable conductors and in their resistance per mile, uniform temperature of the cable, absence of earth-current, or of leakage from trolley systems, good measuring instruments, care and skill in the measurement. Under the most favorable conditions faults in such loops have been located to an electrical precision of a single foot, and to a precision in mechanical distance of 2 ft. or 3 ft. Among the most frequently arising unfavorable conditions is that of a high-resistance fault, and particularly when the resistance of the fault is of the same order of magnitude as the normal insulation of the loop. Under such conditions, assuming the same skill and care expended on the measurements, the location is obtained, not of the actual fault, but of the resultant of the actual fault with the total resultant insulation leak of the loop. It is well known to electrical engineers that a correction for the resultant fault has to be applied to the localization. If the real fault happens to coincide with the resultant leak of the normal loop, the correction vanishes. If, however, the real fault is remote from the resultant normal leak, the correction may be very large.

On page 1165 of this number, Mr. H. Mauradian discusses the correction for the Murray loop test when the resistance of the fault is high and when the good wire of the loop has a total leak that is of the same order of magnitude as the fault. He arrives at a simple correction formula, which is worth recording. It should be observed, however, that certain assumptions appear to be involved in the proposed formula that may not always be substantiated. In the first place, the normal leak of the faulty wire is ignored, or taken as zero. In other words, before the existence of the fault, the insulation of the wire to be repaired is taken as perfect. Secondly, the resultant leak in the good wire is taken at the middle of its length; and while that is the most probable place for it, in the absence of evidence to the contrary, it is by no means the only possible place. The consequence of this is that the normal leak is assigned a magnitude equal to the leak in the good wire, and its position is assigned half way along that wire, whereas the actual normal leak is frequently near to the middle of the entire loop. While, therefore, this particular Murray loop correction formula may be useful in a number of instances, it is advisable to remember that when the greatest care is called for, the general formulas of resultant fault correction are more to be depended upon, especially when long cables are under consideration.

Principles of Constructing Wireless Telegraph System.

This topic is the subject of a recent article in the *Elektrotechnische Zeitschrift* by Dr. F. Kiebitz. The article shows that with the ordinary type of spark-discharge telegraphy, the efficiency of the sending system may be very low. In a particular assumed instance of 1000 watts absorbed from the generator it is claimed that only 10 watts would arrive at the antenna, and of this only about 1 watt may be radiated, making a net efficiency of 1/10 per cent. On the other hand, the article points out that with the aid of the modern system of sustained oscillations, the efficiency of radiation has been enormously increased so that it becomes possible to approach the problem of designing a sending station as an electromagnetic machine. A long period of fact and formula accumulation will be necessary before we can hope to design wireless telegraph stations with a similar degree of precision to that available for wire telegraph stations. In the latter, we know just what number, sizes and types of apparatus must be installed to supply a given number and lengths of telegraph wires for an assigned traffic. With wireless telegraphy, the data are very empirical. Small stations of short range can be safely installed by experience gained with preceding equipments; but just why and where the limits exist, have not yet been reduced to arithmetic. As for long-distance wireless transmissions, the data for their construction are still in the air. For many reasons, the success of the United States long-distance wireless telegraph station on the Chesapeake will be a matter of great interest to all electrical workers. This station is to have a tower 650 ft. high which must be able to send messages 3000 miles in any direction. In order to cover this range over the land, it would seem necessary to cover the ocean to a distance of 5000 miles or more, enough to embrace all the coasts of Europe.

The Technics of Arc Lamps.

A recent exhaustive and able paper by Dr. Monasch in the *Elektrotechnische Zeitschrift* gives an admirable résumé of the progress in the development of the electric arc lamp from the European standpoint. It is particularly instructive in that the comparisons it makes are based on first-class Continental practice and not flavored for commercial purposes. For example, the open arc taken as typical burns at 15 amp and gives about 1500 mean lower hemispherical hefners at a specific consumption of about 0.55 watt per hefner. Such a lamp would certainly create a sensation in any American city when contrasted with the kind of thing generally used. Dr. Monasch comments on the introduction of the enclosed arc in terms that make rather interesting reading for those interested in street lighting, and particularly notes the effect of the double enclosing globe on the already weak light flux, particularly toward the end of the long life of the carbon. He credits the direct-current enclosed arc with a specific consumption of a watt or more per mean lower hemispherical hefner when equipped with a clear, and presumably clean, inner globe and no outer globe. It would be interesting to know his unbiased opinion of the alternating-current enclosed arc under service conditions. His figures for the so-called "economy" lamps with single globes and small carbons are very instructive as showing the weak points of lamps specialized for long burning. An "economy" lamp at 6 amp using 7-mm carbons gives with clear globe about 1100 lower hemispherical hefners, while when trimmed with 13-mm carbons the light falls to 620 hefners. We could show him lamps trimmed with other carbons giving much less light than this for the same input. For lamps with opalescent inner and clear outer globes, the late Professor Matthews generally found a scant 400 hefners, even when the current was pushed to 6.5 amp.

From lamps of these types Dr. Monasch passes to modern flaming arcs of the sorts now in extensive use on the Continent for street lighting, incidentally paying his respects to the Carbone type of carbon arc, which he credits with an efficiency lying between that of the ordinary (European) open arc and the enclosed arc. The two types of flaming arcs selected for comparison are, on the one hand, the common form with inclined carbons giving a yellow flame, and the Blondel lamp with vertical carbons of the white variety. These carbons as made by the Siemens Company, by the way, give a light that in color is almost indistinguishable from that of a powerful open arc with pure carbon electrodes, while the luminous efficiency of the mineralized carbons is nearly three times that of the ordinary ones. The Blondel type of lamp gives a decidedly better distribution of light than does the lamp with inclined carbons, throwing the maximum of light further up toward the horizontal; and, other things being equal, its efficiency also seems to be higher. In the comparison before us it gave slightly greater luminous efficiency than its rival in spite of the white carbons, which give light physiologically less efficient than the light yellow of the ordinary flaming arc. A 15-amp lamp of the latter sort gave 3380 mean lower hemispherical hefners as against 3520 for the corresponding type of Blondel lamp. As these figures apply to the lamps with thin opal globes, it is clearly shown that their power is altogether exceptional even for flame arcs, as might be expected from the very large energy input.

It is a pity that Dr. Monasch did not have access for comparative purposes to the American "luminous" arcs, which belong fairly in the flame class, although suffering somewhat from too much specialization in the direction of long life. It is very difficult to get an authoritative value for these arcs, since they have been generally tested with clear globes and are commonly for low input; but the luminous efficiency per mean hemispherical hefner is quite certainly better than that of the big open arcs cited by Dr. Monasch, and very much better than that of even the best enclosed arcs of approximately equal life. The magnetite arc pushed to 6.6 amp, such as has been recently adopted for the public lighting of Boston, is powerful and efficient enough to call for the attention even of Continental experts. The arcs compared by Dr. Monasch are on an 825-watt basis, far in excess of any input standard in this country, and probably in excess of economical limits for street lighting, although suitable enough for public squares. They are four in number: an enclosed arc at 7.5 amp, an open arc at 15 amp and the two flame arcs before referred to. The enclosed arc gave 800 mean lower hemispherical hefners, and the open 1200 as compared with the figures for the flame arcs already given. The spherical values were in due order 511, 762, 1915 and 2090 hefners. It is instructive to note that in these four lamps of so radically different types, the ratios between mean spherical and mean hemispherical candle-powers were fairly uniform, all within a few per cent of 0.6, which is an easy figure to remember. The biggest arc of them all, the type Blondel, with Siemens white carbons, has recently been installed on several important streets of Berlin, where it was already in use for lighting public squares.

Going on with the comparison, Dr. Monasch shows the illumination curves for these various lamps. They are vastly instructive to one who is used to seeing the usual article carefully drawn up to show how some freak lamp with nothing to recommend it save an erratic distribution can give enough light to see a white horse by 200 ft. further than the nearest competitor. These present curves are quite another matter. They start with lamps hung 10 m high and 60 m apart, and with the intent of getting perceptible illumination on a plane a meter above the pavement, even at the point midway between arcs. Under these conditions the lamps show about what would be expected. The flame arcs ran well over one lux at the midpoint, the vertical carbons having decidedly the advantage in distribution, while the carbon arcs barely touched half a lux, the enclosed one failing to reach this figure. The flame arcs gave five times the average illumination of the enclosed arc and about three times that from the open arc. In view of the fact that the proposed changes in the tariff on carbons will penalize flame lamps almost to prohibition, these figures are worth noting. Is it the intention to suppress improved arc lighting for the benefit of those who have apparently nothing to gain by improvements, and who have never seriously attempted to compete with the best grades of European carbon? We have every desire to encourage American industry, but in certain cases the best and only effective way to kick it up stairs is to open the door wide to the entry of high-grade material. The free entry of mineralized carbons would not only help the public that depends on arc lighting, but would hasten the improvement of American lamps and encourage the use of more of them. We want to see more streets lighted up to the German standard.

Report of International Electrotechnical Commission.

The International Electrotechnical Commission has issued in printed form a report of the biennial meeting in London last October of that body. The body was organized at a preliminary meeting held in June, 1906, at which the late Lord Kelvin was elected president, who was succeeded by the late Professor Mascart; at the opening of the recent meeting Prof. Elihu Thomson was elected president to succeed the latter. A portrait of Professor Thomson forms the frontispiece of the report, which also includes an engraving giving a group view of the delegates of the various countries represented at the meeting. Mr. C. le Maistre, formerly acting secretary of the commission, was elected general secretary

The electrical engineering bodies of 16 countries were represented by official delegates, including Canada and Mexico. In the absence of any official representation from the American Institute of Electrical Engineers, Mr. C. O. Mailloux, who was in London at the time of the meeting, was invited to attend the sessions. The committee that considered in detail the various propositions brought before the body, and which was presided over by Sir John Gavey and Dr. S. P. Thompson, requested Mr. Mailloux, in view of his linguistic powers, to act as official interpreter, and at the final general meeting he was accorded a warm vote of thanks for his services. Among those in attendance whose names are well known were, in addition to the above-mentioned, Col. R. E. Crompton, W. M. Mordey, R. Kaye Gray, Alexander Siemens and Leon Gaster, of Great Britain; Dr. Emil Budde, of Germany; P. Boucherot and Ch. David, of France; S. Kondo, of Japan; Joseph Vater, of Hungary; Ormond Higman, of Canada. The British and German electrical engineering bodies were also represented by their secretaries, P. F. Rowell and George Dettmar, respectively. The next meeting of the body will be held in 1910 in Berlin. An account of the work of the meeting will appear in a following issue.

Entertainment Features of the N. E. L. A. Convention.

The arrangements for the entertainment of those attending the coming convention of the N. E. L. A. at Atlantic City have received the active attention of the entertainment committee, which has formulated an entertainment program in which the features are diversified so that everyone can find something to interest and amuse.

Arrangements have been made for the Million-Dollar Pier to be given over for the exclusive use of delegates on Monday night, May 31. The exhibition in the main hall will be formally opened at 8 o'clock. A reception will be held in the same hall at 9 o'clock, followed by dancing, at which light refreshments will be served on the balconies overlooking the ocean and the Boardwalk. Tickets will be provided for admission to the other piers and also for sails on a fleet of yachts at the Inlet.

The Inlet Baseball Park has been secured for Wednesday afternoon, and there will be a baseball game between teams made up of members representing the East and West. The teams will be made up of representative men in the lighting business, many of whom have had experience on either college or home clubs. Mr. Frank W. Frueauff will captain the Western team and Mr. Frank G. Vaughan will captain the Eastern team. The sub-committee in charge of the game, Mr. Joseph W. Lucas, of the Westinghouse Electric & Manufacturing Company, and Mr. Harrison Townsend, of the Philadelphia Electric Company, has been especially active in preparing unique features for this game.

On Thursday evening the large meeting-room on the Pier will be transformed and the delegates will be given a rapid trip to a night scene in Paris. The entertainment committee has named this feature a "Café Chantant," and it will consist of a high-class musical and vaudeville entertainment. The committee is still at work on other details, and if only a portion of its plan is carried out ample enjoyment is assured to attendants of the convention.

Specifications for Hard-Drawn Copper and Copper-Alloy Wires.

The American Society for Testing Materials has appointed a committee to draw up and report to the society in the near future specifications for hard-drawn copper and copper-alloy wire. The committee is made up of 10 members, five of whom represent large producing interests of the country and five large consuming interests. The recommendations of this committee, representing as it does such a large influence in the copper-wire industry, should go far toward fixing standard specifications for hard-drawn copper wire, thereby relieving the present conflicting and chaotic condition in this respect. Following is the membership of the committee: Mr. W. H. Bassett, American Brass Company; Mr. J. F. Tinsley, American Steel & Wire Company; Mr. J. A. Capp, General Electric Company; Mr. H. J. Horn, J. A. Roebling's Sons Company; Mr. C. C. Baldwin, Standard Underground Cable Company; Mr. H. W. Buck, Viele, Blackwell & Buck; Mr. F. W. Wallace, Waclark Wire Company; Mr. C. Crossman, Western Electric Company; Mr. T. D. Lynch, Westinghouse Electric & Manufacturing Company; Mr. C. D. Gray, J. G. White & Company.

Proposed Sale of Opposition Telephone Rights in Chicago.

The Illinois Tunnel Company, of Chicago, is operating under a franchise granted to its predecessor on the supposition that the original company would conduct a competing telephone-exchange service in Chicago, using automatic instruments, with tunnels underneath the streets for the purpose of carrying its wires. The telephone proposition was partially developed, but after a few years the ordinance was amended so that its owners were permitted to carry freight and merchandise under the streets of Chicago through the tunnels on narrow-gage electric railways. However, the terms of the ordinance still required that the company should have 20,000 telephones in service on Feb. 8, 1909. At that time this stipulation was not fulfilled, but a temporary extension was procured from the city authorities by which this provision was held in abeyance for a few months, and the question of what to do with the company's telephone privileges is now under discussion by the City Council committee on gas, oil and electric light. It is reported that the Illinois Tunnel Company is willing to sell its telephone franchise and equipment to the Chicago Telephone Company. Further, it is believed that the older company is willing to buy these rights, for it no doubt could make use of the network of tunnels constituting "Undeground Chicago" in extending its service. However, President B. E. Sunny, of the Chicago Telephone Company, is reported to have said that while his company is willing to make the purchase, it will not accept any requirement that it shall furnish toll connections in Chicago to Independent telephone companies in towns where the American Telephone & Telegraph Company or its licensees have systems.

Proposed Electrification of Steam Railroads in Illinois.

As reported in previous issues, there is a bill pending in the Legislature of Illinois known as the Gardner bill, amending the city and village acts to enable municipalities to stipulate the motive power to be used on railroads within the corporate limits. Strong opposition to this measure has been brought forward by the railroad companies, and it is not unlikely that the bill may fail to become a law or, if it does

pass, it may be so amended as to apply only to the larger cities, where there are railroad terminals, or possibly to Chicago alone. Railroad employees, backed no doubt by the railroad companies, have opposed the bill strenuously. They assert that the third-rail system would be dangerous to switchmen in the railroad yards and that the overhead trolley system would be only less objectionable. They also complain that electrical operation would result in reduction of wages of railroad trainmen to the standard of motormen, while many employees, such as firemen, would lose their positions altogether. The railroad companies themselves do not appear openly in opposition, trusting apparently to the more popular character of opposition from their employees.

As reported in the daily papers, some of the arguments presented against electrification were carried to an absurd extreme Thus, one representative of the Chicago, Milwaukee & St. Paul is reported to have said: "If you give any such power to the cities, we shall begin carrying trainmen out of switch yards about as fast as the ambulance corps picks them up on the field of battle." A contemptuous reference was also made, as reported, to the opposition to the objectionable character of the suburban service of the Illinois Central in Chicago by steam locomotives. The same man already quoted is said to have declared: "The women's clubs are all right, but if they did not have this to talk about they would have to have something else, and I understand they object because some pansy-beds along Michigan Avenue have been spoiled by smoke."

A more serious argument was made by a representative of the Chicago, Rock Island & Pacific, who said that the problem of electrification in Chicago was entirely different from that in New York, because in the former city freight-car handling was of necessity tied up with the passenger and suburban service. To this it is answered that the bill may be amended to give the cities the right to electrify passenger service without requiring the electrification of freight terminals.

Despite vigorous opposition to the bill, the Chicago newspapers appear to be friendly to it and point out that the railroads made the same sort of an outcry when it was proposed to elevate the tracks in Chicago, and also before the 2-cent fare law was passed. It is also pointed out that it must not be assumed that power given to the municipalities by the proposed law would necessarily be abused, or that impossible things would be required. The courts would review and reverse any action of this kind. Again, as to the "pansy-beds" remark, it is declared that none has a better right than women to protest against the dirty and costly smoke nuisance. Further, there is no doubt that the alleged dangers of switch-yard operation are greatly exaggerated, as is shown by the few accidents in the electrified railroad terminals in New York.

Uniform Accounts for Municipal Utilities.

The Ontario Railway and Municipal Board renews, in its report for the year ended Dec. 31, 1908, the recommendation that it be given authority to install a uniform system of accounting in all municipalities operating public utilities. The board holds that a uniform system is needed. Under the law the board is directed to superintend the system of accounts of all public utilities operated by municipal corporation or commission.

Discussing this subject, the report just issued states that in some cases municipal officers frankly confess their inability to supply the information required, advancing the plea that the systems of accounting and of record-keeping in operation preclude the possibility of furnishing much of the essential data sought by the board. In other cases, the report adds, municipal clerks disclaim any responsibility in furnishing the information, asking the board to designate the statute under which the additional work is imposed upon them of preparing the desired reports.

The board, therefore, expresses the opinion "that in the public interest a uniform up-to-date system of accounting and record-keeping should be installed in every municipality operating public utilities, so that every municipality will have at hand all the material necessary to furnish to the board from year to year, the vital data relating to the receipts and outlays in the operation of public utilities, and all statistics necessary to an intelligent analysis and study of the working of such utilities, in order that comparisons may be made with the results attained by other municipalities."

Notable Freight-Interchange Arrangement Between Steam and Electric Railroads.

Railroad men are greatly interested in the joint freight tariff just issued by the Chicago & Eastern Illinois Railroad Company, the Chicago, Rock Island & Pacific Railway Company and the Illinois Traction Company. This tariff provides for interchange of freight shipments, and it became effective on rates within the State of Illinois on April 28, while it will go into effect on interstate rates on June 1.

This arrangement is of far-reaching importance and of much significance as indicating the prominence now attained by electric interurban railways among the great railroad systems of the country. The Rock Island company controls the "Frisco" system, and the new contract puts the interurban system in a position to serve all its territory in the way of handling any class of freight to any point on the 15,000-mile Rock Island-Frisco system. Patrons of the Illinois Traction system will have any access to Chicago in the matter of making freight shipments that the Rock Island Railroad has. The rates are based on the distance tariff of the Illinois Railroad and Warehouse Commission. The Illinois Traction Company will handle all freight cars on a per diem basis and under the M. C. B. rules. It will be allowed the same division of through rates as would be the case with a steam railroad.

Occupying a strategic position in central Illinois, connecting Peoria, Danville, Springfield and St. Louis, the Illinois Traction system will be the originating and delivering company for three great railroad networks. Although, as in the case of a shipment to New Orleans, for example, the distance covered on the interurban lines may be short, nevertheless, the originating company will be allowed 25 per cent of the freight rate under the ruling of the Interstate Commerce Commission. Similarly, in receiving freight, the interurban company will receive not less than 25 per cent of the amount, no matter what the relative length of the haul may be. The arrangement is also advantageous to the steam railroads, for the position of the interurban railway is such that it is enabled to effect very convenient interchange of freight between different lines of the Rock Island system, and between that system and the Chicago & Eastern Illinois, saving long detours. In many cases the arrangement will result in greatly expediting shipments. It is said that last year the Illinois Traction Company derived a revenue of $500,000 from freight. Mr. B. R. Stephens, general traffic manager of the system, is reported as predicting that the interurban system will handle 5,000,000 tons of freight next year, and of this 75 per cent will be through shipments over the steam railroads.

The Illinois Traction system has about 500 miles of interurban track, and its freight equipment includes 30 electric locomotives, 51 motor express cars, 365 coal cars, 25 box cars and 20 flat cars.

Proposed Unification of Elevated Railroads in Chicago.

The plan outlined in the *Electrical World* of March 18 for the consolidation of the elevated railroads of Chicago received formal confirmation on May 3, when the committee in charge of the negotiations consisting of Messrs. Ira M. Cobe, Emile K. Boisot and Samuel Insull, addressed a letter on the subject to the boards of directors of the Chicago & Oak Park Elevated Railway Company, the Metropolitan West Side Elevated Rail-

way Company, the Northwestern Elevated Railroad Company and the South Side Elevated Railroad Company.

In brief, the proposition is that a corporation to be known as the Central Terminal Company, with at least $4,000,000 of capital paid in cash, be formed to lease and operate the lines of the elevated companies, paying a stipulated rental to each company. It is provided that each lease shall continue in force during the life of the franchise of the lessor company. Such lease shall include all the physical property of the lessor, including rolling stock, elevated structure, power plants, transmission lines, etc.

All costs of operation, repairs and all damages and legal expenses shall be paid by the Terminal company. Each lessor company shall make such extensions and improvements from time to time as may be requested by the Terminal company, subject, however, to such conditions as may be stated in the lease. To cover the cost of such extensions and improvements the lessor company shall issue its bonds to be purchased by the Terminal company or otherwise, as may be agreed upon in the lease. The property shall be delivered to the Terminal company free from debt, except accrued taxes and bonded indebtedness. The rentals to be paid are in addition to the interest on existing bonds and on such other bonds as it may be necessary to issue in order to retire floating indebtedness.

On the $10,000,000 capital stock of the South Side company the Central Terminal Company offers an annual rental of $300,000 for the years 1910 and 1911, amounting to 3 per cent a year; for the next two years 3½ per cent is offered; for the next two years 4 per cent; for the succeeding five years 4½ per cent, and the rental thereafter is to be 5 per cent. The Northwestern and Oak Park roads are under the same control. To the Northwestern road there is offered 4 per cent on the preferred stock of $5,000,000 for the year 1910, and 5 per cent thereafter. Beginning in 1912 there is offered an additional $50,000 a year, increasing by various amounts until, in 1921, this additional sum amounts to $350,000 a year available for both roads. Other than this the plan does not indicate what the Oak Park company shall receive. As to the Metropolitan elevated, the rental offered has not yet been made public, but in the case of this company, also, a lump sum will be paid annually and the directors of the Metropolitan company shall determine how the rental shall be distributed as between preferred and common stockholders.

An essential feature of the proposal is the purchase of the Union Loop, used by all the elevated railroad companies, by the new Terminal company. If the arrangement is carried out, each of the elevated companies, before turning over its property to the Terminal company, shall put it in good condition in accordance with the standard to be agreed upon. It is understood that the Oak Park company shall make large expenditures for track elevation and bring its road up to the required standard. The Terminal company agrees to maintain the property up to the standard under the terms of the lease.

The plan of the Central Terminal Company has been carefully worked out after elaborate calculations and engineers' reports considered during a period extending over several months, and it is quite likely that it will be adopted, although the stockholders of the companies affected must give it their approval by formal vote.

Manufacture of Metallic Filaments.

A United States patent issued April 6, 1909, to Mr. Johannes Schilling, Berlin, Germany, describes a process for the manufacture of metallic filaments for incandescent lamps. The process involves the use of a solution of sulphide of ammonia as a binding agent for forming a paste of the powdered metal or metal oxide. A 10 per cent solution is employed. About 30 parts by weight of this solution are mixed with 70 parts of the metals, such as niobium, tantalum, molybdenum, tungsten, uranium, titanium, thorium and zirconium or their oxides in the powdered state. The object is to produce a paste which may be squirted into filaments of the desired diameter. In practice for incandescent lamps a filament having a diameter of 7/100 mm when squirted suffices. It is said that trials made with this filament after squirting have shown that the squirted filament is only slightly inferior in conductivity to the pure metal which has been employed in its manufacture. A current is then led through the filament in the squirted state and the filament is in this way rendered incandescent so that the volatile constituents of the sulphide of ammonia, which are easily decomposed by heat, are soon driven off and the sulphur compounds formed when the current is first passed through are also driven off. The remaining metallic particles are welded together to form the metallic filament.

Niagara Falls Meeting of the American Electrochemical Society.

The fifteenth general meeting of the American Electrochemical Society, held at Niagara Falls, Canada, from May 6 to 8, was the most successful in the career of the society. The attendance was 321, of which 80 were members from Niagara Falls. The proceedings, especially of the first day, with the symposium of papers on the electrometallurgy of iron and steel, had a distinct international flavor. The fact that representatives of practically all large steel companies of this country were present, though not very largely participating in the discussion, bears evidence of the interest now taken by steel men in electric steel refining. The interest kept up to the last day, and the social functions were most enjoyable. The interest of central stations in the subject of an electrochemical load was indicated by the presence of Mr. Becker, of the Brooklyn Edison Company, and Mr. Russell, of the Philadelphia Edison Company.

Visits were paid in the afternoons to the various power companies and to the works of the International Acheson Graphite Company, and of the Development & Funding Company, where the Townsend cell for the electrolytic production of caustic soda and chlorium is in operation. At the power plant of the Ontario Power Company the repair work, necessitated by the damage due to the recent ice jam and flood and requiring the rewinding of the generators, was particularly interesting. On the evening of May 6 a very enjoyable smoker was held, followed by an amusing session of "Section Q," with humorous experimental lectures, etc. On the evening of May 7 a banquet was held, followed by dancing. On the evening of May 10 the Niagara Club tendered to the society an open house. This informal but very enjoyable function closed the program.

The annual reports show that the society is in a very flourishing condition with respect to membership and finances. The new president is Dr. L. H. Baekeland. Dr. J. W. Richards and Mr. P. G. Salom were re-elected secretary and treasurer respectively. Messrs. Tone, Hering and Bancroft were elected vice-presidents, and Messrs. Taylor, Miller and Walker, managers.

The presidential address of Dr. E. G. Acheson was presented on the evening of May 6 and dealt with the movement to conserve our natural resources, pointing out the special function which electrochemists have to fulfill in this movement. His plan involves forest creation and preservation, the impounding of waters, the construction of power plants, and lastly the development of waterways, ushering in the "age of electrochemistry," with which Dr. Acheson associated a new synthetic chemistry of wonderful possibilities.

The two sessions on Thursday morning and afternoon were devoted to the electrometallurgy of iron and steel. The first three papers dealt with the reduction of pig iron in the electric furnace. Dr. E. Haanel, Director of Mines, Canada, was the first speaker. On the part of the Canadian Government he greeted the society on its first meeting on Canadian soil. He then gave an account of the results of his recent visit to Sweden, where a new electric reduction furnace of the Ludvika Company was subjected to extensive tests which turned out very satisfactorily. This furnace is now to be used in a commercial electric iron reduction plant in Norway. It is essentially a combination of a shaft and an electric furnace. There are tuyeres by which the gaseous products of reaction, leaving the shaft at

the top, are blown again into the furnace; the object is to cool in this way the roof of the furnace chamber above the electrodes.

Mr. P. McN. Bennie then described a very similar furnace used by the Noble Electric Steel Company in Shasta County, California. In this furnace, however, the gaseous products of reaction, which are rich in carbon monoxide, are burned above the charge to carbon dioxide, by air being blown into the furnace, to preheat the incoming charge. Mr. Bennie also read a paper by Mr. D. A. Lyon, general manager of the Noble Electric Steel Company, describing the equipment of the company's works, including the furnace plant and the wood distillation plant for the production of charcoal.

Prof. J. W. Richards then presented a theoretical paper in which he discussed in detail the correct proportioning of the charge with respect to carbon. It is important not to use too much nor too little carbon. Dr. Richards discussed the different considerations to be taken into account in order to find the correct amount of carbon. After this discussion of iron reduction in the electric furnace, the electric refining of steel was dealt with in a series of papers, furnaces with electrodes being first discussed.

Major Ernesto Stassano, the distinguished Italian pioneer of electric iron and steel furnaces, who was himself present at the meeting, contributed a paper, which was read in abstract by Dr. J. W. Richards. He emphasized that in any electric iron or steel furnaces the only function of the electric current is to produce heat. The characteristic features of the Stassano furnace in which the charge is heated from above by radiation from arcs between electrodes in the top of the furnace, are that it is tightly closed against the outer atmosphere, that the atmosphere in the furnace is of a reducing nature, and that a very high temperature is available. The arcs in his furnace operate like "enclosed arcs" of great length and burning quietly. The possibility of rotating the furnace provides a method of artificial stirring, which cannot be otherwise than beneficial. Major Stassano emphasized that his furnace with its mechanism is absolutely reliable and contains no real complications. With it he has been able to produce steel of desired composition in one operation from ore by properly proportioning the charge and fluxes.

A paper by Mr. C. A. Keller, of Livet, France, was read by Mr. Bennie. The chief interest in this paper lies in the fact that Keller has given up what might be called the Héroult type of furnace (employing two electrodes in series above the bath) and has adopted what might be called the Girod type, using only one electrode at the top, or if several are used all of the same polarity, while the water-cooled bottom of the furnace forms the other pole. He described a special construction of the water-cooled furnace-bottom for which he claimed a very long life, great reliability of operation and absence of any danger.

A paper by Mr. Paul Girod, which was next presented by Mr. Saunders, described in detail his steel furnace of the general type just mentioned. He gave details of construction and an account of the various plants in which the furnace is in commercial operation. A supplementary paper by Mr. Girod was read by Dr. Richards giving details of the alloys employed in the Girod process. Mr. Girod also made the observation that it seems that steel of higher quality (though apparently of the same chemical composition) is obtained when starting the electric furnace operation with cold material instead of charging molten steel from the Bessemer converter or from the open hearth into the electric furnace.

Mr. R. Turnbull's paper on the Héroult process was next presented. He gave a history of the experiments of many years which have led Dr. Héroult to the kind of furnace which he now uses, and which has now been adopted by the United States Steel Corporation. As to the largest size of furnace of this type which would now be practicable, Mr. Turnbull thinks that in case of refining with only one slag, a 50-ton furnace is distinctly possible. But should two slags be used, owing to the difficulties which may be involved in the taking off of the first slag, it may be possible that the 15-ton capacity is nearing the limit. Mr. Turnbull invited any interested steel men to visit the Héroult Works at La Praz, France, where all the work is done openly.

Dr. Matthew, of the Halcomb Steel Works, of Syracuse—the first American steel works which adopted an electric furnace, and which uses the Héroult type of furnace—gave an outline of extended research work which should be done to clear up certain disputed points and make toward real progress in steel metallurgy. On the experience of his company he stated that the steel made by them in the electric furnace was the best that could be made by any process. But it had not been always so. In the early days such satisfactory results were not always obtained in their electric furnace plant. Electric-furnace operation requires skill and attention, and the



Dr. Kjellin Dr. Buckland Major Stassano

A GROUP OF DELEGATES

choice of any special type of electric furnace depends on many things.

A general discussion followed in which Messrs. Hibbard, Richards, Lane, Moldenke, Brady and FitzGerald participated.

The afternoon session was opened by a short speech of Mr. Simpson, who has done much to create interest in developing an electric iron and steel industry in Canada. His plan is to develop an 80,000-hp water-power.

Four papers by Mr. G. Gin, of Paris, France, were then presented in abstract. In the first he described the construction of a combined induction and electrode furnace, the special features of the design being the production of an automatic circulation of the bath. The three other papers by Mr. Gin dealt with the decarbonization of ferro-alloys; with the manufacture of silico-vanadium, and with the preparation of ferro-vanadium by electrolysis of the trioxide dissolved in calcium fluovanadate.

The last paper dealing with special electric steel furnaces was that of Dr. F. A. Kjellin, which was presented by Mr. John Hay. He first described the simple induction furnace and gave data of power consumption and analyses of steels produced. The combination furnace of Roechling-Rodenhauser was then taken up and the manufacture of steel rails in the same was discussed. The production costs for a 5-ton furnace of this type were given.

The next paper was presented by Mr. Carl Hering, dealing with the working limit in electrical furnaces, due to the "punch"

phenomenon. The general nature of the "pinch" phenomenon is now well-known from former papers of Mr. Hering and of Dr. Northrup. The pinching action is purely electromagnetic and applies equally as well to direct as to alternating currents. It tends to force the fluid out of both ends of the conductor, chiefly at its central axis and parallel to the direction of the current. At a certain critical current rupture immediately takes place.

Mr. Hering has developed a theory of the phenomenon and from it he has determined an approximate formula for the critical current at which rupture takes place. The critical current fixes a very positive limit which the current, and therefore the temperature, cannot exceed in such furnaces. It is greater the deeper the channel, the greater the density, the less the viscosity, the smoother and more regular the channel is and the more free the surface of liquid is from heavy floating masses. The effect, if any, which the width of the channel has is not yet known. For the same change in level the danger is far greater in small or shallow than in large and deep channels. In an appendix to his paper Mr. Hering also gave an account of experiments made with mercury on the small scale. From these it seems that one is on the safe side in using the theoretical formulas of Mr. Hering's paper.

Mr. F. A. J. FitzGerald then presented a paper on the application of the Lash process to the electric furnace. The Lash process is based on the fact that when an intimate mixture of iron ore, carbon, fluxes and cast-iron borings is heated, reduction readily takes place and that by a suitable proportioning of the mixture the desired grade of steel can be obtained. Instead of cast-iron borings, granulated pig iron may be used. The heating may be done either in an open-hearth or in an electric furnace. A suitable mixture for the Lash process in the open-hearth is 60 tons pig iron, 75 tons ore, and 13.4 tons coke. A suitable mixture in the electric furnace is 41 tons pig iron, 103 tons ore and 19.5 tons coke. The process, therefore, serves to a certain extent to produce steel directly from iron ore, although it will be seen that a certain quantity of cast iron or pig iron is required.

A paper by Mr. Remo Catani, of Italy, dealt with large electric furnaces in the electrometallurgy of iron and steel, with special reference to single-phase versus three-phase operation. A three-phase furnace versus a single-phase furnace of the same power presents some peculiar features, of which a few are considered as advantages and others as inconveniences.

The former are neutrality of the hearth; greater facility of making the furnace rotary, above all if electrodes remain in their lines during the rotation; cheaper electrical machinery (alternators, line, transformers). As inconveniences may be considered the larger cross-section of the electrodes put in the furnace; greater number of electrode holders or larger electrode holders in an unfavorable position being exposed to the radiation of the furnace; necessity of running to full load or overload in order to have a good efficiency; possibility of short-circuit through the walls of the furnace without passing of the current through the bath; larger dimensions of the furnace. The chief point of Mr. Catani's paper is, however, the claim that if a certain Swedish 7000-hp, three-phase furnace was fed with single-phase current at the same voltage, its capacity would be increased to about 12,000 hp. Single-phase operation, therefore, appears to facilitate the building of very powerful electric furnaces.

A paper by Mr. H. D. Hibbard discussed the present value of electric structural steel. The beneficial result of the advantages of electric refining (neutral atmosphere and adjustable temperature) lies more in the direction of improved qualities in the product than in lessening its cost. The author discussed especially the question whether the possibility of reduction of oxides, phosphorus and graphite is commercially worth the cost. He thinks that this is still to be proved.

A paper by Mr. Charles A. Foster described a new radiation pyrometer, which is a modification of the well-known Fery pyrometer, the thermo-couple in the latter being replaced by the bimetallic spring which is deflected and acts on a needle, according to the heat concentrated upon it.

The last paper of the day was presented by Mr. C. A. Hansen, of the General Electric Company, on electrode losses in furnaces. He compares especially carbon and graphite electrodes. His chief conclusions are that for electrodes in furnaces of the type discussed in his paper, carbon electrodes are less wasteful of heat than graphite electrodes of the same cross-section at current densities below 200 amp per square inch. Varying the length of the electrode may, to some extent, vary this critical current density. In furnaces taking 500 kw the electrode losses can easily reach 15 per cent of the total load impressed. Since the electrode losses are to a certain extent independent of the length of the furnace, shortening the furnace increases the electrode losses to any amount above 15 per cent. Graphite and carbon have heat conductivities in the ratio of 8 to 1 under the conditions of the experiments. The ratio is brought down to this value from 18 to 1, probably owing to the partial graphitization of the carbon, and the ratio may also vary somewhat with length. The author also gave many interesting details of the changes of physical properties of carbon and graphite with the temperature. The paper was discussed at considerable length by Messrs. Lidbury, Hering and Richards.

FRIDAY SESSION.

The first paper in the Friday session was presented by Dr. E. F. Northrup and described in detail a new type of ammeter for the accurate measurement of alternating currents above 1000 amp. The instrument is based on the pinch effect, the current being measured by means of the centripetal pressure which exists in the interior of a liquid conducting or carrying an electric current. The field of special usefulness of this new instrument is to be found in the accurate measurement of alternating currents of over 1000 amp, there being no assignable upper limit to the current which may be measured. For practical purposes this ammeter is especially useful for determining the ratios of heavy-current series transformers and in making accurate measurements, for any purpose, of large direct or alternating currents. The possibility of making absolute measurements with this instrument is due to the very high accuracy with which it is possible to calculate the dimensions of the instrument.

A paper by Dr. E. F. Kern discussed at length the effect of certain very small additions of gelatine, etc., to electroplating solutions upon the density and smoothness of the deposit. Various addition-agents were tried, like tannin, resorcinol, pyrogallol and gelatine. In general, it seems that the greater the molecular weight of the addition-agent, and the larger the number of adjoiningly grouped hydroxyl (and amine) radicals which the compound contains, the more effective is it in producing denser, brighter, less crystalline and more coherent deposits of lead, copper and silver.

The same subject was discussed in a brief paper by Prof. S. A. Tucker and Mr. E. G. Thomssen, with special reference to the deposition of lead and zinc, and the beneficial effects of small additions of organic compounds to the electrolyte.

A paper by Dr. E. F. Northrup described a new type of autographic recorder and its application to the registration of cooling curves, those of steel in particular. The use of resistance thermometers versus thermo-couples in the autographic recording of cooling curves was also discussed.

A paper by Dr. H. E. Patten and Mr. W. R. Mott dealt with the electro-deposition of some metals from acetone solutions, for instance, sodium and strontium from saturated solutions of the iodides in acetone, cadmium, tin, antimony from solutions of their chlorides, etc.

A paper by Prof. S. A. Tucker and Mr. E. G. Thomssen was of theoretical interest since it was shown that aluminum in small quantities can be deposited from an aqueous solution if the cathode is revolved at sufficiently high speeds. The practical value of this method, however, is said to be small.

A paper by Dr. W. J. McCaughey dealt with the electrolytic deposition of platinum from an electrolyte formed by addition of citric acid to a saturated solution of potassium chlorplatinate.

A paper by Mr. J. A. Yunck briefly described a series of experiments on the electrolytic production of white lead. The

author claims that the process can be carried out at a profit to the manufacturer.

Two papers by Dr. G. A. Hulett dealt with special points of the theory of the Weston standard cell; the first paper discussed the e.m.f. of cadmium amalgams, the second the application of the Gibbs-Helmholtz equation to the Weston cell.

Dr. H. E. Patten and Mr. W. J. McCaughey then presented a paper on the electrolytic reduction of nitric acid.

The last paper of the Friday session dealt with the electromagnetic separation of non-magnetic, non-conducting substances, the author being Mr. A. P. Steckel. The method described had been tried for the concentration of copper ores. While it has not been commercially successful, it is of considerable theoretical interest. It consists in changing the apparent specific gravity of a conducting liquid by electromagnetic means, so that non-magnetic and non-conductive substances in the same can be made to rise to the surface or sink to the bottom apparently against the action of gravity. By the method it is possible to give to any conducting liquid any desired apparent specific gravity from zero upward. The method consists in subjecting the liquid to a powerful magnetic field and at the same time passing a direct current through it in a direction perpendicular to the magnetic field. If the interaction of the magnetic flux and electric current results in a downward force, the liquid appears to become heavier. If the direction of the current is then reversed, the liquid appears to become lighter. By this method it is possible to float pieces of ore or glass upon water and, conversely, to make wood sink.

SATURDAY SESSION.

The first paper of the Saturday session was of a highly theoretical character, dealing with the probable electrical nature of chemical energy, the author being Dr. A. H. Patterson.

Prof. C. F. Burgess then presented a paper by himself and Mr. J. Aston on alloys of electrolytic iron with arsenic and bismuth. Some of the results were quite unexpected. For instance, the addition of 4 per cent arsenic imparts to iron magnetic qualities excelling those of the purest iron and on a par with the best material on record. This is the more surprising as arsenic when present above 0.25 per cent is most detrimental in its physical effects. In the bismuth-alloy series a most unexpected result is the somewhat paradoxical condition of the addition of 2 per cent of bismuth, the most diamagnetic element known, improving the already high magnetic quality of pure iron.

A prominent feature of the Saturday session was the lecture by Dr. L. H. Baekeland, the new president, on the use of bakelite for electrical and electrochemical purposes. As has been explained before in these columns, bakelite is a condensation product of phenol and formaldehyde. It is available in three different forms. The initial condensation product is bakelite A, an intermediate product (obtained by heating A) is bakelite B, while the final product is bakelite C, which may be considered as a polymerized compound anhydride of a phenol-alcohol and methylenglycol.

For all practical purposes bakelite A is used as the raw material to start with. A may be transformed directly into C in one operation, but in other cases, especially in rapid molding processes, A is changed into B in a mold, then removed from the mold and afterward changed into C without the use of the mold. In order to prevent dissociation of A into gases with the production of a spongy product without value, the heating must be carried out under pressure in what is called a "bakelizer."

Dr. Baekeland discussed in detail the methods of block-working, the impregnating processes, the impregnation of coils for dynamos, motors and transformers, coating processes, molding processes, etc. As to the impregnation of coils for electrical purposes it was pointed out that bakelite gives us a ready means to provide coils with a hard and strong insulated mass which cannot soften under the influence of heat, and withstands temperatures at which all hitherto used gums or resins would melt away. But bakelite in its final state, C, is very hard and tough, but not flexible, so that any wires or conductors coated with it can no longer stand much bending or twisting, and for such parts the bakelizing operation should only take place after all wires and conductors are in their final place.

With this aim in view, the wire or conductor provided with its covering of cotton or asbestos can be simply coated with dissolved A solution properly diluted with the necessary amount of alcohol, then submitted to spontaneous drying. This may be helped by a gentle application of heat, but never more than is necessary to carry the material to the stage B, so as to maintain the necessary flexibility. The wire is now wound as usual, and in order to insure more flexibility it may be found useful to heat it slightly. Tape or any fabric, or asbestos impregnated with A, may be put between successive layers just as is done when shellac is used as insulator; after the coil is made up it is now introduced into the bakelizer.

In case the wires are covered exclusively with asbestos it will be advantageous to heat the bakelizer at highest temperatures; however, if cotton or similar organic materials be present, such high temperatures would destroy and carbonize them, and it may be safer not to exceed 140 deg. C. After bakelizing, the coils should be submitted to slow drying so as to expel any remaining traces of moisture or solvents and this operation can be hastened considerably by the use of a vacuum dryer.

In other cases ready-wound coils may be simply impregnated with liquid A, as is done in the impregnation of wood. With some precaution it is possible to slowly transform A into C, or at least into B, in an ordinary drying stove, without the necessity of resorting to a bakelizer, always provided the heating be started at temperatures as low as 60 deg. C. to 70 deg. C. and gradually to 120 deg. C. to 140 deg. C.

In fact, it may be found sufficient not to go beyond B and leave it to future self-heating of the wire when run under overload to arrive at the final condition C.

The following papers were presented very briefly on account of limitation of time:

Dr. J. W. Turrentine described a new graphite cathode dish and a modified oxy-hydrogen gas coulometer.

A paper by Prof. A. Tucker and Mr. W. A. Alexander and Mr. H. K. Huson dealt with the relative efficiency of the arc and resistance furnace for the manufacture of calcium carbide The conclusions of the authors are that in the resistance furnace the temperature can be regulated and held at a point much below that of the arc, and should produce calcium carbide in a more efficient manner than the arc furnace.

A paper by Mr. C. I. Zimmerman was a useful summary of various physical properties of crystalline silicon.

Dr. O. P. Watts and Mr. E. R. Suhm described further experiments with calcium alloys as reducing agents. The authors compared calcium and magnesium alloys with aluminum for reduction purposes. They think that those alloys are superior to aluminum in all cases where none of the charge is blown out of the crucible. The alloys are distinctly superior to aluminum for the igniting mixture. Since the violence of reaction of the alloys increases with the amounts of calcium and magnesium, the most serviceable and cheapest alloys will be those with only enough calcium or magnesium to be readily pulverized.

A paper by Dr. F. K. Cameron described electrochemical methods of soil analysis. The essential feature is the measurement of resistances by a Wheatstone-bridge method.

A paper by Mr. W. R. Mott discussed the function of overvoltage in the corrosion of metals.

A brief paper by Mr. Maximilian Toch referred to the protection of steel against corrosion and emphasized that it is quite necessary for future generations to coat steel which is surrounded by either ordinary fireproofing, masonry or bedded in concrete with a material which shall have electric insulating qualities and moisture-resisting qualities, rather than inhibitive qualities, for the inhibition is merely secondary, and the primary cause of the corrosive effect is water itself. Cement, not concrete, is the real protective agent.

The last paper of the meeting was presented by Mr. Zimmerman on the use of concentric tubular conductors for very large currents, instead of ordinary busbars.

The next meeting will be held in October in New York

Centralized Control of Public-Utility Plants.

The Massachusetts Gas and Electric Light Commission has issued a decision, dated May 4, recommending that the price of gas in Leominster shall not exceed $1.60 per 1000 ft. This case is of interest to central stations on account of its bearing upon the cost of operating public-service properties under centralized control. The Leominster Gas Light Company is one of the constituents of the Massachusetts Lighting Companies, which owns and operates electric or gas plants in Clinton, Ayer, Spencer, Arlington, Milford, Northampton, North Adams, Adams and Williamstown, with headquarters in Boston.

The board points out in its decision that under the Leominster schedule, in force since January, 1907, there is a maximum net price to the smallest consumers of $2 where no discount is allowed, and of $1.70 where the smallest discount is given. The average net price received in 1907 by the company was $1.71 and in 1908 $1.60. At the hearing the petitioners claimed that the cost of operation was high, on account of centralized management. The board finds that the cost of executive administration is substantially one-third of the total operating expenses. Since 1902 the company has paid no dividends, with a 1 per cent exception in April, 1908, all the earnings above operating expenses and interest requirements having been put into the plant.

The commission states, substantially, that "the management cost per 1000 ft. has increased at Leominster in spite of a large growth of business. The lighting companies held in this common control are located in such widely separated communities that their customers cannot be served by the same plants. The management is the same throughout. In some of the companies the president, treasurer and secretary receive no salaries, and in others their compensation is so small as to suggest that it may be less than a fair reward for their services. The board believes that a disproportionate share of the management expense of the group is being charged to Leominster, and more than the ordinary cost for a company of this size and character if independently controlled and managed. The commission states that "in view of the intimate relation which the management and owners of this company sustain to each other, it may be claimed that the management, if it desires, may choose between profits and a high operating cost, and that only the stockholders are interested as to whether a certain amount of income is retained for dividends or expended for management. While it is true that the earnings divided among the stockholders in recent years have been far below what is considered a fair return on capital, it must be remembered that the fair return is not to be measured by the dividends declared, but by the actual profits derived from the business, however disposed of.

"The customers of every company have a right to a price based upon a reasonable operating cost with a proper allowance for depreciation and a fair return upon a reasonable investment entirely independent of the vicissitudes incident to the supply of other communities whose companies may be included in the same ownership. A combination of companies, such as this case discloses, may afford numerous opportunities for increased economies incidental to a more experienced and skilful management, employees of a higher technical training and a better command of the market for its supplies. At the same time it must not be forgotten that such combinations are equally prolific of opportunities for dealing unfairly with the individual communities, and, in our opinion, they will find a temporary justification for their existence only while they demonstrate their purpose and ability to give to the public whom they serve the advantages which it naturally and rightfully expects. The management has inaugurated, and is continuing, the policy of rehabilitating the company's plant and increasing the business. The public interest demands that these efforts to increase the efficiency of its investment should be encouraged and not embarrassed. It is doubtful if the time has yet arrived when the company and its customers can fully enjoy the advantages to come from this policy."

The board concludes with a brief discussion leading to the recommendation of a maximum discount of 20 cents per 1000 and the establishment of a maximum net price of $1.60 as "ample to cover a reasonable operating expense with a proper allowance for depreciation and a fair return upon the value of the property reasonably and actively employed by the company for the public convenience."

Some Figures of Chicago Transmission and Distribution.

In the course of an address delivered before the Electric Club of Chicago on April 28, with the title, "The Transmission and Distribution of Electricity for Light and Power in Large Cities," Mr. D. W. Roper, assistant chief operating engineer of the Commonwealth Edison Company, gave some instructive figures in connection with the actual operation of his company's extensive system of electrical transmission and distribution. For one thing, he made the interesting statement that the cost of the street investment—that is, the conduit, cable, pole lines and distribution transformers—in Chicago central-station practice is about one-third of the total investment and is larger than the investment in power stations. Overhead construction costs only about one-fourth or one-fifth as much as underground construction in residence districts. The maintenance cost, however, is approximately the same for both methods. In Chicago the output of 25-cycle energy has increased 17,000 kw a year during the last five years. The 25-cycle transmission has taken 50 per cent of the copper installed during this period, the amount of copper being 35 lb. per kilowatt. The average length of transmission lines is three miles.

Turning to the direct-current area it is found that the use of direct current has increased at the rate of 3000 kw a year during the five-year period. The copper installed for direct-current service is about 170 lb. per kilowatt of maximum demand. Three-fourths of the copper is in feeders and one-fourth in customers' services. The average length of direct-current feeders is 1500 ft. Comparing 25-cycle, 9000-volt transmission with 115-230-volt direct-current distribution, it is found that 3½ times the load can be sent 13 times the distance by the use of the former system when compared with the latter. In relation to the 60-cycle load on the system, Mr. Roper remarked that 37 lb. of copper had been installed for each additional kilowatt of station capacity installed during the five-year period.

During the last five years the cost of copper has varied from 12 cents to 26 cents a pound. This variation in the cost of copper has a marked influence, of course, on the cost of investment in transmission and distribution systems; and there are other items affecting this cost, such as geographical location of the lines, density of load, etc. In Chicago underground conduits are largely laid in sandy soil, and this is also true in relation to the setting of poles. Where the porous nature of the soil makes it necessary to construct expensive trenching for drainage purposes, the cost is materially increased, of course.

Last year the maximum load on the generating stations in 25-cycle energy was 107,000 kw. Of this something less than 40,000 kw in the central portion of the city was furnished to customers as direct current. Of this, again, about half, or 20,000 kw, was used in the "downtown" business district. In the most congested portion of this district, for one-half mile on State Street, 5000 kw is consumed. This is the district of maximum density on the company's system. It is interesting to note that the total amount of energy distributed as 60-cycle alternating current is about 18,000 kw, or less than the "downtown" load of 20,000 kw. It is a coincidence that for each pound of copper installed for all purposes during the five years, 1 duct-ft. of conduit was installed. The cost of conduit varies from 15 cents to 60 cents or, in extreme cases, $1 per duct-foot.

Taking advantage of the cheap rates for money which have prevailed for some time, the company is making extensive investment in electrical construction in the streets, and work is

now proceeding at the rate of expenditure of about $10,000 a working day.

In answer to questions, Mr. Roper said that the company has over 300 miles of transmission lines and that the burn-outs will average, perhaps, one a month. An electric emergency wagon is used to take men and materials quickly to the scene of accidents.

The Exhaust Steam Turbine.

The subject to which the attention of the members of the Electric Club, of Chicago, was directed at the meeting of May 5 was the application of the steam turbine to the direct utilization of exhaust steam from reciprocating engines for generating electric energy. The speaker of the occasion was Mr. W. L. Stockton, of the Western Electric Company, who said that although exhaust steam turbines had been in quite common use in Europe for four or five years, it is only within the last year or so that they have attracted much attention in the United States.

In power plants steam is used, of course, as a medium for transferring heat into work. The temperature of steam at 150 lb. pressure is about 340 deg. Fahr., and it is exhausted into the air at about 215 deg. It is this difference of 125 deg. of heat which is converted into work. The boiling point of water in 28-in. vacuum is about 103 deg. If steam be taken at 215 deg. and put through an efficient heat engine of some sort exhausting into 28-in. vacuum, it is possible to make use of the difference, or 112 deg. of heat. But the reciprocating engine is not an efficient machine to make use of the steam under these conditions. It is difficult to maintain a 28-in. vacuum on an engine. If it could be maintained, the low-pressure cylinder would have to be extremely large to get the proper expansion, so that the condensation at these low temperatures would be very great. By making use of the turbine for this purpose these objections are removed to a large degree, and in addition the velocity of the steam may be utilized.

Another method of arriving at the same conclusion is to consider that when saturated steam enters a cylinder at 150 lb. pressure and exhausts at 1 lb. above atmosphere, the available energy is about 132,000 ft.-lb. per pound of steam. If this steam is used from 1 lb. above atmosphere to a 28-in. vacuum, the energy available is about 146,000 ft.-lb. per pound of steam, showing a greater available energy than in the case of the steam at 150-lb. pressure exhausting at 1 lb. above atmosphere. It is a fact, said Mr. Stockton, that with high-speed engines that have been in use for some little time, the output of the plant may be increased 100 per cent without the consumption of additional coal. In the case of a compound Corliss engine operating non-condensing, the output of the plant may be increased from 50 per cent to 60 per cent, with additional steam consumption.

As a concrete example the speaker cited a 750-kw compound Corliss unit operating non-condensing. The steam consumption probably will be at least 30 lb. per kw-hour delivered at the switchboard, or a total of 22,500 lb. per hour. Allowing 20 per cent for loss in condensation, there remain about 18,000 lb. of steam for use in the turbine. It will be no trouble to install a turbine that will give 450 kw with this amount of steam. Thus, while the plant was originally giving only 750 kw from 22,500 lb. of steam with the auxiliary, it will be getting 1200 kw out of the same amount of steam, making a steam consumption of less than 19 lb. per kw-hour delivered at the switchboard. If it is assumed that the boilers in the plant evaporate 8 lb. of water per pound of coal, the result will approximate the results obtained with the best gas-engine equipment on bituminous coal.

The cost of such an installation is governed largely by the local conditions, primarily the condensing problem. If condensing water is available in ample quantities, the problem is a comparatively simple one. In general, taking the example cited, the equipment would probably cost between $25,000 and $45,000, the higher figure being reached only in exceptional cases. Assuming an installation costing $30,000, and figuring interest and depreciation at 10 per cent, the extra 450-kw gained will cost $3,000, or about $6.50 a year per kilowatt, which is extremely low. No doubt an additional engine could be installed for half of the $30,000, but when the coal consumption is taken into consideration it will be found that the cost of the low-pressure turbine plant will be equaled by the money paid for coal in a comparatively short time, to say nothing of the cost of boilers and firing.

Until a comparatively recent date it has been the custom to use low-pressure turbines for constant-running conditions. However, steam turbines are now used where the steam supply is intermittent, as in the case of hoisting engines in mines and rolling-mill engines in steel plants. Here the low-pressure turbine makes a fine showing when a regenerator or "heat flywheel" is installed. This regenerator is simply a large tank partially filled with water. The steam is forced through the water, heating it practically to the boiling point. When the supply of steam is inadequate for the demand of the turbine, the pressure in the regenerator naturally drops, and with it the boiling point, so that steam is given off and is used to supply the turbine. A regenerator may be installed capable of carrying a 500-kw unit from three to five minutes at full load while no steam is coming from the engine.

The exhaust steam turbine is not a panacea for all of the station manager's troubles. However, in the case of a plant operating reciprocating engines where additional power is needed, it is worth very careful consideration. It is a fact that the reciprocating engine uses high-pressure steam more efficiently than the turbine, but the turbine makes use of the low-pressure steam more efficiently than the engine. The speaker told of some tests with a compound Corliss engine delivering about 1500 hp to determine the steam consumption when exhausting into the air and when exhausting into various degrees of vacuum. It was found that as the vacuum was increased from atmospheric pressure, the steam consumption decreased materially until 8 in. of vacuum was reached. From that point up to 26 in. of vacuum the decrease was much less marked. The engineer in charge of the tests reasoned from this that for his plant the thing to do was to operate the engine on 8-in. vacuum, exhausting into a turbine at this point; by then maintaining a vacuum of 28 in. he would be able to get 900 hp out of the turbine.

Mr. Stockton said that he is inclined to the belief that future tests will show that the maximum results are to be obtained by using high-pressure steam in reciprocating engines and exhausting into low-pressure turbines above atmosphere, possibly at from 30 lb. to 50 lb. "I do not know, however," said he, "that such an equipment has been installed; but from every viewpoint the low-pressure turbine presents an interesting proposition, and it is certainly destined to come into very general use."

The brief discussion which followed the paper was confined mainly to the asking of questions, which Mr. Stockton answered. One gentleman asked how long the regenerator would carry the rated load, and to this Mr. Stockton answered, possibly about eight minutes. To another inquirer the speaker said that the greater number of exhaust steam turbines so far installed have gone into railway power plants or plants supplying electrical energy both for railways and general service. In the railway plants, where the load is erratic and where the peaks are of short duration, low-pressure turbines no doubt can be installed to take the peak of the loads more cheaply than storage batteries. To a question as to the use of the low-pressure turbine in small plants, Mr. Stockton said that in a plant of less than 300-kw rating it would probably be found that the condenser installation would make the turbine installation too expensive, unless the conditions were especially favorable. To other questions the speaker said that he thought it would not pay to operate exhaust turbines with high-pressure turbines. Further, he said that some new power plants were being built with [illegible] on the basement.

Massachusetts Legislative Notes.

The Senate has given a first reading to the bill to authorize the town of Framingham to purchase electricity for municipal purposes. The House bill relative to the filing of the receiving time of telegrams has been passed to be engrossed by the Senate, with the amendment that the penalty be not over $1 per message for failure to file this time. A resolution providing for a study of the traffic and methods of accounting of the New England Telephone & Telegraph Company has been passed by both branches of the Legislature and laid before Governor Draper for his approval. It is expected that this matter will go through without delay, and facilitate further analyses of the telephone conditions in Massachusetts by the Highway Commission along the lines recommended by its consulting engineer, Prof. Dugald C. Jackson, of the Massachusetts Institute of Technology, who recently completed an exhaustive appraisal of the company's property in connection with the study of telephone rates. The House has sustained the report of the Committee on Public Lighting referring to the next General Court the bill accompanying the petition of Mayor Coughlin, of Fall River, for legislation to regulate the price, quality and pressure of illuminating gas in the city of Fall River. A strenuous attempt was made by Representative Willetts, of Fall River, to amend the report by the substitution of another bill to regulate the price and pressure of the gas, but the effort failed. In the light of the recent action of the House in killing the bill to regulate the price of gas in East Boston and leave such questions to the Gas and Electric Light Commission, which has full powers of recommendation in rate and service problems, it is likely that attempts of this kind to secure legislative rupudiation of the policy of regulation by commission will fall to the ground. The report of the Committee on Public Lighting has similarly been accepted in relation to the price of gas in Charlestown, Mass., reference to next year's session being accepted.

New York Public Service Commission News.

The Public Service Commission of the First District of New York has granted to the Hudson & Manhattan Railroad Company the franchise for which it applied for the extension of its line from Thirty-third Street and Sixth Avenue to the Grand Central Station at Forty-second Street and Park Avenue. The route asked for under Sixth Avenue, Bryant Park and Forty-second Street was established without modification. The terms of the franchise, including the payments to be made to the city in the shape of rentals, the rights of the city to purchase and the terms under which a renewal may be secured after the expiration of the present agreement were all published in the issue of April 15. In transmitting the franchise to the Board of Estimate, the commission recommended its acceptance at an early date and took occasion to point out the advantages which would accrue to the city, especially to the shopping district by this line. The commission also intimated that it would be possible to make a junction between the McAdoo tunnel and the Steinway tunnel by which trains could be run from Long Island City down Sixth Avenue and into New Jersey. The Board of Estimate has not as yet acted upon the franchise, but steps have been taken to advance consideration of the matter so that an early conclusion can be reached.

A number of property owners on the west side of Manhattan have petitioned the Public Service Commission for a four-track subway under Seventh Avenue from Forty-second Street to the Battery. Among those signing the petition was August Belmont, who is the chairman of the board of directors of the Interborough Rapid Transit Company, and it is taken from this that although the Interborough in its proposal contemplated a two-track subway it would not be averse to building one according to the ideas of the commission. President Shonts, of the Interborough, has been conferring with the commission on the general question of subways, and it is believed that since the Robinson-Travis law has been adopted permitting the construction of such lines with private capital that a definite proposal will soon be made.

The Public Service Commission of the First District has granted a franchise to the Union Railway Company to build an extension on Pelham Avenue in the Bronx. This franchise had been previously granted by the Board of Estimate, but refused by the commission. The commission required before making the grant that the Union Railway should pay the city $52,143, which was due on franchise accounts. The Board of Estimate of New York City has also granted a franchise to the South Shore Traction Company of Queens Borough to build and operate a trolley line over the Queensboro Bridge to Jamaica.

The Public Service Commission has decided that the Edison Electric Illuminating Company of Brooklyn should refund to Charles E. Rickerson, a resident of Brooklyn, the sum of $150 which had been collected for connecting his property with the company's mains. The law provides that where the property is within 100 ft. of the company's mains, the connection shall be made free of charge. In this instance, one portion of the property connected was only 59 ft. from one of the company's mains, but the company found it more convenient to make another connection which was distant 106 ft. The gist of the commission's decision is that where the nearest point between the property and the mains is less than 100 ft., the connection must be made free.

At hearings by Commissioner Maltbie, of the First District, on May 5 and 8, in the general investigation into electric light and power companies, the question of franchises was taken up. E. H. Rosenquest, president of the Bronx Gas & Electric Company, testified that the franchise of his company gave the right to furnish current in that area which was the old town of Westchester with the exception of the incorporated villages of Eastchester, Pelham and Williamsbridge. He said, however, that he did not claim an exclusive right to the territory other than in adequately supplying the demand, but he believed that at the present time his company had the only franchise existing for the territory covered. E. S. Bellows, of the Westchester Lighting Company, stated that his company had come into possession of the property and franchises of the Pelham Electric Light & Power Company and of the Pelham Bay Park Electric Light & Storage Company. Through the latter was acquired the right to furnish current to City Island. The company also possessed the rights of the Eastchester Electric Company, which included the lighting of the village of Williamsbridge and the White Plains road. Mr. Bellows also testified that his company was charging the city $100 per year for each arc lamp used in street lighting and in the park. He said that no arc lamps were being supplied to private consumers. John A. Garvey, for the company, admitted that the New York Edison Company had a right to operate in the territory where the Westchester company holds franchises. This was on the ground that as both companies were under the same ownership, the Consolidated Gas Company, there could be no injustice. Mr. Garvey explained that different conditions existed in the different cities which his company supplied and that on this account the rates were variable. In Mt. Vernon, for instance, the rate was 13 cents per kw-hour and in South Mt. Vernon it was only 10 cents. Public lighting in these cities was at the same price.

The Public Service Commission of the First District has asked the Board of Estimate to appoint a representative or a committee to confer with the commission on the subject of establishing a uniform standard of franchise for street railways in New York City. Delos F. Wilcox, chief of the franchise bureau of the commission, has drawn up a report embodying his ideas of a proper franchise in order to furnish a basis for discussion at the proposed conference.

In the case of the Delhi Electric Company the Public Service Commission of the Second District has decided that an electric company is not required to extend its mains further than to that point of a consumer's property which is nearest to the mains.

CURRENT NEWS AND NOTES.

TELEGRAPH DAMAGES.—A judgment has been affirmed by the Appelate Division of the New York Supreme Court awarding $12,065 to a cotton exchange firm as damages on account of an error in a telegram.

THE WIRELESS INSTITUTE.—A society representing wireless telegraph engineers has been formed in New York under the name of "The Wireless Institute." Regular meetings will be held in the Engineering Societies Building, 29 West Thirty-ninth Street. The president is Mr. Robert H. Marriott.

ILLUMINATED SIGNS IN THE SUBWAY CARS.—The McAdoo subway cars in New York City are to be equipped with a sign hanging in the center of the car on which the name of the next stop will appear in letters of light. The names are changed by the guard by shifting a plug in the switchboard at the entrance to the cars.

RADIUM IN COLORADO.—Mr. Thos. F. Walsh, of Washington, D. C., the mining millionaire, states that as the result of researches carried on at his expense, uranium ore had been discovered in Gilpin County, Colorado, and that a process of extracting the radium contained therein has been developed at the Colorado School of Mines.

THE EFFECT OF STARTING CHARACTERISTICS UPON THE OPERATION OF AN INDUCTION MOTOR—In the second equation in this article appearing on page 967 of the April 22 number, the numerator of the first fraction should be 100 instead of S. This correct value enters into the substitutions indicated in the article.

ILLINOIS HYDRO-ELECTRIC COURSE.—Petitions are being circulated among the alumni and undergraduates of the civil and electrical engineering departments in the University of Illinois, asking for the organization of a course in the university treating of water-power development, and including hydro-electric development specifically.

INDIANAPOLIS "WHITE WAY."—Mayor Bookwalter has completed plans for making the principal down-town business district a "Great White Way" by altering the present lighting scheme. The plan involves changing all of the poles of the Traction & Terminal Company in this district and the substitution of larger, ornamental poles to be used jointly.

VICTORY FOR ONTARIO INDEPENDENT TELEPHONE COMPANIES.—The Railway Commission of Ontario has issued an order whereby Independent telephone companies are allowed to install instruments in railway stations. This ends a long agitation for this privilege, the Bell company, which now solely enjoys it, having opposed the admission of the Independent companies to railway stations.

LIGHTNING FREAKS.—During a thunder storm at Niagara Falls last week, a stroke of lightning singed almost all of the hair off the back of the head of a policeman, but without otherwise injuring him. During the same storm a portion of a blanket covering two Italians was burned without injury to the men. During the same storm the transmission line between Niagara and Toronto was put out of commission for a time.

REGULATION OF MICHIGAN WATER-POWER HYDRO-ELECTRIC COMPANIES.—A bill has passed the House of the Michigan Legislature extending the jurisdiction of the Railroad Commission to hydro-electric plants, with the right to determine the maximum rate that may be charged for service. Companies are also required to furnish electric energy for light and power to all cities and villages through which they pass if demanded.

TORONTO RATE SYSTEM.—Mr. Alex. Dow, of Detroit, and City Electrical Engineer Aitken, of Toronto, have submitted a schedule of charges for lighting service by the municipality of Ontario. The proposition is to establish a flat rate of 10 cents per room per month, and to charge in addition 3 cents per kw-hour for all energy used. The present charges in Toronto made by the Toronto Electric Light Company are 8 cents per kw-hour. The proposed rate, therefore, cuts considerably under the rate of the private company.

LONDON UNDERGROUND AMERICANIZED.—William Barclay Parsons, who has been making an inspection of the London Underground Electric Railway Company, says that the recent marked increase in the net earnings of the lines is clearly due to the fact that American methods have been adopted in the management of the properties. He says that the elevator service at the stations has been improved, that American cars are used, that the trains travel faster on shorter headway with briefer stops at the stations and that the abandonment of class compartments has proved very popular. Londoners can now, according to Mr. Parsons, move about with as little waste of time as the people of New York or Chicago.

THE TELEPHONE A PUBLIC NECESSITY.—The Corporation Commission of Oklahoma has recently rendered an interesting decision in which it holds that the telephone is an instrument of public necessity and convenience. The Atchison, Topeka & Santa Fé Railroad appealed from a ruling that it should install a telephone at one of its small country stations, and the Corporation Commission has decided that a railroad must equip its stations with a telephone to produce proper convenience for its patrons, and that the telephone is as essential to their comfort and convenience as the operation of the trains. The railroad commissions of both Virginia and Nebraska have heretofore held that all stations must be equipped with telephones.

THE "ARMOUR ENGINEER."—The current issue of the *Armour Engineer*, which is published twice a year, contains an article by Mr. L. H. Flanders, of the Westinghouse storage-battery department, on the use of the hydrometer in the operation of storage batteries, in which it is shown that the true condition of a storage battery can be determined only by the use of the voltmeter in conjunction with the hydrometer. Mr. W. F. Sims, of the Board of Supervising Engineers, Chicago Traction, treats the subject of underground conduit construction, cost data being included. Among the editorials are one on public utility valuation for taxes and rate of return, and another on reorganization of public utilities on the basis of such valuations.

LIGHTING CROSSINGS UNDER RAILROAD TRACKS IN CHICAGO.—Since the steam railroads traversing the wide area of Chicago have been compelled to elevate their tracks there has been a controversy between the railroad companies and the city as to who should light the subways made where the streets go under the elevated track structure. Some of these subways are quite long where there are a number of tracks, and require several arc lamps. By all recent track-elevated ordinances the roads were compelled to stand the cost of such subway lighting, but they contested the matter in the courts, contending that the city should light its own streets and that the burden should not be put upon them. The city's contention, in the litigation growing out of this situation, has been that the elevated tracks are an extraordinary interference with the street lights and that the roads should make the subway safe for pedestrians. The Pennsylvania Railroad, which has been the most prominent in the opposition to the subway lighting feature of the ordinance, has now notified the Commissioner of Public Works that it will comply with the ordinance and defray the cost of lighting the street subways under its tracks.

HARTFORD LIGHT & POWER COMPANY.—In the description of the gas producer station of this company, published in the April 15 issue, it was erroneously stated that the water consumed in the cooling jackets of the engine and in the scrubber was 250,000 gal. for a 14-hour run or 18,000 gal. an hour. The quantity of water used in the jackets and scrubber is 25,000 gal. in 14 hours or 1800 gal. an hour.

NEW YORK ELECTRICAL SHOW.—The third New York Electrical Show will be held in the Madison Square Garden Oct. 11 to 21, 1909. A uniform scheme of decoration has been adopted, and the charge to exhibitors this year includes no extras of any character so far as the booth is concerned. It is proposed to make the show as largely as possible an operative exhibition illustrating the multiplicity of applications of electrical energy. Mr. George F. Parker is general manager of the show.

PROPOSED ELECTRIC CLUB IN ST. LOUIS.—A number of electrical men of St. Louis, among whom Mr. F. B. Adam, secretary of the Frank Adam Electric Company, is active, are considering the advisability of forming an electric club, something similar to the successful electric clubs of Chicago and San Francisco. Meetings to consider the subject have been held and it is not unlikely that before long St. Louis will have also a full-fledged electric club holding frequent meetings, probably at the luncheon hour.

NIAGARA ICE JAM.—Gangs of men, numbering about 300, are at work repairing the damage done to the Niagara Gorge Road by the ice jam, and it is expected to have the line in operation by May 24. The damaged generators of the Ontario Power Company are being rewound, as it was found that they could not be dried out. Two of the generators in the plant of the Electrical Development Company are used to supply power to the lines of the Ontario Company. Some of the electrochemical industries of Niagara are working only part time on light load until the Ontario plant is again in a condition to supply normal demands.

NORTHWESTERN UNIVERSITY ENGINEERING COLLEGE DEDICATED.—The new College of Engineering of Northwestern University, at Evanston, Ill., recently described in this journal, was dedicated on May 7 before an audience of 600 guests and university people. Mr. Charles Whiting Baker, editor of *Engineering News,* New York, delivered the principal address on "The Need for Broader and More Thorough Training for Engineers." Mr. Baker said that engineering students should not become so deeply immersed in strictly engineering studies as to neglect general culture. President Abram W. Harris, of Northwestern University, made the introduction and was followed by Prof. John Fillmore Hayford, director of the college and formerly connected with the coast survey at Washington, who spoke on "The New College of Engineering, an Opportunity."

ENGINEERING EXPERIMENT STATION AT UNIVERSITY OF ILLINOIS.—Prof. L. P. Breckenridge, of the University of Illinois, who will be professor of mechanical engineering at the Sheffield Scientific School at Yale after July 1, delivered an address before the Western Society of Engineers in Chicago on May 5 on "The Engineering Experiment Station and Its Relation to Illinois Industries." Professor Breckenridge is well qualified to speak on this subject, because the experiment station has been under his direction since its establishment. The station is connected with the University of Illinois at Urbana, Ill., and has done a great deal of useful work in making physical tests and in collecting statistics and data relating to manufactures and industries particularly applicable to the State of Illinois. It has studied the coals of the State, the prevention of waste in coal mining, relative value of materials for cement found in the State, and has made investigations of a large number of other subjects of engineering interest. Professor Breckenridge described the experiment station with the aid of lantern-slide pictures and also gave diagrams based on its statistical researches. At the conclusion of his lecture the discussion resolved itself largely into expressions of regret at his leaving the State university.

"MOVING-DAY RUSH" IN CHICAGO ELECTRIC SERVICE.—During the week ended May 1 the Commonwealth Edison Company of Chicago received 2644 applications for new service. More than half of these applications represented changes due to the removal of customers to new locations, but there still remains a large number of new connections, showing a gratifying increase over the spring "rush" week of last year, when the corresponding figure was 2012 applications. During the week the company installed about 300 new overhead service connections, and as many of these were in apartment buildings containing several residence customers, the actual number of new customers was much greater than this. The greatest demand for extension of electric service at present seems to come from the North Side, where a large number of apartment buildings and stores have been erected or are in course of erection.

ELECTRIC CLUB OF CHICAGO.—At the regular weekly meeting of the Electric Club of Chicago, on May 5, the civic committee, through its chairman, Mr. F. J. Postel, presented a resolution, which was adopted, opposing the passage of the so-called "Kleeman bill," which, at that time, had advanced to a third reading in the lower house of the Illinois Legislature. This bill, as readers of these columns are aware, gives to municipalities along the line of the Drainage Canal the refusal, at cost, of the electric energy generated by the water-power plant of the Sanitary District for street lighting and other purposes before it is offered to private consumers. The resolution adopted by the Electric Club opposes this bill on the ground that the municipalities are now able to get power for their needs at an unusually low price, only the surplus being disposed of to private users, and that there is no present need for further legislation on the subject. The preamble and resolutions state that the bill is opposed to public policy and that it would compel the Sanitary District to waste thousands of horse-power during the hours of daylight. Mr. W. L. Stockton, manager of turbine sales for the Western Electric Company, addressed the club on the subject "The Exhaust-Steam Turbine." Before adjournment, Mr. J. M. Wakeman, of New York, vice-president of *Electrical World,* and Mr. Thomas G. Grier, of Chicago, lately returned from Porto Rico, were called upon and addressed the club briefly.

HEROISM AND FOOLHARDINESS.—Two incidents were reported in the daily newspapers of May 4 which illustrate the difference between heroism and foolhardiness, between a man's purposeful courage and a boy's reckless foolishness. The first is recorded in the list of awards of the Carnegie Hero Commission. Mr. John G. S. Walker, of Alexandria, Pa., was awarded a bronze medal and $1,000. Mr. Walker, fully clad, jumped into the forebay of the plant of the Wilson Electric Company, at Alexandria, Pa., on Sept. 27, 1908, knowing that there were three turbine waterwheels in the forebay which might suck him beneath the surface, and saved Miss Claire McCauley, Philadelphia, who had fallen into the water. A contrast to this is afforded by the case of Joseph Novak, a 10-year old boy, who climbed an electric light pole at Center Avenue and West Nineteenth Place, Chicago, "on a dare" and removed a handkerchief which some other boys had thrown over the wires and dared him to remove. Young Novak was thrown to the ground and badly hurt, for the wires which he touched were carrying electricity of a potential dangerous to human life, but supposed to be safely removed from meddling fingers. The first incident requires no comment beyond a tribute of admiration; the second, which is only one of a number of similar entirely unnecessary accidents, would seem to indicate that the parents and teachers of boys who will climb should point out to them the absolute necessity of never touching electric wires.



DAM ACROSS RIO DAS LAGES, FORMING A RESERVOIR WITH A CAPACITY OF 7,220,000,000 CU. FT.

The Hydro-Electric Power Plant of the Rio de Janeiro Tramway, Light & Power Company.

By L. L. Perry.

TO supply electricity for railway, light and power purposes in the city of Rio de Janeiro, the capital and metropolis of Brazil, of which the population is 811,443, the Rio de Janeiro Tramway, Light & Power Company has constructed an hydro-electric plant on the Lages River, 51 miles from the city.

WATERSHED.

This river, properly called the Rio das Lages, rises, as shown by the map, on the edge of the Brazilian plateau and its entire watershed is within 60 miles of the sea. A useful watershed of over 193 sq. miles (500 sq. km) exists above the elevation of (1325 ft.) 404 m. The flow of this tropical stream varies widely with the seasons of the year, but a natural storage basin exists such that a capacity of (7,220,000,000 cu. ft.) 204,400,000 cu. m useful storage is obtained by building just above the main fall a dam of a maximum height of (138 ft.) 42 m and a length along the crest of (656 ft.) 200 m. This reservoir is of sufficient size to impound all the natural flow of the river not required by the daily power service, with the exception of the floods due to the torrential rains of the wet season. The dam was completed during the past dry season, and the rainy season now closing has filled the reservoir.

In a distance of 1000 ft. (305 m) there is a natural fall of 285 ft. (87 m). Below a series of rapids in a distance of 6000 ft. (1824 m) gives an additional head of 600 ft. (183 m), and the dam increases the head further by an amount varying from 69 ft. to 131 ft. (21 m to 40 m) according to the level of the water in the reservoir.

Weir readings of the flow indicated that there is sufficient water to develop 40,000 brake-hp, and making full allowance for a load factor of from 50 per cent to 75 per cent, there is ample margin for the supply of this amount of power. Rainfall measurements at this point in comparison with other rainfall measurements in Brazil indicate that an average yearly rainfall of over 150 in. (3500 mm) can be relied upon. On the basis of the watershed of 193 sq. miles, a yearly rainfall of 50 in. and a

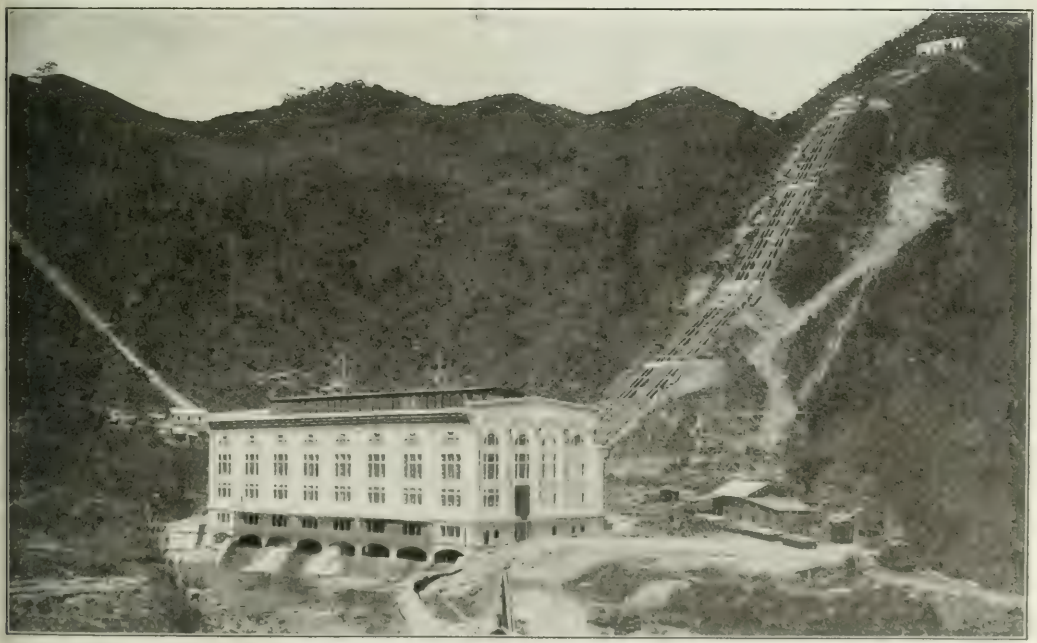


FIG. 1.—POWER HOUSE OF THE RIO DE JANEIRO TRAMWAY, LIGHT & POWER COMPANY.

run off of 40 per cent. sufficient water is obtained for the 40,000 hp at 70 per cent load factor.

The reservoir has an area when full of (7.18 sq. miles) 18.6 sq. km, with a mean depth of (37 ft.) 11.34 m. A reference to the map of the reservoir shows that it is of unusual character, that it is made up of a large number of deep ravines, so that the average depth is great. Hence the question of evaporation even in a tropical sun is not of importance.

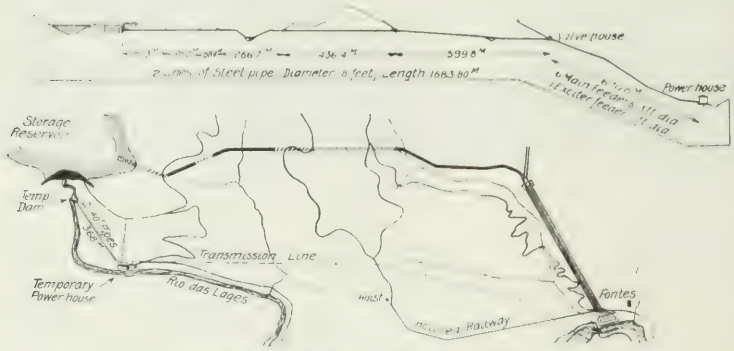


FIG. 2.—PLAN AND PROFILE OF HYDRAULIC DEVELOPMENT

To provide an additional amount of power, when such may become necessary, the company will direct water to the Lages reservoir from the watershed of the Rio do Pirahy. A reference to the map of the two watersheds will show that the waters of the Lages (now utilized) reach the sea 34 miles (55 km) south of the city of Rio de Janeiro, but those of the Pirahy (to be later used) reach the sea through the Parahyba River, whose mouth is 161 miles (260 km) north of the city. At Sapucaia, on the Parahyba River, the company owns another water-power about 100 miles (161 km) from the city.

DAM AND PIPE LINES

Granite-ledge rock 500 ft. (150 m) above the chief fall of the Rio das Lages gave a splendid natural location for the dam. It is a concrete structure of arched form with a radius of (492 ft.) 150 m. The stone was quarried on the ledge near the dam site, carried by dump-cars and cable-ways to each side of the dam and crushed and put through the concrete mixers. The sand was taken from the riverbed above the falls by a suction dredge working in water of a maximum depth of 80 ft. (24 m), and, as the dam progressed, was brought down the river from an increasing distance up to 3½ miles (6 km). The spillway is of a length of 450 ft. (137.123 m) and is at elevation (1325 ft.) 404 m, and the lowest intake entrance is at an elevation of (1262 ft.) 385 m, so that the gross head will vary by (63 ft.) 19 m between reservoir full and reservoir empty, or less than 6 per cent. The friction head in the feeders is calculated at 6.6 per cent of the total head.

The arrangement of the intake leading into the two main 8-ft. feeders is such as to provide for taking the water from the surface instead of from the depth of the reservoir, screens and gates being provided at three levels. The entrance to each 8-ft. (2.44 m) feeder is controlled by a 9-ft. x 12-ft. (2.75-m x 3.66-m) Coffin gate, controlled from the top of the intake by suitable gearing. The 8-ft. feeders consist of riveted-steel pipe carried on concrete piers, usually 24 ft. (7.3 m) apart. The thickness of the pipe varies from ¼ in. to ⅝ in. (6.4 mm to 16 mm); the longitudinal seams are double riveted and cylindrical joints are used. The 8-ft. feeders have each a total length of (5524 ft.) 1683.8 m, and are under a maximum pressure head of (186 ft.) 56.78 m. Beginning at the intake and extending throughout the plant, half of the hydro-electric system may be connected to one 8-ft. feeder, while the other half is independently operated from the second feeder.

The pipes lead from the intake through tunnel No. 1 a distance of (614 ft.) 187.3 m; then through an open cut, known as canal No. 1 (345 ft.) 105.2 m, through tunnel No. 2 (290 ft.) 88.4 m, from tunnel No. 2 to tunnel No. 3 there is straight pipe for (443 ft.) 135.3 m, and the rest of the distance is made up of an inverted siphon of (432 ft.) 131.4 m length and (95 ft.) 29.054 m height. This siphon is used to cross a deep valley. Tunnel No. 3 passes through ledge rock (1430 ft.) 436.4 m, and the pipes are concreted in at each end, where soft rock was encountered. At the exit of tunnel No. 3 8-ft. relief pipes were carried up (52 ft.) 16 m above the spillway level to prevent any injury or inconvenience from water-hammer. From tunnel No. 3 an open cut, called canal No. 3, leads for (1968 ft.) 599.8 m. Canal No. 3 terminates in a valve house, just before which were inserted a second pair of relief pipes of 8 ft. in diameter, carried up to the same level as the other two. A meter-gage construction railway, 1.9 miles (3 km) long, was built at an elevation of (1325 ft.) 404 m to convey materials for the dam and the 8-ft. feeders.

At the valve house a double receiver is provided, each half receiving an 8-ft. feeder controlled by a 96-in. (2.44-m) Coffin valve. Between the two halves is a 60-in. (1.52-m) valve, and from each half, controlled by 36-in. (915-mm) Escher-Wyss valves, three high-pressure 36-in. pipes lead to the power house. The 36-in. valves can be closed by Pelton-type turbines supplied with water from the receiver (155-ft. head), and these turbines can be started by solenoids actuated from the power house, so that in an emergency the water can be quickly shut off the 36-in. pipes and waste of water prevented. In each 36-in. pipe was inserted a Venturi water meter, made by the Builders' Iron Foundry, and a recording and integrating mechanism is employed.

To supply water for the exciter turbines a 12-in. (300-mm) exciter pipe is connected to the receiver through valves on each side. The receiver is at an elevation of (1139 ft.) 347.22 m, and the 36-in. feeders have each a length of (2198 ft.) 670 m, terminating at elevation (304 ft.) 92.78 m, about (3.9 ft.) 1.19 m below the nozzle elevation. In each a 6-in. (15-cm) relief pipe is provided just below the receiver and carried above the spillway level. The whole arrangement is calculated to provide at the beginning of the high-pressure pipes the nearest possible equivalent to the open reservoir, and experience has shown that



FIG. 3.—VIEW OF PIPE LINE AND SURGE PIPES.

his has practically been obtained. The 36-in. pipes are of a hickness of from (39/100 in.) 10 mm to (102/100 in.) 26 mm, epending on the head. The grades are indicated on the profile f the development. The material is lap-welded steel in lengths f (33 ft.) 10 m, with flanged ends held together by bolted lamping rings. These pipes are carried on concrete piers 33 ft. part. Material for the valve house and high-pressure pipes as handled by a cable railway on the pipe-line route.

For the dam and 8-ft. feeders material was conveyed to the pper railway by an inclined cable railway having a maximum rade of 57 per cent. This inclined railway was fed by the ompany's private railway of 13 miles (21 km), which connects at Lages with a branch line of the Estrado Ferro Central Brazil (Brazil's most important railroad), so that all mate-

The normal output of the power house is 40,000 hp at 88,000 volts, three-phase, 50 cycles, delivered to four circuits, for which the full number of six vertical-shaft units, of 8700 hp each, has been installed, giving a maximum unit capacity of 52,200 hp, of which one unit is considered a reserve. The line voltage requires the customary transformers, and high-tension and low tension switching apparatus. The entire hydraulic and electric equipments are divided into two independent systems.

A reference to the cross-section of the power house shows that it consists of the machinery section and the control section. The high-pressure pipe of each unit passes through the basement beneath the control section and terminates in the wheel-pit on the stream side. In the machinery section above the wheel-pit is the thrust-bearing floor, at which level, away from



FIG. 4—INTERIOR OF THE GENERATING STATION OF THE RIO DE JANEIRO TRAMWAY, LIGHT & POWER COMPANY.

at could be carried without reloading from the docks in Rio arbor to the power house site. This private road is of (5 ft in) 1.60 m gage.

POWER HOUSE.

The power house is located so close to the banks of the stream at practically no tail-race work at all was necessary. The undation consists of a heavy concrete mat on a very hard ravel, mixed with boulders, making a most excellent founda- on and requiring a minimum amount of concrete. The base- ent walls are of concrete, as are all floors, while the super- ructure is a steel-frame building with walls of brick finished th cement plaster. The over-all dimensions of the power ouse are: length, 235 ft 7½ in. (72 m); width, 95 ft 11 in. (29 m), and height, 78 ft 11 in. (24 m) from wheel-pit floor to ves. The roof is of book tiles covered with tarred and raveled paper, and in the generator-room the customary monie- r was inserted. Throughout this tropical power house all indows are equipped with mosquito screens, for at certain sea- ons moths and other insects are troublesome.

the stream, are mounted the oil pumps for the governors and thrust bearings. Further away from the stream are the transformers in masonry pockets.

Above the thrust floor is the main or generator floor, where an electric crane handles all generating and transformer units, for the transformer pockets extend up through the main floor in such manner as to allow the use of the crane in handling them in the pockets or in removing them therefrom. The control section of the house is described under the switchboard arrangement.

The six vertical-shaft units run at 300 r.p.m. As shown by the cross-section of the unit, the weight of the moving member is carried by the thrust bearing on the intermediate or thrust-bearing floor. There is one steady bearing just below the thrust bearing, while an upper steady bearing is mounted in a spider supported from the bedplate of the generator, so that the revolving field is overhung from the top of the shaft. As the shaft was made in Zurich and the revolving field in Pittsburgh, it was arranged to use a taper keyway in the hub of the field so that it

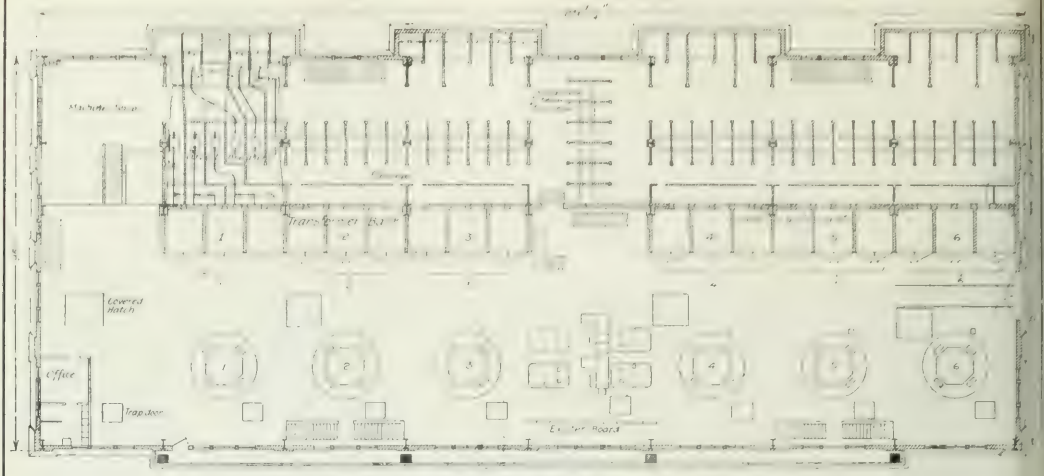


FIG. 5.—GENERAL PLAN OF POWER HOUSE AT GENERATOR FLOOR LEVEL.

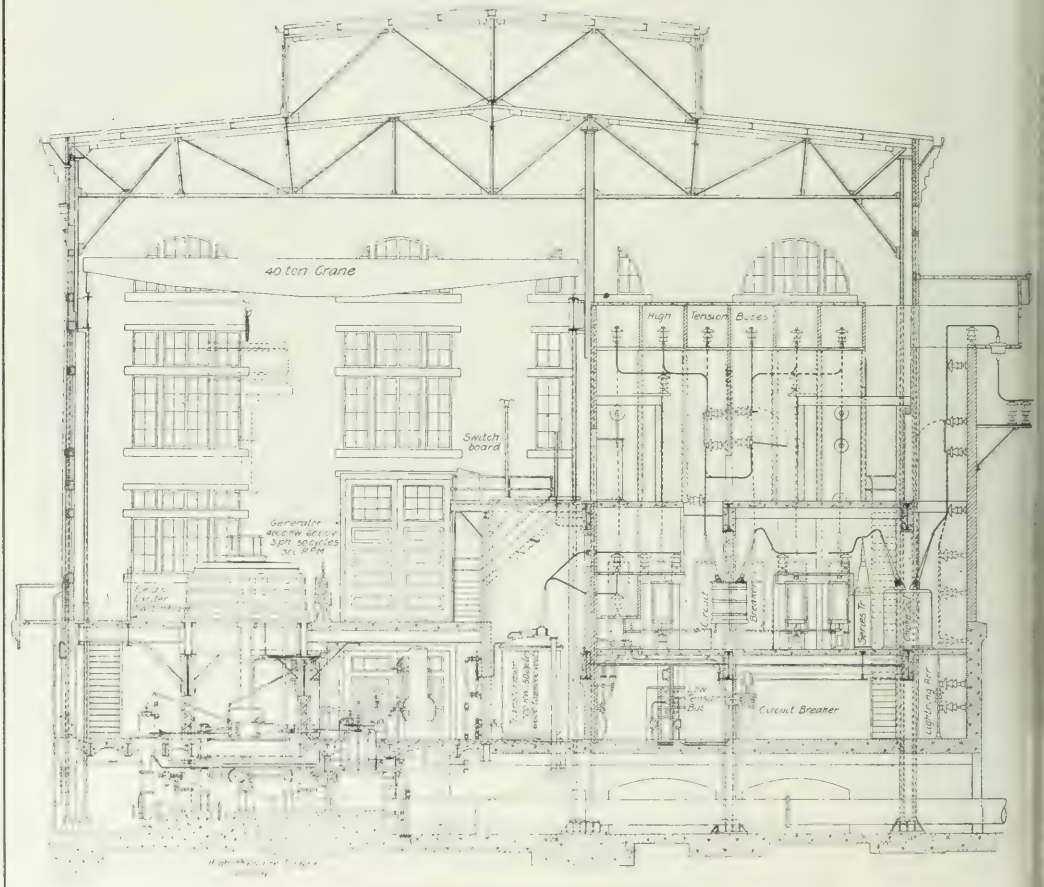


FIG. 6.—SECTIONAL ELEVATION OF POWER HOUSE.

HYDRO ELECTRIC POWER PLANT OF THE RIO DE JANEIRO TRAMWAY, LIGHT & POWER COMPANY.

is not necessary to ship the shaft to the generator builder for essing on the field. To align the revolving member of the it, the ends of the upper bearing spider have adjustable edges. There is also provision for adjustment between the dplate and the stationary armature to adjust the air-gap.

TURBINES.

The turbine employed is of the Pelton type and has but a

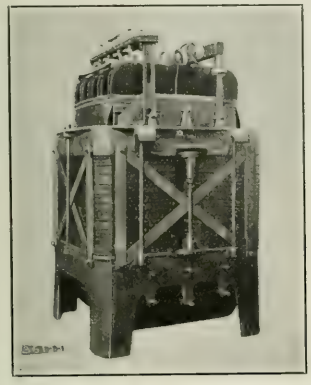


FIG. 7.—80,000-VOLT, 1700-KW TRANSFORMER.

ngle runner upon which are directed streams from four nozzles at 90 deg. The runner consists of a cast-steel disk to which e riveted 18 cast-steel buckets, with a pitch diameter of (83.46) 2120 mm. As the maximum head with the reservoir just ll is (1017 ft.) 310.03 m, and the minimum head with the in- ce just submerged and a friction loss of (56 ft.) 17.1 m is 98 ft.) 273.9 m, the ratio of peripheral speed to spouting locity varies from 42.7 per cent to 45.4 per cent. The four edle nozzles are connected by levers and shaft to the piston of

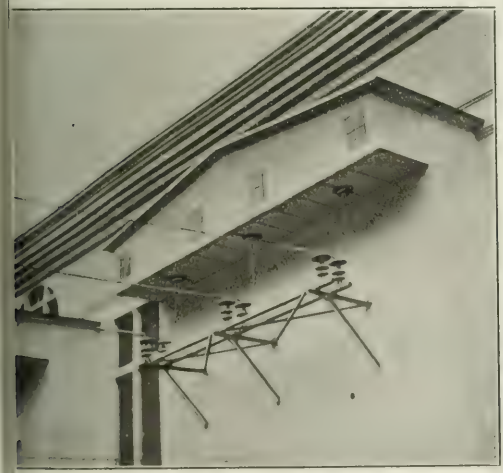


FIG. 8.—OUTGOING 80,000-VOLT LINE.

governor cylinder. This is single acting with an oil pres e from the governor opening the nozzles against the water ssure combined with a disk spring movement tending to close. closing movement of 20 per cent of the needle opening auto- tically opens a relief valve, so that the pressure in the water umn may not rise more than 10 per cent above normal. The ief valve is actuated by a pair of tandem cylinders in which water pressure in the feeder itself tends to open, and an oil ssure from the governor tends to close the valve, so that en the needle movement relieves the oil pressure the relief opens and stays open until the oil pressure fills the oil cylinder; this may take two minutes. The governor is of the typical Escher-Wyss type for high-head work. Each turbine has its own governor pump, driven by a Pelton wheel fed from a by-pass on the main turbine valve; this pump delivers oil at 350 lb. to the square inch to the governor, and by means of reducing valves supplies oil at 120 lb. to the thrust bearings. The oil



FIG. 9.—EXCITER SWITCHBOARD.

pump is provided with an accumulator into which is piped a reserve oil main fed by two reserve pumps in such a manner that, should the pump of any unit fail, oil from the reserve pumps is automatically fed into the accumulator. The main turbine valve is opened and closed by water pressure from the by-pass above mentioned, but the speed of opening and closing is automatically regulated. The guaranteed efficiency is 80 per cent at 95 per cent gate; 78 per cent at 75 per cent gate, and 75 per cent at 50 per cent gate. The guaranteed regulation in speed is 3 per cent speed change on 25 per cent load change; 6 per cent speed on 50 per cent load, and 10 per cent speed on

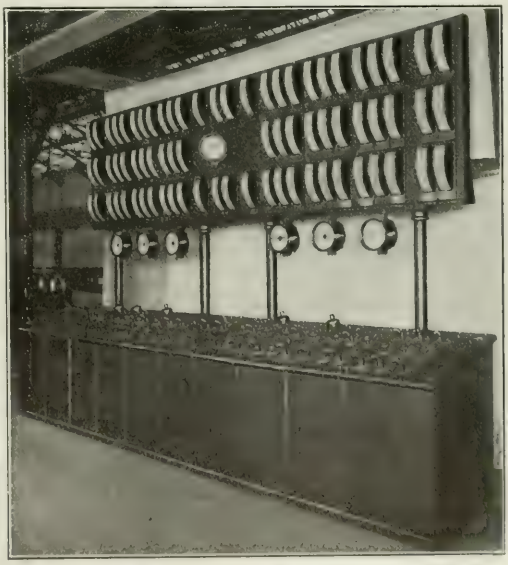


FIG. 10.—BENCH TYPE CONTROL BOARD.

100 per cent load. From no-load to full-load the speed variation is 3 per cent.

GENERATOR.

As indicated in the cross-section of the unit, the generator is of the internal revolving-field type. The 20 poles are of laminated iron dovetailed to the cast-steel, umbrella-shaped spider, which has seven arms of H-section. The field coils are of strap copper, wound on edge, and are held in place by wedges of non-magnetic metal fitted into grooves at the pole tips. The outside diameter of the field is 112⅝ in. (2855 mm). The field is

wound for an exciting voltage of 250 volts, and the collector rings are of cast iron, mounted on the upper side of the field spider, and accessible from a bridge over the top of the unit. Brush holders have 2-in. vertical adjustment.

The stationary armature is wound for a normal voltage of 6000. The casting is in halves, and the laminations are dovetailed to the casting. There are 180 slots of the open type, and in each is a single coil of three turns. The coils are completely formed and insulated before being assembled and are connected in series star. The inside diameter of the casting is 128 in. (3251 mm) and the bore 114 in. (2895 mm). The generator has a normal rating of 4000 kw on 33 deg. C. rise and overload ratings of 5000 kw continuously on 35 deg. rise, and 6250 kw for two hours on 55 deg. rise. It should be noted that the air temperature in the shade is very often above 35 deg. C.—that is, 95 deg. Fahr. The voltage regulation is 8 per cent and the efficiency from 4000 kw to 6250 kw is above 97.7 per cent, not including friction or windage.

tors. The low-tension winding is designed for 6000 volts and the high-tension windings may be connected in multiple or in series to give either 44,000 volts or 88,000 volts with delta connections. A voltage of 76,120 is also possible if star connections are used, and an arrangement of taps allows for some adjustment of the ratio so that the generators may operate at 6000 volts when the line voltage is somewhat less than 88,000, as would occur before the plant is fully loaded. The full-load efficiency of the transformers is 98.3 per cent; their regulation is nine-tenths of 1 per cent on non-inductive load, and 3 per cent on a load with 80 per cent power factor. These transformers are located in fireproof masonry pockets under the crane runway

SWITCHBOARD

The exciter units with their busbars, rheostats, etc., are placed in the center of the station, as shown in the plan of power house, dividing the six units—all placed in one line—into two groups of three. The control switchboard is placed in a gallery oppo-

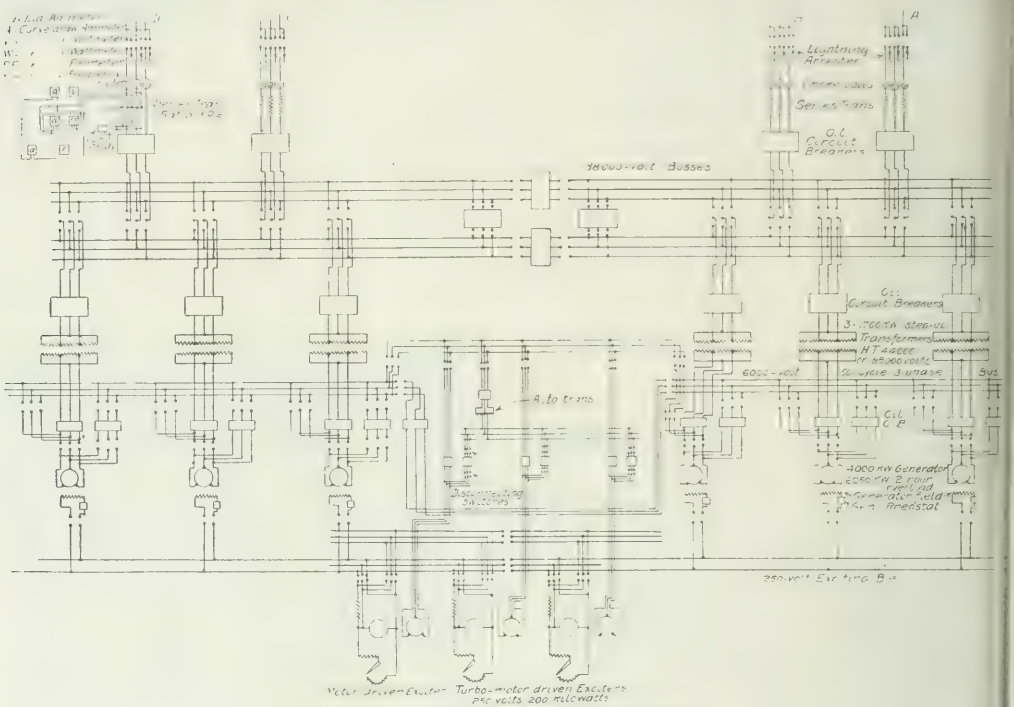


FIG. 11.—DIAGRAM OF ELECTRICAL CONNECTIONS

EXCITERS AND AUXILIARIES.

To provide excitation current and energy for such auxiliaries as crane and lamps, as well as for switch and operating circuits, there were installed three 200-kw exciter sets wound for 250 volts and operating at 500 r.p.m. Two of these are composed of a Pelton-type turbine and a 400-hp, 6000-volt induction motor upon a common shaft with the exciter, thus allowing the exciter to be driven by either the motor or the turbine. The third set is similar, except that it has no turbine, though such can be added when desired. The arrangement of the exciting circuits is such that they are not carried to the switchboard gallery, but go direct from the exciter board on the main floor to the generators and are opened and closed through distant-control switches. This arrangement removes the heavy exciting buses from the control desk.

TRANSFORMERS.

There have been installed six three-phase banks of oil-insulated, water-cooled transformers. Each bank comprises three 1700-kw, single-phase transformers, so that the size and number of banks correspond to the size and number of generate the exciter units, affording the chief operator a good view all units. The exciter board is located on the main floor rectly opposite the control gallery, all exciter switches and rh stats being electrically operated from the gallery. The cro section of the power house shows the location of the galle which lies in a bay between the two groups of transform corresponding to the two groups of generators. Immediately the rear of the transformers is the low-tension bus struct built in sections to correspond to the two generator grou This structure is of masonry enclosing the busbars in comp ments, and masonry barriers protect the oil circuit-breakers disconnecting switches. All breakers are solenoid opera Above the low-tension structure are the high-tension oil circ breakers, from the top terminals of which leads are carr through two sets of disconnecting switches to the two sets high-tension buses located at the top of the building. E transformer bank or outgoing feeder has but a single oil circ breaker, but the disconnecting switches allow for throwing either set of buses. Especial attention is called to the loca of these high-tension disconnecting switches on the same fl

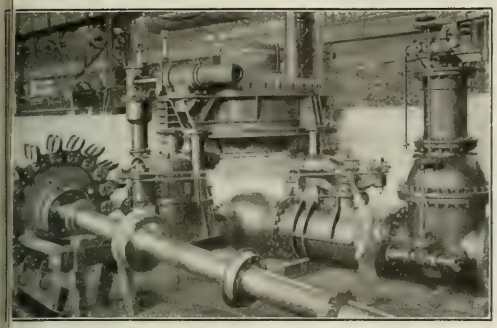


FIG. 12.—DETAILS OF 9000-HP HYDRAULIC TURBINE.

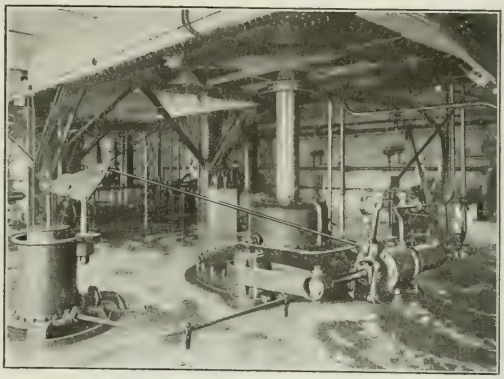


FIG 13.—THRUST BEARING FLOOR.

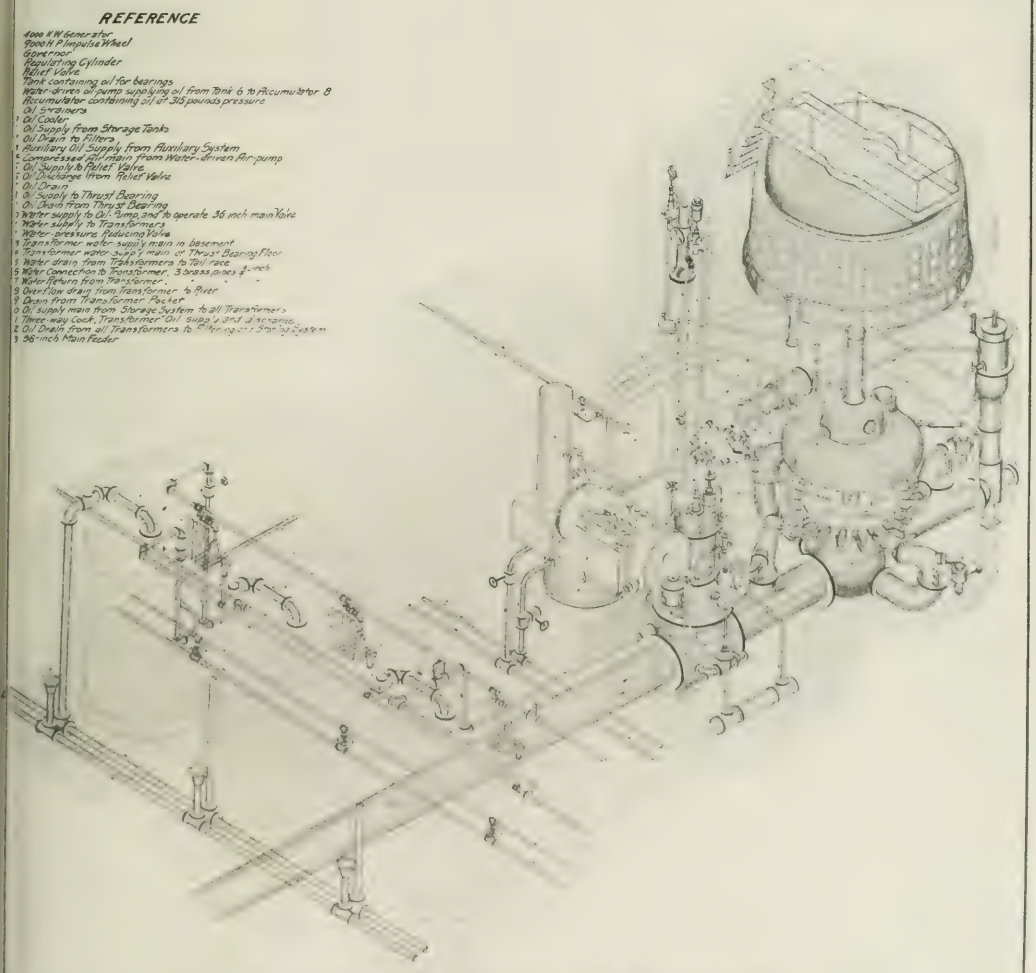


FIG. 14.—COMPLETE PIPING CONNECTIONS OF ONE OF THE 9000 HP UNITS

HYDRO-ELECTRIC POWER PLANT OF THE RIO DE JANEIRO TRAMWAY, LIGHT & POWER COMPANY.

with the operating board and adjacent thereto, so that the pulling of these can readily be effected by the switchboard attendant. Each set of buses, both high and low tension, can be divided at the center of the station by a sectionalizing circuit-breaker, and each pair of halves of the high-tension bus can be paralleled through a circuit-breaker.

All high-tension, 88,000-volt, wiring has been enclosed in masonry compartments. The high-tension delta itself is made in compartments, and from the delta of these transformers out to the line there is always a masonry barrier between two phases. As the lighting, power and railway service of the city is fed from a single power house, it was considered most advisable to use these barriers to prevent any possible disabling of the entire high-tension wiring either through fire or arcing.

There are four outgoing lines, two from each half of the station. As each feeder can be thrown to either set of buses and these can be opened at the middle, it is possible to operate the station in four distinct parts, each part upon an outgoing feeder. For ordinary operation parallel running is employed. Each outgoing feeder is to carry 10,000 hp normally and 20,000 hp in an emergency. The feeder switches are automatic through the customary series transformers and inverse time-limit relays. Low-equivalent lightning arresters with oil-immersed choke coils

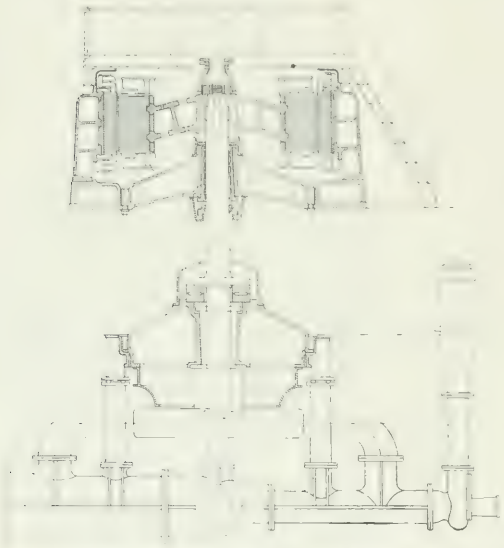


FIG. 15.—SECTIONAL ELEVATION OF HYDRO-ELECTRIC UNIT.

are used. The feeders pass out through the station walls through Locke wall bushings, as shown by the exit of feeder.

The control board is of the bench-board type, of black-enameled marble, with the indicating instruments on a separate instrument frame. The recording instruments are on a separate frame at the rear of the operator. All operating circuits are 250 volts, direct current. Mimic buses are provided on the bench board.

The plant has been constructed under the direction of the president and consulting engineer, Dr. F. S. Pearson, with Mr. L. J. Hirt in charge of design and Mr. C. H. Kearny in charge of construction. The company performed all construction work not included in the work of the pipe-line and power-house contractors. The low-pressure feeder pipes and the power-house steel were supplied and erected by the Riter-Conley Manufacturing Company; the high-pressure pipes and turbines and accessories were supplied and erected by Escher, Wyss & Company, and the entire electrical equipment was supplied and erected by the Westinghouse Electric & Manufacturing Company.

A description of the transmission and distribution systems will appear in a later issue.

Interconnections of Electrical Equipment of Indiana Steel Company, Gary, Ind.

By E. A. Lof.

BEFORE giving a description of the switchboard equipment for the above plant, it seems desirable to present an outline of the arrangement of the generating equipment and the various auxiliary machinery.

The prime movers consist of horizontal twin-tandem, double-acting gas engines, the gas for them being obtained from the eight blast furnaces. In order to secure a more reliable operation the plant has been divided into two distinct sections, which are known as stations No. 2 and 3, respectively. Both stations are located in the same building, but can be operated either entirely independent of each other or in parallel. Station No. 3 is now completed and in operation and station No. 2 is rapidly nearing completion.

By referring to Fig. 1 it will be seen that the generating equipment for station No. 3 consists of nine 3000-hp gas engines, capable of developing about 50 per cent overload. Engines Nos. 1 and 2 are directly connected to 2000-kw, 250-volt direct-current generators and engines Nos. 3 to 9, inclusive, are directly connected to 2000-kw, 25-cycle, 6600-volt, three-phase generators. For the excitation of the generators there are installed one motor-driven set consisting of one 500-kw, 250-volt generator and one three-phase, 25-cycle, 6600-volt synchronous motor.

Station No. 2 has an equipment of eight 3000-hp gas engines also directly connected to 2000-kw, 25-cycle, 6600-volt, three-phase generators, and in addition there are two 2000-kw, 25-cycle, 6600-volt, three-phase steam turbo-generator units. The exciter equipment for station No. 2 consists of two 500-kw 250-volt sets similar to the one in station No. 3. These sets are intended for the excitation of the eight gas-engine-driven generators. There is also installed one 70-kw, 125-volt induction motor-driven exciter for the two turbo-generators. One of the 500-kw exciters is a reserve unit.

In a separate building, next to station No. 3, there is installed a 10,000-amp storage battery, the purpose of which is to reduce the fluctuating load on the generating equipment. In connection with this battery is furnished the necessary auxiliary machinery, which is installed in station No. 3.

All of the switching devices are of the remote-control type electrically operated from benchboards located on the gallery in the centers of stations Nos. 2 and 3, respectively.

ALTERNATING-CURRENT GENERATORS.

As before stated, the alternator equipment consists of 1 generators; the connections for these are shown in the diagram of Fig. 2. By referring to this diagram it will be seen that the generator leads are divided into two branches, each branch feeding energy into one set of the three-phase busbars. In each of the two branches are provided one three-pole, single-throw, non-automatic oil switch and on each side of these switches three single-pole, single-throw disconnecting switches.

The oil switches have no overload protective devices, but they are provided with plain double-pole, reverse-power relays which will automatically open the switch on a reversal of the power in the circuit. These relays are operated from separate series current transformers and only one relay is required for the two generator oil switches. All energy for operating the opening and closing coils of the various switches is obtained from the 250-volt direct-current system.

An automatic synchronizer is installed in connection with the generators, synchronous motors, etc. The automatic synchronizer consists essentially of two solenoids acting on cores hung on opposite ends of a rocker arm. The solenoids are connected so that the right-hand end of the rocker is at the extreme lower end of the stroke when the e.m.fs. of the generators to be synchronized have no phase difference, and is at the upper end of the stroke when the phases are in opposition. This relation causes the rocker arm to oscillate up and down in unison with the fluctuations of the current in the synchroni-

ng lamps. When the right-hand end of the rocker arm approaches the lower end of its motion with less than a predetermined speed, the contact closes the circuit of an auxiliary relay, which in turn closes the circuit operating the closing coil of the oil switch. The auxiliary relay is used to avoid carrying the closing current of the main switch through the contact of the automatic synchronizer. The closing of the contact occurs before synchronism by a predetermined length of time sufficient to permit the main switch to complete the circuit exactly at the point of synchronism. The synchronizer does not make contact at all unless the difference in speed of the machines is less than a predetermined amount. The control switches, which are mounted on the benchboard panels, are of the drum-type construction, one control switch being provided for each of the two oil switches for each generator circuit. These two control switches are mechanically interlocked on the benchboard in order to prevent the generator being connected to both sets of the busbars at the same time. When the control switch is turned to the trip position, the circuit through the trip coils of the main switch is completed, thus opening the connection from the generator to the busbars. At the same time an e.m.f. of 100 volts from the alternating-current busbars is impressed upon the left-hand posts of the synchronizer, which action brings the rocker arm from the synchronous position to a horizontal position, thereby opening the synchronizer contacts and leaving them in a safe position.

On turning the control switch to the closed position, an e.m.f. of 100 volts from both the busbars and the generator is impressed upon the synchronizer, the rocker arm of which starts to oscillate. At an instant later the closing circuit is completed as far as the auxiliary relay, and the direct-current circuit, which operates the relay, is closed as far as the synchronizer. When the synchronizer closes its contacts the relay also closes and operates the main switch. On returning to the "off" position after closing the main switch, the controller opens the direct-current circuits to the synchronizer and to the closing coil of the main switch. This latter circuit is opened at a second point by the relay. An instant later the shunt transformers are disconnected from the synchronizer.

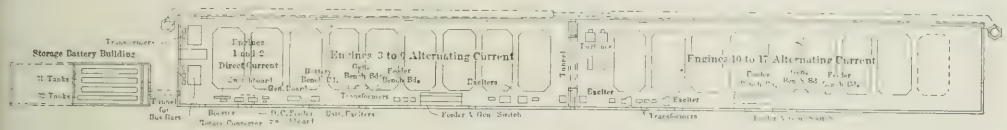


FIG. 1.—PLAN OF POWER HOUSE.

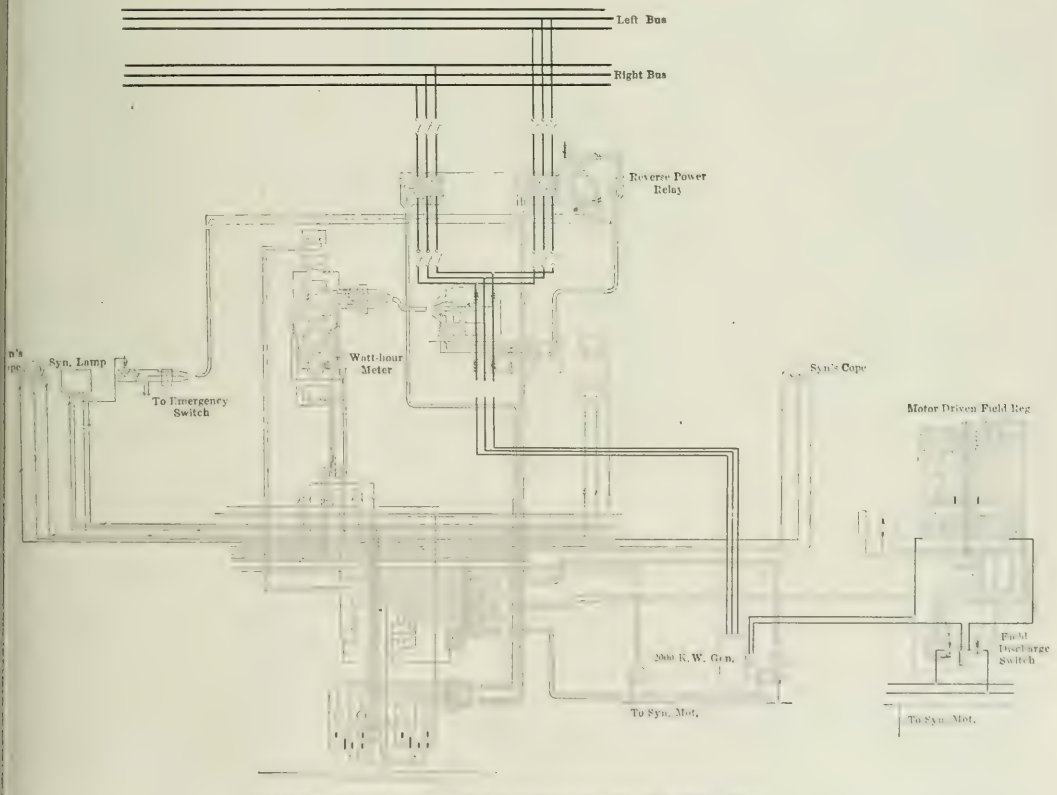


FIG. 2.—WIRING DIAGRAM FOR ALTERNATING-CURRENT GENERATORS.

In addition to the automatic synchronizer there is provided one 16-in. illuminated-dial synchroscope for each of the two sets of busbars, so that if desired the machines can also be synchronized independently of the automatic synchronizer. The synchroscopes are mounted on swinging brackets. With the control switches, which are mechanically interlocked, there are provided one red and one green indicating lamp for show

ing the closed or open position of the main switch. These signal lamps are operated automatically by means of small switches, which are mounted on the main oil switches.

Each generator has its own control panel on the benchboard. The following instruments are provided for each generator: Three alternating ammeters, one field-circuit ammeter, one three-phase watt-hour meter, one three-phase indicating wattmeter and one alternating voltmeter. In addition to these instruments there is provided one alternating voltmeter for each set of busbars, mounted on pivoted brackets on the generator section of the benchboards. Each section is also equipped with a power-factor switch by which the operator can connect any circuit to one common power-factor meter.

For each generator field circuit there is provided one double-pole electrically operated field-circuit discharge switch and one electrically operated field-circuit rheostat. The field-circuit

bars, it is taken off by two separate branches terminating into one combined outgoing feeder circuit. For each branch there is one three-pole, single-throw automatic oil switch, with three single-pole, single-throw disconnecting switches on each side. The two oil switches for each feeder circuit are provided with one common double-pole, overload and inverse-time-limit relay operated from two series transformers. The two control switches, which are mounted on the benchboard, are mechanically interlocked in order to prevent the feeder circuit from being connected to more than one set of the busbars at one time. Red and green indicating lamps are also provided for these control switches.

Each feeder circuit has on the benchboard panel three alternating ammeters and one three-phase watt-hour meter, and all the necessary instrument transformers are, of course, included. In addition, there is provided on the benchboard for each feeder

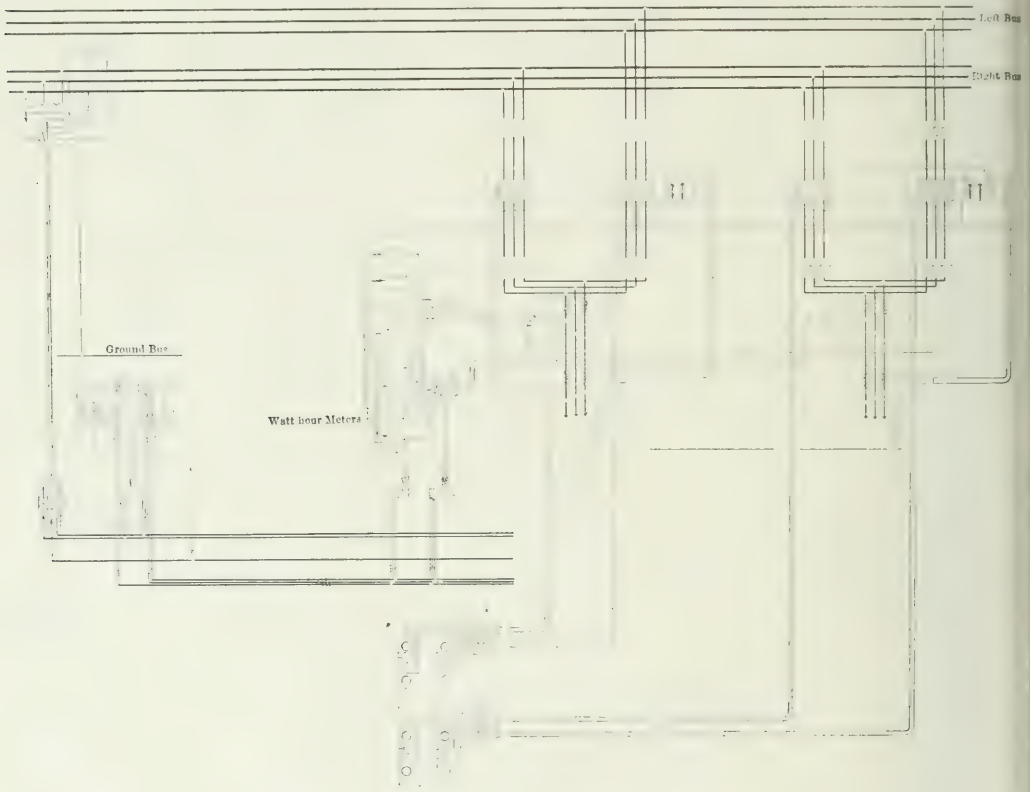


FIG. 3. WIRING DIAGRAM FOR ALTERNATING-CURRENT FEEDERS

discharge switches are of the magnetic blow-out type mounted on the same framework as the cross-head type rheostats. The control switches for these, as well as for the governor motors, are located on the benchboard sections. The governor-control switches are provided with extra contacts wired to colored indicating lamps, which will show to the engine attendant if the speed is to be raised or lowered. This equipment is used as an emergency signal system in case the governor motor should fail to operate.

ALTERNATING CURRENT FEEDERS.

Station No. 3 is equipped with two 10,000-kw, two 3000-kw, two 2500-kw and four 1000-kw outgoing feeder circuits, and station No. 2 is provided with ten 10,000-kw circuits. The connections for these circuits are shown in the diagram of Fig. 3. In the same manner as energy is fed into the main bus-circuit one power-factor switch for connecting the common power-factor meter to any feeder circuit.

HIGH-TENSION LINE.

Besides the above-mentioned feeder circuits there is one 9000-kw, 22,000-volt circuit for connection with the Illinois Steel Company Works at South Chicago. By means of this line the two works can be connected together and either deliver or receive energy from each other as the demands may be. The control apparatus for this line circuit are approximately the same as for the other feeder circuits with the exception that, of course, 22,000-volt oil switches are provided and also that the necessary synchronizing apparatus are included.

TIE LINE.

As before stated, the stations No. 2 and No. 3 can either be operated entirely independently or in parallel. In order to

accomplish the latter a tie line is provided between the two stations. This line runs on brackets outside the building and the connections to it in each station are similar to the feeder connections with the addition of the necessary arrangements for synchronizing. The tie line has a rating of 10,000 kw.

SYNCHRONOUS MOTORS.

The connections for the synchronous motors driving the exciters are approximately the same as for the generators. For each synchronous motor there are provided two non-automatic three-pole, single-throw oil switches with one double-pole reverse-power relay and the necessary transformers. Control switches for the main oil switches and for the field-circuit rheostat are also provided, as well as indicating lamps and power-factor meter switch. The necessary apparatus for synchronizing are also provided, because all of the sets are started from the direct-current side.

On each motor panel on the benchboard are mounted one alternating voltmeter, one three-phase indicating wattmeter and one three-phase watt-hour meter. On one of these panels has also

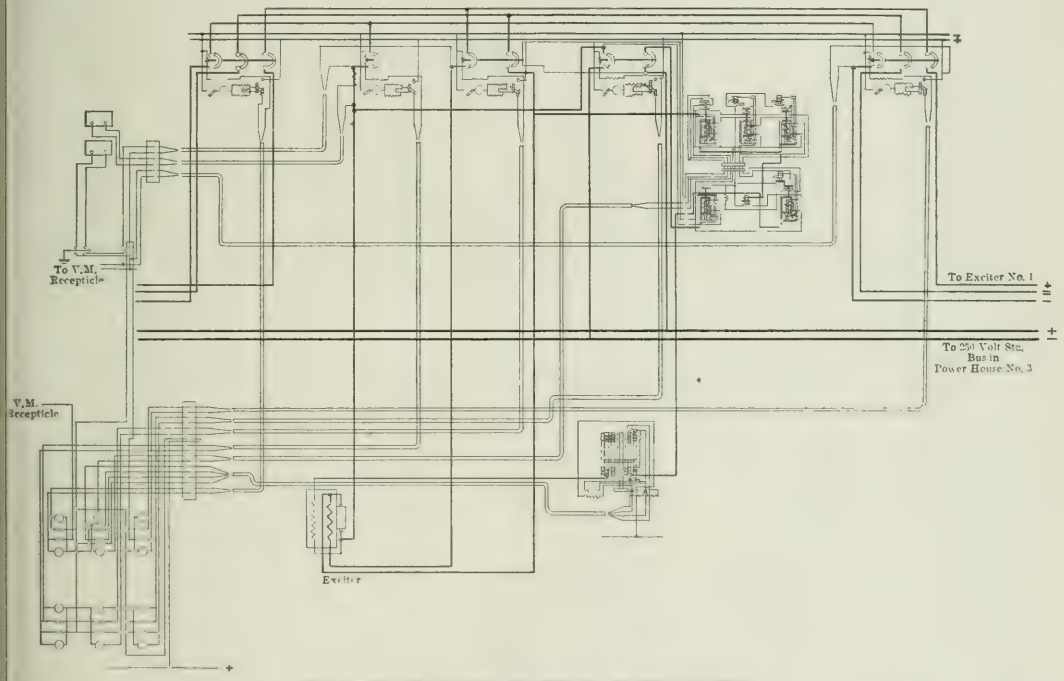


FIG. 4.—WIRING DIAGRAM FOR 500-KW, 250-VOLT EXCITERS

been located an emergency switch for connecting the direct-current control circuit to the storage battery in case anything should happen to the 250-volt exciters or generators.

EXCITERS.

The connections for the three 500-kw exciters are shown in Fig. 4. By referring to this diagram it will be seen that the exciter sets are started from the direct-current side and that a separate double-pole, 250-volt starting bus is provided.

When starting the exciter a double-pole, non-automatic, motor-operated circuit-breaker is closed, and this, in turn, energizes the automatic starter. When the last contact of the starter is closed, which condition is indicated by a signal lamp, and the motor is revolving at full speed, the synchronous motor is synchronized with the alternators, after which the starting breaker is tripped and this disconnects the automatic starter. After this connection is completed the exciter is paralleled with the other exciters, the direct-current generators, or the storage battery by closing, first, the single-pole, non-automatic breaker and then the double-pole breaker. The double-pole breaker carries the positive lead and the equalizer, and the single-pole represents the negative. The control of these motor-operated circuit-breakers is accomplished by the switches on the benchboard, where the usual indicating lamps are provided. Each exciter panel is equipped with one ammeter, one voltmeter and one two-wire, 250-volt recording wattmeter.

The three exciters are connected to a common exciter busbar, which is sectionalized for each exciter by means of a three-pole, 2000-amp, non-automatic rigidly connected arm tie-circuit-breaker. A similar breaker is also provided for tying the exciter busbar to the main generator busbar.

DIRECT-CURRENT GENERATORS.

The two gas-engine-driven 2000-kw, 250-volt direct-current generators installed in station No. 3 are automatically protected by motor-operated circuit-breakers. The positive and equalizer circuit-breakers are non-automatic, rigidly connected and operated by one motor, while the negative breaker is equipped with overload and reverse-power devices and operated by a separate motor. The positive and negative breakers are of 8000 amp rating, while the equalizer has a rating of only 2000 amp.

The circuit-breakers are controlled by switches on the benchboard. The opening of the positive and the negative circuit-breakers from the benchboard completely disconnects the generator from the busbars. If the voltage of the machine falls sufficiently below the voltage of the busbars to cause a reversal of the power of the generator, the reverse-power device will open the circuit-breaker and it can not then be closed until the voltage of the machine is equal to that of the busbars.

Each generator is equipped with a motor-driven rheostat controlled from the benchboard. An ammeter and a voltmeter are mounted on the respective benchboard panels. No shunts are being used with these ammeters; the ammeter leads are connected directly to the generator leads and the compensation for heating being taken care of by means of compensating coils. Each generator is provided with a watt-hour meter

mounted on the circuit-breaker panels, which are located in front of their respective generators.

DIRECT-CURRENT FEEDER CIRCUITS.

These are fed with energy from the main direct-current bus-bars—four 500-kw, one 1000-kw, three 1500-kw, and one 2000-kw, 250-volt direct-current circuits. The positive lead of each circuit is protected by a single-pole automatic motor-operated circuit-breaker, while in the negative lead only a single-pole knife switch is provided.

The single-pole circuit-breakers range from 2000 amp to 8000 amp in normal rating. As the feeder circuits supply energy to machinery which is subject to heavy overloads for a few seconds at a time, it was found that some device had to be supplied to retard the tripping actions of the overload armature of the circuit-breakers in order to prevent the circuit from being opened on a rise of current which would not be dangerous unless continued for an extended period. For this work there is provided a time-limit device which allows the circuit-breaker to stay closed when the load is at or less than the adjustment of the overload armature. Should the current, however, rise above the value of the adjustment, then the time required for the breaker to open is decreased in proportion to the square of the current. The fact that this device is free from relays and that there is no movement of the tripping armature until the current has reached a magnitude dangerous to the apparatus in the circuit renders it particularly adaptable to this kind of service.

The current in each feeder is measured by an ammeter located on the benchboard and, in addition to this, the power is recorded by means of a wattmeter located on the respective switch panels.

In a subsequent article descriptions will be given of the storage-battery installation and the details of the switchboard equipment.

The Advantages of Forced Draft in Generators and Motors.

By Alex. Churchward.

Only recently has air cooling by forced draft been introduced into the design of the smaller sizes of stationary direct-current motors in this country. However, for several years designers have made particular effort to insure complete ventilation of all parts of the larger type of directly connected units, rotaries and similar machines, which are subject to considerable heat rise. It is safe to assert that were it not for the proper cooling and ventilating of these large machines by forced draft, their present high efficiency could not be maintained, their output rating would be reduced and the temperature rise would be so great that in time the insulation would be destroyed.

One of the most important essentials in the design of high-grade direct-current machinery is magnetic stability, or the resistance of the magnetic field, as a whole, against distortion by armature reaction. To obtain this very desirable feature the field must be made "stiff," to use a designer's expressive term. To insure a stiff field necessitates either the use of a large amount of copper and great depth of winding in the field coils with low current density and natural heat radiation, the coils being only cooled on the surface, or a smaller amount of copper windings of less depth, higher current density and forced ventilation within and around the coils. The smaller spools permit the use of smaller machine frames, and motors designed for artificial self-ventilation can, therefore, be made smaller, lighter and more adaptable to many uses.

Another very desirable consequence attending the use of forced ventilation is the ability of machines provided with this feature to carry large overloads. As the heat generated in the windings varies as the square of the current, it will be readily seen that a machine which will run within the safe temperature limit at normal loads will heat rapidly, possibly to a dangerous point, under overloads, unless some provision is made to carry off the extra heat generated. In large machines the radiation of heat is a comparatively simple proposition as all of the parts are large and there are no small pockets to hold the hot air; moreover, owing to the larger size of the parts it is a simple matter to provide the necessary air-ducts without perceptibly increasing the over-all dimensions of the machine.

Complete ventilation by means of air-ducts has been in vogue in even the small sizes of alternating-current motors for some years, and it has not been a hard matter to accomplish this result owing to the type of primary and secondary windings used in such motors. In small direct-current stationary motors, however, no similar expedients to reduce the temperature appear to have been generally employed. If it is desirable to use forced ventilation in the alternating-current motor with its simple squirrel-cage armature of comparatively large diameter and short, shallow core, which permits a large opening between the core supports and the shaft, it is evidently more desirable, and necessary even, to adopt forced ventilation in the direct-current motor with its solid armature of small diameter and greater length, compared with that of the alternating-current motor armature. Furthermore, in the direct-current motor the heat from the commutator due to the brush losses, contact losses and friction must also be radiated.

In Germany some of the principal manufacturers have realized the great advantages of artificial cooling in direct-current motors and are putting out complete lines of such machines. The small direct-current motor does not receive the care and inspection that the larger sizes enjoy; it is usually placed in some location that is worthless for anything else and is seldom inspected until there is a breakdown. A motor, to give the greatest satisfaction to the user under such adverse conditions, must possess so great magnetic stability that there will be a minimum sparking at the commutator under any conditions encountered in service.

To obtain a field of requisite stiffness in a small motor of limited dimensions and weight would be impossible unless forced draft were resorted to. One may choose, therefore, between a light, compact and moderate-priced motor provided with forced draft that will operate well and withstand any ordinary abuse, and a naturally ventilated motor of larger weight, size and cost that will remain cool, but will be sensitive to changes of load.

The use of forced draft does not mean that the motor designed for artificial ventilation will have a lower efficiency than one without forced draft; on the contrary, it will run cooler, and the gain, due to the lower resistance, will more than offset by a considerable margin the amount of power required to provide the increased ventilation. Yet another and still greater gain will be attained, for, with a very stiff field, the commutation is more perfect; the commutator in a very short period of time assumes that beautiful burnished appearance which means low brush-friction losses and low contact losses between the brushes and the commutator; with an ordinary machine having a sensitive or less stable field the commutator may become rough and black, and the losses in this case may reduce the efficiency by from 5 per cent to 10 per cent. In railway work if the motors were not cooled by forced ventilation due to the draft maintained by the speed of the car, it would be impossible to put motors onto the standard trucks giving power enough to drive the cars.

The same general statements are true in regard to automobile motors, which to-day are conceded to represent the highest development in direct-current motor design. When one takes into consideration the small space occupied, the high efficiency obtained and the tremendous overloads which have to be carried, the performance of the automobile motor is marvelous. The writer has in mind one instance which very clearly demonstrates the real advantage of forced cooling. A vehicle was equipped with a motor, the temperature rise of which was 50 deg. C. at normal load when tested on the bench; subsequently when the vehicle was driven for hours at high speed

and over bad roads and the average current consumption of the motor was in the neighborhood of twice the normal at the end of the run, the temperature of the motor was not over 45 deg. C. above the atmosphere. The motor was so placed under the vehicle that it was thoroughly cooled by its passage through the air.

If, as has been pointed out in the foregoing, it is worth while to take advantage of that which is virtually forced ventilation in street-car and automobile motors, it would seem to be good practice and engineering to use artificial ventilation in all classes of stationary work for the purpose of gaining the advantages pointed out above. To accomplish such results in the small stationary motor it is necessary merely to place at the end of the armature shaft a fan which will force the air along the armature, over the commutator and between the field spools, so that no dead air may be pocketed to accumulate heat.

Location of Faults in Cables.

By H. Mauradian.

In determining the location of high-resistance leaks to ground in a cable, the Murray or the Varley loop tests are generally resorted to. Both methods suppose a good pair and a bad pair in the cable. This is not always the case, because it sometimes happens that there are practically no good pairs in the cable to be tested, so that the Murray or the Varley loop tests are extremely unreliable, and, in fact, are not used. Moreover, even if there would be a good pair or pairs in the cable, the search for a good pair consumes considerable time. It should also be borne in mind that unless the so-called good pair is relatively very good with regard to the bad pair, the location indicated by the ordinary method may be very much at variance with the true location.

It may be shown that the exact formula for the localization would be:

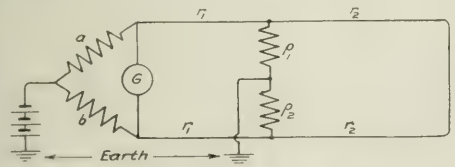
$$r = R \times \frac{\rho_1 - \rho_2 \frac{a}{b}}{(\rho_1 - \rho_2)\left(\frac{a}{b} + 1\right)} \qquad (1)$$

where

R = loop resistance.
ρ_1 = leakage to ground of good pair.
ρ_2 = leakage to ground of bad pair.

a and b being the resistances in the bridge arms (Murray loop test).

It may be further noted that the knowledge of ρ_1 or ρ_2 is not



LOCATION OF FAULTS IN CABLES.

necessary. If a balance is obtained with the two wires open at the other end,

$$\frac{a'}{b'} = \frac{\rho_1}{\rho_2} \qquad (2)$$

a' and b' being the resistances in the bridge arms.

In substituting this relation in (1)

$$r = R \times \frac{\left(\frac{a'}{b'} - \frac{a}{b}\right)}{\left(\frac{a'}{b'} - 1\right)\left(\frac{a}{b} + 1\right)} \qquad (3)$$

The Murray loop test, as ordinarily applied, would give

$$r = R \times \frac{b}{a + b} \qquad (4)$$

It may be shown that relation (3) dwindles into the ordinary Murray loop formula when $\rho_1 = \infty$ in equation (1), because the following relation would obtain:

$$r = R \frac{1}{1 \times \left(\frac{a}{b} - 1\right)} = R \frac{b}{a + b}$$

which is the same as (4).

To show how important the error committed would be in applying (4) for the localization of high-resistance leaks to ground, assume

$\rho_1 = 5{,}000{,}000$ ohms
$\rho_2 = 1{,}000{,}000$ "

$$\frac{a}{b} = 2$$

$\frac{a}{b}$ being the ratio of the resistances in the Murray loop test. Then (4) would give

$$r = R \frac{b}{a + b} = R \times \frac{1}{\frac{a}{b} + 1} = \frac{R}{3}$$

while the true location is at

$$r_1 = R \frac{5 - 2}{(5 - 1)(2 + 1)} = R \cdot \frac{3}{12} = \frac{R}{4}$$

The relative error would be, therefore, 25 per cent.

English Patent Law—An Important Case.

By an English Barrister-at-Law.

Citizens of the United States who own English patents have been in a state of some doubt with regard to their rights under the act which has recently come into force in England. Section 27 of the act provides that at any time not less than four years after the date of a patent, and not less than one year after the passing of the act, any person may apply to the Comptroller for the revocation of the patent on the ground that the patented article or process is manufactured or carried on "exclusively or mainly" outside the United Kingdom. The second clause of the section authorizes the Comptroller to revoke a patent on application, unless the patentee is able to prove that the article is produced or the process carried on to "an adequate extent" in the United Kingdom.

Until a few weeks ago there was no authoritative case as to the meaning of this enactment; but on April 1 the judge to whom the administration of this act is largely entrusted made a general statement of great interest to patentees who are foreign to England. He was dealing with a case in which the patent, a Belgian one, was revoked because it was not worked in England.

In the case under review, Mr. Justice Parker set himself to define the words "exclusively or mainly" and "adequate extent." He said: "The keynote of the section is, in my opinion, forfeiture for abuse of the monopoly at the instance of even a common informer, the abuse being in certain circumstances presumed unless otherwise disproved." It was contended on behalf of the patentee that the patented article could not be said to be "mainly" manufactured abroad unless more than 50 per cent of the articles were manufactured outside of England. His Lordship said that he did not think that a process or article could be said to be "mainly" carried on or manufactured abroad merely because it was carried on or manufactured abroad to a somewhat greater extent than in the United Kingdom. To come within the subsection, the disparity must, in his view, be greater than a mere percentage. He also said that if the article be manufactured within the United Kingdom to an extent as substantial as may reasonably be expected, having regard to what is being done abroad, he did not think the state of circumstances was as contemplated by the section. These phrases are somewhat vague, but the real truth of the matter is that each case must be decided in accordance with its own peculiar facts.

Mr. Justice Parker makes it quite plain that the comparison is to be made between manufacture abroad and manufacture in Great Britain. The question whether the articles manufactured abroad are or are not imported into England is not an element

to be taken into account Again, the question whether the foreign manufacture is carried on under foreign patents does not matter. "Suppose," said his lordship, "the patentee had no foreign patents, and yet for some reason of his own chose to prevent the industry arising here (i.e., England) while industries in the patented article or process were being developed abroad. I think the section would apply." The section is meant to hit any abuse of the monopoly, the object or result of which was to benefit foreigners at the expense of the traders of the United Kingdom.

With regard to what is manufactured in the United Kingdom to an "adequate extent," Mr. Justice Parker did not lay down any general principle. He pointed out, however, that manufacture would not be adequate "if it be less than it would have been but for the fact that the patentee has exercised the rights conferred by his patent to the hurt of British industry—for example, the fact that he has given preference over British traders would be material." Again, no reason for non-manufacture can be satisfactory "which do not account for the inadequacy of the extent to which the patented article is manufactured, or the patented process is carried on in this country, by causes operating irrespective of any abuse of the monopoly granted by his patent. A patentee must not give preferential terms to foreigners and then seek to defend his conduct by offering to grant licenses in this country on similar terms. He must at least take the same pains to develop the new industry here as he does abroad." But the patentee who has allowed part of the home demand to be satisfied by importation from abroad has not necessarily precluded himself from proving that the manufacture of the patented article is adequate, or from giving satisfactory reasons why it is not adequate. In other words, the policy of the section is to give fair play, not protection, to the British industries.

The mere fact that there is no demand for the patented article in Great Britain will not, in Mr. Justice Parker's view, be a satisfactory reason for not working. Even in the absence of demand, the manufacture might be inadequate, because the rights of the patentee might have been so exercised as to preclude the growth of the demand by the imposition of unreasonable prices or unreasonable terms for licenses. Again, the fact that the patent cannot be worked at a profit in this country is not of itself a sufficient reason for not working. "Could he have started an industry if he had used his monopoly fairly as between home and foreign trade, or if he had devoted the time and money which he has expended in developing a foreign industry in developing a home industry?" That is the question to be asked in all cases. An industry which has been carefully fostered abroad might well have been made successful in this country.

The remainder of Mr. Justice Parker's general observations were devoted to the consideration of certain difficult questions which have arisen in the Patent Office with regard to precedure. This judgment should do much to clear the air for those who contemplate the institution or the defence of proceedings under the new English act.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS.

Battery Charging at Salem, Mass.

The Salem Electric Lighting Company, of Massachusetts, has lately developed a considerable business in the charging of small storage batteries for automobile sparking service. The company makes a flat charge of 50 cents or 60 cents, according to the size of the battery, and also for a small charge will renew the elements of the cells when necessary, although the company does not plan to make general storage-battery repairs. Recent developments in the electric carriage situation have indicated the importance of owners of electric automobiles being able to secure battery parts at the regular market prices. The company stands ready to meet the electric vehicle charging demand with a low rate, and has extended its direct-current lines to all parts of the city of Salem, so that any owner of an electric machine who desires may charge his battery in his own private garage. In Salem it has been found that certain owners of electric machines lost heart through the battery renewal prices which obtained in the town; but as electric carriages are very much desired locally, the hope is that this situation will be much improved at no distant date. It is a well-known fact that in not a few cities the local garage people have sold battery plates at the list prices to their customers, and while the details of the Salem situation in this respect have not come to hand, it is desirable that the owner of an electric vehicle shall not be required to pay unduly for plate renewals through the intention of the garage man to reap a temporary profit.

A Cut in Tungsten Lamps at St. Louis.

The Union Electric Light & Power Company, of St. Louis, Mo., has adopted the policy of selling tungsten lamps at 25 per cent below list prices, in addition to which 15 cents credit is given on tungsten lamps burned out and brought back for exchange. This policy has been adopted to control the output of tungsten lamps in St. Louis and keep up the "more-light-for-the-same-money" policy rather than allow contractors to spread "the-same-light-for-less-money" idea.

Central-Station Enterprise.

The United Electric Light & Power Company, New York, has interested the New York post-office in a trial of electric automobiles in the transmission of mail between various substations in the upper district of the city, the charging service being furnished by the light and power company. It has also encouraged the use of electric drills, with the result that this type of drill is now superseding steam drills within its territory in excavating rock in building operations. By intelligently representing the advantages of the electric hoist, a large construction company has been induced to purchase 12 52-hp alternating-current hoists, which will supersede the steam hoists.

Consumers and the Electric Meter.

The Southern Railway & Light Company, of Natchez, Miss., has sent to its customers as part of a sheet giving a complete schedule of rates for light and power the following information bearing on the electric meter:

"The electric meter is an open book in which we keep the accounts of our customers, and you can do the same if you only will. There is nothing mysterious about the electric light business, nor the electric meter; you can read it just as well as we can, and calculate your bills as easily as you do any other bill. If you do not know how to read a meter we will be pleased to show you. It is seldom that disputes arise with persons who read their meters, because they know when they are using current. Unless you read your meter you may unconsciously waste electricity. Never measure your bills by what Mrs. So-and-So pays; you would not think of settling your other bills on that basis. Do not entertain the silly idea that electric meters are constructed to run fast; meters are designed by the manufacturers to run correctly, and we do our utmost to keep them so, but do not claim that they never vary, no more than the watch you carry or the clock that is in your home. If a meter is incorrect it can readily be detected by an honest and careful test, which we make in every instance when so requested by our patrons."

Disposing of Shopworn Heating Appliances at Des Moines.

A plan used by the Des Moines Electric Company in disposing of various electric cooking utensils which had become out of date or shopworn in being used for trials and demonstrations may be of value to other companies which have accumulated a similar stock. The company had about 25 each of coffee percolators, chafing-dishes and water heaters. These were not all shopworn, some being of old design. The company made the offer to any new residence consumer, where the house had not been wired previously, that it would sell one of these utensils and credit the consumer with the purchase price of the utensil on his monthly bill, up to an amount of $12. In other words, if a person wired his house and took a utensil costing $12, the monthly bill would be zero until $12 worth of electricity had been used.

Inspection of Central-Station Consumers' Installations.

At the Iowa Electrical Convention, April 22, a short discussion was led by Mr. W. J. Greene, of Cedar Rapids, on the importance of inspecting consumers' installations. Mr. Greene thought it important that central-station companies inspect installations to which they connect in order to reduce fire risks and that no new connections should be made without inspection and test either by the central-station company or by some other authorized inspector. Mr. Greene favored the establishment of municipal inspection of electric work. It was suggested that where municipal and insurance inspection is lacking the central-station company should do this work for its own protection. President Mathes, of Dubuque, expressed the opinion that the central-station companies should not take any chances on the work of contractors, but should inspect all jobs before connecting to them. The discussion which followed brought out several cases of death from low-voltage circuits caused by the absence of grounded secondaries.

Selling Domestic Appliances Increases Day Load at Humboldt, Iowa.

Mr. E. M. Sterns, of Humboldt, Ia., in a paper presented at the recent convention of the Iowa Electrical Association, told of some of his efforts in getting a day load by the sale of domestic electrical appliances in his town of 2000 inhabitants. His best income from day load is the revenue from domestic appliances. He secured samples of all the articles along this line, advertised, and started in to dispose of them. Electric irons were put out in four-dozen lots on 30 days' trial until all prospects were supplied. He started in last summer with a dozen fans, and before the hot season was over had a fan in nearly every business house and 30 in residences. Most of the commercial customers who have display windows run their fans in winter to keep the frost off the glass. He suggested that the most satisfactory way to start the sale of electrically operated washing machines is to have the merchant who handles washing machines in the town put one in his window on display and have him make the sales. The same method will work out with the sewing-machine motor. He has not been able to interest people in electric cooking who do not heat their houses with a furnace. The people who have furnaces are usually the ones who can afford to cook by electricity. He had thought the electric curling iron would be a winner, but he found even in his quaint little hamlet that fashion had made the gentler sex the victim of the present Hottentot hair-dressing styles that do not admit curls or waves, and consequently this article was a dead one. Domestic electric appliances have played an important part in the growth of his day load, and without it he thinks he would no doubt go back to the old 12-hour service.

Cordial Relations with Customers.

A subject close to the heart of Mr. Glenn Marston, of New York, is the furthering of cordial relations between central-station companies and their public. Mr. Marston was present at the weekly luncheon of the Electric Club of Chicago on April 28, and by invitation of President Howlett he addressed the members briefly on this subject. He advocated strongly a perfectly frank and open policy in dealing with the public in matters relating to electric service. Cordial relations should be promoted by persuading both the company and the public to accept the viewpoint of the other side. The central-station business should be explained fully, freely and openly. Newspaper men should be made to understand the general features of the work of supplying electricity, that they in turn may make the newspaper-reading public familiar with the real importance of this great undertaking. Mr. Marston pointed out that probably no other business enterprise has done so much for civic advancement during the last 20 years as has the central-station industry. This industry has helped to mitigate the smoke nuisance, aided to abolish child labor, reduced hours of labor and increased wages for machinery operatives by providing the advantages of electric power, and has given greater protection to life and property by lighting the streets effectually, to make them safe at night. But how many customers of central stations have had these facts brought to their attention? The speaker intimated that every electrical man, whether directly engaged in central-station work or not, should make it his business to point out to his non-electrical friends what electricity has done and is doing in making life in the community and the nation better worth living.

Publicity Campaign at Oklahoma City.

The Oklahoma City Gas & Electric Company is carrying on a publicity campaign at the present time along lines followed successfully by other utility companies elsewhere, but which received its first test as applied to electric lighting and gas in Oklahoma City. The idea underlying a series of full-page advertisements now being published in local newspapers covers the education of the public to a point where it can give intelligent consideration to any problem regarding lighting which may arise in the future. A series of 12 historical chapters, covering all the important facts concerning corporate change and improvement since the inception of the enterprise, is to be followed by further chapters covering various phases of operation which will be of public interest.

The original announcement stated very clearly the object of the series. A commendable feature of the historical matter is the emphasis laid upon the large expenditures due to changes in the art—expenditures which leave no tangible assets representing the original investment, but which are necessary, and a proper charge against the rates of the company. The company is not afraid to admit past errors, and turns them to good account by showing the advances which have resulted from former mistakes. The mere statement of costly errors is an impressive lesson on the risks attendant upon the proper development of a public utility.

A number of other companies are contemplating campaigns of a similar nature, the general opinion being that the companies will find it profitable to have the public know enough about the lighting business to forestall the attacks of uninformed agitators which have done so much in the past to hamper the efforts of companies to give service which assists in the development of the cities in which they operate.

The advertisements were prepared by a publicity bureau in Chicago, under the supervision of Mr. A. S. Huey, vice-president of H. M. Byllesby & Company. "We did not feel competent to prepare such matter ourselves," said Mr. Huey recently, "for our business is the operation of public-utility properties, not talking about them. When such campaigns are carried on the best talent available should be employed. It is not economy to

save money in the preparation of educational matter at the expense of effectiveness. There are several concerns who make a specialty of this sort of work, and who can do it better than the average manager, or employee whose experience is not broad enough to cover a large number of places. In my opinion it is just as important to have this work done by specialists as it is to have engineering work done in that manner." The results from the campaign have been so satisfactory that H. M. Byllesby & Company, it is understood, will carry on similar educational work in other cities where they have public utility interests.

A Successful Electric-Sign Campaign.

In a paper presented at the recent meeting of the Iowa Electrical Association, Mr. J. B. Lindl, of Dubuque, gave an account of a successful electric-sign campaign recently carried on in that city. Since last October 40 signs have been erected aggregating 3282 2-cp lamps, besides a number of transparencies using from 1 to 10 16-cp lamps. Most of the signs are operated on a flat-rate of 10 cents per lamp per month, and of those on meter, three are lighted all night. The total estimated annual income from this source is $3,938, which is constantly being increased.

The campaign was commenced through an arrangement with the two leading newspapers of the city to put up signs for them and supply energy on the basis of payment in advertising. The signs were erected at night, and on the day they were to be put in service advertisements were run in the journals calling attention to the new signs, while letters were addressed to 500 business men bringing the sign proposition forcibly before them. As these were the first announcements and coincided with putting the newspaper signs in the service, a live interest in the campaign was immediately created.

A number of inquiries were received the following day and others continued to come in steadily. The method employed in placing the signs was on the basis of selling advertising and not signs, as nearly every merchant believes in advertising. When an inquiry was received from a prospect a design was made and the cost of construction and erection estimated, to which was added the cost per year of the current, and the total divided by 12. The merchant was then made a proposition on the basis of the monthly figure thus deprived. Apportioning the first cost of the sign in this manner helped very much in getting the campaign started, as most of the merchants make a monthly charge for advertising, and if the total first cost of the sign were to be charged to advertising in any one month, it would make the account for that month entirely out of proportion to the other months of the year.

After a small number of signs had been installed, another letter was sent out to merchants, drawing attention to the valuable advertising which firms, mentioned by name, were getting out of their electrical signs. As no merchant wished to be considered a back number, this brought in another lot of inquiries, and from that time on from one to three signs per week were put out. Somewhat later a movement was started in the newspapers to "boost Dubuque, Ia.," and advantage was taken of this to embody in advertising the fact that nothing could do more to boost the city than to have the main street so well illuminated with electric signs that it, like Broadway, could be called "The Great White Way," which statement appealed to the civic pride of a number of the merchants. Other means of advertising, out of the ordinary lines, were employed, with the final result that every merchant in the city was willing to talk electric signs, whereas six months before it was impossible to get a hearing on the subject.

For some months the company built its own signs, as they could construct somewhat more cheaply than other makes sold at the time, but it was finally decided that too many signs had been constructed on the same general plan, and consequently an agreement was entered into with a sign manufacturing company in Chicago whereby it was to arrange with prospects for signs at a discount of one-third off their list price; the company in turn paid for the signs at a discount of 40 per cent, the difference covering freight, cartage, etc. Under this arrangement the customer was given the same plan of payment as when the signs were made by the company. The sign company sent a salesman to the city, with the result that in three weeks 19 signs were sold. The advantage of such an arrangement is at once apparent when one considers that it means a free solicitor for the best kind of business a central station can get.

The Central Station and Portable Vacuum Cleaners.

At the Iowa Electrical Association Convention, held at Cedar Rapids, Ia., April 21 and 22, a part of one session was given to a discussion of vacuum cleaning machines as a means of increasing the central-station companies' business. Mr. Otto E. Brownell, of Lake City, presented a paper on this subject giving his experiences. He operates a plant which gives no day service. In September, 1908, he purchased a small, portable vacuum cleaner on 30 days' trial, and announced to his customers that he would allow each one an evening's free trial of this machine to demonstrate its work. Mr. Brownell immediately found that he was temporarily one of the most popular men in Lake City, especially with the ladies. The free trial engagements were made many days ahead. After this introduction of the machine, he made a practice of renting it at 75 cents per evening. He found that some of his customers use the machine at frequent intervals instead of sweeping, while others use it only at such times as they would otherwise take up rugs and carpets for beating. He thought that vacuum cleaning had been exploited too extravagantly by makers of such apparatus and that claims had been made for it that could not be substantiated—for example, freshening up faded carpets and cleaning walls of dirt which no mechanical process could remove. Nevertheless, Mr. Brownell thinks that vacuum cleaning is destined to have a very rapid growth and that it will help to popularize and increase the use of central-station service.

In discussing this paper, President L. D. Mathes, Dubuque, emphasized the point brought out by Mr. Brownell that the introduction of the vacuum cleaner is likely to get electric service into houses where electric lights have not been able to gain an entrance before. It is one of the numerous things that is popularizing electricity in the home. Mr. F. L. White, of Traer, reported having purchased a small $100 machine which he has been renting out at $1 per day. During house-cleaning season it is engaged a long time ahead and during a good portion of the time in other seasons. The price of $1 per day includes delivery. The man delivering the machine explains to the consumer how to connect and use it.

Mr. J. T. Moffitt, of Tipton, expressed the opinion that any central station not having a vacuum cleaner is making a mistake. His company has a $100 machine for which it charges $1 for a half day and $1.75 for a day's use. A calendar is kept posted in the station showing engagements ahead for the machine. In engaging the machine, the consumer simply has to go to the station and place his name on any blank date ahead. The only trouble in connection with the business is that the machine almost creates a scandal among housekeepers by the amount of dirt it gets out of supposedly well-kept houses. Mr. M. A. Harrison, of Nevada, said that his company had interested a man who does house cleaning in purchasing a machine. They helped him select a machine, showed him about properly connecting it at the consumer's premises and gave him the use of their show window for a time for its exhibition and display. This man charges 5 cents per square foot for cleaning rugs and carpets. Mr. F. J. Hanlon, of Mason City, reported that six machines costing $165 each have been sold in his town. Mr. E. M. Sterns, of Humboldt, said that there were two machines owned by private parties in his town.

Mr. J. R. Cravath told of a plan carried out in a suburban town near Chicago where about 35 residents advanced $10 apiece to a trustworthy man who makes a business of cleaning,

this amount being applied on the purchase of a machine and cart. Subscribers to this fund are paid back in cleaning services at a rate lower than that charged those not in the club. The machine purchased cost $325 and has a ½-hp single-phase motor, triplex pump, centrifugal dust separators and strainer. It is taken from house to house on a substantial cart and attached to any lamp socket, but a 15-amp fuse is temporarily inserted in the circuit supplying that socket while the machine is in use on account of the high starting current required by the motor. President L. D. Mathes expressed the opinion that the best plan ultimately will be to have the vacuum machine owned by the man who does the work, thus avoiding a responsibility of the central-station company in the matter.

Mr. C. K. Wilkerson, of the General Compressed Air & Vacuum Machinery Company, of St. Louis, thought that the prices central-station men had been charging for the use of a machine were not sufficient. The charges of $5 per day for a man and machine would not be prohibitive as it would be cheaper than house-cleaning in the old way. Mr. Charles Strader, of the Duntly Manufacturing Company, of Chicago, told of an experimental campaign for the introduction of cleaning machines which his company had made at Lincoln, Neb. Thirty-two machines had been sold there, following a campaign to encourage people to buy machines for their own use. Some few machines had been rented for $2 a day plus 50 cents cartage. The Lincoln Gas & Electric Light Company had helped the business and one month had placed the picture of a machine on one end of its monthly bill.

In conclusion, President Mathes said that central-station men appreciated the importance of the vacuum-cleaning business, but that their only reason for going slow was in order to be sure they were not purchasing machines that would be worn out or out of date in a few months. Central-station companies have had plenty of experience of this kind with other apparatus, and have learned to be cautious in the purchase of new types of machines.

INTERIOR WIRING AND ILLUMINATION

Arch Street-Lighting in Manchester, N. H.

The accompanying illustration shows the street-lighting effect produced by electric arches on Elm Street, Manchester, N. H. This street, which is the principal business thoroughfare of the city, is 68 ft. wide from curb to curb. Ten structural



ARCH STREET LIGHTING IN MANCHESTER.

steel truss arches are employed at average distances apart of 300 ft., the steel trolley poles being used as supports. Each arch carries 68 16-cp carbon-filament lamps, under a white enameled hood. These arches were erected, early last winter, by contributions from the merchants and real estate owners benefited by the illumination, and the energy is supplied by the city under a contract with the Manchester Traction, Light & Power Company. They are lighted from dusk until 10.30 o'clock on the two evenings each week when the stores are open for business, and give to the street a most attractive appearance. The erection of these arches was the direct result of the efforts of the Manchester Board of Trade and is a feature of its general policy of promoting local business.

So far as is known, these arches are the first to be put in service in New England.

Spectacular Electric Sign Advertising.

Electric signs may be divided roughly into two classes—the large, spectacular display signs, often, but not always, placed on roofs of buildings, and the far more numerous small electric signs, generally used on, or projecting from, store fronts. Of late years general advertisers—that is, advertisers whose wares appeal to the general public—have made an increasing use of the spectacular signs to call attention to their products in a manner which simply cannot be overlooked by anyone who has eyes to see. These spectacular electric signs are often beautifully designed and displayed in different colors, and frequently with moving lines of light in various combinations controlled by an automatic sign flasher.

One prominent national advertiser has given it as his opinion that the big special electric roof sign is the very best means of advertising to be had for impressing the general public. It is probable that there will be a great increase in the number and variety of spectacular electric signs, and as central stations usually supply electricity to operate these devices and as electrical manufacturers profit by the sale of the lamps, wiring, sockets, flashers and other accessories required, it is evident that the subject is not only interesting but important from the point of view of those who are interested in electrical pursuits. It may be noted also that where there are a number of the large spectacular signs the use of the smaller electric signs is greatly stimulated, for the large displays serve to fix the electric-sign idea firmly in the minds of beholders.

New York City has been the great center in this country for spectacular electric sign displays, and a large part of the reputation of the "Great White Way" is due to the taste and skill of the electric sign designer. But elsewhere throughout the country these spectacular signs are increasing in number and attractiveness. In Chicago, in particular, the national advertisers heretofore have been rather backward in erecting large display signs, alleging, with some degree of truth, that the opportunities for advantageous location of these advertising announcements are inferior to those of New York, owing to the peculiar topographical conditions of the latter, with numerous favorable locations where signs may be displayed that will be visible for a long distance. However, there are many excellent locations in Chicago and other Western cities for roof signs, and the general advertiser is now spending more money than ever before in roof signs in Western cities, particularly in Chicago. The big signs have come to stay. In Chicago most of the large electric signs are erected and maintained by the Thomas Cusack Company. This company is old to the sign business, but has only taken up electric sign advertising within the last two years. It finds a great demand for this method of advertising and regards this branch of its business as very successful and promising.

Among the prominent electric signs in Chicago is the W. K. Kellogg sign, at Randolph Street and Michigan Avenue, which can be seen for a mile south on Michigan Avenue and can be read for the greater part of that distance. This sign is 45 ft. high and 62 ft. wide and contains 1100 lamps. It is a "skyrocket" sign. Out of the blackness of the night a line of light shoots up from the bottom and around to an arrowhead, then the name "W. K. Kellogg," is written in script letters of light, and finally the entire sign is flashed on. Nine tons of steel were used in making the structure for this sign, and it

may be remarked that few of the large display signs are built on structures requiring less than 6½ tons of structural steel. The streak of light giving the "skyrocket" effect is 160 ft. long and is connected to the flasher by 40 circuits. To write the name "W. K. Kellogg" 160 circuits are needed to connect the lamps with the flasher. The wire needed to connect up the lamps in the streak and in the name measures 14,000 ft. in length.

At State and Lake Streets is a striking roof sign 52 ft. high, 42 ft. wide and containing 1270 lamps. The distinctive features are two vertical columns 50 ft. high and 2 ft. in diameter which, by the medium of electric lights and a flasher, have the appearance at night of turning rapidly. These columns are painted yellow, so that they are also conspicuous in the daytime, and they account for 620 of the lamps of the sign. They are joined by straight, steady-burning rows of green- and red-colored lights. The purpose of this sign is to announce the opening of Forest Park, a suburban amusement park, and there is appropriate lettering for that purpose. The words "Forest Park" are outlined in red lamps and are 7 ft. high. The other lettering is 3 ft. high.

A roof sign of unusual length is placed near the Wells Street Bridge, Chicago, and advertises "The Fair" store. It is 120 ft. long, 35 ft. high and contains 1450 lamps.

Attention is attracted on State Street, near Monroe Street, Chicago, by a "fountain" sign 45 ft. high with 1240 lamps. Here a fountain made of electric lights is in continuous motion, having a lifelike effect of gushing water. The basin is bordered by steady-burning lights and in the center are a number of twinkling lamps representing splashing water. This sign advertises a certain brand of coffee.

A sign that is simple yet effective is that of the Chicago Opera House, illustrated herewith. In this sign the "lightning" zigzags down and lights a red arrow at the bottom of the flash; then the lights in two ovals, which are red and white, flash on and revolve rapidly in opposite directions. After a brief interval the reading matter within the inner oval is flashed on and stays for a few seconds, then the entire sign



FIG. 1.—SIGN AT RANDOLPH STREET AND MICHIGAN AVENUE, CHICAGO.

goes out. In this sign 704 lamps are used with a Reynolds-Dull flasher.

The "Owl" cigar is advertised in an attractive manner by a spectacular sign on the Junction Building, at Ninth and Main Streets, Kansas City. This is of the general "skyrocket" type. The rocket shoots up and bursts into 80 colored lights, from which streams of light fall, while in the center is outlined the figure of a gigantic owl, 20 ft. high and 8 ft. wide, with green eyes, which wink and blink continuously. Instantly the words "Owl Cigar" flash on, while underneath the line "Now 5 Cents" is spelled out, this completing the sign. The action in this sign is continuous, there being no period of time when some part of it is not attracting attention.

A feature of the Alaska-Yukon-Pacific Exposition at Seattle this summer will be three large spectacular signs built for the Elgin Watch Company by the Cusack company. There will be one "fountain" sign, one skyrocket sign and one picture sign. Two of them will be 40 ft. x 40 ft. and one 35 ft. x 35 ft. They will be operated for four months from June 1. The "picture" sign will show a watch with a dial 10 ft. in diameter and keeping time. The hands of the watch and the numerals on the dial will be illuminated by candelabra lamps.

Among the general advertisers who are using spectacular signs in the West are W. F. McLaughlin & Company, of Chi-



FIG. 2.—CHICAGO OPERA HOUSE SIGN.

cago, coffee importers, who have large signs in Springfield and Peoria, and for whom others will be erected in Des Moines and Dubuque. The United Cigar Manufacturers Company, of New York, has two large roof signs in Kansas City, one in Minneapolis, one in Indianapolis and one in Chicago.

In general, 4-cp carbon lamps are used for the lettering in these large spectacular signs. Two-cp lamps are frequently used in streaks and streamers. In the colored parts 8-cp sizes are often employed, particularly for the green, which will not show as far as red unless stronger lamps are used.

For bulletin-board lighting the Cusack company uses tungsten lamps altogether, employing the 100-watt size. For wall signs, flaming-arc lamps burning 17 hours are installed. They are supported on angle iron structures at a distance of 12 ft. or less from the wall on which the sign is painted.

The steel structures for the large roof signs are elaborately

strengthened with diamond bracing after plans drawn by competent mechanical engineers, so that it may be certain that the building can stand the strain imposed by the sign construction. Every sign is wired differently, depending on the design. One fact that the electric sign designers have found by experience is that the wider the bar of the letter the larger must be the lamp required to get the best results in lighting it. The sockets used are of the enclosed-clip type made by Pass & Seymour. No. 14 rubber-covered wire is used.

On the roof of the building at the northwest corner of State and Randolph Streets, Chicago, is an electric sign writer, by which advertising announcements can be spelled out and changed as often as desired. This sign is about 40 ft. wide and 35 ft. high. It consists of four lines, each containing 15 box letters, so that an announcement containing 60 letters and spaces is possible, although in practice the full number of boxes cannot ordinarily be used with the words which it is desired to employ. The electric sign writer is operated by a keyboard, and two men are constantly employed to maintain

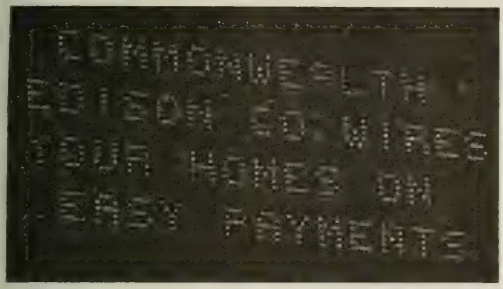


FIG. 3.—SIGN AT CORNER OF STATE AND RANDOLPH STREETS, CHICAGO.

and operate it. When it is in operation one man is writing out on a keyboard, something like that of a typewriter, the coming announcement, while the other is engaged in arranging the set of contacts for the keyboard man's next attention. When the contacts are all assembled for one set of letters, the man in charge of the switches and contacts throws the whole number in at once and thus a new announcement appears instantaneously. With an ordinary announcement it takes about 1¼ minutes to change any one set of words to another. In this electric sign writer there are 3000 contact points, each one controlled by three springs which make and break contact in a space of three-sixteenths of an inch. The mechanism is somewhat elaborate, and the device needs considerable attention. The two attendants have a little galvanized-iron house on the roof of the building supporting this sign-writer and with a stove and carpeted floor are prepared to carry on their rather exacting duties in comfort.

New Telephone Patents.

IMPROVEMENTS IN CIRCUITS.

With magneto exchanges there has always been more or less trouble, due to the subscribers on one of two connected lines ringing through to the other connected line in the endeavor to ring off. This is especially so when the bells of the subscribers' lines are of considerable lower resistance than the bridged clearing-out drop at the central office. As long as all the lines to be inter-connected are magneto this through ringing is of little moment to the subscriber, provided the clearing-out drop can be thrown at all. When, however, one of the subscriber lines of a connection is a common battery line, or when the clearing-out drop cannot be thrown, the real difficulty begins. In one form of switchboard this has been overcome by the use of a double-wound, clearing-out drop. Mr. R. H. Manson, of Elyria, Ohio, has overcome this difficulty by including in one side of his cord pair two condensers in series. The clearing-out drop is bridged from the mid-point between the condensers to the other side of the line. It will, therefore, be understood that ring-off current from one of two inter-connected lines must pass through but one condenser to reach the clearing-out drop, while it must pass through two condensers in series to reach the bells of the other line. By properly adjusting the capacity of the condensers, the operation of the clearing-out drop may be made positive under all conditions. Mr. Manson has patented this arrangement and has assigned it to the Dean Electric Company.

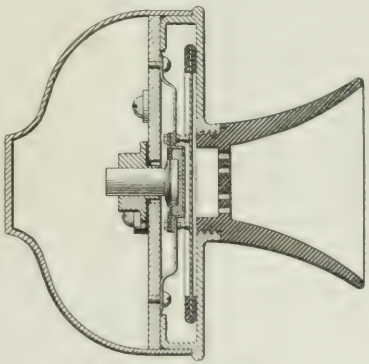
There have been a good many schemes for a high-efficiency transmission conductor which consists of a combination of two or more insulated conductors, associated in electrostatic inductive relation, but conductively insulated from each other. It will be understood, of course, that such a conductor operates purely through the electrostatic inductive relation. Mr. I. Kitsee, of Philadelphia, has found that the transmitting efficiency of such a conductor may be greatly improved provided that the two strands be associated with a third strand, insulated from both, and connected to earth at frequent short intervals, and he has obtained a patent upon such a combination.

Mr. E. R. Corwin, of Chicago, has patented an arrangement for an inter-communicating system, designed for operation in conjunction with exchange magneto telephone lines. His inter-communicating system is operated upon the central energy system and a primary, or switching station, must be provided for receiving and distributing incoming calls. The operation of the exchange drops is effected by means of kick coils connected in the circuit and responsive to the movements of the switching keys.

There has been made a reissue of the patent for the Wheatstone-bridge type of subscriber circuit now used by the Dean Electric Company. The reissue has been granted to Mr. R. H. Manson.

NEW APPARATUS.

Below is shown in section a transmitter, the invention of Mr. C. T. Mason, of Sumter, S. C., his patent being assigned to the Sumter Telephone Manufacturing Company. It will be seen that this transmitter is of the inverted solid back type. However, the movable electrode is not secured to the diaphragm directly, but is supported by means of flat springs attached to



MASON TRANSMITTER.

its flange. Two studs arising from this flange form the only contact between the transmitter diaphragm and the button. It is claimed that this contact, remote from the center of the diaphragm, effects a very great increase in the movement of the electrodes.

PARTY-LINE SYSTEMS.

A patent has also been granted to Mr. C. F. Bradburn, of Delmer, Ont., for an apparatus which he calls a "primary pointer and dial." This apparatus is one of the features of a party-line telephone system which is not described in the present specification.

Letters to the Editors.

The Patent Situation.

To the Editors of Electrical World:

Sirs:—I have noted with interest the articles and letters of Mr. Elsas, Mr. Crosby and Mr. Mayo in recent issues. The article by the writer seems to have been taken in the light of an intended reformation or revolution in the patent laws of this country; while it was merely intended as a monograph on the particular points which it presented. The remedies suggested were tentatively advanced as a possible solution of that particular phase of the difficulty which was discussed, leaving out of consideration for the time being their effect on other sides of the question. The article does not pretend to be on the patent situation, but on only one of its many phases; and because the courses suggested might do away with some of the disadvantages noted, it does not follow that those courses would be wise when considered from every standpoint.

There are many points brought up in the above articles which have a direct bearing upon the ultimate practical value of such courses as were suggested; and these points of bearing would necessarily be closely regarded if it were the intention to put the suggested remedies into effect. In fact, it might be that some other consideration would entirely outweight the ones set forth in the article; but the purpose of the article was not to recommend any legislation of a revolutionary character, but merely to discuss some points which have been interesting to the writer. Taken in this light, it is still thought that there is basis for the remarks made and the conclusions drawn.

Los Angeles, Cal. James T. Barkelew.

Commutation Phenomena.

To the Editors of Electrical World:

Sirs:—The article on "Commutation Phenomena," by Mr. C. L. Kennedy, in your issue for April 22, is interesting in many ways, but it seems to me that his method of reasoning does not take all of the principal factors into account. However, it does not appear to have been his object to consider all of the details. The following considerations should, therefore, be interesting in connection with his article.

Since a certain number of the leakage lines interlinked with a short-circuited coil pass through iron for a part of their path L the coefficient of self-induction is not a constant but is some function of the reciprocal of the rate of change of current with respect to time, so that L becomes smaller the greater the rate of change. This effect is favorable to commutation, but its magnitude cannot well be derived from theoretical considerations in connection with a formula. Since this action makes $E = L\frac{di}{dt}$ smaller than it would be for $L =$ constant, the slope of the curves in Mr. Kennedy's Fig. 2 will not increase as rapidly as there shown. Mr. A. Press, in your issue for March 10, 1906, takes this effect into account by giving to L one-fourth the value usually calculated. The armature m.m.f. also sets up a field, the lines of which travel between points which, for a ring winding, lie opposite to the brushes. These lines are cut by the conductors of the short-circuited coils and, therefore, set up an e.m.f. which opposes reversal, thereby raising the current curve of Mr. Kennedy's Fig. 1 above a straight line, even when L is zero. Stray lines from either one of the main polls may influence the result, but this fact does not alter the above statement.

Again, it should be noted that at the last moment of short-circuit "$\frac{di}{dt}$ approaches infinity" only for the condition, $RT - L = 0$, where $R =$ the contact resistance, and $T =$ the time of commutation, assuming that the brush covers one bar or less, and that R and L are constants. When L is greater than RT $\frac{dt}{di}$ may even become negative, but as this condition is generally avoided it need not be discussed here. The current density at the trailing tips during the last moment of short-circuit also approaches infinity closest for the condition $RT - L = 0$, but, of course, cannot reach it, since the finite current then passing will arc around the mathematical tip. Very often the commutation is taken to be unsatisfactory for all loads above the point where sparks of a greenish tinge begin to appear at the trailing edges, irrespective of how long such a spark may continue, so that for ordinary purposes the potential difference—or its equivalent, the current density at the last moment—between segment and brush at and near the last instant is the determining factor, rather than the length of time a spark endures. This time has an influence on the life and temperature of brush and segment, but it would seem that the requirement of complete sparklessness will completely overshadow the importance of this time element by the use of which Mr. Kennedy seeks to explain the reason why a brush tip is not immediately destroyed. Another requirement of satisfactory commutation is that the current density between brush and segment should not be high enough to burn or blacken the contact surfaces, which may sometimes happen with wide brushes.

The oscillograph could do much to clear points not easily accessible to mathematical analysis and on which there is as yet much doubt and uncertainty, as, for instance, the effect of different brush widths and lengths; different pole widths; different coil, lead and contact resistances; the variable character of self and mutual inductance; time; current density, number of bars covered by brush, etc., and it is a matter of some surprise that few investigations such as the above, and similar to the tests of Messrs. Bailey and Cleghorne, noted in your issue for Dec. 15, 1906, have as yet been reported. These tests show that R is a function of the time T, the greatest contact area of a segment and the rate of change of current with respect to time. This function is $C\sqrt[4]{\frac{T}{a}\frac{di}{dt}}$, in which C represents a constant such that $R = C\sqrt[4]{\frac{T}{a}\frac{di}{dt}}$, as may be easily shown.

Poland, Ohio. A. F. Puchstein.

Location of Vessels by Wireless Telegraphy.

To the Editors of Electrical World:

Sirs:—Although at first sight the location of vessels at sea by virtue of the variation of energy received from electric waves with distance may seem feasible, a consideration of actual conditions might lead to a different conclusion. The method suggested by Mr. Bela Gati in your issue of April 29, relying for its precision on relative quantitative measurements, is undesirable for the following reasons:

First, the requirement of exact measurement by crude operators on the high seas, especially in times of excitement, is very difficult.

Second, the additional attention entailed in the proper care of the necessary instruments on shipboard—instruments which, if they are to measure weak signals from long distances, must be quite delicate.

Third, the intensity of the signals from a certain station may vary considerably in a short time, due to variations at the transmitter—quite probable in the case of a disabled ship—due to atmospheric disturbances or to changes at the receiving end.

Fourth, the superposition of interfering signals upon the receptor, changing the effective received energy and leading to an erroneous result.

A method whereby the direction or bearing of the wave-emitting station is determined with a reasonable degree of accuracy is, perhaps, all that is desired; if it were not that the arrangement of the aerials is not suitable for ship rigging, the "multi-aerial, radiogometer" system of Bellini and Tosi might be useful in this way.

Brooklyn, N. Y. L. Espenschied.

Grounding Interior Circuits.

To the Editors of Electrical World:

SIRS:—I note in your columns that Dr. C. P. Steinmetz has expressed very clearly and decidedly his opinion that all electric circuits taken inside of buildings should be grounded in order to prevent the unknown existence of abnormally high voltages on such circuits, and it is gratifying to have his high authority registered in favor of the practice. That the normal voltage of a circuit is sufficient to be dangerous to persons of low vitality is by no means a reason why grounding of that circuit is not advisable. The action of the National Electric Light Association last year was to recommend that secondary circuits be grounded in cases where the voltage between any conductor and ground would not be over 150 volts, and that secondary circuits be not grounded where this voltage would be in excess of 150. The reason given for this recommendation by the committee was that under some circumstances alternating-current voltages of 200 volts and over are dangerous even if not fatal. Their evident conclusion was, therefore, that a circuit which is already dangerous to handle cannot be made safe by grounding. This may be good logic as far as it goes, but overlooks the important consideration that an abnormally high potential on any circuit will always produce an unnecessarily dangerous condition. For example, a 220-volt, three-phase motor circuit could not be grounded if the 150-volt limitation were adhered to; yet if such a circuit is not grounded, and if a voltage of 2000 volts to 6000 volts exists on it by virtue of some cross with high-tension wires outside the building, it is absurd to maintain that conditions will be as safe as if the 220-volt circuit were grounded so as to prevent an abnormal voltage existing. While it is, of course, more important that ordinary lamp circuits be made safe for handling by all kinds of people than it is to have motor circuits grounded, it is nevertheless throwing away a very wise safety precaution not to ground the three-phase, 220-volt circuit, and the same remark applies to higher voltages used inside of buildings.

PHILADELPHIA, PA. JAMES K. TRENT.

Depreciation of Electric Lighting Plants.

To the Editors of Electrical World:

SIRS:—While I agree in general with the remarks of Mr. Marston in your issue of March 15 regarding Holyoke's municipal lighting finances, his statements regarding depreciation should not be allowed to pass without comment.

He states that the allowance of 3 per cent is insufficient. This is probably true in most cases, but that amount set aside annually and compounded at 4 per cent would retire the investment in about 22 years, instead of 30, as stated. In your issue of Feb. 25, 1909, Mr. Thornton, of the J. G. White Company, estimates the depreciation of the Connecticut River Transmission Company's hydro-electric plant at 2 per cent, presumably on the sinking-fund basis, which indicates an average life of about 27 years.

The fixing of depreciation in advance is, of course, difficult, but it has ceased to be as much a matter of guesswork as formerly. Construction is constantly being improved and standardized, and much useful data are being accumulated along this line. The question had exhaustive discussion at the Cincinnati Electric Light convention of 1902 (see *Electrical World and Engineer*, Aug. 9, 1902). Here the New York Edison Company was reported as using an 8 per cent straight depreciation fund, the Massachusetts Gas and Electrical Commission 5 per cent, while the American Institute of Electrical Engineers recommended 10 per cent. Motions to call the depreciation from 7½ per cent to 10 per cent were made, but not adopted. Before the Iowa Electrical Association in 1906 the life of electric lighting plants was placed by different speakers at 12½, 14, 16 2/3 and 20 years. It would seem that the Massachusetts figure of 5 per cent—which compounded annually at 4 per cent would replace the investment in 15 years—should not be far wrong for well-built modern plants taken in their entirety. Certainly the 15 per cent suggested by Mr. Marston is far too high.

If it is true that practically all of this Holyoke plant has been scrapped within six years, it is certainly a remarkable and unusual case, and worthy of further investigation.

ST. LOUIS. WILLIAM H. BRYAN.

Operation of Producer-Gas Electrical Generating Plants.

To the Editors of Electrical World:

SIRS:—Referring to the discussion of the difficulties arising in the operation of producer-gas power plants, in your issue of April 15, this will undoubtedly be received with diverse opinion by those who have been most closely associated with work of this character. I find myself in complete agreement with some of your statements, particularly in regard to obtaining gas power-plant operators. It must be remembered, however, that this is often due to the prejudice of former steam-plant men rather than to the actual difficulties in acquiring a correct working knowledge of gas power-plant work. Given a steam man of open mind, it is not in the least difficult to make an excellent gas operator of him in a comparatively short time; conversely, it is safe to say that the great majority of so-called failures in producer power plants may be traced directly to wilful negligence and deliberate refusal of the operator to learn his new duties. I know personally of a number of high-grade producer men who declare that nothing could influence them to go back to steam.

Given an intelligent operator, I believe that you have overestimated the difficulties attendant upon producer operation in stating that "conditions are 10 times worse than with the engine alone," and that "unreliability has been the principal drawback of the producer plant." You speak of the steam boiler as having greater heat storage capacity (in the form of steam), and reasoning therefrom that the maintenance of a uniform supply of motive fluid is very much less dependent upon fluctuations in the handling of a fire than in the case of a producer plant. I believe your deductions are entirely wrong. As a matter of fact, a producer fuel bed has a many times greater heat-storage capacity than any steam boiler. It is possible to run a producer plant at full load for half a day without charging a pound of coal, the while maintaining fairly good gas. For this reason short-time tests on producers, say, of two or three hours' duration, are absolutely meaningless owing to the very long time element involved in the complete gasification of a pound of carbon fired to ash. On the other hand, in the case of a steam boiler, how long would it be possible to refrain from charging coal without incurring a serious drop in steam pressure?

To determine how a producer fuel bed would respond to changes in load, some tests were recently conducted at East Pittsburgh, running an hour and a half at no load, instantly throwing maximum load (15 per cent overload) on the engine and producer, this continuing for one hour, then dropping to no-load for an hour and a half, and so on throughout the day. It may interest you to know that without a single adjustment of valves, ignition or air supply at producer or engine, not a single hitch occurred in this program. The quality and the heat value of the gas varied no more than during normal operation at steady load. This shows that the producer fuel bed is capable of responding instantly either to small or excessive demands, due to the great heat-storage capacity above mentioned.

Now as to reliability: Can one find a record in all steam-plant practice to compare with that of the producer plant of the Jersey City terminal of the Erie Railroad, which was in actual service (continuous) over four years without a day's shutdown and without inspection or repair of the internal parts of the producer?

Here at East Pittsburgh, a test run of 12 months' duration has just been terminated on a producer of the bituminous type, delivering tar-free gas. This producer has been run on many

different kinds of fuel and at all loads and under all conditions without encountering difficulties in operation during this period. The condition of the producer at the end of the year's run was practically as good as at the start; in fact, the plant was immediately started off on another long-test run for different fuels. During the year's operation on bituminous slack, peat and lignite, there were no tar or clinker formations to interfere with operation, and gas was delivered of sufficiently uniform quality to make it unnecessary for adjustments at either engine or producer through an entire day's run.

As to the gas engine itself, the question of reliability would seem to have been settled in face of the following facts: At the power plant of the Iola Portland Cement Company, Iola, Kan., the record of one year's operation of 14 engines, of the vertical and the horizontal types, averaging about five years in service, shows *an average of 96 per cent of the possible running time.* The regular schedule is a month's run day and night without shutdown, and longer, if possible.

At the Edgar Thomson Steel Works, Bessemer, the 3000-kw electric engine has a record of 35 days' continuous operation without stop. The blowing engines of the same size and type have records of practically 40 days without a stop. A 25 x 30, 600-hp, three-cylinder, single-acting engine operating a gas compressor in the Ohio natural-gas district has a record of 45 days overload, without a stop.

There is unfortunately at the present time a tendency to judge the status of producer plants in general by the results of "2 x 4" plants cheaply constructed and badly operated. It is time that the engineering fraternity came to a realization of the results that are obtainable in up-to-date installations properly equipped and properly operated.

PITTSBURGH, PA. J. R. BIBBINS.

[Our correspondent has evidently misconstrued the spirit of the comment to which he refers, which bore on the unreliability of operation due to the employment in the first stages of operation of labor not sufficiently skilled. The adoption of the gas engine and gas producer in smaller central stations has been retarded by reports of difficulties experienced in getting such plants to a normal operating basis; and it cannot be too strongly impressed upon prospective users that care must be exercised in the selection and training of operators if they wish to avoid trouble during the first weeks or months of service. Any competent engine attendant can in time acquire the skill necessary to run a gas-producer power plant if he takes an intelligent interest in the new line of work; but the owner should be guarded against the employment of men on the sole ground that they are good engine-tenders, as the majority of men of this class will probably not possess the necessary versatility to qualify sufficiently quickly to conduct a gas-producer plant successfully from the beginning.—EDS.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Frequency Converter.—A. BLOCH.—An illustrated article on the theory of the Kolben-Seidener frequency converter. Its stator is identical with that of an ordinary three-phase induction motor, its rotor with the armature of the three-phase direct-current synchronous converter. It is provided with an ordinary direct-current winding, which is connected on one side with a commutator and on the other side with three slip rings. Fig. 1 shows the method of using this converter. The stator of the frequency converter is directly connected with the three-phase primary network, while the commutator of the rotor is supplied by means of three brushes with three-phase currents of the same frequency as the stator, but of variable voltage. The voltage regulation is carried out with the aid of a transformer.

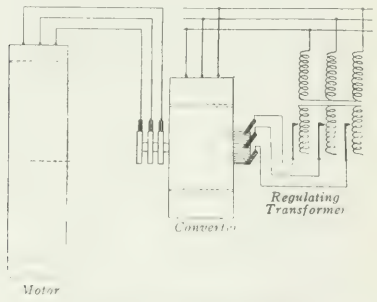


FIG. 1.—FREQUENCY CONVERTER.

According to the voltage impressed on the commutator the rotor assumes different speeds. The slip is proportional to the commutator voltage if the effect of the voltage drop in the winding is neglected. The frequency of the e.m.f. induced in the rotor is proportional to the slip and therefore also to the voltage at the commutator. If the voltage drop is neglected, the slip-ring voltage is equal to the commutator voltage. In this way three-phase currents of variable frequency can be taken from the slip rings. This machine may, therefore, be used as the starting machine for a three-phase squirrel-cage motor, as shown at the left of the diagram. There are no losses in starting resistances. The method of starting a three-phase induction motor with the aid of a variable frequency is discussed and an outline of the general theory of this frequency converter is given. —*Elec. und Masch.* (Vienna), April 18.

Improving the Wave Form of E.M.F. of Alternators.—A note on a recent British patent (12,390, 1908; April 15, 1909) of the Siemens Brothers' Dynamo Works and M. Kloss for the elimination of higher harmonics from the e.m.f. wave forms of alternators. The armature slots produce ripples in the e.m.f. wave form on account of the fluctuation of the magnetic flux when the edges of the poles pass the teeth. These ripples may result in trouble on account of resonance and may be the cause of considerable losses in the circuit. One way of eliminating these harmonics is to slightly shift the poles so that the ripples induced by the north poles neutralize those induced by the south poles, but this requires very careful erection. According to the present invention the armature is provided with a number of slots greater or less than those actually required, and the winding is inserted so that a small phase displacement is produced between the consecutive coils which belong to the same phase. By this means the vectorial sum of the higher harmonics can be arranged to amount to practically zero.—Lond. *Elec. Eng'ing*, April 22.

Commutator Polyphase Motors.—E. ROTH.—A continuation of his theoretical article. The author applies his general formula to the following three special cases: The first is one investigated before by Heyland, Blondel and Behrend, and relates to zero action of the regulation transformer and zero value of the stator resistance. The second case is a more general case studied before by Blondel and assumes only the stator resistance to be zero. The third case is that of the short-circuited polyphase induction motor, and the author's investigation leads to the circular diagram of Osanna and the diagrams of Grob-Lehmann. The paper is to be continued.—*La Lumière Elec.*, April 17.

Starting Three-Phase Induction Motors.—A note on a recent British patent (28,192, 1908; April 15, 1909) of the Allg. Elek. Ges. for a method of raising, in steps, the potential at the terminals of an induction motor on starting without interrupting the current or demagnetizing the motor. The neutral connection of the auto-transformer is first opened, and the motor is

connected to points about halfway along the three windings. A pressure of one-eighth the full line potential is impressed on the motor, and it is magnetized. On closing the neutral connections of the transformer, the pressure rises to about one-half the normal, and the motor starts up, taking about 200 per cent of the normal line current; the neutral connections are then opened again, on which the motor speeds up further. Finally the transformer windings are short-circuited and the motor is running in its normal condition.—Lond. *Elec. Eng'ing*, April 22.

Flux Density in Teeth.—F. BLANC.—A translation in abstract of his recent German paper. After showing the limitations of the ordinary methods for finding the actual induction in teeth, the author proceeds to show how the general equation, combining the apparent and real flux densities, can be used in connection with the magnetism curve in question for the graphical determination of the required ampere-turns.—Lond. *Electrician*, April 23.

Commutation.—R. RUEDENBERG.—A paper in which the author first refers to a certain vital point of the theory of commutation and then determines the conditions under which the danger of sparking exists under usual practical conditions. He discusses the effect of equipotential connections upon the sparking limit and points out a way of extending this limit still further by means of an auxiliary resistance winding.—*Elek. Zeit.*, April 22.

Mercury Rectifier.—G. SCHULZE.—An account of an investigation carried out at the German Reichsanstalt on the current which a three-phase, direct-current rectifier permits to pass in the direction in which it is assumed to be impermeable, at various loads and voltages up to 500 volts. This current has an order of magnitude of 10^{-1} amp.—*Elek. Zeit.*, April 22.

Lamps and Lighting.

Arc Lamps.—B. MONASCH.—The conclusion of his illustrated paper on recent progress in European arc-lamp practice. The author compares various arc lamps as to their efficiency for street lighting. Some of the chief curves are given in Fig 2, in which curve *I* refers to the intensive flame-arc lamp, *II* to the flame-arc lamp with Blondel carbons, *III* to an arc lamp with pure carbons one above the other, and *IV* to enclosed-arc lamps. Each of these lamps consumes 825 watts. In each case the lamps are placed at a distance of 60 m from each other and at a height of 10 m above the ground. The curves in the

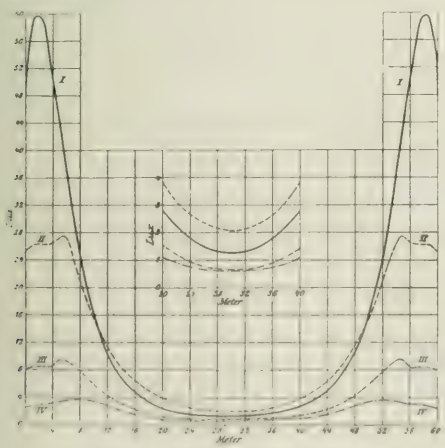


FIG. 2 LAMP EFFICIENCY CURVES

diagram give the illumination in a horizontal surface 1 m (3.3 ft.) above the ground. The abscissas give the distance in meters of the point at which the illumination is measured from the arc lamp. It will be seen that intensive flame-arc lamps give the strongest illumination right below the arc lamps. But the best all-around illumination is obtained with the Blondel arc, because it gives the highest illumination at the point midway between two lamps. For this reason, the author thinks that the Blondel arc lamp is most suitable for street lighting. He further discusses briefly indirect illumination and describes some attempts made by the Allg. Elek. Ges. to give to arc lamps a more pleasing appearance.—*Elek. Zeit.*, April 22.

Tungsten Lamp.—The grant of a British patent to the Siemens & Halske Company for a process of removing the carbon from metallic filaments, prepared by mixing powdered tungsten with a carbonaceous binder, was opposed by the Wolfram Metal Filament Lamps, Ltd., on the ground of the existence of previous patents. The process claimed consists in heating the filaments in acetic acid vapor. After hearing evidence on both sides, the Comptroller-General has allowed the grant of the patent.—Lond. *Elec. Eng'ing*, April 22.

Power.

Three-Phase Variable-Speed Motors.—An illustrated description of a method of the Oerlikon Company of operating three-phase induction motors at variable speeds by means of changing the number of poles of the stator. Details are given of the behavior of a 500-hp motor used in a steel plant. The stator has two separate windings, which are embedded in 72 slots, thus allowing four and eight or six and 12 poles to be respectively obtained. The rotor of this motor is of the squirrel-cage type. Detail diagrams of the behavior of the motor are given for four poles in series and in parallel; for six poles in series and in parallel; for eight poles and for 12 poles. A comparison of the results obtained between no load and full load for each stator winding, for both series or parallel connections, and when using either the smaller or greater number of poles, shows that (1) the no-load current, when parallel connections are employed at the same speed with the smaller number of poles, does not differ considerably from the no-load current obtained with double the number of poles; while with series connections, the no-load currents with the smaller number of poles are only about a quarter those with the double number of poles. (2) The current at maximum output, and, in fact, the maximum output itself, is nearly four times greater with the smaller number of poles when parallel connections are used than the current and corresponding output with double the number of poles. In the case of the series connections, however, the current and output are nearly the same with the smaller number of poles as with the double number of poles. The corollary to this is that it is possible to do without the parallel connections with the lower number of poles—i.e., with four and six poles, when the motor is being used for a constant output at the different speeds corresponding to the individual steps. This is particularly the case when the motor is used for driving tools, where a constant power gives a greater torque at lower speeds. On the other hand, the use of parallel connections with the smaller number of poles—i.e., four and six—is desirable when it is necessary to maintain a constant torque at all speeds. Parallel connections with this type of motor are recommended for driving pumps, printing presses, rolling mills, hoisting gears or traction installations.—Lond. *Electrician*, April 23.

Rolling Mills.—V. GRAUBNER.—The first part of an illustrated lecture in which the author compares the economy of operation of rolling mills by steam or by electric power. On the basis of actual results obtained in practice, he states that the steam consumption of rolling mills operated by steam is approximately double the steam consumption with electric operation, if 7.8 kg (17 lb.) of steam are figured per kw-hour. A table is given of the first cost of the electric equipment of a rolling mill. Three-phase currents will generally be used, although in special cases, especially in smaller works and in the case of lower speeds, direct current is also employed.—*Elek. und Masch.* (Vienna), April 25.

Electric Cranes.—H. H. BROUGHTON.—A continuation of his long serial. The author here deals with the design and construction of the mechanical equipment of cranes. The mechanism required for effecting the usual crane motions is treated in four sections. The first section relates to lifting mechanism. The article opens with a short discussion on the determination of the size of motor, and a simple expression is given suitable

for most ordinary types of jib and overhead traveling cranes. Then follow notes on wire ropes, flat link-chains, the gear ratio, spur-and-worm gears, shafting, barrels, blocks and hooks, mechanical brakes, limit switches, and the "free-barrel" system. Lifting magnets and safety tongs are also described.—Lond. *Electrician*, April 23.

Refuse Destruction.—J. A. Robertson.—A paper read before the Glasgow Section of the (British) Inst. Elec. Eng. The author gave the results of the first year's working of the plant at Greenock. His general conclusions are that given a suitable design of plant, ordinary town refuse may be destroyed at a combined works without giving rise to nuisance troubles, always provided that the sanitary object of the destructor is considered of primary importance. Where local conditions permit the steam to be utilized for at least nine hours per day it will be of distinct financial advantage to combine the electricity works with the refuse destructor. A combined scheme should only be undertaken after careful investigation and under expert advice. In the interest of efficiency the combined installation should be under the control of the electrical engineer. The financial adjustment between the electricity and cleansing departments should be made on the basis of value supplied, including saving in capital expenditure and labor costs (if any). As to the heat value of town refuse the author states that in Liverpool, where 600 tons of refuse are burned every day, no less than 9,209,369 kw-hours were generated from destructor steam during 1907, and this result has been obtained with non-condensing compound engines, using 50 lb. of steam per kw-hour. In addition to the destructor plant, the equipment of the Greenock works comprises two coal-fired boilers, and the generating plant consists of two 750-kw and two 400-kw continuous-current sets with steam superheated to 500 deg. Fahr. and a 26-in. vacuum. Under working conditions the average steam consumption, including all losses, is 26.5 lb. per kw-hour. In the discussion which followed the paper, the opinion was expressed that combined refuse destructor and electricity plants have greater advantages in small towns than in large ones.—Lond. *Electrician*, April 23; *Elec. Eng'ing*, April 22.

Steam Turbine.—I. N. Hollis.—A second article on the field and future of the low-pressure steam turbine, giving a survey of its history and examples of installations.—*Eng. Magazine*, May.

Steam Turbine.—M. B. Carroll.—A brief article endeavoring to show that the low-pressure steam-turbine proposition is entirely reasonable and is based on easily proved facts.—*Gen. Elec. Review*, April.

Traction.

Mexico.—A profusely illustrated article on the conditions of electric railway operation in Mexico City. The streets are narrow and the traffic is at times very heavy. The company operates double-truck cars in trains of one motor-car and one or more trailers even on the narrowest streets.—*Elec. Railway Jour.*, May 1.

Installations, Systems and Appliances.

Warsaw.—C. Tainturier.—An illustrated description of the generating station of the municipal tramway system of Warsaw. The plant contains three turbo-generators running at 1500 r.p.m. Each generator has a capacity of 1200 kw and gives direct current at 600 volts. The chief interest in the plant rests in the automatic control of all operations. The coal arriving in railroad cars is weighed automatically, also the coal supplied to the boilers. The water consumed is measured. The steam furnished by each boiler is registered by the steam meter of Hallwachs. The temperatures in different parts of the plant are recorded by electric pyrometers. The flue gases are analyzed by means of carbon-dioxide recorders, and so on. A complete and permanent control of this kind naturally results in high economy in operation.—*La Revue Elec.*, March 30.

Ward Leonard Motor-Generator Set.—The operation of large motors with heavy fluctuations in load, and especially of large haulage gear by means of a Ward Leonard motor-generator set, has the following disadvantage: With this system the motor is brought to rest by completely cutting out or short-circuiting the excitation of the starting machine which supplies current to the motor. As a rule, it is, however, not always possible to bring the motor completely to rest by this means, owing to the presence of remanent magnetism in the starting machine, even after the excitation has been cut out or short-circuited. This remanence suffices to induce a small e.m.f., which, however small, is still sufficient to produce heavy currents, on account of the low resistance of the dynamo, motor and leads, thus imparting an undesired motion to the dynamo. This difficulty has up to the present mostly been surmounted by leaving it to the discretion of the operator as to how far it is necessary to push back the control lever in order to counteract exactly the remanent magnetism in the starting dynamo, which prevents the motor from coming to rest when this lever has been brought to its "off" position. Felten & Gilleaume-Lahmeyerwercke has devised the method shown in Fig. 3. It consists of a winding *K*

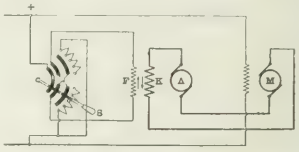


Fig. 3.—Diagram of Motor Generator Connections.

mounted on the field magnet of the starting dynamo *A*, through which the armature current of the dynamo flows and which is connected up in such a way that it tends to remove the magnetic field still present, owing to the remanence. This winding has been rated in such a manner that upon cutting or short-circuiting the main excitation *F* the magnetism still present is just neutralized. If, then, the control lever for stopping the motor is put into its "off" position, by which means the main excitation *F* of the starting dynamo is cut out, the current generated by the remanent magnetism flows through the winding *K* in such a direction that a complete demagnetization of the field is attained so that the motor positively comes to rest. To attain the desired action this winding need only consist of a few turns, so that under normal working conditions of the generator it scarcely exercises any influence at all, and therefore only causes extremely low losses.—Lond. *Electrician*, April 23.

High-Tension Switchgear.—J. Mathivet.—A long illustrated discussion of switchgear construction and arrangement for all voltages between 1000 and 50,000. Among the many recommendations made is one to avoid the use of insulating cables. They result in a feeling of false-security, since after a certain time the insulation resistance will have decreased and the insulation will no longer yield the original protection. The article is illustrated by numerous diagrams.—*La Revue Elec.*, April 15.

Switchboard.—An illustrated description of the main switchboard of the Pratt Street power house in Baltimore. A total of 16,000 kw in generator capacity is connected to the switchboard and current is distributed at 13,000 volts to five converter substations in different parts of the city.—*Elec. Railway Jour.*, April 24.

Electrophysics and Magnetism.

Cable Papers.—C. Beadle and H. P. Stevens.—A continuation of their paper giving details on the composition and durability of cable papers. The ash in the cable paper will always amount to 1 or 2 per cent, even in the best papers. But mineral matter, which would increase the percentage of ash, should be avoided. If a paper is sufficiently loaded with mineral matter the air-space volume becomes reduced from, say, 60 per cent to 29 per cent, and consequently its capacity for absorption of hydro-carbon in a similar ratio. Paper to be impregnated for cables should be regarded not as the insulating medium, but rather as the medium which holds the insulator; consequently it is required to have as great a power of absorption as possible consistent with the necessary strength, durability and other physical qualities. In Germany the Government has a special bureau for paper testing. The mechanical properties of papers are considered to be represented by data of (1) tenacity—i.e.,

actual resistance to tensile strain given by the breaking length; (2) "elasticity," or rather elongation, up to the point of rupture; (3) resistance to rubbing. The table below shows the "normal" standards into which paper is divided by the German testing bureau.

The effect of moisture on paper is briefly discussed and also the effect of thickness on the actual strength. The actual strength of any particular make of paper can be increased by increasing the thickness, but by this means, beyond certain limits, the specific strength is found to be diminished. Paper of greatest specific strength is generally found to be that of moderate thickness, so that if one wants to impart strength in

Class.	Average breaking length in meters.	Average elongation in per cents of original length.	Resistance against crumpling.	Number of double bendings.
1	6,000	4.0	Very great	190
2	5,000	3.5	Very great	190
3	4,000	3.0	Great	80
4	3,000	2.5	Rather great	40
5	2,000	2.0	Average	20
6	1,000	1.5	Small	3

the way of paper, and at the same time build up considerable thickness, this is best done by working on several ply of paper, rather than by a single ply of thick paper coiled so as to overlap.—Lond. *Electrician*, April 23.

Transmission Line.—An illustrated description of the 45,000-volt transmission line of the Compagnie Electrique du Nord, in France. The company which exploits this district supplies energy produced at the Lens coal mines and also works a concession for the electric haulage of boats over some 52 miles of canals in the district. The total length of the transmission line is 32 miles. The transmission line runs along the canals and steel towers are employed. The 45,000-volt porcelain insulators are triple-petticoated, enameled brown, weighing 20 lb., and the outside diameter of the largest petticoat is 1 ft. They were tested at the works before shipment at 110,000 volts each, and each petticoat was separately tested to sudden variations of temperature and to mechanical stresses. They are cemented to iron supports. Wire netting has been placed beneath the lines wherever railways or public roads are crossed.—Lond. *Electrical Review*, April 23.

Wiring.—A description of a new system of wiring, called "simplex," for surface wiring. Three grades of flexible twin wire are available for surface work of this kind. The first grade is armored with tinned-iron wire, the second grade is covered with flame-proof material in place of such armoring and is weather-proofed beneath the flame-proofing, and the third grade is simply covered with cotton, the covering beneath this cotton also being weather-proofed.—Lond. *Electrician*, April 23.

Electrochemistry and Batteries.

Regenerative Primary Cell.—An illustrated description of a new primary cell, working on the principle of the Lalande cell.

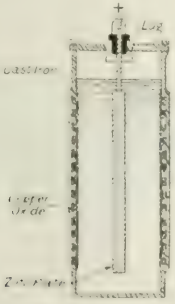


FIG. 4.—SECTION THROUGH CELL.

It possesses the advantage that the copper oxide depolarizer, which is pasted onto the interior of the containing vessel, can be re-oxidized after each discharge by merely heating the vessel. Only the zinc and caustic soda solution need be renewed. The cell is shown in Fig. 4. It consists of a cast-iron vessel, to the interior surface of which the copper oxide is affixed by a special process. The copper oxide can be regenerated simply by heating without fear of the material becoming detached from the cell. It is stated that cells are in use which have been regenerated about 200 times. The amalgamated zinc plate lasts a number of regenerations. When the oxide has been converted, the solution is emptied out, and the case only is heated in a dry condition until the material is re-oxidized.—Lond. *Elec. Eng'ing*, April 22.

Calcium Carbide and Cyanamide.—An illustrated description of a large calcium carbide and cyanamide works, combined with a water-power plant at the Norwegian coast. The present power installation, at Tysse, has a capacity of 23,000 hp. The total producing capacity is 32,000 tons of calcium carbide and 12,500 tons of cyanamide per year. Some details of the power development and of the furnace plant are given.—*Electrochem. and Met. Ind.*, May.

Ferrochrome.—J. ESCARD.—The author first gives notes on definite compounds between iron, carbon and chromium, and then describes commercial methods for making ferrochrome. The electric furnace methods of Gin and Heibling are described.—*La Lumière Elec.*, April 17.

Electrolysis of Salt.—LEPSIUS.—A lecture in which the author gave a review of the industry of alkali-chloride electrolysis in Europe. The diagram cells, the mercury-cathode process and the gravity process were discussed, and some notes were given on the uses of chlorine.—*Electrochem. and Met. Ind.*, May.

Electrochemical Amalgamation Process.—E. E. CAREY.—A description of an electrochemical system of amalgamation which is designed to extract from the sands or pulp all gold values not encased. The ordinary copper plate of usual amalgamating practice acts as cathode, while graphite anodes are employed. A mercury salt is used as electrolyte, and mercury is constantly deposited on the copper plate together with the precious metals. —*Electrochem. and Met. Ind.*, May.

Units, Measurements and Instruments.

Aluminum Condensers.—G. SCHULZE.—A translation of his recent German paper on aluminum electrolytic condensers of high capacity. They may be useful for practical purposes if a certain amount of energy loss in the condenser is permitted. Details are given of the construction, together with the results of tests. One general rule established in the tests is that the product of capacity of the condenser and the voltage of formation is almost constant.—*Electrochem. and Met. Ind.*, May.

Recording Apparatus.—M. EDELMANN.—An illustrated description of a photographical recording apparatus for physical purposes. The apparatus is able to hold 75 m of paper or film. The recording mechanism can be started or stopped at any moment. It is not necessary to insert new paper each time after a record has been made. The speed is adjustable.—*Phys. Zeit.*, April 1.

Telegraphy, Telephony and Signals.

Telephone Cables.—F. G. C. BALDWIN.—The first part of an illustrated paper read before the Birmingham Section of the (Brit.) Inst. of Elec. Eng. on dry-core, air-space or paper-core cables. The author gives some of the more important considerations occurring in actual telephone practice, and describes the various operations which a telephone cable undergoes after its manufacture, with special reference to the practice of the National Telephone Company.—Lond. *Elec. Engineer*, April 23.

Miscellaneous.

Aluminum Welding.—M. U. SCHOOP.—An article on welding aluminum plates by means of the oxy-acetylene burner, with notes on the uses of aluminum containers especially for chemical purposes.—*Electrochem. and Met. Ind.*, May.

Thermit Welding.—Illustrated notes on some recent interesting applications of thermit welding on the Pacific Coast. One was the repair of a large commutator ring in the plant of the San Francisco Gas & Electric Company.—*Electrochem. and Met. Ind.*, May.

NEW APPARATUS AND APPLIANCES

Household Apparatus for Ozonizing Drinking Water.

The accompanying illustrations show a device for ozonizing drinking water for domestic purposes, which has recently been placed on the market by the Felten & Guilleaumewerke, Frankfort-on-Main, Germany. The ozone-producing apparatus consists of an aluminum plate and a metal-lined glass plate, between which a brush discharge passes. As this brush discharge, however, only occurs at higher potentials, a small step-up transformer is necessary for converting the supply voltage to the higher voltage. The transformer and the ozonizer are self-contained in a covered case, which is grounded in accordance with the wiring regulations, and is therefore harmless.

The method of action is as follows: The instant the water tap is turned on an automatic membrane contact switches the transformer into circuit, the high-pressure terminals of which are connected to both plates of the ozone-producing apparatus. Between these plates a violet brush discharge occurs which converts the ordinary oxygen of the surrounding atmosphere into ozone. The ozone thus formed is drawn from the producer through a thin metal tube into the special emulser.

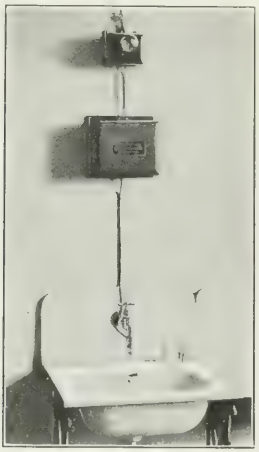


FIG. 1.—OZONIZER IN USE.

This emulser, which can be screwed on to the tap without any alterations whatever being necessary (as shown in Fig. 3), consists of a small water spray pump, in the lower part of which are arranged several mixing chambers, which consist of tubes with holes, placed in such a manner that the incoming water spray is split up into innumerable particles which again are converted into a mixture of water and ozone.

Fig. 1 shows the complete apparatus for the purification of water, connected to a water supply. As may be seen, the complete ozonizer is of a neat and compact design, and the emulser necessitates only a small extension of the water tap. The installation of the complete apparatus is extremely simple, it being only necessary to attach the ozonizer to the wall, screw the emulser to the tap, connect the terminals on the transformer to the electrical service in the building and the ozonizer to the emulser by means of a thin metal tube.

The consumption of current, which, of course, only occurs when water is taken from the tap, is said to be less than that of an ordinary 16-cp, 110-volt incandescent lamp. On flowing out the water at first smells slightly of ozone; this smell, however, disappears after a few seconds, and the taste of the drinking water thus treated is not impaired in any way, although the germs are destroyed.

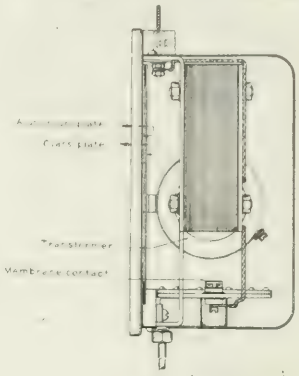


FIG. 2.—SECTION OF OZONIZER.

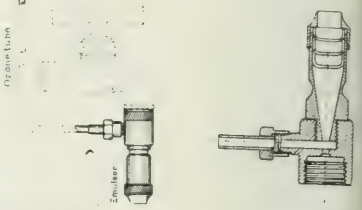


FIG. 3.—SECTION OF EMULSER.

New Fixtures for Indirect Lighting.

The National X-Ray Reflector Company, 249 East Jackson Boulevard, Chicago, which last fall brought out reflectors and fixtures for use with indirect lighting, now offers several new designs for adapting this indirect lighting system to existing

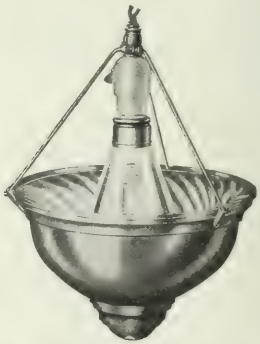


FIG. 1.—INDIRECT UNIT FOR DROP-CORD.

fixtures. This system of indirect lighting, which has been marketed under the name of "I-Comfort," simply consists in placing on a chandelier an efficient one-piece corrugated mirror-glass reflector under the tungsten lamp, thus throwing all of the light to a light-colored ceiling to be reflected by the ceiling

down into the room. Fig. 1 shows one of these units for use attached to a drop-cord where a drop-cord installation already exists and it is desired to change to direct illumination with minimum expense. Fig. 2 shows a device intended to make possible the use of indirect lighting units on old chandeliers on





FIG. 2.—INDIRECT UNIT ON OLD CHANDELIER. FIG. 3.—ROD PENDANT FOR INDIRECT LIGHTING.

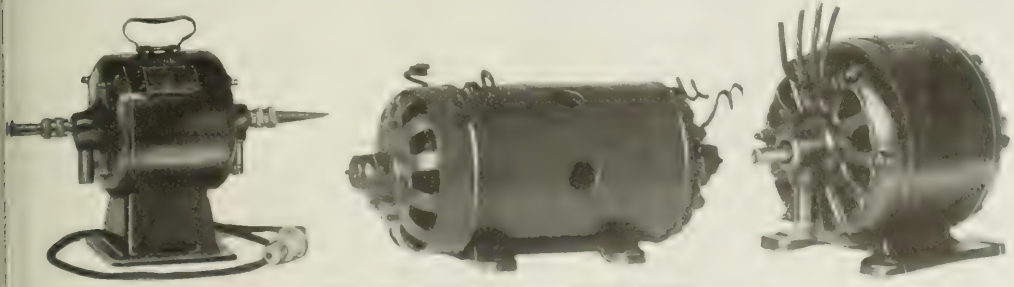
which chandelier-arms are at an angle of 45 deg., as is very common. Fig. 3 shows a very simple square-rod pendant one-lamp fixture. Most of the one-lamp designs heretofore brought out have been suspended with chains.

A Central-Station Automobile Department.

The General Vehicle Company, of Long Island City, has taken a notable and most progressive action in organizing a central-station department, with a view to co-operating with the managers of electric lighting plants in the more general introduction of commercial and industrial electric vehicles, delivery wagons, trucks, drays, etc. The recent activity in this field of work must have impressed everybody, and it looks as though the central stations of the country were at last awake to their opportunities in this direction. The company has retained as manager of this department Mr. J. H. Vail, formerly chief engineer of the Edison Electric Light Company, and a central-station engineer of broad experience as well as wide acquaintance throughout the United States. Mr. Vail has not only designed and installed many lighting stations and electric railways, but has operated them as well; and no one is in a better position to give practical aid and encouragement to companies about to enter this growing field of current consumption. The General Vehicle Company is deservedly recognized as a pioneer in this line of development and has hundreds of automobiles in industrial service in all parts of the country. The older designs are familiar and well tried, but the latest standard types embody many important advances and improvements and have already demonstrated a higher efficiency and a lower cost of maintenance. The policy of the company is to push the industrial vehicle. It does not contemplate or advocate the manufacture of the pleasure type with which the use of gasoline is so closely associated. A vital fact is that under normal conditions of use the electric truck or wagon is much more economical than the steam or gasoline, besides giving a wider range and a more expeditious service than horse transportation. It is therefore now a matter of business enterprise, as well as a subject of station efficiency, for lighting companies to consider; so that by their own example they give possible customers an example of what the electric automobile can do. Any central station of fair size in any city of decent roads ought to have an electric or two of its own; while in large cities the number of electrics charged from the circuits is now in many places up in the scores and hundreds, showing what can thus be done to increase the connected load.

Small Single-Phase Motors.

The rapidly increasing use of small motors, particularly for household and office purposes, retail stores, driving small tools, etc., has led to recent noteworthy developments in the design and construction of this class of electrical machinery. This is strongly indicated by the line of "DA" single-phase motors, now constructed by the Westinghouse Electric & Manufacturing Company, which range in capacity from 1/20 hp to ¼ hp, and are made for frequencies of 25, 40, 50 and 60, and for voltages of 110 and 120. Several motors of this type are shown in the accompanying illustrations. Of these Fig. 1 forms part of a buffing, polishing and grinding machine. Fig. 2 is a motor generator for charging storage batteries, ringing bells, etc., while Fig. 3 shows a standard type that can be fitted to numerous uses. The motors are arranged for continuous service, and the speed is very nearly constant, ranging between the limits of 1200 r.p.m. and 3400 r.p.m. By the use of suitable gears and pulleys, the motors can be adapted to almost any service requiring power within their capacity. As will be seen from the several illustrations, the frame and brackets are shaped to protect the working parts. Laminated iron cores on both the stator and rotor carry the windings in insulated slots. The winding of the primary or stator consists of insulated coils placed in the slots by hand, while the secondary winding is of the squirrel-cage type, consisting of copper bars in the rotor slots connected to short-circuiting end rings. The motors can be switched directly on the circuit, no starting device other than the switch being required. The bearings are of such design that under ordinary conditions one filling of vaseline will be sufficient for lubrication for several months. Four wires come through bushed holes in the bearing brackets, as shown, and the method of joining these wires determines the direction of rotation; to reverse the direction of rotation it is simply necessary to interchange the connections of the wire coming from the two inner holes. The motors are furnished with and without automatic centrifugal clutches, the latter being desirable where machines connected have a high standing friction. Small motors of this type can be put to no less than 82 different uses.



FIGS. 1, 2 AND 3.—SMALL SINGLE-PHASE MOTORS.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

There has been a distinct improvement in retail trade during the past week, and there has been some improvement in wholesale and jobbing lines, although as yet the orders are mostly for filling-in purposes. In some sections of the West good growing weather has taken the place of the cold, wet spell that did much to retard crop development. The entire condition of crops, however, is not as satisfactory as has been hoped for. The Government report of conditions, which was issued last week, shows that the acreage of winter wheat has decreased more than 2,000,000 acres since the original planting, and that the promise for the crop at the present time is only about 400,000,000 bushels, as against a crop last year of 437,000,000 bushels, and an average crop for the past eight years of 421,000,000 bushels. In the industrial line there is a distinctly better feeling, especially in iron and steel, where numerous orders have been received and where many reports indicate that plants are working at almost full normal capacity. The Lackawanna Steel Company announces that it is operating at 100 per cent, and the Bethlehem Steel Corporation and the Republic Iron & Steel Company are having enough work to keep their plants employed at between 90 and 100 per cent. This is the best condition that the steel industries have been able to report since the period of depression began in the fall of 1907. It is true that this activity will not be reflected in the profits of the company to the extent that it would formerly have been, because prices are now very much lower than at any time within the past six or eight years. The effect of low prices, however, is shown in the building trades, which have been stimulated to a point of activity not known for several years. Reports from 80 of the principal cities in the United States show that the total estimated expenditure for building during the month of April was $73,106,000, as compared with $72,000,000 in the month of March and $50,500,000 in the month of April a year ago. This activity will necessarily have a direct effect on all branches of trade, because it employs labor that has for a long time been idle. In the textile markets both cotton and woolen goods are in active demand, and the mills are kept reasonably busy. The high prices for cereals in Chicago are now attributed to the apparent scarcity rather than to speculative manipulation. The practical settlement of the coal miners' wage dispute and the favorable decision on the commodities clause of the Hepburn bill have done much to stimulate activity in the coal mining and coke industry. While the producers have been carrying, and now have on hand, unusually large stocks of coal, there is no indication that mining operations will be curtailed in the near future. Collections continue to be only fair, but the general tone of business grows more and more optimistic as the weeks pass by. Business failures for the week ended May 6 were 214, as against 268 the previous week, 288 in the same week of 1908, 154 in 1907, 162 in 1906, and 168 in 1905.

THE COPPER MARKET.

The April figures of the Copper Producers' Association, which were made public on May 10, while they showed only a trifling increase to the aggregate surplus, were undeniably disappointing. It had been expected that there would be a decrease and that the takings for export and domestic consumption would run several million pounds above the production. This hope was indulged because for several days there has been a much better feeling in the copper market, there has been a good speculative demand from abroad and more liberal buying at home, and prices have advanced from ¼ to ⅜ cent per pound. An analysis of the association's figures shows that the output for April amounted to 3,785,809 lb. per day, while the output during March was only 3,776,085 lb., thus showing a daily average increase of 9723. The totals showed a decrease, owing to the fact that March had one more day than April. The association's figures are: Production from all sources of marketable copper for April, 113,574,292 lb.; deliveries of marketable copper, 112,656,121 lb.; stock on hand May 1, 183,198,073 lb. Thus we see that, in spite of the active campaign that was made to secure domestic orders, and in spite of the heavy buying abroad that was known to be largely for speculative purposes, there is still an accumulation at the end of the month. The market, on the other hand, is in a better condition than it has been recently. There is considerably more activity among the melters, and inquiries are very plentiful. The strengthening of the steel business has had its effect upon copper; with activity in the steel industries there must, of a necessity, be some activity in the electrical and brass industries. Quotations on the metal exchange on May 10 were:

Lake	13⅛ @ 13⅜
Electrolytic	12¾ @ 13
Casting	12⅝ @ 12⅞

The London prices May 10 were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	59 15 0	59 10 0
Standard copper, futures	60 10 0	60 5 0
Market	Strong	Easy
Sales of spot		1900 tons
Sales of futures		3000 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	.....	.....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 6
London, best selected	67 15 0	59 0 0

KELLOGG TELEPHONE BUSINESS IN POSSESSION OF ITS OLD OWNERS.—Following the recent decision of the Illinois Supreme Court, which concluded the protracted litigation due to the disputed ownership of the stock of the Kellogg Switchboard & Supply Company, Chicago, the former owners of the company, including Milo G. Kellogg, who established the business, and his associates, are now in possession of the business and factory of the company. The American Telephone & Telegraph Company has restored to its previous owner every certificate of stock of the Kellogg Company. It is not necessary to rehearse the manner in which the control of the Kellogg Company passed out of the hands of the original owners, as a comprehensive abstract of the decision of the Supreme Court in relation to the case was published in the *Electrical World* as recently as March 4. On April 27 the reinstated stockholders of the Kellogg Company met and elected a board of directors consisting of Messrs. Milo G. Kellogg, Francis W. Dunbar, Kempster B. Miller, Leroy D. Kellogg, J. B. Edwards, James G. Kellogg and Wallace L. DeWolf. All of these gentlemen, with the exception of Mr. DeWolf, are representatives of the old ownership of the company. The directors elected the following officers: President, Milo G. Kellogg; vice-president, Leroy D. Kellogg; secretary and treasurer, Seymour Guthrie; executive committee, L. D. Kellogg, Francis W. Dunbar and J. B. Edwards. This proceeding places the company back in the ranks of the Independent telephone manufacturers. It is reported that the company is doing a large business. Mr. J. B. Edwards is the general superintendent and Mr. Francis W. Dunbar is the chief engineer.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in the present issue are announcements of proposed new plants or considerable extensions of present plant at Montpelier, Vt.; Asheville, N. C.; Newark, Del.; Niles, Mich.; Salt Lake City, Utah; Madison, S. D.; Bodie, Cal.; Colorado Springs, Colo.; Cuyahoga Springs, Ohio; Amarillo, Tex.; Weleetka, Okla.; Spokane, Wash.; Arvonia, Va., and Chickasha, Okla.

TRANSFER OF ELECTRIC LIGHT PLANT AT NEPONSET, ILL.—Ira Dunlap, of Kewanee, Ill., is reported to have come into possession of the central-station plant at Neponset, Ill. Until Jan. 1 last this plant was operated by the Neponset Electric Light Company. It then passed into the hands of Fred Kauffman of Neponset, who has now turned it over to Mr. Dunlap.

WHITNEY COMPANY APPARATUS TO BE SOLD.—The attorneys of the General Electric Company have prepared an order asking for the sale of the electrical apparatus which was sold by the manufacturing company to the Whitney company, of North Carolina, as the result of a judgment in a foreclosure suit. The Whitney company is an organization which was developing a hydro-electric power plant at the Narrows in the Yadkin River, in the central part of North Carolina, for the purpose of supplying energy to numerous cotton mills in that vicinity. It owned the entire capital stock of the Yadkin River Electric Power Company, the Yadkin Land Company, the Yadkin Mines Consolidated Company, the Barringer Gold Mining Company, the Rowan Granite Company and the Yadkin & Virginia Copper & Land Company. These concerns owned upward of 7,000 acres of land in that section of North Carolina. The Whitney company went into the hands of a receiver in February, 1908, and was unable to complete payment for the electrical apparatus which had been contracted for and delivered by the General Electric Company. This apparatus consisted of 4 generators, 5 exciters, 10 transformers, 5 generator rheostats and 5 exciter rheostats, the total bill for which amounted to $154,246. Partial payment was made on the account, but after the company got into financial difficulties it was unable to complete its contract. The notes which had been issued for the deferred payments were endorsed by A. O. Brown & Company, Wall Street brokers, who failed last August, and by Whitney & Stephenson, of Pittsburg. E. F. Buchanan, who was a member of the firm of A. O. Brown & Company, was president of the Whitney company.

D'OLIER GOVERNMENT CONTRACTS.—The D'Olier Engineering Company, Philadelphia, has secured a contract from the United States Government for a complete hydro-electric plant at Fort Yellowstone, Yellowstone National Park, including penstock and concrete power house. This installation will be used for furnishing light and power throughout Yellowstone Park and will consist of three 150-kw alternating current, 3-phase, 60-cycle generators, each direct-connected to a 280-hp D'Olier-Francis turbine water wheel which will operate under a head of approximately 275 ft. A complete switchboard and the transmission wiring are included in the contract. The same company is installing at the Norfolk Navy Yard and Charleston Navy Yard, 15-in. vertical volute pumps in the dry dock caissons to take the place of pumps purchased by the Government from other parties which failed to develop the capacity required. Each of the D'Olier pumps will have an average capacity of 7000 gal. per minute and the caisson will be emptied of water in something less than 30 minutes.

ELECTRIC LIGHT COMPETITION IN ST. LOUIS.—The Light & Power Company, a new organization, has applied to the Board of Public Improvements of St. Louis for a permit to string wires across certain streets. The company owns an old franchise granted some years ago to A. S. Aloe and others, and it is held that if the present request is granted it means that this franchise is valid and the lighting business of the city is open to the company. The application is made at this time because the Circuit Court in St. Louis recently held that the West End Light & Power Company, operating under a franchise granted in 1885 to Browning, King & Company, had a right to erect poles and string wires in the city streets. If this decision is affirmed, the West End company expects to make extensive developments. Up to this time the business has been altogether in the hands of the Union Electric Light & Power Company, a subsidiary of the North American Company.

WILL NOT INTERCHANGE BUSINESS.—The Chicago Telephone Company has refused to close its deal with the Illinois Tunnel Company unless the City Council waives the demand which it has made for connections with the independent companies in towns where a Bell company is located. In other words, the Chicago Telephone Company refuses to make connections with the independents where there is a Bell plant. President McRoberts says that the city must decide immediately whether or not it will waive this demand, and if it refuses to consent to the sale of the telephone plant to the Tunnel company the former will start immediately to install the 20,000 automatic telephones required by their franchise to be in place before the first of October.

ELECTRICAL COMPANIES BUYING LEAD.—Vice President Edward Brush, of the American Smelting & Refining Company, says that the company is now earning at the rate of 8 per cent on its $50,000,000 of common stock, which is largely due to the heavy demand of the electrical manufacturing concerns for lead. Mr. Brush said that not long ago the company had 10,000 tons of surplus lead on hand, but that this is now all gone and the smelters are oversold for several months ahead. Sales for April exceeded the production by several thousand tons and the company is now looking around for new sources of supply. The Pennsylvania Railroad, according to Mr. Brush, has recently ordered 1,000,000 lb. of copper and 600 tons of lead. The National Lead Company has also been buying as much lead as it bought prior to the panic, due to the heavy business in white lead.

WESTERN ELECTRIC COMPANY'S BUSINESS.—Preliminary reports for the month of April of the business done by the Western Electric Company show that it was considerably better than for the month of March, which in itself had been the best month since the beginning of the fiscal year, Dec. 1, 1908. While it is stated that the company is consuming considerably more copper than it did several weeks ago, it is not as yet taking more than 50 per cent of the normal amount. A representative of the company stated that the business in all branches was very satisfactory, that orders were coming in rapidly and that the plants were increasing the number of workmen every day. Business for telephone apparatus has been especially large, and many valuable orders have been received for equipment and for switchboards.

INSULATED WIRE BUSINESS MORE ENCOURAGING.—"While it is hardly proper to say that our business is greatly improved," said a representative of a large insulated wire concern, "we are certainly receiving a great many more inquiries and there is every indication that business will be very satisfactory in the fall. There is an unusual amount of building going on and that eventually means trade for us. We do not get our contracts when the buildings are started, but we know that wire will be needed before the buildings are ready for occupancy. The wire factories are busier than they have been for a long time."

OTIS ELEVATOR BUSINESS IMPROVING.—A material gain in the business of the Otis Elevator Company has been recorded since the beginning of the year. The business of 1907, which amounted to $15,000,000, was the best record the company ever made, and the business for 1908 amounted to about 70 per cent of that sum. It is now said that the orders at the present time are running at about 85 per cent of the record year. The company now has on hand a number of large jobs, including several for the Government, and inquiries are being received in sufficient volume to promise good trade in the future.

THE ELECTRICAL TRADES ASSOCIATION, of Chicago, is conducting a vigorous campaign for the purpose of getting into the association the men in the electrical field who are not already members. The present membership is over 200 and it is the desire of the association to increase this to 300. The membership committee meets May 15 and applications should be made in time to be received before that meeting. Applications should be addressed to Mr. Frederic P. Vose, secretary, Marquette Building, Chicago, Ill.

GENERAL ELECTRIC TO ENLARGE ITS TOLEDO PLANT.—The City Council of Toledo, Ohio, has granted to the General Electric Company the right to close up a street that ran between two buildings of its plant, and the ground will be utilized for new structures that will considerably add to the size and efficiency of its lamp factory at that point. It is planned to spend about $150,000 on the improvement.

CONTRACT FOR BALTIMORE CONDUITS.—The Board of Awards of the city of Baltimore has just placed with the Great Eastern Clay Company, of New York, a contract for terra cotta conduits, for use by the Subway Commission. The contract calls for about 1,000,000 ft. of conduit, which will cost something like $60,000.

NEW NIAGARA 10,000-HP UNIT.—The Canadian Niagara Power Company is arranging for the purchase and installation of an additional 10,000-hp vertical shaft turbine and generator. The general manager is Mr. Philip P. Barton, Niagara Falls, N. Y.

DIRECT-CURRENT SIDE-ROD LOCOMOTIVES.—The General Electric Company is preparing plans for a direct-current locomotive of the side-rod type similar in design to the single-phase side-rod locomotive described last week.

12,000 HP IN TURBINES FOR A CHATTANOOGA PLANT.—The S. Morgan Smith Company, York, Pa., is building 42,000 hp in vertical shaft turbines for the operation of 10 umbrella type G. E. generators in the power plant of the Chattanooga & Tennessee River Power Company, now under construction.

Financial Intelligence.

THE WEEK IN WALL STREET.

There was a much stronger and more active stock market during the past week than has been the rule within the last two months. This may be attributed to the favorable decision on the commodities clause of the Hepburn law, and many Wall Street authorities are so declaring. But the interesting fact remains that the industrials have shown more strength and more activity than have the railroads. It has been a freely expressed opinion in the financial market for some time that the prices of stocks has been pushed so high that any ordinary improvement in business conditions had already been discounted. This opinion is not reflected in the buoyant and active condition of the market at present. While there is still evidence of profit taking every time stocks advance a few points, there is no denying the fact that the general tone is strong, and there is no bear element which dares to make an extensive reactionary campaign. The condition of the iron and steel industry has undoubtedly done much to contribute to this optimistic tone. In broad terms, it may be stated that the rate war in the steel business is over. The mills are fairly busy and prices are being advanced all along the line. The meeting of the light rail makers last week, at which a minimum price agreement was reached, was but an indication of the feeling prevailing among all of the iron and steel industries. The equipment producers claim to be busy, and there has been special strength shown in the companies furnishing this line of material. American Locomotive, Pressed Steel Car and Railway Steel Spring have all been conspicuously strong.

NEW YORK.

	May 3.	May 10.	Shares Sold.		May 3.	May 10.	Shares Sold.
All.-Ch.	10⅛	15½	9,200	Int.-Met., pfd...	47	46⅞	25,650
All.-Ch., pfd...	50½	50⅞	8,975	Mackay Cos....	78½	78½	3,400
Amal. Cop.	77⅝	82⅛	217,625	Mackay Cos.,pfd.	73¼	73*	900
Am. D. T.....	29*	——		Manhattan Elev.	143½*	146⅜	848
Am. Loc.	56	57½	18,115	Met. St. Ry....	27½	30	760
Am. Loc., pfd..	115	115½	2,000	N.Y. & N.J.Tel.	125*	123*	450
Am. Tel. & Cbl.	76*	76*	——	Steel, com.....	56⅜	57⅛	615,300
Am. T. & T....	140¾	140¾	47,200	Steel, pfd.....	116¾	119	65,853
B. R. T.....	78⅝	79½	50,800	W. U. T.....	75¼	75⅝	22,790
Gen. Elec.....	160	159	5,561	West'h., com...	83¼	83⅜	6,640
Int.-Met., com..	17⅛	16⅜	29,630	West'h., pfd...	120*	120*	200

PHILADELPHIA.

	May 3.	May 10.	Shares Sold.		May 3.	May 10.	Shares Sold.
Am. Rys.	46	45½	——	Phila. Elec.	12	12	——
Elec. Co. of A.	12⅜	12⅜*	——	Phila. R. T....	35½	33¼	——
Elec. Stor. B'ty.	45½	48¼	——	Phila. Traction.	94	93*	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	58⅞	56¾	——

CHICAGO.

	May 3.	May 10.	Shares Sold.		May 3.	May 10.	Shares Sold.
Chi. City Ry...	180*	180*	——	Chi. Tel. Co...	132½	133	——
Chi. Rys., Ser.1.	109½*	109½	——	Met. El., com..	19*	19*	——
Chi. Rys., Ser.2.	38½*	38½*	——	Nat'nal Carbon.	85	84	——
Com. Edison....	114½	115½	——	Nat. Carb., pfd.	120*	118*	——
Chi. Subways...	26½*	27¼	——				

BOSTON.

	May 3.	May 10.	Shares Sold.		May 3.	May 10.	Shares Sold.
Am. Tel. & Tel.	141	140¼	—	Mex. Tel.	3	2½	——
Cum. Tel.....	131*	135*	——	Mex. Tel., pfd.	5½*	5½	——
Edison El. Ill.	253*	250	——	N. E. Tel.....	132½	132	——
Gen. Elec.	160	160	——	W. Tel. & Tel..	11¾	12½	——
Mass. Elec. Ry.	14½	13¾*	——	W. T. & T., pfd	85	85	——
Mass. E. R., pfd	72	71	——				

*Last price quoted.
Shares sold are for week May 3 to May 8.

United States Steel stocks have advanced to new high records, and the volume of trading in them has been enormous. Although there have been some shipments of gold to Europe, the money market appears to be unaffected. Cash is plenty and rates are cheap. Call money for a few days was a trifle higher, but not high enough to cause any interference with speculative business. Quotations, May 10, were: Call 1¼@2 per cent, 90 days 2¾@3 per cent. The quotations in the table are those of the close on May 10.

DIVIDENDS.

American Smelters Securities Company, quarterly, preferred, "A" 1½ per cent, "B" 1¼ per cent, payable June 1.

American Telephone & Cable Company, quarterly, 1¼ per cent, payable June 1.

Brooklyn Rapid Transit Company, quarterly, 1 per cent, payable July 1.

Des Moines Electric Company, preferred, initial, 3 per cent, payable May 15.

Georgia Railway & Electric Company, common, quarterly, 1½ per cent, payable May 20.

Mobile Electric Company, preferred, quarterly, 1½ per cent, payable May 10.

Northern Ohio Traction & Light Company, quarterly, ½ per cent, payable June 15.

Springfield, Ohio & Xenia Railway Company, 1½ per cent, payable May 5.

DECISION AGAINST ECONOMIC POWER COMPANY.—The Court of Appeals of New York has handed down a decision holding that the charter of the Economic Power & Construction Company is unconstitutional, insofar as it grants that company sweeping powers to use the streets of any municipality in the State without the consent of the local authorities, and without making any compensation. The ground for the decision is that the title of the company did not express the subject of special franchises which were granted, and the court was unanimous in its decision. The charter of the Economic company, which was granted 16 years ago, was the most sweeping in its provisions ever granted in the State. It practically gave the company the right to do almost any kind of business, and gave it franchises through the streets of any city in the State without the further consent of any municipal or State authority. When the company attempted under this charter in 1907 to excavate trenches in the streets of Buffalo, for the purpose of laying steam mains and electric conduits, the city authorities interfered, the validity of the charter was thrown into court and the decision handed down last week is the determination of that litigation. The company has never done any considerable amount of development work, and at the first hearing of the case refused to permit its books or accounts to be examined. After long litigation on this point, an order of court was finally issued compelling the company to submit its records to the court. The present decision simply robs the Economic company of its unusual franchises; if it now continues its development work it must secure privileges in the same manner as any other company.

CHICAGO ELEVATED RAILWAY MERGER.—The Central Terminal Company, which is to be the holding company for the merged elevated railway lines of Chicago, pledges itself to expend its $4,000,000 of capital stock for the acquisition of property for use in its business. Until these funds are needed they will be invested in marketable, interest-bearing securities. The holding company will take leases on the Northwestern, Oak Park, South Side and Metropolitan elevated railway properties, and each of the four leases will continue as long as the lessor's rights to operate exist under the present ordinances and for such time as additional rights may be secured by future legislation. Each elevated company, prior to turning over the property to the leasing company, promises to put its equipment in good condition, and the holding company agrees to maintain the property up to that standard during the time of the lease. All of the equipment is to be identified by the name plates of the original companies, and the cost of operation, repairs, replacements, damages, taxes and legal expenses shall be paid by the Terminal company. Rentals are to be paid in addition to the guaranteeing of the interest on existing bond issues. These rentals have not as yet been made public, and it is doubtful if they have been definitely agreed upon. The transaction includes the taking over of property which is valued at about $95,000,000, and it is stated that large sums will be spent by the promoters of the merger to bring the lines up to the highest standard of efficiency.

PITTSBURGH (KAN.) PLANT SOLD.—The Electric Bond & Share Company has purchased the entire capital stock and all the bonds of the Home Light, Heat & Power Company of Pittsburgh, Kan. This company had a capital stock of $200,000 and an authorized bond issue of $200,000, only $55,000 of which had been issued. It has been operating natural-gas driven motor sets aggregating 650 kw. The company is in the heart of the coal mining district in southeastern Kansas and is near Joplin, Mo. The plant will be put in first-class shape, and it is believed that there will be an excellent market for its energy.

NEW SEATTLE-SPOKANE LINE.—Albert M. Dewey, president of the Okanogan Electric Railway Company, says that a bond issue of $3,000,000 for the road has been placed with French capitalists. The proceeds of this issue will be used to build an electric line 75 miles long from Nighthawk in central Washington to a point on the Columbia River near the head of navigation. The new line will open up a new field in the lumber, mineral and agricultural districts of Washington. The plans also call for an extension of the road east to Spokane and west to Seattle, making, when entirely completed, a system of more than 500 miles. Engineers have been engaged in preliminary surveys of this line for several months. If a pass can be found through the Cascade Mountains, the road will be built by way of Bridgeport to a point connecting with the Great Northern Railway at Rockport. The company has a 50-year franchise.

APPLICATIONS FOR BOND ISSUES.—The Public Service Commission of the Second District has received the following applications from lighting companies for bond issues: Hornell Gas Light Company, $115,000; Penn Yan Gas Light Company, $55,000; Lyons Gas Light Company, $50,000; Norwich Gas & Electric Company, $170,000; Iathaca Gas Light Company, $240,000; Homer & Cortland Gas Light Company, $160,000; Palmyra Gas & Electric Company, $60,000, and the Newark Gas Light & Fuel Company, $60,000. In almost every instance portions of these bonds are to be used for extensions and improvements. The commission has also authorized Leslie Sutherland, receiver of the Yonkers Railroad Company, to issue $100,000 5 per cent receiver's certificates, payable in not less than two years, the proceeds of which are to be used for renewal and reconstruction of both the roadway and its equipment.

LEWISTON & REEDSVILLE ELECTRIC RAILWAY SOLD.—All of the capital stock of the Lewiston (Pa.) & Reedsville Electric Railway Company has been purchased through Dodge & Day, engineers, Philadelphia, by the Utilities Corporation. This holding company, which was recently organized through the instrumentality of Dodge & Day, has a capitalization of $1,000,000, 6 per cent preferred and $1,000,000 of common stock. The announced purpose of the new company is "the purchase of electric light, street railway and gas properties where there is an opportunity for expansion and an increase in earnings from centralized and efficient management."

RIO DE JANEIRO TRAMWAY EXPANDING CAPITAL.—The shareholders of the Rio de Janeiro Tramway, Light & Power Company met in Montreal last week and voted to increase the stock of the company from $25,000,000 to $40,000,000 by making an issue of 150,000 new shares at par. The company has secured control of the Ferrocaril de Jardin Botanico, or the Botanical Gardens Railway, which owns about 75 miles of electric line and 350 cars. The London Stock Exchange has recently listed $6,000,000 of 5 per cent 50-year bonds of the company.

NEW YORK TELEPHONE COMPANY PROSPEROUS.—It is said that the business of the New York Telephone Company has been so satisfactory that the directors are seriously considering increasing the dividend rate from a 6 per cent to a 7 per cent basis. The company is capitalized at $50,000,000. the majority of which is held by the American Telephone & Telegraph Company. The Western Union Telegraph Company, however, owns about $10,000,000 of the stock, and the increase would be of substantial benefit to the earnings of that concern.

BOSTON TRACTION MERGER PETITION.—The Middlesex & Boston and the Newton Street Railways have petitioned the Massachusetts Railroad Commissioners for authority to consolidate their property and franchises, the new company to be known as the Boston & Middlesex Street Railway. The Middlesex & Boston Street Railway is also petitioning the commission for authority to increase its capital stock to $822,000 for the purpose of effecting this consolidation.

VIRGINIA PASSENGER & POWER COMPANY SOLD.—At the receivership sale of the Virginia Passenger & Power Company, at Richmond, Va., May 5, the property was bought in by representatives of the bondholders' committee for $8,100,000. Douglass Robinson was chairman of this committee, which represented the Gould interests. There was only one bid made for the property. The company operates 120 miles of railway and furnishes energy for power and lighting.

LINCOLN STATION MADE FLOOD PROOF.—H. L. Doherty & Company, who have charge of the operation of the Lincoln (Neb.) Gas & Electric Light Company, announce that they have raised their power house so that the station will hereafter be flood proof. This is a steam station, and last summer it was put out of business for an entire week on account of a flood. Such a catastrophe will hereafter be impossible.

MEXICAN TELEPHONE & TELEGRAPH COMPANY.—At the annual meeting of the stockholders of the Mexican Telephone & Telegraph Company, in Portland, Me., May 6, a new bond issue of $1,000,000 for construction purposes was authorized. The following directors were elected: George H. Butters, Lewis C. Benton, B. Nason Hamlin, James Menzies, W. French Smith, H. B. Thayer and B. E. Freytag, of London, Eng.

METROPOLITAN SALE POSTPONED.—Judge Lacombe, of the United States Court in New York, has ordered the postponement of the sale of the Metropolitan Street Railway property until June 29, owing to the improbability of the Appellate Court rendering a decision in the case of the Guaranty Trust Company before June 1, the date originally set for the sale This suit was brought in the interest of the bondholders

CALIFORNIA GAS & ELECTRIC CORPORATION BONDS.—The $5,000,000 refunding 5 per cent bonds of the California Gas & Electric Corporation which were recently purchased by Lee, Higginson & Company and the National City Bank of New York, are being offered to the public at 95½ and interest, making a yield of almost 5.30 per cent.

EXTENDING CENTRAL NEW YORK TROLLEYS.—The system of tractions in Central New York known as the "Beebe System," because C. D. Beebe and his friends have been instrumental in its development, is being rapidly developed and put into first-class condition. The report of Jan. 1 shows that the entire trackage on that date of the seven affiliated lines was 261.43 miles.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses	Net earnings.	Charges	Surplus
Chicago Railways Company:					
March, 1909	$985,927	$699,000	$286,927	$...	$
March, 1908	857,732	608,310	249,422	...	
International Steam Pump Company:					
Year ended March 31, 1909	.....	...	1,525,093	1,311,...	213,...
Year ended March 31, 1908	.....	...	1,804,...	1,...	293,...
Kansas City Railway & Light Company:					
March, 1909	548,961	300,887	248,...	168,...	80,804
March, 1908	488,741	267,037	221,...	153,...	67,880
Norfolk (Va.) & Portsmouth Traction Company:					
Year 1908	1,877,930	1,104,346	773,...	790,...	*17,046
Year 1907	2,616,458	1,...	983,...	730,...	253,...
Rochester & Eastern Rapid Railway Company:					
Quarter ended Dec. 31, 1908	68,...	46,...	22,...		
Quarter ended Dec. 31, 1907	73,666	...	28,...		
Rochester (N. Y.) Railway Company:					
Quarter ended Dec. 31, 1908	652,474	1,...	250,...		
Quarter ended Dec. 31, 1907	630,068	...	1,...		
Rochester Railway & Light Company:					
Quarter ended Dec. 31, 1908	2,502,...	1,262,920	1,...	...	...
Quarter ended Dec. 31, 1907	2,364,290	...	...	764,150	...
Philadelphia Company:					
Year 1908	16,...	...	...	...	...
Year 1907	15,...	...	9,413,770	5,061,060	...
Toronto Rapid Transit Company:					
Quarter ended Dec. 31, 1908	...	...	...	...	
Quarter ended Dec. 31, 1907	126,...	...	...	...	
United Railways Investment Company:					
Year 1908	1,452,672	...	...	...	...
Year 1907	...	...	...	...	...

*Deficit.

GENERAL NEWS

Construction News.

TROY, ALA.—The Standard Chemical & Oil Company, it is said, will rebuild its power plant recently destroyed by fire.

JEROME, ARIZ.—The City Council has granted the Arizona Overland Telephone Company a franchise to erect a telephone system in Jerome.

PHOENIX, ARIZ.—The Stoddard Copper Company, Phoenix, contemplates the installation of electrical machinery in its mines at Stoddard, electricity to operate the machinery to be supplied from the power plant at Fossil Creek. The transmission line is not yet completed and it is not expected that power will be available before next fall.

CORNING, ARK.—D. W. Reynolds and J. Pickrell, of Louisville, Ky., are reported to be interested in a proposition to construct an electric railway from Corning to Maynard, a distance of about 18 miles.

LITTLE ROCK, ARK.—The City Council is reported to be considering the question of issuing $65,000 in bonds for the installation of an electric light plant.

BERKELEY, CAL.—The transmission lines along University Avenue to West Berkeley are being replaced with a three-phase line in that section of the town. This improvement is due to the demand of the factories on the waterfront for better and steadier service. The substation being erected in West Berkeley will furnish electricity for the new system.

BODIE, CAL.—Plans are being made by the Standard Consolidated Company, it is reported, to enlarge its power plant at Green Creek.

FRESNO, CAL.—Preparations are being made by the San Joaquin Light & Power Company for extensions of its transmission lines into Orosi and Sultana and also to furnish electricity to the farmers in Stokes Valley and the foothill country.

GRASS VALLEY, CAL.—Notice of appropriation of 5000 cu. in. of water in the Middle Yuba River has been filed by Dr. A. H. Tickoll, to be utilized for power purposes. It is proposed to build a power plant on the Nevada County side of the river, where 500 hp can be developed.

MARICOPA, CAL.—A company has been formed recently by local business men for the purpose of building and operating electric light, water and natural gas systems in Maricopa. F. T. Torpey is president, and H. C. Mosier, secretary of the company.

MODESTO, CAL.—Plans are under way for forming a new irrigation district, which will be known as the Wright Irrigation District, which is to include a large territory surrounding Oakdale. If the project goes through, the new district will condemn and take over the water rights and ditches of the San Joaquin Canal & Irrigation Company, with power plants at Knights Ferry.

PASADENA, CAL.—The business men of South Pasadena are considering the question of installing a new lighting system for the principal business streets of that city. It is proposed to substitute electroliers for arc lamp posts.

SACRAMENTO, CAL.—The City Council has passed an ordinance requiring all wires to be placed underground in certain districts in the city.

SAN DIEGO, CAL.—The San Diego Gas & Electric Company has increased its capital stock from $1,500,000 to $3,500,000. The company, it is said, is planning to make extensive improvements to its system.

SAN FRANCISCO, CAL.—The Smith River Power Company, recently incorporated, proposes to develop the water power of Smith River, to be utilized to generate electricity to be distributed in portions of Del Norte and Humboldt Counties, Cal., and Josephine County, Ore., for lamps and motors. It is proposed to construct two plants. Charles M. Lindsay, of San Francisco, is president of the company.

COLORADO SPRINGS, COL.—The Golden Cycle Mining Company, which owns a large coal mine north of the town, is preparing to construct a power plant at a cost of about $200,000. The company will furnish electricity for lamps and motors in Colorado City.

GREELEY, COL.—An agreement has been entered into between the Northern Colorado Power Company, of Denver, and the Home Gas & Electric Company, of Greeley, which will benefit the farmers of Weld and Morgan counties. Under the agreement the Northern Colorado Power Company will take over the leases to furnish electricity in Weld and Morgan counties, and will erect a transmission line from the Lafayette power house to Greeley by the way of La Salle, Evans, Kersey and adjacent country, which will complete the loop, taking in Greeley on one side, and on the other from Lafayette to Fort Collins, thence to Greeley. For the past two years the companies have been competitors in Greeley.

NEW BRITAIN, CONN.—The Connecticut Company has been awarded a contract to furnish 180 arc lamps for street lighting at $85 per lamp per year, with the privilege of renewal for five years.

NORWICH, CONN.—The Uncas Power Company, of Norwich, has [illegible] the Willimantic & Stafford Street Railway Company with electricity from the Scotland power station for a term of five years. Electricity will be distributed between Willimantic, Stafford and Rockville, and will be used for heating and motors only, the railway company having the privilege to furnish electrical service to the towns through which it passes. The railway company will take the service direct from the power house and will erect a transmission line from the power station at Scotland to Stafford. The power will not be used for operating the railway.

PUTNAM, CONN.—The Putnam Light & Power Company expects to discontinue the use of its steam plant and obtain electricity for operating its system from Mechanicsville, where a water power is being developed. The company also plans to erect a transmission line to Thompson and to abandon the steam plant now in use there. The plant of the Fort Hill Light & Power Company at Thompson, [illegible] recently purchased by the company. Arthur Liste is treasurer.

WINDSOR, CONN.—The Northern Connecticut Company has changed the minimum rate for electricity for lamps from $18 to $12 per year. The present rate is $2 monthly for the months between October and April and $1 per month for the rest of the year. The new rate is $1 per month the year around. The company is planning to discard the flat rate and put all consumers on the meter basis immediately.

NEWARK, DEL.—The Elk River Heat, Light & Power Company contemplates the installation of an additional unit in its plant within the next six months, and will erect transmission lines to several other towns. The company supplies electricity for the municipal electric light plant and to local manufacturing plants. E. W. Melony is general manager.

LEESBURG, FLA.—J. Y. Clark has applied for a franchise to establish an electric light plant in Leesburg.

ATLANTA, GA.—It is reported that the Towaliga Falls Power Company contemplates making improvements to its power plant. It is said that the company will issue $100,000 in bonds to pay for same.

ATLANTA, GA.—The Coosawattee & Mountaintown Rivers Power & Improvement Company, recently incorporated, contemplates the construction of a 100-ft. dam. It is estimated that from 4000 to 5000 hp can be developed. Hall Brothers, Temple Court, Atlanta, Ga., are engineers in charge of the work.

DUBLIN, GA.—Arrangements are being made by the Dublin Telephone & Telegraph Company to improve its service. A new switchboard will be installed and new cable erected in the business section.

HAMPTON, GA.—At an election to be held soon the people will vote on the proposition to issue $20,000 in bonds for the construction of electric light plant and water works system.

SPRINGFIELD, GA.—The Effingham Telephone Company, recently incorporated, will take over and extend the telephone line now in operation between Guyton, Pincora and Tusculum, Ga.

NEPONSET, ILL.—The plant and holdings of the Neponset Electric Light Company have been purchased by Ira Dunlap, of Kewanee, Ill.

PEORIA, ILL.—The Illinois Traction System has awarded a contract for the construction of a substation at Mackinaw and is planning to rebuild the substation at Minier.

STREATOR, ILL.—It is reported that investigations are being made with a view of installing a new light, heat and power plant in Streator to cost $100,000. Frank L. Stevenson is chief engineer of the company.

BRAZIL, IND.—The Vigo Light & Power Company, known as the Fauvre Syndicate, with headquarters in Indianapolis, is preparing to make extensive improvements in the Brazil electric plant, which was recently purchased by the syndicate. New equipment will be added so as to make it a part of the great transmission system to be operated from the coal fields.

COLUMBIA CITY, IND.—The Home Telephone Company has contracted with the Western Electric Company, of Chicago, to install a new central energy switchboard. The batteries will be charged from the city electric light plant and a gasoline engine and dynamo at the telephone company's plant will furnish the energy should any accident occur to the city light plant. The wires in the city will be encased in cables, and the offices moved to the Peabody block.

FORT WAYNE, IND.—The Home Telephone Company is planning to construct a conduit leading from Wells and Superior streets into Bloomingdale and the 'phone service in the suburb will be more than doubled. The company is in the market for 1000 ft. of 400-pair cable, 2000 ft. of 300-pair cable and 1500 ft. of 200-pair cable.

FORT WAYNE, IND.—Announcement has been made that a new electric railway, which is to connect Fort Wayne and Defiance, Ohio, has been financed, and that work on construction of the road will commence in the near future. The railway will be 43 miles in length and will follow the old canal bed for the greater part of the way. It will be known as the Toledo, Defiance & Fort Wayne Railway. The project includes the purchase and reconstruction of the electric railway in Defiance. Dr. Bennett, E. D. Hamaker and other Toledo and Defiance capitalists are interested in the enterprise.

LIGONIER, IND.—Messrs. Lyon & Greenleaf, of Ligonier, have been granted a franchise to construct and operate an electric light plant in this city.

ALLISON, IA.—The Corn Belt Telephone Company is contemplating the construction of a new exchange building.

ALTOONA, IA.—The Rural & Four-City Telephone Company has been granted a franchise to erect and maintain a telephone system in Altoona, O. A. Repass, of Dallas Center, and R. L. Parker, of Prairie City, are interested in the company.

FARNHAMVILLE, IA.—The Farnhamville Mutual Telephone Company is planning to erect a toll line to Paton.

WATERLOO, IA.—The Waterloo Water Company, which has been contemplating the installation of electrical equipment for operating its pumping station, has abandoned the project for the present, owing to its franchise having expired, and the city is considering the purchase of the plant. If the company is granted a franchise, the proposition will be taken up again.

WINFIELD, KAN.—The electric light plant owned by the Alexander Milling Company has ceased operations and the business turned over to the municipal electric plant. The plant is a direct-current system and was established six years ago.

LOUISVILLE, KY.—The plant and holdings of the Jefferson County Electric Company at Riverview Park were sold at auction on May 3, by E. L. Williams, commissioner of the circuit court, to James L. Clarke, Jr., for $8,000. The property was appraised at $28,320, and was built by a company to furnish electricity for lamps and motors to the White City. It is expected that the plant will furnish electrical service to the Riverview Park attractions.

PINEVILLE, KY.—The capital stock of the New Pineville Telephone Company has been increased from $3,600 to $20,000.

GREENVILLE, MAINE.—The Greenville Light & Power Company has commenced work on the reconstruction of its power plant at Wilson Stream. A new and larger building will be erected to provide room for additional equipment, which will be required to furnish electricity to the Monson slate works.

MACHIAS, MAINE.—The voters of the Union District have authorized action to be taken to contract with the Cherryfield Electric Light Company to light the streets of the district for the remainder of the municipal year. An appropriaion of $300 was made to pay for the service.

LEWISTON, MAINE.—The Auburn & Turner Railroad Company contemplates extending its railway from Turner Village to Livermore Falls.

BRIDGEWATER, MASS.—The Edison Electric Illuminating Company, of Brockton, has purchased the plant and holdings of the Bridgewater Electric Light Company and will take over the plant and operate it under its own name.

CHICOPEE, MASS.—The citizens of Willimansett and Aldenville are contemplating having the villages lighted by electricity, and a movement is on foot to have the transmission lines of the Chicopee municipal electric plant extended to these sections. It is said that the commission has promised to have the service extended, but owing to changes having been made in the plant the work has not been done.

FALMOUTH, MASS.—The power station of the Buzzards Bay Electric Company, which proposes to erect an electric plant to furnish electricity in the towns of Falmouth, Wareham and Bourne, will probably be located at Woods Holl. An option has been secured on the Fay Wharf property by Eugene Carpenter, treasurer of the company. Orders have been placed for poles and other materials and it is expected that work on construction of the plant will begin soon.

HAVERHILL, MASS.—The contract for installing electrical equipment in the new high school building was awarded to the M. B. Foster Electrical Company, of Boston, Mass., for $15,775.

OAK BLUFFS, MASS.—The Martha's Vineyard Electric Light & Power Company has filed amendments to its charter changing its name to the Buzzards Bay Electric Company. Allen A. Brown is president and Eugene Carpenter, treasurer, of the company.

PEABODY, MASS.—The Municipal Light Department has commenced work on the distributing system of the municipal electric light plant preparatory to installing a new system, for which an appropriation of $ was recently voted. Most of the work will be done by the department.

REVERE, MASS.—The Municipal Light Board is considering replacing the electric incandescent street lamps now in use with [illegible] of arc [illegible]

TYNGSBORO, MASS.—The citizens have voted to appoint [illegible] to make arrangements with A. A. Flint to furnish electricity in Tyngsboro.

DETROIT, MICH.—The Detroit River Tunnel Company has awarded a contract to the Butler Brothers Hoist Company, of Detroit, for the construction of a substation and battery building, to be erected on the Detroit River, foot of Eleventh Street, to cost about $100,000.

ESCANABA, MICH.—It is reported that the Escanaba Electric Railway Company contemplates extending its railway from Escanaba and Wells to Rapid River via Gladstone.

GRAND RAPIDS, MICH.—The Village Council has entered into a contract with the gas company and will install an [illegible] lighting system, electricity to be furnished by the Grand Rapids-Muskegon Power Company. [illegible] to be used [illegible]

SAULT STE. MARIE, MICH.—The Lake Superior & Michigan Power Company is making arrangements to construct a dam across the St. Joseph River, near Betrand, and will also build a large power house at that place.

PONTIAC, MICH.—Application has been made to the City Council by William H. Osnum, of Pontiac, for a franchise to erect a transmission line for the distribution of electricity in this city. Mr. Osnum has secured the power plant and property of the Clinton River Power Company at Amy and is planning to furnish electrical service in Pontiac.

FERGUS FALLS, MINN.—The Dayton Hollow Power Company is contemplating extending its transmission lines to Mooreton, Wyndmere, De Lamere, Milnor, Gwinner and Oakes, N. D.

WORTHINGTON, MINN.—Plans are being considered to install a small electrical and steam unit in the municipal electric light plant to furnish electricity for day service during the coming summer. J. E. McElligatt is superintendent.

GRENADA, MISS.—The citizens on May 1 voted to issue $5,000 in bonds, the proceeds to be used for improvements to the light and power plant.

HANNIBAL, MO.—The Mexico, Perry & Santa Fe Traction Company has petitioned the City Council for a franchise for a right-of-way in and through Hannibal from the western city limits to the union station. The company proposes to construct 100 miles of interurban railway from Columbia to Hannibal, at an approximate cost of $25,000 per mile.

JOPLIN, MO.—Plans are being made to construct an interurban electric railway between Joplin and Neosho, 20 miles in length, which will be equipped for both passenger and freight service. D. L. Robinson, treasurer of the Joplin & Pittsburgh Railway Company, is interested in the project.

THREE FORKS, MONT.—Plans are being made to erect a new telephone exchange in Three Forks by the Three Forks Telephone Company.

FAIRMONT, NEB.—T. J. Bender, of the Fairmont Water Company, has been granted a 25-year franchise by the City Council to construct and operate an electric light and power plant. It is said that an expenditure of about $10,000 is contemplated.

WALTHILL, NEB.—The proposition to bond the town to build a water and light system was defeated at a recent election.

GOLDFIELD, NEV.—Plans are being made by A. A. Codd, manager of the St. Ives lease, to increase the output of the mines, which will include the construction of a power plant and mill on Walker River.

ATLANTIC CITY, N. J.—The Venice Park Railroad Company has applied to the City Council for a franchise to construct a street railway from Ohio Avenue to Gramercy Avenue, about one mile in length. The company will soon file incorporation papers.

CAMDEN, N. J.—The Delaware & Atlantic Telephone Company is making preparations to place its wires underground on several streets in this city.

GLASSBORO, N. J.—The borough is advertising for bids for lighting the town with electricity.

JERSEY CITY, N. J.—The Street and Water Commissioners have issued orders for placing telephone, telegraph and electric light wires underground on Monticello Avenue.

ORANGE, N. J.—At an election held May 5 the citizens voted in favor of constructing an electric light plant.

WEST PATERSON, N. J.—The Board of Improvements has decided to advertise for bids for lighting the streets of the city for a term of five years from the expiration of the present contract, which is held by the Public Service Corporation and will expire July 1.

BALDWINSVILLE, N. Y.—The Seneca River Power Company has submitted another proposition to the Board of Village Trustees to furnish a street lighting service. The company offers to furnish electricity to operate the local pumping station, which supplies the village with water, and to furnish electricity for 65 arc lamps for $3,500 per year. The pumps are now operated by steam power.

BROOKLYN, N. Y.—The Coney Island & Brooklyn Railroad Company has notified the Public Service Commission that it will apply for permission to authorize a sale of bonds to the amount of $350,000, the proceeds to be used to relay tracks on the Franklin Avenue line and also part of the DeKalb Avenue line. The commission is now considering an application of the company for the issue of $ [illegible] improvements to the Coney Island Avenue line.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, at the office of the Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until May 17, for installing electrical equipment in new Public School 164, on Fourteenth Avenue, between Forty-second and Forty-third Streets, Borough of Brooklyn. Plans and specifications and blank forms can be [illegible] at the above office and at the branch office, [illegible] ston Street, Brooklyn.

BUFFALO, N. Y.—The Buffalo & Lake Erie Traction Company is making [illegible] from West Seneca [illegible] Hamburg Township.

CHATHAM, N. Y.—The Hudson River Telephone Company has purchased the property of the [illegible] W. D. Tim Brock on the corner of Hillsdale.

CHATHAM, N. Y.—The Consumers Electric Light, Heat & Power Company, [illegible] by [illegible] to [illegible] [illegible] Main [illegible]

JAMESTOWN, N. Y.—The Municipal Lighting Commission has made a substantial reduction in the rates for electricity for commercial lighting. The rate has been 6 cents per kw hour. The new rates are graded according to the amount used and are as follows: 6 cents per kw hour for the first 2,000 kw used in one year, 4 cents per kw hour from 2,000 to 4,000 kw, and 3½ cents per kw hour for all above 30,000 kw. A further discount of 10 per cent is allowed for prompt payment of bills. C. G. Sundquist is superintendent.

KINGS PARK, N. Y.—The contract for the construction of power house at Kings Park State Hospital, Kings Park, N. Y., has been awarded by the State Commission in Lunacy to Ross-Bush Company, New York, N. Y., for $44,747.

NEW YORK, N. Y.—The Sinking Fund Commission on May 1 voted to appropriate $210,000 to build an additional story to the Seventh Regiment Armory and to install a lighting and heating plant.

NEW YORK, N. Y.—The Board of Estimate and Apportionment has granted the South Shore Traction Company a franchise for a street railway from the Manhattan end of the Queensboro Bridge to Jamaica and the line dividing the counties of Queens and Nassau.

NORWICH, N. Y.—The Norwich Gas & Electric Company has been granted permission by the Public Service Commission, Second District, to execute a mortgage for $400,000, and to issue $175,000 in bonds, the proceeds of $85,000 to be used to retire an outstanding issue; $36,000 to discharge obligations and $40,000 for extensions and betterments to its system.

PALMYRA, N. Y.—The Public Service Commission has authorized the Palmyra Gas & Electric Company to execute a mortgage for $100,000, and to issue $60,000 in bonds, the proceeds of $35,000 to be used for discharge of obligations, and $14,000 for extensions and improvements to its plant.

POUGHKEEPSIE, N. Y.—The State Commission in Lunacy has awarded the contract for construction of power house at the Hudson River State Hospital, Poughkeepsie, N. Y., to Peter Keeler, of Albany, N. Y., for $47,900.

VICTOR, N. Y.—The Public Service Commission, Second District, has granted the Despatch Heat, Light & Power Company, of Despatch, N. Y., permission exercise a franchise to furnish electricity in Victor.

YONKERS, N. Y.—The Public Service Commission, Second District, has authorized Leslie Sutherland, receiver for the Yonkers Railroad Company, to issue $100,000 6 per cent receiver's certificates, payable in not less than two years, the proceeds to be used for renewal and reconstruction in Yonkers and purchase of new rails, etc.

YONKERS, N. Y.—Proposals will be received at the office of the Board of Contract and Supply for furnishing and delivering f. o. b. Yonkers, N. Y., one engine to be direct connected with dynamo of standard make and guaranteed to supply 7 kw at 115 volts. Also a submerged centrifugal pump direct connected to a standard motor, with all necessary auxiliaries. Copies of general plans and specifications and form of proposal may be obtained at the above office, Manor Hall, Yonkers. James D. McIntyre is secretary.

ASHEVILLE, N. C.—Announcement has been made by the North Carolina Electrical Power Company, a subsidiary of the Weaver Power Company, that it will commence work on its power plant on the French Broad River as soon as an agreement can be reached with the Southern Railway Company. The proposed plant will have an output of about 10,000 hp and will cost about $450,000. Captain W. T. Weaver is at the head of the enterprise.

BREVARD, N. C.—The Transylvania Cotton Mill Company has completed its mill building and is now installing machinery which will include 4000 spindles, etc., for manufacturing yarns. The plant will be driven by electricity, which will be obtained from the hydro-electric plant of the Cascade Power Company, located at Hamilton Shoals, on Little River, six miles from Brevard.

FOREST CITY, N. C.—A company has been organized to construct a knitting mill in this city. Ten hosiery machines and a gasoline engine will be installed. G. P. Reid is president.

GREENSBORO, N. C.—The General Assembly has appropriated $30,000 for improvements to the North Carolina Sanitarium for Treatment of Tuberculosis, which will include the installation of a power and pumping plant to furnish heat, light, power and water, and a sewerage system.

LOUISBURG, N. C.—G. W. Ford is reported to have purchased a water power about eight miles from Louisburg, which he proposes to develop to be utilized to generate electricity, which will be transmitted to Louisburg.

AKRON, OHIO.—Plans have been completed by the Adamson Machine Company for the erection of a new plant. A new power house will be erected and three 20-ton electric cranes will be installed, contract for which has been placed with the Cleveland Crane & Engineering Company, Wickliffe, Ohio. Orders have also been placed for a 100-hp, 3-cylinder vertical Warren gas engine.

ATHENS, OHIO.—Extensive improvements are planned for the local system of the Athens County Home Telephone Company, which will include a new exchange, placing the wires underground on Court Street, the installation of a new switchboard and the erection of several miles of [illegible]

BOWLING GREEN, OHIO.—[illegible] Bowling Green & Napoleon Electric Company [illegible] cables from Bowling Green to Tontogany, a distance of [illegible]

BUCYRUS, OHIO.—The contract for lighting the streets of this city expired May [illegible] and the Bucyrus Gas & Electric Light Company has refused to [illegible] the service without a new contract, and as a result the streets of the city are in darkness. Several months ago the city awarded the contract for street lighting to a new company, but the new plant has not yet been started. The present company refuses to sell electricity for lighting unless a new contract, pending the starting of the new plant.

CUYAHOGA FALLS, OHIO.—The City Council has passed an ordinance to issue $4,000 in bonds for improvements and extensions to the municipal electric light system.

DAYTON, OHIO.—Plans are being prepared by the Home Telephone Company for extensions to its system, which will include the erection of branch exchanges in Riverdale, North Dayton, the East End, Oakwood and the West Side. About $200,000 will be expended on the extension of cable lines during the summer.

NATIONAL MILITARY HOME, OHIO.—The contract for installing two boilers and stokers at the Central Branch National Home for Disabled Volunteer Soldiers was awarded to the Babcock & Wilcox Company, New York, N. Y., for $11,985. W. K. Ortt is treasurer.

CHICKASHA, OKLA.—Arrangements are being made by the Chickasha Light, Heat & Power Company for the reconstruction of its plant. It is proposed to replace the present single-phase, 1100-volt system with 3-phase, 2200-volt, 60-cycle equipment and install additional boilers. The output of the plant will be increased to 600 kw. It is understood that steam turbines will be installed.

OKLAHOMA CITY, OKLA.—At a special election held April 27 the citizens voted to grant the Oklahoma Interurban Traction Company a blanket franchise to the streets and public highways in the city of Oklahoma.

WELEETKA, OKLA.—We are informed that the Weleetka Water Power Company, which is owned by the Oklahoma Midland Electric Railway Company, will start work on the construction of its plant about June 1. C. J. Blake is president and manager.

BAKER CITY, ORE.—We are informed that the Eastern Oregon Light & Power Company has been organized to take over the plants and properties of the Fremont Power Company, the Baker Light & Power Company and the Elkhorn Light & Power Company. It is expected that formal transfer of the property will be made during this month. Mr. Ray Nye, president of the Nye-Schneider-Fowler Company, of Fremont, Neb., will be president of the new company.

MONMOUTH, ORE.—A special election will soon be held to vote on the proposition to issue $20,000 in bonds for the construction of an electric light and water plant.

PORTLAND, ORE.—The Western Oregon Trust Company, owning a section known as Parkside, has applied to the County Commissioners for a franchise to construct and operate an electric railway.

AMBRIDGE, PA.—The Ambridge Heat, Power & Light Company, recently incorporated with a capital stock of $150,000, proposes to furnish both gas and electricity in Ambridge.

CLIFTON, PA.—The Clifton Power Association is considering the question of lighting the village. For further information address Augustus Nathan.

PEN ARGYLE, PA.—The Slate Belt Electric Street Railway Company is planning to make additions to its power plant.

PITTSBURG, KAN.—The Electric Bond & Shareholders' Company, of New York, N. Y., has secured the controlling interest in the Home Light Heat & Power Company, which furnishes natural gas and electricity in this city and in Frontenac. The new company was represented by C. M. Maxwell.

SAYRE, PA.—The Sayre Electric Company is taking its share of the project to boom the town. The company is making arrangements to erect a large sign to be placed on the top of the high smokestacks, which will read "Electric Power Cheap." The entire end of the large power house will be illuminated with electric lamps and a sign reading "Sites for Factories." The company has submitted a proposition to the Waverly Chamber of Commerce, which owns valuable land east of the village for factory sites and homes, to install a large electric sign upon the land the electricity for the same to be furnished at actual cost to the company. In addition to this the company has offered a room heated and lighted to the newly organized Board of Trade.

PROVIDENCE, R. I.—Beginning with June the price of electricity for lighting the streets will be reduced from $104.75 to $100 per arc lamp per year, which will be in effect until 1912 when the exclusive franchise of the Narragansett Electric Lighting Company will expire.

WOONSOCKET, R. I.—The contract for the construction of the new power house for the Scotia Worsted Mills has been placed. A 350-hp compound engine and new boilers will be installed.

BEAUFORT, S. C.—The city has sold a bond issue of $40,000, the proceeds to be used for the construction of an electric light plant, water works system and town hall.

CHARLESTON, S. C.—The Citizens' Electric Light & Power Company has petitioned the City Council for a franchise to erect transmission lines

underground conduits, etc., necessary for the transmission of electricity and gas throughout the city.

GREENVILLE, S. C.—Application has been made to the City Council for a franchise for the Paris Mountain Railroad.

GREENVILLE, S. C.—The question of the franchise of the Public Utilities Company, which was declared null and void about two months ago, was reconsidered and a commission appointed to meet the representatives of the company and take up the matter of lower gas and light rates.

MADISON, S. D.—Bids will be received by William Rae, city recorder, until May 21 for furnishing a producer gas engine and electrical equipment for the municipal electric light plant.

WAKONDA, S. D.—The citizens are considering the question of installing street lamps, water system and other public improvements.

AMARILLO, TEX.—Frank A. White, receiver of the Amarillo Water, Light & Power Company, writes that it is proposed to increase the output of the plant by 400 hp and also to make many improvements to both the light and water systems in general, plans for which have not yet been decided upon.

BRYAN, TEX.—The city is contemplating the purchase of the local electric plant and enlarging it; if not able to buy it, a new plant will be built. The city recently voted to issue bonds to the amount of $75,000 for an electric light plant, water-works system and sewer system.

DENISON, TEX.—The capital stock of the Denison Light & Power Company has been increased from $125,000 to $200,000.

DENTON, TEX.—The Southwestern Telephone Company is planning to rebuild and extend its local plant, which will involve an expenditure of several thousand dollars.

GREENVILLE, TEX.—At an election to be held in June the citizens will vote on the proposition to issue bonds for improvements to the municipal electric light plant, the cost of which is estimated at about $65,000.

GROVETON, TEX.—It is reported that the Groveton Light & Ice Company contemplates increasing its capital stock from $20,000 to $25,000.

SNYDER, TEX.—The Scurry County Telephone Company has purchased the telephone exchange of the Texas & Pacific Company and will make improvements to same. R. N. Miller is president and George T. Curtis vice-president and general manager.

TEXAS CITY, TEX.—The Texas City Company has commenced work on extensive improvements which will involve an expenditure of $1,000,000 within 12 months and an expenditure of an additional $1,000,000 in 1910. It is said that the company will install a power plant to furnish electricity for lamps, etc. A. B. Wolvin, of Duluth, Minn., is president.

SALT LAKE CITY, UTAH.—The Salt Lake & Ogden Railway Company is negotiating for interpole motors, automatic air brake, etc., for car equipment and generator and substation equipment. The company is equipping its steam railroad between Salt Lake City and Ogden to be operated by electricity. The road is 35 miles in length.

FAIR HAVEN, VT.—It is reported that capital to the amount of $1,000,000 has been assured for the construction of an electric railway between Fair Haven and Granville. A charter was granted by the State Legislature two years ago, and franchises have been secured from some of the villages through which the railway will pass. A temporary organization has been effected, with Mr. Heinz, president of the Coney Island Railway, as president; William Nathaniel, of Poultney, Vt.; A. Mulholland, of New York, N. Y., and A. Y. Gray, of Middletown.

MONTPELIER, VT.—The Corry-Deavitt-Frost Company, of Montpelier, it is said, has decided to erect a second power plant, to be located on the Winooski River about one mile above the present plant situated at Kinney's mills. The new plant will have an output of 1000 hp. P. S. Terrill, of the General Electric Company, has been engaged to take charge of the new plant, and construction work will begin in the near future.

ARVONIA, VA.—Plans are being made by the Philadelphia Trust & Securities Company, of Wilmington, Del., for the construction of a hydro-electric plant on State River, about one and one-half miles from Arvonia. The plant will develop about 2000 hp and will cost about $200,000. C. P. E. Burgwyn, of Richmond, Va., is engineer in charge.

DAMASCUS, VA.—The capital stock of the Damascus Light & Power Company has been increased from $5,000 to $[illegible].

DINWIDDIE, VA.—The stockholders of the Dinwiddie Telephone Company have voted to increase the capital stock of the company to $25,000. The company is making plans to extend its telephone lines throughout the county.

EMPORIA, VA.—The Town Council has awarded the contract for the construction of its new telephone plant to the Home Telephone & Telegraph Company, of Henderson, N. C., surveys for which are now being made. The cost of the system complete is estimated at $15,000.

HONAKER, VA.—The Town Council is reported to be considering the question of granting franchises for the installation of electric lighting and water works systems.

NORFOLK, VA.—Estimates for the cost of a municipal electric light plant have been submitted to the light committee of the City Council by Messrs. Strabrough & Grant, of Norfolk, consulting engineers, and H. M. Gumm, of this city. The report submitted by Strabrough & Grant estimates the cost of a plant at $[illegible], the report of Mr. Gumm estimates the cost of an inefficient plant at $[illegible] and one in connection with the sewer pumping plant at $[illegible]. Mr. Gumm also submitted a proposition to the light committee, offering to operate the municipal plant, if it is installed, on a commission basis, and also proposes to take care of the interest on the bonds, the depreciation and makes other concessions in connection with his offer.

RICHMOND, VA.—Contracts have been awarded by the City Council for the construction of the municipal electric light plant as follows: For electrical equipment, including generators, switchboards, 1000 arc lamps, etc., to Hotchkiss & Gordon, agents for the General Electric Company, for $96,592; for turbine water wheel and governor, to the S. Morgan Smith Company, for $15,250; the Electrical Company of Virginia, for impulse water wheel, at $735; the Coldwell-Wilcox Company, for eight intake gates and thimbles, for $7,280; two water-tube boilers, to the Babcock & Wilcox Company, for $9,928. The contract for reconstruction of building was awarded to E. C. Woodward, for $5,640; for steel, iron work and traveling crane, to Bergdall & Pauling, at $7,750; the concrete work, construction and reconstruction of the power house, foundations and the excavation of tail races, to A. W. McClay & Company, for $48,669.

BELLINGHAM, WASH.—The Whatcom County Railway & Lighting Company has been granted a franchise to construct its lines on Dock and North streets.

OROVILLE, WASH.—The City Council has directed the city attorney to take necessary steps for calling an election to vote on the proposition to issue bonds for the construction of electric light and water works systems. The plans call for the construction of a pumping plant on Lake Osoyos, about a mile distant from the town.

SEATTLE, WASH.—In order to secure electrical service the residents of Lincoln Beach and Fauntleroy Park district have offered to raise the sum necessary to secure an immediate extension of the West Seattle lighting system into the district.

SPOKANE, WASH.—The Washington Water Power Company is contemplating the erection of a new power house on Howard Street, to cost about $50,000.

SPOKANE, WASH.—Plans are being made by the Washington Water Power Company to extend its transmission lines into the Cœur d'Alene mining districts this spring.

SPOKANE, WASH.—The Washington Water Power Company has announced a reduction in the rates of electricity for residences beginning Sept. 1, 1909, as follows: First 20 kw per month, 10 cents per kw-hour; from 20 to 40 kw per month, 9 cents; from 40 to 60 kw per month, 8 cents, and all in excess of 60 kw per month, 5 cents per kw-hour. The present rate is 13 cents per kw-hour.

TACOMA, WASH.—The new high-tension transmission line from the substation at Twenty-fifth and C streets to the new substation at Station C at the South Tacoma wells will soon be completed and placed in service. While this transmission line is primarily for transmitting electricity from the substation to South Tacoma for operating the air compressors and pumps at the South Tacoma wells, it will later become part of the general distributing system of the city. The line is designed to carry 60,000 volts, although at present it has a voltage of 30,000.

FAYETTE, W. VA.—It is reported that the Fayette Railway Company contemplates the construction of a power house at Fayette. L. D. Lacy, of Richmond, Va., is president.

FORT SPRING, W. VA.—B. F. Mann, of Fort Spring, is reported to have purchased land on Second Creek in Monroe County, for the purpose of erecting a hydro-electric plant. It is understood that three dams will be erected and several power houses, which will furnish electricity to operate a proposed electric railway from Ronceverte to Rich Creek.

DE PERE, WIS.—Plans have been prepared by the Fox River Valley Telephone Company to extend its telephone lines to Morrison and Pine Grove.

MATTOON, WIS.—W. C. Duchac, of Antigo, Wis., has applied for a franchise to maintain an electric light plant in Mattoon.

MILWAUKEE, WIS.—The Chain Belt Company contemplates increasing the output of its plant and may install a gas engine and generator this year.

NEW WESTMINSTER, B. C.—The British Columbia Electric Railway Company is planning to construct a tram line across Lulu Island Bridge, with spurs to the manufacturing plants established there.

NEW WESTMINSTER, B. C., CAN.—It is reported that the Provincial Government has granted the Vancouver Power Company permission to build a 60-ft. dam at Coquitlam Lake, the water power to be utilized to generate electricity. The cost of the work is estimated at $400,000.

GALT, ONT., CAN.—The hydro-electric project will again be submitted to the vote of the people. The mayor has refused to sign the by-law already carried by the Council, on the ground that it was not in accordance with the original agreement, and has expressed his intention to carry an appeal to the Privy Council but has decided to await the result of the [illegible] election before taking [illegible].

OWEN SOUND, ONT., CAN.—At an election to be held May 10 the citizens will vote on a by-law authorizing an expenditure of $[illegible] for establishing an electric light plant.

HAVANA, CUBA.—The Home Telephone Company has obtained a [illegible] from the Government for a period of seven years, under which it is to pay $24,000 for the first two years and $[illegible] annually for the remainder of the contract. Through error it was stated in the issue of May 6 that the company was to pay $16,000 for the remainder of the contract.

Company Elections.

NORWICH, CONN.—At the annual meeting of the Uncas Power Company the following named officers were elected: Charles W. Comstock, president; John D. Hall, secretary, and Zebulon R. Robins, treasurer.

NEW YORK, N. Y.—At a meeting of the board of directors of the Hudson & Manhattan Railroad Company, held May 5, the following named officers were elected: W. G. McAdoo, president; Wilbur C. Fisk, vice-president; C. W. King, secretary; W. J. Martin and William Everdell, Jr., assistant secretaries; William H. Barnum, treasurer, and F. W. Walz, assistant treasurer.

SCHENECTADY, N. Y.—At the annual meeting of the stockholders of the Schenectady Power Company, held recently, the following trustees were elected for the ensuing year: George E. Greene, of Hoosick Falls, N. Y.; H. R. Leyden, of Troy, N. Y.; G. E. Emmons, H. W. Starr and James O. Carr, of Schenectady.

New Industrial Companies.

THE CHARLES L. KIEWERT COMPANY, of New York, N. Y., has been incorporated with a capital stock of $20,000 for the purpose of manufacturing electrical machinery, etc., by Charles Kiewert and Robert W. Kiewert, both of Milwaukee, Wis., and W. F. Hessel, of New York, N. Y.

THE ELECTRIC MANUFACTURING COMPANY, of Cleveland, Ohio, has been incorporated with a capital stock of $25,000 by C. S. Britton and others. The company proposes to manufacture small electrical devices.

THE INDIANA ENGINEERING COMPANY, of Indianapolis, Ind., has filed articles of incorporation with the Secretary of State. The capital stock is placed at $30,000. The company proposes to construct steam and interurban railroads, etc., and carry on a general construction business. Henry T. Wilkerson, Albert K. Roweswell and Gilbert Helm are directors.

THE LEOMINSTER ELECTRIC COMPANY, of Leominster, Mass., has been chartered with a capital stock of $2,000 to deal in general electrical supplies. Albert E. Hastings, of Fitchburg, is president; Edward A. Bruce, of Fitchburg, treasurer, and Benjamin Preston, of Leominster, clerk.

THE LUNKENHEIMER COMPANY, of Boston, Mass., has been incorporated with a capital stock of $1,000 to manufacture and sell engineering supplies. Edward M. Moore is president, and William W. Beal, clerk, both of Boston, Mass.

THE NEW JERSEY ELECTRIC COMPANY, of Trenton, N. J., has filed articles of incorporation with a capital stock of $100,000 to manufacture electrical appliances. The incorporators are: Charles B. Kennedy, Frederic R. Brace and William H. Geraghty, all of Trenton, N. J.

THE NORWALK INCANDESCENT LAMP COMPANY, of Augusta, Maine, has been incorporated with a capital stock to manufacture and sell lamps, carbons, etc. L. S. Kearney is president and treasurer, and E. M. Thompson, clerk, both of Augusta.

THE PARKHURST ELEVATOR & MANUFACTURING COMPANY, of Peru, Ind., has been incorporated to manufacture and install electric elevators, hoisting machinery, apparatus, etc. The capital stock is $100,000. The directors are John W. Parkhurst, R. H. Bouslog and R. A. Edwards.

THE PEOPLE'S PROTECTIVE TELEPHONE SUPPLY COMPANY, of Troy, N. Y., has been chartered with a capital stock of $20,000 to deal in telephone supplies. The incorporators are: Patrick E. De Lee, William E. Saunders and Daniel Gaffey, of Troy, N. Y.

THE PICKHAM BOILER COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $42,400 by E. E. Ledbetter, J. D. Pickham, C. E. Carpenter and E. D. Ledbetter, of Chicago, Ill. The company proposes to manufacture boilers and machinery.

THE RANDOLPH INSULATOR COMPANY, of Newark, N. J., has been chartered with a capital stock of $100,000 by Leonard M. Randolph, Edwin M. Lines, both of Newark, N. J., and Theodore McCurdy Marsh, of East Orange, N. J. The company proposes to manufacture electrical machinery.

THE TELEPOST COMPANY OF DELAWARE, of Wilmington, Del., has been incorporated with a capital stock of $10,000 by H. Lee Sellers, R. H. Sellers, of Jersey City, N. J., and Harry W. Davis, of Wilmington, Del.

New Incorporations.

MARMADUKE, ARK.—The Independent Rural Telephone Company has been incorporated with a capital stock of $2,000 and the following named officers: T. R. Corley, president; B. B. Stone, vice-president; G. C. Meridith, secretary, and C. B. Ross, treasurer.

SACRAMENTO, CAL.—Articles of incorporation have been filed for the Sacramento & Sierra Railroad Company with a capital stock of $1,000,000 to construct and operate a railway from Sacramento to Lake Tahoe, a distance of 126½ miles. The company also proposes to engage in the lumber business and to build and operate electric plants and operate boats on the Sacramento River and San Francisco Bay.

COLORADO SPRINGS, COL.—Articles of incorporation have been filed for the San Juan Water & Power Company by Henry McAllister, W. H. Vaile and others.

GUNNISON, COL.—Articles of incorporation have been filed for the Gunnison County Co-operative Telephone Company by W. A. Gillospey, William Dalton, R. P. Weiglema and C. T. Stevens. The company is capitalized at $50,000.

WILMINGTON, DEL.—The Spring Hill Light & Water Company has been incorporated with a capital stock of $100,000 by E. B. McNair, R. B. Cook, of Brandywine Head, Del., and D. J. Reinhardt, of Wilmington, Del.

HINESVILLE, GA.—The Liberty County Telephone Company has been organized to construct a telephone line from Hinesville to McIntosh, Ga., by J. R. Ryon, E. C. Miller, S. B. Brewton and others.

MIDDLECREEK, ILL.—The Middlecreek Farmers' Telephone Company has been chartered with a capital stock of $2,500 by Scott Belknap, William B. Smith and A. O. Galloway.

GEORGETOWN, IND.—Articles of incorporation have been filed for the Georgetown Telephone Company, with a capital stock of $9,000, by A. P. Goodner and others.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the Short Line Traction Company with a capital stock of $10,000. The directors are: Joseph F. Weber, Frank T. Edenharter and George F. Mull.

KNOX, IND.—The Knox Water & Light Company has been incorporated, with a capital stock of $20,000, to construct and operate a combined water, heat, light and power plant to supply the town with water, light, heat and power for public and domestic uses. The directors are Frank A. Green, William S. Daniels, A. Reiss, Thomas A. Grish and William Guyatt.

WEST TERRE HAUTE, IND.—The West Terre Haute Light & Power Company has been chartered to furnish light and power in West Terre Haute. The company is capitalized at $10,000 and the directors are Charles Monniger, August Fromme and Monroe George.

PORTLAND, IA.—The Portland & Cameron Telephone Company has been incorporated with a capital stock of $5,000 by F. H. Dunn, F. A. Hill and P. M. Johnson.

WALLINGFORD, IA.—The Wallingford Telephone Company has been formed with a capital stock of $6,000 and the following named directors: J. P. Kennedy, P. S. Anderson, S. T. Sevaton, O. O. Anderson, O. C. Olson, G. W. Gilbertson and C. B. Larson.

CHOKIO, MINN.—The Chokio Telephone Company has been incorporated with a capital stock of $2,000 by A. F. Reidner, Charles McAllen, James McNally and others.

THREE FORKS, MONT.—Articles of incorporation have been filed for the Three Forks Telephone Company with a capital stock of $2,500 by J. B. Russell and others.

HOBOKEN, N. J.—The Alabama & Tennessee Telephone & Telegraph Company has been incorporated with a capital stock of $200,000 by George A. Berger, George B. Fielder and Frederick W. Schaeffer, all of Hoboken, N. J.

HOBOKEN, N. J.—Articles of incorporation have been filed for the Citizens' Light, Heat & Power Company by C. F. Maitiage, A. F. Bruggeman, A. Hannibal, W. E. L. Keuffel, C. Wolff, C. F. Freerichs, M. Koschel and E. Rehm, all of Hoboken. The company is capitalized at $500,000 and proposes to erect a power plant in Hoboken to supply electricity for lamps and motors; also to enter the gas lighting field.

NEW YORK, N. Y.—The Public Service Telephone Company has filed articles of incorporation, with a capital stock of $10,000,000, for the purpose of operating telephone and telephone systems in towns and cities in New York State, the Dominion of Canada and elsewhere. The incorporators are: J. A. L. Campbell, of New York, N. Y.; W. L. Ganzel, of Garwood, N. J.; R. F. Routh, J. P. Hauck, R. H. Robbins and A. J. Appell, of New York, N. Y., and J. K. Hetch, of Brooklyn, N. Y.

NEW YORK, N. Y.—The Triborough Railroad Company, of New York, has filed articles of incorporation with the Secretary of State to construct and operate an electric railway from the intersection of Canal, Walker and Baxter Streets, in Manhattan Borough, to the intersection of Fulton Street and Flatbush Avenue extension, Brooklyn. The company is capitalized at $50,000 and the directors are: William Bradley, James E. Gaffney, Henry Steers, of New York City, and William E. Bolte, of Maywood, N. J.

BURLINGTON, N. D.—The Burlington Farmers' Telephone Company has been organized with a capital stock of $25,000 by William J. Kluver, Henry A. Parrie, Daniel Baker and others, of Burlington, N. D.

CLYDE, N. D.—Articles of incorporation have been filed for the Clyde Mutual Telephone Company, with a capital stock of $26,000, by J. H. Morgan, Gordon Brotherston, of Clyde, N. D., and others.

HARVEY, N. D.—The Manfred-Fram Telephone Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: John Fryer, of Harvey; George Jensen, of Manfred, N. D.; K. C. Kapseng and others, of Harvey, N. D.

HAZLETON, N. D.—Articles of incorporation have been filed for the Emmons County Telephone Company with a capital stock of $4,200 by A. L. Geil, of Hazleton; H. O. Batzer, F. E. Kaiser and others.

KULM, N. D.—The Swede Township Telephone Company has been incorporated, with a capital stock of $5,000, by G. H. Davidson, Jacob Bjur, R. Ogren and others, of Kulm, N. D.

MANDAN, N. D.—The Southern Morton County Telephone Company has been chartered with a capital stock of $25,000 to erect a telephone system to Glen Ullin and Flasher.

MAX, N. D.—The Pleasant Valley Farmers' Telephone Company has been chartered with a capital stock of $50,000 by Peter D. Podhola, E. C. Jones, both of Max, and others.

COLUMBUS, OHIO.—The Columbus, Plain City & Urbana Traction Company has been chartered, with a capital stock of $10,000, by Randolph W. Walton, Frank E. Ruth, Herbert M. Myers, Charles A. Heath and W. L. McVey. The company proposes to construct and operate an electric railway from Columbus to Plain City and to Urbana.

OTTOVILLE, OHIO.—The Ottoville Telephone Company has been incorporated, with a capital of $5,000, for the purpose of building a telephone system in Putnam, Paulding, Allen and Van Wert counties. J. C. Wannemacher, John J. Miller, A. A. Roth, E. G. Odewelter and George Wannemacher are incorporators.

PERRYSBURG, OHIO.—Articles of incorporation have been filed for the Suburban Light & Power Company by George W. Moser and others. The company is capitalized at $15,000.

VICKERY, OHIO.—The Vickery Telephone Company has been incorporated with a capital stock of $4,500 by H. N. Prentice, J. H. Garvin, Edward Shoupe, F. Durnwald, Charles White and others.

CEDAR, OKLA.—The Orchard Center Telephone Company has been chartered by William H. Thorn, Joseph Charviz, Charles S. Choats and others.

CHICKASHA, OKLA.—The Chickasha Hydraulic Electric Company has been chartered, with a capital stock of $25,000, by Dennis O'Brien, C. E. Ross and Charles M. Fechheimier. The company has acquired water power rights, located about six miles from the town, where it proposes to construct a plant in the near future.

GRAND, OKLA.—The Pinkston Telephone Company has been incorporated with a capital stock of $2,500 by P. C. McKemy, A. L. Squire, A. V. Halloway and J. M. Householder.

MUSKOGEE, OKLA.—The Muskogee Electric Company has been chartered by R. J. Johnson, G. W. Walker and E. Hirsch.

TESCA, OKLA.—The Tesca Telephone Company, of Tillman County, has been incorporated with a capital stock of $1,000 by J. E. Smith, Samuel Dickey, Samuel Ellis, W. P. McIntire and N. A. Chamberlain, all of Frederick.

WILLOW, OKLA.—The McKissack Telephone Company has been incorporated, with a capital stock of $500. The directors are J. A. Stout and F. McKissack, both of Willow.

LENTS, ORE.—The Lents Home Telephone Company has been incorporated with a capital stock of $3,000 by C. Dann, O. B. Guisness and W. I. Price.

MARSHFIELD, ORE.—The Coos Bay, Oregon & Idaho Railway Company has been chartered with a capital stock of $25,000 to construct and operate (a steam or electric railway) from Coos Bay, via Roseburg, to Boise, Idaho. The incorporators are: William Grimes, Henry Sengstacken, J. Virgil Pugh, Josiah C. Gray, John R. Smith and P. Hennesey.

AMBRIDGE, PA.—The Ambridge Heat, Power & Light Company has been chartered with a capital stock of $150,000 by F. T. Heberline, E. G. Schell and John Reed Miner, all of Ambridge. The company proposes to generate both gas and electricity for heating, lamps and motors.

CRESCO, PA.—The Cresco & Greentown Telephone Company has been granted a charter to construct and maintain a telephone line between Cresco and Canadensis and Greentown. The company is capitalized at $5,000, and the directors are Stewart Shively, Myron A. Price, Foster B. Mikels, Charles W. Seese and Lafayette Price, all of Canadensis.

SUNBURY, PA.—The Chillisquaque Connecting Railway Company has been chartered with a capital stock of $18,000 to construct a street railway, 2½ miles in length, from Lewisburg to the Pennsylvania Railroad. The directors are: W. H. Lyons, of Sunbury, president; Boyd A. Musser, J. C. H. Newcomer, C. M. Clement and Guy Webster.

SUNBURY, PA.—The Montandon & Milton Electric Railway has been incorporated to construct a street railway from West Chillisquaque to Milton via Montandon and Chillisquaque, a distance of 9 miles. The company is capitalized at $60,000 and the directors are: W. H. Lyons, of Sunbury, president; A. Musser, J. C. Newcomer, C. M. Clement and Guy Webster.

SUNBURY, PA.—A charter has been granted to the Sunbury, Lewisburg & Milton Electric Railway Company to construct an electric railway from Monroe Township to Lewisburg via Winfield, 10 miles in length. The capital stock of the company is placed at $60,000. The directors are W. H. Lyons, of Sunbury, president; Boyd A. Musser, J. C. H. Newcomer, C. M. Clement and Guy Webster.

PEEVER, S. D.—The Farmers' Telephone Company has been incorporated with a capital stock of $7,000 by A. M. Anderson, Berger Bergerson, John M. Hines and others.

WASTA, S. D.—The Ely Springs & Wasta Telephone Company has been organized with a capital stock of $10,000 to construct a telephone line to White Owl, a distance of about 50 miles.

CARTHAGE, TENN.—Articles of incorporation have been filed for the Carthage Home Mutual Telephone Company, with a capital stock of $5,000, by J. R. Curtis, J. B. Chapman, W. B. Aldred, F. Swope and W. D. Gold.

CASTALIAN SPRINGS, TENN.—Articles of incorporation have been filed for the Castalian Springs Home Telephone Company by J. H. Shoulders, J. C. Corum and T. S. Corum.

IVYGAP, TENN.—The Ivygap Telephone Company has been chartered, with a capital stock of $4,000, by J. H. Davidson, E. S. Jackson, N. A. Roberts and others.

LIVINGSTON, TENN.—The Livingston branch of the Home Telephone Company has been incorporated with a capital stock of $2,000. The officers are: W. A. Ormsby, president; J. S. Masters, G. W. Carmack, vice-presidents; H. M. Wells, manager; J. H. Ward, treasurer, and W. D. Fiske, secretary.

NASHVILLE, TENN.—Articles of incorpation have been filed with the Secretary of State for the Warren County Telephone Company by W. S. Ross, J. C. Biles, John B. Biles and William Biles.

NASHVILLE, TENN.—The Nashville & Crocker Springs Rapid Transit Company has been incorporated to build an electric railway from Nashville to Crocker Springs, a distance of 12 miles. It is said that surveys will be made at once and contracts awarded within 30 days. The officers are Lee Guggenheim, president and general manager; W. F. Webb, vice-president; R. B. Jones, secretary.

ALPINE, TEX.—The Alpine Power Company has been incorporated, with a capital stock of $35,000, by H. W. Townsend, R. B. Slight and J. H. Derrick. The company proposes to construct and operate an electric light plant, water-works system and ice plant.

LEAGUE CITY, TEX.—The League City Telephone Company has been organized for the purpose of establishing a telephone system in League City and to extend to several nearby towns. G. W. Butter is president; J. E. Walker, vice-president and manager; O. V. King, secretary, and John P. A. Atkinson, treasurer.

MOUNT CALM, TEX.—The Mount Calm Water & Light Company has been organized with a capital stock of $5,000 and the following officers: J. H. Morgan, president; E. K. Herring, vice-president; W. G. Getton, secretary.

NIXON (P. O. LULING), TEX.—The Nixon Telephone Company has been incorporated with a capital stock of $6,200 by C. S. Penfield, P. H. Tom and D. N. Campbell.

RANDOLPH, UTAH.—Articles of incorporation have been filed for the Randolph Utility & Power Company with a capital stock of $10,000. The company proposes to furnish power for public and private use. A. E. Wing is secretary.

ST. GEORGE, UTAH.—The St. George Electric Company has been organized with a capital stock of $20,350 to construct and operate an electric light plant in St. George. The company has taken over a contract to light the town for a term of 25 years. Work has already commenced on the construction of the plant. The officers of the company are: A. H. Ensign, president; George Z. Edwards, vice-president; R. J. Evans, secretary and treasurer, and B. E. Slusser, manager.

ALUMWELLS, VA.—The McFadden Telephone Company has been incorporated, with a capital stock of $5,000. A. A. McFadden, of Alumwells, is president.

BENTONVILLE, VA.—The Warren County Farmers' Mutual Telephone Company has been incorporated, with a capital stock of $5,000, and the following officers: R. T. Morrisonville, president; R. A. Tristoe, secretary, both of Bentonville.

CLOVER, VA.—The Staunton River Telephone Company has been incorporated, with a capital stock of $100,000. The company has completed about 100 miles of metallic telephone line in Halifax County, and contemplates the construction of about 200 miles additional to Houston and other cities. The officers of the company are: W. H. Dorin, president, of Mt. Laurel, Va.; J. T. Lacy, of Scottsburg, Va., vice-president; W. S. Adkisson, secretary; G. B. Gibson, treasurer, and R. H. Fuller, general manager.

GRUNDY, VA.—The Slate Telephone Company has filed articles of incorporation, with a capital stock of $1,500. The officers of the company are S. R. Hurley, president; E. E. Smith, secretary and treasurer.

LA CROSSE, WASH.—The La Crosse Telephone Company has been chartered with a capital stock of $3,000 by J. H. Clarke, J. S. Shrock, P. O. King, C. E. Hoover, A. Guske, J. A. Zaring, E. S. Knowlton and I. F. Moore, all of La Crosse.

Personal.

MR. S. B. STORER, consulting electrical engineer, delivered an address on the subject "The Cost of Energy" before the Technology Club of Syracuse, N. Y., on Wednesday evening, May 5.

MR. JOSIAH NORCROSS, superintendent of the municipal electric light plant at Reading, Mass., has resigned to accept a position with the Edison Electric Illuminating Company of Boston, Mass.

MR. ERNEST B. KOST has resigned from the staff of the Washington Water Power Company to become commercial agent of the Northern Idaho & Montana Power Company, with headquarters at Sandpoint, Idaho.

MR. GEORGE H. DAVIS, of Ford, Bacon & Davis, engineers, New York, is the author of a contribution to the *Manufacturers' Journal* with the title "Growth of Communities as Affected by Corporations," which makes a strong plea for fair treatment of public utilities and other corporations.

MR. N. B. WINTER, general manager of the Frostburg (Md.) Illuminating & Manufacturing Company, has written us saying he would like to secure the agency for a thoroughly good electric automobile and wishes to receive correspondence on the subject. The company has a central station and gas works.

MR. CARL S. DOW has joined the staff of Mr. Walter B. Snow, publicity engineer, Boston. Mr. Dow, who is a graduate of the Harvard engineering course, has recently been publicity manager of the B. F. Sturtevant Company, and formerly was in charge of the instruction and textbook departments of the American Correspondence Schools.

MR. P. C. CHRYSLER.—The General Vehicle Company has arranged to open a Chicago office in charge of a Western manager, and has engaged Mr. P. C. Chrysler, who formerly represented the company and sold most of the electric wagons now in use in the Middle Western States. Mr. Chrysler takes up the work with perfect confidence that, the electric wagon having made good, he will be able to make a record in the disposal of a large part of the factory's product.

MR. C. A. S. HOWLETT, district sales manager in Chicago for the Western Electric Company, has been elected president of the Chicago branch of the National Safes Managers' Association. Mr. Howlett is also president of the Electric Club, of Chicago, and has also been active in the affairs of the Sales Managers' Association, and the value of his work is thus fittingly recognized. The association embraces representatives of nearly all the large business houses of Chicago.

MR. DWIGHT T. RANDALL, M. E., member of the American Society of Mechanical Engineers and late engineer in charge of fuel tests, Technologic Branch, United States Geological Survey, has associated himself with the Arthur D. Little Laboratory of Engineering Chemistry, of Boston, in charge of the department of fuel engineering. Mr. Randall, who is a graduate of the University of Illinois, was formerly connected with R. W. Hunt & Company and Westinghouse, Church, Kerr & Company, and later was in charge of the steam engineering laboratory of the University of Illinois and of steam and boiler tests at the St. Louis Exposition.

MR. BERNARD ELSHOFF, superintendent of the electrical department of Allis-Chalmers Company, has severed his connection with this company. Mr. Elshoff joined the Bullock Electric Manufacturing Company of Cincinnati 14 years ago, in charge of the winding department. His exceptional skill, ability and energy won him the confidence of the management and he became assistant general superintendent of the Bullock Company. In 1907 he became superintendent of the electrical department of Allis-Chalmers Company, in which capacity he organized this company's electrical manufacturing department in Milwaukee. Mr. Elshoff's address is "The Aberdeen," Milwaukee, Wis.

MR. THOS. B. DOOLITTLE, on the occasion of his retirement from active service with the American Telephone & Telegraph Company, which grants him a full-pay pension, was given a testimonial banquet on May 4 at the St. Botolph Club, Boston. It was a memorable and most delightful affair and was presided over by Mr. John J. Carty, chief engineer of the corporation. Among those present were Messrs. E. J. Hall, vice-president; R. W. Devonshire, general manager; T. B. Bailey, purchasing agent; H. V. Hayes, consulting engineer; W. S. Allen, statistician; C. J. H. Woodbury, expert; C. W. Pitman, cashier; C. R. Truax, special agent; V. M. Berthold, foreign department; A. A. Marsters, secretary to the president; T. E. Pigott, chief, instrument department; G. D. Milne, assistant treasurer; S. A. Richardson, assistant auditor; A. C. Blood, traffic engineer; J. Wyman, F. E. Warner, C. B. Doolittle, J. C. T. Baldwin, T. Cotter, F. C. Ross, F. A. Buttrick, S. H. Mildram. The speeches of the evening were about as numerous as the participants, and while all paid a personal tribute to the guest of the occasion, a great deal of interesting data came out as to the marvelous growth of the Bell telephone system, with which Mr. Doolittle has been connected from the very earliest days. Letters were also received and read from President Vail, and Messrs. Fish, Lockwood, Pickernell and others, all evincing the high esteem in which the writers held their distinguished and veteran colleague. A great many people know Mr. Doolittle only as the introducer of hard-drawn copper wire, but those familiar with the inner history of American telephone development know that no one has assisted more usefully than he in the improvement and perfection of every detail of the modern art. The debt owed by telephony to this stalwart and vigorous septuagenarian is simply incalculable.

Obituary.

MR. WILLIAM J. CLARKE, of Mount Vernon, N. Y., died March 29 after a short illness due to cirrhosis of the liver and complications. Mr. Clarke, who was born at Trenton, Canada, Feb. 5, 1861, at the age of 15 invented a patent doorstep, the model of which is still in the Patent Office Museum at Washington, D. C. As a young man Mr. Clarke was a telegraph operator. In 1885 he became the manager of the Trenton Electric Light Company, with which he remained until 1890, when he became general manager of the Hamilton Electric Light Company, remaining in that capacity until 1894. In 1895 he went to Washington, D. C., later to Philadelphia, and finally to New York, where he remained for some time as the sales manager of the Adam Bagnall Electric Company. In 1898 he organized the United States Electrical Supply Company and began the manufacture of high-frequency apparatus etc., for colleges and schools and later added wireless telegraph apparatus. He also gave many lectures throughout the country on "Wireless Telegraphy," "The Wonders of Modern Science," etc. Mr. Clarke took part in the first efforts by which the international yacht races for the America Cup were reported by wireless from the ocean to the shore. Mr. Clarke will also be remembered in connection with his interesting electrical lectures and demonstrations at the Madison Square Garden electrical shows in New York and the electrical shows in Chicago. He is survived by a widow, a young son and a daughter.

MR. CHAS. T. HUGHES.—We regret to record the death from pneumonia last week at his residence, at East Orange, N. J., of Mr. Chas. T. Hughes, one of the notable Edison pioneers of 30 years ago. He was about 64 years of age and had been an invalid for some years, although still quite active. He was originally employed on the New York Central Railroad, and was also with the early Albany Telephone Company. He went with Mr. Edison at the Menlo Park laboratory in October, 1879, and while engaged on the development of the incandescent lamp and other inventions, was more particularly identified with the electric railway work which was undertaken at that period. Photographs of the time show him running the electric locomotive on the Menlo Park track. A few years later Mr. Hughes became identified with the commercial side of the art, and for a time represented the Edison and Sprague interests, with headquarters at Syracuse, N. Y. The Edison General Electric consolidation brought him to New York, and he became later a prominent member of the force of the General Electric Company, enjoying very thoroughly the esteem and confidence of Mr. Coffin. His knowledge of men and affairs and of the growth of the industry made him very useful so long as he was able to attend to business. His death was quite sudden. The funeral took place at his house on May 5. Among the pallbearers were Messrs. Thos. A. Edison, W. E. Gilmore, T. C. Martin, John A. Hill, G. C. Sims, Ralph Beach, T. Beran, and many "old timers" were present, including Messrs. F. R. Upton, C. L. Clarke, J. H. Vail, W. S. Barstow, W. J. Clark, E. W. Hammer, W. Bee, W. H. Meadowcroft, D. McF. Moore and J. J. Mahony. The house was filled with friends and was fragrant with flowers. The interment was at Rosedale Cemetery. Mr. Hughes was married in 1887 to Mrs. L. Young-Eaton and leaves a widow, but no children. In an interview Mr. Edison expressed very pathetically his deep sense of loss in this bereavement, which took from him so old and valued a friend and associate.



CHAS. T. HUGHES.

Trade Publications.

AUTOMATIC BUCKETS of the orange-peel and clam-shell types, designed for the rapid and economical handling of coal, ore, etc., are described in bulletin No. 34 of the Browning Engineering Company, of Cleveland, Ohio.

HIGH-SPEED POWER PUMPS.—The Fort Wayne Engineering & Manufacturing Company, Fort Wayne, Ind., has issued a booklet on its domestic high-speed power pumps driven by electric motors. The pump is of the double-acting piston type coupled to the motor by a reducing gear consisting of a double-threaded steel worm engaging a bronze gear, the whole running in oil.

COAL AND ORE HANDLING MACHINERY.—This is the engineer's edition of Catalog No. 091 issued by the C. W. Hunt Company, of West New Brighton, N. Y., and contains illustrations and descriptions of hoisting and conveying plants erected by the company together with details of the various parts and pieces of apparatus which are used in connection with such systems.

LIGHTING FIXTURES.—Catalog No. 8 of the F. W. Wakefield Brass Company, of Vermilion, Ohio, illustrates a great variety of possible styles of electric lighting fixtures which can be made from standard bodies, arms, stems, etc. The tungsten fixtures have chain stems which provide a flexible support and absorb vibrations, thus protecting the lamp filament. The detachable link chain made by the company is featured.

MACHINERY AND TOOLS.—Brown & Sharpe Manufacturing Company, Providence, R. I., has issued its 1909 catalog of machinery and tools. In the 551 closely printed pages of this pocket-size book are given data on milling machines, grinding machines, automatic gear cutting machines, screw machines, cutters, accurate test tools and machinists' tools of every description made by the company. The last pages contain many useful tables.

AUTOMATIC DRAFT CONTROL.—In a pamphlet entitled "Automatic Draft Control for Steam Boiler Furnaces," the Green Fuel Economizer Company, of Matteawan, N. Y., describes an improved appliance recently brought out by that concern for regulating the draft of steam boilers that the pressure within the firebox is at all times neutral. To accomplish this end just enough pressure is supplied under the grates to force the air through the fuel, while enough draft is applied in the smoke flue to draw the gases of combustion through the boiler. This is said not only to give the ideal proportion of air for perfect combustion at all loads, but also to prevent the escape of flame and hot gases of combustion through the open firedoor and through crevices in the brick-setting, as where forced draft is used, while also preventing the drawing in of cold air and the dilution and consequent cooling of the gases of combustion, as where induced draft only is used.

Business Notes.

THE S. MORGAN SMITH COMPANY, York, Pa., has opened a Chicago office in the American Trust Building, with Mr. J. C. Temple, a well-known hydraulic engineer, in charge.

THE CROCKER-WHEELER COMPANY has placed Mr. Edmund Lang in charge of its repair shop at Ampere, N. J. Mr. Lang for five years held an executive position with the Wheeler Condenser & Engineering Company.

NORTHERN CRANES.—The Southern Wisconsin Power Company, of Madison, Wis., has recently installed a 30-ton traveling Northern crane and a 6-ton electric mono-rail hoist, both furnished by the Northern Engineering Works, of Detroit.

MR. HORATIO A. FOSTER will have headquarters for some time at 12 Woodward Avenue, Detroit, where he will assist in making an appraisal of the property of the Detroit United Railway, which work will be in charge of Mr. B. J. Arnold.

MacGOVERN, ARCHER & COMPANY have recently sold to the Long Island Railroad Company two 150-kw rotary converters, to be used in the substation at Huntington, L. I., and to the Elgin, Aurora & Southern Traction Company, of Aurora, Ill., one 500-kw rotary converter.

THE WM. J. SMITH COMPANY, New Haven, Conn., has appointed the well-known engineering firm of Vickers, Sons & Maxim, Ltd., 32 Victoria Street, London, S. W., England, as sole agent for the sale of "One-Lock" adjustable reamers in Great Britain, France, Belgium, Germany and Austria.

MR. R. M. MERRITT has resigned as New England manager of the Hoyt Electrical Instrument Works to become associated with the Wetmore-Savage Company, Boston. Mr. E. W. Carter will look after the New England interests of the Hoyt Electrical Instrument Works, the change taking effect May 1.

MR. T. L. PARKER, who has been representing the Manhattan Supply Company for the past five years, is now the Western sales agent and distributor of the Marshall Electric Company, Hyde Park, Mass., and is located at 120 Franklin Street, Chicago, Ill., with a good stock of Marshall sockets, pipe-ends and other specialties.

RENOLD SILENT CHAIN DRIVE.—In an article in the issue of April 29, describing the change from steam to electric power transmission at the Boulton shop of the Fredericksburg & Potomac Railroad Company, "flexible chain" is referred to as the medium of connection between motors and shaftings. As this designation is rather ambiguous it may here be added that the drive is one of nine Renold silent chain drives fitted up by the Philadelphia works of the Link-Belt Company.

BIRD-ARCHER FOREIGN OFFICES.—The increasing demand for Bird-Archer boiler compounds in the Orient has necessitated the opening of the following new offices by the Bird-Archer Company, of New York: Honolulu, J. P. Lynch, 42 Young Building; Manila, Lambert Springer Company, 99 Plaza Santa Cruz; Yokohama, T. M. Laflin, Exchange Market; Hongkong, Shanghai and Singapore, United Asbestos Oriental Agency, Ltd. All of these agents have competent steam engineers to direct boiler owners in the proper use of the compounds.

DIAMOND RUBBER PLANT EXTENSION.—With 3800 employees on the payroll for April, the Diamond Rubber Company, of Akron, Ohio, has under way extensions to its plant which will give employment to more than 200 additional men by fall. No new lines will be taken on by the company at present, but the increased space will be used for the extension of practically all departments, including rubber-covered wires and cables. The city of Akron has lately vacated an entire street adjoining the Diamond factories to permit of the growth of the plant, and in return the Diamond company paid the entire cost of paving the remaining portion of this street not abutting upon its property, the bill for which will be not far from $15,000.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 4, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

920,123. BURGLAR ALARM; W. N. Fawcett, New York, N. Y. App. filed July 31, 1908. Closed circuit alarm operated by breaking of wire placed across the window or door.

920,124. ELECTRIC CLOCK-WINDING MECHANISM; F. H. Feraud, Granite City, Ill. Simpified mechanism for winding a clock by a pawl and ratchet driven by an electromagnet.

920,143. REVOLVING FURNACE FOR VOLATILIZING ZINC ORES; H. H. Hughes, Springfield, Mo. App. filed April 6, 1908. Powdered zinc is fed into a cylindrical, somewhat inclined, furnace, the walls of which are provided with an electric heater.

920,169. CONNECTOR FOR CONDUITS FOR ELECTRIC WIRES; G. E. Neuberth, Newark, N. J. App. filed Jan. 27, 1908. A clamp coupling having a lip on each side, one pair of lips being clamped together by suitable screws.

920,179. ELECTRICAL KEY SOCKET; C. D. Platt, Bridgeport, Conn. App. filed Sept. 10, 1908. Has a closing block with an angular opening and angular shaft engaging the opening loosely. Details.

920,208. CIRCUIT-BREAKER; Lewis C. Steele, Columbus, Ohio. App. filed Aug. 16, 1907. For temporarily interrupting a current for testing purposes having a tubular body with plugs, one plug being reduced.

920,220. ELECTRIC ARC LAMP; C. J. Toerring, Philadelphia, Pa. App. filed May 3, 1906. A gravity feed for an inverted type of lamp. Makes use of a counterweight and a flexible connection between the carbon holder and counterweight operated by an electromagnetic clutch.

920,222. RECIPROCATING ELECTRIC MOTOR; C. W. Tremain, Chicago, Ill. App. filed April 14, 1908. For working a drill having two reciprocating armatures coupled together so as to work simultaneously in opposite directions.

920,230. ELECTRICAL CURRENT CONNECTIONS FOR BOATS; E. Westrom, Hamburg, Germany. App. filed March 19, 1907. A cable leads from the boat and a curved guide is carried by the boat over which the cable passes. A grooved wheel supports the feeding wire.

920,242. TELEPHONE TRANSMITTER; R. C. Brown, Salem, Mass. App. filed April 26, 1907. The electrodes are arranged, the one near the center of the button, the other radially remote therefrom and so constructed that when the button is rotated the electrodes will be in electrical contact with the resistance material.

920,258. SYSTEM FOR TELEPHONING TRUNKING; S. H. Browne, Pittsburgh, Pa. App. filed April 3, 1905. Multiple contacts are connected with the trunk at central and relays and extensions connect the trunk with switching and signaling devices.

920,259. CALL DISTRIBUTING TELEPHONE EXCHANGE SYSTEM; S. H. Browne, Pittsburgh, Pa. App. filed April 3, 1905. Makes use of a cut-off relay, a plurality of trunks, an automatic selecting switch connected to said trunks successively by which the line relay starts the switch and the cut-off relay stops the switch in connection with the trunk.

920,261. HARMONIC BELL FOR TELEPHONES; W. M. Bruce, Jr., Springfield, Ohio. App. filed Sept. 11, 1907. A torsional rod is connected to one end of the armature plate and at the other to the supporting plate and serves both as a pivot and spring for the bell clapper.

920,262. TROLLEY WIRE HANGER; J. Bryan, of Pittsburgh, and H. Etheridge, of McKeesport, Pa. App. filed July 24, 1907. Maintains a permanent adjustable tension between the trolley ear hanger and the trolley wire connecting ear. Details.

920,269. TROLLEY WHEEL HARP; W. M. Caswell, Warren, Pa. App. filed June 8, 1908. A trolley wheel harp having chambers to receive lubricating oil with pockets for preventing the escape of oil.

920,277. TELEPHONE APPARATUS; J. L. Creveling, New York, N. Y. App. filed Nov. 5, 1908. A receiver with an additional ear piece and a sound duct connecting the two. Can be screwed into the ordinary telephone receiver without altering its appearance.

920,300. CONTROLLER-CHECKING DEVICE FOR STREET RAILWAY CARS; N. Fallek, Denver, Col. App. filed June 15, 1908. A check which insures a step-by-step movement of the crank. Makes use of a pawl and ratchet with special operating means.

920,331. ARC LAMP; C. C. Hughes, Philadelphia, Pa. App. filed April 13, 1906. Arc lamps of the harp-wire type. Special feeding means for the carbon.

920,339. ELECTRIC RAILWAY SYSTEM; C. A. Huse and J. G. Douty, Williamsport, Pa. App. filed Sept. 17, 1907. Spaced contact switch boxes are arranged at intervals along the road and are connected to the feed wire by switches operated by magnets on the car. Details.

920,350. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; J. W. Lattig and C. L. Goodrum, Wyncote, and Philadelphia, Pa. App. filed Sept. 16, 1903. Uses a centralized battery for selective purposes and for transmitters and also a central source for ringing current. Particularly applicable to the Strowger system.

920,364. GROUND WIRE ATTACHMENT; C. W. Messner, Philadelphia, Pa. App. filed Feb. 26, 1908. For connecting a pipe or cable to ground by means of a strip metal clamp surrounding the pipe and secured thereto by a screw.

920,378. ELECTRICAL SIGNALING APPARATUS; J. D. Nelson, Cincinnati, Ohio. App. filed May 4, 1907. The "pulling" of one signal box automatically prevents the operation of another box until the last one actuated has transmitted its signal. Makes use of an undulating current which is changed to a direct current when the circuit is broken.

920,391. PROCESS FOR REFINING METAL; J. H. Reid, Newark, N. J. App. filed Nov. 11, 1908. Melts the ore, mixes with carbon monoxid gas, rotates the mass and exhausts the surface thereof.

920,401. OUTLET BOX; J. N. Seism, Syracuse, N. Y. App. filed Feb. 12, 1908. An outlet box provided with a diaphragm adjusted to different planes within the box and supporting the electric fixture with means for forcing the diaphragm toward the cover of the box so as to bind the fixtures between the diaphragm and cover.

920,425. TELEPHONE TRANSMITTER; R. C. A. Browne, Salem, Mass. App. filed April 26, 1907. A transmitter button with variable resistance material in the button receptacle together with a plurality of compressing surfaces independent of the electrodes.

920,427. TROLLEY; H. Burkhard, Chicago, Ill. App. filed Aug. 1, 1908. A trolley for electric railway cars having a long cylindrical roller with curved guides at each end to avoid wearing grooves at the end of the roller.

920,429. PROTECTING HOOD FOR SPARK PLUGS; R. W. Burnham, Ocean Point, Maine. App. filed Aug. 3, 1908. For protecting spark plugs from water by a cylinder which slips over the plug and has a tubular arm for the wire.

920,431. TELEPHONE TRANSMITTER; C. L. Chisholm, Marysville, N. B., Can. App. filed Jan. 8, 1907. A thick diaphragm with a microphonic element having a contact pin of inconsiderable area engaging but unsecured to said diaphragm.

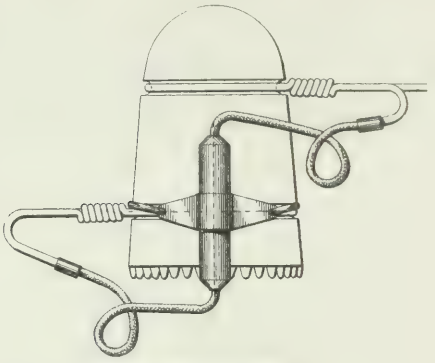
920,435 APPARATUS FOR SELECTIVELY AND AUTOMATICALLY ANNOUNCING THE APPROACH AND DESTINATION OF TRAINS TO A JUNCTION POINT; J. P. Coleman, New York, N. Y. App. filed Jan. 6, 1909. Provides an apparatus on the car and in the trackway for giving the destination as well as the approach of the train.

920,473. DISTILLATION FURNACE; W. McA. Johnson, Hartford, Conn. App. filed May 8, 1906. The furnace has a vapor outlet, a permeable casing within the furnace spaced from its walls and electrodes at opposite ends of the casing.

920,485. MULTIPLE ARC LAMP; W. Mathiesen, Leutzsch-Leipzig, Germany. App. filed Oct. 31, 1906. A pair of converting electrodes with squared-off ends are provided with guides and a pair of initial arc-forming portions are also provided.

920,490. PANEL BOARD FOR ELECTRICAL POWER DISTRIBUTION; A. C. McWilliams, Chicago, Ill. App. filed Sept. 30, 1905. For interchanging a consumption circuit with a meter circuit so that any consumption circuit may be readily connected with any meter.

920,527. DISINFECTANT HOLDER FOR TELEPHONE TRANSMITTERS; F. R. Bigler, Kansas City, Mo. App. filed Dec. 4, 1908.



920,208—Circuit Breaker.

Comprises a bulb which is perforated which contains the disinfectant and is contained within the mouthpiece.

920,569. FLAT-IRON STOVE; E. L. Hegarty and H. L. Moody, Waterville, Mo. App. filed Nov. 27, 1908. A block having a slot in which an electric flat iron may be inserted with the handle projecting into the slot, the bottom of the iron receiving a heating plate.

920,610. PROCESS AND APPARATUS FOR PRODUCING OXIDS OF NITROGEN BY MEANS OF A ROTARY FLAME; I. Moscicki, Freiburg, Switzerland. App. filed Oct. 3, 1908. Maintains a flame between electrodes and introduces auxiliary cooling gases within the flames.

920,613. ELECTRIC SAFETY FUSE; T. E. Murray, New York, N. Y. App. filed July 18, 1907. A fusible strip is arranged within a porcelain tube having brass caps with inert material between the strip and the tube.

920,614. PERFORATED BLOCK FOR ELECTRIC CONDUCTORS; F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 27, 1908. A block having a series of grooves in one of its faces and a series of intersecting grooves in an opposite face, the intersection of the grooves forming perforations with electric conductors mounted therein. These serve as terminals for an electric switch.

920,623. CHANGEABLE RATE FOR ELECTRICITY METER; A. Nicol, Berlin, Germany. App. filed Dec. 14, 1907. For use where more is charged during the evening than by day. Makes use of a shiftable member which throws in a higher rate registering train of gearing.

920,624. SOUND INTENSIFIER; A Nikiforoff, Warsaw, Russia. App. filed Nov. 21, 1907. For amplifying telephone currents by actuating a microphone diaphragm by means of an armature worked by the receiver.

920,626. DYNAMO ELECTRIC MACHINE; J. E. Noeggerath, Schenectady, N. Y. App. filed July 23, 1908. The collector rings and brushes contain magnetic material and members of non-magnetic material are inserted in the path of a stray flux passing through the collector rings.

920,627. CURRENT-COLLECTING APPARATUS; J. E. Noeggerath, Schenectady, N. Y. App. filed Aug. 23, 1907. For use with collectors requiring a great number of brushes and rotating at high speeds so as to make them accessible by providing an opening in the magnet frame through which the brushes can be reached.

920,630. ELEVATOR; C. H. Ocumpaugh, Rochester, N. Y. App. filed Aug. 27, 1907. The breakage of the rope does not permit the elevator to drop, but the latter is held in place by the mechanism normally used to operate the elevator. The elevator is operated without an attendant.

920,639. PROTECTION FOR ELECTRIC METERS; G. R. Rastey, Milwaukee, Wis. App. filed Nov. 8, 1906. Avoids interference with telephone meters by providing a fuse or fuses and enclosing them and the meter in a protecting case and conduit making them inaccessible.

920,652. TESTING APPARATUS; E. F. Ricketts, Baltimore, Md. App. filed Feb. 21, 1906. Testing apparatus for polyphase or single-phase instruments, including a transformer, a variable resistance in parallel with the primary thereof, and connections with the secondary of the transformer for the standardizing instruments and instruments to be standardized.

920,654. RAILWAY SIGNALING SYSTEM; W. G. Roome, Los Angeles, Cal. App. filed July 10, 1906. Records the movement of cars at a central office by means of sectional circuits which operate electromagnetic devices at the station.

920,667. AUTOMATIC SWITCH; A. W. Schramm, Riverton, N. J., and A. E. Oswald, Philadelphia, Pa. App. filed Aug. 29, 1907. A quick-brake switch operated by fluid pressure, which pressure may be adjusted.

920,674. TROLLEY; I. Shepherd, Chicago, Ill. App. filed Sept. 3, 1907. A trolley wheel mounted in a pivot head at the top of the trolley pole so that the head may follow the wire at all times.

920,710. SINGLE-PHASE MOTOR. E. F. W. Alexanderson, Schenectady, N. Y. App. filed Dec. 26, 1907. A single-phase motor of the commutator type having inducing and exciting windings on the stator connected in series, main commutator brushes connected in series with both stator windings, exciting brushes and means for impressing a shunt voltage on the exciting winding and the main brushes.

920,725. COOLING DYNAMO ELECTRIC MACHINES; J. G. Callan, Lynn, Mass. App. filed April 23, 1906. Cools the current collector of dynamos by means of a fan.

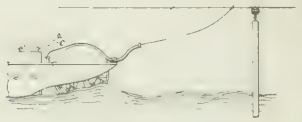
920,778. ELECTRICAL PROTECTIVE DEVICE; C. A. Rolfe, Adrian, Mich. App. filed Dec. 29, 1903. For low-tension circuits which can be restored by merely reversing the position of the heat cartridge. The cartridge is made double

920,786. ELECTRICAL APPLIANCE; J. S. Stewart, New York, N. Y. App. filed Feb. 25, 1908. A lamp receptacle comprising a body having grooves and a head having screw holes from which the groove extend.

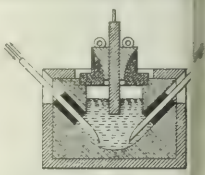
920,798. MEANS FOR COOLING ELECTRIC MOTORS; J. B. Wiard, Lynn, Mass. App. filed Feb. 23, 1907. The armature conductors are made hollow and cooled by blasts of air through them.

920,809. INDUCTION GENERATOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 3, 1907. Designed to run at double synchronous speed by providing an auxiliary winding on each member of half the number of poles of the main winding, one auxiliary winding having polyphase connections and the other supplied with direct current.

920,827. ELECTRIC LIGHTING SYSTEM; J. L. Creveling, New York, N. Y. App. filed May 28, 1908. Regulates the output of a generator on a railway car and keeps the voltage constant by means of a storage battery and suitable variable resistance devices.



920,229—Electrical Current Connection for Boats.



920,893—Art of Extracting Aluminum and Other Metal

920,833. SYSTEM OF TELEGRAPHY; R. L. Dean, Kansas City, Mo. App. filed April 5, 1906. Makes use of perforated tape which actuates a transmitter. The receiver is chemically treated paper.

920,843. ALTERNATING-CURRENT MOTOR CONTROL; F. Eichberg, Berlin, Germany. App. filed Oct. 26, 1906. Brushes short-circuit the rotor winding on the line of magnetization of the stator and are used in starting, and a second set of brushes, displaced 90 deg., are used for running.

920,846. DYNAMO-ELECTRIC MACHINE; H. F. T. Erben, Schenectady, N. Y. App. filed Feb. 1, 1907. A rotor with its end supporting the coils of the rotor suitably slotted to break the conductive continuity of the end member.

920,853. ARC LAMP HEADLIGHT; R. Fleming, Lynn, Mass. App. filed May 6, 1905. An enclosing globe is provided for the ends of the electrodes which is locked in place. The light may be used on direct or alternating circuits.

920,854. DYNAMO-ELECTRIC MACHINE; W. L. R. Emmet, Schenectady, N. Y. App. filed Nov. 22, 1907. A stationary field with a stationary vertical shaft carrying a spider, commutator shell and collector shell.

920,861. RESISTANCE MATERIAL; H. Geisenhoner, Schenectady, N. Y. App. filed Feb. 3, 1908. A steam-hardened compound of comminuted aluminum with silica and a hydrate.

920,886. POLE PIECE FOR DYNAMO-ELECTRIC MACHINE; L. Underwood, Lynn, Mass. App. filed Jan. 11, 1908. Fastens laminated tips having projecting end plates to pole pieces cast integral with the frame of the machine.

920,893. ART OF EXTRACTING ALUMINUM AND OTHER METALS; H. S. Blackmore, Mount Vernon, N. Y. App. filed Sept. 12, 1903. The process of producing aluminum from its ores by the combined action of a direct and an alternating current disposed through an electrolytic conductor containing a compound of the desired metal.

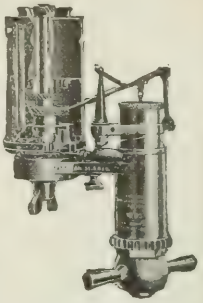
920,895. MAGNET TOY; W. J. Kerr, Smethport, Pa. App. filed July 9, 1908. A magnet is suspended from a frame and a dancing figure having an armature stands on a support beneath the frame and follows the movements of the magnet.

920,896. ALTERNATING-CURRENT MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed May 19, 1906. A multipolar motor with a wave-wound armature connected to successive commutator sections, each winding having a coil pitch equal to the distance between the poles with brushes distributed around the commutator.

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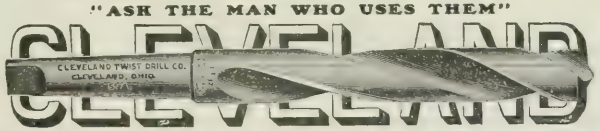
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The Hoosic River Power Developments.

Elsewhere we give an account of a hydraulic development more than usually interesting. Power plants have come of late years to approximate to certain set types which may be taken mostly for granted, but now and then a situation arises which gives full scope for the resources of the engineer. The Hoosic River plant here described belongs to the second category on account of the fact that the total fall is divided into two sections too far apart to admit of utilization as a unit and requiring somewhat different individual treatment. The upper fall at Johnsonville is about 5000 hp at 35-ft. head; storage possibilities about it are, however, excellent, so that a dam about 500 ft. long and 40 ft. high backs up the water to form a reservoir no less than six miles in length and capable of storing a month's supply of water for the Johnsonville plant. This plant consists of two 2500-hp horizontal turbines each coupled to a 1800-kw, three-phase generator. The Johnsonville plant will, so to speak, bear the brunt of the service; during low-water periods it will be run as the water may be needed in the plant below, so that no water will get down stream until after having done duty through the Johnsonville turbines.

The second plant is at Schaghticoke, where a fall of 146 ft. is available. Here four units are installed, each consisting of a Pelton-Francis vertical-shaft turbine directly coupled to a three-phase generator of corresponding power. Through a large part of the year this lower plant obviously furnishes ample power irrespective of what is going on at Johnsonville, but at times when storage is necessary the whole stream will do its turn in Johnsonville before it gets down to the bigger power house and higher head at Schaghticoke. The arrangement is one which is beautifully economical of water, and the plants being worked systematically together, the total efficiency of the stream will prove exceptionally high from the hydraulic point of view. The Johnsonville plant, in fact, will operate under full-load condition all the time, since each of its generators can be given full load whenever it is used at all, leaving the fluctuations to be handled by the Schaghticoke plant which operates on the Johnsonville tail-water.

The transmission line of this duplex plant, although not at an exceptionally high voltage only 33,000 is worth a word of comment as one of the few important lines in the East using the new suspension insulator. A glance at the [illegible] the line shows both the good and bad points of the suspension type. The former are fairly obvious, and the most casual inspection will show that the danger of the swaying of the lines were carried in suspension, to which reference is now and then made, is practically a negligible quantity. The [illegible] swaying is possible and the weight of the wires should be sufficient insurance against troubles of this kind. On the other hand, the towers required for a double suspension line are tall and somewhat unwieldly, quite certainly [illegible]

pensive than some of the other designs that are in use, and where this type of line is used the necessary height increases the temptation to put all one's eggs in one basket by running both circuits on a single line of towers. Experience has shown that this unpleasantly gives a chance of putting both circuits out of commission together in case anything serious happens. This difficulty is, of course, lessened by the long distances between wires, which, however, still further increases the height of the towers. It will require some little experience with this type of line design to show whether it is on the whole better or worse for such moderate voltages than lines with ordinary insulators placed on less lofty supports. However, somebody has to try out these experiments, and in the present instance the construction appears to be thoroughly good.

Improvements in the Quartz Lamp.

From time to time we have published notes regarding the quartz-mercury arc, which is being somewhat extensively exploited in Germany, and in the Digest this week will be found a description of the latest form of this very interesting lamp. It is used there chiefly for display purposes at present, much as the flaming arcs were at first used in this country. Yet it has properties which under favorable conditions might make it an illuminant which would have to be taken seriously for general out-door lighting. The quartz lamp is merely an intense mercury arc, mercury vapor being driven to high temperature and high light-giving power by concentration in a working tube of hardly more than capillary dimension. The light-giving part of one of the modern quartz lamps is, in fact, about the size of a small lead pencil and delivers from 1200 to 3000 hefner-candles, at the specific consumption of hardly more than ¼ watt per candle. The lamps recently reported take from 2½ amp to 4 amp according to size and voltage. The specific consumption just stated applies to the voltage at the tube terminals, which is about 85 for 100 to 130 volts supply and 160 to 180 for double this voltage. Obviously the efficiency reckoned upon the voltage of supply, including ballast, is not so good, running to about 0.37 watt per hefner. This, however, is an efficiency quite comparable with that of flame arcs. One, therefore, has in this quartz lamp a rather exceptional combination of properties—a union indeed of the high efficiency of the flame-arc lamp with more than the endurance of a tungsten incandescent. The life of the tubes employed in the recent models of quartz lamps is stated to be from 2000 to 3000 hours' running, but at times attaining 5000 or 6000 hours. At the present time we understand that practically all the quartz tubes used for this purpose are the product of a single factory. The technology of quartz glass appears to involve some exceptional difficulties which have hindered greatly the application of material otherwise valuable for lamps and for many other purposes. Molten quartz seems never to be at any temperature obtained really fluid, but always somewhat pasty and liable to serious trouble from the formation of bubbles. The quartz tubes as made for these lamps, in spite of showing evidence of the great difficulty of getting a temperature high enough for working them, are very good looking and it may be that further experience will enable them to be turned out in many places and on a sufficiently large scale to bring the lamp into extensive use. At the present, however, the employment of such lamps in this country would be hazardous on account of the extremely local nature of the supply of the necessary material. The light of the quartz lamp is a great improvement on that of the ordinary mercury arc, but is conspicuously lacking in red. It is amply good enough, however, for out-door lighting, and the time may come when it will have to be taken seriously for the larger uses of electrical illumination. At present, from the American standpoint, it is merely a highly interesting specialty, but it will bear watching.

A New Magnetic Surveying Ship.

In the old sailing-ship days, when clipper ships used to race with each other through the trade-wind zones, when vessels were built of timber and sheathed with copper, the magnetic deviation of the compass due to masses of magnetic material on the ship was zero. The variation of the compass was the declination or angle between the geographical and magnetic meridians. The declination was recorded for most parts of the navigable world, so that the navigator could tell where true north lay by taking the direction of compass north and applying the declination for the place. The idea of determining the compass error from day to day never entered the navigator's mind. Nowadays, with steel hulls in vessels with steel decks, steel masts, steel ropes, steel everything, the deviation error of the compass due to the ship's magnetism may be much larger than the declination. In fact, it is sometimes found impossible to make a compass act serviceably in particular locations on a vessel owing to the marked local magnetic field swamping the earth's magnetic field. Moreover, the ship's magnetic effect varies from week to week, not merely on account of change in the arrangement of equipment or cargo, but also on account of changes in the magnetism of the ship's hull in different magnetic latitudes or on different magnetic courses. Consequently, navigators are compelled to measure their compass variation, including combined deviation and declination, at frequent intervals, usually by taking the sun's bearing, at any determined time, but particularly at rising and setting.

It is evident that a modern steel vessel is unsuited for accurate measures of the magnetic declination at sea, because the deviation due to the steel in the vessel is so large by comparison with the declination. Although a knowledge of magnetic declination over the oceans is not so important to navigators as it used to be, yet it is of great importance to magneticians generally. The Department of Terrestrial Magnetism of the Carnegie Institution of Washington employed a wooden survey yacht, the *Galilee*, on valuable work for nearly three years in the Pacific Ocean, cruising about under sails, and measuring the earth's magnetic field. Recently it has been decided to build a special wooden ship for this work, to be named the *Carnegie*, a brigantine 155 ft. long, of 12½ ft. mean draft, and 570 tons displacement. Since the *Galilee* narrowly escaped loss for want of auxiliary power, a small internal-combustion engine is to be used on the *Carnegie* capable of giving the vessel a speed of 6 knots in calm weather. The auxiliary power plant is to be of non-magnetic material as far as possible, all fastenings are to be of non-magnetic metal, and the rope rigging is to be all of hemp. It will be interesting to learn how nearly non-magnetic a survey vessel can be constructed with an auxiliary power plant, propeller and propeller shaft. The magnetic observatory is placed amidships, on the main deck, comprising a square room and two towers. The vessel is designed for long cruises, and

can work in any part of the navigable world. Her crew may be kept actively at work, but will probably not suffer from overstrenuous life.

A Graphical Study of Self-Induction.

Self-induction may be defined as that property of a circuit by virtue of which changes in current strength can only be brought about by electromotive forces. Moreover, the more sudden the changes in current, the more powerful these electromotive forces must be. In fact, at any instant, the inductive e.m.f. is equal to the self-induction in the circuit multiplied by the rate of change of current. This property of a circuit is therefore analogous to inertia in matter; forces are invoked when matter changes its velocity, and the magnitude of these forces depends upon the suddenness in the change of velocity. Hence self-induction is sometimes described as the electromagnetic inertia of a circuit. The rules of the differential calculus naturally apply to the phenomena either of mechanical inertia or of electromagnetic inertia. But it is not necessary to use the calculus in order to understand and to describe these phenomena. Graphic methods, for example, may be used. The article by Mr. F. P. McDermott, Jr., on page 1215, discusses the application of a graphic method to problems connected with the rise of current in a circuit possessing resistance and inductance under the application of a steady e.m.f. The curve of current rise is developed graphically by successive steps. It is shown that the method may be extended to cases of divided circuits, which are distinctly more complex than simple undivided circuits. All such graphic methods have their value, not only for giving quantitative results to those who cannot use the calculus, but also for illustrating and throwing side lights upon the subject to those who can and do avail themselves of the calculus. All methods are good and helpful in their proper spheres of influence. Nevertheless, a careful study of this particular graphic method will, we believe, reveal the fact that anyone who can understand and apply this method would be amply capable of understanding and applying the regular method of the calculus with but little extra effort. In other words, the use of elementary calculus in most engineering problems is not nearly so difficult as is commonly supposed by the uninitiated.

Electricity and the Conservation of Energy.

At a recent joint meeting in New York of the Societies or Institutes of Civil, Mechanical, Electrical and Mining Engineers a paper was read by Mr. Lewis B. Stillwell upon the subject of "Electricity and the Conservation of Energy." This paper is of interest to all engineers, because it points out that the question of conserving natural resources is, aside from its general relations to the public at large, essentially an engineering question, in the technics of which engineers should have a leading voice and an authoritative judgment. Whether a certain line of policy in conservation should be followed in the main, is a political and economical question that lies within the decision of the community at large. But questions as to what particular policy should be adopted in detail, how to carry it into effect, and what to expect therefrom are engineering questions that can only be properly answered after consultation with qualified engineers. The paper points out that there are three ways in which electricity serves to save coal: First, by enabling waterfalls to supply power at a distance; second, by enabling coal power to be used at a distance from large economical engines, and third, by substituting electric locomotives for steam locomotives. It is pointed out that in 1908 the plants of the Niagara Falls Power Company delivered 560,000,000 kw-hours, or 64,000 kw-years. This saved to the nation in that year 1,000,000 tons of coal if burned in the individual plants of the consumers, or nearly 2,000,000 tons if burned in a large number of small plants. But that was not all of the benefit. Much was produced electrochemically by the Niagara water-power, which could not have been produced commercially in any manner by steam-power. Since the total output of coal in the world in that year is placed at about one thousand million tons, Niagara power saved about one quarter of 1 per cent of this total, or about one-half of 1 per cent of the total coal output of the United States.

Concerning water-power available in the United States, there is still much guess-work, but the report of the Inland Waterways Commission estimates it at 37,000,000 hp available at a cost comparable with that of steam installation. The estimate of the industrial use of power in the United States at the present time is 25,000,000 hp in stationary engines and 2,000,000 more in locomotives, or 27,000,000 altogether. Only 5,000,000 hp in this total are at present derived from water-power. With the exception of a scant 1,000,000 hp from gas and oil engines, the rest is all developed from coal. Consequently, according to the estimate of the commission above referred to, the water-power of the United States capable of being developed at a cost comparable with steam installation would supply all the power used at present in the United States and half as much more. It must, however, be remembered that a large part of the said available water-power is remote from present markets and that a considerable fraction of it is at a distance from markets greater than the present commercial radius of electric-power transmission.

The paper also discusses at some length the political or economic policy that many recommend at present of taxing working water-powers to pay for developing water-way transportation. Doubts are expressed as to whether we can afford to pay large sums for canal systems. A reasonable expenditure for canals is admitted to be commercially justifiable; but what many seem to think a proper expenditure on canals is claimed to be unsound finance. This is a large public question, but of great importance to engineers and to engineering; but, whatever its precise answer may be, we entirely agree that, for the present, electric reclamation of water-power should be encouraged as far as possible and not burdened unnecessarily by taxes. Every hydraulic kilowatt utilized industrially saves at least 10 tons of coal per year, not merely for one year, but for all time. There can be little doubt that the only way to utilize the water-power of the country to its full effectiveness with the greatest economy is to use the water of a river many times over in smaller hydro-electric plants, rather than to attempt using it only once or twice in colossal plants. By this means, a large number of small lakes can be made for impounding the water on the tributary streams at relatively small cost for land, dams and power houses; while all the stations will contribute power to a large electric-conducting network. In this way, under collective operation, the natural differences of water level may be availed of most favorably.

The Patent System in Its Relation to Industrial Development.

At the annual meeting of the American Institute of Electrical Engineers, held in New York, May 18, Mr. Frederick P. Fish presented a paper entitled "The Patent System in Its Relation to Industrial Development." The paper opens with an interesting historical account of the patent system from its earliest beginnings in the fifteenth century, and treats in detail the development of the patent system of Great Britain, founded toward the end of the sixteenth century. Taking up the patent system of this country, Mr. Fish says that while many other considerations may have played an important part in our national development, it seems to him certain that this development is largely due to the special character of our patent system, and its efficiency in encouraging invention. Our patent system amounts simply to the grant to one who has had the intelligence and skill to make an improvement in the useful arts which involves invention, of the exclusive right, for a term of 17 years, to make, use and sell that which he has discovered, invented or designed. Our system is much more liberal than those of foreign countries. In some countries a patent grant is forfeited if there is no manufacture under it within a certain limited period; or again, the owner of a patent may be forced to grant licenses to manufacture the invention covered. Mr. Fish does not favor either of these restrictions.

Referring to some of the criticisms of our patent system, Mr. Fish believes that some reform could be brought about by an intelligent and well-directed effort on the part of the patent bar and the courts. He added that many of the evils ascribed characterize the practical operation of all human institutions, and we can only hope to minimize them. He favored the establishment of a single Appellate Court to take the place of the nine independent Courts of Appeal now existing, and a reorganization of the Patent Office that will enable it to do more effective work in its examination of applications.

Referring to the proposition that patent protection exists primarily, not for the benefit of the inventor, but for the benefit of the community, he said that the patent systems of the world agree in giving legal sanction to property in inventions, partly because of a feeling that the inventor has some abstract right in them, but for the most part as a matter of public policy to stimulate and secure the promotion of the useful arts. In regard to the suggestion that our patent system should discriminate against foreigners, Mr. Fish said that he was satisfied that there should be no change made in our present policy of non-discrimination.

In the opinion of Mr. Fish there is no valid foundation for the suggestion that inventors are not adequately compensated. To many of them their inventive capacity is a part of their stock in trade. Because they can invent, they receive substantially more by way of salary and standing than would otherwise be the case, as do those who are deft in the use of tools, or who show skill as designers or capacity as salesmen. In many instances the inventor is the only one who has made any profit out of an enterprise based on patents. And it should not be overlooked that by far the greater part of inventions, particularly at this late stage of the older arts, are mere details of improvement or alternative devices or methods from which, regarded specifically, no large amount of profit can be made by any one. Such inventions are only valuable as incidents to the manufacture, and cannot be segregated and appraised independently. In conclusion, Mr. Fish expressed the belief that in spite of occasional cases of hardship, such as occur in every business and profession, the ordinary social and business principles which, irrespective of the patent law, determine the distribution of the profits of invention as between the inventor, capitalist and the business man, result in securing to the inventor, on an average, a larger portion of that to which he would be entitled under ideal conditions (such as never can be obtained) as would come to any other workman in our vast industrial army.

Patent Claims.

The current issue of *The Forum* contains an article by Mr. H. Ward Leonard entitled "The Legal Monstrosity of Our Patent System" which severely arraigns our present patent system. In opening it is stated that the individual who gets the least return for what he produces is the American inventor, which class, moreover, is becoming rapidly exterminated under existing conditions. The article considers in detail the subject of patent litigations, including the prohibitive cost to the ordinary inventor, the method of taking testimony and the manner in which the bench is handicapped in arriving at proper decisions. The portion of the paper relating to claims is abstracted below.

The author asserts that under the ingenious pretence that various changes were needed for the protection of the public, interested parties have molded the patent system until it now represents the maximum of complication and legal expense, and the minimum of protection to the inventor. The inventor is perfectly competent to disclose his invention, but under the present system full and complete and accurate disclosure by him is entirely inadequate. The invention must be described in a series of peculiarly worded claims, and unless this peculiar, unique method of expression be employed with absolute accuracy, the inventor finds that although he has produced his valuable invention after years of labor, and has disclosed it so that the world gets the full benefit of his labors, he is not *secured* in any way whatsoever by the Government.

The method claims must not be "structural," and the apparatus claims must not be "functional"; there must not be anything "obscure," or "vague," or "indefinite" in the language, which must satisfy perfectly some hypercritical novice of an examiner frequently just out of school. The claim which succeeds in running the gantlet of this absurd system must express absolutely and without the slightest inaccuracy, exactly what was originally invented, when, years later, the patent is before the court because the invention has at last been appreciated and the patent has been infringed.

To be sure, to draw such a claim is practically impossible, and probably no patent lawyer or patent examiner, or judge, or anyone else, could do it if the bare specifications and drawings were given him at the filing date; but the inventor, who is not a lawyer, nor a rhetorician, nor an etymologist, is expected to do this, or else when his patent finally is adjudicated he will find the United States Government through its Judiciary Department saying to him: "While it is true that your invention possesses great merit and many advantages, and while it is admitted that it has been a source of benefit to the public and of profit to the infringers, and it is unquestionable that your disclosure was 'full, clear, concise and exact,' so that those skilled in the art were readily able to, and did, secure the advantages of the invention, yet unfortunately for you we cannot *secure* you in anything at all, because the language used by your patent lawyer or you, even though it was suggested by the Patent Office itself, was worded not quite accurately enough to describe with absolute precision the exact invention you really made."

Furthermore, the pretence that these peculiarly worded claims serve to protect the public by automatically giving to everyone who reads the patent full and accurate knowledge of just what the scope of invention is, so that they can respect it, is fallacious and misleading. So far as the ordinary honest manufacturer or user is concerned, the *claims* might as well be in Sanskrit. The *disclosure* is understood perfectly by the manufacturer or skilled user, if it be one in his line of manufacture or use, but the *claims* he never understands until he reads the court decision, if even then. He makes no attempt to understand them. What he does, if he has any reason to think that he ought to consider the patent at all, is to consult his patent lawyer. And now we can understand why we have the system of claims. Nine-tenths of the cost of getting out a valuable patent is represented by the fees paid to patent

the principal east and west thoroughfares, was specially decorated during the show for a distance of two blocks by festoons of colored incandescent lamps. Excellent music was provided afternoons and evenings by Green's band, with Blanche B. Mehaffey, soprano soloist.

The Omaha Electric Light & Power Company occupied the stage of the Auditorium with an industrial power exhibit. The local supply and contracting firms, which largely made of the rest and thereby jeopardized their ability to partake of exhibits. These exhibits were an excellent selection of appliances calculated to arouse public interest. During the show period *The Electric World Daily*, "A Journal of Power," was published under the management of the contract agent of the Omaha Electric Light & Power Company, Mr. I. B. Zimman.

The evening of May 12 the Sons of Jove held a rejuvenation at the Elks' Club, at which 13 candidates crossed the burning sands. Four out of the 13 sacrificed themselves for the cause of the 13 and thereby jeopardized their ability to partake of nourishment in a sitting posture for a few days. It is not recorded that there were any fatalities. After the initiation there was a spread at the Henshaw. The rejuvenation was in charge of Mr. A. G. Munro, statesman for Nebraska.

One feature of the show was the popular experiments and



FIG. 2.—GENERAL VIEW OF OMAHA SHOW, SHOWING REVOLVING CHANDELIERS.

lectures carried on by Dr. Frederick H. Millener, experimental engineer of the Union Pacific Railroad. The decorative lighting of the show was turned on a number of times by wireless telegraph relays operating solenoid switches. On some occasions the wireless impulses for turning on the lights were received from Fort Omaha, four miles away, and at other times from a wireless sending station in the building. The apparatus employed was partly the same that Dr. Millener has been using in his experiments for transmitting wireless signals from stationary semaphores along the line of the Union Pacific Railroad to moving locomotive cabs.

The Omaha Electrical Exposition Company has a membership of 12 of the prominent supply and public service corporation men of Omaha, the officers being as follows: Mr. G. W. Johnston, president; Mr. A. G. Munro, vice-president; Mr. Wilgur L. Burgess, secretary; Mr. J. R. Lehmer, treasurer; Mr. F. A. Nash, chairman advisory committee; Mr. J. M. Gillan, manager; Mr. Waldemar Michaelsen, superintendent of light and power.

"Wireless" Activity Around the Great Lakes.

With Chicago as a center there have been of late manifestations of renewed activity in the district of the Great Lakes in extending wireless communication. A wireless station was lately installed on the roof of the Auditorium Annex Hotel, and on May 3, according to the daily newspapers, and as noted in the issue of May 6, the first wireless messages ever transmitted between New York and Chicago were received and sent at this station. The Annex station was installed by the United Wireless Telegraph Company of New York, which company also has a station in Cleveland and one at Benton Harbor, Mich., across the lake from Chicago. In Buffalo, as previously noted, it is building a station on the *Evening Times* building, and it is also promised that there will be a station in Detroit, although the location has not been decided. In Milwaukee there will be a station on the Pabst brewery, and the smokestack of this establishment, 230 ft. high, will support the aerial wires. The new St. Paul Hotel, in St. Paul, Minn., will have a station, and it is also planned to erect stations at Duluth, Minn., and on Mackinac Island. Another station is under construction at Grand Haven, Mich., on the east shore of Lake Michigan, and arrangements are practically completed for a location at Manitowoc, Wis., on the west shore of the lake. Other Lake Michigan locations for "wireless" stations will be Holland, Mich., and Petoskey, Mich. Eventually the United company plans to have nine stations on the shores of Lake Michigan.

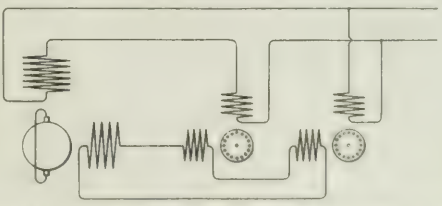
In addition to the land stations, the passenger boats of the Graham & Morton, Goodrich and Crosby steamship lines on Lake Michigan will be equipped for wireless. On the Canadian side of the Great Lakes negotiations are now under way with the Dominion Government for procuring licenses for "wireless" stations, which will be placed at Toronto, Sarnia, Collingwood, Owen Sound, Port Arthur and Fort William.

It is not the intention of the builders of these wireless stations to compete with ordinary telegraph lines, although commercial business will be accepted, it is said, and even solicited in some special cases where the nature of the business is especially favorable. The principal idea appears to be to enable passengers on lake boats to communicate with the shore at all times and also to provide a special means of communication for hotel guests. Tuning devices are used to prevent interference and it is thought that these will prove effectual.

In addition to the work of the United Wireless Telegraph Company in the Great Lakes basin, the Radio-Telephone Company of New York (DeForest and Stone systems) is erecting "wireless" stations for telephone service in the same area. The steel tower of this company in Chicago is placed on the tall Majestic Building on Monroe Street, in the "downtown" district, and is very conspicuous. It is said that the top of the pole surmounting this tower is 432 ft. above the street level.

Constant-Speed, Single-Phase Commutator Motor.

The arrangement shown herewith consists of a single-phase repulsion motor receiving exciting current from two single-phase induction motors used as tertiary-circuit generators for giving e.m.fs. in time-quadrature with the primary e.m.fs. The



primary coils of one induction motor are connected in parallel across the supply circuit, while the primary coils of the other induction motor are placed in series in the supply leads. The excitation of the repulsion motor varies to any desired extent with the load on the machine. This scheme was patented on April 20 by Mr. Marius C. A. Latour, who proposes to employ it for obtaining constant-speed characteristics as an alternating current commutator motor.

Thirty-Mile Transmission from Steam Power Station at Galena, Ill.

Succeeding the Tri-State Light & Power Company, of Galena, Ill., the Interstate Light & Power Company, of Madison, Wis., has been incorporated with $400,000 common stock and an authorized bond issue of the same amount. The issue of preferred stock has not been determined as yet. The company will build a steam-driven generating plant at Galena to produce electricity which will be transmitted to several points in the State of Wisconsin, the length of transmission being about 30 miles. The station will have a capacity of about 3000 kw, and it is probable that steam turbines will be installed. The voltage of transmission will be 33,000, and electricity will be supplied for lighting Platteville, Cuba, Benton and Hazelgreen, Wis., the energy being sold at wholesale to the local lighting interests in the places named. In addition electricity for operating motors will be supplied to about 25 zinc mines in the vicinity. The officers of the company are: President, Mr. A. O. Fox, Madison, Wis.; vice-president, Mr. O. E. Osthoff, Chicago; secretary, Mr. M. F. Fox, Madison, Wis.; treasurer, Mr. Leroy E. Caldwell, Chicago. H. M. Byllesby & Company, of Chicago, are the engineers for the company, and the American Trust & Savings Bank, of Chicago, and other banks, are financing it. The Power Construction Company, a subsidiary corporation, will build the plant and turn it over to the Interstate Company.

The southwest corner of Wisconsin and the northwest corner of Illinois present a locality with many active and potential enterprises in the way of mining and manufacturing, and it is believed that this new power-transmission plant will be a decided help in the development of the region. The plant will be of especial interest owing to the unusual length of transmission from a steam power plant.

Energy Transmission Through Aerial Lead-Covered Cables.

The Niagara-Oswego Power Company, which was recently formed for distributing Niagara energy in Fulton, N. Y., is planning to install at that place a system of 6600-volt aerial lead-covered cables. Each cable will consist of three No. 6 stranded copper conductors insulated by cambric and protected with a lead covering. The cable will be suspended from a steel messenger wire similar in all respects to the method commonly used with telephone cables. The cable will be placed on the existing telephone poles and will provide the maximum of security with the minimum of constructive difficulties and maintenance cost.

Energy for these cables will be obtained through three 250-kw transformers, now in use at Baldwinsville, which will be placed in a substation to be erected in Fulton. These transformers will be connected to the 33,000-volt transmission lines of the Oswego River Power Transmission Company, which now reach from Baldwinsville to Fulton, and are being extended to Oswego, the poles for the additional line being already in position.

At Baldwinsville the Seneca River Power Company is arranging three 75-kw transformers to carry the load for which the larger transformers mentioned above are now used. By means of this transformer equipment, 25-cycle energy from Niagara is employed for operating lamps and motors in Baldwinsville. Tungsten lamps are in common use. That the service has been satisfactory is shown by the fact that the actual load has increased by about 30 per cent during the past year in spite of the substitution of tungsten for carbon lamps. Moreover, the low frequency has not been found objectionable, neither have the fluctuations in the voltage, although no voltage regulators have been installed.

In order to obtain high-frequency energy for arc-lamp circuits a 60-cycle generator is directly driven by a 25-cycle, 75-hp induction motor. Belted to this motor-generator set is a waterwheel utilizing a low-head fall in the Seneca River which formerly supplied energy for the lighting in Baldwinsville. Under normal conditions the gate admitting water to the wheel is left completely open so that it operates at a certain constant load. When the 60-cycle load exceeds the output of the waterwheel, the speed of the set decreases somewhat and the motor carries the excess load. When the high-frequency load decreases the motor load decreases also and may even reverse, in which latter case this machine is driven above synchronism and acts as an induction generator. In case the waterwheel is inoperative, the motor carries all of the 60-cycle load. The president of the above-mentioned companies is Mr. S. B. Storer, consulting electrical engineer, Syracuse, N. Y.

Duty on Mica.

In a letter to the *New York Times*, Mr. W. J. Gibson gives a history of mica tariff duties, and points out the unfairness of the present tax and that proposed in the tariff measure now before Congress.

Until 1872, he states, mica had not appeared in the tariff at all. In the act of 1872 and 1883 "mica and mica waste" were on the free list. It appeared for the first time on the dutiable list in the McKinley act of 1890 at 35 per cent ad valorem. In the Wilson act of 1894 it was made dutiable at 20 per cent ad valorem. In the Dingley act in 1897 a duty was imposed on it as follows: "Mica, unmanufactured or rough trimmed only, 6 cents per pound and 20 per cent ad valorem; mica, cut or trimmed, 12 cents per pound and 20 per cent ad valorem."

This language, he says, looks very innocent to the unsuspecting reader, but the result was to put a duty on some qualities of mica of 4000 per cent, or 40 times its value. This is what is known as a compound duty, a specific and ad valorem duty combined, and whenever it is resorted to it is designed to impose a very high duty on the article which is the subject of it. In the Payne and Aldrich bills the duty upon these qualities of mica has been reduced 1 cent a pound, that still makes the tax on the long ton over 3700 per cent, and 3333 per cent on the short ton.

In conclusion Mr. Gibson says there is no reason for a duty upon mica at all, as it is a product of nature and is easily taken out of the ground. This country consumes almost 10 times as much as can be found here, yet the lucky finders of this one-tenth are able to induce Congress to impose this outrageous protective tariff on this product of nature.

Tungsten Lamp Terminals.

A patent issued April 27 to H. Remané and E. Hurwitz, of Berlin, and E. Gottschalk, of Charlottenburg, Germany, relates to a bi-metallic tungsten lamp terminal. In the specification it is stated that at the present time the ends of the tungsten filaments used in electric lamps are attached to metallic supports by fusing the ends of the supports which, when they solidify, holds the ends of the incandescent filaments firmly in place. This method can be carried out successfully when platinum wires are used as the supports or current leads; but if nickel wires be used, frequent breakages will occur, caused by the formation of an alloy of a small portion of the nickel with the tungsten when the nickel ends are fused (by means of the electric arc). This alloy is itself readily fusible and causes a reduction in the sectional area of the filaments in the vicinity of the fused portion owing to the fusible alloy running down, and this causes the filaments to break readily at these weakened places. If copper be used for the supporting wire instead of nickel, another defect is caused by the filament breaking through and escaping from the surrounding fused globule before it has solidified.

The present invention relates to a means for obviating these inconveniences by using, as a filament support, a wire containing two metals, one being, for instance, copper itself or a metal

(such as silver) which behaves like copper, and a second, for instance, nickel or a metal (such as iron) of analogous behavior. It is important that one of the metals should readily form alloys with tungsten, while the other metal should not. A convenient means consists in using wires composed of alloys of the above-mentioned metals, though it is also sufficient for the two metals to be merely mechanically united, in the wires. For example, a wire can be used composed of nickel with a coating of copper, or a copper wire coated with nickel.

Street Lighting in Chicago by Energy from the Drainage Canal.

Every arc lamp maintained for street lighting in the city of Chicago by the municipal government is operated by means of electricity generated in the hydro-electric plant of the Sanitary District on the Chicago Drainage Canal, at Lockport, Ill., 30 miles from the center of the city. In all there are 11,670 street lamps maintained and operated by the Department of Electricity of Chicago, of which Mr. William Carroll is city electrician. Of this number 4958 are supplied with electricity generated in municipal lighting stations existing before the Drainage Canal plant was put into operation, and now operated by means of electric motors driving the existing generators, these motors being operated by electricity from the Drainage Canal plant.

Lamps to the number of 6712 are operated from new substations, the Drainage Canal energy being transformed to the requirements of the street-lighting circuits without the interposition of moving machinery. Two of these substations are located on the South Side, one at Emerald Avenue near Thirty-fourth Street, and the other on Wentworth Avenue near Forty-eighth Street. A third is on the West Side, on Wood Street near West Nineteenth Street. The Wentworth Avenue substation, which may be considered as typical of the practice which has been adopted in utilizing the high-potential energy from the Drainage Canal plant for street lighting, is illustrated and briefly described herewith:

This substation is a substantial and attractive building, erected of brick trimmed with Bedford stone, with reinforced-concrete roof and floors, supported by steel beams and cast-iron columns, with interior walls of white-enameled brick. The station is built in a thoroughly workmanlike manner and is fireproof.

The principal electrical apparatus consists of three 250-kva transformers, 30 regulators and the switchboard equipment for the incoming high-potential and outgoing circuits. Electrical energy is received from the Sanitary District at 12,000 volts, 60 cycles, three-phase, the e.m.f. being decreased to 4250 volts in the secondaries, as shown in Fig. 4. The primaries of the transformers are delta-connected, and the secondaries are star-connected. Fifty-lamp arc circuits are connected in multiple from these three transformers, there being nine on each phase of the secondary system, making 27 circuits from all of the transformers, or a total of 1350 lamps. The neutral of the star-connection of the secondary system is grounded. The

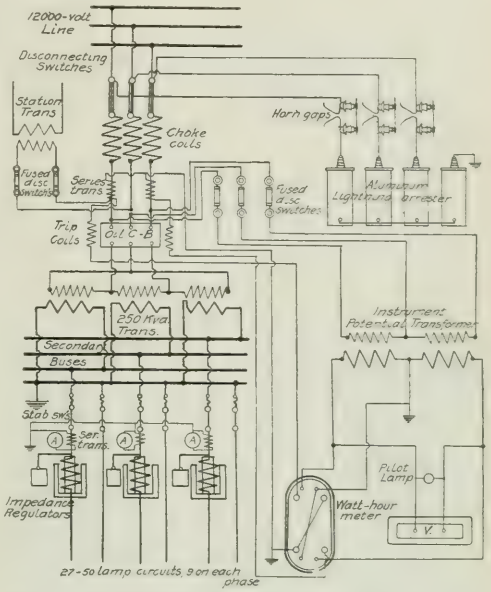
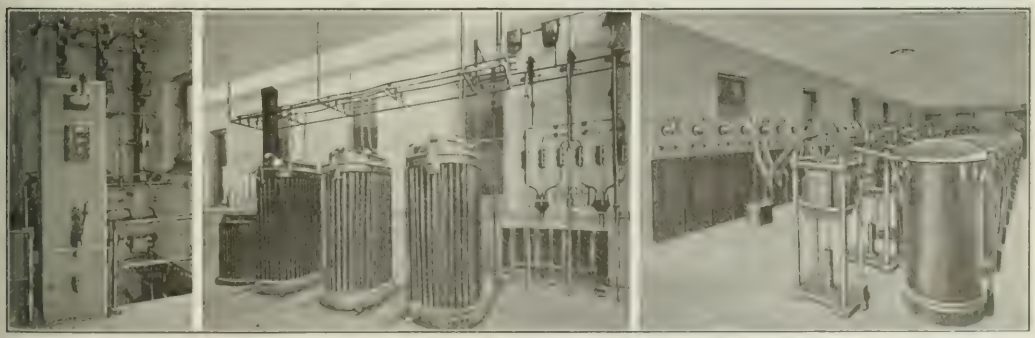


FIG. 4.—WIRING DIAGRAM FOR WENTWORTH AVE. SUBSTATION.

streets lighted from this substation extend from Thirty-ninth Street on the north to Fifty-fifth Street on the south, and from Grand Boulevard on the east to Halsted Street on the west. If the necessary money can be obtained by the authorization of a municipal bond issue, it is intended to extend the system of substation street-lighting to cover the whole city.

Use is made of 7.2-amp, alternating-current series enclosed-arc lamps with from 75 volts to 85 volts at the lamp terminals. The lamps will operate about 100 hours without requiring renewal of the electrodes. The lamp-posts are spaced about 225 ft. apart, as a rule, and the lamp is suspended 14 ft. above the sidewalk. Both overhead and underground constructions are used in supplying electricity to the lamps; where overhead construction is used an effort has been made, in the newer work, to render it as inconspicuous as possible. The lamps operate all night and every night, averaging about 8½ hours'

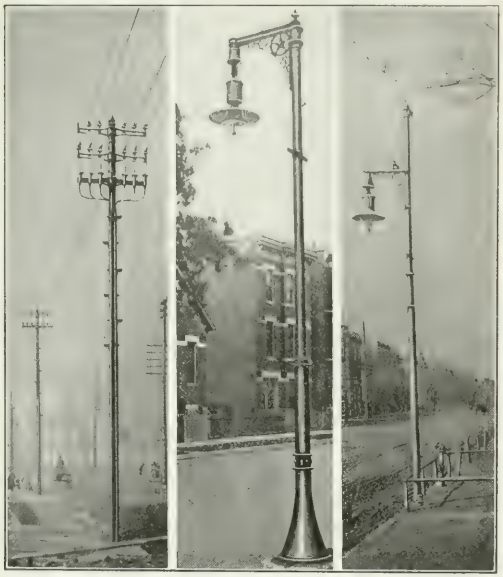


FIGS. 1, 2 AND 3.—VIEWS OF INTERIOR OF WENTWORTH AVE. SUBSTATION.

service in summer and 14 in winter, or an average of about 11 hours' use out of the 24 throughout the year.

The electricity used costs the city $15 per hp-year for night service. The Sanitary District offers electricity for day service also to factories and other motor users, endeavoring so to plan the load that there will be no overlapping between the demands of the private consumers and the starting-up time of the city electric lighting service. This result would seem to be rather difficult to accomplish in winter, but as the rated output of the Sanitary District generating station has not as yet been reached either for the day service or for the night service, no difficulty has thus far been experienced in making this arrangement.

Electricity for the Wentworth Avenue substation is taken from the Chicago terminal station of the Sanitary District at Western Avenue, near Thirty-first Street. It is brought into the substation through underground cables, and the incoming circuits are provided with aluminum-cell lightning arresters. The substation building consists of two stories, but the upper floor does not extend clear across the building, being, in fact,



FIGS. 5, 6 AND 7.—POLE LINE AND LAMP-POSTS.

a wide balcony. Through the space thus left the high-potential circuit apparatus extends through the two floors, and this open space also provides room for a hand-operated crane of sufficient lifting capacity to handle the parts of any piece of apparatus in the building. The transformers are on the ground floor, while the regulators and switchboard for the outgoing circuits are on the upper floor or balcony. Here also is the high-potential control panel, so that the entire substation is operated from this gallery.

On the high-potential control panel is the handle for operating the main three-phase oil switch. There is also a Thomson polyphase meter, reading in kw-hours, and a voltmeter reading up to 175, but arranged to be multiplied by a constant of 100 to show the actual potential measured. At the bottom of this panel is a relay for operating the oil switch. All iron structures and all secondary circuits are grounded, and the whole installation presents a neat appearance both inside and out. All of the apparatus is of General Electric manufacture except one transformer made by the Allis-Chalmers Company, which is temporarily installed for the purpose of lighting Gage Park.

There are 30 constant-current, 50-lamp regulators on the balcony floor. Fifteen of these are air-cooled and 15 are oil-cooled. Adjacent to these is a 30-panel circuit switchboard provided with stab switches working in fiber tubes, each tube being equipped with an expulsion fuse. The panels of this board are of blue Vermont marble, each equipped with an ammeter reading up to 10 amp and two apertures for the stab switches, the negative bus being grounded. Plenty of room is provided at the back of the board, which is easy of access. The outgoing circuits are led from the substation in eight-conductor cables.

The substation machinery is operated by one man, but as the building is open continuously three men are needed, relieving one another in eight-hour shifts. The two night men do the operating, the duties of the day man being rather those of a custodian and watchman. The first night man goes on duty at 3 p. m. and stays until 11 p. m., his successor going on at 11 and going off at 7 a. m., when the day man goes on duty. The number of street arc lamps now actually operated from this station is 1303, but the ultimate output of the station, with the present apparatus, is sufficient for 1500 lamps.

Telephone Company Not an Accessory to Fire Department.

A recent court decision has held that a failure to give connection with a fire-engine house was not a ground of liability to the owner of a building destroyed by fire. A lumber company owning a plant at Lebanon, Ky., brought an action against the local telephone company, of which it was a subscriber, to recover damages for the loss of its plant by fire. When the night watchman discovered the boiler house to be on fire some time after midnight he at once rang central for the purpose of telephoning the alarm to the engine house, but the central office failed to answer his call, and it was only after he had made repeated efforts, during an interval covering some 20 or 30 minutes, that he succeeded in getting central to answer and furnish the needed connection. In the meantime the fire had gained such headway that when the fire department reached the scene it was beyond control and the buildings and their contents were totally destroyed. The petition did not charge that the defendants were under any contract with the city of Le[illegible]anon to maintain a fire-alarm system in the city, and hence their liability had to be determined under their general contract with their patrons. They agreed to furnish connection between the patrons upon request and subject to such reasonable rules s might properly be adopted and enforced in a town of the size of Lebanon. It was held that the facts upon which a recovery was sought were entirely too remote and speculative to support the cause of action, and a judgment for $10,000 in favor of the plaintiff, secured in a lower court, was accordingly reversed. The mere fact that the defendant company's operator was negligent in the discharge of her duty, and plaintiff suffered a loss, were not sufficient to create a liability; but there must to negligence and loss be added a state of facts showing that the negligent act was the proximate cause of the loss. The court reasoned that, in order to find for the plaintiff, it would be necessary to presume that the watchman in the engine house was awake and at his post of duty ready to answer the call immediately upon receipt of the notice of the fire; that he would at once have sounded the alarm by ringing the bell; that upon the ringing of the bell the members of the fire department, whether paid or volunteers, would have heard the alarm and promptly responded to the call, and would have reached the scene of the fire before it had spread to the main buildings. The fire-fighting apparatus must have been in perfect working order, and the fire department must have succeeded in confining the fire to the boiler house, and put it out before it had spread to the other buildings. The court held that when it is considered that each of these separate agencies is wholly inde-

pendent of the other, and none of them under the direction or subject to the control of the defendants, it is readily seen that in order to hold that the negligence complained of was the proximate cause of the injury or loss, a series of unallowable presumptions must be indulged in.

New York Public Service Commission News.

The Board of Estimate of New York City has not as yet acted upon the application of the Hudson & Manhattan Railroad Company for a franchise under Sixth Avenue from Thirty-third Street to Grand Central Station. The matter was referred to a special committee, but it is expected that it will be granted at the next meeting of the board. Mr. Frank Hedley, general manager of the Interborough Rapid Transit Company, has written a letter of protest claiming that the extension of the McAdoo tunnel will interfere with the completion of the plans of the Steinway tunnel company.

The Public Service Commission of the First District of New York has ordered that all subway express trains must be equipped with side doors. The question as to whether the doors shall be in the center or at the end is left to the convenience of the company. Center doors will be installed.

Mayor McClellan has signed the Travis-Robinson bill which permits the construction of rapid transit lines by private capital.

At the general investigation into the affairs of the electric lighting companies by the Public Service Commission last week, the question of franchises was again taken up. Mr. C. F. Matthewson, representing the New York & Queens County Electric Light & Power Company, testified that his company was operating under a franchise granted by the Council of Long Island City in 1894 and that at the present time it was the only company authorized to do business in that portion of Greater New York. With regard to that portion of the city which had formerly been the village of Flushing, Mr. Matthewson said that his company operated under a franchise granted to the Flushing Electric Light & Power Company—since absorbed—by the town trustees on Jan. 19, 1897. The right to operate in the villages of College Point and Whitestone were acquired in the same way, through franchises granted to the Flushing company. The rights to operate over the county roads in this section were in every case obtained in the shape of permits from the boards of supervisors and highway commissioners. These grants were for the most part for terms of 25 years from date, with renewal privileges. He said that his company held franchises from both the highway commissioners and board of supervisors for the territory that was formerly the town of Jamaica and also for the territory that was subsequently included in the village of Richmond Hill. These franchises for the most part extended for 45 years from different dates in the year 1896. In some portions of Richmond Hill the company is operating on grants given by private land owners. Mr. Matthewson claimed that if there was any doubt as to the rights of his company in this section, under the grants referred to, the invitation and acquiescence of the authorities to the company's operations for a period of 13 years furnished sufficient authority. Mr. Matthewson said that so far as possible the electric lighting business and the gas business had been separated in this territory and that whatever rights with regard to the latter his company had acquired had been leased to the New York & Queens Gas Company.

Party-Line Telephone Systems.

A step-by-step party-line telephone system on the group plan has recently been patented by Mr. A. J. Farmer, of Detroit, Mich. The branches of the party line are all carried to some central point remote from the central office, where there is located a special step-by-step device for connecting the stations together as required. Currents working in unison over the two sides of the main line advance the switch, while currents over one side bring it back home.

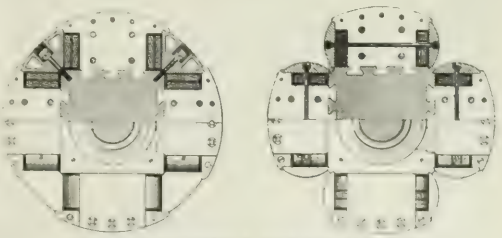
Private Use of Electric Automobiles.

The late Charles T. Hughes, who was always deeply interested in transportation, and who in the early eighties had charge of Mr. Edison's electric railway experiments at Menlo Park, became an automobile enthusiast during recent years, and up to the time of his death last week enjoyed nothing more than the use of his electric machine. The free locomotion that it gave him seemed to offset entirely the inertia that would otherwise have been inflicted upon him by invalidism. In an interview with the writer a few weeks before his fatal attack of pneumonia he said: "I have had an Edison storage battery in one of my cars for about four years. I was sick one year and did not use it very much, but I have used it three years every day, at least three hours, rain or shine. About four or five months ago I noticed that the voltage did not keep up, so I took it to the storage battery people. They discharged it, looked it over, and found that the batteries were a little out in some way and they fixed it up. With that exception, the battery is exactly just as good to-day as the day I put it in. I do not give it any attention myself. I have depended entirely upon a very ordinary, and I might say, ignorant, colored man, who has done everything with it that has ever been done. There has been absolutely no trouble to me. The man has done what was necessary. For eight months I was under the impression that the battery ought to be filled with distilled water every three weeks. I happened to look at the notice on the door of the garage at Llewellyn Park as to the care of Edison storage batteries, and saw it ought to be filled once a week. Then I changed my practice.

"I do not know how much mileage I could get. Of course I go up hill and down. I think my machine will make about 12 miles an hour. I have frequently been out four hours, and as much as 4½ hours, running all the time. I think I can get 50 miles easily on a level to-day."

Revolving-Field Magnet Structure.

In a patent granted to Mr. B. A. Behrend, on April 20, it is stated that the centrifugal stresses to which a revolving disk is subjected are greater at the center than at the edge and the maximum local stress is greatly increased when a hole is placed at the center of the disk. The inventor proposes to construct the revolving shaft of a high-speed generator so as to be free from all joints. The ends of the shaft are tapered so as to provide practically uniform strength to all parts, while the shaft itself is made of high-permeability steel and serves as a portion



FIGS. 1 AND 2.—BEHREND REVOLVING FIELD COILS.

of the magnetic path. The core is rectangular in cross-section and is provided with dovetailed slots for supporting the pole pieces, as shown in Fig. 1.

Fig. 2 shows a modified arrangement for which a second patent was issued to the same inventor on the same date. According to the latter arrangement, the field coils are held in place by slab-shaped plates bolted through the pole pieces; in the former, use is made of wedge-shaped pieces inserted between the pole pieces for supporting the sides of the field coils. In each case dovetailed end-pieces serve for supporting the ends of the field coils.

Meeting of the Arkansas Association of Public Utility Operators.

At the second annual meeting of the Arkansas Association of Public Utility Operators, held at Hot Springs May 12-14, practically all of the lighting and railway companies in the State were represented, and many supply dealers were also in attendance. Upon the opening of the first session, President D. A. Hegarty in the chair, Secretary J. E. Cowles rendered his annual report, in which he gave details of a publicity campaign during the past year, in which more than 3000 documents having relation to the legislative situation were distributed among the public utilities of Arkansas. President Hegarty followed with his address, in which he pointed out that the organization is unique in that its membership includes all of the public utility concerns in the State, private and municipal, with the exception of telephone companies. He made a plea for fair treatment of public utilities, and referred to the fact that during the legislative session just closed a number of measures were introduced including drastic and contradictory laws against public utility companies, every one of which, however, was defeated.

The first paper was presented by Mr. J. M. Hewitt, president of the Marianna Electric Light & Power Company, entitled "The Relation of Public Utilities to the Public." The author contested the right of the public to control over corporations to which it has granted franchises. He said that the public cannot claim the right to regulate the rates of utilities, for if their business is being operated upon a profitable basis the returns are largely because of economies introduced in the management, which in the case of government operation the public would not be able to obtain. The rates, he contended, regulate themselves, and tend to go down as the demand goes up.

Mr. S. F. Dibble, of the General Electric Company, presented a paper on "The Sale of Motors by Central Stations," in which he advocated that lighting companies should control the sale of motors to be placed on their circuits. He held that in the last analysis the sale of motors and all current-consuming devices is the province of the central station, and must remain so; but if any lighting company in a small town is inclined to co-operate with a local dealer, the latter should be required to exploit the particular make of motor selected by the company, while in larger places where there are several dealers, and where it is advisable to handle different makes, the central station should absolutely prevent the sale of motors not of the highest grade. The central station should be advised by the dealer of all prospective purchasers, should assist as much as possible, but should reserve the right to deal direct with the customer whenever deemed advisable. The central station is in a much more favorable position to sell motors than the dealer, for while the latter is actuated solely by the profit on the sale of the motor, the central station can have no reason for recommending a certain motor except the desire to furnish a machine which will give the most satisfactory service. He strongly advised the central stations to sell only one make of motor, and that made by the company which is spending dollars where other manufacturers are only spending cents in improvements in design and construction.

At the second session Mr. J. E. Cowles, electrical engineer of the Little Rock Railway & Electric Company, read a paper on "Tungsten Lighting." The question to him appeared to be not whether central stations can afford to introduce the tungsten lamp, but rather whether they can afford to reject it. Many companies are too apt to consider only the immediate effect on their income of a change, rather than the future effect through satisfaction to present consumers and inducements for obtaining new ones. The new lamp enables the central station to compete with gas, and it has met the former frequent objection to electric lighting as being too expensive. Mr. Cowles stated that the property with which he is connected has recently displaced gas in many residences by means of the tungsten lamp. He considered that the central station and not the contractor should supply the tungsten lamp, as the former can furnish them more cheaply. His company furnished the first installation at cost plus 10 per cent, and renewed at cost plus 5 per cent, which latter will always cover breakage if lamps are properly handled. In the case of a prospective customer using another illuminant, it has been found satisfactory to install tungsten lamps on 30 days' trial. As an illustration of the long life of the tungsten lamp, Mr. Cowles called attention to a 250-watt tungsten lamp in the hotel where the meeting was held that had been burning more than 5000 hours and was not yet blackened. It had been turned off but once since it had begun burning, and as there was an engine on the floor directly above it, the conditions were not ideal for long life. In the discussion which followed, Mr. George D. Rosenthal, of the General Electric Company, said that instead of small lighting companies having experienced a reduction in income through the introduction of high-efficiency lamps, the opposite was true, as these lamps had supplied a competitive weapon, and this, with the better service, had resulted in nearly every instance in a larger connected load. He recommended that central stations should handle or sell all high-efficiency lamps in order to secure the best results. He urged solicitors to talk better illumination and not lower bills when urging customers to use tungsten lamps.

Mr. W. H. Walkup, manager of the municipal plant at Searcy, read a paper on "The Operation and Management of Small Central Stations of 250-kw or Less," which went into the details of routine operation and business management. He strongly advised that the superintendents of municipally operated plants should be given much more latitude than is usually the case. He said that at present the control of such plants was usually monopolized by a board, much to the detriment of the plant. He also strongly favored meter rates for small plants, and pointed out in detail the objections to the flat rate. In the discussion several members criticized the conduct and service of municipal plants in Arkansas. A recommendation that all meter testing should be done at the plant was contested by Mr. Cowles, who said that wherever possible such testing should be done on the customer's premises. Mr. L. E. Gould, associate editor of the *Electric Railway Journal*, reviewed briefly the meter-testing rules of the Wisconsin Railway Commission, which body, among other things, required that all meters be tested on the customer's premises at stated intervals. Since this rule has been put into effect one company had found that the saving in former unmetered current had more than paid the wages of the meter employee necessitated by the rules.

In connection with the Question Box, the subject of buying coal on specifications was discussed. President Hegarty said that Arkansas coal contained from 15 to 20 per cent ash, and that if it were bought on specification a penalty or bonus could be fixed according to whether the ash contained was greater or less than the specified percentage. The Little Rock and Pine Bluff companies had tried to induce coal dealers to sell according to specifications based upon those of the United States Geological Survey, but the dealers refused because there was a market available which did not make such close scrutiny of the fuel. Mr. Hegarty suggested a penalty of 10 cents per ton for every increase of one-quarter of 1 per cent of sulphur. Concerted action on the part of public utilities in the State was urged, in order to bring force to bear on coal dealers, and a committee was appointed to study the situation and draft specifications. Mr. Fred T. Benson, of the General Electric Company, presented a paper on "Tungsten Sign Lighting," which referred particularly to the new 4-cp, 5-watt tungsten lamps of 10 to 12 volts, which are burned 10 in series on direct-current circuits, and used in multiple on alternating-current circuits, with a transformer having a 10-to-1 ratio.

The following officers were elected for the ensuing year: President, Mr. B. C. Fowles, general manager Pine Bluff Corporation; first vice-president, Mr. J. M. Hewitt, president Marianna Electric Light & Power Company; second vice-president, Mr. S. A. Stern, Home Water Company, Little Rock; third vice-president, Mr. C. T. Griffith, general superintendent Little

Rock Railway & Electric Company; treasurer, Mr. E. T. Hardin, superintendent Hot Springs Street Railway Company; secretary, Mr. J. E. Cowles, electrical engineer Little Rock Railway & Electric Company. It was announced that the next meeting would be held at Pine Bluff, Ark., in 1910, the exact date to be fixed later.

Nebraska Electrical Association Convention.

The Nebraska Electrical Association held its second annual convention of the electric light and power men of the State at the Millard Hotel, Omaha, May 11, 12 and 13. The second annual electrical show, promoted by the electrical interests of Omaha, was in progress at the Omaha Auditorium during this time.

The first session of the convention was called to order by President E. A. Bullock, of Norfolk, on Tuesday afternoon at 2.10. Mayor James C. Dahlman, of Omaha, give the address of welcome, which was replied to by President Bulllock. As Mr. William Bradford, of Lincoln, the secretary, was absent on account of sickness, Mr. T. H. Fritts, of Grand Island, was appointed secretary pro tem.

President E. A. Bullock in his address called attention to a misconception that had arisen in some quarters which was in effect that the association was an organization for raising or establishing uniform rates over the State. Such an object was impossible of attainment. The only object of the association is mutual improvement of member companies through exchange of ideas and information. On account of the high cost of coal in Nebraska, the solution of engineering problems in connection with central stations is not the same in many other neighboring States. Nebraska stations have also to deal with a more progressive class of consumers than some further east, which introduces other problems.

Mr. Bullock suggested that co-operation of the smaller stations might be practised to advantage as regards two matters. One of these is in trying out new devices. For one plant to try out all the new things is out of the question. But a new appliance coming out could be tried out in two or three stations and some other appliance in two or three more and so on, each station communicating its experience to the others and so accomplishing in a short time at small expense something that would otherwise cost much more. There is no reason why all should be buying experience of this kind independently. The other suggestion for co-operation attracted considerable attention and favorable comment later, which was that small stations combine in the employment of a contract agent or new business solicitor of high grade who would organize a department for serving all the companies participating.

Commenting on the action of the association last year in voting to take in municipal plants, he thought this action wise. He expressed himself strongly on the obligations that a franchise imposes on the company receiving it even though not definitely expressed in the document. One of these is that of giving adequate service and keeping up with the growth of the town. Another is that of giving reliable and continuous service. High rates he considered more dangerous to the owners of the plant than to the public, because they tend to restrict the number of consumers and gross revenue. As a matter of public policy, street lighting should be done at nearly cost. He called attention to the charge that in connection with the regulation of public service companies profits will be restricted to 6 per cent on the investment. If this is to be the rule, there is no more incentive to the owners of a private plant to show enterprise in developing the property and introducing economies in operation than in the case of a municipal plant. Whatever they do there is only 6 per cent for them. He asked the question: "Are we to settle down to a municipal-plant method of operation?"

Mr. M. P. Ellis, of the Holophane Company, read a paper on the "Relation of the New Prismatic Reflector to the New High-Efficiency Units." This was followed by a short discussion. Mr. William Bradford was on the program at this point for a paper on public service legislation, but on account of his illness Mr. B. C. Adams appeared in his place. He read at length from an address of Mr. Henry L. Doherty before the Wisconsin Gas Association last summer which appeared in these columns. This dealt mainly with the issue that there is a value in a public service property which is in addition to its physical or tangible value and which is not represented by the franchise value. This is the value put into the property by good management and enterprise and is represented in the ordinary business by good will and by the cost of organizing and starting the business and building up a force of employees and methods of conducting the business. Mr. Adams in conclusion said that in Wisconsin the public service companies were co-operating with the commission in all ways. He recommended that Nebraska companies keep posted on commission legislation proposed. There was considerable discussion of the public service commission bill which had failed to pass the last Legislature.

Mr. W. J. Scott, of Kearney, thought this matter of a public service commission one of the most vital issues before the convention. He pointed to the good working of the law in Wisconsin. The Wisconsin commission in cases brought before it would not allow a business to be conducted at a loss. In some cases an increase of rate had been ordered. A State commission stops the bickering that may occur between a company and a city council. The city council then has no right to say that a company shall not charge more than so much without regard to cost. Mr. Joel M. Roberts, of York, thought that a company would be more likely to get better treatment from a commission than from a city council. Mr. B. P. Egan, of Nebraska City, was favorable to the commission idea. Mr. H. A. Holdrege, of Omaha, thought it proper to delay endorsing a public service bill or the general idea. He was not favorable to turning over matters to the present Nebraska Railroad Commission as had been proposed. Mr. E. J. Sullivan introduced a resolution for consideration at a later session favoring a public service commission. Mr. B. C. Adams, of Lincoln, uttered a word of warning to the effect that everything depends on the kind of a public service bill adopted. A blind endorsement of anything bearing the name may make trouble.

President Bullock urged central-station men to "get the unfairness out" of their systems and then to proceed to secure such a public service commission as will be fair to everyone concerned.

The meeting adjourned to convene at the Electrical Show at 6 p. m., whence the party proceeded to Hanson's café where an elaborate banquet was served by the courtesy of the Omaha Electrical Exposition and the Omaha Electrical Club. The toastmaster was Mr. George W. Johnston, of the Johnston Electrical Company, of Omaha, president of the Electrical Exposition Company. Those responding to toasts were Messrs. B. P. Egan, of Nebraska City; Waldemar Michaelsen, city electrician of Omaha; Joseph Thomas, of the Capital Electric Company, of Denver; A. G. Munro, of the Nebraska Electric Company; E. J. Sullivan, of Omaha; Geo. D. Loring, of the Shelby Electric Company; F. H. Brooks, of the Lincoln Traction Company; Edward F. Schurig, of the Standard Electric Company; J. M. Gillan, manager of the Electric Show, and E. A. Bullock, of Norfolk, president of the Nebraska Electrical Association. The Elks' Quartet gave a number of selections between toasts which were well received.

Wednesday morning's session was opened with the appointment of an auditing committee and a nominating committee. Mr. L. J. Schwengel, of Holdrege, read a short paper descriptive of an absorption system ice plant that his company has placed in operation at Holdrege. This utilizes the exhaust steam of the light and power engines and is producing 25 tons of ice for each additional ton of coal over and above what the plant formerly used before the ice-making plant was installed. The reliability of these figures was questioned by some of the other members operating ice plants, although the superior efficiency of the absorption system as compared with the compression system of refrigeration was admitted. Mr. Fritts, of Grand Island, reported making four tons of ice to three tons

of coal with an independent steam-driven compressor. Mr. Bullock, of Norfolk, reported making five tons of ice to one ton of coal with an independently motor-driven compressor and furnishing steam for the reboiler in the ice plant.

Mr. E. A. Bullock gave an informal talk on economy of operation, taking as his text a letter recently received from a member on the importance of the percentage interest on investment as to the cost of production. He urged members to go slow about throwing out good and reliable apparatus to put in more economical apparatus. It is all right to put in economical apparatus when extending the plant for the purpose of carrying the greater part of the output, he said, but keep the old apparatus for emergencies and peaks. Considerable discussion followed.

At the Wednesday afternoon session Mr. E. J. Sullivan brought up the resolution favoring a public service commission. After some discussion this was tabled, as it was not considered advisable to commit the association without knowing the exact nature of the bill proposed, and the Legislature does not meet until after the next convention of the association.

On motion of Mr. H. A. Holdrege, of Omaha, it was voted to appoint a committee to consider the advisability of affiliating with the National Electric Light Association in accordance with recent changes in the rules of that body. The president appointed Messrs. H. A. Holdrege, of Omaha; B. C. Adams, of Lincoln, and B. P. Egan, of Nebraska City.

A paper was read by Mr. H. C. Porter, of Omaha, on new business-getting which, with the long discussion which followed, took the remainder of the afternoon.

The nominating committee submitted its report of nominations for officers for the coming year, and the following officers were elected:

President, Mr. B. C. Adams, of Lincoln; vice-president, Mr. Joel M. Roberts, of York; secretary, Mr. Frank McMaster, of Beatrice; treasurer, Mr. L. J. Schwengel, of Holdrege. Executive committee: Messrs. E. A. Bullock, of Norfolk; B. P. Egan, of Nebraska City, and W. J. Scott, of Kearney. The place of next meeting was discussed and invitations were received from both Lincoln and Omaha. The matter was finally referred to the executive committee. On special invitation from the chair, Mr. Frank McMaster, of Beatrice, gave an account of the work done at Beatrice recently in checking over customers' meters and looking over installations to see that they are getting the light that they should for the money.

The president-elect, Mr. B. C. Adams, is general manager of the Lincoln Gas & Electric Light Company. His early training in central-station work was received in connection with the properties in which Mr. Henry L. Doherty is interested. Before going to Lincoln he was connected in various capacities with the Madison Gas & Electric Company. In 1906 he went to Lincoln as superintendent of the electrical department of that company. In 1906 he served as secretary of the Northwestern Electrical Association. He is an able representative of the most modern type of central-station manager, schooled in methods of analysis which are calculated to get the most out of central-station investments.

Annual Convention of Indiana Telephone Men.

The fourth annual State convention of the Indiana Independent Telephone Association was held in the Claypool Hotel, Indianapolis, May 12 and 13. Supply men occupied one whole floor of the hotel. President C. S. Norton in his annual address, in reviewing the work of the year, said the association had largely increased its membership and that only a few of the 454 Independent telephone companies in the State remain unenrolled. The number of Independent telephones added during the year brought the total up to more than 221,000. Toll business has increased until the messages are averaging 100,000 a month, the receipts amounting to $23,000. This is an excellent showing from the 100 companies now in the Clearing House, which has been in operation since last August. Mr. Norton pointed out how a division of the toll was made on a mileage basis, the authority for making the rates being vested in the Clearing House Association. He warned the managers of telephone companies to prepare to come under the jurisdiction of a public utilities commission, which, he said, would certainly be enacted by the next Legislature and which he believed would be beneficial.

Secretary Allen J. Payton, in submitting his annual report, declared that the granting of a new 30-year franchise with increased rates to the Indianapolis Telephone Company had put new life and vigor into the Independent movement throughout Indiana, and assured that the Bell people would not gain control of the telephone business in Indianapolis—a central point essential to the Independents. The reports from the district vice-presidents, without a single exception, showed material improvement and gratifying increase in business.

The annual dinner was an enjoyable occasion to more than 200 telephone men and guests. The subjects on the program for after-dinner talks may as well have been left blank, since only a few of the excellent speakers stuck to the subject assigned. City Attorney C. D. Bowan declared emphatically for a single telephone system, where possible, under proper restrictions. This declaration brought out a hearty discussion by other speakers who universally agreed with Mr. Bowen provided the single system was the Independent system. Mr. James S. Brailey, Jr., who is at the head of the largest Independent companies in Indiana and Ohio, talked on "Telephone and Other Securities," and asserted that, compared with other public service companies, the Independent telephone companies have far less water in them, and as a rule the securities represent actual investments. He declared that the stability in earnings was sufficient to place and to keep telephone securities in more active demand than any other securities. He insisted that the strength of the Independent companies was found in the fact that they were home-owned—80 per cent of Independent telephone property and stock being owned by home people. Messrs. M. L. Clawson, Will R. Hough, A. J. Payton, E. M. Wasmuth, N. G. Hunter, Theodore Thorward and F. O. Cuppy made characteristic after-dinner talks, each taking occasion to declare the position of Independents safe and impregnable. Mr. James P. Goodrich presided as toastmaster with grace and dignity.

The morning session of the second day was opened by an interesting and instructive talk on "Telephone Laws and Legal Decisions," by Hon. Thomas E. Davidson. Mr. Davidson pointed out just what rights the companies had under a number of conditions and circumstances constantly arising. He advised telephone companies to employ good attorneys to advise and keep them out of trouble. "Extent, Limit and Rate for Party-Line Service" was a subject assigned to Mr. Thos. D. Sheerin. Mr. Sheerin, though a young man, made a good impression and is thoroughly familiar with his subject. He pointed out that the earnings of party lines were much greater than single lines when cost and maintenance were compared. He declared that it was generally admitted that country service was furnished at a less cost, and even though the party-line rate is lower, the country patron is better pay and in the end the party lines were the better revenue getters.

Mr. Walter J. Uhl read a paper on the advisability of paying for extensions out of earnings. Mr. Uhl said the practice is not a good one and is conducive to trouble, especially while the present low rate is maintained. He advocated that dividends be paid out of earnings, after the necessary reduction had been made for depreciation and repairs, and urged the safer plan of extensions being made by the sale of new stock rather than by bond issue. With proper capitalization and payment of dividends on it, telephone securities could thus be made standard, and a steady demand for them could be maintained. Mr. J. W. Coffey read a paper on "The Clearing House," giving in detail a full account of its organization, purposes and utility. Mr. Coffey declared that the clearing house was absolutely essential to the future life and prosperity of Independent telephony and predicted that within two years every company in the State would be a member.

The present officers, Messrs. C. S. Norton and J. W. Payton,

president and secretary respectively, were re-elected. The next annual convention will be held in South Bend, where the annual meeting of the Michigan Association will be held at the same time. Some of the sessions of the two bodies will be joint meetings.

The Successful Engineer.

In a recent paper Mr. F. C. Sargent, electrical engineer of the Malden, Mass., and several allied central-station companies, considered the elements of success of the engineer. A man who knows only how to do certain things, but does not know why they are done so, usually remains, he said, in a subordinate position. He must get the habit of analyzing and must also have his knowledge systematized. Imagination is also essential to the engineer—a constructive, creative imagination tempered by experience and good judgment. An engineer who cannot see beyond the present is not a safe guide.

One finds that the engineer who makes the biggest income and who occupies the most important and responsible position is the one who has the most business or practical knowledge. Our leading consulting engineers do not spend a large portion of their lives plotting curves, making tests or even making anything more than simple calculations. They spend their time dealing with large questions on purely commercial lines, and, as a rule, the bigger the engineer, the more he knows about practice and business, the less he knows about text-books and science. In his relations with his employer, the engineer must act in his capacity as an investigator, a counselor and a judge. It is his duty to his employer to keep himself informed as to the most modern methods of engineering, and if possible to show them wherein economies may be made. On the other hand, an engineer's employer should consult him in reference to all matters pertaining to engineering, such as standardization of apparatus, whether proper terms and amounts have been used in contracts, approval of forms, in reference to policy on changes of methods of manufacturing, distribution or new apparatus. These consultations should be with the executive heads as much as possible, as many times, when an engineer's recommendations are given second-handed, there may be some vital fact lost sight of that would make a great difference in the ultimate cost.

Instruction in Illuminating Engineering.

The May meeting of the Chicago Section of the Illuminating Engineering Society was held at noon on May 13 at a downtown hotel. After luncheon Vice-President George C. Keech, who was in the chair in the absence of Chairman J. R. Cravath, announced the appointment of a nominating committee to propose the names of officers for the Chicago Section to serve for one year from June, 1909. The members of this committee are Messrs. William E. Keily, M. E. Terbush and Charles A. Luther, People's Gas Light & Coke Company.

Prof. W. E. Barrows, of Armour Institute of Technology, Chicago, read a paper on the subject of "Instruction in Illuminating Engineering" at that institution. He first outlined the need of the illuminating engineer and the importance of the work, asserting that perhaps $25,000,000 a year is wasted in this country in uneconomical and inefficient systems of illumination. In September, 1907, a short course relating to the principles of illuminating engineering was established at Armour. It was given to senior students and consisted of notes of instruction, principally from technical magazines, supplemented by lectures. This course has been developed and enlarged, and is now offered as an elective to juniors and seniors in electrical engineering, and is chosen by about half of them. Professor Barrows described the present course and enumerated the laboratory equipment needed. In the development of this course considerable original work has been accomplished in working out constants for mathematical calculations and in other directions. These were described, with the aid of diagrams and tables, by the speaker, and his hearers approved the thorough manner in which the subject has been handled.

In the discussion Mr. Albert Scheible complimented Professor Barrows and his college on the high character of the work done in illuminating engineering, as shown by the paper. He asked if the course could be taken separately, say by architects. The answer to this was that it is the intention to give this course or a similar course to architectural students at Armour. The course will be available also for evening students. Mr. George H. Jones referred to an elementary course on this subject in the electrical engineering department of the University of Wisconsin as far back as 1896, and Professor Barrows said that he believed the University of Wisconsin, as well as Armour Institute, had a carefully worked-out course in illuminating engineering at the present time. So far as he is aware, no other technical colleges have similar courses now available for students.

The next meeting of the section will be held on June 10, at which time officers will be elected. It was decided by vote to hold this meeting at noon, as has been the case in the last two meetings, instead of in the evening.

CURRENT NEWS AND NOTES.

WIRELESS COURSE.—The Ohio State University will establish next year a regular course of instruction in wireless telegraphy and telephony.

CONVENTION OF WEST VIRGINIA INDEPENDENT TELEPHONE ASSOCIATION.—The fourth annual convention of the West Virginia Telephone Association will be held at Parkersburg, May 27 and 28. Mr. W. C. Handlan, of Wheeling, is president.

GOLD TELEGRAPH KEY.—The Washington delegation in Congress has presented to President Taft a golden telegraph key for use in opening, on June 1, the Alaska-Yukon-Pacific Exposition at Seattle. The key is adorned with gold nuggets from Alaska and has a base of Alaska marble.

NATIONAL FIRE-PROTECTION ASSOCIATION.—The thirteenth annual meeting of the National Fire-Protection Association will be held in New York City May 25-27. Among the reports to be presented will be one by Mr. C. M. Goddard as delegate of the American Institute of Electrical Engineers. Mr. Godderd will also preside at the meeting as president of the association. Mr. W. H. Merrill, of Chicago, is secretary.

GERMAN PATENTS AGREEMENT.—The patent agreement between this country and Germany, which was signed at Washington Feb. 23, has passed the second reading in the German Reichstag. In the debate on the measure it was stated that the Americans reaped the greater advantage from it, as no compulsion to work patents existed in the United States, while under the agreement Americans are released from the German compulsory clause. Whether the United States later would introduce compulsory working was, it was stated, uncertain, but the agreement presented the possibility that Germany might secure some advantage which it hitherto did not possess.

"SINGING SPARKS."—Professor Slaby and Count von Arco, of the German Telefunken Wireless Telegraph Company, have, according to a cable dispatch, perfected a new system of wireless telegraphy, which is stated to consist in sending out the vibrations which form the messages as pure musical tones, which are capable of being heard by the receiver, no matter how softly they may be attuned. It is claimed by the inventors that by means of this device it will be possible for the first time since the wireless telegraphy was established to maintain communication in spite of the most violent atmospheric disturbances. Another advantage claimed is that it will be possible to work with much smaller antennæ for the aerial wires by which the energy is absorbed. In an interview in a New York newspaper, Prof. M. I. Pupin said that the new system should also greatly increase the range of wireless telephony.

FAST GAS METERS.—Of the gas meters tested during the month of April by the New York City Public Service Commission, 50.2 per cent were found to over-register. Of the electric meters 14.1 were found too fast and 5.9 per cent too slow.

INDIANA MUNICIPAL LEAGUE.—The fourth annual meeting of the Indiana Mutual League will be held at Lafayette, June 22-24. The program prepared by Secretary J. L. McNary, of Logansport, includes a number of subjects relating to municipal lighting and kindred public service questions.

PUBLIC-UTILITY TESTING AND ACCOUNTING.—The University of Wisconsin will give a six-weeks' summer course in testing electric, gas and water service, and also a course of the same length in public-utility accounting. As the university is co-operating with the Railroad Commission of Wisconsin in its work, it has special facilities for instruction on the above subjects.

COLCHESTER PAGEANT.—For several years historical celebrations known as "pageants" have been the rage in Great Britain, the functions being organized on a large scale and frequently involving great expense for settings, costumes, etc. Among those for the present year will be one at Colchester, June 21 to 26, with 3000 performers, in which Gilbert will figure as a historical character and have his achievements narrated by the chorus.

WATER-POWER DEVELOPMENT DATA.—The U. S. Geological Survey has issued a "List of Publications of the United States Geological Survey Relating to Water Resources" which includes a number of papers relating to water-power development. These papers are available through application to the Director of the U. S. Geological Survey, Washington, D. C. If the free supply has been exhausted, they can usually be secured at a nominal price from the Superintendent of Documents, Government Printing Office.

UNLIGHTED CITY STREETS.—The city of Bucyrus, Ohio, has been in darkness for several weeks. The street-lighting contract expired on May 2 and the company refused to continue to light the streets, pending the completion of a plant by another company which secured the contract, unless the city would enter into a contract for the time desired. This the Council refused to do and the plant was closed down. Owing to the fact that the annual convention of the national body of the King's Daughters is to be held this week, the town is in an awkward position.

TELEPHONE RATES AT JAMESTOWN, N. Y.—Mayor Samuel A. Carlson, of Jamestown, N. Y., has vetoed the resolution of the Common Council of that city authorizing the Home Telephone Company, of Jamestown, to raise its rates, as announced in the issue of May 6. A two-thirds vote is required to pass a resolution over the Mayor's veto. Mayor Carlson's contention is that before the telephone rates are increased the people should first be given an opportunity to vote on the question of the purchase of the company's plant by the city for municipal operation.

WIRELESS EXPERIMENTS.—As previously noted, a series of experiments will be conducted at Brant Rock, Mass., prior to the final award of the navy contract for a wireless equipment having a radius of 3500 miles. The experiments will begin the middle of June. Brigadier General James Allen, chief signal officer of the army, and several officers of that corps will be present in the interests of the army, and Lieutenant-Commander Cleland Davis and Lieutenant George C. Sweet, of the Bureau of Equipment of the Navy, will represent the naval service. The series of experiments to be carried on will include both wireless telephone and telegraph.

JUNE MEETING ILLUMINATING ENGINEERING SOCIETY.—The next meeting of the New York Section of the Illuminating Engineering Society will be held June 10 in the Engineering Societies Building, 29 West Thirty-ninth Street. Two papers will be presented as follows: "The Evolution and Development of the Flaming-Arc Lamp," by Mr. L. J. Auerbacher; "The Illuminating Efficiencies of Various Types of Lighting Installations," by Mr. E. B. Rowe. The last-mentioned paper has been prepared particularly for installing engineers, contractors and salesmen.

INTER-DEPARTMENT BASEBALL LEAGUE IN CHICAGO.—Among the 2500 employees of the Commonwealth Edison Company, Chicago, there are enough baseball enthusiasts to afford ample material for an inter-department league. Such an organization has been formed with Mr. John W. Ferguson, assistant general contract agent, as president. Thus far six departments of the company have entered baseball teams in this league. These are the statistical, operating, treasury, contract, inspection and meter departments. Championship games will be begun on June 5, and the schedule runs to Sept. 25. Mr. George F. Long will act as press agent for the league.

TWELVE THOUSAND-VOLT TRANSMISSION IN CHICAGO.—Heretofore the standard potentials for transmission for the Commonwealth Edison Company, Chicago, have been 9000 volts to 20,000 volts, but it is planned to introduce 12,000-volt transmission, and the new Troy Street substation, to which reference was made recently in the *Electrical World,* will be a transformer substation, stepping down 12,000-volt, 60-cycle energy from the Quarry Street generating station to the standard 2300-volt potential for distribution. The 12,000-volt energy will be obtained at first by means of a 5000-kw motor generator to be installed at Quarry Street this summer, but later on generators producing 12,000-volt, 60-cycle energy direct will be installed.

NAVAL WIRELESS TELEGRAPH EXPERT WANTED—The United States Civil Service Commission will hold an examination June 9 to fill a vacancy in the position of wireless telegraph expert in the Bureau of Equipment, Navy Department. The salary is $3,000 per year. The duties of the appointee will be as follows: To have charge of the laboratory tests of all instruments and apparatus pertaining to wireless telegraphy; the standardization of circuits and instruments used in wireless; the development of special apparatus and methods of wireless signaling suited to special conditions, and of new forms of sending and receiving circuits; to inspect the various wireless stations and to make the necessary measurements of their electrical constants; to carry on quantitative experimentation and original investigation in wireless telegraphy, and, in general, to carry out such work as may be necessary for the development of the science.

A QUICK SHIFTING OF SUBSTATION EQUIPMENT.—It became necessary recently to move the entire equipment of the rotary converter for railway service which had been installed in the north end of the White City (Sixty-third Street) substation, Chicago, to the Fernwood substation on Michigan Avenue near 103d Street. The outfit consists of one 300-kw rotary, three step-down transformers, one oil switch, one complete alternating-current switchboard and one complete direct-current switchboard, the total weight being about 50,000 lb. Orders were given to the construction department to make this removal on a Thursday and shortly after midnight on Friday the equipment was loaded onto flat cars of the Chicago City Railway Company at White City and was taken to Fernwood, a distance of about eight miles by track. On the following Tuesday the machine had been installed for service and was furnishing electricity to the railway line. The operation also included the removal of several 2300-volt oil switches at the Fernwood substation to make room for the new equipment.

Divided-Fall Hydro-Electric Developments on the Hoosic River.

ONE of the most effective schemes for overcoming the inherent disadvantages of fluctuating stream flow in hydro-electric developments is to be found at Johnsonville and Schaghticoke, N. Y., where provisions have been made for storing water when it is plentiful and using it with the minimum of waste during the dry season. A reservoir six miles in length along the valley of the Hoosic River has been formed by erecting a concrete dam approximately 500 ft. in length and 40 ft. high at

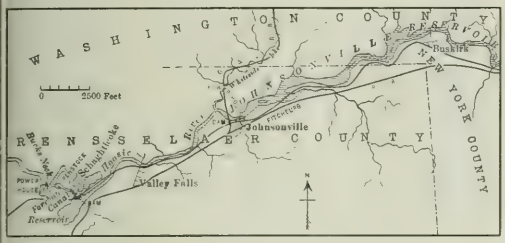


FIG. 1.—JOHNSONVILLE AND SCHAGHTICOKE HYDRO-ELECTRIC DEVELOPMENTS.

Johnsonville, about 20 miles northeast of Schenectady, N. Y. This reservoir is capable of storing an amount of water sufficient to operate 5000 hp in turbines under a 35-ft. head continuously for one month during the dryest season, although the stream flow may decrease to one-half of this value. However, the 40-ft. fall in six miles of stream at Johnsonville is not the greatest on the Hoosic, because from Schaghticoke to a point about one mile down stream the fall is approximately four times as great, or sufficient to operate 20,000-hp in turbines. Moreover, the river takes a circuitous route below Schaghticoke so that the actual straight-line distance from this place to the point just mentioned is less than 2500 ft. It was found advantageous, therefore, to store the water at Johnsonville and arrange to use 5000 hp at that point and to utilize the same water in separate turbines to obtain 20,000 hp at Schaghticoke.

In order to carry out the above plans there has been constructed at Schaghticoke a concrete dam for diverting the



FIG. 2.—JOHNSONVILLE POWER HOUSE DURING CONSTRUCTION.

stream into a canal leading into a forebay, which feeds the water as desired into the penstock for the Schaghticoke turbines. During low-water periods the Johnsonville turbines will be run as water may be needed in the forebay, no water being allowed to escape from the storage reservoir to the lower reservoir until it has been robbed of its energy for the turbines. The relative amount of load to be carried by the Johnsonville plant will be determined by the relative depth of water in the Schaghticoke reservoirs and forebay. In any event, however, the Johnsonville plant will operate at a high efficiency because each generator can be given constant full load whenever it is in use, the fluctuation in demand being handled by the Schaghticoke generators.

A view of the Johnsonville power house and sluice gates in

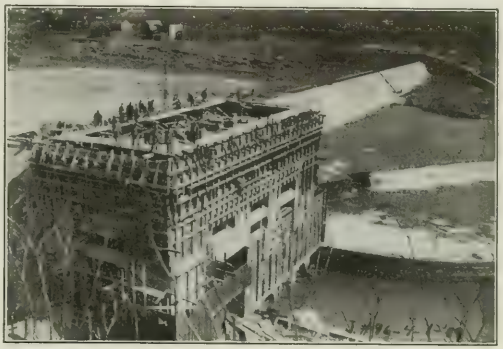


FIG. 3.—JOHNSONVILLE DAM AND POWER HOUSE NEARING COMPLETION.

the dam during construction is given in Fig. 2, while Fig. 3 shows the remaining section of the dam. The building is a single-story, concrete structure with end rooms for holding the transformers, switches and protective devices. It contains two 1800-kw alternators directly connected to 2500-hp, horizontal shaft S. Morgan Smith turbines. Each turbine is provided with two separate sets of runners and guides so arranged that the end thrust is balanced. The governors for the turbines are of the Lombard oil-actuated type, gear connected to the gate-opening mechanism. The turbines are placed external to the generator room in a concrete compartment connecting through submerged arches to the storage reservoir. Adjacent to these arches is arranged a chute in the dam, so that no trouble is expected from floating ice; the usual iron racks serve for preventing floating débris from entering the turbines.

The alternators are three-phase machines wound for 4400 volts and 40 cycles, and each is provided with a 110-volt exciter

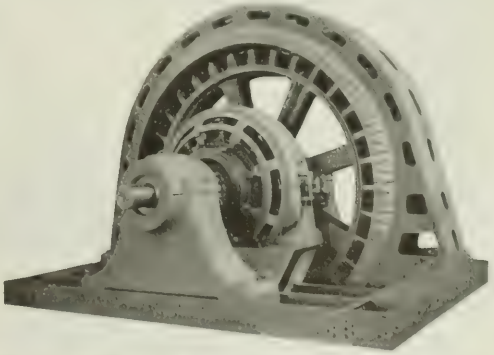


FIG. 4.—ALTERNATOR WITH SELF-CONTAINED EXCITER GENERATOR.

mounted on its shaft. Each exciter is a 60-kw interpole machine; it is capable of supplying power for the station lamps, operating the control motors and furnishing excitation for both alternators when necessary.

Each alternator is directly connected through solenoid-operated, oil-insulated switches and knife-blade disconnecting switches to the primary circuit of an 1800-kw, three-phase, water-cooled transformer. The solenoids for operating the

switches are brought into action by means of definite time-limited relays energized by series transformers. Although it is not the expectation to parallel the transformers on the primary sides, yet means are at hand for doing so if desired, on account of the fact that either generator or both may be directly connected to a local 4400-volt, three-phase circuit which will distribute energy for mill purposes in Johnsonville. The 32,000-volt leads of the transformers pass through oil switches operated by 110-volt motors governed by inverse time limited series relays. A set of 32,000-volt busbars allows the secondaries of the transformers to be parallel for connection to the outgoing line. Horn-gap lightning arresters are connected to the neutral point through three aluminum cell arresters, the neutral point being in turn joined to earth through a fourth electrolytic cell. The horn-gaps are placed on the roof of the station, leads passing through and from them by way of double-petticoated porcelain roof bushings. On account of the presence of the horn-gaps the aluminum cells are not directly connected to the lines; hence there is no continuous loss of energy in the arresters and they have no tendency to become warm. However, the films upon which the action of the arresters depends would slowly become dissipated if the cells remained disconnected, so that provision is made for short-circuiting the gaps once per day for maintaining the films in operating condition. A change-over switch allows the connections of two of the four cells to be interchanged at will in order that the film of the cell joining the neutral point and earth may be kept in proper condition.



FIG. 5.—A VIEW SHOWING THE SCHAGHTICOKE DAM FROM BELOW.



FIG. 7.—UPPER SLUICEWAY IN DAM SHOWING ICE PASSING OVER DAM DURING WINTER FLOOD.

The main transmission line from the Johnsonville station is a 32,000-volt, three-phase, No. 2 copper circuit for connecting the Johnsonville transformers in parallel with the transformers at Schaghticoke. This circuit, which leaves the building through three plate-glass windows, is carried on steel lattice-work towers arranged for supporting the three wires in a horizontal plane. Each wire is held in place by means of two 25,000-volt disk insulators joined in series.

The water which passes through the Johnsonville turbines or over the dam at this place is allowed to follow the natural bed of the Hoosic River to Schaghticoke, where it enters a reservoir formed by the dam shown in Fig. 5. This dam has been given an upstream bow on account of the normal contour of the river bed at this point to obtain extra length of spillway. It varies in height with the irregularities of the bed but averages about 25 ft. with a 25-ft. width of base. The down-stream side is given such a curvature as to deliver the overflow water with the least amount of vertical velocity, while the upstream side is perpendicular, as noted in Fig. 6.

At the lower end of the reservoir there are placed 10 hand-operated gates; two of these allow the reservoir to be drained when necessary, while the others admit water to the forebay.

The forebay is formed largely of earthen embankments. At the lower end, however, the concrete structure shown in Fig. 8 has been erected for admitting water into the penstock and eliminating ice and debris. The water is conveyed from the forebay to a surge tank by means of a ⅜-in. sheet-steel penstock 12.5 ft. in diameter. This penstock, which is about 90 ft. long, is supported on concrete piers with the exception of a 400-ft. section, which is on semi-circular, steel supports forming a bridge structure across the Hoosic River, as seen in Fig. 10.



FIG. 6.—GATES FOR ADMITTING WATER TO THE FOREBAY AT SCHAGHTICOKE.



FIG. 8.—LOWER SLUICEWAYS IN THE SCHAGHTICOKE DAM ON THE HOOSIC RIVER.

A view of the surge tank is given in Fig. 11. This tank, which has been placed at a point below the hydraulic level of the forebay, will permit water to rise in it without overflowing in case of an excess pressure at the turbines by a too rapid closing of the gates. From the surge tank four 6-ft. sheet-steel pe-

stocks pass to turbines for driving alternators, while one 2-ft. penstock is installed for supplying water to two exciter turbines, four water-cooled transformers and other devices in the generating station. No valve is provided at the surge tank for the 2-ft. penstock, but each of the other penstocks is equipped with a valve driven by a 250-volt, 7.5-hp motor remotely controlled in which a hydrostatic pressure of 150 lb. per square inch is maintained by means of reciprocating pumps driven by 12.5-hp, 250-volt, direct-current motors. For the purpose of synchronizing the alternators and dividing the load properly between them when they are joined in parallel, each governor is equipped with a direct-current motor for varying the fulcrum of



FIG. 9.—RACKS AT THE ENTRANCE TO PENSTOCK AND GATEWAY FOR DIVERTING FLOATING ICE AND DEBRIS.



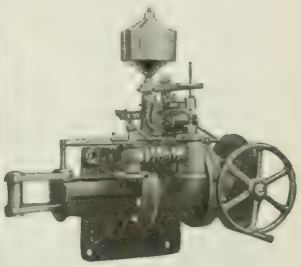


FIG. 10.—SUPPORTS FOR 12-FT. PENSTOCK ON SPAN OVER THE HOOSIC RIVER. FIG. 13.—MOTOR-CONTROLLED GOVERNOR OF WATER-WHEEL.

from the station. An indicating device in the station, employing three lamps, serves to show when each valve is open, partly open or closed.

The main turbines, of which there are four, are Pelton-Francis vertical-shaft machines rated at 5000 hp under a head of 146 ft. with a speed of 300 r.p.m. It is said that these turbines operated at an efficiency of 85 per cent when tested recently. Details of the turbine, governor and alternator are shown in the sectional elevation of Fig. 12. The turbine set is equipped with an oil-lubricated roller bearing at the top and two guide bearings along the 11-in. shaft. The oil for the

the lever of the centrifugal mechanism which determines the speed at which the oil valves will be opened or closed. The governor motors are controlled remotely from the switchboard gallery which overlooks the generator-room. Fig 13 gives a



FIG. 11.—SURGE TANK, PENSTOCKS, GENERATING STATION AND TRANSMISSION LINES.

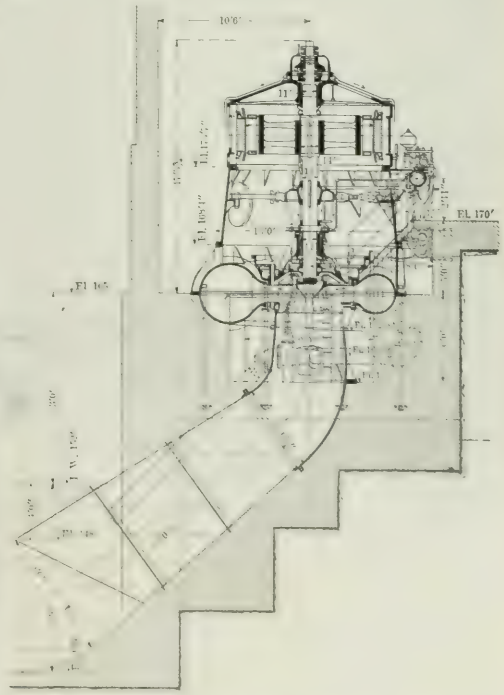


FIG. 12.—CROSS-SECTIONAL ELEVATION THROUGH TURBINE AND GENERATOR.

bearings is circulated by means of a belt-driven pump which furnishes oil to the upper roller bearing from which it flows by gravity to the guide bearings.

The speed of each turbine is regulated by an oil-actuated Pelton governor rated at 15,000 ft.-lb. Oil for the governors is taken from two storage tanks provided with air cushions

view of the governor mechanism, which can be adjusted by hand when desired. The oil under pressure is admitted to one end or the other of a cylinder, the position of the piston in which regulates the opening of the gates admitting water to the turbine runner.

As will be seen from Figs. 12 and 14, the alternators are of

the revolving field type. Each is a 3000-kw, three-phase machine designed for 4400 volts. Being built with 16 poles, it delivers 40-cycle current when running at 300 r.p.m. The combined efficiency of the turbine and generator at full load is about 82 per cent.

The three 4400-volt leads from each generator are laid in fiber conduits which convey them through series transformers, solenoid-operated oil switches, and disconnecting switches to a set of 4400-volt busbars, which are equipped with sectionalizing switches.

The leads, oil switches, operating solenoids, disconnecting switches, busbars and sectionalizing switches are located immediately below the switchboard gallery, as indicated in Fig. 15. The series transformers work through definite time-limited relays to close the circuits of the solenoids, which receive energy from the station's 250-volt, direct-current circuits.

From the 4400-volt busbars, circuits pass through four 3000-kw transformers for increasing the e.m.f. to 30,000 volts, which is impressed upon a second set of busbars arranged in a room above the switchboard gallery. The scheme of connection shown in single, instead of triple, circuit is illustrated in Fig. 17. The 4400-volt feeders supply energy in Schaghticoke for operating the DuPont Powder Mill, the Cable Flax Mills, the Empire Grist Mill, and for village lamps, including 40 40-cp, 12-volt, 4-amp, constant-current series tungsten street lighting units. Moreover, energy is supplied at 110 volts through two 50-kw, single-phase transformers for the station lamps, which include carbon-incandescent lamps and six carbon-arc lamps. In addition to the circuits shown in Fig. 17, an incoming 32,000-volt circuit receives energy from the generators at Johnsonville.

Only low-tension circuits pass to the switchboard, although all of the station circuits are represented on the board by means of leads from series and shunt instrument transformers. The wiring of the board is well illustrated in Fig. 16, which shows also the field rheostats for the exciter generators.

The exciter generators are 150-kw, 250-volt, interpole, direct-current machines, provided with commutators held in place by shrink rings. Each generator is driven at 600 r.p.m. by a 250-hp horizontal-shaft, Pelton-Francis turbine. The direct-current generators supply energy not only for the field circuits of the generators, but also for the various control motors connected with the station, for certain emergency station lamps, and for a 20-ton Alliance Machine Company crane.

There are four main transformers, each of which is an oil-insulated, three-phase unit rated at 3000 kw. The transformers are placed in individual fireproof compartments separated from the generator-room by iron doors. Each transformer is equipped with three 1.25-in. cooling coils through which water flows continuously from the exciter-turbine penstock. Provision is made for removing the oil rapidly from the transformer through a 6-in. pipe into a special tank when desired. Moreover, the transformers are placed on wheels so that they can be drawn into the generator-room under the crane when repairs become necessary.

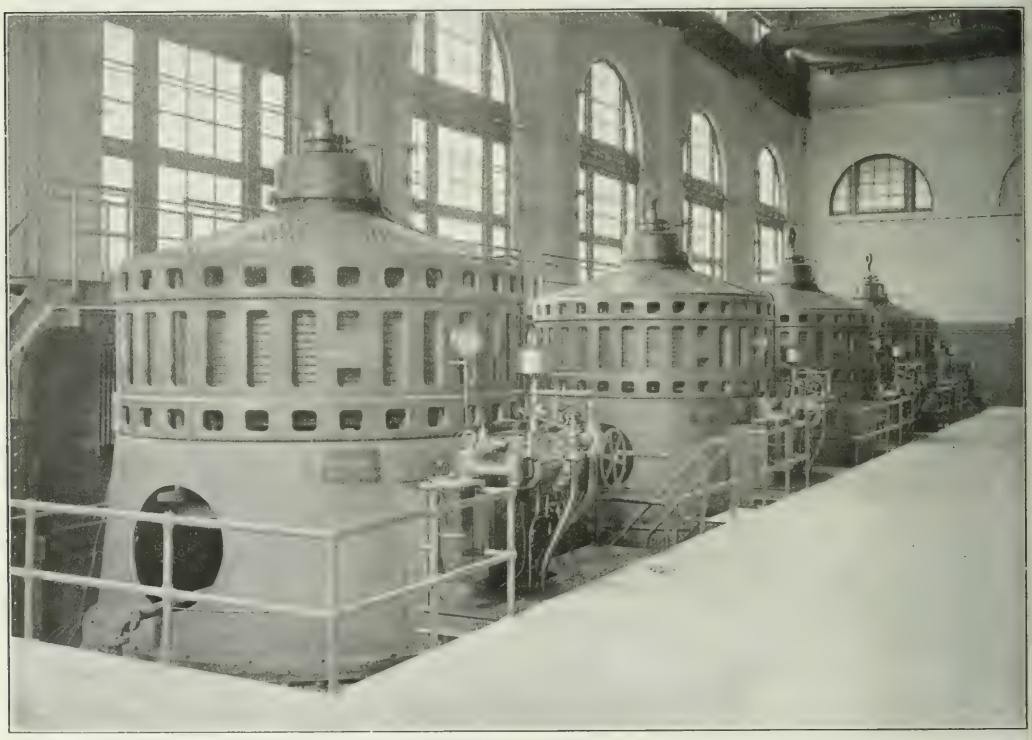


FIG. 14.—GENERAL VIEW OF ALTERNATORS.

The arrangement of the lightning arresters and outgoing circuits from the building is similar to that used at Johnsonville, except that the main leads pass upward through the roof by way of porcelain bushings rather than through the side wall. The six bushings, three horn-gaps and three disk-strain insulators for one of the three three-phase, 32,000-volt lines are illustrated in Fig. 18. As noted previously, one circuit connects with the Johnsonville station; the other two form No. 3-0 copper cable transmission lines for delivering energy to a substation at the works of the General Electric Company, at Schenectady, 18 miles distant. The two three-phase circuits

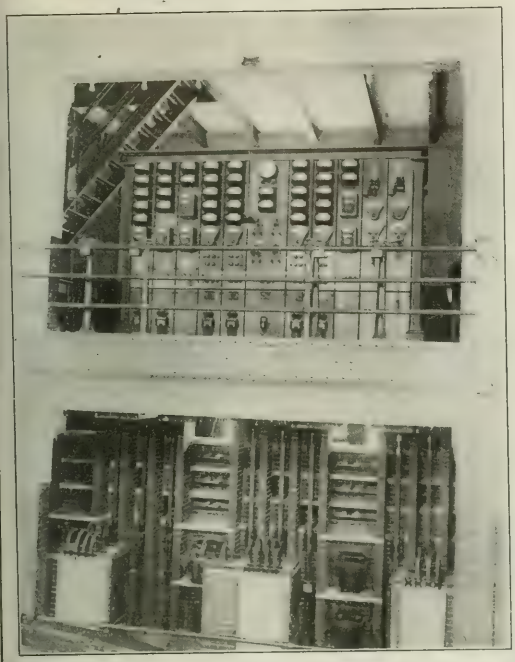


FIG. 15.—SWITCHBOARD AND 4400-VOLT CIRCUITS IN SCHAGHTICOKE STATION.

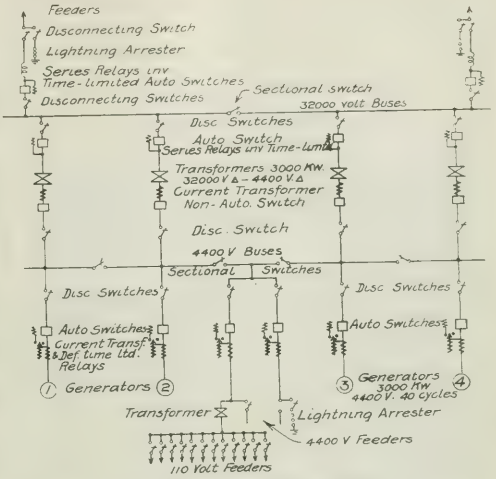


FIG. 17.—DIAGRAM OF CONNECTIONS.

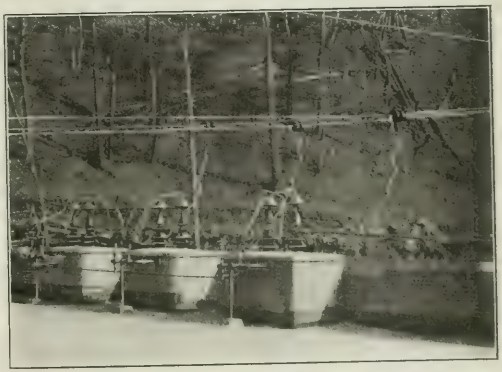


FIG. 18.—ONE OF THE LINES LEAVING SCHAGHTICOKE STATION SHOWING HORN GAP ARRESTERS.

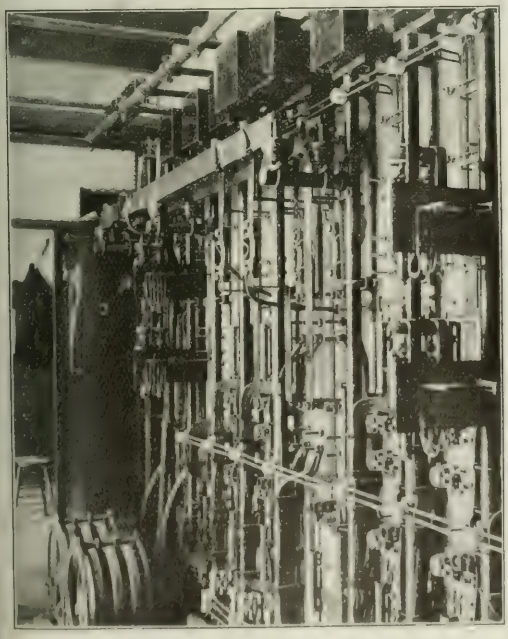


FIG. 16.—REAR OF SCHAGHTICOKE SWITCHBOARD.



FIG. 19.—GENERAL VIEW ALONG TRANSMISSION LINE.

are carried on a single line of steel towers, although for the first span leaving the building twin poles were provided, as shown in Fig. 11. This span is dead-ended against six anchor poles located on the hillside at the rear of the station, the disks shown in Fig. 18 serving as strain insulators in this span. The six wires are here arranged in a horizontal plan, while along the remainder of the pole line they are placed and Sanders Lake near Schenectady. Three special towers 96 ft. in height were required near Schenectady, while the standard 76-ft. towers were suitable for the span across the Hudson. Additional special heavy towers were required at points where the line changed direction abruptly. As shown in Fig. 22, the angle towers are substantially braced, while the wires are held in place by duplicate sets of strain insulators.

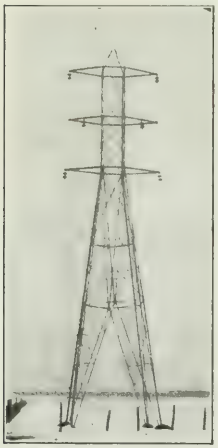


FIG. 20.—PARTIAL TRANSPOSITION.

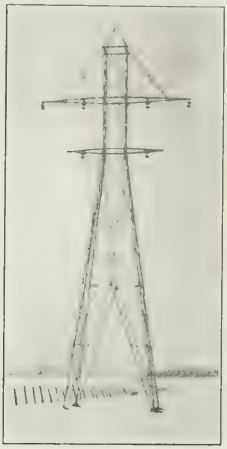


FIG. 21.—TRANSPOSITION TOWER.

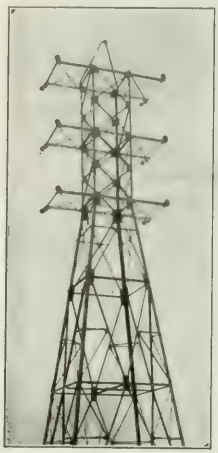


FIG. 22.—ANGLE TOWER, WITH STRAIN INSULATORS.

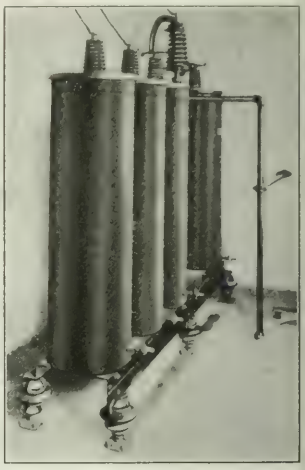


FIG. 24.—ALUMINUM-CELL ARRESTER WITH CHANGE-OVER SWITCH

in two vertical planes—one for each three-phase circuit—as shown in Fig. 19. Of the 197 towers between the generating station and the substation, 12 are for partial-transposition (Fig. 20), and 6 are transposition towers (Fig. 21). At each transposition point the wires are given one-third of a turn helically, so that there are two total turns throughout the route. The straight-line towers are 51 ft. in height to the lowest cross-arm, the cross-arms being separated by 10 ft. Each tower is extended above the upper cross-arm for supporting a ⅜-in.

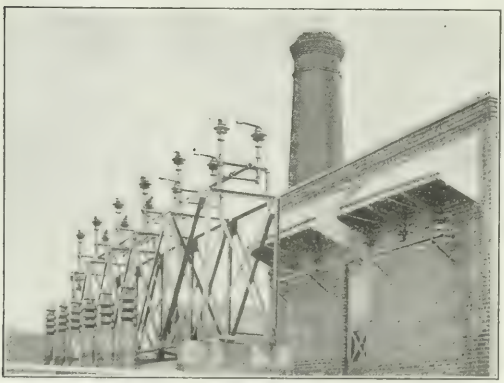


FIG. 23.—DUPLICATE THREE-PHASE CIRCUITS ENTERING SUBSTATION AT SCHENECTADY.

steel cable used as a grounded wire for protection from lightning. The individual circuits are separated by about 17 ft. and are held in place by two porcelain disk suspension insulators similar to those used on the Johnsonville line.

Where the natural surroundings will permit, the towers are given a 600-ft. spacing; however, spans twice this length were necessary when crossing the Hudson River near Schaghticoke

At each railroad crossing an uninsulated angle-iron bar, with upturned ends, is placed below each pair of wires so that any broken wire will be "grounded" before it can cause danger to life.

Two No. 6 galvanized-iron wires transposed at every tower have been erected for telephone service. To eliminate all danger from the high-tension wires, the telephones are connected to the iron wires by means of insulating transformers.

At the Schenectady substation the six transmission lines enter the building through petticoated porcelain roof bushings, as shown in Fig. 23. In shunt to these circuits are two three-phase lightning-arrester equipments arranged with horn-gaps and aluminum cells similar to those used at Johnsonville and Schaghticoke. The horn-gaps with short-circuiting mechanism are illustrated in Fig. 22, while the aluminum cells with change-over switch for charging the fourth cell—as explained previously—is shown in Fig. 24. With the exception of the grounded wire along the whole line the aluminum cells are the only lightning protective devices used in conjunction with the circuits.

An unusual feature of the above equipment is the frequency, namely, 40 cycles. This value was chosen in order that the new equipment can be paralleled with the older equipment receiving energy from a steam plant at Schenectady and a water plant at Spiers Falls and Mechanicville these three plans furnish energy for the General Electric Company, the Schenectady Illuminating Company and for operating the Schenectady railways. This value of frequency is preferable to 60 cycles for rotary converters and better than 25 cycles for general illumination.

The above-described hydro-electric equipments are owned by the Schenectady Power Company, of Hoosic Falls, the officers of which are: President, George E. Greene, Hoosic Falls; vice-president and general manager, Howard W. Starr, Schenectady secretary and treasurer, H. R. Leyden, Troy; manager, E. B Doen, Schaghticoke. The consulting engineers were Messrs Viele, Blackwell & Buck, New York. The electrical equipment was supplied by the General Electric Company, while the transmission line towers were built by Milliken Brothers, of New York.

A Graphical Study of Self-Induction.

BY F. P. MCDERMOTT, JR.

THE transient phenomena occurring in circuits containing self-inductance are usually studied by means of differential equations. In this article, however, a certain type of problem is treated graphically. The method employed enables curves to be plotted quickly, and may be understood without a knowledge of calculus.

The type of problem here discussed is defined by the conditions that only one inductive resistance occurs in the combination of circuits studied, that this possesses a self-inductance which is independent of the current through it, and that it is possible to express the relation by the equation $e = p\,(I - i)$, where

e = the e.m.f. of self-induction at any instant.
i = the current at the same instant,
p = a constant, depending on the resistances, and
I = a constant depending on the resistances and the applied e.m.f.

In addition to the above notation, the following is used:
E = the e.m.f. applied to the circuit, or combination of circuits,
L = the self-inductance,
R = the resistance.
a = the rate of rise of current.
t = time.
$k = p \div L$.

The prime and double prime symbols are used where the circuit is divided, in order to indicate to which branch a quantity belongs.

The subscripts 0, 1, 2, etc., are used to connect other quantities with the various values of i, that is, when $i = i_0$ $t = t_0$, etc.

The units used are volts, amperes, ohms, henrys, seconds and amperes per second. The curves are plotted according to the usual practice, in which the X axis represents time, and the Y axis, current. From the definition of the henry

$$e = aL \qquad (1)$$

When the current is rising, a is positive and, therefore, equation (1) as written, gives e a positive value for rising current; when the current is rising, e has that direction which opposes the current. The positive direction of e is therefore defined as that direction which opposes the current. In the problems here discussed $e = p\,(I - i)$. Equating this with the value of e given in (1), dividing by L and substituting $k = p \div L$,

$$a = k\,(I - i) \qquad (2)$$

To construct the time-current curve, having given the values of I and k, and the initial value i_0 of the current, proceed as

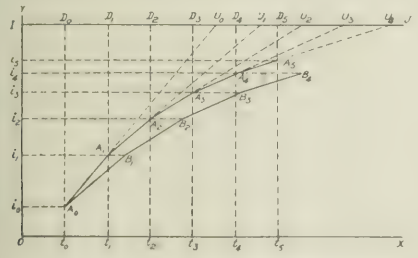


FIG. 1.—EARLY AND LATE CURVES OF CURRENT INCREASE.

follows: Draw the co-ordinate axes OX and OY, Fig. 1. Select a suitable current scale and draw the indefinite horizontal line IJ, at a height representing I amp. If some definite value of t, say t_0, has been assigned to the time at which i has the value i_0, locate the point A_0 in the position corresponding to these values. The scale for i was determined when IJ was drawn, but the scale for t must also be settled before locating this point unless $t_0 = 0$. Generally no particular value of t_0 is found, in which case it is convenient to let i_0 occur at the time $t = 0$. A_0 may then be located without previously determining the scale of time. Draw the ordinate t_0 (which coincides with the Y axis when $t_0 = 0$), passing through A_0 and meeting IJ at D_0. From equation (2) it is seen that the current rises at the rate of $k\,(I - i_0)$ amp per second when i has the value i_0. That is, $I - i_0$ amp in $\frac{1}{k}$ seconds. Locate U_0 on the line IJ, to the right of D_0, so that $D_0U_0 = \frac{1}{k}$ seconds. If the time scale has not previously been determined, a scale should now be selected which will give U_0 a convenient location. Join A_0 and U_0. The line A_0U_0 represents a rise of $I - i_0$ amp in $\frac{1}{k}$ seconds, which is the rate at which the current is rising when it has the value i_0. Since i_0 and t_0 do not enter in the expression $\frac{1}{k}$, giving the length D_0U_0, it follows that the corresponding line for any other value of i has the same length. This fact is the basis of the construction here employed. Assume that A_0U_0 represents with sufficient accuracy the time-current curve until after the instant t_1. Draw the ordinate t_1 meeting A_0U_0 in A_1 and IJ in D_1. Locate U_1 on the line IJ, to the right of D_1, so that $D_1U_1 = D_0U_0$. Draw A_1U_1. Then A_1U_1 represents the rate at which the current increases when it has the value i_1. Assume that this represents the time-current curve with sufficient accuracy until after the instant t_2. Draw the ordinate t_2, thereby locating the point A_2, and proceed in a similar manner to find the points A_3, A_4, etc. Then A, A_1, A_2, A_3, etc., is the time-current curve required.

There is an error in this construction which may be made as small as desired by taking the instants t_0, t_1, t_2, etc., sufficiently close to one another. These instants are here selected so as to make the diagram easily understood, but at the sacrifice of accuracy. The possible magnitude of the error may easily be determined. The point A_1 is located by assuming that the current changes from the value i_0 to the value i_1 at the rate represented by the slope of the line A_0U_0. In reality the current changes at this rate only when it has the value i_0 and at a slower rate thereafter. The line A_0U_0 therefore represents the current as reaching values subsequent to i_0 earlier than it actually does. Even if the point A_1 were correctly located, A_1U_1 would represent the current as reaching values subsequent to i_1 too soon. As A_1 represents the value i_1 reached too soon, so much the more does A_1U_1 represent the current as reaching its various values too soon. Similarly the whole curve, with the exception of the starting point A_0, represents the current as attaining its different values too soon. Draw A_0B_1 parallel to A_1U_1, meeting the horizontal line $i = i_1$ at B_1. Draw B_1B_2 parallel to A_2U_2, meeting the horizontal line $i = i_2$ at B_2. Similarly locate the points B_3, B_4, etc. A_0B_1 represents the current as changing from i_0 to i_1 at the rate at which it changes when it has the value i_1. This is the slowest rate of change that it has at any time in passing from i_0 to i_1, and therefore A_0B_1 represents the current as reaching the values subsequent to i_0 too late. Similar reasoning applied to the remainder of the curve, $B_1B_2B_3$, etc., shows that all portions of it, with the exception of the point A_0, represent the current as reaching its various values too late. The two curves here described may be called the "early" and the "late" curves respectively. The true curve lies between the two. If a point be plotted midway between A_3 and B_3, for example, this point represents the time at which the current reaches the value i_3, with an error not exceeding $\frac{1}{2}\,A_3B_3$. The application of the method will now be illustrated by a few problems.

Problem 1.—A battery having an e.m.f. of 10 volts is connected to a coil of 20 ohms resistance and 1 henry self-inductance. Plot the curve showing the values of the current immediately after the battery is connected.

The excess of the battery electromotive force E over that consumed by resistance is consumed by self-induction. That is, $e = E - iR$, or, in this case, $e = 10 - 20i = 20\,(0.5 - i)$. This equation, therefore, possesses the form $e = p\,(I - i)$ as

required by the second condition $p = 20$ and $I = 0.5$. But $\frac{p}{L} = \frac{20}{1} = k$. The conditions of the problem can thus be reduced to the form of equation (2), by writing $a = 20\,(0.5 - i)$. At the instant that the battery is connected the current is zero,

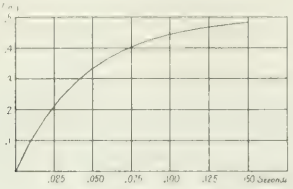


FIG. 2.—EARLY BUILDING-UP CURVE.

and this instant is also taken as the zero of time. With this information the curve is plotted. Fig. 2 shows the "early" curve.

Problem 2.—After the current has reached its steady value, in the arrangement described in problem 1, an additional resistance of 10 ohms is inserted without opening the circuit. Plot the time-current curve showing the effect.

At the insertion of the additional resistance $i = \frac{10}{20} = 0.5$ amp. As in the previous problem, $e = E - iR$. After the insertion of the additional resistance, the total resistance of the circuit is 30 ohms. Therefore $e = 10 - 30\,i = 30\,(0.333 - i)$. Here $p = 30$, $I = 0.333$. $k = \frac{p}{L} = \frac{30}{1} = 30$. For the zero of time take the instant at which the additional resistance is introduced. A portion of both the "early" and the "late" curves are shown in Fig. 3. In this case e is negative, and the current is decreasing.

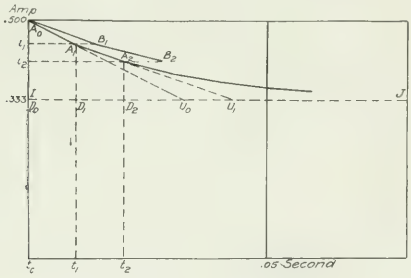


FIG. 3.—REDUCTION CURRENT TIME CURVES.

As this makes the construction slightly different from that previously described, a few of the construction lines are given. The points are lettered to correspond with Fig. 1.

Problem 3.—With the scheme of connections shown in Fig. 4, determine the currents i, i', i'', in the various branches immediately after the battery is connected to the circuit.

The electromotive force between Y and Z is that of the battery, less the drop in XY. This value must be further reduced by the resistance drop in the inductive branch in order to obtain the value of e.

$$e = 50 - 5\,i - 10\,i'' \qquad (3)$$

By inspection of Fig. 4,

$$5\,i + 20\,i' = 50 \qquad (4)$$

$$i = i' + i'' \qquad (5)$$

Eliminating i from (3) and (5),

$$e = 50 - 5\,i' - 15\,i'' \qquad (6)$$

Eliminating i from (4) and (5),

$$i' = 2 - 0.2\,i'' \qquad (7)$$

Eliminating i' from (6) and (7),

$$e = 40 - 14\,i'' = 14\,(2.86 - i'') \qquad (8)$$

Since i'' is the current whose change produces e, the value of e is obtained in the required form, where $p = 14$, $I'' = 2.86$, $k = \frac{p}{L} = \frac{14}{0.35} = 40$. At the instant of the connection of the battery to the circuit, i'' is zero and this instant is taken as zero of time. The curve i'', Fig. 5, is the "early" curve, plotted ac-

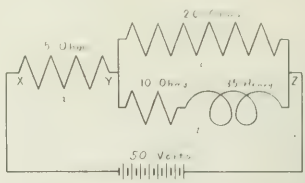


FIG. 4.—INTERCONNECTED CIRCUITS.

cording to the data here given. Having obtained the i'' curve, the others may be plotted from it. The construction of a few of the points on these curves is given in detail. The i' curve is plotted by the use of equation (7). Draw a horizontal line representing 2 amp. At the time $t = 0$, $i'' = 0$, and $i' = 2$. The point A_0' is plotted accordingly. On the ordinate t_1 locate a point A_1' lower than the 2-amp line by a distance equal to $0.2\,i_1''$. A construction for obtaining the various values of $0.2\,i''$ is shown in the illustration. $QP = 0.2\,RP$, P being located at any convenient point on the horizontal axis. $A_1''M_1$ is a horizon-

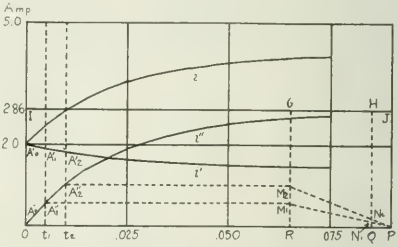


FIG. 5.—CURRENT INCREASE IN INTERCONNECTED CIRCUITS.

tal line, meeting the ordinate RG in M_1. N_1 is the point where the line M_1P meets the ordinate QH. Then $QN_1 = \frac{QP}{RP} RM_1 = 0.2\,RM_1 = 0.2\,i_1''$. A_1' is therefore located a distance QN_1 below the 2-amp line. Similarly, other points on the i' curve are located, and the curve is drawn through these points. To obtain the curve for i, make use of equation (5). Add together the values of i' and i'' at a given instant to get the value of i at that instant, and plot the point accordingly. When sufficient points have been obtained, draw the curve through them.

Measuring Small Currents of High Frequency.

Mr. Riccardo Arno read a paper recently before the International Society of Electricians in Paris on an instrument for measuring telephone currents and in general periodic currents of high frequency and very feeble intensity. The instrument contains a magnetic system with a vertical axle subject to the action of two rotary fields, equal but revolving in opposite directions. A coil coaxial with the magnetic system carries the current to be measured. "The action of this coil changes the hysteresis lag the more the greater the intensity and the frequency of the current, within certain limits. There results a variation of the hysteresis of the magnetic system and one gets a deflection. The rotary fields are in general produced by two sets of coils one in series with an ohmic resistance and the others with self-inductance or capacity. A movable coil for each field permits bringing the instrument to the zero point.

The Switchboard Equipment of the Indiana Steel Company at Gary, Ind.

BY E. A. LOF.

IN a previous article the main interconnections of the electrical equipment of the Indiana Steel Company, at Gary, Ind., were described. The present article deals with the storage-battery installation and the details of the switchboard equipment.

STORAGE BATTERY.

One of the main features of the Gary installation is the large storage-battery installation which is provided for the purpose of minimizing the fluctuations of the load on the generating station. This installation consists of two separate batteries connected in parallel. Each battery consists of 125 cells, 73 plates per cell, and has a rating of 4320 amp with a momentary rating of from two to three times that amount. The batteries are installed in a two-story building located directly north of the power house; the connections between the battery house and the power house are run through a tunnel.

The alternating-current regulation is accomplished by means of two 2000-kw, split-pole rotary converters. The collector-ring side of each of these converters is connected to a set of step-down transformers, the high-tension side of which connects through two electrically operated oil switches to the main alternating-current busbars. The oil switches are of the automatic type, provided with overload and inverse-time-limit relays. Each control panel is equipped with three ammeters, one voltmeter, a three-phase indicating wattmeter and the necessary control switches, indicating lamps and synchronizing plugs and receptacles.

The positive lead on the direct-current side of each converter is connected to two single-pole, motor-operated, carbon-break circuit-breakers, one being the starting breaker and the other being the running breaker; the former is rated at 1500 amp and the latter at 10,000 amp. The positive lead, after passing through these breakers, by means of a set of double-throw and single-throw switches are connected to the storage battery or to the main direct-current positive busbar.

The negative lead runs to the automatic starter which consists of six 1500-amp contactors with magnetic blow-outs, one 10,000-amp toggle-joint magnetic blow-out type contactor and the necessary relays. The positive lead connects to the 12,000-amp automatic overload battery circuit-breaker and thence through knife switches to each set of the storage battery.

To start the rotary converter, the 1500-amp starting breaker is first closed. Then the circuits to the first of the six contactors of the starter are closed, after which the remaining contactors of this size close automatically in succession, the rapidity of the closing being governed by the series relay. The closure of the last contactor completes the circuit of the 10,000-amp toggle-type contactor and closes it. This contactor, in turn, short-circuits the starting contactors and at the same time opens the control circuit to their windings thereby causing them to drop out. The converter is then synchronized with the busbars and the oil switch is closed. Each oil switch is provided with a contact switch which, when closing the oil switch, will complete the control circuit through the low-voltage coil on the direct-current starting circuit-breaker and trip it. The voltage of the converter is then adjusted and the running breaker is closed. This circuit-breaker is designed to open automatically on overload, and to open if the converter should attain a dangerously high speed, or if the voltage should decrease to too low a value. The opening of the oil circuit-breaker on the high-tension side will also cause the breaker to be tripped.

All of these breakers and the starters are controlled by switches on the benchboard, the control switches for the running breaker and the starters being mechanically interlocked in such a way that the running breaker can not be closed when the starter is open; furthermore, it is necessary to trip the running breaker before the starter can be opened. In addition, provision is made that when the toggle-type starting contactor opens it completes the circuit through the tripping coil of the running circuit-breaker.

As before stated, the rotary converter is of the split-pole type. It has two distinct and separate field windings and cores The main field is excited from the main exciter busbars in the usual way and its field-circuit leads are connected through a double-pole, solenoid-operated field-circuit discharge switch, the field-circuit rheostat being of the motor-operated cross-head type.

The regulating or auxiliary field winding of the rotary obtains its current from a synchronous motor-driven special synchronous converter. The current for this converter is supplied from a series transformer in each leg of the generator leads. Through three-pole Pallet switches on the generator oil switches, the regulating transformer leads for each generator are connected to regulator transformer buses, one set being provided for each of the main alternating-current busbars. The transformer buses are, in turn, connected through regulator transformer bus-selector switches and through regulator transformer series-paralleling switches to three totalizing auto-transformers. These transformers are finally connected to the six slip-rings of the synchronous converter, while from the commutator is taken the regulating current for the auxiliary field of the rotary. A three-pole switch, which is operated automatically, is provided for short-circuiting the totalizing transformers when the running circuit-breaker of the converter opens.

The pallet switches on the generator oil switches are so arranged that the regulating transformers of each generator are short-circuited when that particular generator is not in service. Connections are also made through two switches so that when stations No. 2 and No. 3 are tied together the battery will regulate on both. Should, however, either tie switch be opened for disconnecting the two stations, no regulation is possible on station No. 2 and all of the series transformers in the generator leads of that station are at the same time short-circuited. All the regulating transformer switches are of the magnetic blow-out type controlled from the benchboard.

The synchronous motor for driving the synchronous-converter is started by means of an auto-transformer starter, which is connected to the low-tension side of either set of the rotary-converter transformers by means of remotely controlled throw-over switches. The potential starter, which is also remotely controlled, consists of three sets of three contactors in connection with three auto-transformers.

To start the motor the operator throws pilot switch No. 1 to position No. 1, thus energizing two sets of the contactors. One set of the contactors will connect the three auto-transformers across the line and the other set will connect the motor to intermediate taps on the auto-transformers. This position will give the motor a suitable c.m.f. for starting and accelerating. The operator holds the pilot switch in the starting position while the motor is accelerating. When the motor has been brought up sufficiently close to synchronous speed, or possibly to synchronous speed, he throws pilot switch No. 1 to position No. 2, thus disconnecting the auto-transformers by means of the two sets of contactors noted above and connecting the motor directly across the line by means of the third set of contactors.

To stop the motor use is made of a second control switch, No. 2, which, when thrown to one side or the other, will operate the holding coils of the last set of contactors, thus opening these contactors and stopping the motor.

As noted previously, two control switches are provided, one for starting and the other for stopping the motor. The first two sets of contactors, which control the starting position of the motor, are not equipped with holding coils and it is necessary for the operator to hold these switches in the closed position while the motor is accelerating. The three sets of contactors which connect the motor directly to the line are equipped with holding coils, so arranged that these switches will remain in closed position without taking current, but the holding coils must be energized to open the switches. Auxiliary con-

tacts are provided for operating pilot lamps on the benchboard.

The field circuit of the synchronous motor receives energy from the main exciter buses; a double-pole, solenoid-operated field-circuit switch and an electrically operated field-circuit rheostat are provided.

In the positive lead of the converter is installed a left-and-right reading 20,000-amp ammeter operated from a minerallac shunt, and for the battery there are provided two recording wattmeters, one left-and-right reading ammeter and one recording voltmeter.

The direct-current regulation of the battery is accomplished by means of two 2000-amp, 60-volt boosters. The motors and generators of these booster sets are of the interpole type, the field coils of the generator receiving energy from a separate motor-driven exciter, the field circuit of which is connected through a carbon regulator to the positive direct-current totalizing feeder busbar.

The positive side of both the booster generator and the booster motor of each set is protected with single-pole circuit-breakers closed independently and so arranged that whether closed from the benchboard or at the circuit-breaker switchboard by hand, the generator breaker cannot be closed before the motor circuit-breaker, nor can it be kept closed when the motor circuit-breaker is open. For this reason the generator and motor circuit breakers are both electrically and mechanically interlocked. The negative leads of the booster generators are provided with knife switches and are connected to the negative converter and battery busbar. In the negative

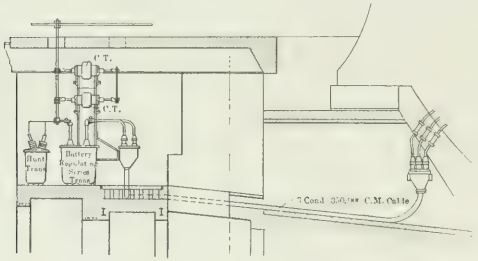


FIG. 1.—SUPPORTING TABLE FOR ALTERNATING-CURRENT GENERATOR CABLES.

booster-motor lead is installed an automatic contactor-type starter, which is also controlled from the benchboard; the connections are so made that the generator circuit-breaker cannot be closed when the motor breaker is closed and the starter is open, in order to prevent the booster generator from taking energy from the busbars and running as a motor. In addition to the overload coils, each breaker is provided with low-voltage coils connected to the speed-limiting device on the booster. The generator circuit-breaker is of 2000 amp rating and the motor circuit-breaker is rated at 500 amp.

Each booster generator is equipped with manually operated field-circuit rheostat and a double-throw field-circuit switch for making connections to either the main excitation bus or to the motor-generator exciter. The motor of this exciter set is connected to the main busbars through a double-pole circuit-breaker and an automatic starter, and the field circuit of the exciter is also connected to the main busbars through a double-column carbon regulator and is provided with the necessary rheostats and field-circuit switches.

Each booster panel is provided with two ammeters and the exciter with an ammeter and a voltmeter. All control switches and indicating lamps for the various circuit-breakers and starters in connection with the booster equipment are located on the benchboards, the circuit-breakers, switches and starters being placed on panels close to the machines.

GENERATOR LEADS.

The leads connecting the alternating-current generators with the oil switches in the busbar structure consist of 350,000-circ. mil, three-conductor, lead-covered, paper-insulated cable. For the support of this cable there is provided in the basement a concrete table running the total length of the station and close to the general foundations. By referring to Fig. 1 it will be



FIG. 2.—GENERATOR OIL SWITCH AND BUSBAR STRUCTURES.

seen that this table is provided with grooves, one for each cable. Potheads, filled with minerallac compound, are provided where the cable is connected to the generators as well as where the cable is connected to the copper bars in the busbar structure. Underneath the cable table are brackets supporting the field-excitation busbars, while on the side of the table supporting columns are provided for the support of the field-circuit rheostats and switches.

The leads for the direct-current generators and the exciter consist of bare copper bars of ¼-in. thickness by from 3 in. to 6 in. wide, the bars being separated by means of ¼-in. spacers and supported on iron hangers and insulated with slate slabs.

BUSBAR STRUCTURE.

The busbar structure is of the so called "double-deck" construction with the generator switches located on the main floor

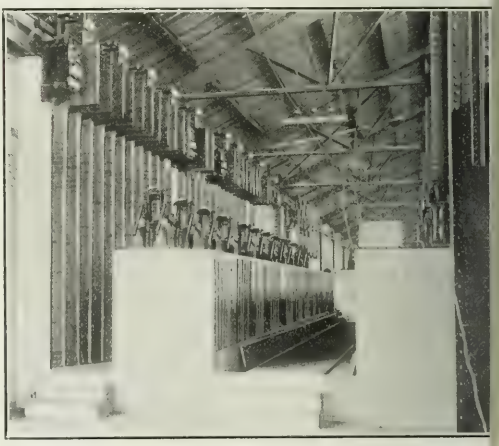


FIG. 3.—ALTERNATING-CURRENT FEEDER OIL SWITCH STRUCTURES.

and the feeder switches directly above on the gallery. Fig. shows the lower tier comprising the generator oil-switches and the two sets of alternating-current busbars. Fig. 3 shows the upper tier with the feeder oil switches, the out-going feeder and the lightning arresters.

By referring to Fig. 2 it will be seen that the generator switches are arranged in two rows with one switch in each row for each generator, the switches connecting the generators to either the left or right set of the busbars. The feeder

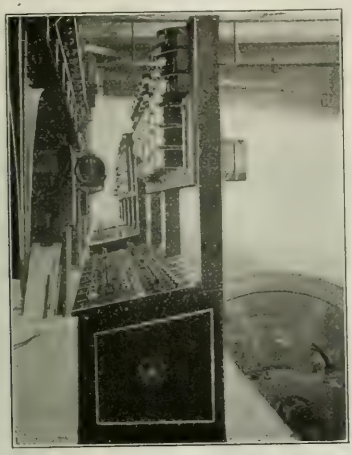


FIG. 4.—CONTROL BENCHBOARDS FOR STATION NO. 3.

switches are located correspondingly, so as to connect the outgoing feeder circuits to either the left or right busbars.

The structure is built of brick and supported by a very substantial iron skeleton work. All exposed surfaces are lined with white-enameled brick. All leads and busbars are separated by brick barriers, and walks are provided through the structure.

The direct-current busbars consist of laminated bars insulated by means of slate slabs and supported on iron hangers.

BENCHBOARDS.

All of the switching devices mentioned above are electrically



FIG. 5.—GENERATOR CONTROL BENCHBOARD.

operated and controlled from benchboards located on the gallery so as to allow the operators an uninterrupted view of the stations. In order to facilitate the operation they are suitably divided into several sections.

The benchboards consist of a very substantial frame construction with slate panels upon which are mounted the instruments, the control switches and the indicating lamps. The sides and rear of the board consist of sheet-steel sections, which can easily be removed in order to get an easy access to the interior of the boards. Between the instrument panels and the control switch panel there is a large open space which gives the operator a clear view of the station. Fig. 4 shows the three benchboard sections for station No. 3 as they are installed, while Figs. 5 and 6 show one of the benchboard sections on the construction floor. Fig. 6, which gives a good view of the interior of the benchboard, shows that each section is provided with test panels on which terminate the instrument wiring as well as all the control wiring from the various switches, instruments and transformers in the various parts of the station. These test panels are very easily accessible by removing the rear sheet-steel doors, and they afford means for testing each individual circuit without opening it. All of the instruments are of the horizontal-edgewise pattern with a dull-black finish. The direct-current instruments are of the permanent-magnet type and the alternating-current instruments are of the dynamometer type.

For the illumination of the benchboards there is provided a continuous reflector mounted in front of the boards and extending along the full length of each section.

RELAY BOARDS.

Separate relay boards are provided, upon which are mounted all the reverse-current and overload-time-limit relays. One re-

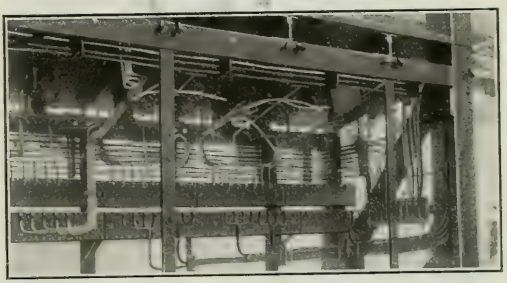


FIG. 6.—INTERIOR OF CONTROL BENCHBOARD, UNDER CONSTRUCTION.

verse-current relay is furnished for each set of generator oil switches; these relays energize special relay switches, which in turn close the tripping circuit of the oil switches. For each set of the feeder oil switches, one double-pole, overload and inverse-time-limit relay is furnished. These relays operate directly on the tripping coils of the oil switches.

DIRECT-CURRENT GENERATOR AND EXCITER SWITCHBOARDS.

Fig. 7 shows a view of the generator switchboard for one of the direct-current generators and also the heavy direct-current busbars, which are supported on hangers under the gallery. One switchboard is furnished for each of the two direct-current generators; it is located on the main floor in front of the machine which it protects. By referring to the illustration it will be seen that the board is built in two parts, each separated from the other. The part to the left consists of two panels on which are mounted the negative generator circuit-breaker and one watt-hour meter. The right-hand part of the board, which faces the generators, consists also of two panels on which are mounted the positive and equalizer circuit-breakers. By so dividing the direct-current switchboards that the negative devices are on entirely separate panels from the positive apparatus the danger of short-circuits is considerably diminished.

The direct-current generator and storage-battery busbars and connections are clearly shown in Fig. 7; the enormous size of these can be imagined when it is known that nearly 100,000 lb. of copper is used in them.

The three exciter switchboards are located separately in front of the respective exciters and are of the same construction

as the direct-current generator boards. All boards are of Monson Maine oil-finished slate, and the framework is of a very heavy, self-supporting construction.

DIRECT-CURRENT FEEDER SWITCHBOARD.

This switchboard is located on the gallery immediately above the direct-current generator boards. Like these, it is con-

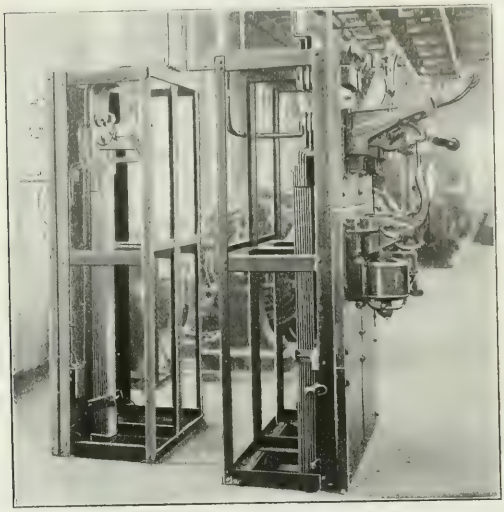


FIG. 7.—DIRECT-CURRENT GENERATOR SWITCHBOARD.

structed in two separate sections, one for the negative apparatus and one for the positive. In Fig. 8 is shown the positive side, on which is mounted the knife switches and watt-hour meters, while Fig. 9 shows the negative side with the negative, motor-operated circuit-breakers. The positive side also contains one panel for the carbon device for the storage-battery regulation. The direct-current feeder circuits consist of bare

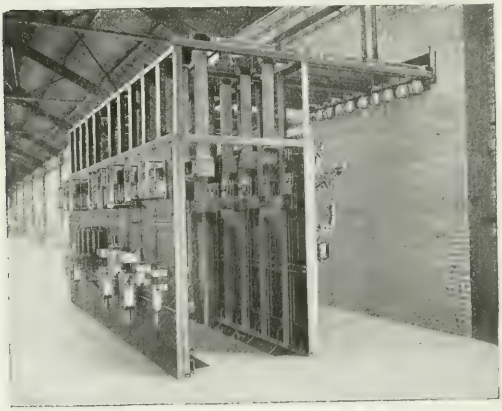


FIG. 8.—POSITIVE DIRECT-CURRENT FEEDER SWITCHBOARD.

copper bars which pass through ducts in the building wall and are insulated by slate panels. On the outside of the building is provided a bracket upon which is mounted heavy insulators for supporting and anchoring the copper bars.

STORAGE-BATTERY SWITCHBOARD.

This board consists of several panels and, like the other direct-current boards, is divided into two parts. It contains all of the circuit-breakers, switches, etc., for the control of the storage battery, the synchronous converters, the boosters and various auxiliary machines in connection with the storage-battery regulations. The panels consist of slate supported on heavy framework. The heavy copper connections are supported on heavy brackets on the rear and run from there through the basement to the synchronous converters and the battery house. Fig. 10 shows a view of this switchboard.

OIL SWITCHES.

All of the generator oil switches are of the non-automatic type and the feeder switches are of the automatic. They are three-pole, double-break, part of them being operated by means

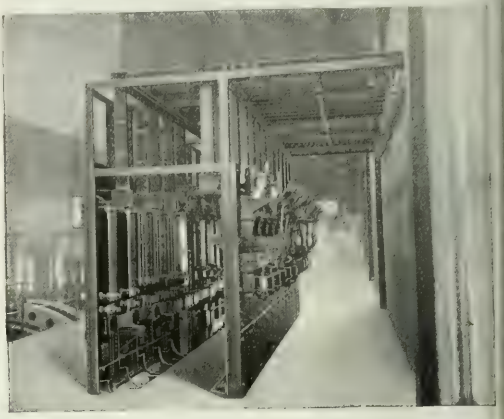


FIG. 9.—NEGATIVE DIRECT-CURRENT FEEDER SWITCHBOARD.

of electromagnets and some by means of motors. All of the live metal parts are immersed in oil, of which only a relatively small amount is required. Provision is made for easily removing the oil tanks for repairs and inspection.

The switches are erected in a masonry structure with each pole of the switch and the oil tank in which it is immersed in a separate fireproof compartment. There are two breaks in series for each pole of the switch, each break being in a separate compartment.

Energy for the electromagnets and motors for closing and

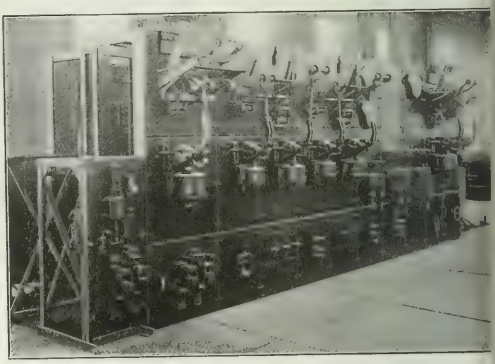


FIG. 10.—STORAGE BATTERY, ROTARY AND BOOSTER SWITCHBOAR

tripping the switches is obtained from the exciters, direct current generators or storage battery. In case of failure of the operating circuit, the switches can easily be operated by hand without in any way disturbing the mechanism.

The construction of the oil switches is such that the entire switch is set in place and lined up before the oil tanks are placed in position, with the contacts exposed to view so that they can be accurately adjusted. All sediment formed in the

oil settles at the bottom of the tanks, leaving the oil clear about the contacts. The oil level is readily determined by means of a small sight gage. When necessary, the tank can easily be drained and refilled when in position. The tanks themselves, which are made of sheet steel, are thoroughly insulated from the circuit and all live metal parts are placed inside of it under oil, so that no high-tension parts are exposed in the compartments. Mounted on each oil-break switch is a small double-

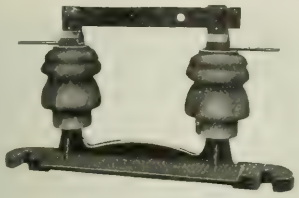


FIG. 11.—6600-VOLT DISCONNECTING SWITCH.

pole, double-throw pallet switch of the knife-blade type. This switch is operated by the motion of the levers of the oil switch and is used for the indicating and tripping circuits.

CIRCUIT-BREAKERS AND SWITCHES.

The direct-current generators, the direct-current side of the rotary converters, the battery, the boosters, the synchronous motor-exciter sets, the induction motor-exciter sets, the tie boards and the direct-current feeder circuits are protected with motor-operated carbon-break laminated circuit-breakers controlled from the benchboard, the open or closed position of the breaker being shown by red and green indicating lamps.

When the control switch is thrown to the closing position, the motor is put in circuit and a magnet is energized. This magnet forces a worm on the end of the motor-shaft into mesh with a worm-gear which is connected by means of a rod to the closing-arm of the circuit-breaker, at the same time cutting out the control switch at the benchboard, and thereby connecting the motor directly on the control bus. The breaker is fully closed in about three-fifths of a second, at which time the position of the laminated contact operates another switch, which opens the motor and magnet circuits, thus throwing the worm out of mesh and at the same time putting the control switch into circuit ready to open the circuit-breaker, which action again throws the motor switch into the closing position. The operator at the benchboard cannot close the circuit-breakers against overload, nor is there means for equipment control from the time the motor is started until the breaker is fully closed.

These circuit-breakers are of standard design, very substantially built, having only six millivolts drop from contact to contact at the rated current of the circuit-breaker; two millivolts being lost in the laminated contact bridge and two millivolts at each contact. The knife switches which are used in ratings up to 10,000 amp are of the multi-blade rear-connected type, having an extra-fine "draw-file" finish.

The disconnecting switch used on the 6600-volt, alternating-current system in connection with the oil switches are of a very substantial construction, as shown in Fig. 11. It will be seen that the base consists of an iron casting, with two cast-iron pins, upon which are cemented two high-tension insulators. Upon these insulators in turn are cemented cast-iron caps to which the switch jaws are bolted. By using this construction, the switches will always remain in alignment and can easily be mounted on the wall or at any other place. All switch parts are well finished and liberally designed.

STARTING SWITCHES.

All of the motor starters are of the multiple-contactor type, including the necessary cast-iron-grid resistors, and all contactors are provided with magnetic blow-outs. The starters, which are controlled from the benchboard, are provided with independent opening and closing coils. These coils are not energized after the first starting switch has been closed, so that a failure of the supply voltage will not open the starting switch. The first starting switch is energized by the closing of the control switch on the benchboard, and the first starting switch in turn energizes the next contactor, the closing of which in turn energizes and closes the next, and so on until the last one cuts out the last section of the resistor. The rapidity of this closure is governed by a series relay, and the closing of the last contactor short-circuits the other contactors and at the same time opens the circuit to their windings, thereby causing them to drop out. One side of the opening and closing coil is connected to one side of the control bus and the other side of the coils is connected to the above-mentioned control switch. The last contactor of the starters is provided with small contact switches which closes a circuit to the indicating lamps on the benchboard which show the open or closed position of the starter.

LIGHTNING ARRESTERS.

Each 6600-volt, alternating-current feeder-circuit and tie-line is provided with one three-phase multi-gap lightning-arrester. These arresters consist of a series of spark gaps shunted by a graded resistance but without a series resistor.

Ample space is provided between the different phase leads, which are separated from each other by means of fireproof barriers. Each arrester can be separated from the line by disconnecting switches. Fig. 12 shows the lightning arrester equipment for the 22,000-volt line to South Chicago Works.

Besides the above lightning arresters, there is provided for each set of 6600-volt busbars a three-phase lightning arrester of the electrolytic type. This lightning arrester consists of three columns of aluminum trays supported by a porcelain rod and separated by means of porcelain washers. These trays, which are connected between the line and the ground, contain a liquid electrolyte, the evaporation of which is prevepted by

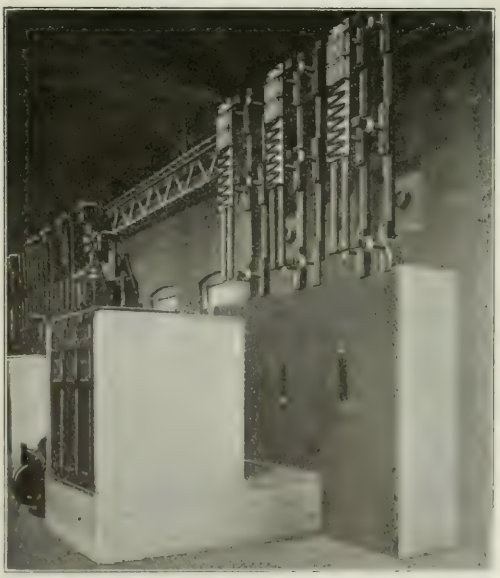


FIG. 12.—22,000-VOLT LIGHTNING ARRESTER EQUIPMENT.

a film of oil on its surface. The columns are set in stone jars filled with oil.

When a current passes from the trays to the electrolyte there is formed on the trays a film which has the desirable characteristics of preventing the flow of current at normal voltages and of breaking down with abnormal voltages to such an extent that it practically forms a short circuit; then, upon cessation of normal potential, the film regains its resistance

The direct-current feeder circuits are protected with single spark-gap arresters in which the discharge spreads itself over a block along a number of minute discharge paths.

CONTROL WIRING.

All control wiring between the benchboards and the oil switches, circuit-breakers, starters, instrument transformers, etc., consist of double-braid rubber-covered wires of sizes ranging from No. 6 to No. 12 B. & S., no smaller size being used. All of the wires are installed in electroduct conduit, which is laid in the gallery and engine-room floors and also in the basement. All joints in these conduits are well reamed to avoid possibility of destroying the insulation of the wire, and several connection boxes are installed where the continuous runs would have been too long.

STATION LIGHTING.

For lighting the two stations about 400 incandescent lamps and 100 arc lamps are installed, the incandescent lamps being distributed on the switchboard gallery, around the engines and generators and in the basement. The arc lamps are suspended on the roof trusses and on brackets fastened to the building columns and on the building walls.

Energy for the incandescent lamps is taken from the 6600-volt system. For the arc lamps, however, energy is obtained from the 250-volt, direct-current system. All of the arc lamps are provided with inner globes and white enameled metal shades.

The above-described switchboard equipment was designed and built by the Western Electric Company, of Chicago.

Non-Attendance Electrical Plant at Westfield, Mass.

There has been in successful operation for about six years at Westfield, Mass., a novel hydro-electric installation of small capacity which is of interest on account of its almost automatic character. No attendance is required in this plant, with the exception of about half an hour's work at night and another half-hour's visit in the morning for oiling and cleaning. The plant is owned by John C. Buschmann, proprietor of the Bismarck Hotel, and a prominent tobacco dealer and real estate owner of the community. It supplies electricity to the above-



FIG. 1.—EXTERIOR OF NON ATTENDANCE PLANT.

mentioned hotel, to a tobacco warehouse, and also to the proprietor's residence adjoining. All the current used in these places is employed in lighting service at about 225 volts. The installation is a direct-current one throughout. There is no auxiliary city service connected.

The plant is located about three-eighths of a mile north of the Bismarck Hotel, which is situated close by the Westfield station of the Boston & Albany Railroad. The proprietor owns a pondage of approximately 20 acres lying immediately behind the station, and which receives the flow of Powder Mill and Timber Swamp brooks. The power house is located at the base of an earth dam about 200 ft. in total length, with a spillway of stone masonry about 50 ft. wide. There are no other water power developments on this water privilege. The dam gives a head of 22 ft. on the single water-wheel which the station contains, and at no time has it been necessary to use flash boards.



FIG. 2.—TURBINE-ROOM.

The pond is employed in winter for ice cutting for the use of the hotel, but no difficulty has ever been experienced with the ice in relation to the continuous operation of the machinery.

A small gate house is installed at a bulkhead at the top of the dam above the power station, controlling the flow of water through a steel-riveted penstock 42 in. in diameter and ⅜ in. thick. This penstock is 40 ft. long, and it delivers water to the wheel without change in direction. The power-station building is a brick structure of one story, 32 ft. long and 20 ft. wide with masonry foundations. The generating machinery consists of an 18-in. McCormick horizontal turbine made by J. & W. Jolly, of Holyoke, Mass., direct-connected on a horizontal shaft through a coupling with a 150-amp, 250-volt, compound-wound direct-current generator built by the E. G. Bernard Company of Troy, N. Y. This unit is mounted in a masonry foundation and the normal capacity of the turbine is 56 hp, the speed being 300 r.p.m. The wheel-case is covered with an insulation re-



FIG. 3.—DAM AND SPILLWAY.

sembling asbestos, to prevent condensation from the atmosphere, and the case is fitted with a ¾-in. pipe tap for drinking and washing purposes. A 14-ft. draft tube extends from the bottom of the turbine case to the tailrace of the plant, which leads ultimately into Westfield River. The tailrace is about 50 ft. long, and discharges into the spillway below the dam. It is of masonry, 8 ft. deep and 9 ft. wide.

The turbine is controlled automatically by a Lombard go-

rnor, which is direct-connected to the wheel, and adjusted to point where it will respond to the turning on or off of one 6-cp incandescent lamp in the station. A special cone receptacle has been installed on the stem of the governor valve to collect oil and prevent dripping or spreading over the floor. There are three bearings on the generating unit, and each is quipped with a thermostat alarm which rings a bell in the iotel office in case a bearing becomes overheated. Another ;ong is located in the station for the same purpose. When a ;earing becomes overheated, the plant can be immediately shut lown by an electric switch controlling the governor, the switch ;eing located at the hotel. A battery of 12 cells of the liquid ype is used for the thermostatic and shut-off connections.

The wiring in the station is all carried overhead through the generating-room to a switchboard consisting of a marble panel containing a voltmeter and ammeter, a field rheostat, a circuit-breaker, and a double-pole, single-throw knife switch, for cutting the generator in and off the line. The panel is 48 in. high by 36 in. wide, and from this the outgoing line is run to the hotel. The line consists of two parallel circuits of No. 4-0 conductors in multiple, or four wires in all, carried on chestnut poles spaced 75 ft. apart and varying in height from 25 ft. to 30 ft. Two galvanized-iron wires are installed on the pole line for the operation of the thermostat circuit, and there are also two similar wires installed for a private telephone line between the hotel and the station. The switchboard and wiring were installed by the Berkshire Electric Company, of Pittsfield, Mass., as were the bells and thermostats. The turbine room is lighted by four 16-cp incandescents. The average loss on the line is about 4 volts. The present connected load amounts to about 350 lamps of 16 cp. Current is distributed from the hotel office as a center, a 36-in. x 30-in. panel having been installed at this point. On it are mounted an ammeter and a voltmeter, which are duplicates of those at the generating station, together with appropriate enclosed fuses and knife switches from which branch lines run about the premises.

This plant has frequently run for 6 to 12 weeks at a time without stopping, and with only casual attention for a short while each day. The man who looks after it is employed about the premises of the hotel on non-technical work most of the time, and is not an engineer or electrician. When the plant was installed the work was done under the supervision of Mr. J. Fred Buschmann. Messrs. Rivers and Young, of Holyoke, renovated the water-power by raising the level of the old dam 4 ft., installing new aprons, building the power house, lowering the wheel pit, and constructing the tailrace walls. Mr. Buschmann has a general oversight of the operation of the plant at present. The total cost of the installation was about $10,000, including the hydraulic work, station equipment and line.

Guard Wires on Transmission Lines.

By Max H. Colloiom

The desired main function of a grounded guard wire over a transmission line is to protect the power wires from direct lightning strokes, and to discharge the latter to ground with the least inductive and other effects upon the system. To attain these results a study of the characteristics of atmospheric lightning must be made as far as possible in order to judge the probable behavior of guard wires of different materials, form and arrangement.

The researches of Dr. C. P. Steinmetz indicate that the current of a single stroke of atmospheric lightning is of the order of 10,000 amp and has a frequency of 500,000 cycles per second and over. These figures seem to illustrate that a good protection against direct lightning strokes cannot very well be expected from practically any guard wire installation used up to the present, as will be explained later on.

The conditions affecting the amount of protection afforded by a guard wire are its inductance and its specific ohmic resistance. The first named causes the well known skin, or self inductive, effect, whereby at very high frequencies current density in the outer shell is increased and the middle is practically unused.

There appears to exist a widespread misconception that in case of high-frequency currents only the surface of a conductor is believed to influence the conductance of it without regard to the specific ohmic resistance of the material at all. This is obviously wrong, as there is certainly a definite radial distance over which the current density varies from 100 per cent on the very rim down to, say, 1 per cent further inward. The difference between outside and inside radius, or the width of such an annular ring (in case of a solid round wire) may be very small with high-frequency currents, but it still represents a definite part of the cross-section of the wire. It follows therefore that the specific resistance, particularly that of the very rim of the ring, is of great importance, and the more so the smaller this effective ring is.

The width of this effective ring is not only dependent upon the frequency of the current, but also, to a very great extent, inversely upon the magnetic permeability of the conductor. Therefore the effective cross-section in an iron wire must be very much smaller than in a non-magnetic wire. Moreover, the specific ohmic resistance of iron being very high (about seven times greater than copper) it follows that the effective resistance of an iron wire offered to a heavy high-frequency current is enormous, and the more so the greater the distance between adjacent grounds. It would seem surprising therefore that iron guard wires have not proved protective on some systems, for it can easily be imagined that the equivalent spark-gap of such a protective system under a direct lightning stroke may be greater than that of the ionized air at the place of lightning between the guard wire and power wires and between the latter and the steel-tower structure.

In connection herewith the writer desires to call attention to a dangerous method of protecting ground wires by placing them inside an iron pipe, when entering the ground. This arrangement certainly introduces a very high inductive resistance and offers a constant source of danger to adjacent structures.

As a rule, iron guard wires are galvanized and the thin coat of zinc will be quite effective as a non-magnetic shell of comparative low specific resistance. However, galvanizing lasts only for a few years, after which the effective resistance of the iron wire alone determines the amount of protection afforded.

A great improvement over a single solid iron wire can be had by using a number of smaller iron wires stranded into a cable. By this arrangement the resistance to the magnetic flux pulsating around the cable is very much increased, and consequently the inductive resistance of the cable proportionally diminished. However, this improvement does not appear great enough in case of a direct lightning stroke with its enormous amount of current as to give an iron cable a protective quality anywhere near such of a non-magnetic cable. It has, moreover, the disadvantage of a short life on account of corrosion assisted by the accumulation of moisture in the interstices of the cable.

On account of the foregoing it seems evident that only non-magnetic conductors, or those magnetic conductors having a comparatively large non-corrosive and non-magnetic outer shell (copper-clad steel wire), would be likely to offer sufficient protection. As a solid conductor is subject to considerable increase in resistance by skin effect, it would be of advantage to build the conductor in form of cables, or flat ribbons, or eventually tubing if it can be properly supported, as, for instance, in power stations. The latter forms are generally recommended by manufacturers for connecting their lightning arresters to ground.

As the ohmic and inductive resistance of a conductor is proportional to its length to the ground, it follows that grounding on every pole, if this can be accomplished, would give the best protection obtainable. As mentioned in recent literature, grounding of a steel tower can easily be done by extending one leg of the tower far enough into the ground where conditions allow of this. A short distance between adjacent grounds is of great importance, as it reduces the inductive effect upon the power wires, when lightning discharge over the ground wire takes place; and, on the other hand, it has an increased tendency to dampen out any high-frequency surge in the power wires proper, caused by switching, short-circuits, grounds, etc.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Information Bureau of the Commonwealth Edison Company.

A general information bureau has been established by the Commonwealth Edison Company at its headquarters, 139 Adams Street, Chicago, in charge of a courteous information clerk. This department is located on the ground floor of the building, directly opposite the main entrance, in a conspicuous place. All orders, complaints and inquiries are first handled here, and the service is proving of convenience to the public. In addition, it is expected that the bureau will prove a distinct help to the other departments, which may secure information of various kinds needed in furthering the business of the company by applying to this department. Previously the contract department maintained an information desk on the second floor of the building, but there was no general bureau of information taking cognizance of all the varied activities of the company.

Advertising.

Mr. John Lee Mahin addressed the members of the Electric Club of Chicago at the weekly luncheon on May 12 on the general subject of advertising. Mr. Mahin gave some of his ideas on this comprehensive subject in an instructive talk. He said that a good salesman's time is too valuable to be devoted to any of the work that an advertisement can do. Advertising is a form of educational work in selling. The merchant is simply an organized salesman. To be a leader he must teach his trade something. Similarly, the salesman should teach the buyer something. In Mr. Mahin's judgment every piece of advertising copy should be subjected to 10 tests, which he enumerated as follows:

1. Does it reflect the spirit of the house? This spirit is not necessarily the expression of any one man, but in a large way it represents the "atmosphere" of the establishment, and it should characterize the advertising.

2. Is it specific? The test of the specific nature of advertising as contrasted with what may be termed generic advertising is that in the latter case if the name of a competitor be substituted for that of the advertiser the advertising would be equally true. If the advertising is specific this will not be the case.

3. Is it timely?

4. Is it pertinent?

5. Is it consistent with the traditions of the house? By this Mr. Mahin meant that the advertising should not be freakish; that is, if the house stands for quality the announcements should lead one to expect that. If it is a bargain house, then the character of the announcement should be modified accordingly.

6. Is it persistent? Continuity in advertising breeds confidence on the part of the buyer.

7. Is it authoritative in tone? The advertising should be neither mandatory on the one hand, nor imploring on the other.

8. Is it institutional? Advertisements are read by large numbers of people, and they should be so worded that an appeal will be made to certain groups who may be expected to see the announcement in the particular medium selected.

9. Is it plausible? In relation to this trait, Mr. Mahin related that someone had remarked to him that if plausibility was to be sought, a confidence man would make an excellent advertiser. To this the speaker answered that if the confidence man only "made good," as the advertisement must do, he would make a "crackerjack" good salesman.

10. Is it sincere? This was the last of Mr. Mahin's tests, and he intimated that no doubt it was the most important of all.

In the brief discussion, Messrs. Frank L. Perry, H. F. Holland and H. E. Niesz took part. Answering a question relating to the proportion of selling cost to be spent in advertising, Mr. Mahin remarked that this depended altogether on the character of the campaign that was undertaken. If people must be educated to buy a new article, the proportion of advertising expense must be heavy, but in case of an old-established line, where the educational work has been done, the advertising is continued in force as an economy in keeping selling expense down. In this case the amount of advertising will be proportionately much smaller. No hard and fast rules can be laid down as to the amount of sales expense to be set aside for advertising. The advertising should not be imitative; it should be original, not only in the preparation of the copy, but in the selection of mediums and the laying out of the general campaign. Some of the most effective advertising of to-day is appearing in the trade and technical press. Every proposition must be handled individually and on its own merits.

New Business at Hoopeston, Ill.

The Hoopeston Gas & Electric Company in the fall of 1907 began a movement to extend its business. The power-plant was first enlarged by the addition of a producer-gas engine and the 125-cycle alternating-current service which had been given previously was changed to 60 cycle, three-phase. Power load, of which the company had connected 150 hp in 500-volt, direct current motors, was continued by the use of a 56-kw motor



EXTERIOR OF HOOPESTON GAS & ELECTRIC COMPANY'S OFFICE

generator set driven by a three-phase, 30-hp, 2000-volt motor. All additional power was taken on the three-phase service. In April, 1909, the company had 325 hp in motors connected, and 50 electric irons out. The population of the town is 5409. The company fitted up an up-to-date office near one of the main streets, the exterior of which is shown in the accompanying illustration.

Desirable Summer Business.

Various classes of profitable summer business for the central station were discussed at the meeting of the Commonwealth Edison branch of the National Electric Light Association in Chicago on the evening of May 11. Principal attention was

evoted, however, to furnishing electrical energy for charging utomobiles and for operating refrigerating plants. Mr. George Harvey Jones presided, and he announced that the branch had membership of 390 and that active effort would be made to ncrease this number to 500. Mr. Jones also made the announcement, which was greeted with applause, that the company had ffered to send two men representing the branch to the Atlantic ity convention of the National Electric Light Association. hese men will be chosen by letter ballot and the result announced later.

Mr. E. W. Lloyd, general contract agent for the Commonwealth Edison Company, read a paper illustrated by diagrams on he subject of "The Relation of the Central Station to the utomobile Business." This was substantially the same paper resented by Mr. Lloyd before the recent Electric Vehicle Conference in Chicago, and given in abstract in the issue of April 8. Before reading his paper, however, Mr. Lloyd gave ome interesting figures about the business of providing electricity to the summer amusement parks in Chicago. He said hat during the season of 1908 the Riverview Park took 00,000 kw-hours, having a connected load of about 20,000 6-cp lamp equivalents. This year this load will be approximately 25 per cent greater. White City took about 1,000,000 w-hours, with a load of 60,000 16-cp lamp equivalents. Sans ouci was represented by a consumption of 250,000 kw-hours, he installation being in round numbers 10,000 16-cp lamp quivalents. In addition several other smaller parks are customers of the central station, and in all the revenue from musement parks last year was about $100,000. In presenting is paper on automobile service, Mr. Lloyd made the interesting tatement that the company will make a complete canvass of the lectric automobile situation in Chicago this summer. A list ill be prepared of all consumers of electricity for this purpose, nd it will be carefully analyzed and the information classified o that it may be readily available.

Mr. Ernest Lunn, superintendent of storage batteries for the Commonwealth Edison Company, read a short paper on the eneral outlook for the electric vehicle, particularly the power agon. He remarked that the company has 14 electric trucks nd more on order. There is no doubt of the practicability of he electric automobile from an economical point of view. Increased life of batteries, improved methods of suspension and mprovements in vehicle design have had much to do with the resent success of the electric vehicle, particularly the power agon.

With the aid of a blackboard diagram, Mr. Lunn considered he subject of overcharging vehicle batteries. He recommended hat an ampere-hour meter be installed on the automobile. This nstrument indicates the amount of energy put into the battery, nd can be set for any predetermined amount, the pointer maklg contact with a contact point and automatically cutting out he source of charging current at the stage desired. One recent mprovement has been in the rubber jars holding the cells. Formerly in the company's delivery wagons it was necessary o remove the sediment at the bottom of the jars once in three nonths. Now, with more space available for the collection of ediment, it is not necessary to do this work more often than nce in nine months. In the case of a pleasure vehicle it would ot be necessary to clean out the sediment as often as this, nd the period of time might even be as long as two years.

Many of the newer trucks have single-motor equipments. The ost of electricity for delivery wagons such as the Edison Com any uses is about 2.4 cents a kw-hour. It is interesting to ote that the hard-rubber tires used on these vehicles cost about he same in operating service as the electricity to charge bat eries. Where pneumatic tires are used it is generally conidered that the expense for maintenance and renewals is at least cents a mile in the case of trucks. In answer to a question, Mr. Lunn said that so far as he knew no recent development n the Edison storage battery had been reported.

Mr. Jones, the chairman, spoke of a new type of mercury arc ectifier used for charging electric vehicles. This new rectifier s arranged so that six sets of automobile batteries may be charged at one time instead of one set only, as is usually the case with the rectifiers now in common use. With this new outfit several combinations may be made and any number of batteries, from one to six, may be charged at one time. The new equipment is said to be about as efficient as the old one.

Mr. R. F. Schuchardt, editor of the *Edison Round Table*, the new magazine published by the Commonwealth Edison branch of the N. E. L. A., explained briefly the object of this interesting publication in inciting its readers to the highest degree of team work. He took occasion to reveal the fact that Mr. E. A. Edkins was the heretofore unknown "Scribbler" whose little talks in the magazine have received much attention. Mr. Schuchardt praised Mr. Edkins for his valuable assistance, and the latter was called upon and made a plea for active work to increase the membership of the branch.

Mr. Frank Hoffman, of the Contract Department, read an instructive paper on "Artificial Refrigeration." He gave the history of the development of this art and showed how it has improved the conditions of living by making it possible to preserve meats, fruits, vegetables, fish, etc., for use at seasons of the year when these food products would not be otherwise obtainable or would not be capable of long preservation without the use of ice, which is sometimes impracticable. The speaker described the apparatus used and mentioned three types of ammonia condensers. He also gave figures to show the first cost and the cost of operation of refrigerating plants of various sizes, using electrical energy to operate the condenser pumps.

A number of instances were cited to show that after allowing 15 per cent for interest and depreciation, the refrigerating machines, using electricity for power, show a marked economy in operation compared with the purchase of ice, while there are many incidental advantages, such as cleanliness, convenience and the saving of floor space.

Selling electricity to operate refrigerating plants can be made a profitable summer business for the central station. Chicago has a large number of refrigerating machines, but only a portion of them are driven by electric motors. It is evident that the field is not thoroughly developed, especially in the case of small units. Philadelphia central-station interests have been particularly successful in this work. It is a fact that the electric motor is particularly well adapted to drive refrigerating machinery. Ice machines may be run at night by electric motors at very low rates and operated by the watchman in charge of the building, for very little attendance is necessary. Ice can be manufactured by this means for $1.80 a ton, with current at 5 cents a kw-hour and water costing 10 cents per 1000 gal.

Mr. George B. Johnson, of the contract department, called attention to the model motor-driven refrigerating plant in Electric Shop as an actual demonstration of the benefits of the system.

Mr. John F. Gilchrist made the interesting statement that Mr. Hoffman, the author of the paper on refrigeration, was the chief engineer of the first Edison central-station plant in Chicago, dating back to 1882. Mr. J. W. Ferguson announced that it was probable that during the summer the branch would hold a field day with outdoor sports as a variation from the ordinary technical meetings.

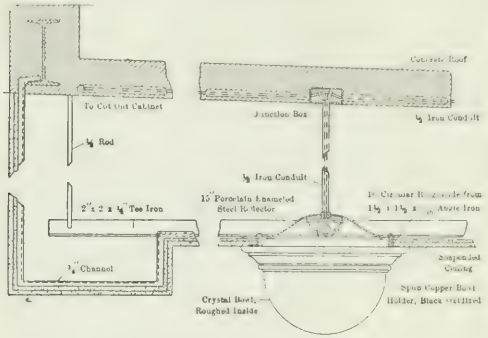
INTERIOR WIRING AND ILLUMINATION

Wiring Rooms with False Ceilings.

There are two general methods at present employed in wiring rooms with false ceilings. Where the falsework is some distance from the supporting floor or roof, it is usual to run conduit on the falsework, if it is of such construction as to be able to carry the pipe, and bring the outlet flush with the plastered ceiling. Oftentimes the falsework is of flimsy plaster of paris

construction so that the conduit must be supported from the floor or roof overhead. However, in the average installation with lath and plaster work, the method of running the conduit on the lath has much to commend it if heavy fixtures are not used, because it is more expeditious than the other method of fastening the conduit to a floor and for all practical purposes makes as good and as reliable a job. As a matter of fact, the average contractor or wireman would rarely run conduit up to the floor or roof and drop to the ceiling, since this requires extra lengths of conduit and wire and extra outlets.

The accompanying illustration shows a method of running



DETAILS OF CEILING CLUSTER.

conduit in a roof and dropping down to the false ceiling through conduit and a wireless cluster. In this case portions of the building, which is a one-story structure, have no ceiling other than the finished roof and inasmuch as these portions are lighted from fixtures fastened to the conduit in the roof, it was not worth while to vary the construction for a single room. The roof in question is of concrete and the conduit was placed in the forms and embedded in the cement. Hung from the false ceiling are 16-in. crystal bowls fastened in spun-copper rims as shown. Angle-iron rims, which support the bowls enclosing the lamps, are inserted in the suspended ceiling and an annular space is left between the bowl and the rim to provide an outlet for the heated air. Above the cluster is placed a white, steel-enameled reflector so that very little light is absorbed. Under the conditions imposed this system of wiring is admirable, although the cost per outlet would necessarily be high.

Animated Electric Sign on Broadway, New York.

At the corner of Thirty-sixth Street and Broadway, New York, a firm of electrical advertisers has erected a small animated sign which is quite effective. The sign is 4½ ft. x 20 ft. 2 in. and contains about 600 lamps of 2-cp rating fitted with color caps. The name of the firm appears in green; the circle in the center of the sign around the transparency is studded with red, white and green lamps; the lightning streaks are in amber and the words "electrical advertisers" are in white. The feature of the sign is the rapidity with which the various combinations are made. There are three consecutive flashes of lightning almost every second. The circle revolves continuously and the transparency which it surrounds is lighted by nine 25-watt tungsten lamps which are flashed on and off. The sequence with which the various lamps burn is as follows: The whirling circle burns all the time; a succession of lightning strokes, three at a time, follow; the firm name is then lighted followed by the transparency and the words "electrical advertisers." All the lamps are then extinguished with the exception of those in the circle and a few streaks of lightning appear, whence the cycle begins again.

Fig. 1 shows the sign as it appears by day and Fig. 2 is a view of the mechanism within the office by means of which the various lighting combinations are obtained. The flashers and switches are driven by a 1/20-hp, direct-current motor. Referring to Fig. 2, the first flasher from the motor is used to produce the revolving wheel effect and runs at high speed. Coupled to this by a reducing gear is the flasher used to produce the streak lightning. This type of flasher makes three streaks a revolution and while it can be run as high as 50 r.p.m., which is as fast as an ordinary incandescent lamp will light up and

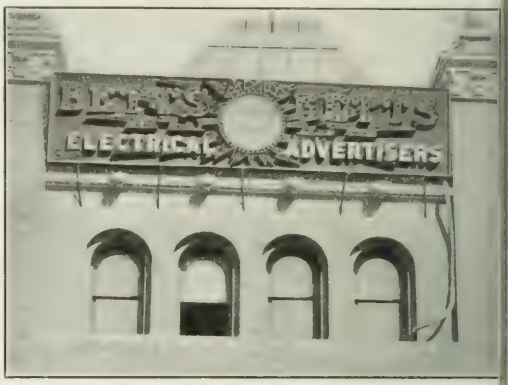


FIG. 1.—DAY VIEW OF SIGN.

extinguish, it is not run quite so fast, 30 r.p.m. being sufficient for lightning effects. There are four circuits on the first flasher and 10 circuits on the lightning flasher. Adjacent to the latter is a main flasher with a double-pole, carbon-point switch for controlling the circuit to the circle lamps and a similar switch for controlling the circuit for the lightning lamps. These switches keep their respective circuits open and closed for definite periods of time. At the end are two three-pole, carbon-point switches; the first controlling the circuit feeding the lamps in the firm's name and the other controlling the lamps in the legend giving the firm's business. These switches give the

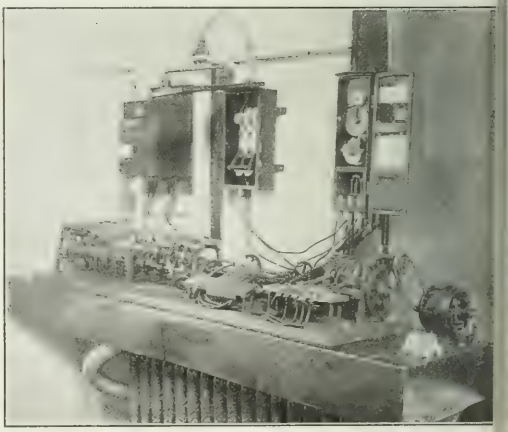


FIG. 2.—VIEW OF ANIMATED ELECTRIC SIGN MECHANISM.

flashing and changeable effect to the sign and are designed especially for heavy loads such as flashing a sign on and off as a whole. Being cut into the mains they do not require each small circuit to be run to the flasher. The flashers are of the Reynolds-Dull type, and by means of the Anderson time switch shown the sign is automatically started at 7 p. m. and extinguished at 1 a. m. The sign is lighted every night and requires about 40 amp at 118 volts.

Electrical Equipment of the Blackstone Hotel, Chicago.

Among the fine modern hotels of the country, few will excel the Blackstone, which is now in course of construction at Michigan Boulevard and Hubbard Place, Chicago. The building will extend 22 stories above the ground and two stories below the street grade, and will present a handsome and dignified appearance. It will contain 400 bedrooms, each with private bath, as well as a large restaurant, private dining-rooms, a ballroom and all the accessories of a modern hotel. The hotel is being fitted up in accordance with the most modern ideas, and its appointments will be elegant. Electricity will be extensively employed for light and power, and the electrical equipment will present several features of interest.

So far as can be estimated at present, there will be between 9500 and 10,000 electric lights. Flaming-arc lamps will be placed on the exterior of the building at the third floor and also around the roof line. It has not yet been determined whether



THE BLACKSTONE, CHICAGO.

the hotel will operate its own electric generating plant or buy electricity from the Commonwealth Edison Company. Tungsten lamps will be used exclusively, and there will be handsome fixtures.

In all the guests' rooms the electric lights will be controlled by a switch in the corridor door, so that when the guest locks the door on the outside on leaving the room, all the lights inside the room will be turned out, thus effecting a saving in electricity which in a large hotel will assume considerable proportions. The lights in the guest rooms will be in the form of table lamps rather than chandeliers, and the brackets on each side of the bureaus will be attached to the bureaus themselves instead of to the walls, thereby allowing these articles of furniture to be moved with greater freedom. Two electric lights will be provided in each bathroom, and they will be mounted on rods and so arranged that the person using the mirrors can raise or lower the lights to a suitable height.

Connections to table lamps and electric heaters will be installed in all the public dining-rooms, but so far as at present arranged, the only cooking by electricity will be done by a number of electric toasters in the kitchen, sub-kitchen and pantries. In the dining-rooms electricity will be employed to operate motors for electric fountains and various electric designs, as well as for keeping dishes hot which come to the table for service.

Six electric elevators will be used in the building, four of these being one-to-one traction elevators for passenger service, and two worm-gear traction-service elevators. The Otis Elevator Company has the contract for installing these machines. There will also be three hydraulic elevators of the plunger type and three electric dumb-waiters of the Burdett-Rowntree design. Electric motors will be used wherever possible to drive the different kinds of machinery, as well as in the kitchen and in the laundry. It may be remarked that the kitchen is on the second floor of the hotel instead of in the basement, as is usual, while the laundry is on the twenty-first floor.

Telephones, of course, will be installed in every room and department of the hotel. One particularly interesting feature is the installation of the most complete and comprehensive telautograph system ever put into any hotel. The Gray National Telautograph Company has the contract for this installation, which will be similar to that used in the Hotel Astor, in New York, but will be even more comprehensive. In connection with the house telephone service, the telautographs will be used to give a direct record of orders transmitted in the routine of hotel service. The Chicago Telephone Company is causing to be manufactured a special telephone switchboard with telautograph keys attached so that the joint telephone and telautograph service will be as prompt and efficient as can possibly be worked out.

There will be an electric carriage call at the Hubbard Place entrance, and the revolving entrance door will be operated by an electric motor, thus obviating the necessity of turning the door by hand.

Time stamps will be used extensively, and there will be a number of electric clocks in the building, although it is not impossible that a portion of the time system may be operated by pneumatic clocks. The watchman service and fire-alarm service will naturally be installed in the most efficient and up-to-date manner.

The Blackstone is being constructed by the Drake Hotel Company, and the entire cost of the hotel and furnishings will be about $2,500,000. The Drake company is controlled by the members of the Drake family and the estate of John B. Drake. Messrs. Tracy C. Drake and John B. Drake, who learned the hotel business in the old Grand Pacific Hotel, under the guidance of their father, the late John B. Drake, are the president and vice-president of the company and the active managers of the new hotel, which will be open to the public early next year. Marshall & Fox are the architects for the building and the George A. Fuller Company is the builder. The architects' consulting mechanical and electrical engineers are L. L. Summers & Company, and their structural engineers are Ritter & Mott. Robert W. Hunt & Company will have charge of the testing of all electric wire used in the hotel.

New Telephone Patents.

NEW APPLIANCES.

Mr. C. Adams-Randall, of New York City, N. Y., has patented a transmitter which is especially designed to permit the user to adjust, by means of a controller, the transmitter efficiency of his station for any particular call. He forms his transmitter of several independent units, each arranged, through the controller, to augment the other, either by means of additional battery or induction coils, or both, as the case may be. The inventor's intention is to have the controller normally seek the position of the lowest transmitting efficiency. If this be insufficient for any call the user will gradually "turn on more transmitter." Upon completion of the call the restoration of the hook-switch will permit the controller to return to normal.

For complete supervision on the two-wire common battery switchboards it has usually been necessary to associate two

relays with each end of the cord pair. One of these effects the initial lighting of the cord lamp, responding to the insertion of the plug in the jack, while the other relay, responding to the connecting subscriber's hook-switch, serves to control the lamp to give the supervisory indications. Mr. W. W. Dean, of Chicago, has patented and assigned to the Kellogg Company an apparatus combining these two relays in one unit. The armature of one of the relays carries the contact anvil, while the armature of the other part carries the contact point. The contact is closed whenever the anvil part is de-energized, while the contact point is energized. When both are energized the anvil is drawn away from the contact, while when neither is energized the contact has fallen back from the anvil.

Letters to the Editors.

The Tariff on Carbons.

To the Editors of Electrical World:

Sirs:—A new joker has been added to the old joker on the method of imposing the duty on electric-light carbons. The first joker was to reduce apparently the rate of duty on electric-light carbons from 90 cents to 70 cents, but instead of basing the new figure on carbons per 100, it was made to apply to 100 ft. This actually raised the duty, as the old rate did not specify the length, and consequently the carbons could be imported in double lengths and cut in two, this, of course, reducing the tariff tax.

Now the latest is an amendment by Senator Smoot, acting for the Finance Committee, which proposes a change to 35 cents per 100 ft. on carbons made of petroleum coke, and to 65 cents per 100 ft. on all other carbons for electric lighting purposes.

This at first sight looks like a material reduction, but in fact it is practically only a reduction of 5 cents per 100 ft., because carbons made of petroleum coke are neither manufactured in Europe nor imported. In other words, a substantial reduction of duty is proposed on an article not imported, while the article which has been imported will, even with 65 cents per 100 ft. duty, be just as much excluded from importation as it would be at 70 cents per 100 ft.

New York. Hugo Reisinger.

Commercial Aspect of Nitrogen Fixation Processes.

To the Editors of Electrical World:

Sirs:—I have read with interest the editorial in your issue of April 22, 1909, commenting on the recent water-power developments in Scandinavia, but I question whether the criticism of the engineers and investors of this continent is, in this instance, well founded.

The writer has given a great deal of attention to the problem of the fixation of atmospheric nitrogen, and in the summer of 1908, acting under the instructions of Messrs. Smith, Kerry & Chace, engineers, Toronto, Canada, made visits to Switzerland and Norway for the purpose of investigating two of the best-known European processes, Messrs. Smith, Kerry & Chace having at that time organized a powerful syndicate to take up this new line of manufacture. The inspections proved to be most interesting and instructive, and particularly that of the plant of the Société Norvegienne de l'Azote at Notodden in Norway, this company having 40,000 hp then at work and having undertaken the development of an additional 225,000 hp.

The capital expenditure on such a plant as that now working at Notodden is, however, enormous and it is only under exceptionally favorable circumstances that the product can be made at a cost that will permit competition with the natural Chilean nitrate. You may recall that Messrs. Bradley and Lovejoy, of Niagara Falls, N. Y., made one of the earliest efforts to develop this business on a commercial scale and were not able to do so successfully.

At the present time, this line of enterprise seems to the writer to be particularly suited to countries which have capital in abundance seeking investment, and a large number of technically trained men whose services can be secured at low cost. The rapidity with which important improvements are being made to the known processes indicates the experimental condition that the industry is still in. Satisfactory experimental plants are of such magnitude and are so costly in operation that they cannot be worked by an individual investigator unless he has great wealth at his command. Furthermore, the processes cannot be worked successfully unless power can be developed at figures comparable to those given in your article, and unless the owner of the developed power is willing to accept something like $7 per horse-power per annum as reasonable rental. There are few powers available in the United States the output of which could not be sold at a much more remunerative rate than this; and we may therefore expect to see the nitrate factories on this continent finally located near some of the great water-powers in the unsettled sections of Canada.

It should be remarked that the patents embodying the results achieved up to date by the European syndicates have been taken out on this continent by the representatives of those syndicates, and that these are more or less basic in character. The writer's experience is, that the syndicates are not willing, at present, to dispose of their patent rights at any price, but these must be secured from them before any American development can be effectively undertaken.

The writer's conclusion is that our neglect of the fixation processes arises from economic causes, and is in no way chargeable either to apathy on the part of our investors or to ignorance on the part of our engineers. The attention of both can for the present be more profitably given to other matters; but it may be but a very short time before this business will become commercially very attractive to us, and then I do not fear that we will be open to further criticism for being behind in technical matters.

Montreal, Can. L. A. Herdt.

The Patent Situation.

To the Editors of Electrical World:

Sirs:—The article, "A Phase of the Patent Situation," by Mr. Barkelew, in your issue of March 18, and those subsequent writers indicate that more discussion is necessary before the serious defects in our patent system will be located. As far as the Patent Office work itself is concerned, there should be no cause for complaint, and anybody who has had dealings with that office must be struck by the discipline prevailing in the various branches and the business-like manner in which all departments are conducted.

Mr. Barkelew enumerates the theoretical sides of the "principles of the patent law as practised in this country," and to illustrate the defects I will take the opening sentences of his first four paragraphs and show the practical, or rather, the impractical side of the same. Time and space will not permit detailed treatment or discussion of the minor changes proposed. These will rectify themselves automatically when the foundation has been made sound.

Mr. Barkelew states, "It may seem superfluous to discuss the general principles of the patent law as practised in this country, but as it has a vital bearing on the subject matter of what will follow it would seem best to make a brief résumé of the inherent fundamentals."

Keeping the fundamentals clearly before us we will not go far astray. The Constitution gives Congress the power *to secure* for a limited time *the exclusive right to inventors* in return for their inventions. To this day Congress merely has passed laws, but has never created or organized any department or institution which could *secure* the rights to the inventor, or the subsequent owner of a patent, as called for by the Constitution.

"The granting of patents is in the nature of a contract, the two parties to the contract both receiving and giving."

This is true in a broad sense. The inventor is compelled to describe his invention in such clear language that anybody

versed in the art can make it. In return for his publication, time, labor and money spent in developing his invention, he gets a piece of paper, but not the protection the Constitution states *should* be given. All that the paper is good for is an identification of the date, description of the invention and the name of the inventor.

"Taking the assumption of personal ownership as a starting point." . . .

In our present social institutions "ownership" means the recognition by others of the article possessed. In fact, it is their "will" that the owner should enjoy the article and in case of theft it is "their will" that the stolen property be returned to the rightful owner. For this purpose we have the police and the courts, or law-enforcing agents; and if a person takes an article in a dry goods store, for instance, without paying for it, the proprietor needs only to call an officer of the law, who will take charge of the thief.

This procedure does not, however, exist in commercial properties, such as patents. Owing to the laxity of our laws and the cumbersome mechanism of securing justice, many people "in the arts" oppose the "will of our institutions" and that of the people at large and simply appropriate the well-described novelty which Congress has not secured to its owner. It is, therefore, not "property," nor can we speak of a "contract" or "personal ownership." People with flexible consciences cultivated into this state by our very laws, which are not supervised, take a bold stand, derive all the benefits belonging to another and if accused, make him the defendant in his own suit—he must prove that he really is the owner. It takes generally from three to five years to show this grain of truth. At the outset it is conceded by both parties to the suit that the court does not understand the technical or scientific side of the subject, which has now so vitally entered in most commercial enterprises and products; for this reason the expert testimony has become so necessary an adjunct to our present litigation. The said grain of truth is buried in a mountain of such testimony which it takes the judge some four to six months to dig out and separate from the surrounding rubbish, if he can recognize it or find it at all. Supposing he has found it, he ponders over the process or device in question, the principles of which are entirely foreign to him, and renders his judgment in accordance with *his* understanding.

How different is that procedure from the method of the policeman who takes his man into the open court where his case is disposed of in half an hour or so!

There have been suits fought on a patent for over 10 years which have cost the defendants thousands of dollars yearly and which, if they had been presented in a court of judges experienced in the art, would have been ruled out in a month.

The negligence of supervision of our patent laws affects not only the individual inventor or manufacturer, but the same go-as-you-please, non-supervision or non-inforcement is detrimental to the whole people of the United States. Who is there to accuse a shrewd man or firm for holding on to a monopoly for a longer time than 17 years; who to act?

Sometimes a broad patent is issued some 8 or 10 years after the first or fundamental patent has been published, thereby giving the firm a further extension of so many years. The later patent stands in the way of public rights. The "public," the "people," are not represented, and if anyone does not like this condition he may start manufacturing and get involved in a suit and foot the bills himself. While he is constitutionally right, he is wrong before the law until he has proved his case. There is no standing commission or department whose attention can be called to such abuses and who would investigate such charges in the interest of the people as a whole at public expense. The Attorney-General, who has acted three or four times in behalf of the people during the existence of our present patent system, is too far removed from the patent situation to be considered a suitable officer to devote much time to patent-law investigation and abuses.

I may now close fittingly with the fourth item selected, which speaks for itself, namely: "The above is the principle of operation of the present system."

ST. LOUIS, MO. L. GUTMANN.

An Early Electric Motor.

To the Editors of Electrical World:

SIRS:—In the report of the meeting of the New York Electrical Society of April 29, contained in your issue of May 6, page 1073, I find a reference to my discussion of Mr. Behrend's paper; and a certain dynamo, designed by me 24 years ago, is referred to therein as "probably the first of its type." This is a little misleading, since the term "type" is now so much used in the sense of *design* or *pattern*.

The dynamo in question was, as I stated in the discussion, the first compound-wound dynamo of any design built and used in this country, so far as I have been able to ascertain. This was its chief and perhaps only merit, especially when seen from the time-point of "20 years after." I was careful to state in my discussion that I am very much more proud of its being "early" than of its excellences of design or "type." It was not only the first but also the last of that "type." The art of dynamo design had not evoluted very long before I was convinced that this design, like all others of its day, was more or less of an abomination. Like the boy who was reproved by the minister for fishing on Sunday, and sought to discount his sin by saying he had caught only one fish and that was very small, I find consolation in the fact that there was only one of those dynamos "perpetrated," and that it was a small one—only 10 kw, if I remember rightly.

I do not feel so much abashed about the *motor*, however. Indeed, as I said in the discussion, I am not ashamed of it;

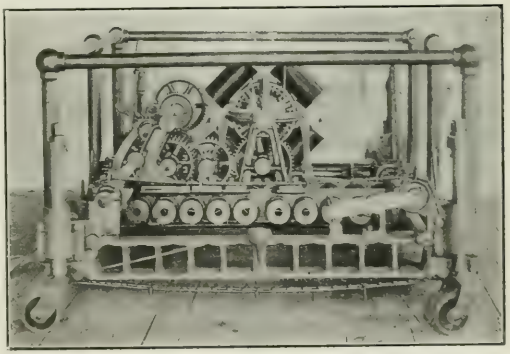


FIG. 1.—FRONT VIEW OF ELECTRICALLY DRIVEN COAL CUTTER.

on the contrary, I am proud of it even now, because it was really an "achievement" for its day, and for many a day after. I said that I had preserved a picture of this motor which I was not ashamed to show. As this pioneer design may be of interest to some of your readers, I send you herewith two photographs of the "Lucas" coal-cutter, which was equipped with the motor in question.

Fig. 1 shows the front end of the machine. This view shows the commutator end of the motor, both of the *two* brush-holders being visible. The coal-cutting machine was designed to bore 10 parallel holes as closely as possible to each other into the coal so as to form a sort of horizontal "undercut" in place of the undercut made by the miner by the pick. In Fig. 1 the 10 augers or drills are removed, the ends of the 10 driving shafts for them being visible, and also the square openings through the frame through which these augers passed. The entire mechanism moved on guides as fast as was supposed to be right to "feed" the augers into the coal. Fig. 2 shows the rear of the machine after the augers have been fed in. All the gearing shown served for conveying power from the motor to the augers and to the feed-mechanism.

The makers and the owners of the machine were unable to find any motor manufacturer, large or small, in this country, to undertake the responsibility of designing or building a motor suitable for this machine in 1884. The design was undertaken

by the firm of Mailloux & Rae, and was made by the writer in October and November, 1884. The motor was constructed at the works of J. H. Bunnell & Company, and was completed in the early part of 1885, together with the dynamo above mentioned. They were both put in operation in a coal mine at Saltsburg, Pa., in the spring and early summer of 1885.

According to the agreement made with the owners of the machine, the design was not to be paid for unless certain requirements were fulfilled by the motor, to the satisfaction of a disinterested expert, if necessary. The requirements agreed to were severe enough to try the skill of a good motor designer of even 10 or more years later. They included the following features: The motor must be adapted to its location and its shape must be such that it will utilize whatever space is not needed for the gears or for access to them or for "maneuvering" the machine (this machine being, of course, already made and without reference to the motor); it must not exceed 27 in. in height and (about) 30 in. in axial length; the motor shaft must have a certain relation to the mechanism for driving and feeding the augers; the total weight of the motor and of the reduction gear must not exceed 250 lb.; the speed must not

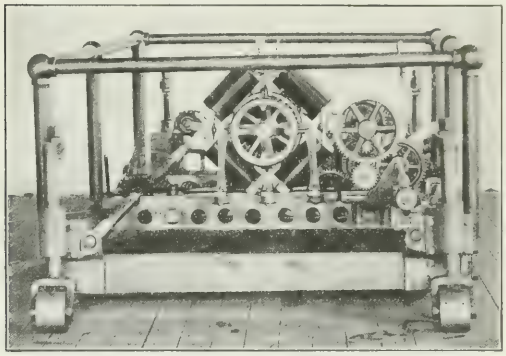


FIG. 2.—REAR VIEW OF ELECTRICALLY DRIVEN COAL-CUTTER

exceed 750 r.p.m.; the power output must not be less than 2½ (2.5) brake-hp.

These requirements were *all* complied with to the satisfaction of an expert engaged by the mine owners, and the design was duly paid for. If the state of the art of motor design at that period is taken into consideration, the designer of this motor feels that he has reason to be proud rather than ashamed. The motor was certainly the first multipolar motor designed, built and put in operation in this country. Moreover, it was also the first multipolar motor with cross-connected commutator, and requiring only two brushes. This feature was an original invention of the writer, who, however, discovered on trying to get a patent, that Mordey was a little ahead of him. This motor had wrought-iron field cores and cast-iron pole-pieces. The armature was of the Pacinotti slotted type, with 32 sections only. It was designed for operation as a series motor with a starting resistance, on a constant-potential circuit of 350 volts at the dynamo terminals, or about 300 volts at the motor with full load. This was very high tension for that time. The pole pieces were given a great deal of attention so as to obtain good commutation. The results were satisfactory enough; the motor did not flash over at any time and it did not spark as much under full load and overload as many motors of much later "vintage." In the brake tests the load was run up to over 4 brake-hp for short periods without difficulty. The efficiency (which, of course, was *not* guaranteed), ranged between 40 per cent and 70 per cent, according to the load, the best efficiency being obtained at a little under 2 hp.

As first tried with the coal-cutting machine (as originally built), the results were negative. This was naturally a great disappointment to the inventor and to the owners of the machine, who did not hesitate, of course, to blame the motor. The writer, however, foreseeing this, had insisted on a limiting or maximum power output being agreed to, and had refused to guarantee that the machine would operate as a coal-cutter with that or with any power whatever. Dynamometer tests made of the machine, but not cutting coal, had indicated that the power required should not exceed 1.5 hp or 2 hp. Hence, 2.5 hp was deemed ample margin. The tests showed invariably that after starting to bore the coal and running with a low current for a short time until the augers had entered the coal to a depth of an inch or two only, the current would rise rapidly until the fuses blew. The fuse limit was raised until the input at the time the fuses blew exceeded 7 kw or 8 kw, with very little improvement in the result. Moreover, the number of augers was reduced until one only remained, without material benefit. This led the writer to the conclusion that there was something radically wrong about the "boring." A few experiments made with a drill set in the chuck of a lathe and fed into a chunk of coal at various rates of feed soon elucidated the mystery, by showing that the augers were *driven* too fast (600 r.p.m.) and were *fed* too slow (1/64 in. per turn). This caused the drills to "glaze" the coal without cutting, so that after a few turns the feed merely increased the pressure against the bearings until the power available could no longer produce motion. The writer, having discovered the trouble, was retained to rearrange the "gear-ratios." The rotating speed of the augers was reduced to about 60 r.p.m.; and the feed was increased to about ¼ in. per turn of the augers. It then became possible to make complete borings with all the augers, with less than 3 hp. This did not prevent the machine from being a failure, nevertheless, because the holes made by the augers left too much coal between them, necessitating too much hand work to complete the "undercut."

The motor had "made good," but the coal-cutter had not; and both found their way to the "grave-yard" together. The motor, as the writer sincerely believes, deserved a far better fate. Many a design, poorer and less original in all respects, served, later, as the pretext for some stock company that flashed like a meteor for a brief period over the electrical horizon and left only "smoke" and worthless paper behind. This motor had the fate of the many a flower

"That is born to blush unseen,
And waste its sweetness on the desert air."

And so, I thought I would take this opportunity to give this unfortunate, precocious motor a decent burial. Requiescat in pace.

NEW YORK. C. O. MAILLOUX.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

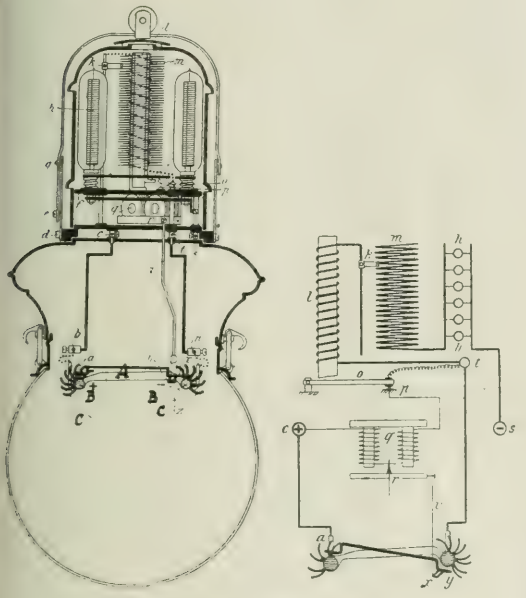
Turbo-Alternators.—An illustrated description of a 32,000-kv-amp turbo-alternator recently installed in the electricity works of the Aston Manor Corporation. The construction of the rotor is particularly interesting on account of the high speed at which it runs (1500 r.p.m.). It has salient poles, but no separate pole-shoes, and the spaces are machined out of the solid. The shaft is forged in one piece with the rotor. The characteristic curves of the machine are given from which it is seen that the voltage rises 4.5 per cent, when full non-inductive load is thrown off, and 15 per cent with a full inductive load of 80 per cent power factor.—Lond. *Elec. Eng'ing* April 29.

Polyphase Commutator Motors.—E. ROTH.—The conclusion

of his long mathematical paper on the theory of polyphase commutator motors with shunt excitation. In the present instalment the author discusses the most general case and gives the circular diagram for this case.—*La Lumière Elec.*, April 24.

Lights and Lighting.

Quartz Lamp.—O. BUSSMANN.—An illustrated description of the latest form of the Küch quartz lamp. This lamp is essentially a mercury-vapor lamp with a quartz tube, the specific consumption being 0.2 watt per hefner cp, and the life being 2000 or 3000 hours, or even up to 6000 hours. The high efficiency of the lamp is due to the high temperature of the mercury vapor which is estimated at 5000 C. or 6000 C. The



FIGS. 1 AND 2.—QUARTZ LAMP

mechanism of the quartz lamp serves only for starting, not for regulating the lamp, and is therefore very simple and hardly subject at all to wear and tear. Fig. 1 is a cross-section of the lamp and Fig. 2 shows the connections of the circuit. The quartz tube *A* has at each end a closed cylindrical vessel *B* filled with mercury. The connections to the external circuit are made through the walls of *B* with the mercury. *C* are metallic leaves for cooling the ends of the lamp. The other letters refer to the same portions of the lamp in both illustrations. The quartz tube is held on its axle *a x* in bearings. By means of the lever *v* the tube is connected to the armature *r* of a shunt magnet, *q*. On closing the circuit, the armature of the shunt magnet is attracted and the quartz tube so tilted that the mercury flows over from the upper end to the lower end and closes the circuit. Current now passes through the mercury in the tube. This current magnetizes the inductance coil *l* which attracts the armature *o* and thereby opens the circuit of the tilting magnet *q* at *p*. The quartz tube now returns into its original position, the mercury separates again into two parts and an arc is formed. The process is exactly analogous to the starting of an arc lamp in which the two carbons are first brought into contact and then separated from each other. But in the quartz tube the arc would not remain lighted if there was air in the tube. The arc will then be broken, the tilting mechanism will act again, a new arc will be started and more mercury will evaporate. This will be repeated until there is sufficient mercury vapor in the tube to maintain the arc. But this occurs only if the quantity of air in the tube is small. If it is beyond a certain limit, a sufficient quantity of mercury cannot evaporate and the starting mechanism will continue to operate, the arc being lighted and extinguished in regular intervals until the lamp is disconnected. Since the resistance of the arc changes, it is necessary to use a series resistance. This consists of iron wires in a hydrogen atmosphere represented by *h* in the illustrations. The choking coil *l*, besides acting on *o*, also serves for another purpose. Mercury-vapor lamps are sensitive with respect to voltage variations, and if in a network the voltage drops suddenly by several volts when some large motors are connected to the circuit, the current in the quartz lamp is liable to drop so as to extinguish the lamp. The tilting mechanism would then act again, but the temporary extinction of the lamp would be troublesome. The inductance coil *l* produces in case of a certain drop of current, a rush of current in the same direction so that the lamp remains lighted. Fused quartz has a zero temperature coefficient of elongation. For the connections through the walls, a metal of zero coefficient must, therefore, also be used. This is nickel steel. It is cut in form of cones and these are tightly set into corresponding holes in the wall, a tight fit being assured by applying some mercury and covering the joint on the outside with some material which prevents the mercury from flowing out and evaporating. The commercial quartz-tube lamp for 100 volts to 130 volts consumes 4 amp and 85 volts, giving 1200 hefner candles. For voltages between 200 and 250 two lamps are made, one for 2.5 amp and 160 volts at the quartz tube, giving 1500 hefner candles, the other for 3.5 amp and 280 volts, giving 3000 hefner candles. The excess voltage is consumed in series resistances in the same way as in arc lamps. There are now in preparation four models for interior lighting for semi-indirect illumination, absorbing 2.5 amp and 4 amp at 110 volts and 1.5 amp and 2.5 amp at 220 volts, respectively.—*Elek Zeit.*, April 29.

Enclosed Flame-Arc Lamp.—A note on a recent British patent (8304, 1908; April 22, 1909) of W. J. Davy for preventing a deposit on enclosed flame-arc lamp globes. The arc is surrounded by a glass cylinder, which extends down nearly to the bottom of the inner enclosing globe. No deposit is formed on the interior of this cylinder, as it is kept hot, and, furthermore, there is a strong draught of air along the inner surface. Above the bottom plate of the body of the lamp is a metal cylinder which surrounds the cylindrical chamber containing the controlling mechanism. Air passes up through the glass cylinder, past the arc, up between the metal cylinder and the mechanism chamber, then down between the metal cylinder and the outer case, and finally through perforations in the metal ring between the glass cylinder and the inner globe into the latter. The chemical residue is deposited on the cool metal surfaces. Four small-flame carbons in a parallel are used on the top, and one large plain carbon below, this preventing failure to strike due to a deposit of silica on the lower carbon.—Lond. *Elec. Eng'ing*, April 29.

"Tubolite" Lamp.—An illustrated note on the tungsten tubolite lamp. A straight length of about 7 in. is fixed in the tubu-



FIG. 3.—END OF LAMP SHOWING SPRING ATTACHMENT AND ONE INTERMEDIATE SUPPORT.

lar lamp in the manner illustrated in Fig. 3, which shows one end of the lamp and one of the two intermediate supports. The lamp is rated at 12 cp, 25 volts, and consumes 1.45 watts per candle, this consumption remaining constant throughout the whole life of the lamp, which, as far as is known at present, extends to 1000 hours. If the consumption is measured in front of the reflector it works out to less than 1 watt per candle. To take up the expansion of the filament, it is supported at both ends by six metal springs of strip metal.—Lond. *Elec. Eng'ing*, April 29.

Tungsten Filament.—A note on a recent British patent (17,438, 1908; April 22, 1909) of Siemens & Halske Company

for making a tungsten filament from tungsten nickel alloy. A ductile alloy of tungsten and nickel is obtained by intimately mixing the two metals in the form of powder or reducible compounds, and then sintering the product together by heating below the melting point of tungsten. A suitable alloy, which may be rolled and drawn into wire, contains 10 per cent nickel, and if a pure tungsten wire is required, the nickel can be removed after drawing by heating the wire by passing a current through it in a vacuum. The powdered metals or compounds are pressed into rods 1 mm to 2 mm in diameter, and these are heated in quartz tubes through which hydrogen is passed. The temperature is raised gradually up to about 1600 deg. C. and kept so for some minutes, during which time the rods are converted into an alloy of tungsten and nickel.—Lond. *Elec. Eng'ing*, April 29.

Vacuum Meter.—H. J. Reiff.—A fully illustrated article on a vacuum meter, based on the principle of MacLeod, and its use in incandescent-lamp factories.—*Elek. Anz.*, April 22, and 25.

Power.

Steam Engines.—The (British) Engineering Standards Committee has issued a report on reciprocating steam engines for electrical purposes, which is intended to assist engineers and makers of steam engines for electrical purposes to a mutual understanding. The steam pressures specified as standard are 100 lb., 150 lb., 200 lb. and 300 lb. per square inch, and these are defined as low pressure, intermediate pressure, high pressure and extra high pressure, respectively. The following exhaust pressures are recognized as standard: 15 lb. per square inch absolute (non-condensing), 2.5 lb. per square inch ("medium" vacuum), and 1.5 lb. per square inch ("good" vacuum). A table of standard speeds for various outputs from 30 kw to 1000 kw is given. The clauses on cyclic speed variation and governing are as follows: "The maximum permissible variation in speed of the generator, when direct coupled to a steam engine, throughout one revolution—that is to say, in the amount the rotating part forges ahead plus the amount it lags behind the position of uniform rotation—shall not exceed one-thirtieth of the angle between the two poles, i.e., the angular variation shall not exceed: 6 deg. in a two-pole machine, 1.2 deg. in a 10-pole machine, and so on. The maximum temperature increase or reduction in speed, due to suddenly taking off or throwing on the whole load, shall not exceed 10 per cent of the standard full-load speed, and the continuing alteration in speed shall not exceed 5 per cent of the standard full-load speed. Also the maximum temporary variation in speed due to the load being varied gradually, or by steps not exceeding 20 per cent of the rated load, shall not exceed 5 per cent of the standard full-load speed." The standard continuous overload capacity is given as 20 per cent.—Lond. *Elec. Eng'ing*, April 29.

Electric Energy from Peat.—K. B. Eller.—A brief note on a peat power station which was erected at Skabersjo, in Sweden, in 1903, and has now been working for over five years. The bog which supplies the peat is only small, about 37 acres, with an average depth of 5 ft., and is estimated to last for a period of 30 years. There are two suction-gas producers and two gas engines, with direct-coupled electric generators of 150 hp each. The power is conducted from Skabersjo to Svedala, a distance of two to three miles, and there some of it is used for lighting the streets and some is distributed to mechanical works and several small industries. Although the by-products, with the exception of tar, are not recovered—the plant not being large enough to make this remunerative—the cost of production is very low. The price of power paid by the consumers is, besides a small yearly charge per motor, 2 öre (= about ½ cent) per hp-hour.—Lond. *Engineering*, April 30.

Water-Power Transmission to Paris.—A. Blondel.—A paper presented to the French Association for the Advancement of Science on the scheme of Blondel, Harle and Mahl, of transmitting electrical energy from the Rhone River to Paris. It is estimated that about 1,000,000,000 kw-hours could be transmitted to Paris every year. Two systems are especially compared: the direct-current, high-tension series system of Thury and the three-phase system. While the author does not reach any definite conclusion, he appears to look on the Thury system quite favorably.—*La Revue Elec.*, April 30.

Traction.

Electrification of Railways.—J. A. F. Aspinall.—An abstract of his presidential address to the (British) Inst. Mech. Eng. The general question of the desirability of converting existing steam railways to electrical working is first discussed, after which the Liverpool-Southport electrified section of the Lancashire & Yorkshire Railway is described, where electrification was resorted to "not to save money, but to make money." If this course had not been followed it would have been necessary to increase the terminal facilities. By electrification both the platform operations and the signal operations per train are reduced to one-half the number necessary for steam trains, and thus the capacity of the terminal stations is doubled. Before the electrification of the Liverpool-Southport line, the six-wheeled, coupled tank locomotives consumed 80 lb. of coal per train-mile with express trains and 100 lb. with stopping trains, these heavy figures being due to the high acceleration required. On the other hand, the consumption of coal at the power station in 1908 was found to be only 49 lb. per train-mile for the electrical trains. Another interesting point is that of rating. Apparently a steam electrified railway stands at an advantage, because the rating law, in dealing with the "hypothetical tenant," considers the steam locomotive as part of the tenant's capital, and therefore allows a deduction from the rate, but in the case of an electrified railway the power station is rated separately, and this increases the annual expenditure. With electric rolling stock, the center of gravity has been brought low and a greater proportion of the weight is not spring-borne. The result is a greatly increased wear of tires and rails. This defect could be remedied by raising the motors and transmitting the drive in some other way. The wear would be reduced, but, on the other hand, the drive would be less direct and less efficient, and the construction of the motor-cars would be more difficult. Concerning the cost of operation the author makes the following remarks: Any railway company having the opportunity of putting down its own plant in the country with ample facilities for getting cheap coal and water should be able to produce current at the generating stations at a "works cost" of less than 0.5 cent per kw-hour, the coal consumption being under 3 lb. per alternating-current unit. With such figures as these, it is possible to work a high-speed service at 19 cents per train-mile, including "works cost" for the power house, substations, battery stations, "operating costs," for motor and electrical equipment, repairs, car repairs, guards' and motormen's wages, lighting and heating of cars, repairs of third and fourth rails, bonds and cables, and all working stores. The cost per car-mile varies between 5.5 cents and 6 cents according to the number of cars run. The total current-producing charges, including conversion at substation, the cost of battery stations and depreciation of batteries, absorbs 9.04 cents out of the 19 per train-mile. With the exception of the depreciation of batteries, no sum is included for depreciation of plant or for interest on outlay. The above figures are not intended to, and do not, include any part of the cost of maintaining the running track, the passenger and goods stations, or costs for the platform staff, or any other items required for the railway, whether worked as a steam line or as an electric line. The great economy to be hoped for in the future for electrical railways, where no water power is available, is in the production of electricity in very large quantities. Further economies may be sought in improvements of the motors so as to reduce the cost of repairs and in improvements of the whole design of the improved truck.—Lond. *Electrician*, April 30.

Electric Locomotive.—An illustrated description of an experimental locomotive which has been built at Schenectady, the distinguishing feature of which is the use of motors mounted above the frames and coupled to the driving wheels by connecting rods and side rods. The locomotive is to be equipped with two 800-hp, 15-cycle, single-phase motors, with a tractive effort of 30,000 lb. at 18 miles per hour.—*Elec. Rail. Jour.*, May 8.

Overhead Conductors.—P. Dawson.—In a continuation of his long illustrated serial on electric traction of railways, the author deals with overhead construction and discusses especially the design of insulators and the suspension of the trolley wire.—Lond. *Electrician,* April 30.

Thury System for Traction.—Bourdel.—An abstract of a paper read before the International Association of Electricians in Paris on the principal features and equipment of a direct-current, constant-current traction system, all the motors being in series according to the Thury system.—*L'Industrie Elec.,* April 25.

Installations, Systems and Appliances.

Paris.—A. Soulier.—Since 1889 the supply of electrical energy in Paris has been in the hands of six large companies. In 1907 the municipal board decided to take over the electrical supply, but since the certain introduction of one uniform system would have involved enormous inconveniences, it was decided to adopt a transitory system for the period from 1907 to 1913. For this purpose the city of Paris was divided into four zones: the first being equipped with the three-wire direct-current system; the second with the five-wire direct-current system; the third with the single-phase alternating-current system, and the fourth with the two-phase system. To supply these different zones with electrical energy single-phase currents will be generated at 3000 volts and two-phase currents at 12,300 volts at a frequency of 41 2/3, and will be transmitted to various substations.—*L'Industrie Elec.,* April 25.

Tariff for Electrical Energy.—L. George.—The first part of an article classifying and discussing the various systems of charging for electrical energy.—*L'Industrie Elec.,* April 10 and 25.

Water Rheostats.—F. Lobbe.—An article giving formulas and drawings for water rheostats, especially for use on three-phase systems.—*L'Industrie Elec.,* April 25.

Wires, Wiring and Conduits.

Aluminum and Bimetallic Conductors.—E. F. Northrup.—A long and valuable paper in which the author points out the complications due to the fact that besides ordinary solid, round copper conductors, there are now on the market stranded, aluminum and bimetallic conductors. This variety of competing conductors, when taken in connection with the two methods in vogue of defining conductivity, has led to a certain confusion of ideas as to the precise meaning of conductivity and the best way of determining and stating the relative worth to the user in dollars of conductors of different qualities and types. After a general introduction on conductivity, the author explains the two different definitions of Matthiessen's standard of conductivity and sums up the relations which exist between the general and specific properties of conductors. He then deals in detail with bimetallic conductors, and the comparative money value of different types of conductors. He takes as standard of value the market price of a given length and weight of copper. It is then easy to express the value to the user of any other conductor, as one of aluminum, or of bimetallic conductors, as compared with this copper conductor. The value to the purchaser will be the value of the conductor as a conveyor of electric power as compared with the value of a specified copper conductor. If the conductor considered has value additional to its power-conveying capacity, such as superior tensile strength, then this must be separately considered and allowed for. The measurement of conductivity is then discussed and in the appendix a summary is given of the many formulas derived in the article.—*Electrochem. and Met. Ind.,* May.

Heating of Cables.—L. Lichtenstein.—The standardization rules of the German Association of Electrical Engineers cover the permissible maximum current in underground cables for voltages up to 10,000. In order to get data for higher voltages the author has made experiments with eight different cables with a single core and with three conductors. The results are given in diagrams and the following tables are derived for the permissible currents. The first table relates to single-core cables with about 5 mm insulation thickness. The first column gives the cross-section in square millimeters (1 mm = 39 mils); the second the permissible maximum current in amperes for non-armored cables, and the third column the permissible maximum current for armored cables, buried in the ground.

Sq. mm.	Amp.	Amp.	Sq. mm.	Amp.	Amp.
16	104	100	50	208	200
25	130	130	70	256	246
35	168	161	95	308	295

The next table relates to three-core cables with 17 mm insulation thickness, the cables being buried in the ground:

Sq. mm.	Amp.	Sq. mm.	Amp.
25	82	70	150
35	100	95	175
50	120	120	205

The first column represents again the cross-section in square millimeters, and the second column the permissible current in amperes.—*Elek. Zeit.,* April 29.

Cable Papers.—C. Beadle and H. P. Stevens.—The conclusion of their long paper on the composition and durability of cable papers. The authors discuss the methods of manufacture and composition of cable papers and ash determination. They finally mention that papers impregnated with rosin oil may deteriorate when heated in contact with air, but that no deterioration probably takes place if the heating is carried out not in contact with the atmosphere, as in lead-sheathed cables.—Lond. *Electrician,* April 30.

Electrophysics and Magnetism.

Radio-Active Elements.—Strömholm and Svedberg.—The chemical characters of most of the radio-elements are only imperfectly known. It has been found that some of them accompany certain well-known elements in precipitation, while others volatilize at high temperatures. Whether the volatilized substances are the uncombined elements, their oxides or other componds are unknown, while in the case of precipitations the phenomenon of absorption may play an important part in such exceedingly low concentrations as exist in these cases, so that conclusions in regard to chemical relations must be drawn with caution. In view of these circumstances, the authors have undertaken a study of the subject by the use of isomorphism. As an example of the behavior of normal elements, the following experiments were made: To equal portions of a warm saturated solution of barium nitrate, equal amounts of dilute solutions of silver, mercuric, lead and bismuth nitrates were added, and after cooling it was found that the crystallized barium nitrate contained neither silver, mercury nor bismuth, but it had taken up much lead in solid solution. From a similar series of experiments with potassium nitrate none of the above-mentioned metals showed a solubility in the solid phrase, while in the case of sodium nitrate a considerable amount of silver and a little lead were found in the crystals. The authors applied this method to a solution of Rutherford's thorium X and found that this element is isomorphous with barium and lead, that it follows barium in its precipitations, and therefore belongs to the alkali-earth group of metals. Similar experiments with thorium nitrate solutions gave less definite results on account of the numerous radio-active bodies present in such solutions, but it is the purpose of the authors to extend their studies by this method to other series of radio-active elements.—Abstracted from *Zeit. f. anorgan. Chem.,* Vol. 61, p. 338, in *American Jour. of Science,* May.

Discharge Tube.—J. J. Thomson.—A lecture before the Royal Institution on electrical striations. The author describes the apparatus by means of which he explored the electric field in the discharge tube. The different colors observed in the striæ are due to two causes: First, a difference in local temperature or speed, low temperatures give a reddish glow, higher temperatures a bluish glow. There is, secondly, a separation of colors with regard to the different gases in mixtures.—Lond. *Electrician,* April 9.

Electrochemistry and Batteries.

Caustic Soda and Chlorine.—F. G. Donnan, J. T. Barker and B. P. Hill.—An illustrated Faraday Society paper on the Finlay cell for electrolysis of alkali-chlorides. It is a diaphragm

cell with two diaphragms and three compartments. The middle compartment between the two diaphragms is filled with fresh brine and this is pressed into the anode as well as the cathode compartments. In this way the anodic and cathodic products of electrolysis are kept separate from each other. The authors give details of the current and energy efficiency of this cell.—Lond. *Electrician*, April 30.

Nitric Acid from Air.—Schoenherr.—An illustrated paper read before the Berlin Electrical Society on the new process of the Badische Company for the fixation of atmospheric nitrogen. —*Elek. Zeit.*, April 22 and 29.

Ferrochrome.—J. Escard.—A continuation of his article on methods for the manufacture of ferrochrome. He refers briefly to an electrolytic method and then discusses the aluminothermic process, and emphasizes finally the importance of the ferrochrome industry.—*La Lumière Elec.*, April 24.

Units, Measurements and Instruments.

Leakage Switch.—An illustrated description of an instrument of English make, intended to safeguard against leakage to earth on an electrical installation, which may not suffice to blow the fuses, but may cause a fire. The instrument detects a leakage on either wire, and deals with it by opening the circuit on both poles. As shown in Fig. 4, the instrument consists of a differential relay, trigger and set of tumbler switches. The relay consists of two moving coils $C_1 C_2$, as used in ammeters, which are mounted on a common spindle, electrically divided in the middle. The coils are respectively connected in shunt to two small resistances B_1 B_2, which are traversed by the main current flowing to the installation; when the lead and return currents are equal, the torque on each coil due to the bar-magnets and the shunt current is the same, and as the coils are connected on opposition they remain at rest. But if a leakage occurs on either side of the circuit the balance is upset and the coils rotate, bringing the tongue *p* into contact with one prong of the fork, and completing the circuit through relay *m*. The latter lifts the trigger *m* and releases the arm of the switch *b*, which, being pulled by the spring *s*, flies over to the left and opens both switches, *A* and *B*, which are coupled by the insulating link *e'*. The switches can be closed by pulling the handle *H* outside the case, which first opens switch *C* and then, by means of the slotted link *f*, closes *A* and *B*, which are held closed by the trigger. The circuit cannot be closed, however, until *H* is pushed home again, leaving the instrument set as at first. If the leak is still on, the trigger is at once lifted and the circuit broken again, so that it is impossible to leave the installation alive and in a dangerous condition. Less than a quarter of an ampere difference between the lead end and the return currents suffices to actuate the instrument, no matter how great these currents may be. Ordinary tumbler switches, moving coils, etc., are employed in the construction of the apparatus.

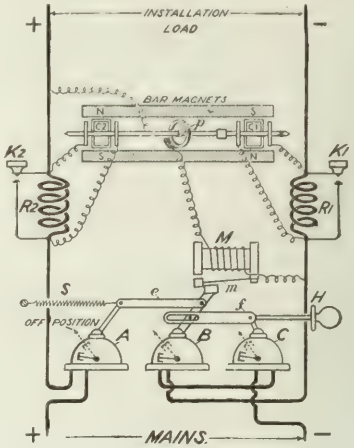


FIG. 4.—DIAGRAM OF CONNECTIONS.

which may, therefore, be expected to prove reliable in use. The keys K_1 K_2 serve for testing the instrument by short-circuiting the resistances.—Lond. *Elec. Review*, April 30.

Telegraphy, Telephony and Signals.

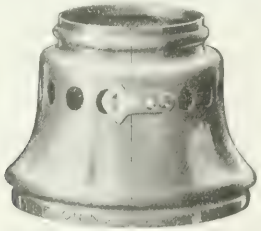
Wireless Telegraphy.—Count Arco.—A description of a new system of wireless telegraphy used by the Telefunken Company. It is a compromise between the "spark" and the "arc" systems. Technical details of the equipment used are not given, but its practical and technical advantages are fully discussed. Among these are that the use of small antennæ is possible, a high efficiency is obtained and large powers can be employed, while electrically the arrangement is much more free from disadvantages than are the older systems. There is very great freedom from disturbance, and messages can be made quite "private," while the signals are transmitted as clear as musical tones.—Lond. *Electrician*, April 30.

Wireless Telephony.—Henry.—An article dealing with the system of Majorana and Collins.—*L'Industrie Elec.*, April 25.

NEW APPARATUS AND APPLIANCES

Tungsten Lamp Shade-Holder.

The Tregoning Electric Manufacturing Company, of Cleveland, Ohio, has just placed on the market a new shade-holder,



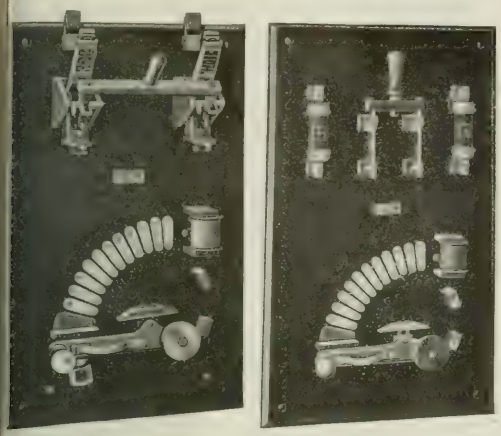
TUNGSTEN LAMP SHADE-HOLDER

for use in connection with tungsten lamp shades. It is of one piece, perforated shell, and has a security snap lock, preventing the holder from becoming detached when subjected to vibration. One of its features is the simplicity with which it is attached to the socket and shade, this being accomplished by a slight pressure of thumb and finger. Attachment of the holder to the shade and socket is obtained simultaneously. Separate parts, such as thumbscrews, collars, wire rings, etc., are eliminated, the method of locking and securing the socket and shade to the holder being embodied in one piece.

Starting Panels for Direct-Current Service.

The use of starting panels for direct-current motors instead of a starting rheostat with separate switch and fuses is becoming quite common in a large number of industries, mainly because the panel insures a more satisfactory location for rheostat, fuses, switch or circuit-breaker than is often accorded to some of these parts when mounted separately. A line of starting panels has recently been placed on the market by the West-

ghouse Electric & Manufacturing Company, ranging in capac- from a starter for a ¼-hp motor at 110 volts to one for a o-hp motor at 220 volts, including panels for 500-volt cir- its. These panels are made up in several different styles and



FIGS. 1 AND 2.—STARTING PANELS.

an be mounted with wall brackets or on tubular supports esting on the floor.

Each panel consists of a slate slab on which are mounted the heostat contacts and contact arm, the main switch and fuses r the circuit-breaker. In the smaller sizes the resistance is ounted on the back of the panel, but in the larger sizes it is

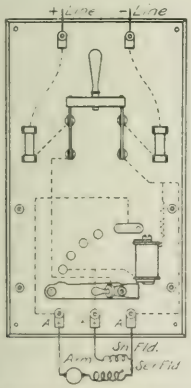


FIG. 3.—DIAGRAM OF CONNECTIONS.

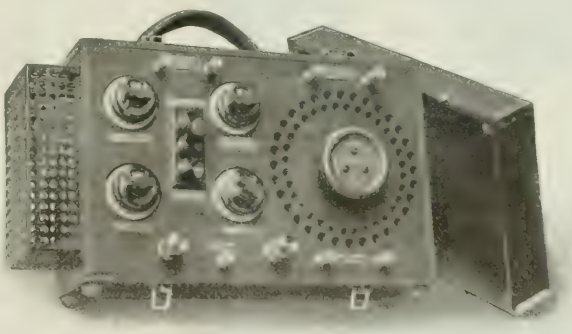
mounted separately. Five terminals are provided for con- ection to the line wires and the motor leads, and are plainly marked so that it is difficult for a man, even if unfamiliar with starting apparatus, to make a mistake in connecting, especially as a diagram is sent with the starting panels.

Fig. 1 shows a starting panel with a carbon-break circuit- breaker, and Fig. 2 shows another panel with the same arrange- ment of face-plate contacts, etc., but which has a main switch and fuses instead of a circuit-breaker. All sizes are provided with low-voltage release devices which automatically return the contact arms to the starting position on interruption of the power. Fig. 3 shows the diagram of connections for a panel for a 1¼-hp motor. It will be noted that the low-voltage release coil is independent of the field circuit, so that the start- ing panels are suitable for shunt, series or compound motors. All contacts on sizes over 1¼ hp, either 110 volts or 220 volts, are renewable from the front without disturbing any connec- tion. In all sizes the initial contacts are protected from burn- ing by a quick-break arcing tip on the front of the panel, or by a blow-out coil on the rear, which prevents burning the con- tact on opening the circuit.

The question of whether a panel with circuit-breaker or switch and fuses is preferable cannot be answered definitely to apply to all installations, since each has its advantages and hence its own particular field. If fuses and circuit-breakers are rated to open the circuit at a certain current, the breaker will positively open the circuit as soon as the current reaches that value, even though the current remains at this high point only a very short time, while the fuse will carry currents in excess of its capacity for brief intervals. For this reason fuses may be preferable for motors that are liable to very brief overloads, especially where expert supervision of the electrical apparatus is maintained, such as in large mills and factories.

New Portable Testing Set for Watt-Hour Meters.

While the meter departments of electric-light companies are generally equipped with modern testing instruments of the in- dicating or portable rotating standard types, little attention has been given to a quick, economical method of loading meters in place, large quantities of energy being used at times in lamp- bank loads, etc. The portable testing set illustrated herewith and made by the Mohawk Electric Company, of Albany, N. Y., is claimed to offer numerous advantages over the older methods employed. The apparatus can be used only on alternating- current circuits, and while the set is particularly applicable to testing meters of the induction type, all types of direct-current meters can also be tested where alternating current is available for this purpose. By using a transformer of special design



TESTING SET FOR WATT-HOUR METERS.

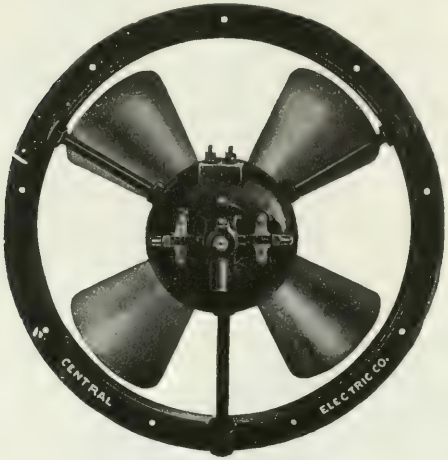
and employing non-inductive resistance units for control, no appreciable errors are introduced. The connecting terminals and plug switches are all plainly marked, and by the use of but four snap switches and an adjustable rheostat, any desired load can be instantly obtained. Provision is made also for testing other apparatus, such as a large number of lamps for wattage rating, etc. The sets are made for 5, 15, 25, 50, 75, 100 and 200 amp on 110-volt circuits, and weigh about 16 lb.

Modern Ventilation.

To meet the demand for a reasonably priced ventilating de- vice, the Central Electric Company, Chicago, Ill., is marketing the fan shown in the accompanying illustration and which is particularly adapted to use in hotels, cafés, restaurants, saloons, stores, bakeries, halls, theaters, churches and billiard parlors where the ventilating fan is an absolute necessity in order to

properly serve the convenience of the public. In other places it also serves not only as a means of ventilation, but for removing dust, dirt, vapors, odors, etc., as in kitchens, boiler and engine-rooms, laundries, lavatories, candy factories, machine shops, mechanical works, breweries, textile mills, cold-storage houses, rubber factories, newspaper offices, starch factories, paper mills, packing houses, tobacco factories, etc.

This fan is made in both direct-current and alternating-current types, is 12-in. or 16-in. in diameter and embodies the latest improvements in motor design, all the parts being perfectly balanced and mounted in improved bearings, thus insuring minimum attention and noiseless operation. Particular attention has been given to the design of the supporting frame and a construction secured which is not only simple and strong, but one which is easily installed or removed. The motor bodies and supporting frames are finished in dull black marine, the blades, brush holders and oil cups being finished in polished lacquered brass, thus securing a combination which is durable and



VENTILATING FAN.

pleasing in appearance. The motors are wound for use on 100-125-volt or 200-300-volt circuits. The alternating-current fan is wound for 25-cycle, 30-cycle, 40-cycle, 60-cycle, 125-cycle or 133-cycle circuits, thus giving a very wide range of application.

Special Transmission Line Towers.

Energy for operating the Syracuse, Lake Shore & Northern Railway, which extends from Syracuse to Fulton, N. Y., is obtained from the generating station of the Ontario Power Company at Niagara Falls. The energy is transmitted over 60,000-volt circuits to a transformer substation in Syracuse where the e.m.f. is changed to 33,000 volts for further transmission to railway substations along the route of the above-mentioned railway. The 33,000-volt, three-phase transmission line crosses the Seneca River at Baldwinsville and the Oswego River at Phœnix. At each of these places it has been necessary to erect special transmission towers for carrying the line across the river. The span at the former place is 900 ft. in length, while that at the latter is 700 ft. A view of one of the spans is shown in Fig. 1, a side view of one of the supporting poles being given in Fig. 2. The tower measures 55 ft. in height to the lowest insulator, the other insulators being placed vertically 5 ft. apart and separated by 9 ft. horizontally. Each of the six cables was erected with a stress of 3000 lb., but the towers have been designed for an estimated maximum strain of 8000 lb. for the highest wind velocity when the cables are covered with sleet.

The cable is attached by means of clamps to a saddle which rests on and is supported by six porcelain insulators mounte on wrought-iron pins. For transferring the strain of the cable to the insulators use is made of a 1-in. steel pin so placed o the saddle that there is no twisting moment on the insulator In case repairs become necessary any one insulator may be re

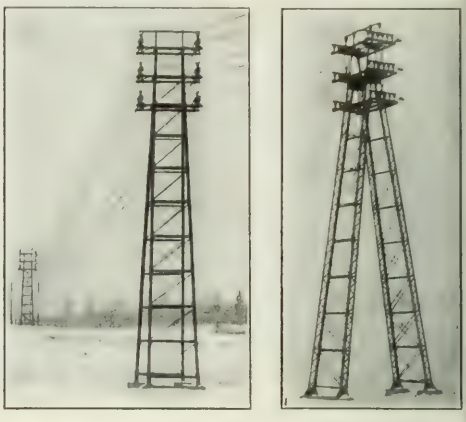


FIG. 1.—TOWERS FOR SPAN ACROSS THE OSWEGO RIVER. FIG. 2.—SI VIEW OF TOWERS SHOWING ARRANGEMENT OF INSULATORS.

moved without disturbing the other five, which continue to su port and insulate the cable from the tower.

Each tower is built in two parts resembling ladders. The parts are erected separately and bolted together in their fin resting-places. These towers were designed and built by t Archbold-Brady Company, Syracuse, N. Y.

Weather-Proof Tungsten Cluster.

The Benjamin Electric Manufacturing Company, Chicago, placing on the market the tungsten substitute for arc lam shown in the accompanying illustration. As will be seen, it h a porcelain-enameled steel reflector and glass globe, the form being 20 in. in diameter and the latter 12 in. Above the form is a body portion of copper, metal cross-arms with porcela knobs, weatherproof porcelain connecting block and suspensi loop. The globe may be suspended and held in position f cleaning and removing lamps, or may be entirely removed desired. This is accomplished by means of a rod passi through the hollow support. The fixture is ventilated at t top and bottom through holes small enough to keep out i sects. An inside reflector of white-enameled steel, with ope ings for the lamps, assists in the radiation of light, this a



WEATHER PROOF TUNGSTEN CLUSTER.

the main reflector being low enough to secure a good distrib tion of the horizontal rays in a downward direction. T fixture is furnished without the upper portion for attachme to a gooseneck or other form of suspension, where the wir are concealed. It is made for four and five lights and is suitab for up to 100 watts.

Retail Branch of Buckeye Electric Company.

Because of the fact that the Cleveland Electric Illuminating Company, of Cleveland, Ohio, discontinued the sale of lamps of all kinds on May 1, the Buckeye Electric Company, in order to secure its share of the business thus released, has opened a handsome display and salesroom in connection with its general offices in the Cuyahoga Building, that city. This is a novel departure from the usual policy of manufacturers and the result will be watched with interest. The central-station sales aggregated about 250,000 lamps per year, and, of course, there is a desire on the part of all concerns handling lamps to secure as much of the business as possible. The management of the Buckeye Electric Company felt that the opportunity for securing a good proportion of the business would be much better if it could have a display-room, where both large and small users might see the lamps in use and judge of their fitness for the purposes desired. Heretofore only large jobs have been handled direct, but now all business will be taken care of by the office or its agencies.

The stockroom, opening directly into the lobby, has been fitted up to carry 4000 lamps at all times. On the wall 30 lamps have been arranged on brass bars for display and sample work. They range from 8-cp carbons to 250-watt tungstens, with tantalums and other kinds that may be desired. Reflectors are also carried in stock, so that the full outfit may be sold over the counter. These sales are usually for cash, but credit is extended in case the purchaser is shown to be good by the ratings of the retail credit men's association.

Twenty-five agencies have been established in various parts of the city which carry in stock 8-cp and 16-cp carbon and 40-watt, 60-watt and 100-watt tungsten lamps, of the voltage furnished by the company in the sections of the city where they are located. These adjuncts to the central salesroom have proved very valuable so far.

After opening the salesroom the company entered upon a campaign of newspaper publicity, using large space with attractive cuts and arguments for its product. Not only was the sales and display-room advertised, together with the fact that any quantities of lamps could be purchased direct, but the agencies, with their locations, were named. The cost of this publicity was no small factor in the business, but the results have fully justified the expenditure. While the space used is not so large now as at the beginning, the advertising is continued in attractive form and will be kept up in order to maintain interest constantly in the plan that has been adopted.

All lamps sold over the counter and by the agents command the long price. No attempt has been made to undersell any one else or to offer prices or terms that are better than if the product was handled by retail stores. The entire argument is for the quality of the lamps and the kind of service that is furnished. For instance, the company gets 20 cents each for carbon lamps, while some others are offered at smaller figures. The business is being built up upon a substantial basis that will insure permanency.

Mr. L. P. Sawyer, secretary and treasurer of the company, states that the people of Cleveland are growing better acquainted with tungsten lamps than any other city in the country and that they are appreciated for their high quality and illuminating power. During the first three months of the year the sales of this kind of lamp increased 100 per cent over any like period previous to that time. Almost the entire increase in the business of the company has been in tungsten and tantalum lamps. Carbon-lamp sales have just about held their own.

In its campaign for business the company makes it a practice to replace arc lamps rather than any other kind of incandescent lamps. This plan is more satisfactory to all central-station managers, from the fact that there is no investment nor maintenance expense on their part. General satisfaction has been secured from this policy and no change is in contemplation.

Special men are employed to work with the agents and keep up their interest in the sale of lamps. The agents are usually men engaged in some other line of business, drugs, stationery, grocery or something of the kind. Many persons come into their places of business and they have an opportunity of talking lamps to them. This system has been found satisfactory for the residence business, but, of course, on the large orders men adapted to that kind of work are sent out. The company has built up a good business in both branches and through its publicity and hustling staff of salesmen expects to make the local sales second to none in the country.

The Westinghouse Electric Toaster-Stove.

An ideal electric combination cooking appliance for table use is embodied in the design of the new Westinghouse electric toaster-stove, which is not only a satisfactory electric toaster, but is available, by the simple substitution of a suitable top, as an electric stove for cooking a variety of dishes. The entire outfit is of artistic form and is finely finished in nickel steel, being designed for use at the table, where toast, cakes, muffins, scrambled eggs and a dozen other breakfast dishes may be

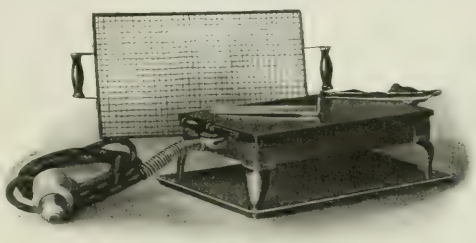


FIG. 1.—ELECTRIC TOASTER.

served piping hot, prepared by this quickest, simplest and nicest method of modern cooking.

The construction of the toaster-stove may be readily seen from the accompanying illustration (Fig. 1). For toasting, the heater surface is covered with a wire grid, and the uniform toasting heat impinged on the bread insures delicious, evenly browned toast. Used as a cooker, the steel top replaces the wire tray, providing a hot surface for any ordinary cooking operation. If necessary, the steel top may be inverted, turning up a narrow rim which serves to retain fluids on the hot plate. The toaster-



FIG. 2.—ELECTRIC TOASTER.

stove handle can be removed and used as a pancake turner. The toaster-stove will heat water in an extremely short time and makes an admirable hot plate for keeping food warm. It cannot overheat or burn out, even if left in circuit continuously. The toaster-stove measures 7 in. x 11 in. and weighs 5 lb. It is furnished complete with heater, toasting grid, cooking tray, detachable cord connection, and crumb tray. The heating element is of the well-known Westinghouse type, and is practically indestructible. The toaster-stove consumes 500 watts, and is made available for any voltage between 100 and 125.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The actual condition of commercial business was very little improved last week, but there was a considerable betterment noted in all industrial lines, and the general tone of business men was very much more cheerful. Weather conditions have been more favorable throughout the West and Southwest and planting has advanced more rapidly. It is practically conceded, however, that the wheat crop this season will be considerably short of what it was last year. The wholesalers and jobbers report that they are receiving orders only for filling-in purposes, but as even in the best of years this is an off season, these reports cause no astonishment. Retail business is only fair, but there is a general feeling in all branches that the fall trade will be very satisfactory. While there is an unusual amount of building, the lumber trade is not quite as brisk as it was a few weeks ago, and some of the Southern and Pacific Coast mills have been compelled to curtail their working hours. It is in the industrial line that the revival of business is becoming most marked. Reports from many of the leading industries show very satisfactory returns. This is especially true in the iron and steel products and in woolen and leather manufacturing. W. E. Corey, president of the United States Steel Corporation, announced last week that the plants of the big concern were now being operated at about 70 per cent of normal capacity, which is an increase of 10 per cent within the past 60 days. Representatives of the great electrical companies say that orders are being received in very much better volume and that if the improvement continues in the present ratio 1909 will probably equal 1907. The American Steel & Wire Company claims that within the past two weeks orders have been received in record-breaking volume and at times have run as high as 20,000 tons a single day. The United States Cast Iron Pipe & Foundry Company is operating at about 85 per cent of normal and has every prospect of reaching full capacity in the early fall. The International Harvester Company is practically running full time. The United States Rubber Company reports that it has sufficient business upon its books to keep its plant in steady operation for the rest of the year. All of these things indicate that the industrial tide has turned. The earnings of the railroad companies continue to grow, gross earnings are considerably in advance of a year ago and net earnings are in most instances the best in the histories of the roads. Collections continue to be rather slow but there seems to be little disposition on the part of creditors to use strenuous methods. Business failures for the week ended May 13 were 224, against 214 in the previous week, 281 in the same week of 1908, 184 in 1907, 161 in 1906 and 191 in 1905.

THE COPPER MARKET.

There has been very much more real strength and activity in the copper market during the past week than has shown up at any time within recent months. It was very generally understood that the rush of sales in March, which were largely advertised by the copper producers as evidence of returning interest, were in fact mostly speculative and really counted for little. The present condition is different and prices have been strengthened not on account of speculative buying but because it is apparent that there is an improved demand for the finished products in which copper plays a part. Wire, sheets, plates and castings are all in better demand and the manufacturers of electrical goods are better employed. All manufacturers have bought more liberally and there have been inquiries for some round lots for future delivery—a class of business which the producers do not at the present time seem inclined to encourage. The fact that consumers are anxious to buy has advanced prices for both lake and electrolytic to above 13 cents, with the prospect that a still further advance will be logical in the near future. For the first time in many months the consumers seem to be willing to purchase in advance of actual requirements. Heretofore they have been willing to allow the burden of carrying surplus copper to rest upon the producers, and have only bought to fill orders already taken. There is a disposition now to anticipate future business and this in reality is one of the most hopeful signs of the times. Among some of the statisticians of the copper market it is calculated that the consumers now have on hand a very liberal supply. These calculators figure that, according to the producers' returns, the consumers have taken 189,000,000 lb. since Jan. 1, and that in the same period they have used less than 130,000,000 lb., leaving in their hands at least 60,000,000 lb. This would mean a stock sufficient for a month and a half of normal business. Such figures, however, do not agree with present anxiety of the consumers to purchase. There is no doubt that American takings in May will be the heaviest of the year, that the exports will continue to be large and that consequently, in spite of the heavy production, there may be no addition to the surplus stock on June 1. Quotations on the Metal Exchange May 17 were:

Lake	13⅛ @ 13⅜
Electrolytic	12¾ @ 13
Casting	12⅝ @ [illegible]

The London prices May 17 were as follows:

	Noon.	Close.
	£ s. d.	£ s. d.
Standard copper, spot	58 7 6	59 8 9
Standard copper, future	59 1 3	59 2 6
Market	Easy.	Steady.
Sales of spot		400 tons
Sales of futures		850 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	[illegible]	[illegible]
Lake	14.55	12.55
Electrolytic	14.[illegible]	12.12½
Castings	14.12½	12.50
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 15 0
London, best selected	67 10 0	59 0 0

ELECTRIC WEIGHING MACHINES FOR SUGAR IMPORTS.—Since the exposure of the irregularities in the weighing of raw sugar imports by the customs weighers and inspectors, the Government officials have determined to put into service automatic devices for this purpose. This is in line with plans that Gen. James S. Clarkson, Surveyor of the Port, has long been preparing. An automatic weighing machine that would record on a dial and which could not be tampered with was what General Clarkson wanted. He gave his ideas to Frank Davis, a Government employee with mechanical training, for development, and it is now believed that a machine that will answer the purpose has been designed. Mr. Davis did all his work at the United States Mint in Philadelphia, where the sample machine was built and tried. The plans have been kept secret ever since and the Government owns all the rights to the machine, although Mr. Davis, the nominal inventor, will derive a small royalty from them when they are actually placed in service. Bids have been asked for 20 of these machines, manufactured on the Government's plans, and the proposals will be opened at the Treasury Department, in Washington, May 20. The scales, so it was stated at the Custom House, have been thoroughly tested both here and in Washington and have finally been brought to a state of perfection where all objections have been overcome. They are electrically operated and automatically register the weights upon a scale protected by a glass case so it cannot be tampered with. The inspectors have keys to the machines for the purpose of taking out the records, but the machine will not operate when unlocked. It is proposed by the Government officials eventually to perfect the machines so that they will automatically register on tapes in the Surveyor's office as well as upon the tape in the machine. At the present time, however, this attachment is not contemplated. The machines have never been commercially manufactured and the bids are asked on the Government's specifications.

ELECTRO-MECHANICAL ENGINEERING BUREAU has opened offices in the Monadnock Block, Chicago, for consultation, inspection and tests along mechanical, electrical and chemical lines. The bureau will give expert attention to any technical subject, including the development and design of devices, processes and patentable ideas.

AMERICAN ELECTRICAL MACHINERY FOR JAPAN.—Takata & Company, 60 Wall Street, have recently placed a number of important orders for American electrical machinery for shipment to Japan, as follows: For Yokkaichi Electric Light Company—One 750-kw, 2300-volt, 60-cycle Westinghouse steam turbine outfit, including exciter; a 9-panel Westinghouse switchboard for the main station; a 5-panel switchboard for the transformer station; a 3-panel switchboard for the Kuwana substation; three Westinghouse 11,000-2200-volt step-up transformers; three 75-kw step-down transformers of the same type; eight 35-kw, 11,000-2200-volt transformers and a complete equipment of lightning arresters and spark gaps for both high voltage and low-voltage circuits. For the mechanical equipment there have been ordered three 326-hp Heine boilers; a Knowles surface condenser of 3000 sq. ft. cooling surface, with a double-acting air and circulation pump; a Knowles vertical triplex pump, to be driven by a Westinghouse 16-hp induction motor, and a Knowles plunger feed pump. For the Sapporo Water Power Electric Company the following apparatus has been ordered: From S. Morgan Smith & Company, York, Pa., a 650-hp McCormick horizontal turbine to operate under a head of 120 ft., which will be controlled by a Lombard type D governor; from the Westinghouse Company, a 400-kw, 3-phase, 11,000-volt, 60-cycle alternator, with a motor-generator exciter set; a power station switchboard to form a continuation of the present switchboard; a 3-panel substation switchboard; four 11,000-2200-volt, 150-kw step-down transformers, and three 20-kw step-down transformers for the substation. For the Tsuyama Electric Company an order has been given to S. Morgan Smith & Company for a 500-hp McCormick turbine to operate under a head of 88 ft., and to be direct coupled to a 300-kw alternator; for the same plant, a Lombard governor to control the above turbine; a 10-kw, 125-volt Westinghouse compound-wound exciter and a complete Westinghouse switchboard equipment for the above apparatus. For the Kanegafuchi Spinning Company for its Hiogo plant, a 1500-hp, 2300-volt Westinghouse steam turbine unit, together with an exciter, and also a motor-generator exciter set; two 50-kw, 60-cycle Westinghouse transformers; a Knowles condensing plant, consisting of a condenser of 3500 sq. ft. of cooling surface; a triplex air pump and a centrifugal circulation pump, the pumps to be driven by a 15-hp and a 20-hp Westinghouse induction motor, respectively.

FIGHTING THE PROPOSED CARBON TARIFF.—The dealers in flaming arc lamps are striving to head off the increase in the tariff on lighting carbons that is proposed by the Senate bill. The organization of dealers that was formed some weeks ago has employed George H. Mann, an attorney with offices at 60 Wall Street, to represent them before the committee. In speaking of the matter one of the importers said that he was confident the committee was working under a misapprehension of the facts and that it did not understand the trick in the bill through the insertion of the word "feet." He had seen the figures that the committee was using as its basis, and from these he thought erroneous conclusions were reached. "Taking the figures of 1907, in which the imports were 8,179,290 carbons valued at $157,311," he said, "the duty paid was $73,613, or 46.79 per cent ad valorem. The committee concludes that under the proposed bill this same lot of carbons would pay a duty of $57,253, or 39.39 per cent ad valorem. This would be true if the carbons imported that year has paid the full rate of 90 cents per 100. This was avoided, however, by importing in double lengths. The average length of the carbons imported in that year was probably 24 in., so that the 8,179,290 carbons probably measured 16,358,580 ft. and under the new law would pay a duty of $114,510, or about 73 per cent ad valorem. The senators do not understand that this would be the result of inserting the word 'feet.' Senator Smoot introduced an amendment last week which reduced the rate on the higher grades of carbons to 65 cents per 100 ft. and on the ordinary coke carbons to 35 cents. As there are none of the latter carbons imported and never will be even if there were no duty, this concession means nothing to the users of carbons." The fact that the matter has attracted some attention and that some of the senators are interested is considered by the importers to be a hopeful sign. The importers are leaving no stone unturned to fully acquaint the members of Congress with the facts about the carbon business.

AT WORK ON PENNSYLVANIA'S CABLE ORDER.—The Standard Underground Cable Company has already begun work on the big order for lead covered transmission cable for the Pennsylvania Railroad terminal. The entire work is expected to be completed and the cable delivered within six months. There will be about 100,000 ft. of the heavy cable which will be laid in the conduits already prepared and will extend from the Hackensack Meadows to the Long Island City power house. The cables will each carry three conductors, paper insulated and lead covered. The total cost to the railroad will be about $250,000 and the installation will be made as soon as the cable is delivered. The conductors will be 250,000 circ. mils and will carry a current of 11,000 volts, which will be stepped down to 650 volts before reaching the service wires.

UTILIZATION OF PEAT.—The Peat Engineering Company, with offices in St. Clair Building, Toledo, Ohio, has been formed to further the development of a peat industry in this country. The members of the firm are Messrs. Ernest V. Moore, Herbert Garnett and Francis J. Bulask. Mr. Moore is an honor graduate of McGill University and has received the Gowski gold medal for original peat research. Mr. Garnett organized and was general manager of the Irish Peat Development Company, the largest peat concern in Ireland, and has been a peat expert for the United States Department of Agriculture. Mr. Bulask has installed a number of peat utilization plants. The new firm will make analyses, supply drawings, contract for, erect and, if desired, operate for a period peat plants.

INTERNATIONAL STEAM PUMP COMPANY PROSPEROUS.—The annual report of the International Steam Pump Company for the year ended March 31, 1909, showed a balance for dividends of $1,064,000, which compared with $1,223,545 in the previous year. The amount added to the surplus was $204,200. The net profits were comparatively very much heavier than the gross earnings, which is explained by President Guggenheim by the fact that rigid economies had been practised in the manufacturing end. The gross business was but 60 per cent of last year, while the net profits were 92 per cent.

ALLIS-CHALMERS SALES.—We are informed by the Allis-Chalmers Company that it has during the past 90 days taken contracts for upward of 30 steam turbines and generators, aggregating in capacity nearly 50,000 kw and that negotiations are now pending for more than double that number. Among the orders recently placed is one for a unit of 2000 kw for the Public Service Corporation of New Jersey, to be installed at Camden, another of 2000 kw purchased by the Stone & Webster Engineering Corporation for the El Paso Electric Railway Company, El Paso, Tex., and a 2000-kw machine to be placed on a "repeat" order in the public service station of the city of Columbus, Ohio.

MINERALLAC ELECTRIC COMPANY, Monadnock Building, Chicago, has been incorporated to take over the business of the old Minerallac Company and the Chicago Electric Meter Company. The officers are as follows: President, L. A. Ferguson; vice-president, P. Junkersfeld; secretary, G. A. Freeman; treasurer, J. H. Goehst. The company will manufacture and sell the Chicago printing attachment to integrating wattmeters, high-tension insulating compounds, voltmeter switches, reverse-current relays, speed-limit devices, cable cleats and bushings and, other specialties. With increased capitalization and an attractive and varied output, it is expected that the new company will do a flourishing business.

STATION APPARATUS WANTED.—The Chickasha Light, Heat & Power Company, Chickasha, Okla., writes that it will commence within three weeks the reconstruction of its plant, and is in the market for boilers, steam turbo-generators, condensing apparatus, pole line material and switchboards. It will operate 2300 volts, 60-cycle, three-phase. C. G. Johnson is superintendent of the work.

COAL BRIQUETTING.—Roberts & Schaefer Company, Old Colony Building, Chicago, has just closed a contract to build a briquetting plant in Kansas City, which will be in operation by August 1. C. T. Malcolmson, the electrical and mechanical engineer, who was connected with the Government fuel testing plants at St. Louis and Jamestown, is now associated with the Roberts & Schaefer interests, which have taken up coal briquetting in a very thorough manner, believing that the industry here should be comparable in extent with that already developed in Europe.

WILL BE NO SMELTING AGREEMENT.—John D. Ryan, president of the International Smelting & Refining Company, declares emphatically that there will be no rate agreement

between the new concern and the American Smelting & Refining Company. "Our company will be competitive in every sense of the word," said Mr. Ryan, "and we are going after the business in any district where we think we can get it." Mr. Ryan said that the new plant of the International Company at Tooele, Utah, which is 35 miles from Salt Lake City, will go into commission by Jan. 1, 1910. The plant at Perth Amboy, N. J., is operating at about full capacity.

RECENT ORDERS OF CROCKER-WHEELER COMPANY.—Recent orders booked by the Crocker-Wheeler Company include two 1000-kva, 6600-volt, three-phase, 25-cycle alternating-current generators for the Nordberg Manufacturing Company, Milwaukee, to be used for supplying light and power to the Miami Copper Company, Globe, Ariz. The Houston, Tex., Electric Company, Houston, has purchased an 800-kw, 575-volt direct-current generator. Two three-phase, 2300-volt, 50-cycle alternators, having a combined capacity of 550 kva, are to be added to the equipment of the municipal plant at Pasadena, Cal. A motor-generator set consisting of a three-phase, 60-cycle, 2300-volt, synchronous motor and a 300-kw, 575-volt direct-current dynamo was sold to the Boise Valley Railway Company, Boise, Idaho. An order from Charles Wouter, Chicago, calls for a 100-kw generator with a range in potential of from 125 to 250 volts, and a similar order from the Timken Detroit Axle Company, Detroit, Mich., is for a 100-kw, 250-volt, direct-current generator. A Form W motor, having a capacity of 200 hp, built for 230 volts, was shipped to the Hunt Engineering Company at Des Moines, Iowa. This motor is series wound and will be used in operating a derrick. Two 100-hp, 3-phase, 60-cycle induction motors of the wound rotor type, rated at 100 hp each, were billed to the Boston & Corbin Copper & Silver Mining Company, 82 Devonshire Street, Boston. The National Tube Company, McKeesport, Pa., has added to its 22,800 hp of Crocker-Wheeler motors to the extent of 275 hp for the operation of rolling mill machinery, etc.

ALUMINUM.—The manufacturers of aluminum in this country report that there is not a great amount of business being done at the present time, although some aluminum transmission wire is being sold, and from the number of inquiries that are being received it is evident that electrical companies are taking more interest in the use of aluminum for transmission purposes. Although the principal patents under which the Aluminum Company of America has been operating have expired and the field is now practically open, there has not as yet been any definite announcement made of rival concerns entering the business. Aluminum continues to be quoted at from 20 to 23 cents per pound, and it is not believed that the proposed reduction of 1 cent in the present tariff rate will have any material effect upon the price.

INTERBOROUGH WILL BUY EQUIPMENT.—Specifications have been prepared and bids asked by the Interborough Rapid Transit Company, of New York City, for 150 steel cars for the subway division and 100 cars for the elevated roads. So far bids have not been asked for the motor equipment of these cars, but it is understood that specifications are being prepared. The cars of the Interborough now in service are provided with two motor equipments, each motor being of about 200 hp. Heretofore these motor equipments have been fairly evenly divided between the General Electric and the Westinghouse. As the contract for the cars has not yet been let, it is not likely that bids will be asked for the electrical equipment in the near future.

Financial Intelligence.

THE WEEK IN WALL STREET.

The past week on the New York Stock Exchange was one of some activity and considerable strength in prices. It is true that whenever there occurred an advance of more than a few points that the profit-takers showed up and prices were apt to recede under their selling, but on the whole the stock market shows the effect of the bettered condition in commercial and industrial affairs. The reports from all industrial centers bring tidings that the tide has turned and that business has at last taken that change for the better that has so long been looked for. The reports from the railroads show vastly increased earnings; the commercial conditions, while nothing to boast of, are more satisfactory than a month ago; the crops have had some growing weather and the money market is remarkably easy. Even the tariff bugaboo seems to alarm Wall Street no longer. It seems to be very thoroughly understood that there will not be such a revision of the tariff as to hurt any manufacturing interests. It is even believed that there is an end of the debate in sight. The greatly improved condition of the steel trade has done much to help along. The mills are all busy and even if the orders have been taken at rates much lower than last year, they were not taken at a profitless rate and the plants will be kept busy. While there were no especial developments during the week it is evident that the railroads are preparing to buy equipment. In fact a number of small orders have been placed and inquiries for much larger ones have been made. There is no secret about the fact that the roads need cars, locomotives and rails. When the managers of these properties are satisfied that it is safe to branch out there will probably be such a rush of orders that all plants will be working overtime. While this perfectly satisfactory condition of affairs is prevailing at home the foreign markets are showing equal improvement. American securities are strong in London and the foreigners buy on every price recession. The improved tone of the copper metal market has done much to strengthen the prices of the copper stocks. Amalgamated, which is of course the leader of the market, has been conspicuously strong and there is already talk of an increase in the dividend. The shares of the electrical companies have shown considerable strength and both General Electric and Westinghouse were active and strong on May 17, which is the last day under review. The bond market continues to be very strong and every issue that is offered is subscribed without any trouble. The banks are still well supplied with cash and rates are cheap, in spite of the fact that there were heavy takings of gold for Europe during the week. On May 17 call money was quoted at 1¾ @ 2 per cent, 90 days 2½ @ 2¾ per cent. The quotations in the table are those of the close, May 17.

NEW YORK.

	May 10.	May 17.	Shares Sold.		May 10.	May 17.	Shares Sold.
All.-Ch.	15½	16	1,520	Int.-Met., pfd.	46½	44½	22,700
All.-Ch., pfd.	50⅛	51½	9,300	Mackay Cos.	78½	79½	2,600
Amal. Cop.	82⅛	82¾	131,175	Mackay Cos., pfd.	73*	73½	1,100
Am. D. T.	29*	29*	——	Manhattan Elev.	146½	147	1,550
Am. Loc.	57½	56⅝	8,930	Met. St. Ry.	30	30*	100
Am. Loc., pfd.	115½	115	1,000	N.Y. & N.J.Tel.	123*	123*	——
Am. Tel. & Cbl.	76*	77¾*	50	Steel, com.	57⅛	56⅜	413,355
Am. T. & T.	140¾	139⅞	12,600	Steel, pfd.	119	118¾	18,928
B. R. T.	79½	78⅞	58,550	W. U. T.	75¾	76	6,600
Gen. Elec.	159	160	6,235	West'h., com.	83⅜	84¼	5,350
Int.-Met., com.	16⅜	16¼	15,020	West'h., pfd.	120*	120	——

PHILADELPHIA.

	May 10.	May 17.	Shares Sold.		May 10.	May 17.	Shares Sold.
Am. Rys.	45½	45¾	——	Phila. Elec.	12	12⅜	——
Elec. Co. of A.	12⅜*	12½	——	Phila. R. T.	33¼	34⅜	——
Elec. Stor. B'ty.	48¼	48⅜	——	Phila. Traction.	93*	92½*	——
E. S. B'ty, pfd.	49*	49*	——	Union Traction.	56¾	56¾	——

CHICAGO.

	May 10.	May 17.	Shares Sold.		May 10.	May 17.	Shares Sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	133	134	——
Chi. Rys., Ser. 1.	109½	109½*	——	Met. El., com.	10*	10*	——
Chi. Rys., Ser. 2.	38½*	38½	——	Nat'nal Carbon.	84	85	——
Com. Edison.	115½	119	——	Nat. Carb., pfd.	118*	120*	——
Chi. Subways.	27¾	26½	——				

BOSTON.

	May 10.	May 17.	Shares Sold.		May 10.	May 17.	Shares Sold.
Am. Tel. & Tel.	140¾	140	——	Mex. Tel.	2½	2⅜*	——
Cum. Tel.	135*	138	——	Mex. Tel., pfd.	5½	5½*	——
Edison El. Ill.	250	250	——	N. E. Tel.	132	133½	——
Gen. Elec.	160	160⅞	——	W. Tel. & Tel.	12½	12	——
Mass. Elec. Ry.	13¾*	13½	——	W. T. & T., pfd	85	87	——
Mass. E. R., pfd	71	71	——				

*Last price quoted.
Shares sold are for week May 10 to May 15.

DIVIDENDS.

American Railways Company, quarterly, 1½ per cent, payable June 15.

Butte (Mont.) Electric & Power Company, quarterly, 1½ per cent, payable June 1.

Chicago Telephone Company, quarterly, 2 per cent, payable June 30.

Columbus (Ohio) Railway Company, quarterly, 1¼ per cent, payable June 1.

Grand Rapids Railway Company, quarterly, 1 per cent, payable June 1.

Kings County (N. Y.) Electric Light & Power Company quarterly, 2 per cent, payable June 1.

Laclede Gas Light Company, St. Louis, preferred, semi-annual, 2½ per cent, common, quarterly, 1½ per cent, payable June 15.

Philadelphia Electric Company, semi-annual, 3 per cent, payle June 15.
St. Joseph, Mo., Railway, Light, Heat & Power Company, per cent, payable June 1.

TOLEDO RAILWAYS & LIGHT COMPANY.—Plans are ing perfected for the reorganization of the Toledo Railways Light Company. During the past week, a stockholders' otective committee has been formed of which William E. utton is the chairman. A circular has been sent to all stockolders by this committee stating that the time has come when ompt and effective action must be taken and that it is necesry for the stockholders to co-operate directly with the credirs in a proper plan for refinancing. There is already in istence a bondholders' protective committee and it is with is committee that the stockholders desire to co-operate. The itstanding liabilities of the company are $12,421,960 and about If of this amount is either overdue or will become due July 1. is said that public sentiment in Toledo is favorable to an tension of the expiring franchise, and if this is done, the mpany should be able to refund its indebtedness and to raise w capital for extensions and improvements.

HUDSON TUNNELS ALMOST READY.—Large signs ve been posted on the Hudson Terminal buildings on Church reet in New York, announcing "On July 1, trains will run om this terminal; Pennsylvania railroad three minutes; Erie, x minutes; Lackawanna, ten minutes." Work upon the nnels is being pushed rapidly with night and day forces and ere is no doubt that they will be completed on the date set. he two upper tubes of the system are now handling passengers the rate of 17,000,000 per year and it is estimated that when e lower tubes are in operation, the system will have a travel about 80,000,000 passengers per year. It is figured out that on count of the low cost for operation and maintenance, the ntire Hudson & Manhattan Railroad property will bring in a tal net revenue of $1,000,000 above all interest and sinking nd requirements.

THIRD AVENUE RAILROAD SALE ORDERED.—The cree of foreclosure against the Third Avenue Railroad propty, in New York, was ordered in the United States Court, lay 17, and the date of sale set for Sept. 2. This judgment as entered in the suit of the Central Trust Company, acting trustee for the $37,560,000, 4 per cent mortgage bonds, inrest on which has been defaulted since July 1, 1907. The tle not only includes all the physical property of the company t all the securities which it held including the 20,000 shares of e Union Pacific Railroad Company, which turned up in the mpany's treasury. This is the first step in the reorganization f the company, and it is said the bondholders are preparing protect their holdings.

SOUTHERN TELEPHONE COMPANY FOR SALE.—he Columbus (Ga.) Automatic Telephone Company has petioned the City Council for permission to surrender its franchise nd sell its physical assets to the Southern Bell Telephone & elegraph Company. The company has been operating an exnange since 1903 and has about 900 subscribers. The company as not been a financial success, and it is said the bondholders ould be obliged to foreclose unless the company's assets were old and the debts paid. The Southern Bell Company agrees to ay $50,000 for the poles, conduits, wires, etc. This would give e bondholders about 40 cents on the dollar, but the stockolders would get nothing. The capital stock of the company $130,000.

EXTRA DIVIDEND FOR UNITED METALS SELLING OMPANY.—The United Metals Selling Company has declared an extra dividend of 50 per cent which represents the isbursement of the cash received from the International melting & Refining Company for the plant at Perth Amboy, J. In addition to the $2,500,000 in cash received the United Metals company got between $3,500,000 and $4,000,000 in stock.

IOWA CITY CONSOLIDATION.—The Iowa City (Iowa) Electric Light Company and the Iowa City Gas Light Company have been combined under the title of Iowa City Gas & Electric Company. George S. Carson, who was president of both of the old companies, is the president of the consolidated enterprise. Mr. Carson, who is a former president of the Iowa Electrical Association, is one of the enterprising central-station men of Iowa, and he is confident that the new company will be stronger and better fitted to serve its customers than both of the old ones.

ELECTRIC STORAGE BATTERY COMPANY.—The stock of the Electric Storage Battery Company has recently been in considerable demand upon the Philadelphia exchange and there has been considerable improvement in prices. It is said that this demand is due to buying by insiders who are well acquainted with the company's business. A director of the company is responsible for the statement that orders have been coming in steadily within the past few months and that the outlook for increased earnings was never brighter than it is at present.

BROCKTON EDISON STOCK.—The Edison Electric Illuminating Company of Brockton has petitioned the Massachusetts Gas and Electric Light Commission for authority to issue 1600 additional shares of stock to pay for additions to the plant, the purchase of new property, and the purchase of the property of the Stoughton Gas & Electric Company. The Edison company has also petitioned the commission for permission to purchase the plant, franchise and business of the Bridgewater Electric Company.

WASHINGTON, BALTIMORE & ANNAPOLIS STOCK.—During the past week there was considerable activity in the stock of the Washington, Baltimore & Annapolis Electric Railway Company on the Cleveland Stock Exchange where the stock is frequently traded in. This was supposed to be occasioned by the announcement that the General Electric Company had purchased a large block of the bonds of the company. Several thousand shares changed hands at prices ranging from 5⅞ to 6⅛.

LACLEDE GAS LIGHT COMPANY DEAL.—The negotiations for the sale by the North American Company of the Laclede Gas Light Company, of St. Louis, to the American Light & Traction Company, have not been completed as yet, but there is no hitch in sight and the transfer will undoubtedly be made. Experts are now making an examination and appraisal of the property and until this is finished the deal cannot be completed.

REFINANCING BOSTON ILLUMINATING CONCERN.—The Edison Electric Illuminating Company has petitioned the Board of Gas and Electric Light Commissioners for an approval of an issue of $160,000 additional capital stock, the proceeds to be used to retire part of the floating debt and for acquisition of the Stoughton Gas & Electric Company. The company also asks for approval of the purchase of the Bridgewater company.

NEW YORK AIR BRAKE COMPANY INCREASES CAPITAL.—The New York Air Brake Company has filed with the Secretary of State of New Jersey an amendment to its certificate of incorporation increasing its capital stock from $10,000,000 to $13,000,000. The plants of the company have been greatly enlarged recently and the business has been very satisfactory.

PULLMAN ELECTRIC POWER PLANT.—The Pullman Company has started improvements on its plant at Pullman which involve an expenditure of $3,000,000. A power house costing $100,000 will be erected, which will contain an electrical equipment to develop 8,000 hp.

BONUS FOR CANADIAN BELL TELEPHONE SHAREHOLDERS.—As a result of the sale of its line in the province of Saskatchewan, it is promised that a bonus will be paid to the shareholders of the Bell Telephone Company of Canada.

REPORTS OF EARNINGS

	Gross Earnings	Expenses	Net Earnings	Charges	Surplus
...onda, Johnstown & Gloversville Railroad Company					
Quarter ended March 31, 1909					
Quarter ended March 31, 1908					
...xington (Ky.) & Interurban Railway Company					
March, 1909					
March, 1908					
...ford Avenue Railroad Company					
Quarter ended March 31, 1909					
...nited Railways of St. Louis					
April, 1909					
April, 1908					

*Deficit.

GENERAL NEWS

Construction News.

ANNISTON, ALA.—The Alabama Power Development Company is securing a right-of-way for a hydro-electric power transmission system between Anniston and Talladega, via Munford and Jackson Shoals.

DOTHAN, ALA.—The City Council has passed an ordinance to issue bonds for extensions and improvements to the municipal electric light plant.

FORT SMITH, ARK.—The Fort Smith Light & Traction Company, through H. M. Byllesby & Company, of Chicago, Ill., has purchased from John A. Stewart Electric Company, of Cincinnati, Ohio, the following electrical and steam equipment for its plant: One 1650-kw, 60-cycle, three-phase, revolving field, General Electric alternator, direct connected to a Hamilton-Corliss, cross-compound, heavy duty engine.

ROGERS, ARK.—Plans are being considered by the Rogers, Pea Ridge & Northern Interurban Railway Company for the construction of an electric railway which will connect Rogers and Pea Ridge, also Diamond and Electric Springs, for which preliminary survey has been made. The railway will be 20 miles in length, and it is expected that construction work will begin within 90 days. It is proposed to erect a power plant and repair shop in Rogers. V. R. Potter is president, and Bryan Snyder, secretary, both of Rogers.

FAIRFIELD, CAL.—The Board of Supervisors has granted the Randall, Trowbridge & Wright Company a franchise to construct an electric railway connecting Vallejo, Benicia & White Sulphur Springs. The price paid for the franchise was $100 and 2 per cent of the gross receipts of the company. The White Sulphur Springs property has been purchased by the company and will be improved for a summer resort.

GRIDLEY, CAL.—The city is reported to be considering the purchase of the electric light plant and franchises belonging to the estate of the late R. F. Beebe.

GUERNEVILLE, CAL.—The Snow Mountain Water & Power Company has awarded a contract to G. W. Nelson for the erection of a transmission line from the Fulton line of the company to Guerneville, a distance of 17.58 miles, for $300 per mile.

LOS ANGELES, CAL.—The Board of Public Works has awarded the contract for ornamental posts for lighting Fifth and Main Streets to Central Street to the Llewellyn Iron Works, for $100 per post.

LOS ANGELES, CAL.—Contracts have been awarded by the Pacific Electric Company for the construction of the electric railway connecting Delhi with Huntington Beach, a distance of 10 miles.

MODESTO, CAL.—The La Grange Light & Power Company is making arrangements to secure a site near Dry Creek bridge in this city on which it will erect its buildings. A. Scott is superintendent.

OAKLAND, CAL.—The City Council has granted the property owners along Telegraph Avenue from the junction of Sixteenth Street and Broadway to and including Twenty-second Street permission to erect electroliers between the streets named, the lamps to be maintained by the city.

SANTA ANA, CAL.—The Santa Ana Valley Irrigation Company has applied to the Board of Supervisors for a franchise to construct a transmission line up the Santa Ana Canyon to the county boundary for the purpose of furnishing electricity.

SELMA, CAL.—The Board of Trustees has granted the application of the local telephone company, allowing it to rebuild its system in the town, which will involve an expenditure of about $10,000.

SONORA, CAL.—Plans are being made to equip the Reiner mine to be operated by electricity, which will be furnished by the Tuolumne Water Power Company.

TRUCKEE, CAL.—It is reported that the Donner Ice Company contemplates installing an electric plant.

HARTFORD, CONN.—The House of Representatives has passed the bill granting amendments to the charter of the Connecticut River Company. The charter gives the company the right to widen and deepen the canal, to build a dam or dams across the Connecticut River between the towns of Windsor Locks and Enfield, or Enfield and Suffield, at any point above the present mills of the American Writing Paper Company at Windsor Locks and below the Enfield dam, and on either or both sides of King's Island, and to maintain all the appurtenances to the dam and power plant, and to generate and distribute electricity. The company proposes to build a new canal about two-thirds of a mile in length to connect the river channel near Windsor Locks with the pool above the dam. The present canal is about 75 ft. wide and only 10 ft. deep, while the proposed canal is to be 40 ft. wide and 20 ft. deep.

NEW BRITAIN, CONN.—Plans have been prepared by Landers, Frary & Clark for the construction of a large electric power plant to furnish electricity for operating and lighting their entire plant.

NEW HAVEN, CONN.—Arrangements are being made by the United Illuminating Company to place its wires underground on Grand Avenue from the power station at Mill River to the center of the city.

NORWICH, CONN.—The Uncas Power Company has applied to the State Legislature for an amendment to its charter giving it the privilege to supply electricity in any city or town in New London County where there are no power companies operating.

EUSTIS, FLA.—The Town Council has passed the ordinance granting a franchise for an electric light plant, and a contract has been made with Childs & Company for the installation of the plant, subject to a vote of the taxpayers.

JACKSONVILLE, FLA.—A. Metaner, of this city, has applied to the City Council for a franchise to install an automatic telephone system in Jacksonville.

LA BELLE, FLA.—E. E. Goodno is reported to be considering plans for the construction of a hydro-electric plant to furnish electricity for lamps and motors in La Belle.

LEESBURG, FLA.—The Senate has passed the bill authorizing the Town Council of Leesburg to establish an electric light plant and water works system.

AMERICUS, GA.—The lighting committee of the City Council has accepted plans prepared by E. H. Davis, of Griffin, Ga., and contracts for construction of the plant will be awarded May 26. The plant will be erected and operated in connection with the municipal water works system. The cost of the plant is estimated at $20,000.

COLUMBUS, GA.—The Columbus Automatic Telephone Company has applied to the City Council for permission to surrender its franchise and sell its property to the Southern Bell Telephone & Telegraph Company. The Bell company agrees to pay the company $50,000 for its plant and system.

CORNELIA, GA.—A 30-year franchise has been granted to the Woffo Shoals Power & Light Company to furnish electricity for lamps and motors in Cornelia. J. Wells, of Atlanta, Ga., is interested in the enterprise.

HAMPTON, GA.—At an election held May 10 the citizens voted to issue $20,000 in bonds for the construction of an electric light plant and water-works system. W. M. Harris is chairman of committee.

WASHINGTON, GA.—The Washington Telephone Company contemplates making improvements to its system, which will involve an expenditure of about $5,000, and includes the erection of new poles and replacing open wires with cables.

GRANGEVILLE, IDAHO.—The Whitebird Telephone Company, recently organized, proposes to erect a mutual telephone line from Whitebird to Grangeville, a distance of 20 miles.

TWIN FALLS, IDAHO.—The City Council has granted George Aiken a franchise to construct an electric railway in Aiken.

WALLACE, IDAHO.—The Washington Water Power Company is making investigations in this city and in the Cœur d'Alene district with a view of extending its transmission lines to the smaller mines and prospects, including those on Sunset Peak, and between Mullan and Burke and also in the Murray district.

HAMBURG, ILL.—Plans are being made by the Merida Telephone Company to lay a cable across the Mississippi River and extend a telephone line from the west bank to Elsberry, Mo., to improve the long distance service.

KANSAS, ILL.—It is reported that the Board of Trustees has decided to sell the municipal electric light plant. It is said that the plant will be sold for $4,000, the purchaser to pay for it by furnishing street lamps for the village for a term of seven years, making the cost of the service $7 per year.

MACKINAW, ILL.—The Illinois Traction Company has awarded contracts for the construction of a new power house and substation at Mackinaw, to cost $8,000. It is stated that plans are being drawn to rebuild the plant at Minier at a cost of about $8,000.

MASCONTAH, ILL.—Plans are being considered to construct an electric railway to connect Mascontah and Belleville. Captain Charles Hewitt and H. M. Needles, of Belleville, are reported to be interested in the project.

NORRIS, ILL.—The Peoria & Galesburg Railway Company has been granted a franchise to erect its proposed electric railway over certain streets in Norris.

NORTH CHICAGO, ILL.—The contract for installing an outside lighting system at the naval training station, North Chicago, has been awarded to the D'Olier Engineering Company, of Philadelphia, Pa., for $25,510.

ONARGA, ILL.—It is reported that the local telephone company contemplates rebuilding its system and installing new equipment.

ROCKFORD, ILL.—The plant and holdings of the Rockford & Interurban Company, operating the local street railway and electric interurban railways from Rockford to Janesville, Wis., and Belvidere and Freeport, Ill., was purchased May 11 by an Eastern syndicate. I

stockholders will receive par value on the common stock amounting to $1,000,000, and also on preferred stock amounting to $50,000. The new owners have assumed a bonded indebtedness of $2,725,000.

BLUFFTON, IND.—The Bluffton, Geneva & Celina Interurban Company has applied to the County Commissioners for a franchise to construct its railway over the county roads between this city and Adams County.

BLUFFTON, IND.—The W. B. Brown Chandelier Company is planning to erect an addition to its factory and to equip the plant to be operated by electricity.

COLUMBIA CITY, IND.—Arrangements are being made by the Whitley County Telephone Company for the reconstruction of its system in this city and to South Whitley. It is proposed to move the exchange to larger quarters and install a new switchboard and to place all wires in cables.

EVANSVILLE, IND.—Specifications are now being prepared by the Board of Works for the contract for lighting the streets of the city. Although the present contract for street lighting does not expire for more than a year, the Board proposes to give any company which wishes to compete with the Evansville Gas & Electric Light Company sufficient time to erect a plant in case they are awarded the contract.

FORT WAYNE, IND.—The Fort Wayne & Wabash Valley Traction Company has been awarded the contract for furnishing electricity for lamps and motors for the Federal Building for the year beginning July 1, 1909, at four cents per kw-hour, with no lamp renewal privileges. The bid of the municipal electric plant was eight cents per kw-hour with a decreasing scale depending upon the amount used.

INDIANAPOLIS, IND.—The commission appointed to construct and equip a tuberculosis hospital near Rockville will receive bids at Room 54, State House, Indianapolis, Ind., for the construction and installation of a power and light plant in connection with the hospital.

INDIANAPOLIS, IND.—Bids will be received by the trustees of the Indiana School for Girls, after June 1, for the construction of an addition and improvements to the power plant and for lighting the grounds of the school.

INDIANAPOLIS, IND.—Plans have practically been completed for making several of the streets in the downtown business district a "Great White Way." The plan involves changing all of the poles of the Indianapolis Traction & Terminal Company in the district and the substitution of larger and ornamental poles. It is proposed to install 10 arc lamps to each square. The new lamps will cost the city $74 each per year. It is expected that the street railway will pay part of the expense of rearranging the lighting system. The plan does not include all of the streets in the business district of the city at the present time.

SARATOGA, IND.—The Eastern Indiana Telephone Company has been granted a franchise to construct and operate a telephone system in Saratoga. The company will rebuild the local telephone exchange and new equipment will be installed. The head office of the company is located in Winchester, Ind.

UPLAND, IND.—The Town Board has granted a franchise to the Hartford City Electric Light Company to furnish electricity to light the town. The company will extend its transmission lines to Upland, a distance of eight miles. The company also operates at plant at Jonesboro, eight miles west of Upland, and it is proposed to connect Upland with Hartford City and Jonesboro.

BOONE, IA.—Contracts have been awarded by the Boone County Telephone Company for the construction of a new exchange building in Boone. The company proposes to erect an entire new plant this year at a cost of about $125,000.

DES MOINES, IA.—Arrangements are being made to install electroliers from West Twelfth Street to the capitol, on Locust Street, and on Walnut Street from Eighth Street to Twelfth Street. The merchants on Fourth Street have also contracted for cluster lamps.

MASON CITY, IA.—The Western Electric Telephone Company contemplates rebuilding its telephone line to Algona at a cost of several thousand dollars.

MITCHELLVILLE, IA.—The Rural & Four-City Telephone Company has been granted a franchise to construct and operate a telephone system in Mitchellville. Franchises have now been secured by the company in Prairie City, Altoona and Mitchellville.

REINBECK, IA.—The Traer Mutual Telephone Company contemplates the installation of a new switchboard and other improvements to its system.

EL DORADO, KAN.—Plans are being made by the El Dorado Motor & Machine Company for an addition to its plant, which will include the installation of a 6-hp gasoline engine and an electric plant to furnish electricity for charging storage batteries and operating it in their shops.

RUSTON, LA.—Extensive improvements are being made to the municipal electric light plant, which will include the installation of a 100-kw, two-phase, Westinghouse alternator and 25 transformers for a 2300 arc lamp circuit. The generator replaces a direct-current dynamo and will be used in connection with a single-phase alternator, which heretofore has been used for incandescent lamps. The cost of the work is estimated at $25,000. E. S. Gray is superintendent.

BALTIMORE, MD.—Plans are being made by the Consolidated Gas, Electric Light & Power Company for making improvements to the Penn Street substation, which will involve an expenditure of about $25,000. F. C. Latrobe is president of the company.

BALTIMORE, MD.—Superintendent of Lamps and Lighting McCuen has given orders for additional goose-neck arc lamps to be erected on North Avenue between Oak and St. Paul Streets, and has also decided to extend the system of cluster lamps on North Avenue Bridge westward to Mount Royal Avenue.

BALTIMORE, MD.—Contracts have been awarded by the Board of Awards for conduits for the Subway Commission, as follows: To the Great Eastern Clay Company, New York, N. Y., 1,000,000 ft., for $60,000; the American Conduit Company, Chicago, Ill., and the Fiber Conduit Company, of Orangeburg, N. Y., 100,000 ft., for about $10,000.

BALTIMORE, MD.—The Consolidated Gas & Electric Company has submitted a proposition to the city of Baltimore to supply natural gas in the city. It is proposed to construct a pipe line from West Virginia, 230 miles in length, and to furnish natural gas at the following rates: For domestic lighting, 58 cents per 1000 cu. ft.; for cooking purposes, 45 cents, and for fuel and power, 40 cents. In return for the franchise the company offers to let the city choose five of the 18 members of the board of directors and to turn over 40 per cent of the company's income after all fixed charges and 4 per cent on common stock are paid. The work will require an initial expenditure of from $12,000,000 to $15,000,000.

BOSTON, MASS.—Bids will be received until June 12 at the U. S. Engineer Office, Boston, Mass., for electrical cable. For further information apply to Edward Burr, Lt.-Col., Corps of Engineers, U. S. A.

MALDEN, MASS.—The Malden Electric Company has been granted permission to construct an underground conduit system for its cables and wires. It is said that the company contemplates an expenditure of about $300,000 on the system within the next five years.

NORTH ANDOVER, MASS.—Plans have been completed by Charles T. Main, of Boston, Mass., mill architect and engineer, for a new power plant for W. T. Stevens & Sons Company, of North Andover. The plans include the construction of a power house, the equipment of which to include a 360-kw Westinghouse turbo-generator set with two exciters and a motor-driven Le Blanc condenser. The boiler room will be equipped with two horizontal return tubular, 72-in. Bigelow boilers with forced draft. Space is provided for duplicate boiler installation. The pump room will be equipped with boiler feed pump and a 1000-gal. fire pump. The stack is to be of brick 150 ft. high with a 6-ft. flue.

SHELBURNE FALLS, MASS.—It is reported that negotiations are under way between H. L. Harriman and associates of Boston, Mass., and the Lamson & Goodnow Manufacturing Company, of Shelburne Falls for the purchase of the water-power rights owned by the latter, at North River, where the company has a dam, and at Scott's bridge. The water rights owned by George G. Merrill were purchased a short time ago. It is said that if the plans are carried out the new owners will furnish power for operating the cutlery factory. Mr. Harriman is interested in the power development at Vernon, Vt.

WAKEFIELD, MASS.—The managers of the Wakefield electric light plant have made arrangements to secure electricity for day service from the municipal electric plant at Reading for a term of two years, with the privilege of renewal. For the past four years the town has purchased electrical energy for the day service from the Malden Electric Company at the rate of 3¾ cents per kw-hour. Under the new contract the price paid for the first 35,000 kw-hours is 2½ cents per kw-hour, and all used above that amount will cost two cents per kw-hour. The contract takes effect June 28.

WORCESTER, MASS.—It is reported that the Connecticut River Power & Transmission Company is planning to extend its transmission lines to Worcester to furnish electricity to the north works of the American Steel & Wire Company to operate the new electric furnaces now being installed.

ALPENA, MICH.—The Board of Supervisors has granted the Alpena Power Company permission to construct a cement and concrete dam across Thunder Bay River to replace the old dam known as the Richardson dam.

HARTWICK, MICH.—The capital stock of the Osceola Rural Telephone Company has been increased from $3,000 to $6,000.

HILLSDALE, MICH.—The proposition to issue $12,000 in bonds to enlarge the municipal electric light plant was defeated an an election held May 10.

BAUDETTE, MINN.—At an election held recently the citizens voted to issue $25,000 in bonds, the proceeds of $5,000 to be used for improvements to the municipal electric light plant.

MIDDLE RIVER, MINN.—Plans are being considered to erect a telephone line between Middle River and New Folden.

NASHWAUK, MINN.—The question of installing an electric light plant is under consideration by the City Council.

PINE CITY, MINN.—The Pine City Electric Power Company is reported to have awarded a contract to the Fort Wayne Electric Works, of Fort Wayne, Ind., for the installation of equipment in its power plant for $10,000.

ST. PAUL, MINN.—We are informed that the Western Transportation Company will soon be in the market for contracts for the construction of several electric railways in which it is interested. One of the railways will extend from Portage to Grand Rapids, via Bragg ville, Ontonagon and Ewen-Bup, a distance of 80 miles, for which surveys and right of way have been secured for a distance of 50 miles from Bragg ville, via

Griggsville to Oxford. Contracts have been let for ties and poling. The company also contemplates building a railway from Galesville to Ettrick, Wis., a distance of about 10 miles, and is also considering the construction of an interurban railway 60 miles in length in Montana. J. N. Braun is president of the company.

WARREN, MINN.—The Springfield Boiler & Manufacturing Company, of Springfield, Ill., has been awarded the contract for furnishing a 100-hp internal furnace boiler for the municipal electric light plant for $1,850. W. Haney is superintendent of the plant.

MOUNT OLIVE, MISS.—The Town Council has awarded the contract for the installation of the municipal electric light plant to K. Cramer, of Hazlehurst, Miss.

CASSVILLE, MO.—Arrangements are being made by the Cassville & Western Railroad Company to equip its railroad, now operated by steam power, between Cassville and Exeter, Mo., a distance of five miles, to be operated by electricity, which may be extended to Carthage, Mo., and ultimately to Eureka Springs, Ark. The present plans contemplate the development of water power of White River, to be utilized for the generation of electricity, and the erection of a power house in Cassville.

ELDORADO SPRINGS, MO.—B. F. Proctor is reported to be receiving bids for the construction of an electric light plant.

KANSAS CITY, MO.—Arrangements are being made by the Interstate Railway Company to commence work on the construction of its proposed electric railway from Kansas City to Dearborn and St. Joseph, a distance of 48½ miles, about June 15. George R. Collins is president.

LICKING, MO.—Announcement has been made that the Rolla-Cabool Interurban Railway Company has made financial arrangements for the construction of its proposed electric railway passing through Licking, Raymondville and Houston. The railway will be 75 miles in length. E. E. Young, of Licking, is promoter of the project.

ST. LOUIS, MO.—As a result of the decision handed down by Judge Grimm, of the United States circuit court, the Board of Public Improvements has granted the West End Light & Power Company permission to erect its wires in front of the property of W. Hall Trigg, who sought an injunction to prevent the company from erecting its transmission lines in this city. The company purchased the franchise of Browning, King & Company several years ago. Jesse D. Dana is president of the company.

ST. LOUIS, MO.—The Light & Development Company, which has secured the franchise held by A. S. Aloe and others, has applied to the Board of Public Improvements for permission to erect transmission lines in the West End. The company proposes to start the power plant in the Buckingham annex for the purpose of furnishing electricity for lighting the Buckingham and annex.

ARMSTEAD, MONT.—Barnett & Bates are reported to be interested in a project to construct an electric light plant on Beaverhead River.

LEWISTOWN, MONT.—S. W. Gebo, owner of the Spring Creek coal properties, located three miles from this city, has applied to the City Council for a franchise to install an electric light and gas system in Lewistown. A special election will be held soon to vote on the proposition to grant the franchise.

BANCROFT, NEB.—The citizens are considering the question of issuing $8,000 in bonds for the construction of a municipal electric light plant.

BRISTOW, NEB.—Plans have been completed by the Fairfax Mutual Telephone Company, the Spencer Telephone Company and the Bristow Mutual Telephone Company to erect a copper toll line from Lynch to Bonesteel, and later to extend it to Dallas.

CAMBRIDGE, NEB.—The plant of the Cambridge Electric Light Company is reported to have been destroyed by fire, causing a loss of from $20,000 to $25,000.

GARDNERVILLE, NEV.—A company has been organized by H. H. Springmeyer and A. Jensen, of Carson Valley, for the purpose of constructing a street railway from the terminus of the Carson Valley branch of the Virginia and Truckee Railroad to Gardnerville, a distance of one mile.

DUBLIN, N. H.—The Dublin Electric Company contemplates replacing the present street lighting system with series incandescent lamps with tungsten lamps. General Electric apparatus will be used. C. F. Appleton is treasurer and general manager.

DURHAM, N. H.—The Selectmen have granted the Lisbon Falls Gas & Electric Company a franchise to erect a transmission line for the distribution of electricity in Durham.

LACONIA, N. H.—The Laconia Electric Lighting Company has submitted a proposition offering to replace the present street arc lamps with 100 incandescent lamps of 32 cp.

HADDONFIELD, N. J.—The Borough Council is reported to be considering the question of installing a municipal electric light plant in connection with the water works. Mayor Roberts the second time has vetoed the ordinance authorizing a five-year contract with the Public Service Corporation for lighting the borough.

PEDRICKTOWN, N. J.—The citizens are considering the question of installing a lighting system in the town.

DEMING, N. M.—A bill has been introduced into the House of Representatives at Washington, D. C., providing for an appropriation of $300,000 for the construction of an electric power plant at Deming, to furnish electricity for an irrigation project. The work to be done under the supervision of director of the reclamation service.

LAS CRUCES, N. M.—The Las Cruces Electric Light & Ice Company is reported to be considering the question of installing a water works system in Las Cruces.

ALBION, N. Y.—Business men and capitalists of Middleport have agreed to pay $15,000 for the $30,000 in bonds, secured by a mortgage on the plant of the Middleport Gas & Electric Light Company, which will separate that company from the Lockport, Albion, Brockport and other enterprises consolidated under the name of the Albion Power Company, of which Sanford T. Church is receiver. Justice Wheeler at Buffalo has issued an order permitting the Middleport Gas & Electric Company to be turned over to the local bondholders. Sanford T. Church, receiver, stated that the other interests were willing to permit the sale of the bonds, with the understanding that the plant was to be turned over to those who purchased the bonds for operation. While the plant has been turned over to the purchasers of the bonds, the Albion Power Company still has some control of the property.

CASTILE, N. Y.—James C. Horning writes that he owns water rights, partly improved, located at Lamont, N. Y., three miles distant from Castile. It is estimated that 400 hp could be developed at the lowest water periods and contracts can be secured to furnish electricity to light four villages. The electric railway from Rochester to Letchworth's Park will run within 2½ miles of the park, and it is thought likely that it would purchase electrical power to operate the road. Mr. Horning would like to sell the property or interest parties with capital to carry out the project.

FORT TOTTEN, N. Y.—Sealed proposals will be received by the constructing quartermaster at Fort Totten, N. Y., until June 15, 1909, for the construction of an electric lighting system at Fort Totten. Plans, specifications and information furnished upon request at the above office. Plans and specifications may be seen at the office of the chief quartermaster, Governor's Island, N. Y.

FULTON, N. Y.—Plans are being made by the Oswego River Power & Transmission Company for the construction of a transmission line from Baldwinsville to Fulton, N. Y., to transmit Niagara Falls power, which will be sold to the Niagara-Oswego Power Company. A substation will be erected, which will be equipped with three 250-kw transformers to change the voltage from 33,000 to 6600 volts. S. B. Storer, of Syracuse, N. Y., is president of both companies.

GENEVA, N. Y.—The Empire Coke Company contemplates extensive improvements to its plant, which will involve an expenditure of about $200,000, and will include the installation of two 150-hp gas engines, to be supplied by the Alberger Gas Engine Company, of Buffalo, N. Y., and two 100-kw Westinghouse generators. New gas compressors will be added. E. H. Palmer, of Geneva, is president and general manager.

MALONE, N. Y.—It is reported that the Malone Electric Light & Power Company has purchased the electric light plant owned by S. S. Whittelsey.

NEWBURGH, N. Y.—The Merchants' Association of Newburgh has appointed a committee to make investigations in regard to the construction of an electric light plant and for organizing a company to build the same. The report submitted to the association by George J. Wittman estimates the cost of the plant at $75,000. W. W. Hawkes, Alexander Goldberg, Charles Stones, Elting Burger and George Wittman are members of the committee appointed to look into the matter.

OLCOTT, N. Y.—The street lighting system has been completed and the service placed in operation. Electricity for the system is furnished by the Newfane Electric Company, of Newfane, N. Y.

ROCHESTER, N. Y.—The Rochester Railway & Light Company, through R. M. Searle, vice-president, has written to the Chamber of Commerce offering to send a representative into the field to induce manufacturers contemplating relocating their industries to locate in Rochester, offering among the advantages of the city the company's electrical service. The company offers to pay all of the expenses of the representative and asked when in the field to represent the Chamber of Commerce.

ROSLYN, N. Y.—The Public Service Commission of the Second District has granted the petition of the New York & North Shore Traction Company for extensions and improvements to its railway from Roslyn and along the North Hempstead turnpike to the easterly limit of the Borough of Queens at Little Neck.

ALBEMARLE, N. C.—J. C. Masters, president of the Albemarle Development Company, which is developing the water power of the Yadkin River for electrical purposes, writes that the company will be ready to receive prices on machinery for its plant in 60 or 90 days. The company recently awarded the contract for the construction of its dam to L. A. Moody, of Albemarle. The company contemplates an expenditure of about $1,000,000, which will include the construction of a large hotel, sanatorium, bathhouses, a large dam and power plant.

CARTHAGE, OHIO.—The Cincinnati Traction Company has been granted a 25-year franchise in Carthage, in return for which the company will give the people a five-cent fare. A railway line will be built out the Paddock Road from the Avondale line.

CLARINGTON, OHIO.—The Clarington Water & Electric Company has applied for a franchise to install an electric light system in Clarington. F. V. Iams and E. H. Yost are interested in the enterprise.

CLEVELAND, OHIO.—The Cuyahoga Light Company, of this city, has increased its capital stock from $150,000 to $350,000.

MASSILLON, OHIO.—The City Council has granted a franchise to the Massillon Electric & Gas Company, successor to the Massillon Light, Heat & Power Company, to construct and operate electric light, heat and power systems in Massillon. The company agrees to light the city hall and three engine houses free of charge as long as it is given an exclusive franchise. The city reserves the right to regulate at intervals of not less than five years the price at which the company may furnish heat and power.

RICHWOOD, OHIO.—The proposition to issue $20,000 in bonds for the construction of a municipal electric light plant was defeated at a recent election. The contract with the Richwood Light, Heat & Power Company has expired, and the streets of the town are now in darkness. The Council will award the next contract to the lowest bidder.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company has purchased a site for its new power plant. As soon as plans and specifications are completed for the plant, bids will be called. The company has placed a contract with the General Electric Company, Schenectady, N. Y., for a 2700-hp steam turbo-generator set. The cost of the new building and equipment is estimated at about $200,000.

STEUBENVILLE, OHIO.—The Harrison & Jefferson Telephone Company is making arrangements for the erection of additional toll lines between Steubenville and Martins' Ferry and Bowerston.

ZANESVILLE, OHIO.—Plans are being considered for the construction of an interurban electric railway between Zanesville and McConnellsville, Pa. The new company will be known as the Zanesville & McConnellsville Traction Company. It is proposed to connect the new railway with the Marietta & Parkersburg line, now under construction. A. W. McDonald, of Pittsburg, Pa., and R. C. Burton are interested in the project.

CHICKASHA, OKLA.—C. G. Johnson, superintendent of the Chickasha Light, Heat & Power Company, writes that the company proposes to reconstruct its entire plant and will probably install steam turbine generators. The cost of the work is estimated at $60,000. Clarence G. Johnson, of Chickasha, is engineer in charge of the work.

GRANITE, OKLA.—At the coming election the citizens will vote on the proposition to erect a municipal electric light and water plant to cost about $45,000.

HOBART, OKLA.—The Carnegie Power & Transmission Company, recently incorporated, is preparing plans for the construction of a hydroelectric plant at Carnegie, Okla. The company also proposes to construct an auxiliary plant, with an output of 1000 hp, at Gotebo, which will be equipped with four gas engine units of 250 hp each. Natural gas will be used for fuel.

OKLAHOMA CITY, OKLA.—The John A. Stewart Electric Company, of Cincinnati, Ohio, has purchased the engines and generators, which have been discarded at the plant of the Oklahoma Gas & Electric Company.

CORVALLIS, ORE.—Ernest A. Miller is reported to be interested in a project to organize a company to construct an electric railway from Corvallis to Alsea, via Philomath. The company will be known as the Corvallis & Southwestern Railway Company.

HILLSBORO, ORE.—It is reported that the city has accepted the offer of a syndicate of capitalists for the purchase of the municipal water and light plant, for a consideration of $15,500. The Council will grant the company a 25-year franchise. The new company proposes to construct a new sawmill and will utilize the sawdust and slabs for fuel for the plant. It also proposes to extend and improve the system. John A. Stephenson, of Portland, Ore.; T. R. Yerger, of Everett, Wash., and C. E. Lytle, of Hillsboro, are interested in the company.

JACKSONVILLE, ORE.—A franchise has been granted to the Citizens' Telephone Company to build and operate a telephone system in Jacksonville, and to connect with the rural telephone lines operating in this town; also to construct connecting telephone lines to Central Point, Medford, Phoenix and several other villages in the Rogue River Valley.

MARSHFIELD, ORE.—The County Commissioners have granted J. F. Clark and J. H. Somers a franchise to construct an electric railway over the county road between Marshfield and Coquille.

SPRINGFIELD, ORE.—The McKenzie Valley Irrigation & Power Company, recently organized by farmers to irrigate a large area of country, has been granted a franchise in Springfield to erect an electric plant to supply electricity for lamps and motors. The company agrees to have its system in operation within 18 months and to sell its plant to the city at the end of 25 years if it wishes to buy.

CONEMAUGH, PA.—The Conemaugh Electric Company, recently incorporated, is said to have submitted a proposition to the City Council for the purchase of the municipal electric light plant. The company is capitalized at $60,000.

IRWIN, PA.—The directors of the Manor Valley Railway Company have decided to contract a power plant to supply electricity to operate the Irwin-Herminie Railway.

NEWVILLE, PA.—The Town Council has granted the Cumberland Railway Company a franchise to construct an electric railway in this town.

PHILADELPHIA, PA.—The Hyde Weldon Company, of Providence, R. I., has secured the contract for furnishing new electric equipment of the cars used in Philadelphia, Pa., for $[illegible].

PHILADELPHIA, PA.—The Interurban Gas & Electric Company has absorbed the plants of the Citizens' Electric Light, Heat & Power Company, of Clifton Heights, and the Philadelphia Suburban Electric Company. The two companies have practically been supplying all of the boroughs and townships of Delaware County with electricity. It is said that the consolidation will mean the construction of a large central power plant, which will furnish electrical service throughout the county. It is also understood that the Media Electric Light Company is a part of the new company. It is reported that A. S. Dowling, superintendent of the Media plant, will be general manager of the consolidated company.

SCHUYLKILL HAVEN, PA.—Bids will be received until May 3, by George E. Runkle, secretary of the Town Council, for furnishing and installing a 300-hp engine, a 200-hp boiler and a 200-kw generator in the municipal electric light plant.

SOUTH BETHLEHEM, PA.—The Halcyon Electric Light & Power Company has been reorganized and has voted to increase its capital stock to $60,000. The company has secured a 5-year contract to light the streets of the Borough of South Bethlehem.

TITUSVILLE, PA.—We are informed that the Titusville Northern Railroad Company is in the market for electrical supplies for its railway systems at Titusville, Union City and Cambridge Springs, Pa. Jesse L. Strauss is treasurer.

GREENVILLE, S. C.—The Paris Mountain Electric Company has applied to the City Council for a franchise in Greenville. The company proposes to construct an electric railway from Greenville to the summit of Paris Mountain. A. E. Sussex, of Greenville, is interested in the project.

WESTMINSTER, S. C.—A. B. Grace is interested in a proposition to develop the water power of Chauga's Creek and proposes to build a dam and power house, about four miles above Westminster, to furnish electricity in the towns of Westminster and Walhalla.

BELLE FOURCHE, S. D.—The Belle Fourche & Northern Telephone Company has commenced work on the construction of a telephone line between this city, Camp Cook and Buffalo, which later on will be extended from Buffalo to Bowman.

HILL CITY, S. D.—The Gold Medal Mining Company is contemplating the development of a water power, and if sufficient capital can be secured the company will install electrical machinery to furnish electricity to operate its mining machinery and for lighting the town of Hill City. About 200 hp can be developed. The company would like to interest parties who would furnish the capital necessary to construct the flume and install the machinery. The cost of the work is estimated at $40,000. R. T. Walker, of Hill City, S. D., is interested in the project.

LAKE PRESTON, S. D.—The Lake Preston Milling Company has been granted a franchise by the City Council to install and operate an electric light plant.

WHITE ROCK, S. D.—The White Rock Rural Telephone Company, it is said, contemplates extending its telephone lines to Diamond this coming season.

KNOXVILLE, TENN.—Plans are being made by William T. Lang for the construction of cotton mill for the manufacture of cotton cloth, which will be chartered under the name of the Castle Cotton Mills, Ltd. The company will be capitalized at $1,000,000 and proposes to erect mill buildings of concrete, to be equipped for electric motor drive. It is estimated that about 4000 hp will be required, which the company contemplates purchasing from the Knoxville Power Company.

MEMPHIS, TENN.—Plans are now being made by the collector of customs to improve the lighting system in the Federal building. The old part of the building will be rewired and new fixtures and appliances installed throughout. Tungsten lamps will replace the incandescent lamps now in use on the ground floor.

SPARTA, TENN.—The A. & T. Power Company is reported to have awarded contracts for equipment of its electric plant, including three Trump turbines, a 300-kw generator, governor, etc., to the Trump Manufacturing Company, of Springfield, Mass.

FT. SAM HOUSTON, TEX.—The contract for the installation of an electric invalid's elevator at Fort Sam Houston has been awarded to the Otis Elevator Company, of New York, N. Y., for $3,415.

RUTLAND, VT.—Negotiations are now under way between the Rutland Light & Power Company and the Delaware & Hudson Company, whereby the railroad of the Delaware & Hudson Company and Castleton and Eagle Bridge, between Fair Haven and Whitehall, may be equipped to be operated by electricity. If the deal goes through the Rutland company will take over the passenger traffic of the Delaware & Hudson company in this state. It the deal is not consummated the Rutland company will probably extend its electric railway [illegible] Rogers is president of the Rutland Railway & Light Company.

ST. ALBANS, VT.—The Vermont Power & Manufacturing Company, it is said, contemplates extending the service to the town [illegible]. It is understood that a company will be formed to furnish electricity for lamps and motors in [illegible]. Cambridge Junction and Cambridge will secure electrical power for the service from the Vermont Power & Manufacturing Company. It is [illegible] that the [illegible] local company was formed to extend to those villages.

BASIC CITY, VA.—Plans have been prepared for the construction of a hydroelectric plant to develop 2000 hp, including the construction of a concrete dam, power house, etc., bids for the construction of which will be received by W. M. Page, its treasurer. Plans and specifications can be obtained by bidders for $[illegible].

HONAKER, VA.—Bids will be received by C. A. Honaker, recorder, until June 7 for an electric franchise in Honaker.

ONANCOCK, VA.—Harry L. Richardson, of Laurel, Del., electrical engineer, is reported to be interested in the construction of an electric light plant in Onancock.

CLE ELUM, WASH.—The Cle Elum-Roslyn Railway & Power Company will soon commence work on the construction of its proposed electric railway, which is to extend from Cle Elum to Roslyn, a distance of 12 miles. The power plant, it is said, will be located in Cle Elum. Frank S. Farquhar is interested in the enterprise.

CONCONCULLY, WASH.—It is reported that an electric light company is being organized in this city.

FRIDAY HARBOR, WASH.—The Inter-Inland Telephone Company and the International Telephone Company have each been granted a franchise to erect and operate telephone systems in Friday Harbor.

NOOKSACK, WASH.—The Washington Mining & Developing Company, which proposes to construct a hydro-electric plant on Collins Creek, six miles from Nooksack, has commenced work on the construction of its plant, the cost of which is estimated at $200,000. Major A. J. Reed, of Louisville, Ky., is president and general manager.

PORT ANGELES, WASH.—Thomas T. Aldwell, of this city, and George A. Glines, of Winnipeg, Man., owners of the water-power rights of the Elwha River at the Canyon, it is reported, contemplate the development of the water power in the near future.

TACOMA, WASH.—The Tacoma-Seattle Power Company has submitted a bid to furnish the city with an additional 1500 hp at 1¼ cents per kw-hour, the same rate that it is now furnishing 5000 hp to operate the municipal electric light system. The contract will expire Nov. 8, 1912, the same date the other contracts of the company expire, when it is expected that the hydro-electric plant on the Nisqually River will be completed.

WAITSBURG, WASH.—The Waitsburg Electric Light Company contemplates remodeling its plant and will install an auxiliary power plant to operate the system during the low water periods. The cost of the work is estimated at $3,000.

WENATCHEE, WASH.—The Entait Light & Power Company has applied to the City Council for a franchise to construct and operate an electric light and power plant in Wenatchee. The company agrees to furnish electricity for lighting the streets of the city at the rate of $96 per lamp per year for less than 10 lamps of 2000 cp with an all-night service and $84 per lamp per year on a contract of ten or more lamps for a term of three years or longer; the maximum charge for electricity for all lighting service not to exceed 15 cents per kw-hour and $50 per hp per annum for motors of 5-hp or over.

WHITE SALMON, WASH.—A franchise has been granted to erect and operate transmission lines in White Salmon.

WHEELING, W. VA.—The City Council has granted a franchise to the Rapid Transit Railway Company to construct and operate an electric railway over certain streets in the city. A. M. Schenk, of Wheeling, is president of the company.

WHEELING, W. VA.—The Wheeling Traction Company is planning to make extensive improvements this summer, including the purchase of eight new cars. The railway will be extended through Rayland; a new feed cable will be purchased and erected from the power house to Martins Ferry.

ANTIGO, WIS.—It is reported that F. C. Duchac, of Antigo, has applied to the Village Council for a franchise to install and operate an electric light plant in this village.

EAU CLAIRE, WIS.—The Wisconsin Telephone Company is planning to extend its system in this section of the state, which will involve an expenditure of between $10,000 and $15,000. General improvements are to be made at Hudson and New Richmond.

GRAND RAPIDS, WIS.—The Grand Rapids Street Railroad Company is making plans to commence work on the construction of its proposed electric railway, which is to extnd from Grand Rapids to Port Edwards and Nokoosa, seven miles in length. As yet no definite arrangements have been made for electricity to operate the railway. F. J. Wood, of Grand Rapids, is treasurer.

HARTFORD, WIS.—The Wisconsin Telephone Company is securing the right of way for a 40-wire toll line to be erected from Milwaukee to North Lake, Beaver Dam and to Stevens Point. The company expects to build as far as Beaver Dam this year.

HUBERTUS, WIS.—The capital stock of the Richfield, Hubertus & Holy Hill Telephone Company has been increased from $2,000 to $12,000.

MILWAUKEE, WIS.—The City Council has granted the Milwaukee Electric Railway & Light Company a franchise for several extensions to its lines in Milwaukee.

VIOLA, WIS.—E. R. Cushman, of Viola, Wis., writes that he has a good water power for sale and that there is a good opening to establish an electric light plant in Viola. The village has a population of 1000 and is anxious to have an electric system installed.

LETHBRIDGE, ALTA., CAN.—The ratepayers have voted in favor of spending $132,000 for the construction of an electric light and power plant. Address the mayor.

VANCOUVER, B. C., CAN.—Plans are being made by Frank Huston for the construction of a sawmill and planing mill in Vancouver. Both mills will be operated by electricity.

VANCOUVER, B. C., CAN.—The British directors of the British Columbia Electric Street Railway Company have voted $2,500,000 for extensions and improvements to be made to the system this summer. R. H. Sperling, of Vancouver, is general manager.

VICTORIA, B. C.—The British Columbia Electric Railway Company, it is said, has been making investigations at Jordon River with the view of increasing its supply of power, and if negotiations are consummated with the city it will probably establish a new plant at a cost of about $2,000,000. It is estimated that 10,000 hp can be developed all the year around. The proposition calls for a series of reservoirs for the storage of surplus water.

BROOMHILL, MAN., CAN.—The Municipality of Albert has voted in favor of a municipal telephone system. For further information address W. Kilkenny, Broomhill, Man.

WINNIPEG, MAN., CAN.—At the annual meeting of the Winnipeg Electric Railway Company it was decided to issue $1,500,000 in new stock for extensions and improvements to its system.

NEW GLASGOW, N. S., CAN.—The plants, properties, franchises, etc., of the New Glasgow Electric Light Company, it is reported, have been transferred to the Egerton Tramway Company.

COBOURG, ONT., CAN.—The council has granted the Provincial Steel Company permission to build an electric railway from its plant to the lake front. The Cobourg, Port Hope & Havelock Electric Railway Companies have also been given permission to enter the town.

HAMILTON, ONT., CAN.—The Board of Aldermen has accepted the offer of the Hamilton Electric Light & Power Company to furnish electricity for the illumination of Gore Park and extension from May 24 until Sept. 30 for $550, and for the city hall sign for the same period for $50.

LONDON, ONT., CAN.—Tenders will shortly be called for the supply of wires, insulators, cross-arms, poles, etc., for the distribution system in connection with the Hydro-Electric Power Commission project. For further information address E. I. Sifton, city engineer.

ODESSA, ONT., CAN.—The Ernestown Telephone Company, with main office in Odessa, has been incorporated. For further information address J. F. Dawson.

STRATFORD, ONT.—A proposition has been submitted to the City Council by N. M. Cantin, of St. Joseph, on behalf of New York capitalists, offering to construct an electric railway between St. Joseph and Stratford, a distance of about 65 miles, upon condition that the city guarantee bonds of the company to the amount of $250,000.

TORONTO, ONT., CAN.—Representatives from the municipalities of Acton, Brampton, Georgetown and Milton on May 10 held a conference with the chief engineer of the Hydro-Electric Power Commission in regard to contracts for the supply of electrical power.

TORONTO, ONT., CAN.—Contracts have been awarded by the Board of Control for conduits and cables for the municipal electrical distributing plant to cover the southern portion of the city from Dufferin Street to Don and south of Queen Street. For cables to the British Insulated & Helsby Cables, Ltd., of Prescot, England. The prices varying from 20 cents to $1.34 per ft. From 75,000 to 100,000 ft. of cable will be used. The contract for conduit was given to the American Pipe Company, of Akron, Ohio, at 4 7/10 cents per ft. Single-duct conduit will be used. K. L. Aitken is city electrical engineer.

MONTREAL, QUE., CAN.—The Dominion Government is now considering the electrification of the Intercolonial Railway from Montreal to Moncton, N. B. The water power at Grande Rapids will be developed to furnish electricity to operate the railway if the plan is carried through. D. Pottinger, Moncton, N. B., is general manager.

New Industrial Companies.

THE BRIGHTON ELECTRIC COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $2,000 for the purpose of doing general electrical work. The incorporators are William D. Taylor, Edward McCourt and John W. Taylor, of West New Brighton, N. Y.

THE CONTINENTAL ELECTRIC COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $12,000, for the purpose of doing a general electrical engineering and contracting business by Harry Bierm, E. E. Schmuck and Alje Bierm.

THE ELECTRIC EQUIPMENT COMPANY, of Oakland, Cal., has been incorporated by G. F. Bulen and others.

THE ELECTRICAL WIRING COMPANY, of New York, N. Y., has been chartered with a capital stock of $1,000 by Theodore Trendelberg, of Jersey City, N. J.; Russell G. Gory, of Montclair, N. J., and Joseph S. Merline, of New York, N. Y. The company proposes to do general electrical work.

THE JAMES P. MARSH & COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $50,000 by Charles H. Frank, M. N. Miller and Daniel Scanlan. The company proposes to manufacture gages and valves.

LEONARD KEIL, of New York, N. Y., has filed articles of incorporation, with a capital stock of $2,000, for the purpose of dealing in machinery, engines, boilers, etc. The incorporators are: George Deulerman, Winifred E. Keil and Leonard Keil, of West New York, N. J.

THE LIVINGSTON RADIATOR & MANUFACTURING COMPANY, of New York, N. Y., has filed articles of incorporation for the purpose of manufacturing motors, engines, cooling and heating radiators, etc. The company is capitalized at $100,000, and the incorporators are John N. Boyle, Albert S. Rockwood and Thomas Roberts, all of New York, N. Y.

THE MISSOURI ELECTRIC STORAGE BATTERY COMPANY, of St. Louis, Mo., has been incorporated, with a capital stock of $25,000, by N. P. L. Rosch, E. M. Cooper, Charles Wilson and others. The company proposes to manufacture storage batteries.

THE NATIONAL RAILWAY DEVICES COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $200,000, by Francis E. Hickley, Harry J. Berman and William L. Carlin. The company proposes to manufacture railway supplies and appliances.

THE NATIONAL TELEPHONE EQUIPMENT COMPANY, of Columbus, Ohio, has been incorporated, with a capital stock of $175,000, by W. F. O'Gara, R. C. M. Hastings, Thurston Matheny, J. P. Hazelton and R. L. Tuggle.

THE PHOENIX BRASS & METAL COMPANY, of New York, N. Y., has been chartered with a capital stock of $10,000 by Edward Gunnell, Stephen McFarland and Patrick J. O'Brien, all of New York, N. Y. The company proposes to manufacture steam, water apparatus, valves, etc.

THE SYRACUSE INDUSTRIAL GAS COMPANY, of Syracuse, N. Y., has been incorporated by Leon F. Smith, Nelson H. Henderson and Charles L. Ackerman, all of Syracuse, N. Y. The company is capitalized at $15,000 and proposes to manufacture gas producers, motors, engines, machinery, tools, etc.

THE TELEPHONE IMPROVEMENTS COMPANY, of Boston, Mass., has been incorporated, with a capital stock of $50,000, for the purpose of manufacturing telephone apparatus. F. F. Phillips, Jr., is president, and M. Wood, treasurer and clerk, both of Boston, Mass.

New Incorporations.

PRESCOTT, WASH.—Articles of incorporation have been filed for the Prescott Telephone & Telegraph Company by Joseph Utter, W. W. Winkle, J. D. Walter, Charles H. O'Neil and L. Burman, all of Prescott. The company is capitalized at $2,000.

SOUTH PRAIRIE, WASH.—Articles of incorporation have been filed for the South Prairie Light & Manufacturing Company by A. Anderson and others. The company is capitalized at $10,000.

VANCOUVER, WASH.—The Home Telephone Company has filed articles of incorporation with a capital stock of $150,000. The incorporators are: Judge W. W. McCredie, H. C. Phillips, A. L. Miller, J. D. Eaton, all of Vancouver, Wash., and Robert Tucker, of Portland, Ore.

FAIRVIEW, W. VA.—The Proctor & Peabody Telephone Company has been chartered, with a capital stock of $5,000, by E. R. Parsons, Albert Ganer and J. M. Wells, all of Proctor, W. Va.

FAYETTE, W. VA.—Articles of incorporation have been filed for the Fayette County Traction Company, with a capital stock of $75,000, by R. D. West, John Reese, E. G. Blume, C. E. Nestor, W. G. Wheatley, all of Fayette. The company proposes to construct an electric railway from Fayette Station to Fayetteville.

HUNTINGTON, W. VA.—The Cabell-Lincoln Rapid Transit Company has been incorporated, with a capital stock of $10,000, by S. G. Griffith, L. H. Cammack, S. H. Bowman, H. S. Byrer and J. T. Colbert, all of Huntington. The company proposes to operate and control motor carts for general transfer purposes.

NELSON, W. VA.—The Aaron's Creek Telephone Company has been incorporated with a capital stock of $5,000 and the following officers: D. T. Winston, president, of Virgilina, Va.; A. H. Nelson, of Nelson, vice-president, and T. B. Nelson, of Nelson, secretary and treasurer.

WALLACE, W. VA.—The Wallace Telephone Company has been incorporated, with a capital stock of $5,000, by D. C. Bennett, G. W. Schrader and Homer E. Hildreth, of Wallace, and A. Hayes Moore, of Mannington, W. Va.

CECIL, WIS.—The Cecil-Green Valley Toll Line Company has been organized to construct a telephone line from Cecil to Green Valley station and to within a mile of Pulcifer. About 25 miles of telephone line will be erected this summer. The officers of the company are: J. S. Breuch, president; Anton Berg, vice-president; J. H. Kuehl, secretary and treasurer, and Herman Borcher, manager.

DOUSMAN, WIS.—The Dousman & Marlboro Railroad Company has been incorporated, with a capital stock of $2,000, to construct an electric railway between Dousman and Marlboro, 6½ miles in length. The incorporators are: James M. Pereles, Phonse J. Pereles, Mason Pereles, Jr.; William H. Lindwurm and Henry Campbell.

EAU CLAIRE, WIS.—The Riverview Telephone Company, of Riverview, Wis., has been incorporated with a capital stock of $20,000 by John H. Perkins, Frank Knight and D. W. Shoudy.

ELEVA, WIS.—The Eleva Farmers' Telephone Company has been incorporated with a capital stock of $8,000 by J. A. Nelson and others.

OCONTO, WIS.—The Oconto Rural Telephone Company has been incorporated with a capital stock of $5,000 and the following named officers: George Glynn, president; Yarwood Matravers, vice-president; H. L. Reeves, secretary.

TAYLOR, WIS.—The Springfield Farmers' Telephone Company has been incorporated with a capital stock of $6,000 by John Lambert and others.

PORTAGE LA PRAIRIE, MAN., CAN.—The Manitoba Power & Electric Company has been incorporated with a capital of $100,000. The provisional directors are: W. H. Carter, A. H. Aldinger and A. J. Williams, of the Carter-Halls-Aldinger Company, Winnipeg, Man., and Chicago, Ill.

ROSEWOOD, MAN., CAN.—The Rosewood Rural Telephone Company has decided to build at once a telephone line to Ste. Anne. G. Claydon is manager.

ALTONA, ONT., CAN.—The Central Telephone Company has been incorporated here, with a capital of $40,000. J. Underhill is secretary.

APSLEY, ONT., CAN.—The Apsley Telephone Company has been incorporated with a capital of $10,000 by D. Brown, Z. Tucker, of Apsley, and D. Davidson, of Peterborough, Ont.

COBOURG, ONT.—The Cobourg, Port Hope & Havelock Electric Railway Company has been incorporated to construct an electric railway to extend across Northumberland County to Warkworth and Campbellford, thence to Havelock, with branches from a point near Warkworth to Roseneath and Hastings, by H. T. Bush, E. S. Huycke, of Port Hope; W. J. Crossen, of Cobourg, and Reeve J. Knox, of Havelock. H. A. Ward, of Port Hope, is secretary.

THAMESVILLE, ONT., CAN.—The Thamesville Telephone Company has been incorporated with a capital of $10,000. The provisional directors are: W. J. Mitton, Camden; T. Marven, J. Coutts, of Thamesville, Ont.

ABERNETHY, SASK., CAN.—The Foster Rural Telephone Company has been incorporated with a capital of $5,000.

Legal.

FRANCHISE HELD VALID.—A decision of the circuit court handed down by Judge Grimm May 5 gives the West End Light & Power Company, of St. Louis, Mo., the right to erect transmission lines in St. Louis under the franchise granted to Browning, King & Company in 1885, which was purchased by the West End company several years ago. Judge Grimm, in his decision, holds that the franchise is not void because of the failure of the original grantee to carry out the full provisions. W. Hall Trigg sought an injunction against the company to prevent it from erecting wires in front of his property. Jesse D. Dana is president, and Arthur Kloes, vice-president and secretary of the company.

Personal.

MR. THOS. D. LOCKWOOD delivered an address at the May meeting of the Pittsfield A. I. E. E. Branch on "The Satellite Systems of Primary or Pioneer Inventions."

COUNT VON BERNSTORFF, German Ambassador to the United States, was a distinguished visitor at the West Allis plant of the Allis-Chalmers Company in Milwaukee on May 7.

MR. C. E. STEPHENS, of the Westinghouse Electric & Manufacturing Company, presented a paper on the subject of street lighting before the Pittsburgh A. I. E. E. Section at its meeting on May 11.

MR. R. C. McMILLAN has become chief statistician of the Buffalo Electric Company, Buffalo, N. Y. Formerly Mr. McMillan was connected with the statistical department of the Commonwealth Edison Company, Chicago, which is in charge of Mr. E. J. Fowler.

MR. WILLIAM F. SMITH, formerly connected with the electrical department of the New York Central Railroad and the Otis Elevator Company and for the past few years electrical engineer for the Virginian Railway, has been appointed general manager of the Electrical Alloy Company, of Morristown, N. J., manufacturer of Phoenix and Ideal resistance wires.

MR. JOHN J. SCHAYER has been appointed manager of the Electric Shop, which is the beautiful downtown display rooms of the Commonwealth Edison Company, Chicago. The Electric Shop will be a separate department of the company's business, and Mrs. E. L. Stickney, who has direct charge of the reception rooms and salesrooms, and Mr. F. C. Prabel, stockkeeper, will report to Mr. Schayer.

MR. PAUL H. BATE has the distinction of obtaining the largest amount of new business to the credit of any solicitor for the Commonwealth Edison Company during the year 1908. Mr. Bate's record for this year is the handsome total of 56,500 16-cp lamp equivalents, or 2,825 kw. Mr. Bate won the first prize of $500 in the N. E. L. A. competition of last year for the best power solicitor's handbook. He evidently practises what he preaches.

MR. D. J. FLEMING, who was for several years connected with the Allis-Chalmers Company, of Milwaukee, Wis., in the power and contract department, has recently joined the Westinghouse Electric & Manufacturing Company in the capacity of sales engineer, with headquarters at East Pittsburgh, Pa. Mr. Fleming was also connected with the General Electric Company at Schenectady, N. Y., for a number of years, where

to look a complete course in the testing department and later served in the sales engineering department.

MR. J. H. DAVIS.—Announcement has been made of the promotion of Mr. J. H. Davis from assistant electrical engineer to electrical engineer of the Baltimore & Ohio Railroad, with headquarters at Baltimore. Mr. Davis succeeds Mr. L. T. Gibbs, who died several months ago. Mr. Davis is a graduate of the University of Arkansas, where he studied both civil and electrical engineering, completing the course in civil engineering to the middle of the senior year and receiving his degree in electrical engineering in 1897. From that time until March 17, 1901, he was associated with the St. Francis Levee Board, doing dike and levee work along the Mississippi River north and south from Memphis, under the supervision of the United States Army. From March, 1901, until October, 1905, when he entered the Baltimore & Ohio service, Mr. Davis was connected with the electrical department of the Pennsylvania Railroad at Altoona, Pa.

MR. W. H. COLMAN, who has been for several years assistant manager of the supply department of the Chicago office of the General Electric Company, has been promoted to be manager of the department, succeeding Mr. F. N. Boyer in that position. Mr. Boyer is assistant manager of the Chicago office, and henceforth will give his entire time to general problems of administration, assisting Manager J. W. Johnson. Mr. Colman has had an experience in the electrical business dating back to 1889, when he entered the employment of the old Edison General Electric Company in Chicago under Mr. John I. Beggs, district manager. He began as a mailing clerk, but he was soon advanced to the position of city salesman, in which he continued after the consolidation of the Edison company with the Thomson-Houston Company to form the General Electric Company in 1892. In 1895 Mr. Colman went to Detroit in charge of the Detroit office of the General Electric Company, but the year following he was transferred back to Chicago as assistant manager of the supply department in the Chicago office, a position he continued to fill until his recent promotion.

PROF. HENRY S. CARHART will retire Oct. 1 as head of the Department of Physics, University of Michigan, and receive a pension from the Carnegie foundation. Prof. Carhart has occupied the chair of physics at Ann Arbor since 1886, having previously been professor of physics at Northwestern University (1872-1886). In 1865 he entered Yale, and shortly after went to Wesleyan University, from which he was graduated with the degree of B.S. After graduation he taught school for two years, then took one year's post-graduate work at Yale, which was followed by a course in the Harvard summer school of chemistry. Prof. Carhart for some years made a specialty of the primary battery, on which subject he is the author of an authoritative treatise. He also has paid much attention to electrical measurement. The work by which he is best known, however, is in connection with the standard cell, his improvement of the Clark cell having been adopted at the Chicago Electrical Congress as the international standard.



PROF. HENRY S. CARHART

Prof. Carhart has been a leading delegate at several of the international electrical congresses, and served a term as president of the American Electrochemical Society. He has received a number of honorary degrees, among others that of LL.D. from Wesleyan University. Always an exponent of the highest ideals, Prof. Carhart has been a forceful factor in American scientific and educational circles; and with leisure now to carry on research work unimpeded, science has gained rather than lost by his retirement from teaching. He will attend the Darwin centennial celebration in London June 22-24, as the representative of the University of Michigan, returning in September. His retirement takes effect Oct. 1, when he will receive the title of professor emeritus.

Obituary.

MR. C. I. ZIMMERMAN, post-graduate student at the University of Wisconsin, died at Madison May 15 as the result of exposure in the lake following the capsizing of a boat. Mr. Zimmerman was formerly connected with the Carborundum Company at Niagara Falls as electrochemical engineer. He contributed a number of papers on electrochemical subjects to technical journals and *Transactions of Societies*, and at the recent Niagara Falls meeting of the American Electrochemical Society presented two papers. His death at an early age is a distinct loss to the profession in which he had already become a prominent figure.

Trade Publications.

RHEOSTATS.—The American Electric Fuse Company, Muskegon, Mich., in a catalog just issued, describes and illustrates Allen-Bradley rheostats and electric controlling apparatus. These devices are described with great minuteness, and dimension diagrams and price-lists are given.

WIRES, CABLES AND CORDAGE.—The Borden Manufacturing Company, Chicago, has issued its catalog No. 11, of electrical wires, cables and cordage. The catalog covers a full line of all kinds and gives a good deal of information. It contains many useful tables and is well illustrated.

NATIONAL METAL MOLDING.—With the title "It's a Snap" the National Metal Molding Company, Pittsburgh, has issued a folder in which the advantages of metal molding are brought out by reference to the installation of an installation made for the Fidelity Title & Trust Company, Pittsburgh.

CONDENSING APPARATUS.—In a pamphlet of recent issue the A. S. Cameron Steam Pump Works, East Twenty-third Street, New York City, describes and illustrates Cameron condensing apparatus. The company has extended the line of manufacture to cover jet and surface condensers for high vacuum steam turbine work.

REGENERATIVE FLAMING ARC LAMP BULLETIN NO. 79 of the Adams-Bagnall Company, Cleveland, has for its subject the new flaming arc lamp made by this company, which differs radically from the typical flaming arc. By means of two side tubes a constant circulation of gases is maintained between the top and bottom of the inner globe surrounding the arc, thereby intensifying the light and giving rise to the name "regenerative."

DIXON GRAPHITE PRODUCTS.—The Joseph Dixon Crucible Company, Jersey City, has issued a pocket edition of its general catalog, which lists its principal products, such as crucibles, facings, lubricating graphite greases, pencils, protective paint, etc., giving brief descriptions and prices. The booklet is of commercial envelope size, and will conveniently go in the pocket or desk pigeonhole. It is substantially bound in tough cover stock, and attractively printed.

Business Notes.

THE STUART-HOWLAND COMPANY, of Boston, has recently added six new men to its already large force of salesmen on the road in order to take advantage of the increasing market offered for its various lines.

THE MOORE ELECTRICAL COMPANY, of Newark, N. J., has recently completed installations of white Moore Light tubes in the work of the United Piece Dyeing Company, Paterson, and those of Chene Brothers, South Manchester, Conn. A. Hall, the Broadway photographer, has also had the underside of his skylight ribbed with Moore tubes in order to be entirely independent of daylight.

THE TAUNTON-NEW BEDFORD COPPER COMPANY has occupied its new factory at Taunton, Mass., where it will carry a full stock of made-up parts of Hill switches so that shipments can be made the day following the receipt of an order. The company is now prepared to give estimates on switchboards of any size for both direct and alternating current service. An addition will soon be made to the new factory for the manufacture of steel cabinets for switch and panel-board work.

THE WAGNER ELECTRIC MANUFACTURING COMPANY has opened an office in Denver, Col., located in the Ideal Building. The new office is in charge of Mr. O. H. Davidson, of the Electric Manufacturers' Sales Company. Mr. Davidson will have charge of the Wagner company's business in Colorado, New Mexico, Utah, Montana and eastern Idaho. Mr. Davidson has been located in Denver for the past three years and has a wide acquaintance in the electrical line in his territory.

GRANT FLAMING ARC LAMPS.—The German-American Electric Company has been awarded a contract for the installation of 20 flaming-arc lamps by A. Holthausen, the largest dry goods dealer in Union Hill, N. J. The lamps will be installed throughout the Holthausen building and will burn with white carbons. The German-American company states that this is probably the first time a contract has been awarded for flaming-arc lamps for this purpose, and that the order was received in competition with clockwork feed lamps.

THE DARLEY ENGINEERING COMPANY, builders of patent suction conveyors, has discontinued its Pittsburgh office, and its engineering, purchasing and sales departments hitherto located there have been transferred to the main office in the Singer Building, New York City. The Chicago office will remain, as at present, in the Monadnock Building. The new officers of the company are as follows: W. A. Stadelman, president and general manager; C. L. Inslee, vice-president; W. Hudson, vice-president; W. W. Ricker, treasurer, and M. D. Chapman, secretary.

THE KIMBLE ELECTRIC COMPANY, of Chicago, in its new factory at 324-326 Washington Boulevard, has twice the capacity of its old factory, but the orders received since the change have also doubled in number, so that the company still finds it difficult to keep up with the demands of its business. Variable-speed alternating-current motors are made in sizes from ¼ hp to 1½ hp. They are adapted for driving printing presses, pipe organs, blowers, etc., and the company is bringing out a new motor which may be varied in speed from 100 to 5000 r.p.m. and reversed by simply throwing a lever. Mr. Austin Kimble, the inventor of this motor, is manager of the company.

ALLIS-CHALMERS GAS ENGINES.—At the West Allis works the Allis-Chalmers Company there is great activity in the gas engine building line, as a result of orders crowding close upon others received since the

first of the year, the units of which are now being assembled for shipment. Among orders just received are for three gas engines, aggregating 1000 hp, direct connected to three Allis-Chalmers electric generators, for the Palmetto Phosphate Company, Tiger Bay, Fla.; a gas engine of approximately the same size, with generator, for the Armstrong Cork Company's plant at Camden, N. J.; a 1500-kw gas-driven electric unit and seven standard 30,000 cu. ft. gas-driven blowing engines for various blast furnace plants.

DOSSERT & COMPANY, 242 West Forty-first Street, New York City, manufacturers of solderless connectors, cable taps and terminal lugs, will exhibit this year at the coming convention of the National Electric Light Association at Atlantic City a number of improvements and new applications of its devices of special interest to central-station engineers, including elbows for connecting ingoing and outgoing solid buses through oil switches; special lugs for remote-control switches; special two-way studs for tapping from solid rods direct to buses and special studs for transformer connections. Dossert & Company also expect to exhibit at Atlantic City for the first time the results of thorough and exhaustive tests of their devices now in progress at Cornell University.

THE HOLOPHANE COMPANY MOVED.—The general offices of the Holophane Company, with the headquarters of the sales and engineering departments, have been moved to Newark, Ohio, where Holophane glass is manufactured. The business of the company has been handled heretofore from New York City, but in the interests of more prompt shipments and to better serve the steadily increasing market, the concentration of the entire organization was deemed advisable. The branch offices of the sales department located in New York, San Francisco, Boston and Chicago, however, will continue as before. Only one working day was lost between the cessation of the business in New York and the opening in Newark. Practically the only inconvenience experienced by customers was due to delay caused by mail being misdirected to New York after the closing of the old office.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 11, 1909.

[Conducted by Wm. F. Bissing, Patent Law, 2 Rector St., N. Y. City.]

920,906. ELECTRIC COOKING VESSEL; F. Bolling; Frankfort-on-the-Main, Germany. App. filed Nov. 5, 1908. Heats the side of the vessel by means of a heating element placed directly on the vessel and a projecting strip soldered to the vessel over the element and insulated therefrom.

920,920. COMMUTATOR FOR DYNAMO ELECTRIC MACHINES; F. W. Cox, Wilkinsburg, Pa. App. filed April 4, 1906. Commutator consists of a clamping ring with auxiliary clamping rings engaging intermediate portions of the segments.

920,925. VOLTAGE REGULATOR; F. Darlington, Pittsburgh, Pa. App. filed March 3, 1906. Voltage variations are effected by varying the active lengths of transformer windings by means of a contact wheel driven by a motor which contacts successively with the windings.

920,926. MOVABLE TERMINAL FOR VOLTAGE REGULATORS; F. Darlington, Pittsburgh, Pa. App. filed March 3, 1906. A plurality of contact rings are arranged side by side on a common axis and are resiliently mounted thereon by means of springs. The rings engaged the windings of a transformer so as to produce a contact switch. (See 920,925.)

920,927. INDICATING MEANS FOR INSTRUMENTS; H. P. Davis and P. MacGahan, Pittsburgh, Pa. App. filed Oct. 21, 1905. A synchronism indicator having relatively movable members connected respectively to the sources of alternating current, a lamp carried by an arm operated by one of the members and stationary lamps serving as a resistance and illuminating means.

920,932. ELECTRIC SIGNAL APPARATUS; C. E. Duffie, Omaha, Neb. App. filed April 27, 1907. For notifying the engineer of danger ahead by a cab signal operated by a differential relay in the cab and contact means controlled by stationary means on the track.

920,938. CONCENTRATING DEVICE FOR TELEPHONE TRANSMITTERS; O. F. Falk, Belleville, N. J. App. filed Aug. 21, 1908. A funnel-shaped mouthpiece having a passage leading directly toward the diaphragm and a second passage surrounding the diaphragh.

920,965. OZONE PRODUCER; S. M. Kintner, Pittsburgh, Pa. App. filed June 28, 1905. Combines a source of alternating current with a condenser, a single spark gap and a silent discharge gap connected in series therewith. The silent discharge produces the ozone.

920,966. TELAUTOGRAPH; A. M. & K. Knudsen, Chicago, Ill., and Grand Rapids, Mich. App. filed March 12, 1906. The device is provided with a transmitter, a receiver, a recording ribbon, a step-by-step ribbon feed and means for rendering the feed operative by lifting the tracing point of the transmitter from the writing table.

920,970. FOILED PAPER AND METHOD OF PRODUCING SAME; G. F. Mansbridge, Sanderstead, Eng. App. filed Jan. 13, 1906. Subjects each metal-plated sheet separately to the action of the electric current, thereby fusing the metal in proximity to the defective places without burning away the body of the paper, thus insultaing the defective part.

920,898. INDUCTION MOTOR; T. Abtmeyer, Wilkinsburg, Pa. App. filed July 13, 1907. A secondary member for induction motors with tubular conductors angularly disposed with reference to the axis and balancing rods in some of the conductors.

921,013. TRANSMITTING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed April 8, 1907. A high-frequency transmitter in which the discharge gap consists of two separated conductors immersed in a liquid, which liquid is common to the circuit including the prime source of energy and to a high-frequency circuit.

921,014. HYDRO-CONDENSER; H. Shoemaker, Jersey City, N. J. App. filed July 3, 1908. Includes a tank, a plurality of condenser units in the tank, each having a jar of dielectric material with conducting liquid in the jar forming a condenser armature and conducting liquid in the tank contacting with the outer sides of the jar to form the second armature.

921,018. ELECTRICAL APPARATUS; H. C. Sumner, Wilkinsburg, Pa. App. filed Aug. 3, 1907. An alternate-current transformer suspended under the railway car and [illegible] the transformer.

921,022. OVERHEAD TROLLEY [illegible]. App. filed Jan. 29, 1908. A trolley wheel with [illegible] and contact rollers, together with [illegible] a contact ring and a connectible [illegible] hub of the wheel.

921,038. CEILING ROSETTE FOR DROP ELECTRIC LAMPS; W. Wilbraham, Chicago, Ill. App. filed [illegible]. Has a ring [illegible] an axial passage communicating [illegible] the axes.

921,046. CIRCUIT INTERRUPTER; [illegible] W. Wilbraham, Chicago, Ill. App. filed June 16, 1908. [illegible] ture with polar projections [illegible] by the field magnet when the [illegible] armature and released when shunted by the armature and an electric circuit controlled by the movable member.

921,050. SNAP SWITCH; J. H. Wyatt, Philadelphia, Pa. App. filed Oct. 22, 1908. A double push-button snap switch having a pivoted contact member and a detent and operated by a coiled spring. Details.

921,053. TERMINAL STRUCTURE FOR ELECTRICAL APPARATUS; J. H. Zimmermann, Wilkinsburg, Pa. App. filed Nov. 4, 1905. For electrical measure instruments for supporting and protecting the terminals of the instrument by means of an insulating partition between the interior of the instrument and the terminal casing.

921,054. MAGNET SUPPORT FOR ELECTRICAL MEASURING INSTRUMENTS; J. H. Zimmermann, Wilkinsburg, Pa. App. filed Nov. 4, 1905. Supports a plurality of permanent damping magnets end to end on a strip which engages channels in the instrument frame.

921,060. ANNUNCIATOR; J. H. Ballweg, Baker City, Ore. App. filed June 18, 1908. For giving signals in hotel rooms, etc., by means of a rotary drum bearing a series of indicating characters operated by a motor, and started by means of a push-button.

921,108. MAGNETIC ELECTRIC-LIGHT HOLDER; D. J. Hauss, Aurora, Ind. App. filed Feb. 20, 1908. A magnet socket which retains its position when the current is cut off from the light, and which holds the light by means of magnet attraction to any desired position upon an iron object, such as machinery or structural iron, and which can be shifted.

921,116. SELECTIVE SIGNALING SYSTEM; A. W. Jones, Schenectady, N. Y. App. filed May 8, 1906. All the signals are automatically operated upon a breakdown. Normally energized magnets hold the signals at safety, and a signal switch somprising a ratchet wheel sets the signal.

921,119. TELEPHONE; A. G. Kaufman and L. J. Lippmann, New York, N. Y. App. filed Nov. 13, 1906. A plurality of receivers reproduce the same sound at different places and the transmitters are so grouped as to be simultaneously operated from the same source of sound.

921,141. SOUND TRANSMITTER AND RECEIVER; A. J. Mundy, Boston, Mass. App. filed April 23, 1902. Particularly for submarine signaling in which the carbon-containing cups forming the transmitter are contained within a sound-focusing shell and mounted on diaphragms.

921,145. PIPE CLAMP FOR GROUND CONTACTS; T. Nagel, Chicago, Ill. App. filed Dec. 31, 1908. Comprises a saddle with channels and a band having ends passing over the channels, together with a clamp bearing upon the band.

921,168. COMBINED LOCK AND SIGNAL AND LIGHTING SWITCH; W. R. Schlage, Berkeley, Cal. App. filed Dec. 14, 1908. Operates a signal and light when the door is opened by turning the knob of the door.

921,176. ELECTRIC RAILWAY SYSTEM; R. Stearns, Schenectady, N. Y. App. filed May 1, 1908. Opens the line switch of a car when the car enters upon an energized section, thereby disconnecting the car power circuit, but leaving the lighting circuit connected.

921,183. PROCESS OF REDUCING ORES; F. J. Tone, Niagara Falls, N. Y. App. filed April 11, 1906. A refractory receptacle contains the electrodes and the products of reduction are removed from the region of the arc as they are formed and kept in a fused state.

921,187. TELEPHONE EXCHANGE SYSTEM; H. G. Webster, Chicago, Ill. App. filed May 7, 1903. A busy test circuit for testing the condition of the called subscriber's line by means of a test relay of high resistance through which the test circuit is established.

921,196. DETACHABLE PLUG; P. R. Yuzuk, New York, N. Y. App. filed Aug. 17, 1907. A two-part plug, one part being left in the socket and the other disconnectable therefrom and provided with fuse links.

921,199. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; D. E. Brown, Pittsburgh, Pa. App. filed March 6, 1906. Has a cap, a single solid base of insulating material carried by the cap for the terminals and connecting wires and an outer casing engaging with the cap by a threaded connection.

921,[illegible] OVERHEAD TROLLEY SWITCH; F. C. Dobson, Duquesne, and A. [illegible], Pittsburgh, Pa. App. filed Nov. 21, 1908. The overhead trolley switch has a swingable member operated by [illegible] with the track section to guide the trolley wheel across the switch to the main line trolley wire.

921,228. ELECTRIC FURNACE FOR METALLURGICAL PURPOSES. P. [illegible], Niagara Falls, and [illegible], Niagara Falls, Canada. [illegible]

921,237. ELECTRIC SWITCH FOR RAILWAY TRAFFIC CONTROLLING DEVICES; [illegible], New York, N. Y. App. filed June [illegible]

921,[illegible] TROLLEY HEAD AND TROLLEY; [illegible] Mitchell, Long [illegible]. App. filed Nov. [illegible] A [illegible] trolley head the

trolley having a grooved flange with a web having a central opening, side plates secured to the flange and provided with radial slots.

921,286. TIME INDICATING SYSTEM; A. A. Radtke, Chicago, Ill. App. filed June 29, 1908. A plurality of clocks are controlled by a master clock. The improvement is in the contact mechanism.

921,293. TRANSMITTING APPARATUS; H. Shoemaker, Jersey City, N. J. App. filed Aug. 30, 1907. For wireless telegraphy in which a closed oscillation circuit contains a plurality of condensers in series with each other and with inductance, together with a direct connection from the charging source to the terminals of less than the whole number of condensers.

921,299. VOLTAGE REGULATOR; S. D. Sprong and W. E. McCoy, New York, N. Y. App. filed Oct. 3, 1908. Means for compensating voltage variations by throwing a variable rheostat in series with the load, which rheostat is controlled by a motor which, in turn, is controlled by a solenoid actuated by the load circuit.

921,308. THERMOSTAT; J. H. Swan, Chicago, Ill. App. filed June 15, 1905. Thermostat for steam heaters which operates the steam valve of a radiator through electrical mechanism.

921,311. ALTERNATING-CURRENT REGULATOR; C. H. Thordarson, Chicago, Ill. App. filed July 27, 1906. For use with X-ray apparatus, including a coil with a core movable relatively into and out of the coil and of variable cross-sectional area.

921,314. TROLLEY HARP; F. A. Tribbe, Ironton, Mo. App. filed Sept. 23, 1908. A trolley harp having a pivoted member carrying one bearing for the shaft of the trolley wheel.

921,318. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. A telephone line circuit provided with a double-acting relay which displays a line signal in response to a partial energization and prevents the display when energized to a greater extent.

921,319. SIGNALING SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. For telephone systems in which a double-acting relay with two windings is connected with the transmitting circuit, one in the transmitting circuit and the other in a local circuit. When the circuit is grounded, the local winding of the double-acting relay is thrown in, which interrupts the circuit of the receiver and throws in a signal showing that the individual circuit is in trouble.

921,320. SIGNALING SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. Similar to 921,319.

921,321. TELEPHONE SYSTEM; H. G. Webster, Chicago, Ill. App. filed July 5, 1906. Two-wire system with means for securing a busy test without cordae interference with a conversation by associating with the cord circuit, special contacts controlled by the listening key for the test circuit and other contacts control led by a relay for maintaining the talking circuit.

921,325. ELECTRIC SMELTING FURNACE; C. E. Wilson, Hood River, Ore. App. filed July 30, 1908. For the production of ferro-titanium in steel foundries, by means of electrodes which dip into the furnace until the pressure lifts a valve closing the furnace and allows the gas to escape.

921,326. SUBMARINE SIGNALING APPARATUS; E. C. Wood, Somerville, Mass., and F. M. Durkee, Newton; W. F. Kelley and J. B. Millet, Boston, Mass. Makes use of an indicator and telephone with a series of transmitters arranged about the vessel, the telephone being connectable to either one of the transmitters, together with an electrical indicator for indicating the transmitter connections.

921,327. BRUSH-HOLDER FOR ELECTRIC MACHINES; J. H. Woollisicroft, Hawarden, Eng. App. filed Nov. 20, 1908. A brush-holder encircles the brush bar and is provided with a toggle for tightening it on the bar and also has means for applying pressure to the brush.

921,334. TELEPHONE TRANSMITTER; H. F. Albright, New York, N. Y. App. filed Feb. 24, 1906. Details in the construction of transmitters employing a cup containing carbon granules.

921,362. WIRE SUPPORT; T. P. Chandler, Philadelphia, Pa. App. filed July 14, 1908. A support for electric wires in which a two-part clamp clamps the wire, the back of the clamp being secured in an insulator.

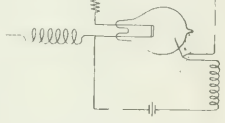
921,384. SELF-RESTORING CLEAR-OUT DROP FOR TELEPHONE SWITCHBOARDS; C. D. Enochs, La Crosse, Wis. App. filed April 30, 1906. When the plug at the end of the cord is raised to make a connection a spring raises a lever which releases the shutter. When the plug returns the weight on the cord pulls back the spring and lever and automatically restores the shutter.

921,385. ANNUNCIATOR; C. D. Enochs, La Crosse, Wis. App. filed July 5, 1907. A drop annunciator for telephone switchboards, provided with a removable coil on the magnet, for operating the drop.

921,391. STORAGE BATTERY PLATE; B. Ford, Philadelphia, Pa. App. filed July 10, 1907. Has a conducting grid having open-faced



920,970. Foiled Paper and Method of Producing Same.



921,526. Apparatus for the Production of Undamped Electrical Vibrations.

receptacles for active material and laminated retaining walls consisting of piles of thin sheets.

921,392. SYSTEM OF DISTRIBUTION; B. Frankenfield, Milwaukee, Wis. App. filed Oct. 14, 1908. Improvement on patent 850,217 employing a booster armature carrying half of the neutral-wire current.

921,398. AUTOMATIC MOTOR STARTER; C. T. Henderson and C. H. Miller, Milwaukee, Wis. App. filed Jan. 7, 1905. Makes use of an air compressor and reservoir in which the air is compressed by a motor controlled from a pressure regulator. The improvement lies in the electric controlling means.

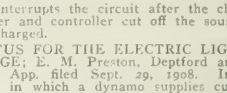
921,408. CLUSTER FIXTURE FOR ELECTRIC LAMPS; P. H. Jaehnig, Newark, N. J. App. filed March 15, 1906. A plural cluster fixture or plural lamp socket having an insulating base with a hollow projection and associated lamp contacts carried by the base with connecting plates on opposite sides of the projection.

921,429. MEANS FOR COUNTING CONVERSATIONS AT TELEPHONE EXCHANGES; J. H. Meyer, Madgeburg, Germany. App. filed July 21, 1905. A counter provided with a circuit closer connected with the speaking and the call change over switch, a relay and mechanism comprising the counting being effected at the end of the call and after the subscriber has taken up the receiver.

921,430. SELF-STARTER FOR ELECTRIC MOTORS; C. H. Miller, Milwaukee, Wis. App. filed Oct. 24, 1907. A rheostat for a motor is operated by means of a solenoid, the circuit through which is closed when the pressure in an air compression tank falls and opened when the pressure rises.

921,433. KNIFE SWITCH; J. H. Miller, Bridgeport, Conn. App. filed Oct. 14, 1907. Improvement in the joint between the block and the blades of the switch.

921,447. APPARATUS FOR AUTOMATICALLY THROWING OUT THE RESISTANCE IN CHARGING STORAGE BATTERIES; G. Pattberg, New York, N. Y. App. filed Oct. 6, 1908. A single solenoid closes the motor circuit before the change in the battery



921,108. Magnetic Electric Light Holder.

resistance and interrupts the circuit after the change is completed. A circuit breaker and controller cut off the source of supply when the battery is charged.

921,454. APPARATUS FOR THE ELECTRIC LIGHTING OF RAILWAY CARRIAGE; E. M. Preston, Deptford and A. E. Kennard, Anerley, Eng. App. filed Sept. 29, 1908. Improvement in car lighting systems in which a dynamo supplies current to the lamps at speed and charges batteries below speed, by means of a switch operated by a governor. Improvement in the sliding framework operated by the governor.

921,474. TROLLEY; C. W. Smith, Haverhill, Mass. App. filed April 9, 1908. A sheave for each journal of the trolley wheel, detachably secured to the trolley head and each having an oil chamber.

921,487. COUPLING FOR SECTIONAL RODS; R. H. Villard, Rochester, N. Y. App. filed Sept. 18, 1906. Interlocking heads for coupling sectional rods used in underground conduits.

921,505. MOTOR CONSTRUCTION; B. A. Behrend, Norwood, Ohio. App. filed June 25, 1906. A cylindrical core body having radial slots for field coils and solid pole pieces, the ends of the pole being slotted for the passage of air.

921,508. THIRD-RAIL SYSTEM; Y. Burgess, Washington, D. C. App. filed Jan. 29, 1908. A stand for third rails having a stem with conductor supports projecting from opposite sides of the stem and a roof on the stem above the supports.

921,512. TROLLEY; P. Coval and D. A. Kunkle, New Kensington, Pa. App. filed Nov. 3, 1908. A pentagraph trolley having pivoted arms for maintaining the trolley wheels on the wire.

921,520. CHANDELIER; O. Dodge and S. G. Camp, Colorado Springs, Col. App filed Feb. 10, 1908. A combination gas and electric fixture having two concentric spaced tubes to provide a gas passage between them with a longitudinally adjustable member inside of the tubes for carrying the electric light wires.

921,526. APPARATUS FOR THE PRODUCTION OF UNDAMPED ELECTRICAL VIBRATIONS; S. Eisenstein, Kief, Russia. App. filed March 27, 1908. A Wehnelt cathode ray tube, an anode in the tube and a cathode within the same coated with oxids of rare earths.

921,531. RECEIVER FOR ELECTROMAGNETIC WAVES; R. A. Fessenden, Washington, D. C. App. filed April 25, 1906. Utilizes the variation in pressure between an electro light and an electrode in contact therewith by the flow of electric oscillations therethrough the resulting motion giving a signal.

921,584. OUTLET BOX FOR ELECTRIC CONDUITS; W. A. Bonnell, New York, N. Y. App. filed Aug. 1, 1908. An outlet box having one or more stationary conduit receiving bushes fixed to the base and conduit clamping plates located at the rear of the base and engaging the conduits in the plane of the base.

921,585. COMBINED CONDUIT CLAMP AND KNOCK-OUT DISK; W. A. Bonnell, New York, N. Y. App. filed Nov. 21, 1908. A knock-out disk and clamping plate in one piece so that when the knock-out disk is broken out the roughened edge of the clamping disk grips the conduit.

921,589. CONTROLLER FOR ELECTRIC MOTORS; H. W. Cheney, Milwaukee, Wis. App. filed Oct. 5, 1908. Means for biasing the movable member of the controller forward to off position during one part of the movement and backward to off position during another part of the movement and unbiased in running position.

921,601. INTERRUPTER CIRCUIT AND APPARATUS; J. F. Engle, Cleveland, Ohio. App. filed June 12, 1907. For producing current for signaling purposes by means of a vibratory contact member and an electromagnetic apparatus having high and low resistance windings.

921,625. DOUBLE CIRCUIT FLASHER; W. J. Phelps, Detroit, Mich. App. filed Sept. 7, 1906. For controlling the circuits of two sets of advertising lamps. Does away with the motor and makes use of a thermostat with a resistance beater controlling it so that the current flowing through the resistance changes the resistance and operates the thermostat to shift the circuit.

921,630. SYSTEM OF ELECTRICAL DISTRIBUTION; B. R. Shover, Chicago, Ill. App. filed Dec. 24, 1906. Improvement in three-phase distribution system supplied through a transformer from a direct current circuit or through an alternating current supply source.

921,641. METHOD OF PREVENTING CORROSION OF METALS IMMERSED IN LIQUIDS; P. E. G. Cumberland, St. Kilda, Victoria, Australia. App. filed June 13, 1907. Prevents corrosion of screw propeller blades, etc., when in contact with sea water by providing two different metals in juxtaposition and constituting the negative electrode and placing an iron electrode in contact with the water in proximity to the screw propeller.

921,642. CONTROLLER FOR ELECTRICAL APPARATUS; F. Darlington, Great Barrington, Mass. App. filed Oct. 20, 1908. A controller having conducting segments with a switch arm engaging them, a reversing switch and ratchet for operating it.

921,650. TROLLEY HEAD; J. E. Robbins, Greensburg, and W. A. and C. P. Kirkpatrick, Indianapolis, Ind. App. filed Feb. 8, 1908. A trolley head having a pair of pivoted spring pressed arms arranged to replace the trolley wheel on the wire. The arms embrace the wire when the wheel leaves it.

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The National Electric Light Association.

The National Electric Light Association ranks foremost among the bodies that represent the interests of the great public utility industries of the country. From whatever point of view it be regarded and considered—size of membership, age of the organization, representative character of its leaders, influence in the art, courage in dealing broadly with large issues—the association undergoes very favorable comparison with the kindred institutions that stand before the public as sponsors for street railways, gas plants, water-works, etc.; and its methods are often cited for study and emulation. And yet it is not fully a quarter of a century old, its first convention having been held in Chicago, in 1885.

Since the Buffalo convention in 1892, the meetings have been held annually, but up to that time, for the first eight years, they were held every six months. For this there were various reasons. From 1880 to 1890 the electric lighting art in America, and indeed throughout the world, was undergoing a series of technical revolutions, and was growing with tremendous rapidity. The men who entered the field were attracted from all quarters, were frequently unacquainted with each other, and often unfamiliar with the conditions of the business; but all of them adventurous spirits, eager for knowledge and perfectly willing to communicate to others the new facts that they learned themselves as they plunged in. It was almost inevitable that at the start the members of the young association should feel the necessity keenly for frequent sessions, and there were even some who regretted and withstood the change to a yearly convention. But time has shown the wisdom of the change, especially now that numerous State and sectional lighting associations have sprung up, so that not a month goes by without the opportunity for central-station managers to get together. It thus happens that in 23 years the association has held no fewer than 31 conventions, visiting for the purpose no fewer than a score of cities. One of these cities was Montreal, where in 1897 it was a [illegible] exhibition, and was feted generously by the local authorities. As the association grew, the burden of entertainment was felt to be onerous by different places visited, and it was determined to alternate between Chicago and New York. This again was found to have objections, and the next convention city is never a certainty now. The farthest Western flight has been to Colorado, but there have been invitations to go further than that, while the officers entertain the hope some day of reaching the city of Mexico. Wherever the association goes now, with its average attendance of over 2000, it does marked good in a stimulus to the industry in the region visited; while in the earlier days its convention was found very helpful in that appeal to local pride which was just the thing needed to secure the renewal of the contract for street lighting or to prevent the passage of some obnoxious, arbitrary ordinance.

Including the present incumbent, the association has had 22 presidents, and these men as a group attest the versatility of talent enlisted and required in the field of illumination. Three of them were graduates of the telegraph key, but so far as known, no others had had any direct acquaintance with electrical work before becoming interested in the development of lighting properties. One came from the bench, another from the bar, while a third has been prominent in American finance for 30 years, and a fourth took active part in the development of the oil industry. Half a dozen are men of technical college training, but the great majority have mastered the central station art as they went along; while two of them have stood also at the head of great electrical manufacturing enterprises. One of them, a forceful, vigorous spirit, is as prominent in gas as in electricity, and absolutely without prejudice either way. This variety of talent has helped the association greatly, keeping it rounded and progressive, and a special element for good has been the fact that the body has never tied up meekly to the big corporations, but has gone after ability wherever it could be found. Waterbury, Conn., and Williamsport, Pa., have given two excellent and efficient presidents to an association which speaks for an investment of $1,000,000,000 and for 5000 companies earning in excess of $200,000,000 annually from supplying the public with electrical service or electrical energy. In fact, the one thing that reveals more clearly than anything else the broad-gage policy of the association is its unremitting work to get the smaller companies into membership for their own good.

And this brings us to a consideration of the actual work done by the association during its existence. Primarily, of course, the conventions have always been held for the sake of listening to papers and reports and discussing them. As the result, the Association's printed publications in the shape of annual proceedings and transactions now fill a long series of big volumes—nearly 5 ft. of shelf—in whose thousands of pages the history and evolution of the art are writ large. The first volumes are a rather curious study, showing how the young association was groping its way to light and life, trying to find its true function, and in the effort doing a few things that in its more mature years it looks back upon with an amused wonder, just as a grave man does on his own boyish pranks. But the latest volume of proceedings, that for the Chicago convention of 1908, gives a good measure of current achievement. There are over 900 pages of text, embodying the contributions of 40 authors of papers and reports, some of them the foremost men in the art, while the discussions carry the names of 100 other men. The present program is not less extensive in scope of work to be done at Atlantic City.

Some associations, as they get on in years, show their age and tend a little to incrustation and dry rot. The National Electric Light Association, strong and authoritative as it is, keeps young and lively as well by "playing up" its junior members. Its present president is one of the youngest men who ever filled the chair, and he is executing a policy that in some societies would be decried as sensational and unbalancing. But when examined, it is seen that the association is wisely driving its influence into new fields with all the momentum behind it of acquired weight and success. It has had several classes of membership—companies, employees of companies, supply concerns, etc., but under its newest and latest plan is affiliating on the one hand State associations and on the other central-station company branches and sections. It is thus creating a federal system of the highest importance, to which various States have already given their allegiance, and at the same time it is giving every official of a central-station company the chance to feel he is in touch with it and the opportunity to get its instructive, stimulating literature. The total membership last year was 1327, but the local company membership in such cities as Chicago, Brooklyn, Rochester and Philadelphia has already brought it up to 2000 more inside of the current year. An organization that thus reaches out in such opposite directions in order to find its fullest measure of usefulness is likely to send its roots down deep to the very well-springs of life and growth.

Grounding the Secondary.

In our issue of April 1 we printed an article by Mr. W. J. Canada giving the result of a canvass of central stations on the question of grounding the secondary. On page 1302 of this issue will be found a collection of replies received by Mr. Canada, confined, however, to those from central stations which accorded permission to make their communications public. A perusal of these opinions on the subject of grounding will increase the wonder in the minds of many who have been nonplussed at the apparent hostility of the National Electric Light Association to the practice of grounding, as expressed in the report of its committee adopted last year, the terms of which, if enforced, would prohibit central stations from grounding the secondary when the voltage exceeds 150. As will be seen from the communications printed, the central stations that have been grounding the secondaries do not report any objections to the practice, either with respect to cost of maintenance of circuits or loss of apparatus. On the other hand, there can be no doubt whatever that wherever grounding has been adopted, deaths from electric shock have been averted. Few probably realize how large is the toll of death from ungrounded secondaries. It is, in fact, so large that were general systematic publicity given to all of the cases which come to the knowledge of this journal alone, electric lighting would be severely handicapped before the public on the score of its danger to life. The underwriters have, on the grounds of humanity and against what they consider to be their financial interest, favored the grounding of the secondary. The American Institute of Electrical Engineers and the Association of Edison Illuminating Companies have registered their approval of the practice. Whenever the subject comes up for discussion at State or other electric light bodies, the opinions expressed in favor of grounding invariably predominate. The national representative of the electric lighting industry, through its committee having cognizance of the subject, thus stands alone in apparent opposition to this means of protection to life, and, moreover, does so without offering any reasonable grounds for the position assumed. The lack of sympathy of the more progessive central-station men toward this attitude is indicated by the rapidly increasing adoption of grounding. If the N. E. L. A. persists in its recent policy with respect to grounding, the result may be to reopen before the public at large the question of the danger of electricity, lead to decisive action on the subject by law-making bodies, and place the industry at large before the public in the unenviable light of ignoring through motives of parsimony the humane reasons which call for the universal grounding of the secondary.

The Operation of Large Generating Systems.

One cannot read the articles on operating features of large generating systems, printed elsewhere in this issue, without being impressed with the minuteness of organization involved. Success depends on reliability of service, which in turn hinges on intelligent management of operating forces, proper disposition of generating equipment and ample safeguard against interruption. Without rigorous system all would be chaos; and because of the personnel involved, coupled with the necessity for rapidity and accuracy of execution, simplicity must be its keynote. As an instance, witness the marshaling of every man connected with the operation of the two huge generating stations and 23 substations of the New York Edison Company by the sound of a whistle and the pressing of a button.

It is notable that each of the large cities mentioned has two main generating stations located in close proximity to each other. In favor of this concentration of equipment is the great advantage of doing away with the large amount of unproductive investment where a number of smaller stations is operated. The more energy that can be generated in one locality, the less the unproductive investment and unproductive labor involved. Moreover, investment in substations and distribution systems is more or less independent of the number of generating stations, and the transmission cost is so small a part of the total that a plant with a proper transmission voltage may be located without reference to the load, coaling facilities and ample water supply being the determining factors of the site.

Reliability of service under conditions of generation is insured by a judicious use of storage batteries, subdivision of the station or the running of two large stations in multiple, and extra care in operating the entire system. In most of the large systems duplicate underground transmission lines are used and secondary tie connections established between generating plants. The substations are supplied through independent sets of feeders following different routes, and the buses in the main station are arranged so as to secure two-bus operation. Every-day practice has so far shown that with these precautions continuous service is amply safeguarded. The load conditions differ in various cities as do also the angularity of the peaks and the amount of reserve apparatus that must be kept in readiness for emergencies. In Chicago, the day load is principally a railway load, so that a sudden thunderstorm would not call for the additional apparatus rendered necessary in New York, for instance, where 30 additional boilers are kept under steam all summer just to meet such emergencies. The rapidity with which large units can be got under way under emergency conditions is little short of marvelous, and to be able to carry a load increasing from 45,000 kw to 85,000 kw in 10 minutes speaks well for a system.

It is interesting to note the manner in which the organization of the working forces in large power houses proceeds along the same lines. As systematization is the vital feature of station operation, not only in large but in small plants, this uniformity is encouraging. In the larger plants, from the chief engineer, through assistant and watch engineers, to oilers, fireroom engineers, water tenders, firemen, coal passers, chief operators, assistant chief operators, watch operators, substation operators, etc., each individual has clearly defined duties and responsibilities. While constant supervision is necessary to keep the system up to standard and by means of drills its operators trained to the highest possible skill in their particular branch, when unforeseen conditions arise and the system as a whole is subjected to test, every man then knows his duty and does it.

Enlargement of the Field of the Consulting Engineer.

When the old-fashioned orthodox novel was in its heyday, Lorenzo and Clarinda were married in about the penultimate chapter, triumphing over the machinations of villainy and the trials of circumstances, while the conclusion was devoted to the statement that they lived happily ever after and to a neat bestowal of all the subordinate interests of the narrative. The story ended there. But writers of present-day fiction evince a tendency to discuss what happened "after," and while their studies of social problems are sometimes wearisome, or perhaps even a pretense to cover an unworthy object, on the whole they have enlarged the field of the story-teller's art and given it greater breadth and strength. Perhaps it may be permissible, if no one's dignity is offended, to point a parallel in the case of the work of the consulting engineer. The engineer makes examinations, prepares reports, designs plants; but is it not usually the case that his work is considered done when the plant is finally put into operation, tested and accepted? He has told his "story," told it well usually; but what happens after? Of course, if the installation is a very large one, belonging to a strong owner with modern ideas, it is probable that it will be operated by a chief engineer of ability and resource, very likely the peer of the designing engineer in professional attainments. This is notably the case with the large electric-service plants of various kinds in the United States. But consider the case of smaller concerns, with power plants intended either for public or private service. Do the men responsible for the operation of these smaller plants never need outside advice and assistance? Are they not often overworked, with no time or inclination, possibly no particular aptitude, to devise economies? Is there not a field here for an extension of the work of the consulting engineer—an extension which would be profitable both to the engineer and to his client?

Taken by and large, it is probably true that comparatively little attention is given to the operating end of the business by consulting engineers. The latter are keen on making installations of engines or waterwheels, dynamos or motors. But very often owners of plants that have been installed for some time can be advised to their advantage of economies in operation or improvements in administration that may be effected. Perhaps the private plant owner, for example, should install the electric drive. Perhaps he should buy his electric energy rather than make it; perhaps the reverse is true under some particular conditions. If the plant owner is a customer of the central station, perhaps he should be advised how best to make use of the energy in the form of electricity brought to his premises. And the central-station manager in charge of the medium-sized plant—may not he also consult with profit the consulting operating engineer, with the latter's wide horizon and experience? Even if the manager is himself an engineer or has a competent chief engineer to operate the plant, it sometimes happens that one may not see the forest for the trees, and that unprejudiced examination and assistance may prove highly valuable.

Articles presented in this issue give some idea of the vigilance, minute attention to economy, careful supervision of detail and the elaborate safeguards to insure reliable and continuous service which are lavished on large central-station plants. In smaller public-service plants, much less in private plants, it is hardly practicable, of course, to duplicate these expensive organizations and large operating staffs. But nevertheless these articles may indicate to many a plant owner directions in which operating conditions may be improved. And by showing what is done in highly specialized organizations, they induce the further reflection that there is undoubtedly a greater field for engineering work in improving actual operating conditions in old-established plants than has yet been cultivated. May not the consulting engineer, then, increase his usefulness by giving more attention to operating, paying as much attention, perhaps, to operation as to construction? Or must this become a separate branch of the profession?

Prices for Public Lighting.

At the present time the municipal market for light is what one might call disturbed under the effect of a bear raid. Fortunately for the long element, it is fairly well margined and not easy to shake out, although some holders have taken fright and unloaded at a sacrifice. The fact is that until some standard basis of values for different grades of the commodity concerned is reached the market will necessarily be depressed. It is much as if the cotton market, all cotton, from waste to Sea Island, were lumped as cotton, and the prices quoted just as sales came without any attempt at further specification. Hence it is but natural to expect all sorts of prices to appear until sales are in a measure systematized. As a rule, recent contracts for lighting have shown large reductions over old rates, yet the significance of such reductions is not always apparent. The whole electrical industry has been passing out of the exploiting era into one of straightforward, business-like, ordinary manufacturing, and with the resulting greater stability, fancy prices have vanished. Yet, on the other hand, the normal costs of both fuel and labor have moved upward, and such lessened costs of production as have been attained have been by reason of heavy investments in equipment, which must be taken into account. Undoubtedly in the case of very many plants the cost of energy at the bus-bars has been greatly reduced in the last decade, but this is not at all the whole story.

The busbar costs customarily quoted, and on which estimates of such a reduction are likely to be made, do not include interest on the investment and depreciation of the equipment. They do include a certain element of depreciation in the form of up-keep charges, yet the heavier depreciation, which means periodic replacements of the plant, is left out. If this is not taken care of by a sinking fund, or its equivalent, it is bound to appear sooner or later as an investment charge or as an extra burden elsewhere. If one runs back over the history of electric lighting, the number of wholesale changes in the art requiring re-equipment as a matter of preserving the value of the system is rather startling. From small arc machines to big ones, from these very often to constant-current transformers, and from these again to mercury-arc tubes; from open arc to enclosed and then back again to luminous arcs; from arcs to carbon incandescents and then to tungsten—all these have compelled heavy reinvestments in one form or another. From whatever standpoint one looks at these costs, or into whatever place in the books they may go, the fact remains that a very large amount of real money has been used up and stands as a legitimate, if unfortunate, charge against the business. The fair selling price for the product cannot be determined until these things are taken into account in one way or another. But the costs of energy that the public hears about are merely those of the dynamo and boiler rooms in nine cases out of ten very instructive as far as they go, but that is all.

These simple generating costs have gone down as the art has progressed, but at what cost? If the whole mass of figures were available, we have a very strong suspicion that in many cases the actual reduction would be very much smaller than the apparent one. If the National Electric Light Association would quietly take up this investigation and determine to what extent generating costs, including all fixed charges against the station, have diminished, some vastly instructive figures would be obtained. To go on to the next stage of the inquiry, what has happened in the same period to the distribution costs? The ordinary arc lamp may be taken as requiring somewhere about 2000 kw-hours per year at the station, which at whatever cost it is manufactured would be salable if turned to other uses for about an average of $100. The distribution charges peculiar to an arc system must be taken into the reckoning at this point. As arc lamps are customarily installed in this country, the connected load per mile of high-tension circuit is about 5 kw to 10 kw. What would be the probable condition of a central station that held such an average all over its lines? The distribution costs have been steadily going up rather than down. Copper has ranged high, good insulation is soaring and the wage rates have tended steadily upward. Poles are getting scarcer and the demand for costly underground construction is incessant. Consequently, whatever saving has been made at the station must be partly or wholly offset by the expenses outside it. These also should be made the subject of a statistical investigation before the industry really knows where it stands in making new prices. In spite of all talk of corporate rapacity and that sort of thing, it is absolutely true that most cities have been getting the energy supplied for street lighting at a nominal price compared with that which would be necessarily charged a private consumer buying a similar amount of energy dribbled about at 5 kw to 10 kw per mile of circuit.

And this takes no account of the care and maintenance of the lamps system, be it arc or incandescent, or of the pains with which continuous service must be maintained. As things have been going of late, with lighting prices, profits on municipal lighting are small compared with what must be maintained on other classes of service. And the constant demand is for a higher grade of service at a lower price. Moreover there is no standard by which comparisons may be fairly made between place and place. One city uses 5-amp alternating current enclosed arcs on a moonlight schedule, and allows the wires to be run in any sort of fashion that is cheap; the next has 6.5-amp direct-current arcs burning all night and every night, with insistence on extension of underground service. One station has cheap water-power, or slack at a nominal price, and another burns high-grade coal at $7 per ton and has to get at that. We believe the N. E. L. A. could do a great service by making a thorough investigation of the prices for public lighting charged all over the country, and bringing out not merely gross contract rates, but the conditions on which

they are actually based. If some little city is reported by its mayor to be getting 2000-cp arcs at $51.64 per year, it ought to be possible at once to assign the reason for the rate. Very likely the arcs are really 6.6-amp alternating run on moonlight schedule with cheap water-power over pole lines that would not be tolerated in any really civilized community. Or cut-throat competition may be in progress, or politics may be involved. It would be most useful if the N. E. L. A. could gather the facts and so classify them as to render a reasonably fair comparison between city and city. In addition, it would be exceedingly useful if some regular basis of comparison between the lights themselves could be established, perhaps even a candle-power rating, to bring the various things sold as arcs to a common measure. But no more illumination measurements down murky alleys, if you please!

International Agreement on Photometric Units.

As announced elsewhere in this issue, an international agreement is reported between England, France and the United States upon a unit of candle-power of luminous intensity to be known as the international candle. This is a matter of great importance in the world of electric lighting. No change is made in France, which adhers to the bougie decimale, nominally one-twentieth of the violle or molten platinum standard, but actually 0.104 carcel. In England, whatever small change may have been actually involved, is covered in specifications of the national pentane flame standard by reference to the amount of moisture in the air of the photometer room. In America, a reduction of 1.6 per cent in the standard of candle-power maintained at the Bureau of Standards will be involved, a change far too small to be detected by the ordinary member of the light-using public, and only capable of being observed by trained photometrists, although its effect on the lifetime of carbon-filament lamps will be very distinct. We may be profoundly grateful for this opportunity to see by the same candle that others see us, and to expunge from future note-books the burdensome cross-ratios between the various candle-powers of the contracting countries. We are left with the international candle and the Hefner, which is nine-tenths of the same, a blessedly simple ratio. Our thanks are due to those who have helped to bring this international agreement about, in which, we understand, several additional countries have already joined, while still others are favorably considering like action.

Transactions of International Electrotechnical Commission.

As announced in a news item two weeks ago, the *Transactions* of the council meeting of the International Electrotechnical Commission, held at London in October, 1908, has at last been published in a very presentable form. The editorial work in connection with such a publication, of international consequence, is naturally much greater than where the publication is merely a national or a local production. In the present instance, the publication appears in the two languages adopted as channels of expression by the commission, namely, English and French, these two languages running side by side, page for page, throughout the book. Consequently, the mere typographical task of securing an even distribution of the text, and of securing accuracy in the printing of both languages side by side, is worthy of considerable endeavor. The general secretary of the commission deserves commendation, in our judgment, for the care and effort at precision which the work manifests. Fifteen countries were represented at the council meeting. In the absence of an official delegate from the American Institute of Electrical Engineers, Mr. C. O. Mailloux, then in London, attended the sessions at the direct invitation of the honorary secretary. An address of welcome, given by the Rt. Hon. A. J. Balfour and reported in full, indicates a remarkably close and precise apprehension of the tasks and opportunities lying before the commission. The rules of the commission were ratified with a few good amendments. It is evident that the main outcome of the commission thus far has been cooperation and a spirit of mutual compromise. This is the more fortunate, because, at the first meeting of the commission, it seemed doubtful whether the various national interests of electrotechnical bodies could be harmonized as they should be, in order to promote a common interest. This outcome is of great promise for the future, and is worth more than actual resolutions would have been without this *entente cordiale*.

Referring to matters of detail, an inaccuracy of terms runs through the entire report. This has been participated in apparently by all parties concerned in the English-speaking representation and publication. It is that the question of an international unit of candle-power, or of luminous intensity, is reported and described as that of an international unit of light. This confusion of ideas and terms in regard to light and candle-power, which is not light but light per solid angle, is as distressing to photometrists as a similar confusion might be in ideas and terms of distance and velocity. The error has been carefully avoided by the French editor in the division of the presentation that appears in the French language. The inaccuracy is, however, merely indicative of the lack of precision which pervades the general domain of English photometric nomenclature. Some very interesting discussion appears in sub-committee proceedings relating to the subjects of international electrotechnical nomenclature and of international symbols and formulæ. The German delegates, with that national thoroughness which commands the admiration of the world, desired nothing less than the adoption of an international electrotechnical dictionary so as to have all terms authoritatively translated and defined. It was fortunately finally agreed that this was too ambitious a project and a more modest procedure was outlined.

This is a matter which presses heavily upon the English-speaking countries in the commission. England and the United States are so different in their climate, area, physical, political and social conditions, that it is very difficult to hold the terms of electrotechnology to the same definitions in both countries. The conditions defy terminology legislation in many cases. For instance, the term "busbars" ordinarily means, in the average case of British practice, massive copper conductors in a central station serving to connect the generators in parallel and supplying a low-tension or moderate-tension network for a fairly dense city or suburban distributing system. That meaning also applies in North American cities, like New York and Chicago; but in many American cases the busbars are comparatively small conductors performing the corresponding functions, say, in a 60,000-volt system. A definition, therefore, which might strictly apply to British practice might not include American practice. To bring into mutual precision the definitions of electrical engineering on both sides of the Atlantic by the

medium of correspondence alone, is an enormous undertaking if the glossary of terms is to be voluminous. The only hope for definitions that will be really helpful and binding internationally, is to commence with the smallest number that will serve and gradually to build up; otherwise there is a danger of having to unbuild and reconstruct. Other difficulties stand in the way of international symbols and notation in electrical engineering formulæ. Differences in language and in habit here make themselves felt. The only hope seems to lie in commencing with the smallest number of international symbols that will really have binding force upon the institutions and countries represented, and then to add slowly to the list as ripened opportunity may permit. Otherwise, attempted legislation of too many symbols at once may break down. We hope that this first volume of *Transactions* may be widely disseminated among all of the electrical engineering institutions of the world. It is a document of much importance, promising more.

Dazzling Headlights.

Some striking experiments on the effect of over-brilliant light on color perception were recently reported from railroad shops at St. Paul. A bill requiring the use of large electric headlights on all locomotives was pending in the Minnesota Legislature, and these experiments were directed toward establishing the effect of such lights on the train hands who had to face them. To a certain extent the conditions of the experiment were *ex parte*, inasmuch as the engineers on whom the headlight was being tested were compelled to line up squarely in front of it for some time instead of getting it as they naturally would on the road in occasional flashes. After dazzling the eyes of the engineers quite thoroughly, they were tried for their perception of colored signal lights, and it was at once apparent that exposure to the rays of the searchlight had in so far blinded them for signal lights that they could not be depended upon to recognize them. Four colors of lights were used in the test—red, green, yellow and white—and no one of the group of engineers tested was able after the exposure to the headlight to state correctly the 24 combinations of light which were shown him. This part of the test may be open to criticism because the inclusion of yellow and white made failure to determine between the two almost absolutely certain. It would have been indeed very remarkable had they been able to discriminate between the yellow and white lights after exposure even to the ordinary form of headlight used on locomotives. That they were unable to distinguish between the red and green lights is, however, a fact of serious significance, since these lights are reasonably easy to distinguish in the presence of any intrusive lights likely to be found at the present time along the railroad. It is undoubtedly true that very long exposure to the rays of an electric searchlight would be more than likely to produce serious temporary impairment of vision. A sufficiently bright light projected upon the retina is likely to produce permanent or long-enduring injury, even to almost total blindness in the area affected. Oculists note a few cases of this kind whenever a solar eclipse happens, owing to the careless exposure of the eye to full sunlight, possibly through field glasses at that. The use of very brilliant searchlights on street cars has been found to be generally objectionable, merely on account of its temporary dazzling effect, and this result must be enormously increased with the powerful searchlights in occasional use on locomotives. Legislatures would do well not to dabble with these technical matters without expert advice.

Playing the Limit with Gas.

We are interested to note that an exhibition of the widely heralded "Press-gas" is being made in Boston. Although limited to a single lamp in front of the office of the gas company, it appears to be a powerful example of the type having three of the large inverted mantles, similar to those used in Berlin and some other places on the Continent. "Press-gas" is merely ordinary illuminating gas worked at high pressure in the mains for the purpose of forcing the combustion, and driving the mantle to higher incandescence. It is in principle identical with the scheme long used in some gas machines for isolated plants, but the later developments utilize pressures far higher than have been thus used. The Boston experiment is said to be working at 2 lb. per square inch in the supply pipe; that is, at about 4 ft. water-pressure in the manometer. Press-gas started out quite moderately a few years ago at 10 or 15 in. water-pressure, and has been gradually creeping upward to 4, 5, and even 6 ft. It must not be supposed that such a pressure plays freely upon the mantle. It, in fact, is largely utilized in inspirating a large extra supply of air, and in thus maintaining a fiercer flame than would otherwise be possible. It enables, too, the burner to consume a large amount of gas in small compass. Burners of all sizes common abroad use from 25 to 35 cu. ft. of gas per hour, giving from 500 to more than 1000 cp, nominal, according to circumstances. The effect is, of course, very brilliant and striking.

From a practical standpoint the value of the system is somewhat doubtful. The considerable cost and trouble of maintaining and installing special distributing mains at high pressure is a rather serious matter from the economic standpoint, and such a system of mains seems to be necessary for the higher pressures now in vogue. There have been a number of systems introduced using local compressors worked by waste heat from the burner, in one case through the medium of a thermopile working an electric motor fan to pump up pressure. Several such schemes have been tried in London, but the tendency seems to be toward separate systems of mains. London has had some experience in "Press-gas" for several years past. It pays about the same price for a single "Press-gas" mantle as for an arc light. Indeed, at any ordinary price of gas, it is evident that the price per mantle cannot be low. Burning 30 ft. of gas per hour for the ordinary street-lighting schedule of about 4000 hours implies about 120,000 cu. ft. of gas consumed. In addition, there is the cost of mantles, of which the life is shortened by the high temperature, and the cost of the pressure supply, whether by separate mains or special devices at the posts. Altogether it is difficult to see how the system can be made economical in spite of the increased efficiency due to the pressure. Mr. Voysey, electrical engineer of the Streets Committee of the Corporation of London, made a series of tests last year on London streets lighted with "Press-gas" and flame arcs respectively, and reported that the former cost for equal illumination about four times the latter. Of course, flame arcs are more efficient, although costing more to maintain, than arcs of ordinary type, but, discounting this difference, it is still hard to see where the economy of the high-pressure gas comes in, interesting as the system is from a theoretical standpoint. Except in London and Berlin, it is comparatively little used. Berlin owns its own gas plant, and buys its electric lights, so that comparisons of cost are therefore difficult to make, although arcs and "Press-gas" are said

to be of about the same cost, comparing an open arc with a single mantle. The closely spaced double mantles used there must cost a pretty penny.

A Daring Power Transmission Project.

We have referred from time to time to the proposed power transmission from the falls of the Rhone near the Swiss frontier to Paris, a project which has been under way for several years past, and which now, although not fairly initiated, seems to have come within the range of practicability. A long report (referred to in the Digest) upon this project appears in *La Revue Electrique*, which report, being drawn up by Professor Blondel, would be worthy of more than a passing notice even if it concerned far less important matters. As our readers may recall, the promoters of this large transmission early sought the aid of M. Thury, and the early plans were worked out with especial reference to the use of the Thury constant-current system, which despite its unfamiliarity in this country, has made good already in a considerable number of important Continental plants installed during the past 20 years. According to Professor Blondel's report, however, the situation has changed for the better in that it is now possible under the French law to secure a private right of way for power transmission lines instead of having to depend entirely upon the public roads. This change, says Blondel, has altered the situation with respect to the methods to be employed by rendering possible the use of the three-phase system, which would hardly have been permitted at very high voltage along the public roads. Moreover, the possibility of a private right of way enables the distance from the power house to Paris to be cut down to about 250 miles, a distance not much greater than that for some years successfully spanned by the transmission from Colgate to San Francisco. Hence, while the original project was laid out for direct current on the Thury system and preferably with underground cables, the present one has been worked out both for direct current and for three-phase currents, and with overhead lines carried on steel towers. The amount of power to be transmitted is about 150,000 kw. The original plan was to use direct current at 120,000 volts, but at the present time Professor Blondel states that this limit can be passed without difficulty and the transmission can be accomplished at 190,000 volts to 160,000 volts, and perhaps even at 200,000 volts, thereby making it possible to take 150,000 kw into Paris at a line efficiency of about 90 per cent. The corresponding three-phase project Professor Blondel has worked out for 120,000 volts between wires and a frequency of about 25 periods.

The plan for the power station includes double horizontal turbines working under an effective head of about 67 m (220 ft.), each pair of double turbines yielding about 14,500 hp. Thirteen such hydraulic units would be required for the full utilization of the stream, and each unit would be direct-coupled to a three-phase generator, or a group of four continuous-current machines in case the Thury system is adopted. The unit machine proposed by Thury is somewhat startling in its output, which is no less than 1000 amp at 2500 volts, this large current being taken care of by means of two commutators. This is a very radical increase in size over any machines of the Thury system yet employed. Yet, considering the fact that two commutators would be available and the commutating-pole construction could be employed if desirable, 500 amp per commutator at 2500 volts, while a large output, does not seem without the bounds of reasonable practice. Certainly a 2500-kw, direct-current unit is big enough to command respect, and odd as the system seems to American eyes, it certainly must be taken seriously in view of the successful operation of previous Thury plants. An interesting modification proposed in connection with this plant is the employment of regulators to cut down the constant current to 500 amp or 600 amp during the hours of light load, thus reducing the loss on the line. At the receiving end of the line the customary motor-generators would be employed, the regulation being by shifting the brushes. In the case of using three-phase currents, each hydraulic unit would be directly coupled to a three-phase generator of 10,000-kw normal output, giving about 12,000 volts. This initial pressure would be stepped up by oil transformers to 120,000 volts for the transmission. The switching system would be planned for remote control following the practice usual in this country.

The propositions for line construction are decidedly interesting. Professor Blondel states that in case the direct current is tried, transmission by underground amored cables insulated for 200,000 volts would be seriously considered, the chief difficulty being the cost. Nevertheless, it is evident that the present scheme has been planned with aerial lines chiefly in view. The direct-current transmission would comprise two lines of six cables, these cables being carried on independent insulators placed upon cross-arms on steel towers, placed about 150 m (490 ft.) apart. Professor Blondel states that the question of insulation of direct currents at high tension is completely solved and that the experiments in Geneva by M. Thury up to 120,000 volts have demonstrated that the insulation is entirely successful and the loss at the insulators insignificant. For the three-phase line there would be four and ultimately six independent lines, 18 cables in all, operated in parallel. The insulators proposed in such a case are radically different from those with which American engineers are familiar, being large porcelain insulators with metallic umbrellas protecting the porcelain from drip. Professor Blondel regards this type of insulator as likely to be entirely successful even for the very high voltage proposed to be employed, and regards the security of the system as almost complete. It would appear, however, that he perhaps pays too little attention to the suspension insulator, which is in so successful use in the Grand Rapids-Muskegon plant, apparently laying too much stress upon the possibility of the cables swaying in the wind. In point of fact, where this suspension insulator has been employed it is found that swaying need not be seriously considered, and the system certainly is far sounder mechanically than the use of porcelain insulators carried upon pins and of such size to give anywhere nearly equivalent insulation. As regards the comparative merits of the two systems, Professor Blondel declines to commit himself regarding both as entirely practicable for the work in hand. From a commercial standpoint he considers the project a promising one and puts himself on record as believing that power can be laid down in Paris at a price permitting competition with electrical energy generated by steam. The capitalization required, however will [illegible] very careful investigation of the financial aspect of the project, before investors will undertake it. We earnestly hope that the project will be put through, since the hydraulic power is admirable, and the [illegible] markets is certainly not beyond fairly conservative limits.

N. E. L. A. Atlantic City Convention Program.

Below is given the final program of the sessions of the National Electric Light Convention, to be held next week at Atlantic City. The general meetings will be held in Marine Hall, and the meetings of the parallel sessions as follows: Technical, Marine Hall; Accounting, Greek Temple; Commercial, Theater.

GENERAL SESSIONS.

First Session, Tuesday, 10 a. m.

President's Address; Announcements; Report of Committee on Uniform Accounting; Report of Committee on Progress, by Mr. T. C. Martin, New York; Private Policy, by Mr. Paul Lupke, Trenton; Report of Committee on State and Company Branches, by Mr. R. M. Searle, Rochester; Question Box, Mr. Alex. J. Campbell, Editor, New London, Conn.

Second Session, Tuesday 8:30 p. m.

Opening Address; Latest Developments in Street and Park Lighting, by Mr. J. W. Cowles, Boston; Methods of Manufacture of Incandescent Lamps, Carbon, Metallized, Tantalum and Tungsten, showing by samples various processes, by Mr. S. E. Doane, Cleveland; Illustrated Lecture, Quality of Light, by Mr. Paul Bauder, Cleveland.

Third Session, Wednesday, 10 a.m.—Manufacturers' Day.

Advanced Information Regarding Developments in Storage Batteries, by Mr. Joseph Appleton, Electric Storage Battery Company; The Regenerative Flame Lamp, by Mr. A. J. Mitchell, the Adams-Bagnall Electric Company; The Status of the Arc Light, by Mr. N. R. Birge, General Electric Company; Recent Types of Arc Lamps and Their Operation, by Mr. C. E. Stephens, Westinghouse Electric & Manufacturing Company; Report of Committee on Meters, by Mr. G. R. Green, Philadelphia; Future Requirements of Central Station Companies, by Mr. P. Torchio, New York; Some Recent Developments in Electrical Apparatus, by Mr. E. W. Allen, General Electric Company; Distributing Transformers as of Interest to Central Stations, by Mr. E. G. Reed, Westinghouse Electric & Manufacturing Company.

Fourth Session, Wednesday, 8:30 p. m.

Address by Hon. F. A. Vanderlip; Address by Mr. G. S. Graham, on The Electrical Industry.

EXECUTIVE SESSION, WEDNESDAY.

Report of Treasurer, Mr. John F. Gilchrist, Chicago; Report of Committee on Public Policy, Mr. Samuel Insull, Chicago; Report of Lamp Committee, Mr. W. W. Freeman, Brooklyn; Report of Insurance Expert, Mr. Wm. H. Blood, Jr., Boston.

TECHNICAL SESSIONS.

Mr. W. C. L. Eglin, Chairman; Mr. W. F. Wells, Vice-Chairman.

First Session, Thursday, 10 a. m.

Report of Committee on Gas Engines, by Mr. J. B. Klumpp, Philadelphia; Some Features of Condenser and Cooling Tower Design and Operation, by Mr. M. R. Bump, New York; The Use of Reactance Coils in Generating Stations, by Mr. P. Junkersfeld, Chicago; Unique Features in Power Plant Design, by Mr. G. L. Knight, Brooklyn; All-Day Efficiency Tests on Station Transforming Apparatus, by Mr. F. M. Farmer, New York; Transformers, by Mr. W. A. Layman; Low-Pressure Steam Turbines, by Mr. C. H. Smoot, New York.

Second Session, Thursday, 2:30 p. m.

Report of Committee on Grounding Secondaries, by Mr. W. H. Blood, Jr., Boston; Report of Committee on Protection from Lightning and Other Static Disturbances, by Mr. B. E. Morrow, Albany; Report of Committee on Overhead Line Construction, by Mr. Paul Spencer, Philadelphia.; Recent Developments in Secondary Distribution Work, by Mr. W. K. Vanderpoel, Newark; Requirements and Specifications for Extra High Potential Transmission Lines, by Mr. A. S. Ives, Poughkeepsie; Performance Specifications and Ratings, by Mr. W. L. Waters, Pittsburgh; Central Stations in Towns of Less than 4000 People, by Mr. J. S. Knowlson, Schenectady.

COMMERCIAL SESSIONS.

First Session, Thursday, 10 a. m.

Methods of Introducing Tungsten Lamps and Their Effect on Central-Station Income, Mr. W. H. Atkins, Editor, Edison Electric Illuminating Company of Boston; Practical Illuminating Engineering in Connection with a Commercial Department, by Mr. G. A. Swain, Public Service Corporation of New Jersey; Intensive Methods of Business Development, by Mr. John C. Parker, Rochester Gas & Electric Company; Can a Display Room Be Conducted Upon a Profitable Basis? by Mr. Frank B. Rae, Jr., New York; Advantages to Be Derived from Uniform Commercial Department Forms and Methods, Mr. C. N. Stannard, Editor, Denver Gas & Electric Company.

Second Session, Thursday, 2:30 p. m.

Compilation of Load Factors, by Mr. E. W. Lloyd, Editor, Commonwealth Edison Company; Paper, Electric Power, Mr. H. J. Gille, Editor, Minneapolis General Electric Company; The Advantage of Group of Individual Drive in Certain Installations, by Mr. C. A. Graves, Edison Electric Illuminating Company of Brooklyn; New York High-Pressure Water System, by Mr. Arthur Williams; Relation of the Electric Vehicle to Central Stations, by Mr. J. T. Hutchings, Rochester Railway & Light Company; Adoption of Electric Heat for Industrial Purposes, Mr. Charles J. Russell, Editor, Philadelphia Electric Company.

Third Session, Friday, 10 a. m.

Electricity for National Advertising, by Mr. George Williams, Henry L. Doherty & Company; Isolated Plants, Mr. R. S. Orr, Editor, Allegheny County Light Company; Central-Station Operation of Steam Plants in Connection with Central-Station Service, by Mr. S. M. Bushnell, Commonwealth Edison Company; Novel Methods of Advertising in Small Towns, Mr. Alex. J. Campbell, Editor, New London Gas & Electric Company; Development of Revenue from Existing Customers, by Mr. T. I. Jones, United Electric Light & Power Company; Electricity for Domestic Purposes, Mr. M. E. Turner, Editor, Cleveland Electric Illuminating Company; The Effect of Various Conditions of Maintenance on the Efficiency of Illumination, by Mr. A. L. Eustice, Nernst Lamp Company.

ACCOUNTING SESSION.

Friday Morning.

Depreciation, by Mr. G. E. Claflin; Payrolls, by Mr. W. W. Freeman, Brooklyn, N. Y.; Cost Accounting, by Mr. H. R. Kern, Philadelphia, Pa.; Supplies, by Mr. E. A. Baily, Brooklyn, N. Y.; Branch Offices, by Mr. E. J. Allegaert, Brooklyn, N. Y.; Memorials, by Mr. T. Commerford Martin, New York.

PROGRAM OF ENTERTAINMENT.

Monday Evening.—Opening of the exhibition of the associate members, 8 o'clock p. m., Exhibition Hall, Million-Dollar Pier. Reception to delegates and guests by the president of the association and reception committee, 9 o'clock, in Exhibition Hall.

Tuesday Morning and Afternoon.—Informal sailing parties, boats leaving Inlet Pier every half hour, beginning 10 a. m.

Wednesday Morning.—Informal sailing parties, boats leaving Inlet Pier every half hour, beginning 10 a. m. *Afternoon.*—Baseball game, West versus East, at Inlet Baseball Park. Game commences at 3 o'clock; players on the two teams are selected from members of the association living in the East and in the West. The Western team is captained by Mr. Frank W. Frueauff, and the Eastern team is captained by Mr. Frank G. Vaughan.

Thursday Morning and Afternoon.—Informal sailing parties, boats leaving Inlet Pier every half hour, beginning 10 a. m. *Evening.*—At 8:30 o'clock, the thirty-second convention, Café Chantant, in Marine Hall, Million-Dollar Pier. A high-class vaudeville performance will be given, and refreshments served throughout the evening.

Friday Morning and Afternoon.—Informal sailing parties, boats leaving Inlet Pier every half hour, beginning 10 a. m.

Exhibits at the N. E. L. A. Convention.

From the standpoints of variety and completeness, the exhibits at the coming N. E. L. A. convention at Atlantic City promise to be the most interesting yet given in connection with that body. All the booths have been taken and the final details have been perfected so that the formal opening of the exhibition will take place on Monday evening, May 31, at 8 o'clock. The booths were completed and ready for exhibits on Wednesday and since then a representative of the exhibition committee has been stationed at the freight entrance of the Million-Dollar Pier to number and register every box and package as it enters the building. This will greatly facilitate location of packages temporarily misplaced. Direct current and 125-cycle, single-phase current are available on the pier for working exhibits, but flaming-arc and other high candle-power lamps will not be permitted to burn uninterruptedly in the exhibition hall, space being provided for this purpose on the side of the pier facing the Boardwalk. Uniform signs, booths, etc., will prevail as heretofore.

Important International Agreement on Photometric Units.

We have received from the National Physical Laboratory of Great Britain the following announcement relating to the establishment of an "international candle" photometric unit:

In order to determine as accurately as possible the relations between the photometric units of America, France, Germany and Great Britain, comparisons have been made at different times during the past few years between the unit of light maintained at the Bureau of Standards, Washington; at the Laboratoire Central d'Electricite, Paris; at the Physikalisch-Technische Reichsanstalt, Berlin, and at the National Physical Laboratory, London.

The unit of light at the Bureau of Standards has been maintained through the medium of a series of incandescent electric lamps, the values of which were originally intended to be in agreement with the British unit, being made 100/88 times the Hefner unit.

The unit of light at the Laboratoire Central is the bougie decimale, which is the twentieth part of the standard defined by the International Conference on Units of 1884, and which is taken, in accordance with the experiments of Violle, as 0.104 of the Carcel lamp.

The unit of light at the Physikalisch-Technische Reichsanstalt is that given by the Hefner lamp burning at normal barometric pressure (76 cm) in an atmosphere containing 8.8 liters of water vapor per cubic meter.

The unit of light at the National Physical Laboratory is that given by the 10-cp Harcourt pentane lamp burning at normal barometric pressure (76 cm) in an atmosphere containing 8 liters of water vapor per cubic meter.

In addition to the direct intercomparison of flame standards carried out recently by the national laboratories in Europe, one comparison was made in 1906 and two in 1908 between the American and European units by means of carefully seasoned carbon-filament electric standards, and as a result of all the comparisons the following relationships are established between the above units:

The pentane unit has the same value within the errors of experiment as the bougie decimale. It is 1.6 per cent less than the standard candle of the United States of America, and 11 per cent greater than the Hefner unit.

In order to come into agreement with Great Britain and France, the Bureau of Standards of America proposed to reduce its standard candle by 1.6 per cent provided that France and Great Britain would unite with America in maintaining the common value constant, and with the approval of other countries would call it the international candle. The National Physical Laboratory, London, and the Laboratoire Central d'Electricite, Paris, have agreed to adopt this proposal in respect to the photometric standardization which they undertake, and the date agreed upon for the adoption of the common unit and the change of unit in America was April 1, 1909. The following simple relations will therefore hold after that date:

Proposed new units = 1 pentane candle = 1 bougie decimale = 1 American candle = 1.11 Hefner unit = 0.104 Carcel unit. Therefore, 1 Hefner unit = 0.90 of the proposed new unit.

The pentane and other photometric standards in use in America will hereafter be standardized by the Bureau of Standards in terms of the new unit. This, within the limits of experimental error, will bring the photometric units for both gas and electrical industries in America and Great Britain and for the electrical industry in France to a single value, and the Hefner unit will be in the simple ratio of 9/10 to this international unit.

The proposal to call the common unit of light to be maintained jointly by the national standardizing laboratories of America, France and Great Britain the "International candle" has been submitted to the International Electrotechnical Commission, and through it to all the countries of the world which are represented on that commission.

The above agreement has received the approval of the British Gas Referees and the standards of the National Physical Laboratory are being maintained in accordance with it.

After the above matter was in type the Bureau of Standards issued a circular dated May 20, in which similar announcement is made of the agreement relative to the unit of light. In addition, the circular of the bureau gives the following account of the history of the new unit and the bearing of its adoption on the electrical and gas interests:

The above announcement marks an important step forward in the history of photometric measurements. For many years the British Parliamentary candle was the unit recognized in this country, but the lack of precision in practical photometry did not permit its value to be very accurately expressed or reproduced. In recent years the gas industry has employed the 1-cp sperm candle, the 10-cp Harcourt pentane lamp, the Hefner lamp and various secondary standards, while the electrical industry has employed incandescent electric lamps either certified by the Bureau of Standards or rated in terms of standards that are consistent with those of the bureau. The unit of the bureau has been maintained very constant, as shown by frequent comparisons with the standards of France, Germany and Great Britain, but differed appreciably from the British unit and hence from the unit employed by most of the gas companies in America.

The Bureau of Standards took the initiative several years ago in bringing about international uniformity in the unit of light by sending its representatives abroad with copies of its standards to determine more accurately the relative values of the units of the several European countries and to urge the adoption of an international unit. In this country the American Institute of Electrical Engineers, the American Gas Institute and the Illuminating Engineering Society have acted together in support of the movement, and have voted in advance to recognize the new unit of candle-power.

In England the National Physical Laboratory has secured the indorsement of the London Gas Referees and the Institution of Gas Engineers.

The union of the three national standardizing institutions of America, France and Great Britain in maintaining a common unit of candle-power, and the co-operation of the German Reichsanstalt in redetermining, from time to time, the ratio of the Hefner unit to the common international candle, assures the highest attainable constancy for the new unit of light.

Unfortunately there is no primary photometric standard that is sufficiently constant and reproducible to be generally accepted as an international standard. France, Germany and Great Britain each have their own primary flame standard, and a great deal of effort has been expended in attempting to determine accurately the relations between them. Until the flame standards themselves are better understood, however, and the atmospheric and other conditions more perfectly controlled, the

unit of light cannot be preserved as accurately by primary flame standards as by incandescent electric secondary standards. The latter, when well made, properly seasoned and carefully measured, permit comparisons to be made (using the means of many settings on several lamps) with excellent precision, the lamps themselves being constant enough and the precision of measurement high enough to fix the final values to about one-tenth or two-tenths of 1 per cent. There is good reason to believe that in this way the international unit of light can be preserved so nearly constant that any inevitable drift occurring one way or the other would be too small to detect with certainty by any of our present flame standards in many years. The Bureau of Standards will continue to standardize flame standards by the electric standards and will also carefully investigate the flame standards. Similar tests and investigations will also be made in Europe, and if any appreciable drift does occur it will sooner or later be detected.

Careful distinction should be made in this connection between a *unit* and a *standard*. An international unit maintained by the co-operative effort of several national standardizing institutions, and checked from time to time by means of all the best primary standards in use, is more likely to be maintained constant than if it were defined to be represented by any single primary standard, unless such a primary standard were reproducible to a very high degree of precision. Such a *unit* can be continued permanent even though all present primary *standards* are ultimately superseded by better ones. The Hefner lamp as a convenient flame *standard* will not be displaced in America or any other country which adopts the international candle as its unit of light. Uniformity among different countries and continuity of value are prime necessities with respect to the *unit*. But the particular standard by which the unit is realized in practice is largely a matter of convenience and circumstance. In photometry of electric lamps electric standards are most suitable. In gas photometry one form of flame standard or another will be employed according to circumstances. It is not expected that all countries of the world will at once adopt the proposed international candle as their unit of light. Those countries which already have the Hefner unit in general use may prefer to continue it. But if all countries which have a unit differing appreciably from the Hefner shall adopt the international candle as their unit, there will then be only two units in use throughout the world, and they will have the simple ratio 9:10. This would result in a distinct gain both in the practice of photometry and in definitions and nomenclature.

The effect of this change of 1.6 per cent in the unit of the bureau, which is in general use for electric lighting throughout the country, is to raise the candle-power rating and decrease slightly the watts-per-candle of electric lamps. A 16-cp lamp will give 16.26 candles in the new unit, or a 16-cp carbon-filament lamp burning at 110 volts will give 16 candles on the new basis at 109.69 volts. The change, though small, is important in the photometry and rating of lamps.

The new unit of candle-power being in agreement with the present English unit as represented by a 10-cp standard pentane lamp, there will be no change in the unit of light now employed by those gas companies which use pentane lamps, provided they are in agreement with the English standard. But as pentane lamps may differ slightly from one another, even when burned under the same conditions, it is desirable for the sake of greater uniformity to have them standardized in terms of the standard candle of the bureau. These variations, amounting to from 1 to 5 per cent, are generally in the same direction; that is, the lamps if not correct usually give less than 10 international candles under standard conditions when burning in a pure atmosphere at a normal barometric pressure of 76 cm of mercury and an atmospheric humidity of 8 liters of water vapor per cubic meter. In anticipation of this change some of the largest gas companies in the United States have already had their pentane and Hefner standard lamps standardized by the bureau in terms of the new unit.

Gas standards will hereafter be certified in terms of the international candle. Electric standards will be certified in terms of the old unit until July 1, 1909, unless otherwise requested. On July 1 the new unit will be adopted by the Bureau of Standards in the certification of electric standards, and it is hoped that manufacturers of electric lamps will adopt the new unit as soon thereafter as possible.

The bureau recommends that all gas and electric companies, all photometric laboratories and all the manufacturers of electric lamps in the United States adopt the new unit of candle-power, if possible, not later than Jan. 1, 1910. Further information with regard to change of photometric unit or to the testing of gas and electric standards will be given by the bureau on request.

We understand that several countries have joined the United States, England and France in adhesion to the new unit, and that favorable action from a number of others is expected in the near future.

Western Union Wins Long-Standing Suit Against Bell Company.

After litigation extending over a period of 26 years the Western Union Telegraph Company has won a suit for damages from the Bell Telephone organization, involving an award estimated at approximately $6,000,000 on account of shares of stock received by the defendant in connection with telephone rentals and royalties paid by the plaintiff. The suit was brought to require the defendant to account for shares of stock which it is alleged by the plaintiff were within the covenant by the defendant to account for 20 per cent of all rentals or royalties received from licenses or leases for speaking telephones, upon the ground that these stocks were received as rentals for such licenses. An appraisal of the stocks for which the suit was brought will shortly be filed, with the report of the master Everett W. Burdett, Esq., of Boston, in the United States District Court. The Western Union company sought about $10,000,000 in this action, but there have been large reductions in the claims.

The present master was appointed in 1904 on the decree of the Circuit Court of Appeals remanding the case to the United States Circuit Court to enter a decree for the plaintiff for an accounting and further proceedings. The plaintiff proved by June, 1905, that the telephone company had received up to Nov. 1, 1904, stocks to the par value of $17,735,364 for licenses to rent and use telephones, and had received as dividends $13,692,114, and that the interest on the dividends amounted to $7,340,726, making at the par value of the stocks $38,768,205, and had also received for licenses to use and rent telephones $167,790 in cash, and as interest thereon $129,008, making in all $39,065,003, for 20 per cent of which it was accountable to the plaintiff if the stocks were to be taken at their par value. The parties to the suit are the Western Union, the American Speaking Telephone Company, the Gold & Stock Telegraph Company, the Harmonic Telegraph Company, American Bell Telephone Company and the American Telephone & Telegraph Company, successor.

In discussing the decision, Mr. George V. Leverett, general counsel of the American Telephone & Telegraph Company, said that the report does not, in its present form, attempt to give the account, but simply outlines the principle by which the master expects to be guided in stating the account in figures. "The master has followed the rules laid down for him in the Circuit Court of Appeals, but in developing the account has allowed substantial deductions claimed by the telephone company. The whole principle of the accounting, as interpreted by the master, is disputed by the defendant, and when the accounting has been completed the defendant company still will claim that it is not liable under the contract.

"The present status of the case is that both parties will file suggestions, in the light of which the master will, if he shall see fit, revise his report. A formal report will later be filed in the Circuit Court and the parties will then take their exceptions to the report, which will be argued before the court itself."

When the filing of the report is completed, which may be

within a fortnight, the case will be argued before the United States Circuit Court in Boston and then may go higher to the United States Circuit Court of Appeals and finally to the United States Supreme Court.

Officers of the Western Union expressed gratification at the outcome of the suit, which has been pending since 1879. While the $6,000,000, it was said, would be fairly satisfactory, several details are yet to be passed upon and their adjudication may result in an additional amount. "We are glad the suit is settled," said Col. Robert C. Clowry, president and general manager of the Western Union, yesterday. "We sued for more than the $6,000,000, but shall be fairly content with the award."

Important Telephone Decision.

On May 20 Judge R. W. Taylor, of the United States District Court for Northern Ohio, sitting at Toledo, refused to grant the petition of the United States Telephone Company that a temporary restraining order issued against the Central Union Telephone Company and the American Telephone & Telegraph Company, denying them the right to connect with Independent exchanges, be made permanent. In asking this action of the court the United States Telephone Company took the ground that it already had 99-year contracts with most of the Independent companies in Ohio, although seven or eight of them had so far broken the contracts as to connect with the Bell system. It was further alleged that the Bell companies were endeavoring to form a monopoly and finally secure control of all the Independent business.

Judge Taylor held that the court did not have jurisdiction to decide the matter in reference to the local Independent companies which were not represented, and that no such relief as sought through this action could be granted without their presence. The effect of sustaining the bill filed by the United States Telephone Company, he said, would be to order a specific performance of the exclusive contract with this company, to the effect that the local companies may not make connection with any other long-distance company for 99 years. This is sought without asking the other party whether it consents to have a decree against it which shall fix its contract rights with the complainant and the defendants.

Regarding alleged violation of the Sherman anti-trust act, the court said that the United States Telephone Company is proceeding in that manner instead of the defendants. The contract, he says, is contrary to common law and void and it is in violation of the common law and the statutes of the State of Ohio requiring equality and impartiality of service to all persons similarly situated. It would be against the rules of equity and public policy for a local telephone company to make a contract that would give one company the long-distance business of its patrons exclusively. By making such a contract it disables itself from entering into any other arrangement to furnish its patrons long-distance service or competition in that branch of service.

Attorneys for the complainant company argued that the charter of the local companies does not require them to furnish long-distance service and that it is a common carrier within the limits of its own exchange, its own lines and among its own patrons. If it extends its service beyond local use, when not so required, it is violating no provision of the statute if it gives to a long-distance company the exclusive right to make connections with the exchange, as it only disables itself from doing that which by law it was not required to do at all. It was also argued that through the power to consolidate with other companies or lease its properties to another company, a local company has more complete authority to annihilate itself than is shown in the exclusive contract with the long-distance company. The court held, however, that the consolidation or the leasing company, as the case might be, would be compelled to perform the same service as the original company and in every way would take its place. It would have no more authority or power to disable itself by giving an exclusive right to long-distance business to any one company that its predecessor had.

Referring to the case cited of the Chicago, St. Louis & New Orleans Railroad Company vs. Pullman Company, in which it was held that a 15-year exclusive contract was valid, the court said that the telephone is different in that it is not claimed that either of the companies is able to furnish connections with all the places with which subscribers may wish to talk. A sleeping-car company may furnish adequate and comfortable service over a certain line of railroad, but the telephone company cannot furnish it all over the country. Several other reasons were given to show that the kind of service in the two cases is different. The argument that telephone companies have no more right to force connections upon each other than railroads is treated quite at length, but there again the court holds is a difference.

The court said that when a company came into a community offering to give the people long-distance service and connection with the rest of the world, public policy will say that it shall be treated no differently from the individual who requests telephone connection with the exchange on terms to which he is entitled.

Independent local companies do not make long-distance companies any the less public by extending their connections to the latter, nor do they become any less local and independent by permitting connection with long-distance companies. If they have granted connection to one long-distance company, it would certainly seem that under either the statutes or common law the same right should be given other companies that desire them. Courts have had great difficulty in escaping the claim that local companies must be compelled to permit their exchanges to be connected and where they have once been connected, the decisions are to the effect that they cannot be disconnected.

The court discussed the subject of discrimination as practiced among telephone companies and quoted the following syllabus from another case of a similar nature: "Where an operator of a telephone system furnished connected immediate service to separate exchanges and their patrons, but denied such service to another exchange and its patrons of the same class, the operator discriminated against the latter in violation of the common law and of the statute of Indiana, requiring telephone companies to supply applicants impartially."

The court said: "I find myself profoundly impressed with the soundness of the conclusion just quoted and, indeed, I can conceive of no plausible argument against it. The telephone company is a public servant and is a common carrier of news, as the Indiana Supreme Court puts it. It cannot enter into a contract which tends to create a monopoly; and it cannot deny to one person the rights and privileges which it grants to other persons similarly situated. The contract in question does tend to create a monopoly, in that it refuses to the subscribers to the local company any opportunity through the local exchange for competitive service; and the local company ceases to be a common carrier, devoted to a public use, offering the same terms, opportunities and privileges to all persons similarly situated, in that it undertakes to give to the complainant what it denies to the defendant.

"The position which counsel for the complainant take comes to this when we analyze it: The Bell Telephone Company is a wicked monopoly. Some years ago the United States Company concluded to fight it. The only way to fight the devil was with fire. The only way to fight the monopoly was to monopolize all unoccupied territory. The way to monopolize this unoccupied territory was to go to a local telephone which had no long-distance connection and offer to connect with long-distance connection, provided a perpetual monopoly of it was given in return.

"This purpose to destroy the Bell monopoly may be admitted to be virtuous. The method resorted to was obnoxious. It was a mere repetition and imitation of the methods which, when followed by the Bell company, are so bitterly denounced. The philosophy that the end justifies the means, when the end is

virtuous and the means vicious, has long since been discarded, if it ever had any avowed supporters. But even that philosophy cannot apply to a mere business undertaking. The purpose to destroy the telephone monopoly was not a virtuous purpose; it was a business proposition which incidentally led, we may assume, to a righteous result. What becomes of the righteous result when the means to accomplish it are the means of unrighteousness?—the ultimate result of which may be that we discover we have exchanged one master for another, or if not, that we have emphasized the strength of the former master. Counsel, of course, will not deny that if the Bell company should acquire control of the complainant, these contracts would be just as valid and the shield of our defense would be turned into a weapon with which to destroy us."

On Saturday the directors of the United States Telephone Company and representatives of the Ohio Independent Telephone Company met at the general offices in Cleveland and decided to bring suits against all local companies that violate their contracts in the State courts, since the decision of the Federal Court is that it has no jurisdiction in the matter of contracts with the local companies because they were not made parties to the suit. In two out of three cases already brought in the State courts the decisions have been in favor of the Independents and the contract has been held valid. All suits will hereafter be brought in the counties where contracts are violated. However, the leaders of the Independent movement believe that few of the local companies will violate their contracts with the United States Telephone Company, because of their loyalty to the cause they have been championing.

Another interesting feature is that under the decision of Judge Taylor, any long-distance company has a right to demand connection with the exchange of a company which has granted that privilege to any other company and upon equal terms. This opens up all Bell territory to the Independents, as well as Independent territory to the Bell interests. An exchange with long-distance service cannot refuse a second or third connection. Whether the companies will make use of this privilege remains to be seen. It will either act as a bar to both companies or a means of fierce competition.

Electric Railway School of Practice.

The Metropolitan Street Railway Company, of New York City, has announced the organization of a school for the practical training of technical employees. The expenses of the school will be defrayed by the company, and it will be open to college and scientific school graduates. The pupils will be paid living wages while taking the two-year course.

The difficulty of obtaining high-class men who are willing to begin at the bottom and learn the street-railway business was what led Mr. Oren Root, Jr., general manager of the Metropolitan, to work out the school plan and resolve to try the experiment, which was approved by the receivers of the company. A prospectus of the school and application blanks have been sent to the presidents of 19 colleges and scientific schools, with the request that the plan be brought to the attention of those students to whom it might appeal.

The schools and colleges from which Mr. Root expects to recruit the majority of his pupils are as follows: Amherst College, Brown University, Cornell University, Cambridge Manual Training School, Dartmouth College, Hamilton College, Massachusetts Institute of Technology, Purdue University, Brooklyn Polytechnic Institute, Pratt Institute, Rensselaer Polytechnic Institute, Stevens Institute of Technology, Syracuse University, Tufts College, Union College, Wesleyan University, Sheffield Scientific School, Worcester Polytechnic Institute and Williams College.

Mr. Root said it was his intention to establish a practical training school for young men, particularly graduates of high schools, manual training schools, colleges or universities, who have had more or less technical training and who intend to enter upon the vocation of operating street railroads. It is the aim to make the conditions advantageous to the young man who has an inclination to enter upon work of this character.

Such a man, under the proposed plan, will have an opportunity to acquaint himself with the details of the work, while receiving at the same time a salary which will, with strict economy, enable him to be self-supporting. He may thus determine for himself whether he is fitted and has a liking for employment of this character. On the other hand, the Metropolitan Street Railway Company will profit by the experiment in that it will be possible to test the capacity, ability and adaptability of applicants, who will constitute a body of candidates from whom men may be chosen when it becomes necessary to fill vacancies in the regular operating staff.

The course will be two years. During the first year the student will be paid $15 a week. The second-year man will receive $20 a week. To give him a general idea of the street-railway business he will be assigned to duty in the maintenance of way, the electrical, the equipment and the transportation departments, spending three months in each department.

In the maintenance of way department the student will do field work in connection with renewal of rails, installing tracks, surveying, etc., and will study designing and construction of buildings, efficient and economical handling of men, laying of pavements, fireproof car-house construction, time keeping, etc. In the electrical department he will familiarize himself with the conduit and feeder system, the location and character of the cables by which power is transmitted from the power station to the cars on the streets, electrical and steam engineering, etc.

While in the equipment department the student will be assigned to work in the car barns and repair shops. He will study maintenance of car equipment under operating conditions, rewinding of armatures, repairing of commutators, blacksmithing, lathe turning and metal work in general.

In the transportation department he will learn to operate a car and will become thoroughly familiar with all its mechanism. He will act as conductor and motorman for a short period. Then he will have a thorough course in the details of regulating the service under normal emergency conditions. He will also learn routine work in the division offices, such as time keeping, checking up the cash received from conductors, making up of accident and other reports, etc.

Mr. Root calls attention to the fact that the work is hard, as the street cars of New York City are operated 24 hours a day throughout the entire year, including Sundays and holidays, and adds that only men physically strong and capable of hard work and long hours ought to apply for admission to the training school. Any man who feels that he can fill the requirements and who desires to enter upon such an apprenticeship may file his application with Mr. F. T. Wood, assistant to the general manager for receivers, Metropolitan Street Railway Company, 621 Broadway. The application should be filed in person before June 15, or between July 1 and July 15 of the current year. Application blanks will be forwarded upon request.

Annual Meeting of National Electrical Trades Association.

The annual meeting of the National Electrical Trades Association will be begun at the Exchange Club, Boston, at 10 a. m. on June 21. This association comprises local associations in five different cities of the United States and has a total membership of 450 electrical manufacturers and jobbers. The official delegates to the annual meeting will consist of one representative from each of these cities, together with Mr. Frederic P. Vose, of Chicago, the general secretary. These delegates are: Philadelphia, Mr. Charles M. Wilkins, of Partrick, Carter & Wilkins; Boston, Mr. Norman Marshall, of the Marshall Electric Company; New York, Mr. John F. Dale, of the Dale Company; Chicago, Mr. James Wolff, of the New York Insulated Wire Company; San Francisco, Mr. C. C. Hillis, Electric Appliance Company. Mr. Wilkins is president of the national association and Mr. Marshall is vice-president. In addition to the official delegates it is believed that there will be a record-breaking attendance of members of the association.

Tesla Propulsion Company.

The Tesla Propulsion Company, with $1,000,000 capital stock, has been incorporated at Albany, N. Y. The directors include Mr. Nikola Tesla, Mr. Jos. Hoadley and Mr. Walter H. Knight. Mr. Tesla said the company will manufacture apparatus constructed on a mechanical principle of his discovery, entirely new, and of the greatest economical value, the details of which he will make known in about six weeks. The principle, he says, minimizes the size of a power producing plant and increases to a maximum the power produced. A plant now being built for the Alabama Consolidated Coal & Iron Company will not be one-third of the size of the ordinary equipment for its work, while the air blast which it will include and other details will have a far superior value. In connection with this plant Mr. Tesla said he would install a turbine of his own invention, and that the air blast will be supplied under the turbine principle. The new mechanical principle involved is applicable to air, steam, gas and water-power, and may be used for locomotives, automobiles or any power application. With it a locomotive as powerful as any now used need not be half the present size.

Hydro-Electric System of Southern Power Company.

The Southern Power Company, Charlotte, N. C., has now in service three of its chain of hydro-electric stations, aggregating 60,000 kw—the Catawba, Great Falls and Rocky Creek plants. An 18,000-kw station at Ninety-Nine Island is well under way, and preliminary specifications have been issued for the machinery of a 147,000-kw station at Wateree. The equipment of the latter will consist of 14,000-hp, horizontal twin turbine units, and 8500-kw, 11,000-volt, 180 r.p.m. generator units having a power factor of 85 per cent. In addition there will be four units made up of 3000-kw generators coupled to 4000-hp vertical twin turbines.

The Catawba plant of the Southern Power Company was completed in 1904, and the second or Great Falls plant in 1905. There remain several undeveloped powers aggregating 50,000 kw, so that the system will eventually comprise 250,000 kw.

Of the lines now in service, over 400 miles are operated at 100,000 volt, steel towers being used over about 200 miles. Fifty-eight miles of line is operated at 11,000 volts. One-hundred-thousand-volt twin steel tower lines aggregating 260 miles are being built, of which 116 miles are nearly completed and all will be ready for operation by Sept. 1. One-hundred-thousand-volt transformers, having a capacity of 120,000 kw, have been purchased for this latter distribution.

At present 46 substations supply power from 11,000-volt and 100,000-volt lines to over 100 cotton mills, the mill load being 80 per cent of the total. Twelve 100,000-volt stations are being built, two of which are about completed. Mr. W. S. Lee is chief engineer, and Mr. J. W. Frazer assistant chief engineer.

Chicago Electric Club and the University of Illinois.

At the meeting of the Electric Club, of Chicago, on May 19, Mr. F. P. Vose occupied the chair in the absence of President Cowlett. The speaker after luncheon was Dr. David Kinley, Professor of economics and dean of the graduate school at the University of Illinois, who made a bright speech relating to the work and needs of that university. He enlivened his remarks with several stories, and one of them that evoked applause related to a conversation overheard between two men who were leaving a lecture. One asked the other how he liked the address, and the answer was that it was illuminating in an old-fashioned way. The first speaker inquired what that meant, and the other replied that the speech had more gas in it than electricity. Dr. Kinley hoped that a similar criticism could not be applied to his address.

The University of Illinois, the speaker said, is a modern university with modern ideas. He described the work of the various colleges and made more extended reference to the activities of the Engineering Experiment Station, which has proved of great value and has received a great many requests from manufacturers to solve particular industrial problems. Dr. Kinley also referred to the School of Commerce, which is in his immediate charge. Here the principles of business administration are taught, and many of the graduates of the school are doing well in practical business life. Turning to the needs of the university, the speaker said that more than 30 members of the faculty have been called to other positions within the last two years. To retain men of a high grade it is necessary to pay salaries commensurate with those which obtain in business and professional pursuits outside the university. That explains why the university is asking the Legislature for an appropriation of $25,000 to increase salaries.

At the conclusion of Dr. Kinley's talk Mr. W. S. Taussig spoke briefly, and he was followed by Mr. W. L. Abbott, who offered a resolution to the effect that the club "indorse the request of the University of Illinois for a reasonable increase in appropriations for general operating expenses, for the Engineering Experiment Station and for increasing salaries of important positions." This resolution was promptly seconded and was adopted without a dissenting voice.

New York Public Service Commission News.

In the investigation by the Public Service Commission of the First District of New York into the affairs of electric light and power companies, held last week, Messrs. C. F. Matthewson and C. D. M. Thomas, of the New York & Queens Electric Light & Power Company, give the details of the various grants and franchises under which their company operated in that section of Greater New York which was formerly embraced in the villages of Jamaica, Richmond Hill, Flushing, College Point and Whitestone. The company derived its rights from grants that had been given to a number of local companies, all of which have been subsequently bought up and consolidated. These privileges for the most part were awarded by boards of supervisors and highway commissioners. In almost all of these grants the contract for public lighting embraced the feature that one free light should be furnished for every 10 lights that were paid for. Mr. Matthewson testified that in most instances this provision was still in force and the city was deriving the benefits therefrom. It was shown that the first franchise that was granted in the village of Flushing, in 1899, was issued to the Flushing Electric Light & Power Company and was considered at that time to be merely experimental. The purpose of the franchise was "to afford the residents of the village an opportunity of testing the value of the system of electric light and power."

The Public Service Commission has granted the application of the receivers of the Metropolitan Street Railway Company for a rehearing on the order recently adopted requiring the company to install wheel guards on its cars. The company stated that it is now experimenting in various types of wheel guards and that it would give the result of these experiments at the rehearing.

It was announced at a public hearing before the Public Service Commission last week that the subway loop which is to connect the Manhattan terminals of the three East River bridges is practically completed and ready for the tracks except that portion at the end of the Brooklyn Bridge which will be under the foundations of the new municipal building. As the plans for this building are not yet perfected, the new subway is likely to remain idle for some time.

Governor Hughes, of New York, heard arguments on May 22 upon the Travis-Robinson rapid transit bill which repeals the Elsberg law and permits the construction of rapid transit lines with private capital. As the bill was drawn with Governor Hughes' approval it is not likely that it will be vetoed

The Wireless Institute.

No. 2 of Vol. 1 of the *Proceedings* of the Wireless Institute contains a paper presented at the May meeting of the body by Mr. Greenleaf W. Pickard entitled "Antennæ." The subject is treated both historically and technically. To Professor Dolbear is assigned priority in the use of the wireless antenna in connection with hertzian radiations. In the discussion data as to range of wireless working are given.

The officers of the Wireless Institute are as follows: President, Mr. Robert H. Marriott, Brooklyn; vice-presidents, Messrs. Harry Shoemaker, Jersey City, and Greenleaf W. Pickard, Amesbury, Mass.; directors, Messrs. John S. Murphy and Richard A. Somerville, New York; treasurer, Mr. Eugene M. Thurston, New York; secretary, Mr. Sidney L. Williams, 42 Broadway, New York.

Convention of Society for Promotion of Engineering Education.

The seventeenth annual convention of the Society for the Promotion of Engineering Education will be held at Columbia University and Pratt Institute, in New York and Brooklyn, on June 24, 25 and 26. These dates immediately precede those of the meetings of the American Institute of Electrical Engineers, the Society for Testing Materials and the American Society of Civil Engineers, and New York City is very near the geographical center of the meeting places of three other societies. It will, therefore, be a convenient place of meeting for all who wish to attend the convention of one of the other societies.

The program of the meeting, besides a number of papers, will include a report of the Joint Committee of Engineering Societies on Engineering Education, by Prof. Dugald C. Jackson; a report of the Committee on Technical Books for Libraries, by Prof. Arthur H. Ford; a report of the Committee on Engineering Degrees, by Prof. William F. M. Goss; a report of the Committee on Entrance Requirements, by Prof. Robert Fletcher. In addition a special session will be devoted to the discussion of engineering mathematics by a Committee of Fifteen appointed at the Chicago meeting of the American Association for the Advancement of Science, which was requested to prepare a special report for the Society for the Promotion of Engineering Education for its meeting in 1909.

Massachusetts Legislative Notes.

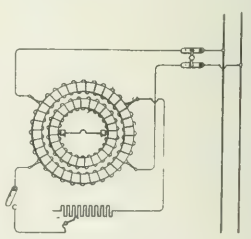
The Committee on Public Lighting has issued a favorable report on the petition of the Association of Massachusetts Gas Companies for legislation to permit gas companies and gas and electric light companies to adopt a sliding scale and to adjust capital to the value of property employed in business. A bill has been introduced into the Senate as a result of this action providing the terms under which the sliding scale may be adopted. Any gas company desiring to adopt the sliding scale is required upon the vote of its directors to petition the board of Gas and Electric Light Commissioners for a valuation of its plant and property, the company paying for all the expenses of the appraisal. The board is to determine the actual value of the real and personal property of the company, but without increase on account of the value of location, earning capacity, franchise, or good will; from the value so determined is to be deducted any indebtedness of the company and the remainder regarded as the net value of the plant and property for the purposes of the adoption of the sliding scale. The proposed law contains provisions for the approval of the plan by the commission, and for the issuance of new stock under certain restrictions. The standard rate of dividends for any company accepting the provisions of the act is 6 per cent per annum, and the standard price of gas $1 per 1000 cu. ft. Any company charging more than $1, and which desires to adopt the provisions of the act, may start with such a price with a reduction of 1 per cent in dividends for each 5 cents of price in excess of $1. If in any year the maximum net price charged by the company has been less than the standard price fixed by the company, it may declare dividends exceeding the standard rate in the ratio of one-fifth of 1 per cent for every 1 cent of reduction of the maximum net price below the standard, and a similar provision applies to the reduction of dividends when the net price has exceeded the standard price. The acceptance of the act holds for 15 years, but the commission has authority to change the price on appeal of the municipal authorities. An company accepting the act is allowed, after making such an allowance for depreciation as the commission may deem reasonable, to accumulate an emergency fund not in excess of 10 per cent of its capital stock in the aggregate. This fund is to be invested and used in a manner to be decided by the commission and the annual returns to the board are to show the amount charged off to depreciation and the emergency fund.

The same committee has reported a bill to enable gas and electric light companies to issue additional capital stock at a price not less than par as fixed by the stockholders and subject to the approval of the Gas and Electric Light Commission, in a manner similar to the authorization of electric railway stock issues under the supervision of the Railroad Commission. The action, if passed, will both enlarge the powers of the Gas and Electric Light Commission and enable central station and gas companies to issue new shares of stock with a little less rigidity as to price.

Braking Action of Repulsion Motor.

A peculiar interaction between electric and magnetic circuits is described in a U. S. patent recently issued to Mr. Maurice Milch. The performance is that of a repulsion motor when disconnected from the supply system and short-circuited upon itself without any interconnection between the rotating and stationary parts.

The machine is provided with two sets of primary terminals, one for clockwise rotation and the other for counter-clockwise rotation. If, when the machine is operating as a repulsion motor, revolving in, say, a clock-wise direction, the active primary leads are disconnected from the supply system and the other leads are short-circuited upon themselves, the residual magnetism in the core will produce in the rotor winding a current which will react upon the short-circuited stator winding and upon the magnetism of the motor in such a manner that the magnetism and the currents in both short-circuited members



MILCH BRAKING SCHEME.

will be increased. The effect is cumulative and large currents will be almost instantaneously produced, resulting in a strong braking action. In practice this cumulative effect is too sudden and produces too severe a shock upon the motor and the gear if both the primary and the secondary windings are directly short-circuited. In order to reduce the shock a variable impedance is inserted in one of the circuits, as shown in the accompanying illustration. By short-circuiting the primary member through the whole of this impedance at first and then gradually reducing the amount of impedance included in the short-circuit as the motors slow down the braking effect may be readily controlled.

A Reminiscence of the Morse Telegraph.

In his autobiography, "Lights and Shadows of a Long Episcopate," the late Rt. Rev. Henry B. Whipple, Bishop of Minnesota, quotes an interesting visit made by him to the room in the Capitol at Washington where in 1844 Mr. S. F. B. Morse was experimenting with the telegraph. Speaking of the practicability of making a rapid journey between Albany and Utica in another connection, Bishop Whipple says: "This seemed no less a flight of the imagination than did that of a statement made to me upon my first visit to Washington, in 1844. After visiting the places of interest in the city I went to the Capitol to say good-by to a friend who was a member of Congress. As I was leaving the room he said: "By the way, the sergeant-at-arms has given a room in the basement to a man who claims that he can send a message by wire in less than a minute. I do not believe in it. It is probably one of the many schemes to get an appropriation from Congress. But it may amuse you to see it.'"

Bishop Whipple continues: "I went to the basement and found a tall, thoughtful-faced man who received me courteously, and in answer to my queries said, with a smile: 'There is no possible deception. I can convince you in one minute of the value of this invention. You see that battery? It is connected with a wire the other end of which is near the Relay House. I will send the message, "Mr. Whipple of New York is here." In a moment the answer came back. It was before the day of reading by sound, and the alphabet consisted of a series of dashes on a coil of paper. Mr. Morse—for it was he—tore off a slip of paper, and making the alphabet on another slip, said: 'You must read this. What is the first letter?' 'T,' I answered; and on, on, until I was able to read the message: "Tell Mr. Whipple that he is looking upon an invention which will revolutionize the commerce of the world.'"

The point of the story is somewhat blunted by the fact that the electric telegraph had been in commercial use in Europe as early as 1837.

Physiological Effects of Illumination.

At the Boston meeting of the Illuminating Engineering Society, held May 12, Prof. Sidney W. Ashe presented a paper entitled "Physiological Effects of Illumination," which gave some of the results of research by the author at Columbia University. The paper relates more particularly to the reaction of the pupil of the eye to color. Among the subjects treated are the functions of the pupil, its reaction to light stimulus, visual -acuity, pupillary reaction, physical errors, physiological errors, use of mydriatics and myotics. Following are the conclusions of the paper:

1. In measuring the diameter of the pupil great care must be taken to choose the same average value each time, as the pupil keeps changing continually.

2. The use of mydriatics, myotics and all forms of diaphragms should not be used in studying visual acuity or the contraction of the pupil, as they change the normal action of accommodation of the eye.

3. The readings of light intensity or luminosity should be taken with a flicker photometer where a difference of color exists and each observer should use his own values of luminosity, owing to a difference of appreciation in each individual.

4. Lights should be carefully standardized and where fine spectral colors are used, a glass with a carbon bisulphide prism mounted in connection with a pair of condensing lenses will give pure spectral colors, whose wave lengths and luminosity may be readily determined with the spectro flicker photometer method.

5. Under these conditions the writer has found that for equal luminosities there is a difference in the size of the pupil for different colors arranging themselves in the order red, white, green, etc.

6. As the quantity of light which would enter the eye varies as the square of the diameter of the pupil, a small change in diameter makes a large change in intensity.

In the discussion, Mr. Preston S. Millar criticized the accuracy of the flicker photometer, while in the determination of the relative intensity of different colored lights different observers will with it agree better; this proves only that it is a simple instrument for use in that kind of work. It remains to be demonstrated if the flicker photometer yields satisfactory results on differently colored lights. Dr. Williams described the use of the simple photometric wedge in measuring the difference in intensity of electric lights. The wedge film is moved across the field of vision until first one light is cut out and then the other. An apparatus was discussed for the practical application of this method.

Southwestern Electrical & Gas Association Convention.

The Southwestern Electrical & Gas Association held its fifth annual convention at Dallas, Tex., May 21-22. The registration exceeded that of any previous meeting, more than 340 members and guests being in attendance. The first session opened with an address of welcome by a city official, and a response by Mr. Sam A. Hobson. After other introductory business, President R. R. Stichter, general manager of the Texas Traction Company, of Dallas, delivered his address, which dealt largely with matters of association policy, and included several recommendations which were referred to a committee. In its report later at the meeting, the committee expressed the opinion in reference to a suggestion for the appointment of committees on uniform city laws and on publicity that these subjects could best be handled by the appointment of an officer who would make a specialty of the work connected therewith. As to the appointment of two standardization committees, one on material and another on accounts, the committee was of the opinion that the only way to deal with work of this kind was to subdivide it among the different State and Territorial associations, who in turn would report their decisions to the National Association for action.

The program of the Dallas meeting included papers dealing with electric lighting, electric railway and gas subjects. In addition to the papers, of which abstracts are given below, one was presented by Mr. Thomas Cook entitled "Economies That Can Be Made in the Operation of a Small Central Station," of which an abstract will appear later.

Mr. W. B. Head presented a paper on "Producer-Gas Plants for Small Central Stations," which was strongly in favor of the use of such plants, particularly in Texas, where, with lignite coal, they have shown, it is stated, an enormous saving over steam plants. Several manufacturers of producer-gas plants are guaranteeing a fuel consumption of 2 lb. to 3 lb. of lignite per brake horse-power with 50 per cent load factor. The writer says that after a year's experience with a 100-hp unit he feels safe in saying that a first-class gas-producer plant is as reliable in every respect as a steam plant. A somewhat better class of labor is needed, however, to operate the former, but skill on the part of the attendant is not as necessary as carefulness. The cost of installation is about 40 per cent more than that of a steam-engine plant. In concluding he said that the successful use of lignite in the producer plant means much to Texas from an industrial standpoint.

Mr. Fred M. Lege, Jr., of Galveston, Tex., presented a paper entitled "Low-Pressure Turbines." In general, he said, it is safe to say that in large plants, comprising two or more reciprocating engines, the low-pressure steam turbine has a proper place, whereas in smaller plants having only one engine, and this in poor condition, it is generally better policy to install a complete high-pressure condensing turbine of the full power required, and hold the old engine as a reserve. While a high-pressure turbine will more economically utilize energy in steam than a reciprocating engine, when an increase is necessary to an existing reciprocating plant where good engines are in use, a low pressure turbine can oftentimes be installed to better ad

vantage than any other piece of apparatus, entailing no increase in the boiler plant or building proportionate to the increased capacity, and in many cases without any increase in space. This affords a means of increasing the capacity of an existing central-station equipment with respect to steam engines with but little increase of fuel used or additional boiler capacity. A combination of a low-pressure steam turbine and an existing reciprocating plant, the high-pressure engines exhausting into a suitable receiver and then into a low-pressure turbine, which in turn exhausts into a good condenser, affords as efficient a means of utilizing available energy of steam as can be desired. A low-pressure turbine requires something like 34 lb. of steam per kw-hour with a vacuum of 28 in. In the case of an existing plant operating compound and simple engines of 120-lb. pressure and exhausting into the atmosphere, by installing a low-pressure turbine an increase of approximately 100 per cent capacity is available, without any increased cost of fuel other than necessary for the auxiliaries, which would not exceed 15 per cent. In the case of compound-condensing units, and with a vacuum of 26 in., the addition of a low-pressure turbine will increase the capacity approximately 70 per cent and the combination will reduce the steam consumption per kw-hour from 22 lb. to 15.5 lb. of steam. The efficiency of a well-designed low-pressure turbine is remarkably uniform over a large range of load.

Prof. Arthur C. Scott, of the University of Texas, presented a paper entitled "Lamps for Residence Illumination," which dealt with the characteristics and comparative economy of operation of such lamps. The Nernst lamp and various types of incandescent lamps were described and illumination curves given for them; the Welsbach gas mantle was also considered. The paper included results of a life and photometric test of lamps made during the past year at the University of Texas by Mr. C. W. Conrad and Mr. W. W. McCullough. The lamps tested were carbon-filament, Gem, graphitized-filament, tantalum, tungsten, Nernst single-glower and reflex Welsbach gas lamps. The comparative costs per 1000 candle-hours were as follows:

Thirty-cp reflex Welsbach, horizontal-cp basis, 24.76 cents; 80-cp reflex Welsbach, on basis of mean candle-power between vertical and horizontal values in lower hemisphere, 21.08 cents; 60-watt tungsten lamps, 14.89 cents; 40-watt tantalum lamps, 26.42 cents; 50-watt Gem lamp, 32.87 cents; 110-volt, 16-cp carbon-filament lamps, 42.55 cents; Nernst 0.6-amp lamp, horizontal-cp basis, 26.44 cents; Nernst 0.6-amp lamp on basis of mean candle-power between vertical and horizontal values in lower hemisphere, 12.40 cents.

The Question Box was printed in advance and formed an interesting contribution to the proceedings of the convention. Below are given some of the answers which appeared to be of more general interest:

A station reported that the consumption of Texas fuel oil was 5 lb. per kw-hour at the switchboard. Two replies stated that there was no relation between the specific gravity and calorific values of ordinary fuel oils. A test was reported in which 14.84 lb. of water were evaporated by a pound of fuel oil having a calorific value of 17,241 lb.-Fahr. units, or 16.33 lb. with oil freed from all water. An inquiry as to what the price of lignite should be for it to prove more economical than good slack coal received the reply that lignite must be purchased at $1 or less per ton in the bin to prove as economical as good coal at $3 per ton. In reply to a query as to the overload capacity of steam turbines, it was stated that one type of these would carry enormous overloads far in excess of its guarantees, and that it was more efficient and reliable than a reciprocating engine. Of six answers in reply to a query as to whether it is advisable to use single-phase motors of 5 hp or less on polyphase circuits, four advised the use of single-phase motors of less than 5 hp, and one the use of single-phase up to 25 hp. A number of answers in reply to another query stated that single-phase motors are entirely satisfactory for operation on 60-cycle circuits. As to the location of lightning arresters, four replies were that they should be located outside the station, and the same number that they should be in the station, but not on the switchboard. One recommendation was that they should be mounted on a rack above the switchboard. Concerning the use of alternating-current motors for elevator service, three replies made to a query on the subject stated that they are not as well suited for general elevator work as direct-current motors. A difference of opinion developed as to the advisability of the use of the three-phase system for a service of 100 kw or less. One reply was this is practically impossible unless phase regulators were provided, and another that while it was possible it would be injudicious. Several replies were in the affirmative. In reply to a query as to the reduction in capacity when an alternator is changed from 133 cycles to 60 cycles, one reply was 40 per cent and another 45 per cent. Two rather remarkable opinions are among the number in reply to a query as to the tungsten lamp; one of these was that it is too frail for general use, and another that the tungsten lamp is not proving a success in the North! Two replies as to the average life of tungsten lamps were that they are giving fully their rated life of 800 hours. Of four replies as to the advisability of grounding the neutral of a three-wire secondary, three were emphatically in favor of grounding, while the fourth was opposed. Several replies to an inquiry as to the extent the central station should enter into competition with supply men were adverse to such competition. Four opinions in reply to a query as to the slotting of the mica of commutators were in favor of the practice.

The Southwestern Electrical & Gas Association was organized in 1899 as the Southwestern Gas, Electrical & Street Railway Association, and assumed its present name in 1901 upon the absorption of the Electrical Association of the Southwest. The territory covered includes the neighboring States and Mexico, but recently all officers have been residents in Texas, and only eight of the active member companies are in other States.

The following officers were elected to serve for the ensuing year: President, W. B. Head, Stephenville; first vice-president, W. B. Tuttle, San Antonio; second vice-president, J. E. Carroll, Beaumont; third vice-president, C. H. Dunbar, Houston; secretary, E. T. Moore, Dallas; treasurer, A. E. Judge, Tyler.

Tesla to Signal to Mars.

In a two-column letter to the New York *Times*, Nikola Tesla discusses the subject of signaling to Mars. He believes that certain electrical disturbances which he observed in the summer of 1889 must have emanated from Mars, but that all doubt in this regard will soon be dispelled. He criticised unfavorably the various methods that have recently been proposed to convey signals to Mars, and offers one of his own which he states is simple in principle, although perhaps not easy of execution. This consists, first, of a circuit properly designed and arranged with one of its ends connected to an insulated terminal at some height, and the other to earth. Inductibly linked with this is another circuit in which electrical oscillations of great intensity are set up, the above combination being known as the Tesla wireless transmitter. By a careful attunement of circuits, and by means of certain methods which he has not yet described oscillations of transcending intensity can be obtained. Mr. Tesla states that he has passed a powerful current around the globe, and obtained an activity of many millions of horse power; assuming that only a rate of 15 million horse power is readily obtainable, this is 6000 times more than that obtainable by the Pickering mirror method. By the employment of the proposed method, the electrician on Mars instead of utilizing the energy received by a few thousand square feet of area, from a parabolic reflector, is enabled to concentrate in his instrument the energy received by dozens of square miles, thus multiplying the effect many thousands of times; and by proper methods and devices he can magnify the received effect as many times again. Mr. Tesla states that in his experiments in 1899 and 1900 he produced disturbances on Mars incomparably more powerful than could be obtained by any light reflectors, no matter how large.

Gasoline-Electric Car.

The General Electric Company has for several years given considerable attention to gasoline-electric cars, during which period several different types have been the subject of design and experiment. One of the latest of these is illustrated in the accompanying engravings, which has a seating capacity of 50 passengers and an 8-ft. baggage space.

The car is mounted on double trucks, the forward one being equipped with two standard railway motors of 100 hp each. The power plant consists of a gasoline engine and an electric generator of 125 hp and a controller similar to a standard railway controller. The speed of the cars is from 50 to 60



FIG. 1.—GASOLINE-ELECTRIC CAR.

miles per hour and the car can be started, stopped and reversed without stopping or changing the direction of rotation of the gasoline engine. The company believes that the flexibility and easy operation afforded by the electric drive more than counterbalance any advantage secured by a mechanical connection between the engine and the axles.

The power plant consists of an eight-cylinder, 100/125-hp, 550-r.p.m., four-cycle gasoline engine of the V type, direct connected to an eight-pole, 80-kw, 600-volt commutating pole generator and direct-coupled, 3½-kw, 32-volt exciter. Engine cooling is provided by means of thermo-siphon circulation in radiators of the fin tube type of 2000 sq. ft. cooling surface and 60 gal. capacity, suitably placed on the roof of the car. The cooling system is arranged so that it may be filled from the exterior of the car.

The ignition system consists of high-tension magneto and plugs. The carbureter is of overflow type with adjustable con-

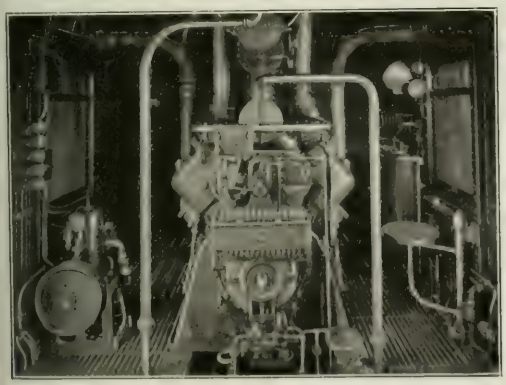


FIG. 2.—VIEW OF MACHINERY COMPARTMENT.

trol for warm air supply. The gasoline is supplied to the carbureter by means of a plunger pump mechanically driven from the engine. An auxiliary hand pump is also provided for starting. An air pump driven from the main crankshaft of the engine supplies air for the brakes and whistle. The gasoline tank is of steel and of 90 gal. capacity; it is located under the car body and is filled from the exterior of the car.

The controller connects the motors progressively in series and in parallel, and the voltage applied to them is controlled by varying the strength of the generator field, which is accomplished by the movement of a handle on the controller. The controller is provided with a reversing handle to change polarity of the armature current in relation to the field current of the motors and thus reverse the car. Substantial handles for spark and throttle are conveniently placed on the controller. The manufacturers have developed a special controller which can be arranged for operation from either the self-contained power plant or from the 600-volt overhead trolley circuit of an electric railway system. When operating from the self-contained power plant the speed of the motors is governed as described above. When operating from the overhead trolley the motors are controlled in the usual manner—i.e., series parallel connections with intermediate steps obtained by placing resistance in the main circuit. The same handle accomplishes both operations. Interlocking devices are provided to prevent operation from one circuit when there is a connection with the other.

Combined straight and automatic air brakes are provided, the straight air being for use when the car is operated alone and the automatic air for use when hauling a trailer furnished with standard automatic brake equipment. The gasoline engine is started by compressed air from the main reservoir through a distributing valve to the several cylinders in succession. For recharging the reservoirs if necessary when the main engine is shut down a single-cylinder, single-acting air pump direct connected to a 4-hp, single-cylinder, two-cycle gasoline engine is furnished as part of the equipment and is located on the left side of the engine compartment. This auxiliary air pump equipment is complete and includes all necessary accessories, such as carbureter, ignition outfit, cut-out cocks, valves, etc.

The car is electrically lighted by 25-volt incandescent lamps. Current is supplied from the exciter when the main engine is running and from a 12-cell storage battery located under the car body when the main engine is shut down. Automatic means are provided for switching the lights from one circuit to the other and also for charging the battery from the exciter. A 32-cp incandescent headlight is provided as part of the equipment. The car body is heated by a system of hot water circulation of the thermo-siphon principle, the heat being obtained from the exhaust gases.

CURRENT NEWS AND NOTES.

RETURNS FROM INVENTIONS.—In the discussion of the paper by Mr. F. P. Fish, presented at the annual meeting of the American Institute of Electrical Engineers, Dr. C. P. Steinmetz said that the direct financial gain from all of his inventions was altogether about $500. On the other hand, he believed that indirectly, in salary and reputation, he had received at least the value which the inventions possessed.

PHILADELPHIA A. I. E. E.—The annual social meeting of the Philadelphia Section of the American Institute of Electrical Engineers is to be held at Atlantic City on June 2, while the National Electric Light Association is in session under President Eglin, who is a member of the section. The members will meet for dinner at the Hotel Poinsettia, on the Boardwalk, at 7 p. m., and under the circumstances a very large attendance is expected.

THE PATENT OFFICE AND BATTLESHIPS.—In his recent A. I. E. E. paper dealing with the patent system, Mr. F. P. Fish referred to a comparison of the cost of conducting the U. S. Patent Office and the expense entailed by a battleship. A modern battleship costs complete about $12,000,000. In 1906 the receipts of the U. S. Patent Office were $1,790,921 and the expenditures $1,554,891, leaving a profit to be turned over to the Treasury of $236,030. On the basis of these figures, the cost of a single battleship would maintain the Patent Office for seven or eight years. According to the comparison quoted by Mr. Fish, the annual cost of maintaining a battleship is several times greater than the annual cost of conducting the Patent Office.

ELECTRIC HEADLIGHT ATTACKED.—The Georgia railroads have attacked the constitutionality of a State law requiring all engines on main lines to be equipped with electric headlights. Recently electric headlights have been unfavorably criticised in the West owing to their blinding glare.

RENSSELAER POLYTECHNIC INSTITUTE, Troy, N. Y., will hold its commencement exercises on June 15 and 16. The first day will be signalized by the opening of the new Russell Sage Laboratory, when addresses will be made by Mr. R. W. DeForest, President Smith, of the Mechanical Engineers, and President-elect Stillwell, of the Electrical Engineers. On the second day a special address will be delivered by President Bates, of the Civil Engineers.

EDISON CONCRETE HOUSES.—Mr. Thomas A. Edison announces through the newspapers that he has completed his scheme for building a concrete house for $1,200 which, if constructed of stone in the same design, would cost between $20,000 and $30,000. The house would have a floor plan of 25 ft. x 30 ft. and contain six rooms, bathroom and cellar, and could be built in a fortnight. The plant of cast-iron molds, etc., for building such a house would cost $40,000, with which 150 houses could be built in a year.

BURN THE UNIVERSITIES!—In a letter to the members of the Illinois Legislature attacking technical education in general and the University of Illinois in particular, Mr. R. T. Crane, of Chicago, says that "instead of appropriating funds for such institutions it would be a good deal better for the State to put a torch to them and burn them down, to go out of the 'higher education' business and permit the boys to go back to their homes and assist in supporting their families, instead of causing them a heavy expense."

SENATE INCREASES DUTY ON HIGH-GRADE CARBONS.—The United States Senate on May 21, by a vote of 43 to 35, fixed the rate of 35 cents per 100 ft. on low-grade and 65 cents per 100 ft. on high-grade electric light carbons. In the acrimonious debate on the subject of the duty it was stated that none of the former grade is imported. The high-grade carbons, such as are used in flaming-arc lamps, have heretofore been imported in lengths of 24 in. to 28½ in., paying a duty of 90 cents per 100 lengths. The Senate duty is therefore a virtual increase from 90 cents to $1.30 or to $1.42 per length.

CAMBRIDGE SUBWAY CONSTRUCTION BEGUN.—The construction of the new subway to be built in Cambridge, Mass., by the Boston Elevated Railway, has been begun at the intersection of Bay Street and Massachusetts Avenue. The subway will provide a rapid transit route between the business center of Boston and Harvard Square, Cambridge, and the running time will be cut from the present 22 minutes to about 8 minutes. At Harvard Square free transfers will be given between the subway trains and surface cars connecting with outlying points. The third-rail system will be installed, and multiple unit operation applied to the train service.

DUTY ON TUNGSTEN.—In a discussion in the Senate on May 21, concerning the imposition of a duty of 25 per cent ad valorem on tungsten, inquiry was made concerning the present price of tungsten. Senator Heyburn said that the price was $400 per ton; Senator Burton said that tungsten sold for $900 per ton; Senator Aldrich said he had been informed by men engaged in the tungsten industry that it sold for $1,300 per ton, and Senator Nelson quoted from a pamphlet which stated that tungsten ranged in price from $1,200 to $1,500 per ton. As a result of the discussion the matter of duty on tungsten was put over for future consideration.

ELECTRIC VEHICLE DATA.—A census has been taken recently by the *Electrical World* of the various features of the development of the electric automobile field by central stations. Already returns have been received from nearly 1400 central-station companies. It is desired to make the census as full and complete as possible at an early date, and the earnest request is now made by the editors that any blanks not yet filled out should be attended to at once and sent in. The census has already brought out the fact that central-station managers are intensely eager to learn what their colleagues are doing in this respect of building up a new and profitable load for their plants; and such interchange of information as this inquiry affords should be most valuable to them.

ENGINEERS' SOCIETY OF PENNSYLVANIA.—A meeting will be held at Harrisburg, Pa., June 9-11, at which the organization will be perfected of the Engineers' Society of Pennsylvania. The new body will include all branches of the engineering profession, and will hold an annual convention for the discussion of engineering subjects. At the coming meeting 20 papers will be presented and an illustrated lecture delivered on the Panama Canal by a member of the Panama Board of Consulting Engineers. Arrangements have been also made for visits to a number of plants, etc., of engineering interest. Mr. F. Herbert Snow, Harrisburg, is president and E. R. Dasher secretary of the society. Prof. J. P. Jackson, of Pennsylvania State College, is one of the vice-presidents.

STRAY CURRENT BRINGS TWO FRIENDS TO BLOWS.—Escaping electricity which charged the Twelfth Street bridge in Chicago recently caused a curious misunderstanding. Two men who were well acquainted and on friendly terms approached the bridge, one slightly in advance of the other. The first man stepped on a car rail and received a smart shock. He jumped, and believing his companion had jolted him severely, he quickly turned and struck the latter. The compliment was returned in kind, but in the scuffle the two men received other electric shocks and realizing that electricity was their adversary they laughed and shook hands just as a policeman was about to interfere. The cause of the escaping electricity was then quickly located and easily repaired.

AN EDITOR VINDICATED.—About two years ago our contemporary *Power* printed an article exposing the pretensions of the promoter of a carbonic gas engine which, it was claimed, would, in the absence of leakage, run indefinitely with a single charge of gas under pressure; or more specifically, that it would in practice continue to run and develop power in large and useful quantities for some 30 days without any other source of energy to draw upon. In consequence of the publication of the article, Mr. F. R. Low, editor of *Power,* was arrested on a charge of criminal libel, and the suit was tried in Philadelphia on May 13. The judge, after hearing only part of the evidence prepared for the defendant, instructed the jury to find a verdict in his favor, which verdict was duly rendered.

ARMOUR INSTITUTE GRADUATING CLASS.—Armour Institute of Technology, Chicago, will graduate a class of 27 in the electrical engineering course this spring, all of whom will receive the degree of B.S. This degree will also be conferred on 14 graduates in mechanical engineering, 19 in civil engineering, 7 in chemical engineering, 4 in fire-protection engineering and 3 in architecture. Advance degrees will be conferred on five men in the electrical engineering department, five in civil engineering, four in mechanical engineering and one in chemical engineering. The theses of the electrical engineering graduates cover a variety of subjects, including tests and examinations of lightning arresters, the permutator, railway motors and electrification projects, current transformers, photometers, primary cells, measuring instruments, transformers, incandescent lamps and also a report on one isolated plant.

System of the Philadelphia Electric Company

GENERATION, DISTRIBUTION AND SALE OF ELECTRICAL ENERGY IN THE QUAKER CITY



THE city of Philadelphia has an area of 129 sq. miles and a population of about 1,500,000. Covering this vast territory are the lines of the Philadelphia Electric Company, the only public-service company selling electricity in the city. In the district comprising the old city founded by Penn in 1682, and extending from the Schuylkill to the Delaware River, and from South Street to Callowhill Street, a three-wire, 115-230-volt system of distribution prevails. The feeders and distribution circuits are for the most part underground. In the outlying territory a two-phase, three-wire, 60-cycle system is used, and inasmuch as most of the consumers are connected to 115-230-volt secondary mains, a uniform distributing voltage is maintained in the entire city. The alternating current is generated at 6000 volts and is distributed by means of substations at a tension of 2400 volts. The 6000-volt feeders are run underground, and the 2400-volt distribution lines are principally overhead. The chief generating stations of the company are Station A, located at Twenty-eighth and Christian Streets; Station G, Twenty-sixth and Callowhill Streets; Station C, formerly the Edison Station, at Ninth and Sansom Streets, and Station J, which is located in the northeastern section of the city. It is planned eventually to maintain practically two generating stations, Station A and Station J.

STATION A.

This station is located on a plot having an area of 335,000 sq. ft. at Twenty-eighth and Christian Streets and the Schuylkill River. The site is especially valuable for power-house purposes as it is free from intersecting streets, has the river on one side and the Baltimore & Ohio Railroad and the Pennsylvania Railroad immediately adjoining it. The location insures ample water at all times for feed water and condensing purposes; fuel can be brought by rail and by water, and a large, well-paved street facilitates the hauling of miscellaneous supplies. A map of the property is given in Fig. 5. The present station is 160 ft. x 160 ft. in cross-section, and houses about 25,000 kw of generating machinery at normal rating. This is one complete section of the projected plant, which will comprise five such sections and have a total rating of 125,000 kw. The second section will be built directly east of the present structure, or on the end away from the Schuylkill River. The structure is built of steel with heavy red-brick outer walls and with windows for light and ventilation on three sides. The fourth side is closed with a temporary galvanized-iron sheet-metal wall, heavily braced against wind pressure, which will be removed when the next section is completed. A skylight of heavy wire-glass covers the central part of the engine-room. The roof proper is made of cinder concrete, and extending over the coal bunkers are copper

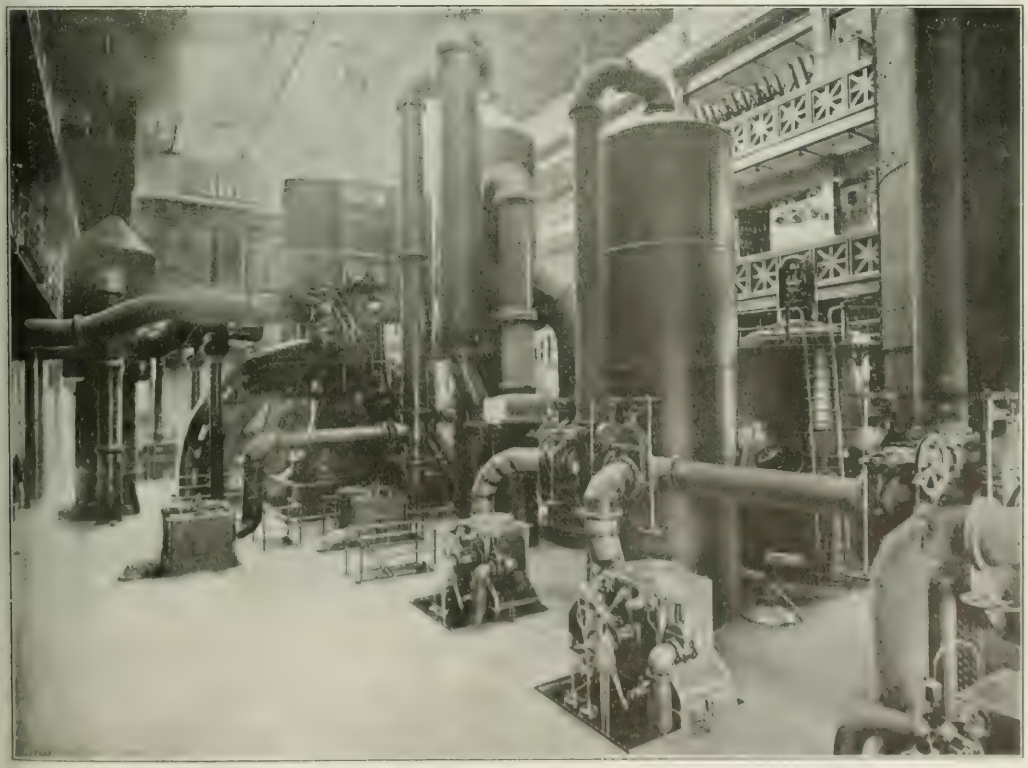


FIG. 1.—GENERATOR ROOM OF THE CHRISTIAN STREET STATION OF THE PHILADELPHIA ELECTRIC COMPANY

louver to provide ventilation for the bunkers, and to carry away the heat from the fireroom floors. The engine-room floor is 20 ft. above the basement floor, and is lined with white-enameled brick for a distance of 6 ft., and buff brick above this to the full height of the building. An ornamental red tile floor with a border of diamond-shaped figures of deep green is provided. In order to give ready access to the condensing equipment lo-



FIG. 2.—COALING ARRANGEMENTS AT CHRISTIAN STREET STATION.

cated in the basement, which is at street level, the section of the floor immediately over the pumps is covered by steel plates, which are removable, so that the condensing machinery may be handled by means of the crane in the engine-room. The latter is of 60 tons capacity and runs the full length of the engine-room. It is electrically operated, and has an auxiliary hoist of 5 tons capacity for handling lighter parts.

The generating equipment comprises a 2000-kw, two-phase, 6000-volt alternator, direct connected to a Wetherill twin-tandem-compound engine; a 5000-kw alternator, direct-connected to an Allis-Chalmers double-horizontal-vertical, cross-compound engine and three 5000-kw, five-stage Curtis turbo-generators. The 2000-kw unit is equipped with a vertical jet condenser of the Deane type. The Allis-Chalmers engine exhausts directly into a Weiss barometric condenser giving a vacuum averaging about 28 in. throughout the year. The governor of this engine is of the flywheel type, giving a regulation of about 2½ per cent from no load to full load. In order to insure satisfactory operation with the very heavy valve gear, this governor transmits its motion to the valve gear through a hydraulic cylinder, the piston of which is directly connected to the valves. A safety governor is provided to cut off steam from the engine in case of excessive speed. One of the turbo-generators operates at a normal speed of 514 r.p.m., while the two others run at 720 r.p.m. Safety trips, which protect the machine in case of excessive speed, are set for 15 per cent to 20 per cent above normal. Two turbines exhaust into barometric condensers designed by the company's engineer, and a vacuum of over 28 in. is maintained on the three turbines at all times. The step-bearing pressure of the 14-pole turbo-generator unit is 550 lb. per square inch, while the pressure for the 10-pole turbo-generator unit is 775 lb. The turbines have proved extremely satisfactory in operation, so that the load is generally carried upon them at all times, except when an increase calls for the use of the reciprocating engine units.

An accumulator 12 in. in diameter by 10 ft. stroke acts as a reserve upon the step-bearing system. The pressure varies directly with the load, and care must be exercised that the sudden overloads which sometimes have to be carried on the generators do not cause the pressure to rise to a point approaching that of the accumulator, as the step blocks would rub and cut very rapidly. In the two 10-pole turbo-generator units, which have smaller blocks than the other turbo-generator, the area of the recess in the blocks was considerably increased, with the result that the necessary pressure at no load was found to be reduced. The increase in pressure due to the load was also reduced, so that a much flatter curve was obtained, which made it impossible under any conditions of load for the step-bearing pressure to approach that of the accumulator. An oil flow of about 12 gal. per minute is maintained at each step block.

In connection with the accumulator four heavy accumulator pumps are installed, any two of which can carry the combined load of the three turbines. The pumps are of Worthington manufacture, and two of them, together with the main and auxiliary accumulator, are shown in one of the engravings. The piping between the pumps, accumulators and step bearings is of heavy steel, and each section, together with all fittings used in connection with the 150 lb. oil supply to the turbine governors, were tested above the working pressure before being placed in service.

The importance of maintaining the quality of machinery oil has led to the adoption of a gravity supply and filter system of ample size to meet all requirements. There is kept on hand in the station a constant supply of 20,000 gal. of machinery oil, one-half of which, owing to the design of the storage tanks, may be kept in reserve indefinitely. This oil is used for every purpose around the station, including the step bearings of the turbines. With the facilities on hand for warming, filtering and

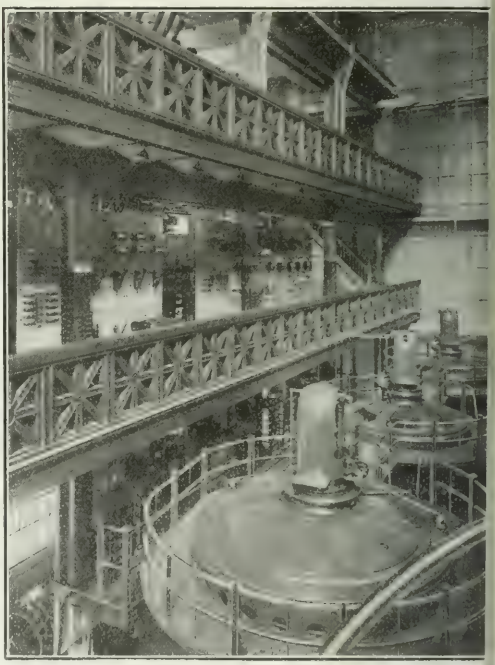


FIG. 3.—TURBO-GENERATORS AND SWITCH GALLERIES IN CHRISTIAN STREET STATION.

cooling the oil it has not been noticed that the use of machinery oil on the step bearings of the turbines detracts to any extent from its quality.

Inasmuch as the temperature of the water in the Schuylkill River varies considerably between winter and summer, about twice as much water is required for condensing purposes

summer as in winter. The tidal conditions are also such that centrifugal pumps are not best adapted for this work. Rotary pumps of a positive-displacement type, whose output varies directly with the speed, are therefore installed in connection with the turbines, and have proved very suitable for this work. The general appearance and construction of the units may be seen by reference to the cross-section of the building.

The boiler equipment occupies two floors, each carrying 16 Babcock & Wilcox boilers having a normal rating of 630 hp, and supplying superheated steam at a pressure of 175 lb. At the present time most of the furnaces are hand-fired, although several types of stokers have been installed for experimental purposes. Bituminous coal is supplied from barges on the Schuylkill River, and a railroad siding with a hopper is also provided. The coal-handling apparatus at the river edge consists of a Mead-Morrison coal tower, having a total lift of 85 ft. from river to boom. The coal is lifted from the barge by a 1¼-ton clam-shell bucket at the rate of approximately 150 tons per hour. The bucket dumps the fuel into an apron, from which it drops into a crusher, whence it is loaded into 3-ton cars on a cable railway and automatically dumped into a hopper at the station. Two men are required to handle the coal-conveying apparatus in the upper floor of the tower and two additional men handle the small cars. The two-roll crusher at the tower and the cable railway are both driven by induction motors having a horsepower rating of 30.

At the station the coal-handling apparatus consists of a link-belt two-roll crusher, together with a bucket elevator rated at 150 tons per hour. By this means the coal is lifted from the ground to the bunkers, and distributed by longitudinal conveyors, one on each side of the bunkers. The capacity of the coal bins is 2000 tons, or 13 tons per lineal foot of the station. The fuel is distributed through pipes leading from the bunkers directly to the middle of the fireroom floor in front of each boiler. The bunkers being divided into sections, any trouble due to spontaneous combustion is not serious, since the section of the bunker affected can be quickly emptied. All of the steel work in the bunkers is protected by a layer of concrete at least 2 in. thick. The ashes from the furnaces are dropped through chutes to the basement, whence they are removed by means of steel cars of the dumping type run on a light steel rail directly over a drain through which all water in excess of that actually needed for cooling the hot ashes is carried off to the sewer.

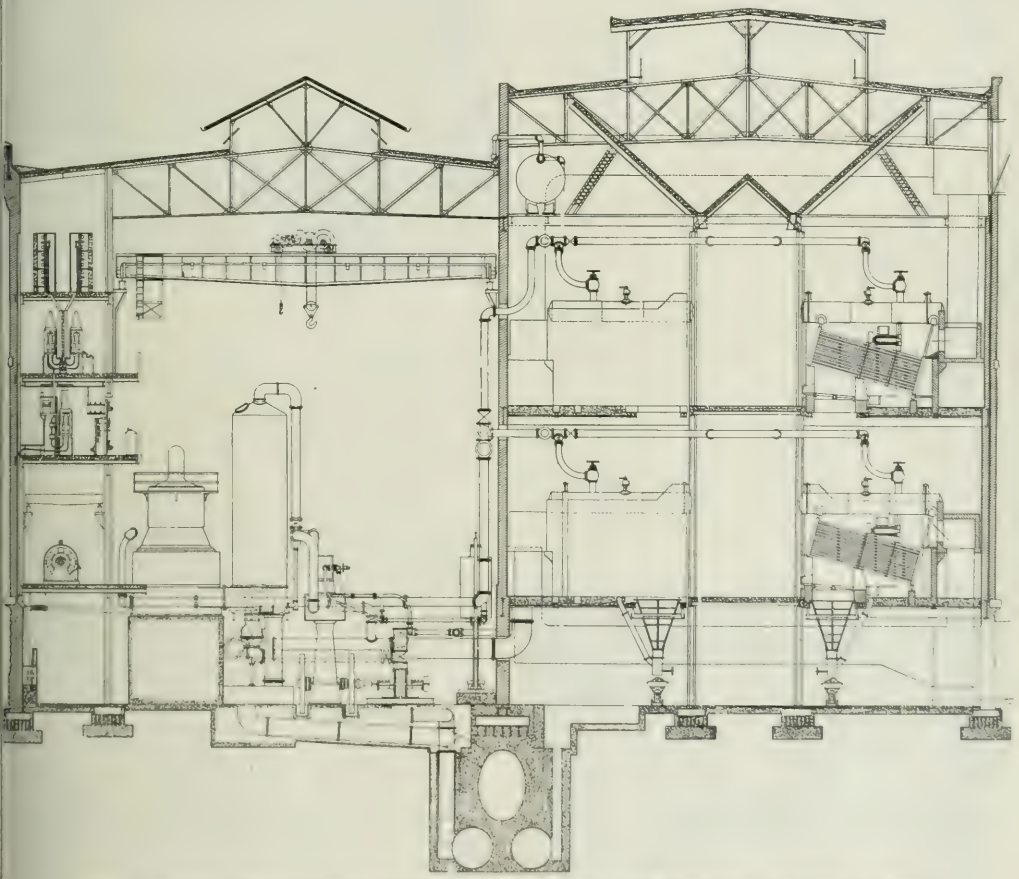


FIG. 4—CROSS SECTIONAL ELEVATION OF CHRISTIAN STREET STATION OF THE PHILADELPHIA ELECTRIC COMPANY.

The boiler-feed pumps are located at the street level in that portion of the basement lying between the engine-room basement and the ash-handling equipment. This section of the building is closed by heavy brick walls, perforated at intervals with openings protected by self-closing doors. The apparatus in this section is arranged in three groups, each of which is capable of supplying feed water to the entire boiler system of the plant. Water is taken from the hot well at about 100 deg. Fahr. by the boiler pumps and is passed through Cochrane open heaters. The exhaust from all auxiliaries, together with the discharge of all steam traps, is directed into these heaters so that the water delivered by the boiler-feed pumps has an average temperature of about 190 deg. Fahr. Section No. 1,

located next to the river, and section No. 3 farthest from the river, have heavy combination flywheel pumps, each of which is driven by a vertical compound engine. The steam cylinders are connected to an independent crank, which operates both the heater pumps and the boiler-feed pumps at the same time by means of a walking-beam connection. A special governing

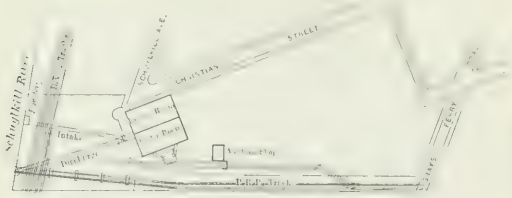


FIG. 5.—PROPERTY MAP, CHRISTIAN STREET STATION.

mechanism is provided so that the pumps may be operated at whatever speed is desired, the normal full-load speed being 75 r.p.m. These pumps were built by Robert Wetherill & Company in accordance with the specifications and plans of the mechanical engineer of the Philadelphia company. Pump section No. 2 comprises two Snow duplex boiler-feed pumps and two small heater pumps.

Water from the Schuylkill River for condensing and boiler-feed purposes is conveyed 350 ft. through cast-iron segmental conduit, bolted together in 2-ft. sections, the tunnel being 10 ft. 2 in. in diameter. Portions of this tunnel are laid in concrete, and in other places the foundation is of clay, gravel or solid rock. Water enters the concrete forebay through a heavy iron grating with bars 1½ in. between centers. Each of the three river openings measures 8 ft. 10 in. high. Inside of the forebay another double set of screens of 1½-in. mesh, constructed of heavy copper wire, is arranged. The screens are removable for cleaning, the upper screen being balanced over a pulley against the lower screen and the intermediate screen being carried by a balance weight. The bottom of the opening into the river front is 8 ft. 10 in. below normal low water.

Under the station the cast-iron tunnel changes in form by

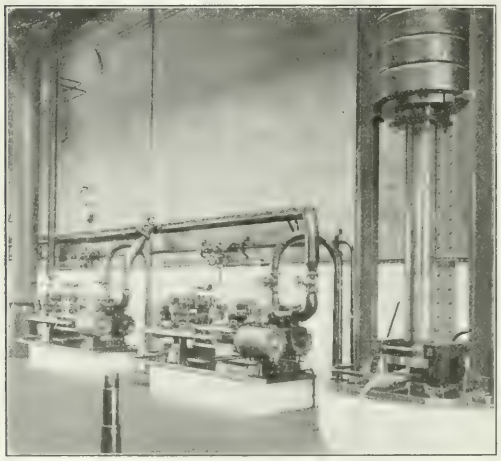


FIG. 6.—ACCUMULATORS AND STEP-BEARING PUMPS.

means of a 30-ft. long concrete section to the two 7-ft. circular tunnels, shown in the cross-section under the middle wall of the station. The bottoms of these tunnels are 8 ft. below mean low tide. Five suction pockets are located at the side of the north tunnel for the condenser pumps. Pockets of smaller diameter are located on the fireroom side of the other tunnel for the boiler-feed or fire pumps. Openings, 4 ft. in diameter, ar provided at frequent intervals between the tunnels. The dis charge conduit under the building shown in the cross-section elevation is elliptical in shape, having a vertical major axis c 12 ft. and a minor axis of 8 ft. The tunnel changes in the sec tion directly outside of the building, being reduced in the sam



FIG. 7.—FEEDER COMPARTMENTS IN BASEMENT.

concrete section as the intake to a diameter of 10 ft. 2 in cast-iron sectional conduit leading directly to the river. A shown in the plan view of the property, this discharge condu empties into the river about 200 ft. below the intake so that th hot discharge water does not mingle with the condensing wate

Running lengthwise of the station in the basement on th Christian Street side are compartments of concrete ar alberene stone for the outgoing 6000-volt feeders. This se tion is separated from the engine foundations and from th steam-driven auxiliaries of the plant by a low wall. At th present time there are four groups of such compartments, ea of which is equipped with six high-tension cables. No lea covered cable is installed on any high-tension circuit within th station, all such wiring consisting of single conductors heavi insulated with rubber and braid. In the cross-sectional elev tion of the building it will be noticed that the cables run to di connecting knife switches, thence to the first mezzanine galler where are located the main automatic oil switches, back which are the necessary series and shunt transformers for t instruments. Passing directly from the automatic oil switch

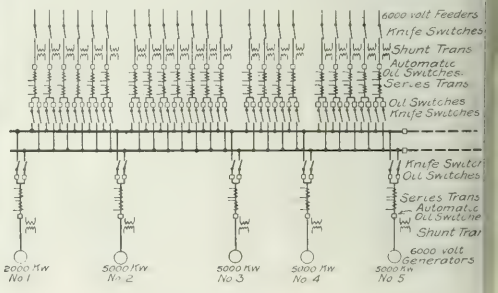


FIG. 8.—DIAGRAM OF BUSBAR CONNECTIONS IN MAIN STATION

and transformers, the feeders ascend through concrete and t ducts to selector switches, which standing back to back, conn the feeder directly to the busbars overhead. These oil switch may be operated manually or controlled from the benchboa Located on the highest gallery are the two main two-pha three-wire system busbars, which run the entire length of t

lant. Each bus is built up of 4 in. x ¼ in. copper bars and is laced in a separate fireproof compartment and mounted on eavy porcelain insulators set in alberene stone slabs directly n the concrete.

Knife switches similar to those in the basement allow any eeder or generator to be disconnected from the bus in case it

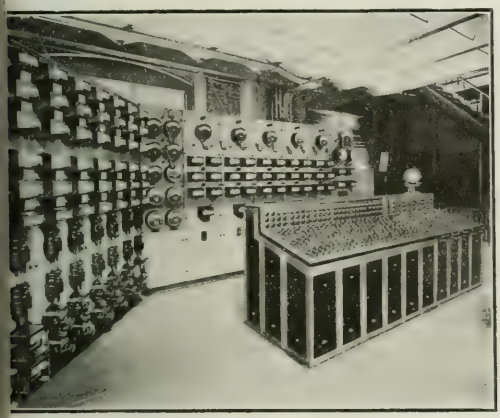


FIG. 9.—CONTROL BOARD IN CHRISTIAN STREET STATION.

desired to work on the oil switches or other parts of the aparatus. By means of interlocking doors and a special lock, he key of which can only be obtained on application to the hief operator, the switches in the basement are securely kept rom interference. In this way, in case of trouble on the nderground system, the station operator, after opening the nife switches, can lock the compartment doors and be entirely ure that it is safe for the underground department to work on

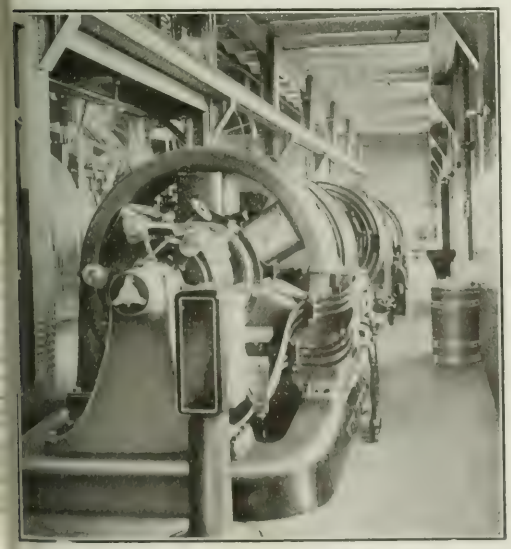


FIG. 10.—MOTOR-GENERATOR EXCITER SETS IN MAIN STATION.

he system. A diagram of the 6000-volt connections is given, nd this shows the general arrangement of the alternator and eeder wiring.

The exciters of the station consist of a 100-kw, high speed team-driven 250-volt generator, one 130-kw generator driven y a 6000-volt induction motor of Westinghouse build, one 300-kw generator driven by a General Electric 6000-volt induction motor, and one 50-kw machine for battery charging, operated by a General Electric 6000-volt induction motor. In addition there is installed a battery of 140 cells, having a capacity of 400 amp-hours at a one-hour discharge rate, with sufficient space in the tanks for increasing the number of plates 50 per cent. By means of an end-cell switch the number of cells in circuit may be increased from 122 to 140, two cells at a time. The storage battery is kept floating on the exciter system at all times, and the exciters themselves are equipped with reverse-current circuit-breakers on the direct-current side and overload circuit-breakers on the alternating-current side.

The direct-current board is located directly above the exciters on the first gallery, the exciters being located on the Christian Street side of the engine-room floor. Two sets of busbars are provided, and the field coils of any machine and all auxiliary apparatus operating controlling mechanism, etc., are arranged with double-pole, double-throw switches, so as to be

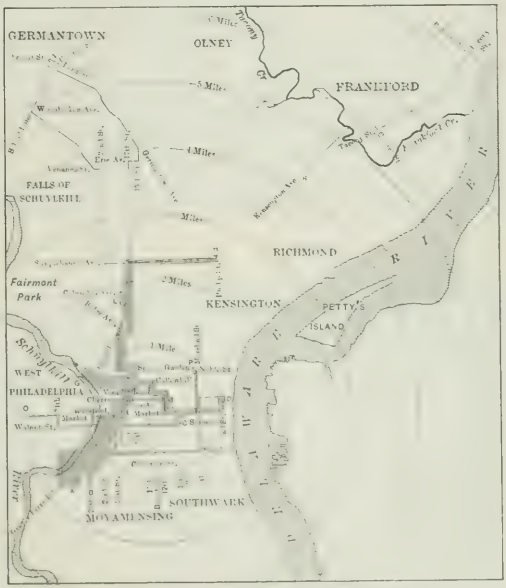


FIG. 11.—MAP OF 6000-VOLT CABLE SYSTEM.

operative from either bus. The direct-current board is on the same floor as the main feeder and generator switches. Located directly above the direct-current board on the same gallery with the hand-operated selector switches are the benchboard and the instrument panels for all feeders and generators, including panels for synchronizing and other general indicating instruments and for duplicate sets of indicating instruments for each exciter and exciter battery. On the extreme eastern end of the board are mounted an illuminated-dial voltmeter indicating the pressure on the exciter system; a frequency indicator for each bus; a voltmeter for each bus; an auxiliary end-cell indicator and switches for controlling the direct current supplied to the oil switches, relays and the benchboard. A double set of synchronizers and synchronizing switches are also provided, so that in case of trouble with any set of synchronizing transformers another set on an entirely different phase can be thrown into service by the operation of one switch.

As shown in Fig. 9, the benchboard is divided into two sections, one section comprising 24 feeders and the other controlling the five main generators. Upon the lower board are mounted the controllers for the main field rheostats, switches for the speed control of the generators; field break switches, and the small controlling switches for the generator oil switches. The other board has installed on it switches for con-

trolling the motor-operated oil switches of the feeders. The red or "in" lamps on this benchboard are located on a vertical panel. The upper row of red lamps is for No. 1 bus, the lower row for No. 2 bus and the middle row for the main or automatic switches of the feeder or generator. Dangerous overloads on the generators are automatically indicated by the lighting of a red lamp through a relay. Small switches are arranged in three rows: those for No. 1 bus are on the bottom, those for No. 2

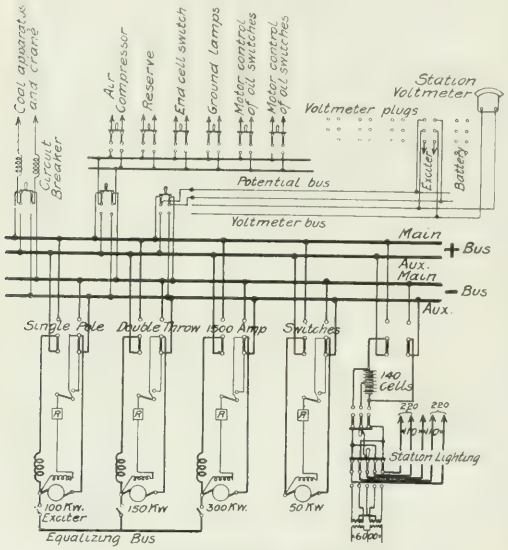


FIG. 12.—EXCITER BOARD CONNECTIONS.

bus are on the upper row and, as in the case of the lamps, the main switches lie midway between the selector switches. By glancing down the row of switches or the row of indicating lamps the operator can see at a glance which generator or feeder is in service. The green, or "off," lamps being of less relative importance are located on the inclined slab under the front of the switch, so that their indication is not concealed by the hand of the attendant during switching operations. Underneath the table are fuses for the protection of the motors on the oil switches and other motor-driven appliances, synchronizers and frequency indicators controlled directly from the table. Mounted on the generator end of the table is a double-scale Hartmann & Braun frequency indicator, which by its vibration indicates the exact frequency of both buses. This type of frequency indicator has been found very satisfactory, and has practically superseded in the Christian Street station all other forms. The general layout of the whole electrical equipment can be seen by a reference to Fig. 4, which shows the Christian Street side of the building. Above the engine-room floor are the main automatic switches with the direct-current board; on the gallery above are the selector switches and instrument board and the operator's table, and on the gallery above these are the busbar compartments, and on the river end the storage battery.

Radiating from Christian Street are 20 6000-volt underground three-conductor cables of 250,000-circ. mil cross-section These feed the various substations, where the potential is stepped down to 2400 volts by means of air-blast transformers, or to 220 volts, direct current through rotary converters or synchronous or induction motor-generator sets. The direct current is used to supply the underground Edison service in the heavily congested districts of the city.

STATION G.

This was the first complete alternating-current generating station installed by the company and contains four 1000-kw, two-phase units operated by twin tandem-compound condensing engines and has been fully described. This plant is now used as an emergency station. The first two engines installed were of the Greene type, built by the Providence Steam Engine Company. They are equipped with governors of the Rites type driven by two belts each and damped with a special locking dash-pot with a floating valve to assist in parallel operation. The last two machines are of the Pennsylvania Iron Works Company build. Wheeler surface condensers are used. The four alternators are equipped with 30-kw, belt-driven, 125-volt shunt-wound exciters and in addition there is installed a 50-kw Siemens & Halske 125-volt, compound-wound exciter directly coupled to an Armington & Sims high-speed engine. The plant is equipped with a modern switchboard using hand-operated oil switches and all indicating instruments, as well as the operating handles of all switches, are on a gallery above the high-tension apparatus.

The boiler equipment comprises eight Aultman & Taylor boilers fitted with flat grates and superheaters. All boilers are hand fired with hard coal. Two 12-ft. Buffalo Forge Company fans are installed in the boiler-room, one at each end, with ducts leading to the boiler furnaces. These are used for forcing the fires under the boilers in case of sudden rise in load. The stack is an ornamental structure, rectangular in shape with a circular bore 9 ft. in diameter and is 150 ft. high.

Ten high-tension cables of 115,000-circ. mil section transmit energy to the various substations. The plant is still kept in readiness for immediate service and in the winter is used to carry a part of the peak load when this is necessary.

STATION J.

The district supplied by Station J, located on the Delaware River, at Tacony, includes certain large manufacturing industries which are centered relatively near the station. A new substation is now under way to care for the proper distribution of the load in this territory. Eventually this substation will probably be tied in with the outlying substations fed from



FIG. 13.—GENERAL VIEW OF STATION Q.

Christian Street and the whole of the northern district of the city will thus be well protected in case of serious cable troubles. Station J, an interior view of which is given herewith, contains 2640 kw in alternating-current machinery and feeds besides 1750 arc lamps.

STATION C.

The Edison system is supplied with energy from Station C having steam-driven machinery rated at 4500 kw and 1600 k

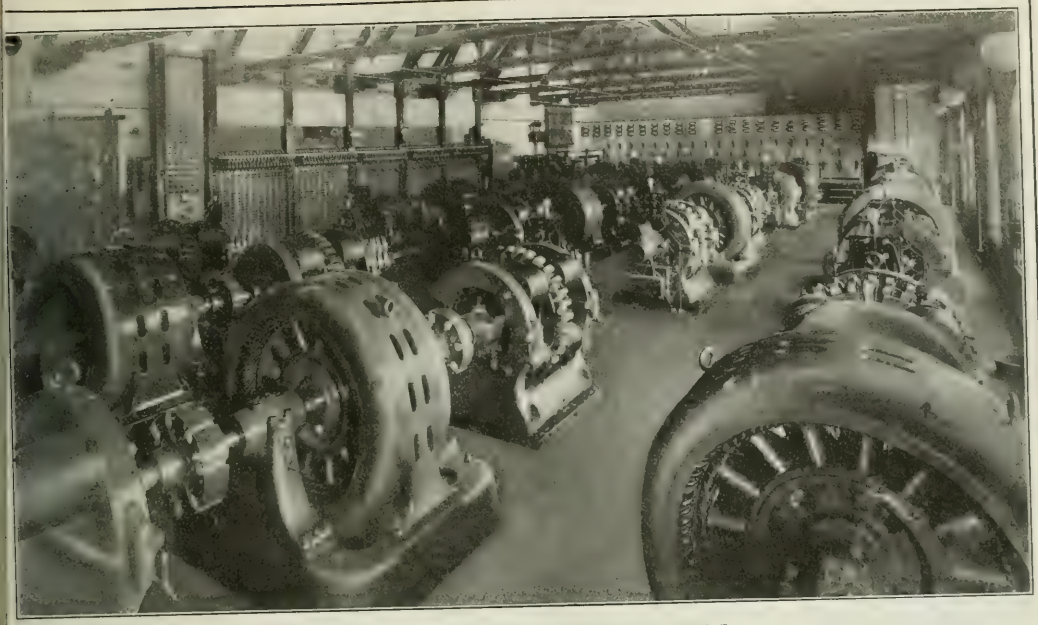


FIG. 14.—MOTOR-DRIVEN ARC MACHINES IN STATION F.

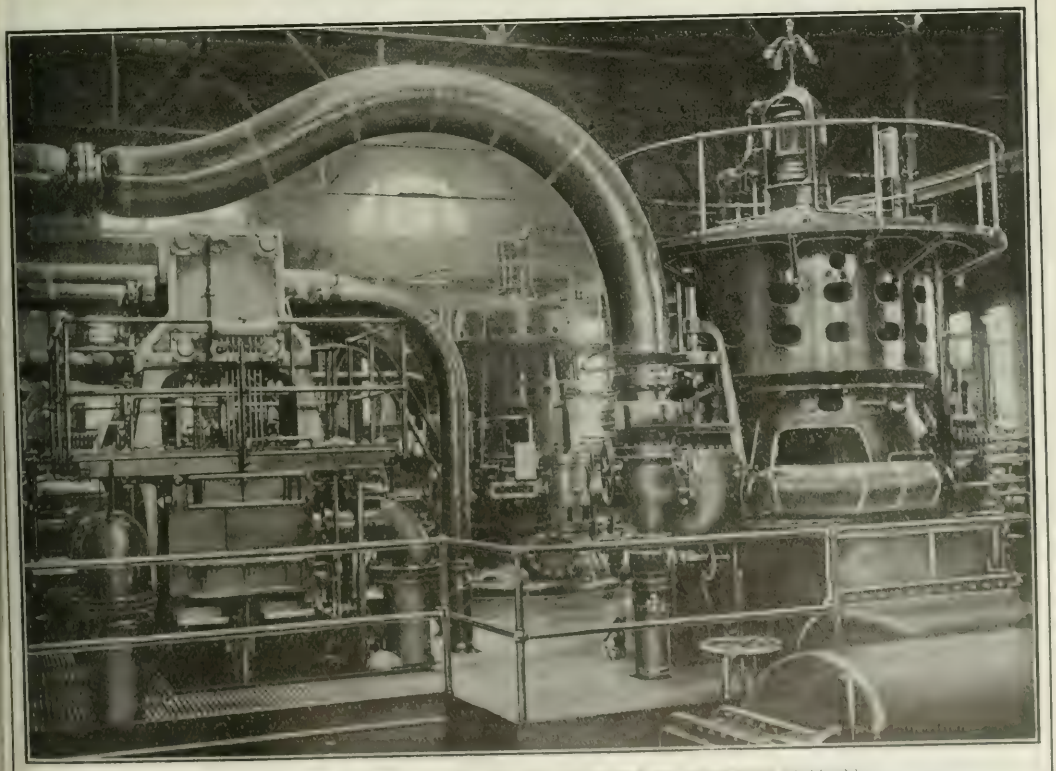


FIG. 15.—GENERATING EQUIPMENT IN STATION I ON THE DELAWARE RIVER AT CHESTER.

GENERATING STATIONS OF THE PHILADELPHIA ELECTRIC COMPANY.

of transforming apparatus and from three substations which are supplied from Station A. The substations are located so as to feed into the network at points of heavy load where the feeder drop would make direct-current supply from the central direct-current station unsatisfactory.

During the rebuilding of the Philadelphia system many of the district stations were retained and converted into substations. In some cases, however, the growth of the load has necessitated the construction of complete new stations at points carefully selected with a view to the future as well as the present load.

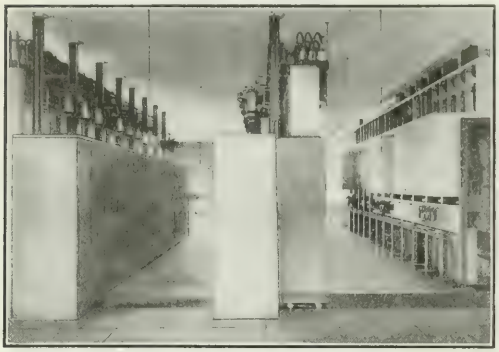


FIG. 16.—BUSBAR COMPARTMENTS, STATION Q.

STATION Q.

One of the latest stations to be erected in the Edison district is located on Arch Street, between Eleventh and Twelfth Streets, and running back to Cherry Street. The present station is located on the Cherry Street end of the property and ample space is available for extending the station to any size that would be called for at this location. The illustrations show the equipment in this station so well that extended descriptions are unnecessary. The incoming 6000-volt feeders and the outgoing direct-current feeders are on the first floor,



FIG. 17.—AUTOMATIC REGULATORS AND CONTROL BOARD IN STATION Q.

together with the 1000-kw, 6000-volt, 60-cycle synchronous motor-generator sets, rheostats, etc., the operator controlling the entire apparatus from the gallery. The upper floor contains the 6000-volt buses and the solenoid-operated oil switches. The direct-current generators are provided with interpoles so that commutation at all loads and under all conditions of operation is very satisfactory. A motor-driven blower supplies air to the commutators at extremely high overloads. Under normal conditions it has not been found necessary to use this blowing attachment to any great extent. The machines are started from the direct-current side, synchronized and then

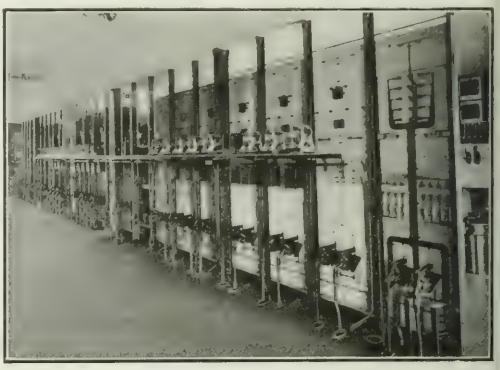


FIG. 18.—REAR VIEW OF SWITCHBOARD, STATION O.

thrown directly on the 6000-volt buses. In the basement of the station is installed a storage-battery plant of chloride accumulators, the present rating of the equipment being 450 kw.

STATIONS O AND P.

Two of the latest type of transformer substations are located at Marshall and Noble Streets and at Fortieth and Market streets, respectively. These are designated station P and station O, and both are illustrated herewith. Each of these stations has been designed for an ultimate output of 4000 kw divided between four 1000-kw banks, each consisting of two 500-kw transformers. These transformers step down from 6000 volts to 2400 volts, and are of the air-blast type provided with adjustable dial heads for giving suitable voltage at the secondary terminals. Automatic regulators with compensating voltmeter attachments acting through relays keep the voltage constant at any desired potential. The capacity of each regulator is 16½ kw, permitting a voltage range of 15 per

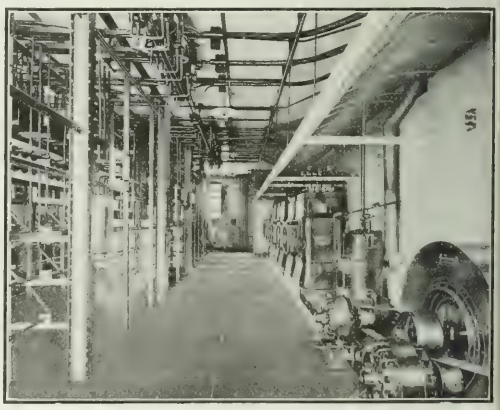


FIG. 19.—BASEMENT OF STATION O.

cent. The distributing circuits of the alternating-current substations have been limited to a load of 500 kw each. The stations operating entirely automatic, the duty of the operator consists in keeping the building and apparatus clean and in carefully inspecting the relays. A diagram of the substation connections shows that it is possible to operate the station and care

for all circuits even though one or more of the regulators may be in trouble or any mishap occur to the series or shunt transformers. Service from these substations is all overhead.

DISTRIBUTION.

Generally speaking, the overhead distribution can be divided into two classes—alternating-current lighting and motor



FIG. 20.—TRANSFORMER STATION P, ILLUSTRATING TYPICAL SUBSTATION BUILDING.

circuits and direct-current series-arc circuits. The city has been divided into numerous sections, the location of which is governed by load centers. At each of the load centers a distributing or substation has been erected, from which alternating-current circuits radiate. In the underground district cable feeders are run from the generating and substations to junction boxes, conveniently located, from which mains radiate and to which the various consumers are connected. Some of the large



FIG. 21.—BASEMENT OF STATION P.

consumers have feeders running directly from one or more substations as well as connections to the street service mains. The standard type of manhole used in the underground district is shown in Fig. 26. The company owns approximately 650 miles of pole lines. The poles are of chestnut exclusively, and are purchased under rigid specifications, having in all cases an 8-in. top, the butt measurement depending on the size of the pole. No poles are set which are less than 40 ft. long, and the average length of span is 120 ft. The method of running services to individual houses in residential sections is shown in Fig. 29. The plan is to tap the lines on poles on side streets and continue the circuits along the backs of the houses in a sub-

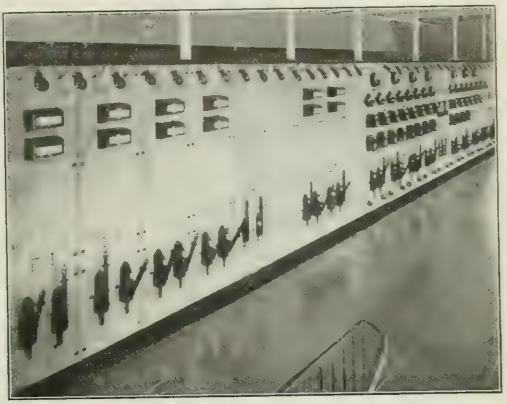


FIG. 22.—CONTROL BOARD, STATION P.

stantial manner. This makes it unnecessary to erect poles in the back yards and also shortens the length of the service leads.

STREET LIGHTING.

There are more than 12,000 arc lamps covering the entire area of the city. The distance between the lamps varies with the location; in the central portion of the city the lamps are located approximately 200 ft. apart, and this distance is increased in suburban districts to 400 ft. or 500 ft. The series-arc lighting system, which includes all the street lamps and a considerable portion of the commercial lamps, is made up of 9.6-amp, constant-current, open-arc lamps. This service is furnished from five stations located in various parts of the city and the energy for which is supplied by 125-light Brush arc machines. About one-third of the machines are driven by synchronous motors, and the remaining machines are steam driven. It is expected shortly to operate all the arc machines by means of motors. The arc circuits are made up of groups



FIG. 23.—AUTOMATIC REGULATORS IN STATION P.

of 125 lamps, the layout of the system being so arranged as to minimize the amount of wire and also to readily locate trouble.

BUSINESS GETTING AND BUSINESS BUILDING METHODS.

For the purpose of facilitating the work of the commercial department the city is divided into districts, each district being

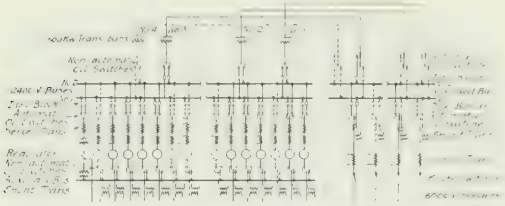


FIG. 24.—DIAGRAM OF ELECTRICAL CONNECTIONS IN STATION P.

supervised by a district manager, who is responsible to the general agent for new business. The district manager has under his supervision the obtaining of new business and the retaining of old business, collections, attention to complaints and all other matters pertaining to the district, subject to the central authorities.

The solicitors are assigned to the several districts according to their size and importance. A further subdivision is made by allotting sub-districts to solicitors. The solicitors meet with the district manager each morning and receive the work for the day. Card reports of every visit are made and through the medium of a daily report the work of the solicitor is carefully followed. These reports are submitted to the district manager and a record made and passed on to the main office, where they are further examined and filed in a card cabinet for ready reference.

The district solicitors are in constant communication with architects, builders and real-estate operators. Bulletins are issued daily from the general agent to the district office announcing building and real-estate operations. This bulletin is a summation of the knowledge obtained from construction reports received from various sources. Special departments, such as electric sign, exhibition and power, have been organized to assist the general soliciting force in obtaining business. If the case under consideration requires special attention, as for instance, engineering negotiations, formal proposals, meetings with committees and boards, the matter is handled under the immediate direction and co-operation of the general agent through the special departments. Solicitors are instructed in the essentials of the business by means of special instruction, temporary transfer to meter and electrical departments, and

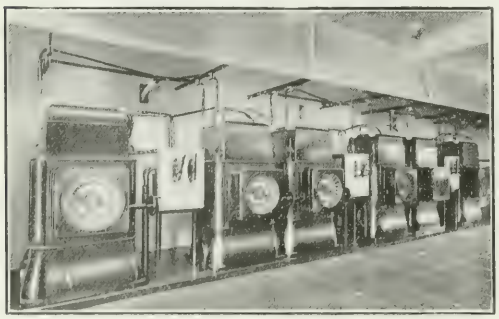


FIG. 25.—STEP DOWN AIR BLAST TRANSFORMERS IN STATION P.

through meetings of the various technical organizations within the company. In this way the solicitor becomes familiar with the conditions relating to the business.

The electric sign department is especially equipped to negotiate for sign business. Until recently the city ordinance restricted the placing of signs over the pavement. This restriction has very much hampered the work of the department. Under the new ordinance there is practically no limit as to the size of length of sign, and there is no doubt but that considerable business will result. Though hampered by the restric-

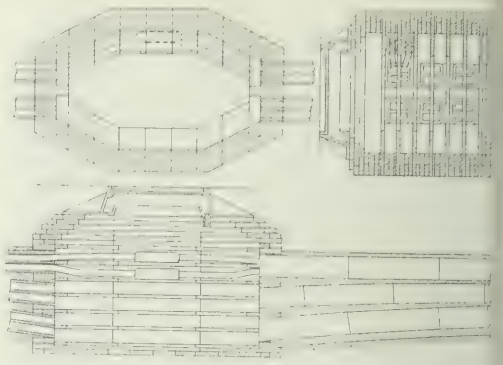


FIG. 26.—STANDARD MANHOLE CONSTRUCTION.

tions, the company has succeeded in building up a large sign business, particularly in the central part of the city.

The exhibition department is well prepared to assist the solicitors in exhibitions and demonstrations of any character. The main showrooms are located in the main office building, 1000 Chestnut Street. On the first floor, main entrance, is a large display-room for lighting and small heating, lighting and power appliances. In the basement, immediately below the showroom, may be seen an elaborate equipment of motor-driven appliances. All the apparatus in the display-rooms is operative. A complete photometer room is provided for testing lamps and demonstrating the use of lamps and shades. The photometer is equipped with modern testing instruments for the purpose of showing to present and prospective consumers the relative merits of lamps and all lighting appliances.

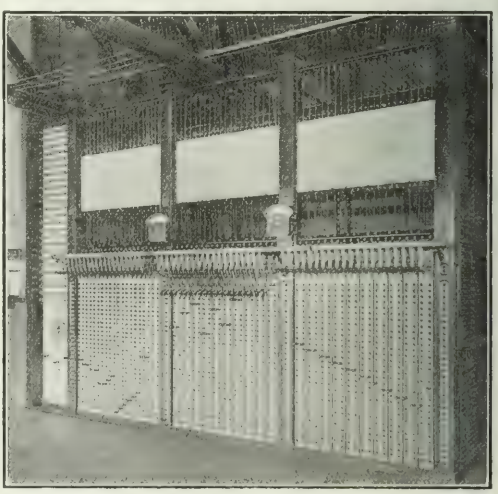


FIG. 27.—TYPICAL ARC CIRCUIT BOARD.

The power department was organized especially to deal with those cases involving special features and to encourage the use of electricity in the many manufacturing plants throughout the city, for new-building operations, refrigeration work and any special electrical application; and further to assist the district

nager or solicitor in obtaining new or retaining old business. This department associates with the architect and consulting engineer whenever required, and assists the manufacturer who cannot afford an expenditure for expert advice. Whenever necessary the full resources of the engineering and commercial

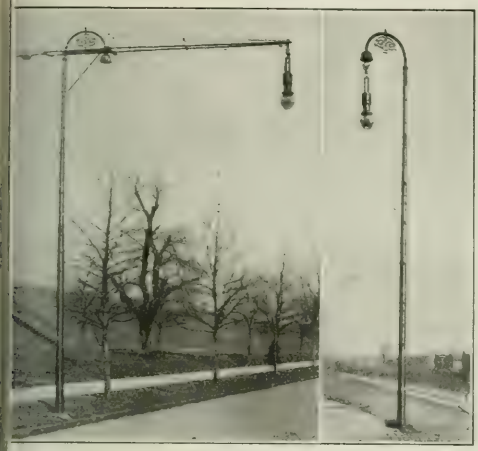


FIG. 28.—STANDARD POSTS FOR PUBLIC STREET LIGHTING.

partments are readily obtained for the purpose of developing and concluding any particular field of endeavor.

A commercial inspection department investigates the com-



FIG. 29.—BACK YARD DISTRIBUTION IN RESIDENTIAL SECTION.

mercial features particularly with reference to the cause for complaint of high bills. This department is under the direction of the district manager and is in charge of a competent commercial man, who makes a special study of lighting effects, and assisted by the power department gives consideration to the proper distribution of motors. The company is always on the alert to suggest to the consumer changes that will tend to reduce the cost of electric service.

The Philadelphia Electric Company is not only an extensive user of electric vehicles itself; but also a promoter of this type of automobile. In order to encourage a greater use of electric cars, the company furnishes electrical energy for charging automobile batteries at reduced rates, the only restriction being that the owner may not charge batteries between the hours of 4 and 7 p. m. during the winter months. A customer who has his own garage and charging set and who is using electricity in his house, need not have a separate meter, and may earn a low rate under the regular schedule without restriction as to hours of charging. At these rates the ordinary monthly charge for operating automobiles will average less than $10.

The demands of the public, the establishment of sanitary laws and the enactment of pure food laws have brought about a condition which makes the establishment of mechanical refrigeration machines a necessity from the standpoint of cleanliness, economy and all-around utility. The cost of electricity to operate a refrigerating machine is frequently very much lower than the cost of an equivalent refrigeration by means of ice. The



FIG. 30.—ELECTRIC-SERVICE AUTOMOBILE.

other advantages are so manifest that numerous installations have been and are being made in this city. The company has 62 refrigerating plants on its circuits, varying in output from ¼ ton to 35 tons, and representing 497 tons of refrigeration. A special department is maintained to take care of the refrigeration business, to answer all inquiries and to furnish necessary data in the way of cost of installation and operation.

The company has given free renewals of standard lamps for many years to those of its customers who use electricity from its mains exclusively. Tantalum and tungsten lamps are sold to customers at less than market price, and this charge for both purchase and renewals is considerably lower than the figure which represents the difference between the cost of the standard carbon-filament lamp and the new lamp. Tantalum lamps have heretofore been sold and renewed at a cost of 30 cents. A reduction in price for both the installation and renewal of this type to 25 cents is now announced. The cost of the tungsten lamp, for both installation and renewal, is considerably higher than the tantalum lamp. Special prices for tungsten lamps are made to those who use electricity exclusively from the company's circuits, and customers are urged to take advantage of the economies placed at their disposal.

The company has advertised extensively through the newspapers, its company bulletin and by means of circulars, pamphlets, etc. It endeavors to be continually in the minds of the public and to persuade them that its product will meet their requirements.

Lighting Conditions at Atlantic City.

CHANGES WHICH HAVE BEEN MADE AT THIS SEASIDE RESORT SINCE THE LAST CONVENTION

THE name Atlantic City is so inseparably connected with the idea of a summer resort that few realize that this "City by the Sea" has a permanent population of over 40,000 inhabitants. During the summer season it is estimated that as many as 4,000,000 people promenade on the city's famous Boardwalk. The necessity for catering to the demands of this army of pleasure seekers has given rise to the permanent settlement which makes up the city; for little, if any, manufacturing is done. The city is primarily a health and pleasure resort, and to add to the pleasure of a holiday or to ease the burden of care is the study and aim of those upon whom the reputation of the city depends. During the past few years comprehensive and well-matured plans have been laid looking toward the general beautification of the city and



FIG. 1.—ARC POST AND STANDARD USED ON ATLANTIC AVENUE.

the elimination of the essentially flimsy and temporary features characteristic of summer resorts. Some of the schemes laid out have already been executed, such as the paving of the streets and the illumination of the city's principal thoroughfare, Atlantic Avenue.

Electricity for public and private uses is furnished by the Atlantic City Electric Company, whose station adjoins the tracks of the Pennsylvania Railroad Company. The building houses 1400 kw in direct-current machinery and 2690 kw in alternating-current apparatus. The direct-current apparatus comprises three Fort Wayne three-wire machines, one rated at 600 kw and driven by a Wetherill engine and the other two rated at 400 kw and driven by cross-compound Allis-Chalmers engines. There are nine 125-cycle, single-phase alternators of General Electric, Stanley and Westinghouse make feeding th alternating-current lines. The boiler equipment comprise 2820 hp in Edgemoor water-tube boilers fitted with Jone under-feed stokers; 1200 hp in double-deck return-tubular boi ers and 1400 hp in single-deck return-tubular boilers. Fee water is obtained from a driven well 850 ft. deep. The boiler fitted with stokers operate under forced draft, the equipmer being built by the American Blower Company. The fuel use is a mixture of bituminous and anthracite screenings, the pro portions used depending on load conditions. Ordinarily fou parts of anthracite screenings are used with one of bituminou The latter costs about $3.20 per ton, while the prices paid fo screenings are $1.50, $1.90 and $2, depending on the mines fro which they are received.

At present all the circuits are run overhead, but work wi soon be started on some underground work on Atlantic Aven and also on the Boardwalk. Four blocks of underground co duit will be laid on Atlantic Avenue and for 11 blocks the ci cuits now overhead on the Boardwalk will be transferred a fed from cables placed under the deck of the walk. All of th lamp circuits will be fed from four-wire, three-phase cable while the motor circuits will still be fed from the direct-curre mains. Atlantic City at present relies entirely upon surfa



FIG. 2.—PORTION OF THE BOARDWALK BY NIGHT.

drainage to carry off the rainfall, and inasmuch as the city built on sand, water is found not far from the surface. F this reason water-tight underground work is out of the qu tion and the company will use lead-covered cables and w install them under the presumption that they will genera be under water.

A new generating system will shortly be installed at Atlan City, but whether the station will be built somewhere else at the present site utilized has not yet been definitely det mined. At any rate, a 60-cycle, three-phase system will t the place of the present 125-cycle, single-phase system and p sibly exhaust-steam turbines will be used in conjunction w whatever type of prime mover will be installed. The compa has quite a steam-heating load; enough, in fact, to use all exhaust steam available. This heating season extends o eight months of the year. The plant operates non-condens and in summer when the lighting load is heaviest and the he ing load nil, the exhaust steam will be used to drive lo pressure turbines. During the heating season the low-press turbines will be cut out of service.

The connected load at present fed from the station is proximately 6100 kw, including 800 series arcs and 1974 kw motors. All the buildings being above ground—that is, with

sements, and most of them being residences—the day load is t very large, the average for the year being 600 kw. The se rate for lighting circuits is 16 cents per kw-hour, subject a discount, which is as high as 50 per cent, based on the nsumption and length of contract. The base rate applies ore particularly to those residences which are only open two



FIG. 3.—ATLANTIC AVENUE BY NIGHT, SHOWING TOWER OF CITY HALL.

three months during the summer. Large consumers of en- gy are given a special rate which is considerably lower than e rates quoted above. The heating mains extend for a total stance of seven miles. The two-pipe hot-water system is nployed and the rate is 20 cents per square foot of radiating rface.

The company has pushed the tungsten lamp energetically and is a great number connected both on flat rate and on meter sis. There are approximately 2500 tungsten lamps connected i a flat rate. The bulk of the lamps are rated at 100 watts id burn from one-half hour after sunset to midnight. The te for these is $2 per month each. The flat rate only ap- ies where the lamp is visible to the company's inspectors. patrol system is maintained on e tungsten flat-rate circuits so at undue advantage is not taken the company. The tungstens e sold for cost to those con- mers who burn them on me- red circuits.

Although the Boardwalk is ore widely known by visitors, e principal thoroughfare and e one most frequented by the sidents of Atlantic City is At- ntic Avenue. The general autification plan of the city lled for paving this street and so illuminating it with ornate c posts and standards. Un- rtunately this work was en usted to an architect, so that hile architecturally the po- d standards may leave little be desired, from an illuminat- g viewpoint they are very ults. Reference to Fig. 1 will ow wherein these lighting fixtures are lacking. The heavy on lyre in which the arc is placed casts a perceptible shadow d the ribs in the lantern also interfere with the distribution f the light from the incandescent lamps. There are 38 blocks n Atlantic Avenue illuminated by means of these fixtures, or ree miles of thoroughfare. Two arcs are placed at diagonal rners and three standards are placed on each side of the block and spaced 95 ft. apart. The posts are 30 ft. high to the pinnacle and the standards are 12 ft. 3¼ in. high from the sidewalk. Besides the arc at the top of the post there are 12 25-watt tungsten lamps in the lantern further down and eight 8-cp lamps in the street markers. The standards have six 25-watt tungsten lamps in the lantern. The posts are of cast iron, and the lanterns and street markers are of bronze. In all there are 77 arc posts and 201 standards and the cost erected was $44,000. The complete scheme of illumination on the avenue provides for an arc lamp at each corner, and the lantern being as high as the lanterns on the standards, festooned incandescent lamps will be strung along the avenue from lantern to lantern on special occasions. At present the lamp-posts and standards are fed from overhead wires. Two of the illustrations herewith show the appearance of these fixtures at night. The City Hall, on this avenue adjacent to the Pennsylvania Railroad station, has received a generous treatment of outline lighting and is clearly shown in one of the views.

The Boardwalk is at present lighted by arc lamps along the outer edge of the walk and by festoons of incandescent lamps. The walk is 60 ft. wide and four miles long, and besides the arc lamps at each street intersection, there are upward of 10,000 incandescent lamps in the festoons. A small stretch of the walk is shown in Fig. 2, and illustrates the general scheme of lighting which has already been described in detail in our columns. The lamps used are frosted and are rated at 4 cp with a 25-cp lamp in the center of the festoon. When the festoons were erected four summers ago it was only expected that they would be used for a few months, and being erected in a hurry no extra care looking toward permanency was taken. The scheme has weathered the storms of three years, however,



FIG. 1.—LOOKING DOWN ATLANTIC AVENUE, SHOWING ARCS AND STANDARDS.

which is surprising in view of the light construction. Actual use has shown that for cheapness and reliability the plan of lighting is without a peer.

The growth in size and elaborateness of the electric sign is nowhere so well shown as on the Boardwalk. Although aggressively conspicuous and always commercial, the signs do not mar, but rather add to the attractiveness of the walk. In the

April 1 issue several of these signs were illustrated and described. Since then a number of others have been erected by the Valentine Electric Sign Company and these are illustrated herewith. The sign load on the Boardwalk approximates 500 kw, and it is interesting to note that because of climatic conditions and the action of the salt water, it is neces-

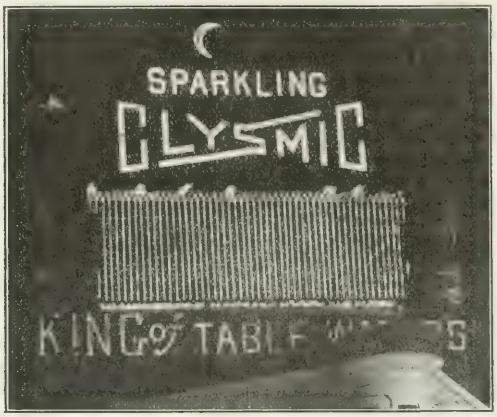


FIG. 5.—SIGN GIVING WATER FALL EFFECT

sary to rebuild the signs every two years. The sign shown in Fig. 5 is one of the largest at present erected and is intended to show a water-fall effect with surrounding scenery of rocks, trees, etc. The sign is 75 ft. long and 72 ft. high. The water-fall effect is worked over a space of 54 ft. wide and 23 ft. high and this section is operated by means of a gravity flasher of 36 points operating about 1700 lamps. The letters in the word "Clysmic" above the water-fall range from 8 ft. to 14 ft. in height and together with the words "sparkling" and "king of table waters" burn steadily. The trees are lighted by means of lamps set at irregular points and the color effect is produced by



FIG. 6.—SIGN WITH SKYROCKET EFFECT.

color caps. The rocks, etc., are lighted from reflectors. The entire sign contains about 2400 lamps ranging in rating from 2 cp to 32 cp and divided on approximately 75 circuits.

The sign shown in Fig. 6, while much smaller than the one described above, is located on the reverse side of it and is quite as attractive. A rocket effect shooting 50 ft. or more int the air breaks in a series of vari-colored stars and showers c light which pour down over the reading matter of the sig which reading matter appears as the shower disappears. Th sign is 18 ft. x 30 ft., and contains about 800 lamps operated b a combination flasher. Over 1000 lamps are in circuit on th sign shown in Fig. 7. The sign occupies a space 36 ft. x 36 f and the various parts flash successively, the border flashing co tinuously in such a way that it has the appearance of gradual shunting around from place to place. All the color effects ar produced by means of various tinted paints and color cap The lamps are all rated at 2 cp. The relative size of the sign can be estimated from the view of the Boardwalk; the sign the background faintly visible is 60 ft. x 90 ft. and is locate about a mile below the sign shown in the foreground.

Plans have been prepared for beautifying the Boardwalk the near future just so soon as more needed improvemen have been made elsewhere in the city. The scheme provides f widening the walk to 100 ft. and illuminating it by rows standards spaced 20 ft. from each side of the walk and 20 apart. At street intersections five ornate arc lamp posts w be placed, one at each corner and one in the center. Th standards will have clusters of incandescent lamps and festoo



FIG. 7.—FLASHER SIGN ON BOARDWALK.

of incandescent lamps will be looped from standard to standa

Projecting into the ocean from the Boardwalk are a numb of steel and concrete piers. All of these are outlined w lamps and the Million Dollar Pier, in particular, is brilliant and attractively lighted within. The latter pier is connected p the circuits of the Atlantic City Light Company and the co nected load during conventions is as high as 350 kw. The co pany has also made a contract to light the Steel Pier, the co nected load approximating 350 kw. Almost all of the lar hotels on the Boardwalk have isolated plants, the exhaust ste from which is used for baths and heating purposes. Bre down connections are had with the lighting company, howev

A feature of the lighting situation at Atlantic City is the v between the rival gas companies which has lasted for mon and has resulted in slashing of rates, free piping, free fixtur free mantles and in a number of cases free gas for a limi period. The new company, Consumers' Gas & Fuel Compa sells gas at 90 cents per 1000 cu. ft., and since October the ol company, the Atlantic City Gas & Water Company, is offer g gas with the inducements mentioned at 50 cents per 1000 cu. f This has in a measure reacted on the electric light compa since those consumers which have both gas and electricity u more gas and less electricity during the past winter because the extra heat obtained. The electric light company has, ho ever, not lost any customers, and what with new patrons m ages to keep its output up to normal.

Operating Features of Various Generating Systems.

ORGANIZATION OF OPERATING FORCES AND CONTROL OF APPARATUS IN EMERGENCIES.

IT is admitted that an efficient operating force is as essential to an electric light company as an economical generating station, and that a plant with mediocre equipment but excellent organization can give as good service, if not better, than a superior outfit operated by a less proficient staff. The larger the station, the greater the need for organization and system, and the more reliable must the service be. Continuity of service at all hazards has been the aim of every large company, and since all generating, controlling and distributing apparatus is vulnerable, it is interesting to note what elaborate precautions have been taken to protect the consumer from the effects of mishaps at the generating end of the system. The organization of the operating forces, their control under ordinary working conditions, their direction in emergencies and the manipulation of the apparatus in the stations are also matters of more than passing moment. For these and other reasons the accounts of operating conditions in large and small cities which follow should be of interest to operating engineers and managers, since they show what has been accomplished and may indicate what can be done along similar lines even in smaller plants.

Operation of the Boston Edison Company's L Street Station.

THE Edison Electric Illuminating Company, of Boston, operates the largest central-station plant and distribution system in New England. The company now supplies 31 cities and towns with electrical energy, serving an area of 466 sq. miles and a population of about 1,250,000. The point most remote from the main generating plant is Hopkinton, 43 miles southwest of the station. During the past five years the company's lines have been pushed farther and farther into the suburban and semi-rural districts of eastern Massachusetts, in accordance with a policy of eliminating the relatively inefficient stations of small capacity scattered throughout the different communities, generating practically the entire energy consumed or will shortly be, generated at the L Street station in South Boston. This is the largest power plant in New England, and it is the center of operating control for the system. The business district of the Boston direct-current district is at present mainly supplied from another power plant of the company, located on the Atlantic Avenue waterfront, in the midst of the business section of the city. Although this station is a plan of modern design, motor-generator sets have been installed at this point, which

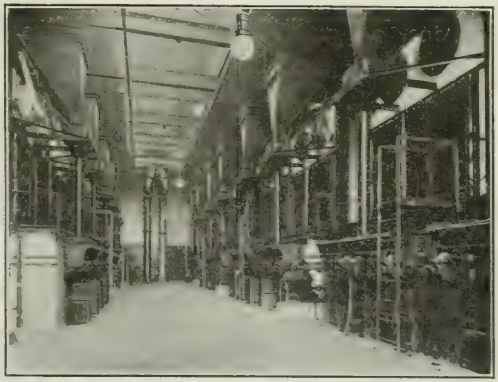


FIG. 2.—TYPICAL BOILER-ROOM AISLE.

will enable more or less of the direct-current load to be thrown upon the L Street station, leaving a considerable part of the Atlantic Avenue equipment available as reserve capacity. A large capacity in storage batteries is also available in Boston for emergency and general peak service.

The operating features of the L Street plant illustrate the care which the company takes to maintain absolutely reliable service without sacrifice of production efficiency. This station is located about two miles from the business center and is connected with the various distributing points on the system by inter-station transmission lines of both underground and overhead type, arranged to provide for continuous service under all anticipated conditions of operation. The outlying stations are

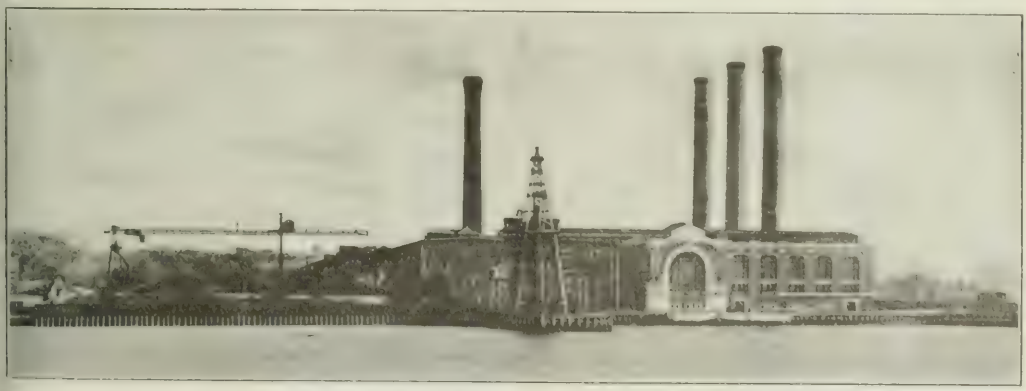


FIG. 1.—EXTERIOR VIEW OF L STREET STATION, COAL HOISTING PLANT IN FOREGROUND.

as a plant of the most modern design located on the waterside at Boston and distributing from the former steam stations of local companies as substations. Increased economy and reliability of service have been the natural result of the company's expansion.

The entire alternating current output of the company is now, supplied with three-phase, 6600-volt service, and the urban

alternating-current service is handled by 2300-volt, three-phase lines, a few of the nearer substations being temporarily supplied with 4600-volt service. A general diagram of the system is shown herewith, three-phase lines for supply and tie service being indicated for the sake of simplicity as single lines. In general, each substation is provided with an operating and an auxiliary bus, and has at least two different methods of connection with the generating station. A full description of the methods of handling the distribution system has been mentioned in a previous issue.

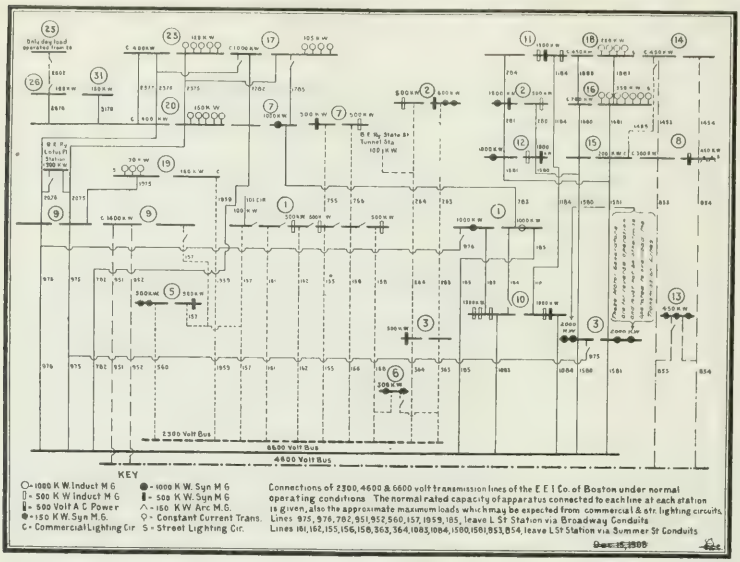


FIG. 3.—GENERAL DIAGRAM, BOSTON EDISON ALTERNATING-CURRENT SYSTEM.

The L Street plant consists essentially of two separate stations so far as the buildings and generating apparatus are concerned. The two divisions of the plant are officially designated at station 4-1 and station 4-2, but they are electrically connected through suitable transforming and switching apparatus to serve the alternating-current system in common. The two stations are of radically different types, representative of the state of the art of design at the periods of their respective construction. Station 4-1 at present contains 12 Babcock & Wilcox boilers rated at 550 hp each, operated at 160-lb. steam pressure, and supplying six 1500-kw, 2300-volt, three-phase, 60-cycle General Electric revolving field alternators direct driven by vertical cross-compound McIntosh & Seymour engines. The boilers in station 4-1 are equipped with Hawley down-draft furnaces, hand fired. Natural draft is provided by a brick chimney 225 ft. high and 11 ft. 6 in. inside diameter. City water is used for boiler supply in station 4-1, the feed-pump installation consisting of three 8-in. x 10-in. motor-driven Goulds triplex pumps. The pump speed is 32 r.p.m. and each unit has a capacity of 208 gal. per minute against 160-lb. boiler pressure. There are 12 National feed-water heaters in this station, each being of the vertical type, with 750 sq. ft. of heating surface. One heater per engine unit is arranged to take the exhaust steam and a second is piped to receive the air-pump exhaust. The feed-water in this station enters the boilers at about 190 deg. Fahr. Each engine is provided with a Blake vertical, twin-jet condenser and air pump. A 4500-ton coal bunker is installed above the boilers. In the engine-room of the 4-1 station are installed 40 Brush arc generators of 6.6 amp capacity direct-connected in pairs to 200-hp, 2300-volt, three-phase synchronous motors, for supplying the street-light-

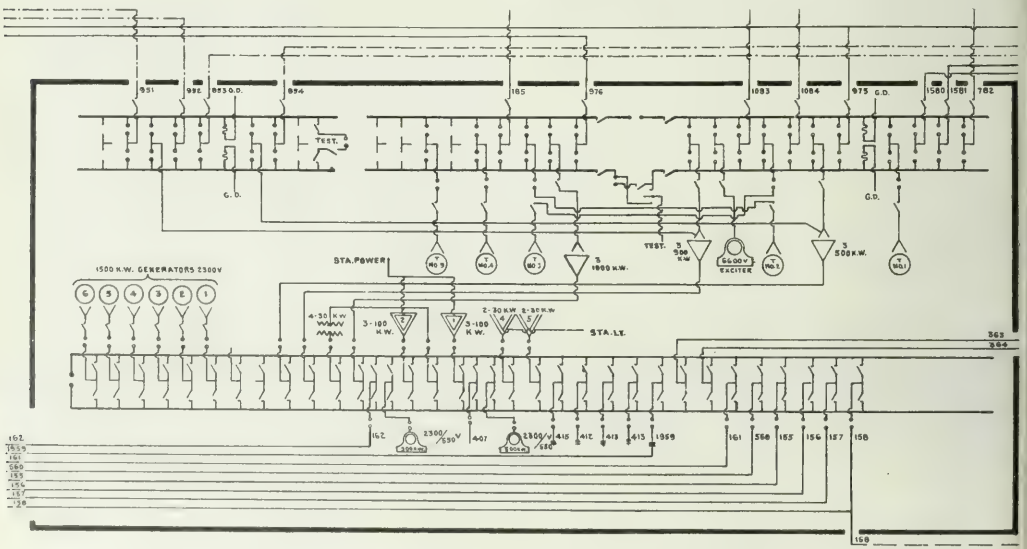


FIG. 4.—L STREET STATION BUSBAR, GENERATOR AND LINE CONNECTIONS.

ing service of the city of Boston. There are also installed on this floor one 150-kw and two 500-kw, 2200-volt to 550-volt motor-generator sets for supplying energy to motor-driven

station auxiliaries and to certain lines of the Boston Elevated Railway Company. The 75-kw motor-driven and one 50-kw, 125-volt engine-driven exciter sets are installed in the engine-room, these, in connection with a 150-kw motor-driven unit in the 4-2 station, furnishing the excitation for the entire L Street plant. In addition a storage battery of 1048-amp



FIG. 5.—BOSTON EDISON COAL FIELD AND BRIDGE, L STREET STATION.

capacity for one hour at 125 volts is installed in a separate building adjoining the station, and kept floating on the exciter bus at all times.

There are two switchboards in station 4-1, one on the engine-room floor and for the arc service, and the other on a gallery immediately above, devoted to the generators, exciters, motor-generators, transformers and 2300-volt service. These boards are of the panel type, equipped with manually operated apparatus in the main. The accompanying drawing (Fig. 4) shows the generator, transformer and busbar switching arrangements in both divisions of the L Street station.

Station 4-2 is at present undergoing a change in the size of its electrical generating machinery. At the December peak, in 1908, there were available four units of 5000-kw capacity each and one 8000-kw unit, all being Curtis-General Electric turbo-alternators. Two of the 5000-kw units are now being replaced by 8000-kw sets, so that by the fall of this year the electrical generating plant at L Street station 2 will consist of two 5000-kw and three 8000-kw turbines of three-phase, 60-cycle, 6900-volt design. The steam for these machines will be supplied by the present installation of boilers, which consists of 36 Babcock & Wilcox units of 512 hp each, set in five rows of batteries. Station 4-2 is built on the unit principle, with separate boiler



FIG. 6.—TURBINE PLANT, L STREET STATION.

batteries and auxiliaries for each turbine. The operating steam pressure is 175 lb., and the boilers are equipped with Roney stokers. The new turbines are five-stage machines. Each turbine is supplied with steam through a line which increases in size from 8 in. to 14 in. as it passes across the rows of boilers corresponding to the turbine. The different turbine steam lines are tied together by 10-in. connections, with appropriate valves to provide for emergency service in case of trouble on any steam line. These valves are electrically operated, controlling switch boxes being installed at convenient points in the boiler-room. The 8000-kw units have a continuous capacity of 12,000 kw each. The boilers are supplied with feed water by an installation of five Worthington 17-in. x 12-in. x 15-in. horizontal duplex pumps having a capacity of 308 gal. per minute each. The 8000-kw turbine at present installed has a feed pump of the same make, the size being 20 in. x 14 in. x 15 in.

In station 4-2 are installed four vertical feed-water heaters of National make, each having 1600 sq. ft. of heating surface. The feed water is raised to about 200 deg. Fahr. before it enters the boilers. Natural draft is relied upon as in the first division of the station, there being three Custodis brick stacks in service. Each is 250 ft. high and 16 ft. in inside diameter; there are no economizers in either section of the station. The turbines are operated at from 150 to 160 deg. Fahr. superheat. On account of the favorable showing made by the company's steam-turbine equipment, there exists to-day at L Street a considerable reserve boiler capacity, so that it will not be necessary to install additional boilers in connection with the turbine changes now in process. On the normal station peak a load of 1500 kw per 500-hp boiler is carried. At present all 12 boilers of station 4-1



FIG. 7.—OPERATING ROOM, L STREET STATION.

are operated on a single stack. Sixteen, 12 and 8 boilers are operated independently on the separate stacks of the second division of the L Street plant. No provision was made in the station design for operating on different stacks, a separated plan of working being considered better.

Each of the 5000-kw turbines is provided with a Worthington surface-condensing outfit, including a 10-in. x 24-in. x 18-in. steam-driven dry-air pump; a 4-in. centrifugal wet-vacuum pump of the two-stage pattern, direct driven at 1200 r.p.m. by a 10-hp motor in two instances and a 15-hp motor in the other cases; and a 28-in. centrifugal circulating pump having a capacity of 18,000 gal. per minute, driven by a Harrisburg engine. Each of the 5000-kw units has a steam-driven, water-cooled step-bearing pump operated at a pressure of about 1100 lb. per square inch, giving a bearing pressure of about 800 lb. per square inch. The circulation water for the 8000-kw turbine is handled by a 30-in. steam-driven volute centrifugal pump. This unit has a centrifugal wet-vacuum pump, turbine driven, a 12-in. x 30-in. x 18-in. dry-vacuum pump, steam driven, and a 12-in. x 3½-in. x 15-in. horizontal duplex step-bearing pump. At the present writing the active turbine equipment in this station consists of one 8000-kw unit and two 5000-kw sets, a fourth 5000-kw set being held solely in reserve on account of its having one less stage than the others, and consequently being less economical in operation.

The company burns New River coal, approximately 90,000 tons per year being consumed at the L Street station, and about 15,000 tons elsewhere. The fuel is brought to the plant

by water and stored in a coal field having a capacity of 70,000 tons on the station property. An elaborate motor-driven conveying system is in service, including traveling belts between the wharf tower and the field, a bridge crane of the cantilever type for field service, and conveying equipment connecting the field with the two divisions of the station. The capacity of the belt conveyor installation is 400 tons per hour. It is operated only in the daytime, in view of the large storage capacity above mentioned. Coal analyses are made by the company's department of standardization and tests, samples being taken from barge loads and from the boiler-rooms. Above each boiler in the turbine station is a pocket having a capacity of 44 tons. Coal used in the engine station boiler-room is recorded by checking car weights as fired, and that used in the turbine fire-room is weighed by hopper scales located above the stoker spouts. The total weight of coal used by each division of the line number; thus, line 1959 runs from L Street to substation 19, Milton, the actual line number being 59.

The operating organization of the plant at L Street has been worked out with great care, and it is the result of long experience in handling the system under normal and emergency conditions. In the operating chart (Fig. 8) are shown in skeleton form the relations of the different officers and station attendants. The generating department deals with the expense of operation and also the repairs and renewals of all steam and electrical machinery and apparatus, including storage batteries, necessary to deliver to the busbars and switchboards the output of the generating system; the necessary distribution from substations and incidental office work. The head of the department has headquarters at the main offices of the company on Boylston Street, Boston, and is responsible for the administration of the physical generating and distribution plant, paying special con-

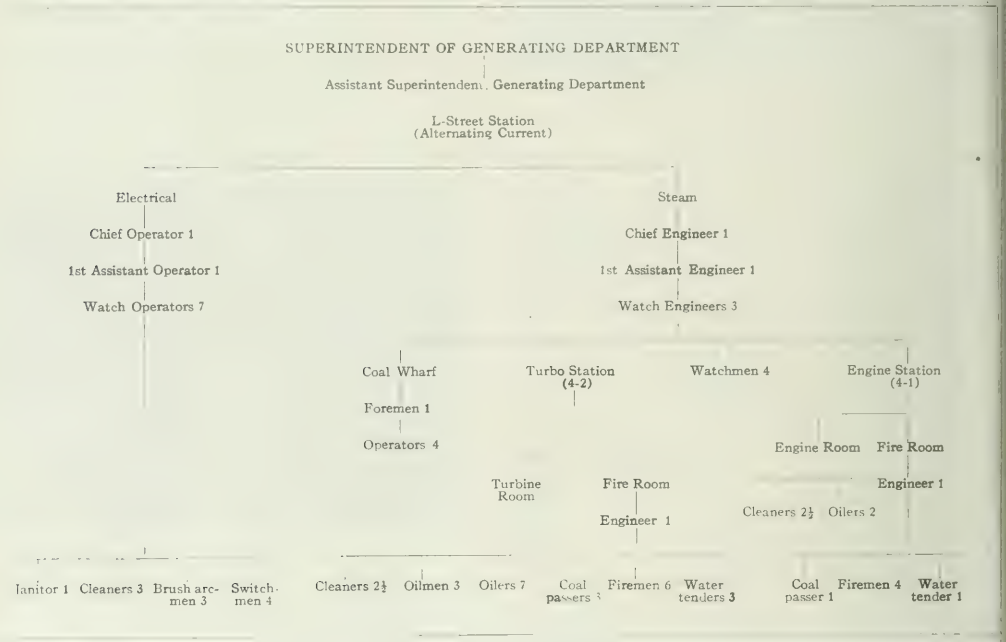


FIG. 8.—OPERATING CHART.

the plant is tabulated and sent to the office of the superintendent of generation daily, with other statistics to be outlined later.

The general scheme of wiring and busbar arrangement at the L Street plant is shown in the accompanying drawing. The switching apparatus of the turbine division of the station represents the latest type of remote-control equipment, a separate building being provided for all high-potential service. The operating center of the plant from the electrical point of view is a separate room between the turbine and the engine divisions of the station in which are concentrated the controlling and measuring apparatus in immediate connection with the turbine and transformer units, the possibilities in the way of connection being exceedingly flexible. In general, there are two sets of busbars, one for regular and the other for emergency operation. Each set is sectionalized horizontally, and any generator or feeder circuit can be thrown upon any busbar of the proper voltage, as well as any transmission circuit running from L Street to the company's substations. Provision is also made for tying corresponding sets of three-phase busbars together when necessary. In general, the scheme of transmission line numbering is such that the substation to which the line immediately connects can be seen in the first or first and second numerals of

sideration to reliability and economy of service in all their aspects. Reporting to the superintendent of generation is an assistant superintendent, whose duties are essentially executing the orders of his superior, watching the instrumental accuracy and condition; keeping in touch with the load and its variations and the possibilities of economical handling of it in the system, supervision of the general handling of apparatus, analysis of operating results, studies of irregularities in the system and technical investigations leading toward the improvement of conditions, studies of labor requirements, and general supervision of all conditions affecting the reliable and efficient maintenance of service.

The L Street station is in general divided into an electrical organization and a steam organization, as shown. In brief, the work of the electrical division is to maintain a uniform pressure at the feeder terminals throughout the entire system; to load all machinery under its charge properly and economically, and to be responsible to the department for the welfare of all electrical machinery, which must at all times be, so far as possible, ready for operation. All the repairs except minor ones, in this division, are done by outside parties. The electrical operation is in immediate charge of a chief operator of long experience with

the company, who is constantly in touch with the system at all hours of the day and night, thoroughly acquainted with practical station service and in harmony with the plans of the department head. The duties of the chief operator cover a wide executive range, with the fundamental requirements of continuous and economical production as the standard of reference. Among the matters which are constantly before the chief operator are the loads distributed between the different portions of the electrical plant, the condition of all electrical apparatus from hour to hour, anticipation of variations in the demand of the system upon the generating plant, general regulation of the system, manner in which subordinate employees are performing their duties, co-operation with the chief engineer of the steam division to give the latter so far as possible advance notice of the probable demand for units, and maintenance of satisfactory service and contentment among the electrical personnel. Interpretation of periodical or casual instrumental records and the adjustment of the equipment to meet expected conditions with safety and efficiency are also functions discharged by the chief operator in the administration of the installation.

The assistant to the chief operator is required to occupy the post of the latter when necessary, being a first-class understudy. He must be familiar with the electrical apparatus of the entire system, and circulate among the different installations in generating and distributing service, noting any irregularity in the operation of the machinery or in the men on the different watches, and to keep his superior in touch with such details as do not come under the immediate notice of the latter. In cases of emergency the assistant chief operator goes at once to the station and stands ready to assist if needed.

The watch operators are men who have come up the line, and who understand all the electrical combinations which can be made with machines, switches and lines throughout the system. The watch operator in each shift and division of the station is in immediate charge of the electrical control of his section of the plant, and under him are switchboard men and cleaners. At L Street the operation of the engine station requires a more extended electrical organization than is needed in the handling of the turbo-alternators. On a given shift the turbine plant is handled by one operator at the switchboard in the main operating-room, with the watch operator in charge, who covers the two divisions of the station. The switchboard and Brush arc men indicated in the chart are mainly occupied in the engine station. The cleaning force carries on its work through the electrical plant as directed by the watch operator in charge at the time.

The steam organization at L Street is in charge of a chief engineer, who, like the chief electrical operator, is constantly on demand and continually in touch with the conditions at the station. The chief engineer is responsible to the head of the generating department or his representative for the satisfactory and efficient operation of the steam plant. He is of necessity a first-class mechanic with a wide experience in steam-power plant service, possessed of good disciplinary powers, and alert to exercise a broad supervision over the handling of all the equipment in the plant from the coal wharf to the generators. Economy of operation and reliability of service form the groundwork of this official's duties. In the steam division of the plant the chief engineer's responsibilities correspond to a large extent with those of the electrical operating chief, the two working hand in hand all the time to produce the best results.

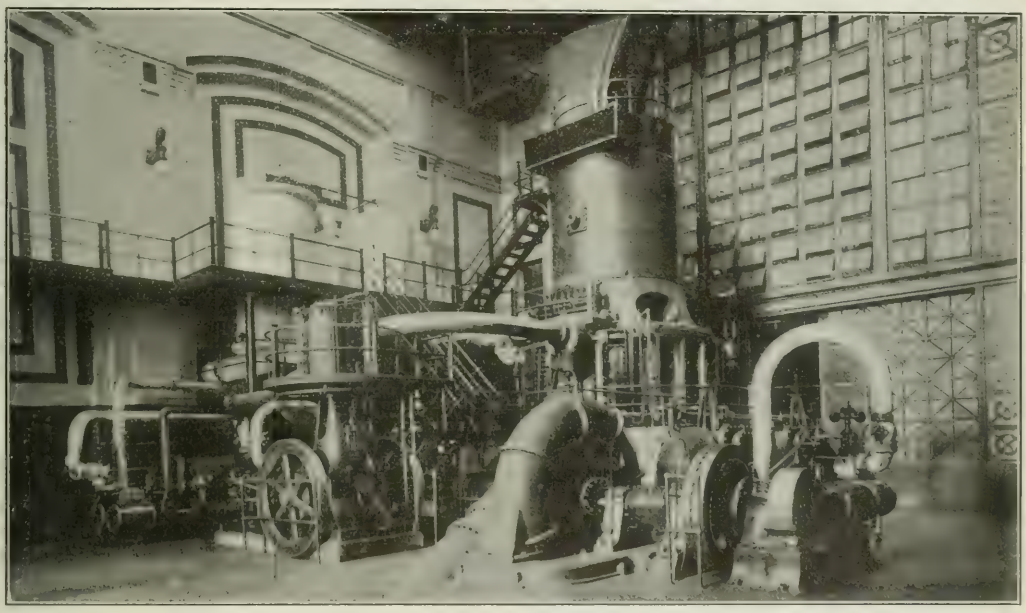


FIG. 9.—NEW 12,000 KW CURTIS TURBO-ALTERNATOR.

Reporting to the chief engineer is a first assistant engineer, corresponding to the assistant electrical operator. He is in immediate charge of the engine and turbine-rooms, and under him are the watch engineers, who, in the absence of the chief, have absolute control over every piece of steam apparatus from the ends of the crankshafts to the outer ends of the circulating water intake, including all labor incident to steam operation. The first assistant is primarily held responsible for economy of operation in both labor and material of the steam system. It is his duty to note and report to his chief any repairs needed, whether large or small, whether in the line of keying cranks or wrists, opening of cylinders, adjustment of pistons, packing leaky valves or glands, maintaining steam piping, supervising the water-line operation, the working of air and circulating pumps, [illegible] or engine oil and waste, the operation of the oiling and step-bearing systems, dry-air and wet-vacuum pumps, number of boilers and quality of coal in use. He is required to instruct all the men in his charge regarding the working of all steam appa-

ratus on the system, and to oversee the conditions under which overtime may be needed. The watch engineers are required to perform as nearly as possible the duties of the first assistant engineer, particular reference being made to the keeping of all apparatus in prompt repair.

The oilers are required to keep the motive power in operation after the machinery has been started, and to know that the lubrication of each machine in service is being properly performed. In case of any irregularity in the operation of an engine or turbine, the oiler is required to give immediate notice to the watch engineer in charge. He is also required to see that his machinery does not use too much lubricant and when a unit goes off the line to wipe and clean it ready for the next run. The cleaners are general utility men, with special duties as indicated by their classification. They are in evidence not only to keep the apparatus in such condition as will render it attractive to the eye and efficient in service, but to render such assistance as may be required in the work of the watch engineers and their subordinates.

The boiler-rooms are each in charge of an engineer whose immediate superior is the engineer in charge of the watch. The boiler-room engineer carries a first-class engineer's license and is familiar with the manner in which the load rises and falls. He makes a special point of keeping in touch with the watch engineer and endeavors to know as far ahead as possible what the demands upon the station are going to be. Under the boiler-room engineer in each division come the kinds of repairs which are executed in the fireroom, including boilers, headers, leads, valves, furnace brickwork, grates and all other items that are found in this part of the system.

The water tenders are in charge of the fireroom watches when the boiler-room engineers are off duty, are immediately responsible to the watch engineers, and have a quota of firemen under their charge, as well as all other men of the fireroom force. Among the principal duties of the water tenders are the watching of the boiler feed and regulating of the water supply so that with a heavy demand the station will not be caught with water too low, and then when absolutely obliged to put in water in larger quantities than usual, causing extra heavy firing and a reduction in the efficiency of the boiler plant, the observation of decreasing loads and adjustment of the water to correspond; the observation of the depth of the fires and anticipation of opportunities to bank, fire, light or clean; observation of steam leaks and reporting of necessary small repairs to the watch engineer.

The firemen are selected men of reliable temperament whose duties are to burn coal with care; who will use judgment in both firing and cleaning; observe the character of coal which comes through to the boiler-room and regulate the depth of stoker feed and the speed of the grate in accordance with the quality of fuel and the demand for steam with prompt action under instructions. The coal-passers look after the cleaning of the boiler-room in addition to the handling of the fuel.

The chief electrical operator and the chief engineer of the steam division each have a clerk to assist in miscellaneous and routine record work. The entire electrical and steam system is interconnected by a telephone service focused on a private branch exchange at L Street, which is equipped with lines to all substations and the general offices of the company. Three operators handle this service. The plant at L Street operates on three eight-hour shifts daily.

At the present time the engine station at L Street is used mainly as a stand-by plant and as long as it is economical to carry the load on the turbines and transform the energy necessary to supply the 2300-volt circuits of the company, the steam-engine installation is allowed to stand still. When for any reason it has been necessary to operate the engine station, these units are the first to be taken off the line as the load decreases. At present the temporary service supplied at 4600 volts is being taken through two banks of transformers, three units being of 500-kw rating and three of 900 kw. The two sections of the L Street station are tied together by three 1000-kw transformers wound for a conversion from 6900 volts to 2300 volts. The company is planning to increase its transmission potential on some of its outlying substation lines from 6900 volts to 13,800 volts during the summer in anticipation of future demands, and this work will be handled at L Street by two three-phase, air-cooled General Electric 5000-kw transformers.

The draft over the fires at L Street averages about ¼ in., a draft of ½ in. being secured at the peak load. The stacks in the turbine section give a draft of about 1½ in. The chimneys are equipped with automatic damper regulators, hand damper regulators being on the individual boilers. The hand dampers are set for the anticipated conditions of each watch at the beginning of the run. The chimney dampers are set in the turbine station to partly close at 178 lb. steam pressure. A carbon-dioxide recorder is in service in the boiler plant of the turbine station, the average percentage of CO_2 being about 13. The stokers in this division of the plant are operated by motors, provision being made for maintaining continuous service in case any single motor fails. The stoker adjustment for service is made by setting a nut for the throw desired. City water supplies the make-up for the boiler feed in the turbine plant. The ashes average from 9 per cent to 11 per cent by weight as taken from the pits. This work, with the weighing of the coal, is handled by the coal passers. The boiler tubes are blown off about every two days and the boilers daily. Coal is crushed to a size that could pass through a 2-in. ring in the fuel-handling and conveying installation. The turbines operate on from 28½-in. to 29-in. vacuum, with a 30-in. barometer. The daily coal consumption check is made on a 24-hour run beginning at 7 a. m. The lubrication of the turbine bearings is overseen by the steam division oiler on duty at each machine. Spare governor parts, valves and step blocks are kept in reserve for turbine use. The coal supply is protected by a hydrant system against fire. Engine, cylinder and dry-air pump oils are used in the plant. On each watch the condenser water going back to the boilers is tested for salt-water leakage by the usual nitrate of silver test. The station piping is not arranged according to any color scheme. No trouble is experienced from boiler scale, but compound is used as a precautionary measure. The turbine step bearings are water cooled. On account of the depth of the intake and discharge conduits no trouble has been experienced in the plant from ice. The temperature of the intake water varies on the average from about 30 deg. Fahr. in winter to 70 deg. in summer.

Hourly readings are taken and recorded in the steam division as follows: Time and state of individual boilers banked or steaming; feed-water temperature, and steam pressure. The times at which boilers are blown down and fires cleaned are recorded on the station log. In the turbine-room the steam pressure on each unit, the vacuum, feed-water temperature at each unit, and temperature of the condensed steam are taken and recorded hourly, together with circulating-water intake and discharge temperatures. The barometer is read three times a day. The time is also recorded for the turning over of each turbine unit started, the time of starting and the time when each machine was shut down.

Communication between the operating and turbine-room is effected by a Corey engine-telegraph installation giving the indications of ready, start, stop, turn, speed, trouble, stand-by, etc. Telephone connection is also available, and in addition the operator on duty in the electrical switchboard-room has a megaphone. Separate switchboards are provided for the station power and lighting circuits, and the latter are arranged so that in case of trouble on the alternating-machinery lines a transfer can at once be made to the exciter bus and battery, thus keeping lights in service in the more important parts of the turbine-, engine- and boiler-rooms. Each turbo unit is provided with a frequency indicator to assist the watch engineer in bringing the machine up to speed. All 2300-volt totality switchboard meters are given a regular monthly check by the standardizing and testing department. Meters on arc service are checked half-yearly. In addition many meters are checked on special order. Integrating meters are installed in the circuit of each generator, feeder and transmission line and the meters on generators are checked twice a month and quarterly on feeders.

The 40 arc generators and 20 synchronous motors in the engine station are operated by two men, who also look after three exciters. A third man per shift assists in the regulation of the voltage on the 2300-volt service of the company. The arc sets are inspected and cleaned thoroughly each day, air pressure at 75 lb. being used for blowing out such apparatus. One

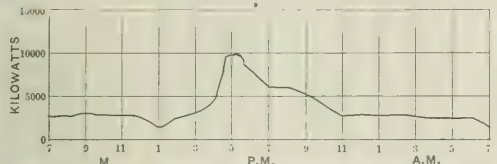


FIG. 10.—LOAD DIAGRAM, 4-1 ENGINE STATION, DEC. 22, 1908.

cleaner can look after 10 sets, and also perform minor duties. Each turbine in the 4-2 station is handled by an oiler under the supervision of the watch engineer. The turbine-unit electrical control is all handled from the electrical operating-room. In starting or stopping a turbine the watch engineer takes the throttle and co-operates with the electrical operator according to the signals received and sent. Ordinarily about eight minutes are allowed to bring a turbine up to speed ready for synchronizing, but in emergencies this can be done in less than a minute. Both the turbine and electrical rooms are equipped with synchroscopes. No regular attendance is required in the oil-switch-room, busroom or cable-room of the turbine station.

After a turbine has operated approximately 75 hours to 100 hours, the electrical parts are thoroughly inspected. Every four months the unit is taken apart and cleaned, blown out, inspected and varnished. With all possible care the accumulation of dirt in the narrow air-gap is frequently so considerable that many hours are required to remove it from the inner parts of the machine. The turbine brushes are inspected nightly, but Sundays are used for more general inspection in the station than any other days, on account of the lightness of the load. Installed in the armature laminations of each turbo-alternator is a recording thermometer of the Bristol type. The company endeavors to keep the armature temperature down to about 58 or 60 deg. C., a rise to 80 deg. being considered dangerous, with a room temperature of 25 deg. A power-factor indicator is connected with each unit in the electrical operating-room. Each turbine panel carries three alternating-current ammeters, one

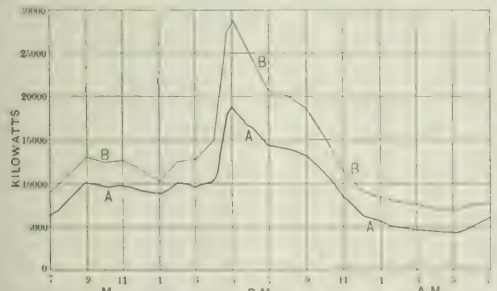


FIG. 11.—LOAD DIAGRAM, DEC. 22, 1908, 4-2 TURBINE STATION (A); TOTAL L STREET (B).

voltmeter, a field ammeter and kw-meter. The turbines are equipped with hydraulic governor valves, motor controlled. Arc sets are started through auto-transformers on half voltage, about 25 minutes being required to start up all 20 of the motor generators.

Each turbine is provided with a non-automatic reverse-current relay which shows a lamp signal at the switchboard panel in case of reversal of current. Automatic circuit-breakers are installed in the 2300-volt lines and set for three times normal full-load current. Time-limit relays are installed in the transmission and 4600-volt circuits. Arc circuits are tested three times daily for low voltage, and a galvanometer insulation test is made six times a week. Inter-station lines are tested for insulation semi-annually.

Daily station reports are sent to the generating department office showing the number of men on and off duty during the 24 hours, extra men employed and the reasons, time of starting and shutting down city arc lines, feeders out of circuit, dynamos not ready to run, repairs made, and unusual happenings. Recording wattmeter readings are sent to the office daily in two field books which alternate between the office and the station. Records are also made showing the readings of indicating wattmeters on all generators, feeder, auxiliary and transformer circuits by shifts, per hour, with the turbine loads and power factors. Systematic use is made of synchronous apparatus in order to keep up the power factor, which averages from 89 to 90 per cent. A daily record card is sent to the office signed by the chief engineer and the chief electrical operator, showing the coal consumption, engines running, water used, kw-hours generated and assigned to the different services, boilers and engines not ready for service.

The climax of the station year is the December peak, which is shown for 1908 in Fig. 10 for the engine station 4-1 at L Street; Fig. 11, the turbine station 4-2, and the two combined. The maximum load on the L Street plant was about 28,000 kw at 5 p. m., Dec. 23, 1908, the total load on the Atlantic Avenue station and batteries bringing the maximum output at this time to about 35,000 kw. The division of the load between the two sections of the L Street plant shows that the bulk of the energy was generated by the turbine station. There were nine engines and turbo-generators in operation at 5 p. m. The curve shows the time in which each machine was cut in and out of service in relation to the load. The minimum number of machines in service was three. The rating of each engine unit was 1500 kw. Turbines 3 and 4 are 5000-kw units and turbine 5 is an 8000-kw outfit. The normal rating of the generating units in service at 5 p. m. was 31,000 kw, figuring the largest turbine at its guaranteed continuous capacity of 12,000 kw. The number of boilers operated under steam in the maximum hour was nine, with one banked in station 4-1: in station 4-2, 12 boilers were steaming and none was banked at the time of the peak. The number of 24-hour men required to handle the station in December, 1908, was 91.

Practical Operation of Fisk Street and Quarry Street Stations in Chicago.

As is shown by the load curves accompanying this article, by far the greater part of the electrical energy generated by the Commonwealth Edison Company, of Chicago, is produced at the Fisk Street and Quarry Street power stations, both of which have been described at length in previous issues. An exhaustive account has also appeared in this journal relating to the operating practice of the company, applying more particularly to the outside transmission and distribution. But the actual operating conditions under which the stations are made to do their work day by day still remain to be described, and it is the purpose of the present article to give in outline an idea of this very important feature of the company's work.

The Fisk Street generating station is placed on the South Branch of the Chicago River, near the corner of West Twenty-second Street and Fisk Street. Just across the river is the newer Quarry Street plant. There are 10 9000-volt, three-phase, 25-cycle turbo-generators in the Fisk Street station, having a total maximum rating of about 120,000 kw. In the Quarry Street station there are three generating units of similar type, but rated at 14,000 kw each. Thus the rating of the two stations is about 162,000 kw. In addition, the company generates both direct current and 25-cycle alternating current at the old Harrison Street station and has still other generating stations in reserve, in addition to numerous storage batteries connected to the system. As will be noted by the curves, the peaks of the load are taken by the Fisk Street station, the newer and even

more economical Quarry Street plant being operated at practically steady load to attain its greatest efficiency.

Both the Fisk Street and the Quarry Street stations are operated under the supervision of one chief engineer, who reports to the chief operating engineer at the downtown office at 139 Adams Street. Each station has its own independent opera-

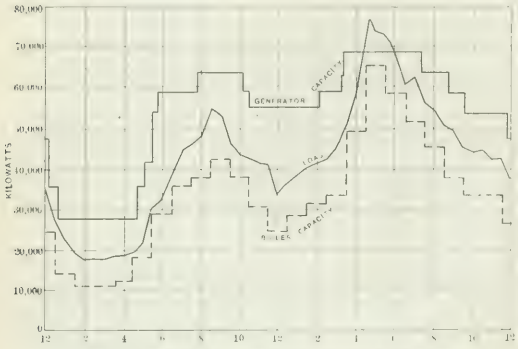


FIG. 1.—GENERATOR, BOILER AND LOAD CURVES

tion staff, however, under the direction of assistant chief engineers for each station. There is a chief electrician and an assistant to chief engineer to assist in the operation of the two stations, the former being responsible for the electrical end and the latter for the steam end of the plant. Operating organization charts for the two stations are given herewith. The two plants are connected by a ferry on the river, and, of course, by telephone. They are also electrically connected by two tie lines, each cable being capable of transmitting at least 12,000 kw.

The stations form independent generating plants, so that a breakdown in one would not affect the other, yet are near enough together so that they enjoy the economy and convenience of combined operation. The assistant chief engineer for each station is held responsible for his own plant, reporting to the chief engineer, whose office is in the switchhouse at Fisk Street. The assistant chiefs have their offices in their respective plants. About 400 men are needed to operate the two stations,

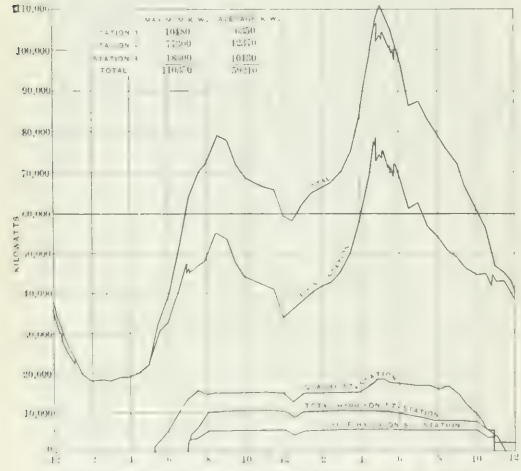


FIG. 2.—LOAD DIAGRAM. TOTAL OUTPUT DEC. 8, 1908

and they are divided into three eight-hour shifts. Fisk Street is operated continuously, never having a load of less than 15,000 kw, but Quarry Street is shut down from midnight to 5 a. m. By far the greater force of men is employed at Fisk Street owing to its larger size, 24-hour operation and the fact that all repair work and auxiliary operation, such as welfare work, are centered at this plant. What follows descriptive of the operating practice of the two stations will therefore be considered to refer to Fisk Street unless Quarry Street is specifically mentioned.

OPERATING ROUTINE.

As stated before, there are three watches. Ordinarily these are from 7 a. m. to 3 p. m., from 3 p. m. to 11 p. m., and from 11 p. m. to 7 a. m. These are the hours of the watch engineers and of the majority of the men, but broken watches are also arranged for a portion of the men so that there are men on duty with overlapping hours and the arrangement is such that the greater part of the force is on duty at the hours of peak load.

During each watch there is on duty one watch engineer, and at Fisk Street a first and second assistant watch engineer. The watch engineer has a responsible position. He has charge of the operation of all steam-driven machinery, and is responsible for all machines available for carrying the load of the station. He keeps himself informed concerning the load condition and confers with the boiler-room engineer about the possible and probable operating and load conditions. He must know at all times the boiler capacity immediately ready for service. He keeps in touch with the switchboard operator and load dis-

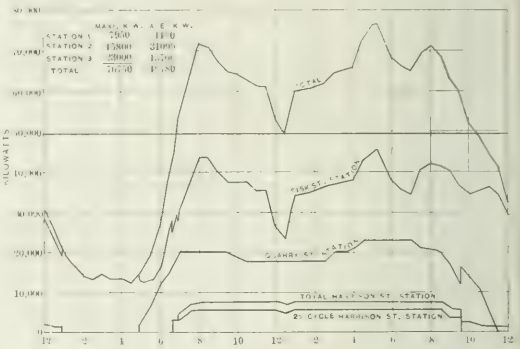


FIG. 3.—LOAD DIAGRAM. TOTAL OUTPUT APRIL 27, 1909.

patcher. The load dispatcher, by the way, has his office in the downtown headquarters of the company. With his assistants the load dispatcher directs the opening and closing of all switches throughout the entire system, including generating stations, substations and storage batteries.

In the absence of the chief engineer or his assistants the watch engineers at Fisk and Quarry streets have charge of the stations. A log is kept of the operation of the station, and on reporting for duty the watch engineer examines the entries of the two previous watches in the log to ascertain the exact condition of the apparatus given into his charge. He signs his name in the presence of the preceding watch engineer to signify his understanding of the conditions entered in the log, and thereupon relieves the preceding watch engineer. During his watch, in turn, he enters in the log all proceedings of operation or changes affecting the apparatus in his charge. In case of serious accident, the watch engineer must immediately notify the chief engineer, his assistant and the load dispatcher. The first assistant watch engineer gives all his time to assisting the watch engineer, but the second assistant does some operating and repair work, but is available for general supervision in emergency.

At this time of the year the morning load begins to pick up sharply before 5 a. m. and rises steadily to about 8 a. m., when the morning peak on the system is experienced. This is due to the fact that the company supplies so great a proportion of its output to railway companies. The fact that people all go downtown about the same time makes the morning demand heavy. In the winter the evening peak, coming on late in the after-

noon, is much heavier than the morning peak owing to the heavy lighting load.

There are two operating switchboard galleries at Fisk Street, and from these are displayed placards to show the load on each of the generating units in operation. These figures are changed by the switchboard operator from time to time, as

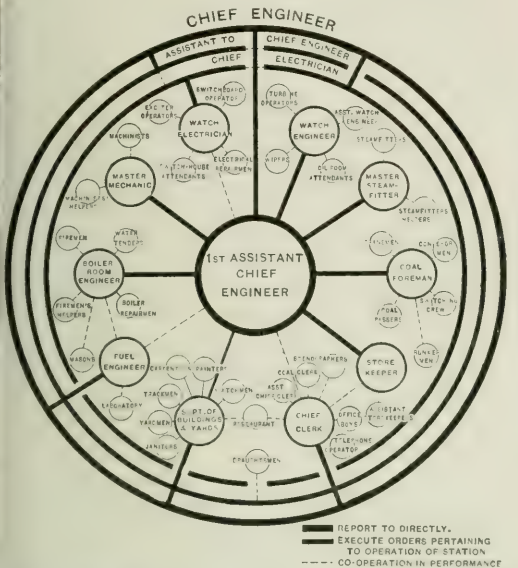


FIG. 4.—OPERATING ORGANIZATION CHART FOR FISK STREET STATION.

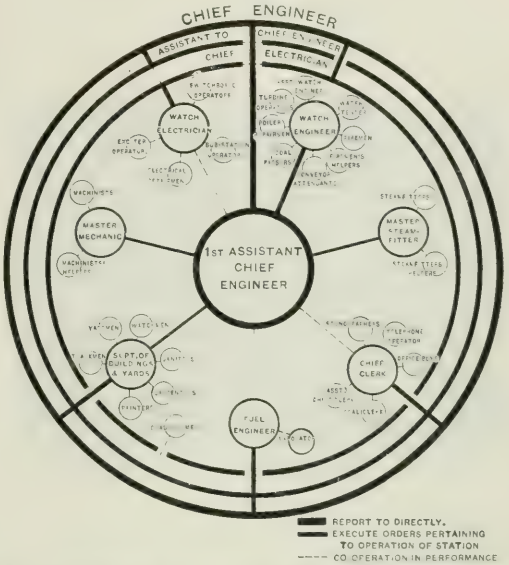


FIG. 5.—OPERATING ORGANIZATION CHART FOR QUARRY STREET STATION.

the load varies on the units, and the watch engineer and his assistants watch them closely. As the figures increase toward the maximum rating of the machine, the watch engineer causes other boilers and generators to be started up before the maximum capacity of the machines already in use is reached. In addition, the watch engineer keeps a careful outlook on the weather. If he sees a storm coming up which will mean darkness and a consequent sudden rush for light, he must be prepared for this demand with both steam and electrical units, first notifying the load dispatcher. Within 15 minutes the watch engineer without special preparation can have one unit, consisting of the turbo-generator and the eight boilers that go with it (in the case of Fisk Street), ready for service.

The switchboard operator also watches the load very carefully, and if it comes up rapidly he notifies the watch engineer. The busbars in Fisk Street are sectionalized, and not more than 50,000 kw is permitted on one set of buses. As a rule, the watch engineer or one of his assistants stands by while each new unit is being started. A signal system between the operating switchboard galleries and the floor of the station is provided. When a machine is ready to be thrown in, the turbine operator blows a whistle, which notifies the switchboard operator that the machine is ready to be synchronized and put on the system. As soon as the switchboard operator hears this signal he synchronizes the machine and closes the main switch connecting it to the busbars, giving a signal to the watch engineer that the machine is on the system. At the same time he notifies the load dispatcher. Similarly, when machines are cut out, a corresponding routine is observed.

One turbine operator is provided for each unit for each shift. He is responsible for the efficient operation of the turbo-generator and its auxiliaries to which he is assigned. He looks out for the lubrication and sees that the highest possible vacuum is maintained in the condenser. He watches to see that the various gages indicate normal conditions, and as often as necessary he inspects the governor, top and middle bearings, valve mechanism and all oil lines to and from the turbine. He keeps a close watch on the temperature of all return oil from bearings at step, and he at once investigates any abnormal rise in temperature or any interruption of flow, at the same time reporting the fact to the watch engineer. His assistant helps him generally in the performance of these duties and specifically is charged with the duty of keeping the unit in a neat and clean condition.

Neither the turbine operator nor the assistant is permitted to leave his unit except to call for assistance without the permission of the watch engineer or his assistant. In case of accident the turbine operator must station himself at the throttle and the assistant on the floor between the Corliss and feed pumps ready to execute orders from the watch engineer or his assistant. Twenty-one turbine operators are required for the Fisk Street station, the arrangement of watches being such, of course, that the greatest number is on duty at times of peak load.



FIG. 6.—COAL STORAGE FOR FISK AND QUARRY STREET STATIONS.

When all the units in Fisk Street station are in operation 250 gal. of oil a minute, or 15,000 gal. an hour, are needed for the film of the step bearings on which the revolving parts of these great machines turn and also for lubrication. There are three oil rooms for oil wells, pumps, filters and the like, and

each of these has an oil-room attendant during the busy hours. At night one oil-room attendant looks after the three rooms. At Quarry Street the oiling arrangement is quite different. Here the oiling system is a part of the generating units, and the turbine operator looks after it.

BOILER-ROOM PRACTICE.

All steam-generating apparatus, including steam piping in the boiler-room, coal- and ash-handling machinery and also the shifting steam locomotive in the yards, is in charge of the boiler-room engineer. This man reports direct to the assistant



FIG. 7.—ONE OF THE BOILER-ROOM BAYS, FISK STREET STATION.

chief engineer for his station, and he is held responsible for the maintenance, operation and the efficiency of the men in the boiler-room. He sees that the boilers are kept in first-class condition, and he hires and discharges the men in the boiler-room. The watch engineer directs which boilers shall be put into service and which shall be kept in reserve with fires banked in anticipation of coming load. In general, the watch engineer directs the use of the boilers, but the boiler-room engineer must see that plenty of boilers are ready for service at all times. He has at Fisk Street 80 boilers in his charge. His hours are from 8 a. m. to 5 p. m. He notifies the watch engineer in writing of the probable time when boilers down for repairs will be available for service. He keeps a daily record on the "boiler-room report" of all the work in progress or completed. He also keeps a daily "fuel report," showing all coal consumed daily for each unit and the amount of coal in storage each morning. He also directs the work of the masons engaged in making furnace repairs.

For each 16 boilers one water tender is provided. The firemen and firemen's helpers report to the water tender. The water tender sees that the boilers are properly fired and reports to the boiler-room engineer. It is to the water tender that the watch engineer gives orders when to put boilers into service and when to cut them out. The water tender maintains normal water level in his boilers and must see that they are fired in such a manner as to produce the most economical results. He must see that the safety valves are tested once a week and is responsible to the boiler-room engineer for the efficient operation of the steam-generating apparatus to which he is assigned. He must be prepared to take care of any emergency or sudden change of load. When the boiler-room engineer is not on duty he reports direct to the watch engineer.

OPERATION OF ELECTRICAL APPARATUS.

As before stated, there is a chief electrician, who reports directly to the chief engineer, supervising the electrical operation of both stations. Reporting to him is a watch electrician for each watch, who is responsible for handling all electrical apparatus in the generating-room and switch house. He does all dangerous work in making electrical connections or any testing; in fact, he is responsible for the operation and maintenance of the entire electrical equipment of his station. He makes daily inspections of the electrical equipment, including ground tests on all of the exciters and exciter buses. He also makes insulation tests on the fields of all generators not in service and such other tests on lines and apparatus as may be assigned to him by the chief electrician or the load dispatcher.

In the absence of the chief electrician, the watch electrician on duty assumes full charge of the electrical department. Like the watch engineer, he carefully examines the entries of the two previous watches in the switchboard and exciter system logs on reporting for duty. Similarly, he enters all proceedings of operation in the proper logs during his watch. It is a part of his duty to instruct his subordinates in the safest and most efficient methods of performing their various duties. He notifies the chief electrician in case of trouble and in case of serious accident the chief engineer and the load dispatcher also.

A switchboard operator and an assistant are on duty at each operating switchboard gallery during each watch. The switchboard operators rank next to the watch electrician, and do all the switchboard operating. They open and close all switches on the switchboard and put the generators on or off the system, working directly under the supervision of the load dispatcher at headquarters and in conjunction with the watch engineer. In case of any trouble the matter is reported to the watch electrician, who straightens things out. Should an emergency require prompt action, however, the operator may use his own judgment and act without orders except in closing line switches, replacing clips and separating the busbar system, but when time will permit such operations are performed upon order only, after due notice to the load dispatcher, watch engineer and the exciter operator.

It is the duty of the switchboard operator to keep informed of general operating conditions, and he advises his superiors of any unusual conditions. In case of serious trouble the switchboard operator devotes his attention to the operation of his station,

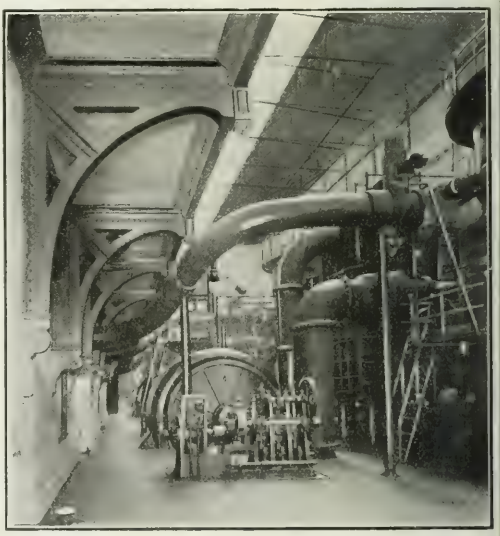


FIG. 8.—VIEW ON FLOOR OF TURBINE-ROOM, FISK STREET STATION.

while his assistant keeps the load dispatcher posted on the nature of the trouble and general operating conditions. The chief electrician and the watch electricians are the only men in the station authorized to place and remove high-potential transformer fuses, close and open disconnective switches and place and remove ground connectors, but in emergency the switchboard operator may send a man to perform these duties, but the man so sent shall call the load dispatcher and receive his order direct before performing any operation of this kind. The switchboard operator keeps a log of all operations.

Exciter operators are responsible for that part of the exciter system to which they are assigned. They also look after the supply of electricity for the motors, signal lights connected to the auxiliary bus, electrically operated valves on the turbines, and relay and operating supply for the switchboards and operating galleries. The exciter operator keeps sufficient exciters in service to maintain normal field excitation without overloading the exciters or discharging the batteries. He also charges the excitation batteries according to instructions from the chief electrician, and it is his duty to keep in touch with the switchboard operator and the watch engineer regarding changes in load distribution. He keeps a log and also, on forms provided, a record of the excitation.

At Fisk Street the oil switches and the principal switching apparatus are in a separate switch house. The rooms in this switch house are in charge of switch-house attendants, who operate the recording integrating wattmeters according to instructions and also keep a record of the loads on the various generators, exciters and lines. These men keep a close watch on all signal lamps to insure a supply of electricity to the relays in the oil-switch control circuits. They immediately notify the load dispatcher of any overloaded line. In case of any irregularity in the operation of the oil switches, the switch-house attendant notifies the load dispatcher and the watch electrician. He examines the locks on generator switches, tie switches and line switches to see that they are properly set before attempting to operate the switches. In his log he keeps a record of the time of the opening and closing of all switches and of other proceedings in the switchroom to which he is assigned. He also enters all work in progress on electrical equipment in the



FIG. 9.—VIEW IN TURBINE ROOM, FISK STREET STATION.

switch house, all checking of meters, all electrical tests made from the switch house and a record of all apparatus out of service.

FUEL INSPECTION, REPAIRS AND OTHER FEATURES OF OPERATION.

An important functionary in the operation of the two stations is the fuel engineer. He makes tests of boilers and tests of different kinds of coal, determining the relative heat values of the latter. He advises the chief engineer as to what coals give the best results and whether the furnaces and boilers are in good condition. He makes a scientific analysis of the fuel and points out how to get the best results from it. As 75 per cent of the operating expenses in these stations is due to the money spent for coal, it is very important to keep a close watch on the fuel end. The fuel engineer also makes tests of ashes taken away to see that there is no waste by unburned coal, showing whether the furnaces are in good shape and whether the firemen are doing their duty. He has the supervision of laboratory assistants for fuel analysis, and the coal buyer at the downtown office is guided by his reports and tests.

The coal foreman reports to the assistant chief engineer at



FIG. 10.—SWITCH HOUSE, FISK STREET STATION.

Fisk Street. He has charge of the handling of coal in the yards and sees that plenty of coal is kept in the bunkers and that all refuse is removed from the station. The coal passers, conveyor men, yard masters, switching locomotive crew, etc., report to him.

Renewals and repairs to machinery are made in a repair shop, which is in charge of a master mechanic. When anything is broken the trouble is reported to the master mechanic, and he takes charge of all overhauling, the watch engineer turning the matter over to him. The machine shop is in the Fisk Street building, and here the master mechanic, with a force of machinists and assistants, does the repair work for both stations.

The master steam fitter has a pipe shop and a force of pipe fitters. He takes care of all piping in both stations, and has a force of steam fitters and laborers to assist him.

There is a superintendent of buildings and grounds, and under him are the painters, carpenters, janitors, tinsmiths, track foreman and track crew. The last named have to do with the railroad tracks in the yards, of which there are five or six miles, one steam locomotive being used for switching. The building superintendent keeps up the buildings, grounds and tracks and sees that everything is kept neat and tidy.

All supplies, both steam and electrical, are kept in a storeroom, which is in charge of a storekeeper. When supplies are needed application is made to the storekeeper and the person applying must have written requisitions signed by persons authorized to do so, such as the watch engineer, boiler-room engineer, master mechanic and others.

In such a large organization there is a considerable force of office help needed. A branch telephone exchange is maintained in the office, which is located in the switch house, and there is a chief clerk, who has charge of the entire office force. The fuel clerk makes daily reports to the chief clerk of all fuel burned and of number of cars of coal coming in and cars of rubbish shipped out.

One feature of the welfare work of the Commonwealth Edison Company is a large restaurant for employees which is maintained in the switch house at Fisk Street for the benefit of the staffs at the two stations. Meals are furnished at all hours at a fixed price which averages about two-thirds of the actual

cost, the company defraying the remainder. Ordinarily the restaurant is open from 6:30 to 8 p. m., but in case of any unusual happening it is kept open at night. A competent woman is in charge and she reports to the superintendent of buildings. At this restaurant as many as 185 of the Edison people have been fed at one time.

Watchmen are on duty to guard the main entrances to the property, and they admit only such persons as have proper authority to enter, it being necessary for visitors to obtain passes from the downtown office. The watchman sees that all employees register on their cards on entering and leaving and also records the number and time of all cars entering and leaving the yard. During the daytime two watchmen are on duty, one guarding the entrance, while the other patrols the property, keeping a careful lookout for fire or any other unusual occurrence. The patrolman records his progress by means of watch boxes provided for that purpose. He notifies the watch engineer in case of trouble, and in case of fire turns in an alarm.

FIRE PROTECTION.

Both stations have elaborate systems of fire protection. The watch engineer on duty is also the fire marshal, and certain men who can best be spared from their ordinary duties are assigned for fire-service duty, organized into three companies, each with its own captain. Some of these men are pump men, some pipe men, some nozzle men, etc. An ample supply of fire-fighting apparatus is kept on hand, and it is the duty of the superintendent of buildings to inspect this paraphernalia from time to time.

The property on each side of the river is divided into fire districts, there being six of these districts at Fisk Street and six at Quarry Street. Within these districts are placed 38 fire-alarm boxes. When a box is "pulled" a fire whistle on the station indicates the number of the district by the number of blasts. On hearing the alarm the captain of each company runs to the fire-pump room where he notes the location of the box on the fire-alarm register. While the captain is ascertaining the location of the fire, his men are getting out the apparatus, and by the time he is back with the information to the fire station the company is ready to proceed to fight the fire. There are 15 fire-alarm boxes on the Quarry Street property and 23 on the Fisk Street side.

Operating Features of the New York Edison System.

THE system of the New York Edison Company comprises two main generating stations known as Waterside No. 1 and Waterside No. 2, and 23 substations; together with extensive underground distribution circuits. One substation has 8000 kw in steam-driven generating machinery for emergency use; another has 900 kw of generating machinery, while a third is equipped with 1700 kw of steam-driven apparatus which is held in reserve for winter peak conditions. All of the substations are equipped with storage batteries and by fall there will be storage batteries available on the system having an output of approximately 100,000 amp at a three-hour rate of discharge.

The huge stations on First Avenue, Thirty-eighth, Thirty-ninth, Fortieth Streets and the East River have already been described in detail in our columns; the newer station, Waterside No. 2, having been described at some length in our issues of March 4, 11 and 25 and April 8 this year. Many of the operating features connected with the system were incorporated in these articles and had space permitted much more could have been written. The system has never been completely shut down since since it was established and regularly operated as a commercial proposition, or in a period of over 25 years, and such an exceptional record could not have been secured without good organization and without in some measure anticipating what might happen and then guarding against it.

There are between 700 and 800 men employed in the operation of both Waterside stations. These are located on adjacent blocks and in practice are operated as a single station; there being heavy ties between the high-tension buses and interconnected steam and water mains, so that from a mechanical as well as an electrical viewpoint the stations may be considered as one. Moreover, the underground network is very solidly connected, adding greatly to the rigidity of the system. The substations feed into the network at such points as will give them their share of the load, and by having three bus voltages and by transferring the feeders from one to the other as charging conditions of load require, a uniform pressure is maintained on the system. On the first of the year there were connected to the system 3,480,719 incandescent lamps, 32,516 arc lamps, 1106 vapor arc lamps, 1103 kw in heating apparatus, 4430 kw in storage batteries and 205,373 hp in electric motors. The maximum load carried by the station on Dec. 22, 1908, was 135,000 kw.

The operating force is under the direct supervision of the electrical superintendent of the station and his assistant, who report to the associate general manager and the chief engineer at the company's main office on Duane Street. The distribution of all energy from the station is controlled by the system operator, whose station is on the switchboard gallery in Waterside No. 1. The general operating force works in three shifts. Ordinarily these are from 11 p. m. to 7 a. m., from 7 a. m. to 3 p. m. and from 3 p. m. to 11 p. m. There are two other shifts from 1 a. m. to 9 a. m. and from 2 p. m. to 10 p. m. which cover peak load periods.

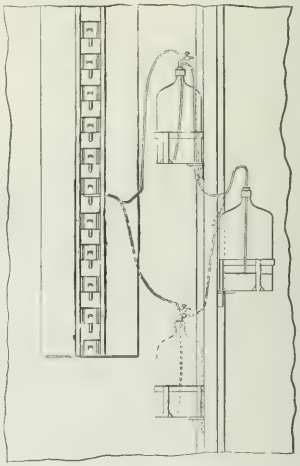


FIG. 1.—CONTINUOUS GAS-SAMPLING APPARATUS.

The boiler-room engineer is responsible to the chief engineer of the system, who instructs him as to repairs and directs which boilers shall be kept in reserve, which put out of service, and who also sees to general operating conditions. The system operator by means of an illuminated sign signals the boiler-room engineer how many boilers are required under steam, and this signal must be acknowledged immediately by the engineer. One chief and three assistants are allotted to a watch in each station, under whom are four water-tenders and the necessary firemen. In Waterside No. 2 the boilers fitted with stokers are kept under load at all times, together with the necessary number of hand-fired boilers. The firemen have nothing to do but fire and the fires are changed every five hours. The boilers are fitted with shaking grates and the live coal is pulled forward while the rest is dumped into the ash pits. The cleaning periods are timed to come just before peak loads.

Each boiler is equipped with a continuous gas sampling apparatus and from this is taken an average sample every six hours which is analyzed by Orsat apparatus. Records are posted in the firerooms and from these a check is obtained on each fireman. For this purpose gases are sampled in the middle of the first pass of the boilers. Check samples are also taken period-

ically from the flues so as to obtain a record on boiler settings, leakages, etc. The double bottle arrangement used in sampling the gas is shown in Fig. 1. The bottles hold 5 gal. of water each, and one bottle siphons water out of the other. The firemen are changed about from time to time, so that one man does not always work near the window and another in a hotter part of the room near the partition wall.

All the fuel used is subject to test. The company has a well-equipped laboratory under the direction of competent chemists, who analyze every boat load of coal, making proximate analyses for daily records and ultimate analyses for records of special coal supply; using for daily records the calculated heat value of the fuel, with periodic calorimeter tests from average samples. All coal analyzed is taken from a continuous sample of each car load. These samples are taken with automatic apparatus from the coal delivered to the weighing hoppers. Ash analyses are made daily to determine the percentage of combustible matter in the boiler refuse as a further check on the firemen.

The fuel used is not purchased on specifications as usually understood. There are no bonuses or penalties; although the company reserves the right to reject coal that is not satisfactory. The anthracite coal is not bought in the open market, but is purchased direct from the producers so that the company can limit its purchases to certain specified mines. All the anthracite used comes from the Scranton district, while the bituminous coal comes from Pennsylvania and Maryland. The latter fuel must not contain over 20 per cent of volatile matter, 8 per cent of ash and 1½ per cent of sulphur.

Other features of boiler-room operation have already received consideration in our columns. It might be of interest, however, to state that during the summer months 30 banked boilers are kept connected to the line ready for instant use. By simply turning on the blowers these can be got under way in five minutes. Owing to the summer thunderstorms which come on suddenly, it has been found necessary to keep this number of boilers under steam during the day. At night the boilers are used to carry the peak load. As indicative of the summer day load conditions and of the rapidity with which these demands are satisfied, it might be stated that not long ago during a sudden storm the load increased in 10 minutes from 45,000 kw to over 85,000 kw, or over 90 per cent. This was taken care of in the main station without recourse to the batteries.

In the generator-rooms there is an assistant chief engineer for each watch, under whom are watch engineers and oilers for the auxiliaries of each turbine. Ordinarily there are two watch engineers on duty with the exception that after midnight only one watch engineer is on duty. The oilers look after a number of turbines and for the auxiliaries. As pointed out in previous articles, once the turbine throttle has been opened wide, the operation of the unit is controlled by the switchboard operator.

There are two electrical foremen in each station having under them a number of assistants who look after the switchboard and electrical galleries. During peak loads the electrical foreman designates some assistant to make a tour of the electrical galleries every half-hour, so that any fault developing at such critical times may be detected. During other portions of the day the galleries are inspected every two hours.

As stated previously and in other articles, the distribution of all energy from both stations and from substations is under the direct supervision of the system operator, who is responsible for the operation of the entire system. Feeders, rotaries, boilers, etc., are put in and out of service only on his order and he receives at frequent intervals reports from all substations giving the load on each feeder and the reserve held in the batteries.

In front of the system operator is a map with all stations, feeders, etc., painted in. Hooks are fixed at the feeder ends on which the operator places a blue tag if the feeder is dead, or a red tag giving the load on the feeder if it is in use. When a feeder is tied through one station to reach another, it is indicated on the operator's board by a piece of elastic ribbon with rings on the ends which are placed over the feeder hooks, thus completing the connection through the station. If a feeder is held off for any reason this is also indicated by a tag. One of the system operator's duties is to keep posted on the weather conditions, and besides receiving the weather bureau's reports he makes stated readings of the thermometer and barometer, notes the direction of winds, and the condition of the sky. During cloudy weather or when the clouds lower, the system operator notes conditions every few minutes. If a storm sweeps over the lower portion of the city which is not noticeable at the Waterside stations, even while it is yet a great way off, the system operator is apprised of its coming by either substation operators or others connected with the system, and has units ready to throw in.

The load is divided among the units so that, should the largest unit operating break down, the others can carry its load without becoming unduly overloaded. Moreover, another unit is always ready to be thrown into circuit, all the auxiliaries being in operation, so that by simply opening the throttle the unit can be got under way. A 14,000-kw set can be synchronized and thrown in in less than two minutes, and the reciprocating units

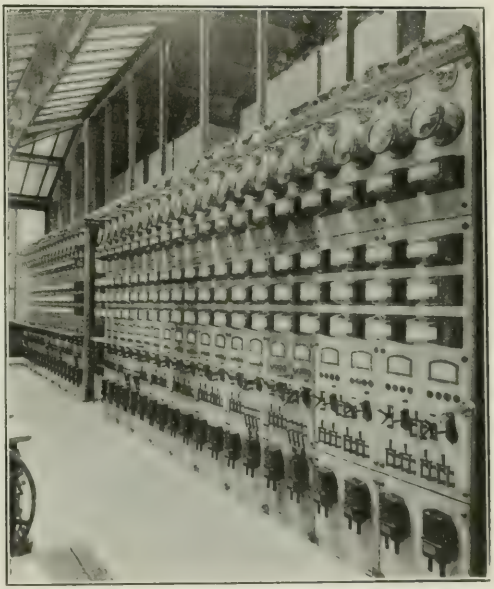


FIG. 2.—MAIN SWITCHBOARD IN WATERSIDE STATION NO. 1.

in Waterside No. 1 have been thrown in in about one minute time and again. If more than one unit is required, the system operator can order as many as are required started at the same time.

In emergencies, one blast of the 4-in. emergency whistle is sufficient to bring every operator to his post in less than a minute, and by means of the code signals sent over a system of gongs the operators in every substation connected to the system can be summoned to their switchboards and rotaries immediately. Thus every man connected with the actual operation of the system may be summoned to his post in less than two minutes and being under the supervision of one man, the system operator, whose orders are obeyed instantly, it will be appreciated that any untoward condition which is within the possibility of human agency to remedy will be corrected speedily. Should every source of communication fail, an improbable condition, and the operators in the various substations be thus deprived of a directing head, the company has instructed them how to act under such circumstances. How zealously the company has guarded its reputation for continuous service and with what

forethought it has anticipated trouble and provided for meeting it, will be evident from what follows.

HANDLING 6600-VOLT APPARATUS.

According to the rules of the company, all persons are prohibited from entering the high-tension galleries without permission, and no employee may handle or touch, either with or without rubber gloves, any switch, cable, bus, connection, conductor or any other apparatus which ordinarily carries 6600-volt current until he has positively ascertained that such apparatus is disconnected from all source of energy. If work is to be done on any part of the high-tension system in regular service, notice is given to the system operator as to the character of the work, and the approximate time required for its completion. If any alterations are to be made in the connection or location of any of the high-tension apparatus, or any addition is to be made, full information with a sketch is furnished to the system operator by the department desiring to make the changes or additions at least 24 hours before the work has begun. The foremen and operators in charge of stations are expected not to allow work to be started on the high-tension system or auxiliary apparatus connected therewith without first notifying the system operator.

Before beginning work on the apparatus, the foreman of the

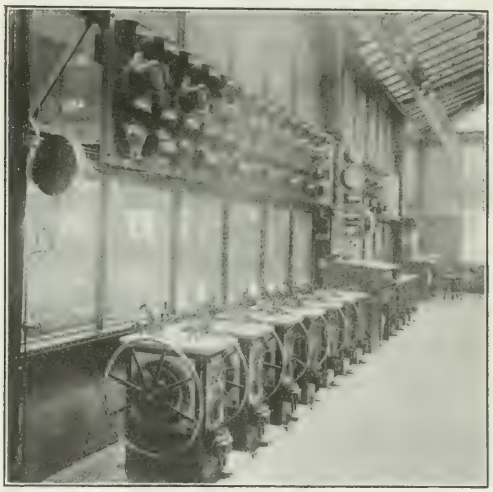


FIG. 3.—OPERATING GALLERY IN WATERSIDE STATION NO. 1.

electrical construction department ascertains from the operator in charge of the switchboard at the station in which the work is to be done whether the cable, switch, bus or other connection on which he desires to work is dead—that is, that it is not connected, either directly or through primaries of shunt transformers, with any source of high potential in any station, and that the cable, etc., has been discharged to ground since last carrying high-potential current. Before permitting the foreman of the electrical construction department to begin work, the operator in charge of the station notifies the system operator that the construction department is ready to proceed with the work, notice of which has previously been given. Upon word from the system operator authorizing the work, the station operator blocks the switches, attaches ground wires and places a "not clear" card on the apparatus. In applying the ground wires the operator first discharges the three conductors with a wire provided for that purpose, and then connects the three conductors together and to ground by means of a special device. In doing this work the operator is required by the company to wear rubber gloves and exercise great care.

The foreman of the electrical construction department personally inspects the blocking of the switches, the posting of the "not clear" cards and the grounding of the apparatus upon which he is to work. When he reports the work finished the operator notes the same in the high-tension log-book, and after a personal inspection notifies the system operator that the apparatus held off is again ready to be placed in service, and on instructions from him removes the switch blocks, ground wires and "not clear" cards. A note is made in the log book of this fact.

If it is desired to make an insulation test, or to do work on the high-tension cables in the subway, the system operator instructs the substation operator as to the blocking and grounding of switches, and the posting of "not clear" cards, and all such work is recorded in the high-tension log-book. If the cable is to be tested from the substation end, the person making the test personally inspects the discharging of the cable. In blocking type-H oil switches, the knife switch on the motor is opened and "not clear" cards hung on both the oil switch and the pilot switch controlling it. In blocking type-K switches, "not clear" cards are hung on the switch handles and on the pilot switch controlling the oil switch. In blocking the circuit-breakers, a cap provided for the purpose is placed on the under side of the air dash-pot, and a "not clear" card is hung in a conspicuous place on the panel. In blocking direct-current rotary converter switches, a combined blocking device and "not clear" card is placed on each of the outside pole armature switches on the direct-current switchboard. As a further precaution the direct-current circuit-breakers are left open. When work is being done on cables special care is used in blocking all switches, posting "not clear" cards and in returning to service those cables connected to substation switches which cannot be grounded. The operator immediately reports to the system operator any fault which develops in any part of the transmission or transforming system, or any incident which in any way affects the service or necessitates taking any of the transmitting or transforming apparatus out of service for testing or repairs.

HANDLING DIRECT-CURRENT FEEDERS BETWEEN GENERATING STATION AND SUBSTATIONS.

When the underground department desires to work on high-tension feeders, a representative is required to make a written request a day prior to beginning work, on a prescribed form, for such feeders as the department desires, stating fully the work intended to be done, the maximum time necessary for its completion and giving a rough sketch showing changes in connections or numbers. If necessary, the system operator sends a copy of this request to the electrical construction foreman at the Waterside station, and if the latter is ready with switches and apparatus to co-operate with the underground department, and to make a phase test if required, a note to that effect is made on the original request held by the system operator. The latter then shows the original request to the foreman operator on watch for his information, and he is required to sign the original request. The feeder or feeders are then turned over to the underground department, after being properly protected by the operating department in the generating station and substation on order from the system operator.

As soon as the work is completed the underground department is required to notify the system operator, and if no other department is working on the feeder or apparatus connected to it the system operator issues instructions to the operating department to remove all grounds, and to the electrical construction department or operating department to make a continuity test, and to the underground department to make a galvanometer test, unless he finds that such test would seriously interfere with the operation of the system, in which case it is omitted if it is deemed safe to do so. If the test is satisfactory the underground foreman presenting the original request reports in person to the system operator, notes on the original request the time of completion and signs his name, to which the system operator attests.

A feeder is tested for insulation with high potential, preferably from the generating station, or by the operating department with an inverted rotary converter in substation; the rotary being started from rest with both low-tension and high-tension alternating-current switches closed on the feeder to be tested. If a phase test is necessary after the insulation test is complete, the

electrical construction department at Waterside station is notified, and when the test is complete the foreman makes a note to that effect on the original request. If it is necessary to make a phase test in the substation, the electrical construction foreman does so. When the feeder is again ready for service the system operator has the original request signed by the foreman operator or operator on watch. This signature is taken as an evidence that the high-potential test was satisfactory, that the correct number cards have been placed on the switches and panels, and that all relays, etc., in the Waterside station have been properly adjusted. The system operator also ascertains from the substation operator, whose initials he places on the original request, that correct feeder numbers have been placed on all switches and panels, and that relays, etc., are properly adjusted in the substation.

The underground department is held responsible for giving the correct numbers and designations of feeders to the electrical construction department in both Waterside and substations. The underground department solders brass bands having proper numbers stamped on them to the lead sheaths of all high-tension feeders inside of the building line at Waterside station. If it is desirable to hold off a feeder for testing it is not necessary for the underground department to make a written request, since the matter may be arranged by telephone. The electrical construction foreman is required to notify the foreman operator and the system operator with regard to any changes in the position of feeder switches in Waterside station, and the number of same is given by the underground department, and also to notify the foreman or operator of the substation of any change of connections in the substation. If the electrical construction department wishes to disconnect feeders from the switch panel, or transfer to other switches, or do work of a similar nature, a similar practice is followed as outlined for the underground department.

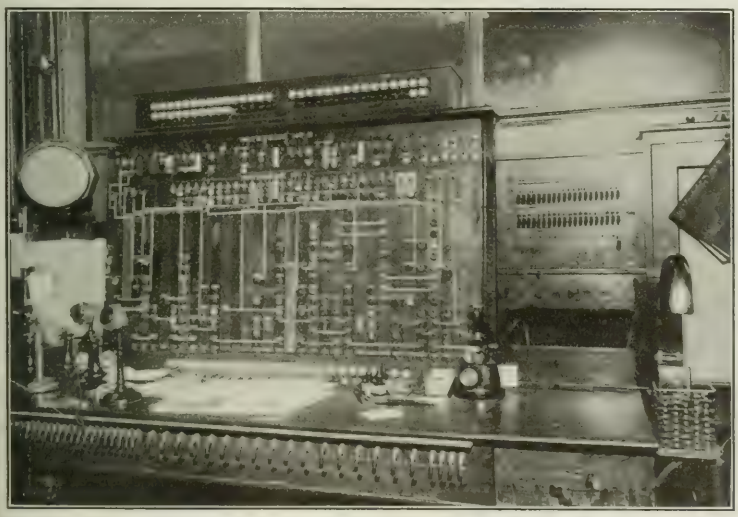


FIG. 4.—SYSTEM OPERATOR'S DESK IN WATERSIDE STATION NO. 1

The system operator is very particular to require insulation and phase tests in all cases where there is the slightest possibility that underground clamps have been left on, or that the conductors have been twisted from their original position. The insulation test is preferably made at the Waterside station. As soon as the changes have been made the system operator corrects his operating map. In case of any trouble on the cable or subway system, the system operator immediately notifies the underground department, and takes all possible precautions to prevent further development of the trouble. In making tests, repairs, etc., on tie feeders between substations the regulations are somewhat similar to those already indicated for feeders between the generating and substations.

RESTORING SERVICE AFTER TOTAL INTERRUPTION.

If the service had been interrupted, and the accident is of such a nature that it can be promptly restored, specific instructions are issued to the various employees to guide them in this work. If it is unnecessary to clear the bus, and if the Waterside stations have been separated, they are left separated until normal conditions are restored, or until it is desirable to tie them together. If they have not been separated they are left tied. The feeders and as many generators as possible are left connected to the bus, and the voltage or frequency or both are reduced when necessary, so that the substations can readily reconnect the rotaries. The voltage and frequency are then raised as the load requirements demand.

If it is necessary to clear the bus, the generating stations are separated, if they are not already operating independently, until normal conditions are restored, or until it is desirable to tie them together. One generator is then connected to the bus, and several other generators are then synchronized and connected, the turbo-generators being used first, and then the reciprocating-engine units, the voltage and frequency being reduced if necessary. After the necessary feeders have been connected such other generators as may be required under load conditions are synchronized and cut in. In any emergency all of the substations are under general instructions to immediately take load from any feeder which is alive.

If it is necessary to start the rotary converters from the alternating-current side, the substations are notified to get ready to start from standstill. The engineer is notified to shut down all turbines, and to station a man at the throttle of each turbine, and to cause all available engines to be turned over slowly. The buses are cleared, and, if necessary, one engine-driven generator and one motor-generator are connected to a section of the bus, in order to supply the station lighting. The exciters are connected to this bus if necessary. The available bus in Waterside No. 1 is connected to the available bus in Waterside No. 2 by means of the station tie cable. All of the turbines which are shut down and are available for service are connected to the bus in each station, each with its field circuit closed and the rheostat half cut in. If any turbines are still revolving and it is desirable to quickly stop these so as to use them in starting up the system, one or two reciprocating engines are synchronized with them, the turbine throttles are closed, and then the engine throttles.

All of the feeders which were in service at the time of the accident are connected to the bus in each station, and if any of these are not available the substations are notified to keep such feeders clear, and if necessary the numbers of other feeders to be used in their stead are designated. When both generating and substations are ready one long blast of the emergency whistle is given, when the man at each turbine throttle opens the throttle just enough to open entirely the by-pass. At each succeeding blast of the emergency whistle the throttle of each turbine is opened one-sixth of a turn of the throttle wheel. As many single blasts of the emergency whistle as may be necessary fully to load the turbine are sounded, the intervals between blasts being sufficiently long to permit the turbines to respond to one setting of the throttle before another setting is required. When the turbines begin to take the load, the latter is divided

between them by means of the regular engine signals "raise" and "lower" and the engine signal whistle.

The field rheostats are left half out of circuit until it is necessary to lower the voltage to keep the load on the turbines within their safe carrying capacity, or to raise the voltage in order fully to load the turbines, except when, in order to balance the power factor, slight adjustment is necessary. In adjusting the voltage care is exercised that the two stations adjust at the same time, so that the power factor is kept balanced. After the turbines have been connected to the bus the engine-driven generators are connected to the system as required. When sufficient generators are connected to carry the load at normal voltage the voltage is raised to normal, and the substation operators notified that they may use their regulators.

In case of total interruption of communication between the substations the following is the procedure: The turbines in Waterside station are started, and observations are made from the feeder instruments in order to ascertain which substations are started. If only a few substations start, the turbines are shut down and after a short wait started again. This procedure is continued until the majority of the substations well distributed over the system, and particularly the larger substations, are started, when the system is restored to normal as mentioned in the foregoing paragraphs.

SUBSTATION EMERGENCY MEASURES.

In case of serious interference with, or a total interruption of the high-tension supply to the substations, the substation operators are required to pick up load on any feeder which is alive, and in those substations which have steam apparatus in commission everything possible is done to get the steam units into operation. In all cases of trouble the three direct-current buses are tied together by closing all the battery switches, and both the auxiliary bus switches are closed on the direct-current feeders, and the station lighting is transferred to the main bus Normal pressure is restored by cutting in all the end cells of the battery if necessary.

If the ammeters on the rotary converters indicate that the supply of high-tension current through any feeder is discontinued, and that the rotaries connected to it are inverted for an appreciable time, the rotaries are disconnected from the high-tension feeders, and the system operator notified. The rotaries are kept running from the direct-current side and in readiness to be synchronized and connected as soon as the system operator notifies the substation operator to that effect, or when the pilot lamp indicates that the feeder is alive. If it is impossible to synchronize in any substation, the system operator is notified of that fact, and arrangements are made to start the rotaries from the alternating-current side.

When the substation operator receives word from the system operator that the alternating-current supply is interrupted and cannot be promptly restored, or in case the generator station is shut down and cannot be reached by telephone, and the pressure on the system has dropped to such a point that the station lighting is no longer useful, the operator is required to open all main bus-feeder switches, and to disconnect all rotaries from the system, and to put the regulators in the low-voltage position. When the system voltage has dropped to about 30 volts each side, all auxiliary bus battery switches are opened, thus disconnecting the battery from the direct-current system, and leaving it available for supplying the station lamps, field circuits of the rotaries and electrically operated switches and relays. The substation operator is required properly to examine all high-tension switches, and to make certain that they opened properly when last operated, since it might be possible that the voltage at the time was not sufficient to cause them to make a complete movement.

When the system operator notifies the substation operator to get ready to start from standstill, or in case of total interruption of communication, the available rotaries that were running at the time of the trouble to the high-tension feeders are reconnected, unless contrary instructions are received. The field circuits of these rotaries are connected to the main bus to which the battery is connected, and the field rheostats are cut in at the "weak" or "all in" position. If the system is at zero voltage, both direct-current legs of each rotary are connected to the auxiliary buses to which the direct-current feeders are connected, the system operator notified, whence the generators in the main station are started. When started in this manner, with interrupted telephone service, if the rotary converter runs inverted for an appreciable time, with a large and increasing load, it is disconnected, as it is possible that the feeder to which the rotary is connected has short-circuited during the trouble.

If the system is not at zero voltage, one leg of each rotary is connected to the auxiliary buses, the regulators are placed in a neutral position and the system operator notified. When the voltage on the rotary is equal to or higher than the auxiliary bus pressure, the remaining rotary switches are closed to the auxiliary buses simultaneously. When the rotaries are under way, the fields are gradually strengthened until the rheostats are about one-half cut out, and when the voltage is high enough to operate the power-factor indicator, unity power factor is maintained.

Except for what slight adjustments are necessary to balance the load between the rotary converters, the substation operators are instructed not to use the regulators until directed to do so by the system operator. When the auxiliary bus pressure is equal to or higher than the main bus pressure, the two buses are tied together. If the rotary rocks, the operator is required to open the field circuit on the discharge clip, and to leave the circuit open a few seconds, whence it may be closed again.

By means of a fire-alarm system of gongs, definite signals are transmitted simultaneously from the system operator to all substations. The signals cover all emergency instructions, and all operators are thoroughly familiar with the code of signals and act in accordance with them. Should other instructions be necessary the substations can be reached by a slower, but quite reliable system of telephones. To be sure, many of the accidents guarded against have not and might never occur; but in order that skill may be acquired in meeting such emergencies, drills are regularly held. It is assumed that the accidents have occurred and the proper precautions are at once taken. In this way every substation is included in a drill at least once a month. To this may be attributed the high efficiency of the operating force.

Practical Operation of the Philadelphia Electric Lighting System.

ELSEWHERE in this issue is published a description of the newest features of the Philadelphia Electric Company's system. In the company's equipment are one main generating station, seven auxiliary generating stations—many of which only carry an arc load, and some of which contain besides transforming apparatus—and nine substations. All of the auxiliary generating stations and substations are connected either directly or through other stations with the main generating station at Christian Street and the Schuylkill River, and it is here that operating interest centers.

The organization of the operating force at Christian Street consists of a superintendent, a chief engineer in charge of the mechanical department, an assistant superintendent in charge of the electrical department, and an assistant superintendent in charge of the alternating-current substations. Directly under the chief engineer are two first and two second assistant engineers, and under the electrical and substation department are four foremen who have general oversight of their respective parts of the system. Short weekly meetings are held to give all these men an opportunity to present matters which are of special importance, and these meetings have been found to be very beneficial.

In the boiler-room all boilers in service are swept down regularly every two weeks by a crew of boiler cleaners. The firemen work in two shifts of 12 hours average and extra men are used over the peak-load periods. Shaking grates are used in the furnaces, which burn soft coal. On account of avoiding as far as possible any excessive smoke and at the same time keeping in

mind the possibility of labor troubles in the fireroom, several types of stokers have been installed by way of experiment. At the present time one bank of boilers is being operated continuously for two-week intervals with the Taylor stoker, upon which a regular series of tests is being conducted to determine its characteristics, due regard being given to its overload capacity, its freedom from smoke, flue-gas analysis under different

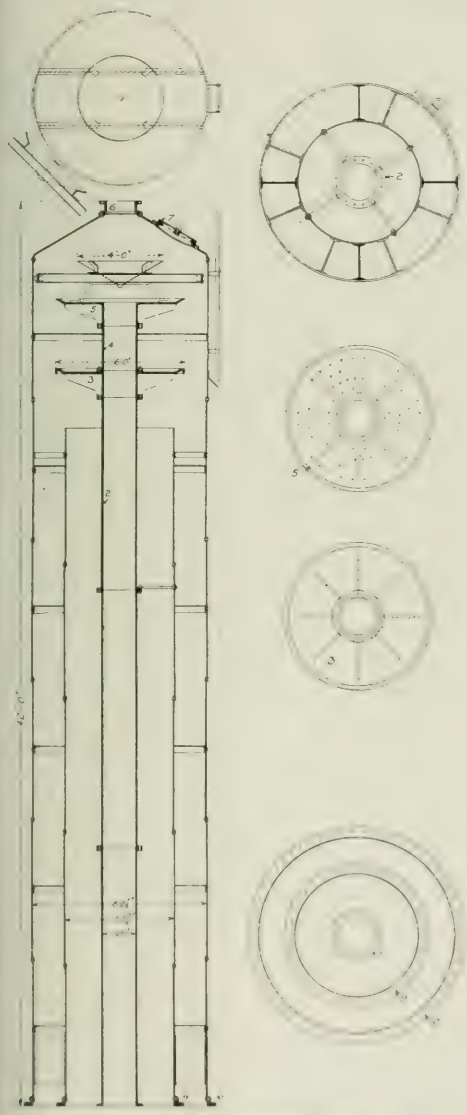


FIG. 1. DETAILS OF EXHAUST CONDENSER.

draughts and degrees of loading, and cost of unconsumed coal in the ash, and boiler evaporation per pound of coal.

The average analysis of the coal shows moisture, 1 per cent; sulphur, 1½ per cent, hydrocarbons, 65 per cent, ash, 10 per cent; giving an average equivalent heating value of 14,200 lb.-Fahr. units per pound. A carefully prepared sample is taken from every barge of coal and a copy of the analysis is sent to the shipper.

Boiler-feed water is taken from the river and an analysis is frequently made of the water; caustic soda ash and "cutch" being used in such quantities as may be necessary. A 6-in. connection with the city's water main is provided in case of serious trouble with the water-supply system. All the water piping of the boiler-feed system is heavily galvanized and the main lines are run in duplicate. The screens at the intake are cleaned and inspected carefully every week, being washed off by a hose attached to a small pump.

A complete system of inspection covers in detail every piece of apparatus in the station, each piece being known by a special number. These inspections are made weekly and are reported on inspection cards. On the latter is entered a list of apparatus not in perfect order, and any apparatus marked defective must not appear on two consecutive cards, the card itself constituting a written order for the head of the proper department to have every item mentioned on it put in shape before the next week's report. The daily log book is very complete and forms a minute record of operating conditions.

The last units installed in the Christian Street station are equipped with condensers designed by the company's engineer and embody features of more than passing interest. The condenser, which is shown herewith in detail, is built of ½-in. boiler plate properly stiffened and is mounted upon a special cast-iron exhaust base through which the exhaust steam from the turbine, the injection and the discharge water are separately taken care of. In general, the condenser consists of three concentric openings. The inner tube, extending the full height of the condenser, carries the cooling water, which at the top flows out horizontally over a flat circular perforated spray plate of large diameter and small depth so as to give the largest possible amount of surface for the elimination of air entrained in the cooling water. The 18-in. suction line to the air cylinder of the condenser pump is located directly above the center of this intake column. In order to prevent the splashing or the possible drawing over of water into the air pump in case of trouble with the condenser pump, or otherwise, a steel baffler is securely fastened above the injection pipe and practically midway between that and the air-suction line. External spray plates, also perforated, by their overflow at the edge still further break up the water and allow the air pump to abstract the last vestige of air. The exhaust pipe, which is concentric with the column of injection water, terminates 4 ft. or 5 ft. above the level which would be reached by a column of water from the hot well. Immediately outside of the exhaust steam chamber is the annular space for the descending column of discharge water, the height of which varies with the vacuum in the condensing chamber.

A feature of the system are the new automatic substations of the company. The station at Marshall and Noble Streets requires one operator, who, with suitable hours off for recreation, looks after the plant for 24 hours; the dwelling, which is part of the station, being made his home. All repairs are cared for by an emergency department under the control of the assistant superintendent of substations. All large repairs and construction work are looked after by the construction department of the company, which, under the supervision of the heads of the engineering department, prepares and executes all plans for switchboard extension and construction, as well as for new stations. The station contains only transformer and control apparatus and is entirely automatic in operation.

In only two of the original stations has the 2400-volt, steam-driven machinery been kept in commission; the station at Tacony, which up to the present has been to all intents and purposes a separate part of the 2400-volt system, and the station on Susquehanna Avenue, where some 1500 kw of the 2400-volt, steam-driven apparatus is still available, although very rarely used, being kept to help in case of heavy peaks or for emergency conditions.

The main circuits running from the stations are of No. 0 size, which has been made a standard. The size of the wire used for branches depends entirely upon conditions, but is never smaller than No. 4. Each branch is properly protected by fuses to localize trouble and thus prevent any large number of consumers being affected. The secondary distribution has been [illegible] to allow as few consumers as pos-

sible and also furnishing constant potential at the extreme ends of the system, the variation not exceeding 2 per cent. No. 0 wire is used almost exclusively for secondary distribution circuits. In congested districts where large motor installations are encountered as well as large lighting loads, it is the practice to separate the motor from the lighting load. In installations, however, where small motors as well as lamps are in the same building, five-wire, two-phase service is introduced, making it possible to use 220 volts for the motors and 110 volts for the lamps. The arc circuits are made up in groups of 125 lamps, and the layout is such that not only is the amount of wire necessary a minimum, but trouble can be readily located, it being possible in most cases when a circuit is open to close a portion of the circuit immediately and find the break on the remaining part as soon thereafter as possible.

In the operation of the stations, as far as possible, all 6000-volt feeders are connected on one common bus, while at the substations an effort is made to operate the feeders on separate buses. By this means it is thought that the most reliable service may be obained, and the automatic action of circuit-breakers at the substation ends may frequently be cut out temporarily and the circuit-breakers at the main station relied on to take care of any serious trouble that may occur. This circuit-breaker is set so high that it opens only in case of trouble really serious. In this way a great many interruptions of circuits which are not

WEEKLY INSPECTION REPORT OPERATING DEPARTMENT

Week Ending ——

Inspection has been made of a machinery apparatus etc called for on Inspection Sheet No and, excepting as below everything has been found in first class operating condition

Insp No.	Not in first class condition—Reason	Insp No.	Inspection not made—Reason

FIG. 2.—INSPECTION REPORT BLANK.

in trouble are avoided, the defective circuit not being allowed to interfere with the other circuits.

The city of Philadelphia being spread over a considerable area and being free from very congested districts, like New York, for instance, unlooked-for overloads do not come on quickly. The greater part of the city is made up of private dwellings or two-family houses, two stories high. Thunder storms are usually seen approaching from the Christian Street station and provision made for carrying the extra load which the storm might cause to be thrown on the system. Ordinarily the units running can carry the extra load. It is the practice in Philadelphia, as elsewhere, to divide the load among the units so that should one go out for any reason, the others will carry the load without overheating or until another unit can be started.

In training its operators the company realizes that it requires some time to get an efficient force and that because an operator has had experience with smaller systems it does not necessarily suffice when operating a larger system. The company aims to give the operator a thorough knowledge of each piece of apparatus used, as well as an intimate acquaintance with its entire system. The assistant operators, as a rule, are selected from the helpers, and the foremen from the operators. In the mechanical department, the engineers work up through the positions of assistants, pump men, oilers, machinists, etc. The organizing and building up of a piece of human machinery which will keep operating under all conditions in a satisfactory and competent manner has been found by all large operating companies to be equal in importance with the installation of good apparatus and machinery.

Operating Results from a 6000-kw Central Station.

IN considering the factors which enter into the cost of producing electrical energy at the busbars of a modern central station it is important to appreciate the fact that plants whose equipments do not represent the latest and most complete practice in all station departments may still afford valuable object lessons. The most modern installation naturally commands widest interest with respect to the economy of production; but the fact that the great majority of stations are still in something of a transition stage emphasizes the necessity of analyzing with care all operating results, and, when possible, of finding out the reasons for the variations in the cost of production.

The following figures of operation are presented as suggestive in the work of a 6000-kw plant which is undergoing a gradual change from obsolete methods of production to more modern standards of generation, covering the results of the past four years. The costs given apply to the expenses of manufacturing at the station and do not take account of any characteristic fixed charges.

The equipment of the station—located on tidewater in eastern Massachusetts—in 1905 was varied. The boiler plant then consisted of 10 Roberts horizontal-return boilers, each having 88 3½-in. tubes, rated at 125 hp, and operating at a steam pressure of 100 lb. per square inch; and two Babcock & Wilcox water-tube units, with 168 4-in. tubes each, the boiler rating being 350 hp in each case with 115-lb. steam pressure. The total boiler horse-power rating was 1950 normal. The engine units of the plant comprised three 24-in. x 42-in. x 48-in. Allis compound engines, running 100 r.p.m., and rated at 900 hp each; one Corliss 20-in. x 36-in. x 48-in. 500-hp engine, making 75 r.p.m.; one Ball engine, 13-in. x 12-in., at 300 r.p.m., 100 hp; and one Allis-Chalmers 24-in. x 48-in. x 48-in. engine rated at 1000 hp at 100 r.p.m. The total engine horse-power rating was 4300 normal and there were 17 dynamos in the plant, many being belt-driven.

The operating force in the station is comprised of 18 men, including four engineers, five firemen and nine engine-room and electrical attendants. Table I gives the total cost of manufacture for the year:

TABLE I.—COST OF PRODUCTION, 1905; STATION RATING, 300 KW.

Kw-hours delivered at station bus	5,498,747
Cost of manufacture:	
Fuel	$30,01
Oil and waste	60
Water	2,98
Wages at station	17,49
Station building repairs	2,01
Steam equipment repairs	3,53
Electrical equipment repairs	2,97
Total	$60,52
Cost of production per kw-hour at busbars:	Cents
Fuel	.56
Wages at station	.31
Miscellaneous	.22
Total	1.10

These figures show that fuel and labor were the chief items of cost in 1905, and that the station made an excellent showing considering its general design and limitations. The fuel burned in that year was bituminous coal at $3.35 per ton; coke at $3.50; anthracite breeze at $2.50, and tar at $1 per barrel. The principal fuel was the bituminous coal, 6835 tons being consumed by the station. About 10 per cent of the operating cost was steam and electrical maintenance.

In the year 1906 the station output was 6,052,518 kw-hours, of which 2,107,214 kw-hours were sold for electric motor service. The data do not give the power sales for the preceding year. The cost of production per unit in 1906 was 1.415 cents, due to an expenditure of $16,092 for steam-plant maintenance. This portion of the station equipment demanded about 4.5 times as much money for repairs in 1906 as it did in 1905. The com

pany continued its practice of burning mixtures of fuel. The results of the year are shown in Table II:

TABLE II.—COST OF PRODUCTION, 1906; STATION RATING, 5000 KW.

Kw-hours delivered at station bus	6,052,518
Cost of manufacture:	
Fuel	$38,323
Oil and waste	892
Water	4,159
Wages at station	18,296
Station building repairs	4,488
Steam plant repairs (equipment)	16,092
Electrical equipment repairs	3,623
Total	$85,864
Cost per kw-hour:	Cents.
Fuel	.634
Wages at station	.302
Steam equipment repairs	.266
Miscellaneous	.213
Total	1.415

The station was operated in 1906 by 19 men—i.e., five engineers, seven firemen and seven steam and electrical attendants in the engine-room. Four of the Roberts boilers were disposed of and two new Babcock & Wilcox boilers purchased. The new units each consisted of a 400-hp boiler having 192 4-in. tubes with steam pressure at 115 lb. The Allis-Corliss and Allis-Chalmers engines remained in service as in 1905, but two new units of 500-kw and 1500-kw Curtis turbo-alternators were added. The total number of electric generators in the plant in 1906 was 16. The installation of the turbines was the first step in a policy of modernization which will probably in time result in the elimination of all inefficient steam equipment and belted apparatus. Without having full details of expeditures at hand, it is difficult to fix the responsibility for the heavy steam-equipment maintenance charges which had to be met in this year, and which, in fact, continued through 1907 and 1908, as will be seen in the subsequent data. It is probable, however, that the older steam machinery and mechanical driving apparatus were at a critical point in 1906, and that the heavy cost of repairs was due in part, at least, to the obsolescence and depreciation of the old and out-of-date equipment. The company burned 8367 tons of soft coal in 1906, and the average cost per ton was $3.17. Considerable coke at $3.50 and tar at $1 were also consumed. The figures for the year show that the fuel situation was favorable, but that the station machinery was not in shape to take full advantage of it, since the cost per kw-hour for fuel consumed was over 0.01 cent higher than in the previous year.

The output of the station at the busbars increased in 1907 to 8,216,267 kw-hours. The station was operated with the same boiler equipment as in 1907. The Corliss engines were disposed of this year, leaving a total engine rating of about 6700 hp. There were 15 electric generators in the station in 1907. The operating force consisted of 23 men—six engineers, nine firemen and eight steam and electrical attendants. Mixed fuel was burned, but the largest item was 9884 tons of bituminous coal costing $3.35 per ton. Gas, coal, coke and tar were also consumed under the company's boilers. Table III shows the cost of production:

TABLE III.—COST OF PRODUCTION, 1907; STATION RATING, 5000 KW.

Kw-hours delivered at busbar of station	8,216,267
Cost of manufacture:	
Fuel	$44,747
Oil and waste	1,182
Water	4,932
Wages at station	23,166
Station building repairs	6,166
Steam equipment repairs	14,181
Electrical equipment repairs	5,354
Total	$98,728
Cost per kw-hour:	Cents.
Fuel	.545
Wages at station	.282
Steam equipment repairs	.172
Miscellaneous	.201
Total	1.200

In 1908 the output of the station rose to 8,776,165 kw-hours. The unit cost of production remained substantially as in the previous year, the figure being 1.21 cents. The company added two new Babcock & Wilcox boilers of 400 hp each, and all boilers were operated in this year at a steam pressure of 120 lb. per square inch. The company substituted a 1500-kw Curtis turbo-alternator for the 500-kw unit previously installed. The station was operated by 22 men in 1908, six engineers, eight firemen and eight steam and electrical attendants. The total rating of the steam-generating machinery in 1908 was 8200 hp. In 1907 the company sold 3,008,528 kw-hours for power service and in 1908, on account of the business depression, the power sales dropped to 2,764,508 kw-hours. There were still 15 generators all told in the plant in 1908 at the end of the fiscal year. The fuel consumed included 13,507 tons of bituminous coal at $3.64 per ton, as well as gas, coke and tar. Table IV gives the operating results for 1908:

TABLE IV.—COST OF PRODUCTION, 1908; STATION RATING, 6000 KW.

Kw-hours delivered at busbar of station	8,776,165
Cost of manufacture:	
Fuel	$54,158
Oil and waste	1,030
Water	3,551
Wages at station	25,937
Station building repairs	4,547
Steam equipment repairs	12,932
Electrical equipment repairs	3,993
Station tools and sundries	222
Total	$106,370
Cost per kw-hour:	Cents.
Fuel	.617
Wages at station	.296
Steam equipment repairs	.147
Miscellaneous	.150
Total	1.210

In this year about $4,000 was saved in the smaller items, which offset slight increases in certain of the larger factors of cost. The lesson of the four years is that it pays to watch station economy very closely in a transition period; that the full benefits of improvements cannot always be secured at once, but are dependent upon the completion of a policy of betterment, and that there is a close relation between high expense of equipment maintenance per unit and more or less undesirable station composition.

Economy of Production in Central Stations.

At the Nebraska Electrical Association convention, May 11 to 13, 1909, President E. A. Bullock, of Norfolk, Neb., gave an informal talk on economy of production by central stations. He took as a basis for his talk a letter received from a member of the association who had recently built an entirely new and modern power plant and had discarded entirely the plant before in service. The new plant was designed for relatively high economy as small central stations go. The letter of this member, after a few months' experience in operating with the new plant, called special attention to the fact that about 75 per cent of the cost of giving electric central-station service consists of fixed and investment charges, and that only about 25 per cent is a variable operating charge influenced by economy of station operation. This member called attention also to the fact that the additional investment necessary to install a new power plant and discard an old one calls for considerably greater gross revenue to pay interest on the investment and to make the company's bank balance appear as it should.

Mr. Bullock in commenting on the situation indicated by this letter outlined as a generally safe policy for central stations to follow to make additions to the plant in the shape of modern economical machinery, but as far as possible retain the old apparatus as a reserve and for carrying peak loads. This apparatus is usually more valuable to the company which has it installed than it would be to any purchaser of second-hand apparatus. It affords a reserve and peak-load carrying capacity at the lowest possible investment. Mr. Bullock stated that he is putting in a 300 kw condensing steam turbine as an addition to his plant, with which turbine under full load it is hoped (though not too confidently) that the fuel cost will be reduced to ½ cent per kw-hour. He, however, is keeping all of the old apparatus for reserve.

He also referred to producer gas plants as economical sources of power in Nebraska. These plants are being improved constantly and after the first six months of service can be relied upon to give good service. During the first six months, however, there is much to be learned by the owners and operators. He also spoke of the possibility of putting in a chain grate stoker in his plant, even though it is small for such an installation. He thought that it might make it easier to retain good firemen, especially during the hot weather, as it would relieve the firemen of some hard work. It would not reduce the labor account any. It might also improve the boiler economy.

Mr. H. A. Holdredge, of Omaha, in regard to the use of an automatic stoker in a small plant, expressed the opinion that it might be found hard to handle because of the difficulty of banking fires and of adjusting to changes of load. When the Omaha central station, of which he is manager, changed from hand-firing to chain grates, a reduction of two-thirds in the boiler-room force was made. As to whether any improvement in fuel economy was caused by the automatic stokers, he could not say, because so many other changes were made in the station at the same time.

A member asked a question as to the performance of the Diesel engine using crude oil. Answering this question, Mr. J. R. Cravath, of Chicago, said that this type of engine was capable of producing power at a very low rate per kw-hour and that it was giving excellent service in a number of plants in different parts of the country. One reason this type of engine is not more extensively used is the high first cost, which for the 250-hp units amounts to approximately $120 per kilowatt of capacity. This is so high that it has prevented many stations from putting in these engines. They are necessarily very massive on account of the high compression used.

Mr. Charles C. Smith, of Exeter, Neb., reported having operated in his station a Hornsby-Akroyd oil engine for a number of months past. A mixture of one-half crude fuel oil and one-half gas oil is employed. This mixture costs 4 cents per gallon at Exeter when purchased in car-load lots. There is a slight flickering of the lamps which he says is not noticeable to the ordinary person. The cost of a crude oil engine of this kind is from $60 to $65 per horse-power, as compared with a gas engine and producer outfit, which would cost about $100 per horse-power.

Mr. E. V. Capps, of Blair, called attention to the possibility of increasing the capacity of existing plants by the installation of condensers. He has recently done this in his plant. The installation of condensers increases the capacity of the plant from 15 to 20 per cent, and improves the economy about 10 per cent. The cost of plant per kilowatt of capacity is reduced by the installation of condensers, because the additional capacity is obtained cheaper by the installation of condensers than by the installation of additional non-condensing apparatus.

Grounding the Secondary.

OPINIONS OF CENTRAL STATIONS ON THE SUBJECT.

IN our article in our issue of April 1 Mr. W. J. Canada contributed an interesting article entitled "Grounded Secondaries," in which reference was made to a correspondence with central-station companies as to their experience with grounded circuits. Through the courtesy of Mr. Canada we are enabled to print below a selection from such of these letters as the writers will permit to be made public.

We are led to believe that the grounding of your secondaries is most necessary for the protection of life. In fact, our Canadian Electric Association has come to the conclusion that every lighting company should ground one side of their secondaries; or in case of a three-wire system, to have a neutral grounding.—*The London Electric Company,* London, Ont.

We have an extended experience with the grounded system, which we believe is much preferable to the use of ungrounded secondaries, as the ground absolutely limits the potential introduced into the consumer's premises. We have had no comparative figure as to the cost of plant maintenance with grounded or ungrounded secondaries, and it is our experience that grounded secondaries minimize troubles of all kinds. Our local underwriting interests strongly endorse the use of grounded secondaries. We have no means of ascertaining the public's preference in this matter; it is our opinion that the public in general is not sufficiently well informed to be able to pass upon or even discuss the merits of the two systems. We have adopted the uniform grounding of all our secondaries for the purpose of limiting the voltage which can be introduced into the customer's premises, and thereby reducing the fire hazard and the hazard to life and limb.—*Union Electric Light & Power Company,* St. Louis, Mo.

Our most satisfactory operating condition is with the neutral of our secondaries grounded. This gives the least trouble. It seems it is far safer and the change was made primarily for the safety of the public.—*Chippewa Valley Railway, Light & Power Company,* Eau Claire, Wis.

We have had experience both with the grounded and ungrounded secondaries. Our secondary distribution was entirely ungrounded up to the year 1905, at which time we proceeded to ground the secondaries throughout the whole system. Since then we have had considerably less expense and trouble in the operation of the distribution system. The underwriters are heartily in accord with the grounding of the secondaries from their standpoint, and the reason that we made this change was that we considered it superior to the ungrounded system from the fact that there is less danger to life and property.—*Rochester Railway & Light Company,* Rochester, N. Y.

The grounding of our secondary service has in no way affected the reliability or the cost of maintenance of that service. The object in grounding the service was to prevent the possibility of dangerous voltages upon the wires in our customers' premises.—*Omaha Electric Light & Power Company,* Omaha, Neb.

We distribute with a 2300-volt primary system, transforming to 118-236 volts, three-wire secondary. For some time past we have made a practice of grounding the neutral of this three-wire secondary. So far as we have been able to determine there has been no difference in service rendered the customer between grounded and ungrounded secondaries, and our experience has shown practically no difference between the two systems in maintenance to the plant. The system of grounded secondaries has been of assistance to us in a few instances in locating trouble on our lines, as it has caused our ground detecting devices to indicate when an ungrounded secondary would not have shown any trouble. The public has given practically no attention in this vicinity to the question of grounded or ungrounded secondaries, as we have had no trouble of any sort which would bring this question before the public. We made the change from ungrounded to grounded secondaries in order that we might take every precaution to protect our lines and remove to every extent possible the slightest liability of injury to any person due to defects in our system.—*The Schenectady Illuminating Company,* Schenectady, N. Y.

We cannot say that we have discovered any difference in the maintenance to our system through grounding. The grounded

neutral, no doubt, results in less minor troubles, especially on the consumers' premises. We feel it is generally admitted by the public and underwriting interests that it is favorable to ground the neutral, but that the difficulty usually arises on account of the extreme difficulty in securing a thorough ground. We are gradually working toward the grounding of our secondary distributing systems, as it will increase safety both to life and property.—*The Dayton Lighting Company,* Dayton, Ohio.

We believe that the grounded secondary has given the most satisfactory service to our customers. Necessarily, the addition of a ground wire and means for grounding this wire at the base of the pole implies that much more to maintain and therefore increases the maintenance charges. We believe the grounded system has given the least minor trouble. The grounded system is regarded best by the public and underwriters' interest from the standpoint of decreasing the hazard to life.—*Commonwealth Edison Company,* Chicago, Ill.

The grounded secondary system has given the most satisfactory service to consumers, and the grounded system is regarded favorably by the public and underwriting interests. The change was made to grounded secondaries for safety.—*Edison Illuminating Company,* Detroit, Mich.

Our distribution system up to the present date has operated as two-wire, 2200-volt primary, 105-volt secondary, and we have never made a practice of grounding the secondary. Our experience with this system is that it has given most satisfactory service; we have experienced very little trouble of any kind in its operation, and we believe that it is regarded entirely satisfactory to the city underwriting interests as well as to the public in general. However, at the present time we are changing our distribution system in the underground district, which will be on the basis of 110-220-volt, two-wire, alternating-current, with the neutrals grounded, the system in all respects being similar to an Edison three-wire network.—*Louisville Light Company,* Louisville, Ky.

We formerly had a 2300-volt system but changed this to 4000 volts in order to reduce copper and prevent excessive losses. Our system as now running is 4000 volts between legs or 2300 to ground, using the standard 2300-volt transformer between one leg and ground. The low-tension or 115-volt side is also grounded. We connected to ground to give the added protection that it seems to be agreed by engineers this affords. It is rather difficult to tell which system gave the least trouble, as the old system was in bad shape, but during the last two years has been put in good shape. We have had very little trouble with our present system. The principal reason for grounding the secondaries is as given above—i.e., to keep the primary voltage, lightning and foreign current off the secondaries. Another reason is to be able to connect 115-volt, three-phase motors between two of the secondaries and ground, thus forming a balanced three-phase, 115-volt circuit with two standard transformers, the 220-volt motors being fed from between the three legs of the secondaries which form a balanced three-phase, 220-volt circuit.—*Utah Light & Railway Company,* Salt Lake City, Utah.

We ground our secondary system on water pipes whenever we can, which is in 9 cases out of 10, probably. The city engineer objected at first, but when it was explained to him that it was done for public safety, and in a manner not to injure the water pipes, he withdrew his objections. The advantage of water-pipe ground is shown when horses received severe shocks while standing on wet ground between a ground wire merely driven into the ground, and a water pipe, there being sufficient difference of potential between the two to cause the shock.—*Ottawa Electric Company,* Ottawa, Ont.

From experience we believe the grounded system gives the least troubles. It was adopted by this company for the protection of the consumer. Very few companies have adopted grounding of their own accord, the demands of underwriters and the public having been largely the cause of a change. Nevertheless, all first-class, up-to-date engineers appreciate the advantage of grounding and are recommending it in all cases.—*The Edison Light & Power Company,* Wichita, Kan.

We are running both a direct- and alternating-current service, but only the direct-current circuit is grounded. It is our intention practically to rebuild and rearrange the plant so far as the distribution system is concerned. When this is done we shall use a grounded neutral on both our direct- and alternating-current secondary distribution, and we may also ground the neutral of our primary distribution if we decide to use a 2200-4400-volt system.—*Fall River Electric Light Company,* Fall River, Mass.

Our alternating system originated in a three-phase generator operating 2300 volts, 60 cycles, supplying a suburban and substation territory, the first at 2300 volts, the second with a step-up to 11,000 volts from 2300 volts and step-down at the substation. The secondary circuits consist of 104-208-volt, three-wire system in some districts, and in others 250-500 volts, three-wire. Grounded secondaries are preferred by us in all installations.—*Narragansett Electric Lighting Company,* Providence, R. I.

We have operated with our neutral point on these systems grounded for some years and find it gives satisfactory results. There is no doubt at all in our minds that the neutral point of transformers and secondary distributing systems should be grounded in order to give the best protection to life and property. When this is effectively done, should the primary wire come in contact with the secondary wire, or should the transformer break down from any cause, the high-voltage current immediately goes to ground and blows a fuse on the primary side of the transformer, thereby cutting off the dangerous current. We certainly recommend having the neutral point of 110-230-volt distributing systems grounded.—*The Toronto Electric Light Company,* Toronto, Ont.

This company had been operating 2300-volt single and three-phase system in its several districts without grounds on its secondaries up to about four years ago. At that time, owing to the numerous fatal accidents which were being recorded in the daily press in various parts of the country, it seemed advisable to the company to take advantage of the additional protection afforded by grounded secondaries, and, therefore, arrangements were made for the immediate grounding of all secondary services on the system, with the exception of 220-volt and 550-volt three-phase secondaries used for power purposes. This work was all done at the company's expense, and the installation of these grounds covered a period of approximately 3½ years. With the exception of the additional personal insurance factor for customers, we do not know that there is any difference in the quality of service furnished our customers as between grounded or ungrounded services. Aside from the possible burning out of transformers previous to grounding the secondaries, we have no basis of comparison which would show us whether our maintenance cost has been affected by grounded services. We occasionally burn out a transformer even now, which might or might not be due to the grounding of our secondaries, but it is impossible in some cases to determine what has been the cause of the burn-out, there being no evident reason apparent. We have lost in one or two cases transformers due to the failure of service wires where installed in iron pipe leading down the sides of buildings, this being purely due to indifferent work by the contractor installing these service wires, and should not be attributed to the fact that the secondaries are grounded. We [illegible] troubles which have occurred other than those above mentioned, but owing to the necessity of [illegible] ground connections are at all times in good condition, it might be assumed that the grounded service [illegible] the company slightly more trouble [illegible]. Our rules in this territory specify that all new services must be provided with ground wires at the customer's expense, and it is, of course, necessary that some attention and time be given

to see that these rules are complied with. This might possibly be classed as additional trouble or additional maintenance from the company's point of view. We consider that the public, from expressions of opinion and from the entire lack of fatal accidents on our system from troubles due to high pressure on secondary services in buildings, view the company's action in installing ground wires as one which is to be commended, and certainly the underwriting interests in this territory have commented very favorably upon our present practice. Other than individual expressions of opinion, we have no real method of knowing just how the public feel in the matter, but such expressions of opinion as have come to our notice have been exceedingly favorable. In conclusion, we may add that under no conditions would the company go back to the operation of an alternating-current distributing system with ungrounded secondaries, particularly on lighting service. The company is seriously considering some action at this time for the additional protection of its power services, which operate at higher voltage than the lighting service, and if in the future, suitable apparatus can be developed to reduce this hazard, the company will take immediate steps to avail itself of such additional protection as may be devised.—*The Edison Electric Illuminating Company of Boston.*

We have a 60-cycle, 2300-volt, 110-220-volt system with grounded secondaries. We have never operated with ungrounded secondaries, and, therefore, are unable to speak from experience as to which is the better; but our system has been extremely successful with the grounded secondaries, and we have had practically no minor troubles.—*Edison Electric Illuminating Company,* Brooklyn, N. Y.

We cannot say that we have discovered any difference from grounding as to maintenance to our plant or system. The grounding neutral, no doubt, results in less minor troubles, especially on the consumers' premises. It is generally admitted by the public and underwriting interests that it is desirable to ground the neutral, but difficulty is often experienced in securing a thorough ground. We are gradually working toward the grounding of our secondary distributing system, as we feel that by so doing the factor of safety both to life and property is increased.—*The Dayton Lighting Company,* Dayton, Ohio.

We have had extended experience with the grounded system and believe it to be much preferable to the ungrounded system, as the grounding absolutely limits the potential introduced into the consumer's premises. We have had no comparative figure as to the cost of plant maintenance with grounded or ungrounded secondaries, but it is our experience that grounded secondaries minimize troubles of all kinds. Our local underwriting interests strongly endorse the use of grounded secondaries. We have adopted grounding of all our secondaries for the purpose of limiting the voltage which can be introduced into the customer's premises, and thereby reducing the fire hazard and the possible hazard to life and limb.—*Union Electric Light & Power Company,* St. Louis, Mo.

Our conduit system here is a 2400-volt, 220-volt, three-wire secondary system, with the neutral grounded as often as possible to water mains. We find this very successful, and absolutely the cheaper in maintenance, so far as the central station is concerned. Where the service connections are charged against operating it makes it quite expensive as compared to overhead work. The two-wire system, ungrounded secondaries, has given us the least minor troubles, such as short circuits and fuses blowing. The three-wire grounded neutral system is considered the best by the general public and the underwriting departments. In one case the grounding of the secondaries was brought about mostly for the protection of life and limb. All of our overhead two-wire secondary mains are to be permanently grounded (one leg) on all new installations starting April 1, 1909. This additional work is to be done by the contractors equipping buildings, the grounds to be made outside of all service switches and meters, and the connection to the water main to be done by the department when setting the meter. This ground connection is to be No. 4 gage or larger.—*Public Service Corporation of New Jersey,* Newark, N. J.

In Switzerland the practice of a number of central stations is to ground permanently the secondary from transformers, the neutral point being grounded of multi-wire or polyphase systems. We consider grounding desirable from the standpoint of safety to life.—*Technical Testing Bureau,* Swiss Electrical Association.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Chicago Branch N. E. L. A. Delegates Elected by Ballot.

Acting upon the generous offer of the Commonwealth Edison Company, of Chicago, to send two members of the Commonwealth Branch of the National Electric Light Association to the Atlantic City convention, the members of the branch selected their delegates by ballot. There was an exciting campaign, and so much interest was aroused that 80 new members were added to the branch as the result of the election, the membership now standing at 462, being considerably the largest of any branch of the association. The election resulted in the choice of Mr. Ernest A. Edkins, chief clerk of the second vice-president's office, and Mr. John C. Manley, assistant superintendent of the construction department. Mr. Guy Lunn, chief electrician of the Fisk Street station, only failed of election by a few votes. Messrs. Edkins and Manley will accordingly represent their branch at the convention. The Commonwealth Edison Company will also send a strong delegation directly representing the company. The members of the branch appreciated the opportunity of electing two of their members to go to the convention, as it gave some of the younger employees an opportunity which would not have been otherwise available.

Interesting Small Turbine Installation.

The Norfolk Electric Light & Power Company, of Norfolk, Neb., has juts put in a 200-kw De Laval condensing steam turbine driving a two-phase, 60-cycle alternator. This turbine is installed in the company's present steam plant, and will just about double its present capacity as to generating apparatus. Water for condensing is obtained from wells. The plant has heretofore been operated with simple non-condensing engines. This is the interesting station described in our issue of Jan. 21, which has its yearly peak loads during the day in summer. This summer peak is made up of the company's power business plus flatirons. The power business includes the operation by motor of a neighboring ice plant and the pumping of the city water. It is hoped to bring about considerable reduction in fuel cost by the use of the condensing turbine. This is guaranteed to consume not over 23.5 lb. of steam per kw-hour on full load.

Price of Tungsten Lamps in New York City

The Public Service Commission on May 18 and 21 granted permission to the United Electric Light & Power Company, the New York Edison Company and the Brooklyn Edison Company

to put into effect immediately a revised tariff making reductions in charges for tungsten lamps. The application was made in conformity with an order issued last December requiring the approval of the commission to any changes in rate schedules. The new rates of the several companies are as follows:

UNITED ELECTRIC LIGHT & POWER COMPANY.

Lamps. Watts.	Customers entitled to free renewals.	Customers not entitled to free renewals
25	$0.48	$0.60
40	.40	.58
60	.75	.75
100	.85	1.10
250	1.75	2.25

NEW YORK EDISON COMPANY.

Lamps. Watts.	Customers entitled to free renewals.	Customers not entitled to free renewals
25	$ .475	$ .60
40	.575	.70
60	.75	.90
100	.85	1.10
250	1.75	2.25

EDISON ELECTRIC ILLUMINATING COMPANY OF BROOKLYN.

Lamps. Watts.	Customers entitled to free renewals.	Customers not entitled to free renewals
25	$ .50	$ .60
40	.60	.70
60	.75	.90
100	.90	1.15
250	1.75	2.25

Electric Cooking Demonstration in Los Angeles.

The Edison Electric Company, of Los Angeles, Cal., is giving to the people of that city an interesting demonstration of electric cooking in the San Fernando Building. Mrs. A. M. Colby, of Boston, is the demonstrator, and between 10 a. m. and noon and between 2 p. m. and 4 p. m. daily she shows how easy it is to prepare appetizing dishes by the aid of the appliances in the electric kitchen. A variety of electric cooking utensils and electric appliances of other kinds are shown.

High-Efficiency Lamps and Reflectors.

At the convention of the Nebraska Electrical Association at Omaha, May 11 to 13, Mr. Morgan P. Ellis, of Chicago, read a paper on "The Relation of the Holophane Prismatic Reflector to the New High-Efficiency Units." He called attention to the fact that this class of reflectors for use with tungsten lamps had been recently redesigned so that three new types have been brought out for each size of lamp. These types are known as the extensive, intensive and focusing, the focusing being the most concentrating and the extensive the most widely distributing to the three types. Referring to criticisms as to the effect of dust and dirt in impairing the efficiency of reflectors, he called attention to the fact that dust affects all reflectors alike. The reflecting efficiency of the prismatic reflector is not affected by dust on the upper side.

In the discussion which followed, a question was asked by a member as to the success of the 250-watt tungsten lamp. Mr. George Loring replied that the 250-watt tungsten lamp is now more of a success than in the past, and he predicted that it would be used in large quantities during the next 12 months.

Mr. B. C. Adams, of Lincoln, expressed his belief in the use of units smaller than 250 watts. When small units are used there is not so much inconvenience when one burns out, and the cost of renewals is not brought so forcibly to the user's mind.

Mr. E. A. Bullock, of Norfolk, Neb., condemned the use of an exposed cluster of tungsten lamps surmounted by a flat reflector, as is so commonly used now. He pointed out that better efficiency can be obtained by placing reflectors over each lamp and that this avoids the glare. Mr. Ellis explained why better efficiency is secured by placing an individual reflector over each lamp. He stated that the area [illegible] reflector reduces the illumination about 15 per cent.

Electric Cooking Publicity in Denver.

During the latter half of the month of April the Denver Gas & Electric Company gave a series of cooking demonstrations which had an average daily attendance of 5000 women. In order to get the lessons the most complete publicity arrangements were made with the *Denver Post*, allowing it to claim the right of bringing Mrs. E. O. Hiller, of Chicago, the demonstrator, to Denver for the benefit of the Denver women. This publication has the largest circulation in the Rocky Mountain region and it has little trouble in making a success of any worthy movement to which it directs its attention. In the Sunday issue preceding the opening of the school the newspaper devoted several columns to the purposes of the demonstration and the result was a packed attendance at the first lesson. It was found that the company's hall accommodations were too limited and the demonstrations were shifted to the ordinary of the Brown Hotel. Although this hall has a capacity of over 1000, it was too small for the large number of women who wanted to take advantage of the lessons, and the company hired the Auditorium where the Democratic convention was held last year. The stage was divided into two rooms, in one of which was every electric appliance for cooking and household purposes; the other room contained gas appliances. There were several electric cooking demonstrations and these were largely attended. One of them was held at night and the Auditorium was packed. Every appliance was thoroughly explained and since the domonstrations their sale has been better than in months. Denver got a great deal of good out of the demonstrations and the company feels that it reached every household of Denver as it could not with any other kind of advertising.

Enterprising Electric Plant Owner.

In response to an inquiry suggested by a rather vague newspaper notice of a new electric lighting plant in a Western town, a communication was received which reveals a spirit of enterprise worthy of being recorded as a lesson to any managers of small central stations who may regard their field as too limited for indulgence in hustle.

"We have installed just a small 12-light plant in our store building for the purpose of demonstrating to our farmer friends what can be done in the way of lighting their buildings on the farm with electricity. We operate this plant with a 3-hp gasoline engine and light our entire building, which has a frontage of 100 ft. and is 60 ft. deep. We use 30 25-watt and 5 60-watt tungsten lamps. That seems like quite a load for a 12-light plant, but it carries it to perfection. We have the wiring arranged so we can switch the lights either on to the city circuit or on to our own plant, thereby giving the customer a practical demonstration of the fact that we have the better light, and that with our little plant he can have better electric lights on the farm than the city folks enjoy. It is easy to demonstrate this to the customers' satisfaction for the reason that when we switch from the city lights to our own we give them a little more voltage. We have the switches arranged so we can cut out a few of the lights at a time to demonstrate the effect on the engine and dynamo of carrying a full load or a part of a load. We try to be up to date in our line, and have added this electric light proposition as an advertisement and as a stimulant to the gasoline engine business.

"We have not given you the data you ask for the reason that we couldn't do so intelligently if we should try, for it is all Greek to us. What we know about electricity wouldn't blot the flyleaf of a very small almanac. We just know this: We have operated this little plant since last November and it hasn't given us a single minute of bother. It is always ready to go and we can have the lights burning in three-quarters of a minute any time. We have learned that it isn't necessary for us to know anything about electricity to operate this plant successfully."

Overhauling Meters and Illuminating Engineering at Beatrice, Neb.

At the convention of the Nebraska Electrical Association, May 11 to 13, at Omaha, Mr. Frank McMaster, of the Beatrice Electric Company, described work he has recently been doing for that company in the way of testing and calibrating consumers' meters and looking over each installation with a view to improving the illumination which the consumer is obtaining. Defective wiring is also noted.

About 800 meters have been tested. They were tested in place on the consumer's premises by comparison with a standard portable recording watt-hour meter. The load is obtained by turning on a number of the consumers' lamps. This incidentally gives the desired opportunity to look over the consumer's installation and note defects and places where the consumer is not getting the illumination which he should for the money he is spending. Blackened lamps are taken out and in many cases the consumer is persuaded to try tungsten lamps in the more important rooms. In many cases the fusible cut-outs were found to be in very bad shape, offering considerable fire risk. Many cut-outs were found which were entirely uncovered and in which various things had been substituted for fuses.

Out of the 800 meters, one case of plain theft of electricity was found. In three cases circuits were connected to the service before it reached the meter, evidently by oversight. Meters were tested at full load and at one-tenth load. Only four fast meters were found out of the 800, the maximum error in favor of the company being 5.5 per cent. The total average of the slow meters was between 3.5 and 4 per cent slow. In correcting meters the attempt was made to get them not over 1 per cent slow and never to leave them fast. He estimated from the result of this overhauling that the company at Beatrice could afford to pay $1 per meter to have each meter put in shape for correct registration.

As to the number of installations which could be gone over in this way per day, he had heard it claimed by one large company that one man could test 20 to 35 meters per day. He was convinced that if any such record were made it must be by "absent treatment" of many of the meters. The average number of installations tested and inspected per day at Beatrice varied from seven to nine. When the company receives a request that a consumer's lighting be inspected it is usually necessary to make such inspection at night, and it is usually feasible to make only two such inspections in an evening. The work described, he said, was not to be considered simply as meter testing, but as a general inspection of the consumer's installation with the idea always in mind that the company is not selling the consumer electricity, but light.

In the discussion of this talk Mr. E. A. Bullock, or Norfolk, said that he had imported an expert last year to test the 500 meters on his lines. These were inducted meters of Westinghouse and General Electric manufacture. Out of these 500 meters 40 were found 30 per cent slow. One meter was found 10 per cent fast, and all the rest were within 10 per cent of correct. It had taken 60 days to test these 500 meters.

Discussion on New Business Topics at Nebraska Convention.

At the convention of the Nebraska Electrical Association, May 11 to 13, parts of several sessions were given to discussion of new business topics. In one session the importance of increasing business where a plant had been rebuilt and has considerable excess capacity was forcibly brought out. In such a case the interest and depreciation charges on the new plant necessitate extra effort to get the plant loaded.

In his presidential address Mr. E. A. Bullock, of Norfolk, suggested the co-operative employment of a good new business solicitor by several small central-station companies. Mr. B. P. Egan, of Nebraska City, endorsed this idea, as did also Mr. E. V. Capps, of Blair.

Mr. H. C. Porter, manager of the new business department of the Lincoln Gas & Electric Light Company, read a paper giving some of the methods used in getting business by his company. As illustrating how a system of following up possible business may benefit a company, he cited the fact that in a period of four months previous to the convention his company had secured and connected 100 prospects in the face of competition of another central-station company in the same field. Mr. Porter thought that in central stations like most of those in Nebraska every employee of the company should constitute a member of the new business department. To illustrate the possibilities for the new business department, he stated that no town in the State is adequately lighted. In most towns gasoline lighting plants are plenty; also individual steam-power plants. To introduce electric power it is often necessary to put in electric motors on trial, but good judgment must be used as to where it is desirable to do this. Comparatively few people are acquainted with applications of electricity to different kinds of work. Show-window lighting offers an attractive field of development for most companies. In advertising do not try to tell too much at once, but have an advertisement tell one thing in a plain and striking way. Since electric-lighting companies sell advertising in the shape of electric signs, such companies should be liberal advertisers in all ways to show their faith in advertising.

Mr. B. P. Egan, of Nebraska City, speaking of the building up of business by means of the tungsten lamp, said that in the first installation of tungstens in his town he had put in 25 40-watt tungsten lamps in place of 25 16-cp carbon lamps. This reduced the customer's wattage slightly, but the increase in illumination was sufficient to be striking, and to attract special attention. He therefore made up his mind as a result of this experiment to adhere to larger units, and his campaign proceeded successfully along such lines. He is now putting in tungsten fixtures as a substitute for arc lamps.

Mr. L. E. Watson, of Beatrice, reported having installed a number of 250-watt tungsten lamps. A dozen of these have been installed in a church since last September without a burnout. Altogether the company has several dozen 250-watt tungstens on its lines giving fine satisfaction. Some have been put in to replace arc lamps and thus the company has saved the maintenance of the arc lamps.

Mr. Joel M. Roberts, of York, said that his company carries a regular advertising space in the newspapers. He makes it a point to see that the paper is supplied with news items as to the improvements and new buildings in town, incidentally mentioning the fact that the house or store has been wired for electric light.

Mr. L. E. Watson, of Beatrice, commented on having seen an advertisement of the Norfolk Electric Light & Power Company which occupied a half-page of a Norfolk newspaper and gave a list of all the motor users in town. He copied this idea in Beatrice and thought that it did the company considerable good.

President Bullock explained that one reason for this advertisement in the Norfolk newspaper was that his company was in the midst of a campaign to secure the pumping of the city water by electricity. The appearance of this advertisement had its effect on the citizens and City Council, because it was naturally reasoned that if so many other concerns found it of advantage to buy electric power the city would find it also of advantage. The city pumping contract was secured after two months' effort.

Mr. B. C. Adams, of Lincoln, suggested that the manager of every small company make it a point to use himself all of the various appliances which he is trying to introduce. In a large city it does not make much difference whether the manager uses these appliances or not, because so few people are acquainted with him and his home. In a small town it is generally known what the manager has in the shape of electric equipment in his house.

Mr. Porter in response to a question as to the way prospective customers are secured, said that the city is divided into five districts, with a man for each district. These men make an actual house-to-house canvass. In this way they get information on the conditions in each house and the gas or electric appliances which the consumer is not using, but might be induced to purchase. Records of these calls are kept in card index and the best prospects followed up.

Mr. Scoutt, of Kearney, said that a card index record of all the buildings in town made up in this way had proved of great assistance to his company in knowing where to direct its efforts for business.

Mr. Smith, of Exeter, reported having 15 washing-machine motors in use in a town of 900 population. President Bullock, of Norfolk, a town of about 4000 population, said that his company paid about $18 per month for newspaper advertising. The popularity of the electric iron and the way it is used were soon learned when there was a temporary shut-down of the plant. The loudest complaints came from those who used the electric iron and who would not iron in any other way.

Electric Talks at Fort Wayne.

The Fort Wayne & Wabash Valley Traction Company has been carrying on for weeks past an interesting campaign to educate public sentiment by means of newspaper advertising. The city of Fort Wayne recently completed a municipal plant for street lighting, and following upon this the city officials began to enter the commercial lighting field by underbidding the Fort Wayne & Wabash Valley Traction Company, which was already in the field. The object of the company's advertising campaign was to convince the citizens of the unfairness to the company and the undesirability to the city of the policy of taking the taxpayers' money to enable the municipal plant to underbid and ruin the business of a private corporation, thereby not only doing the corporation an injustice, but taxing all the people of Fort Wayne for the benefit of the few who obtain low electric lighting rates as a result of this policy. These advertisements appear daily and occupy a space 6½ in. x 12 in. Following is a reprint of one of the "Electric Talks," which has the caption "A Press View of the Facts":

"Is not the entire attitude of the present city administration toward both street and commercial lighting an utterly discredited one?

"Where shall we find an apology for it outside of those who are receiving favors under its reprehensible discriminations?

"Is not the candidate for official honors who presumes on public acceptability of present administrative lighting policies simply inviting public rejection?

"Note what the ably edited, conservative *Fort Wayne News* said editorially May 1, 1909:

"'The citizens generally recognized the fact that Fort Wayne was far behind other cities of the State in the matter of street lighting, yet they made no complaint, for they believed that improved conditions would come with a municipal plant. They rested easy in the opinion that Fort Wayne would show the country how street lighting should be done.

"'But the hopes of citizens have had no realization in fact. Instead of improving upon the contract lighting the city has, if anything, fallen below it, for it has in many instances located lights for political pull rather than with an idea of rendering the best public service.

"'Instead of perfecting the street lighting system as the public expected, the authorities seemed obsessed with the idea of "getting action" on the Traction Company, and to this end the interests of the people of Fort Wayne have been sacrificed.

"'The city has assailed the Traction Company by rushing into the commercial field and furnishing a favored few lights and power at ruinous rates.

"'No schedule has been established and all sorts of rates have been accorded, many of them it is asserted, below the cost of production.

"'As a consequence of this short-sighted and puerile policy the city stands discredited.

"'It is doing street lighting and commercial lighting, but it is doing neither in a satisfactory or businesslike manner.

"'The service in both departments is discriminatory and unjust and the many are bearing a burden for the benefit of the few.

"'All property owners pay taxes, yet many of them are deprived of the right of a properly lighted street.

"'Moreover, the taxes which all pay are employed in giving cheap light and cheap power to the favorites of the administration. The many do not benefit thereby.

"'The *News* has no desire to place the city administration in an unfavorable attitude, but it maintains that the facts are plain and speak for themselves.

"'Men familiar with business are convinced that the continuance of the present policy means only one thing, and that is the burdening of the people of this city with an onerous tax rate to support a mismanaged institution.

"'The burden is one that is destined to grow greater, too, unless the city faces about, renounces its policy of petty spite and proceeds to develop this light plant as any other business is developed.

"'There is no facing about in proposals to continue present city policies!'"

Power Costs in a 725-kw Central Station.

The following figures of electrical energy cost for the past three years have been calculated from the records of a 725-kw central station, located in eastern Massachusetts about 50 miles from tidewater. The plant is of the reciprocating-engine type and has remained unchanged in the general character of its design for the period under consideration. Its total normal capacity in 1906 was 575 kw. In 1907 a 250-hp engine and 150-kw alternator were added, and in 1908 the equipment remained the same as in the preceding year. During the three years the cost of manufacture, exclusive of fixed charges, varied from 2.88 cents to 2.14 cents per kw-hour delivered at the power-station switchboard. The figures quoted below are of interest, not on account of any notable economy of production, but because they are representative of careful operation under the limiting conditions obtaining, and illustrate the influence of varying factors entering the cost of generation.

In 1906 the equipment of the station consisted of four boilers, three engines and three generators. There were two Allen boilers of the horizontal return-tubular type, each having 124 3-in. tubes, operating at 110 lb. per square inch, and rated at 150 hp each, and two 150-hp Dillon boilers, one having 124 3-in. tubes and the other 92 3½-in. tubes, horizontal type, operating at 110 lb. per square inch. The engine equipment consisted of one Armington & Sims 13-in. x 20-in. x 15-in. engine rated at 250 hp with a speed of 265 r.p.m.; one McIntosh & Seymour 15-in. x 23-in. x 17-in. engine rated at 250 hp, speed, 220 r.p.m., and one 16-in. x 16-in. Ball & Wood engine rated at 211 hp, speed 250 r.p.m. The electric generating apparatus consisted of

TABLE I.—575 KW CAPACITY.
Cost of Manufacture, 1906.

Output at busbars, kw-hours	650,880
Costs:	
Coal, bituminous, 2417 tons, at $4.88	$11,790.23
Oil and waste	348.47
Water	46.62
Wages	4,760.98
Station, building repairs	58.80
Steam equipment repairs	62.94
Electrical equipment repairs	11.07
Total	$17,080.11
Cost per kw-hour:	cents.
Fuel	1.810
Labor	.732
Miscellaneous	.344
Total	2.886

a 175-kw Bullock alternator and two General Electric 200-kw alternators. The operation of the plant in 1906 required the services of six men, including three engineers, two firemen and one oiler. The cost of coal was $4.88 per ton.

The total energy generated in the plant in the year 1906 was 650,880 kw hours. The company's total sales were 538,010

kw-hours. The output devoted to street and public lighting was 113,449 kw-hours, while the power sales were 226,082 kw-hours. The total cost of generating, exclusive of any fixed charges on the plant and its equipment for the fiscal year ended June 30, 1906, was determined as in Table I.

In 1907 the company added a second McIntosh & Seymour engine of the same type and size as the existing outfit, raising the total engine rating of the plant to 961 hp. A 150-kw Bullock alternator was purchased from the Allis-Chalmers Company and added to the station machinery, the total rating being increased to 725 kw. No additions were made to the boiler plant. The operating force was raised to 10 men, the staff consisting of four engineers, four firemen and two oilers. The station generated 886,800 kw-hours, the total sales being 654,952 kw-hours. The sales of energy for public lighting were 160,827 kw-hours and for power service 340,100 kw-hours. The cost of manufacture was made up as shown in Table II:

TABLE II.—725-KW CAPACITY.
Cost of Manufacture, 1907.

Output at busbars, kw-hours	886,800
Costs:	
Coal, bituminous, 2175 tons at $4.98	$10,836.85
Oil and waste	284.04
Water	222.33
Wages	6,266.54
Station building repairs	286.25
Steam equipment repairs	994.10
Electrical equipment repairs	138.46
Total	$19,029.17
Costs per kw-hour:	Cents.
Fuel	1.220
Labor	.705
Miscellaneous	.215
Total	2.140

In 1908 the company sustained the business losses incidental to a year of financial depression in a moderate-sized manufacturing town, and its power sales dropped to 309,473 kw-hours. The total station energy generated was 889,760 kw-hours, representing a small increase in output at the busbar. The total sales of the company were about 42,000 kw-hours more than in 1907, amounting to 696,494 kw-hours. The principal gain in energy sales occurred in the field of public lighting, the volume being 228,556 kw-hours. The company had to face a serious rise in the cost of coal in this year to $5.31 per ton. The operating force was reduced to eight men, the staff consisting of three engineers, two oilers and three firemen. Table III gives the detailed operating results of the year:

TABLE III.—725-KW CAPACITY.
Cost of Manufacture, 1908.

Output at busbars, kw-hours	889,760
Costs:	
Coal, bituminous, 2299 tons at $5.31	$12,205.05
Oil and waste	224.32
Water	71.43
Wages	6,669.26
Station building repairs	402.63
Steam equipment repairs	1,161.11
Electrical equipment repairs	24.43
Total	$20,758.23
Costs per kw-hour:	Cents.
Fuel	1.370
Labor	.750
Miscellaneous	.220
Total	2.340

Reviewing the operation of the station as a whole during the three years, it is clear that the plant has been handicapped by a rise in coal price of 8.8 per cent, but the improvement in the motor load, so far as it is apparent, was decidedly helpful in decreasing the fuel consumption per unit of output. The station economy, as a whole, is not poor for so small a steam plant equipped with compound engines, although there is evidently room for the betterment of the installation, judging by the coal consumption. The labor costs are rather unsatisfactory, considering the increase in station output, even a reduction in the force giving little relief in the last year of the tabulation. The unit figures in this branch of the station work indicate the importance of making close studies of the attendance in small as well as large stations. It is significant that the steam and electrical equipment repairs amounted to about the same combined total yearly, but that the electrical repair cost steadily diminished. The steady increase in the steam-plant maintenance suggests that in this portion of the station greater care should be taken to secure the best possible efficiency of apparatus.

Twenty-Four-Hour Service in Small Iowa Towns.

At the Iowa Electrical Association convention, April 21 and 22, considerable attention was given to questions pertaining to building up day load in small towns. Mr. M. A. Harrison, of Nevada, gave some of his experiences in the form of a paper. He admitted that local conditions govern the amount of business to be obtained, but the general conditions in the smaller towns of Iowa are similar. In his opinion, there are few of these towns of 2000 inhabitants upward that cannot increase revenues sufficiently to cover the increased cost of giving daylight service.

While it is true most of the small towns have little manufacturing, nearly all have waterworks, printing offices, blacksmith shops, laundries, machine and repair shops, plumbing shops and grain elevators that require power. These, together with the domestic uses of current, and the lighting on during the daytime, will make an aggregate increase in revenue sufficient to offset the expense of daylight operation. Most of the daylight business can be taken on with the present equipment without additional investment.

Mr. Harrison, who comes from Nevada, Ia., admitted that he ventured in the 24-hour service with fear and trembling, but the conditions were such that they felt they must make the effort because of the competition of gasoline plants with the local gas plant. The plant consisted of a Corliss engine belted to a single-phase 60-cycle generator. The company first closed a contract with the city to install motors in the waterworks pumping station, which had previously been operated with steam. A 10-hp motor belted to a triplex pump was used for the first installation and proved a good advertisement and practical demonstration of electric power. The steam laundry, previously located in the central part of town, purchased a building one block from the station and made a contract for electric power and steam for a dry-room and water heating. This was the beginning of the day service.

Nearly 50 electric irons were placed inside of 90 days, much exceeding the company's expectations. As there is only one unit in the station, it is shut down from 6 to 7 a. m. in summer and from noon to 1 p. m. in the winter. At first prospective consumers were skeptical and thought the company could not obtain enough daylight business to justify furnishing the service and would discontinue it, but as the business increased the company was able to take over some of the gas and gasoline lighting which could never have been obtained if day service had not been started.

It was expected that there would be a loss in the daylight operation the first year, but the increased revenue a little more than paid for the extra fuel, space and labor. Day service was started in July, 1907. At present there is 68 hp in motor load connected, consisting of waterworks pumps, grain elevators, blacksmith shop, laundry, plumbers, produce and poultry merchant, printing offices, tailors' irons and 75 domestic flatirons. When day service was first started it was advertised in the two tri-weekly newspapers in the town.

The company put in a stock of motors from 5 hp down and kept them on hand ready to install immediately when wanted. Several gasoline engines were displaced by installing motors on trial besides the engines. In a few instances they had to take the engines as part payment on the motor in order to close the deal, but succeeded in disposing of them at cost out of town. To encourage the use of flatirons, a discount of 20 per cent is given on current used in excess of 8 kw-hours each month. Washing-machines were put out on trial, as well as desk fans and sewing-machine motors. Some people have wired their homes to enable them to get power to operate a washing-machine where they would not have incurred the expense for lighting only.

They have promoted the portable vacuum cleaner by encouraging a man who does housecleaning to purchase a machine and by allowing him free use of the company's show window for a few days in which to exhibit it. The machine is doing satisfactory work and running most of the time. One of the most

effective forms of advertising is that placed on each monthly bill, which is changed each month, and apparently attracts attention of a large percentage of the consumers. One of these advertisements recently called attention to the large number of different kinds of work electricity is performing in the community. The following is a quotation from one of the advertisements recently used on a monthly bill:

"When you turn the faucet and draw a drink of water, did it ever occur to you that it was pumped by electricity? When your clothes go to the laundry, electricity does the work; several are using it in their homes to operate the washing-machine, and for ironing it is unexcelled. It prints the local newspaper, and grinds the coffee for the groceryman; it pumps air to the forge for the blacksmith, and operates the tools for the workmen at the monument shop. Up-to-date physicians are using it in their treatment, the electric heating pad is so far superior to the hot-water bottle, and one of the latest applications is that of assisting the cobbler in repairing shoes. There are many other purposes for which it will soon be used."

Mr. Harrison said that it would have been impossible to have convinced his company that so much day load could have been secured inside of a year, and there is still more to come.

In the discussion of Mr. Harrison's paper, Mr. Flanders, of the Westinghouse Machine Company, called attention to the possibility of using a storage battery for carrying the day load. The battery can be purchased for from $30 to $60 per kilowatt of capacity, and can be used on either alternating-current or direct-current systems. In an alternating-current system a motor-generator set would be required. Mr. H. Coughlin, of Waterloo, brought up the question of fixed charges in connection with day service. If an extra unit has to be installed for day service, as would be the case in many of the smaller plants, the fixed charges on this investment must be considered. Mr. F. L. White, of Traer, said that he handled day load by the operation of a 25-hp engine unit. The large unit in the plant is operated only four hours a day.

Mr. J. T. Moffit, of the Tipton Light & Heat Company, said it was the practice of his company to run half the night up to a year ago. Since then a compromise schedule has been adopted so that the plant is shut down from midnight until 5 a. m. during the winter months and from midnight until 7 a. m. during the summer months, also one hour at noon. Mr. A. W. Zahm told about a plant in a town of 1100 population that started to give day service two years ago. One of the devices which had been pushed to secure a day load in that town was a combination washing-machine and pumping outfit in which one motor can be connected either to drive the washing-machine or to drive the small pump for raising water from the cistern to the tank. These complete outfits, with a 220-volt direct-current motor, cost about $30. Between 40 and 50 have been placed within the past year.

Mr. E. H. Burlingham, of the People's Gas & Electric Company, Chillicothe, Mo., paraphrased John Sherman's famous statement that "the way to resume specie payment is to resume" by saying that "the way to begin day service is to begin." After that go out and get the business. In his experience consumers will not fall over each other trying to get central-station day service. Its advantages must be brought to them repeatedly.

INTERIOR WIRING AND ILLUMINATION

A Striking Sign at Omaha.

The Omaha Electric Light & Power Company recently secured a contract for the lighting of a large sign at Omaha advertising "Old Dutch Cleanser." This sign is shown in Fig. 1, together with a neighboring sign advertising a cigar. Both are flashed signs and are very effective. The Old Dutch Cleanser sign is of particular interest to central-station contract agents because it is the first attempt of the company manufacturing this article to advertise it in this way by the electric sign. It indicates that the Cudahy Packing Company, the manufacturer, is beginning to recognize the value of electric signs for advertising this product, which is already very extensively advertised in other ways. The results from this sign in Omaha will very likely mean the installation of similar signs in other cities over the country. The sign contains about 1000 lamps, half of which are 4-cp lamps and the remainder 2-cp. The order in which this sign is flashed is as follows: (1) "Old Dutch Cleanser"; (2) "chases dirt" (figure of woman with club raised); (3) club falls; (4) entire sign flashed off. On the neighboring sign smoke from a cigar is indicated by flashing the lamps in waves in a very effective way. The cleanser sign is turned on from dusk to midnight. A recent test made by a representative of the Cudahy Packing Company and Mr. I. B. Zimman, contract agent of the Omaha Electric Light & Power Company, showed that practically every person passing a certain point a block away from this sign was attracted to look at the sign in passing. It is 38 ft. high x 54 ft. long, built on an angle iron frame construction by the Thomas Cusack Company, the large billboard and sign concern.



"OLD DUTCH CLEANSER" SIGN.

An Illuminated Interior Sign.

The Denver Gas & Electric Company is using an illuminated sign inside of its general office and salesroom for the purpose of attracting attention to certain seasonable advertisements. It is easily seen either from the street or from the room. It is illuminated with a border of 34 frosted 16-cp lamps, which burn night and day and make the sign stand out so as to be easily seen by passers-by, both night and day. The use of illuminated interior signs in this way is feasible not only for central-station companies, but for their consumers.



INTERIOR NIGHT AND DAY ELECTRIC SIGN.

A Review of Ornamental Curb-Line Illumination.

Mr. D. F. Fradette, contract agent of the Des Moines Electric Company, at the Iowa Electrical Association convention, April 22, in a paper entitled "Ornamental Curb-Line Illumination," told of the post lighting installed on the down-town streets of



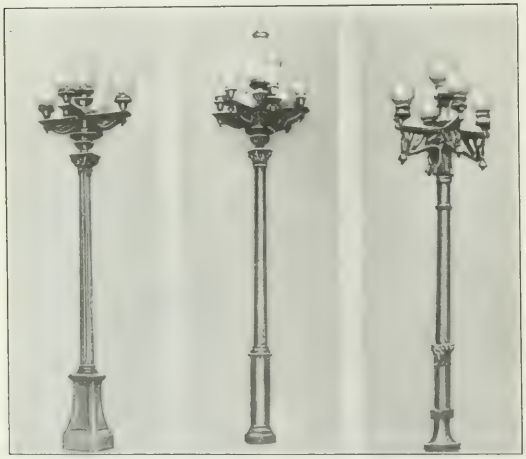
FIG. 1.—WALNUT STREET, DES MOINES.

Des Moines and also reviewed the systems used in several other cities. An abstract of this paper is given below.

DES MOINES.

Mr. Fradette stated that after an investigation, carried on by the local commercial association and the Des Moines Electric Company, the consensus of opinion seemed to be that the post form of lighting is the one most desirable. The post offers less menace to firemen during a fire, and from the standpoint of artistic beauty during the day there is no question as to its superiority.

In Des Moines there is a commercial club, which decided that the city streets should have some form of attractive lighting. With the assistance of the Des Moines Electric Company it decided upon iron poles. The company then got prices and photographs of nearly every type of pole on the market and submitted them to the club, which selected the type shown in Fig. 7. After deciding on the type of pole and probable cost, the matter was taken up with the City Council, which passed an ordinance



FIGS. 2, 3 AND 4.—POSTS, LOS ANGELES, CAL.

making the type of pole selected by the commercial club a standard and specifying that the pole spacing should be not more than 56 ft. nor less than 44 ft. The pole casting costs $59. The total cost set up complete in place and connected is $85.

The electric company, with the assistance of committees of local merchants, made an active campaign. Seventy poles were installed in six months. The more blocks which adopted this scheme, the easier it was to get the rest. The later blocks have been placing poles 16 to the block, or 44 ft. apart, on account of the better effect secured by the frequent spacing. The property owners pay for the poles and the tenant pays for the operation. Each pole has a lock switch in the base and the lamps are turned on by the patrolman when he turns on flat-rate windows



FIG. 5.—SIXTEENTH STREET, DENVER.

and signs. They are turned off at midnight. The rate per year for each pole equipped with five 100-watt tungsten lamps is $69.50. The appearance of Walnut Street at night is shown in Fig. 1.

LOS ANGELES.

In Los Angeles, Cal., the merchants of Broadway organized and installed a type of pole costing $100 complete (Fig. 3). Broadway was later followed by Spring Street (Fig. 2) and Hill Street (Fig. 4). The poles were placed 115 ft. apart on both sides of the street. Each of the five globes contains three 8-cp



FIG. 6.—FIFTEENTH STREET, DENVER

lamps. An attempt recently made to use tungsten lamps was a failure because of the jarring from the passing cars. Mr. Fradette notes that no such trouble has been experienced in Des Moines with 100-watt tungsten lamps. A defect noted in the Los Angeles posts is the shading of the middle globe by the outer globes.

OAKLAND.

In Oakland, Cal., a city of 70,000, there are now installed over 600 three-globe posts, each globe containing three 16-cp lamps

These posts are placed three on each side of the street, six to the block. The cost of each post is approximately $85 set up complete. The solicitation and installation were carried out by a private contractor. The cost of installation was borne by the merchants and the lighting is paid for by the city. In Denver, Col., as a result of co-operation between the street railway, the city and the electric light company, the street-railway poles are used for lamp suspension. On Sixteenth Street (Fig. 5) a square ornamental casing was placed over a steel railway pole.



FIG. 7.—POST, DES MOINES, IA.



FIG. 8.—POST, SUPERIOR, WIS.

These poles are spaced 90 ft. apart, or four pairs to a block Only one of the arc lamps is used, the other being a dummy. The casing on Sixteenth Street cost $160. The lighting is paid for by the city at a cost of $60 per lamp per year. On Fifteenth Street, Denver (Fig. 6), no casing was used, but an ornamental bracket was placed on a special railway pole. This bracket cost the city only $50. The spacing is the same as on Sixteenth Street.

SUPERIOR, WIS.

At Superior, Wis., a city of 50,000 inhabitants, the publicity committee decided on the system to be installed and did the soliciting. The post adopted is shown in Fig. 8. The street at night makes a fine appearance and denotes a progressiveness which will cause people to stop and investigate the resources of such a city (Fig. 9). The side lamps on this post are 100-watt tungsten, and the top lamp 40-watt tungsten. The poles are wired so that the side lamps may be turned off at midnight and the middle lamp is left burning all night. These



FIG. 9.—STREET LIGHTING, SUPERIOR, WIS.

posts are spaced 55 ft. apart on both sides of the street, or 16 to the block. The cost per post has averaged $80 complete. They are supplied from an independent circuit set in a groove which was chipped in the edge of the cement walk. This system of connecting the poles by setting a conduit in a groove chipped from the edge of the walk seems to be the most popular, but many have done as in Des Moines, namely, fished the wire under the walk and connected to the nearest feeder, each pole being turned on by a lock switch in the base.

Business-Street Illumination by Merchants' Associations in New Jersey.

By William H. Stuart.

IT has been conclusively proved in Newark, N. J., that brilliant electric illumination of the business streets will not only draw trade, but will attract it from other quarters not so brilliantly lighted. In Newark the 36 flaming-arc lamps that have been in operation on South Broad Street since Jan. 17 have changed conditions considerably. Where formerly a few hundred people would pass along that thoroughfare, now there are thousands. The increased light has not only brought increased trade, but quite a few new large business concerns as well, and store space in that locality is now at a premium.

The development of this movement and its successful operation are due to the various merchants along South Broad Street who saw that the retail business of the city was monopolized entirely by North Broad Street and who banded together to devise means to attract the trade to their stores. An association, having as members every merchant on that street, was formed and called the South Broad Street Improvement Association. It was soon discovered by discussion that the means to be employed in winning trade dwindled down into one, electricity. The first plan suggested was the greater illumination of the individual show windows, the lamps in which were to be kept burning until a stated hour each night. Inasmuch as all the merchants could not afford to go into it on the same scale as some, and maintain it, the scheme was rejected. The next plan presented was the festooning of the street and shops with incandescent lamps. This was abandoned on account of the quick depreciation of street lighting of this character and the expense of installation and maintenance. Flaming-arc lamps were finally adopted, and, as noted in the Jan. 28 issue, 36 four-carbon flaming-arc lamps of Scott make were lighted amid a public demonstration enthusiastic and appreciative. The spectacle was made all the more enhancing by a heavy fall of snow which cast a reflection that was very beautiful. To the flaming-arc equipment there was added strings of incandescent lamps which were run across the street every 50 ft. This extra lighting was removed after two weeks.

The association after its organization and the final selection of the lighting plan went to the Public Service Corporation and asked for an estimate on the cost of installation and operation of such a scheme of lighting. The Public Service Corporation made a proposition by which it agreed to erect, light and maintain 36 four-carbon Scott flaming-arc lamps along South Broad Street, spaced every 100 ft. on both sides of the street, for the sum of $270 per lamp per year, provided a three-year contract was signed. The lamps were to burn every night all night. The contract was signed and the work on the equipment was immediately started. The merchants' association then made arrangements with the city whereby the association was to pay to the city the difference between the price the city paid the lighting company for the old enclosed street arc lamps, which was $70 per lamp per year. This amount —$200 per lamp per year—is paid by the association in a lump sum to the city, which is responsible for and pays the lighting company. The association placed a subscription list before its members and asked that the total amount be subscribed to take care of the cost of the equipment for three years. Each merchant was allowed to contribute just what he thought the light was worth to him. No trouble was experienced in raising more than enough money to carry out the project. The increased amount of business already done by the various merchants has more than repaid them. Within a short time the association will extend this lighting scheme south on Broad Street and will have an equipment of over 80 flaming-arc lamps. The distance covered will be about three-quarters of a mile.

The success of this venture caused merchants on other streets in Newark to organize and adopt this scheme of attracting business by electric light. It was also taken up by the merchants of other New Jersey cities. In Newark, the merchants

of Market Street are organized into an association known as the Market Street Business Men's Association.

Five of the Market Street business men called a special meeting of the merchants of that street and a permanent association was organized and incorporated. While the principal work of the association is to secure some electric illumination that would attract trade, there are various other improvements to be carried out. The association will place along both sides of the street 68 poles from the Pennsylvania Railroad station to the Court House, a distance of three-quarters of a mile. Two plans were considered. The first one was the use of two single flaming-arc lamps on each pole, one lamp projecting out into the street and the other over the sidewalk. The other plan was the use of one double flaming-arc lamp on each pole. The Public Service Corporation was approached and asked as to the cost of the erection and operation of the lamps. The figures given were, $350 per year per lamp for the double flaming-arc lamps and $300 per lamp per year for the single flaming-arc lamps. The merchants next sought the authorities, with the result that the city entered into an agreement with the Public Service Corporation to light the street with flaming-arc lamps; the municipality collecting the difference in the cost of the flaming-arc lamps and the enclosed arc lamps from the merchants' association. The association in order to raise the necessary funds has used a different scheme than that employed by the South Broad Street Association. A legal contract, which each member is obliged to sign, binds him to pay for the lighting of the street at the rate of so much per running-foot frontage of his establishment. If the merchant fails to live up to the contract he is liable to a suit for damages. This plan, which was approved by all the members, will prevent any of them withdrawing and leaving the others to bear the entire expense. The distance illuminated is measured off in feet and the rate per running-foot determined; but as there are two sides of the street lighted, this amount is halved. It is expected that the cost to a merchant with a frontage of 25 ft. will not exceed $100 per year.

The North Broad Street Merchants' Association has been organized some time, but as the merchants on this thoroughfare have always enjoyed a great amount of trade it has not been found necessary to inaugurate any improvement campaign until now. With business men in other parts of Newark attracting considerable trade from North Broad Street, the association has determined to install a flaming-arc equipment similar to that of South Broad Street. This installation is expected to be in use within a few months. The cost of this installation will be apportioned among the members on the same plan as that adopted by the Market Street Merchants' Association.

In Hoboken, the storekeepers on First Street, from Washington Street to Madison Street, a distance of nine blocks, have formed an organization known as the First Street Merchants' Improvement Association. The membership at the first meeting numbered 36, at the second 70, and at the third meeting, 175. The association approached the city officials some time ago and sounded them on the subject of the city bearing some of the expense of an installation of flaming-arc lamps. The authorities would not go into any flaming-arc-lamp proposition, but agreed to install three additional enclosed arc lamps on each block along First Street if a petition was presented by the merchants for this equipment. The city will bear the expenses of erection and maintenance. The association now has the petition before the City Council. When this equipment is in use it is the intention of the association to install 30 flaming-arc lamps, allowing three lamps to each block. As First Street is a narrow thoroughfare, the flaming arcs will be extended on outriggers from poles to the center of the street. This will give an equal amount of light to both sides of the street. The association feels that the additional arc lamps installed by the city will not show up very well alongside the flaming-arc lamps and will then ask the company to remove them and apply the cost of operating them to the expense of maintaining the flaming-arc lamps. The merchants will pay for this lighting at the rate of so much a running-foot frontage.

The Merchants' Co-operative Association of Jersey City Heights, in Jersey City, which has been organized over two years, has taken up the work of securing an installation of flaming-arc lamps along Central Avenue, from Manhattan Avenue to North Street, a distance of 3500 ft. Thirty flaming arcs will be employed and spaced every 100 ft. diagonally or every 200 ft. on the same side of the street. The association has completed its working plans, which are to make arrangements with the city whereby the latter will make a contract with the Public Service Corporation to light Central Avenue with flaming-arc lamps, removing the present street arc lamps. To pay for this lighting an assessment will be placed on each piece of property along the street, which will amount to about $1.50 per year per foot frontage. The association has already secured the consent of the property owners along Central Avenue to this plan. As this assessment will be placed only on the property along Central Avenue there has been no objection to this plan by the city officials. The lamps will be placed in operation in the early fall to help in the regular annual mardi-gras festival.

As a means of attracting attention to Monticello Avenue, the shop street of the Bergen section of Jersey City, owners of stores along that thoroughfare have organized the Monticello Avenue Business Men's Association, which will direct the campaign of advertising the attractions of the avenue. They have all agreed to illuminate their establishments with electricity at night and pay special attention to their window displays. Monticello Avenue has rapidly developed as one of the big business veins of the city and the association has determined to inaugurate an effective campaign for its improvement by employing flaming-arc lamps in the early fall.

The shopkeepers on Main Street, Paterson, have recently illuminated three blocks of that thoroughfare from Market Street to Broadway. The persons interested, while not as yet formally organized, call themselves the Merchants' Improvement Association. When the idea was conceived it was the intention to have all the merchants brought into an association and to illuminate Main Street for quite a distance, but it was soon found that it would take considerable time to get an extensive proposition under way and the longer the matter was delayed the less the effect would be. The merchants along the three blocks individually agreed to erect 26 Polar flaming-arc lamps. The lamps are placed on outriggers attached to the front of the buildings. The outriggers, wiring and lamps are furnished by the merchants, who also furnish the carbons and provide for the trimming of the lamps. The energy is to be supplied through consumers' meters and a separate meter is set for each pair of lamps. The lamps are lighted each night at dusk and switched off at 11:30 p. m. Unlike the work in other cities, the local merchants' association has not asked the city to help defray the expense, as there are not enough street arc lamps on the three blocks to take into consideration. A month before the present lighting scheme went into effect the lighting company offered to furnish 22 Excello flaming-arc lamps, install them on octagonal wooden poles, with ornamental goose-neck tops and operate them on a three-years' contract at $180 each per annum. This plan had to be abandoned because the city authorities would not permit the erection of the poles and the necessary overhead wiring. Recourse was then had to the plan adopted. The merchants have met with strenuous objections from the Early Closing Association. The clergy, while they do not wish to throw cold water on the method of attracting trade to the city stores, are also up in arms against the illumination, because it will break up the early closing movement by drawing out the people at night and keeping the stores open. The situation at present seems to favor the merchants, who intend in a short time to organize, after which more definite arrangements will be made between the association and the lighting company.

In New Brunswick, about 40 merchants on Bernard Street and Church Street have agreed to the erection of 30 flaming-arc lamps. The lamps will extend for 1½ blocks on Bernard Street and two blocks on Church Street, and will be erected and used under the same conditions as exist in Paterson. The arcs will be operated, two in series, and the energy will be registered

by meter, two lamps to each meter. The lamps, wiring, carbons, trimming and energy will be paid for by the merchants individually. It is expected to have the full equipment of 30 lamps lighted on May 1.

The Progressive Association of Perth Amboy, composed of the tradesmen along Smith Street, will have an equipment of 20 flaming-arc lamps which will be burning in a short time. No plan has been decided upon by the association at present for the erection of the lamps and the payment of the expense. The scheme which seems likely to be adopted is similar to the one employed in Paterson. On the opening night a public demonstration will be arranged with parades and music.

The Public Service Corporation has made a set rate for equipments of this nature, using the Scott lamp, of $300 per lamp per year, including all expenses for the single flaming-arc lamps and $350 for the double lamp. The minimum number of lamps in any equipment is placed at 30.

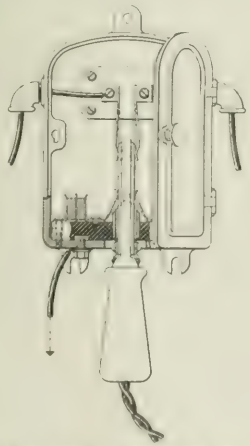
New Telephone Patents.

IMPROVED APPARATUS.

The arrangement of cabling multiple jacks in the multiple switchboard has been standard for many years. In fact, it would seem that the early designers hit upon the only feasible plan permitting the required accessibility. Nevertheless, because of the diminishing size of the jacks, there has been greater and greater difficulty in reducing the vertical dimension of the cables sufficiently to prevent these piling upon the cable shelf faster than the jacks pile in the frames. Flat-type cables have been devised to meet this demand, but, as ordinarily constructed, this type of cable is not of stable shape.

To overcome this difficulty, Mr. W. L. Runzel, of Chicago, Ill., has devised a cable made up of a number of small spherical cables laid side by side with separators between. The whole is then covered with a braiding, which is sewed through from flat to flat, through the separators. This gives a fairly stable construction. Mr. Runzel has assigned his patent to the Runzel-Lenz Electric Manufacturing Company.

For interurban despatching by telephone it is usual to have the telephone carried upon the cars, and to have connections along the line at proper intervals suitable for the attachment of any car telephone to the despatch wire. All sorts of connections have been suggested and used, ranging from the crudest exposed contact devices to the most elaborate jack boxes. Above is shown a jack box for this purpose, patented jointly by Messrs. J. B. Taylor and W. S. Bralley, of Schenectady, N. Y. A flat plug is used with conducting strips on either side of the blade. Considerable ingenuity is shown in the method of sealing the box upon the withdrawal of the plug. The bushing, it will be noted, is so shaped that the protector connection springs come down over it to seal the opening. Another good feature lies in the connection of the protector with the insertion of the plug. This patent is assigned to the General Electric Company.



TAYLOR AND BRALLEY TELEPHONE JACK BOX

Mr. F. B. Cook, of Chicago, Ill., has patented an individual line protector, in which the fuse links are enclosed in tubular apertures in the base block. To promote reliability of action the fuse wire is crimped so that each length used has exactly the same degree of contact with the walls of the tube. A copper-plated iron wire is used as the fusible conductor.

Another protective device is described in a patent issued to Mr. W. E. Ashby, of Chariton, Ia. This is an adaptation of the old comb-type open-space cutout. The combs are mounted upon a circular base. A tilting knife-blade switch arrangement permits the ready opening of the connection to line and the grounding of the instrument.

There have been invented a good many clever metal boxes or casings for telephone sets, but nearly all of these contemplate the mounting of the transmitter as an entirely separate unit. Mr. C. E. Bilton, of Bridgeport, Conn., however, has pressed up a transmitter front as a part of the front box wall, thus providing for the diaphragm seat and mouthpiece receptacle.

A message-counting device is the subject of a patent granted to Mr. W. O. Weissich, of San Francisco, Cal. The apparatus has a push button actuating an exposed counter. Only a full throw of the button will signal the central operator that a count has been made, and the push button is locked against return to normal at all intermediate positions.

The harmonic ringer has received a good deal of attention and it has been found that this problem is not nearly so simple as it would seem at first sight. This is because of the extraneous effects due to the rebound of the bell clapper from the gongs and to the normal vibration of the bell proper. Mr. Klas Weman, of Buffalo, has patented a ringer which he claims overcomes these features. He supports his armature on a long, flexible rod, this rod paralleling the cores midway between them, and being secured to the yoke end of the magnets. The armature describes a circular motion about this point of support and, therefore, has a sort of sidewise swinging motion, rather than a tilting one. The hammer rod is made flexible so that the vibration is long and free.

It has been found advisable to associate the clearing-out signal with the keyboard keys. This is generally done with lamp signals. Where magnetic signals are used it has, however, not been found so convenient. In order to overcome the difficulties heretofore found, Mr. O. M. Leich, of Rochester, N. Y., has patented a combined ringing and listening key and signal. The device is so arranged that operation of the listening key will mechanically restore the shutter of the signal and thus this latter may be enclosed entirely within a protecting case, having windows for exposing the dial. The apparatus is thus free from danger of accidental derangement in handling the cords. The patent is assigned to the Stromberg-Carlson Company.

A step-by-step lock-out party-line system has been patented by Messrs. R. C. N. Hastings and T. Matheny, of Athens, Ohio. The novelty of this system lies in the fact that the stations are selected off both sides of the line. The normal signaling limb of the line is grounded at the last station, and when a sufficient number of steps have been sent down this limb to ground, to correspond to the last station connected to it, a switching device at this last station transfers the ground to the other side of the line, so that, the next step being sent out, the second limb of the line properly meets ground in order to effect a selection of the sets wired off this side. Provision is also made so that the outermost subscriber involved in any connection may cut off the part of the line beyond him, thus removing the ground connection during conversation.

CLEARING OUT CIRCUITS.

We recently described an arrangement of condensers to make more positive the operation of clearing-out drops, at the same time reducing the tendency of the clearing-out signal to talk through. Another arrangement has been designed with this same end in view, the joint invention of Messrs K. Weman and T. S. Hemenway, of Buffalo, N. Y. In this invention a high-resistance locking relay is bridged across the cord circuit.

This responds to the first ringing impulse, locks itself and also bridges a low resistance clearing out drop across the line. This latter responds to the later ringing impulses, and, being of low resistance, shields the distant bells as well as being positive in action.

Letters to the Editors.

Cost of Water-Pumping in Duluth.

To the Editors of Electrical World:

Sirs:—In your issue of May 6, 1909, on page 1085, in an article by Mr. George J. Kirchgasser, a comparison is made between the cost of pumping water in the cities of Buffalo and Duluth, and it is stated that the price charged the city of Duluth is $6.50 for each 1,000,000 gal. of water pumped. This does not represent the true conditions, as the price to the city ranges from $6.50 per 1,000,000 gal. to $5.50 per 1,000,000 gal. as the quantity of water increases, the higher price being paid when the average number of gallons pumped per day is 1,000,000 and the lower price for an average amount of 15,000,000 gal. These prices, it will be seen therefore, compare very favorably with those charged in the city of Buffalo.

Duluth, Minn. W. N. Ryerson.
General Manager, Great Northern Power Company.

Engineering Classification.

To the Editors of Electrical World:

Sirs:—After reading the article in your issue of Jan. 14 by Mr. George W. Lamke on filing electrical engineering data, it appeared to me that the classification suggested had advantages over others which have been proposed from time to time, and I thought of adopting it for my own use. I find, however, that there are some subjects which hardly seem to fall under any of the headings given. Some that have already occurred to me are as follows:

Electric Generating Stations and Substations.—Descriptive. Specifications and Design. Tests. Management. Cost and Tariffs.

The engineering press is continually publishing descriptions of modern stations, sometimes giving figures and other information of real value. There have also been recently several very valuable papers read before the various engineering institutions covering the whole field of the central station, or one or more of the sub-headings of that subject, which I have enumerated above.

Combined Prime Movers and Generators.—Descriptive. Specifications and Design. Tests.

The technical press contains frequently descriptions of combined generating sets, giving useful figures relating to the mechanical and electrical side individually and *combined,* and I think these might be arranged under the sub-headings given below, in a special section.

Load equalizers—by which I mean devices such as the Ward Leonard, Ilgner or allied flywheel sets and other arrangements for the same purpose—are at present receiving a good deal of attention. It hardly appears to fall under headings No. 35 or No. 36, and it seems worthy of a more important place than No. 38.

It appears to me that there should be some section to include *General Matter* relating to electric drives, such as gearing, couplings, etc., which might be useful in a variety of the many uses to which the motor is put. Of course, any matter relating to special applications should, as far as possible, come under special headings on those subjects, such as locomotives, cranes, elevators, machine tools, printing, etc.

If Mr. Lamke or anyone else can suggest a satisfactory way of amplifying the classifications given in your issue of Jan. 18 last, I am sure their efforts would be highly appreciated by a great number of your readers.

Bryngwyn, North Wales. T. S. Littlebos.

Locating Wireless Sending Stations.

To the Editors of Electrical World:

Sirs:—The point raised in your issue of April 29 in relation to the location of stations sending wireless messages is of the very highest importance in connection with an important use of wireless telegraphy that is likely to develop, namely, that of helping the rescue of ships in distress at sea. The fact that the *Baltic* was able to go to the rescue of the *Republic* after her collision with the *Florida,* owing to the fact that the wireless operator had the pluck to stick to his signal key and keep on rapping out the distress signal, has interested the whole of the scientific world and the whole of the marine world. It is one important chance in favor of those who go down to the sea in ships. Many of the ships that are never heard of might have been rescued, or at least something might have been known of their fate, if they had been fitted with wireless apparatus, and if the operator had done as Binns did. But, as your comment points out, there is a very weak point in the affair. It is part and parcel of the wireless system, as far as inventors have gone at present, that the signals go out in all directions and there is nothing to tell from what direction they come. In the case of the *Republic*—in the case of any ship in danger of foundering at sea—this is a great advantage, because it makes known the distress to every ship within the radius of the wireless apparatus carried. But, as you have pointed out, it does not make known the position of the ship in distress, and that is a very serious matter indeed. Apart from the difficult task of hunting up the ship, the time occupied in doing so might neutralize the advantages obtained by calling other ships to the assistance of the one in distress. As everyone knows, minutes are often of the very greatest importance in cases of collision. It happened very fortunately in the case of the *Republic* that she was able to keep afloat for a long time, and therefore the rescuing ship had time to reach her, notwithstanding the difficult hunt required. In many cases the question of having to hunt for the ship would render the service practically useless. She would have gone down before the rescuing ship could reach the spot, and possibly leave no trace behind.

There is a very simple method, however, of getting over the difficulty, namely, to signal the latitude and longitude. It should not be difficult, once the matter is called to the attention of the maritime authorities, to arrange a simple code of signals by which the latitude and longitude can be given with a very small number of taps of the signaling key. In view of the small time sometimes allowed to a ship after collision, the smaller number of signals that can be arranged to give these data, the greater will be the chances of rescue. Failing that, however, and until such a code is formed, it would not take very long, and it should be quite easy to signal, after the distress signal, latitude so-and-so, longitude so-and-so. Any ship anywhere in the neighborhood would then be able to make full speed for the spot quite as unerringly and with greater speed than, say, a motor would, if a signal was made from some place on land where somebody was in distress. There is, as seamen will recognize, a weak point to this. In foggy weather the latitude and longitude are no known accurately. Whenever the sun is visible observations are taken about 9 o'clock in the morning and again at noon, the first being for the longitude and the second for the latitude. In addition to this, the ship's course is plotted on the chart, which all ships carry, each distance on any course being marked, and the position corrected from time to time from the observations of the sun. When there is any possibility of the sun being obscured during the day, and it happens that stars or the moon are visible at night, observations are taken of them, of stars for the latitude and of moon and stars for the longitude, the ship's position being corrected by these observations. In the case of ocean highways so much frequented as that between Europe and America, and with the powerful steamers employed in the ocean traffic, the "dead reckoning," as the plotting of the ship's course and distances on the chart is called, will not be very far out, and the position can be obtained at any moment with fair accuracy. If, therefore,

he latitude and longitude were signaled as accurately as could e given from the chart, any ship within range could very asily find the spot or could get within such range of it that he increasing and decreasing power of the signals themselves would act as guides.

In addition to this, having given the latitude and longitude of he ship in distress, if that ship was also fitted with submarine ells, any rescuing ship, which also carried submarine signals, would be able to feel her way to the ship in distress when with-n a fairly wide range, such as that the approximate latitude nd longitude would give her.

BATH, ENGLAND. SYDNEY F. WALKER.

Steam Consumption Tests of a 500-kw Turbo-Generator Set.

To the Editors of Electrical World:

SIRS:—I have read with interest the article by Prof. A. C. Scott on "Steam Consumption Tests of a 500-kw Turbo-Generator Set," which appeared in your issue of May 6.

As the designer of this turbo-generator, which was built by he Allis-Chalmers Company, I wish to point out that the unit lescribed is an enclosed 500-kw, two-pole, 3600-r.p.m. generator, whereas the illustrations in the article show the stator and otor of an open-type, 1500-kw, four-pole, 1800-r.p.m. generator. Furthermore, the generator installed at the plant of the Water, Light & Power Commission of Austin, Tex., is a modern arti-icially ventilated generator with inclosure for muffling the noise, whereas Figs. 1 and 2 of the article represent one of the oldest types of turbo-generators of my design.

Professor Scott refers to the metal wedges holding the field coils in the rotor slots and states that these are made of man-ganese bronze. These wedges are, in reality, made of extruded brass. The rings holding the end connections of the rotor coils are made of chrome-nickel steel and not of nickel steel, as Mr. Scott states. Nickel steel would be utterly unsuitable for these rings.

PITTSBURGH, PA. B. A. BEHREND.

To the Editors of Electrical World:

SIRS:—Permit me to state, in reply to the criticisms of Mr. B. A. Behrend concerning my description of Allis-Chalmers turbo-generator published in your issue of May 6, that the illustration of the stator originally sent to the *Electrical World* with the report of test for publication, was taken from Bulletin No. 1054 of the Allis-Chalmers Company. The illustration sent was correct for the machine tested, but evidently through an oversight, an older type of machine was illustrated in Fig. 1 of the May 6 issue.

It should be evident to one reading the paragraph pertaining to the manner in which the machine is ventilated, however, that the description does not fit the stator shown in Fig. 1, said paragraph being as follows:

"The cool air is drawn in at the sides of the machine by means of fans which discharge it over the end connections of the armature coils into the base of the machine, whence it passes through ventilating ducts in the core to an opening at the top of a cast-iron frame."

The descriptive details concerning wedges for holding field coils in the rotor slots and rings for holding the end connections of the rotor coils were taken from the bulletin above mentioned, dated September, 1908. As the test was made in December, 1908, and the bulletin appeared to be the latest concerned with the type of turbine tested, it was assumed that the statements therein were sufficiently reliable to be used in the description given.

AUSTIN, TEX. A. C. SCOTT.

[The editors are responsible for including the wrong illustrations in Professor Scott's article, which were selected from photographs on hand and hastily assumed to correspond to the engravings in the bulletin referred to.—EDS.]

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Motor Converters.—H. S. HALLO.—A paper read before the (British) Inst. Elec. Eng. on what he calls motor-converters (and what is called in Germany "cascade converters," the design being due to Bragstad and La Cour). The converter consists of an ordinary induction motor with wound rotor and a direct-current machine, rigidly coupled and arranged with either two or three bearings. The author discusses the principle, operation and design of this machine. Fig. 1 represents

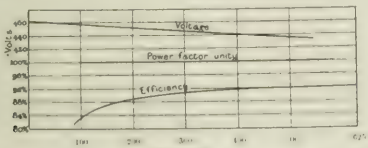


FIG. 1.—CHARACTERISTICS OF CONVERTER.

the characteristics of a 500-kw set. The efficiency, especially at low loads, is remarkably high. Fig. 2 indicates the possibility of an excellent regulation by the shunt rheostat. Sometimes it is required that a motor converter shall be capable of supplying either a traction system at 500 to 550 volts, or a lighting system at, say, 420 to 460 volts. Owing to the great flexibility of the direct-current voltage it is possible to build converters for the above extreme range of voltage, and, as a matter of fact, several such machines with a voltage regulation of as much as 30 per cent are in successful operation. In order, however, to improve the power factor in such a case it is advisable to use a synchronous booster in series with the rotor winding. Motor converters can also be used inverted and also for wire supply. The outer mains in the latter case are connected as usual to the positive and negative terminals of the dynamo, while the middle wire is connected to the star-point of the rotor windings and may be earthed. When large out-of-balance currents are to be dealt with, it is necessary in order not to overload the brush gear of the slip-rings, to use a three-pole change-over switch arranged so that when the switch is down, the three slip-rings are short-circuited and connected to

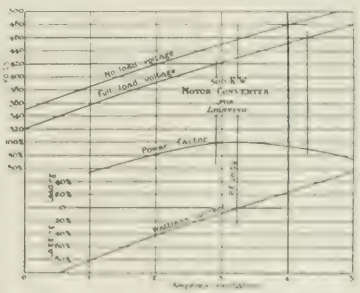


FIG. 2.—EXTERNAL CHARACTERISTICS OF CONVERTER.

the middle wire, so that all brushes on the three slip-rings are called upon to carry the current in turn. When the switch is in the other position the slip-rings are no longer short-circuited, but connected to the alternating-current starter; the switch must be in this position during the starting up of the

converter. A motor converter thus connected up automatically balances the current, and the voltage difference between the two halves does not exceed 1 per cent of the voltage between the outers, with an out-of-balance current of as much as 50 per cent of the full-load current. With 20 per cent out-of-balance current the voltage difference would be well under ½ per cent, and it is thus clear that the balance is excellent and more than sufficient for all ordinary requirements. If, however, it should be necessary to raise the voltage of the heavier loaded half, a series booster must be put in circuit, and driven by the extended converter-shaft. The largest of several converters of this type in operation in British substations is a 1500-kw machine of the three-bearing type of the Manchester Corporation Electricity Department.—Lond. *Electrician*, May 7.

Induction-Motor Diagram.—S. P. Smith.—The first part of an article, illustrated by diagrams, on the application of the no-load and short-circuit diagram of induction motors. The first part of the present paper contains a description of a diagram for induction motors by means of which the efficiency, torque, power factor, etc., can be accurately determined, and an actual example is given showing how the same can be drawn from the no-load and short-circuit currents and losses. The second part of the paper is devoted to a new application of this diagram, whereby the efficiency of induction machines, when tested by the modified Hopkinson method, is accurately obtained for both motor and generator. Lastly, a method for calculating these results is deduced, and checked by means of the diagram. —Lond. *Electrician*, May 7.

Turbo-Commutators.—R. J. Roberts.—A discussion of several points in the mechanical construction of high-speed commutators. The author discusses the kinked form of segment, the method of calculating the shrinkage allowance, the usual method of fixing the balance weights, the construction of lugs and risers, and the question as to the necessity of a spring collar. He thinks that it is not absolutely necessary. A taper is, however, necessary.—Lond. *Electrician*, May 7.

Connection in Parallel of Three-phase Machines.—A. Herrmann.—An article illustrated by diagrams on some special points in comparing phase differences when connecting two three-phase machines in parallel.—*Elek. Anz.*, May 6.

Lamps and Lighting.

Comparison of Lamps.—A. Linker.—A comparative review of the development of new lamps. The author gives the following table of the cost of fuel or electric energy for the different sources of light for one hour and giving 100 hefner-candles:

	Consumption for 100 hefner cp-hours.	Price of fuel or energy in pfennigs (100 pfennigs = 24 cts.).	Cost for 100 hefner-hours in pfennigs.
Stearin candle	920 grams horizontal	140 (per kg)	130
Paraffin candle	770 grams horizontal	155 (per kg)	120
Petroleum	300 grams spherical	28 (per kg)	8.4
Petroleum incandescent lamp	90 grams spherical	28 (per kg)	2.5
Alcohol incandescent lamp	0.25 liter spherical	30 (per liter 90 per cent)	7.5
Gas (ordinary burner)	1,700 liter spherical	16 (per cubic meter)	27.2
Gas (Argand burner)	1,000 liter spherical	16 (per cubic meter)	16.0
Gas incandescent lamp	200 liter spherical	16 (per cubic meter)	3.2
Inverted gas incandescent lamp	160 liter spherical	16 (per cubic meter)	2.6
Acetylene	120 liter spherical	100 (per cubic meter)	12.0
Acetylene incandescent lamp	30 liter spherical	100 (per cubic meter)	27.2
Electric carbon-filament lamp	320 watt hours horizontal	50 (per kw-hour)	16.0
Nernst lamp	150 watt hours horizontal	50 (per kw-hour)	7.5
Tantalum lamp	150 watt hours horizontal	50 (per kw-hour)	7.5
Osram, tungsten, zirconium, Sirius, colloid lamps	100 watt hours horizontal (at 100 volts)	50 (per kw-hour)	5.0
Bergmann, A. E. G., Sonnenlamp, Econo lamps	120 watt hours horizontal (at 220 volts)	50 (per kw-hour)	6.0
Electric arc lamp, without globe	120 watt hours hemispherical	50 (per kw-hour)	6.0
Electric arc lamp, with globe	170 watt hours hemispherical	50 (per kw-hour)	8.5
Enclosed arc lamp	147 watt hours hemispherical	50 (per kw-hour)	7.35
Lilipur lamp	90 watt hours hemispherical	50 (per kw-hour)	4.5
Reyrolle and Regensburger lamps	80 watt hours hemispherical	50 (per kw-hour)	4.0
Helion lamp	50 watt hours hemispherical	50 (per kw-hour)	2.5
Quartz lamp	27 watt hours hemispherical	50 (per kw-hour)	1.35
Siemens flame arc, Polar lamp; Bremer lamp, Rebofa flame arc	20 watt hours hemispherical	50 (per kw-hour)	1.0
Mercury vapor lamp (Westinghouse)	20 watt hours hemispherical	50 (per kw-hour)	1.0
Beck lamp	19 watt hours hemispherical	50 (per kw-hour)	0.95
Petroleum flame arc	15 watt hours hemispherical	50 (per kw-hour)	0.75

(The figures are, however, not strictly comparable, since in some cases the candle-power means the horizontal, in others the spherical and still others the hemispherical candle-power as indicated in the second column. The comparative costs of electricity and gas, on which the figures are based, are according to the third column, 50 pfennigs = 12½ cents per kw-hour and 16 pfennigs per cubic meter or $1.13 per 1000 cu. ft. of gas.) The cheapest and best illumination is by means of arc lamps, at least where lamps of high intensity are needed. For lamps of lower candle-power, gas incandescent lamps are cheaper than metallic-filament lamps if only cost of gas and the cost of electric current are considered. However, the author thinks that the total cost is about the same for both kinds of illumination, besides the other advantages of electric lighting.—*Elek. u. Masch. Betr.*, April 5.

Tungsten Lamp.—A note on a recent British patent of Siemens & Halske Company (17,350, 1908; April 29, 1909). The addition of nickel to tungsten increases its ductility, but lowers its melting point. By adding somewhat less than 8 per cent of nickel, however, and melting, an alloy is produced which is sufficiently ductile to allow of rolling and drawing into fine wire for lamp filaments.—Lond. *Elec. Eng'ing*, May 6.

Power.

Steam Boilers.—J. T. Nicholson.—A paper giving the results of an experimental investigation of the loss of heat transmission from the flue gases to the water in steam boilers. The author believes that there is an exceedingly thin stationary film of gas on the one side, and of water on the other side, which oppose very great resistance to the flow of heat; thus, the use of copper instead of steel, or thin tubes instead of thick, in the hope of obtaining a better heat transmission, is futile. By increasing the speed of gases, however, to 10, or even 50 times, that which now obtains, the cooled films adhering to the surface of the plate are torn off and whirled into the body of hot gases, while new hot films take their places. The communication of heat from a film to the plate is practically instantaneous, and if the cooled films can thus be rapidly replaced, the rate of transfer of heat from the gases to the plate can be enormously accelerated. An evaporation of 45 lb. of water per square foot per hour has been secured by the author by simply increasing the rate of flow of the gases through the flue of a Cornish boiler, beyond the bridge; this was effected by nearly filling up the flue with an internal cylindrical water vessel of boiler plate, leaving only an annular air space 1 in. wide, 40 in. in mean diameter, and 10 ft. long. The heat transmitted through the plates was 34,450 b.t.u. per square foot per hour, about eight times the rate usually obtained, the speed of the gas current being about 330 ft. per second. This experiment shows that the rate of heat transference is directly proportional to the speed of the flow of the gas, and as Rankin's and Peclet's formula takes no account of the speed, it obviously breaks down. The power required to drive the exhausting fan amounted to about 4½ per cent of the whole power available; on the other hand, the output of the boiler was increased to eight times the normal, and there would therefore be a great saving in the cost of boilers, floor space, etc., for equal output. The author has developed a mathematical formula for the heat transmission from the gas flow along the flue. As regarded the bearing of his results upon boiler practice, the author stated that a reduction of the heating surface to even one-tenth of that now usual could be made without increasing the chimney temperatures or

lowering the efficiency. Or if the surface were unchanged, but the cross-sectional area through the flues reduced, a much lower chimney temperature and higher efficiency could be secured. Draughts of 10 in. or 20 in. of water gage, induced by fans, should always be employed for economical working. If the boiler were designed on the economizer principle, with strict attention to counter-current methods of flow, a chimney temperature of 100 deg. to 150 deg. Fahr. could be attained, corresponding to a boiler efficiency of over 95 per cent. Thus, the margin of additional evaporation more than covers the power required for the fan, and therefore higher economies are attainable, with smaller boilers, less floor space and lower costs than at present. Combustion could be carried on in a lined chamber, ensuring perfect smokelessness. The author believes that the proposed new method of working is capable of effecting radical improvement in steam-boiler practice, without which the steam engine cannot retain its pre-eminence in the economical production of power.—Lond. *Elec. Review*, May 7.

Power from the Sun's Heat.—Two illustrated articles, one describing recent experiments by Shumann on utilizing the heat from the sun for producing power. The other article, by H. E. Willsile, gives a review of experiments made by him and J. Bogue. Both articles are profusely illustrated.—*Engineering News*, May 13.

Ontario.—L. DRAKE DEL CASTILLO.—A review of the water powers of the province of Ontario, Canada.—*La Lumière Elec.*, May 1.

Traction.

Single-phase Railway.—The first part of an illustrated description of the railroad from Rotterdam to Haag and Scheveniggen in Holland, which has a total length of 20 miles (track length, 45 miles) and is operated with single-phase current at 10,000 volts. Three-phase currents are generated at 5000 volts and 25 cycles and are transformed by the Scott arrangement into two-phase currents at 10,000 volts. The line is divided into two parts, electrically separate from each other and connected to the two phases.—*Elek. Zeit.*, May 6.

Single-phase Railway.—A fully illustrated article on the conversion of the New Canaan branch from 500-volt, direct-current to 11,000-volt, single-phase operation. This branch of the New York, New Haven & Hartford Railroad, 7.66 miles long, was equipped with the 500-volt, direct-current overhead trolley about 10 years ago for passenger service only, and was converted about one year ago to the 11,000-volt, single-phase system. Current is supplied from the main power station at Cos Cob, and the results demonstrate the adaptability of the single-phase system for branch line electrification.—*Electric Railway Journal*, May 15.

Installations, Systems and Appliances.

Rating and Cost of Steam-Electric Stations.—H. M. HOBART.—The first part of an article giving a great number of tables of estimates. The rating is based on the following specification: "The sets shall be capable of dealing with 25 per cent overload for one hour, and with 50 per cent overload for five minutes without detriment to any part. When continuously operated at the rated output, no accessible part of the electric generator shall sustain a temperature rise, as thermometrically determined, of more than 40 deg. C. above the temperature of the engine-room, in the neighborhood of the generating set." The following table is then given as representative for the cost of complete electric stations (1 £ = $4.90):

Aggregate rated capacity of generating sets installed.	Cost of complete station in £ per rated kilowatt of all generating sets installed.	Total cost of electricity supply station in £.
48,000 kw.	13	624,000
24,000 kw.	15	360,000
12,000 kw.	16	192,000
6,000 kw.	18	108,000
3,000 kw.	21	63,000
1,500 kw.	25	37,500
750 kw.	30	22,500

Tables are then given showing how much of the generating plant is to be considered as spare plant for differing load factors; the difference is the maximum load for which the station is designed. The following table gives the capital cost of generating plants for differing load factors:

Aggregate rated capacity of generating sets installed, kw.	Capital cost of complete generating station in £ per million kw-hours output per annum for following load factors.						
	1.00	0.80	0.60	0.40	0.30	0.20	0.10
48,000...	2,110	2,560	3,330	4,860	6,340	9,290	18,200
24,000...	2,280	2,820	3,660	5,360	6,950	10,100	20,000
12,000...	2,480	3,050	3,920	5,860	7,600	11,200	21,700
6,000...	2,860	3,460	4,560	6,750	8,780	12,850	25,000
3,000...	3,420	4,170	5,440	8,000	10,500	15,400	30,000
1,500...	4,800	5,100	6,630	9,680	12,700	18,800	36,800
750...	5,450	6,400	8,150	11,900	15,400	22,800	45,100

The interest on this capital outlay and the annual outlay necessary for overhauling and for repairs and for new plant, as the old requires from time to time to be discarded, may be covered by the term "annual capital expenses." This is assumed as 10 per cent, so that one-tenth of the figures given in the preceding table represents the annual capital expenses in pounds sterling per 1,000,000 kw-hours for the different load factors. The article is to be continued.—Lond. *Elec. Review*, May 7.

Storage Battery.—A description of a battery to be installed in the Dickinson Street generating station of the Manchester Corporation, which will be the largest storage battery in England. It is to be employed to use the surplus power of the traction generators to assist in dealing with the peak of the lighting load, and at the same time to deal to some extent with the traction peaks. The battery will consist of 210 cells in series, and is to maintain with one of the boosters a voltage of 450 across the lighting busbars. When required for traction service two of the boosters will be run in series. Charging will be carried out from the 525-volt traction busbars. The following discharge rates are guaranteed: 8400 amp for 1 hour; 5000 amp for 2 hours; 3900 amp for 3 hours, and 11,200 amp for half an hour. It is further to withstand a maximum discharge rate of 15,000 amp. The normal charging rate is to be 4100 amp, and the maximum charging rate 6500 amp. The weight of each cell will be about three tons, and the total floor space occupied by the battery will be about 5800 sq. ft. The three boosters will be of the reversible type. Each set is to consist of a motor driving one booster. The boosters will be separately excited, and are to have laminated field systems to allow of rapid reverse.—Lond. *Elec. Eng'ing*, May 6.

Wires, Wiring and Conduits.

Failure of Transmission Tower.—E. DURYEA.—An illustrated article on the failure of a portion of a steel tower electric transmission line in California.—*Engineering News*, May 13.

Distribution of Currents in Networks.—G. MATTAUSCH.—The first part of a paper profusely illustrated by diagrams on a simple method of determining the distribution of the current in an electric network consisting of many branches.—*Elec. Anz.*, May 2.

Electrophysics and Magnetism.

Elementary Quantity of Electricity.—F. EHRENHAFT.—A description of a new method for determining the smallest quantity of electric charges carried by ions or atoms. The author has already shown that there is a phenomenon in gases quite similar to the Brownian movement in liquids. If a direct-current arc of 40 volts and 3 amp or 4 amp is passing between metallic electrodes of 0.5 cm diameter under a closed globe, exceedingly small particles of metals or combustion products remain suspended in the air. If they are drawn by suction before a microscope or ultra-microscope and then subjected to the action of the homogenous electric field of a small condenser it is found that these little metallic particles (silver, zinc, platinum, etc.) obey the laws of electrostatics. When the electric field is established by closing the circuit of the condenser, part of the particles is seen to travel toward the anode, others toward the cathode, while some remain at rest where they are. It therefore seems that the first two groups of these particles are charged with quantities of positive and negative electricity. On the basis of this observation, the author has made a series of measurements which appear to show the existence of large ions

which carry electric charges. Their mechanical mass can be determined by observation with the microscope of their fall in the gravitational field of the earth. Their electric charge can be found by observing with a microscope their mobility in an electrostatic field. Their charge is identical with that of univalent ions and the value is in good agreement with the value which follows from Planck's radiation theory and is one-half the charge of the alpha particle measured by Rutherford.—*Phys. Zeit.*, May 1

Electric Origin of Molecular Attraction.—W. Sutherland.—A highly theoretical paper on some fundamental difficulties in the theories of electric origin of molecular attraction. According to the author an hypothesis advanced years ago by Fessenden seems, when suitably interpreted, to be justified by a discovery of Mills, made also in this country, though both ignored fundamental physical difficulties in obtaining their results. To account for the facts it is proposed to look upon atoms as electrized, just as we speak of a magnet as being magnetized. But an electrized molecule causes the whole of its domain to be electrized as if for a given chemical substance each molecule possessed an invariable amount of positive electricity and an equal amount of negative and as if these amounts were uniformly distributed through the domain of the molecule, whether its state is gaseous, liquid, or solid. This statement applied only to considerations respecting the total potential energy of molecules. In other words, as regards total energy each molecule behaves as if it had an electric moment proportional to the linear dimensions of its domain.—*Phil. Mag.*, May.

Electron Theory and Induction Currents.—R. J. A. Barnard.—A mathematical paper on the direct application of the electron theory to induction currents. If electrons are moving about in a conductor, even when no current is flowing, an electromagnetic force is acting on each electron when there is an external magnetic field. But since the electrons are moving in such a case impartially in all directions, there can be no resultant effect produced by these forces. Even if a current is flowing, the resultant effect of the electromagnetic force will be perpendicular to the conductor; and, therefore, if the electrons cannot escape from the conductor, no effect on the current, except the Hall effect, is produced in this way. But if the conductor is moved bodily, the motion of the positive and negative electrons so produced will cause a component electromagnetic force on the positive electrons to act along the conductor in one direction and on the negative in the opposite. These forces drive the positive electrons in one direction and the negative in the other, so that their effects add together and produce the induction current. The motion of the secondary circuit in a fixed field is first mathematically discussed, and it is then pointed out that the idea of relative motion naturally gives the same expression for the e.m.f. when the circuit is fixed and the field varying. But the force acting is no longer the electromagnetic force in the ordinary understanding of the term, but an electric force.—*Phil. Mag.*, May.

Röntgen Rays.—C. G. Barkla and C. A. Sadler.—An account of an experimental investigation in which the authors investigated the laws governing the absorption of Röntgen rays, by the use of homogeneous beams of X-rays varying considerably in penetrating power.—*Phil. Mag.*, May.

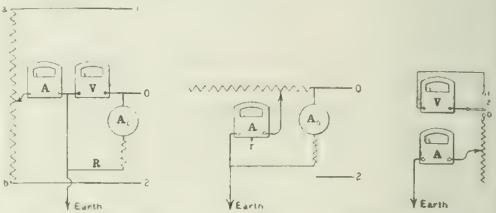
Condensation of Radium Emanation.—E. Rutherford.—An account of an investigation of the condensation of radium emanation and of experiments with liquefied emanation.—*Phil Mag.*, May.

Electrochemistry and Batteries.

Alternating Current from a Galvanic Cell.—W. Kistiakowsky.—A description of a peculiar galvanic cell which gives current with a periodical change of direction. As electrodes, the author uses iron sheets 0.2 mm thick, and 0.2 cm to 7 cm broad. They are suspended in the electrolyte to a depth of 3 cm to 4 cm. The electrolyte is a chromic acid mixture of a certain concentration, prepared by mixing equal volumes of an 0.2 normal H_2SO_4 solution and a $K_2CR_2O_7$ solution saturated at 18 deg. C. When such a cell is closed through a voltmeter with a zero point in the center, the needle is first deflected to one side to +0.4 volts and then returns, and after 5 or 10 seconds the needle is deflected to the other side to —0.4 volt. It then returns to zero, is again deflected to +0.4 volt and so on. This may go on for hours. This phenomenon is connected with the periodic phenomena observed by Ostwald with the solution of chromium.—*Zeit. f. Elektrochemie*, May 1.

Units, Measurements and Instruments.

Insulation Measurement of a Live Three-Wire System.—G. Kapp and D. Coales.—An illustrated description of various methods of testing the insulation resistance of a three-wire network during working. The first method is indicated in Fig. 3, in which *a b* represents a potential slide the resistance of



FIGS. 3, 4 AND 5. MEASURING INSULATION OF LIVE WIRES.

which need not be known. The ends are permanently connected to the outer wires 1, 2, and the slider is connected through an ammeter A to earth. The middle wire is connected through a voltmeter V of resistance ρ to earth. R is the usual earthing connection with its ammeter A. To measure the total fault resistance, push the slider into such a position that A reads zero, and note the reading of V which will be called e. Then push the slider into such a position that V reads zero, and not the reading i on A. The fault resistance is then

$$f = \frac{e\rho}{i\rho - e}$$

The second method is indicated in Fig. 4 The middle wire has, besides its usual earth connection, a connection with a graduated resistance with sliding contact, and the latter is connected to earth through a low-reading milli-ammeter, say, of 1 ohm resistance. To make a test, set the slider so that the pointer of the ammeter reads a little under half its total range, and note the corresponding resistance in circuit between the slider and the middle wire. Let this be ρ and the current i. Then shift the slider so as to reduce the resistance to such a value $\rho_1 =$ that the current is exactly doubled. This will bring the pointer to near an end of the scale. Thus both currents can be read with great accuracy. If r is the resistance of the ammeter, the combined fault resistance is

$$f = \rho - 2\rho_1 - r.$$

In a third method, which permits ascertaining the individual fault resistances of the three mains, a slight variation of the difference of voltage between the two sides of the system is made use of. The (British) Board of Trade permits a variation of 4 per cent in the voltage. If the normal voltage is 250 on each half of the system, unbalancing is permitted so as to get 240 volts on one side and 260 volts on the other side. Fig. 5 represents the apparatus used for the purpose. The outer wires are connected to the terminals 1, 2, and the middle wire is connected to 0. V is a voltmeter capable of reading the pressure between the two outer wires. It is provided with a switch so that it may also be used to measure the pressure between one outer (say, the wire 1) and the middle wire. A is the low-reading ammeter used in connection with the test according to the method 2 described above, but its series resistance is not altered during the test. The pressure between the two outer wires is kept constant, but the voltage on one side of the middle wire is increased, and on the other side decreased by 8 per cent, as explained above. If K is the combined conductivity of the three faults and the ammeter with its series resistance, if E_1 and E_2 are the original voltages on each side of the system, and E_1' and E_2' the altered voltages, then the conductivities of

the three faults will be as follows, c applying to the middle wire:

$$c_0 = c - K\frac{e-e'}{E_1'-E_1}$$

$$c_1 = K\left(\frac{E_2}{E}\frac{e-e'}{E_1'-E_1} - \frac{e}{E}\right)$$

$$c_2 = K\left(\frac{E_1}{E}\frac{e-e'}{E_1'-E_1} + \frac{e}{E}\right)$$

E is the voltage across the outers, e and e' are the voltages between the middle wire and earth, and c is $c + c_2 + c_0$, known from the test made according to the second method. The test need not be made at the switchboard, but can be made at any point on the system. The accuracy of the determination of the fault conductivity depends upon the determination of the small differences between the large voltages E_1' and E_1. To render this measurement sensitive two methods are suggested: (a) in which a voltmeter having an initial spring tension, and, say, of 10,000 ohms resistance, reading from 230 volts to 270 volts, is used; (b) in which a low-reading voltmeter is connected to a sliding contact on a slide wire connected to the outer mains, the other terminal of the voltmeter being connected to the middle wire. Both these methods are described and illustrated. —Lond. *Elec. Eng'ing*, May 6.

Stroboscopic Slip Counter.—G. Kapp.—A modification of the well-known stroboscopic disk, the object being to facilitate the observation. The arrangement is shown in Fig. 6. The disk S

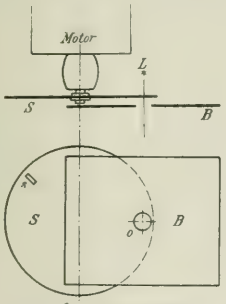


FIG. 6.—SLIP COUNTER.

is revolved by means of the motor. L is an arc lamp connected to the primary terminals of the motor. The greater part of the disk is screened off by means of a screen B. Both the disk S and the screen B are black. A small hole o is left in the center of the screen B and a transparent paper is pasted over this hole. A small slit s is cut near the periphery into the disk S. Whenever the slit s passes before hole o, the light of the arc lamp passes through s and lights o up. The method of observation is to count the light flashes of o. If a is the number of light flashes in the time t, then the slip in per cent of the primary frequency n is

$$s = \frac{100}{n}\frac{a}{t}.$$

Since it is easy to count up to 180 light flashes per minute, it is possible, even with a two-pole motor and with a frequency of 50 cycles, to determine the slip accurately if it is not above 6 per cent. For motors with more poles, even a larger slip can be accurately measured. The author tried to replace the arc lamp by a metallic-filament lamp. But even with a metallic filament in an atmosphere of hydrogen, its thermal inertia is too great to show periodic light flashes at 50 periods.—*Elek. Zeit.*, May 6.

Excess Load Meter.—A note on a recent British patent of H. Aron (21,576, 1908; April 29, 1909). A meter is described which only begins to register when the load exceeds a certain limit. It is a motor-driven meter, the driving torque of which is opposed by a spiral spring. When the torque of the meter exceeds a predetermined amount, the shaft is rotated; and to allow of its continuous rotation the spring is released automatically after each rotation. Small weights are lifted successively by a rotating portion of the meter so as to keep the backward torque as uniform as possible, and are arranged so that the backward torque is reduced to zero by a very small backward movement of the meter, thus rendering the locking of the meter drive against backward movement unnecessary.—Lond. *Elec. Eng'ing*, May 6.

Testing Instruments.—C. A. Hobein.—In testing alternating-current switchboard wattmeters or ammeters it is customary to arrange a lamp bank or suitable current transformers in order to obtain the desired variations in load. The author describes a simple and light device which will vary the current through any range desired. On most switchboards 110-volt, alternating current may be obtained either from the lighting circuit or from the secondary circuit of potential transformers used to operate voltmeters or wattmeters. A small transformer with 110-volt primary and 2-volt to 4-volt secondary is required. As most instruments are now wound with 5-amp current coils the transformer needs a capacity of only 20 watts in order to give maximum load on a wattmeter, or maximum scale reading on an ammeter. In order to vary the current it is necessary to have a resistance. This can be made by winding some iron wire on a cylindrical piece of slate or wood covered with asbestos. By connecting the resistance in the circuit as shown in Fig. 7 the flow of current can be regulated as desired. T is the 20-watt transformer, S is a standard ammeter, and A the ammeter to be tested. R is the resistance, B is a rod of copper or brass supporting the slides S_1 and S_2. S_1 is insulated from B by means of a bushing F, while S_2 is in contact with B. It will be seen that large variations can be obtained by moving slide S_1, while small variations can be obtained by moving S_2. This apparatus is portable. The amount of current desired can be quickly adjusted.—*Electric Journal*, May.

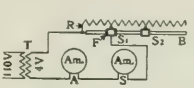


FIG. 7.—TESTING INSTRUMENTS.

Self-Demagnetizing Factor of Bar Magnets.—S. P. Thompson and E. W. Moss.—Their complete illustrated paper read before the Lond. Physical Society on the self-demagnetizing of bar magnets. The paper consists of three parts: (1) A discussion of the significance and definition of the self-demagnetizing factor of magnets in general, and of bar-magnets in particular; (2) a redetermination of the values of the self-demagnetizing factor for bar magnets of circular section; (3) a determination of the values for the self-demagnetizing factor for bar magnets of rectangular cross-sections of various proportions.—*Phil. Mag.*, May.

Wehnelt Interrupter.—H. Kost.—The anode of the Wehnelt interrupter is usually made of platinum or nickel. The present author makes it of carbon covered with a layer of copper. The thickness of the copper layer determines the permissible current. The construction of his interrupter is described and illustrated. —*Elek. Anz.*, April 18.

Relays.—H. J. Reiff.—An illustrated article describing several forms of relays, based on the principle of the capillary electrometer.—*Elek. Anz.*, March 28.

Pinch Effect and Wehnelt Interrupter.—P. Bary.—The first part of an article in which the author endeavors to show that the operation of the Wehnelt interrupter can be explained completely by the electromagnetic pinch effect.—*La Lumière Elec.*, May 1

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—J. A. Fleming, G. B. Dyke and H. W. Richardson.—Their complete three (British) Physical Society paper abstracts of which have already been noticed in the Digest. They deal with the production of steady electric oscillations in closed circuits; with a method of testing wireless telegraph receivers; and with the effect of an air blast upon the spark discharge of a condenser charged by an induction coil or transformer.—*Phil. Mag.*, May.

Wireless Telegraphy on Board Ship.—Meissner.—An editorial in which the equipment of the large German steamers with Marconi apparatus is deprecated and the use of the apparatus of the German companies (Telefunken, etc.), is advocated. —*Elek. Zeit.*, May 6.

Miscellaneous.

Tantalum.—A. Siemens.—A lecture before the Royal Institution in London on tantalum and its industrial applications. The lecturer first dealt with the physical and chemical properties of the metal and showed that at ordinary temperatures tantalum was unaffected by all acids (except fluoric), alkalies and moisture. He also showed that it was an ideal material for mechanical apparatus and for implements, which, if made of steel, would be liable to rust. As regards physical properties, it was tough and malleable, so that it could be drawn into fine wire or hammered into thin sheets. Nevertheless, it was quite elastic, and as hard as soft steel, its tensile strength being 27 tons per square inch. The filament used in tantalum lamps was 0.03 mm in diameter and should, therefore, support a weight of about 80 grams. Tantalum was also being used for making nibs, which were manufactured in the usual way, though at first it was not entirely satisfactory for this purpose, as the loss by abrasion was rather great. But by slightly oxidizing the surface the nibs became hardened so that this loss was considerably reduced, though it was still greater than that of ordinary steel pens. Another use of tantalum was that it seemed to be a suitable material for making the knives used by surgeons, if slightly oxidized before polishing. If heated to a dull red it absorbed gases, and in so doing lost its strength and became brittle, a property which somewhat detracted from its usefulness. Its melting point in vacua being about 2300 deg. C., it was suitable for use as electrodes in vacuum tubes, and was, in fact, being extensively employed for this purpose. Turning to its applications as filaments for incandescent lamps, the lecturer showed that the original diameter of the wire used for this purpose had been reduced from 0.05 mm (2 mils) to 0.03 mm (1.2 mil). After the lamp had been used for a short time the strength of the filament decreased, and it also underwent certain structural changes. After about 1000 hours it showed signs of a capillary contraction, as if the filament were going to break into a series of drops. As to the manufacture of the tantalum filament it was stated that the metal is reduced from the ore in the form of a black powder, which is compressed and finally melted in a vacuum into buttons. These buttons consist of pure malleable tantalum, and are rolled and finally drawn into wire. Filaments for about 45,000 lamps are made from 1 kg (2.2 lb.) of tantalum. In conclusion, Mr. Siemens mentioned two interesting properties of the metal, viz., that if heated in a high vacuum any oxygen contained in the metal would be expelled, so that the filaments which were "spotted," owing to the fact that a certain amount of oxide was contained in them, would become uniform after burning for a few minutes at the normal voltage. Tantalum would also act as a rectifier when used in an electrolyte as if it were made of the anode. It then became quickly covered with a film of oxide, which stopped the current.—Lond. *Electrician,* April 30; *Elec. Engineering,* April 29.

Lamps for Heating.—An article in which the author gives the results of tests of "radiator" lamps. He shows that from the radiation point of view, bright lamps are best. Most of the heat energy is thrown off from them in vibrations of high frequency and short wave-length; some of it is visible to human sight, and appears as light. It is frequently supposed that the energy which appears as light is wasted, but that is not the case, since light, while it does not heat the air in passing through it, heats objects in its path. A dull lamp, or a non-luminous radiator, heats the air which is in contact with it, and gets rid of its heat mainly by convection, partly by conduction and only to a slight extent by radiation. The effect of coloring a lamp on the outside is to decrease its radiating and to increase its convective properties, by absorption of the short-length vibrations. Frosting the glass of a lamp by sand blasting has no effect on its properties as a radiator. It does not decrease the transparency of the glass. Radiant heat of all wave lengths can come through frosted glass as well as through clear glass, but it is broken up and diffused in its passage. This causes the lamp to present a softened and more pleasing appearance than a bright filament visible through clear, unshaded glass. The spherical candle power of a frosted lamp is the same as that of a clear lamp, other things being equal, but the candle-power in any given direction may be increased or decreased according to circumstances. It is important in the design of a radiator oven with lamps to make provision for getting rid of the heat generated immediately around the lamps. This is generally done by the aiding air connection currents around the lamps by means of double backs, or channels, behind the reflectors, by which cool air from the bottom of the radiator may rise, become heated, and then be dispersed into the room from the top of the apparatus.—Lond. *Elec. Review,* May 7.

Electric Welding.—V. D. Green.—A paper read before the Birmingham and District Electric Club. The author describes the Benardos system and the "voltex" system, and then deals at greater length with the process of welding due to Elihu Thomson. With regard to the horse-power necessary for various kinds of work, the following set of figures are given:

ROUND IRON AND STEEL.

Diameter.	Area.	Hp.	Seconds.	Hp seconds.
¼ in.	.05 sq. in.	.2	10	20
½ in.	1 sq. in.	4.2	15	63
⅜ in.	.22 sq. in.	6.5	20	130
⅝ in.	.3 sq. in.	9.0	25	225
¾ in.	.45 sq. in.	13 3	30	399

These figures were taken from actual tests made upon Thomson welders. For extra heavy iron piping, rather more energy was required on account of the greater radiating surface in proportion to the mass.

EXTRA HEAVY IRON PIPING.

Inside diameter.	Area.	Hp.	Seconds.	Hp seconds.
½ in.	.3 sq. in.	8.9	33	293.7
¾ in.	.4 sq. in.	10.5	40	420
1 in.	.6 sq. in.	16.4	47	770.8
1¼ in.	1.1 sq. in.	32.3	70	2,261
2 in.	1.65 sq. in.	42	81	3,528
3 in.	3.0 sq. in.	96.2	106	7,197

Generally speaking, iron and steel required less energy than copper, brass coming between them in this respect.—Lond. *Elec. Review,* April 30.

Technical Education in England.—A paper read before the (British) Association of Teachers in Technical Institutions. The author shows that the defects of English technical education are due, not to the lack of money or effort, but to the absence of national organization, resulting in competition between existing colleges. He considers it essential that the Board of Education should establish a national system of technical education.—Lond. *Electrician,* May 7.

BOOK REVIEWS.

High-Tension Underground Electric Cables. By Henry Floy. New York: Electrical Publishing Company. 135 pages, 4 ills. Price, $2.

The manual is arranged as a reference book for engineers interested in the design of underground transmission systems. It contains in condensed form a large amount of information concerning practical experiences with high-tension cables. A valuable feature of the book is a table giving complete data on cables used by 35 different companies in the United States and Canada; these cables vary in length from 1 mile to 340 miles, and are operated at e.m.fs. from 6600 volts to 25,000 volts. Full instructions are given for testing the insulation of cables, while formulas are developed for calculating the capacity of cables from the dimensions of the dielectrics. The concluding chapter of the book deals with the cost of cables, especially as affected by the variation in the e.m.f. The book should prove of much value to engineers contemplating the installation of transmission systems in congested districts.

Development and Electrical Distribution of Water-Power. By Lamar Lyndon. New York: John Wiley & Sons. 317 pages, 158 ills. Price, $3.

This treatise is devoted largely to descriptions of actual installations rather than to a discussion of theory or methods of

design. In addition to the complete descriptions of nine prominent hydro-electric generating and transmitting systems, the book contains discussions of the various details, including dams, canals and flumes, power houses, waterwheels, generators, transformers, transmission conductors, pole lines, lightning-protection and controlling apparatus. Although the theories relating to the hydraulic and electric features are barely touched upon, yet numerous hints are given concerning the selection of certain design proportions in the hydraulic end and the choice of certain machines for the electrical end. The discussions deal largely with actual equipments and the suggestions are based on operating experience. The book contains very few errors, although one error is repeated a great number of times. After explaining properly that "power" is measured in watts, the author continually uses the incorrect terms "energy" when referring to watts and "power" when dealing with kw-hours, kw-years or hp-years. The treatise is of value as a convenient reference book relating to standard practice in hydro-electric transmission installations.

The Hughes and Baudot Telegraphs. By Arthur Crotch. London: S. Rentell & Company. 83 pages, 41 ills. Price. 1 shilling and 6 pence.

The writer has presented a very practical description of these two forms of telegraphic type-printer, suitable for the use of telegraph operators and for students of telegraphy generally. The description is clear and enters into constructive detail. The electrical principles of action are subordinated to the mechanical principles. The work may well serve as a guide to the assembling, testing and construction of the Hughes and Baudot instruments.

Naval Electricians' Text-Book. (1908.) By Lieut-Comdr. W. H. G. Bullard, U. S. N., Annapolis, Md.; U. S. Naval Institute. 976 pages, 407 ills. Price, $6.50.

While this volume is primarily intended for use as a text-book for midshipmen at the U. S. Naval Academy, its plan is such as to render it useful to anyone desiring to have at hand a comprehensive work containing formal statements of elementary electrical principles, simple and clear descriptions of a large range of present-day electrical apparatus and appliances, together with routine instructions for their operation and care. We assume that the work is complementary to a systematic course of instruction in electrical science and electrical engineering, as its contents relate almost entirely to the descriptive and operative side of the electrical art Otherwise, we fear that one depending upon knowledge gained from it alone will, after graduation, find it difficult to keep abreast of electrical development or even to retain the information of condensed handbook order garnered at school from its pages. On the other hand, as an instructive book for the routine care and operation of the apparatus specifically considered, the book is excellently planned and executed.

Hydro-Electric Plants. By R. C. Beardsley. New York: McGraw Publishing Company. 512 pages, 480 ills. Price, $5.

This book treats both theory and practice and deals with both the hydraulic and the electric sides of hydro-electric developments. The nine chapters are given the headings: hydraulic principles, measurement of flow, reconnaissance of water-power, materials, hydraulic construction, power-house construction, power-house equipment, power transmissions, and tables and formulas. Somewhat more than half of the book is devoted to hydraulic features, which are treated in an instructive and convincing manner. Much attention is paid to power house construction and equipment, the descriptive matter dealing more with the building and turbines than with the electrical apparatus. The chapter entitled "Power Transmission" covers gearing, shafting, belting, rope transmission and electrical transmission; it could well have been divided into two parts, dealing respectively with mechanical couplings and electrical transmission systems, the former being treated as a station detail and the latter as a prominent feature of the electric installation.

As will be noted from the above brief outline, the book contains much information relating to hydraulic features. Considerable care has evidently been exercised in rendering the statements accurate. It surprises one, therefore, to find a fundamental error in a hydraulic unit on page 1, where the value of the "miner's inch" is given in gallons without specifying the time. The book as a whole is well written. The arrangement makes it particularly suitable for the use of the engineer who is familiar with electrical apparatus and wishes guidance in the design or selection of hydraulic details or equipment.

Transient Electric Phenomena and Oscillations. By Dr. C. P. Steinmetz. New York: McGraw Publishing Company. 556 pages, 102 ills. Price, $5.

Few indeed are the writers who can discuss with any degree of authority the subject selected by Dr. Steinmetz for his latest contribution to electrical engineering literature. The debt of the profession to the author for his present work is, therefore, even greater than that for his earlier books. The former contributions dealt largely with relatively familiar subjects, which, however, were treated in an original and most thorough manner, while the present book covers instructively a subject that has usually been avoided by writers on electrical engineering topics.

The book is divided into four sections, dealing, respectively, with transient phenomena in time, in space, in both time and space, and with periodic transient phenomena. Under the first head fall the building up of the magnetism in a direct-current generator, the charging of a condenser, the storage of energy in a magnetic field, the surging of energy between magnetic and electrostatic fields, short-circuiting of alternators, etc. Transient phenomena in space exist in long-distance transmission lines and in high-frequency conductors, used in aerial communications. The section on transient phenomena in both time and space deals with stationary waves in underground and overhead transmission systems and in telegraph circuits; with traveling waves and free oscillations in electric circuits; transition points and energy in complex circuits, and inductive discharges from transmission lines. Periodic transient phenomena are those encountered in current rectifiers and voltage regulators.

The book may be said to deal largely with those phenomena which are usually neglected in designing transmission systems of moderate length, but which should not be ignored in interconnected systems of great length comprising high-voltage overhead circuits and medium-voltage underground cables. In addition, it deals with phenomena of more frequent occurrence, which are treated, however, in most cases, more exhaustively than has been done hitherto. The treatment throughout the whole book represents work of a pioneer nature, either with reference to the phenomena discussed or concerning the method of attack or skill in presentation. The physical relations discussed are much more complex than those covered by the author's well-known book, "Alternating-Current Phenomena," but the reviewer ventures the assertion that the average reader will be able to follow the demonstrations with less difficulty than encountered with the earlier book, largely because in the present treatise the author has expressed the inter-relations in the familiar languages of the algebra, the trigonometry and the calculus rather than in "symbolic equations," which are as a foreign language to most readers. The treatment dealing, as it does, with highly complex inter-related phenomena is necessarily mathematical, but the author has made a surprisingly limited use of calculus. Moreover, the equations employed are fully translated into statements of the physical relations, and little doubt can exist in the mind of the reader as to their significance.

Beyond any doubt the book represents the author's masterpiece. It will be the standard treatise on the subject of transient electrical phenomena for many years to come, and historically will always occupy a high place in electrical literature.

NEW APPARATUS AND APPLIANCES

Frink Reflectors.

By W. H. Spencer.

As far back as 50 years ago, when nobody even dreamed of illuminating engineering, when the oil lamp was the most commonly used illuminant and gas lighting was in its infancy—at such an early stage of the art of illumination, Frink reflectors



FIG. 1.—SHOWROOM REFLECTOR.

were in extensive use. As a consequence of the gradual accumulation of experience in this long period, it was entirely possible to secure satisfactory results in design in the absence of systematic engineering data or methods, which have only recently been formulated. Such empirical design is, however, apt to fail if the proper engineering intuition is lacking, but with

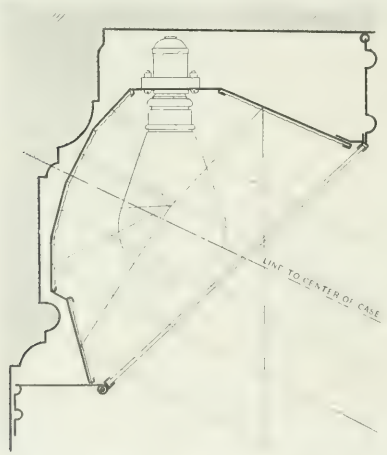


FIG. 2.—DESIGN OF SHOWROOM REFLECTOR.

this present, the principles actually involved in designs found successful in use will, as a rule, eventually be capable of verification on theoretical grounds when these latter are established. This has held true in the case of Frink reflectors, which, in fact, have in the past represented correct illuminating engineering as understood to-day, for in addition to serving satisfactorily the purposes for which they were specified, they prove to be correct in principle when checked by up-to-date mathematical calculation. Nowadays the use of quick mathematical calculation greatly facilitates reflector design, and that method is bound to

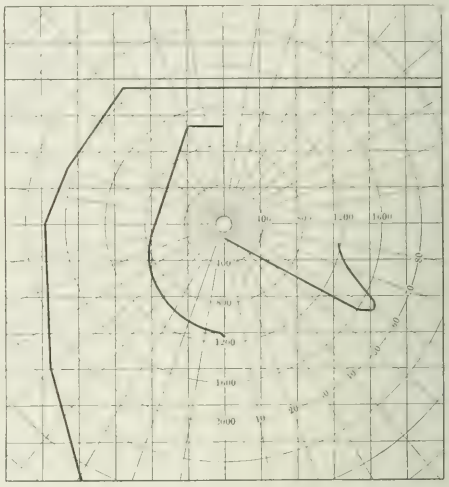


FIG. 3.—THEORETICAL REFLECTOR DESIGN.

be of still higher value when united with experience gained in long practice in the art.

An interesting example may be cited showing the relation between correct theory and successful practice. A showroom 30 ft. x 30 ft., and especially the showcases near the walls, were to be illuminated. A pillar was located exactly in the center of

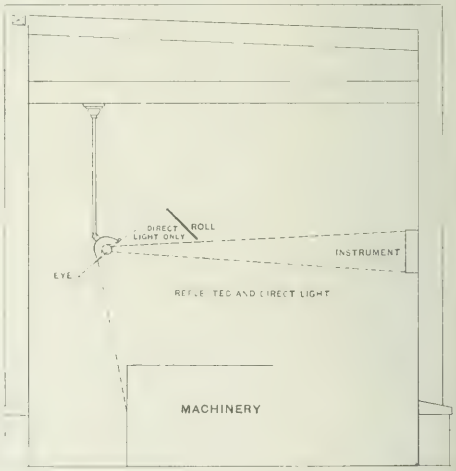


FIG. 4.—REFLECTOR FOR RAILROAD SIGNAL TOWER.

the showroom and surrounded by a settee, and the specifications were drawn up for the illumination of the showroom and showcases from a fixture surrounding the capital of the pillar, as shown in Fig. 1. The illumination of the counters was fixed at 2 candle-ft., and on the showcases at 3 candle-ft. Fig. 2

shows the design of the Frink reflector for accomplishing the desired result. The greater part of the light in parallel beams is directed (at 65 deg. from the vertical) toward the center of

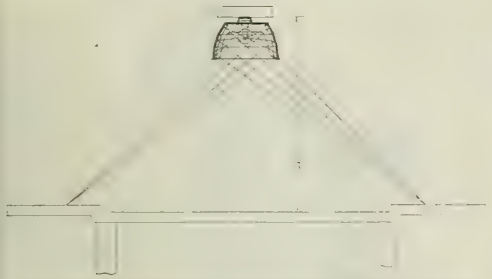


FIG. 5.—CONCENTRATING REFLECTOR FOR WORKING TABLES



FIG. 6.—BANK SCREEN AND DOUBLE-DESK REFLECTORS

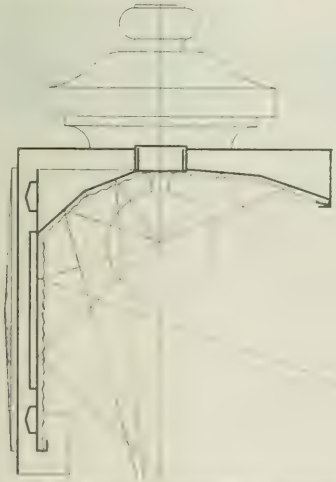


FIG. 7. DESIGN OF SPECIAL REFLECTOR FOR LIGHTING WALL CASES AND COUNTER CASES.

the showcases, leaving one panel and the direct light of the lamps for the illumination of the counters. A polar curve, Fig. 3, was then laid down for the fixture as a whole, which shows that by far the larger part of the light is directed at angles from 50 deg. to 70 deg., that a considerable amount of light is directed at angles from 70 deg. to 80 deg., and a somewhat smaller part at angles from 50 deg. to 60 deg., while the direct light of the lamps is almost sufficient for the horizontal illumination of 2 ft.-candles on the plane at angles from 0 deg. to 50 deg. In



FIG. 8.—STORE REFLECTOR.

practice the design thus, in fact, departed from exactness by an amount so small as to be scarcely recognizable to the naked eye, though evident by photometric measurements.

An advantage of the Frink system of illumination of great interest to the illuminating engineer consists in the possibility of screening the eye of the observer from the direct light and glare of the lamps and at the same time utilizing this otherwise harmful light for useful illumination. An example of this is illustrated in Fig. 4, which shows a reflector used for special illumination in the signal towers of railroads. The same lighting unit illuminates the indicator, special machinery, instruments, etc., while no light strikes the eye of the operator nor of an engineer coming in out of the darkness. Still another example is illustrated in Fig. 5, which shows a reflector designed to con-



FIG. 9.—[illegible] GALLERY REFLECTOR [illegible] NEW YORK.

centrate the light upon a working table, for instance, on the needle points of sewing machines and the like—while at the same time concealing the lamps from the eyes of the operator.

Not only concentration of light, but also uniform illumination can be readily and effectively obtained by Frink reflectors. For

instance, a reflector of similar appearance to that illustrated in Fig. 5, but designed to illuminate uniformly the working plane, can be used with great advantage for double bookkeeper desks and drafting tables, or when cut in half and properly modified it can be applied over bank windows, flat-top and single bookkeeper desks. Such a reflector is shown in Fig. 6, representing an installation which has met with much satisfaction as the eyes are shielded from the glare of the lamp, while a uniform illumination is provided for the working plane.

All the above effects are combined in a reflector of a design shown in Fig. 7. This reflector is designed to illuminate showcases and counters with an equally uniform illumination, avoiding, however, any glare proceeding directly from the lamps or reflected from mirrors or other glassware. An actual installation of this reflector is shown in Fig. 8, which gives a fair idea of the artistic effect which can be obtained by this class of design. Fig. 9 shows the effect of a Frink art-gallery reflector, properly designed and properly placed. The result is an evenly diffused light over the entire picture space, without glare in the pictures or shadows caused by heavy frames.

Electrically Operated Household Utensils.

By means of a single motor and flexible shaft the A. A. Automatic Manufacturing Company, of New York City, has adapted a great many kitchen and household utensils to electric drive. The "automatic kitchens," as they are termed, are made



FIG. 1.—ELECTRICALLY OPERATED HOUSEHOLD UTENSILS.

in three styles. The first style is primarily intended for use in small apartments where space is limited. By means of a flexible shaft a potato-peeler, coffee-grinder, dough-mixer, butter-churner, egg and cream beater, fruit-juice extractor, ice-cream freezer, meat and food chopper, washing-machine, vacuum cleaner, etc., may be operated from the motor. The second style has an advantage over the first style in that either one or two utensils may be operated at the same time, the machine being provided with two flexible shafts, one operating at slow speed and the other at a higher speed. The third style possesses the advantage that all the utensils are clamped to a revolving-table top in proper position. When a change from one utensil to another is desired, the table top is revolved until the utensil desired is brought opposite the flexible arm of the motor. In addition the manufacturer is bringing out a large machine for hotel and restaurant use, having as many flexible

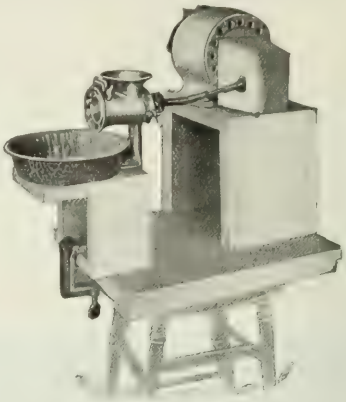
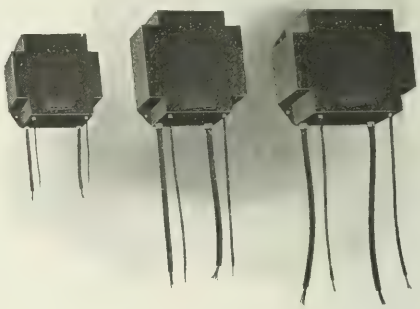


FIG. 2.—ELECTRICALLY OPERATED CHOPPER.

shafts as there are utensils to be operated. Two of the outfits are illustrated herewith.

Tungsten Sign-Lamp Transformer.

The Packard Electric Company, of Warren, Ohio, has designed and placed on the market a line of special transformers to meet the new conditions of sign-lamp service, with the tungsten low-voltage lamp. The transformers are neat in appearance, compact and as light in weight as is consistent with good economy. They can be attached to the sign itself, which eliminates the voltage drop in the low-voltage leads. The trans-



TUNGSTEN SIGN-LAMP TRANSFORMERS.

formers are designed to give an exact ratio of 10 to 1 under full-load conditions, and are controlled through the primary circuit so that when the sign is not illuminated the transformer loss is eliminated. The transformers are not made on the auto-transformer principle, but are designed with separate primary and secondary coils amply insulated from each other. The vacuum drying and impregnating system of insulating is used as with the company's standard transformers. The case is made of leaded sheet iron the better to withstand weather conditions, and is filled with solid compound of high heat conductivity, insuring reasonable temperature limits. Moreover, it is sealed in place to exclude moisture. All of the leads are carried out through porcelain bushings, each carefully sealed in.

Heavy Wire Terminations.

By ANTHONY GORHAM.

Broadly considered, the material and labor involved in the installation of a large open-work conductor may be divided into two general items, that necessary for supporting the conductor between termination points or "dead ends," and that necessary for terminating or "dead ending" the conductor. The installation of runs between termination points, as a rule, presents no difficulties. Insulating supports, which can be readily

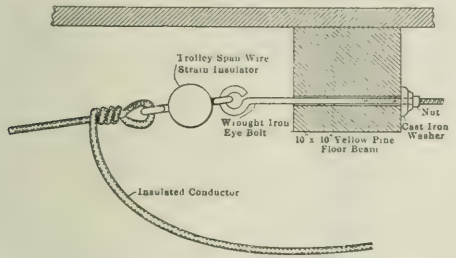


FIG. 1.—AN UNECONOMICAL METHOD OF TERMINATION.

and ruggedly mounted, are commercially obtainable in many convenient types. These, spaced frequently, serve to support the conductor against lateral displacement, and to insulate it from adjacent materials.

Almost invariably the work of terminating a large open-work conductor is the most exacting, and frequently the most expensive unless expedient methods are used, involved in its installation. It should be added that the word "termination" as used here does not necessarily imply the actual termination of the conductor. Where the direction of a feeder run is changed (as shown, for instance, in Fig. 5) it is necessary that the conductor be "dead-ended," at the end of each run, to a strain sustaining appliance. The same construction is involved at a "dead-ending" whether the run is actually terminated or whether its direction is changed, so the word "termination" as used in this article may imply either condition.

In modern industrial-plant practice it has been found best to depend entirely on the terminal supports for sustaining the longitudinal tension in the conductor and to incorporate with such supports appliances for tightening it, for mechanically connecting it with the tightening device and for insulating it therefrom. Obviously a vital requirement of any method of termination is that it shall be capable of sustaining a tensile stress great enough to keep the conductor it holds taut. Because of this requirement the only practicable methods involve the use of strain insulators of one type or other, which serve to transmit the tension in the conductor to some stationary support and at the same time to insulate the conductor from that support. For tightening, some form of bolt or turnbuckle is used.

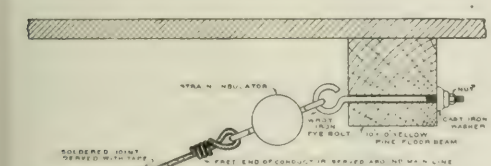


FIG. 2.—ANOTHER UNECONOMICAL METHOD.

From the standpoint of good construction, there appear to be but three feasible methods of making a heavy wire fast at its termination. (1) By carrying the wire (as shown in Fig. 1) without cutting it, through the eye of a strain insulator and serving the bight around the main line. (2) By cutting the wire, carrying the end through the strain insulator eye and then serving this free end around the main line, as shown in Fig. 2. (3) By using a cable clamp and a strain insulator as shown in all of the other drawings.

Obviously the first method (Fig. 1) can be advantageously applied only in the case of comparatively small conductors. With the exercise of much muscle, judgment and good workmanship it is possible that it might be utilized in emergency cases where conductors as large as, say, 300,000 circ. mils, and even a little larger, are involved. The process, however, of bending the bight of a conductor of large size into a spiral-shaped serving around the main line, is a time-consuming, and, therefore, an expensive one. This is particularly true where two adjacent terminations are necessary (as shown in Fig. 5) in the same conductor, because of a change in direction, or if the termination has to be made high above the ground from a staging or in a confined space. To sum up the status of this method it may be said that it is impossible to use it for very heavy wires and is not to be recommended, because of the labor cost involved, for any except small wires, say, those smaller than No. 0.

In the method shown in Fig. 2 there is no limit to the size of the conductor that can be handled, inasmuch as a length, at the end of the conductor, can be "skinned" and the strands composing it unwrapped. Each strand can be carried through the strain insulator eye, one at a time, and served around the skinned portion of the main line. The served ends should then be soldered to the main line, to hold them in position and to

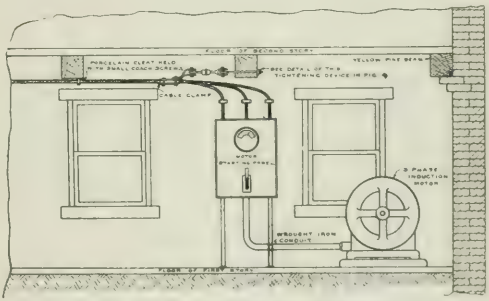


FIG. 3.—TERMINATING MOTOR FEEDERS.

prevent the joint failing upon the application of a tensile stress. Then an independent length of conductor must be served around and soldered to the main line as indicated. This independent length may convey electricity to the adjacent conductor (if the termination is made to permit of a change in direction of the run) or to a nearby energy consuming device. Here again the expensive item, labor, is an important factor. Unstranding the conductor ends, serving them around the main line and soldering them is slow, expensive work and if neatly done requires considerable skill. Furthermore, it is almost always necessary to cut off waste ends which are usually too short to have any other than a junk value. It appears, then, that while this method is feasible for all sizes of conductors, it is expensive and should not be used if a less costly method is available.

In the other method (shown in all illustrations except Figs. 1 and 2) it is only necessary to bolt a cable clamp to the conductor, a section 4½ in. long having been "skinned" for its reception, and to fasten the clevis of the cable clamp to the eye of a strain insulator. These operations require no skill and take but little time. The result is a neat, quickly completed sturdy job. The conclusion is, therefore, that the method is the neatest and the most economical of all, if the cost of a cable clamp is less than the cost of extra labor and waste ends inherent to both the other methods. It will be found that in practically all cases the cost of the cable clamp will be less.

Absolute comparisons in dollars and cents have purposely

been avoided in the above discussion of the relative merits of the three methods. This is because that, even if several examples were tabulated, definite labor rates, a specific number of men required to do the work and a certain cost of conductor would have to be taken while they would be accurate for one plant in one section of the country, they would not apply absolutely to another plant in another section with a different grade of labor. Such variances might cause misunderstandings. It is believed that the truth of the conclusion, that the

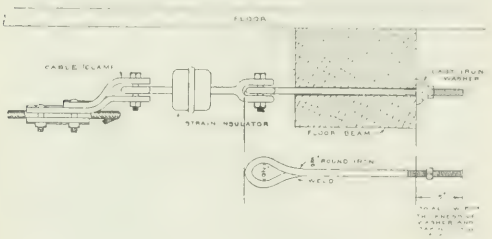


FIG. 4.—DETAIL OF EYE BOLT IN FIG. 3.

clamp method is best and cheapest, will, after what has been outlined, be conceded by all who have handled much heavy wire. If one doubts, he should terminate one end of a certain run by either of the first two methods and use the clamp method at the other, keeping costs in each case.

Descriptions of some examples of terminations representative of good practice follow. In each, because of its general superiority, the method in which a cable clamp is used to hold the conductor is utilized.

Fig. 3 illustrates an excellent method of terminating wires conveying electricity to a large motor or other electrical appliance installed in a building of brick and wood "mill" construction. Enlarged details of the terminating appliances used in Fig. 3 are shown in Fig. 4. The cable clamp is held on the conductor by four ½-in. bolts. A short section of the conductor is bared for its reception. The clamp provides a means for attaching the balance of the "dead-ending" equipment. The cable clamp is a patented contrivance and may be secured through any dealer in electrical supplies. The strain insulator shown, provided with an eye at one end and a clevis at the other, is also a commercial article. Its function is to transmit the pull in the conductor to the adjacent eye bolt at the same

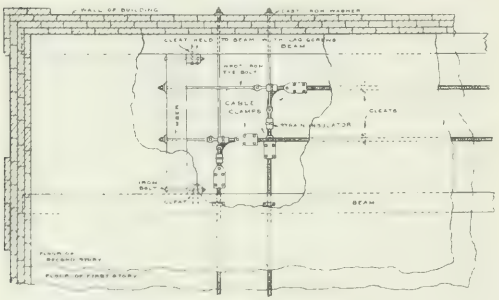


FIG. 5.—RIGHT-ANGLE TURN IN HEAVY WIRES.

time insulating one from the other. The eye bolt can be readily formed, from ⅝-in. round wrought iron, by any blacksmith.

Referring again to Fig. 3, it is assumed that at the other end of each of the wires therein shown there is a terminal arrangement the same as shown in that figure. In erecting the job (Fig. 3) the conductors should first be strung through or raised up into the porcelain cleats, which should be sufficiently loose about the conductor so as not to grip it. The conductor being in place in the cleats, a cable clamp is bolted to it at one end (which will be denominated end No. 1), a strain insulator bolted into this clamp, the eye bolt inserted in the hole through the beam and the washer and nut run on the eye bolt. The nut should be on only far enough to insure all of its threads engaging with the bolt threads. End No. 1 having thus been temporarily made fast, the wire should be drawn taut from the other end, which will be designated as end No. 2. Accordingly another clamp is bolted, at the correct location, on the conductor at end No. 2. A sling, from a set of tackle blocks, is made

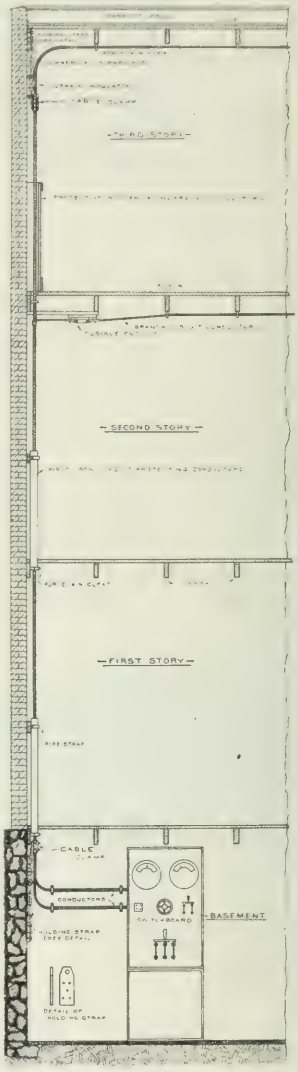


FIG. 6.—FOUR STORY VERTICAL RUN.

fast around the conductor just forward of the clamp, which prevents the sling from slipping. The line from the tackle blocks is pulled upon and the greater part of the slack drawn from the conductor. If the point of application of the clamp at this end, No. 2, was well chosen, it should now be possible to engage the eye of the strain insulator (it having already been bolted to the eye bolt, which, with nut and washer on, rests ready in the hole in the beam) with the clevis of the cable clamp and to insert the bolt that holds them together. This

having been done, the conductor can be stretched as tightly as need be by turning the nuts on the eye bolts at ends Nos. 1 and 2. The job is completed by tightening the lag screws holding the porcelain cleats. The cable clamp and the "alive" metal portion of the strain insulator should be, in this and in all cases, served with insulating tape to meet National Electrical Code requirements.

In Fig. 5 a plan view of a second-story corner of a mill building, with a section of the floor broken away, is shown. It

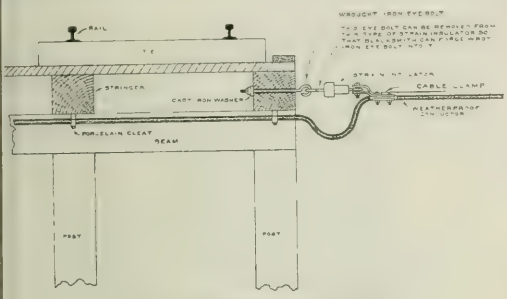


FIG. 7.—TERMINATION AT A TRESTLE.

indicates a substantial arrangement for making a right-angle turn in a two-wire feeder, carried on the ceiling and on the lower face of the floorbeams. Cable clamps, strain insulators and eye bolts are used in much the same manner as described in connection with Fig. 3, and the description given in connection with that illustration applies here. Four terminating appliances are necessarily used in this case because strains in two directions must be provided for. It is profitable to consider the complication and labor that this job would have involved had the terminations been made without using cable clamps.

It is frequently necessary to install a heavy vertical feeder or "riser," several stories in length, to distribute energy for motors or lighting appliances installed on several stories of a structure. In Fig. 6 an excellent example of an installation of this character is delineated. Turnbuckles are availed of to tighten the conductor. These are threaded right-hand at one end and left-hand at the other, and may be purchased through any hardware concern. They are regularly manufactured in a variety of wrought-iron rod sizes and can be furnished with either eye bolt or hook bolt at either or both ends. The holding strap, detailed in the lower left-hand corner of the illustration, is cut from wrought-iron or mild-steel plate and the holes

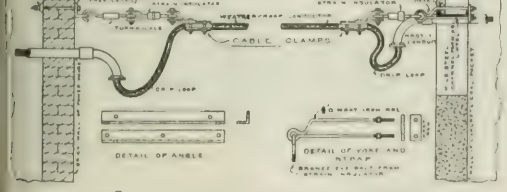


FIG. 8.—TWO TERMINATIONS ON SAME FEEDER.

are drilled or punched through it. It is essential that this holding strap be substantially secured to its support. In the illustration it is shown held with lag screws to a wooden cleat, but in a steel-framed building it would be bolted to some steel member.

Fig. 7 illustrates a dead end, at a wooden trestle such as frequently must be made in a feeder to an electric locomotive trolley wire or third-rail. The only unusual feature of this application is the strain insulator, which has an eye at each end, instead of an eye at one end and a clevis at the other, as those previously referred to have had. One of these eyes can be removed, by unscrewing, to enable the blacksmith to forge and weld the eye of a wrought-iron eye bolt into it. This procedure is impracticable with the ordinary type of strain insulator because of the low melting point and inflammability of the insulating material used in strain-insulator construction. This type of insulator is designed to withstand the severest

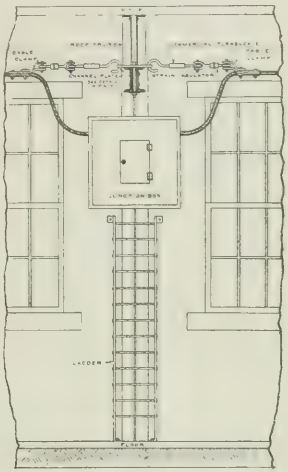


FIG. 9.—DEAD-ENDS AT A JUNCTION BOX.

strains and is of considerably more rugged construction than the ordinary. All of its metal parts, with the exception of the insulated bolt, are of bronze.

The two out-of-door terminations shown in Fig. 8 are at opposite ends of the same run. The conductor shown carries electricity from a brick generating station to a coal-handling crane in a reinforced-concrete coal pocket. It being a three-phase installation, three wires are necessary. A mild-steel angle, which is detailed in Fig. 8, bolted to the brick wall of the power house, provides means for attachment at that end and a special type of U-bolt or yoke, also shown in detail, made by the plant blacksmith, furnishes means at the other. It is to be noted that the eye in the U-bolt is forged around the removable eye of the strain insulator, which is of the heavy type referred to in connection with Fig. 7. This particular run is of No. 00 stranded wire and is 195 ft. from building to building. There are no intermediate supports, the stress being

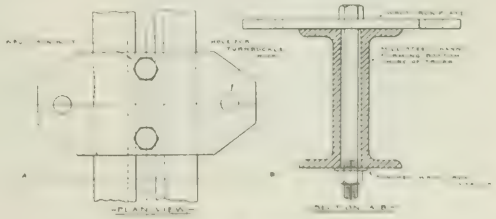


FIG. 10.—DETAIL OF CHANNEL PLATE.

wholly taken by the terminal cable clamps, strain insulators and bolts.

Mains feeding into a sheet-steel junction box are shown in Fig. 9. The junction box is attached to a steel column just under the bottom chord of the roof truss. Each of the conductors is supported, in its run down the building, on large porcelain cleats carried on the top of the channels constituting the roof-truss bottom chords. The scheme used to provide attachment for the turnbuckle hooks is shown in Fig. 10.

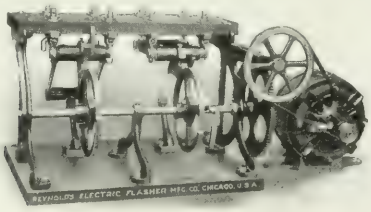
Tungsten Sign Lamp.

The General Electric Company is placing on the market a tungsten sign lamp in voltages of 8, 10 and 12, consuming 5 watts and rated at 4 cp. The new lamp can be operated on alternating-current circuits in multiple on special sign transformers for reducing the ordinary 100-130 volts to tungsten sign-lamp voltages. As sign lamps generally operate in banks and burn continuously, the transformer is carrying full load or none at all and can be cut off when the sign is not in use. The sign transformer can therefore be operated at a very high efficiency. The lamps may also be used in series on circuits of standard voltages. Lamps selected for uniform amperes are supplied for this service when it is made known that lamps ordered are intended for series operation.

The lamp has a very sturdy V-shaped filament well supported by an anchor, will burn in any position, and it is estimated will give an average life of 2000 hours. This is the significant point in regard to this lamp because the saving of 15 watts per lamp, due to the use of tungsten instead of carbon, will, during the life of the lamp, result in a saving of 30 kw-hours for each lamp. As the net cost to central stations of the tungsten over the carbon lamp is only from 20 cents to 25 cents, this will readily be seen to involve a substantial net saving per lamp

Electric Sign Flasher.

The Reynolds Electric Flasher Manufacturing Company, of Chicago, has brought out a new flasher for electric signs and electrical designs, which in its mechanical and electrical features is an improvement on the previous types made by this company. A view of this flasher as built for two 20-amp circuits is shown below. Each of the double-pole switches seen on the flasher is rated at 20 amp, at 110 volts, although as regards size and strength they are about equivalent to a 50-amp hand-operated switch. These switches have the self-lubricating jaws which have been a feature of "Reco" flashers for some time. The jaws are U-shaped, being turned back in such a way



ELECTRIC SIGN FLASHER.

as to form a pocket for grease, which is fed to the contact surface through a slot in the switch jaw; when once lubricated in this way, the flasher will operate a long time without additional lubrication, while at the same time the life of the switch is prolonged and oxidizing of the blades and jaws avoided. The switch jaws are made of ½-in. x 3/64-in. copper, and the blades are ⅝-in. x ⅛-in. copper. The top and bottom slabs of the flasher are of slate. Switches for controlling larger circuits are constructed of proportionately heavier copper.

An important feature of the flasher is the provision made to prevent the various parts from working loose, as a flasher must operate continuously for long periods without attention. The switch terminals and binding posts in the upper slab of slate have rectangular channels milled in the slate, into which the terminals fit closely, so that they cannot turn and work loose. There are also channels milled out to receive the iron frame which supports this top slab. These channels, however, are only in the corners and do not extend clear across the end of the slab so as to weaken it. The bearings are made by boring holes directly in the iron standard, as the speed of the shaft is very slow and the complication of special journal boxes not desirable. The worm and gears are machine cut.

The opening and closing of the switches is accomplished by a new form of mechanism. An iron dog attached to a hard-fiber switch axis engages a case-hardened tooth on the wheel which operates the switch. The tripping of the mechanism is accomplished with this tooth. The wheel carries a sector which engages with the dog and causes the switch to open instantaneously, thus avoiding undue arcing.

The new "Reco" will produce any desired effect, from flashing whole signs to flashing hundreds of lamps one at a time. It is built with both single- and double-pole switches. The single-pole switch operates by flashing up one word, one letter or one lamp at a time. The double-pole switches are for flashing up whole signs, double-face signs, whole words or any number of lights at one time.

New Type of Pittsburgh Transformer.

In developing the new type of transformer shown in the accompanying illustrations, the Pittsburgh Transformer Company has adhered to its well known core-type design which has been altered in its relative proportions in order to utilize to the fullest extent the great advantages of the alloy steel used in the cores of the new transformer. In its mechanical design this transformer is claimed to possess a number of exclusive features, as well as important improvement along lines which have come to be regarded as standard by transformer users. Experience has indicated that a large proportion of transformer troubles is due solely to mechanical construction, which, although good, still leaves much to be desired, and as a result the purpose has been to produce a transformer distinguished by ruggedness heretofore unapproached in the manufacture of small transformers.



FIG. 1.—VIEW OF TRANSFORMER, SHOWING PORCELAIN BUSHINGS

The porcelain bushings through which pass the primary and secondary leads, are extremely large, for example, the bushing used in the 3-kw size weighs 12 oz., whereas it is common practice to use, in such small transformers, a bushing weighing slightly less than 1 oz. The most obvious advantage of the large bushings is that breakage is practically impossible and this at once does away with grounded primary lines due to broken bushings. Other advantages are that on account of the great size of the bushings, very high insulation strength is secured, which reduces the chances of trouble from lightning or static discharge. The effects of wet weather, accompanied by heavy leakage

ground and burning off of primary leads, are obviated, as the leakage surface of the large bushings is so great that ample insulation is maintained under the most adverse conditions. To accommodate porcelain of such size the new cases are designed with bushing pockets or receptacles of correspondingly increased proportions, and are arranged so that the bushings issue from the case at an angle of 30 deg. The bushing, therefore, slants away from the case both inside and outside, and this enables great "jumping" distances to be provided as a



FIG. 2.—TRANSFORMER COMPLETE.

protection against abnormal rise in potential. A further advantage of bushings set on an angle is that this prevents the leads being drawn up against the case, either on the inside or outside, by inexperienced or careless linemen, or from accidental causes. The new bushings are heavily coated with the best glaze, and have all edges rounded to prevent cutting or chafing the leads.

Paper-insulated flexible leads are used exclusively, as it has been found that the usual rubber insulation is not suited for use in oil transformers on account of the fact that it rapidly deteriorates under the action of oil, whereas oil materially improves the insulating qualities of the paper insulation used upon these cables. The transformer, therefore, is not subject to troubles which so frequently occur on account of failure of the insulation at or near the point where the lead passes through the transformer case.

The transformer is held between cast-iron top and bottom plates and is firmly centered therein by means of set screws. The bottom plate engages the sides of the case, and the top plate also fits the case closely, but to insure absolute rigidity set screws in the top plate are tightened up against the case so as to take up all play. Bolts passing through the top plate engage drilled lugs on the transformer case and hold the transformer in place. The new case is thus designed to secure solidity and strength to an unusual degree, so that rough handling will not cause movement or shifting of the parts to the damage of the coils or leads.

There are eight heavy porcelain bushings babbitted into place on the top plate. The four secondary leads and the four primary leads pass through these bushings and are cemented into them. By this means the leads are held firmly in position so that they cannot move or shift and cause short-circuit. Immediately after leaving the coils the leads pass into these bushings, from which they pass through the heavy porcelain bushings cemented into place in the case. This substantial construction gives the transformer great insulation strength and eliminates the danger of accidental grounding of the leads which might cause burn-out of the transformer or shock to persons making contact with lamp sockets, switches or appliances. The new cases have been designed with unusually large space around the coils, leads, terminal block and cables. As a result the transformer shows increased insulation strength, and as there is more oil surrounding the transformer cooler operation is obtained. The cover is arched from the edge of the case, which thus gives increased clearance directly over the leads where clearance is of great importance. Ample clearance between the cover and the porcelain terminal block is also thereby secured. This construction strengthens the cover greatly. The cover is provided with a storm lip of unusual depth so that driving rain, snow or dust cannot enter the transformer. A felt gasket, 1 in. wide, is seated in a deep groove on the underside of the cover and is compressed between the cover and the edge of the case which affords further protection against the weather.

The outline of the cover has no sharp corners, but it smoothly curved, so that this gasket is properly cemented in place and held securely in position at all points. The bolts which fasten the cover in place pass through lugs on the cover entirely outside of the storm lip, which is an improvement over the common practice of drilling such bolt holes inside of the storm lip, whereby moisture is liable to drain from the cover into the transformer.

The new Pittsburgh transformer, although unusually massive in its proportions, i., as will be seen from the illustrations, of graceful design and presents a sightly appearance when installed.



FIG. 3.—TWO SIZES OF TRANSFORMERS.



FIG. 4.—VIEW OF TRANSFORMER CASES, SHOWING MEANS OF SUPPORT AND CENTERING IN CASE.

Leaf-Unit Electric Flatiron.

The General Electric Company has lately brought out a new flatiron, the heating unit of which is new both in material, construction and shape. The resistance metal used is named by its patentees "Calorite" and is claimed to be capable of withstanding oxidation to a point several hundred degrees hotter than any metal previously used in heating devices, its melting point being 2370 deg. Fahr. The resistance of "Calorite" is twice that of nickel-silver and 73 times that of copper and it is this high specific resistance which enables it to be used in a single thin grid-layer or leaf. In the majority of designs, the heat must

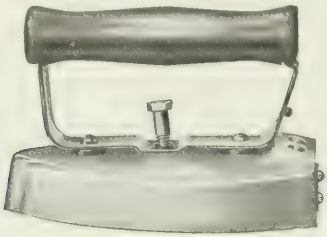


FIG. 1.—COMPLETE IRON.

either pass through two or more layers of heat insulation or radiate through an insulating air space. The "Calorite" leaf unit has such close thermal relation to the working surface of the iron that it cannot overheat. This construction obviously precludes the use of any auxiliary protective device to insure the life of the heating unit.

In the new iron the heat is evenly distributed over the entire

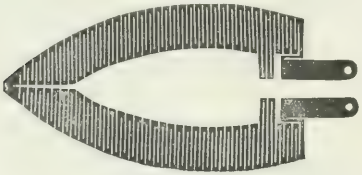


FIG. 2.—CALORITE HEATING UNIT.

working surface. A "scorch" proof is stated to show that this is practically as well as theoretically true. The toe, the heel and both sides are heated equally, providing for efficient ironing in any direction. The construction of the iron is very simple and rugged. The body is of two hard gray steel cast-iron plates held together by two heavy steel bolts. The thin leaf unit is firmly clamped between these plates and separated from them

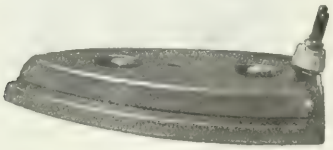


FIG. 3.—BASE OF IRON.

only by a sheet of clear amber mica 2/1000 in. thick, which provides the necessary insulation.

The shell cover, held by one bolt, carries a well-made handle riveted to it, a continuous air jacket being formed between this shell cover and the working part of the iron. This insulating air jacket not only covers the top of the iron, but the sides and ends as well, and the use of the objectionable asbestos is eliminated.

The attachments are made of unbreakable material, the use of porcelain being entirely avoided. The leaf-unit flatiron will be equipped with a plain attaching plug, with combination-indicating switch plug or with permanently attached cord, if desired. The few parts of the new iron are readily interchangeable and the iron can be completely disassembled by removing three bolts. The leaf-unit iron is available in the 5-lb. or 450-watt size, and the 6-lb. or 550-watt size. The iron is finished in highly polished nickel.

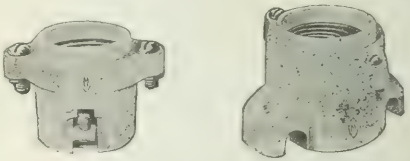
Porcelain Sign Receptacles.

The Marshall Electric Company, Hyde Park, Mass., has placed on the market a complete line of sign receptacles which are claimed to be a considerable improvement over receptacles



FIG. 1.—RECEPTACLE FOR METAL SIGNS.

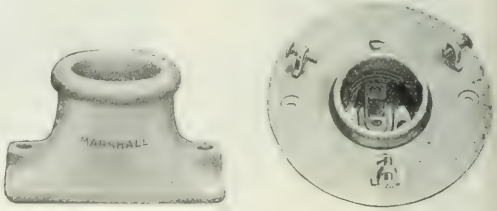
heretofore in use for sign work. In general exterior appearance they are very similar to ordinary sign receptacles, but these latter have frequently failed when exposed to the weather owing to corrosion of the shells. To obviate this defect the present sign receptacles are provided with copper screw shells; moreover, the center contact is an elastic spring and is well separated from the other parts by a mica washer. Fig. 1 is a receptacle for metal signs where the wires are sealed in the back, while Fig. 2



FIGS. 2 AND 3.—RECEPTACLES FOR METAL SIGNS.

is of use where no sealing of wires is required. Fig. 3 is designed for use on wooden sign boards.

The same company has also just brought out a new line of



FIGS. 4 AND 5.—PIPE END RECEPTACLES.

molding and pipe-end receptacles, shown in Figs. 4 and 5. The former are similar in exterior design to receptacles heretofore on the market, but with the socket made much stronger, being built into a heavy outer porcelain instead of on a frail base block. The device is very quickly wired. The pipe-end receptacle is shown in Fig. 5. The conductors pass straight through without cutting and are quickly inserted and connected to the binding screws. No pulling or twisting of the wires is necessary. The receptacle also includes a 2¼-in. shade-holder.

"Venus" Small Arc Lamp.

A small arc lamp, about 18 in. long, has been brought out by the American Automatic Manufacturing Company, 105-109 Madison Street, Chicago, and is illustrated herewith. The lamp is attractive in appearance, and by reason of its diminutive size it is adapted for many classes of indoor work. It is said that the actual candle-power of this lamp is 517, with a consumption of electrical energy of 350 watts. The light is



SMALL ARC LAMP

white and steady. It is pointed out that the efficiency of the "Venus" arc lamp is considerably higher than that of the tungsten incandescent lamp, with which it is compared. The lamp is built for alternating current or direct current at 110 volts, or it can be connected two in series on 220-volt circuits if necessary. By using sand-blasted outer globes, or Holophane shades, it may be made to give a soft, mellow light. The carbons used are ¼ in., and the lamp will burn 30 hours without trimming.

"Tinol" Solder.

The American Tinol Company, 2100 Fairmount Avenue, Philadelphia, Pa., is introducing a new solder called "Tinol," which was originated in Germany. It consists of finely granulated solder, each grain being coated with a fatty organic substance neither acid nor alkaline. This coating or "flux" begins to melt before the solder, but is not completely evaporated until the solder has set, thus protecting fully against oxidation during the entire operation. The mixture of granulated solder and fatty flux forms a paste of a consistency that allows its easy application by a knife blade, glazier's spatula, stiff bristle brush, or even with the fingers. As it is convenient for some work to use solder in stick and wire form, "Tinol" is also made up in rods and wires of different sizes, ranging from No. 0 down to No. 18. These rods and wires are all hollow and contain the same flux used in the "Tinol" paste. Any source of heat may be utilized, as a gasolene or alcohol torch, hot poker, the usual copper tool, etc.; for light work an ordinary wax match will answer. One advantage of the fine granulation of the solder is that much less heat is needed than with bar solder, since each grain melts much more readily.

A report of a test made by the German Postoffice, which controls the telegraphs and telephones, states that by the usual method, using ordinary solder, three joints made in an underground cable sleeve of 4½-in. diameter and 14-in. length averaged an hour and between 6 lb. and 8 lb. of solder (including the melting pot waste). On the other hand, with "Tinol" the average per sleeve was reduced to 2½ ounces and 21 minutes of time. Moreover, out of a total of 20 sleeves tested at 50-lb. pressure, all of the "Tinol" joints were sound, while with ordinary solder imperfections in 3 out of every 10 had to be replaced.

The use of "Tinol" is stated to do away with the need of scrupulous cleaning of each wire or strand, to require less time, to give a cleaner joint with less skilled labor, and to eliminate all danger from acid fluxes. For lighter work, such as interior lighting, telephone connections, etc., simply scraping off the insulation, twisting the wires together, smearing on a little "Tinol" paste, and heating with a small torch, or even a wax match, results in a clean and firm joint. A further advantage lies in the ability to prepare a number of joints for soldering and then quickly pass from joint to joint with the torch. As the paste is applied to the cold joint, the awkward handling resulting from the need of simultaneous holding of the wire (frequently necessarily in confined places), the application of the solder and heating is avoided; a helper is therefore not needed and the work, even in confined quarters, is rendered very easy.

In switchboard work a little "Tinol" paste is easily applied to awkward corners by the point of a knife, and a thin hot wire will melt the "Tinol." In connection with work of this character the well-known pyrographic outfits sold by dealers in artists' materials have been found very useful, such an outfit having burning points of various shapes that are readily introduced into places difficult of access. In the most delicate instrument work the method just described has been found to be useful.

An entirely new method of soldering has been found possible in some lines. "Tinol" paste, for example, has been applied to joints and melted by the passage of a sufficiently heavy current; wherever applicable this gave particularly good results due to the heat passing from the inside outward. Brushing the paste on broad surfaces and bringing these together under the requisite pressure and heating in gas furnaces has given good results for quantity work. For lesser quantities, pressing between heated tongues is a neat and effective method. For narrow joints in sheet metal work, the paste is applied to the edge of the joint and then heated in any convenient way, by torch, soldering iron, etc. For wider joints, the paste is thinned down with a little water and applied with a stiff bristle brush. This is then heated with a torch, or otherwise, as may be convenient, until the metal glistens; in this way the entire surface of the joint is at one operation thinly and uniformly coated with clean tin. A second application of paste is then made, the parts laid together under pressure and heated; a perfect union of the entire surface is the result. It is easy in this way to get perfect joints of several inches in width between thin and thick brass, copper, iron, steel, galvanized metal, nickel-plated metal, lead, etc., and perfect joints between any of the dissimilar metals mentioned are also readily made.

Among specimens submitted with the above information by the manufacturer are sheet lead of 0.018 in. thickness, with a joint of 7/16 in. x 3½ in.; sheet lead of 0.018 in. thickness soldered to 0.022 sheet steel with a joint of ½ in. x 3½ in.; two iron plates of 0.117 in. thickness soldered with a joint of 1¼ in. x 4½ in. Also a lot of various copper wires and cables, with and without sleeves; lead and block tin slip joints, railway signal leads of stranded galvanized wire jointed to iron rods, solder-locked nuts and bolts, etc. Cuts taken through the joints show the completest possible penetration of the solder into the joints.

"Tinol," the patent rights of which is controlled by the above company, is furnished in the shape of paste, rods and wire in varying proportions of tin and lead, ranging from 100 per cent tin to 20 per cent tin and 80 per cent lead.

Multi-Vapo-Gap Lightning Arrester.

In the multi-vapo-gap lightning arrester manufactured by the Lord Electric Company, of New York and Boston, the path provided for the discharge consists of a mechanical vapor cloud, and, inasmuch as it is impossible to transmit a dynamic current by means of the cloud, the arrester is said not to carry the working current. The body of the arrester is a hygroscopic mass holding moisture in suspense in a fixed and definite volume. This suspended moisture is maintained in a static conductor form, and the hygroscopic mass is sealed hermetically in a porcelain housing. The impedance of the arrester is said to be nil, owing to the fact that the globules, although mechanically separated, are extremely close together. This multiplicity of vapor-gaps eliminates the necessity of having an air-gap, and together with the low impedance is said to make the building up of a static charge on the line impossible. A tell-



MULTI-VAPO-GAP LIGHTNING ARRESTER.

tale device, which can also be used to open the circuit, indicates and records the passage of a discharge. The arrester has no moving parts, contains no metal, aside from the terminals, and no carbon in any form. It is made in two forms for station and line and car use, and the terminals are suitably marked so that there can be no mistake made in connections.

Combined Starting Switch and Circuit-Breaker.

Supplementing its line of six-pole oil auto-starters, intended for starting induction motors up to 500 hp, and for voltages of 2500 or less, the Hartman Circuit-Breaker Company, of Mansfield, Ohio, has recently brought out a type of starting switch intended for motors of 30 hp or less, and for potentials up to 600 volts. The starter shown in Figs. 1 and 2 is intended for star-delta connection, by which method a starting voltage of 57.8 per cent can be obtained, without the use of transformers. These starters are also furnished with transformers, the coils being mounted in a cast-iron case, to which is bolted the oil switch, making the layout self-contained. The new starter is a double-throw automatic oil-switch, with six sets of contacts on both starting and running sides. These contacts are made easily removable, and the bridging contact is formed in such manner that it can be reversed and both sides used. The contacts have a continuous carrying capacity of 50 amp, and experience has shown that the current-carrying capacity will improve with use. The contacts are brought together with a powerful toggle action, insuring good contact at all times. Fiber barriers are placed between each set of contacts, and these barriers may be readily dropped for inspection of the contacts, as will be observed in Fig. 2, where the barriers have been dropped on the starting side.

While the starter can be furnished in the non-automatic form, the usual practice is to provide the same with single or double overload coil protection, and it can also be furnished with low-voltage protection on the running side. On the starting side only a portion of the turns of the overload coils are in series—

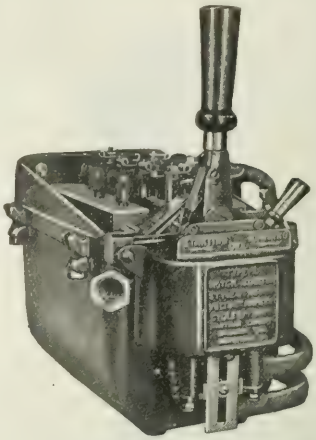


FIG. 1.—SIX-POLE STARTING SWITCH, WITH DOUBLE OVERLOAD COIL.

usually one-fourth—although this may be varied according to the current required for starting the motor. The starter thus combines the features of a starting switch with those of a circuit-breaker, and neither fuses nor auxiliary circuit-breaker are required in connection with the starting device. The operating handle is made with an inner and outer lever, which feature prevents starting the motor while excessive overload or short-circuit conditions exist, as the switch will return to

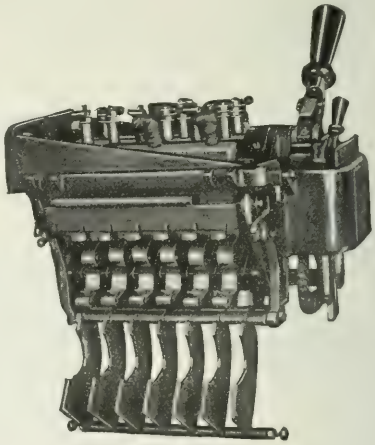


FIG. 2.—STARTING SWITCH WITH OIL TANK REMOVED.

the "off" position regardless of the fact that the handle may be held by the operator.

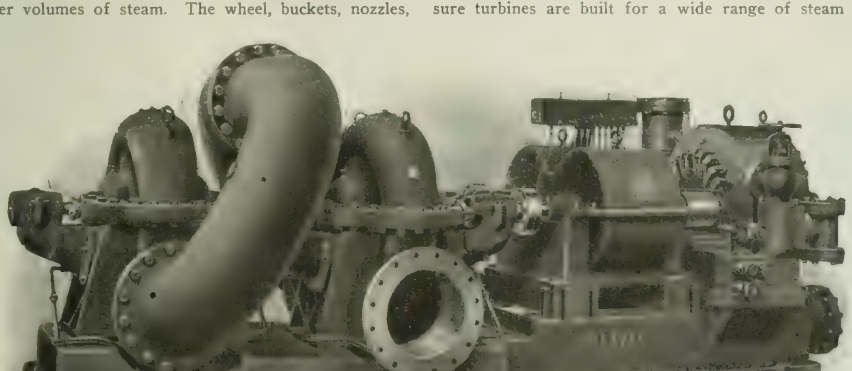
The starter was designed with a view of making it as near "fool-proof" as it is possible to have such a device. The construction of the operating mechanism is such that it is impossible to throw to the running side first, and it is also impossible for the operator to go off, and leave the switch in the starting position, as it will return to the "off" position when the oper-

ting handle is released. A quick break is provided when the witch is opened on overload or low voltage, and when tripped y hand from the running side. On the starting side, the construction is such that the operating handle must be thrown uickly from the starting through to the running position, as otherwise, the handle will stop at the "off" position. This eature not only prevents the excessive burning of contacts, but lso prevents the slowing down of the motor while passing rom the starting to the running side.

Low Pressure Turbines.

There are two general types of low-pressure turbines built y the De Laval Steam Turbine Company, of Trenton, N. J., hese being known as the low pressure turbine and the combinaion high- and low-pressure turbine. The low-pressure turbine s built to operate on low-pressure steam and in case of failure f the low-pressure steam supply the turbine must be fed with team that has been reduced by means of a reducing valve to a ressure near that of atmosphere. The machine in general is standard De Laval steam turbine, the only modification being n the steam passages, which have been enlarged to take care f the larger volumes of steam. The wheel, buckets, nozzles, high-pressure governor. On the total or partial failure of the low-pressure steam supply, the machine will automatically draw from the high-pressure steam supply the amount necessary to make up the deficiency. In case of the complete failure of the low-pressure steam supply the machine will operate on high-pressure steam and under this condition will give, it is claimed, practically the same economy as would a steam turbine designed for the high-pressure condition only. The combination high- and low-pressure turbine is built particularly for conditions where continuous operation is essential and where the supply of low-pressure steam is intermittent or is apt to fail completely. The regulation obtained when changing from one steam pressure to the other varies from 2 per cent to 3 per cent, this being taken on an instantaneous change from one condition to the other, such as seldom occurs in actual service. The machine is also arranged with a by-pass valve which allows the admission of high-pressure steam into the low-pressure compartment, enabling the turbine to operate under full-load conditions non-condensing. This by-pass valve is not automatic and is added simply to enable the machine to carry full load in case of failure of the condenser apparatus or during repairs to condenser apparatus.

Both the low-pressure and combination high- and low-pressure turbines are built for a wide range of steam conditions



LOW-PRESSURE TURBINE.

tc., are all of the company's standard construction, the nozes having practically the same ratio of expansion as those ommonly used for high-pressure, non-condensing work. The urbine is built in all sizes from 7 to 300 brake horse-power at arious speeds ranging from 3000 to 600 r.p.m. The machine adapted for driving all types of apparatus now driven by igh-pressure turbines.

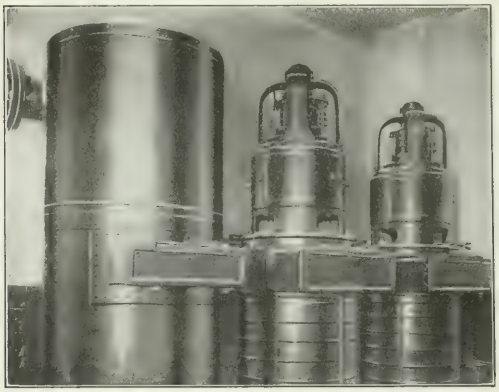
The combination high- and low-pressure turbine is built to perate either on low-pressure steam or high-pressure steam, s conditions may require. The machine is built with two nozzle ompartments; one for high-pressure steam and the other for ow-pressure steam. Each compartment is furnished with ozzles having the proper ratio of expansion for the conditions nder which they operate. A portion of all of the nozzles are urnished with shut-off valves to allow of the proper regulation f the nozzles for the highest economy under variable conditions. The machine is furnished with two steam connections; ne for high-pressure steam and the other for low-pressure eam, each connection leading to its own governor valve, which turn is driven by a separate governor. The turbine is arranged to be entirely automatic, the low-pressure governor ering set for a speed a few revolutions higher than that of the varying from 5 lb. pressure above atmosphere to 10 in. of vacuum on the steam inlet. They are also built for low vacuums in order to meet conditions where the temperature of the circulating water or existing condensers prohibit the maintenance of a high vacuum. The steam consumption of the turbine varies somewhat with the sizes and operating conditions; the manufacturer states that the average machine operating with steam at atmospheric pressure, exhausting into a vacuum of 27 in. to 27½ in. will use from 28 lb. to 32 lb. of steam per brake hp-hour.

The company is also building a high-speed, low-pressure turbine particularly adapted for a direct connection to centrifugal pumps and blowers. This class of machine is built in both the low-pressure and combination high- and low-pressure types and consists of the De Laval wheel which is direct connected to the machinery to be driven by the turbine. On account of the direct connection of the wheel and the elimination of the usual reduction, the machine can only be operated for good economy with high speed and for this reason is not particularly adapted to direct-current generator work, but is particularly adapted for high-speed pumping and blower work, such as power-plant auxiliaries, boiler-feed pumps, elevator pumps, etc.

Vacuum Cleaning Equipment for Office Building.

The Spencer Turbine Cleaner Company, of Hartford, Conn., and New York, has installed in the new Fifth Avenue Building, Madison Square, New York, a complete vacuum cleaning outfit for daily use in cleaning the entire building. The installation is illustrated herewith and consists of an 8-sweeper machine driven by a 20-hp motor, and a 12-sweeper machine driven by a 30-hp motor. These connect with 13 risers in the building, and by means of an installation of 185 valves every part of the building is within convenient reach of a moderate length of hose. In the Spencer turbine cleaner the main element of the system is the exhauster. This consists of a vertical shaft on which the impellers are mounted, the weight of all rotating parts being balanced by the air pressure inside of the surrounding casing. A revolving element driven by a direct-connected motor, together with removable dust-receiving and collecting chambers, two at the top of the impellers just below the motor, and the other at the bottom of the turbine below the impellers, constitute the whole of the mechanical equipment. The floor space occupied is very small, the base of a 15-hp machine, which operates six cleaning tools at one time, covering a space only 31 in. square.

The dust-laden air enters the top chamber at a tangent, and the resulting whirl of the air deposits in that chamber the heavier dirt; the lighter particles are carried through the turbine, but cause no injury, since there is a clearance of over ⅛ in. between the impellers and the stationary parts. The velocity of the incoming air is constantly increased by each succeeding impeller, so that when it reaches the lower dust-separating chamber, the air near the outer casing is said to be traveling at the rate of a mile a minute. The lighter particles of dust which have passed through the impellers are thrown by centrifugal force against the casing of the machine and dropped to the lower receiving chamber. The air, practically freed from the dust, is then carried through a pipe to a chimney flue or other convenient outlet. The design of the exhauster is such that it will handle a large volume of air, while the suction is practically constant under all conditions of load up to its maximum capacity. The energy required to operate the turbine is stated to be proportional to the load. This follows from the inherent design of the machine, and not by the use of any extraneous appliances. If it is desired to change the tools, or go from room to room, the air can be shut off by a valve in the operating handle. The vacuum maintained at the tool under average conditions is about 3 in., and owing to the large amount of air exhausted, and the large size of tool, larger particles than ordinary are handled, and work is more rapidly performed. With the type of tool used, not only dust and dirt, but such litter as cigar-stumps, matches, nutshells and similar size accumulations are removed by the cleaner.



VACUUM CLEANING EQUIPMENT.

A feature of the system are the fixtures and tools used in connection with it. The inlet valves are placed flush with the surface of the wall to which they are attached, and the hose coupling is merely pushed into the valve, where it is automatically locked in proper position. When the coupling is removed, the value automatically closes and renders the opening air tight. A special reinforced suction hose of large diameter and light weight is used, a 1¼-in. hose weighing 55 lb. per 100 ft. The line of tools is adapted to cleaning every kind of article in every location. A swivel attachment enables the operator thoroughly and rapidly to clean under and around furniture, around window casings and in similar inaccessible places without changing his position. The width of the slot in the tools varies from ½ in. to ¾ in., and these have given good service on bare floors, hard-wood floors and stone. The apparatus is designed to exhaust 125 cu. ft. of air per minute.

Electric Heating Devices.

The question of efficiency in electric heating devices is entirely one of construction. That is to say, certain metals and substances are better adapted as resistance mediums for heating elements, because they may be contained in the space provided by an iron or other heating device, and have durabl

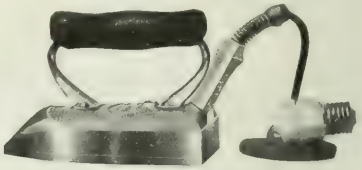


FIG. 1.—"SUPERIOR" IRON.

qualities. The problem which has been difficult of solution has been to obtain, besides a suitable resistance medium, a construction such that the heat is conducted with a minimum los to the ironing surface, where it is needed. The 6-lb. flatiron brought out by the American Electrical Heater Company, of Detroit, Mich., and illustrated herewith, is claimed to embod a practical solution of this vexed problem. No wire is use in the heating element since this requires a core and di integrates with age and usage. Heat is generated by a fl element which is said to be a portion of and to cover the entir bottom plate of the iron. An even distribution of heat is sai to result without much loss. The coffee percolator recent placed on the market by this company is shown in Fig. 2. Th device does not boil the coffee, but starts to percolate aft the circuit has been closed and by the time the liquid reach the boiling point the beverage is ready to serve. A new di



FIG. 2.—"AMERICAN UNIVERSAL" COFFEE PERCOLATOR.



FIG. 3.—DISK HEATER.

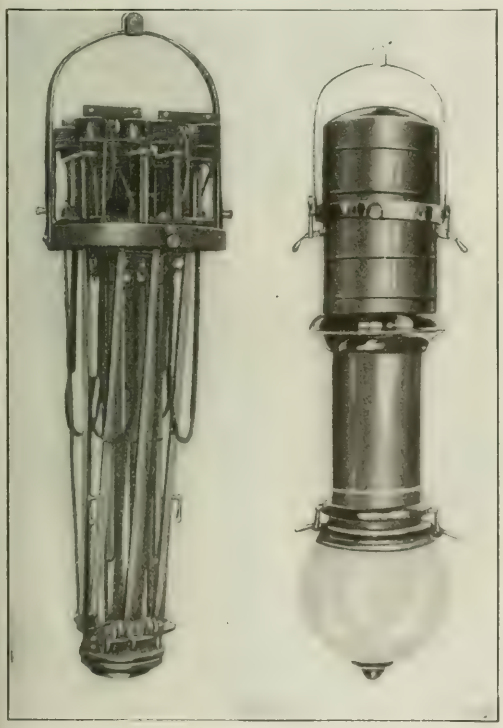
heater, suitable for a great many purposes, is shown in Fig. This device is provided with a steel-clad element which is ef cient and durable and instantly replaceable. It is highly finish and provided with ebonoid handles and heat-insulated legs, prevent it from scorching or scratching polished surfaces.

Toerring Flaming-Arc Lamp.

The C. J. Toerring Company, of Philadelphia, has placed upon the market the flaming-arc lamp shown in the accompanying illustration, which is claimed to combine simplicity in street wiring, rigidity of construction, rapid trimming and general durability and reliability.

As is well known, the flaming arc requires a drop across its lamp terminals of only 55 volts, making it necessary to burn two lamps in series on 110 volts. If these lamps are spaced at a considerable distance, the wiring involved is a considerable item. The method heretofore used has been to burn two lamps on a pole, which requires just double equipment as far as globes, etc., are concerned and double the time to trim and clean the lamps.

To eliminate these very considerable items in maintenance, the present lamp is so constructed that it can be hung directly



FLAMING-ARC LAMP

across a 110 volt line, running two arcs in series within a single globe. Each arc is dependent on its own regulating mechanism, which insures a perfect burning and regulation that would not be possible were the two arcs regulated by a common feeding device. The regulation of each arc for an alternating system is provided by a rotating aluminum disk actuated by a series and a shunt magnet, whereby a chain run on a pulley is unwound to feed the arc, and rewound to lengthen the arc gap. The series coils, blow magnets, arcs and resistance are all in series, each shunt being connected directly across its own arc. The two sets of carbons are trimmed in an inclining position downward, supported by chains from above, which in turn is regulated by its own aluminum-disk motor.

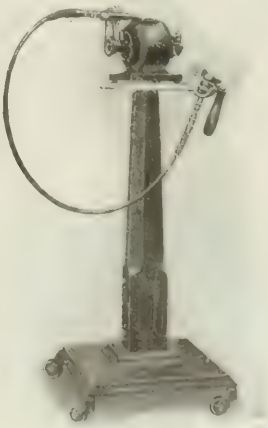
When the current is first thrown on, a pressure of 110 volts actuates the shunts, causing a rapid rotation tending to lower the two sets of carbons. Should one set get together before the other, the shunts, of course, are short-circuited and the downward rotation will stop on that side the other pair of carbons still continuing down until contact is made at their tips. This closes the series circuit and throws a series current into the series coils, causing a rapid rotation tending to pull the carbons upward and apart. As soon as these tips are pulled apart, however, a small shunt current immediately begins to flow, which, at a definite height of the carbons in the economizer, will cause a balance and the disk will become stationary. The arcs are now each burning at its required voltage and at a designated point in the economizer a definite distance from the blow magnet pole tips which stretch them and hold them rigidly on the carbon tips. As the carbon burns away, causing the arc gap to increase, the shunts predominate and slowly unwind the pulleys, lowering the carbons as they are consumed. This gives an ideal feed, as the carbons by this method are always being fed a little and with a smooth, steady motion only as far as needed. Should an imperfection in the carbon cause an over-feed—that is, lowering the tips too low momentarily—the series magnet will immediately predominate and pull them back to the desired point once more. Over-feeds are impossible, as are also short and jerky feeds due to the crumbling away of the carbon on a copper support, or any other method of feeding.

The construction of the lamp is such that all moving parts are enclosed in a weather and dust-proof cap, which never has to be removed by the trimmer. The castings and guide rods have been made extra heavy to avoid buckling, and all chances for grounds and short-circuits have been eliminated. All possible parts are made of brass heavily nickeled, the essential iron pieces being japanned. Beaded insulation and asbestos-coated wire are used exclusively, and the guide plate on the base through which the carbons run are one solid piece of fireproof stone which will not crack under heat. The casings are so ventilated as to prevent any ash getting to the upper lamp parts.

The efficiency of these lamps is stated to be about ⅛ watt per candle-power. They are usually hung on 25-ft. poles, either in one straight line through the middle of the street or staggered on both sides of the street to be lighted.

Vibrator and Hair-Drier.

The pedestal vibrator built by the James Barker Iron Foundry & Machine Works, and illustrated by Fig. 1, is equipped with a slow-speed series motor making it applicable to direct-current and alternating-current circuits. Speed variations are obtained



through step pulleys and belt, and this is said to lessen in a measure the noise of operation and vibration of the handle. There are no reciprocating parts in the mechanism and all running parts are immersed in oil. The universal handle employed permits the flexible shaft to assume easy and natural

curves. Phosphor bronze or hardened and ground steel is used in the bearings and the moving parts are encased in such a way that accident is impossible. A wide assortment of applications is manufactured by the company. The hair drier, which is illustrated in Fig. 2, produces a strong breeze of electrically heated air.



FIG. 2.—HAIR DRIER.

The button switch shown on the motor in the illustration changes the wind instantly from hot to cold by merely switching the heating element employed out of circuit. A universal motor is used and the entire mechanism is enclosed and protected by screens. The machine is small and neat in appearance and, the manufacturer says, does not give evidence of the amount of wind and heat produced. Wherever possible the parts are made of aluminum.

Tungsten Lamp Shipping Case.

The accompanying illustration shows a shipping case for tungsten lamps made by the Sefton Manufacturing Company,



FIG. 1.—CASE READY FOR SHIPMENT.

of Chicago. The cases are constructed of heavy corrugated paper; in the illustration the case is shown with the closing flaps turned up. In each of the corners is an ingenious paper spring, which, together with a top and bottom spring (one of which is shown outside of the case), forms shock absorbers for the inner case containing the lamps. The inner case will hold 50 or more lamps.

In a recent test trip, made by the makers, 50 tungsten lamps

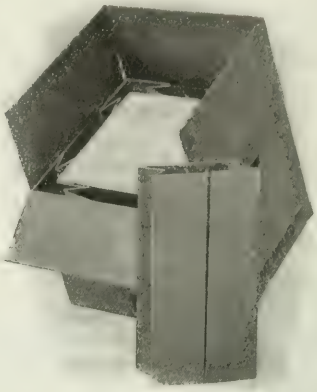


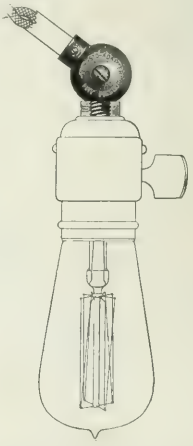
FIG. 2.—CASE FILLED WITH TUNGSTEN LAMPS.

were shipped in a Sefton case by express from Chicago to New York and returned without the breakage of a single filament.

Adapter for Tungsten Lamps.

The tungsten lamp lasting longest when burned in a pendant position, it is necessary to use some form of adapter when connecting it to the ordinary chandelier socket, which points at an angle of about 45 deg. The Frank Mossberg Company, of Attleboro, Mass., manufactures the "Tungsto" adapter illustrated herewith.

The "Tungsto" adapter is applicable to any style of fixture and is interposed between the socket and the steam as indicated.



ADAPTER FOR TUNGSTEN LAMPS.

The adapter is made in various finishes and holds the lamp rigidly in proper position.

Regenerative Flaming-Arc Lamp.

As is well known, flaming-arc lamps in operation evolve umes from the chemically impregnated electrodes which, if the amps are not properly ventilated, are deposited on the globe and nterfere seriously with the efficiency of the lamps. The Adams-Bagnall Electric Company, of Cleveland, Ohio, has brought out lamp in which the hitherto objectionable fumes are made to erve a useful purpose, the construction of the lamp being such hat the gases generated are circulated by means of side tubes nd the matter in suspension thus subjected repeatedly to the ction of the arc, with the result that the chemicals exercise heir function on the flame many times before finally settling in he bottom of the lamp, and the life of the carbons is greatly ncreased.

The lamp, which has been appropriately termed a regenerative amp, is illustrated herewith. The positive or lower electrode is f star-section, the grooves between the eight rays of the tar being filled with a chemical composition applied in the orm of a paste and finally baked. The component parts of the aste are calcium fluoride, which gives a whitish-yellow color; alcium tungstate, which gives a purple-white color, and sodium ngstate or potassium sulphate, which is added merely to teady the arc. The upper or negative electrode is of high-rade carbon and slides in a tube vertically above it, the posi-ve electrode remaining fixed. Surrounding the arc is a clear-lass cylinder, outside of which is a translucent globe. The nner glass cylinder is in communication with two metal tubes,

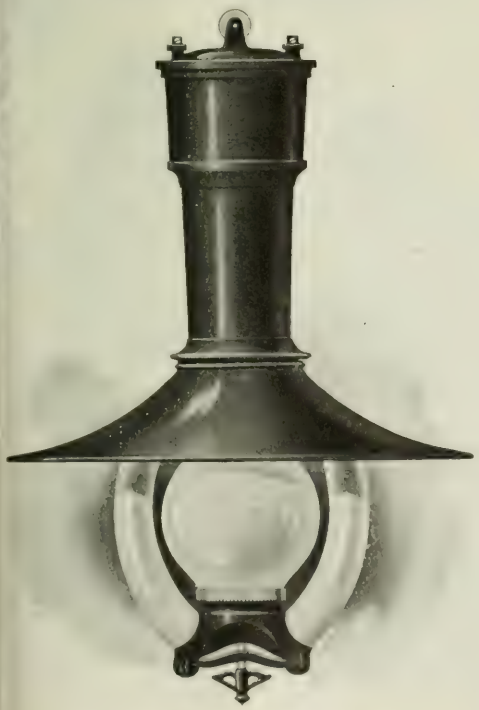


FIG. 1.—REGENERATIVE FLAMING-ARC LAMP.

early shown in the illustration, through which the gases scend only to re-enter the bottom of the cylinder, thus being bjected to the high temperature of the arc over and over gain.

Because of the high temperature of the gases and also the rect draft past the arc, the inner glass cylinder has no de-osit for the greater part of its length, the color and brilliancy of the light being thus constantly maintained although the arc is enclosed.

The resultant light from the arc is of a brilliant yellow color. The spectrum is of the band-and-line type, showing that the gases are incandescing. The upper electrode is 18 in. long and ⅝ in. in diameter, while the lower electrode is 7 in. long

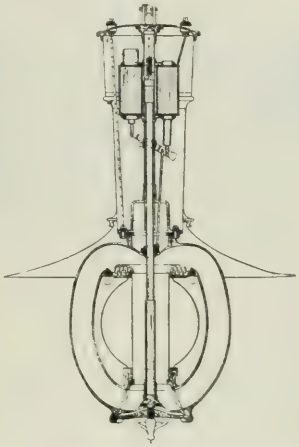


FIG. 2.—SECTIONAL ELEVATION OF LAMP.

and ⅞ in. in diameter. The life of a single pair of electrodes is over 70 hours and their arrangement gives a favorable distribution of light, as is clearly shown in Fig. 3. About 15 grains of the composition are volatilized every hour. The curve shows that a maximum of 3400 cp is obtained at an angle of 40 deg. below the horizontal.

These flaming arc lamps are designed for operation on either

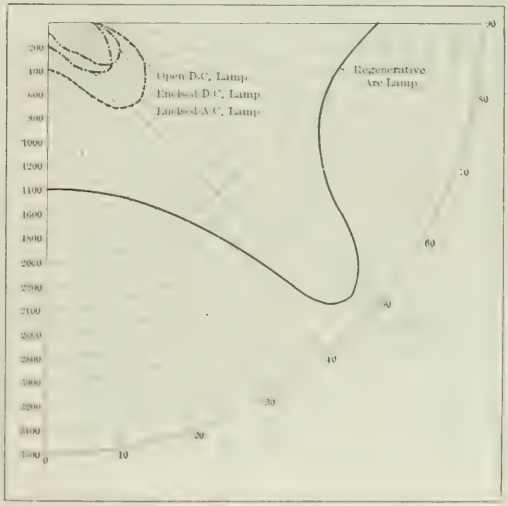


FIG. 3.—CURVES OF LIGHT DISTRIBUTION.

direct-current or alternating-current circuits having a potential of 100 volts to 130 volts. The current consumption on 110 volts is said to be 3 amp, which corresponds to an unusual efficiency even for the flaming arc, which economy is further enhanced commercially by the long life of the electrodes. The lamp gives a mean lower spherical candle-power of 2200, with a consumption of 330 watts.

Porcelain Protective Devices.

The Metropolitan Engineering Company, of Brooklyn, N. Y., has brought out a line of porcelain protective devices which embody distinctive features of unusual interest. The line was

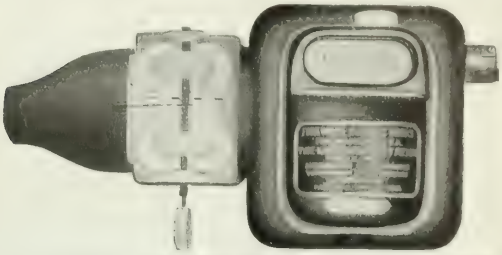


FIG. 1.—METER FITTED WITH OPEN-END CUT-OUT AND METER GUARD FRAME.

designed by Mr. Thomas E. Murray, vice-president and director of the New York Edison Company, and differs from anything now on the market, although serving the same purposes as existing apparatus.

In the line are meter seals, open-end cut-outs and meter guard frames, reversible fuse switches; double-branch, twin-circuit cut-outs; sealable-plug cut-outs, fuses, guards, etc., and the element of protection which these afford to central-station services against criminal tampering with circuits will doubtless appeal to operating managers of lighting companies. Space limitations preclude detailed descriptions of all the features of the line which will be apparent to experienced lighting men from observation of the engravings published herewith. Fig. 1 shows a watt-hour meter fitted with an open-end cut-out and meter guard frame, all parts being in position and sealed. The permanent connections are in the base of the cut-out. The fuses are entirely enclosed in the porcelain handles and by removing the intervening piece of porcelain the neutral connection, where there is one, is open for inspection. By removing the porcelain end piece, connections may be easily made to the terminals. It will be evident that the wires leading to the meter cannot be tampered with except by breaking the seal of some other part of the cut-out and that the type of

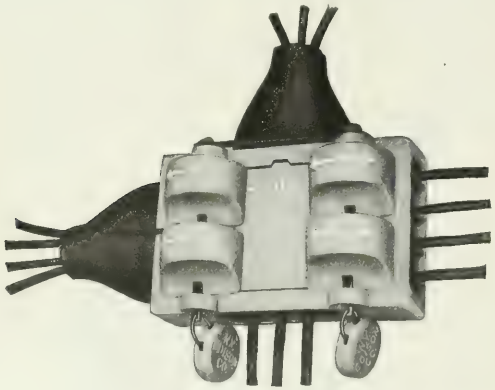


FIG. 2.—THREE-WIRE, DOUBLE-BRANCH, TWIN-CIRCUIT CUT-OUT.

fuse used precludes the possibility of accident under any conditions whatever when it is being inserted. Through the agency of a tell-tale pin hole, the porcelain blackens when a fuse blows so that a defective fuse is thus indicated. The three-wire, double-branch, twin-circuit cut-out shown in Fig. 2 is fitted with reversible on-and-off fuses. A device of this kind is capable of wide application. In apartment house work, for instance, if the tenant vacates, it is an easy matter to cut out the service by simply reversing the fuse handles. This not only breaks the connection but also indicates that it is broken and by means of the seal no change can be made by an unauthorized person without detection. A single branch plug cut-out with sealable features is shown in Fig. 4. With the

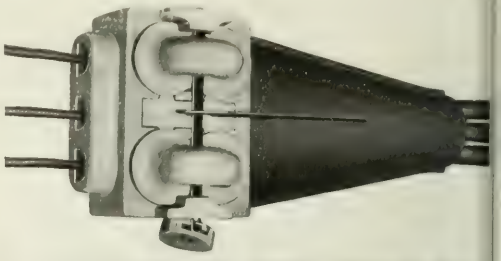


FIG. 3.—CUT-OUT WITH FUSES, TERMINAL GUARD AND SEAL IN PLACE.

porcelain cover and fuses in position, the copper bar is passed through slots in the fuse handle and the leads sealed against

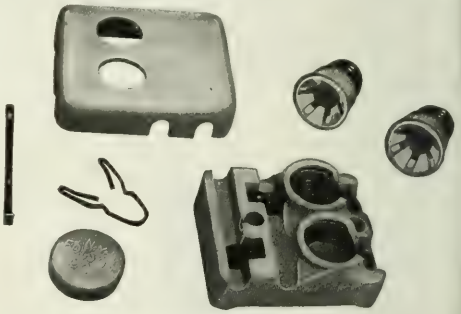


FIG. 4.—SINGLE-BRANCH, TWO-WIRE PLUG CUT-OUT.

interference. Fig. 3 shows a standard cut-out with fuse terminal guard and seal in place, and Fig. 5 shows a single

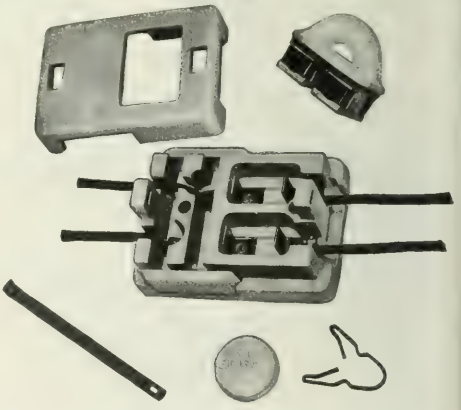


FIG. 5.—SINGLE-BRANCH, TWO-WIRE CUT-OUT.

branch, two-wire cut-out with detachable fuse handle. The illustration shows the type of fuse used and the large contact surfaces provided. It is needless to state that all of the devices have been subjected to rigid tests which they have withstood. Emanating from a practical central-station man, familiar with every detail of the business and knowing the need of such devices, it is safe to assume that the line will meet the claims made for it in practice.

Protected Service Connection Block.

However great his faith in human nature, even central-station managers know that an exposed cut-out and service switch is

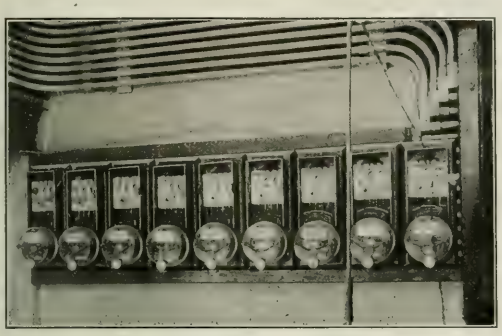


FIG. 1.—PROTECTED METER INSTALLATION.

a source of temptation to which many consumers have yielded. Many managers have sought to apprehend the culprits and bring them to justice, while others have tried to remove the temptation. As a result of the latter effort many forms of protected cut-outs, sealed service switches, etc., have made their appearance. Keeping step with the developments of this particular phase of central-station trouble, the Price-McKinlock Company, of Boston, Mass., is marketing a number of service protective devices designed to cure this evil, one of which, a fuse block cover, has already been described in our columns. The connection block is illustrated herewith. Where it is desirable and practicable to carry the service wires in conduit directly to the meter, this block offers a means of terminating the conduit at the meter and taking the wires into and out of the meter without leaving any exposed leads or connections. The enclosing box is so made that line and load wires may be brought in on either side as desired. It fits snugly against the meter, protecting one or more of its supporting screws so that it is impossible to disturb the meter connection or remove the meter from the wall without breaking the seals of the connection block cover.

Three important features of the device include, first, a practical terminal for the line and service wires to the customer's meter; second, a method for mounting and dismounting the meter without interrupting the customer's service; third, the terminals and disconnecting plugs or straps are so arranged that the meter can be cut out of service and into any desired test connection by a simple operation that does not involve the hazard of a short circuit or require the use of cumbersome



FIG. 3.—PARTIALLY CONNECTED SERVICES.

connection straps or terminals and without interrupting the customer's supply. With the use of this device it is possible so to install meters that the likelihood of theft of energy is largely removed, the speed and accuracy of meter testing is increased and, consequently, the cost of such tests greatly reduced.

Fig. 1 shows a meter installation thus protected on the circuits of the United Electric Light & Power Company of New York. There are six screw plugs provided, four for fuse plugs and two for switching purposes. By means of the latter an inspector may test a meter without cutting a wire, opening a taped joint, or interrupting the customer's service for an instant. The two upper right-hand receptacles are arranged to take specially designed connecting plugs so that ordinary fuse plugs cannot be inserted in these two receptacles.

By screwing the connection plugs into their sockets, the meter is by-passed and the consumer's supply uninterruptedly continued. By removing the other plugs the meter is disconnected from both load and line and may be removed or replaced without the use of any instrument other than a screwdriver, or, if a test is desired, any combination of connections may be made, the by-pass plugs then removed and the test made. The special

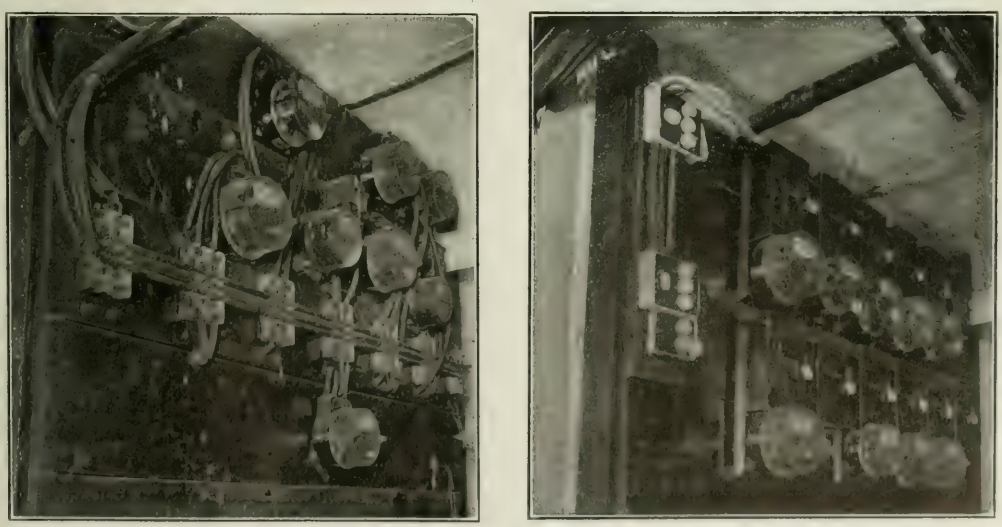


FIG. 2.—VIEWS OF SAME INSTALLATION WITH AND WITHOUT CONNECTION BLOCKS AND PROTECTIVE DEVICES.

ly designed by-passing plugs cannot be left inserted in the receptacles, as it is impossible to replace the cover of the device until these plugs have been removed.

The use of the block greatly facilitates meter testing, especially in laboratory work, when testing one or more instruments with a standard where it is desirable to remove an instrument from its connection without disturbing the others. In addition to possessing the element of protection, the outfit is convenient for installations in apartment houses where tenants move with frequency and where meters are disconnected and reconnected at intervals. By the use of such a device the meter may be left in place but disconnected, or the meter may be removed entirely and the cut-out closed and sealed.

As an illustration of the advantages possessed by the device over former methods, Fig. 2 will be interesting. This gives two views of the same installation; one showing a good installation of meters under former conditions with latent possibilities for theft of energy; and the other shows a meter installation with the connection blocks and protective devices installed.

An illustration showing the use of the two protective devices, namely, the fuse block cover and the meter connection block, is given in Fig. 3. Here the meters controlling the apartments



FIG. 4.—PROJECTED CUT-OUT.

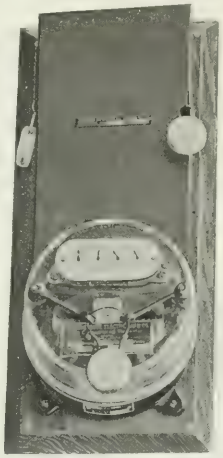


FIG. 5.—PROTECTED METER.

are all located in the basement. Each cut-out, placed by the electrical contractor, has been covered with the device described and placed under seal. But two of the apartments have been cut into service and here meters are placed with the connection block, the covers sealing the cut-outs reversed, fuses installed and again placed under seal. The remaining seven vacant apartments where service has not yet been established, show all of the terminals protected by the fuse-block covers. Loops brought out under these cut-outs are "dead," as the fuses in the cut-outs have not been placed.

When service is installed the cover is reversed to its normal position and sealed, making the fuses accessible, but at the same time making it impossible to place a "jumper" or otherwise tamper with the connection without breaking the company's seal. The illustration shows these covers both with service cut in and cut out. Where the service is in use the fuses are visible, and where discontinued the white circles are simply the porcelain of the cut-out block showing through the holes in the iron cover.

Fig. 4 shows the installation of one of these cut-out covers within a cabinet furnished and placed by the electrical contractor. Here the customer has not been connected, the cut-out terminals are under seal and no fuses installed. When service is cut in the cover will be reversed, the fuses inserted and the cover again sealed.

Fig. 5 shows the meter as it leaves the central-station company's storeroom, equipped with the meter connection block and mounted on a board which is secured to the wall on the customer's premises. The box is, of course, not under seal until after installation.

Automatic Intercommunicating Telephone Equipment.

The increasing demand for intercommunicating telephone service throughout the country has induced the Western Electric Company, which supplies all the equipment used by the entire Bell system, to place on the market two types of metal

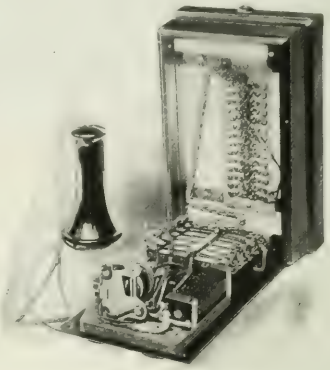


FIG. 1.—ARRANGEMENT OF NON-FLUSH WALL SET.

automatic intercommunicating telephone equipment. These sets are made in two types, a non-flush set for mounting on a wall and a flush set for mounting in a wall, both compactly mounted in a fireproof iron case, having a hard, durable, black japanned finish with nickel trimmings.

The non-flush wall set has all the telephone apparatus mounted on a door, which is hinged at the bottom so that it

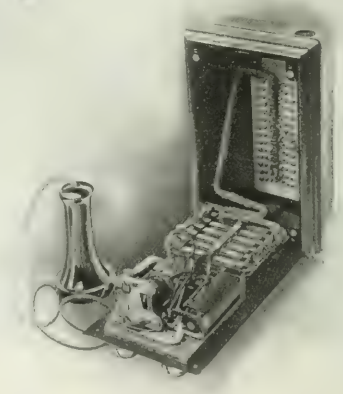


FIG. 2.—ARRANGEMENT OF FLUSH WALL SET.

can be swung down as in Fig. 1. To make the apparatus accessible for maintenance and inspection, all current-carrying parts, including the transmitter, are insulated from the case and a concealed binding post receiver is used. A noticeable feature of this set is the dustproof side used in connection

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

Irregular weather conditions during the past week have done much to retard advances in retail business. Very little is being done by the wholesalers and jobbers, which is to be expected at this season. A few reorders are being received, but these are mainly for filling-in purposes. The agricultural situation is not materially changed, in spite of the unseasonably cold weather. It is generally conceded that crops will be later than usual, and in some instances lighter. Retailers throughout the country are believed to be very lightly stocked, and the jobbers are preparing for a large business in the fall. In the industrial world there has been considerably more activity. The lower prices for iron and steel brought out a large volume of business, and the mills generally throughout the country are running on full time. So many orders have been booked that the advance in prices has been general for most all steel products, and in many instances wage cuts which were made earlier in the spring are rescinded. Orders for electrical supplies are better than they were a few months ago, but as a rule they continue to be for small apparatus rather than for heavy machinery. So far the orders for steel rails are very backward, although it is known that many companies have their specifications prepared. Collections continue to be only fair, there being little improvement noted from week to week. Business failures for the week ended May 20 were 219 against 244 for the previous week, 234 in the like week of 1908, 165 in 1907, 170 in 1906 and 179 in 1905.

THE COPPER MARKET.

During the past week the condition of the copper market is distinctly improved and a general sentiment seems to prevail that we are on the eve of a material advance. This is made plain by the renewal of speculative activity both at home and abroad and by the apparent awakening of domestic consumers to the belief that they had better lay in stocks at present quotations. Large purchases have been made within the past few days and the selling agencies are kept busy answering inquiries for heavy takings to be delivered June, July and August. The selling agencies are not particularly anxious to acquire this class of contracts at present prices and many melters are finding difficulty in having their demands supplied. The takings for export during the past week have also been very heavy, most of the orders for export, however, running for June and July delivery. The exports for the month of May have been heavy and will probably amount to about 60,000,000 lb., which, taken with the domestic purchases, promise to bring about a reduction in the surplus stock on June 1, instead of the usual increase. Consumption in the United States, it is estimated, is now equal to what it was in 1907, and is about 60 per cent of the record made in 1906. Foreign consumption is about 80 per cent of what it was in 1908. In the mean time production continues at a record rate and there is no denying that the surplus at home and abroad will amount to something like 500,000,000 lb.

During the past week prices for electrolytic and casting have been slightly advanced, but present quotations prevail only for moderate lots. Quotations on the Metal Exchange May 24 were:

Lake	13¼ @ 13¼
Electrolytic	12¾ @ 13
Casting	12¾ @ 12¾

The London prices May 24 were as follows:

	£ s. d.	£ s. d.
Standard copper, spot	59 15 0	59 15 0
Standard copper, futures	60 8 9	60 8 9
Market	Easy	Steady
Sales of spot		400 tons
Sales of futures		1,100 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard		
Lake	13 15 0	12 5 0
Electrolytic	13 15 0	12 12½ 0
Casting	13 15 0	12 0 0
London, spot	£63 2 6	£53 12 6
London, futures	63 17 6	56 10 0
London, best selected	67 0 0	59 0 0

ALLIS-CHALMERS BUSINESS INCREASING.—It is stated that the business of the Allis-Chalmers Company for the month of April was the largest of any month in the past two years, that it was three times that of April, 1908, and 20 per cent more than that of the same month in 1907. Every branch of the business has shown improvement, but the main growth has been in steam turbines and in gas engines. It is said that within the past 90 days orders for 30 turbines have been taken and that many other orders are in prospect. The fact that the business is up to that of 1907 does not mean, however, that the earnings will be as great, for prices have been very materially lower and many of the new orders will not be delivered until after the end of the company's fiscal year on June 30. It is not likely that there will be any dividend declaration for the preferred stockholders until next year. The improved condition of the company is reflected in the bond market where the Allis-Chalmers 5s are becoming popular and sold last week as high as 86. These bonds were quoted as low as 55 during the early months of 1908. During the past two months a large number of orders have been taken for apparatus for moderate-sized plants, averaging about 400 hp. The aggregate of this class of apparatus will amount to 161,985 hp. Among the electrical companies which have purchased are: The Pacific Gas & Electric Company, San Francisco; Northern Idaho & Montana Power Company, Sand Point, Idaho; Michigan Power Company, Lansing, Mich.; Utah Light & Railway Company, Salt Lake, Utah; La Porte Electric Company, La Porte, Ind.; Detroit United Railways, Detroit, Mich.; Oak Park Power Company, Flint, Mich.; Board of Public Works, Harbor Spring, Mich.; Maumee Electric Company, Maumee, Ohio; Murphysboro Water Works, Electric & Gas Light Company, Murphysboro, Ill.; Intercolonial Railway of Canada, Moncton, N. B.; Milwaukee & Fox River Valley Railway Company, Elkhart Lake, Wis., and Rockford Electric Company, Rockford, Tenn. The Milwaukee Electric Railway & Light Company ordered two 1500-kw motor-generator sets, one 500-kw balancer, six 2000-kw transformers, two 300-kw transformers, two 300-kw motor generator sets and a 300-kw generator of the water-wheel type, much of this apparatus constituting a "repeat" order.

ADDITIONAL 150,000-KW HYDRO-ELECTRIC EQUIPMENT FOR SOUTHERN POWER COMPANY.—The Southern Power Company, Charlotte, N. C., has issued preliminary specifications for 16 hydro-electric units aggregating 150,000 kva for its Wateree station on the Catawba River. The specifications call for 14,000-hp horizontal twin-turbine units at 180 r.p.m., and 8500-kw, 11,000-volt generators, with 85 per cent power factor; also four units consisting of 3000-kw generators coupled to 5200-kw vertical twin turbines. Exciter rheostats, etc., are called for in both specifications. The specifications for switchboard apparatus and transformers will be issued later.

BOSTON ISOLATED PLANTS DISPLACED.—The Jordan-Marsh Company, of Boston, which previously operated an isolated plant, has made a contract for 10 years with the Edison Illuminating Company, of Boston, for electrical power of over 2000 hp and will employ electricity for operating all its elevators, cash-carrier system, fire pumps, etc. R. H. Stearns & Company have abandoned plans for an isolated plant for their new building now being erected, and closed a contract for 26 years with the Edison Company. A contract has also been closed for 50 years with the George A. Carpenter Company for the Blake Building now being erected.

SENATE ADOPTS CARBON TARIFF SCHEDULES.—After a four-hour debate, the Senate on May 21, adopted the Smoot amendment to the Aldrich tariff bill, fixing the duty on lighting carbons at 65 cents per hundred feet for all the better grades of carbons and 35 cents for ordinary coke carbons. This, according to the importers, increases the present rate about 35 per cent. The importers will continue to fight against the new duty and will endeavor to secure a modification when the bill reaches the conference committee.

ELECTRICAL EQUIPMENT OF NEW YORK PIERS.—The North-Eastern Construction Company, of New York, has been awarded the contract for the mechanical and electrical equipment of the new Chelsea piers in the North River. The total amount of the contract is about $750,000. There are nine of these piers in all, the most commodius and modern in New York harbor. They are 800 ft. long and 150 ft. wide, double-deck. Five of the piers will be occupied by the lines of the International Mercantile Maritime Company, comprising the White Star, the Red Star, the American and Atlantic Transport lines; three will be occupied by the Cunard Steamship Company, and one by the Compagnie Generale Transatlantique. The General Electric Company has been given a contract for two 300-kw, three 150-kw, three 100-kw and one 70-kw Curtis turbines. The same company also has a contract for a switchboard of 23 panels. The piers will be equipped with 1000 arc lamps, and the energy will be generated at three separate power stations, one being operated by each of the steamship companies. The contract for wiring has been awarded to the Watson-Flagg Engineering Company, of New York. The power plants will also supply steam for heating the piers. The piers will be equipped with 44 elevators, 64 coaling and cargo winches and 13 baggage conveyors, all of which will be electrically operated. The plans and specifications for this work were prepared by Mr. Henry C. Meyer, Jr., who is the engineer of the steamship companies, subject to the approval of the Department of Docks and Piers. The installation will not be completed for five or six months.

HEAVY ORDERS FOR TRACTION EQUIPMENT.—The railway departments of the Westinghouse plants are said to be busier than ever before in their history. There has been a heavy increase in orders during April and May and this is especially noticeable in the line of electric locomotives. Among the work of this character now being turned out at the shops in East Pittsburgh are three locomotives for the Fort Dodge & Des Moines Railroad Company. Two of these are to be used as freight locomotives and the other as a shifting engine. For the Honolulu Rapid Transit & Railway Company, 30 60-hp railway motors are being made. The Havana Electric Railway Company has sent in an order for a complete substation and power-house equipment, consisting of two 1000-hp turbo outfits, four 500-hp rotary converters, 18 transformers, as well as switchboard and auxiliary apparatus. The Wilkes-Barre & Wyoming Valley Traction Company is having 44 100-hp motors constructed. An unusual number of orders for electric mining locomotives have also been placed at the East Pittsburgh electric works. Within the last month these orders have averaged more than one locomotive per day, coming from coal companies in Pennsylvania, Virginia and West Virginia; from iron mines in Minnesota, and from copper, silver and gold mines in the West. Electric locomotives are coming into greater demand than ever for hauling coal from the mines as well as for the general transportation of the mine products.

ROCKFORD (ILL.) CENTRAL STATION TO BE REMODELED.—By increasing its capital stock from $1,000,000 to $2,000,000, in accordance with a certificate filed with the Secretary of State at Springfield, Ill., on May 12, the Rockford Electric Company, of Rockford, Ill., is placed in possession of funds which will be devoted largely to a general remodeling of the main generating station of the company. Work is already under way for this new improvement, and the additions will include two 2000-kw alternating-current turbo-generators, three 750-kw, three-unit motor-generator sets, three 500-hp boilers, chain grates for all boilers, coal- and ash-handling crane with structural runway and coal-bin equipment. To provide room for a portion of the additions the roofs of the engine-room and boiler house of the station will be raised, and advantage will be taken of the change to make the power house practically fireproof. A new overhead traveling crane will be placed in the engine-room, and there will be a new switchboard in a switchboard gallery. The Rockford Company has a deserved reputation for enterprise, and under the management of Mr. F. H. Golding is one of the most successful central-station companies in cities of the size of Rockford.

MILLS BUYING ELECTRICAL EQUIPMENT.—A large installation of squirrel-cage induction motors, aggregating 2200 hp, is being made at the Bonnie Cotton Mills, Kings Mountain, N. C. These motors, which have been furnished by the Crocker-Wheeler Company, of Ampere, N. J., will operate on a 2080-volt, three-phase, 60-cycle circuit. There are 32 machines in all, varying in output from 20 to 100 hp. Each unit is controlled from a separate panel, built of blue Vermont marble. Two 10-kw 2200/110-volt transformers will also be installed in this plant. The Youngstown Sheet & Tube Company, Youngstown, Ohio, has also added to its 5000 hp of Crocker-Wheeler motors by installing a 500-hp synchronous motor. This machine will operate on a three-phase, 25-cycle circuit at the high potential of 6000 volts. It will be used to drive a centrifugal pump. The Indiana Steel Company, Gary, Ind., has placed an order with the same manufacturers for 21 motors, aggregating 655 hp, for rolling mill service. These machines will be used to operate cranes on a 220-volt direct-current circuit.

STAR-FLAMING ARC LAMP.—The star-flame lamp, a new arc-lighting unit claimed to be of unique design and remarkable efficiency, will be introduced at the N. E. L. A. Atlantic City convention. The lamp is the invention of Mr. W. H. Gardiner, of Henry L. Doherty & Company, who is well known to central-station men. The new unit is stated to give remarkable illuminating results, a long series of tests made while the lamp was in actual commercial service showing an efficiency in the lower hemisphere of about three candles per watt. The lamp will be marketed by the Star Electrical Concern, 74 Cortlandt Street, New York, of which A. W. Young is general manager.

NEW HAVEN RAILROAD ELECTRIFICATION.—It has been formally given out that the New York, New Haven & Hartford Railroad Company has perfected its plans for the electrification of another considerable section of its lines. The plans contemplate the installation of electricity on the Harlem Terminal tracks and upon that section between Stamford, Conn., and New Haven. It is said that all four of the tracks through the new cut at New Haven and the Cedar Hills yard will be electrified. No statement was made as to when work will be undertaken, but it was said that it could be completed within 18 months after it is started.

AUTOMOBILES TO DISPLACE HORSE DELIVERY SERVICE OF 66 NEW YORK CITY FIRMS.—The Studebaker Automobile Company has concluded a contract with the Piercy Company, New York City, whereby the delivery service of the latter will be changed over from horses to automobiles. The Piercy Company now supplies delivery services to no less than 66 mercantile and other firms, for which an equipment of 400 horses and 250 delivery wagons and trucks have been necessary. The stable space released and substation garages now being established will give the company accommodation for 500 automobile vehicles.

ELECTRIFICATION ON DELAWARE & HUDSON.—Negotiations are now pending between the Rutland (Vt.) Railway, Light & Power Company, of which G. Tracey Rogers is president, and the Delaware & Hudson Railroad Company with a view to electrifying that company's lines from Castleton to Eagle Bridge, N. Y., and from Fair Haven to Whitehall, N. Y., and operating them in connection with its present lines. If the negotiations now pending are not concluded, the Rutland Railway, Light & Power Company will probably build from Fair Haven, Castleton Corners or Hydeville to Poultney.

STANDARD UNDERGROUND CABLE COMPANY.—The Standard Underground Cable Company has closed supplementary contracts with the Pennsylvania Tunnel & Terminal Railroad Company for 100,000 ft. of duplex, rubber-insulated and lead-covered cable, sizes No. 2-0 and No. 4, to be used on the 2200-volt signal circuit, and also for approximately 20,000 ft. varnished cloth insulated braided cable, sizes ranging from 1,000,000 to 2,000,000 circ. mil. The total amount of the Pennsylvania contract for cable, not including the present supplementary contracts, will amount to 250,000 ft. of triplex 11,000-volt cable, instead of 100,000 ft. as had been stated.

SALE OF WHITNEY COMPANY'S APPARATUS.—The sale under foreclosure of the electrical apparatus which formerly belonged to the Whitney Company, of North Carolina, which was referred to in the issue of May 13, has been set for June 14. The court directs that the apparatus shall be sold at the principal gate of the General Electric Company's plant at Schenectady.

TWO THOUSAND FIVE HUNDRED STEEL REFLECTORS FOR A SILK MILL.—Messrs. Schwarzenbach, Huber & Company have given an order for 2500 Holophane-D'Olier steel reflectors for installation in their silk mills at West Hoboken, N. J.

ASK A HEARING ON NEW YORK CITY BUILDING CODE.—A large number of electrical contractors of New York have signed petitions, addressed to the Board of Aldermen, asking for a public hearing on the new building code. Two reports have been made by the special commission that was appointed to draw up a new law, but no public hearing has been held. The majority report has no section that is especially devoted to electrical construction, but the minority report provides explicit regulations on the subject. As a rule the contractors express themselves as unfamiliar with the meaning of the law, but all are opposed to the ordinance being rushed through without a full opportunity for discussion having been accorded. "What we really want," said one of the leading contractors, "is the adoption by the city of the Underwriters' National Code. This code has been most carefully drawn and can hardly be improved. In addition to that, what we most desire is uniformity, so that we will know exactly what is expected of us. We formerly had to stand three inspections—the city's, the underwriters' and that of the Edison company. Then the Edison people accepted the underwriters' certificate and now we have two inspections. If the city will simply enact that buildings must be electrically constructed according to the underwriters' code and will accept that certificate, it will get the best results, will give us only one inspector to satisfy and will get its inspection done for nothing."

LIQUID GAS COMPANY.—Through a recent announcement that a Bavarian inventor's process for making liquid gas, known as Blaugas, had been sold to a $5,000,000 corporation with Commodore E. C. Benedict as president, and numbering among its directors Judge Gary, chairman of the U. S. Steel Corporation; Theodore N. Vail, president of the American Telegraph & Telephone Company; Theodore P. Shonts, president of the Metropolitan Street Railway, and that a large sum of money had been handed over to the inventor as the purchase price, the public is appraised of another development in industrial progress. This corporation was organized by Franck Z. Maguire and W. W. Gooch, both well known in electrical circles. Mr. Maguire was seen recently by a representative of the *Electrical World* and stated that it would be premature to give information respecting the Blaugas Company of America at the present time, but that he wished to take the opportunity to express his great sympathy with the endeavor of the journal to improve the status of the patent laws. Much of the best inventive work, said he, is now coming from Germany and it is because that country is affording the inventor very much more protection than we do. It is high time to ask the question, "Where are we eventually to finish in this contest, particularly when skilled labor is so much cheaper in Germany than with us?"

WESTINGHOUSE BUSINESS CONTINUES TO EXPAND.—There is a constant betterment manifesting itself in the various departments of the Westinghouse companies. All of the factories at East Pittsburgh, Wilmerding and Swissvale, Pa., have added to their operative forces within recent weeks, owing to the increased influx of orders, and the outlook continues to present encouraging prospects. While the ratio of improvement which set in at the shops of the Westinghouse Machine Company some months ago is still being maintained, the business for the month of May shows an unusual demand for gas engines of large size. The company is now constructing a complete gas producing and power plant for the Southern Cotton Oil Company, of Savannah, Ga., consisting of two bituminous coal gas producers of 300 hp capacity each and a 600-hp horizontal double-acting gas engine.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in the present issue are announcements of proposed new plants or considerable extensions of present plants at Fort Leavenworth, Kan.; Fort Hamilton, N. Y.; Pullman, Ill.; Seneca Falls, N. Y.; Logan, Utah; Council Bluffs, Ia.; Galena, Ill.; Des Moines, Ia.; Pullman, Wash.; El Paso, Tex.; Chickasha, Okla.; Halstead, Kan.; Clovis, N. M.; Denver, Col.; Colville, Wash.; Antwerp, Ohio; Galveston, Tex.; Orange, Mass.; Gettysburg, Pa.; Leesburg, Fla.; Geneva, Ala.; Abbeville, Ala.; Jasper, Fla., and Everett, Wash.

AUTOMATIC TELEPHONES FOR HAVANA.—The Automatic Electric Company has been awarded a contract to replace the present manual telephone system in Havana with 6000 automatic telephones. This contract will be completed in the fall, and, it is stated, that by Dec. 1 all of the cities and towns of the Cuban telephone system will be using them

Financial Intelligence.

THE WEEK IN WALL STREET.

During the past week the Wall Street stock market remained strong, but only moderately active. There is a universal feeling that the tide has turned, and that from this time on business will improve both for the railroads and the industries. For this reason the market is inclined to advance whenever any buying element shows up. There has not as yet been much desire on the part of the outside public to come in, and on this account dealings are largely professional. Under such circumstances it is inevitable that profit taking will occur after every advance of two or three points, bringing about slight reactions. This has been the history of the market for the past several weeks. The strength in the general tone was pointedly demonstrated by the fact that the death of H. H. Rogers, closely identified with many large enterprises, caused not the slightest flurry. Even the stocks in which he was the dominant influence lost only a few points, and these were regained almost immediately. There seems to be no bear interest in the market, and no disposition to seek lower prices. Reports from the steel industry are extremely encouraging, and this has kept the steel stocks among the most active and strongest. During the week shipments to Europe of gold amounted to several million dollars, but apparently this had no effect upon the money market. There seems to be a plentiful supply of cash, and no amount of gold export affects the rates for money. Rates May 24 were call 1½ @ 2 per cent, 90-day 2¼ @2½ per cent. The quotations in the table are those of the close May 24.

NEW YORK.

	May 17.	May 24.	Shares sold.		May 17.	May 24.	Shares sold.
All.Ch.	10	10	6,400	Int Met., pfd...	44½	44⅝	10,400
All.Ch. pfd...	51½	52	7,550	Mackay Cos....	79½	79¾	500
Amal. Cop....	82⅜	83¾	134,340	Mackay Cos.,pfd.	73½	73½*	800
Am. D. T.....	29*	29*	——	Manhattan Elev.	147	147*	1,325
Am. Loc.....	56⅝	57⅜	10,325	Met. St. Ry....	30	27*	100
Am. Loc. pfd...	115	115*	500	N.Y. & N.J.Tel.	123*	123*	——
Am. Tel. & Cbl.	77¼*	77¼*	——	Steel, com.....	56⅝	60¼	637,078
Am. T. & T....	139⅞	138⅞	14,100	Steel, pfd.....	118¾	119¾	29,992
B. R. T.....	78⅞	79	14,040	W. U. T.....	79	—	12,325
Gen. Elec.....	160	160½*	8,200	West'h., com..	84¼	84	12,450
Int.-Met. com...	10¼	10	8,850	West'h., pfd...	120	121	1,100

PHILADELPHIA.

	May 17.	May 24.	Shares sold.		May 17.	May 24.	Shares sold.
Am. Rys.....	45¼	45¾	——	Phila. Elec....	12*	12*	——
Elec. Co. of A.	12½	12½	——	Phila. R. T....	34⅜	33⅝	——
Elec. Stor. B'ty.	48⅜	48½	——	Phila. Traction.	92½*	92⅝*	——
E. S. B'ty. pfd	49*	49*	——	Union Traction.	56¾	57	——

CHICAGO.

	May 17.	May 24.	Shares sold.		May 17.	May 24.	Shares sold.
Chi. City Ry...	180*	180*	——	Chi. Tel Co...	134	132½	——
Chi. Rys., Ser.1.	109½*	109½*	——	Met. El., com..	19*	19*	——
Chi. Rys., Ser.2.	38¼*	38¼*	——	Natl. Carbon..	85*	86*	——
Com. Edison...	119	119	——	Nat. Carm.,ptd.	120*	119*	——
Chi. Subways...	26¼	25⅞*	——				

BOSTON.

	May 17.	May 24.	Shares sold.		May 17.	May 24.	Shares sold.
Am. Tel. & Tel.	139	138½	——	Mex. Tel.....	2⅞*	3*	——
Cum. Tel.....	138*	138*	——	Mex. Tel., pfd.	5½*	5½*	——
Edison El. Ill..	250*	250*	——	N. E. Tel.....	133½	132⅝	——
Gen. Elec.....	160⅞	161	——	W. Tel. & Tel.	12	11½	——
Mass. Elec. Ry.	13½	13½*	——	W. T. & T., pfd	87	87	——
Mass. E. R., pfd.	71	70½*	——				

*Last price quoted.
Shares sold are for week May 17 to May 22.

DIVIDENDS.

General Electric Company, quarterly, 2 per cent, payable July 15.

Indianapolis (Ind.) Street Railway Company, 3 per cent, payable July 1.

Norfolk (Va.) Railway & Light Company, semi-annual, 2 per cent, payable June 5.

Rochester (N. Y.) Railway & Light Company, preferred, quarterly, 1¾ per cent, payable June 1.

Sao Paulo (Brazil) Tramway, Light & Power Company, quarterly, 2½ per cent, payable June 1.

CHATTANOOGA ELECTRIC COMPANY SOLD.—E. W. Clark & Company, of Philadelphia, have purchased from the Electrical Securities Corporation, of New York, all of the bonds and stock of the Chattanooga Electric Company, except 200 shares retained by individual directors. The Chattanooga company furnishes light and power for that city, and was capitalized at $ 50,000 stock and $ [illegible],000 of 5 per cent bonds. It is reported that E. W. Clark & Company are also negotiating for the Chattanooga Railways Company.

METROPOLITAN STREET RAILWAY SALE POSTPONED.—The foreclosure sale of the Metropolitan Street Railway Company, which was originally ordered for June 1, and then postponed to June 29, has been postponed until Nov. 18. The sale cannot be held until the United States Circuit Court of Appeals has acted upon the appeal taken by the Guaranty Trust Company from the decree of foreclosure. As this court adjourns on June 30 the appeal could not be heard before that time, and consequently no decision can be reached until fall. The bondholders are still at work upon the reorganization plan, but as yet have given out no details. The foreclosure sale is a part of the reorganization plan, and no effort will be made in that direction except through this sale.

NEW ORLEANS RAILWAY & LIGHT PLAN.—The directors of the New Orleans Railway & Light Company have decided upon a financial plan involving an issue of $50,000,000 of 5 per cent bonds. The plan provides that the preferred and common shareholders shall part with 25 per cent of their stock holdings at 40 and 15 respectively, and a banking firm in New York, which it is stated has agreed to place the bonds, will be represented upon the board of directors. Of the new bonds issued $30,000,000 will be held in the treasury for the purpose of retiring the same amount of 4½ per cent bonds now outstanding, and the other portion of the issue will be placed from time to time as extensions and betterments are required. New Orleans capitalists are still to be in control of the company.

PHILADELPHIA COMPANY'S STOCK INCREASED.—A special meeting of the Philadelphia Company of Pittsburgh will be held July 22 for the purpose of acting upon the plan for increasing the capital of the company from $42,000,000 to $47,000,000. The proposed increase will be in common stock, and will be used especially for the purpose of exchange for convertible debentures of the aggregate value of $5,000,000. Of these debentures $2,500,000 have already been sold to Blair & Company and Ladenberg, Thalmann & Company, of New York. A large part of the proceeds of this sale will be advanced by the Philadelphia company to the Pittsburgh Railways Company and the Allegheny County Light Company for extensions and improvements.

DENVER GAS & ELECTRIC COMPANY.—The stockholders of the Denver Gas & Electric Company have authorized the directors of the company to make a reorganization and a refinancing of the concern; Henry L. Doherty, as president of the company, will have this reorganization in charge. Mr. Doherty is not prepared as yet to give out any details concerning his plans, but it is probable that when the refinancing is accomplished there will be considerable improvement and extension work done in Denver. A contract is now under negotiation between the company and the Central Colorado Power Company. This contract contemplates the purchase by the Denver company of 5000 kw from the power company.

SACRAMENTO VALLEY POWER COMPANY ORGANIZED.—The Sacramento Valley Power Company, which was recently organized at Redding, Cal., has taken over all the properties and water rights of the Northern Light & Power Company and of the Shasta Power Company. These companies owned plants on South Cow Creek, 2000 hp, and on Snow Creek, 1600 hp, with transmission lines into Redding. Additional water rights have been purchased from early settlers on North Battle Creek, from which it is expected to develop 10,000 additional horse-power. For these new rights $100,000 was paid. When all of its plants are in working order the new company expects to develop 15,000 hp.

CHICAGO ELEVATED RAILROAD MERGER.—It became evident last week that the Metropolitan West Side Elevated Railroad Company, of Chicago, was not satisfied with the terms which had been offered by the Central Terminal Company, the new organization which was to act as the leasing concern for the elevated railroad merger. As one of the directors expressed it: "We can do as well ourselves with the property as the offer that is made by the Terminal Company; why, therefore, should we turn over our holdings to some one else?" It is explicity stated, however, that the Metropolitan directors do not intend to break off negotiations.

NEW YORK POWER COMPANY CLAIM HEAVY DAMAGES FROM STATE.—The State Court of Claims, at Rochester, heard last week the argument in the suit of the Fulton, Light, Heat & Power Company against the State of New York for $3,500,000 damages on account of the State having taken possession of the Oswego River for barge canal purposes. This suit is a test case and there are a number of other damage cases of the same character, involving total claims of $10,000,000, brought by other companies that will depend upon the present decision. The power companies claim that their properties have been destroyed by the action of the State.

NEW SURFACE LINE PROPOSED FOR NEW YORK.—Articles of incorporation have been taken out in Albany for the Upper Broadway Railway Company, of New York, with a nominal capital of $750,000. The articles state that the company proposes to operate a double-track surface railway from Manhattan Street along Broadway and St. Nicholas Avenue to Fort George. The incorporators named are unknown either in the financial or traction world, and the plans of the company have not been made public. As yet no application has been made in New York City for a franchise.

DENTON (TEX.) INTERURBAN RAILWAY FOR SALE.—The property of the Denton (Tex.) Railway & Light Company is to be sold under foreclosure sale July 6, 1909. The company was organized several years ago and has constructed 2⅞ miles of track through the main street of the city and planned to extend to Fort Worth, 30 miles away. The company owns a power plant, two cars and considerable real estate. Detailed information concerning the property can be obtained from E. F. Bates, the receiver, Denton, Tex.

KINGS COUNTY LIGHTING COMPANY.—Application has been made by the Kings County Lighting Company to the Public Service Commission for permission to issue $450,000 of 5 per cent first refunding gold bonds. This issue is a portion of the $5,000,000 for which a mortgage was issued to the Central Trust Company in 1904. Previous to this time $1,333,000 of the authorized amount had been issued.

CHICAGO CONSOLIDATED TRACTION.—Judge Grosscup has entered an order authorizing David R. Forgan and John M. Roach, receivers of the Chicago Consolidated Traction Company, to issue receivers' certificates for $550,000, to be expended in making improvements upon the line.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Associated Bell Telephone Operating Companies:					
March, 1909	$10,897,300	$7,919,500	$2,977,800	$613,900	$2,363,900
March, 1908	10,200,800	7,379,700	2,821,100	674,900	2,146,200
Chautauqua Traction Company, Jamestown, N. Y.:					
Quarter ended Dec. 31, 1908	27,061	17,394	9,666	19,796	*10,130
Quarter ended Dec. 31, 1907	26,464	15,013	11,450	12,429	*980
Crosstown Street Railway Company, Buffalo:					
Quarter ended March 31, 1909	196,526	141,708	54,817	50,650	4,167
Quarter ended March 31, 1908	150,362	96,792	53,569	49,013	4,556
Cumberland Telephone & Telegraph Company:					
April, 1909	531,886	299,083	232,803	42,622	190,181
April, 1908	511,378	304,532	206,846	37,582	169,264
Fairmont & Clarksburg (W. Va.) Traction Company:					
March, 1909	29,460	13,189	16,271	1,893	18,003
March, 1908	25,501	11,688	13,813	1,069	14,060
International Railway Company, Buffalo:					
Quarter ended March 31, 1909	995,280	641,600	353,679	285,392	75,111
Quarter ended March 31, 1908	996,815	660,262	336,553	282,430	60,796
Jamestown (N. Y.) Street Railway Company:					
Quarter ended Dec. 31, 1908	39,580	23,864	15,716	16,317	*601
Quarter ended Dec. 31, 1907	32,401	26,705	5,696	15,386	*9,691
Montreal Street Railway Company:					
April, 1909	294,374	173,552	120,822	37,625	83,197
April, 1908	280,736	170,141	110,595	37,495	73,100

GENERAL NEWS

Construction News.

ABBEVILLE, ALA.—D. G. Zeigler & Company, of Jacksonville, Fla., are preparing plans for the construction of a hydro-electric plant for the Abbeville Power & Manufacturing Company on Abbey Creek, eight miles north of Abbeville, where 8000 hp will be developed. The engineering company will also construct the plant, which will furnish electricity in Abbeville, Dothan, Eufala, Wells, Columbia, Fort Gains, Ala., and Blakely, Ga. The power company has applied for a charter and will be capitalized at $500,000. J. L. Pollard, Dr. C. J. Owens, of Abbeville, and others are interested in the enterprise.

GENEVA, ALA.—The Geneva Power Manufacturing Company has retained D. G. Zeigler & Company, of Jacksonville, Fla., as consulting engineers in connection with the construction of its hydro-electric plant to be located on Double Bridge Creek, about six miles north of Geneva, where 5000 hp will be developed. The power company proposes to build a cotton mill at Geneva. The proposed plant will furnish electricity in Geneva, Enterprise, Hartford, Coffee Springs, Samson and other towns and cotton mills in Alabama. D. O. Vaughn, J. R. Clark, D. G. McInnis, D. H. Morris and A. M. McKinnon, all of Geneva, are interested in the enterprise.

PRATT CITY, ALA.—Arrangements are being made by the Pratt's Home Telephone Company for making improvements to its system, which will involve an expenditure of about $5,000, and will include the installation of a new switchboard.

MESA, ARIZ.—Dr. A. J. Chandler, president of the Consolidated Canal Company, has been granted a franchise to construct and operate an electric street railway in Mesa.

GLENDALE, CAL.—The City Council has passed the resolution demanding the establishment of a municipal electric light plant. Bonds to the amount of $60,000 will be issued to cover the cost of the plant. C. B. Woodbury is city clerk.

GLENDORA, CAL.—The Glendora Irrigating Company has awarded a contract to the Westinghouse Electric & Manufacturing Company for a 100-kw generator and a 75-hp motor for its new plant.

GLENDORA, CAL.—Arrangements have been completed by the Glendora Light & Power Company for extending its transmission lines to the W. B. Glidden neighborhood, two miles distant, which will cost about $2,500.

MONTEREY, CAL.—H. R. O'Bryan has applied to the Board of Supervisors for a franchise to construct an electric railway in Monterey County.

NEVADA CITY, CAL.—A double-cylinder eight-drill giant air compressor has recently been installed at the Pittsburgh mine of the Pittsburgh Consolidated Gold Mining Company. The compressor will be operated by water power until the electric equipment arrives and the transmission line completed to the mine, when the entire equipment of the mine will be operated by electrical power. M. B. Kerr is manager of the mining company.

PASO ROBLES, CAL.—Plans are being prepared by C. E. Moore, of Santa Clara, Cal., for a municipal electric light plant.

RED BLUFF, CAL.—Plans are being made by the E. Clemens Horst Company to install an additional 150-hp motor for irrigation purposes.

REDDING, CAL.—The Sacramento Valley Power Company has purchased extensive water rights in North Battle Creek in Shasta County, which will be utilized for developing electrical power. The Sacramento Valley Power Company will develop the water power, increasing the output of its plant from 3000 to 15,000 hp.

SAN FRANCISCO, CAL.—The properties of the Tuolumne Water Power Company and the Stanislaus Electric Power Company were sold at auction in Sonora, May 10, to the United Railways Investment Company of New Jersey, the holding company for the United Railroads of San Francisco. It is proposed to organize a new company, which will issue bonds to enable it to complete the work of development and construction of the properties, which extend only as far as Mission San José.

SANTA BARBARA, CAL.—The City Council has granted the Pacific Improvement Company a franchise to operate a trackless trolley system from Santa Barbara to the Hope ranch.

DENVER, COL.—It is reported that plans are being made by the Colorado Power Company for extensive additions to its system, which will involve an expenditure of nearly $3,000,000. It is proposed to push work on the Gore Canyon plant, and the smaller plants, which will ultimately furnish 100,000 hp. The company expects to furnish electricity from the Shoshone plant in Denver early in June.

BRIDGEPORT, CONN.—It is reported that the United Illuminating Company has awarded a contract for the construction of a brick power house.

MIDDLETOWN, CONN.—The City Council has entered into a contract with the Middletown Electric Light Company under the terms of which the city is to pay $89.50 per arc lamp per year.

HAVANA, CUBA.—The Automatic Electric Company, of Chicago, Ill., has been awarded the contract for changing over the manual switchboard telephone system to the automatic system in all of the important cities in Cuba. The contract provides that at least 6000 automatic telephones shall be placed in the city of Havana not later than Sept. 1, 1909.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 26 for furnishing one 1000-kw and two 1500-kw turbo-alternators for the navy yards, New York, Philadelphia and Boston. Specifications can be obtained on application to the bureau or to the commandant of the navy yards named. R. C. Hollyday is chief of bureau.

WASHINGTON, D. C.—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 26, for furnishing and installing piping, pumps, condensers, heaters, etc., in the central power plant, at the navy yard, Puget Sound, Wash. Plans and specifications can be obtained on application to the bureau or to the commandant of the navy yard. R. C. Hollyday is chief of bureau.

JACKSONVILLE, FLA.—Arrangements are being made by D. G. Zeigler for the organization of a construction company for the purpose of constructing and equipping water powers in the South. It is understood that the company will have its headquarters in Jacksonville, Fla., and will make a specialty of developing hydro-electric plants and will take securities in payment of construction work. The company is to be capitalized at $1,000,000.

JASPER, FLA.—D. G. Zeigler & Company, consulting engineers, of Jacksonville, Fla., have been retained as consulting engineers for the development of a hydro-electric plant on the Allappaha River, seven miles from Jasper, Fla., and 18 miles from Valdosta, Ga.; Quitman, Ga.; Lake Park, Ga., and Statesville, Ga., all of which will be furnished with electricity from the plant, which it is expected will develop 10,000 hp.

LEESBURG, FLA.—The Town Council has granted a 30-year franchise to J. Y. Clark to install an electric light plant and water works system. It is said that Mr. Clark will commence work at once on construction of the plants so as to have them in operation by next winter.

ST. AUGUSTINE, FLA.—The City Council is considering the question of issuing bonds to the amount of $8,000 for electric lighting.

COLLEGE PARK, GA.—The City Council has granted the Fairburn & Atlanta Railway & Electric Company a franchise to construct an electric railway in College Park. The company proposes to build an electric railway from Fairburn through Stonewall and Red Oak to College Park, 11 miles in length.

FITZGERALD, GA.—The Fitzgerald & Ocilla Electric Railway Company has filed a mortgage in favor of the Windsor Trust Company, of New York, N. Y., to secure an issue of $250,000 in bonds. The company proposes to construct an electric interurban railway connecting Fitzgerald and Ocilla, 12 miles in length.

LAWRENCEVILLE, GA.—J. T. Holbrook, superintendent of the municipal electric light plant, has recommended that the electric light plant be enlarged. The improvements will include the installation of a 125-hp engine direct connected to an 80-kw, 2300-volt, three-phase generator, with necessary accessories; also one 70-hp boiler with heater, etc., and also to extend the transmission lines to other parts of the city.

HONOLULU, HAWAII.—Plans are being considered by the Honolulu Rapid Transit & Land Company for the construction of a five-mile extension between Honolulu and Pearl Harbor.

PAYETTE, IDAHO.—The Idaho-Oregon Light & Power Company is now ready to furnish electricity in Payette. It is said that the company will extend its transmission lines to Payette Heights, to furnish electricity for lamps and motors and for irrigation purposes in that section.

KENDRICK, IDAHO.—The Council has granted a franchise to C. B., H. M. and A. N. Richards for the construction and operation of an electric light plant in Kendrick.

WALLACE, IDAHO.—The capital stock of the North Idaho Telephone Company has been increased from $25,000 to $100,000.

CHICAGO, ILL.—The Chicago, Wheaton & Western Railway Company has awarded the contract for the section of its proposed electric railway from Wheaton to Geneva to W. C. Carrington, Gary, Ind. Henry C. Wood is president of the company.

GALENA, ILL.—The Interstate Light & Power Company, recently incorporated, has acquired the properties and franchises of the Tri-State Light & Power Company, of Galena, Ill., and Platteville Electric Light & Power Company, of Platteville, Wis. The new company will make improvements to the plant, contracts for which are now being awarded. It will furnish electricity for lamps, motors and mines in Galena, Ill.; Platteville, Hazel Green, Cuba City and Benton, Wis. The officers of the company are A. O. Fox, of Madison, Wis., president; George B. Caldwell, of Chicago, Ill., vice-president; Morris F. Fox, of Madison, Wis., secretary; L. A. Caldwell, of Galena, Ill., treasurer; H. M. Byllesby & Company, of Chicago, Ill., consulting engineers, and J. A. Stewart, Galena, Ill., superintendent.

JOLIET, ILL.—Mayor Comm has recommended that all electric wires be placed underground in the business section of the city.

PEORIA, ILL.—Application has been made to the City Council by W. T. Irwin, president of the Peoria Railway Terminal Company, for a franchise to construct and operate a passenger and freight railway along South Washington Street.

PULLMAN, ILL.—Plans are being made by the Pullman Company for extensive improvements and extensions to its plant at Pullman, which will involve an expenditure of about $3,000,000, and include the installation of an 8000-hp electric power plant, at a cost of $100,000, to furnish electricity for motors for the shops.

ROCK ISLAND, ILL.—The Galesburg & Rock Island Traction Company has announced that work on the construction of its proposed electric railway will be under way at four different points by July 1. The railway will extend from Galesburg to Alexis, thence to Preemption; from Preemption to Milan, and thence to Rock Island. Cars will be operated into Rock Island from Milan over the tracks of the Tri-City Railway. The cost of the road is estimated at $2,000,000.

CLERMONT, IND.—The Board of Trustees will make improvements to the Indiana Girls' School, for which an appropriation was made by the last General Assembly, which will include improvements to the power plant and for lighting the grounds. Bids will soon be asked for the proposed work.

EVANSVILLE, IND.—The Hercules Buggy Company is reported to be installing an electric power plant with an output of 500 hp to supply electricity for operating all four of its industrial plants. A new power house is being erected, which will be equipped with a water-tube boiler and a Corliss engine. Electricity will be distributed to the different departments to operate motor-driven machinery.

INDIANAPOLIS, IND.—The National Coning Machinery Company, recently incorporated with a capital stock of $1,000,000, proposes to construct a plant at a cost of about $500,000 to be equipped with both steam and electrical machinery. The directors are William A. Scott, Alfred C. Wood and Malon F. Woody.

MARION, IND.—The Western Motor Company is preparing to erect a large plant in this city. The company will equip the plant with electrically driven machinery and will manufacture motors of all kinds. J. L., A. C. and Charles Barley and J. W. Stevenson, all of Marion, are interested in the enterprise.

MISHAWAKA, IND.—Joseph Colbert, M. E. Robbins and Edward Went are members of a committee appointed to co-operate with the light committee of the Business Men's Association in the project to secure a new lighting system for the city.

PLYMOUTH, IND.—The City Council has awarded the Plymouth electric light plant a 10-year franchise and a contract for lighting the city for a term of five years. C. D. Snoeberger is president and treasurer.

WESTVILLE, IND.—The La Porte Electric Company has been granted a franchise to furnish electricity in Westville, under which it agrees to extend its transmission line to the town as soon as 60 subscribers are secured. The proposed line will be erected by the way of Pinola and Pinhook, a distance of about 12 miles. The company will also furnish electricity to residents along the line.

BETTENDORF (P. O. DAVENPORT), IA.—A proposition has been submitted to the Council by the Bettendorf Car Company offering to install a water and light system in the town.

BOONE, IA.—It is reported that E. G. Pratt, president of the Boone Gas Company, has secured an option on the property of the Boone Electric Company, the Boone Suburban Railway Company and the Central heating plant. It is said that Mr. Pratt proposes to ask the Council for a suitable franchise to combine the systems. Plans are being considered for extensive improvements to both the electric plant and street railway which will involve an expenditure of about $200,000. John Reynolds is president and general manager of both the Boone Electric Company and the Boone Suburban Railway Company.

COUNCIL BLUFFS, IA.—It is said that plans have been completed and that contracts will soon be awarded for the new substation of the Citizens' Gas & Electric Company on First Avenue at a cost of from $7,000 to $10,000. The equipment will be entirely new, with the exception of eight transformers, which will be removed from the present substation.

DES MOINES, IA.—The Des Moines Electric Company is advertising for bids for the construction of a new power plant to be located on the river front. The present power house is to be torn down and the new building erected on the same site. The new station will be 135 ft. x 62 ft. and will have two stories and basement. A smokestack 200 ft. high and 16 ft. in diameter will be erected. Contracts have already been awarded for a 1050-kw steam turbine and for boilers of same capacity. The cost of the plant with equipment is estimated at $200,000. The output of the plant will be increased by 65 per cent. It is expected to have the plant completed by Nov. 1. Paul B. Sawyer is general manager of the company.

FORT LEAVENWORTH, KAN.—Bids will be received until June 15 by Major Thomas H. Slavens, constructing quartermaster, U. S. Military prison, Fort Leavenworth, Kan., for furnishing building material for power house and furnishing and installing machinery for power plant at U. S. military prison Fort Leavenworth, Kan. Plans and specifications will be furnished by the above office upon a deposit of $10, which will be refunded when same are returned, or they may be seen at the following offices: Depot Quartermaster, Omaha, Neb.; Depot Quartermaster, St. Louis, Mo.; Depot Quartermaster, New York, N. Y., and Chief Quartermaster, Chicago, Ill.

HALSTEAD, KAN.—Bids will be received by J. D. Lange, City Clerk, until May 28 for furnishing material for a water works system, including power house machinery, two 200-gal. per minute, triplex power pumps and for two 25-hp gas engines. Plans and specifications can be seen at the office of the city clerk, Halstead, and at the office of Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo. Plans can be secured upon application to the engineers upon payment of five dollars.

ST. JOHN, KAN.—The City Council is considering the question of installing an electric light plant and water works system in St. John, for which plans have been prepared. Burns & McDonnell, of Kansas City, Mo., are the engineers.

PADUCAH, KY.—We are informed that the Kentucky & Ohio River Interurban Railroad Company contemplates commencing work on the construction of its proposed electric railway connecting Paducah and Cairo, Ill., about June 1. The railway will be about 35 miles in length.

NEW ORLEANS, LA.—Arrangements are being made by the New Orleans Railway & Light Company for the extension of the Clio Street line from Napoleon Avenue to the Protection Levee, a distance of about three miles. Application for a franchise will be made at the next meeting of the City Council.

NEW ORLEANS, LA.—Bids will be received by the Court House Commission until June 15 for the installation of electric fixtures in Court House, New Orleans. Plans and specifications are on file in the office of the commission and at the office of P. Thornton Marye, architect, Candler Building, Atlanta, Ga.

NEW ORLEANS, LA.—It is reported that the directors of the New Orleans Railway & Light Company have decided to issue $50,000,000 in bonds, of which $30,000,000 will be held in the treasury to provide for the retirement of $30,000,000 4½ per cent bonds now outstanding and the remaining $20,000,000 will be issued from time to time, as required, exclusively for extensions and betterments and the purchase of new equipment, and for the payment of $1,266,000 debenture notes as they become due.

RUMFORD, MAINE.—The Rumford Falls Power Company has awarded the contract for completing excavations, foundations, stone and concrete masonry, brick station, etc., in connection with the hydro-electric development project at Rumford Falls started last year, to the H. P. Cummings Construction Company, of Ware, Mass. Charles A. Mixer is engineer of the Rumford Falls Power Company.

HAGERSTOWN, MD.—The Street Commissioners have awarded the contract for new machinery for the municipal electric light plant to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., for $25,000. The new equipment will double the output of the plant.

ATHOL, MASS.—The plant and holdings of the Athol Gas & Electric Company have been purchased by W. G. Webber, of Marlboro. The new company will retain the present office in Athol. It is expected that the plant will be improved. W. G. Webber is president of the new company and W. D. Smith, vice-president.

BOSTON, MASS.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 26, for furnishing and installing piping in the central power plant, navy yard, Boston, Mass. The cost of the work is estimated at $7,000. Plans and specifications can be obtained on application to the bureau or the commandant of the navy yard named. R. C. Hollyday is chief of bureau.

BROCKTON, MASS.—The Selectmen have granted the Edison Electric Illuminating Company permission to take over the property of the Stoughton Gas & Electric Company, and have also granted the company a new franchise. Under the terms of the franchise the company agrees to reduce the price of electricity for lamps from 20 to 15 cents per kw-hour and to give all consumers of electricity for lamps and motors the same rates as allowed in Brockton. The company assumes the street lighting contract and agrees to maintain the service for the fire-alarm whistle.

HARDWICK, MASS.—The Selectmen have made arrangements with the Ware Electric Company to run two more wires from Gilbertville to Hardwick Center to furnish electricity in the town. The town is to purchase the transformers.

HAVERHILL, MASS.—The New Hampshire Electric Railways Company has awarded the contract for the construction of a sub-station in Methuen to E. A. Peabody & Son, of Lawrence, Mass. The station is located on the line of the Lawrence & Methuen line, and will furnish electricity for the western division.

LEE, MASS.—The Lee Electric Company is extending its transmission lines to Lenoxdale for the purpose of furnishing electricity for lighting the village. Twenty-two tungsten lamps will be required.

LYNNFIELD, MASS.—It is expected that the town will soon have an electric lighting system, as the municipal light board has secured the number of contracts demanded by the managers of the Reading municipal electric light plant before extending transmission lines to Lynnfield.

ORANGE, MASS.—Plans are being made for extensive improvements on the Orange Electric Light Company's plant. The present plans call for the construction of a new dam and power house at Wendell Depot.

UPTON, MASS.—The Upton Electric Light Company has submitted a proposition to the Selectmen for lighting the streets of the town. The company agrees to establish a street lighting system and furnish street lamps on a three-year contract as follows: On a moonlight schedule, the

lamps to burn until midnight, 60-cp incandescent lamps at $16.50 each per year; 40-cp lamps, at $14.50 each, and for 32-cp, $13.50 per lamp per year. An appropriation of $1,650 a year is recommended for lighting the town. The Selectmen have been authorized to light the town by electricity, instead of kerosene.

WARE, MASS.—Preparations are being made by the George H. Gilbert Manufacturing Company for operating its No 1 and No. 2 mills by electricity instead of steam power as at present. Electricity will be supplied from the electric power plant at No. 4 mill.

WHITMAN, MASS.—Announcement has been made by the Edison Electric Illuminating Company of Brockton that the price for electricity for lamps will be reduced from 20 to 15 cents per kw-hour for residential and commercial lighting.

MINNEAPOLIS, MINN.—Orders have been placed by the Minneapolis General Electric Company for two 1000-kw rotary converters, at a cost of $76,000.

MIZPAH, MINN.—William Potter is reported to have been granted a 15-year franchise by the Village Council to install an electric light and power system in Mizpah.

CAPE GIRARDEAU, MO.—Contracts have recently been awarded by the Cape Girardeau-Jackson Interurban Railway Company for equipment for its power house as follows: For switchboard instruments, to the Western Electric Company, and for switches and circuit breakers to the Westinghouse Electric & Manufacturing Company.

EL DORADO SPRINGS, MO.—B. F. Proctor, who was recently granted a franchise to install an electric light system in El Dorado Springs, is now erecting a plant in this town.

SEDALIA, MO.—Only one bid was submitted for street lighting, which was rejected by the City Council. The bid was submitted by the Sedalia Light & Traction Company for a term of 10 years at the rate of $67.50 per lamp per year. The City Council has adopted a resolution authorizing the city counselor to prepare an ordinance providing for the construction of a municipal electric light plant; also authorizing the Mayor to call a special election to vote on a bond issue not to exceed $150,000 for the construction of the plant.

BROKEN BOW, NEB.—J. W. Earley, of Columbus, is reported to have been granted a franchise by the Council to install an electric light and power plant. The plant is to be equipped with new machinery and will have an output of 100 kw.

WEEHAWKEN, N. J.—The Weehawken Contracting Company contemplates installing a new two-phase power circuit and a block transformer service. James B. Ryan is secretary and manager.

CLOVIS, N. M.—Sealed proposals will be received at the office of E. J. Feagan, city clerk, until June 16, for furnishing material and labor and constructing complete water works, electric light and sewer systems for the City of Clovis; separate bids will be received as follows: 1—For furnishing cast iron pipe and special castings. 2—For material and constructing steel tower and tank having a capacity of 100,000 gal. at an elevation of 125 ft. 3—For four motor-driven, deep-well pumping machinery units. 4—For electrical equipment, including generators, switchboard, lighting equipment, etc. 5—For furnishing material and constructing chimney. 6—For drilling two wells 500 ft. deep; material for casting to be furnished by the city. 7—For furnishing certain materials not above mentioned, consisting of three 66 in. x 16 ft. boilers, boiler feed pumps, two high-grade engines, hydrants and valves, poles, wire, power house materials, etc., and constructing water works and electric lighting systems complete, ready for operation. All materials to be furnished f. o. b. in Clovis. Plans and specifications on file at the office of the city clerk, Clovis, and at the office of Burns & McDonnell, engineers, Scarritt Building, Kansas City, Mo. Parties desiring plans for personal use may secure same on application to the engineers and payment of $10 to cover cost of the prints, or for $5 for either set of plans.

ALBANY, N. Y.—Bids will be received until June 9 by the State Commission in Lunacy at the Capitol, Albany, N. Y., for installing an outside lighting system at the Middletown State Hospital, Middletown, N. Y. Drawings and specifications may be seen at the hospital or may be obtained from Franklin B. Ware, state architect, Albany, N. Y.

AMITYVILLE, N. Y.—The Amityville Electric Light Company has been granted permission by the Public Service Commission, Second District, to execute a mortgage of $[illegible] to secure an issue of $[illegible] in bonds, the proceeds of $[illegible] to be used to refund an outstanding issue of $[illegible], and $[illegible] for improvement to its plant. Thomas F. Byrne is general manager of the company.

BATAVIA, N. Y.—Judge Holt, of the United States Circuit Court at Rochester, N. Y., has authorized the sale of the plant and holdings of the Geneva, Canandaigua & Seneca Electric Light, Power & Gas Company to be sold on June 10 and the proceeds of the sale distributed among the creditors. The plant furnished electricity generated at Niagara Falls in Batavia. Marc W. Comstock, of Buffalo, N. Y., is receiver of the company.

BROOKLYN, N. Y.—The contract for installing electric equipment in new Public School No. [illegible], Borough of Brooklyn, has been awarded to Cowles & De Young, [illegible] Broadway, New York, N. Y., for $[illegible]. C. B. J. Snyder is superintendent of school buildings.

BROOKLYN, N. Y.—The Kings County Lighting Company has applied to the Public Service Commission for the issuance of [illegible] stock at $[illegible] in bonds, the proceeds to be used for the [illegible] per cent bonds falling due [illegible] and for the [illegible] acquiring property and [illegible]

BROOKLYN, N. Y.—The Court of Appeals handed down a decision in favor of the Brooklyn Rapid Transit Company in the matter of the proposed extension of the Nostrand Avenue line from Nostrand Avenue and Flatbush Avenue and Nostrand Avenue to Avenue Q, a distance of about 1½ miles. The company will commence work at once on the extension.

BROOKLYN, N. Y.—Bids will be received until June 1 by C. B. J. Snyder, superintendent of school buildings, Department of Education, New York, N. Y., for installing electric equipment in addition to and alterations in Public School, No. 84, on Glenmore Avenue, Borough of Brooklyn. Blank forms and estimates and specifications may be obtained at the office of the superintendent, Park Avenue and Fifty-ninth Street, New York, N. Y., and also at branch office, 131 Livingston Street, Borough of Brooklyn.

BUFFALO, N. Y.—It is reported that the Economic Power & Construction Company will renew its application to the City Council for a franchise to supply electricity and steam heat in Buffalo. Herbert P. Bissell is interested in the enterprise.

BUFFALO, N. Y.—Bids will be received until June 2 at the office of public works, City Hall, Buffalo, for the construction of underground conduits for the Police and Fire Department wires in the districts wherein all overhead wires are to be placed underground. Plans and specifications can be seen and blank forms of proposals secured on application to the Bureau of Engineering. Francis G. Ward is commissioner.

FORT HAMILTON, N. Y.—Bids will be received at the office of the Constructing Quartermaster, Fort Hamilton, N. Y., until June 15 for material and labor required for the construction of an electric lighting system and substation at Fort Hamilton. Plans and specifications can be seen at the office of the Chief Quartermaster, Department of the East, Governors Island, N. Y., or at the above office. A deposit of $10 will be required on all plans sent out from the office, which will be refunded upon the return of the same.

GENEVA, N. Y.—The Economic Power & Construction Company, it is said, will apply to the City Council for a franchise to furnish electricity in Geneva.

ILION, N. Y.—Plans are being made by the Clarke & Baker Company to erect a new building in Ilion for cabinet work, which it is said will be operated by electricity. The company will require a number of motors, but definite plans have not yet been decided upon.

LESTERSHIRE, N. Y.—H. B. Sweet, Clarendon Building, Utica, N. Y., consulting engineer, has been engaged to prepare preliminary plans and estimates for the construction of a municipal electric light plant in Lestershire.

NEWBURGH, N. Y.—The Public Service Commission, Second District, has authorized the Newburgh Light, Heat & Power Company to issue $18,000 in debenture bonds, the proceeds to be used for the construction of a transmission line to supply electricity to the Ashokan Aqueduct contractors.

NEW YORK, N. Y.—Announcement has been made by the Hudson & Manhattan Railroad Company that it proposes to construct 12 miles of single track during the present year.

NEW YORK, N. Y.—The Interborough Rapid Transit Company contemplates enlarging its power plant, but as yet has not definitely decided upon the equipment to be purchased.

NEW YORK, N. Y.—The Public Service Commission has granted the United Electric Light & Power Company permission to put into effect a revised tariff showing a proposed reduction of from 10 to 25 per cent in the charges for tungsten lamps.

NEW YORK, N. Y.—Bids will be received at the office of the Armory Board, Hall of Records, New York, N. Y., until June 2, for the installation of an electric elevator in the armory of the Sixty-ninth Regiment, Lexington Avenue and Twenty-first Street, New York City.

NEW YORK, N. Y.—The Long Island Railroad Company has awarded the contract for the construction of its proposed electric railway between Melville and Amityville, a distance of nine miles, to the Seaboard Construction Company, of Brooklyn, N. Y.

NEW YORK, N. Y.—Sealed proposals will be received until June 3 by I. W. Stevenson, commissioner of [illegible] Park Row, New York, N. Y., for constructing the railings, stairways, etc., roadway and footwalk pavements, [illegible] and electrical [illegible] of the Manhattan bridge. Blank forms and specifications may be obtained at the above office.

NEW YORK, N. Y.—Bids will be received by John W. Brannan, president of the Board of Trustees, Bellevue and Allied Hospitals, Twenty-ninth Street and First Avenue, New York, N. Y., until June 1, for electric [illegible] to be delivered [illegible] Dr. [illegible] Blank forms may be obtained at the office of the [illegible] Fifty-ninth Street, New York, N. Y., [illegible] and specifications must be delivered.

NEW YORK, N. Y.—[illegible] Board of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until June [illegible] for installing electric equipment in addition to and alterations in Public School No. [illegible] on Glenmore Avenue, Borough of Brooklyn. Blank forms and estimates and specifications may be obtained at the office of the superintendent, Park Avenue and Fifty-ninth Street, New York, N. Y., and also at branch office, 131 Livingston Street, Borough of Brooklyn.

PORT CHESTER, N. Y.—[illegible] Port Chester Electric Company, [illegible] Port Chester Gas Light Company, [illegible] Port Chester Electric Railway Company, [illegible] Port Chester Gas & Electric Company, [illegible]

SENECA FALLS, N. Y.—The Geneva, Waterloo & Cayuga Lake Traction Company, it is said, contemplates the construction of an auxiliary power plant at Cayuga Lake Park, N. Y. The equipment will include a 200-kw generator and a 200-hp Ball engine. W. C. Gray, of Seneca Falls, is manager.

SYRACUSE, N. Y.—The Syracuse Lighting Company has applied to the Public Service Commission, Second District, for permission to execute a mortgage for $2,500,000 to secure an equal amount of bonds, of which $207,000 will be expended immediately for improvements and extensions to its system. The company proposes to expend $160,000 for extensions to its gas and electric service to districts not now supplied, and $47,000 for improvements to its electric power station and in laying high-pressure gas mains. J. C. De Long is general manager.

THERSEA, N. Y.—Negotiations have been completed by the Thersea Hydro-Electric Power Company for taking over the James Wakefield property, which includes a water privilege. The company is making improvements to its plant, which it expects to have completed early in July.

WEST SENECA, N. Y.—The Town Board has granted the Great Lakes Security Company a franchise to lay conduits and erect transmission lines for the distribution of electricity in West Seneca for a term of 59 years. The company is said to be a holding company for the Buffalo General Electric Company.

HICKORY, N. C.—It is announced that one of the largest cotton mills in the world will be built in Hickory when the proposed water power development on the Catawba River at this place is completed. Col. M. E. Thornton is at the head of the water power development.

ANTWERP, OHIO.—A. A. Painter, owner of the local electric light plant, is planning to install a 75-kw, 60-cycle, three-phase alternator, and also in the near future expects to make further additions to the plant, which will include the installation of a 150-hp boiler, a 125-hp engine and 100-kw, three-phase generator to furnish electricity for day service.

CLEVELAND, OHIO.—The Cleveland, Alliance & Mahoning Valley Railroad Company is reported to be making arrangements to begin work immediately on its proposed electric railway. The company has taken over a steam railroad between Ravenna and Hudson, which it will equip to be operated by electricity, and will also extend it from Hudson to Cleveland by the way of Twinsburg, Randall and Woodland Hills. The railroad between Ravenna and Warren has been purchased by the company, which will also be equipped to be operated by electricity at once. The main offices of the company are located in the Electric Building, Cleveland, Ohio.

DAYTON, OHIO.—The Board of Education has accepted the proposition of the Dayton Light Company to install a power plant at the Manual Training School.

EATON, OHIO.—The new Eaton Electric Light Company has submitted another proposition to the Town Council for consideration. It is said that the price for street lamps is $21.50 each per year, the same rate that is now paid. The company will also establish a day service. If a 10-year contract is granted the company it will rebuild its plant at a cost of from $15,000 to $20,000. Judge Elam Fisher represented the company before the Council.

FOSTORIA, OHIO.—The electric light franchise and contracts of the City Heat & Light Company were sold by the receivers May 12 to Charles Ash, president of the Commercial Bank, for $53,126, and the large gas plant, dismantled, to the Consolidated Railways & Light Company for $10,000. The street lighting contract still has eight years more to run.

GALLIPOLIS, OHIO.—The Kanauga Traction Company, which has been operating a five-mile gasoline motor railway between Gallipolis and Kanauga, is now equipping the railway to be operated by electricity. The company also contemplates making extensions to the road during the summer. J. S. Howard is secretary and treasurer.

NORTH BEND, OHIO.—Bids will be received by Thomas Hynes, village clerk, until June 14, for furnishing electricity for lighting the streets and public places for a term of ten years, in accordance with plans and specifications now on file in the office of the village clerk.

WARREN, OHIO.—The Peerless Electric Company has transferred all its holdings in Newton and Warren Townships, including land, water rights, power plants and transmission lines and a franchise in the city of Warren, to the Hydro-Electric & Gas Company. The last named company has been granted a franchise in Niles to furnish electricity to operate the municipal electric light plant. Work will commence immediately on construction of the transmission lines to Niles.

CHICKASHA, OKLA.—We are informed that the Chickasha Light, Heat & Power Company will commence work within three weeks on the reconstruction of its plant. The company is in the market for boilers, steam turbines, generators, condensing apparatus, pole line material, switchboards, material for brick building, etc. A 2300-volt, 60-cycle, three-phase system will be installed. C. G. Johnson is superintendent of the work, and C. L. Whedon is manager of the company.

RYAN, OKLA.—The citizens are considering the question of installing an electric light plant, water works and sewer systems, at a cost of from $45,000 to $60,000, which will soon be submitted to a vote of the people.

TEXHOMA, OKLA.—Investigations are being made by G. D. Sturdevant, of Kansas City, Mo., with a view of securing a franchise for the installation of an electric light plant and water works system.

PORTLAND, ORE.—Plans are being made by the Portland Railway, Light & Power Company for extensions to its railway system, which will require the construction of seven miles of new track.

PANAMA.—An agreement has been made between the Isthmian Canal Commission and the Panama Railroad Company, under which the railroad company will construct and operate all telegraph and telephone lines and equipment that may be needed by the company and the commission. The commission agrees to pay the company $7.50 per month for each telephone instrument and $2,400 per month for all services rendered by the company in maintaining operators, signalmen and other employees made necessary by the operation of the canal commission's trains over the company's tracks.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until June 14, for furnishing the following supplies: Centrifugal pump and engine, portable rock crusher plant with elevator, motor car, gasoline motors, transformers, speed changing device, motor driven trolley, electric hoist, etc. Blanks and general information relating to this circular (No. 512) may be obtained from the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 316 Hibernia Bank Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officer.

GETTYSBURG, PA.—The Keystone Electric Light, Heat & Power Company contemplates making extensions to its plant, which will include the purchase of one 125 or 150-kw, single-phase, 200-volt, 60-cycle generator. T. P. Turner is general manager.

HAZLETON, PA.—It is reported that it is proposed to form companies in Black Creek, Foster, Sugarloaf, Nescopeck and Butler Townships, all within a radius of 12 miles of Hazleton, for the purpose of furnishing electricity for lamps and motors in those towns. Electricity for operating the different systems will be obtained from the plant of the Harwood Company, now under construction at Harwood. Calvin Pardee, of Philadelphia, Pa., president of the Harwood Company, and others are interested in the enterprise.

PITTSBURGH, PA.—A special meeting of the stockholders of the Philadelphia Company will be held July 22 to vote on the question of increasing the capital stock of the company from $42,000,000 to $47,000,000. It is stated that a large part of the proceeds will be advanced to the Pittsburgh Railway Company and the Allegheny County Light Company for extensions and improvements.

SLATINGTON, PA.—Bids will be received by A. N. Kennel, borough clerk, until June 15 for lighting the streets of the city for a term of five years from Jan. 1, 1910, with either gas or electricity. Specifications for electric lighting may be seen at the office of the borough secretary.

LAMAR, S. C.—The proposition to issue $5,000 in bonds for the construction of an electric light plant will be submitted to the vote of the people.

CHATTANOOGA, TENN.—S. W. Devine has applied to the City Council for a franchise to construct and operate a street railway in Chattanooga.

JOHNSON CITY, TENN.—Contracts will be awarded by the Johnson City Traction Company in the near future for the construction of an extension to its system, 1½ miles in length.

LEBANON, TENN.—Plans have been completed for the construction and equipment of the plant of the Lebanon Woolen Mills Company, which will be operated by electric power.

EL PASO, TEX.—The El Paso Electric Railway Company has commenced work on the construction of the extension of its power plant, located on South Santa Fe Street. Additional equipment to be installed will include a 1500-kw, horizontal, Allis-Chalmers turbine engine, direct connected to a 2200-volt, two-phase generator, with a new switchboard gallery, traveling crane, boiler plant and condensing apparatus. The Stone & Webster Corporation, of Boston, Mass., has charge of the work.

GALVESTON, TEX.—Plans and specifications have been prepared by W. D. Masterson, superintendent of electrical department, for increasing the output of the municipal electric light plant, which includes the installation of an engine and generator and erection of 300 arc lamps, together with rectifiers, transformers and switchboards.

PALACIOUS, TEX.—A. C. Randolph, who holds a 50-year franchise, is planning to install an electric light plant with sufficient output to supply 1500 16-cp lamps, at a cost of $10,000.

LOGAN, UTAH.—The Board of Trustees of the Utah Agricultural College has decided to erect an electric light plant at the college at a cost of about $20,000. Lorenzo M. Stohl, of Salt Lake City, Utah, is president.

BROOKNEAL, VA.—Surveys are being made for the construction of a dam to be built across Staunton River for the development of water power to be utilized to generate electricity. E. R. Monroe is reported to be interested in the project.

LYNCHBURG, VA.—Plans are being made by the People's Improvement Company to commence work on the construction of its proposed electric railway connecting Fairview Heights and Lynchburg, a distance of one mile, about June 1. The company will be in the market for rails, ties, poles and overhead material. When completed the road will be operated as part of the Lynchburg Traction & Light Company's system. R. J. Hughes, of Lynchburg, Va., is president of the company.

MARTINSVILLE, VA.—Plans are being made to establish a $300,000 cotton mill in Martinsville, one-sixth of the capital stock to be taken by local people and the rest by the promoters of the enterprise. It is proposed to utilize the Reynolds factory on Franklin Street. An option has been taken on 500 hp of electrical power. It is expected to have the mill in operation by Jan. 1, 1910.

NORTON, VA.—The city is reported to be prepared to grant a franchise for an electric light plant.

RICHMOND, VA.—Mayor Richardson has vetoed the ordinance awarding the contracts for equipment for the municipal electric light plant, on the ground of its irregularity.

RICHMOND, VA.—The Jamestown Portland Cement Company, incorporated, with a capital stock of $2,400,000, proposes to erect a large cement plant on the James River, about 10 miles above Newport News. The American Cement Engineering Company, of New York, N. Y., has the contract for the construction of the plant, which will include the installation of a 4000-hp power plant. It is expected that the construction company will award contracts for machinery, which will include electrical equipment, steam shovels, elevating and conveying machinery, etc., before Sept. 1.

CHEHALIS, WASH.—The North Coast Railroad Company has filed notice of appropriation of two water rights of the Cowlitz River. One of which calls for 500 cu. ft. of water per second from Ohanapecosh or the main fork of the Cowlitz River, the water to be carried a distance of six and one-quarter miles to Lake Frederick, where a power station will be erected. The second appropriation is from Muddy Fork of the Cowlitz, and calls for 500 cu. ft. of water per second, which will also be carried to Lake Frederick, a distance of four and one-quarter miles. The water will be utilized to generate electricity, which will be distributed in Lewis, Pierce, Kittitas, Yakima and King counties.

COLVILLE, WASH.—The Stevens Power & Light Company, successors to the Northwestern Light & Power Company, contemplates increasing the output of its plant by 600 kw. The company also furnishes electricity in Meyers Falls and Kettle Falls. The officers of the company are: A. H. Sperry, of Spokane, Wash., president; H. R. W. Williams, of Colville, vice president and manager; E. B. Bird, of Spokane, secretary and treasurer.

EVERETT, WASH.—J. A. Soderburg, proprietor of the Index Granite Works, has made arrangements with the owners of the water rights at Sunset Falls to construct a hydro-electric plant at the falls, work on which will commence in a few weeks. It is estimated that at least 7000 hp can be developed.

NORTH YAKIMA, WASH.—A. N. Mougan, of Seattle, Wash., is reported to be interested in a project to establish an electric power plant on the Yakima River, near this city, where, it is said, 10,000 hp will be developed.

PULLMAN, WASH.—Plans and specifications for extensions to the heating and lighting plant of the State College are now under consideration by the trustees of the college. The cost of the work is estimated at $50,600, and will include the construction of an extension 66 ft. x 110 ft., which will be used for an engine and boiler room. A smokestack 150 ft. high will be erected.

SEATTLE, WASH.—Plans have been submitted to the City Council for the expenditure of the $535,000 available for extensions to the municipal electric light plant from the $800,000 bond issue. J. D. Ross, electrical engineer, recommends an expenditure of $250,000 toward the construction of the new dam; for new street lamps, $150,000, and $135,000 for extensions to the commercial lighting service. L. B. Young is superintendent of the plant.

SPIRIT LAKE, WASH.—A decision handed down by Judge Sanford has awarded water rights for Spirit Lake and the middle branch of the Toutle River to the St. Helens Mill & Power Company, of St. Helens, Ore. The company proposes to erect a power plant, sawmills and other industries in the St. Helens district and Skamania County, which will involve an expenditure of about $1,000,000.

EAU CLAIRE, WIS.—It is reported that the Dells Paper & Pulp Company contemplates the construction of a new plant at Jim Falls, which will include a hydro-electric development. The company recently purchased a 300-hp induction motor for its plant in Eau Claire.

GRAND RAPIDS, WIS.—The Council has granted the Grand Rapids Street Railroad Company a franchise to construct a street railway in Grand Rapids. The company proposes to construct an electric railway between Grand Rapids and Neskoosa, a distance of seven miles. Neal Brown, of Wausau, is president.

MENOMONIE, WIS.—The Chippewa Valley Railway, Light & Power Company has entered into a contract with Red Wing Gas Light & Power Company, of Red Wing, Minn., to furnish electricity from its plant in Menomonie for lamps and motors in Red Wing.

RHINELANDER, WIS.—The contract for the construction of the large dam, power, foundation of power house and excavation at a tail race in the Wisconsin River at Rothschild has been awarded to George M. Painter & Company, of Chicago, Ill.

FORT YELLOWSTONE, WYO.—Bids will be received [illegible] June 12 by Lieut. G. C. Smith, constructing quartermaster, U. S. A., Fort Yellowstone, Wyo., for the construction of a reinforced concrete reservoir for the hydro-electric power plant at this post. Specifications, blank proposals and [illegible] may be had on application.

CAMROSE, ALTA., CAN.—The Board of Trade is willing to offer inducements to anyone who will establish an electric light and power plant in Camrose. For further information address R. L. Rushton.

EDMONTON, ALB., CAN.—The City Council has awarded the contract for structural steel work for the new power house to the Edmonton Iron Works for $16,769.

EDMONTON, ALTA., CAN.—The Government is considering the adoption of automatic telephone instruments throughout Alberta. Hon. W. H. Cushong, minister of public works, is now touring several American cities inspecting the various systems in operation.

CRESTON, B. C., CAN.—A franchise has been granted by the town officials for the installation of an electric light system in Creston.

VANCOUVER, B. C., CAN.—The city solicitor has received instructions to obtain options on water powers within a radius of 50 miles of the city.

VANCOUVER, B. C., CAN.—A company has been organized and the capital secured for an electric car line to tap the country on both sides of Okanagan Lake. The main line will be 100 miles in length, with several branches. John F. Langan, of Chicago, is interested.

VANCOUVER, B. C., CAN.—Announcement has been made that the British Columbia Electric Railway Company will begin work at once on extensions to its railways east of Vancouver, aggregating about 15 miles. The work includes the construction of an initial railway in Burbany, about six miles in length. Contracts have been awarded for preparing the right-of-way for the line on Hastings Street east from Campbell Avenue to the eastern boundary of Hastings towusite, which will require about seven miles of track.

BELMONT, MAN., CAN.—Sealed tenders will be received by Raymond R. Houghton, secretary and treasurer, until May 31 for the complete construction of a rural telephone system throughout the rural municipality of Strathcona, Manitoba. Plans and specifications may be seen at Belmont and also at the office of the chief engineer of the government telephone system, Winnipeg, Man.

ST. JOHN, N. B., CAN.—The New Brunswick Telephone Company has started work on its conduit system. The initial expenditure will be about $18,000, but the entire cost is estimated at $250,000.

STELLARTON, N. S., CAN.—The Pictou County Electric Company, successor to the Egerton Tramway Company, has recently placed orders for engines, generators, condensers, poles, etc., at a cost of about $35,000. The company has recently taken over the property of the New Glasgow Electric Company, of New Glasgow, N. S.

FORT WILLIAM, ONT., CAN.—The Canadian Pacific Railroad Company has decided to install a telephone system between Fort William and White River for the operation of trains.

OWEN SOUND, ONT., CAN.—The citizens on May 15 voted in favor of the by-law appropriating $30,000 for extensions to the electric light plant.

TORONTO, ONT., CAN.—The Hydro-Electric Commission has awarded a contract for copper wire to the Dominion Wire Manufacturing Company, of Montreal. The Ohio Brass Company, of Mansfield, Ohio, will supply the suspended insulators. The electrical equipment of the protective system in the stations will be supplied by the Westinghouse Electric & Manufacturing Company.

MONTREAL, QUE., CAN.—It is reported that the McGill University contemplates the installation of a power plant, to cost $150,000.

REGINA, SASK., CAN.—Sealed tenders will be received by S. P. Porter, deputy commissioner of telephones and railways, until June 1 for the construction of the Wapella-Esterhazy and Gainsboro-Alameda-Carlyle telephone lines. Plans and specifications may be seen at the department.

New Industrial Companies.

THE BROWER ENGINEERING & CONSTRUCTION COMPANY, of Newark, N. J., has been chartered with a capital stock of $[illegible] to do a general engineering business. The incorporators are: Joseph N. Barnes and Lawrence E. Brower, of Denville, N. J.; Cecil H. Humphreys, of New York, N. Y.

THE CONTINENTAL SIGNAL COMPANY, of Wilmington, Del., has filed articles of incorporation with a capital stock of $2,000,000. The incorporators are: M. L. Rogers, S. E. Roberson, Harry W. Davis, of Wilmington, Del.

New Incorporations.

MURFREESBORO, ARK.—[illegible] Power Company has been incorporated, with a [illegible] proposes to develop water power to be [illegible] to generate electricity. The [illegible] Shannon, [illegible] and J. W. Dellins, treasurer.

AUGUSTA, GA.—Articles of incorporation have been filed for the Richmond Development Company by H. H. Alexander, T. S. Raworth, C. S. Bohler, R. H. Land, Jr.; E. H. Calloway and others. The company [illegible]

city and proposes to rebuild the line, develop the water power of Spirit Creek and make other improvements to the property.

CUTHBERT, GA.—Articles of incorporation have been filed for the Cotton Belt Telephone & Telegraph Company by C. J. O'Farrell, Jr., J. G. Dean and J. M. Bell. The company is capitalized at $21,000 and proposes to establish telephone lines in Cuthbert and in other cities in this State.

POCATELLO, IDAHO.—Articles of incorporation have been filed for the Idaho Independent Telephone Company, with a capital stock of $1,000,000, by H. R. Risley and others.

BUSHY PRAIRIE (P. O. LAGRANGE), IND.—The Farmers' Mutual Telephone Company has been incorporated, with a capital stock of $5,000, by Arthur K. Hammond and others.

PORTLAND, IA.—The Portland Heights Telephone Company has been incorporated, with a capital stock of $10,000, and the following named officers: E. L. Bitterman, president; R. B. Pickford, vice-president, and Arthur Pickford, secretary and treasurer.

KEVIL, KY.—Articles of incorporation have been filed for the Kevil Independent Telephone Company, with a capital stock of $1,000.

WELSH, LA.—The Planters' Telephone Company has been incorporated, with a capital stock of $25,000. The officers of the company are: H. E. Wesson, president; W. B. Gabbert, vice-president; John H. Cooper, secretary, and E. C. Willard, treasurer.

LA GRANGE, MAINE.—The La Grange & Alton Telephone Company has been chartered with a capital stock of $5,000. The officers are P. E. Speed, president; W. R. Hunter, treasurer, and A. W. Knowles, clerk, all of La Grange.

INDIANOLA, MISS.—The Sunflower Light, Ice & Power Company has been chartered, with a capital stock of $25,000, by A. F. Gardiner, W. B. Bartin, C. C. Moody and others.

CLAY CENTER, NEB.—The Glenville & Inland Telephone Association has been incorporated, with a capital stock of $10,000, to construct and operate a telephone system in Clay County. The incorporators are J. R. Shawcross, A. Batterman, H. B. Francisco and E. A. Holt.

BATTLE MOUNTAIN, NEV.—The Landor County Power & Light Company has been capitalized for the purpose of installing an electric plant to light the town.

Legal.

PLANT OF THE ROCKINGHAM POWER COMPANY ORDERED SOLD.—In the Circuit Court of Appeals, sitting at Richmond, Va., Judge J. C. Pritchard has entered a decree in the case of the S. Morgan Smith Company against the Rockingham Power Company and the Knickerbocker Trust Company, of New York, N. Y., ordering the sale of the property of the Rockingham Power Company, of Rockingham, N. C., on July 14 at Wadesboro, N. C., the sale being for the purpose of winding up the affairs of the power company. Commissioners appointed to make the sale are W. H. Brown and W. A. Leland, receivers of the power company. The court also authorized the receivers to issue certificates of indebtedness which will take precedence as a lien on the company's property in preference to and in priority to any other indebtedness, or lien now existing against said property. Provision was also made for securing funds to protect the property until the date of the sale in July.

Personal.

MR. HUGO REISINGER has received from the Emperor of Germany the commander's cross of the Order of the Crown of Prussia.

MR. E. J. RICHARDS, superintendent of the Newburgh (N. Y.) Light, Heat & Power Company, has resigned that position, and has joined the forces of J. G. White & Company, of New York City.

PROF. ELIHU THOMSON delivered an address May 14 before the Pittsfield A. I. E. E. section, the subject being "Thunder Storms and Wireless Transmission." The large attendance included many ladies.

MR. MAX LOEWENTHAL, who has been instructor in electrical engineering in the Stuyvesant Evening Trade School, New York, supported by the city, was the recipient at the close of the present term of a handsome silver loving cup from his pupils.

MR. GEORGE G. WARD, vice-president of the Commercial Cable Company, sailed from New York on May 22 on the *Baltic* for London to arrange for various improvements in the service, and, it is said, to make arrangements for a new cable between St. Johns, New Foundland and New York.

MR. H. M. BEUGLER, who was until recently in the service of the Elmira Water, Light & Railroad Company and was also with Messrs. Dodge & Day for some time as constructing engineer, has gone with the Newburgh, N. Y., Light, Heat & Power Company and will have charge of the electrical department of the business.

MR. CHARLES C. STARR, who for the past five years has been manager of the Halifax office of the Canadian Westinghouse Company, has resigned, having been elected president and managing director of The John Starr, Son & Company, Limited, Halifax, N. S., one of the oldest [illegible] in Canada.

MR. CLARENCE T. ROSE has been appointed superintendent of [illegible] in the lighting department of the Little Rock Railway & Electric Company, to succeed Mr. Chas. E. Mathes, resigned. Mr. Rose has been connected with the properties owned by the Newman interests and operated by Ford, Bacon & Davis for the last five years, and his promotion is given in recognition of the services rendered during that time.

MR. ANGUS SINCLAIR.—The friends of Mr. Angus Sinclair, president of the Sinclair Publishing Company and editor of the *Railway and Locomotive Engineer*, will be interested to learn of his recent marriage to Mrs. Mullin, widow of Mr. E. H. Mullin, who was so well known in the electrical field as publicity manager for the General Electric Company. Mr. Sinclair's friends are overwhelming him with congratulations.

MR. U. N. BETHELL.—The Emperor of Japan, upon the joint recommendation of the Ministers of Foreign Affairs and of Communication, has conferred upon Mr. U. N. Bethell, of New York, president of the New York & New Jersey Telephone Company, the Bell Telephone Company of Pennsylvania and the Central New York Telephone & Telegraph Company, the Imperial Order of the Rising Sun. This has been done in recognition of services rendered by Mr. Bethell in giving assistance to the representatives of the Japanese Government who have been sent to this country within the last few years for the purpose of investigating the telephone system and the management of large industrial enterprises. The order conferred is one of great distinction.

MR. PAUL DOTY, second vice-president and general manager of the St. Paul (Minn.) Gas Light Company, was recently elected president of the local Business League, which discharges the same functions as a chamber of commerce or board of trade. The League does excellent work for the community and is highly respected throughout the Northwest. It is quite an honor for a public service corporation official to be placed at the head of such an organization, but the compliment is a deserved one, and is only another proof that no more public-spirited citizens can be found than they who administer great utilities on a broad and liberal basis, seeking the general welfare. In the lighting field Mr. Doty's activities are too well known to need enumeration.

MESSRS. D. PFEIL, A. HETTLER and H. MEYER, of the Siemens & Halske Company, of Berlin, are now visiting this country and will spend three or four weeks in studying electrical and mechanical development in the United States, visiting a number of leading cities and establishments. Mr. Pfeil is a director of the company and in charge of the railway signaling department. Mr. Hettler is works manager at Wernerwerke, and Mr. Meyer is an engineer on the railway staff. Director Pfeil was here last in 1894, and is very much struck with the progress made in the intervening 15 years, especially in the erection of tall buildings. The itinerary of the party has been laid out by Dr. K. G. Frank, the representative of the great German company for the United States. It embraces Schenectady, Niagara, Chicago, Cincinnati, Pittsburgh, Washington and Philadelphia.

MR. ROBERT T. LOZIER has become a special representative of the Engineering & Electrical Securities Corporation, which is a financial company with a paid-up capital of somewhat over $250,000 and a surplus of about as much, of which Mr. J. G. White is the president. To his new duties Mr. Lozier brings a remarkable familiarity with the whole electrical field, accompanied by an unusually wide range of acquaintance in the mechanical field as well. He was one of the earliest "Edison men," dating back to old 65 Fifth Avenue in the early eighties, and has, so to speak, grown up with the art. As an active member of the American Institute of Electrical Engineers, the Engineers' Club and the New York Electrical Society, Mr. Lozier has given many evidences of the ability and popularity that will serve very advantageously in this new and important connection.

MR. H. A. REED.—On May 14 at their home in Newark, N. J., Mr. and Mrs. Henry A. Reed celebrated the fiftieth anniversary of their marriage, when a large number of friends gathered to extend their congratulations upon the jubilee. Mr. Reed is one of the veterans of the telegraphic and insulated wire arts, and his connection with the Bishop Gutta Percha Company covers and includes active participation in all the great modern electrical developments. Among those present were Miss A. Julia Reed and Mrs. F. A. Sawyer, who were bridesmaids at the wedding in 1859. A large luncheon party was given during the day, and in the evening there were about 120 visitors, while scores of congratulatory letters and telegrams were received, including very cordial ones from Rear Admiral Cone and Mr. and Mrs. Henry Watterson, of Louisville. There were also a number of beautiful presents, family and public, including a rich Tiffany case of gilt armored finger-bowls from the leading rubber-covered wire manufacturers of the country, a vase from the Bishop office staff, and a mahogany chime clock from 30 members of the Roseville (N. J.) church.

Obituary.

MR. HENRY H. ROGERS, who died at his home in New York May 19, one of the wealthiest men in America, was largely interested in electrical and kindred enterprises. He was one of the organizers and heaviest owners of the Amalgamated Copper Company, and was interested in a number of other copper propositions. He was vice-president and director in the Atlantic Coast Electric Railway and the Brooklyn Union Gas Company; president and director of the Richmond Light & Railroad Company, and a director in the United States Steel Corporation.

Trade Publications.

FLEXDUCT.—The National Molding Company is sending out a folder of interesting design having for its subject "New Flexduct" flexible tubing. It is in the form of a mailing card folded once, the exterior simulating a section of Flexduct.

RECORDING INSTRUMENTS.—Recording pressure gages for hot blast, top gas, steam and water are featured in Bulletin No. 103 of the Bristol Company, of Waterbury, Conn. Recording thermometers, electric pyrometers, and electric time recorders are also described.

"THE STAMP OF APPROVAL" is the title of a small folder which the Okonite Company, of New York, is distributing broadcast throughout the country. This folder calls attention to the fact that Okonite wires bear the approval stamp of the Underwriters' Laboratories.

GLASSWARE FOR TUNGSTEN LAMPS.—The Gleason-Tiebout Glass Company, of Brooklyn, N. Y., has issued a second bulletin devoted to tungstenware, which is manufactured and designed to supply the demand for efficient as well as artistic glass. Test curves show the distribution of light obtained by the use of the various reflectors listed.

ELECTRICAL SPECIALTIES.—Henry D. Sears, of Boston, Mass., general sales agent of the specialties manufactured by the Weber Electric Company, has issued catalog No. 2 describing the sockets, receptacles, rosettes, cut-outs, cleats, knobs, insulators, socket rings, etc., manufactured by the company. This line was placed on the market less than five years ago, and owing to its design, quality, workmanship, appearance, etc., has won a place in the front ranks.

DISTRIBUTING TRANSFORMERS.—With this title the Westinghouse Electric & Manufacturing Company has issued a handsomely printed 52-page pamphlet (Circular No. 1502), with illuminated cover, having for its subject transformers, lightning arresters, insulators, cross-arms, etc. Considerable space is devoted to underground and overhead construction applicable to congested and scattered districts. Information is also given on potential regulating systems. The pamphlet is well written and contains information of value to a central-station man or others interested in the distribution of power by alternating current.

"A SUCCESSFUL ENTERPRISE" is the title of an artistic pamphlet just issued by the Robbins & Myers Company, Springfield, Ohio. The contents of the pamphlet consist mainly of a description of the growth of the company as an electrical manufacturing concern, and excellent halftone illustrations of the plant and offices are shown. A section is devoted to illustrations showing the many applications of Robbins & Myers motors for industrial purposes; also the company's various styles of fan motors, ceiling fans, exhaust fans, etc. In addition to this pamphlet, the company has issued concurrently two booklets, Nos. 72 and 74, describing and illustrating the company's "standard" fans.

Business Notes.

FRINK COAST AGENT.—Mr. W. A. Purcell has been appointed San Francisco agent for I. P. Frink for the general line of Frink's reflectors.

THE MAXWELL-BRISCO MOTOR COMPANY, of New Castle, Ind., has taken the initial steps to establish and conduct a large technical school at this place. It is proposed to expend $100,000 in building and equipment on a site adjoining the company's large factory.

ELECTRIC POWER AT PULLMAN, ILL.—The plans for the extensive electrical additions to the car plant of the Pullman Company at Pullman, Ill., to which reference was made last week, are being drawn up in the main offices of the company in Chicago under the general supervision of Mr. Richmond Dean, the general manager. All machinery in the $3,000,000 additions will be electrically operated, individual motors to be installed wherever practicable. The power house will probably be equipped with steam turbo-generators.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 18, 1909.

[Conducted by Wm. F. Bissing, Pat. Law, 2 Rector St., N. Y. City.]

921,660. AUTOMATIC FIRE ALARM SYSTEM; F. Bain, Chicago, Ill. App. filed Jan. 13, 1908. A piping system which is filled with a fluid so that when heated the pressure of the fluid will vary and operate a signal.

921,661. TROLLEY; C. Baker, Philadelphia, Pa. App. filed Oct. 15, 1908. The harp is elastically supported and can rotate with relation to the pole so as to permit the wheel to follow the wire.

921,665. CONSTRUCTION OF ELECTRIC TRAMWAYS; S. G. Bennett, Heath Town, Wolverhampton, England. App. filed Nov. 16, 1905. A shallow conduit tramway having switches at intervals each with a projecting lever struck by the plow.

921,666. AUTOMATIC SWITCH; C. H. Bierman, Milwaukee, Wis. App. filed Dec. 30, 1908. An automatic switch for changing polarity in car lighting systems comprising a wheel and wedge which is clamped to the wheel to cause it to turn.

921,668. BANDING OR WINDING MACHINE; C. Boderck, Brooklyn, N. Y. App. filed June 10, 1907. Machine for winding bands of wires on armatures.

921,678. SEPARABLE ELECTRIC CONNECTOR; F. C. De Reamer, Schenectady, N. Y. App. filed Dec. 7, 1906. A two-part plug with a base portion of insulating material carrying electrical contacts and a detachable portion with metallic fingers engaging the contacts.

921,686. PRODUCTION OF TITANIUM OXIDE; F. A. J. FitzGerald and P. McN. Bennie, Niagara Falls, N. Y. App. filed Nov. 18, 1907. Crushes the ore, separates it preliminarily magnetically, mixes with a reducing carbon and heats so as to reduce the iron, but not the titanium, to the metallic state; then removes the iron.

921,693. SYSTEM OF DISTRIBUTION; J. L. Hall and A. F. Knight, Schenectady, N. Y. App. filed Aug. 21, 1905. For searchlights where the voltage is regulated by a motor generator.

921,715. TELEGRAPHY; I. Kitsee, Philadelphia, Pa. App. filed Oct. 10, 1907. Uses rapidly recurring or induced impulses and polarized relays, together with a localized circuit operated only when no current is flowing through the relays.

921,732. ELECTRIC CUT-OUT; W. B. Potter, Schenectady, N. Y. App. filed Jan. 5, 1905. A thermo cut-out with three or more branches, one for each circuit.

921,740. ELECTRIC RAILWAY; W. G. Roome, Los Angeles, Cal. App. filed Dec. 3, 1906. Supplies power to a sectional third rail by means of a feed conductor controlled by track circuits.

921,758. SIGNALING SYSTEM FOR RAILWAYS; J. M. Waldron, Yonkers, N. Y. App. filed Sept. 20, 1905. Track circuits between signals and around their entrances and a section of the track circuit is eliminated by the signals after the signals have been set to danger by the train.

921,761. ELECTRICAL SWITCH; I. G. Waterman, Santa Barbara, Cal. App. filed Oct. 1, 1907. Provides a compound switch suitable for use in connection with [illegible]

921,768. SYSTEM OF MOTOR CONTROL; H. E. White, Schenectady, N. Y. App. filed Aug. 3, 1908. For controlling motors by means of a dynamic brake by connecting them in a closed circuit through resistance. Makes use of a master switch and a set of switches controlled [illegible]

921,784. POLARIZED MAGNET; E. A. Burlingame, San Francisco, Cal. App. filed July 13, 1908. [illegible]

921,[illegible]. SYSTEM OF ELECTRIC DISTRIBUTION; [illegible] W. Mexander, Schenectady, N. Y. App. filed [illegible] for three-wire systems for automatically compounding the voltage between the neutral and an outside wire with varying load.

921,800. ELECTRIC LIGHT KEY SOCKET; W. C. Clark, Keewatin, Ont., Can. App. filed March 30, 1908. A push key socket for incandescent lights including a rotable rod having a pin and a cross bar with a set of teeth engaging with teeth on a contact bar.

921,826. ALTERNATING-CURRENT MOTOR; W. E. Goldsborough, La Fayette, Ind. App. filed Aug. 11, 1903. Impedance coils are placed between the coils of the armature and a short-circuiting ring, the impedance being diminished at suitable points to permit passage of current through them and increased at other points so as to prevent leakage of current through them.

921,833. HOLDER OR SUPPORT; F. F. Hespe, Hoboken, N. J., and M. Larsen, New York, N. Y. App. filed Oct. 15, 1906. For concealing wires passing to the lamp socket by means of a tubular ring attachable to the socket and supported between hollow shells.

921,836. WEATHERPROOF LAMP SOCKET; H. T. Hochhausen, Brooklyn, N. Y. App. filed July 25, 1907. A petticoat insulator fits over the base of the lamp socket.

921,839. KEY SOCKET SWITCH; H. Hubbell, Bridgeport, Conn. App. filed Dec. 21, 1908. Comprises a shaft with an angular block loosely thereon and a contact plate at right angles to the shaft and connected thereto.

921,844. IRRIGATING DEVICE FOR ELECTRICAL GROUND CONNECTIONS; Budd J. Jones, Cincinnati, Ohio. App. filed Feb. 10, 1908. A rope is placed around the pole for conducting water to the ground plate.

921,866. ARC LAMP; B. Monasch, Berlin, Germany. App. filed May 8, 1906. For flaming arc lights, having a lower negative electrode and an upper non-consuming electrode with a disk-shaped arcing surface to prevent climbing of the arc.

921,875. FIRE ALARM; A. T. Newman, Greeley, Kan. App. filed June 25, 1908. A fuse plug with a wax fuse holding the spring out of engagement with another contact.

921,803. MULTIPLE OPERATION OF VAPOR ELECTRIC DEVICES; R. E. Russell, Schenectady, N. Y. App. filed Sept. 18, 1905. Connects the vapor devices in multiple and supplies them with alternating current, together with equalizing devices in circuit with direct-current leads and suitable impedances.

921,894. COMBINED AUTOMATIC SIGNALING AND TELEPHONE SYSTEM; E. E. Salisbury, Chicago, Ill. App. filed Nov. 25, 1901. Improvements in systems for fire alarms. Details.

921,903. OZONIZER; E. W. Smith, Philadelphia, Pa. App. filed June 20, 1907. Makes use of a waterjacket and electrodes through which the current passes to ozonize.

921,914. DYNAMO-ELECTRIC MACHINE; A. H. Timmerman, St. Louis, Mo. App. filed Nov. 5, 1906. Means for centering the plates forming the cores of the field and armature.

921,[illegible]. SYSTEM OF [illegible] Schenectady, N. Y. App. filed Nov. 11, 1905. For changing alternat[illegible]

921,[illegible]. [illegible] Weintraub, Schenectady, N. Y., and M. C. A. Latour, Paris, France. App. filed Nov. 20, 1907. For amplifying current in telephony, telegraphy, particularly wireless, by using a mercury vapor lamp [illegible]

921,935. INCANDESCENT LAMP SOCKET; A. L. Williams, Water[illegible]

lamp socket to which the socket and base are locked together automatically.

921,943. PROCESS FOR ELECTRICALLY COATING WITH TIN OR ALLIED METALS; J. C. Beneker, Waukegan, Ill. App. filed June 27, 1907. The electrolytic solution contains sodium hydrate, thio sulphate and tin chloride.

921,950. ELECTRIC VEHICLE CHARGING WALL SOCKET AND PLUG; J. N. Davis, Denver, Col. App. filed March 9, 1908. See title. Details.

921,969. PULL SOCKET; M. J. Flynn, New York, N. Y. App. filed June 26, 1908. A pole socket switch in which a flexible driving member rotates a driven member to make the connection, the latter being returned by a spring.

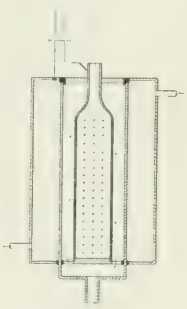
921,970. ADJUSTABLE SUPPORT FOR DROP LIGHTS; P. Frantz, Dixon, Ill. App. filed Sept. 28, 1907. A support for drop lights in which a drum and cord support the light at different elevations.

921,989. AUTOMATIC MOTOR STARTERS; W. F. Hendry, New York, N. Y. App. filed Dec. 21, 1905. A motor starter in which the starting resistances are cut out and the devices locked in running position. Solenoid switches with mechanical self-locking means are used.

922,001. TELEPHONE; E. Koehler, Philadelphia, Pa. App. filed Jan. 12, 1909. Transmits speech by telephone with the transmitter placed against the chest.



921,844.—Irrigating Device for Electrical Ground Connections.



921,903.—Ozonizer.

922,006. ELECTRICAL SIGNALING SYSTEM; A. D. T. Libby, Elyria, Ohio. App. filed May 12, 1906. Uses transformers and circuit changes in harmonic systems of signaling.

922,014. SIGNALING APPARATUS; J. Melvin, Toowoomba, Queensland, Australia. App. filed Aug. 6, 1908. For signaling at night on board ship by illuminating the semaphore arms by electricity.

922,024. TROLLEY SWITCH; C. P. Nachod, Philadelphia, Pa. App. filed Oct. 27, 1908. A longitudinal frame with contact strips yielding laterally and supported on the frame.

922,033. MOVABLE CONTACT FOR ELECTRIC SWITCHES; J. G. Peterson, Hartford, Conn. App. filed Jan. 11, 1909. Details in the construction of a double-pole rotary snap electric switch.

922,034. PUSH-BUTTON ELECTRIC SWITCH; J. G. Peterson, Hartford, Conn. App. filed Feb. 1, 1909. A two-push-button switch in which the shank of one button has a hook which engages with a complimentary hook in the rocker plate of the switch.

922,057. REGULATOR FOR ELECTRIC CURRENTS; T. Spencer, Philadelphia, Pa. App. filed Nov. 25, 1905. A solenoid coil moves an iron core in accordance with variations of resistance in the circuit, thus varying the impedance.

922,079. CELL FOR ELECTROLYTIC OR OTHER PURPOSES; H. S. Blackmore, Mount Vernon, N. Y. App. filed Sept. 24, 1907. Comprises the combination of a receptacle with an electrode comprising carbon and a binder, an opposite electrode and a body of electrolyte.

922,081. ELECTRIC GAS IGNITER; W. D. Brackett, Minneapolis, Minn. App. filed March 2, 1908. A pair of handles of insulating material with a spring yieldingly connecting the handles and conducting rods driven into the other ends of the handles, which rods can be brought together to produce the spark.

922,098. ELECTRICAL TRANSMITTING APPARATUS FOR CONTROLLING THE SIGHTING OF GUNS; A. T. Dawson and G. T. Buckham, Westminster, London, England. App. filed Nov. 20, 1908. Controls the position of an electrically actuated pointer by means of a cam disk situated at the back of the range dial and driven by gearing from the spindle of the transmitter switch.

922,099. POLARIZED RELAY; R. L. Dean, Kansas City, Mo. App. filed Feb. 6, 1908. For printing telegraphs. Employs two tongues, two sets of contact stops and restores the tongues to normal after being actuated by the electromagnet.

922,107. BRUSH RIGGING FOR DYNAMO-ELECTRIC MACHINES; G. Dunn, East Orange, N. J. App. filed Jan. 2, 1908. The brush holder is mounted on a stud. From this it is insulated by suitable insulation, but the stud can be made of metal and connected with the supporting frame, thus securing strength.

922,119. DYNAMO-ELECTRIC MACHINE; J. D. Firmin, Norwood, Ohio. App. filed Feb. 19, 1906. Holds the field coils in place on the poles by means of a clamp which draws the field coil onto a seat on the pole.

922,123. MACHINE FOR TESTING INCANDESCENT LAMPS; T. W. Frech, Jr., Cleveland, Ohio. App. filed Dec. 26, 1905. A rotatable head whirls the lamp so as to show whether the bases have been properly applied to the bulb; if not the lamp wobbles.

922,134. METHOD OF TREATING MILK; J. L. Goucher, New York, N. Y. App. filed Sept. 18, 1906. For freeing milk from bacteria by electrolysis.

922,172. CONTROLLER REGULATOR; C. E. Lord, Norwood, Ohio. App. filed Nov. 30, 1906. To insure a step-by-step movement in throwing the controller from "off" to "full on." Uses a handle and pawl to stop the handle.

922,175. MEANS FOR REGULATING THE SPEED OF PRIME MOVERS AND MOTORS; E. Meckelburg, Charlottenburg, Germany. App. filed Aug. 25, 1908. For hoisting engines and elevators in which the depth indicator driven by the hoisting motor acts upon the controlling means of the motor by means of a variable transmission gear driven by a constant-speed motor.

922,192. RELAY; H. C. Rice, Denison, Tex. App. filed June 5, 1908. Makes use of two armatures—one sensitive, the other insensitive, the latter being substituted automatically for the former when the current becomes abnormally powerful.

922,206. COMPOSITE SIGNALING SYSTEM; H. B. Stone, Providence, R. I. App. filed July 20, 1908. The line circuit is used for simultaneous telegraphic and telephonic communications by means of a repeating coil having all of its secondaries connected in series with each other and with two sides of the line, the primary connected to the telephone branch and a connection from the telegraph branch to line through one of the secondaries.

922,218. AUTOMATIC VOLTAGE REGULATOR; H. L. Van Valkenburg, Norwood, Ohio. App. filed July 30, 1906. A series of switches, a pair of solenoids for each switch, and connections whereby each solenoid when it operates its switch closes the circuit of a corresponding solenoid of the next pair.

922,219. AUTOMATIC VOLTAGE REGULATOR; H. L. Van Valkenburg, Norwood, Ohio. App. filed July 30, 1906. A series of switches separately actuated, some biased to open and some to closed position, and a potential regulator controlled by the switches.

922,230. COMMUTATOR-TYPE, HIGH-SPEED, DYNAMO-ELECTRIC MACHINE; C. J. Yates, Norwood, Ohio. App. filed Oct. 31, 1906. Direct-current turbo-generator in which all parts of the armature projecting beyond the core are firmly held in position by means of end clamps.

922,245. DYNAMO-ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed March 14, 1907. A shaft with a collector ring, a collector lead, a nut for clamping the ring to the shaft and the lead to the ring.

922,309. ELECTRIC WIRE CONNECTOR; F. More, Kingston, N. Y. App. filed Feb. 25, 1908. For securing the wires to the battery cells in a battery chute elevator by means of a special form of connector which clamps the battery leads to the wire.

922,313. INSULATOR; L. McCarthy, Boston, Mass. App. filed Feb. 14, 1907. A screw insulator for joints of gas and electric fixtures having metallic portions separated by laminated insulation.

922,318. AIR-BRAKE SYSTEM; E. J. Newton, Chicago, Ill. App. filed June 27, 1905. The energy of the moving vehicle operates the brake through the agency of an air reservoir, which is filled with air by means of a compressor controlled by electric circuits.

922,320. ELECTRICAL SIGNALING SYSTEM; J. G. Nolen, Chicago, Ill. App. filed Feb. 2, 1903. For fire alarms. Details.

922,333. ELECTRICAL WATER HEATER; Delia B. Rawson, Los Angeles, Cal. App. filed July 8, 1907. An electric water heater with a core having spiral grooves in which the heating element is located. (See illustration.)

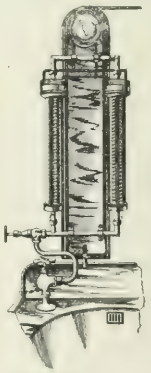
922,360. WIRE ATTACHMENT FOR ELECTRICAL DEVICES; H. Trumbull, Plainville, Conn. App. filed Oct. 19, 1905. For a knife switch in which the wire attachment is formed of bent plate of metal.

922,362. MEASURING INSTRUMENT; H. L. Van Valkenburg, Norwood, Ohio. App. filed Sept. 29, 1908. For measuring variations in current of potential by providing an indicator having a pair of receptacles each with a flexible diaphragm and filled with fluid, the receptacles being connected by a tube, containing the air bubble which gives the indication. The diaphragms are actuated by the core of an electromagnet supplied with current.

922,368. FLOOR CONDUIT AND DETACHABLE COVER THEREFOR; C. W. Wachtel, Jr., Newark, N. J. Improvement in conduit sections for flooring.

922,391. ELECTRIC SIGNAL; P. I. Chandeysson, St. Louis, Mo. App. filed Jan. 25, 1908. Semaphore blade signal operated by an electric motor with a four-pole armature and a four-pole field.

922,399. ELECTRICAL TRANSMITTING APPARATUS FOR CONTROLLING THE SIGHTING OF GUNS; A. T. Dawson and G. T. Buckham, Westminster, London, England. App. filed March 20, 1909. A rotary transmitter switch controls a pointer moving over a range dial and a cam disk actuated by the switch moves the dial.



922,333.—Electrical Water Heater.

922,410. ELECTRIC LIGHTING SYSTEM; C. Feldmann, Delft, Netherlands. App. filed May 24, 1907. For car lighting systems using alternating currents in which when the speed of a car drops the impedance in the lighting circuit is altered so as to maintain the voltage on the lamps.

922,436. ELECTRICAL SIGNALING SYSTEM; R. H. Manson, Elyria, Ohio. App. filed April 18, 1907. For selective signaling in which periodic currents of different frequencies are used. Makes use of a pole changer and transformer, with a key for actuating the pole changer.

922,443. ELECTRIC SWITCH; W. Van. P. Steiger, Bridgeport, Conn. App. filed Nov. 12, 1908. A two-button snap switch having a pivoted contact member with a spring for actuating it. Details.

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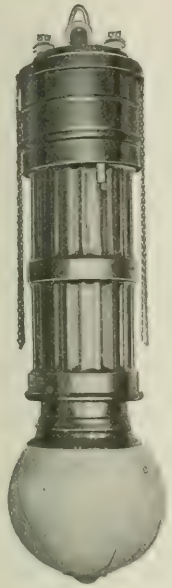
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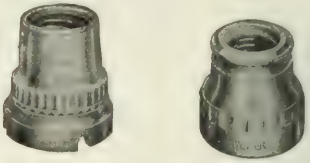
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Export Trade.

"Small by degrees and beautifully less" is a phrase that might well be applied to the exports of electrical goods from the United States during the past year. It is well to cultivate optimism, but the strain is rather severe when everything justifies a pessimistic trend of thought. Only a Mark Tapley could revel in riotous cheerfulness over such statistics as apply to electrical exports lately, and, so far as we are aware, there are not many Mark Tapleys in the business. It is now evident that 1909 is likely to fall far below both of the two years preceding. The exports of electrical instruments for April show a value of $490,483 as compared with $586,427, and a total of $4,940,397 for 10 months, as compared with $5,808,371 in 1908 and $6,888,971 in 1907. In heavy electrical machinery the same decline is to be noted. The value in April was $489,026 as compared with $566,586 a year ago, while the 10 months' figures are $5,302,122 as compared with $7,366,634 in 1908 and $7,124,240 in 1907. Our best customers have had apparently neither the money nor the inclination to buy, and it will be interesting to see how soon and how far the new revival of electrical industry in this country, as marked by our Convention issue last week, will carry them over and away from the present "dead center" of depression and relaxed demand.

The Electric Light Convention.

The convention at Atlantic City of the National Electric Light Association is now in full swing as we go to press, and will continue in session throughout the week. A portion of the proceedings is given in this issue, the remainder to appear in the next. The program this year is most extensive in character, few if any topics of interest and importance being omitted. The usefulness of the meeting will depend, however, to a large extent on the discussions, bringing out many latent ideas and suggestions of value, while, as every old conventioner knows, that which he learns outside the meeting room is often of more benefit to him than either papers or discussions. Fortunately, there is very little that the association cannot treat "out in the open," and in reality the more information the public can be given of the work of such a body, the more cordial is its appreciation of the earnestness of purpose that animates the men seeking to supply the necessities of the country in regard to electric light and power.

As to the actual work, it is evident that the association is attempting a good deal, but it may be taken for granted that what is planned will be, if possible, accomplished, and that one more impress for good will be left on the industry. The social atmosphere of such an occasion is as perceptible as the ozone in the breezes off the Atlantic, but the real motive of assemblage is the diffusion of knowledge and the stimulus

derived from one's associates. In this respect the convention of 1909 bids fair to equal, if not surpass, any of its predecessors. The association will soon be celebrating its first quarter of a century, and is to be congratulated on having "made good" in a most emphatic manner in that term of years.

Low-Voltage Tungsten Lamps.

We have from time to time referred to the experiments which have been made in central-station practice with tungsten lamps worked at 30 volts to 60 volts. Trials of this sort have not been very numerous, the great bulk of all tungstens being for the usual pressures of 110 volts to 120 volts. To work at the lower voltages means either lamps in series or the use of alternating current with tertiary transformation. The former proposition is not a very practical one save for occasional cases, so that interest centers practically upon the use of low-voltage lamps worked off auto-transformers or their equivalent. On general principles, to lower the distributing voltage is a step backward, but this particular service relates at present chiefly to interior wiring already established, which is a somewhat different matter since at, say, 60 volts, the current demanded by the tungsten lamps is enough less than that for which the wiring was planned to compensate for the less voltage. The 30-volt plan seems at least temporarily bad on account of the lack of fan motors and other useful appliances for so low a voltage. At 50 volts to 60 volts, however, this objection does not hold, and the real issue is the gain possible in using the lower-voltage lamps. As a matter of experience, the thicker filament of the low-voltage lamp gives a material improvement in life, and, what is of more importance from the standpoint of domestic lighting, enables one to get an efficient and durable lamp of 10 cp or 12 cp.

The weakest point of central-station work is domestic lighting, which has by default gone largely into the hands of the gas men. The electric light man too often turns down these small consumers almost with contempt, while the latter gives them a welcome and pays his dividends with the proceeds. The low-voltage, low candle-power, high-efficiency lamp may be of material help in dealing with gas competition among small consumers if it is intelligently applied. Of course, there is some loss of energy in the tertiary transformation, enough perhaps to deter the larger consumers who are earning good discounts. The small user generally pays the maximum rate and can afford to waste a little energy in transformation if thereby he can get high-efficiency lamps without heavy depreciation. At low voltage a practical and durable 15-watt lamp can be had, while the larger sizes are of still sturdier qualities. For the sake of these, the small user can well afford 15 watts or 20 watts loss in his house transformer. But how about the central station? In the first place, it is quite certain that its regulation would suffer seriously if a big load with tertiary transformation should grow up. Second, the bills of many small consumers would be cut dangerously near to the non-paying point. As to the former count, a big load of this sort can be prevented. As to the second, it is certainly up to the central station to devise some method for taking care of the small consumer that will involve less fixed charges than at present. One point often forgotten is that domestic lighting is for the most part after the peak and should not be treated like the commercial peak load in reckoning costs of service. Another i that gas companies have the problem of the small consume always with them and make its solution pay. It looks dubiou to us whether the low-voltage tungsten lamp is more than passing phase of growth, but it certainly seems to have a valu in dealing with the small consumer if his patronage is of valu to the central stations, as it is to the gas companies.

Elementary Illumination Calculations.

If the work of the illuminating engineer is to be maintaine above the level of mere empiricism, it must be carried on b and through the medium of, photometric measurements, i order that specifications for illumination may be intelligentl prepared by the owners of the building, may be definitely com plied with by the constructors, and may be certified to by in spection at the completion of the building. The engineerin computations involved in such specifications must not only b accepted by illuminating engineers as scientifically correct, with in a satisfactory degree of precision, but they must also b reasonably simple. It is of no use having technical facts withi the scope of mathematical formulas, if these formulas are s long, complex or laborious that they cannot be applied by th engineer in his daily work. If a navigating officer, on shipboar had to spend three hours in hard computation over his noo sights, in order to work out his latitude, instead of the minu or two ordinarily so occupied, noon sights would be honore more in the breach than in the observance. Applied scienc always had two aims in view simultaneously—first, to kee square with pure science, so as not to go adrift into error, an second, to make the mathematical work as easy and swift a possible.

The article by Mr. N. Whitney, printed elsewhere, presen some facts known to illuminating engineers in a compact form for the use of those who are not familiar with recent practic in the predetermination of horizontal illumination, by lam of given photometric data, supported in rooms of given dime sions. There are three main types of indoor artificial illumin tion in general demand, and they are often confused or n clearly separated in the apprehension of illuminating enginee ing students. These are respectively discernment illuminatio æsthetic illumination, and illumination for scrutiny. Discer ment illumination is illumination merely for the purpose finding one's way, without colliding with persons or things the vicinity. It would be represented specifically by the ill mination required in a hallway, or a corridor with termin doors. Æsthetic illumination is illumination for the purpose n merely of avoiding obstacles, but also for pleasing the eye, a for instance, the illumination in a reception room. Illumin tion for scrutiny is either illumination for reading, writin draughting or minute examination at short range, or for caref examination of objects at long range, as on the stage of theater. It is characteristic of discernment illumination that can be of relatively very feeble intensity with comfort, a certainly with economy. Moonlight intensity is often qu sufficient out of doors, and illuminations of from one-thousand to one-tenth of a foot-candle, preferably in yellowish light, a commonly sufficient indoors. Æsthetic illumination is cha acterized by a careful selection both of intensities and colors illumination. Considerably greater ranges in both are call

or than in mere discernment illumination. The intensities may un from one-thousandth of a foot-candle up to a foot-candle or more. In this direction, æsthetic taste is often of greater importance than engineering knowledge. Illumination for scrutiny requires much greater intensity of illumination than either of the other types. From one to five foot-candles, for short-range work, is commonly demanded.

In all types of illumination, the brightness of the light-sources directly exposed to the retina ought not to exceed one or two candles per square inch. Reading rooms of all kinds naturally require illumination for scrutiny over a considerable area and thus need a large average illumination. It is for such rooms, in particular, that the formulas of Mr. Whitney's paper are most generally required. In æsthetic illumination, and particularly in discernment illumination, less care is needed in assigning light sources according to formulas. Furthermore, in the use of carbon-filament incandescent lamps, it is customary to assume that after they have fallen off in candle-power to a certain degree, it pays to smash and replace them by new lamps. That philosophy is sound enough in many cases of illumination for scrutiny, but the doctrine of the axe is often sheer heresy when applied to æsthetic illumination or particularly to discernment illumination. A lamp in a hallway may be blackened by age so far that it gives only half its original candle-power. As a source of lumens per dollar it has become very expensive by comparison with its primitive lighting power. But if it still gives enough light to go about by without discomfort, it is waste of money to smash the lamp. When, however, a renewal is finally made, it might be worth while considering the insertion of a lamp of smaller candle-power, with less excess over actually needed illumination. Such a renewal may involve a smashing point when the new illumination shall have fallen off uncomfortably. The doctrines of the smashing point and of uniform illumination all over the floor of a room must both be taken with limitations, and both call for precision in the original installation of the lamps.

Concerning Technical Libraries.

With all the present interests in library organization and administration it ought to be possible to increase greatly their usefulness to technical students. Every institution of learning, to be sure, has its own library, more or less extensive and available. Certain lines of technical reference books and periodicals have, of course, to be duplicated in all libraries of any pretensions, but it is impossible for any university library to cover the whole range of periodicals in science and technology without very great expense. Many sets, especially of long-established papers, are very costly, and as found in libraries in general are rarely complete. It seems hardly necessary that such sets should be duplicated in neighboring libraries, and yet, as a rule, the federation of libraries is not carried far enough to make all the resources of a given city available for the very investigators who need them most and could make the best use of them. Consider for a moment the actual process of running down the bibliography of a single small topic, the difficulty of which is hardly realized save by those who have tried it. One starts commonly with the references in standard books, and looking up the monographs mentioned, perhaps nominally on topics remote from the thing in hand, goes on from references in these to still others, always in three languages, sometimes in half a dozen. The number of references runs up in a sort of geometrical progression—an endless chain of references covering 50 years or more of time. The common books and periodicals are soon exhausted, and then the real trouble begins, and the library difficulty enters.

Many scientific writers are slovenly in their references, and one often is confronted by things like: "As Stiggins has shown in his early monograph before the Philosophical Society of Benares," etc. The first thing is to find out where the proceedings, if any, of this organization are to be found. A search through the available indices may locate the set in the files of a quasi-private incorporated library; then comes the unwinding of the red tape to get access to the library, and once there, one usually has to drag the whole set into the reading-room and go through it, the stacks being, of course, closed. Very likely at the end it is found that the paper has been printed only in abstract. And so the chase goes on. If the reference is definite, an inter-library loan may simplify things, since most civilized libraries take part in inter-library loans; but this device is futile in the common case of having to share blind references through sets. Now, by proper co-operation it should be possible to cut short the labor in such instances. In the first place, all well-organized libraries should have their sets of technical periodicals listed in a printed list, noting in each case any gaps that may exist. Such lists should be exchanged between libraries, indexed and kept up to date, so that the references, so far as material is concerned, can be quickly located. Of course, there are such lists to-day, but they are not kept sharply up, and the matter of gaps is not taken care of as it would be if the lists of each library were periodically revised and kept up to date. The next step is to secure the maximum of accessibility. Why should not the strictly scientific and technical sets of periodicals in a library be located in a special reference room to which prompt access can be had by those who need it? Most libraries are liberal in their policies toward scholars, but the stack is, for obvious reasons, carefully guarded. A technical reference room is not a place likely to be frequented save by those who are there for business, and it would there be possible to run down in an hour references that would require a day, and the handling by the library staff of half a ton of books, if the consultation were done in the ordinary way.

With indexing well kept up and the literature made accessible in this simple way, one could locate the library needed and run down his subject in very much less time than is now possible. We could mention libraries where bound sets of periodicals on kindred technical subjects are scattered over three different departments of the library, some accessible easily and others with difficulty and requiring not a little preliminary labor to locate them at all. An apparently simple electrical problem is not necessarily confined to electrical periodicals in its references, so that the practice somewhat in vogue of encouraging certain libraries to specialize on certain subjects does not always work well. Close indexing of technical sources and quick availability of the materials are the things most necessary to give the investigator his best opportunity. A great mass of needless work is done every year merely on account of the difficulty of getting quickly at the published work of others on the same subject.

The Atlantic City Convention.

By Telegraph.

FOLLOWING a year of remarkable growth, the thirty-second convention of the National Electric Light Association begun here this (Tuesday) morning gives every indication of being a worthy culmination of the year's efforts. All meetings are held on the new Million-Dollar Pier of steel and concrete. As one enters this huge structure from the Boardwalk, he passes between the registration bureau and secretary's office. Directly in front of him is a large open space which during the daytime is fitted with easy chairs and rugs for a lounging place. In the evening this space may be cleared for dancing. Grouped about are the exhibits of electrical apparatus and further seaward on the pier is the meeting hall where the session of this morning was held.

The exhibition hall is a large and lofty apartment with arched ceiling studded with incandescent lights of various colors. Several designs are worked out in the overhead lamps, including a waving American flag and eagles with flapping wings. Opposite the main entrance, over a balcony where the well-known Filipino band is stationed, are several vaulted recesses, and the lamp designs in these were particularly tasteful and effective. Flaming arcs and large electric signs make the exterior of the pier conspicuous at night. A brilliant scene was presented at the exhibition hall last (Monday) evening, when the exhibits of associated members were formally opened for inspection.

Following the opening of the exhibition there was a reception by the officers of the association to delegates and visitors. In the receiving line were Mr. and Mrs. Joseph B. McCall, of Philadelphia; President W. C. L. Eglin and Miss Eglin, of Philadelphia; Mr. and Mrs. W. W. Freeman, of Brooklyn; Mr. Frank W. Frueauff, of Denver; Mr. John F. Gilchrist, of Chicago, and Miss Harriet Billings, of New York. Mr. McCall was chairman of the reception committee and Mr. Frank H. Gale, of Schenectady, of the exhibition committee. Dancing followed the reception and the lights, the music, the handsomely gowned ladies and the less conspicuous men, with the setting of attractive exhibits, formed a pleasing ensemble.

In point of attendance it is impossible at this writing to make an accurate forecast other than that it will be very large. Before the convention opened this (Tuesday) morning, the number of persons registered as in attandance had reached 900, and this number will be doubled no doubt before the concluding session of Friday. The advance registration reached 1350, whereas at no preceding convention has this figure exceeded 1000.

President W. C. L. Eglin, of Philadelphia, opened the first session on Tuesday morning promptly and introduced Mayor Stoy, of Atlantic City, who bade the convention welcome. The Mayor said he realized the great importance of electric illumination, which has done much to make Atlantic City what it is. His greeting, therefore, was particularly cordial. On motion of Mr. McCall a vote of thanks was extended to the Mayor.

President Eglin then delivered the annual presidential address, which was followed with close attention by the large number of members who were present.

The address was largely devoted to matters relating to the routine work and organization of the association. Referring to the State and company branches, he said that during the past year three of the former and 22 of the latter have been established. There had been some feeling among members of existing State organizations that these bodies might lose their identity and importance if they became affiliated with the association, but this feeling, Mr. Eglin believed, will undoubtedly rapidly disappear when there is a fuller knowledge and a better appreciation of the aim of affiliation. Standardization of methods and authoritative opinion are much to be desired, and although State associations are doing good work, they cannot recommend standards that will be adopted universally unless they have been approved by a national organization. To produce best results along these lines, it appears logical that as early as practicable all of the present State electric light organizations should become affiliated with the national body representing the electric light industry.

Experience gained during the past year seems to indicate that the company sections develop keen interest in the work of the association and materially increase the value of its *Proceedings*, while they enable a very large percentage of the employees of the member company to benefit from the work of the national body. A company branch enables all of the departments of the company to come together on a common ground, it assists in reducing all friction between the different departments and materially develops the men through an interchange of thought and ideas in the presentation and the discussions of papers. Four of the company branches issue *Bulletins* as a vehicle for general company news, and these mediums should do much in encouraging the ambitious employee. It is expected that many other company sections will be organized during the coming year.

Mr. Eglin expressed his strong belief in the success of the policy of having geographical and State sections wherever they can be supported. The smaller companies cannot afford to send representatives to conventions of the N. E. L. A. when far removed from their locality, while the State associations, with local officers known to the membership, interest them, and such members can materially assist in the work of the national association. For example, the chairman of committees of such bodies may serve as members of similar committees of the national association, with advantage to both sides. Moreover, through co-operation much duplication of work may be avoided, and certain routine work can be centered in the headquarters of the association, as a permanent staff there will be much more efficient than the work of numerous staffs not permanent in their personnel and scattered throughout the country.

Referring to the matter of income, Mr. Eglin stated that the revenue of the association at the present time is approximately $30,000, and that while this, with careful management, has been sufficient for usual current expenses, it is not enough to take care of the extraordinary expenses entailed at conventions, which latter have been provided for from a special fund which the membership subscribes each year for the purpose, and which amounts usually to between $10,000 and $12,000. A finance committee has been appointed to give special attention to the allotment of money available, to checking up various expenditures during the year, to see that the moneys of the association are properly invested and safeguarded and to building up the financial responsibility of the association. This committee should be a permanent sub-committee of the executive committee, and appointed promptly by each incoming ad-

ministration. Reference was made to the library for the association, which has recently been started and which, it is hoped, will develop into a reference library of great value to the members. There are many books, pamphlets and periodicals which may not be of much present value to members but which would be highly prized by the library. Donations to the collection will be highly welcomed, and in particular the library should contain complete files of the monthly *Bulletins* published by various member companies, since these have not only a historical value, but will be of benefit to members whose companies are considering the advisability of issuing publications of this class. Reference was made to the completion of a central station solicitor's handbook based upon manuscripts received in a prize competition instituted by the Co-operative Electrical Development Association. A copy of this will be given to each member of the association, and a limited number has been reserved for sale.

Taking up the subject of the Question Box, which is at the present time published in the monthly *Bulletin* of the association, President Eglin stated that as the result of a conference with Mr. Alex. J. Campbell and Mr. Paul Lupke, each of whom has had much experience as editor of the Question Box, a plan was devised to improve its value. The headings have all been rearranged, and a large number of sub-editors appointed corresponding to the various departments covered, to whom will be submitted all the questions and answers now in hand. The revised Question Box will be issued in loose-leaf form, convenient for filing or binding.

On motion of Mr. Dudley Farrand, of New York, Mr. Eglin's address and its recommendation were referred to a committee, which was appointed by the secretary of the association. Mr. John F. Gilchrist, of Chicago. This committee consists of Messrs. H. L. Doherty, of New York; C. L. Edgar, of Boston, and W. W. Freeman, of Brooklyn.

The report of the committee on uniform accounting was presented by Mr. H. M. Edwards, of New York. The committee points out and discusses briefly the differences between the sandard system of accounts of the association and the system prescribed by the New York Public Service Commissions. The report also presents, with the recommendation of the committee that it be adopted, a classification of construction expenditures. In presenting his printed report Mr. Edwards took occasion to compliment in cordial terms the classification of accounts adopted by the Wisconsin Railroad Commission. The discussion of the report will come up in accounting session on Thursday morning.

In the absence of the editor of the Question Box, Mr. Alex. J. Campbell, of New London, Conn, the printed report on this subject was read by Secretary Gilchrist. Mr. Campbell stated that the policy hereafter in conducting the Question Box would be to make it appeal rather to the small than the large companies, as the latter have on their staff specialists to consider the various problems that develop; and that answers to queries would be solicited from a larger number of members than in the past. During the year the sections of the Question Box which have appeared in the *Bulletin* will be revised, new material added and the whole printed in loose-leaf form properly numbered and indexed. From time to time pages in the handbook thus formed can be withdrawn and new sheets substituted, thereby keeping the information up-to-date. The next subject brought up was one of general interest and national importance, relating to the conservation of natural resources. Mr. Dudley Farrand, of Newark, N. J., who is the representative of the association on the National Conservation Commission, appointed as the result of the great interest of Theodore Roosevelt in this subject, submitted a report reviewing the progress of the movement and pointing out the importance and practical relation which this subject bears to companies supplying electric service.

He said that President Taft is heartily in favor of the movement and that although the work is at present carried on by private funds, it is probable that Congress will make an appropriation to defray the expenses of the continued investigation of this great problem. Mr. T. C. Martin, of New York, presented his annual report on progress in abstract. The printed report is a document of 64 pages replete with data relating to the advance of the art during the year, both at home and abroad.

After a general summary, sections of the report are devoted to regulations and rates, public service commission legal decisions, conservation of resources, municipal ownership, recent advances in plant design, special street lighting, metallic-filament lamps, flaming arcs and other illuminants, current-selling methods, electrical automobiles, artificial refrigeration, electric heating and cooking, measures for public safety, dealing with contractors and welfare work for contract station employee. Mr. Paul Lupke, of Trenton, N. J., contributed one of his characteristic "Human Interest" papers, the title being "Private Policy." Mr. Martin read the paper, and Mr. Lupke's practical suggestions and lively sallies were received with laughter as well as applause. Mr. R. M. Searle, of Rochester, N. Y., presented the reports of the committee on State and company branches and soon thereafter the convention adjourned until evening.

General, technical, commercial and accounting sessions constitute the four classes of meetings into which the convention of 1909 is divided. To-night (Tuesday) there will be a second general session, with morning and evening general sessions on Wednesday. Technical sessions will be held on Thursday morning and afternoon, commercial sessions on Thursday morning, Thursday afternoon, Friday morning and Friday afternoon, while there will be accounting sessions on Thursday morning and afternoon. Thus there will be three simultaneous sessions on Thursday.

In his address President Eglin announced one feature of the convention of unusual interest. This is the promised address of President Frank A. Vanderlip, of the National City Bank of New York, on Wednesday, the subject of which will be "Electrical Securities." Mr. Vanderlip will meet some of the prominent members of the association at a dinner to be given early Wednesday evening by Mr. Eglin. It is stated that Messrs. C. A. Coffin, A. N. Brady, Chas. L. Edgar, Samuel Insull and possibly George Westinghouse will also be Mr. Eglin's guests at the dinner. Mr. Vanderlip is familiar with many features of electrical development and he will touch on the magnitude, stability and growth of investment in the electrical field. Among the entertainment features the championship baseball game between the "Eastern Electrifiers" and the "Western Winners" on Wednesday afternoon is looked forward to with the keenest interest.

New York Convention Special.

The New York special train of parlor cars left the Pennsylvania Railroad depot at Jersey City on Monday at 10:15 a. m. and arrived promptly at sea level at 1:05. Including the party from Boston, no fewer than 160 delegates and friends were on board. Mr. George F. Porter, master of transportation, was present to superintend matters, and while the train was on its way he received news of the Chicago special and its safe arrival an hour or two ahead of the Eastern contingent. En route a number of conventionees were picked up at Newark. As a matter of fact, a large number of attendants from cities along the Atlantic Coast had gone on ahead, taking advantage of the double holiday, but Mr. Porter was very much gratified at the appreciation shown of the facilities afforded by the special on a crowded public holiday.

Past-President C. R. Huntley, his son Walter and De Lancey Rankine, of the Niagara Falls Power Company, started from Buffalo on an automobile trip to Atlantic City, judging all the conditions favorable at this beautiful season of the year. Everything looked promising for a safe and speedy run, but at Canandaigua they had the misfortune to lose a front wheel. Happily no one was hurt, and nothing daunted, the party pursued its way, arriving in good time for all that was going forward of importance.

Some idea of the interest taken in the convention may be formed from the fact that the Public Service Corporation of New Jersey began the week with 40 of its staff in attendance and will have no fewer than 200 present while the convention is in session.

New England Delegation to N. E. L. A. Convention.

The New England delegation to the Atlantic City convention of the National Electric Light Association left Boston at 6 o'clock Sunday evening in special parlor cars attached to the Fall River line train for New York, under the management of Mr. Charles H. Hodskinson, of the Edison Electric Illuminating Company of Boston, master of transportation for New England. The party consisted of a total of 73 delegates, including a number of ladies.

At Fall River the delegation embarked for New York on the steamship *Commonwealth,* arriving at the Hudson River pier Monday morning. They were transferred to the Jersey City terminal of the Pennsylvania Railroad by the special annex ferryboat *Baltimore,* and left by special train with the New York delegation for Atlantic City at 9:55, arriving at 1:05 p. m. Several delegates also made the journey by other routes. The delegation included the following:

Adams, F. D., Bridgeport Electric Light Co., Bridgeport, Conn.
Mrs. F. D. Adams, Bridgeport, Conn.
Ayer, J. I., Simplex Electric Heating Co., Cambridgeport, Mass.
Atkins, W. H., Edison Elec. Ill. Co., Boston.
Bates, Edgar W., Cohasset Electric Light Co., Cohasset, Mass.
Bates, G. M., Westinghouse Elec. & Mfg. Co., Boston.
Bliss, A. E., Malden Electric Co., Malden, Mass.
Mrs. A. E. Bliss, Malden, Mass.
Blood, W. H., Jr., Stone & Webster, Boston.
Mrs. W. H. Blood, Boston.
Brown, P. C., Brookline Gas Light Co., Allston, Mass.
Mrs. P. C. Brown, Allston, Mass.
Burleigh, C. B., General Electric Co., Boston.
Mrs. C. B. Burleigh, Boston.
Carey, G. B., Narragansett Electric Light Co., Providence, R. I
Chase, W. W., Pawtucket Electric Co., Pawtucket, R. I.
Cole, W. H., Waltham Gas Light Co., Waltham, Mass.
Cowles, J. W., Edison Elec. Ill. Co., Boston.
Davis, C. B., General Electric Co., Boston.
Mrs. C. B. Davis, Boston.
Davis, C. S., Marlborough Electric Co., Marlborough, Mass.
Mrs. C. S. Davis, Marlborough, Mass.
Davidson, J. E., Consolidated Lighting Co., Montpelier, Vt.
Davenport, E. R., Narragansett Elec. Lt. Co., Providence, R. I.
Day, C. B., Northampton Elec. Ltg. Co., Northampton, Mass.
Mrs. C. B. Day, Northampton, Mass.
Dunn, T. L., Edison Elec. Ill. Co., Brockton, Mass.
Elden, L. L., Edison Elec. Ill. Co., Boston.
Mrs. L. L. Elden, Boston.
Gray, Jesse E., Narragansett Elec. Lt. Co., Providence, R. I.
Gallagher, F. A., Jr., Narragansett Elec. Lt. Co., Providence, R. I.
Hachfield, A. E., Narragansett Elec. Lt. Co., Providence, R. I.
Hadley, P. H., Fall Mountain Elec. Light & Power Co., Bellows Falls, Vt.
Hampson, R. H., General Electric Co., Boston.
Hodskinson, C. H., Edison Elec. Ill. Co., Boston.
Holmes, W. E., Newton & Watertown Gas Light Co., Newton, Mass.
Mrs. W. E. Holmes, Newton, Mass.
Hovey, F. H., Stone & Webster, Boston.
Hunnewell, J. A., Lowell Electric Light Corp'n, Lowell, Mass.
Ingalls, Roger P., Simplex Electric Heating Co., Cambridgeport, Mass.
Keenan, W. J., Pettingell Andrews Co., Boston.
Kerr, Joseph, Dedham & Hyde Park Gas & Electric Co., Dedham, Mass.
Mrs. Joseph Kerr, Dedham, Mass.
Knowlton, H. S., *Electrical World,* Newton, Mass.
Lukes, J. B., Stone & Webster, Boston.
Marsh, C. D., Edison Elec. Ill. Co., Boston.
Maxwell, M. A., Massachusetts Lighting Co., Boston.
Mrs. M. A. Maxwell, Boston.
Meloon, W. G., Twin State Gas & Electric Co., Dover, N. H.
Montrop, J. E., Edison Elec. Ill. Co., Boston.
Nelson, A. F., Edison Elec. Ill. Co., Brockton, Mass.
Paul, C. A., Bridgeport Electric Light Co., Bridgeport, Conn.
Mrs. C. A. Paul, Bridgeport, Conn.
Peckham, W. T., Naragansett Elec. Light Co., Providence, R. I.
Perkins, Oscar H., Stuart-Howland Co., Boston.
Price, F. S., Pettingell-Andrews Co., Boston.
Mrs. F. S. Price, New Bedford, Mass.
Price, C. R., New Bedford Gas & Edison Light Co., New Bedford, Mass.
Robinson, T. Russell, Grafton Electric Co., Boston.
Rollins, R. W., Hartford Electric Lighting Co., Hartford.
Ross, M. S., Hyde Park Electric Light Co., Hyde Park, Mass.
Sanderson, F. N., Abington & Rockland Light & Power Co., Abington, Mass.
Sargent, F. C., Malden Electric Co., Malden, Mass.
Mrs. F. C. Sargent, Malden, Mass.
Scherck, Leon C., Boston.
Smith, F. E., Edison Elec. Ill. Co., Boston.
Smith, H. W., Fort Wayne Electric Works, Boston.
Smith, S. F., Salem Electric Lighting Co., Salem, Mass.
Mrs. S. F. Smith, Salem, Mass.
Tonkin, W. J., The Ansonia Electrical Co., Ansonia, Conn.
Townsend, A. F., Cape Breton Electric Co., Ltd., Sydney, Cape Breton.
Tregoning, Edgar, Attleboro Steam & Electric Co., Attleboro, Mass.
Mrs. Edgar Tregoning, Attleboro, Mass.
Wade, E. C., Boston.
Wahn, C. P., Westinghouse Elec. & Mfg. Co., Boston.
Whitaker, J. S., Rockingham County Light & Power Co., Portsmouth, N. H.

Convention "Special" from Chicago.

A large and congenial party, a swift and handsomely appointed train and pleasant weather during the most charming season of the year made the journey from Chicago to Atlantic City on the "Electric Light Special," over the Pennsylvania Railroad, a delightful introduction to the duties and pleasures of convention week. Ninety-two (92) ladies and gentlemen were on the train, which was in charge of Messrs. J. J. Schayer, Western manager of transportation for the N. E. L. A., and F. O. Birney, local passenger agent in Chicago for the Pennsylvania lines. Both of these gentlemen were most attentive to the comfort of their passengers. The train was run as a second section of the "Pennsylvania Special," the 18-hour train between Chicago and New York, and it made practically the same fast time, leaving Chicago at 3:05 p. m. on May 30 and arriving in Atlantic City, 900 miles distant, at 11 a. m. May 31. It was drawn by two powerful locomotives for a portion of the distance, and consisted of 1 composite-car, 1 dining-car, 4 standard 12-section sleepers and 1 observation-compartment car. Stops were made at Fort Wayne, Ind., and Lima, Ohio, to take on passengers, and the run through five States was made so quickly that it hardly amounted to more than a night's ride. The party was one of the largest ever carried for an equal distance to an electric-light convention.

Before starting the party, grouped at the end of the train, was photographed in the Union Station, Chicago. The train had several distinguishing features. The dining-car interior was beautifully decorated with twining vines and flowers, interspersed with miniature lamps in red, furnished with the compliments of Electric Commonwealth Edison Company. Special menu cards of artistic design were provided. Every lady was presented a frangrant bouquet of sweet peas. The Central Electric Company installed small Opalux shades in the smoking room of the composite car, and in the compartment car. Electric fans were liberally provided. At breakfast on Monday the tables in the dining-car were ornamented with small American flags in honor of Decoration Day.

Following is an alphabetically arranged list of the names of those traveling on the Chicago special train:

Adams, B. C., Lincoln Gas & Electric Light Co., Lincoln, Neb.
Allen, C. E., General Electric Co., Schenectady, N. Y.
Almert, Harold, Chicago.
Armstrong, G. W., Excello Arc Lamp Co., Chicago.
Baker, Frank J., North Shore Electric Co., Chicago.
Barker, W. J., Denver Gas & Elec tric Co., Denver.
Beardsley, Havilah, Westinghouse Elec. & Mfg. Co., Kansas City.
Mrs. H. Beardsley, Kansas City.
Beck, H. M., Elec. Stor. Bat. Co., Chicago.
Birney, F. O., Pennsylvania R. R., Chicago.
Boyer, Frank N., General Elec. Co., Chicago.
Brooks, Richard A., Denver Gas & Elec. Co., Denver.
Bryan, F. A., Indiana & Michigan Elec. Co., South Bend, Ind.
Burling, W. R., *Electric City Magazine,* Chicago.
Busch, Joseph W., Westinghouse Electric & Mfg. Co., Chicago.

Bushnell, S. Morgan, Commonwealth Edison Co., Chicago.
Chappelle, C. C., Westinghouse Machine Co., Chicago.
Mrs. C. C. Chappelle, Chicago.
Cheney, Edwin H., Wagner Elec. Mfg. Co., Chicago.
Cobb, J. W., Washington Water Power Co., Spokane, Wash.
Colman, W. H., General Elec. Co., Chicago.
Cravath, J. R., Associate Editor *Electrical World*, Chicago.
Cushing, Frederick W., Highland Park, Ill.
Dodd, Philip S., *Electrical Review and Western Electrician*, Chicago.
Dostal, J. F., Denver Gas & Elec. Co., Denver.
Duffy, C. N., The Milwaukee Elec. Rway. & Light Co., Milwaukee.
Eaton, Walter R., Cambridge Elec. Light Co., Cambridge, Mass.
Edkins, Ernest A., Commonwealth Edison Co., Chicago.
Fellows, W. H., Leavenworth Light & Heating Co., Leavenworth, Kans.
Flannigan, R. L., Springfield Light, Heat & Power Co., Springfield, Ill.
Fox, Wm. A., Commonwealth Edison Co., Chicago.
Frantz, Howard M., H. W. Johns-Manville Co., Chicago.
Gilchrist, James M., Federal Elec. Co., Chicago.
Mrs. J. M. Gilchrist, Chicago.
Glaze, H. C., General Elec. Co., Denver.
Mrs. H. C. Glaze, Denver.
Golding, Frank H., Rockford Elec. Co., Rockford, Ill.
Hale, Irving, General Elec. Co., Denver.
Hammond, Edgar H., American Electrical Works, Chicago.
Harris, Edward O., Harris Elec. Co., Mt. Pleasant, Mich.
Hodgson, Wilbur S., Des Moines Elec. Co., Des Moines, Ia.
Holland, Henry F., Pacific Elec. Heating Co., Chicago.
Mrs. H. F. Holland, Chicago.
Junkersfeld, Peter, Commonwealth Edison Co., Chicago.
Keily, William E., Associate Editor *Electrical World*, Chicago.
Kuehmsted, A. O., Gregory Elec. Co., Chicago.
Mrs. A. O. Kuehmsted, Chicago.
Learned, John G., North Shore Elec. Co., Chicago.
Lloyd, Edward W., Commonwealth Edison Co., Chicago.
Logan, Frank G., Economy Light & Power Co., Joliet, Ill.
Mrs. Frank G. Logan, Joliet, Ill.
Lukes, George H., North Shore Elec. Co., Chicago.
Lyman, James, General Elec. Co., Chicago.
MacDonald, William B., Evansville Gas & Electric Light Co., Evansville, Ind.
McJunkin, Wm. D., McJunkin Advertising Agency, Chicago.
Mrs. Wm. D. McJunkin, Chicago.
Miss Helen McJunkin, Chicago.
Malia, James P., electrician for Armour & Co., Chicago.
Manley, John C., Commonwealth Edison Co., Chicago.
Means, E. C., Westinghouse Elec. & Mfg. Co., Denver.
Mrs. E. C. Means, Denver.
Michaelsen, Waldemar, City Electrician, Omaha.
Miley, J. J., Minneapolis General Elec. Co., Minneapolis, Minn.
Munroe, Charles A., Economy Light & Power Co., Joliet, Ill.
Mrs. Charles A. Munroe, Joliet, Ill.
Ohmer, J. P., Indiana & Michigan Elec. Co., Elkhart, Ind.
Osborn, M. C., Washington Water Power Co., Spokane, Wash.
Overshiner, E. B., *Popular Electricity*, Chicago.
Mrs. E. B. Overshiner, Chicago.
Perry, Frank L., representing *Convention Daily* and C. W. Lee Co., Chicago.
Pinckard, W. R., Westinghouse Elec. & Mfg. Co., Chicago.
Pomeroy, J. G., Adams-Bagnall Elec. Co., Chicago.
Porter, H. C., Lincoln Gas & Elec. Light Co., Lincoln, Neb.
Ryerson, W. N., Great Northern Power Co., Duluth, Minn.
Sawyer, P. B., Des Moines Elec. Co., Des Moines, Ia.
Saylor, Geo. A., H. W. Johns-Manville Co., Milwaukee.
Mrs. Geo. A. Saylor, Milwaukee.
Schayer, John J., Commonwealth Edison Co., Chicago.
Schweitzer, S. E., Omaha Elec. Light & Power Co., Omaha.
Springer, E. S., Leavenworth Light, Heat & Power Co., Leavenworth, Kans.
Stannard, Clare N., Denver Gas & Elec. Co., Denver.
Mrs. Clare N. Stannard, Denver.
Tait, Frank M., The Dayton Lighting Co., Dayton, Ohio.
Tate, H. F., National Conduit & Cable Co., Chicago.
Turner, H. W., Butte Elec. & Power Co., Butte, Mont.
Tuttle, H. S., *Electrical Review and Western Electrician*, Chicago.
Von Dachenhausen, A., Butte Elec. & Power Co., Butte, Mont.
Wallace, R. S., Peoria Gas & Elec. Co., Peoria, Ill.
Watson, H. E., Benjamin Elec. Mfg. Co., Chicago.
Young, H. W., Central Electric Co., Chicago.
Young, Henry Walter, *Popular Electricity*, Chicago.
Zimman, I. B., Omaha Elec. Light & Power Co., Omaha.

Opening of Alaska-Yukon-Pacific Exposition.

The Alaska-Yukon-Pacific Exposition was opened by President Taft at 12:30 p. m., June 1, a golden telegraph key set with Alaska nuggets, previously described, being used for the occasion. This key was connected in the White House to the transcontinental lines of the Western Union Telegraph Company, and the current relayed through to a small building just behind the stage of the amphitheatre at the Fair Grounds in Seattle, where a relay was placed to start various devices to announce the formal opening of the fair. The receiving of the message and the design and installation of the receiving apparatus was in charge of Mr. J. D. Ross, electrical engineer for the city of Seattle, who introduced several new ideas.

The amphitheatre is a natural one, sloping toward the east, and will seat thousands of people. At the bottom of the slope is a stage with a seating capacity for 1,500 people. Directly beyond this stage, in full view of the audience, are two large firs, and between these an American flag, claimed to be the largest in existence, was unfurled. This flag measures 36 ft. x 104 ft.

The instant the impulse arrived from the White House the relay on the Western Union line actuated a relay and time-limit device on a large bell placed on the stage, and two strokes on this bell one second apart announced the opening of the fair. Simultaneously with the ringing of the bell another relay connected to the street lighting circuits, which were not otherwise used, and through this connected to the city lighting substation, five miles away, at Seventh Avenue and Yesler Way. At the substation another relay picked up the message and closed a 250-volt direct-current circuit, between ground and another street lighting circuit which passes the two largest whistles in the city, those of the Stetson & Post Company and the Moran shipyards, where the battleship *Nebraska* was built. Solenoids were attached to these two whistles, and through these the President announced the opening of the fair.

The time limit device which actuates the bell at the amphitheatre continued to operate, and at the last stroke of the bell actuated a trip with counterweights, which slowly unrolled the flag at an even rate of 10 ft. per second. When the flag ceased to unroll, five dynamite bombs were exploded at intervals of one second.

Another relay opened the shutter of a camera turned on the audience of the amphitheatre and a photograph taken of the audience waiting expectantly for the President's message. Fifteen seconds later a second photograph was taken, when the audience had reached the highest pitch of enthusiasm. These photographs will be presented to the President. As direct current for power purposes were not available in time at the grounds, all devices there were actuated by 60-cycle alternating current at 110 volts.

Extensions of Chicago Sanitary District Electrical Service.

The Sanitary District is doing a large amount of underground work in extending its distribution system. One of its recent contracts is for supplying electrical energy to the new hospital for consumptives, which is to form a part of the Cook County Hospital at Wood and Harrison Streets, Chicago. The District was the lowest bidder for supplying this electricity, its bid being 2 cents a kw-hour, which is an especially low rate made to county institutions. The new Sanitary District substation at Ashland Avenue and Thirty-fifth Street, Chicago, will be ready for service in a week or 10 days. An additional exciter unit will be added to the Lockport power house, consisting of a twin turbine, 350-kw generator and switchboard. Thirty miles of four-pair, lead-covered, paper-insulated underground telephone cable wire will be laid to connect the power house at Lockport with the Western Avenue station in Chicago.

American Association of Electric Motor Manufacturers.

The annual meeting of the American Association of Motor Manufacturers was held at Virginia Hot Springs on May 24, 25, 26 and 27, when there was an excellent attendance of 60 members, not including guests. During the week a number of interesting and valuable papers and reports were discussed.

On Tuesday, May 25, a paper was presented on "Cost Accounting" by Mr. Benjamin A. Franklin, of Miller & Franklin Company. In the afternoon reports were adopted from the committees on advertising, publicity and expositions, membership, central stations, and other manufacturing associations.

On Wednesday a paper was read by Mr. R. S. Feicht on "Government Specifications," and a report was read from the committee on commercial and engineering practice. In the evening a smoker was given.

Thursday was a busy day. A paper was read by Mr. James Burke on "Methods of Comparing Prices of Motors," followed by discussion. Reports were presented on a number of topics, by committees, including insurance, inspection and regulation.

The officers elected for the ensuing year are: President, S. L. Nicholson; vice-presidents, Class A, C. W. Holtzer; (B) J. C. Hobart; (C) J. W. Ham; executive committee, Class A, C. F. McGilvray; (B) R. J. Russell; (C) F. S. Hunting.

During the convention there were a golf tournament, won by Mr. Charles Robbins, of the Westinghouse Company, and a [illegible] tournament, won by Mr. R. J. Russell, of the Century Electric Company.

Annual Meeting of Oklahoma Electric Light, Railway & Gas Association.

About 50 companies were represented at the annual meeting of the Oklahoma Electric Light, Railway & Gas Association, held in Oklahoma City on May 18, 19 and 20. The program included the reading and discussion of papers of both local and general interest. Mr. J. W. Brown, chief electrician Oklahoma Gas & Electric Company, read the first paper, entitled "Concrete Poles for Permanent Construction," an abstract of which will be printed in another issue. In the discussion which followed the reading of his paper Mr. Brown described in detail the methods of handling the molds and of pouring the concrete mixture of which the poles are cast. Chats were used for the aggregate in the Oklahoma City poles, but selected gravel should give equally good results. Mr. Fred T. Benson, of the General Electric Company, presented a paper relating to the use of 4-cp tungsten lamps for sign lighting. Mr. Lawrence Martin, vice-president of the Chickasha Water Power Company, then described the water-power development in which his company is interested. A head of 20 ft. was obtained by damming the Wacheta River and building a comparatively short intake. Power is generated by two trunk turbines driving 300-kw generators. These have been operated successfully since January, and it is expected that additional units and turbines will be installed as needed until the full water capacity of 1800 hp is utilized. This total amount of power may be had on an average of 18 hours per day. A gas-engine of 275 hp capacity has lately been installed to be used in emergencies. The dam cost about $30,000, and the water-power plant is operated by two men only, each being paid $1.75 per day.

Mr. C. E. Lahman, manager of the Vinita Electric Light, Ice & Power Company, spoke enthusiastically of the water-power possibilities of the eastern part of Oklahoma. The streams there run through rocky beds between the Ozark Mountains, so that good foundations for dams are available, and backwater could easily be taken care of. The rivers are spring-fed and have a more constant flow than those in the western part of the State. The country until lately had been inhabited by Indians and others who had not been progressive, and therefore the opportunities for development were great.

At the opening of the session on the second day Mr. F. H. Tidnam, manager of the Oklahoma Gas & Electric Company, presented his address as president of the association.

President Tidnam directed attention to the great progress in electrical development in the State of Oklahoma during the past year. There has been much activity and promotion in the building of electrical interurban railways, and the water-powers of the State are beginning to receive close attention. He recommended that a competent person should be employed by the association to report to members on the subject of new laws, to give technical information and render other assistance where required. Also, the appointment of a committee to assist small plants in the preparation of reports required by the State, and a business manager for the association, under salary. He advocated changing the name of the association to the Oklahoma Public Utilities Association.

Mr. Galen Crow, of Guthrie, secretary of the association, next spoke of association affairs and outlined a plan for enlarging the scope of the organization by making eligible to membership all public utility companies within the State. After discussion, the association voted to change its name to the Oklahoma Public Utilities Association.

Mr. Charles Hunter, chief engineer of the Oklahoma Gas & Electric Company, described the method for burning oil and gas used in the station of that company. A paper on "White Way Street Lighting" was then presented by Mr. F. W. Caldwell, general manager Shawnee (Okla.) Gas & Electric Company, an abstract of which will appear later. In the discussion which followed the reading of the paper the author stated that his experience had shown it to be a good plan when introducing block lighting first to fully develop one block and then use this as an inducement when soliciting service for other parts of a city. In Shawnee two men had installed 12 brackets and lamps (one side of a block) in one day. Lamps were placed 25 ft. apart to get an even distribution and opal globes had been found most satisfactory because the opalescence showed a "light within a light." The globes were 8 in. in diameter, enclosing 60-watt tungsten lamps. Mr. Caldwell said that within three days after the lamps in the first block had been operated he had contracted for similar lighting covering practically the whole business district of Shawnee. He had found that the "white way" tended to keep people about town awake later and to hold them in the business district longer during evenings, so that the down-town load was increased about 10 per cent. The charge to the merchants along the street was 5 cents per night for each lamp, the company maintaining the lamps.

Mr. F. E. Bowman, manager of the Ada Electric & Gas Company presented a paper on the best methods for obtaining increased load. In discussing this paper, Mr. Galen Crow said that the Guthrie Electric Company had found it profitable to do the city pumping; for three years current had been furnished to operate two 75-hp motors driving pumps which operated against heads of 340 ft. and 280 ft. respectively. The charge to the city was based on the quantity of water pumped, and varied according to a sliding scale from 5 cents to 2½ cents per 1000 gal. All water over 500,000 gal. per day was pumped at the 2½-cent rate. The water was measured by Worthington meters at the pump discharge. The pressure for distribution is ordinarily obtained from a standpipe, but valves were provided so that the pumps might discharge direct to the mains for fire service. Between 13,000,000 gal. and 18,000,000 gal. were pumped each month. The company lately had made an exchange of service contract with the city whereby the company would pump the water used in the city's new filtration plant in return for a sufficient amount of filtered water for use in the company's boilers. Mr. Crow volunteered to give other plants data on pumping which he had collected.

A paper was presented by Mr. Frank Whitten, Oklahoma Gas & Electric Company, on "How to Collect Public Utility Accounts." Mr. R. F. Riseling, auditor of the same company, then read a paper on "Proper Accounting for a Small Company."

Mr. E. C. Reynolds, Sopulpa Light & Power Company, described the gas engine plant operating the generators of that company. Two 150-hp engines were operated at a cost of about $70 per month for natural gas, one engine being run 9 hours per day and the other 24 hours. The very rich gas used furnished a horse-power-hour on 14 cu. ft. or 15 cu. ft. Orders were being placed for larger engines to drive both railway and lighting generators. Mr. F. S. Meyer, Oklahoma Gas & Electric Company, described the meter practice of that company, and Mr. S. F. Dibble, of the General Electric Company, presented a paper on "Small Motors." Mr. W. A. Haller, general manager Oklahoma Railway Company, then presented a paper on "High-Tension Combined Railway and Lighting Service," an abstract of which will appear later. In the discussion Mr. Haller said that the total losses between generators and cars in New Orleans were less than 15 per cent. Mr. Fred Bedford, of Lawton, next described a model ordinance suitable for an electric lighting property in Oklahoma.

At the final session the following papers were presented: "Effect of Tungsten Lamps on the Income and Business of a Plant in a City of 20,000 Inhabitants," by Mr. H. E. Foster, Ardmore; "Tracks, Lines and Cars," by Mr. W. A. Haller, general manager Oklahoma Railway Company; "Tungsten Lamps and Gasolene Competition in a City of 2000 Inhabitants," by Mr. L. B. Griffin, Atoka; "How to Get Customers in a Small City Well Supplied with Oil and Natural Gas," by Mr. S. J. Smallwood, Bartlesville; "Enlarging the Scope of the Association," by Mr. Galen Crow.

The following officers were elected to serve during the ensuing year: President, Mr. E. C. Reynolds, Sopulpa; secretary, Mr. Galen Crow, Guthrie; treasurer, Mr. H. G. Stetman, Chandler.

Convention of Ohio Society of Mechanical, Electrical and Steam Engineers.

The semi-annual convention of the Ohio Society of Mechanical, Electrical and Steam Engineers was held at Canton, Ohio, May 21 and 22. The members of the society met at the Courtland Hotel, Friday afternoon, May 21, and were taken by special car on an inspection trip through the plants of the Canton-Hughes Pump Company and the Canton Boiler & Engineering Company, where they were courteously received and inspected the various processes employed in the construction of pumps and boilers. The remainder of the afternoon was passed in a tour through the principal districts of this city.

At 8 p. m. President F. W. Ballard called to order the first session and, after a brief address of welcome by Mr. C. A. Dougherty, president of the Board of Trade, adequately responded to by the president, Mr. G. H. Gibson, of New York, presented a paper entitled "Hot Salt Water for Steam Boilers," which presented the advantages of the open feed-water heater for the utilization of the heat and exhaust steam. It was contended that this type furnishes a rational method for converting cold, hard water into hot, soft water for steam boilers, and that among its advantages over other systems are simplicity in construction; less room occupied; less cost for building, fittings and installation; greater ease of operation, and absolute prevention of corrosion and the formation of hard scales. The discussion which followed the reading of the paper was participated in by Mr. W. C. McCracken, superintendent of buildings of the Ohio State University; Mr. T. M. Sterling, chief engineer of the Diamond Portland Cement Company, Middlebranch, Ohio, and Mr. William Long, superintendent of machinery of the Toledo Railways & Light Company.

Following this, Prof. H. B. Dates, head of the Electrical Engineering Department of Case School of Applied Science, of Cleveland, read a brief paper on "The Interpole Motor," in which he presented in a simple manner the principles of its design. Part in the discussion which followed was taken by Mr. R. D. Crawford, chief electrician of the Babcock & Wilcox Company, of Barberton, Ohio, and Mr. C. J. Miller, chief engineer and electrician of the American Roll & Foundry Company, of Canton, and others

The last paper of the evening was one on "Heat Insulation" by Mr. L. O. Hooge, of Cincinnati, Ohio, which was presented by Mr. A. E. Brown, of Cleveland, in the absence of the author. The paper stated the principles of heat conduction, convection and radiation, and gave the result of tests of different kinds of heat-insulating material. Calculations are also given showing the amount of saving that may be effected through preventing the loss of heat by the use of a proper insulation. Mr. C. H. Richards, of Lockland, Ohio, and Mr. Brown, both of whom are specialists in heat insulation, discussed the paper.

The second session was called to order at 9:30 a. m., May 22, immediately following a meeting of the Council. President Ballard presided over the brief business session held, in the course of which he reported on the progress of the society, then called on the secretary to give a brief report of the business transacted by the Council, chief of which was the purging of the membership roll, consideration of propositions relative to printing the publications of the society, and the reading of some interesting correspondence, indicating that the society is gaining in standing, and that its publications are in demand. It was reported that the Council did not consider the society as yet in position to conduct an employment department, but, of course, it recognizes its obligations to assist members in whatever manner this can be done through the office of the secretary, and by announcements at the meetings.

The secretary then read in abstract his paper on "The Ethics of Society Membership," emphasizing and illustrating how the society can be put to a considerable expense and the officers called upon to do considerable extra work, merely because members are frequently too careless in the matter of their obligations to the society, financial and otherwise. With respect to service on committees, he emphasized that inasmuch as such opportunities are not presenting themselves very often to any one member, they should be taken advantage of, by rendering service promptly and by endeavoring to make a record by its achievement, as covered by Emerson's words: "The reward of a thing well done is to have done it." The secretary then read in abstract a paper on "Continuous Melting" by Mr. R. H. Probert, past-president of the society. In this paper an account was given of the continuous melting of iron in a foundry in which two cupolas are operated alternately. Information was also included concerning molds and casting operation.

Mr. B. F. Fisher, of Londonville, Ohio, then presented a paper on "Lubrication of Steam Cylinders by Grease," which advocated the use of grease over oils for the lubrication of cylinders. It is stated that a pint or a pound of grease will do the work of 5 lb. of cylinder oil. The author recommended a particular form of cup for grease lubrication, which was described and illustrated. The paper was discussed by Mr. R. J. Brown, mechanical engineer of the Ohio Brass Company, Mansfield.

In the afternoon the members of the society were taken on an inspection trip through the power house of the Northern Ohio Traction & Light Company, and the city water-works, finishing their trip by a visit to the McKinley monument.

The third and last session was called to order by President Ballard at 8 p. m. He announced the appointment to various committees, including the membership committee, committee on publications, and research committee. The latter will control the character of the papers to be presented before the society, and includes in its membership Prof. W. T. Magruder, head of the mechanical engineering department of Ohio State University, and Prof. H. B. Dates, of the Case School of Applied Science. Thirty-three active and one associate members were also elected at this meeting. Invitations were presented from the Columbus Board of Trade, the Commercial Club, of Springfield, by President Ballard, representing Cleveland, and by Mr. Ira Cole, representing Lima, all asking the society to hold its next meeting in the respective cities; when the matter was put to vote Lima, Ohio, was decided upon, the dates of the meeting there to be Nov. 19-20, 1909. Mr. A. L. Eustice, of Pittsburgh, then presented a paper entitled "Recent Development in Glower Lamps and Their Application to Modern Illumination Practice." The paper gave descriptions of the latest types of Westinghouse Nernst lamps, together with illumination curves and comparisons showing the superior efficiency of this type of lamp over other electrical illuminants. In the discussion, Mr. J. A. Hoover, of Cleveland, gave data as to the cost of lighting by Nernst lamps, and forms of lighting contracts. A paper by Mr. Julius Roemer, of Cleveland, Ohio, on "Some Practical Points on Power-Plant Piping" was then presented by Mr. James L. Butler, chief engineer of the American Steel Foundries Company, of Alliance, Ohio, who added a description of systems he has installed in his plants. The society then adjourned after various expressions of satisfaction at the success of the meetings—for which due credit was given the local committee on arrangements.

The Toll-Line Telephone Decision.

In Ohio comparative quiet has succeeded the decision of the United States District Court opening up the long-distance telephone field to all companies which care to compete upon an equal basis. Neither side has made a move to indicate that warfare will result and neither has made any announcement of its intentions in this direction. The independents are watching the situation closely and will take action, if necessary, to protect their interests against invasion, but at the same time people feel that the decision has placed all companies in a position where they will take care of their own business and be careful about treading upon each other's toes. In part a statement issued by the Bell people, following the decision, is as follows:

"When, last November, Judge Tayler, of the United States

court in Ohio, issued a temporary restraining order, ex parte, upon the filing of the bill of the United States Telephone Company, the independent telephone promoters throughout the country had much to say about the effect of such action, publishing many statements under the heading of 'A decision against the Bell by the United States court.'

"Now that Judge Tayler has decided the case after an argument by the counsel for both sides, and has found adversely to the claims of the United States Company on all points, it is perhaps natural that, in the excitement of the moment and before the decision has been carefully digested, statements should be made which are not borne out by the facts.

"The attitude of the Central Union Telephone Company toward the independents who have invested their money has been wholly misunderstood. The Central Union Company desires to prevent duplication of investments throughout its territory, believing that such duplication must result ultimately in loss to the public as well as to the investor, and to that end has sought to interest the independent companies at points where there was no duplication in a method of operation by such independents which would harmonize all interests and bring about the best results to the public.

"Having this in mind, it has made connecting contracts with hundreds of independent exchanges, thereby broadening the scope of such exchanges and guaranteeing to the people the widest possible telephone service at the minimum cost consistent with proper business principle. It has not endeavored to get such independents to sever their connections with other toll lines at any point. It has not sought any underhanded or undue advantage over its competitors, but has been working to the end it believed to be the logical outcome—the unification of the telephone business of the country with safety to the real investor, to its own securities and to those of the independent.

"It does not believe in stock jobbing or stock watering, which the public is ultimately called upon to pay.

"We have no fight with the man who has honestly invested his money for the purpose of rendering to the public a service which was needed in his community, and we desire to assist him in every way possible, but we are unalterably opposed to the methods of those who, for personal gain and without regard to the future needs of the business and the people, seek to build up competing telephone systems, or who seek to force the public to pay on watered securities.

"We feel that this decision by Judge Tayler is the most important that has been rendered in many years and are grateful to him for the careful consideration and able opinion resulting therefrom. He has cleared the air."

Modern Electric Vehicles.

At the meeting of the New York Electrical Society, held in the Engineering Societies Building, New York, May 27, Mr. Day Baker read a paper on "The Practical Application of the Modern Electric Vehicle." Mr. Baker remarked, by way of introduction, that the electric vehicle was not a competitor of the gasoline machine; each had its own field. He described, and illustrated by lantern slides, many commercial electric vehicles and trucks used in the principal cities. A large jewelry house in New York operates 22 electric vehicles and a prominent dry-goods firm reports that in operating costs it saves 28 per cent by using electric wagons as compared with former horse service.

The company he represented has spent much money in experiments with a view to reducing the cost of electric vehicles to the lowest figures. This result it has attained by the reduction of friction, by using ball or roller bearings in the motors, countershafts and wheels, and an efficient silent chain or roller chain-drive between the motor and the wheels. Less energy is thus required, and a lighter and smaller battery may be used. The decrease in battery weight admits of the use of a lighter framework, reducing the dead weight, and further reducing the energy consumption, the battery weight and the friction loss. Another important improvement is the use of a single motor for driving the vehicles, in place of two or four sometimes used in the past.

An electric vehicle, he said, cannot be used profitably where it is not needed. Where the work that is done is less than half the ability of the machine, proper value cannot be derived from the investment. There are also localities where operating conditions prevent a satisfactory return for investment. In England and Wales there are now in operation some 11,000 commercial motor vehicles, and in the United States between 7000 and 8000. In London alone there are 1080 motor buses.

At the conclusion of the lecture a communication was read from Mr. Alexander Churchward in which he discussed the "wattage" or energy consumption of the electric vehicle. In studying the performance of the storage-battery vehicle the "wattage," i. e., watt-hours or energy consumption per ton-mile, he said, was the one most important subject when accomplishing certain predetermined results. The energy consumption, however, is influenced by a number of factors, the principal ones being tires, motors, correct gear ratios, alignment of axles and driving mechanism, diameter of wheels, etc., and these in turn are more or less influenced by the design of the vehicle.

He then considered the segregated losses consecutively and explained how they influence the ultimate or total energy demands of a vehicle. A few years ago, he said, a commercial vehicle consuming 120 watt-hours per ton-mile was considered satisfactory; to-day the energy consumption has been reduced to 70 watt-hours per ton-mile, and in some cases as low as 60. Unless a commercial vehicle is capable of running at its full speed loaded, on hard, level asphalt at an input considerably under 100 watt-hours per ton-mile, it could hardly be said to be successful as far as design and cost of operation are concerned.

New Orleans Electricians' Licensing Law Declared Unconstitutional.

The law for licensing electricians, passed by the Louisiana Legislature last year, has been declared in violation of the Fourteenth Amendment to the Constitution of the United States and therefore invalidated. The decision was rendered by Judge Frank D. Chretion of the Criminal District Court of the city of New Orleans, in the case of George Gantz, charged by a member of the State Board of Electrical Examiners and Supervisors with doing electrical wiring without the prescribed license. The defendant was neither a member of the wiremen's union, nor of the New Orleans Electrical Contractors' Association. His attorney, Mr. George G. Smart, filed a demurrer alleging class legislation on account of the section exempting the Railways, Light & Power Company, and quoting the Fourteenth Amendment. He was sustained on that ground alone, the court declaring it unnecessary to go further.

An appeal has been taken by the Supreme Court of the State by the prosecuting officer, the District Attorney. A decision may be had in six months. Meanwhile the decision will act practically to suspend present operations in prosecuting unlicensed electricians in doing work in the city of New Orleans, although a reversal by the Supreme Court would render them liable.

The New Orleans Electrical Contractors' Association is in cordial relations with the Board of Electrical Examiners and Supervisors, who will continue to issue licenses to any who may comply with its conditions. The association has reduced its initiation fee from $100 to nothing for eligible master electricians, and the board has employed a special attorney in addition to its regular counsel to confer and advise on the possibility of sustaining the law before the Supreme Court of the State, before carrying on litigation. Another law that will hold, in the event of abandonment of the present statute, may be presented to the Legislature next year.

The public regarded the licensing measure as a means to pursue poor workmen by wealthier competitors for business, and workmen were shrewd and quick in creating sympathy by declaring they were deprived of a chance to earn a living. Business that could be handled by contractors at a profit was taken by men for wages and material costs, with perhaps a very small margin. The reasons for fighting the law are principally a fear of losing the $25 exacted for each examination, a feeling that the amount is too much, and a belief that the insurance inspection of the electrical hazard is sufficient for all purposes. The bureau, on the other hand, would favor a reduction from the 230 odd applications by different parties to a reasonable number of qualified and responsible men.

Judge Chretien, in his opinion, says that the "greatest complaint is levied against the section of the act, which, after providing that all electrical workers must be under the supervision of 'master electricians,' exempts from its operation lighting companies, electric railway companies and the department of police and public buildings of the city of New Orleans, in so far as the maintenance and installation of their equipment pole line service and meters are concerned.

"It becomes evident that when conditions are imposed by a law upon a class of people permitting them to carry on their avocation, that the conditions have to apply equally to all those belonging to that class, and that the law has no right to exempt any members of that class from the operation of that law, without being in direct conflict with the provisions of the Fourteenth Amendment of the Constitution of the United States. In this case there is clearly a discrimination made in favor of certain people and corporations falling under the class legislated for, and in my opinion this makes the act unconstitutional, as it does not afford to all of the same class the same guarantee and equal protection which is required by the Constitution."

Continuing, the court says: "The Fourteenth Amendment undoubtedly intended not only that there should be no arbitrary deprivation of life or property but that equal protection and security should be given under all in like circumstances in the enjoyment of their personal and civil rights. That no impediment should be interposed to the pursuits of anyone except as applied to the same pursuits of others under like circumstances; that no greater burdens should be laid upon one than are laid upon others in the same calling and condition, and that in the administration of criminal justice no different or higher punishment should be imposed upon one than as is prescribed to all for like offenses."

New York Public Service Commission News.

Within the next few days it is expected that several definite plans will be submitted to the Public Service Commission of the First District of New York for the construction of subways in the greater city. The Interborough Rapid Transit Company is preparing plans for a $100,000,000 proposition to connect the three boroughs of the Bronx, Manhattan and Brooklyn. This plan, it is said, will be amended to meet the expressed views of the commission. The Bradley-Gaffney-Steers Company is also preparing to submit a bid to build a subway from the Harlem River to the Bridge loop. Several other propositions, including the water-front plan of the Amsterdam Corporation and a moving sidewalk scheme are also said to be in course of preparation.

Governor Hughes has signed the Travis-Robinson bill which provides for the construction of rapid transit routes in New York City by private capital. This bill also contains a provision under which the property owners who have benefited by the construction of a subway can be assessed for a portion of its costs. It is the adoption of this law that has stimulated subway propositions.

Among the committees which were named under a recent act of the New York Legislature providing for investigations was the following, which will look into Public Service Commission matters: Senators, Meade of Rochester, Davenport of Clinton, McCarren of Brooklyn; Assemblymen, Merritt of St. Lawrence, Yale of Putnam, Ward of New York, Walters of Onondaga, Caughlan of New York.

The commission has extended until Oct. 15 the time limit for the Metropolitan Street Railway Company to equip its cars with wheel guards, under the order recently made.

The Board of Estimate, of New York City, has returned to the Public Service Commission the franchise recently granted to the Hudson & Manhattan Railroad Company to build a subway under Sixth Avenue from Thirty-third Street to the Grand Central Station. This was done because the Interborough Rapid Transit Company objected to the plans under Forty-second Street. Mr. McAdoo, president of the Hudson Tunnel Company, has protested against the hold-up and has promised to construct his line exclusively under the southern half of Forty-second Street.

At the hearing before Commissioner Milo R. Maltbie, May 25, in the general investigation of electric light and power companies, J. W. Lieb, Jr., vice-president of the New York Edison Company, read a list of the private concerns which are using the streets for conduits without, as the Edison company claims, any legal authority. These installations, as a rule, are connections between adjacent buildings owned by the same interests. Mr. Lieb also reviewed the various steps by which the New York Edison Company had acquired the smaller companies that preceded it, with their franchises. The old contract between the Brush Electric Illuminating Company and the Edison company was fully explained. Carleton Macy, for the Queens Borough Gas & Electric Company, testified as to the lighting contract for the village of Rockaway Beach. This includes Edgemere, Arverne and all the territory east of these on Rockaway Beach. The franchises of the old companies, which were subsequently obtained by the Queens Borough company, were fully explained.

CURRENT NEWS AND NOTES.

COMPULSORY EXTENSION OF TELEPHONE LINES.—The Connecticut Legislature has passed a measure by a vote almost unanimous providing for the compulsory extension of telephone lines.

NEW YORK FIRE-ALARM SYSTEM.—The City of New York has made a preliminary appropriation of $100,000 for a new fire-alarm system. Such a system has been under advisement for the past six years, and has been the subject of report by Mr. Kempster B. Miller.

PORTUGESE RADIUM DEPOSIT.—A large deposit of uranite phosphate has been discovered near Guarda, Portugal. The mineral is said to contain more than 50 per cent of oxide of uranium, and should be at least three times superior to pitch blende for radium-producing purposes.

TELEPHONE COMPETITION IN NEW YORK CITY.—The Public Service Telephone Company has filed an application with the Empire City Subway Company for space in the subways for its telephone wires. It claims the right to place its wires in the subways under the franchise of the Longacre Light & Power Company, which it has taken over.

RIGHT OF MUNICIPAL PLANT TO SELL SUPPLIES.—A suit has been filed in an Indiana circuit court by J. S. Kelley, an electrician and supply agent of Frankfort, Ind., to enjoin the city officials of that place from selling incandescent electric lamps to the public. The complaint alleges that the ordinance authorizing the city light committee in charge of the municipal plant to sell lamps in sufficient quantities to supply the public is contrary to law and to the charter under which the city operates. The question of competition in matters of this kind on the part of a municipality is a new one.

AUTOMOBILES.—There are now about 160,000 automobiles in the United States, of which 69,000 are registered in New York State. On Jan. 1 there were 41,727 automobiles in Germany, of which 2,252 were for the transportation of freight.

JACK BINNS BEFORE THE WIRELESS INSTITUTE.—Mr. Jack Binns presented a paper entitled "The Wireless Telegraph in Marine Service" before the Wireless Institute at its regular monthly meeting, June 2, in the Engineering Societies Building, New York.

COLLEGE ELECTRIC RAILWAY.—Clemson College, the State institution of South Carolina, proposes to build a short electric line from the college to Calhoun, for the purpose of making a close and direct connection with the nearest railroad main line. The new road will be used for both passenger and freight service.

INTERNATIONAL PATENTS.—At the meeting in London last week of the International Congress of Applied Chemistry, a motion made by an American delegate providing for the appointment of a committee to draft proposals for joint international patent and trade-mark legislation, was carried unanimously and the committee appointed.

CONVENTION OF CANADIAN ELECTRICAL ASSOCIATION.—The next annual convention of the Canadian Electrical Association will be held at the Chateau Frontenac, Quebec, Canada, June 16, 17 and 18. In addition to the reading of papers there will be a number of topical discussions. Committees on statistics, theft of current, meter inspection and grounding of transformer secondaries will present reports. Mr. T. S. Young, Toronto, Ont., is secretary of the association.

GAS HEAT AND COAL HEAT—A Chicago coal company is using large space in the local newspapers to set forth the greater economy of coal over gas for heating purposes. A report by Mr. A. Bement, the fuel expert, is included, which gives comparisons in the form of squares, showing the heat obtainable for $1 from gas and several grades of coal. The square representing gas at 90 cents per 1000 cu. ft. has but a small fraction of the area of squares representing the several grades of coal.

CONVENTION OF RAILWAY TELEGRAPH SUPERINTENDENTS.—The Association of Railway Telegraph Superintendents will hold its next annual convention at the Hotel Pontchartrain, Detroit, Mich., June 23, 24 and 25. Some practical papers on railroad telegraph operation will be presented, and the use of the telephone in railroading will also receive considerable attention. Mr. William Maver, Jr., is down for a paper on "Wireless Telegraphy." Mr. P. W. Drew, Chicago, is secretary of the association.

ELECTRIC HEADLIGHTS.—An interesting situation has arisen in the State of North Carolina over the recent enactment of the Legislature requiring that all locomotives be equipped with electric headlights of at least 1500 cp. The Atlantic Coast Line has asked for total exemption, and the Seaboard for exemption for day trains and branch lines, while the engineers are making a strenuous effort to have the law carried out to the letter. The corporation commission has had several hearings over the matter, but nothing definite has been decided upon yet.

RAILROADS TO STUDY ELECTRIFICATION.—As an indication of the interest the railroads are taking in the subject of electrification, it may be noted that at a recent meeting of the American Railway Association a committee of seven members was appointed to make a study of the subject and to prepare a comprehensive report for submission at a meeting of the association in the fall. Mr. F. A. Delano, president of the association, will select the committee, and the resolution provides that the members may be re-elected at the November meeting, for the ensuing year.

BELFAST KELVIN STATUE.—An unfortunate complication has arisen concerning the location of the memorial statue to Lord Kelvin in his native city of Belfast. It had been decided to erect the statue in the grounds of the Queen's College, but it was subsequently pointed out that such use of the grounds would be legally a breach of trust under the terms of tenure of the property. In the meantime, some of the subscribers to the memorial have served formal notice on the Lord Mayor restraining him from expending any of the money subscribed until the questions regarding the site have been satisfactorily determined.

NATIONAL ELECTRICAL CONTRACTORS' CONVENTION.—The National Electrical Contractors' Association will hold its ninth annual convention at Toledo, Ohio, July 21, 22 and 23, with headquarters in the Boody House. There will be open sessions at 10 a. m., July 21 and 22, at which representatives of other branches of the electrical industry will give practical talks. On July 23 there will be a boat excursion to Sugar Island for an all-day outing with field sports and a baseball game. The banquet will be held on the evening of July 22. All electrical contractors, whether members of the association or not, are invited to attend all the meetings. Mr. W. H. Morton, Utica, N. Y., is secretary of the association.

EDISON ILLUMINATING ASSOCIATION.—The preliminary announcement of the Association of Edison Illuminating Companies has just been issued setting the date for the annual convention Aug. 31 to Sept. 2, inclusive. This is about two weeks earlier than usual. The place of convention is Briarcliff Lodge, Briarcliff Manor, about 35 miles from New York, overlooking the Hudson River from one of the highest promontories, with splendid mountain scenery in every direction. A preliminary meeting is to be held on Monday evening, Aug. 30, and it is suggested that members arrive not later than that time. The nearest railroad station is Scarborough on the New York Central, about 30 miles from the Grand Central Depot. Mr. W. W. Freeman, of Brooklyn, N. Y., is president of the association, and Mr. D. L. Huntington, of Spokane, secretary.

HUDSON-FULTON CELEBRATION.—New York City at the time of the Hudson-Fulton celebration, next October, will be lighted up as never before in history. Chairman William Berri and the members of the committee on illumination visited last week all the historic points in the city which will be especially featured at the coming anniversary and concluded the trip by awarding to the New York Edison Company the contract for lighting the various streets and places around which interest will center. Following this, Mr. Arthur Williams, of the Edison company, announced that he would undertake to festoon Fifth Avenue with lights, beginning at Washington Square and extending to Central Park. In all there will be used 150,000 separate lights burning in Fifth Avenue during the eight days of the celebration. In addition all the borough halls will be especially illuminated, the Washington Arch, in New York, and the arch at Prospect Park, in Brooklyn. Grant's Tomb will not be illuminated out of considerations of good taste, but instead giant searchlights will be turned on the building which will bring it out in relief. Mr. Williams made the suggestion that the people of New York should co-operate with his company and light their residences and places of business in order to heighten the effect.

Producer Gas-Engine Station at Hoopeston, Ill.

THE Hoopeston Gas & Electric Company, of Hoopeston, Ill., has operated a 280-hp gas engine on producer gas since June, 1908. The engine and the two producers which supply it are of the Munzel type, built by the Minneapolis Steel & Machinery Company. The engine, which is of the twin type, consisting of two single-acting engines connected to the same shaft, runs at a speed of 176 r.p.m. The cylinders are 21¾-in. diameter by 32-in. stroke. A 17-ton flywheel also acts as a belt pulley from which is belted a 200-kw, 60-cycle, 2300-volt alternator. This unit is shown in Figs. 1 and 2.

The two producers which supply this engine are shown in Fig. 3. These producers have a nominal capacity of 150 hp each. Anthracite coal of buckwheat size is used in them. A 5-hp motor drives a chain hoist for elevating coal from a hopper just outside the producer-room to a bin over the producers.

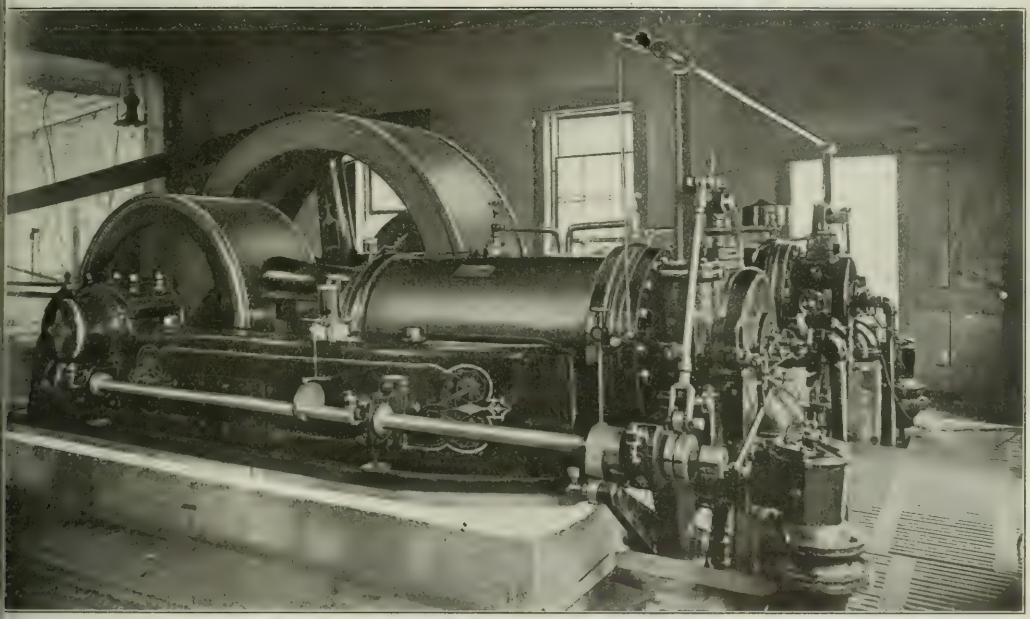


FIG. 1.—280-HP GAS ENGINE AT HOOPESTON, ILL.

From this bin it is let down as needed through a pipe into the producer hoppers.

A cross-section of the producer and wet scrubber is shown in Fig. 4. The producer is at the left and the scrubber at the right. The producer hoppers have the usual air-lock arrangement whereby the hopper is closed tightly by a valve held shut by a weight before the coal is dumped from the hopper into the producer. The coal is fed down to the fire in the producer by a short magazine. The coal settles down in the magazine as fast as the coal in the lower part is consumed. The producer has rocking grates for shaking down the ashes, and poke holes are also provided around the top so that a poker can be inserted to poke around the walls of the producer next to the fire. Very thick, heavy fire-brick lining is used. The air with which the producer is supplied is drawn in under the grates from a preheater located between the producer and scrubber. This preheater raises the air to a high temperature before it reaches the fire in the producer. This heating is accomplished by passing the air along passages heated by the hot gas coming from the producer.

In order to mix a certain amount of steam or vapor with the air sucked into the producer, a vapor pan is provided at the top of the producer which is partly filled with water kept boiling by the heat in the producer below. The steam and vapor given off from this vapor pan are mixed with the air drawn into the producer at a kind of mixing valve, seen just above the preheater, thus introducing some hydrogen into the gas. From the producer the gas passes through the wet scrubber, at the right, which is simply a long cylinder through which water is continually sprayed. The bottom has a water seal so as to close the scrubber from the outside air. This scrubber takes out most of the impurities, ashes, etc., which are drawn through from the producer. From the wet scrubber the gas passes through a dry scrubber, which is simply a kind of strainer, and is inserted as an additional precaution not absolutely necessary. From the dry scrubber it is drawn to the engine through a receiving tank, which is inserted in the pipe line for the purpose of equalizing or reducing fluctuations in suction caused by the strokes of the engine.

This is a suction-type producer; that is, when the engine is in operation the draft through the producer is caused by the suction of the engine on the producer. The oxygen of the air uniting with the carbon of the fuel forms carbon monoxide or producer gas. When the producer gas reaches the engine it is burned to carbon dioxide, CO_2. In this process of burning fuel, approximately one-third of the heat units which would be liberated by the total combustion of the coal are liberated and wasted in the process of burning the coal to producer gas. The other two-thirds are liberated at the time the producer gas is burned in the gas-engine cylinders. The heat units liberated in the process of producer gas-making are largely dissipated by radiation from the producer and piping and by transfer to the water in the wet scrubber. Although the process of utilizing producer gas in a gas engine involves throwing away about one-third of the heat units caused by combustion in the first process of producing the gas, and also involves the waste of about half the remaining heat units in the exhaust of the engine and in the cooling water used in the engine jackets, the total cycle of operations gives much more useful energy per pound of coal than the process of burning it under a boiler for the operation of a steam engine.

The engine at Hoopeston consumes about 1 lb. of anthracite coal per kw-hour for a monthly run. Many 24-hour records are

better than this, as shown later. This is based on actual recording watt-hour meter readings at the switchboard. Fig. 6 shows a curve of kw-output for each hour of the day, as taken from the readings of the recording watt-hour meter every hour. From this it is seen that the engine is not operating under conditions at all favorable to economy, because even at peak load it is not nearly loaded. The maximum load is 130 kw, and the rated capacity of the engine and generator is 200 kw. The efficiency of any gas engine operated by a governor which throttles the mixture is very low on light load as compared to the efficiency on full load.

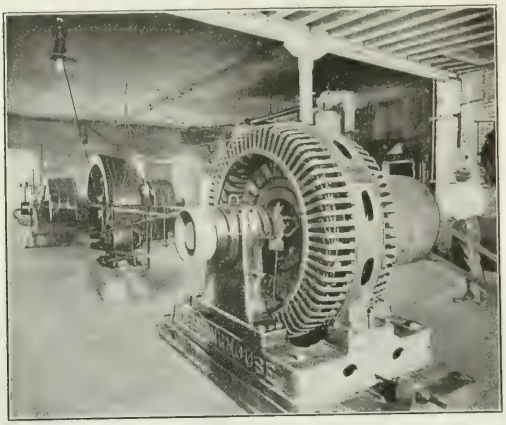


FIG. 2.—200-KW GENERATOR AND GAS ENGINE.

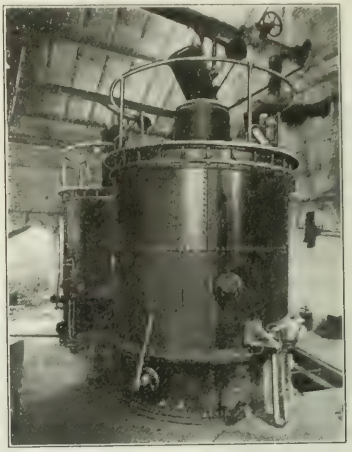


FIG. 3.—MUNZEL GAS PRODUCER.

To obviate this condition of running a large engine 24 hours per day, much of the time very lightly loaded, a second engine of the same type and make is being installed. This second engine is to be a single-cylinder engine of 100-hp rated capacity, 18¾-in. x 28-in. stroke. The speed will be 190 r.p.m., and it will carry a 10-ton flywheel, 8 ft. 6 in. in diameter. This engine will be able to carry the load most of the day, and will give the station a reserve gas-engine unit. Heretofore the reserve has been in the shape of a steam-engine unit and boiler, which were part of the former equipment of the station before the gas engine was introduced.

The steam plant, before the gas-engine plant was put in, took from 10 tons to 12 tons of soft coal for a 24-hour run at a prevailing price of $2 per ton. The price of anthracite coal is in the neighborhood of $4.50 per ton. For the 24 hours' output for which the curve is shown in Fig. 6, which is the output for Jan. 23, 1909, the consumption of anthracite coal by the producers was 2730 lb. and the output 1290 kw-hours, equivalent to 2.1 lb. per kw-hour. On March 31, 1909, the consumption was 2496 lb. for an output of 1060 kw-hours, or 2.5 lb. per kw-hour. For April 1, 1909, the output was 930 kw-hours, the coal consumption 2028 lb., making the consumption 2.18 lb. per kw-hour. On Sundays and days of very light load the consumption is, of course, higher per kw-hour. Even with a consumption of 3 lb. per kw-hour, which has been the prevailing figure for considerable periods of time, the cost of fuel per kw-hour, with hard coal at $4.50 a ton, would be only 0.675 cent, which is far lower than could be obtained with a non-condensing steam plant operating under similar light-load conditions with $2 soft coal. This figure will probably be lowered at least 30 per cent when the smaller engine is started.

As considerable water is required for the engine jackets and gas scrubber, the company operates its own deep-well pump with a 5-hp motor. This pump has an automatic starter controlled by a float in an elevated tank, so that the pump is started whenever the water supply in the tank falls below a certain level.

As is the case with all gas engines, the space occupied by this unit is large for the output obtained. The 280-hp engine

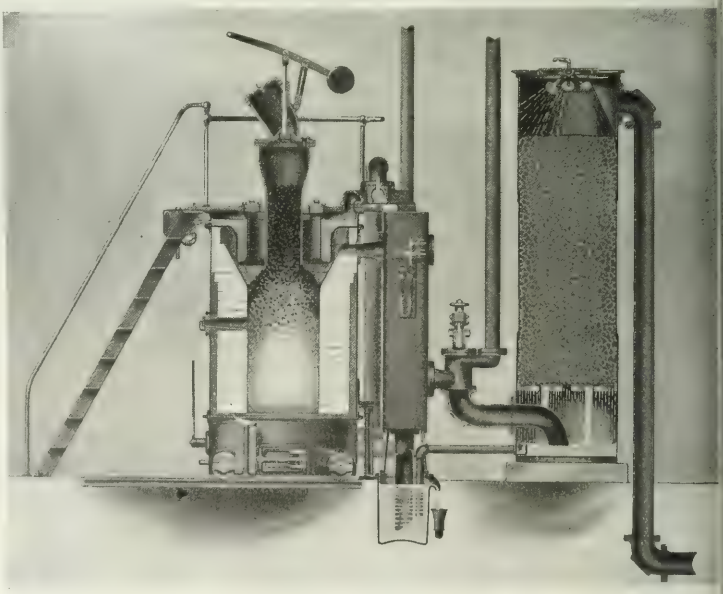


FIG. 4.—CROSS-SECTION OF PRODUCER GAS APPARATUS.

occupies a floor space of 17 ft. x 18 ft. 10 in. As to reliability, which is now one of the chief points of interest in connection with any producer-gas engine plant, the history of this plant seems to have been the same as that of a number of others. During the first few months of operation of such a plant it is an excellent thing to have a steam unit to fall back upon, as in this case, because of the time required to educate men in the proper operation of the producer. The producer is a piece of apparatus not generally understood, and while it is likely that in time a class of engineers will become educated to producer operation, no such class exists now from which to draw. Whenever a new plant is started it must depend on men supplied by the manufacturers, and such other men as the central station can pick up and train. The manufacturers themselves have difficulty in picking up good operators. The troubles experienced in this plant have been mainly an occasional slowing down of engine due to variation in the quality of gas. For long periods these troubles have not showed themselves, and, on the whole, the operation has been reliable and satisfactory and such as to justify the management in the present enlargement of the gas-engine plant. One of the troubles recently experienced has been that of free ignition of the gas before the proper time in the stroke. The trouble has apparently been obviated by greater care in poking the fires so as not to carry hot cinders which ignite the gas before the ignition spark has a chance to operate.

The soil at Hoopeston is of such a character as to give some rather startling results with engine foundations. The underlying soil is blue clay of about the consistency of dough. The foundation of the 280-hp gas engine which was built upon it allows considerable vibration of the engine itself and also causes vibration in buildings several hundred feet away. This vibration is not violent or objectionable, but is noticeable to a person looking for it. For the foundation of the new engine piles will be driven down to bedrock. This, of course, is nothing



FIG. 5.—DRY SCRUBBER, COMPRESSOR AND AIR TANK.

against the apparatus, but shows what unexpected conditions are sometimes met.

Fig. 5 shows the small gasoline engine which drives an air compressor to fill the air storage tank from which the gas engine is started. This air storage tank is shown at the right above the wet scrubber. This small gasoline engine also drives a fan-blower with which fire is started in the producer. In this producer the fire is blown by air pressure from the fan-blower introduced in the ash pit. While this fan-blower is at work a purge-pipe, extending through the roof, is open, which acts as a chimney, out of which the air and products of combustion

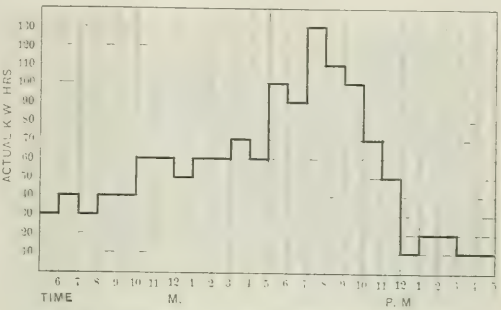


FIG. 6.—KW-HOUR OUTPUT BY HOURS, JAN. 23, 1909.

from the producer pass. When the fire in the producer has reached such a condition that producer gas is given out steadily through the purge-pipe, as indicated by the lighting of the small test flame, the purge-pipe is closed and the gas is blown through the scrubbers and receivers to the engine so as to fill the whole piping system. When these pipes are filled, the air blast is shut off and the engine started. The suction of the engine then draws air into the producers, which is changed into gas as fast as the engine requires it.

Central Power Plant at the U. S. Navy Yard, Charleston, S. C.

By A. P. Ball.

THAT it pays in power-plant work to put a considerable amount of money into the production of clean and pleasant surroundings has long been maintained by European engineers, and attention has often been directed to the fact that certain Continental power plants, equipped with machinery which in this country would be regarded as antiquated, or at least distinctly inefficient, show surprisingly good economy of operation, even when compared with American plants of the most modern design. Investigation of steam power plants in Germany and Holland, where this anomaly is



FIG. 1 [illegible]

particularly pronounced, reveals the curious circumstance that scrupulous cleanliness obtains in and about the plants where the most interesting results have been obtained.

It cannot, of course, be deduced from the above coincidence that cleanliness and neatness in the engine room are important factor in the attainment of economy, but it seems [illegible] a safe

inference that, where sufficient time and attention are devoted to the outward appearances of the plant, a correspondingly greater amount of care is given to the apparatus itself and to the development of expense-saving details. It must also be recognized that clean and orderly surroundings will have a

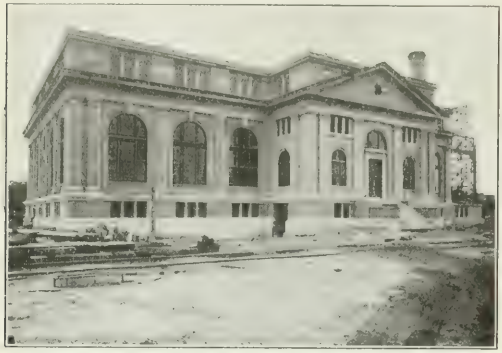


FIG. 2.—ARTISTIC POWER-HOUSE CONSTRUCTION.

practical and well-defined, though possibly intangible, influence on those employed about a steam plant, which will tend toward its betterment in every way. It is well recognized that dirt and neglect usually accompany inefficiency and waste. Would it not also seem that cleanliness is conducive of economy?

If the above conclusions are correct, it will be interesting to watch the results to be attained in the central power plant just completed for the United States Government at the Navy Yard at Charleston, S. C., for this plant is not only of attractive architectural design, with a tasteful scheme of interior decoration, enhancing the pleasing impression given by its neatness and ample proportions, but also embodies approved practice conducive to the highest economy of operation.

It is the policy of the Navy Department to replace gradually by efficient central generating stations the small and relatively inefficient power plants which are now scattered about every Navy Yard. The Charleston Yard is the first one where this plan has been carried out. This is primarily a torpedo-boat station, and the U. S. S. *Atlanta*, parent ship of the torpedo

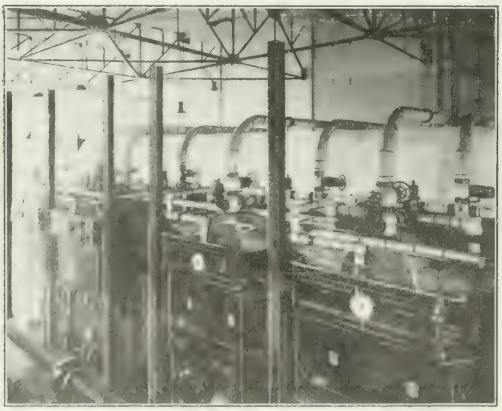


FIG. 3.—ARRANGEMENT OF BOILER PIPING.

flotilla, is permanently stationed there. The work of repairing and building torpedo boats and destroyers requires extensive boiler, foundry and machine shops, which cover a considerable area. The machine tools employed are all driven by individual motors.

In addition to the numerous torpedo-boat moorings along the Cooper River, a large granite and concrete dry dock has recently been completed, over 600 ft. in length and capable of docking the largest ships in the navy.

The pumping of the dock is done by means of four 36-in.

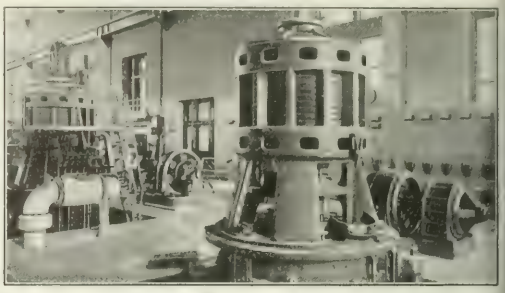


FIG. 4.—INTERIOR OF GENERATING STATION.

centrifugal pumps driven by three-phase induction motors of the vertical-shaft type. Two 12-in. pumps, similarly operated, serve for draining the dock sump. The input required by the pump motors is approximately 1000 kw.

The dock is also equipped with seven electrically driven capstans. Three are located on either side of the dock, and the seventh, a somewhat larger one, is placed at its head. Each of these capstans is directly connected to a variable-speed three-phase induction motor, and is arranged for driving in either direction.

The yard also possesses quite an extensive lighting system. Not only does the plant supply the illumination of the shops, offices and warehouses, but it also provides for the lighting of the officers' quarters, which are segregated at the northern extremity of the reservation, some distance from the rest of the yard buildings.

The new central power plant was designed to replace the several small stations now in use, and to supply energy throughout the yard for all the above requirements. The mechanical equipment for this plant was furnished and installed by Muralt & Company, of New York City, and has been in operation for some time.

The most favorable site for the station, from considerations of energy distribution, was unfortunately a low, marshy stretch of ground, quite characteristic of most of the land along the Cooper River. The final selection of this site rendered the question of suitable foundations rather serious. It was found necessary to drive 16-in. wooden piles very closely together practically all over the site, and reinforce them with large amounts of concrete, in order to carry the weight of the building and equipment. The nature of the ground is clearly shown in

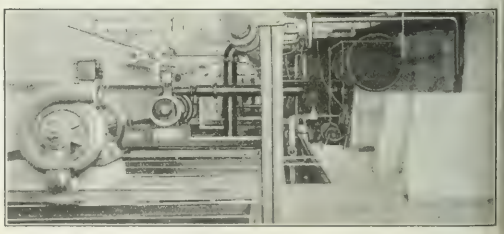


FIG. 5.—STEAM AUXILIARIES.

Fig. 1, which also gives some idea of the piling required and difficulties that were encountered in securing a satisfactory foundation.

The station building itself is by far the most imposing edifice on the reservation, being of a semi-classic style of architecture

with spacious dimensions and plain yet pleasing lines. It is of steel construction, with hard-pressed straw-colored brick walls, trimmings and foundation facings of white sandstone. Its general appearance is shown in Fig. 2.

The interior is divided by a tile partition from end to end, into two spacious rooms used as boiler and engine rooms, respectively. Each is of ample size and is unusually well lighted by numerous large windows. The engine-room, with its walls faced with white tile up to a height of about 10 ft. above the floor and hard-pressed brick from there on up to the lofty ceiling, is very attractive.

The boiler equipment consists of four 350-hp Heine water-tube boilers set in two batteries. They are capable, however, of furnishing an output 50 per cent in excess of their nominal rating for a period of 12 hours continuously. Each boiler has 3500 sq. ft. of actual heating surface and 80 sq. ft. of effective grate surface. These boilers are equipped with Murphy automatic stokers capable of burning sufficient bituminous coal to maintain the boilers in operation continuously at the above overload.

Each boiler is fitted with a Foster superheater sufficiently large to add 100 deg. Fahr. to the temperature of the steam at 150 lb. gage pressure. Provision has been made in the piping system for operating the plant on either superheated or saturated steam, and suitably arranged dampers have been installed for cutting out the superheaters when saturated steam alone is being taken from the boilers.

Fig. 3 gives a general view of the boiler batteries, showing in particular the saturated and superheated connections from each boiler to the engine-room steam headers. The flue is shown passing over the tops of the boilers. During the recent acceptance tests conducted by a board of Government engineers, these boilers showed an efficiency very close to 80 per cent.

A fuel economizer of Sturtevant make, consisting of 28 10-tube sections, is installed in the flue next to the boilers, on a supporting platform of I-beam construction, with a by-pass whereby the flue gases may be diverted entirely or partially around the economizer. Arrangements are made for coal pockets, which will be added at a later date.

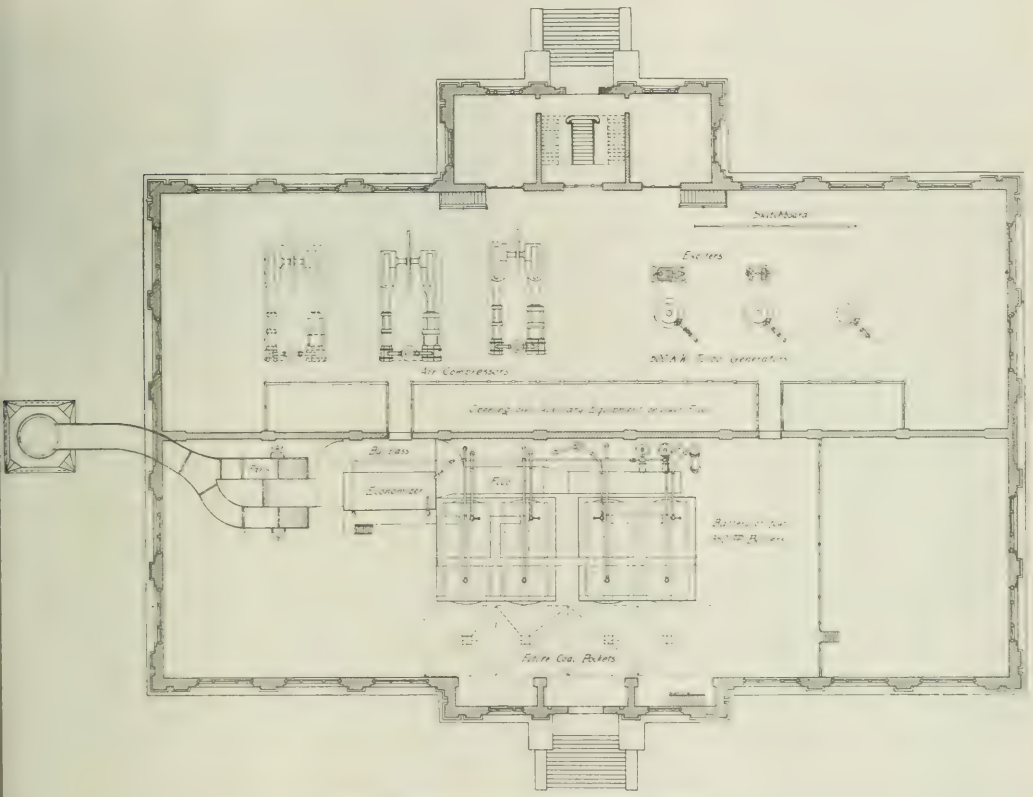


FIG. 6.—PLAN VIEW OF GENERATING STATION

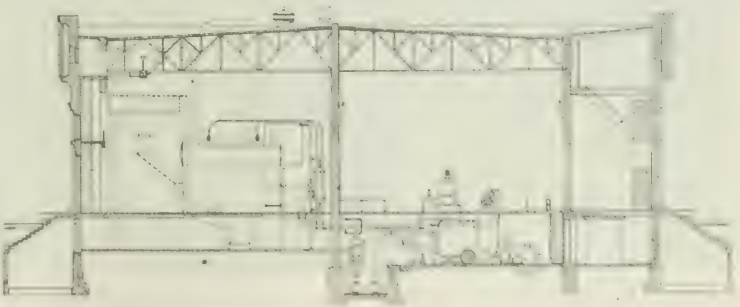


FIG. 7.—SECTIONAL ELEVATION OF GENERATING STATION

The engine-room equipment consists primarily of two 500-kw Curtis turbo-generator sets, which are clearly shown in Fig. 4. This illustration gives an idea of the general interior appearance of the engine-room and scheme of decoration before mentioned.

The turbines are so designed as to operate at 150 lb. initial steam pressure, 100 deg. Fahr. super-temperature and 28 in. of vacuum. Their steam consumption at full load is well within 18.4 lb. per kw-hour. The generators are wound for 2300 volts, 60 cycles, three-phase currents. Each unit is provided with a 35-kw compound-wound exciter set, wound for 125 volts. One exciter is driven by a simple, non-condensing vertical steam engine, the other by a 50-hp, three-phase motor. The switchboard consists of 27 panels of blue Vermont marble.

The engine-room also contains two Laidlaw-Dunn-Gordon steam-driven, Corliss-type, cross-compound air compressors for supplying air for pneumatic riveting machines, drills, etc.

The condensers, pumps and all auxiliaries of the engine-room equipment are located on a floor directly below the engine-room, a view of which is shown in Fig. 5. A large opening along the entire length of the engine-room floor makes all of this auxiliary equipment readily available and at the same time sends a flood of light into the basement.

The piping lay-out is designed to make the most direct connections between the headers and the various units, with bends of large radius. The present piping system has been designed to provide for future extensions, all mains being properly proportioned to take care of the installation of additional units. A maximum of reliability has been the object in view in the arrangement of the entire system.

Figs. 6 and 7 show plan and elevation, respectively, of the generating station and are self-explanatory.

The plant was built by the Bureau of Yards and Docks, Admiral R. C. Hollyday, chief.

A Farm Hydro-Electric Plant Without Operating Attendant.

By P. J. O'Gara.

THAT a farm electric power plant, which will operate without the presence of an operating attendant, is not only possible, but practical has been demonstrated in a small power plant owned by Mr. Ellis Franklin, of Colfax, Cal. About two years ago when the writer first visited the Franklin estate his attention was attracted by a small stream with a normal flow of a very few miners' inches of water, which winds its way through the farm, and in two places makes a plunge of nearly 100 ft. At the writer's suggestion Mr. Franklin consulted the different libraries in San Francisco and Sacramento to see if he could find some information on how to build an electric power plant that would run for, say, a week at a time, without any attention and which might be controlled from the residence; that is, started and stopped, as well as governed. After seeking in vain for information, he appealed to some engineers who told



FIG. 3.—VIEW OF TRANSMISSION LINE OVER HILL.

him that such a thing would not be practical. He was able to get all kinds of information on large commercial plants, but, as far as a farm plant was concerned, no practical information was at hand.

The writer was then asked for help, and he decided to work the problem out on his own ideas. How this was done and the results of this piece of engineering are here given:

The flow of water during the summer months is restricted to a few miners' inches and it was found necessary to provide a reservoir which would store up a considerable supply of water at slight expense. An old miners' ditch, which had been used by the early placer gold miners, was enlarged and deepened so that its storage capacity is about 100,000 cu. ft. The ditch was provided with head gates and spillways, and the water of the little stream was turned into it. From the lower end of the ditch, which is provided with a pressure box, admitting water to the intake, a 6-in., No. 14 riveted-steel slip-joint pipe 445 ft. in length is carried to the foot of the falls, where the power house is situated. The intake, which is 12 in. in diameter, is provided with a wire screen of 0.5-in. mesh. The pressure box, into which the intake extends, is covered over and is also provided with a rack which keeps out all débris. When it is desired the intake can be closed, thereby shutting the water from the pipe line.



FIG. 1.—THE FALLS. FIG. 2.—OLD MINER'S DITCH CONVERTED INTO A RESERVOIR. FIG. 4.—PIPE LINE AND POWER HOUSE IN DISTANCE.

The power house is situated in a canyon at the foot of the hills, but high enough so as to be out of flood water during the rainy season. It is a well-built structure, 18 ft. x 8 ft., with a 2 ft. wall plate, and strong enough to support machinery much heavier than the present installation. The water-wheel is a



FIG. 5.—WASTE GATES AND HEAD GATE OF RESERVOIR.

ft. Pelton of special design and was built by the Pelton Water Wheel Company in its San Francisco factory. It is furnished with ring-oiling bearings, and has run for weeks without any attention. The effective head under which it works is 75 ft., the static head being 80 ft. One end of the shaft carries a 24-in. pulley with a 6-in. face and extra heavy rim, so that with the heavy water-wheel, the couple act as a flywheel in maintaining absolutely constant speed, which is a requirement in the operation of dynamos for incandescent lighting. The other end of the shaft carries the governor pulley. Three nozzles, 1 in., 1¼ in. and 1½ in. in diameter, respectively, are provided and are interchanged according to requirements. When the water supply is short the smallest nozzle is used. The wheel, by careful test, shows a very high efficiency. With the 1-in. nozzle 2.74 hp is obtained, and with the 1½-in. nozzle exactly 6 hp is obtained. The water is supplied to the wheel through a 3½-in. Lunkenheimer stem valve which is operated by a 5-ft. lever, full valve being obtained by swinging the lever through 80 deg. of arc. The lever may be operated either in the power house or from the residence about a quarter of a mile distant.

The electrical machinery in the power house consists of a Western Electric compound-wound, 240-volt generator, with a rating of 4½ kw. It is driven at a constant speed of 1200 r.p.m. by a 4-in., four-ply rubber belt from the water-wheel pulley. Current at an initial pressure of 240 volts is carried to the distributing board in the residence about a fourth of a mile distant over a No. 8 hard-drawn copper transmission line strung on 20-ft. poles with 4-ft. cross-arms, the poles being spaced about 100 ft. apart. The voltage drop is such that the voltmeter on the switchboard at the residence indicates 220 volts, as 220-volt lamps and motors are operated from it. The residence and Mr. Franklin's den are furnished with about 50 lamps, while about 25 more are distributed about the farm buildings. The motor circuit connects with a 3-hp, 220-volt Western Electric motor, which is placed in the basement, and besides operating a centrifugal pump, drives through line-shafting the washer, wringer, churn, cream separator, grindstone and a circular saw for sawing wood up into stove size. The motor has its starting box at the switchboard, so that the pump or other machinery may be started and stopped without going near it. Besides, the line-shafting is provided with tight and loose pulleys which makes it possible to start or stop any piece of machinery without stopping the motor.

The pump above mentioned lifts water from an almost inexhaustible well to a reservoir dug in the hill-side and connected to the pump by a 2-in. pipe 250 ft. long. The reservoir has a capacity of about 6000 gal. and is placed 40 ft. above the level of the pump, furnishing the kitchen, bathroom and laundry with water at a good pressure. In the front yard there is a hose connection with a hydrant which furnishes water to the lawn and may also be used in case of fire.

In the kitchen electrical cooking and heating devices are liberally employed, and the use of an electric iron in the laundry does away with the necessity of building a fire in the stove on ironing day. Small electric stoves are also used in the living-room and bedrooms, since there is always an excess of energy above that necessary for lighting.

The most important and interesting fact regarding this plant is that it is operated from the residence, which is a quarter of a mile away from the power house. It is not necessary for anyone to go to the power house to turn the power on or off—that is, to start or stop the water-wheel. To the right of the switchboard is a crank attached to a shaft passing through the wall to the outside. This shaft carries two winding drums about 2 in. in diameter and securely keyed to it. Around each drum is wound in an opposite direction a flexible wire cable. The cables pass from the drums upward to pulleys fastened to the side of the house, then through a single block tackle and the ends returned to a staple in the wall. The pulley-blocks are attached to two galvanized-iron wires strung over pulleys on the poles just beneath the copper transmission wires; these wires pass through bushings into the power house, the ends



FIG. 6.—VIEW OF EXTERIOR OF POWER HOUSE.

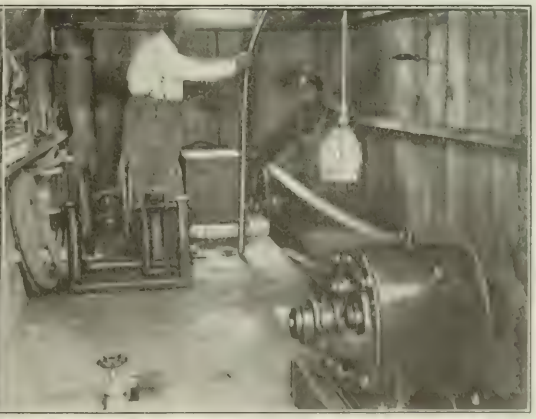


FIG. 7.—VIEW OF INTERIOR OF POWER HOUSE.

being connected to a flexible-wire cable passing through two pulleys, one on each side wall and directly in line with the gate-valve lever before mentioned. The upper end of the lever, which is about 5 ft. long, passes through an iron ring which is connected by two single pulley-blocks to flexible cables. When the crank at the residence is turned to the right, or the direction marked "on," the gate-valve lever is drawn to the right and the valve opened, admitting water to the wheel. Turning the crank in the opposite direction closes the valve. Owing to the small diameter of the winding drums and the added purchase of the pulley-blocks and crank handle, the valve is so easily operated that a child can turn the power on or off. As the switchboard and voltmeter are directly in front of the one operating the crank, the amount of power to be turned on can be closely regulated. An electric buzzer on the switchboard tells when the gate valve is tightly closed.

Mention was made of the governor. This is a small machine of the differential-gear type. The constant-speed wheel of this governor is driven by a small Pelton water-wheel, and the variable-speed wheel is belted direct to the water-wheel shaft. It operates a deflecting hood placed in front of the nozzle. The governor, however, is seldom used, since it consumes power and at the same time is not needed for constant loads, such as lighting and operating the motor for pumping purposes. When the motor is operating the washer, wringer or other easy-running machinery the variation in speed when the load is thrown on or off does not count for anything. The only time when the governor is necessary is when the motor is operating a circular saw for cutting wood into stove lengths.

As all farm equipments should be, this little electric plant is as nearly proof against careless handling as was possible to make it. Further than this it requires practically no attention and the power house need not be visited more than once a week, although it may be carrying its full load nearly all the time.

The average night load is about 5 hp, which is sufficient for all the lamps. During the day the energy is used variously for pumping, washing, etc., so that the amount of electrical energy used on the farm, if valued at the rate of 10 cents per kw-hour, would be worth more than $700 per year. When one considers the fact that the plant did not cost more than $1,500, which includes costly fixtures, water-works system, etc., it is evident that it is paying a handsome profit on the investment, the cost for maintenance being practically nothing.

Alternating-Current Industrial Power Plants.

By Warren H. Miller,
Electrical Engineer, Standard Oil Company.

ALMOST all large industrial establishments are the result of slow growth from the time that some one man of inventive genius and forceful personality began making something necessary to the people and made it honestly enough to retain the confidence of the buying public. The industrial engineer, whether as an employee of the works or as a consulting adviser, has frequently to deal with the modernization of such works, since, sooner or later, the ancient engines, waterwheels and other such wasteful prime movers that have served the growing company faithfully for so many years must be displaced by a modern station distributing the energy electrically. Compared to the public service corporation power houses these plants are never very large. One rated at 2000 kw will run a very large establishment, and even one rated at 100 kw will take care of quite a large concern, principally because the rating need never be much more than 40 per cent of the total motor horse-power, which itself is not large for groups of machine tools. Almost the first question that arises in modernizing the power equipment is over the choice of alternating or direct current, and it is the purpose of this article to show what can be done with the former, beginning with the smallest possible plant.

About the first thing to do is to get in touch with the foremen of the various departments and thresh out approximately what loads will come on and for how long, and once this information is really accurate, a rough load chart can be made up from which the wisest selection of the power units can be made. In further selecting engine sizes to fit these units, it is of prime importance to remember that the average industrial plant power factor seldom exceeds 75 per cent, and that it is therefore essential to consider an engine horse-power as equal to a kilowatt or kilowatt-ampere. This point is not only often ignored in practice and a kilowatt taken as 1.3 engine horse-power, with consequent poor steam economy, but the power factor and efficiency of an alternating-current plant get confused in the engineer's mind, whereas the efficiency is usually about 90 per cent, more or less. In every case the motor must be large enough to take the maximum load, whereas, nearly all the time, the load actually on is less than 50 per cent maximum, since this or that tool is idle while work is being set up in it or light cuts are being taken. The low power factor of an induction-motor load is not especially detrimental and causes no practical loss except when the generator is too small for the engine. It requires a large component of wattless current in the wires of the generator, though it is not felt by the engine. Both the field and armature circuits of the generator will thus become heated long before the engine is fully loaded. On account of this condition, for industrial work, it is poor practice to employ a generator having a kw-rating any less than the hp-rating of the engine.

Even in small sizes an alternating-current plant need be only a little more complicated than an equivalent direct-current installation. In spite of the far greater superiority of the induction motor as a shop prime mover, engineers are reluctant to adopt a small alternating-current installation on the score of complexity at the power house. The facts are just the reverse. Paralleling alternators is quite simple, and with good engines, when once in parallel, they divide a fluctuating load better than compound-wound direct-current machines, and there is no upkeep of brushes and commutators. All such devices as synchroscopes, power-factor meters, frequency indicators, three ammeters for each generator, etc., which are often saddled onto the most diminutive alternating-current installations, are best left to the large power plants. They simply complicate a small board without adding one jot to its practical usefulness.

In selecting prime movers for the alternators one should flee all belt-driven arrangements and make the installation direct-connected throughout, both generator and exciter. The smallest direct-driven unit made is rated at 50 kw, and from that up there is a wide range of sizes available. The exciter is coupled to the stub end of the engine shaft and is virtually a large-framed, direct-current, slow-speed generator of about one-thirtieth the rating of the alternator. In selecting the engine to drive machines, get the best. The high-class engine builders not only put in plenty of metal where it is most needed, but invariably supply an efficient continuous-oiling system reaching every part of the engine as part of the equipment. In smaller plants this enables the electrician to attend to all sorts of outside work, merely visiting the engine occasionally to see that nothing is heating up. The two bearing engine has many good reasons for preferment, the principal being that two bearings not only divide the load equally, but are easier to line and keep lined up as they wear. In the three-bearing unit the load is lopsided, giving uneven wear on the bearings, all three of which must be in line. The latter is preferable, however, in direct-current work owing to the practical objections to turning up the commutator on the long shaft of the two-bearing engine with its accompanying flywheel. This must be shipped to the electrical manufacturer, pressed on the shaft and then swung in a lathe, flywheel and all, and a few thousandths of an inch turned off to get the commutator absolutely true. With the rings of the alternator no such accuracy is required and the revolving field structure is pressed on the shaft in a few hours' time by the erecting crew. Of course, in a three-bearing unit the armature shaft is made separable and can be swung in an ordinary lathe at such times as it becomes necessary to turn up the commutator. In

the event of a burned-out armature section the engine does not have to be pulled apart in either case. With the two-bearing engine the field structure is simply moved to one side, uncovering the armature, and in the three-bearing the armature itself can be taken out of the engine.

In any event, the purchaser should look carefully to the oiling system the engine builder puts on. If it needs a pump, the whole responsibility for the running of the plant is on the check valves of the pump, and a fine piece of grit can, and will, get under the check valves and shut down the plant with melted-out crank-brass babbitt. If a splash system of oiling is employed, sure-to-work arrangements should be provided to get oil to every working part and get it back again. While on the subject of oils it might be pointed out that many a first-class engine has been thrown into the scrap heap for lack of proper oil. Just because the engine may be small, say, 100 hp, the engineer goes up to the machine shop and gets a can of ordinary machine oil to put into the crankcase. It doesn't worry him in the least that the floor of the engine room is soon covered with half the oil he put in, nor that a knock is developing in the crankpin, which was as closely lined as steel and brass will permit. He simply takes out another liner and then wonders why the pin is knocking again inside of 48 hours. The sole trouble is that the oil has not enough body and the pin throws it off like water, and no amount of splashing will force it in between the steel and the brass. If one of those gravity systems with little sight-feed needle valves at every bearing is installed, trouble looms large ahead, for the only remedy for too light an oil is a heavier one, or else the admixture of about one-fourth cylinder oil to give it body. In either case the heavy oil will not feed through the needle valves with any certainty. The usual remedy is to cover the engine with lubricator cups, just as is done after a few trials of the oil-pump scheme.

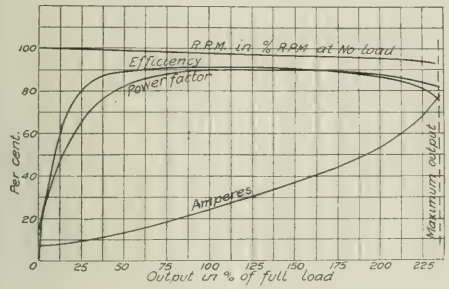


FIG. 1.—CHARACTERISTIC CURVES OF INDUCTION MOTOR.

As regards governing the engines for parallel running, all the high speed engines are very easy to manage, provided only that the governor is of the flywheel type and reasonably sensitive. The writer has paralleled four alternators driven by engines with as many different makes of Rites governors, the engines ranging from 300 hp down to 65 hp, and had no trouble in making each engine carry its share of the load. This is in three-phase work, which is the only system considered for industrial plants having a mixed load of motors, arcs and incandescent lamps. In selecting the frequency either 60 or 25 may be used, preferably the former, without getting into serious difficulties, except in the arc lamps. There has not as yet been developed a really good 25-cycle arc lamp to the writer's knowledge, though the flaming arcs do well on 25 cycles out-of-doors or in large power houses. The tantalum cluster, however, enables this question to be handled without much difficulty. A frequency of 25 cycles is superior in that standard motor speeds of 750 r.p.m. to 500 r.p.m. are much handier for shop drives than the 1200 r.p.m. of the 60-cycle motors, and if a 720-r.p.m. motor is obtained the cost will be about equal to that of the 25-cycle motor. However, unless there is some special reason to the contrary, 60-cycle equipment gives the cheapest and most flexible arrangement and will parallel quite as well with high-speed steam engines as will 25-cycle machines.

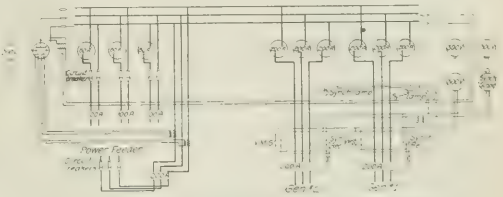


FIG. 3. DIAGRAM OF SWITCHBOARD CONNECTIONS

Having selected engines and generators, the next care will be the switchboard. In this the purchaser should aim above all for simplicity. The switchboard manufacturers have standard panels which cover requirements quite completely, but even these are often too full of interesting, but unnecessary, instruments for a small plant. A good indicating three-phase wattmeter is the most valuable instrument that can be placed on the board. It tells just what the machine is doing,

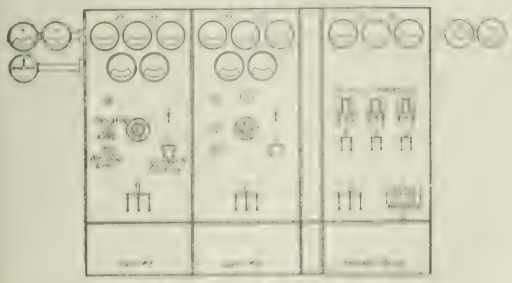


FIG. 2. ELEVATION OF SWITCHBOARD

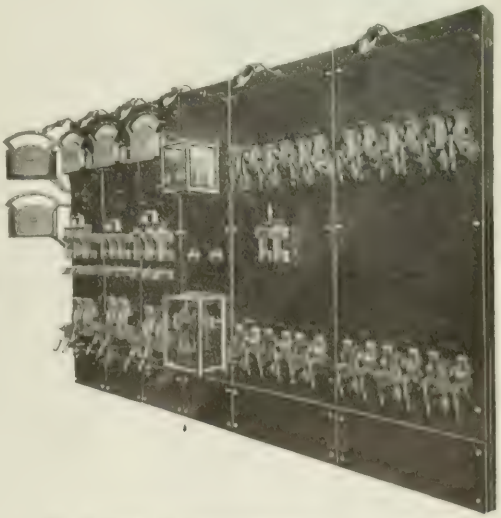


FIG. 4. VIEW OF ALTERNATING-CURRENT SWITCHBOARD

whereas the readings of the ammeter, or ammeters if there are three of them, are interesting, but not impressive. If two machines are running in parallel all the six ammeters may be reading exactly alike, although one machine may be motoring the other, and one set of ammeters registering not output, but

input, all of which the indicating wattmeter will be sure to point out.

All first-class panels should be in three sections: about 20 in. for the top, 48 in. for the middle and 20 in. for the foot section. Standard width appears to be 32 in. There will be one panel to each generator and one each for lamps and motors. In Fig. 4 is shown a fair board for a small installation having a mixed load. On these small boards there is no need of the expensive central-station instrument costing from $50 to $300 each. Neither ammeters nor voltmeters should cost much over $20 each. As this board controls lamps as well as motors in about equal proportions, it is worth while to have three ammeters, since the lighting loads are often very much out of balance on the different phases, and they are accordingly mounted on the top section. On the central section are the exciter voltmeter and ammeter, the generator-field switch, synchronizing lamp, voltmeter and synchronizer plugs, concentric rheostat handles and main three-pole switch. The concentric mounting of generator and exciter-field rheostats is a feature well worth while. Both are then under the hand of the operator, a valuable factor in quick balancing of the load. The generator resistance controller is mounted on a spider behind the board and carries the exciter rheostat on its back.

On the edge of the first generator panel is secured a swinging bracket carrying the bus voltmeter and the incoming machine voltmeter, which latter is connected to the voltmeter plugs of all the generator panels. By this means the voltage of any incoming machine can be adjusted to match that of the busbars. The illustration shows a second bracket carrying a spare voltmeter and a synchroscope. While the former is useful so long as thunderstorms continue in business, the latter is not worth its cost in a small plant, and even in a large one is of little use except to the engineer at the throttle of the incoming machine. No switchboard man would depend upon one to get his moment to throw in the switch, as most synchroscopes will point to zero with the lamps anywhere from dull red to black, and either coming in or going out of phase.

In laying out lighting panels, a single ammeter to each phase is advisable if the three lamp circuits start at the board. These circuits should be as near balanced as possible for the sake of greatest efficiency in running, but practically it makes no difference whether balanced or not, and one phase may have no current on it at all. The machines will continue to run month in and month out, only the plant is losing a little in efficiency and the wiring should eventually be arranged to balance all three circuits.

The motor panel should have as many three-pole switches and as many three-pole circuit-breakers as there are feeders. Each should have a watt-hour meter of the round switchboard type now on the market. This not only tells the operator at once whether energy is being used on that line, but also approximately how much, and at the end of the month saves much friction in charging the energy against the various departments. In a small board it is possible to combine the motor and lamp panels in one by mounting an indicating wattmeter in a swinging bracket together with the ground-detector voltmeter. In this case the panel would have the lamp ammeters on the top section and the motor and lamp switches and circuit-breakers mounted on the middle section, the circuit-breakers and switches being placed in horizontal rows, the former being in the bottom row. As regards the ground detector, there is still room in the market for a detector that will not ground one side of the system, thus cutting the available insulation in half. The static ground detectors listed are, of course, not to be thought of with the ordinary industrial plant. All the wire in the system would not furnish capacity enough to get anything reliable out of the detector. To date, the old-fashioned method of grounding the three legs of the system at the noon whistle through a three-point switch and voltmeter appears to be the only dependable scheme.

Assuming that the instruments have arrived, the first thing to do is to unpack them, and here is where trouble enters. One make requires every panel to be drilled with a small hole to pass a back-connected ground wire. Another make has the moving parts securely tied up, but nothing is said of this, so the electricians are liable to connect them in and close the circuit without taking off the carefully sealed case to investigate. These instruments have a small oil tube which is inserted after the instrument is set up on the board, which tube acts as a dead-beat dampener. There is also a small rider which will load the needle down to a red mark if the instrument is properly mounted and has not been damaged.

No matter which make is purchased, all should be rung out with the magneto and all the fuses tested. The voltmeter resistance is apt to have one of its fine wires broken; the ammeter may be open-circuited; the instrument transformer fuses may be inoperative; and one should know these things before turning on any circuit. The really interesting part of the board is the back of it. The three busbars are mounted horizontally side by side in heavy slate holders secured in cast-iron brackets bolted to the angle-iron framing of the board. It is advisable to tape and shellac the buses and all the leads to them from the machines and feeder switches for safety in working behind the board. Furthermore, electricians are prone to do careless things, such as leaving a screwdriver or wrench on one of the buses and forgetting all about it, until the main switch is thrown. On boards where the buses are alive all the time the danger comes from men working behind the buses with either a screwdriver or small wrench and getting badly burned from some inadvertent short-circuit in spite of all their care.

The first things to connect in are the main machine leads. One should be very careful to see that the A, B and C leads always enter the same busbars. Before synchronizing try the machines, one at a time, on some motor out in the works. If the motor reverses with any one of them, that dynamo's leads are crossed. The exciter leads should also be followed out to see that the positive always runs to the same side of the generator field switches. This may be tested while running by putting a compass under the positive wire. Its north pole must always stand on the same side of the wire. An indication should be made on the wire for future reference when once its polarity has been ascertained.

After following out and connecting in the field resistance leads, one can go over the work on the generator resistance. This is a cast-iron grid affair which is separate from the controller, and is mounted on a spider back of the board. The best thing to do with these grids is to bolt them to the wall in some convenient spot back of the board. Cover the whole set with No. 18 galvanized sheet iron, turning the iron over the top in a hood to provide ample ventilation and to keep dust from settling on the grids. There are some 50 taps on the grids which connect to corresponding buttons on the controller by means of the wire furnished. Every separate grid should be first rung out with the magneto. Being cast iron they often break in shipment, and as the break is usually inside the eye cannot detect it. The resistance being in series, any break will cut out all the sections until the controller passes the break. Then the exciter load is suddenly thrown on the generator with resulting excessive over-voltage. If the generator is a large one the grids will come in separate frames, about 25 grids in each frame. There are two extra taps in each frame marked A. The wiring diagram explains nothing about this, but by going into a trance one can surmise that A probably means "addition" and connect the two frames by a wire joining these taps. Of course, the controller leads connect the grids, but do not connect the sets, though it appears that way at first sight. The last thing to do with the resistance grids is to look them over to see that the electricians have left no washers, nails, bolts or other short-circuiting material lying on them.

The board is now ready, except for synchronizer and wattmeter connections. The former are simple enough, but require close watching to insure that the leads are never crossed. Two small voltage transformers are mounted on the back of the board. The line-voltage side of one is connected to the

buses and the line-voltage side of the other is connected to the synchronizer plugs of each machine. The pair of leads from each machine has a tap to the synchronizer plug of its own panel. The low-voltage leads of the two transformers are connected to each other through the synchronizing lamp. Now, the synchronizer plug is a reversing device in most boards, so that the current from any incoming machine flows through its transformer in the *opposite* direction to the current flowing through the transformer on the buses. So that if the incoming machine is in phase with the busbars, the two voltages in the transformer will be exactly opposite, so that no current will be produced and the lamp not be lighted. As the machine runs out of phase with the buses, the more in unison become the two voltages in the transformers so that finally they are in the same direction and the lamp lights to full brilliancy, the machine being completely out of phase. The engineer at the throttle of the incoming machine can usually place the speed so that the machines will slip one pole in about eight seconds, which is ample time to throw in the switch when the lamps are dark. When placing a new machine in service, one cannot be sure that the lamp is so connected as to be dark at the full-in-phase position except to connect it on its own panel. The two transformers are now on the same machine, the leads to the synchronizer plug, and are in phase so that the lamp should be dark. If it is not, one should cross the leads to the synchronizer plug. The synchroscope will indicate zero at either full-in or full-out of phase, so that one cannot be reasonably certain which is which except by the lamp trial. A good precaution to take with any incoming new machine coming on for the first time is to disconnect its leads to the buses and fuse them to the buses with 100-amp fuses. These will blow sharply if any mistake has been made in either transformers, phase rotation or identity of leads, but will hang on for some time if the machine is connected in right.

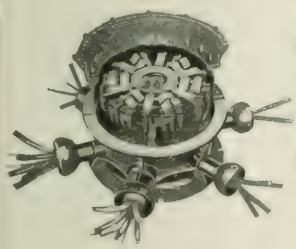


FIG. 1.—EDISON TYPE JUNCTION BOX.

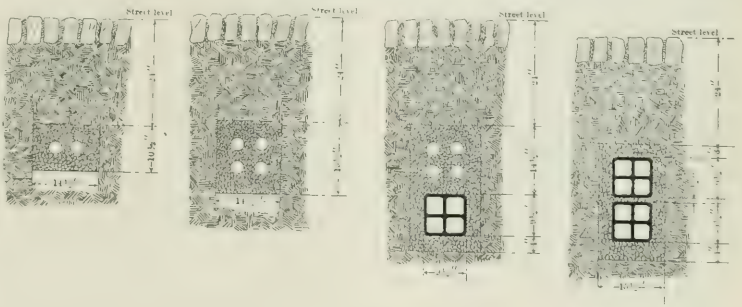


FIG. 2.—TYPES OF DISTRIBUTING CONDUIT.

For material and finish in industrial-plant boards the handsomest and easiest to keep looking well is black enamel. It sets off the polished copper-work and the black finish of the instruments very well and will not take oil stains or look dusty and greasy as marble often does. Green or purple Vermont slate, 2 in. thick with ⅜-in. bevel, gives a board free from cracks, loose cleavage and iron veins. For small low-tension panels blue Pennsylvania slate will answer. The various marbles are none of them very pleasing in proportion to cost excepting the white Italian, quarried in New York State, which is very fine for panels and, because of their location, must be more or less showy. The pink Tennessee marble soon looks very dirty and the blue Vermont always gives an unsatisfactory color scheme. Given the slate it is an easy, though not very economical, matter to make a board. Slate is drilled with an ordinary twist or blacksmith's drill and carpenter's brace, requiring no other pressure than a man's own weight. False holes can be plugged up with neat cement and a very presentable panel for some out-of-the-way generator or synchronous motor made up out of an old panel, no matter how holey. A "satinized" finish can be given it with shellac and lampblack.

The Arrangement of Underground Conduit for Electrical Distribution.

By Sydney W. Ashe.

IN the Edison underground tube system of electrical distribution, which has been in use for many years throughout the United States, the conductors are enclosed in iron conduits before being buried in the ground. This system, while serving the purpose for which it was originally designed, has many disadvantages, principal of which are its lack of flexibility and its excessive cost of maintenance. These disadvantages have given rise to the development of the underground drawing-in conduit system of electrical distribution, which is rapidly becoming the standard system in places where the conditions warrant the high initial cost. The use of underground conduit systems of distribution is not alone confined to electric lighting systems, but is also used with modifications by electric railway and telephone systems. While the following descriptions apply principally to lighting systems, much of the data pertaining to conduit construction applies equally well to the other systems.

The underground conduit system consists of pipes or ducts made of iron, clay tile, wood, fiber or other material laid underground, with manholes, handholes or service pipes for access, and form a complete underground cableway between generating station, substations and customers' vaults or cellars. In other words, by this system it is possible when the conductors are installed to distribute power to the consumer from the main power house through an entirely underground system.

Sometimes an entire distributing system has overhead construction, while in other cases it is partly overhead and partly underground; but where the community is well built up, large parts of the system are usually underground.

Before describing in detail the drawing-in conduit system of distribution it is perhaps well to give the following brief description of the circuits of a modern lighting system: Starting from the main power house, considering an underground system, a series of passages or underground conduits convey three-phase, high-tension, alternating current at 6600 volts, 25 cycles, through lead-covered cables, three conductors in one sheath, to the substation. There it is lowered in voltage by transformers, converted into direct current, at 240 volts, and a three-wire system is produced by means of balancers and storage batteries. From the substation two-wire concentric cables carrying 240 volts pass through underground conduits to the manholes located on street corners, in the middle of a block, or in other suitable places. For several two-wire cables, one single neutral feeder is run to the manhole from the substation. It is the aim of the lighting company to have both sides of the system balanced, in which case there is no current in the neutral feeder. This condition, however, is not stable, so it is always necessary to run at least one neutral. To make this point clearer, suppose that four concentric cables, two-wire, of 1,000,000 circ. mil, 240 volts, are installed, then it would be desirable to install one 1,000,000 circ. mil cable as a neutral. Sometimes the light-

ing system becomes very much unbalanced, as in places where private plants have been abandoned for the lighting system, in which cases it may become necessary to run an extra neutral feeder in order to maintain proper voltage regulation. From the manholes, the feeders extend to junction boxes, close by, the Edison type being used. It might be interesting to state here that this is the only element of the Edison tube system which is now being installed in new work, and this is now being superseded by a new form of cable box termed the 1908 box. (See description given later.) The internal construction of the Edison junction box (Fig. 1) consists of three metallic rings, supported and insulated from each other and from ground, to which are connected the two concentric cables and the neutral feeder composing the three-wire system. These junction boxes have air-tight covers, so as to prevent water leaking through into them. They are connected by double sets of short lengths of pipe to the manholes for ingoing and outgoing cables. The distributing conduits also terminate in the manholes. These distributing conduits are shown in Fig. 2, where they are represented by 3-in. circular holes above the 3.5-in. rectangular openings of the feeder-conduits. In former years considerable trouble was experienced with the regular Edison junction box, as no method had presented itself for properly ventilating the box. The result was that gas would accumulate, become mixed with air, and explode when some of the terminals became loose and blow off the top of the manhole. With the modern system of connecting the junction box to the manhole by a short length of open pipe, the manhole having a sewer connection and a ventilated cover, it is hoped that no further trouble will be experienced in this direction. Inspection every three or four weeks, opening at the manholes, has also reduced this trouble to a marked degree.

The manholes are connected directly to the distributing ducts, which extend through the streets in front of the customer's premises. A service box is installed for about every five or six houses, the distributing ducts connecting them all together with the manhole. From the service box iron-pipe conduits extend into the customer's premises. Through each service connection are drawn three lead-sheathed cables which vary in size from a No. 8 B. & S. gage to a 1,000,000 circ. mil cable. With the smaller size cables the three of them, constituting the three-wire system, are drawn through the same iron pipe. With the heavy service connections separate pipes must be used. This pipe is 2.5 in. in diameter, and is not embedded in concrete. The three cables are connected in the service box to the mains and at the other extremity in the customer's cellar to the service cut-out and service switch. When the service connection is made both ends of the service pipe are plugged with waste and sealed with plaster of paris mixed with cement to prevent gas from leaking up from the subway to the customer's cellar. Formerly cement was used, but it was discovered that the cement combined in time with liquid acid refuse in the earth and destroyed the sheathing of the cables. The use of plaster of paris mixed with cement prevents this action.

PRELIMINARY PLANS.

For some cause or other the demand for an installation of a distributing system arises in some department of a lighting company. This demand may not necessarily mean the construction of an entire system, but may relate to any particular part of the system. It may be a subway, an extension of the distributing mains, a new service for a customer, or any one of many other demands. When this demand arises an inspection is made and a preliminary estimate of the cost of work is prepared. In making an estimate the work may be considered as being done by the company's staff of employees, or part of it may be considered as being let to contractors. It is very difficult to make an accurate estimate of the probable cost of subway construction, for there is no method of predetermining what obstacles in the nature of pipes may be encountered, although in some cities plans have been prepared by the city authorities showing the location of gas, water and sewer pipes, telephone, telegraph or electric-light conduits, and any other pipes or subways which are installed in the various streets. This system is now being instituted by the Public Service Corporation of New York for streets in which there are proposed railway subway lines.

Preliminary estimates with costs, plans and details of the proposed work are then sent to the general superintendent of the company for consideration. When the work has been finally authorized, the permits for opening the streets are obtained from the city authorities. At least three permits have to be obtained in a city like New York before the work can be done: one from the Department of Water Supply, Gas and Electricity permitting the installation of the subsidiary pipe, which permit is known as the authorization; a second from the same department permitting the installation of the cables in the subsidiary pipe, known as the pulling-in permit; and a third from the Bureau of Highways allowing the opening of the street. Should the pavement of the street be either asphalt or wood-block, a permit must be obtained from the pavement company having the maintenance contract, before any action will be taken by the Bureau of Highways. Again, should the street be under the jurisdiction of the Park Department, for example, Fifth and Eighth Avenues from Fifty-ninth to 110th Street, Riverside Drive and Seventy-second Street, or under the jurisdiction of the Dock Department, such as South, Marginal or West Street, additional permits must be obtained from these departments. Bids are then advertised and contracts let, such materials as the company is to supply are ordered by the purchasing agent of the company, providing sufficient materials are not in stock, and the work commences. As the first point in the construction of a subway system is the excavation, the following details are given:

Excavation.—When about to make excavations, the streets to be opened and all things concerning the manner of doing the work are determined by the company's engineer. The actual work is usually done by contractors. Should the work be done by the company's own employees the following details would apply to the company instead of the contractor: The contractor makes all excavations for laying the conduit and when the conduit is properly installed and inspected, refills all excavations and replaces the paving over them in accordance with the current specifications for that class of work of the Department of Highways of that borough. This statement applies to a large city like New York. He also keeps the streets in repair for one year, and cleans and sprinkles them until released by the Department of Highways and the Street Cleaning Department. During construction the contractor does all ditching, bailing, sheeting, shoring, guarding, lighting and watching, besides making all provisions necessary for maintaining and protecting all buildings, poles, sewers, railroads, subways and other structures, and repairs all damage done to them as well as providing and maintaining all bridges, fences and other means necessary for the maintenance of travel on the streets in which the excavations are made. He also provides convenient access to stores and dwellings of abutters, refills all excavations and resurfaces streets, carts away all rubbish and surplus material, furnishes all materials (except castings for manholes and boxes), tools, implements of labor and completes the work subject to the approval of the company's engineer and is subject to his direction at all times.

Proper plans are furnished by the company to the contractor showing in detail the work to be done. The drawings and specifications should co-operate so that no confusion of instructions will result. The material excavated from the trenches, and that used in the construction of the work, must be deposited so as not to endanger the work and so that free access may be had at any time to all hydrants, catchbasins, manholes and other necessary places in the vicinity of the work, all material from the trenches being deposited at least 18 in. from the trench and on one side only when so ordered. As the work progresses all surplus dirt and other useless materials from the trench should be removed by the contractor. The trenches and excavations should be refilled with the rest of the excavations, spread in layers not to exceed 6 in. in depth, thoroughly tamped and freed from stones. The surface of the

streets, including roadways and sidewalks, should be left in as good condition as before the excavation began. When streets are tunneled, they must be broken through and thoroughly tamped.

The depth of all excavations for conduits should be such as to leave a space at least 24 in. between the top of the concrete over distributing conduit and the street surface. The excavation should be of sufficient width to give at least 3 in. clear on each side of the conduit. The trenches when completed should be straight and true between adjacent manholes and so graded that water will flow into one manhole. In the Borough of Manhattan, New York, the city ordinance requires 4 ft. of clearance over the manholes (See Fig. 3), to allow for water pipes and gas pipes. This makes the total depth of the manhole quite large, about 12 ft., so to decrease the cost of excavation ducts are buried in the street at normal depth and slanted down at the manholes (see Fig. 3). The excavation should also be free from foreign pipes. Sometimes obstructions are encountered, in which case a manhole is constructed near the obstruction. As previously stated, the line of conduit must be straight for it would otherwise be difficult to rod the ducts and draw in the cables. Where single tile is used it can be built in around some obstructions. When it is necessary to prevent caving in, the sides of the trenches should be supported by suitable planks and shoring, and the trenches should also be kept clear from water by draining, pumping and bailing.

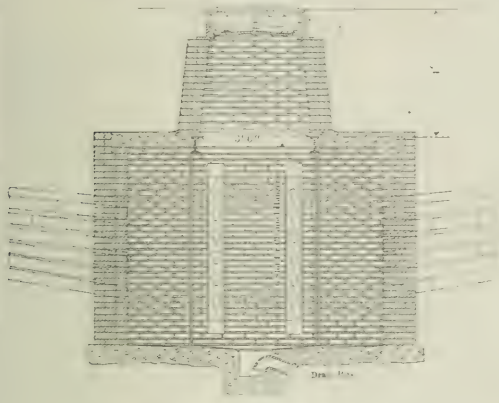
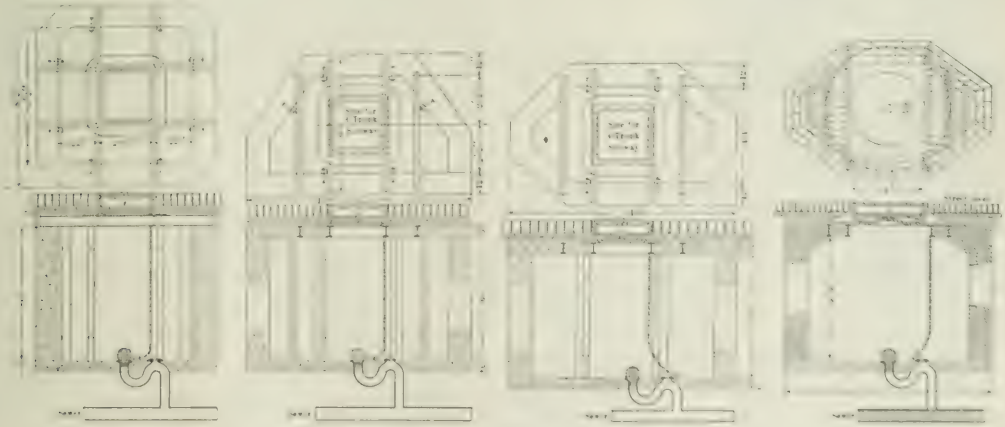


FIG. 3.—SECTION OF BRICK MANHOLE.

Wherever it may be necessary to interfere with the service of any street railway or steam railroad of a foreign company satisfactory arrangements should be made between the railway company and the contractor for properly protecting its traffic. Should any accident occur due to a defective condition of the street surface where the excavation has been made during a period of one year after the work is completed, the contractor should be liable and not the operating company for whom the work is being done. All gutters, curb, flag and paving stones which may have been displaced during the progress of the work should be reset, and when broken should be replaced, the work being done by first-class pavers. In laying out the possible line of the conduit, test-holes should be dug, one at the center of each block and one on each intersecting street corner, to ascertain the location of foreign pipes. Where rock is encountered, it should be removed, blasting when necessary, care being taken in such cases to prevent damage by carefully covering the blast-point with heavy timbers. Rock should be removed without blasting when there is danger of injuring gas pipes, water pipes or electrical conductors which are in close proximity.

Conduits.—Vitrified conduit is used almost exclusively at the present day for underground conductors, and therefore the descriptions below will be confined to this type. Conduit may be single duct, four or six multiple duct. They are 3.5 in. inside measurements, 18 in. long for single duct and 36 in. long for multiple duct. The bore of the conduit should be square and should have maximum and minimum dimensions of 3.75 in. and 3.83 in., respectively. The conduit must be straight, true and free from cracks, burrs, holes or other imperfections and should be thoroughly and evenly burned, vitrified and glazed, and free from iron. In fact, the interior surface must be free from any imperfections which will injure the cable when being drawn through, and which will not properly protect the cable when once installed. When laid end to end, the conduit must be square and true, dowel holes being opposite each other. Dowel pins are used with each length of multiple duct. Conduits are usually delivered at the point where they are to be used, the contractor being responsible for them from the time of delivery. Should any conduits be broken on delivery, the contractor rejects them, being in turn responsible for those broken after delivery.

Circular fiber conduit and iron-pipe conduit is now being used by some companies for the distributing cables. The fiber conduit is usually of the slip-joint type and is 3 in. inside measurement. The iron-pipe conduit is lap-welded, 3 in. inside measurement, 0.21 in. in thickness and is of 7.45 lb per foot



FIGS. 4, 5, 6 AND 7.—CONSTRUCTION OF MANHOLES.

nominal weight. It should be straight, true, free from scale or other imperfections which will injure the cable when being drawn through.

Subway Construction Details.—When the trench for the subway has been properly dug, inspected and passed, a grade stake should be located in the middle of the bottom of the trench at suitable intervals. The side frames should then be put in place with their keeper. A layer of concrete 3 in. in depth should next be placed in the trench, coming to the top of the grade stake. This concrete should consist of one part of Portland cement, three parts of sand and five parts of broken stone, the sand and cement being thoroughly mixed before putting in the stone. Use should be made of a good grade of sand which is free from loam, clay or any foreign substance. The stone may be trap-rock, granite or limestone which is free from dust, and must be of such a size that each piece will pass through a ring 0.75 in. in diameter. The sand and cement should be thoroughly mixed before putting in the stone, and when the stone is added the whole mass should be turned at least five times on a mixing board before placing in the trench. The tensile strength of concrete when hard is affected to a marked degree by the manner in which the materials are mixed. When the mixture has been placed in the trench it should be thoroughly tamped with wooden rammers until water appears on the surface. The concrete bottom of the trench should extend from manhole to manhole and the full width of the trench, and should set for 12 hours before the conduit is laid on it. Where fiber conduits are laid they should be placed horizontally, filling in around the sides and bottom with concrete. Where vitrified conduit is installed it should be laid straight and true and a mandrel should be used to align each duct. The conduit should be aligned also. No offsets are allowed except by consent of the company's engineer. All joints, except iron pipe, must be wrapped with unbleached muslin 5 in. wide and to overlap 10 in. on tile and 4 in. on the fiber conduit. Ducts should be laid so as to break joints, the entire joint being covered with a 0.25-in. layer of well-worked cement, one-half sand and one-half cement. When the subway is completed it should be tested by a mandrel 3.25 in. in diameter and 4 ft. long, pulled through each clay duct, and a mandrel 2.75 in. in diameter and 4 ft. long pulled through each iron or fiber duct. Any duct which is foul and will not allow the mandrel to be pulled through should be removed and re-

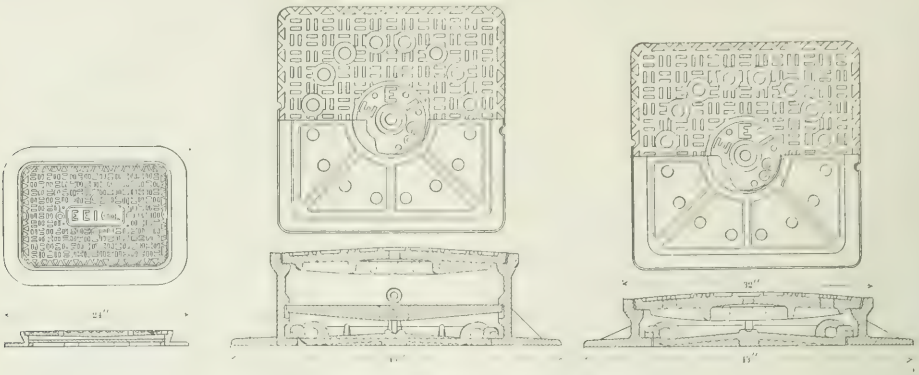


FIG. 9, 10 AND 11.—MANHOLE COVERS F2, F, AND F1.

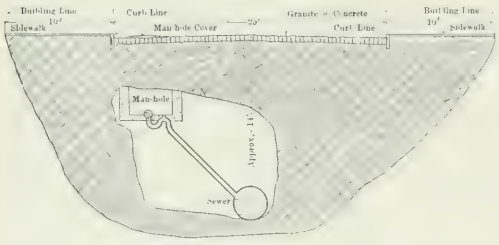
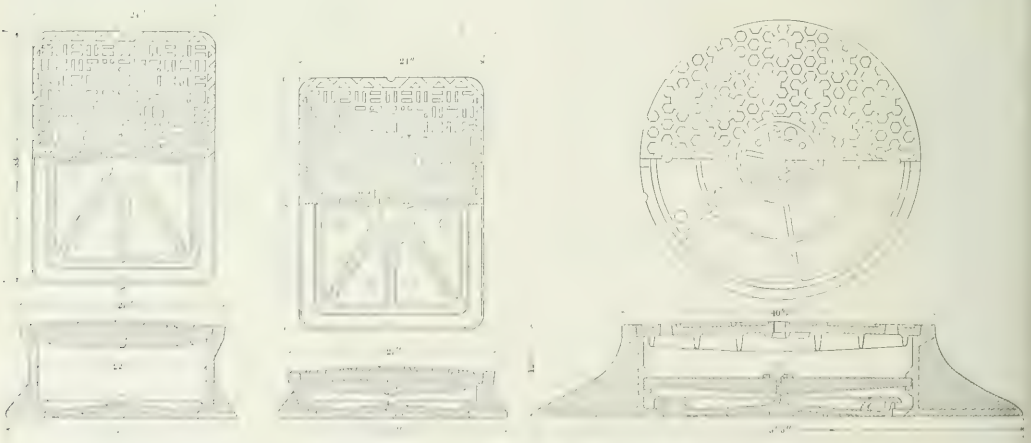


FIG. 8.—SEWER CONNECTION WITH MANHOLE.



FIGS. 12, 13 AND 14.—MANHOLE COVERS F3, F4, AND A.

placed at the contractor's expense. When the conduits have been laid in position, prior to testing, a 3-in. thickness of concrete should be placed on both sides of it, boards being used to insure the desired thickness. A top layer of concrete 3 in in thickness should then be installed. All concrete should set at least 12 hours before refilling the trench and resurfacing the street according to previous instructions. When it is desirable to use four-fiber ducts the retaining frame should be raised and two more ducts should be inserted. The trench should then be filled.

Above the feeder conduits are usually built the distributing ducts, as shown in Fig. 2. By having both the conduits and the distributing conduits in the same trench considerable expense in original construction is saved. These diagrams, Fig. 2, give all of the dimensions for the construction of standard subways. The details of the cost of this type are given below.

Manholes.—The location for manholes is usually decided by the company's engineer, the contractor digging at specified points a test-hole, at least 5 ft. deep, from the curb to the center of the street. Care must be taken to insure that no foreign pipes are in the manhole. Should any occur they should be removed to some other location, the cost of the removal being paid for as extra work. Manholes may be built of concrete or brick. Various forms of standard manhole construction are shown in Figs. 3, 4, 5, 6 and 7. Fig. 4 approaches the rectangular form. Fig. 5 is used when the space is confined and Fig. 6 is used most frequently for large subways. While many of the details of manholes may be specified, such as the casting for the top, sewer connection, location of cable-clamps, etc., it is seldom that the shapes of manholes may be made to conform to standard size owing to the many obstructions encountered in locating them. The writer has in mind one instance in a congested community where a line of subway was constructed in which out of 47 manholes only four could be made to conform to an original standard, the remainder calling for special construction and having irregular internal shapes. Rectangular manholes are not entirely satisfactory, because in fastening the cables in the cable-racks on the side of the manhole, the workman in order to make a neat piece of work will endeavor to use pipe or wood to make a rectangular bend in the cable as it comes from the duct, resulting too often in injury to the cable. A coffin-shaped interior, as shown in Fig. 7, serves to excellent advantage in obviating the above-mentioned difficulty. Each manhole should be provided with a sewer connection, as shown in Fig. 8, which in itself should have a trap to keep the sewer gas from entering the subway system. When this happens there is danger from explosions. The bottom of the subway should be graded so that water will flow toward the sewer connection. Ball screens, made of No. 6 galvanized wire (iron), with meshes close together, should be mounted over the trap, as shown in Fig. 8. A 4-in. wooden plug, thoroughly soaked in paraffin or oil, with 5/16-in. galvanized-iron bolt through the center, and a ⅜-in. galvanized-iron chain to fasten to the top of the manhole should be installed as shown in Figs. 4, 5, 6 and 7. In recent manhole construction, plug-and-chain connection is being omitted, as involving unnecessary expense. When constructing the manholes, double wooden frames are installed and concrete is rammed in between the two frames, thereby making a very substantial wall. When the concrete of the side-walls is set, and the sewer connection has been made, the side-frames are taken out and the concrete bottom is installed. Iron I-beams to support the top of the manhole are next put in place, concrete being placed around it and the cover arranged in position. Cable-racks are also installed on the side walls.

The various sizes of manhole heads are installed depending upon the size and the location of the manhole, and also whether it will be located in a street containing cobble or asphalt, a 12-in. deep head being used for one purpose and a 6-in. deep head being used for the other. It is the practice of some companies to use several types of manhole heads, known as the F_1, F_2, F_3, F_4, F_5 and A heads, as shown in Figs. 9, 10, 11, 12, 13 and 14. The F_3 and F_4 heads are used most extensively for ordinary work, the F_3 head being used for cobble and the F_4 head for asphalt. Where the manhole is built in a narrow place, such as a space between the car track and the curb, use is made of an oblong head, termed the F_5. If the manhole cover must be large enough to admit transformers to the manholes, use is made of a large circular head, known as the A type, illustrated in Fig. 14. The head is shown in position in Fig. 7.

In a subsequent article a description will be given of a recently developed type of junction box, after which cost data will be discussed in detail.

The Prevention and Removal of Boiler Scale—I.

By W. H. Wakeman.

WHERE effective measures are taken to prevent the formation of scale in boilers there would seem to be no necessity for devising ways and means for its removal, but this statement does not cover all points to be considered in this connection for the following reasons: If the steam boilers in a plant are new and free from scale only a preventive is needed, but where they have been used for several years and no special effort made to prevent the accumulation of foreign matter in them, a remedy is certainly needed, and at the same time care should be taken to prevent other scale from forming on the tubes and shell. In the case of a water-tube boiler, the sediment from impure water collects in the tubes, but the effect is the same, as fuel is wasted and boilers are worn out much quicker.

It is a fact worthy of careful consideration that if pure water is used in boilers it not only prevents the formation of scale, but natural conditions combine to dislodge and dissolve what was there, before pure water was substituted for that which is heavily charged with scale-forming impurities. Many manufacturers and steam users believe that if water is "clear as crystal" and appears to be suitable for drinking purposes, it must necessarily be just what is wanted for making steam, but this desirable state of affairs is not always realized in practice because some of the most objectionable impurities which have to be dealt with are not separated and thrown down until the temperature is raised above the boiling point.

There are two plans for introducing a compound for disposing of scale, one of which is to place a large quantity of the substance in the boiler at once, and the other is to send in more or less every day according to conditions. In some cases this is done during an hour (more or less) of running time, while in others it is continued through all of the time that water is going into the boilers. This applies to resolvents that are bought in solid form and dissolved in water, as well as to those that are sold as liquids. It requires intelligent investigation and good judgment to decide where to draw the line between purchasing a solid that is adulterated with harmful ingredients and a liquid containing a large per cent of water that might as well be secured from the nearest faucet free.

If all of the water used is "softened" no special restrictions need be laid on the quantity treated at one time, but if a certain quantity of resolvent is intended to go into a boiler to act on the water in it, care ought to be taken to know that all of it is properly delivered, not only because these compounds are usually sold at high prices, making it expensive to waste them, but in addition to this consideration is the more important fact that the omission or extraction of one ingredient may entirely change the nature of the remaining compound.

For illustration, the boilers of a certain plant were fed from a large tank during a portion of the time, and as they already contained some scale and more was accumulating, the owner purchased a compound in solid form, and the engineer put a prescribed quantity of it into the tank at stated periods. After several months of this service the tank was cleaned and a considerable portion of the compound was found at the bottom, as it had not dissolved. It is very probable that the portion which went into the boiler was complete as the inventor of it expected they it would be used as he delivered it. If the

result is not satisfactory in such a case the disappointment ought to be charged to mismanagement, not to the compound.

Another phase of this subject is illustrated by the following incident: A certain boiler was badly scaled and a quantity of dry compound was purchased to remove it, although no facilities were provided for introducing it into the boiler. As the engineer felt the need of some action in the matter, and he was accustomed to making the best of whatever situation he was placed in, he proceeded to cool off the boiler, get the water out and put a comparatively large quantity of the compound through the front manhole onto the first sheet, in a dry condition, as he did not consider it necessary to dissolve it in water. The boiler was refilled, fired up and used for a week, when it was again opened and a surprisingly large quantity of scale lay in a loose heap just where the compound was left. Of course, this scale came from all parts of the boiler, but it lodged directly over the fire. Fortunately it consisted of hard pieces which allowed more or less water to reach the plate. Had these been mixed with soft mud the result might have been disastrous, because it is more difficult for water to penetrate such a mass, hence there is danger of overheating the plate, and as hot iron is not as strong as the cold article, the pressure carried makes the hot portion bulge or bag, causing a dangerous defect.

Reviewing reports of 10 experiments made under conditions which resulted in comparatively small differences between the temperature of the furnace and of the water in the boiler shows that where the smaller difference was 301 deg. Fahr., the rate of transmission was 301 heat units per minute per square foot of heating surface. When this was increased to 848 deg. Fahr. the rate of transmission rose to 180 heat units per minute.

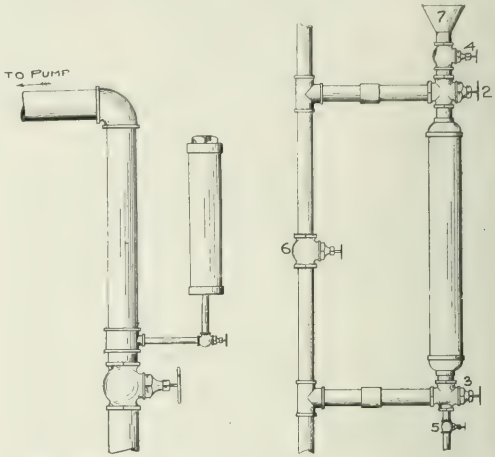
Taking the results secured by 10 other experiments in which the lowest difference of temperature between furnace and water was 1278 deg. Fahr., the rate was 446 heat units per square foot per minute. The highest difference was 1308 deg. Fahr. and the rate of transmission rose to 752 heat units. Inasmuch as a heat unit is sufficient to raise the temperature of 1 lb. of water 1 deg. Fahr., it follows that if water is delivered into a boiler at 212 deg. and raised to 352 deg. (which corresponds to a boiler pressure of 125 lb. by the gage), the latter rate of transmission is sufficient to raise more than 5 lb. per minute through this range. To evaporate water under the same conditions requires 1010 heat units per pound, therefore when the rate of transmission is 752 heat units per minute, or 45,120 per hour, nearly 45 lb. would be evaporated per hour, which represents about 1½ boiler hp.

While this rate appears to be abnormal, nobody can state positively that it is not approached, or even realized, in strenuous practice owing to the following conditions: In a certain very important case a boiler was tested to demonstrate its greatest possible capacity for evaporating water and it developed 1 hp for each 3 sq. ft. of heating surface. This included the whole boiler, but no boiler of an ordinary type has ever been built and put into service in which every square foot of heating surface is equally efficient in evaporating water, therefore, while the average in this case was 10 lb. of water evaporated per hour on each square foot of heating surface, it is quite possible that some of the heating surface was much more efficient than this indicates, while other parts did poor work accordingly.

The foregoing facts show that heat passes through clean boiler plate very rapidly, hence great care should be taken to avoid obstructions of any kind to retard its action, for if it does not pass freely into the water it will accumulate in the plate, which is not in accordance with good practice, hence the necessity for preventing the formation of scale.

Fig. 1 represents a very simple device for feeding compound into a boiler. It consists of a ½-in. nipple connected into the suction pipe of a pump, on the end of which is an angle valve carrying a short vertical nipple, followed by a reducing coupling. A piece of larger pipe, 2 ft. or more in length, is screwed into this coupling and a cap completes the device. The latter need not be put on tight, as it is only intended to exclude dust and give a finished appearance to the feeder. If the pump takes water from a well or a brook there is a partial vacuum in the suction pipe, therefore, when the angle valve is opened the atmospheric pressure forces the compound into the suction pipe. Where the supply comes under pressure through the vertical pipe, it is necessary to locate a valve below the feeder, as shown, and this should be partially closed when the compound is to be drawn into the suction or supply pipe.

Fig. 2 illustrates a more elaborate device for the same purpose, to be used in connection with a vertical pipe. The body consists of a piece of pipe large enough to hold the required quantity of compound after it is dissolved or otherwise prepared for use. It is assumed that this is larger than the connecting pipes which ought to be equal to the suction pipe, therefore a reducing coupling will be required for each end, followed by a nipple and a cross valve, with another valve in the main suction pipe, as shown. This device is operated as follows: When it is to be filled close valves 2 and 3 and open valve 4. Valve 5 should be opened to drain out any water that may remain in the body and then closed again. If the pump is running valve 6 must be open. The device should be filled through the funnel 7, then valve 4 closed, valves 2 and 3 opened, and valve 6 closed in the order mentioned. This will force water through the body and take the compound out with it.



FIGS. 1 AND 2.—SERVICES FOR FEEDING COMPOUND TO BOILERS.

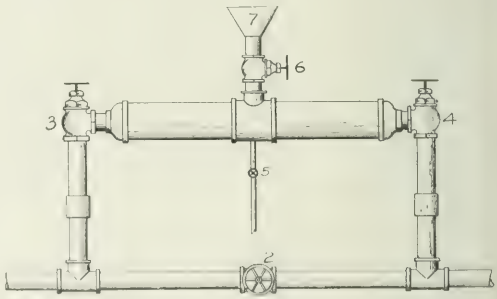


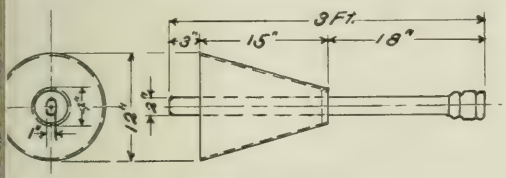
FIG. 3.—HORIZONTAL FEEDING ARRANGEMENT.

Fig. 3 shows practically the same device, but it is intended for use in connection with a horizontal pipe, hence there are slight differences in its construction. The valve 2 is in the main suction pipe, while angle valves are used at 3 and 4. A drip valve is provided at 5 and a stop valve at 6, also a funnel at 7. The operation of this compound feeder will be understood after reading the description of the preceding illustration.

LETTERS ON PRACTICAL SUBJECTS

SAFETY COMMUTATOR BRUSH.

The accompanying illustration gives the details of a safety ommutator brush for lubricating the commutators of rotaries nd large direct-current motors while in operation. As is evi- ent from the engraving, the brush serves as a protection to he hands and arms in case of a flash-over while the commuta- or is being cleaned. The brush is made from a 1-in. x 2-in. ine, 3 ft. long. Notches are cut in the side and a strip of can- as is wrapped and fastened in place near one end by cords rawn tight into the notches and then tied. A frustrum of a



COMMUTATOR BRUSH.

one similar to the usual megaphone is then made up from light ardboard. The small end is closed by a circular piece of ardboard fastened in place with glue. The cardboard should ave a slot cut in the middle of it just the size of the pine stick nd should then be glued securely in place, as indicated. A evice of this kind will be found very serviceable in connection with 60-cycle rotaries, which are prone to flash over at times.

LYNN, MASS. HOWARD M. NICHOLS.

A RAPID GRINDING AND SURFACING METHOD.

The scientific method of grinding a true surface is to place he object on the table of a high-grade surface grinder and hen work off the superfluous metal with neatness and despatch nd a soft emery wheel. But the electrician does not always ave an emery grinder, to say nothing of having an expensive urface grinder at hand when wanted. The next best way is to use the surface plate. The mechanic procures a sur- ace plate worth anywhere from $20 to $200 and smears it ightly with red lead in oil, or with lampblack or chalk, accord- ng to the nature of the article to be made true, which is then laced flat upon the coated plate and moved gently back and orth to rub some of the coating off upon the surface to be reated. Then, with chisel and hammer or file or scraper, he mechanic carefully removes those portions of the work which have been marked by the coating from the surface plate. This performance is repeated until the surface of the work has ecome sufficiently flat to answer the purpose. If it must be xceedingly true, then many repeated daubings and scrapings re found necessary, together with many replacings of the coat- ng on the surface plate. The mechanic must take great care ot to rub too much on the surface plate in the same spot, lest oles be worn in its surface and the plate thereby ruined for ll accurate work. By a method described below all rough sur- facing may be smoothed in a very short time with an accuracy lmost equaling the grinding and surface-plate methods. In fact, the surface plate may be used with this method, but there s no danger whatever that it will be dug full of holes. For nstance, let it be supposed that a 3-in. flange is to be trued up o that it will make a steam-tight joint with nothing but lumbago for packing. The surface plate is brushed clean of ll dirt and dust, and a sheet of clean emery paper placed flat on the plate, with the emery side uppermost. The emery cloth, which may be either fine or coarse as required by the amount of metal to be removed from the flange, is held in place on the plate by means of the thumb and fingers of the left hand, while the right hand is employed in resolving the flange upon the emery cloth. The flange should be held firmly, yet permitted to lie perfectly flat on the emery paper while it is moved in small circles over the surface of the emery paper. Every few minutes the flange should be lifted from the emery paper, which, in turn, is removed from the surface plate and all the metal cuttings and worn-off particles carefully shaken from it, after which the operation is repeated again and again until the desired degree of accuracy has been obtained. Care should be taken to revolve the flange in the hand at least 60 deg. every time it is lifted from the paper. This brings the cutting of the emery in lines which cross each other and there is less danger in cutting down one side or edge more than the others.

SCRANTON, PA. JOHN JACKSON.

DEMAGNETIZING A WATCH.

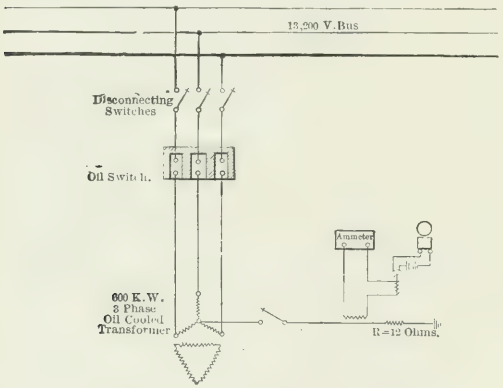
Not long ago I was shown through one of the new ocean palaces in company with a friend who was acquainted with the chief engineer, and in the course of our perambulations we went down into the electric-lighting plant, the size and equipment of which, by the way, surprised me, for I had no idea that an ocean liner possessed such a well-equipped electrical station, for aside from the lighting apparatus there is considerable electrical equipment for other purposes. I was naturally interested in this department of the ship and got into quite close proximity with some of the motors and dynamos. It then dawned on me that I had neglected to leave my watch upstairs, and I was sorry to think that it had become magnetized, for magnetized it was from the way it had already begun to act. The last time this happened to my watch it cost me a few dollars to get it into good running shape again, for I had to bring it to a watchmaker's, and, as is customary, he found several other things wrong with it besides the fact that it was magnetized. The engineer assured me, however, that it would not cost me any money or inconvenience this time, for he had a scheme of overcoming the difficulty that to me was quite novel. It was his method of demagnetizing the watch to which I wish to call attention. He strung the watch on a cord by passing it through the bow and held both ends of the cord between his fingers. He then turned the watch around and around with his other hand until the cord was pretty well twisted so that if the watch was released from his hand it would naturally unwind. Suspending the watch above the field structure of the dynamo so it was about three-fourths of a yard above it, he released the watch, thus permitting it to unwind, at the same time revolving it like a pendulum to and fro from the dynamo allowing it to come within a few inches of the machine. This process was repeated three or four times, which required very much less time than it takes to tell it, alternating on each pole of the dynamo, and the watch was returned to me with the guarantee that it would run as well as it ever did. I had my doubts about the efficacy of such treatment for magnetized watches, but to my surprise it had the desired result, for my timepiece continued to run accurately, after being set, and I have not had the slightest trouble with it ever since. Irrespective of what the explanation is, it occurred to me that this method may be new to some of your readers, and worth knowing as an interesting as well as a time- and money-saving means of demagnetizing a watch.

BROOKLYN, N. Y. L. F. HORTON

[The method of demagnetizing watches usually employed by jewelers consists in suspending the defective timepiece by means of a twisted string between the poles of a horseshoe magnet. As the watch revolves rapidly it is slowly withdrawn from the magnetic field. The whirling motion, of course, changes the direction of magnetization and by drawing the watch farther and farther from the magnet the effect of the field becomes less and less and the intensity of magnetization oscillates between values first in one direction and then in the other, but continually decreasing so that when the watch is entirely removed from the field of the magnet the main spring is no longer affected. By slowly withdrawing a watch from the core of an alternating current magnet the same effect is produced with no twisting motion. Ed.]

GROUNDING A TRANSMISSION SYSTEM THROUGH A SPECIAL TRANSFORMER.

The installation of a large transformer for grounding the neutral of a three-phase transmission system in the middle West possesses features of interest. The company has three stations; a large modern steam station, and two water-power plants. The alternators in the older of the water-power stations generate current at 3500 volts, while the steam station and the new water-power station feed the transmission system at the generating pressure of 13,200 volts. The step-up transformers in the old water-power station, which raise the voltage from 3500 to the generating and transmitting pressure of the other stations, are delta-connected on both secondary and primary. During the part of the day when the lightest load occurs this station has ample equipment to furnish energy for the entire railway system, and therefore the steam station may be shut down. Since the transformers in the old water-power station are delta-connected, it has not been possible until recently to have ground connection on the transmission system while this station is carrying the whole load. To furnish a permanent ground for the entire high-tension system a large transformer with its primary coils star-connected and its neutral grounded through resistance has been installed in the steam generating station. The transmission cables to the substations



ARRANGEMENT OF GROUNDING TRANSFORMER.

all radiate from the bus compartments of this station and by means of the grounded neutral of this transformer there is a ground connection for the transmission system, no matter which of the generating plants may be in service.

The accompanying sketch shows the arrangement of the grounding transformer and its connection with the main high-tension bus of the distributing station. The transformer is of the standard self-cooling type of 600-kw rating with the primary coil star-connected and wound for 13,200 volts and the secondary coil delta-connected and wound for 440 volts. The secondary coil is permanently connected in delta with no exterior taps. Were this secondary to be opened the transformer would act only as impedance in the three-phase circuit. The frequency is 35 cycles.

The primary leads of the transformer are connected with the main high-tension buses of the power station through an oil switch provided with hand-operated disconnected switches. The oil switch is provided with operating contacts on the switchboard, but no automatic relay is connected in the control circuit. The midpoint of the star-wound primary is connected to ground through a disconnecting switch and a cast-grid resistance of 12 ohms. This amount of resistance restricts the current flowing to ground to a maximum of about 600 amp when there is a good ground on any other point in the high-tension system. A series transformer is interposed in the ground lead between the disconnecting switch and the resistance. This series transformer operates the coil of a relay, which is so adjusted that when current to the amount of 40 amp passes through the ground connection the plunger of the relay completes a bell circuit, thus giving an alarm. The relay adjustment is such that when the bough of a tree switches across the transmission line during a storm, or a bird gets in contact with the two sides of the horn arrester, the bell immediately rings. Double ground connections were made by sinking a plate below the water level of the river near-by and by making connection to the negative return cables of the railway system.

The installation of this large transformer for the purpose of grounding the neutral of the three-phase transmission system has been successful. Previous to the time when this transformer was put into service surges occurred on the transmission system, which resulted in troubles to the cable insulation being communicated from one point of the transmission network to widely varying points. Ordinarily such troubles originate because of a ground rather than a short circuit, and now when such a ground occurs, the alarm bell operated from the ground connection of the transformer immediately notifies the switchboard attendant that there is trouble on some feeder line. He at once glances along the line of ammeters and can tell by the swinging of the needles which feeder is disturbed. The oil switch between this feeder and the main bus is immediately opened and thus the trouble is not communicated to the substations; and so far the operators have been able to open feeder lines on which the cables were grounded before the burning at the ground has become disastrous.

Practically the entire load on the transmission system consists of rotary converters, so the phases are balanced. All feeder lines leaving the power station have series transformers on each leg, so that no matter what phases become grounded the entire feeder is automatically cut out. The grounding transformer supplements this system of automatic overload relays and with the assistance of the switchboard operator defective cables are cut out before the short circuit or ground draws enough current to operate the automatic relays. It is reported that since this transformer installation has been in service there has not been a single case of "simultaneous" cable troubles.

CHICAGO, ILL. HENRY POLAND.

CYLINDER LUBRICATION.

It is quite evident from many practical examples that, considering the amount of oil used, cylinder lubrication is not what it should be. It is not impossible to find in many of the large power plants wastefulness in the use of lubricating oils and despite this fact engines suffering from the want of sufficient lubricant. It is known that coal consumption may be increased or decreased in proportion to the lack of amplenes of lubrication on engine and other bearings; but this is one phase in economy testing that does not receive its full share of consideration. For instance, if a valve gear works heavy because of poor lubrication, the steam distribution is not likely to be accurate, especially if the engine is of the four-valve type. This leads to a lowering of efficiency in the steam plant, and a power-house man experienced a practical demonstration of this recently, when his engine slowed down under load, due primarily to the spring and torsion in the valve gear not permitting the respective valves to make their normal travel, thus affecting the steam distribution, with consequent decrease in speed, although the steam pressure was normal. It will, of course, be appreciated that some oils will not lubricate one engine as well as they might another, because of varying conditions. Superheated steam requires an oil with a much higher fire test than saturated steam. The condition of the water that the boiler is using may have some influence on the oil. The writer has known a boiler to prime, and the water carried over to have a chemical influence on the cylinder oil. In some cases a cheap oil will be more affected than an expensive oil. The writer can recall an instance where a black oil carried so much acid that it would not properly lubricate, and caused all of the joints to leak in addition. When the valve was taken out the surface appeared as though no oil had ever been used on the engine. By simply changing the oil the engine worked all right. If oil works out through the joints it indicates that

: contains acid. Tallow will have the same effect, because of the acid contained in it. The amount of oil used is no criterion of the lubrication. Some oils will not lubricate under ny conditions, because they are not suited for the apparatus on which they are being used. In order to determine whether oils re performing their proper functions they should be carefully ested, and after specific runs some of the valves removed so s to determine their condition. With a good grade of oil

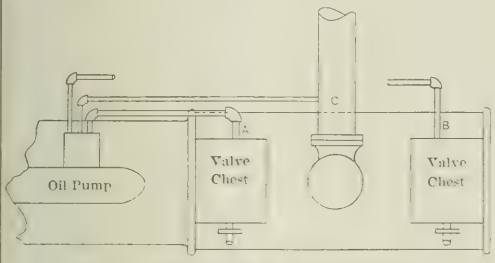


FIG. 1.—MULTIPLE FEED OILING CONNECTIONS.

uited to the work, and all other conditions favorable, the alves and cylinder will appear nicely glazed. If the oil is not uitable, this will be indicated by the condition of the valves. Many engineers will pump oil freely into an engine cylinder ust before starting, and permit the oil and water to pass be-ond the valve chamber. A better practice would be to permit he lubricant to run freely for a short time before the engine s stopped; this will leave the engine in good condition for tarting, and if more or less water is condensed in the cylinder nd valve chambers at starting the lubricant is not carried off with the water. The point at which the oil is permitted to nter the engine has much to do with its effectiveness, and he writer recently had an opportunity of witnessing an inter-sting demonstration of this fact. Referring to Fig. 1, there is multiple oil pump delivering oil through several pipes, two ipes running to valve chambers, and one to the main steam ine above the throttle. It was found by actual test that oil passing over pipe *C* was much more effective than either of the thers. By closing the pipes *A* and *B*, and slightly increasing he feed in the pipe *C*, best results were obtained. This was attributed to the fact that the oil entered the steam line above he throttle, and coming in contact with the steam was thorough-y atomized; while the oil entering the valve chambers came in contact with more or less water, and was not so thoroughly mingled as the oil entering the steam line. In Fig. 2 is illus-



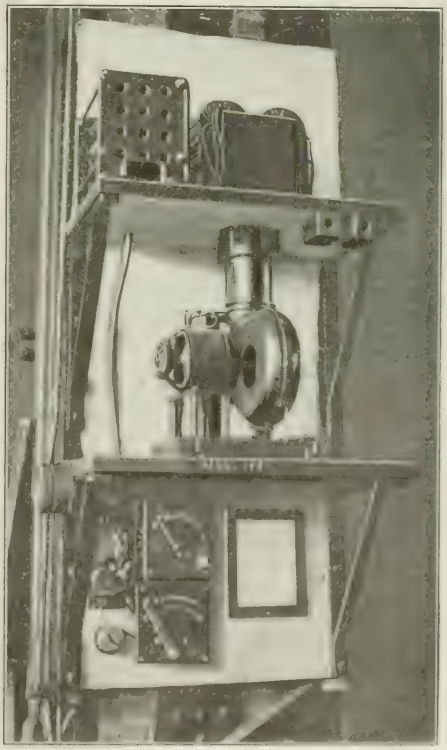
FIG. 2.—WASTEFUL METHOD OF LUBRICATION.

trated a practice often found, of allowing oil to enter the main cylinder direct, only to flow through the cylinder and out, which is a very wasteful method. The same oil permitted to flow through the steam pipe would not only lubricate the cylinder but the valves as well, and about half as much oil would be required. In a compound engine it is much better to feed the most oil to the high-pressure cylinder, for obvious reasons. The writer has found, however, that the same oil does not work as well on both cylinders, and that an oil giving a lower fire test is much to be preferred for the low pressure cylinder.

RICHMOND, VA. C. E. MCGAHEY.

HANDY EQUIPMENT FOR SHOP TESTING.

In many repair shops it is desirable oftentimes to have alternating current for testing purposes. In a great many cities alternating curent is easily secured; but in not a few cases only direct-current is available. Rotary converters or motor-generator sets must, of course, be employed to obtain the alternating current in the latter case. Where 500-volt, direct-current power circuits are available the following equipment designed by the master mechanic of a Chicago railroad is applicable and may be duplicated without excessive cost. A similar scheme can be adopted with direct-current of lower voltage, although the data given herewith are only applicable to 550-volt, direct-current railway circuits. The converter and transforming outfit are shown in the engraving. The equipment comprises a small rotary converter with a step-up transformer, starting and regulating boxes and a fan. From this outfit alternating current is supplied for testing and the voltage can be regulated between the limits of 350 volts and 3000 volts. The complete set is mounted on the wall where it is out of the way and does not take up floor space. With the current available, the converting set was designed and built as follows: Energy is taken directly from the shop circuit, which is fed from the third-rail feeders. A large snap switch is used in connection with a 2-amp enclosed fuse and a small carbon-break circuit-breaker which protects the converting apparatus. From the circuit-breaker the current supply passes to a starting



ARRANGEMENT OF TESTING EQUIPMENT.

box which controls the small converter. The converter was made by adding two slip rings to a [illegible] shunt wound motor. Two taps were brought out from the armature winding to the collector rings. The set so arranged receives direct current at 550 volts and converts it to 375-volt, single phase alternating current. For the purpose of giving severe breakdown tests to motors and generators coils it was

desired to have available a maximum voltage of 3000; therefore, a transformer was built. Its primary coil is connected direct to the slip rings of the small converter and in one side of the primary circuit a control rheostat and box have been placed. The box has nine points to which are connected a series of resistance coils similar to those used in the control circuit of a multiple-unit equipment. With these resistance steps in series with the primary of the transformer, which has 750 turns in the primary and 7050 in the secondary, it is possible to obtain 10 different voltages from the secondary terminals of the transformer. When the direct-current line voltage fed to the small converter is 500 volts the alternating-current voltage obtained from the machine is 350 volts and for each point on the box controlling the resistance in the primary circuit the following alternating-current voltages are obtained at the secondary terminals of the transformer:

Point 1..... 630 volts	Point 6.....2030 volts
Point 2..... 910 volts	Point 7.....2310 volts
Point 3.....1190 volts	Point 8.....2590 volts
Point 4.....1470 volts	Point 9.....2870 volts
Point 5.....1750 volts	

When the line voltage is 550 the alternating-current voltage obtained from the transformer on the last point of the resistance cut-out switch is 2905. As shown in the illustration, this transformer is mounted on a shelf directly over the small converter. On the shaft of the converter is a blower fan which exhausts directly up through the coils of the transformer, a box being provided about the transformer so that the maximum cooling effect may be obtained from the air circulation. While this air cooling is not necessary for regular testing work, it will be found very advisable to cool the transformer if current were to be passed through it for any long period of time unless the transformer is designed to withstand the temperature.

The transformer core is made of laminations cut from No. 26 gage stove iron clamped together by a through bolt at each of the four corners. There are two windings made up of No. 12 wire in the primary, 750 turns, and No. 21 wire in the secondary, 7050 turns; in all 100 lb. of wire were used. The secondary leads of the transformer, which carry a maximum voltage of 3000 from side to side, terminate in spring brass connection boxes enclosed in wood similar to those used for the heating buses connecting the cars of an elevated train, but other schemes are equally applicable.

This simple home-made converting and transforming set is made use of in the every-day work of the winding shop. Alternating current at various voltages is used for testing air-compressor motors, small electrical devices and the field coils and armatures of railway motors. All armatures that are repaired are given an insulation test with alternating current by connecting one lead to the shaft and the other to the commutator bars. In this testing work each piece under test is first subjected to a low voltage and if this is satisfactorily withstood the voltage is increased to a predetermined maximum by the simple method of regulating through the medium of resistance cut in and out of the primary circuit of the step-up transformer. Air-compressor coils are subjected to a test of 1470 volts as obtained when the control switch is on the fourth point.

The contactor magnets are rewound in the shop and field coils for railway motors are tested up to the same voltage as that for air-compressor motors. The mica-insulated armatures are ordinarily tested to 3000 volts. It is, of course, possible to convert a direct-current generator into a rotary converter by adding the requisite number of slip rings and making suitable taps to the armature or commutator. Any alternating-current voltage can be obtained then by means of a suitable transformer. A small two-pole generator may be caused to give alternating current by connecting a pair of insulated metal rings permanently to two commutator bars diametrically opposite each other. The frequency of the alternating current in cycles per second will be equal to the revolutions per second of the armature. For ordinary testing, frequency is not considered; but in the design of a transformer the frequency must be taken into account.

MILWAUKEE, WIS. JOHN HANCOCK.

ENAMEL FOR RHEOSTATS.

The writer has sought for many years information on the constituents of the enamel used in rheostats in which the wire is embedded in the enamel, without avail. Recently, however, a friend has supplied me with some information on this point based upon some foreign rheostats, and feeling that perhaps many of your readers would like to obtain some information on this point the following is sent. In one rheostat, now displaced, two enamels of different melting points were employed.

The enamel which was used to hold the resistance wires to the base plate consisted of felspar, 52 parts; borax, 34 parts; china clay, 14 parts, and the enamel used for covering the wires consisted of 30 parts quartz, 20 parts borax, 34 parts stannic oxide, 9 parts carbonate of soda and 7 parts of potassium nitrate. The latter enamel has a lower melting point than the former. The securing enamel was either used in the form of a powder or in that of a paste made by fusing two-thirds of the felspar with the borax, grinding to a fine powder and mixing with water, adding the rest of the felspar, the china clay and two parts of magnesia carbonate. The process of manufacture consisted in applying a layer of securing enamel to a metal base plate, heating in a muffle furnace to a temperature of about 1300 deg. Fahr. to 1600 deg. Fahr., removing and, while still plastic, pressing the resistance wires into position. A layer of the second enamel was next applied and the whole again heated, this time to a lower temperature, just sufficient to fuse the second enamel while leaving the first sufficiently plastic to prevent the wires dropping through onto the base plate. This method was subsequently improved by bending the resistors in an insulating cement, consisting of equal parts of oxide of iron and lava mixed with a solution of silicate of sodium; the slab so formed being afterward coated on both surfaces with an enamel similar to those above. In the more modern methods of manufacture a cement drying with enamel-like surface is substituted for the separate cement and enamel. A rheostat of this type has the resistance proper in the form of a crimped metallic strip or ribbon made from an alloy containing 78 parts of copper, 18 parts of nickel, 3 parts of zinc and 1 part of ferromanganese.

The cement which is used consists of a mixture of 80 parts of fine clean sand or silica, 20 parts of silicate of magnesium, which is mixed with a sufficient quantity of silicate of soda solution to give the proper consistency. A layer of this paste is placed on the base plate and the crimped resistance wire placed in position, and more filling material applied to occupy the spaces between the crimps and to completely cover the resistors. The whole is then placed aside and allowed to harden, when it dries with a hard, smooth, stone-like surface. Another company has a rheostat made in a somewhat similar way.

The base is made from a compound containing 40 parts of asbestos, 38 parts of silica and 22 parts of calcium hydrate, which is compressed and placed in a closed chamber, where it is treated with steam under pressure (150 lb. per square inch) for about five hours. The resistance wires are placed in grooves either molded or cut in the base, and are covered either partly or entirely with a compound similar to that described above, but made liquid enough to flow around the wires and embed them, by omitting the fibrous material or grinding it to a fine powder. The rheostat is then again subjected to the steam treatment when the whole sets in a firm, compact mass. The melting point of either of the first two enamels can be lowered by adding a suitable quantity of metallic oxide, and it might be possible by this means to bring the enamel down so as to make it amenable to the action of a blowpipe.

NEW YORK. JOSEPH BOYD.

QUESTIONS AND ANSWERS

I have often come across the expression "singing arc" and would be pleased to have you inform me what it means. E. S. C.

Duddell discovered in 1900 that a direct-current arc between solid carbons gave a musical note of high pitch if a circuit containing inductance and a suitable capacity were shunted across the arc; hence the name.

Under what load factor do the best hydro-electric plants operate?

The combined output of the Niagara Falls Power Company and the Canadian Niagara Power Company is over 500,000,000 kw-hours per year and the load factor is over 70 per cent. This is the largest and most satisfactory hydro-electric development from all viewpoints that we know of.

What is the best type of fixture to use with tungsten lamps? G. P.

Tungsten lamps have been substituted for ordinary incandescent lamps in rigid fixtures through adapters, with good results. Since, however, the tungsten lamp is sensitive to vibrations, the best type of fixture for it would appear to be one with a chain stem instead of a pipe stem. The former would take up any vibrations and relieve the lamp. A rigid stem with a hook to which the tungsten lamp may be flexibly attached is also used.

The edge of one of the panels of a marble switchboard has been broken off, and we would like to know if it is possible to replace this piece without making the patch too noticeable. W. K.

The broken pieces may be joined by a cement composed of four parts of gypsum and one part of finely powdered gum arabic mixed to a mortar-like mass with a cold solution of borax. The object mended should not be disturbed for a few days and if necessary the cement may be given the color of the marble by adding the desired tint to the borax solution.

Why is it that in measuring the power on three-phase systems feeding motor loads that a single series transformer is used in connection with the instruments? V. H.

When the load on a three-phase system is made up entirely of motors, the load on the phases is generally considered as balanced, although it might be found that such loads are not truly balanced and that differences of current exist in the phases even when the pressure is uniform. In practice, however, one motor will more or less offset another by being affected in different phases and thus the tendency is to eliminate any unbalance.

Is there a convenient method of determining whether the loads are properly balanced on the two sides of a three-wire secondary network? J. H.

There is a series transformer on the market which is applicable for this purpose. The transformer can be carried by a lineman and placed around the secondary leads. By means of sufficient length of conductor, an assistant on the ground below can read from an ammeter the load in each leg. The transformer is wound on a two-piece ring so arranged that a small segment of the ring on which there is no winding acts as a hinge to be opened and closed over the conductor in which the current is to be measured.

In starting rotary converters which is the preferable method: by means of direct current or from the alternating-current side? M. E. T.

It depends very much on the system which way a rotary converter is started, and also on the condition of the system at the time. When started from the direct-current side, a rotary may be synchronized and put on the line without any sign of disturbance; but in many cases direct-current starting has been abandoned for alternating-current starting on reduced voltage. When started from the alternating-current side, voltage disturbances result which, while not serious on railway circuits, are objectionable on lighting systems unless many converters are in service. The machine may be also run up above synchronous speed by means of a starting motor of the induction type, the motor switch being then opened and the converter thrown in as the speed falls past the point of synchronism.

Wherein does the split-pole converter differ from the ordinary rotary converter, and to what extent does the former machine excel the latter in practice? I. E. H.

The ratio of direct-current voltage to alternating-current voltage in a rotary converter is definitely fixed, so that in order to control the direct-current voltage in lighting stations, for instance, independent of the alternating-current voltage at the generating station, induction regulators, boosters, or dial switches for connecting taps in the transformer winding are required. In the split-pole converter these regulating devices are unnecessary, the machine having means of varying at will the ratio of the direct-current voltage to the alternating-current voltage, by the variation of field excitation. Machines of this type have only recently been placed on the market and the experience gained is too limited to make any just comparison.

What is usually regarded as the proper switchboard equipment; that is, how many instruments should an operator be obliged to watch in a fairly large station? D. L. N.

By some it is considered advantageous to have all the switches and instruments in a station under the operator's immediate reach and there may be cases where considerations other than mere show would call for such practice. Ordinarily, however, an operator should have before him only such instruments and such apparatus as are necessarily required in working the station. For instance, he should have before him such apparatus that every movement of the needle or other indicator means something to him. This not only insures simplicity but reliability as well. The actual instruments will depend on the station equipment, an alternating-current station requiring more instruments than a direct-current station.

How are lightning arresters usually grounded? O. S.

The best ground connection is probably that suggested by the underwriters. A 3-ft. x 6-ft. copper plate or larger of No. 16 Stubbs' gage is buried with 2 ft. of crushed coke or charcoal about pea size both under and above it. The ground wire is riveted to the plate in a number of places besides being soldered its entire length. A cast-iron plate with projecting forks which give large surface contact may possibly be better than the copper plate and the joint between the plate and wire should be thoroughly protected against corrosion by painting it with waterproof paint. In some cases the plate is kept wet by means of water pipe. Galvanized-iron pipe may be driven into the ground about 18 ft. or coils of copper wire may be placed in the bank of a river below water line, or if convenient the ground wire may be connected to steel flumes, steel structure or feed water pipe. The ground wire has also been connected to the rails in the case of street railway systems.

We are operating an alternating-current system in a small city and recently have taken over a fair-sized factory which is now operated electrically by means of induction motors. By means of solicitors we have also connected up quite a few small motors to the system, and although we have 1000 kw of generating equipment in the station, we seem to have difficulty in carrying the load; the generators heating up before full load is reached. This is due to the motor load, because before this was augmented no trouble existed. Would a different type of motor change the conditions? H. K.

Where there are a large number of small consumers on a system and the majority of whom use induction motors because of their simplicity and operating characteristics, the power factor is usually quite low, especially if many motors are running light or only partially loaded. The result on the station equipment would be exactly as indicated—the alternators will heat up. Such a condition, unless remedied, would call for increased investment in generating and transmitting apparatus so that profits would be seriously impaired. By means of synchronous apparatus the power factor of the system can be made unity. It may be possible to get some customer to install a synchronous motor instead of an induction motor to drive his equipment and if necessary a [illegible] could be made as an inducement. The synchronous motor may be first brought up to speed and then the load gradually thrown on by means of a clutch. Synchronous motors require more care than induction motors, are not self-exciting and are started with some difficulty. A large excess of excitation is necessary in order to compensate for the lagging wattless current required by the induction motors.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Blackboard Map for Showing Service Main and Connection.

One of the problems confronting a central-station manager is that of providing some method for representing the service mains and connections in an ever-changing and increasing network of conductors. A neat solution of the problem has been devised and applied by Mr. P. F. Sellers for the Buffalo General Electric Company. One wall of the office of the chief electrician has been arranged as a blackboard, containing about 90 sq. ft., upon which has been painted in oil to a scale of 50 ft. to 1 in. a map of the business district of Buffalo. All conduit and service connections are shown on this map in yellow paint. The locations of manholes distinguished as to size are properly shown in blue paint. The alternating-current system of cables is painted in green, the direct-current, three-wire lighting circuits in red, and the 500-volt direct-current circuits in purple. The sizes of the individual feeder circuits are also indicated at the proper points.

This map is kept up to date with the minimum of difficulty, additions being made in the proper color and removals being painted over in black. The blackboard has proved excellent for representing at each instant the exact condition of the circuits of the rapidly growing network of the company.

"A Better, Bigger and Brighter Buffalo."

During the months of February and March the Buffalo General Electric Company addressed to its constituency a series of 30 "electric talks" through the advertising columns of the local daily papers. These have recently been reproduced in a neat and attractive pamphlet which not only enables a study of the series as a whole, but shows at a glance the direct and forcible nature of the appeal to the intelligence of the community, which is as much interested as the company is in seeing "a better, bigger and brighter Buffalo"—to use the alliterative phrase that is employed with good effect throughout the argument.

It is pointed out that while most of the customers of the corporation can move elsewhere if prospects are not favorable, the company in the very nature of things has to stay where it is and "face the music." Hence it has a keener interest than that of the ordinary citizen in the welfare and prosperity of the city served. Moreover, it is stated that out of the 332 stockholders, 306 are Buffalonians, of whom 161 are women. Twenty others are local estate holders. Only 26 live outside the city; and the pertinent remark is made: "We are loyal members of this community, large contributors to its support and are willing to shoulder our share of responsibility for its future." The distribution system of the company is equal to the wants of a Buffalo twice the size of the present.

As to the six stations of the company, it appears they have a capacity of 21,601 hp, 10 per cent of which is used only during 25 hours of the whole year and in one month of operation. One-half of the plant is used only one-half of the year, within seven months. The total output of all the plants in 1908 was 40 per cent of the entire capacity, but attention is called to the fact that it is all in a state of "readiness to serve" and that the storage battery capacity insures against interruption of the supply from Niagara. Moreover, it is noted that the energy from the falls is transmitted at great cost, and that exaggerated ideas prevail as to the "cheapness" of water-power. A comparison is made of the rates prevalent in Buffalo and elsewhere in 20 other cities, and in every instance Buffalo shows to advantage. The lighting rate ranges from 9 cents to 4 cents and the retail power rates range between 6 cents and 2 cents. On March 1, 1907, a five-year contract was entered into with the city, 2883 arc lamps being lighted at the rate of $56 per year, with underground circuit lamps at $75. The company made the reduction operative, on its own volition, from June 1, 1906, nine months earlier. As everybody knows, this is an unusually low rate for street lighting of 4000 hours. The series closes with an earnest and effective admonition to the readers "to help us boost Buffalo by spreading the truth regarding the city's electrical advantages."

Special Men and Specializing.

By H. H. MacPherson.

One of the chief attractions, and also one of the most important phases of new business work, is the consideration of the human element which enters so largely into every step which the company's representative takes with a prospective customer. There is probably no other place where this human element shows itself so plainly as in what is known in new business parlance as "big business." Consider, for instance, a business territory which has been in the hands of a good man who has been securing a large amount of big business as well as a goodly amount of smaller business. Put a comparatively new man in this same territory and within a month the revenue of that territory decreases enormously, simply because the personal element is lacking between the representative and the prospective customer. During the second month the representative busies himself in re-establishing this natural human relation, and soon the big business begins to come in larger than ever before, after the personal relation has again been established.

The business world as at present constituted divides itself into two great classes—those persons whom a business man knows personally, and those whom he does not know. Other things being equal, the man who is known personally is the man who gets what he goes after.

The problem of knowing what to go after and how to go after it is the largest part of a representative's work. In these respects his business and residence districts are very different. In the residence district business runs along certain well-defined grooves with now and then a striking addition—such as the electric iron. In the business territory the grooves are there, but they are constantly changing and the special cases are in the large majority. Here then arises the need of specializing.

Those merchants who are using sign, outline and window lamps upon the dusk-to-midnight flat-rate contracts at this time of the year are getting some splendid advertising due to the very large number of people who are always downtown until 5:30 or 6 p. m. During the months of early dusk many people who go home at 5:30 or 6 p. m. throughout the year see this lighting who do not see it at any other season of the year. Therefore it seems that this is the best possible time to make contracts for a large number of flat-rate signs, windows and outlines. It is well to specialize on the classes of business throughout the coming month. Probably each representative has a number of good prospective customers in each of these lines to which he is attending in connection with his other work. Or possibly he may have been so busy along other lines that he has neglected future flat-rate customers. In either case there is no question that if a little closer attention be given to this special class of business big results in increased revenue will follow.

A prominent new-business man once said: "I have noticed that no matter how hard you may be working along any par-

icular line or along all lines, when I ask you to specialize along ny one line the immediate results shown in increased revenue n that line are very surprising."

In the same way seasonal variations to a greater or less extent govern the introduction of appliances. During the warm months ranges, water heaters and electric irons are easily sold. n the winter months even more energy is expended in keeping hem in commission and in selling heaters. The long lighting ours also make the solicitation of wiring good revenue-bring- ng business.

Many of the smaller companies consider that specializing is proper for the large companies, but would never do for them. In reality there is more need for periodical effort along particu- ar lines in the small company with a few men than there is in he large company, because the more varied the duties which any one man has the more liable he is to fall into a rut and neglect all of the classes of business which do not have a special interest for him. It refreshes a man and gives him new life n all of his work to take up some neglected phase and find that it will result in a big success when his efforts are properly directed.

A certain man who eventually became one of the best new- business getters in his company was almost completely dis- couraged at the end of his first month in the commercial de- partment. He had failed in his efforts at closing big business and was about to give up in despair. Like many novices in commercial work he had looked upon electric irons as too small a revenue producer to bother with. However, he finally decided to see what could be done with them. His record caused him to regain his lost confidence, and he became one of the best men in the business, simply because he found this neglected part of his work could be made a success.

Although varying conditions may make it necessary to specialize along certain lines at certain times, it is essential that the representative should plan his work so that he will carry on a campaign along all lines even though he is specializing for a short time on one or two. Having the men specialized on different lines every little while serves to teach them that there is good business to be had in every direction, and therefore all lines should be worked continuously. That is one of the hardest lessons which a new man has to learn. If he starts a campaign upon signs and motors, and is successful, it is natural that he should work these lines to the detriment of others. That fact explains why the same territory may have a wonderful reputa- tion one year for signs and the year later for interior lighting.

There are certain classes of business, such as motors, signs, outlines and interior business lighting, which are of the utmost importance to an electric company on account of the large net revenue which they are sure to bring in. The motor load fills up the valleys in the daily load curve and plays a large part in keeping out isolated plants; signs, outlines and windows when lighted from dusk to midnight or on all-night flat rates are one of the most profitable loads which a central station can have, besides being of immense value in an advertising way.

The above are some of the reasons why almost every central- station company finds it a good policy to have special men— men who specialize along these lines. Not every company is large enough to have men who devote their entire time to specialties, but certain representatives are detailed to, say, a small district where they spend a part of their time assisting the other representatives in the capacity of special men.

It is coming to be recognized that the general effect of any special man's work is quite often as productive of good results as the special effect. In other words, the special man's position and work as the executive head of his department in directing the representatives how best to secure business in his line, and in keeping them keyed to the proper pitch, is getting to be a much larger part of his real value to his company than is his original duty as an advisory engineer.

For instance, "special men's morning" in one large company brought out a chart on which was shown the flat rate revenue secured in each district during a certain month a year previous. At the top of this chart in red letters was the question: "Mr. Representative, in March, 1908, your territory turned in flat- rate contracts and revenue as shown below. How about March, 1909?" It is needless to say that March, 1909, beat March, 1908. A new motor man was brought into a company where it had always been considered a breach of etiquette for a special man to go anywhere except when asked to do so by a representative. The special man was also supposed to allow the representative to report all the business secured in his territory even though some of it thus failed to be reported. This new man at once started in to make a thorough canvass of each territory. Dur- ing the first two months he himself closed more motor con- tracts than had the whole department during the entire previous year. Then the representatives themselves got busy and the increased revenue from motor business was astonishing.

When the tungsten lamp first came on the market in a practical form the electric company in a certain city was hav- ing a great deal of trouble with a gasoline-plant epidemic. No less than 50 plants had been installed in about 15 months. This company looked with alarm on the incoming tungsten lamps, foreseeing nothing but a still further decrease in revenue. In order to postpone the decrease as long as possible it began to sell the lamps at cost and also delegated one of its repre- sentatives to make a study of the conditions in the various territories and see what could be done. As a direct result of the plan which he originated the months following his appoint- ment showed the largest increased revenue in years in the very lines which were expected to show the decrease. In addition the number of gasoline plants decreased from 50 to 30.

By such examples as these it is clearly evident that the special man has come to stay. His work is daily becoming more varied and important. His ability as an executive will soon be the most important factor in his work; at least in the larger companies this fact is being most effectively remembered in the training of men for this work.

Improvements in the Rockford (Ill.) Central-Station Plant.

The Rockford Electric Company, which is one of the prop- erties controlled by the American Gas & Electric Company, supplies all of the energy for lighting and for traction on the city and interurban railroads centering in Rockford. For a number of years the central-station service was entirely 110-volt and 220-volt direct current. Some 550-volt direct current was also generated for supplying energy to the city railway lines and rotary converters, and step-up transformers were installed for delivering 13,200-volt, three-phase energy to transmission lines for interurban railway purposes. As the central-station distribution had reached out to cover a very large territory for a direct-current system, alternating-current distribution was in- stalled during 1907 for supplying energy to the outlying dis- tricts.

The company also acquired a local corporation known as the Central Heating & Power Company, which operated a plant near the downtown district for commercial lighting and heating. This plant is still operated during the heating season. A third plant controlled by the company is that at Beloit, which was built by the Rockford, Beloit & Janesville Interurban Railway. This railway was purchased by the interests controlling the Rockford city lines and the other interurban roads centering in Rockford. These latter, always having purchased energy from the central-station company, desired to continue this policy rather than bother with the acquired power plant at Beloit, and therefore the Beloit plant was leased to the Rockford Electric Company and is operated by it primarily for the purpose of supplying energy to the railway companies.

The power-plant situation at Rockford is of engineering in- terest chiefly because of the great variety of equipment and prime movers which are employed in supplying different kinds of energy and in the methods of interconnection between the different classes of customers.

The original main plant was largely a water power equipment

The water-power was gradually outgrown, however, so that now the steam equipment is far greater than the water equipment, although the water-power is applied to as large a proportion of the output as possible. The main plant now has a 600-kw equipment connected to eight new 210-hp waterwheels. This set of waterwheels drives a lineshaft operating 600 kw in 140-volt direct-current generators. There is also another lineshaft from which are operated seven 6.6-amp, 125-lamp Brush arc

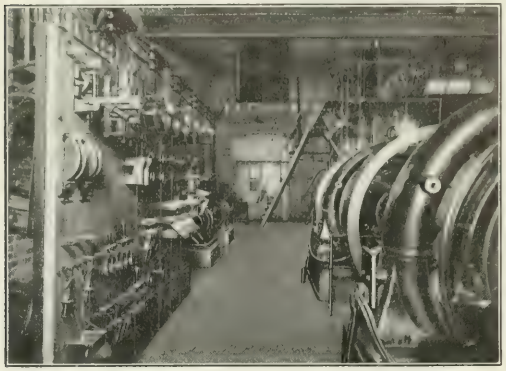


FIG. 1.—INTERIOR OF CENTRAL PLANT.

machines. A new concrete wheel house has just been built. This plant contains a 4100-kw equipment in steam-driven generators. Of this 1000 kw is in the shape of two 500-kw Curtis turbo-alternators, giving three-phase, 60-cycle, 2300-volt energy. The turbines are provided with barometric condensers. The energy from these generators is used for a four-wire, three-phase distributing system giving 2300 volts between the neutral and the lead wires, and 4000 volts between the lead wires. There are a number of compound condensing engines, directly connected to 550-volt railway generators and also some condensing engines for direct-current, 110/220-volt service. At the central heating plant there is a 600-kw equipment consisting of two direct-connected high-speed simple and one compound steam engines. At the Beloit railway plant there is a 1080-kw equipment in three-phase, 25-cycle generators, supplying energy to 13,200-volt transmission lines and rotary converters. Since the American Gas & Electric Company took hold of the property in May, 1907, no generating equipment has been added, but

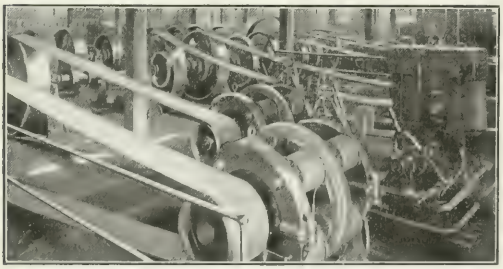


FIG. 2.—GENERATORS OF MAIN PLANT.

machinery has been installed at the main plant which adds considerably to the flexibility of the system, by making it possible to use turbines or engines driving generators for one kind of service to deliver energy to other classes of service. There has been installed one 500-kw motor-generator set, which consists of a 60-cycle synchronous motor, directly connected to two 250-kw, 250-volt, direct-current generators. These generators can either be run in parallel to feed energy into the direct-current lighting network or they can be connected in series to feed energy into the railway busbars at 500 volts. If the conditions are reversed, the railway or direct-current lighting system can feed energy into the 60-cycle system. Another motor-generator set which has been installed consists of a 300-kw, 60-cycle synchronous motor, directly connected to a 25-cycle, 550-volt rotary converter. With this the 60-cycle system can supply 550-volt, direct-current energy to the railway or 25-cycle, alternating-current energy suitable for transmission purposes for the railway. If the 60-cycle system is in need of energy, this process can be reversed. The main plant has excellent coaling facilities, as the sidings of two railroads run to the plant. For the central plant coal must be hauled. The engine- and boiler-room floor in the central plant is below the sidewalk level, as the street at this point is a bridge approach. The boiler-room is under the front part of the building, and coal is unloaded from the street directly in front of the boilers.

The central plant is operated at full load continuously during the heating season, in order to supply exhaust steam for heating. As an adjunct to the large main station it can be operated much more to advantage than as a separate isolated plant running throughout the year with high generating costs during the summer. The interior of the central plant is shown in Fig. 1. Two interior views in the main plant are shown in Figs. 2 and 3. From Fig. 2 it will be seen that there is plenty of the older types of apparatus in part of the main plant. This equipment is gradually being displaced by larger units, as far as the direct-

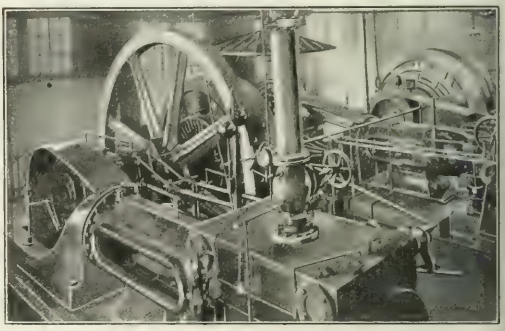


FIG. 3.—ENGINE EQUIPMENT OF MAIN PLANT.

current system is concerned. Some of the Edison bi-polar machines which have been running many years without trouble, although small in size, serve well as balancers on the three-wire system, as the newer generators are wound for 250 volts.

Some very fine work has been done in the building of distributing lines through the outlying districts. When the alternating-current system was installed the size of the direct-current distributing system was very much reduced and everything but the downtown district was supplied with alternating-current energy. Some of the large factory motor users which the company has secured as consumers justify special feeders. All of the new lines have been placed on Idaho cedar poles, from 40 ft. to 65 ft. high. The 13,200-volt railway transmission lines are placed on the top cross-arms, and the 2300-volt and 4000-volt, three-phase, four-wire feeders on the lower cross-arms. In many cases the wires of the telephone company occupy a still lower cross-arm.

Plans and specifications are now being prepared which contemplate the installation of 3000 additional boiler horse-power and two 200-ft. stacks at the main plant with 4000-kw additional steam-generating equipment, the installation of a coal-handling system with bins, of a new fireproof roof for the engine-room and two electric traveling cranes.

Moreover, it is proposed to extend the steam-heating mains from the heating plant to the main plant, a distance of 2500 ft. The object of the proposed improvements is to generate all energy at the main plant and discontinue the heating and Beloit plants, except for emergency reserve.

INTERIOR WIRING AND ILLUMINATION

Street and Sign Lighting in Joliet, Ill.

The Economy Light & Power Company, of Joliet, Ill., has worked out an interesting system of ornamental street lighting in the business district of Joliet. The problem was to meet a demand for improved street lighting along streets where there are electric railway lines. To install the stereotyped style of boulevard lights would have necessitated the erection of ornamental poles alongside steel trolley poles for supporting overhead trolley wires, and it was to avoid this condition that the combination pole illustrated herewith was devised.



FIG. 1.—COMBINATION POLE.

After many experiments it was found there was not sufficient strength in a cast-iron pole to permit of a trolley attachment, and that a steel pole would not permit of sufficient ornamentation. The idea of two separate and distinct poles in one was then taken up. A standard 28-in. steel trolley pole with 7-in., 6-in. and 5-in. sections is used, weighing 632 lb. This serves as a core, and in order to obtain an artistic effect it is surrounded with an ornamental casing, as shown.

The center of the lights suspended from the four arms is 12.5 ft. from the sidewalk. The elevation and distance between the center of the lights were obtained after actual experiments and after consultation with an illuminating engineering authority. A favorable opinion was received from the Commercial Club, the Merchants' Association and the Art Study Club of the city, as to the design, so that there is harmony among all the interests working for a more beautiful city.



FIG. 2.—BUILDING OUTLINE LIGHTING IN JOLIET.

Property holders pay for the ornamental street lighting thus furnished, on a two years' contract, at $1.25 per front foot, per year, divided into 24 monthly instalments.

The poles are spaced 70 ft. to 75 ft. apart and each carry four 60-watt tungsten multiple lamps, which burn from dusk until 11 o'clock, except the lamps on the diagonal corners of street intersections, which burn all night. The latter displace the city arcs at that point, the city paying for this service the price it paid for the overhanging arcs.

In the section in which this street lighting is carried out all of the service is taken into the alleys, the streets being cleared of all wires except those carrying the service for the ornamental lighting. The American Railways Company owns the street-railway system and willingly co-operated in the work, having furnished and erected the steel trolley poles, thus making the only expense to the lighting company that for the ornamental cast-iron exterior and its erection.

About two years ago the Economy company put up the first electric sign in Joliet, in front of its office, reading "Electric Light and Power." It now supplies 69 signs, producing a revenue of $8,874 per year. At present the building of the company is outlined with light, as shown in the accompanying illustration.

This company serves 50,000 people in the cities of Joliet, Lemont, Plainfield, Rockdale and New Lenox. It has a connected load of 191,014 16-cp equivalents, with annual earnings of upward of $310,000. Mr. Charles A. Munroe is manager of the plant of the Economy company.

A Pendant Fixture for Experimental Installations.

BY ARTHUR GILLMAN.

In replanning the illumination of certain departments of an industrial corporation some doubt arose as to what particular arrangement of single lamp lighting units would be most efficient. All of the rooms to be lighted were of practically the same dimensions and had the same general color characteristics. Each had been illuminated by one four-mantle gas lamp centrally located, suspended from the ceiling. Tungsten lamps easily proved the most economical type of illuminant and general illumination seemed desirable; but there was a reasonable question, inasmuch as the work carried on in the rooms was of an unusual nature, whether it would be best, for lighting each room, to install a few high candle-power tungsten lamps or several of low candle-power; the energy consumed per room to be approximately the same in each case.

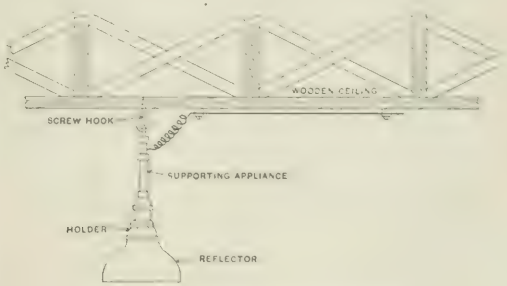


FIG. 1.—APPLICATION OF PENDANT FIXTURE.

Low cost of wiring and fixtures would favor the few high candle-power lamp method, while a more uniform distribution of light and less decided shadows would be obtained by the other method. The problem was so subtle that it was decided to make a series of tests to determine which arrangement was best suited to the conditions. Accordingly, in a typical room detailed for the purpose, several different arrangements of units were tried out. It is the purpose of this article to de-

scribe the makeshift fixture, assembled from stock components by the company's electrician, for use in the trials.

Fig. 1 shows the application of the device and Fig. 2 its details. Obviously, for a very temporary installation, it would be entirely feasible to support a tungsten lamp, shade holder and shade by two wires made up on the socket terminals; but as the trial under description was to extend over quite a period it was deemed best to provide the substantial arrangement shown. The wrought-iron pipe nipples (Fig. 2) were about 8

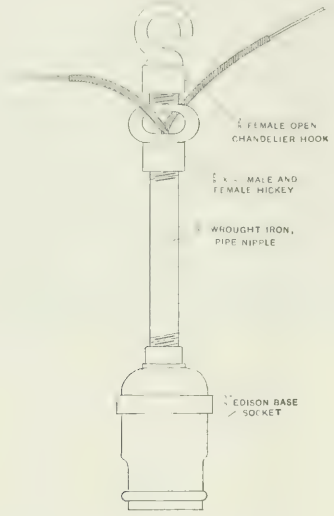


FIG. 2.—DETAILS OF PENDANT FIXTURE.

in. long and threaded at each end with a ⅜-in. standard pipe thread. At one end the keyless socket was twisted on and at the other the malleable-iron "hickey" and the chandelier loop. No. 18 fixture wire was used to convey electricity from the branch wires, cleated to the ceiling, to the socket. Each appliance was wired complete in the electrical shop.

In the wooden ceiling of the room, in which the test was to be made, screw hooks were inserted where there was any probability of desiring to hang an experimental lighting unit. These screw hooks were of small diameter, about 3/32 in., and were all placed prior to the beginning of the experiments. To test the effect of different arrangements of units it was only necessary to hang one of the appliances, shown in Fig. 2, on each of the designated screw hooks (see Fig. 1 showing complete unit in position), insert in the sockets lamps of the desired candle-power and fit the appliance with the proper reflector. Electrical connection between fixture and branch wires was effected through hand-twisted, unsoldered, taped joints, the ends of the fixture wires having purposely been left bare.

In mills and factories, where appearance is not a great factor, fixtures of the described type should be entirely satisfactory for permanent work.

Elementary Illumination Calculations.

By N. Whitney.

Two things are essential to any engineer—and an "illuminating engineer" is no exception—"common sense," which needs no comment, and "judgment," which is largely a matter of experience. One of the things which will greatly assist judgment and render decision easier is keeping all authentic data, and all other data, noting their reliability. This means that when an illumination curve has been worked out, for instance, the data from which it was computed should be filed in a systematic way, so that it will never again be necessary to devote time and brains to ascertain the results arising from similar conditions.

In this article will be explained methods which experience has shown to be correct for solving problems in illumination. It will be assumed that the reader has no particular knowledge of illuminating engineering, but that he understands simple draughting and how to use logarithms and a slide rule. A knowledge of elementary trigonometry is useful, but not essential. The terms and expressions used are those generally employed, no attempt being made to dispute or justify their correctness.

Aside from purely mechanical or electrical problems, the illuminating engineer deals with three units. These are the candle-power, or unit of intensity of the light source; the foot-candle, which is the illumination produced by a source of 1 cp at a distance of 1 ft.; the lumen, or quantity of light required to produce an illumination of 1 ft.-candle over an area of 1 sq. ft. Since a sphere of 1 ft. radius has a superficial area of 4π ($= 12.57$) sq. ft., it follows that 1 spherical cap—that is, 1 cp in every direction—gives 12.57 lumens.

Two laws govern all the practical problems in illuminating engineering; namely, the intensity of illumination varies inversely as the square of the distance from the source; the intensity of illumination on any plant is proportional to the cosine of the angle at which it meets a perpendicular to that plane.

One of the greatest, if not the greatest, single aid to the illuminating engineer is a polar candle-power curve of the light source which may be under consideration and its accessories. Several of the manufacturers of lamps and reflectors advertise their willingness to supply such curves free to responsible parties, and anyone contemplating taking up illuminating work should equip himself with as many as possible.

The illuminating calculator, patented by Mr. Norman Macbeth, is a device of great assistance to the illuminating engineer as it gives graphically, in a way somewhat similar to a slide rule, results otherwise requiring long calculations, even using logarithms, in a fraction of the time. For the present it will be assumed that the reader is not equipped with one of these calculators.

Polar paper, devised by Mr. A. A. Wohlauer, having in addition a set of lines for measuring the quantity of light—in lumens—may now be purchased, and may advantageously be used for measuring the mean upper, mean lower and mean spherical candle-power without resort to the Rousseau diagram. To find the total lumens of any unit by means of this paper, plot

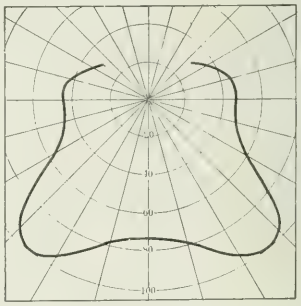


FIG. 1.—ILLUMINATION CURVES.

on it the polar candle-power curve of the unit, and at the points where the dotted radial lines intersect, in either quadrant 0°—90° or 90°—180°, add together and divide by 10. This will give the mean lower hemispherical candle-power (*m.l.h.s.c.p*) and mean upper hemispherical candle-power (*m.u.h.s.c.p*), respectively, usually written $J_{\smile}$ and $J_{\frown}$, adding these together and dividing by 2 gives the mean spherical candle-power (*m.s.c.p*) or J_0.

The lumens in the lower and upper hemispheres are given by

the equations $J_{\supset} \times 2\pi =$ lumens and $J_{\frown} \times 2\pi =$ lumens. The sum of these two equals the total lumens, or total lumens $= J_0 \times 4\pi$.

After securing polar candle-power curves as mentioned, the next step is to compute a table of the angles of various heights (H) and distance (D) ordinarily used. This table is shown (Table I) with angles to nearest quarter degree only, as it is usually impossible and quite unnecessary to read a polar curve any more closely. The heights and distances are given from a point directly under the unit, from 6 ft. to 9 ft. height and 0 ft. to 24 ft. distance.

TABLE I.—ANGLES.

Distances in feet.

Height in feet.	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	22	24
6...	9° 30′	18° 30′	26° 30′	33° 45′	39° 45′	45° 0′	49° 30′	53° 0′	56° 15′	59° 0′	63° 30′	66° 45′	59° 30′	71° 30′	73° 15′	74° 45′	76° 0′
7...	8° 15′	16° 0′	23° 15′	29° 45′	35° 30′	40° 45′	45° 0′	48° 45′	52° 15′	55° 0′	59° 45′	63° 30′	66° 30′	68° 45′	70° 45′	72° 15′	73° 45′
8...	7° 15′	14° 0′	20° 30′	26° 30′	32° 0′	36° 45′	41° 15′	45° 0′	48° 30′	51° 15′	56° 15′	60° 15′	63° 30′	66° 0′	68° 15′	70° 0′	71° 30′
9...	6° 15′	12° 30′	18° 30′	24° 0′	29° 0′	33° 45′	38° 0′	41° 45′	45° 0′	48° 0′	53° 0′	57° 15′	60° 30′	63° 30′	65° 45′	67° 45′	69° 30′

Table II shows the cube of the cosine ($\cos^3 \alpha$) of the angles in Table I. The preparation of such a table is laborious, but a very few computations without it would mean more work than preparing the table. There should be provided also a celluloid protractor having 15 deg. and 5 deg. lines extending to within ⅜ in. of the origin. The protractor need cover only one quadrant, as most curves are symmetrical in both the upper and lower hemispheres, and the upper hemisphere may be treated in a manner similar to the lower.

TABLE II.—CUBE OF COSINE OF ANGLES IN TABLE I.

Distances in feet.

Height in feet.	1	2	3	4	5	6	7	8	9	10	12	14	16	18	20	22	24
6.....	.9594	.8529	.7167	.5748	.4545	.3536	.2739	.2180	.1715	.1366	.0888	.0615	.0429	.0320	.0239	.0182	.0142
7.....	.9693	.8882	.7756	.6544	.5396	.4348	.3546	.2866	.2295	.1887	.1279	.0888	.0631	.0476	.0358	.0283	.0219
8.....	.9762	.9135	.8218	.7167	.6099	.5144	.4250	.3536	.2909	.2452	.1715	.1222	.0888	.0673	.0509	.0400	.0320
9.....	.9823	.9306	.8529	.7624	.6691	.5745	.4893	.4153	.3536	.2996	.2180	.1616	.1194	.0888	.0693	.0543	.0429

METHODS.

The normal illumination in foot-candles at any point is equal to the candle-power of the light source in that direction J, divided by the distance (d) squared (in feet) from the source to that point, or

$$J_n = \frac{J}{d^2} \qquad (1)$$

The horizontal illumination at any point on a horizontal plane is equal to the candle-power of the light source in that direction divided by the distance squared (in feet) and multiplied by the cosine of the angle which the ray of light makes with a normal to the plane, or

$$J_h = \frac{J \cos^3 \alpha}{d^2} \qquad (2)$$

These formulas reduce to a more useful form as,

$$J_n = \frac{J \cos^3 \alpha}{H^2} \qquad (3)$$

$$J_h = \frac{J \cos^3 \alpha}{H^2} \qquad (4)$$

in which, for any given height at which the unit is placed, the denominator is a constant, and the $\cos^3 \alpha$ may be taken from Table II, leaving only the candle-power, which, of course, must vary according to the lamp and reflector used.

Assume now a set of conditions and work out the complete results. Take $H = 9$ ft., and use the accompanying curve.

Consulting Table I it is noted that for $H = 9$ and $D = 1$ the angle is 6° 15′, of course, being 0° at $D = 0$. Laying the protractor on the curve at 6° 15′ the value is found to be 73 cp. At $D = 2$ the angle is 12° 30′ and the candle-power 76. In like manner the other intensities are shown in Table III.

For a large light source, hung at a height exceeding 15 ft., it would be well to carry the illumination calculation further than 24 ft.

Using an ordinary slide rule, set the slider at the height in feet, at which the light source is placed, on the lower or D scale and bring the corresponding value of I (from the above table) on the upper edge of the slide, under the hairline of the slider. Now, opposite the value of $\cos^3 \alpha$ (from Table II corresponding to the height and distance) on the upper (A) scale, read the value of the horizontal illumination in foot-candles. For example, at $D = 2$ in the chosen case the angle is 12° 30′ and $\cos^3 \alpha$ is 0.9306, also $I = 76$. Using formula (4)

$$J_h = \frac{76 \times 0.9306}{81} = 0.874.$$

The values are given in Table IV for $D = 0$ to $D = 24$.

One can now proceed to a determination of the illumination on a horizontal plane. The average condition is that the plane requiring illumination is from 2.5 ft. to 3 ft. above the floor, and since 9 ft. has been selected for H, the height of the source of light will be from 11.5 ft. to 12 ft. above the floor, well out of the direct line of vision.

The selection of the proper distance apart for the sources in lighting an area is one requiring experience and judgment, but the expert can place them correctly almost at the first trial. In the case chosen the results obtained with units 12 ft. apart and an area of 144 sq. ft. per unit (Fig. 2) are as shown in Table V.

TABLE III.

Distance.	Candle-power.	Distance.	Candle-power.	Distance.	Candle-power.
0	72.0	6	97.0	14	68.0
1	73.0	7	99.5	16	59.5
2	76.0	8	99.0	18	55.0
3	81.0	9	96.5	20	52.5
4	86.0	10	90.5	22	50.0
5	93.0	12	78.0	24	48.5

At point A, for instance, there will be the illumination from one unit at 0 ft., three units at 12 ft. distance, and two at 17 ft. distance. Adding the value of J_h as found from the first computations, $0.890 + 3 (0.210) + 2 (0.074) = 1.668$ ft.-candles is the total horizontal illumination. At point H the illumination would be that from one unit at 2 ft., one unit at 10 ft., two units at 12 ft. and two units at 16 ft., the corresponding values of J_h being $.873 + .335 + 2 (.021) + 2 (.088) = 1.804$ ft.-candles.

TABLE IV.

D	J_h	D	J_h	D	J_h
0	.890	6	.091	14	.136
1	.886	7	.601	16	.088
2	.874	8	.508	18	.060
3	.853	9	.427	20	.045
4	.809	10	.335	22	.034
5	.768	12	.210	24	.026

TABLE V.

A = 1.668	F = 1.541	I = [illegible]
B = 1.699	G = 1.127	K = 1.035
C = 1.[illegible]	H = 1.804	L = 2.[illegible]
D = 1.884	I = 1.[illegible]	M = 1.794
E = 1.602		

These distances may be measured on a scale drawing with sufficient accuracy, and values may be taken from the table by interpolation. Similarly at points B, C, D, E, F, G, H, I, K, L and M the results in foot-candles are as in Table V.

For the novice it is advisable to plot these values in a curve, thus showing graphically the "hills and valleys." Experience will soon enable one to judge of the distribution of light by merely noting the computed values in their proper place on the plan. This should be done in any case for reference when similar conditions are encountered.

Practice shows, and one engineer who checked up with an illuminometer (or portable photometer) has stated, that a 33 per cent variation in illumination cannot be detected by the naked eye. It is also true that for most work, such as stores,

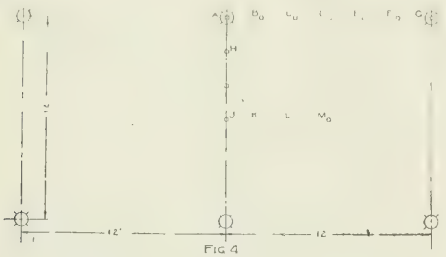


FIG. 2.—DISTRIBUTION OF LAMPS FOR EFFECTIVE ILLUMINATION.

churches, etc., 40 per cent, or even 50 per cent, variation, while detectable, is not objectionable. However, 30 per cent is a much better figure, and should always be attained if structural difficulties are not encountered. In Table V it will be noted that the minimum illumination is 1.427 and the maximum is 2.020, so that the former is 70.6 per cent of the latter. Reflection from ceiling and walls, which need not be calculated practically, can be depended on to increase the illumination and add to the uniformity.

If a higher intensity is desired, of course, two, three, four or more lamps may be used as a group-source without materially altering the light distribution, although more than four lamps to a fixture are seldom used on account of the rather heavy appearance.

Letter to the Editors.

Ornamental Street Lighting.

To the Editors of Electrical World:

Sirs:—It is refreshing to note in connection with Mr. Sawyer's article on "Ornamental Street Lighting at Des Moines, Ia.," which appeared in the first issue in May, that the tendency is toward permanency and effectiveness as indicated in artistic standards and posts, and away from the flimsy and inefficient as exemplified in festoons and arches over the roadway. To the musical ear dissonance can be no more vexatious than is the lack of taste displayed in some forms of public lighting, to a person with even a very ordinary sense of the appropriate. Why anyone should light the middle of a roadway where none but horses travel is beyond comprehension; the more so since at night the roadway is deserted even by horses. True, such a scheme possesses some spectacular merit, but not of lasting quality. With the advent of the more efficient and high candlepower incandescent lamps, the adaptability of the shorter lamppost and standard for street lighting was appreciated as never before, but here, in some cases, the tendency is toward the other extreme. A metal post lends itself to very artistic treatment, and artistic treatment to many is synonymous with classical. Lighting standards should, however, be useful as well as ornamental, and from the very nature of things it would appear that light should not be sacrificed for beauty.

To the writer there are abundant opportunities for compromises in post designs. Some of the heavy lanterns in use are architecturally perfect, but they are about as serviceable for illuminating purposes as are the eyes of a gargoyle. In many cities fluted posts with ornate capitals smaller in diameter than the outer globe of the lamp fixture are used with satisfaction, and where more than one lamp is used, a type of post like that used in Des Moines and in many other cities is pleasing architecturally and gives good illumination as well. But any column on a sidewalk is preferable to festoons of lamps over the roadway.

St. Louis, Mo. Frederick Baylis.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Compounding Alternators by Means of a Condenser.—W. Linke.—An illustrated description of a method of compounding single-phase and polyphase alternators, which has been tried by Eichberg for alternators of small output. For larger machines the high price of the condensers is prohibitive. On the other hand, the method is exceedingly simple and there is no lagging of the change of the voltage at the terminals behind the change of load. Fig. 1 shows the arrangement. In order to reduce the size of the condenser, it is connected to the secondary

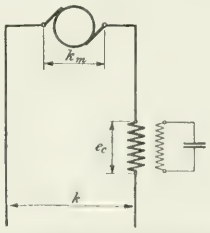


FIG. 1.—DIAGRAM OF CONNECTIONS.

of a transformer, the primary of which is in the main circuit. The ratio of transformation is so chosen that for the maximum current the voltage of the condenser is not above the maximum value permitted by the insulation. The compounding action is explained by means of vector diagrams and the results are given of tests made with an 8-kilovolt-ampere machine. The condenser consisted of 20 Leyden jars with a capacity of 0.2 microfarad. The transformer had a rating of 6 kilovolt-amperes and had an adjustable ratio of transformation. The compounding action follows instantaneously any change of current. Perfect compounding is obtained, however, only with constant power factor and for railways and power transmission the results are entirely satisfactory. In order to reduce the price of the condenser, it is preferable to use as high a voltage as possible. The condenser must be protected against excessive voltages (short circuits in the network). For this purpose the saturation of the transformer may be so chosen that it operates at normal current in the knee of the saturation curve, or horn lightning arresters may be employed, which short-circuit the condenser.—*Elek. Zeit.*, May 13.

Alternating-Current Generators.—Lyle.—An abstract of a (British) Physical Society paper. The author points out that the theory of armature reaction as ordinarily discussed by electricians is unsatisfactory, as an important effect due to the mutual induction between the current in the field winding and the current in the armature circuit is neglected. To simplify the problem, the case of a simple ironless single-phase alternator is first discussed. The magnetic field, supposedly uniform, is due to the current in a fixed coil of wire connected with a

is shown in Fig. 4. The arcs *AD* and *BC* are parts of circles with the center o. The straight lines *AB* and *CD* are parts of radii. For making a measurement, the conductor *AB* is brought into the flux to be determined, the lines of flux being perpendicular to the loop *ABCD*. If an electric current passes then through the loop, the magnetic flux exerts a force on the loop. The forces corresponding to *AD* and *BC* do not have to be taken into account because the direction of these forces passes through o so that the torque is zero. Further, the loop *ABCD* is made so large that *CD* is outside of the flux. The only useful torque is, therefore, due to the arm *AD* and if the radius *r* is made equal to the other arm of the balance, weights placed on the other arm measure directly the torque, from which the magnetic flux intensity may be found directly. Even unskilled investigators when using this balance will get an accuracy of ½ per cent.—*Elek. Zeit.*, May 13.

Water Rheostats.—F. ROSS.—A description of a device which avoids resistance changes with stationary electrodes due to the

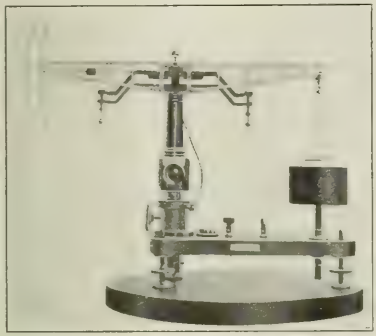


FIG. 4.—VIEW OF BALANCE.

change of the level of the water. When the water supply has been adjusted according to the load to be expected, the lowering or raising of the vessel *e* in Fig. 5 permits adjusting the water level in *a*. By means of the solenoid the arrangement can be adjusted to constant resistance and rendered automatic. —*Elek. Zeit.*, May 13.

Electromagnets for Laboratories.—G. ZINDEL.—An illustrated description of electromagnets designed by Weiss for laboratory purposes. On account of very careful design they give a flux 10 per cent higher than the usual electromagnets. With an exciting current of 53 amp (about 200,000 amp windings maximum) it produces a flux density of 46,000 gauss. The coils are artificially cooled, and this also results in a constant temperature of the air-gap and prevents a reduction of the length of the air-gap during the experiments. The length of the air-gap is regulated by a micrometer.—*Elek. Zeit.*, May 13.

Wehnelt Interrupter.—P. BARY.—The conclusion of his article

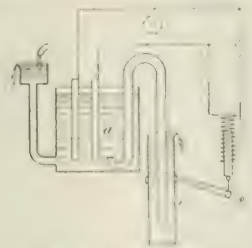


FIG. 5.—WATER RHEOSTAT.

on the theory of the Wehnelt interrupter, considered as a consequence of the pinch phenomenon. The formula, which gives the influence of frequency, is derived from this theory and compared with measurements.—*La Lumière Elec.*, May 8.

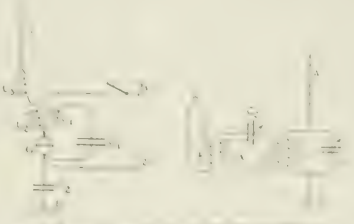
Quadrant Electrometer.—E. ORLICH.—The first part of an illustrated paper giving an account of an investigation made in the German Reichsanstalt on the use of the quadrant electrometer for alternating-current measurements.—*Elek. Zeit.*, May 13.

Air Pump and Vacuum Meter.—U. VON REDEN.—An illustrated description of a new mercury pump and a new vacuum meter. The advantage of the latter compared with the instrument of MacLeod is the small amount of mercury required: for this reason the new vacuum meter permits with greater exactness the measurement of very high vacua.—*Phys. Zeit.*, May 1.

Radiation Pyrometer.—An illustrated description of a modification of the Fery radiation pyrometer. In the ordinary form of this instrument the radiation is concentrated on the junction of a thermo-couple. In the new type a small strip made of two metals with very different coefficients and coiled to the shape of a spiral is used instead of the thermo-couple. The spiral unrolls when heated and the pointer marks the movement of a scale.—Lond. *Eng'ing*, May 14.

Telegraphy, Telephony and Signals.

Wireless Telegraphy.—An illustrated description of the Lepel system of wireless telegraphy. This is called a "spark system" in counterdistinction to the "arc system," all of which have one feature in common, viz., that energy is taken from the supply circuit throughout some portion, or phase, of every cycle of the high-frequency current. This distinguishes the arc from the spark, in which latter no energy is taken from the supply circuit during the existence of the oscillatory current, which therefore dies out very rapidly, since its total energy was stored in the potential form in the condenser before the discharge commenced. In ordinary "arc" generators of high-frequency current, energy is taken from the supply circuit during one-half of each cycle of the high-frequency current; in Marconi's generator it is taken during both halves of a cycle. In ordinary spark systems the number of sparks per second has no relation to the frequency of the current produced, the spark rate being controlled by such external arrangements as an electromagnetic or mechanical break in the primary circuit or by the frequency of a low-frequency alternator. Thus it is not possible to maintain a continuous high-frequency current in any circuit of the generator. Even if the spark rate be high it has no relation to the current frequency, hence successive sparks in general commence with a current out of phase with the tail end of the jig, which may exist in the circuit if the damping be low enough. If, however, as in the Lepel system, the discharge rate be controlled by the high-frequency current itself, a continuous high-frequency current of only slightly varying amplitude is produced in the transmitting circuit. Fig. 6 shows that transmitter where *A* is the aerial wire; *G*, the generator; C_1C_2, capacities; L_1L_2, coupled inductances; L_3, aerial inductances, and S_1S_2, the supply terminals. The current in C_1, *L*, *G* has usually the same frequency as *A*, L_3, L_2, *G*, *E* Fig. 9 shows the receiver in which C_1C_2 are variable capacities. $L_1L_2L_3$ inductances in tuned circuits, L_4 coupling of detector



FIGS. 6 AND 7.—DIAGRAM OF CONNECTIONS.

circuit *D* to intermediate circuit. The generator *G* consists of a box which contains flat metal plates about 3 in. in diameter, which constitute the electrodes of the discharge gap. These are separated by one or two thicknesses of thin paper at the

center, where a small hole is cut in the paper leaving only air between the plates. The paper burns very slowly as the discharge proceeds, one piece often sufficing for from two to three hours' continuous working. A sliding contact on the principal spiral L_1 gives the wave-length adjustment, and the outer, or aerial spiral is hinged so that its mutual induction with the other can be varied within wide limits. In an editorial note, reference is made to the claim of the Lepel Wireless Syndicate that the new system of the Telefunken Company is "a conspicuously spurious imitation" of the method devised by Von Lepel. As to the Lepel system it is thought that "the method of generating is at the bottom merely a mechanical variant of the cooled Poulsen arc in a hydrogeneous atmosphere produced by the burning of the paper; but it is an adaption in which the mode of ensuring a constant arc length and of supplying the necessary atmosphere is of surpassing ingenuity and perfection."—Lond. *Electrician,* May 14.

Wireless Telephony.—E. Nesper.—An illustrated description of arrangements for wireless telephony, due to Poulsen, Ruhmer, Ges. f. Drahtlose Telephonie, Eisenstein, De Forest, Colin and Jeance, Collins, and Majorana. All arrangements which have so far proved successful make use of an arc for the production of high-frequency oscillations, employing one or several devices of Poulsen.—*Elek. Zeit.,* May 13.

Miscellaneous.

"Electric Fire."—In consequence of the breakdown of a tramway feeder cable in the Knott Mill district of Manchester, a water main crossing the iron pipe in which it was laid was made alive, and this resulted in an outbreak of fire in two buildings through ignition of the gas supply. The fires were under control, however, before serious damage was done, and the tramway service in the district was restored in a few hours. —Lond. *Elec. Eng'ing,* May 13.

Electrical Industry in Austria.—E. Honigmann.—The conclusion of his lecture giving a review of the electrical industry in Austria in 1908. He deals especially with the conditions of manufacture, the progress of electric traction, and the reaction of legislation on the industrial conditions in Austria in 1908.—*Elek. und Masch.* (Vienna), May 9.

NEW APPARATUS AND APPLIANCES

Goubert "Multipass" Feed-Water Heater.

The accompanying illustrations show a new type of Goubert feed-water heater, known as the "Multipass" heater, recently introduced by the Goubert Manufacturing Company, New York, and made in sizes of from 50 hp to 5000 hp. This apparatus is guaranteed by the manufacturers to heat feed water from ordinary temperature to within 10 deg. of the temperature of the exhaust steam. Referring to the illustrations, the heater consists essentially of two cast-iron water chambers connected together by a cluster of small, straight brass tubes, which in turn are enclosed within a cylindrical cast-iron shell extending from one water chamber to the other. The ends of the tubes are rolled into steel tube plates in the same manner as boiler tubes are rolled into the manifold. The cast-iron shell surrounding the tubes merely provides an envelope for the exhaust steam, and is of larger diameter than the water chambers, to form an annular belt from which the steam may enter among the tubes from all directions. The exhaust steam enters the shell by the upper opening shown at the right, and what does not condense passes out the lower opening. That which is condensed on the tubes flows to the bottom of the shell and passes out through a drip pipe. It is claimed that with this construction oil or grease in the steam is removed as in an oil separator and passes off with the drip, leaving the remainder of the exhaust steam in the best possible condition for heating systems and other purposes where live steam is sometimes used, but which must be free from all impurities.

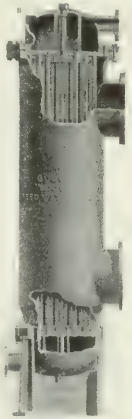


FIG. 1.—VERTICAL MULTIPASS FEED-WATER HEATER.

A great advantage of having the water within the tubes, as in the Goubert heater, is that the scale may be removed without taking down the heater. It is obvious that by removing the top chamber the tube interiors can be examined and cleaned out with little difficulty. Any sediment which falls, either during cleaning or operation, goes down into the bottom of the lower water chamber, from which it may be drawn out through the bottom blow-off openings. But the particular advantage of the water-tube construction is that which gives the Goubert heater its name "Multipass." As will be noted, there are baffles so placed in the upper and lower chambers that the feed-water entering at the bottom must travel back and forth through several sets of tubes, and be subjected to the heat of the steam several times before it can reach the outlet at the top. In a 700-hp heater, the instance (handling 21,000 gal. of water per hour), there are 100 tubes, each 1 in. in diameter and over 7 ft. long. The feed water must travel five times the length of these tubes in the path of the steam, which gives every opportunity for absorbing the largest practicable amount of heat.

The Goubert heater is provided with an expansion joint between the upper chamber and the shell. The upper chamber is supported entirely by the tubes and left free to move up and down. The expansion joint is fitted with a flexible ring gasket composed of layers of soft copper and special packing with wire interwoven. The inner edge is clamped between the shell and an annular ring. The only purpose of this gasket is to prevent steam from escaping into the room, and as it is subjected to no other pressure than atmospheric, the gasket will last for years. Its renewal amounts to nothing more than the replacing of a cylinder head or steam pipe gasket.

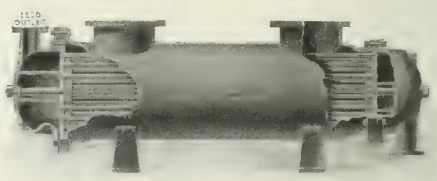
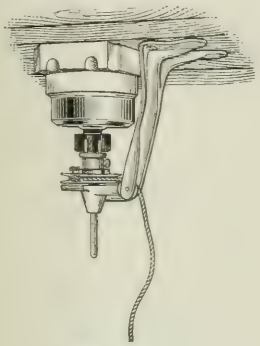


FIG. 2.—HORIZONTAL PATTERN.

While the vertical construction as described is preferable for installations where there is not sufficient head room, as in the cellars of city buildings, the horizontal heater shown in Fig. 2 can be used. This has the same essential features as the vertical type, and is also useful in connection with condensing engines. If it is desired to suspend the horizontal heater from the ceiling, the feet may be replaced by straps, lugs or bolts for that purpose.

Pull Attachment for Snap Switches.

Thomas J. Burke, of the Burke Electrical Works, of New Orleans, La., has devised the attachment for snap switches illustrated herewith. The leg of the device is attached to the ceiling by two common wood screws, or if the ceiling be of metal by toggle bolts. The Code requiring snap switches to have an insulating or hardwood base, the leg is made long enough to take in the switch and base. The metal parts of the device do

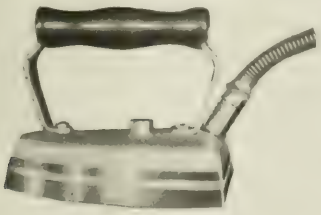


PULL ATTACHMENT FOR SNAP SWITCHES.

not touch the current-carrying parts of the switch, but grasp the switch handle so that there is no danger of shock attending its operation. By means of a sliding shaft the device may be made to operate a switch of smaller dimensions or one set flush with the ceiling. In conduit work the mechanism can be placed adjacent to the switch in the conduit. By means of a cord or chain passed around a grooved disk and over a pulley the switch may be opened or closed, a spring-and-ratchet arrangement returning the grooved disk to normal position after each pull.

The Harwood Electric Iron.

The Harwood Electric Heating Company, of Hutchinson, Kan., has made a number of changes and improvements in its electric iron, the latest form of which is illustrated herewith. The entire bottom of this iron constitutes a heating element. This bottom is a heavy piece of cast iron, one side of which is the polished working surface. The top of this piece has a raised portion in which slots are cut in the solid metal, and in these slots the resistance wire is placed in zigzag form between sheets of mica. As the heat has but a short path through these mica



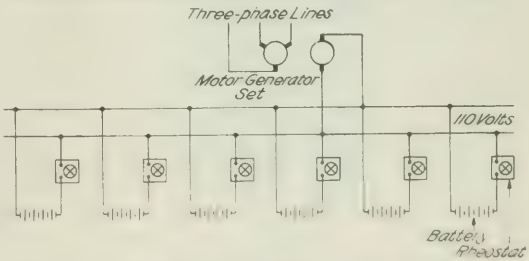
ELECTRIC IRON.

sheets to the sides of the slot, there is good heat conductivity away from the resistance wire into the metal of the iron. The mass of metal in the bottom of the iron constitutes a heat storage which will maintain its working temperature for a considerable length of time. The resistance material not being rigidly held by cement or enamel to the body of the iron, it is not subjected to breaking strains caused by the expansion or contraction of the iron. Realizing that the plug or connector has been the weakest point of many irons, this company has perfected a new switch plug which provides for contacts of some flexibility embedded in porcelain. The porcelain insulation has a metal case which protects the switch plug from breakage. Spiral springs of piano wire are provided between the porcelain and the metal case. These give considerable flexibility to the terminal receptacles.

Battery Charging in Automobile Garages with Mercury-Arc Rectifiers.

In many electric automobile garages having a capacity for charging two or more batteries at one time, the charging is done directly from direct-current feeders or through a motor-generator set from alternating-current feeders. The general connections are similar to those shown in Fig. 1, either with or without the motor-generator. There are a small number of garages using single-circuit rectifier outfits, one for each battery to be charged, but while this method is very satisfactory and highly efficient, the cost of the original installation is rather more than most garages care to invest for this purpose. A large number of charging garages are now using the public-garage type of rectifier, which is described later in this article.

Referring again to Fig. 1, let it be assumed that six batteries are to be charged from the 110-volt circuit, and that the number of cells in the various batteries is as follows: No. 1, 44; No. 2, 40; No. 3, 30; No. 4, 24; No. 5, 16; No. 6, 12. The tabulation in Fig. 1 shows the actual watts delivered to the battery, the watts lost in the rheostats and the efficiency of each circuit, neglecting the loss in the motor-generator set. It will be seen from the last column that the efficiency of the complete system, exclusive of the motor-generator set, will be about 58 per cent; with the motor-generator set having an approximate



	Circuit						
	No. 1	No. 2.	No. 3	No. 4.	No. 5.	No. 6.	Totals
Number of cells	44	40	30	24	16	12	166
Volts, average.	101	92	69	55	37	28	...
Amp., average.	20	20	20	20	20	20	120
Watts used....	2020	1840	1380	1100	740	560	7640
Watts lost....	180	360	820	1100	1460	1640	5560
Watts, total...	2200	2200	2200	2200	2200	2200	13,200
Per cent efficiency	92	84	63	50	34	25	58

FIG. 1. DIAGRAM OF CONNECTIONS AND TABLE FOR CHARGING GROUP OF BATTERIES FROM MOTOR GENERATOR.

efficiency of 75 per cent, the efficiency of the system will average about 44 per cent.

The public-garage type of mercury-arc rectifier is shown in Fig. 2. This outfit is designed for use on a 60-volt, 60-cycle alternating-current circuit and consists of a two-panel, dull-black slate switchboard with necessary regulating compensator, reactance, equalizing rheostats, rectifier tubes and switches, all suitably mounted with a view to obtaining the most compact and convenient equipment possible. The left-hand panel of the switchboard is known as the rectifier-controlling panel, and on it is mounted the apparatus particularly essential to the starting of the rectifier tube and regulation of the rectifier current. The right-hand charging-circuit panel is equipped with six triple-pole, double-throw switches which lead to the various charging circuits, two ammeters and a six-point selector switch for adjusting one of the voltmeters on

the left hand panel for reading the voltages of the various batteries being charged.

The general scheme of connections of the charging circuits on the garage panel is outlined in Fig. 3. The rectifier when charging a group of batteries similar to that shown in Fig. 1 would supply an average of about 193 volts on the charging circuit. It will be noted from Fig. 3 that the six batteries are arranged in two circuits of three batteries each, the batteries being equally divided between the two circuits. The tabulation just below the diagram gives the losses and efficiencies when charging with these connections. It will be noted from this table that the average efficiency of the charging circuits alone, neglecting the very small losses in wiring, is 99 per cent. As the efficiency of the rectifier when delivering 193 volts is about 84 per cent, the total combined efficiency of the complete charging equipment would be about 82 per cent.

Referring to the table in Fig. 1, it will be seen that the total watts used in the charging circuits is 13,200. At 75 per cent efficiency this would mean an input to the motor-generator set of about 17.6 kw. The input to the rectifier under the conditions shown in Fig. 3 would be about 9.2 kw, representing a saving of 8.4 kw for each hour of operation under similar conditions. Of course, a part of this saving would be diverted

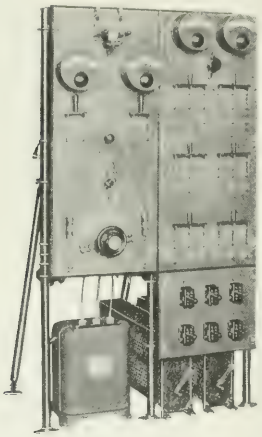


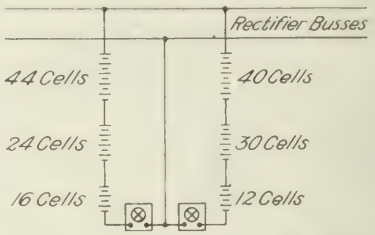
FIG. 2.—PUBLIC GARAGE TYPE OF RECTIFIER.

to the purchase of renewal tubes for the rectifier, but even considering the slight additional expense, it is claimed that the saving in power could figure out at least 20 or 25 per cent.

While some garage operators might consider the combination of cells given in the foregoing example as an unfavorable case, it should be borne in mind that batteries of the various number of cells mentioned are furnished by representative electric vehicle manufacturers for use in their "electrics." Nor is it possible for a garage to control the conditions and make them most favorable to the charging plant. For example, garages are frequently called upon to charge a single battery with a large number of cells, say, a 40-cell battery, and a large number of batteries with a smaller number of cells, for instance, five 24-cell batteries. When charging such a group of batteries from a 110-volt direct-current circuit the efficiency would be about 44 per cent. When charging the same batteries with a rectifier, the efficiency would be about 75 per cent.

In the accompanying tabulation of efficiencies when charging various sizes of batteries, for the purpose of comparison, the charging rate on all batteries is taken as 20 amp, and the average volts per cell as 2.3. While some batteries are designed for a heavier charging rate, the average battery can be efficiently and economically charged at this rate, although the time of charging may be somewhat longer. There are, of course, almost innumerable combinations of batteries possible, but the above will give the general basis for comparison between the various methods of charging.

It will be noted from Fig. 4, which is a complete diagram of connections of the rectifier garage set, that when a battery is connected to the terminals of each of the triple-pole switches marked + and —, with the switches thrown in the upper position the batteries are connected in two series groups similar to Fig. 3. If all the 12-cell batteries are to be charged at one



	Circuit. No. 1.	No. 2.	Totals.
Number of cells	84	82	166
Volts, average	193	189	...
Amperes, average	20	20	40
Watts used	3860	3780	7640
Watts, lost	...	80	80
Watts, total	3860	3860	7720
Per cent efficiency	100	98	99

FIG. 3.—DIAGRAM OF CONNECTIONS AND TABLE FOR CHARGING CIRCUITS FOR GARAGE OUTFIT.

time, they may be placed in series by simply reversing the position of a double-pole, double-throw switch on the left-hand panel. For practically all charging, however, the circuits will be connected in series multiple, as shown in Fig. 3.

In each of the two series-charging circuits is connected a 60-amp ammeter and a rheostat for equalizing the current between the two circuits. In order to use as little of the resistance as possible, the number of cells of battery should be arranged to be as nearly equal as practicable. When it is desired

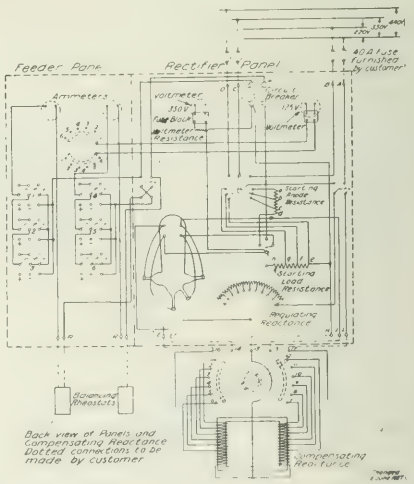


FIG. 4.—DIAGRAM OF CONNECTIONS OF RECTIFIER OUTFIT.

to cut out a battery for any reason, the switch to which this battery is connected should be opened, a sufficient amount of the charging rheostat cut in and the switch thrown into the upper position. This cuts out the battery, but the series circuit is not broken and the charging of the remainder of the batteries will be continued.

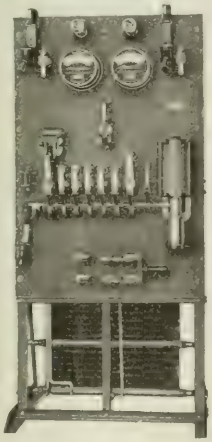
A sub-base, shown below the right-hand section in Fig. 2, is

sometimes furnished. This sub-base is equipped with six non-reversible plug receptacles and six charging plugs. To these plugs should be attached six charging cables leading to various points in the garage. The use of this sub-base permits of readily changing the various batteries under charge from one circuit to the other in order to make the most efficient combination without moving the vehicles from place to place in the garage. With this type of rectifier it is possible to charge at one time a total of 180 cells of lead-plate battery at 20 amp each.

About 30 of these garage panels are now in actual service giving excellent results and, in practice, are stated to prove that the above efficiencies outlined are not merely theoretical.

Fire Pump Electric Starter.

The apparatus shown in the accompanying illustration is designed primarily for the control of motor-driven fire pumps, and finds its widest use in connection with centrifugal underwriters' pumps operating on sprinkled systems. Its purpose is to start and stop the pump automatically on variations of pressure in the system, thus maintaining a constant pressure available in case of fire. It is also so designed that the pump may



FIRE PUMP ELECTRIC STARTER.

be readily started by hand for test purposes or in case of fire should the automatic feature fail. The cut shows one of these starters complete with accessories, including circuit-breaker, ammeter, voltmeter, main-line knife switch, etc., for controlling a 100-hp, 220-volt motor-driven underwriters' fire pump recently installed in Chicago.

The apparatus consists simply of a combined line switch and rheostat, so designed that it can be operated both automatically and by hand. The main line and accelerating switches consist of a series of crank-operated switches closed mechanically and successively by means of cranks on a revolving shaft. This shaft is revolved either by a solenoid through the medium of a rack or pinion, or by a hand lever. A pneumatic governor, connected to the pressure tank into which the pump discharges, controls the circuit of the solenoid, opening and closing said circuit on predetermined limits of pressure, thus energizing and de-energizing the solenoid to start and stop the motor automatically.

To start the motor by hand, the lever at the end of the shaft is gradually raised to a vertical position revolving the shaft through half a revolution, closing the switches in succession and bringing the motor up to speed. The lever is held in the running position by a retaining catch, thus providing the no-voltage release feature. Upon failure of voltage, the lever and solenoid plunger drop to the off position, opening the switches, reinserting the accelerating resistance and opening the motor circuit. The crank switch which is used to make and break the motor circuit consists of a laminated brush with auxiliary carbon contact and is provided with a powerful blow magnet to disrupt the arc. The accelerating switches have heavy "butt end" carbon contacts and all burning and arcing are practically eliminated. The solenoid plunger is retarded by means of a vacuum dash-pot which may be easily adjusted to govern the rate of acceleration of the motor.

In some cases it is desired to provide for a speed regulating feature for increasing the speed of the motor 10 per cent over normal, thus increasing the capacity of the pump in case of emergency. For this purpose a single magnet switch, controlled by push buttons on the panel, is provided, which inserts the required resistance in the shunt field of the motor. The circuit of this switch is controlled by the rheostat in such a way that it is impossible to start the motor with weakened field.

The advantages of this type of starter for fire-pump service lie in its extreme simplicity. The entire automatic feature is controlled by one coil and the hand operation is accomplished by means of one lever. Furthermore, the same rheostat contacts and resistance are used for both operations, and at the same time either control is absolutely independent of the other. All sliding contacts and delicate relays are entirely eliminated and the rugged construction and simplicity of operation make the outfit ready for action under all conditions.

The apparatus described is made by the J. L. Schureman Company, Chicago, Ill.

Fusible and Fuseless Rosettes.

The Trumbull Electric Manufacturing Company, of Plainville, Conn., has just put on the market a complete new line of two-piece rosettes, fusible and fuseless, of the cleat, concealed and molding types. The caps are interchangeable, any cap fitting any base. In designing this new line, particular attention was given to the chief difficulty found in most rosettes, namely, that of the cap loosening or jarring off from the base. The manufacturers state that before marketing the present line of rosettes they were put through various and severe tests, which showed that their construction prevents the caps being loosened from the base by jars.

This result is attained, in addition to great care in assembling, first, by the use of a strong bronze spring of an especially wide range, which follows the contact in the base and holds the



FUSIBLE AND FUSELESS ROSETTES.

caps securely at all times, and, second, by a [illegible] their construction whereby the contact pieces are struck off at an angle in such a way that when strain is put on they are drawn still tighter together. The more the weight thus the closer the contact. The [illegible] for lamp cord being ample, the binding screws heavy and substantial, and while the base and cap [illegible] considerable pressure is required to take them apart.

A Multilet Box and Receptacle.

The accompanying illustrations show the Sprague "Multilet" box with cover fitted with a receptacle, which can be seen within the box. Unlike many other sign and outlet box receptacles the one illustrated is particularly adaptable to Sprague "Multilets" for the reason that the screws securing the wire connections to the clips of the receptacle are tightened from the face of the receptacle and not from the back. This obviates the necessity of having long wires within the box, an advantage which will be quickly appreciated by the wireman.

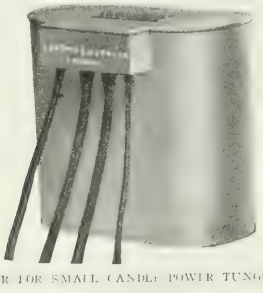




FIGS. 1 AND 2.—MULTILET BOX AND RECEPTACLE.

Sign and Decorative Lighting with Tungsten Lamps.

Recently low-voltage tungsten lamps of various sizes from the miniature up have been perfected and on account of their comparatively thick and short filaments, these lamps stand harder usage and have a longer life than the higher-voltage tungsten lamps. By using a special transformer stepping down from 110 to approximately 10 volts the use of these low-voltage tungsten lamps is made possible. The ordinary 4-cp carbon sign lamp consumes a total of 19.28 watts per lamp as compared with a total consumption of 5 watts in the case of the 4-cp tungsten lamp. As the saving is in a ratio of substantially 4 to 1, the commercial possibilities and desirability of this new combination are obvious. Moreover, the increased cost of the tungsten sign lamp is largely counterbalanced by the increased life, which will frequently reach 2000 hours.



TRANSFORMER FOR SMALL CANDLE POWER TUNGSTEN LAMPS.

In ordinary sign lighting the transformer core losses are proportionately quite high in that signs, like other current-consuming devices, are operated from the regular lighting or power mains, energized 24 hours a day and, therefore entailing a constant core loss in transformers supplying the lamps, a proper percentage of which loss is chargeable against the signs. On the other hand, the tungsten transformer is connected between the control switch and the lamps, so that the core losses only go on while the lamps are burning. Another decided advantage in using the tungsten-lamp transformer for low-voltage lamps instead of placing a group of 10 or so in series across the 110-volt circuit is that any number of lamps can be used and the complete extinguishing of a row of lights is avoided when any lamp burns out. The tungsten sign lamp is also an exceptionally economical medium for the illumination of drug stores, libraries, dens and reception halls, as well as sign and outline work. A transformer for use with small candle-power lamps, made by the Central Electric Company, Chicago, is shown in the accompanying illustration.

Floor Finishing Machine.

The electrically operated floor-finishing machine illustrated herewith is the invention of Rudolph T. Schuttler, of Oshkosh, Wis. The machine is simple in construction, with a horizontal base, in the forward end of which is journaled a vertical shaft. On the lower end of this shaft is attached a hollow disk or buffing wheel, on which is placed the abrasive or polishing material. In the machine illustrated this disk is 7 in. in diameter and is belt-driven by a 1½-hp motor, as shown. Other sizes can be built if desired, but practical demonstration has shown that the 7-in. disk is well adapted for various purposes. The disk makes 2400 r.p.m., and weighs 40 lb. The weight of the whole machine is 175 lb. The abrasive or polishing material is placed on the disk, which is also adapted to contain oil used in finishing floors, the oil percolating through perforations in the lower face of the disk and being used with the felt or other polishing material.

The frame of the machine rests on two wheels, and toward the front end is a caster wheel which allows the machine to be easily moved in any direction. The buffing wheel may be raised or lowered by a lever attached to the handle of the machine and connected by a rod to mechanism provided for that purpose, as shown in the cut. Means are provided for securing the lever in any one of several positions. In operation, however, the disk is said to adapt itself to any surface, apparently following the floor level. The lever and rod simply come into play when it is desired to remove the machine some distance without doing any work with it. In operation the machine is swung from left to right and vice versa after the manner of handling an old-fashioned scythe, and it takes in about 5 ft. of floor surface at a time. The inventor says that he can smooth about 100 sq. ft. of rough, uneven floor surface in an hour by the use of the machine, which is flexibly connected to any suitable source of electricity. After the floor is made smooth the same machine is used to polish it. In working upon new floors abrasive material is first used on the buffing wheel, which will have the effect of a rasp; then sandpaper is used on the disk and lastly this is replaced by felt for the polishing. Mr. John M. Crook, 841 North Fifty-third Avenue, Chicago, is introducing the machine.



FLOOR FINISHING MACHINE.

Indirect Lighting of the American Radiator Company General Offices.

The general offices of the American Radiator Company, at Chicago, have recently been equipped throughout with indirect lighting from chandeliers placed at the outlets which existed when the former direct system was in use. Besides the general offices, the storeroom on the first floor has also been equipped in this way. The former method of lighting was by means of clusters of incandescent lamps under flat opal reflectors, which



FIG. 1.—DIRECT ILLUMINATION.

gave a general illumination. This was supplemented by individual desk lights placed wherever needed. These offices and the store were wired with an outlet in the middle of each ceiling panel, half of the panels being about 16¾ ft. x 24 ft., and the others 16¾ ft. x 18¼ ft. The outlets had six-light clusters with common carbon 50-watt lamps.

The general plan pursued when the indirect lighting was adopted was to place three 100-watt "I-Comfort" inverted reflector units on a chandelier in place of each six-light cluster. In a few places in the offices where especially good light was needed, four-light chandeliers with 100-watt tungstens were installed. The offices on the second and third floors have 12-ft. ceilings. The fixtures on these floors were made 46 in. over all. The store has 13-ft. 6-in. ceilings and the fixture length is 46 in. On the fourth floor, where there are 18-ft. ceilings, the fixture length was 50 in. over all. These heights were adopted after taking into consideration the areas to be covered and the



FIG. 2.—INDIRECT ILLUMINATION.

character of walls. The walls and ceilings of these offices are nearly white. The store on the main floor has a papered ceiling of a tint which is slightly gray in general effect. In another portion of the building, which has low ceilings and which is occupied altogether by typewriters' desks, one-light units spaced at frequent intervals were used. Altogether there were 53 three-lamp chandeliers, 23 one-lamp and 5 two-lamp chandeliers.

The watts per square foot is about 1 in most of the office space, but varies in different parts of the offices, the maximum being 1.3 and the minimum 0.6. The installation was made after a three months' trial of the indirect system in the accounting room and advertising departments. This company's offices in two other cities are also being equipped in the same way. Fig. 2 shows the store on the first floor of the building equipped with the indirect system. The National X-Ray Reflector Company, of Chicago, furnished the reflectors and fixtures.

Fuse and Service Boxes with Interchangeable Fittings.

The H. W. Johns-Manville Company, of New York, has made a number of improvements in its line of fuse, service and subway boxes suggested by its greater experience in the field. The company has discarded its well-known lobster-claw fuse carried on all low-voltage service boxes and now uses a carrier consisting of steel hooks, simultaneously actuated by a single-cover handle. The new type of service box is shown in Fig. 1.

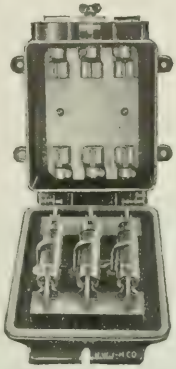


FIG. 1.—SERVICE BOX.



FIG. 2.—RIGHT OR LEFT HAND FITTING.

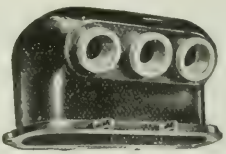
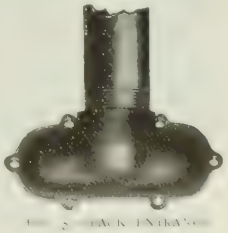


FIG. 3.—ENTRANCE HOOD.

Each end of the box is provided with a large oval boss, the surface of which is planed, jig-drilled and tapped. The wire holes are provided with porcelain bushings. Where it is desired to employ the box in connection with conduit work, the various fittings shown may be used and attached to the box by means of screws. Ordinarily these fittings are attached to the box without a gasket, but where it is necessary or expedient to secure a water- or gas-tight device, a small rubber gasket may be inserted between the planed surfaces of the fitting and the box. When it is desired to place the fuses in circuit, the handle is



FIG. 4.—STRAIGHT-AWAY FITTING.



FITTING.

turned so that it points downward. The fuses are then slipped into the aligning clips in the cover and the handle turned so that it points to the right. The cover may then be closed or opened, inserting or withdrawing the fuses. If it is desired to examine the condition of the fuses without breaking the circuit, the handle is given one-quarter of a turn, thereby releasing the fuses and permitting the cover to be operated, leaving the fuses in their clips. The boxes are designed to be used as switches and in a great many instances are accepted in lieu of the usual cut-out and knife switch.

Exhibition Notes---N. E. L. A. Convention

THE exhibits at the National Electric Light Association convention at Atlantic City this year numbered 69. These are divided among 84 booths and the display covers passably well the entire field of electrical activity. Just prior to the general reception and dance on Monday night, the formal opening of the exhibits was announced by the complete illumination of the auditorium on the $1,000,000 Pier in which the exhibition was held. By means of the vari-colored lamps on the ceiling and sides of the vast hall, different color effects were obtained which were very pleasing. Green and white are the prevailing colors in the decorative scheme, and while the booths are easy of identification by means of the signs used, the committee has been at pains to regulate the exhibits and their arrangement so that one does not hide nor detract from another. As indicated in the engravings herewith, a general uniformity prevails in all the booths. Although not contemplated at first, some of the exhibits are of necessity arranged under the gallery on the north side, and a portion of the lower end of the auditorium is occupied by 14 booths. The vast auditorium in front, however, is kept clear for reception and other purposes, and in this way the exhibition feature does not unduly predominate. Outside the pier a number of flam-



FIG. 1.—GENERAL VIEW OF EXHIBITS AT N. E. L. A., ATLANTIC CITY CONVENTION.

ing-arc lamps are kept burning, the rules precluding their continuous operation inside. Following is a list of the exhibits and those in attendance thereon:

Albert & J. M. Anderson Manufacturing Company's booth is presided over by Mr. Ernst Woltmann. The display is devoted principally to time switches of various types and sizes; oil switches for tensions as high as 3000 volts and some for currents as great as 200 amp being among them. The double-pole, double-throw time switch for potentials not exceeding 250 volts is intended for changing the circuit from one meter to another in cases where an increased rate is charged during the peak load or where double rates are in vogue. The switch has no open position. The double-pole, double-branch time switch controls two separate circuits at intervals that is, closing one before the other and opening both at the same time, or opening one before the other and closing both at the same time. The triple-pole time switch for constant-current transformer circuits is especially interesting. The switch is intended for controlling series arc transformers and their circuits. When all three poles of the switch are closed, the secondary coil assumes such a position that the short-circuiting pole may be opened without causing undue strain on the lamps. This is done automatically by a second action of the mechanism, which throws on the lamps and allows the coil to adjust itself to the load. The company's specialties shown include Ætna insulation, switches and switchboards, heavy copper work, charging plugs and receptacles for automobiles, battery switches, etc. Assisting in entertaining are Messrs. George B. Crane and Alf. Anderson.

Allis-Chalmers Company features a sample board showing the construction of the blading of an Allis-Chalmers steam turbine. A line of transformers, embodying all the latest improvements in design and construction and a portable air compressor mounted on an ordinary four-wheel platform truck, are worthy of note. An induction motor and a direct-current motor are shown, together with a rack containing views in installations of prime movers, including turbines, gas engines, Corliss engines and hydraulic turbines. Representatives of Allis-Chalmers Company in attendance include: Messrs. W. H. Whiteside, M. C. Miller, A. H. Whiteside, J. R. Jeffrey, W. H. Powell, F. C. Randall, Geo. Baiz, C. A. Burns, Harry Byrne, W. G. Clayton, J. T. Cunningham, H. W. Dennison, J. F. Dixon, A. N. Libby, W. C. MacEwen, A. P. Peck, A. F. Rolf, Geo. C. Dresser, W. O. Taylor, L. L. Willard, H. W. Rowley, E. T. Pardee, J. H. Waterman, St. John Chilton, J. B. Nicholson, S. H. Payne, H. H. Pease, E. I. Van Doren, J. C. M. Lucas, A. A. Hutchinson, J. L. Watson, J. F. Shipp, Seldon Jones, B. Moore, O. C. Ross, J. W. Gardner and L. M. Harvey.

The American District Steam Company's exhibit consists of a model of its underground steam mains showing various fittings, etc. Condensation meters, live-steam meters, both of the Holly and St. John type, and models of the various steam specialties manufactured exclusively by the company are also shown. The company's representatives are as follows: Messrs. W. H. Wells, H. J. Babcock, W. J. Kline, H. C. Kimbrough, J. A. Bendure, R. Hall, and Miss R. Shankel, who is in charge of the booth. Detailed data on the operation of district steam-



FIG. 2.—VIEW DOWN ONE OF THE AISLES.

heating plants in connection with electric light and power plants and also data on live-steam plants are available to those interested.

American Electrical Heater Company, while it is not making a special exhibit at the convention, has its interests well taken care of by Messrs. B. H. Scranton and R. Kuhn, who have with them a number of the standard and representative devices made by the company, such as laundry irons, disk stoves, toasters, coffee percolators, etc.

American Electric Lamp Company of New York.—This company's exhibit, located in the center of the exhibition hall, consists of a complete line of samples of every known type and size of American carbon, tantalum, tungsten and metallized filament lamp, from the smallest miniature to the largest tungsten lamp made. In charge of the exhibit is Mr. L. F. Johnston Mr. C. J. Purdy is also in attendance.

The Anderson Carriage Company displays a roadster and a four-passenger brougham The features of these vehicles are many, chief among which are the use of ball bearings and double-chain drive. The representatives present at Messrs G. D. Fairgrieve and E. W. Allen.

The Baker Motor Vehicle Company has placed on exhibition a Queen Victoria and on the street for demonstration purposes is a runabout. The company has sent its chief engineer, Mr. Emil Gruenfeldt, and Mr. Peter Dumont, to explain the superior features of the Baker electrics. In this they are ably supplemented by Mr. O. B Henderson

Benjamin Electric Manufacturing Company has a number of display boards and samples on exhibition showing its line of wireless clusters and lighting specialties. An extensive line of new tungsten fixtures is in evidence and literature covering the various devices shown is being distributed. Messrs. B. G. Kodjbanoff, G. C Knott and H. L. Watson are representing the company during the convention

The Broc Carriage & Wagon Company was not able to secure space to make an exhibit at the convention, but is represented by Messrs John B. Stuber and J. H. Janssen, who are making the acquaintance of the central-station managers and taking up the question of electric vehicles with them

The H. B. Camp Company's exhibit comprises samples of its vitrified clay conduit and some photographs of installations where its duct is used Messrs C. C. Baird and R. P. Keasbey are looking after the company's interests

The Columbus Buggy Company's exhibit consists of a coupé and victoria. The former is on exhibition in the main hall, while the latter is used for demonstration purposes. The company's aim is to interest electric-light men in the present perfection of the electric vehicle and the possibilities of revenue for their plants from the sale of energy for charging batteries. Messrs. R. S. Fend and L. H. Estep are in charge.

Commercial Truck Company has two spaces in the main hall where it is showing a 3½-ton brewer's truck equipped with four-motor, four-wheel drive, which is meeting with such success in heavy hauling problems. An interesting part of the exhibit is the spiral gear drive on a 1000-lb. delivery wagon. The gears and all working parts of this drive are enclosed and the wagon shown is probably the first delivery wagon having such a drive. Messrs. L. A. Tirrill, E. S. Hare and E. R. Whitney compose the representatives of the company in attendance.

Cooper Hewitt Electric Company is showing samples of various types of standard mercury-vapor lamps for direct and alternating current and also its type T lamp, which is a combination of a circular Cooper Hewitt tube and a tungsten. The exhibition space is curtained for demonstration purposes. In attendance are Messrs. C. B. Hill and M. B. Buckman, Jr., the latter having charge of the exhibit.

The Crocker-Wheeler Company has on exhibition a collection of photographs showing its various products, including direct-current motors, induction motors, transformers, etc. Among the representatives of the company present are: Messrs. R. N. C. Barnes, Rodman Gilder, R. J. Randolph and J. R. Lewis.

The Dearborn Drug & Chemical Works, chemists on the treatment of boiler waters and manufacturers of lubricants, has the usual interesting exhibit such as the company arranges each year. Because of the scientific principle originated by this company for the practical correction of boiler waters, its preparations are widely adopted. Representing the company at the convention are Messrs. Robert F. Carr. G. W. Spear, H. G. McConnaughy and Paul T. Payne.

Dossert & Company have on exhibition a number of improvements and new applications of their solderless devices, including elbows for connecting ingoing and outgoing buses through oil switches; lugs for the connection of solid round to flat buses; special lugs for remote-control switches, special two-way studs for tapping from solid rods direct to buses and



FIG. 3. VIEW OF EXHIBITS FROM GALLERY

special studs for transformer connections. Messrs H. B Fegan and H. S. Shope are in attendance

Duncan Electric Manufacturing Company has an unusually large display of the various meters which it manufactures, including house type, switchboard type and a rotating standard test meter. Several sizes of transformers are also shown. The house type of meter was placed on the market early this year. All parts are formed up of sheet metal under heavy pressure and the interchangeability of parts is one of the features of the

instrument. The rotating standard test meter is so made that the pointers after each reading are brought back to zero by simply pressing a small button. In changing the field coils for the various loads, the use of plugs, knife or snap switches is not essential. The company's interests are well taken care of by Messrs. Adrian Tobias and William H. Sinks.

Duplex Metals Company is exhibiting copper-clad steel wire in sections of billets showing the reduction from the original size down to the finished product. Duplex wire, rubber insulated and weatherproofed, so as to be suitable for incandescent and arc-lamp circuits, is also displayed. Representing the company are Messrs. Frank R. Chambers, Jr., James F. Kinder and John B. Given.

Economical Electric Lamp Company not only has all of its turn-down lamps on exhibition, but by means of automatic apparatus shows how each of the lamps works. A miniature hand pulls the string by means of which the large filament is turned on and off and the small filament is lighted and extinguished. Messrs. M. and L. Lobenthal are in attendance.

Electrical World booth, facing the registration offices, was a center of attraction on the opening day, delegates and exhibitors vieing with each other in obtaining copies of the convention number, concerning which innumerable favorable and flattering comments were heard. Representing the business department are: Messrs. J. M. Wakeman, G. W. Elliott, W. K. Beard, C. T. Walker, H. T. Matthew, F. V. Clark, W. Wagner and M. Orton. The editorial staff is represented by Messrs. T. C. Martin, W. E. Kiely, J. R. Cravath, W. H. Onken, Jr., and H. S. Knowlton.

Electric Cleaner Company has a working exhibit consisting of several "Positive" electric vacuum cleaners in operation cleaning rugs. An attractive catalog is distributed, together with other advertising matter on the company's product. Mr. J. M. Rodger is in charge of the booth and he is assisted in demonstrating the cleaners by Messrs. C. C. Richardson, A. B. Cousin and a lady demonstrator.

Electric Cleaner Company is demonstrating a number of its vacuum cleaner outfits. The cleaner is said to have a range of from 0 in. to 12 in. vacuum and to operate on 8 in. at the nozzle. The machine is mounted on ball bearings and can be wheeled from room to room with ease.

The Electric Storage Battery Company is showing various types of storage battery cells for central-station service. Prominent in its booth is one of the largest cells in the world, consisting of 131 type H Exide plates, having a capacity of 22,000 amp-hours. Alongside of this cell is shown the smallest cell made by the company, having a capacity of 1 3/5 amp-hours. Inasmuch as interest is being centered on the electric vehicle the company is showing many different types of Exide cells used for automobile and ignition work. A large map, showing the distribution system for Exide material throughout the country, indicates that approximately 600 centers have been established where such materials can be purchased by the owners of electric vehicles. Attracting the eye is an exaggerated meter showing the current consumed by a motor with the vehicle on various grades. A large corps of representatives are present. Among these are: Messrs. Charles Blizard, Frank Stone, R. B. Daggett, G. H. Atkin, E. L. Raynolds, H. B. Gay, Albert Taylor, H. H. Seaman and H. L. Marshall.

The Electric Suction Sweeper Company has on view two sizes of Hoover electric suction sweepers. The 12-in. sweeper is equipped with a ⅛-hp motor and the 18-in. sweeper is driven by a ¼-hp motor, a rotary fan being employed in conjunction with a brush to effect rapid cleaning. The machine is not strictly a vacuum cleaner. It is operated on the plan of centrifugal exhaust and is therefore a departure from rotary or diaphragm pumps. This reduces the weight, cost and wear and results in simplicity of construction. Mr. W. H. Hoover and Mr. A. W. Wasey represent the company.

The Federal Electric Company is making an exhibition of its signs and various types of tungsten clusters. A sample board of specialties, a "Dim-a-lite" demonstration, a small model of a ground plate installation and a vacuum-cleaner outfit complete the exhibit. The corps of attendants include Messrs. J. M. Gilchrist, H. E. Brinckerhoff and J. J. Magee.

The Fibre Conduit Company is represented by Mr. J. M. Nelson, Jr., and Mr. F. A. Curtis, both of whom demonstrate how much easier and quicker the product of their company can be placed underground than the average conduit. Samples of fiber underground conduit and fittings occupy the booth maintained by the company.

Fort Wayne Electric Works show the different forms of alternating-current meters for service and switchboard use, two shunt and one series transformer used in connection with switchboard instruments, a calibrator used for calibrating meters in service, a special meter-testing board, pedestal commutator truing devices for turning down commutators without removing them from the machine, standard transformers and a number of motors. The small motors range in size from 1/100 hp to 1/6 hp and the larger motors are rated at 3 hp and 5 hp. One of each of the standard lines of fan motors built by the company is also on exhibition. The Compensarc, which is a special auto-transformer device for use with moving-picture machine arc lamps, together with a special switchboard for operating the device and showing relative comparisons, is featured. A full supply of all the company's literature describing the apparatus on exhibition is also available. The exhibit is in charge of Mr. A. A. Serva, assisted by the following: Messrs. F. S. Hunting, J. C. Lott, T. L. Sturgeon, H. W. Smith, C. A. Woolsey, E. H. Porter, J. B. Mills and T. W. Behan.

Fraley Hand Vibrator Company's exhibit in the side aisle is presided over by Mr. Charles M. Schunck. The vibrator is used extensively in barber shops and although operated electrically the actual massage movements are imparted to the hand through a flexible shaft.

General Compressed Air Vacuum Machine Company has one of its portable cleaners in operation. The company is represented by Mr. A. R. Thomas, who points out the advantages of the steel dust-separating tank, positive-pressure rotary pump, which is driven by a ¼-hp motor and the general advantages of vacuum-cleaning apparatus.

The General Electric Company's exhibit is located in the middle of the exhibition hall on the south side. Here are shown a collection of tungsten lamps of various sizes, some of the newer designs of heating and other devices, including the new "Calorite" heat unit flatiron, the radiant toaster, etc. The company is showing various arc lamps, some of which are new to central-station men in general. These include a series of magnetite arcs, carbide lamps, flame arcs, and a new small-sized intensive flame arc. A collection of instruments of special interest to central-station men, and transformers showing the three different stages in transformer development, are features attracting attention. The oscillating electric fans and the standard series tungsten outfits are also shown. As usual, a large representation from all parts of the country is present. Among them are the following: Messrs. C. D. Haskins, D. R. Bullm, P. D. Wagoner, F. G. Vaughen, A. D. Page, E. E. Gilbert, C. W. Stone, T. Beran, E. D. Mullen, F. N. Boyer, T. P. Bailey, F. H. Gale, F. W. Wilcox, W. H. Coleman, A. D. Bobson, H. C. Houck, J. Scribner, H. C. Glaze, G. L. Thompson, C. B. Burleigh and H. J. Buddy.

General Vehicle Company features one of its two-ton standard chasses, which is jacked up so that the motor can be run to demonstrate the operation. One of its 2000-lb. wagons recently furnished to the Atlantic City Electric Light Company is also shown. The company is officially represented by Messrs. Day Baker, J. H. Vail, J. H. Hanson and R. McA. Lloyd.

G. M. Gest, whose specialty is underground construction work, shows besides the various materials used in this work, the Gest patented cable rack and hanger and the reinforced pole of the New York Pole Company. Mr. H. H. Stannard is in charge of the booth.

The Griscom-Spencer Company sent three of its representatives to the convention. These are Messrs. J. B. Spencer, Michaelis and Jarvis. Reilly multicoil feed-water heaters,

Reilly grease extractors and Reilly evaporators are the products which the company feels that central-station men are most interested in.

The H. W. Johns-Manville Company exhibits a complete line of "Noark" fuse and service boxes with interchangeable conduit fittings and entrance hoods. Aside from a number of these boxes, which are assembled with fittings, there is a large service box mechanically operated by an induction motor to show the working of the device. Two 13,200-volt fused switches designed for the protection of transmission lines are exhibited for the first time. The switches are designed to be installed on poles without housing of any kind, the fuses being protected from the elements in a novel manner. A feature of the exhibit is the interchangeable service meter-sealing system, which provides for the installation of any number of meters feeding from a single service which in turn is protected by a service box. Only seven parts are required to make an installation using any one of the four more prominent makes of alternating- and direct-current meters. Theft of energy is prevented and a neat appearing job is obtained in addition. As usual a complete line of fuses and cut-out blocks are shown, a feature being that the line has been extended to 1000 amp. A variety of subway boxes and special fuse devices are on view. Specimens of "Linolite" tubular lighting with both carbon and tungsten filaments, reflectors for show-window, show-case and picture lighting, weatherproof outlining material, a variety of desk and table lamps, Victor combination meters, porcelain high-voltage insulators, asbestos wood for busbar compartments, guy anchors, friction tape, strain insulators, splicing compounds and a variety of other fireproof and insulating materials of interest to central-station men are in evidence. Those present are: Messrs. J. W. Perry, T. L. Barnes, H. M. Frantz, G. A. Saylor, H. M. Voorhis, S. G. Meek, R. C. Cole and R. C. Buell.

Metropolitan Engineering Company has an elaborate display of its meter protection devices manufactured under the Murray patents. The booth is in charge of Mr. R. M. Mann, who, with numerous assistants, explained the features of the porcelain specialties on exhibition which have called forth much favorable comment. Reflector-type signs, utilizing tungsten lamps, are also part of the exhibit.

Minerallac Company is represented by Mr. Frank Kinney and in its booth is displayed the Chicago printing attachment, which may be attached to a watt-hour meter and which prints the amount of energy consumed during intervals of 15, 30 or 60 minutes. Other of the company's products, such as Minerallac insulating compounds, voltmeter switches, reverse current relays, speed limit devices, electroscopes and emergency outfits, are also on exhibition.

National Carbon Company is not an exhibitor this year, but is represented by a large delegation. This is composed of Messrs. D. D. Dickey, A. N. Barron, J. S. Crider, N. C. Cotabish, J. F. Kerlin, F. C. Park, A E. Carrier, C. W. Wilkins, M. W. Allen and W. T. Conn.

National Electric Lamp Association, through its engineering department, has designed its booth so as to show the various types of incandescent lamps manufactured by the member companies. Surrounding the booth on four sides is an arch construction from which is built a dome completely studded with small low-voltage sign lamps and suspended from these arches are several types of tungsten regular Meridian type lamps equipped with prismatic reflectors. The interior of the booth is furnished in a uniform style adapted to the exhibition cases, tables and furniture. The separate exhibits show the processes of manufacture of tungsten lamps from the crude ore to the finished lamp and the exhibition cases and tables demonstrate the many uses of the tungsten lamp and its greater efficiency. The several types and sizes of series and multiple lamps for street lighting are exhibited on a rack. A large case contains an exhibition of all standard Gem, tantalum and tungsten lamps, and many regular, special types of carbon, tantalum, tungsten miniature train lighting and automobile lamps, the latter in their proper reflectors, for several classes of service. Those in charge of the exhibit are: Messrs. P. F. Baader, R. F. Strickland and G. S. Merrill.

The Nernst Lamp Company displays a complete line of its new lamps. Of considerable interest is the new spring type of holder, the design of which makes it applicable to lamps of the old type. This holder makes the mounting of glowers automatically correct, so that glowers may be renewed by common help not having the slightest experience in electrical work. Exhibited for the first time is the new single-glower lamp, a universal cluster, ornamental multiple-glower lamps and universal chandeliers of various types. The representatives present are: Messrs. W. D. Uptegraff, Max Harris, C. A. Barton, G. F. Hom, J. H. Gardiner, J. B. Mitchell, O. Foell, A. L. Eustice, J. O. Little and S. P. Wilbur.

Novelty Incandescent Lamp Company has an assortment of incandescent lamps which is very interesting. There is a full line of carbon filament, regular tungsten and any-position tungsten lamps shown by Mr. R. K. Mickey, the president of the company, who has charge of the display.

Pettingell-Andrews Company shows a full line of P-M specialties, including the devices for the protection and control of services, remote control switches, meter connection blocks, fuse block covers, ground clamps and reflectors. Forming part of the exhibit are also fuses, wires, street fixtures, insulators, glassware, tungsten lamps, tungstometers and meter seals. Messrs. F. S. Price, W. J. Keenan and G. E. Palmer are in attendance.

Philadelphia Electrical & Manufacturing Company's exhibit comprises some interesting line material. A new and complete set of tungsten street-lighting fixtures is shown, and



FIG. 4.—VIEW OF SOME OF THE EXHIBITS.

worthy of note is a line of ornamental brackets as well as hoods and casings to be used with single lamps and clusters so as to give them the appearance of being arc lamps instead of incandescent lamps. An absolute cut-out of merit, as well as fuse boxes and malleable line material of all kinds, embracing many ideas not heretofore shown, are also part of the exhibit, which is presided over by Messrs. C. L. Bundy and W. O. Dale.

Phoenix Glass Company has two representatives at the convention, Messrs. A. H. Patterson and E. H. Peck. The company has brought out a new line of glassware for tungsten lamps which has met with wide approval and the company's representatives say that both factories are kept busy turning out the new product.

Pittsburgh Reinforcing Pole Company is represented by Messrs. R. S. Orr, William A. Donkin and W. A. McCombs. The company's exhibit consists of samples showing the practical application of its reinforcing process. The butt of a pole used on the lines of the Allegheny County Light Company for about 15 years has the decayed portion of the wood cut away, making the butt somewhat like an hour glass in appearance. Reinforcing rods of ½-in. steel, pointed at both ends, are employed; the rod being driven into the sound portion of the butt remaining and spanning the decayed section. The upper end of the rod comes to a point about 12 in. above ground and after all the rods are in position the whole is encased in concrete. The butt of a reinforced pole, which was in service some months, is shown cut in section for the purpose of exhibiting the strength and lasting qualities of a reinforced pole. It is estimated that

the life of a pole can be prolonged 10 years by this means. The appearance of a reinforced pole above ground with its collar of concrete extending about 16 in. above ground and tapering from 3 in. to 1½ in. is shown by actual example.

The Price-McKinlock Company exhibits a line of its specialties including devices for the protection and control of consumers' circuits, remote-control switches, meter connection blocks, fuse-block covers, ground clamps, reflectors and lighting fixtures. Messrs. F. S. Price and G. E. Palmer are in attendance.

Pittsburgh Transformer Company's exhibit consists of the various transformers built by the company. The exhibit is mainly devoted to the display of the new line of transformers which is characterized by high efficiency and rugged construction. The new distribution transformers are made in all commercial sizes from 0.6 kva to 50 kva and are all of the core type. The company believes that its line is among the very best in mechanical construction and design. The familiar Pittsburgh stogies are in evidence as well as a very attractive edition of the "pretty girls." Engraved invitations have been sent out to friends and customers placing the booth at their convenience. Representing the company are Messrs. F. C. Sutter, H. G. Steele, R. V. Bingay, C. R. Lininger and P. H. Butler.

Rauch & Lang Carriage Company is represented at the convention by an electric coupé, the features of which are explained by Mr. J. Harry Killus. A single handle controls six forward speeds, three reverse speeds, two brakes and a single bell. Besides being fool-proof the control is also thief-proof by the use of a Yale-type key. This must be in the control handle when the car is in motion and before leaving the car it is necessary to remove the key, and thus the car is locked.

The Ricker Manufacturing Company, manufacturer of the Rochester meter and service box, is represented by Mr. George Hearn. The exhibit consists principally of the distribution and control specialties made by the company, among which are oil fuse boxes, meter and service boxes, cable junction boxes, divided service boxes and meter loading devices.

John A. Roebling's Sons Company makes its headquarters at booth No. 40, where samples and printed matter illustrating flexible heater cord, fireproof cable for moving-picture machines and brush cable are distributed. Those present include Messrs. W. P. Bowman, G. W. Swan, F. W. Harrington, W. L. Doyle, J. G. Lee and A. V. Errickson.

Sangamo Electric Company exhibits its various types of alternating-current and direct-current watt-hour meters and makes a special feature of its ampere-hour meter for automobile and storage-battery work. Some of the meters are shown in operation as well as various auxiliaries such as current shunts, series transformers, etc. The company is represented by Mr. R. C. Lanphier, who is assisted by Messrs. J. Bunn and Mr. Chapman in explaining the merits of the Sangamo line.

Simplex Electric Heating Company is represented at the convention by Messrs. J. I. Ayer, E. B. Stebbins, R. P. Ingalls and Roger Williams. There is scarcely a heating device of any importance which is not included in this company's exhibit. Prominent are three sizes of ranges representing the latest development in the electric heating line, and it is now possible to supply from stock ranges capable of cooking for 6 to 50 people. One of the advantages of these ranges is that the utensils, which are made of heavy copper, nickel-plated, are removable from the stoves, thereby permitting them to be properly cleaned and washed. All the wires are covered and out of sight so that should a pot spill over there is no danger of short-circuit. The heater in the oven is arranged on hinges so that it can be raised and the bottom of the oven cleaned. A heater to go alongside the kitchen boiler for hot-water supply is also on exhibition. A combination dining-room outfit, consisting of an electric stove, chafing dish, coffee percolator, teakettle and saucepan, arranged to clamp to the electric stove, is featured. The heating devices shown include heating pads, waffle irons, sealing-wax pots, griddles, teakettles, saucepans, radiators, coffee percolators, curling-iron heaters, glue pots, broilers, milk warmers, double boilers, blazers, foot warmers, soldering irons, water cups, sterilizers, three different sizes of chafing dishes, food warmers, household irons and commercial irons. A cord support or suspension arm to hold up the cord of flatirons and a regulator stand arranged to prevent the iron from becoming too hot when set on a stand are among the company's products. The iron, regulator stand and cord support are all wired together with a signal lamp to show when the iron is in circuit. A photograph of a factory in which 200 of these outfits are installed is in evidence.

The Southern Exchange Company is represented at the convention by Messrs. E. G. Chamberlain and W. E. Mitchell. This company makes a specialty of poles, cross-arms, railroad ties and lumber, and its exhibit is particularly emphasized by the sawed pole, octagonal and square, and the high-grade cross-arms of all standard dimensions. Large photographs of the mills and yards in the South are on exhibition, as well as sections of the octagonal and square pole and the round Southern white cedar.

The Spencer Turbine Cleaner Company displays a 5-hp, vertical, direct-driven, two-sweeper outfit for demonstrating purposes. The avidity with which dirt, nails, waste, cigar-stumps, etc., is taken up by this outfit is wonderful and the ease with which the tools are worked and the manner in which they adapt themselves to corners and angles have been the subject of much favorable comment. The company is represented by Messrs. E. W. Muzzy, R. B. Smith, G. H. Noble and S. W. Bowerman.

Standard Electric Accumulator Company of New Jersey is making a demonstrative exhibit of different sizes of batteries from 10 amp to 200 amp to show how the parts are assembled. A battery of 23 cells, which the company is putting out to operate elapse time machines, is on exhibition and a special pamphlet explains all its advantages. Different parts of the battery elements, sparking sets and automobile elements, and a number of charged cells, complete the display, which is in charge of Messrs C. DeWaal and J. J. Shaughnessy.

Standard Underground Cable Company is represented by Messrs. F. G. Cosby, J. R. Wiley, C. J. Marsh, H. P. Kimball, T. E. Hughes, W. H. Marsh and C. W. Davis. The company is showing for the first time and in a comprehensive way samples of quite a number of the very complete line of lead-covered cable terminals for indoor and outdoor use, and cable junction boxes for use in manholes with single conductor and multi-conductor lead-covered cable. A sample of one of the same type of junction boxes which the company has furnished quite extensively in Central and South America for use with steel-tape armored cable laid directly in the ground instead of in ducts as ordinarily, is also on exhibition. Features of interest are samples of special types of cable as well as sections of joints made with the special insulating tubes which have made the jointing of high-tension cables a matter of certainty and simplicity.

The Star Electrical Concern has on exhibition a very neat switchboard from which two Star flame-arc lamps are suspended. The lamp is 1⅝ in. in diameter and 8 in. high and is equipped with a prismatic reflector. The lamp base is of the standard Edison type, allowing it to be screwed into the ordinary receptacle. Mr. W. H. Gardiner, the inventor of the lamp, is in attendance and Mr. A. W. Young is in charge of the booth.

Stave Electrical Company is exhibiting its line of flaming arc lamps, the features of which are already very widely known to electrical readers. Mr. Batterman is representing the company at the convention and demonstrating the lamps.

Studebaker Company's exhibit is devoted to the display of pleasure and commercial vehicles. A victoria phaeton with more than enough mileage to meet any conditions that an electric vehicle is called upon to meet and in which nothing appears to be spared in the direction of comfort is shown and in another part of the hall is a combination passenger and merchandise-carrying vehicle mounted on the commercial-type running gear and designed to carry a normal load of from 1500 lb. to 2000 lb. The battery on the latter vehicle is suspended on

supplementary springs within its compartment. The running gear is conceded to exemplify the highest development of commercial vehicle design.

C. J. Toerring Company is exhibiting enclosed arc lamps of standard designs, a diffused inverted arc-lighting system and flaming-arc lamps. The company's standard direct-current lamps possess the special feature of long carbon life and high efficiency. Tests made several years ago show the lamp to possess a maximum candle-power of 700, which is rather high for an enclosed-arc lamp consuming so little current. The inverted type of enclosed-arc lamps is unique and is finding a wide application for lighting offices, draughting rooms, color-printing establishments and textile mills. The lamp gives an evenly diffused, white light very restful to the eye and preserving daylight color values. The flaming-arc lamp is fitted with two sets of carbons, thus reducing the labor of trimming one-half and inasmuch as the carbon ends are entirely consumed increased economy in carbon consumption is assured. The company also expects to have on exhibition before the close of the convention a Richardson electric blue printing machine which it has lately begun to manufacture.

The Tungstolier Company centers its display around the folding tungstolier. A mechanical device raises and lowers the arms automatically and serves to attract attention to the fixture. The following gentlemen are present: Messrs. E. J. Kulas, R. B. Basham, H. L. Parker and M. Hartman.

The United States Light & Heating Company is exhibiting battery material, consisting of sample plates for central-station use, vehicle battery plates, sparkers, etc. This company absorbed three companies, including the National Battery Company, and its exhibit is for central-station men primarily. The representatives of the company present include Messrs. C. C. Bradford, Bertram Smith, John A. White and J. Allan Smith.

United Water Improvement Company shows how water may be ozonized and rendered immune from disease-bearing germs. A silent discharge is used in producing the ozone and the apparatus being in operation attracts a great deal of attention. Messrs. Fred Mauer and A. Lohman look after the company's interests.

Wagner Electric Manufacturing Company, besides showing its well-known single-phase and polyphase motors, exhibits an operating model of the single-phase centrifugal device. This is so mounted with commutator, shaft and bearings, but without rotor or stator spider and windings, that by connecting it with another operating motor, its action can be observed. In the booth is exhibited a "moralometer," a direct-reading instrument indicating the morals of an individual. Not a little amusement is afforded by this device. The Wagner delegation includes Messrs. F. N. Jewett, W. A. Layman, W. Robbins, E. W. Goldschmidt, J. Mustard, B. Faxon, D. Emerson, E. H. Cheney, A. Collyer, R. D. Lillibridge and Miss J. A. Nelson.

The Waverley Company, manufacturer of electric carriages, delivery wagons and trucks, makes as the principal feature of its exhibit a mounted driving system. A number of photographs of various models is also shown, but no cars. The absence of these is more than offset by the presence of Messrs. H. H. Rice and W. C. Johnson, whose convincing arguments are not to be disputed by central-station men.

Western Electric Company makes an elaborate display of arc lamps, including the Hawthorn flaming-arc lamp, fan motors, small power motors, pole line material, cable, intercommunicating telephones, automobile charging rheostats, transformers and general supplies. The exhibit is located in two booths. The large corps of attendants include Messrs E. W. Rockafellow, O. D. Street, H. R. King, F. M. Dusenberry, M. A. Oberlander, F. D. Killian, R. M. Morris, H. M. Post and Mr Gorden.

Westinghouse Electric & Manufacturing Company occupy a booth in the center of the exhibition space on the north side. The booth is arranged as a pergola with grape-vine and other decorations. The illumination is carried out with various sizes and types of tungsten lamps, ranging from 5 watts to 250 watts. The new 5-watt, 4-cp tungsten sign lamps, exhibited for the first time at this convention, mean a great saving in energy consumption for electric signs, for on account of the physiological effect of their greater intrinsic brilliancy these lamps are said to be as effective in signs as the duller carbon lamps of several times their candle-power. Series tungsten lamps for street lighting are exhibited, with both the paper-cutout and adjuster-socket types of hanger receptacles. Metallized-filament lamps of 40-watt, 50-watt and 80-watt rating are also shown. The display of arc lamps includes a large line of direct- and alternating-current apparatus of series and multiple types, mill-type lamps and metallic-flame, direct-current arc lamps. The Cooper Hewitt Electric Company exhibits its latest mercury-arc lamps in this booth. Westinghouse mercury-rectifier sets are shown for storage-battery and other small direct-current work. Storage batteries and parts are exhibited by the Westinghouse Machine Company. The motor display includes a full line of shunt- and compound-wound, direct-current, and single-, two-, and three-phase, alternating-current apparatus. A small motor-generator set will be used in demonstrating the operation of graphic recording meters, embracing a line of power, current, voltage, frequency and power-factor measuring instruments. Portable and switchboard instruments, circuit-breakers, switches and choke-coils are displayed. The exhibit of electric conveniences includes electric sad-irons of various types, introducing the new, rounded, pressed-steel toe: tailor's goose-irons, new electric toaster-stove, hot plates, glue and chocolate warmers, luminous and non-luminous electric radiators, sewing-machine and fan motors, etc. The Westinghouse men present at the convention include the following: Messrs. W. M. McFarland, C. S. Cook, C. B. Humphrey, G. B. Griffin, H. P. Davis, Geo. W. Bates, Chas. Wahn, Samuel Chase, M. C. Rypinski, W. P. Jend, W. B. Wilkinson, John D. Mickle, W. Clegg, Jr., R. D. Nye, C. R. Gilliland, J. W. Busch, W. P. Pinckard, Lane Schofield and E. C. Means. Representing the Westinghouse Lamp Company are Walter Cary and T. G. Whaling, and the Westinghouse Machine Company's staff includes Messrs. E. H. Sniffin, L. L. Brinsmade, Wm. G. Davis, H. P. Childs, H. H. Van Blarcom, W. H. Worgorhorst, C. C. Chapelle and D. C. Arlington.

Woods Motor Vehicle Company has on exhibition a coupé and victoria, together with a unit motor frame showing the working mechanism of the Woods electrics. Messrs. F. J. Newman, Walter S. Cramner and J. C. Bartlett are in attendance. The booth is in charge of Mr. Carl J. Metzger.

Yawman & Erbe Manufacturing Company is featuring typical central station record filing systems. These include correspondence filing, purchasing records, card ledger, general index, card record of employees, card record of prospective customers, filing of bills and a motor-driven copier. Mr. Edward S. Babcox is in charge of the booth.

Among other companies represented at the convention but making no exhibits are the following: Okonite Company, Messrs. George T. Manson and Romaine Mace; Central Electric Company, Mr. H. W. Young; Rumsey Electric Company, Messrs. L. J. Costa and G. A. Rumsey; D & W Fuse Company, Messrs. W. S. Sisson and H. F. MacGuyer; Jandus Electric Company, Messrs. A. J. Mitchell and L. J. Costa; Power & Mining Machinery Company, Mr. F. P. Thorp; National Conduit & Cable Company, Mr. H. F. Tate; Excello Arc Lamp Company, Messrs. G. W. Armstrong and A. J. Thompson; Bryan-Marsh Company, Mr. A. W. Marcan; Watson Machine Company, Mr. T. A. Acton; Excess Indicator Company, Mr. A. F. Hallcook; Standard Paint Company, Mr. J. G. Sobberthwait; Gould Storage Battery Company, Mr. H. N. Powers; Franklin Electric Company, Mr. B. F. Ott; Atlantic Insulated Wire & Cable Company, Mr. G. F. Porter; Homer Commutator Company, Mr. F. J. Baird; Pacific Electric Heating Company, Mr. H. F. Holland; Gregory Electric Company, Mr. A. O. Kuehmsted; Stuart-Howland Company, Mr. O. H. Perkins; The Ansonia Electrical Company, Mr. W. J. Tonkin; Warren Electric & Specialty Company, Mr. O. C. Turner; Buckeye Electric Company, Messrs. L. P. Sawyer, J. M. Smith and W. O. Conley; Columbia Incandescent Lamp Company, Messrs. H. M. Cosh, C. Leonard and A. C. Garrison; and Mr. J. H. Hallberg.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The steady improvement in the condition of trade which began about the middle of April continued to be in evidence last week. Reports from all centers show that while there is nothing like a boom in retail trade, the condition is healthy and merchants are not complaining. Among the wholesalers and the jobbers but few orders are being received and these are mostly of a filling-in character. This, however, is to be expected at this season of the year and is in no way discouraging. As a matter of fact, there is on all sides now a sentiment of optimism that cannot be checked by any momentary dulness. The crop situation throughout the West is generally accepted as satisfactory. The weather for the past week has been very much better than earlier in May and in most sections full yields are promised. Of course, it is an accepted fact that the winter wheat crop will be short of that of last year, but even this will not necessarily mean any serious scarcity. In the South the cotton crop is in excellent condition, although it is about two weeks later than usual. Business in this section is in first class shape and the planters are more prosperous than ever before in their history. It is in the iron and steel industries that the greatest improvement has been shown. Excepting in the matter of steel rails all branches of the industry are busy. This is especially true of the wire and structural material trade. In the latter the reduced prices have induced a vast amount of new building to be projected. With money cheap, material cheap and labor costing less than it did a few years ago there has been every inducement to invest. The result of this activity has been to fill up the mills with orders so that almost all of them are running full time. This resumption of business is reflected in the railroad earnings and with the re-employment of labor the retailers will soon be making better reports. The gain in bank clearances is another barometer which shows the expansion of business. The gain for New York last week was 12.5 per cent and for the country outside of the city 16.1 per cent. Collections, while not as good as many merchants could wish, have been gradually improving and business troubles are unimportant. Failures for the week, which ended May 27, were 205, against 219 the previous week, 263 in 1908, 142 in 1907, 127 in 1906 and 154 in 1905.

THE COPPER MARKET.

Prices for copper have advanced during the past week from one-quarter to one-half cent per pound. This was more marked in regard to electrolytic than to lake, with the result that at the close of business on May 28 the two coppers were selling at about the same figure. The takings have been unusually heavy, although it is doubtful if the actual melting has very much increased. It was figured at the close of the month that the deliveries into domestic consumption during May were in the neighborhood of 60,000,000 lb. Deliveries for export during the same month were about 65,000,000 lb. The total production for May will probably not exceed 110,000,000 lb., which shows that the figures of the Copper Producers' Association are certain to record a decrease for the month. It is believed in many places that a large portion of these deliveries are now carried as stocks by the consumers, and that the actual amount of copper in the country is not in keeping with the statistics that will be produced by the association. However this may be, the heavy takings have done a great deal toward putting the market in a much healthier condition than it has been for many months. Prices have been advanced abroad as well as at home, and many consumers now appear to be of the opinion that if they do not get in at the present figures they will have to pay a very much higher rate. One of the largest producers in the country was quoted last week as confidently predicting 15-cent copper before the middle of October, and such a price is not out of the range of probability. The speculative market in London has been particularly active of late. The actual imports and exports for the month of May were very heavy, the former being between 15,000 and 16,000 tons, while exports are estimated at almost 30,000 tons. Quotations on the Metal Exchange May 28 were:

Lake	13⅜ @ 13½
Electrolytic	13⅜ @ 13½
Casting	13 @ 13⅛

The London prices May 28 were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	58 17 6	..
Standard copper, futures	58 13 9	..
Market	Easy	..
Sales of spot		400 tons
Sales of futures		1,300 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.60
London, spot	£61 2 6	£54 12 6
London, futures	61 17 6	55 10 0
London, best selected	67 0 0	59 0 0

INSULATED WIRE TRADE PICKING UP.—Makers of insulated wire report that their business is daily growing better, and that there are many inquiries being received for future business. Sales are larger than they have been at any time for the past 18 months, and the prospect for future business seems brighter than at any time since the boom days. The manager of one of the largest wire concerns in the country had this to say of the present condition of trade: "We are doing all that can be expected at this time, and from the number of inquiries that are reaching us daily it is very evident that we will soon be rushing with business. The building boom throughout the country has been almost unprecedented, and, if you will notice, a very much greater percentage than usual is for large buildings. The cheap prices for iron and for other fireproof building material has induced investors to go in largely for this grade of construction. All of this building means big business for the wire people. These are the kind of buildings that are always wired, and completely wired. It must be remembered, however, that the wire contracts are the last that will be made for new buildings, and frequently will not be made until the building is almost completed. The heavy trade, therefore, has not yet exactly reached us, but it is not far off. We cannot say what is coming, but I look for an unusually active fall. Wire prices are low in keeping with all other building materials."

CARBON IMPORTERS NOT DISCOURAGED.—The adoption by the Senate of the Smoot amendment to the tariff bill, fixing the duty on lighting carbons at 65 cents per 100 ft., has not entirely discouraged the importers. While they still assert that the imposition of such a rate will practically mean that an importer cannot sell carbons in this country, except the very highest grades, they still believe that this rate will not be finally adopted. "We have received advices from Washington," said one of the importers who has been active in the campaign for a lower tariff, "that there will be a change in the tariff schedule which was adopted last week, either by the Senate itself or when the bill gets into conference. The carbon question has caused a great deal of talk among the legislators, and they are beginning to understand the situation. Carbons, of course, are but a small matter in comparison with the other features of the tariff bill, but central station men throughout the country have been writing their Senators and Representatives to such an extent that an unusual interest has been created in the question. I have every reason to believe that there will be a modification of the 65 cents rate, although I doubt if the final paragraph on carbons will be the 35 per cent ad valorem rate that was adopted by the House. We are not letting any grass grow under our feet, and we are doing everything we can to inform the members of Congress as to the situation."

NEW SUBSTATION FOR THE NEW YORK EDISON.—Plans have been filed for the construction, by the New York Edison Company, of a new three-story substation on Twenty-sixth Street near Sixth Avenue adjoining the present station. The new building will have a frontage of 75 ft. and will cost about $120,000.

EXTENSIONS OF CHICAGO DRAINAGE CANAL HYDRO-ELECTRIC PLANT.—Contracts have been awarded for an additional exciter equipment in the Lockport (Ill.) power house of the Sanitary District on the Chicago Drainage Canal. Bids were asked on this equipment, and the contracts went to the lowest bidder in each case. The waterwheel unit will be supplied by the S. Morgan Smith Company, of York, Pa. It will consist of two twin turbines on one shaft, having a total rating of 600 hp, and will cost $3,850. The generator will be made by the Western Electric Company, Chicago, and will be a 350-kw, 250-volt, 300-revolution, direct-current machine costing $4,265. The W. A. Jackson Company, Chicago, has the contract for the switchboard equipment, costing $2,075, which will include the bench board, remote-control switches and operating instruments for the new unit. Mr. E. B. Ellicott, electrical engineer for the Sanitary District, is issuing specifications for 17 hydraulic jacks for operating the head gates at Lockport, and also for a four-pier, lead-covered, paper-insulated, underground telephone cable to connect the power house at Lockport with the Western Avenue terminal station in Chicago. This cable will be 30 miles long, and when it is in service it will obviate any danger to communication between Chicago and the power house during storms, when telephone service is most needed. Bids for the hydraulic jacks and the telephone cable will be received on June 9.

HILL-HUPFEL ENGINEERING COMPANY.—The Hill-Hupfel Engineering Company has been incorporated under the laws of the State of New York with $200,000 capital stock. The firm will take over the business of Halbert P. Hill and do a general engineering business, specializing on producer gas plants in conjunction with electrical installation. After October it will manufacture a full line of producers for power plants, using bituminous coal, peat or lignite. The corporation is formed for the purpose of manufacturing Hill automatic gas producers, Hill rotary gas-washers and Hill steam turbines. The active members of the firm will be Halbert P. Hill, now in the consulting engineering business, and Otto G. Hupfel, of A. Hupfel Sons Brewery & Company.

WENTWORTH-DEAN ELECTRICAL COMPANY.—Wentworth & Dean, of 211 West High Street, Lima, O., have incorporated their business as the Wentworth-Dean Electric Company, with a capital stock of $10,000. The company will deal in electrical supplies of all kinds and do a general electrical contracting business as well as the manufacturing of fixtures and controlling devices for street railways. The repairing of motors and dynamos will also be a feature of the company's business. The officers of the company are: President, E. A. Dean; vice-president, E. H. Wentworth; secretary and treasurer, Walter O. Dean.

BOSTON INDEPENDENT TELEPHONE LOSES FRANCHISE.—The Supreme Court of Massachusetts has decided that the Board of Aldermen of Boston exceeded its powers when it granted a permit in 1906 to the Metropolitan Home Telephone Company to open the streets of the city and lay conduits. It is held that the abutting property holders should have been notified and should have been given an opportunity to be heard and that without this the permit was worthless. The superintendent of streets had refused to issue a permit and the suit was brought by the telephone company to compel him to act in accordance with the franchise granted by the Aldermen.

GENERAL ELECTRIC BUSINESS GROWING.—Latest reports from the General Electric Company are to the effect that the company's business is now running at the rate of $53,000,000 per year, which is an improvement of 26 per cent over the business done in the fiscal year ended Jan. 31, 1909. All of the plants of the company are well employed, especially the lamp works and the establishment at Lynn. This plant is now employing 8,000 men as against 5,000 at the low point and 10,000 during the boom of 1907. The weekly payroll is now $105,000 compared to $130,000 at the high point. During the time of utmost depression the weekly payroll was only $60,000.

WESTERN ELECTRIC COMPANY'S BUSINESS.—The returns for April made by the Western Electric Company show that business was slightly better than it was during March, and very much better than it was during April, 1908. Sales to the Bell companies have been very much better than for a long time past, and telephone companies are also good buyers of copper wire and other material. There has been considerable development in the installation of moderate-size motors and generators in small manufacturing concerns. It is stated that wherever energy can be cheaply purchased industrial concerns are giving up the use of steam.

HICKORY (N. C.) WATER POWER ELECTRIC COMPANY.—Colonel M. E. Thornton, president of the Water Power Electric Company, of Hickory, N. C., announces that plans are being made to establish a large cotton mill in Hickory, just as soon as the hydro-electric plant in which he is interested is ready to deliver power. If this mill is constructed at Hickory it will obviate and probably prevent the building of a line for the transmission of power to Senoir and Morgantown. The Hickory industries will then use all the power developed.

ELECTRICAL APPARATUS FOR THE PANAMA CANAL.—Bids have been asked, by the purchasing officer of the Isthmian Canal Commission, to be opened June 14 in Washington, for the following supplies: A centrifugal pump and engine, motor car, gasoline motors, transformers, motor-driven trolley and electric hoist. The transformers asked for are 2 of 20-kw capacity, 5 of 15 kw, 20 of 10 kw, 3 of 7½ kw, 20 of 5 kw, 7 of 3 kw, 5 of 2 kw and 5 of 1 kw. The electric hoist is to be for two tons, operated by 110-volt direct current.

COLONIAL ELECTRICAL AGENCY.—The Colonial Electrical Agency Company, 576 Mission Street, San Francisco, is to become incorporated. The firm represents in the territory west of Denver the Colonial Company and the Economy Electric Company, of Warren, O.; Keystone Fibre Company, of Chester, Pa., and Massachusetts Chemical Company, of Walpole, Mass. The firm intends to take on additional electrical lines.

NEVADA-CALIFORNIA POWER COMPANY.—Work on the transmission lines of the Nevada-California Power Company in the Tonopah mining district is progressing very satisfactorily. The electrical apparatus has been delivered, and will be installed within a few weeks. The company is putting in three 350-kw generators at the Manhattan plant. Other units will be installed later on.

Financial Intelligence.

THE WEEK IN WALL STREET.

For the short week, which ended May 28, there was very little trading on the stock exchange. This was largely due to the fact that the market is almost exclusively in the hands of the professionals and this class of traders objects seriously to carrying commitments over an extended holiday. The general tone of the market, however, was strong and there were several developments during the week which tended to stimulate the feeling of buoyancy. Probably the most important of these was the apparent settlement of the long standing antagonism between the Hill and the Harriman railroad interests in the North-

NEW YORK.

	May 24.	May 28.	Shares sold.		May 24.	May 28.	Shares sold.
All-Ch. ...	16	16	2,410	Int.-Met., pf.	44⅝	46	16,550
All. Ch. pfd..	52	52½	4,200	Mackay Cos..	79¾	79¾	2,500
Amal. Cop...	83¾	85¼	117,950	M'cky Cos.,p.	73½*	73⅞	600
Am. D. T...	20*	20*	—	Man. Elec...	147*	147	400
Am. Loc....	58⅝	58⅞	9,095	Met. St. Ry..	22*	22*	—
Am. Loc. pfd.	115*	115*	10	N.Y.&N.J. Tel.	123*	123*	—
Am. Tel&Cbl.	77¼	77¾*	—	Steel, com..	69⅛	69⅜	468,900
Am. T. & T..	138⅝	140⅜	21,126	Steel, pfd...	120¾	120	19,816
B. R. T.....	79	79½	13,303	W. U. T....	—	85¾	2,500
Gen. Elec....	160½*	160¾	1,200	West'h., com.	81	83¾	4,000
Int-Met. com.	16	16½	11,925	West'h., pfd.	121	121	300

PHILADELPHIA

	May 24.	May 28.	Shares sold.		May 24.	May 28.	Shares sold.
Am. Rys.	45¾	45¾*	——	Phila. Elec..	12⅝	12	——
Elec. Co. of A.	12⅞	12⅞	——	Phila. R. T.	33⅝	33⅞	——
El. St. B'ty.	48½	48½	——	Phila. Trac.	92¾*	92⅜*	——
E.S.B'ty, pfd.	49*	49*	——	Union Trac.	57	56¾*	——

CHICAGO.

	May 24.	May 28.	Shares sold.		May 24.	May 28.	Shares sold.
Chi. City R.	18*	18*	——	Chi. Tel. Co.	133	133	——
Ch. Rys.,Ser. 1	19½	19⅞*	——	Met. El., com.	10*	10*	——
Ch. Rys. Ser. 2	38¼	38¼*	——	Met. El., pf.	—	—	——
Com. Edison	149	149	——	North. Cal. Co.	80*	80*	——
Chi. Subway	26*	26	——	Nat. C., pfd.	116*	116*	——

BOSTON.

	May 24.	May 28.	Shares sold.		May 24.	May 28.	Shares sold.
Am. T. & T.	138⅛	141¼	——	Mex. Tel....	3	3*	——
Com. Tel.	138*	138*	——	Mex. Tel., pf.	5*	5*	——
Edison El. Ill.	230*	232	——	N. E. Tel....	132½	134¾	——
Gen. Elec.	160*	161½	——	W. T. & T....	1	1	——
Mass. El. Rys.	13*	12⅞	——	W. T. & T., p	2*	2*	——
Mass. El. R., p	29½*	30¼	——				

*Last price quoted.

Sales of stocks for the week May 24 to May 28.

west. The agreement of these upon a fair basis for a division of the business assures Wall Street and the railroads that there will be no serious disturbance of rates. Another matter that was satisfactory to the Street was the announcement that the business of the Erie railroad was so greatly improved it would be able to meet all of its financial needs out of its earnings and that at this time it would not be required to issue any of the bonds for which the New York Public Service Commission granted such reluctant permission. The only development of the week, however, which resulted in a distinct advanced movement that could be definitely accounted for, was the announcement that the great iron and steel mills were now bookfull of orders and that full time would be necessary for several months. This condition resulted in the advance of United States steel common to 64⅜, a new high record, while the preferred remained around 120. The dividend report for June amounted to $32,720,119, which was an increase of more than $2,250,000 over the same month last year. This in itself is an indication of that return of prosperity which all traders seem to believe is at hand. The bond market continues to be very strong and the new securities actually sold by the railroads and industrials during the month of May approximate $110,000,000. The total for the five months since the beginning of the year is now in the neighborhood of $635,000,0000. All of these securities have been quickly absorbed and the majority of the offerings have been over-subscribed. The financial condition both at home and abroad seems to be thoroughly satisfactory. While there have been fairly heavy shipments of gold, the banks continue to be overstocked with money. Rates on May 28 were call, 1½ and 2½ per cent, 90-day, 2¾ per cent. The figures in the table are those of the close May 28.

DIVIDENDS.

Blackstone Valley Gas & Electric Company, preferred, quarterly, 1½ per cent, payable June 1.

Mackay Companies, common and preferred, quarterly, 1 per cent each, payable June 1.

Massachusetts Electric Companies, preferred, semi-anual, 1½ per cent, payable July 1.

STANISLAUS ELECTRIC POWER COMPANY.—The purchase of the property of the Stanislaus Electric Power Company, at the recent foreclosure sale, by the United Railways Investment Company, has been ratified, and the new company will at once take over the property. This is the conclusion of negotiations which have been pending for 15 months, and which have been frequently outlined in these columns. The new contract contemplates the issuance of first mortgage bonds on the property, which will take precedence over the original bonds; but it is held that the additional market for power and the improvements that will be made will advance rather than diminish the securities of the present bond issue. For the equities in the preferred and common stock of the power company the underwriters will receive $900,000 of preferred and $900,000 of common stock of the United Railways Investment Company. From the proceeds of the sale of the bonds it is contemplated that the fourth, 10,000 hp, unit will be installed at the Stanislaus power station; the storage dam at Relief Creek will be completed; the steam turbine plant of 5000 kw now under construction by the San Francisco Railway & Power Company at the North Beech power station will be purchased and the installation of an additional steam turbine plant of 9000 kw in the same station will be made. In addition, there will be the acquisition and construction of the necessary distributing lines, including the construction of two 100,000-volt, steel tower, transmission lines from Stanislaus to San Francisco. It is estimated that there can be developed by the Stanislaus property 60,000 hp and that the mines in that section will be willing to pay $60 per hp per annum for the energy. The contract made between the power company and the railroad company provides for a rate of about $30 per hp, and the railroad company expects to use about 25,000 hp. If these calculations are accurate, there should be left 35,000 hp for sale. The projectors of the enterprise claim that there will be a gross return from the railroad company of $750,000 per year, and that the operating expenses will not be more than $200,000, leaving $550,000 net revenue, in addition to what the company is able to sell to outsiders. Altogether, the interests behind the United Railways Investment Company are of the opinion that that concern has made an excellent bargain.

CAPITALIZATION OF INDEPENDENT TELEPHONE COMPANY.—The investigation into the affairs of the United States Independent Telephone Company, in the suit brought by Charles M. Lane at Rochester, disclosed what appeared to be a remarkable state of overcapitalization. The testimony developed that two companies—the United States Independent and the New York Independent Telephone Company—were formed, each having a capital of $50,000,000, and that the only apparent assets of the two concerns were a manufacturing plant in Chicago capitalized at $50,000 and a burglar alarm franchise in New York City valued at $5,000. It was also shown that large blocks of stock were either given away or sold for nominal sums to persons supposed to have political influence. It came out in the testimony that W. J. Conners, chairman of the Democratic State Committee of New York, held a block of $2,000,000 of stock in the United States Company for which he was charged on the books $200,000, but for which it appeared he had never paid. It was also shown that some of the subsidiary companies borrowed money to pay dividends and then increased their capital stock, from the proceeds of which they paid back the loans. The suit was brought by a dissatisfied stockholder who had paid in $4,000.

WESTERN UNION TO GET SIX MILLION DOLLARS.—The United States Circuit Court has finally decided in favor of the Western Union Telegraph Company, that it shall receive $6,000,000 on its judgment against the American Telephone & Telegraph Company. This litigation, which has lasted for about 30 years, was brought to require the telephone company to settle under an agreement by which the Western Union alleged that the telephone concern agreed to account for 20 per cent of all rentals and royalties received from licenses or leases for speaking telephones. The amount was fixed by a special master, Everett W. Burdett, of Boston, who, after extended hearings, settled the basis of royalties. The defendants claim that the award is excessive and that the case could be settled at any time for $2,000,000, but that the American Telephone & Telegraph refuses to settle. The case will undoubtedly be carried to the United States Supreme Court and may be in litigation for another 10 or 15 years.

MORE TALK OF COPPER CONSOLIDATION.—Rumors continue to be persistent in the financial district that a great copper consolidation is in process of formation. It is said that W. E. Corey, president of the United States Steel Corporation, has taken charge of the preliminary negotiations and this is understood to mean that the same interests expect eventually to control the two principal metal industries. That the copper mines of the country are producing to-day more copper than can be sold even at the low prices recently prevailing and that they were induced to do this on account of the excessively high prices that existed a few years ago are two facts that are used as arguments in favor of a consolidation that will control both prices and output.

PUBLIC SERVICE TELEPHONE COMPANY'S PLANS. An application has been filed with the Empire City Subway Company, which has a monopoly of the tube facilities for low tension wires in New York, for space in the company's conduits, by the Public Service Telephone Company. This is the independent company which proposes to operate under the franchise owned by the Long Acre Light & Power Company. The plans as filed call for the installation of 18 exchanges which will provide for 160,000 automatic telephones. It is given out that the capital stock of the company will soon be increased from $10,000,000 to $25,000,000.

CONNECTICUT RIVER POWER COMPANY.—At a special meeting last week of the stockholders of the Connecticut River Power Company, of Maine, a corporation which owns the stock of the Connecticut River Power Company, of New Hampshire, it was decided to increase the capital stock of the company from $2,500,000 to $3,220,000. This company owns the dam at Vernon, N. H., and the new funds are to be used in making improvements and extensions on the property.

CUMBERLAND TELEPHONE COMPANY INCREASE.—The Cumberland Telephone Company had in service on May 1, 220,115 telephone stations, which is an increase of 12,856 since Jan. 1. It has taken the Cumberland company just about five years to increase the number of its stations from 100,000 to 200,000, which speaks significantly for the telephone development of the country.

HELENA & BUTTE ELECTRIC RAILWAY.—The recent issue of $2,500,000 bonds for the Helena & Butte Electric Railway Company have been underwritten by J. G. White & Company, of New York, and work will be commenced on the road at once. The line will be 75 miles long.

REFINANCING DENVER GAS & ELECTRIC COMPANY.—Plans for refinancing the Denver Gas & Electric Company have been only tentatively made, and no public announcement has yet been given out. It is understood, however, that the present purpose is to form a new company, which will probably be called the Denver Gas & Electric Light Company. The new company will have an authorized bond issue of $25,000,000. The amount of its capital stock has not yet been determined, but it will probably not be much greater than that of the present company, which is $3,500,000. The present company is remarkably successful, and is supplying a growing city which is expected to show a population of 225,000 before the next census. The necessity for refinancing arises from the fact that the bond limit of the present company has been reached, and it is necessary to provide for extensions and improvements to meet the development of the city. It is not expected that the entire new bond issue will be put out at once, only a sufficient number of bonds being used to take up the $7,478,600 of bonds of the present company, and to provide for the immediate necessities in the way of extensions. The balance will be held in the treasury for future use as occasion demands. The present company has been most successfully managed by Henry L. Doherty, its president, and Frank W. Frueauff, general manager. Their policy has been to advertise for business, and to push with all of their vigor the sales of the company, both in gas and electricity. The company now has a surplus of $1,383,321, and the earnings, according to its annual report for the year ending April 30, 1909, were 16.75 per cent on its capital stock. Mr. Frueauff, who was in the city last week, had this to say of the success of his company: "We are very proud of the figures shown in our annual report. The gross earnings for the year were $2,256,840; this compared to $689,063 for the year ending April 30, 1902. We think an increase of over 300 per cent in seven years shows that we have not been asleep. The new power contract which we have recently negotiated with the Central Colorado Power Company will enable us to secure water-power upon satisfactory terms from two sources of supply. It will also probably not be required to make outlays for additions to our electrical generating plants for some years to come."

TOLEDO RAILWAYS & LIGHT FINANCING.—The plans for taking care of the underlying bonds of the Toledo Railways & Light Company, which mature on July 1, have been completed. It has been decided to extend the bonds for a period of 2½ years, or until Jan. 1, 1912, raising the interest rate thereon from 5 to 6 per cent. This plan applies only to the underlying bonds, of which $5,300,000 fall due July 1. The 4 per cent bonds of the company, which mature on the same date, will not be taken up at that time, but will be allowed to run on as at present. The directors of the company have executed a contract with Blair & Company, of New York, for the underwriting of the new issues. The holders of the securities will be requested to deposit them with the bankers and consent to the extension. In the event that any of the holders of the present bonds do not care to consent to the extension, Blair & Company agree to purchase their holdings at par. This amounts, as far as the holder is concerned, to the payment of the bond.

CHICAGO CONSOLIDATED TRACTION FRANCHISES.—It is stated that the new franchises of the Consolidated Traction Company, of Chicago, will be similar to those of the City Railway and the Chicago Railways, and will probably provide for a merger of the underlying companies of the Consolidated with the Chicago Railways Company. The City Council is committed to the policy of one fare for the entire city, and disapproves of any plan that would interfere with the unification of all the local surface lines, which ultimately are expected to be under one management. The receivers of the Consolidated have been authorized to issue certificates to the amount of $740,200 in order to provide for necessary rehabilitation. The company at present operates 127 miles of road within the city, and 57 miles outside of the city, much of which has been badly run down.

ELECTRIC BONDS BECOMING POPULAR.—There is evidence in the financial market of New York that the 5 per cent bonds of light and traction companies in Western cities are growing in popularity. For a long time these securities have been neglected in favor of railway bonds and industrial investments. Out of 13 different issues, about half of them being first lien, which have been sold in the New York market within the past six months, the average price has been about 94 and interest. It is said that the investing public is just awakening to the fact that these bonds are secure, and that at such a price as this are a first-class investment.

COMMONWEALTH EDISON COMPANY.—The recent upward movement in the stock of the Commonwealth Edison Company, of Chicago, it is said, has no other significance than that there has been a considerable amount of investment buying. It is positively announced by the directors that there are no specific deals of any kind pending, and that the advance in the stock is purely a legitimate business development. The earnings of the company are steadily increasing; the number of telephone stations is growing every month, and it is predicted that within the near future the dividend rate will be raised from 6 per cent to 7 per cent.

ANACONDA COPPER COMPANY'S EARNINGS DECREASE.—The full report for the year 1908 shows that the gross receipts of the company were $15,604,000 as against $18,751,000 the year before and $29,968,000 in 1906. While disbursements were smaller the amount left for dividends was less than one-third of that of the previous year. In speaking of the decrease John D. Ryan, president of the company, said that the shutdown in January and February of the past year was largely responsible for the decrease. Practically all of the earnings were accumulated in the last six months of the year.

NEW BRUNSWICK TELEPHONE COMPANY PROSPERS.—The New Brunswick Telephone Company has had a very prosperous year. Reports presented at the annual meeting showed the gross earnings for the past year to be $230,595 and operating expenses $138,514, leaving a balance of $92,080.85. From this the company paid a dividend of 6 per cent, leaving a gross surplus of $33,728. The election of officers resulted as follows: New directors, R. Slipp, Fredericton, and J. M. Robinson, St. John. Alfred Seeley, who resigned as secretary-treasurer, was succeeded by A. W. Macklin.

SOUTHERN POWER COMPANY EXPANDING.—The Chester (S. C.) Power Company has been organized by the Southern Power Company to take charge of the light and power business of that city. The capital stock is $50,000. The Southern Power Company has interests equally as important in many other cities and towns all over the Piedmont section of the Carolinas, all of which are operated directly by the parent company, except that at Chester. Dr. W. Gill Wylie, president of the Southern company, is also president of the Chester company.

UNITED RAILWAYS OF ST. LOUIS LIABLE.—The Court of Appeals in St. Louis has affirmed a judgment for damages against the United Railways Company, which was inherited from the old St. Louis Transit Company. The decision declares that when the new company acquired the assets of the old company it could not avoid acquiring at the same time its obligations. This decision is regarded as a test case and involves damage judgments to the amount of $1,500,000 against the old company. It is said that an appeal will be taken.

INTERNATIONAL SMELTING COMPANY.—It is reported that the International Smelting & Refining Company is planning the erection of a plant in Arizona, or at some point in the Southwest, where Arizona copper ores can be conveniently treated. Representatives of the company have been traveling throughout that mining region advising all mining companies not to make long contracts with any other smelter, as it would probably be but a short time before they would have an opportunity to have their smelting done in competition.

BROOKLYN RAPID TRANSIT.—It is stated that the earnings of the Brooklyn Rapid Transit for the fiscal year, which will end June 30, 1909, will amount to about 5 per cent upon its stock. It is also expected that the company will easily be able to earn this amount in the coming year. There is some talk that the dividend will be raised to 5 per cent next fall, but as yet this seems to be entirely problematical. Reports from the operating department of the road show that business is increasing daily.

DEVELOPMENT AT JACKSON SHOALS, ALA.—The Alabama Power Development Company, financed by the Electric Bond & Share Company, of New York, has had a representative in Anniston, Ala., seeking franchises for the installation of electric service. Power is being developed at Jackson Shoals, and it is proposed to connect Anniston and Talladega with the transmission lines. The local lighting and street railway companies are controlled by the same interests.

INTERBOROUGH RAPID TRANSIT EARNINGS.—The report of the Interborough Rapid Transit Company, made to the Public Service Commission, for the quarter ended March 31, 1909, shows that the gross earnings from the operation of the subway division were $3,321,525, an increase of $459,400 over the same quarter in 1908. The net income for the subway was $1,201,440, an increase of $148,450. On the elevated division the gross earnings for the three months were $3,251,230, an increase of only $28,922. The net income was $282,763, an increase of $97,119. Both of these net results are calculated after the payment of taxes, rentals and other deductions. The report shows that the business of the subway continues to grow more rapidly than that of the elevated.

NEW YORK & HARLEM RAILROAD.—The directors of the New York & Harlem Railroad Company are discussing plans to protect their property, which is now leased to the Metropolitan Company for a rental of $400,000, with a guarantee of the payment of interest charges and taxes. The Metropolitan Company has failed to provide for about $800,000, covering franchise taxes, which are now in litigation, and is also in default in its rental. This company owns 9¼ miles of track on Fourth and Madison Avenues, New York, running from the postoffice to the Harlem River. At the meeting of the directors W. K. Vanderbilt was re-elected president, and all of the old officials were re-elected to the positions they formerly held in the board.

NIAGARA FALLS POWER COMPANY BONDS.—The shareholders of the Niagara Falls Power Company voted on June 1 to authorize a mortgage of $25,000,000 to secure bonds maturing in 1932. These bonds bear a rate of interest not exceeding 6 per cent; a definite rate has not yet been fixed. The proceeds of the issue are to be used to refund $9,000,000 of debentures, and the balance for other corporate purposes, chief among which is the construction on the Canadian side of additional facilities. It is expected that the latter will cost about $4,000,000.

SEEKS THIRD AVENUE SALE POSTPONEMENT.—F. W. Whitridge, receiver of the Third Avenue Railroad, has written to Comptroller Metz asking him to postpone the advertised sale of the Third Avenue Railroad property for nonpayment of franchise taxes which was set for June 5. Mr. Whitridge states that he is making efforts to have the matter settled by compromise, or by some other arrangement that will obviate the necessity of the sale. The mortgage foreclosure sale of the property has been set for next September.

WISCONSIN UTILITY VALUES.—Preliminary values on Wisconsin street railway, light, heat and power concerns aggregate $37,344,000. This figure is likely to be reduced about $2,500,000 when the final estimates are made up. The final estimate last year was $33,932,000. The preliminary value of the Milwaukee Electric Railway & Light Company was $22,000,000 of this sum.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American Telephone & Telegraph Company:					
April, 1909	$3,881,707	$161,109	$3,720,058	$592,602	$3,128,055
April, 1908	3,612,424	192,925	3,419,499	648,054	2,771,445
Cape Breton Electric Company, Limited:					
March, 1909	16,462	11,142	5,319	4,065	1,254
March, 1908	17,432	11,433	5,998	4,108	1,890
Dallas Electric Corporation:					
March, 1909	102,666	62,996	39,670	25,584	14,086
March, 1908	87,997	61,758	26,238	25,993	245
Detroit United Railway Company:					
Four months ended April 30, 1909	608,024	374,202	233,822	154,155	91,347
Four months ended April 30, 1908	546,162	350,426	195,737	134,249	66,486
Edison Electric Illuminating Company, Brockton, Mass.:					
March, 1909	20,180	12,270	8,210	2,802	5,407
March, 1908	16,962	8,453	8,508	2,135	6,373
El Paso (Tex.) Electric Company:					
March, 1909	45,602	29,005	16,597	7,911	8,685
March, 1908	43,640	32,567	11,073	7,069	4,003
Galveston-Houston Electric Company:					
March, 1909	95,610	59,075	36,535	18,829	17,705
March, 1908	83,328	51,033	32,505	17,867	14,637
Houghton County (Mich.) Electric Light Company:					
March, 1909	19,771	10,846	8,925	3,499	4,864
March, 1908	18,750	9,715	9,034	3,165	5,869
Houghton County (Mich.) Traction Company:					
March, 1909	25,456	14,905	10,551	5,296	5,254
March, 1908	19,773	12,259	7,514	4,806	2,707
Interborough Rapid Transit Company:					
Quarter ended March 31, 1909	6,842,756	2,723,614	4,481,412	2,907,207	1,574,205
Quarter ended March 31, 1908	6,354,432	2,705,931	3,966,842	2,638,207	1,328,635
Jacksonville (Fla.) Electric Company:					
March, 1909	41,047	23,590	17,456	8,360	9,096
March, 1908	36,965	21,983	14,982	8,397	6,585
Long Island Railroad Company:					
Quarter ended March 31, 1909	1,564,229	1,528,809	35,419	.....	.....
Quarter ended March 31, 1908	1,626,191	1,732,093	*105,902	.....	.....
Lowell (Mass.) Electric Light Corporation:					
March, 1909	28,009	18,472	10,436	3,640	6,796
March, 1908	26,503	15,873	10,629	4,384	6,245
Minneapolis General Electric Company:					
March, 1909	80,039	40,428	48,611	30,134	18,476
March, 1908	83,089	36,466	46,623	31,237	15,386
Northern Texas Electric Company:					
March, 1909	109,013	60,357	48,453	17,173	31,482
March, 1908	91,650	48,403	43,247	14,269	28,978
Paducah (Ky.) Traction & Light Company:					
March, 1909	17,640	10,855	6,785	6,961	*178
March, 1908	18,303	8,975	9,327	6,938	2,389
Pensacola Electric Company:					
March, 1909	19,013	11,549	7,464	4,339	3,124
March, 1908	19,205	13,319	5,885	4,164	1,720
Portland (Me.) Electric Company:					
April, 1909	27,599	10,487	17,112	9,194	7,918
April, 1908	22,442	9,942	12,500	8,798	3,702
Puget Sound Electric Railway Company:					
March, 1909	146,286	103,110	43,176	38,246	6,166
March, 1908	127,448	83,035	44,413	38,246	6,166
Savannah Electric Company:					
March, 1909	46,814	29,215	17,598	15,845	1,753
March, 1908	48,160	35,161	13,098	15,427	2,428
Schenectady Railway Company:					
Quarter ended March 31, 1909	196,821	145,004	50,817	.....	.....
Quarter ended March 31, 1908	192,828	153,381	39,146	.....	.....
Seattle Electric Company:					
March, 1909	420,116	262,078	158,337	80,560	68,777
March, 1908	351,886	214,536	140,350	77,904	62,445
Tampa Electric Company:					
March, 1909	18,170	17,700	474	3,858	16,615
March, 1908	13,121	10,238	2,882	2,236	11,650
Toledo Railways & Light Company:					
March, 1909	215,315	122,472	92,843	70,914	22,166
March, 1908	202,317	109,615	92,702	70,702	22,423
Union Railway, Gas & Electric Company (Milwaukee Electric Railway & Light Company):					
March, 1909	32,171	18,061	14,109	8,190	5,918
March, 1908	28,761	15,973	12,788	8,017	4,771

GENERAL NEWS

Construction News.

ANNISTON, ALA.—The Alabama Power Development Company, financed by the Electric Bond & Share Company, of New York, N. Y., has a representative in town seeking franchises for a central station service, current to be taken from Jackson Shoals.

BESSEMER, ALA.—The Republic Iron & Steel Company is reported to be considering the installation of an electric plant at its mines at Raimund.

BIRMINGHAM, ALA.—The Birmingham & Edgewood Electric Company has applied to the City Council for a franchise to construct an electric railway from the southern terminus of the South Highlands line along Twentieth Street to the city limits. The new company proposes to connect this city with Shade's Valley.

HEFLIN, ALA.—Plans are being prepared by J. B. McCrary & Company, of Atlanta, Ga., for the proposed water works and electric light system at Heflin.

PRESCOTT, ARIZ.—The Arizona Overland Telephone Company has purchased the franchise for a telephone and electric system of Robert Brown, M. J. Hickey and H. T. Andrews. It is said that the company will make Prescott the headquarters for a long-distance system in Arizona, New Mexico and California. The system will include a telephone line already in operation from Globe to Jerome and Flagstaff, and a line will be built east to Albuquerque and west to Needles, and eventually to Los Angeles, Cal.

TUCSON, ARIZ.—Preparations are being made by the Consolidated Telephone, Telegraph & Electric Company for extensions and improvements to the telephone lines recently acquired from the Sunset Telephone Company. The plans call for the construction of a new telephone line from Tucson to Yuma, and will connect there with the system of the Pacific Telephone & Telegraph Company. The plans also call for the completion of the extension to Globe and later to Morenci and Clifton in the Graham County mining sections and the agricultural sections of districts in that county. The improvements will include a copper loop line from Benson to Bisbee, and the erection of a new telephone line from Maricopa to Phoenix to connect with the line from Tucson to Yuma. The cost of the entire work is estimated at about $250,000. C. W. Hinchcliffe is general manager.

DELIGHT, ARK.—John W. Hill is reported to be interested in the construction of an electric light plant in Delight.

NETTLETON, ARK.—The St. Louis & Southwestern Telephone Company contemplates installing an exchange at Nettleton.

SEARCY, ARK.—A project is on foot to construct an electric railway from Higginson to Searcy, a distance of four miles; also a street car line in Searcy, which is to be extended from Searcy to Searchlight Park, two miles distant. The company is to be known as the Searchlight Power & Electric Company. According to the present plans, the power house will be located in Searcy. Louis Lorch, of Searcy, is promoting the project.

WHEETLEY, ARK.—The Wheetley Rice Mill & Power Company has awarded the contract for construction of power house and other buildings to Ilsen & Lesh, Memphis, Tenn.

BERKELEY, CAL.—The Pacific Gas & Electric Company is reported to be contemplating the installation of a 1350-hp motor-generator set in its substation at Hearst and Gee streets.

OROVILLE, CAL.—The Blue Lead Mining Company is making plans for extensive additions and improvements to its mine. Electricity will be used for operating the machinery.

SAN FRANCISCO, CAL.—A 15,000-hp steam turbine has recently been installed in the plant of the City Electric Company by the Westinghouse Machine Company, of Pittsburgh, Pa.

SAN FRANCISCO, CAL.—The city lighting committee is making investigations with a view of improving and extending the lighting system. The committee has engaged an engineer to prepare plans for a more uniform method of lighting the streets and will recommend to the Supervisors not only improvements but extensions to the present system.

SAN FRANCISCO, CAL.—Negotiations are under way by the California Gas & Electric Corporation for the purchase of the property of the City Electric Company. It is said that the price is placed at $5,000,000. The City Electric Company operates a large electric plant at North Beach and is controlled by the Fleischhacker-Mack interests. The company furnishes electricity for motors exclusively.

SAN JOSE, CAL.—Captain T. Ransom, representing the United Railroads, has filed a petition with the City Trustees for a franchise to construct and operate an electric railway on certain streets in this city.

SANTA ROSA, CAL.—The Sonoma Mountain Power Company is extending its transmission lines from Fulton to St. Helena, and plans are being made to extend it to Guerneville.

PUEBLO, COL.—We are informed that the Pueblo Suburban Traction & Lighting Company is preparing to increase the boiler capacity of its power plant by 1000 hp. John F. Vail is general manager.

MIDDLETOWN, CONN.—The Middletown Electric Company contemplates extending its transmission lines to Durham, a distance of six miles. L. C. Whitney is manager.

WASHINGTON, D. C.—Sealed proposals will be received by James Wilson, Secretary of Agriculture, until June 10 for an engine, generator, switchboard, and for labor and materials for use in the extension of the heating system in the buildings of the Weather Bureau at Twenty-fourth and M Streets, in the City of Washington, D. C., in accordance with plans and specifications which may be obtained from the Chief of the U. S. Weather Bureau, Department of Agriculture, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the Commission of District of Columbia, Washington, D. C., until June 10 for furnishing materials and labor for wiring and equipping with electricity and apparatus and making additions, alterations, etc., in Physics Laboratory of the M Street High School in Washington. Blank forms of proposals, specifications and all necessary information may be obtained on application to the property clerk, District Building, Washington, D. C. Henry B. F. MacFarland, Henry L. West and William V. Judson are commissioners.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., for furnishing and installing three motor-generator sets, nine switchboards with necessary accessories, and for wiring, equipping with electricity and making alterations, etc., as specified in the Eastern, Western and Central High Schools in Washington, D. C. Blank forms of proposals, specifications and all necessary information may be obtained on application to the property clerk, District of Columbia, District Building, Washington, D. C. Henry B. F. MacFarland, Henry L. West and W. V. Judson are commissioners.

WASHINGTON, D. C.—Bids will be received until June 8 at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., to furnish at the navy yards and naval stations the following supplies: Brooklyn, N. Y., or Puget Sound, Wash., Schedule 1244—1450 lb. copper wire and 1650 lb. magnet wire, etc. Brooklyn, N. Y., Schedule 1290—100,000 ft. lighting wire, 31,000 ft. interior communication cable, 700 lb. magnet wire, 23,000 conduit straps, 10,200 insulator hangers. Charleston, S. C., Schedule 1276—Electric deck winch. Philadelphia, Pa., Schedule 1290—Armature blades, etc.; armatures, coils, rheostate, etc. Boston, Mass., Schedule 1290—2500 ft. steel enameled conduit. Applications for proposals should designate the schedule desired by number.

LEESBURG, FLA.—We are informed that the Leesburg Ice Company, of which J. Y. Clark is president, has been granted franchises to install water works system and electric light plant. Arrangements are nearly completed for the construction of the water works, but plans have not yet been prepared for the electric light plant. F. M. Stansbrough, of Leesburg, is engineer.

LA GRANGE, GA.—Improvements and extensions have been made to the municipal electric light plant, which includes the installation of a 200-kw Westinghouse generator, a 20-kw motor generator, exciter set, one 320-hp Erie Ball cross-compound Corliss type engine and a 200-hp Cole return tubular boiler. R. W. Underwood is manager.

WAYCROSS, GA.—At an election to be held June 19 the citizens will vote on the proposition of municipal ownership of electric lighting plant and to issue $36,000 in bonds to pay for same. The question of purchasing the plant of the Waycross Electric Light & Power Company is under consideration.

MOUNTAIN HOME, IDAHO.—The plant of the Mountain Home Electric Company, which has been out of commission for some time owing to the burning out of the dynamo, was sold at a sheriff's sale May 12 to the Hewitt Land Company, for $25,000. It is understood that the new owners will make the necessary repairs as soon as possible and put the plant in operation. The streets have been in darkness and residences and business houses have had to resort to lamps.

SANDPOINT, IDAHO.—Surveys are now being made by the Northern Idaho & Montana Power Company for a transmission line to be erected between Sandpoint and Newport, Wash. Plans are also being made to improve the water power development on the Moyie River and to transmit the power to Sandpoint.

DECATUR, ILL.—The Decatur, Sullivan & Mattoon Transit Company has filed a deed making the Windsor Trust Company, of New York, N. Y., trustee for a bond issue of $2,500,000. The company proposes to construct a railway from Decatur to Mattoon, Ill., 48 miles in length, which, with extensions contemplated, will make a total of 100 miles.

EAST ST. LOUIS, ILL.—Plans are being prepared by the engineering department of the Illinois Traction System for the construction of a new power plant to be erected in East St. Louis, on the lower side of the new Mississippi River bridge, now under construction. The power plant will

be the largest of the system and is designed to supply electricity to all the railways of the Illinois Traction System south of Springfield. The plant is to have an output of 10,000 hp, which can be doubled when necessary. Plans will also be made for the new St. Louis station as soon as the site is selected.

MOUNT CARMEL, ILL.—The Mount Carmel Gas & Electric Company has been placed in the hands of a receiver. The company is a newly organized concern and charges the City Council with unfair treatment by revoking its franchise because its plant was not being finished within the prescribed time limit. The company claims that every effort was made to complete the plant and that the work already accomplished represents an expenditure of $100,000 for the installation of gas, electric light and hot water heating systems.

SPRINGFIELD, ILL.—Plans have been prepared for the construction of an electric belt railway to connect all railroads and interurban lines entering the city. The cost of the road is estimated at $200,000. F. B. Martin, of Decatur, engineer of construction of the McKinley lines; will have charge of the work.

TINLEY PARK, ILL.—The capital stock of the Tinley Park Electric Light Company has been increased from $2,500 to $5,000.

BRAZIL, IND.—It is reported that bids will soon be called for the installation of machinery and equipment for the power house being constructed by the Brinkerhoff Piano Company in this city. It is said that plans for the plant are now ready.

ELKHART, IND.—The Indiana & Michigan Electric Company has notified its patrons that after June 20 the price of electricity for commercial lighting will be raised from three to six cents per kw-hour. It is said that the business men contemplate establishing an independent plant.

EVANSVILLE, IND.—The Board of Public Works is asking for bids until June 19, 1909, for the lighting of a portion or all of the streets, public buildings, fire houses and city parks. Bidders will be required to designate the particular streets or buildings and parks they bid on.

INDIANAPOLIS, IND.—The telephone train service put on by the Big Four Railroad between this city and Cincinnati is giving such good satisfaction that the company will next equip the line between this city and St. Louis.

INDIANOLA, IND.—Plans are being considered for making improvements and extensions to the municipal electric light plant, which will include the installation of a generator and Corliss engine. C. C. Litzenberg is superintendent and purchasing agent.

LAFAYETTE, IND.—Trustees of the State Soldiers' Home will receive bids until June 18 for the installation of mechanical stokers for six steam boilers, for a dynamo, engine, switchboard and other equipment. A. C. McCorkle, is chairman of the Board of Trustees.

GRUNDY CENTER, IA.—Plans are being prepared by the Grundy Center Telephone Company for the construction of a new exchange building, to cost between $7,000 and $8,000.

COTTONWOOD FALLS, KAN.—The Home Light & Power Company contemplates the development of a water power and the erection of a transmission line about seven miles in length. W. W. Austin is manager.

LEXINGTON, KY.—The contract for the construction of the proposed electric interurban railway of the Central Kentucky Traction Company, from Lexington to Nicholasville, 12 miles in length, has been awarded to David Pepper, Jr., of Philadelphia, Pa. Swethurst & Allen, engineers and contractors, of Philadelphia, Pa., will do the work. J. B. Crawford, of Lexington, is general manager of the traction company.

LOUISVILLE, KY.—The Louisville Railway Company is planning to construct a new boiler house, which will necessitate the purchase of boilers with a rating of 2000 hp.

MOUNT STERLING, KY.—The Old Kentucky Telephone Company, which recently secured a franchise in Sterling, has commenced work on the installation of a telephone system in this city. The company will install a switchboard costing about $6,000. The plant complete will cost approximately $15,000.

MACHIASPORT, MAINE.—The Machias Canning Company is preparing to light its factory with electricity, generated by its own plant.

ATHOL, MASS.—The Orange Electric Light Company has purchased the plant and holdings of the Athol Gas & Electric Company. Extensive improvements and changes are contemplated by the purchasers, which will include the erection of a concrete dam and a new power house at Wendell. It is said that about 1600 hp will be developed. A new pole line will be erected from Wendell to Athol, and also to Erving, where it is expected that electricity will be furnished for lamps and motors. The Athol power plant will be maintained until the changes are completed at Wendell, when it will be discontinued and held for emergency purposes. A contract has been made with the Athol & Orange Street Railway Company to furnish it with electricity for operating its system from the Wendell plant.

BOSTON, MASS.—The Supreme Court has refused the Metropolitan Home Telephone Company permission to open 100 streets in Boston for the purpose of laying telephone wires.

BOSTON, MASS.—The Boston & Northern Street Railway Company has petitioned the Massachusetts Railway Commission for permission to issue bonds to the amount of $536,000, the proceeds to be used for improvements to its property.

BOSTON, MASS.—The Old Colony Street Railway Company has applied to the Massachusetts Railway Commission for an approval of an additional $275,000 in bonds, the proceeds to be applied to improvements to its system.

CHICOPEE, MASS.—It is said that the committee of electric lines of the Board of Aldermen at the next meeting of the board will recommend that all gas lamps now in use for street lighting to be replaced with 32-cp incandescent lamps, electricity for which to be supplied by the municipal electric light plant.

LUNENBURG, MASS.—The Selectmen have entered into a contract with the Leominster Electric Light & Power Company to light the streets of the town for a term of five years. The company will extend its transmission line from Whalon to this village.

PITTSFIELD, MASS.—The Pittsfield Electric Company has awarded the contract for laying one-half mile of conduits to G. M. Gest, of New York, N. Y., to cost $7,500. The contract for cables has not yet been awarded.

SHEFFIELD, MASS.—Representatives of both Great Barrington Electric Light Company and the Canaan Light & Power Company have been making investigations with a view of extending the transmission lines from either place in case sufficient business is secured to guarantee the expenditure.

SPRINGFIELD, MASS.—It is reported that the Northern Connecticut Light & Power Company proposes to acquire the locks and dams at Enfield and Windsor Locks, Conn., owned by the Connecticut River Company.

WORCESTER, MASS.—By a decision of the Supreme Court the Postal Telegraph Company will be obliged to place its wires underground in Worcester.

KALAMAZOO, MICH.—Arrangements are being made to improve the lighting service at Oakwood Park and Oakwood Heights. Heretofore electricity for lighting Oakwood Park has been furnished from a small plant operated on the grounds, but the M. U. R. has decided to secure the service direct from the Commonwealth Power Company for both suburbs. The Oakwood Heights Realty Company and the M. U. R. will pay for cost of the extension of the transmission lines, which it is estimated will cost about $1,000. J. L. Millspaugh is superintendent of the M. U. R.

BELLE PLAINE, MINN.—The City Council has granted a franchise to Arndt & Rockwelter, of St. Paul, Minn., to install an electric light and power plant.

HAWLEY, MINN.—The citizens on May 20 voted to issue $16,000 in bonds for the construction of an electric light plant and water works system. J. E. Johnson is recorder.

NORTHFIELD, MINN.—The trustees of Carleton College are considering the question of installing a central heating and power plant to furnish electricity and heat for all the college buildings, at a cost of between $30,000 and $40,000.

ST. PAUL, MINN.—Announcement has been made by M. W. Savage, president of the Dan Patch Electric Railway, now under construction between the Twin Cities and points in Southern Minnesota, that arrangements have been made for financing a $4,000,000 loan for the construction of the railway. Thirty miles of the road have been graded.

SHAKOPEE, MINN.—Bids will be received until July 13 for a 50-kw generator for the municipal electric light plant. C. T. Weiland is city recorder.

COLUMBIA, MO.—The City Council has granted the Mexico, Perry & Santa Fe Traction Company a franchise to operate an electric railway in Columbia. The proposed railway will be 60 miles in length.

FRANKFORD, MO.—A committee consisting of J. D. Pitt, J. G. Cash and J. B. Jones, has been appointed to make investigations toward the installation of an electric light plant.

MACON, MO.—Plans are being made for organizing the Hannibal-Palmyra-Bethel-La Platta-Kirksville interurban railway, which will be incorporated under the name of the Muldrow Route. The railway is to be built strictly on the co-operative plan. Henry Funk is chief promoter.

NEVADA, MO.—The plant and holdings of the Missouri Water, Light & Traction Company were sold at auction May 15 by Hiram Phillips, receiver, to A. Mitchell, of St. Louis, Mo. The property was sold under foreclosure of $161,200 first mortgage bonds, held by the Lincoln Trust Company of St. Louis, Mo., and includes electric light plant, water works system and electric railway.

HELENA, MONT.—We are informed that the Montana Rapid Transit Company is planning to commence work soon on its electric railway, which will connect Helena and Butte, 72 miles in length. Spurs will be built from East Helena to Lakeview, an amusement resort; and from Jefferson to Wickes, via Corbin. The company has secured the grade of the Northern Pacific Railroad out of Helena. No contracts for material have been awarded as yet. Arrangements have been made by the company with the United Missouri River Power Company for electricity for operating the railway. Joseph K. Toole is president of the company.

KALISPELL, MONT.—The Northern Idaho-Montana Power Company has purchased the plant and holdings of the Kalispell Water & Electric Company, and it is said that the company proposes to make extensive improvements, which will involve an expenditure of about $200,000.

The company also contemplates extensive improvements to its plant at Big Bend, at a cost of about $100,000.

CALLAWAY, NEB.—The Callaway Light & Power Company, it is said, will petition the City Council for a franchise to light the village.

HAWTHORNE, NEV.—Plans are being made for the development of the water power near Mono Lakes, Cal., about 30 miles from Bodie. It is proposed to install a plant with an initial output of 2500 hp which will supply electricity to the Aurora, Masonic, Lucky Boy, Hawthorne, and contiguous mining districts. J. S. Cain, John Miller, J. E. Adams, A. J. McCune and H. M. Goram, of Los Angeles, Cal.; C. F. Collins, of St. Louis, Mo., and others are interested in the project. Preliminary surveys have been completed for the plant.

CANAAN, N. H.—It is reported that the grist mill water power will be utilized for an electric light plant.

ALLENHURST, N. J.—At a special election held recently the citizens voted to sell the distributing system of the municipal electric light plant to the Atlantic Coast Electric Light Company, for $15,000, which hereafter will furnish electrical service in this borough. A bill was recently passed by the State Legislature allowing the town to sell the plant.

DOVER, N. J.—Arrangements are being made by the Morris County Traction Company, of Morristown, N. J., for the erection of a 1000-hp motor generator plant at its car house in Dover. The plant will be of the direct-current system, and will furnish electricity to operate the cars between Morristown and Dover.

WEST ORANGE, N. J.—Arrangements are being made by the Mountain Railway Company for the construction of a half mile extension to Essex County Park, contracts for which will be awarded within the next six weeks.

AUSABLE CHASM, N. Y.—Joseph A. Powers, of Troy, N. Y., has purchased the Ausable Nail Works in Ausable Chasm, including the water rights in the river, which includes a 60-ft. dam, which is capable of developing about 2000 hp. It is said that the power will be utilized to generate electricity, which will be distributed in this vicinity.

BABYLON, N. Y.—The Babylon Railroad Company has been granted permission by the Public Service Commission, Second District, to extend its railway from its present terminus in this village to Amityville, a distance of 5.81 miles. The company is also authorized to increase its capital stock from $25,000 to $75,000, and to issue common stock to the amount of $50,000, the proceeds to be used in the construction of a new ferry line connecting with its railway in Babylon, at a cost of $38,000. It has also been given permission to execute a mortgage upon all its property and holdings to secure an issue of bonds to the amount of $300,000, to be sold at not less than 5 per cent of their par value, to be used in the payment of indebtedness incurred in reconstructing its line by the Long Island Railroad, $26,308; payment of further reconstruction of its line, $16,180; extension from Babylon to Amityville, $126,000; and other expenses.

BROOKLYN, N. Y.—Bids will be received by Bird S. Coler, borough president, until June 9 for furnishing and installing pumping engine and power plant for operating Gowanus flushing tunnel, in the Borough of Brooklyn. Blank forms and further information can be secured and plans and specifications may be seen at the office of Bureau of Sewers, 215 Montague Street, Brooklyn.

BUFFALO, N. Y.—Contracts have been awarded by the Board of Trustees for the new electric light plant for the city hall as follows: For wiring, to McCarthy Brothers & Ford, for $23,280; generators to the Allis-Chalmers Company, for $3,650; engines, to the Skinner Engine Company, for $4,935, and for steam-fitting to Timothy McAvoy & Son, for $1,465.

BUFFALO, N. Y.—Only one bid was received for supplying electricity for operating the three centrifugal pumps at the pumping station, which was submitted by the Cataract Power & Conduit Company, offering to supply the service at the rate of $25 per horse-power per year, which is the same price that the city now pays. The city is to install and maintain the transmission lines from the company's lines in Niagara Street to the pumping station and to contract for a certain amount

DANSVILLE, N. Y.—The Dansville Gas & Electric Company has been authorized by the Public Service Commission, Second District, to execute a first and refunding mortgage for $125,000 to secure an issue of like amount in bonds, of which $75,000 are to be set aside to be used for redemption of bonds of same amount outstanding, $50,000 are to be sold at not less than par, the proceeds to be used as follows: $30,000 to be applied for the discharge of outstanding debts; $9,000 for payment of the cost of new extensions and improvements, and $11,000 for the purpose of providing a working capital

FORT TOTTEN, N. Y.—Bids will be received by the constructing quartermaster at Fort Totten, N. Y., for the installation of an electric light system at this post.

FULTON, N. Y.—The Common Council has granted a franchise to the Niagara-Oswego Power Company. Under the terms of the franchise the company will be required to have in operation a steam plant with an output of 15,000 hp within nine months, and a security bond of $50,000 be given as guarantee to have it in operation. It also provides that its wires must be placed underground on several of the principal streets in the city.

JAMESTOWN, N. Y.—The Mayor has recommended to the Common Council the proposition to purchase the property of the Home Telephone Company. A committee has been appointed to obtain the lowest price the company will sell the plant. At a recent appraisal of the property the plant was valued at $286,000.

KENMORE, N. Y.—The Frontier Telephone Company has petitioned the Town Board for permission to erect a telephone line along the river road to connect with the Wickwire steel plant.

NEW YORK, N. Y.—Mayor McClellan has signed the franchise authorizing the South Shore Traction Company to construct and operate a railway across Queens Borough and the new bridge.

NEW YORK, N. Y.—Bids will be received by John H. O'Brien, commissioner water supply, gas and electricity, until June 7 for furnishing and maintaining electric lamps for lighting streets, avenues, parks and public places from June 7 to Dec. 31, 1909, inclusive, in the Borough of Manhattan. Blank forms may be obtained at the Department of Water Supply, Gas and Electricity, Room 1319, 21 Park Row, New York, N. Y.

NEW YORK, N. Y.—Proposals will be received by C. B. J. Snyder, superintendent school buildings, Department Education, corner Park Avenue and Fifty-ninth Street, New York, N. Y., until June 8, for repairs, alterations and additions to the electric equipment in Public Schools 14, 26, 28, 51, 57, 70, 127, 141 and 166, Borough of Manhattan. Blank forms, plans and specifications may be obtained or seen at the above office.

SENECA FALLS, N. Y.—The Public Service Commission, Second District, has granted the petition of the Geneva, Waterloo, Seneca Falls & Cayuga Lake Traction Company for permission to extend its railway across Cayuga Lake to Auburn. The commission also granted the company permission to change its name to the Geneva & Auburn Railway Company.

SYRACUSE, N. Y.—The Public Service Commission, Second District, has authorized the Oswego County Light & Power Company to increase its capital stock from $100,000 to $1,000,000, and to issue $4,000,000 in bonds. The company proposes to develop the water power of Salmon River in Oswego County, and will furnish electrical service in Syracuse.

WEST POINT, N. Y.—Proposals will be received at the office of the quartermaster, West Point, N. Y., until June 21 for furnishing and installing electric and combination gas and electric light fixtures in the post headquarters as per plans and specifications in the above office. Forms of proposals furnished on application.

WASHINGTON, N. C.—The Traction Engineering Company, of New York, N. Y., which is now installing an electric railway system in Washington, it is said, will make a proposition to the town to lease the municipal electric light plant, and operating both as one system, under which the city will derive a reasonable profit from the plant.

COLUMBUS, OHIO.—Plans are being prepared by Harold M. Bush, mechanical engineer, Columbus, Ohio, for additions and improvements to the power plant of the Girls' Industrial School, which will include the construction of a new power house, 200-hp. water tube boilers, heaters, hot water pumps, induced draft apparatus, economizer; two 75-kw. generators and engines, vacuum steam heat system, and domestic hot water supply. An appropriation of $49,000 has been made for the work. Contracts will probably be let about July 1.

GALLIPOLIS, OHIO.—The gas plant of the Gallipolis Gas & Electric Company, it is reported, was closed May 20, owing to the plentiful and cheap supply of natural gas from Galion. The electric division will be kept in operation.

LIMA, OHIO.—The Lima Telephone Company has commenced work on extensive improvements to its system, which will involve an expenditure of about $75,000 and include the installation of about 25 miles of underground conduit duct and the erection of about eight miles of aerial cable. George Matheany is manager.

SPRINGFIELD, OHIO.—The Springfield Light, Heat & Power Company has awarded the contract for steel work for its new power plant to be erected on Buck Creek, near North Fountain Avenue, to the Scriebler Company, of Cincinnati, Ohio. The contract for condensers and steam turbine engines was awarded to the Wheeler Condenser Company, of New York, N. Y.

CHICKASHA, OKLA.—The Public Service Company, of Chickasha, recently incorporated, with a capital stock of $750,000, has taken over the plant of the Chickasha Water Power Company and the gas plant in Chickasha. The officers of the new company are: C. Townsend Blake, president; William T. Croslen, vice-president; C. L. Green, secretary, and T. H. W. Williams, treasurer, all of Hobart, Okla.

EL RENO, OKLA.—Plans are being considered by the El Reno Gas & Electric Company for the reconstruction of its distributing system and making two miles of pole line. H. H. Stephens is engineer.

OKLAHOMA CITY, OKLA.—Plans are being made by the Pioneer Telephone Company for extensions and improvements to its system which will include the placing of its wires underground in the business section of the city and erection of two aerial lines. The company also proposes to increase its capital stock from $[illegible] to $[illegible]. Contracts have been awarded by the company for [illegible] of a power [illegible]

DRAIN, ORE.—W. Bowerman, of this city, writes that at present there is no electric plant in Drain, but that there is a good power site for a plant in the town.

PORTLAND, ORE.—The Portland Railway Light & Power Company has entered into a contract with the electric railway between Hillsboro, Oak Grove and Park streets that all motors in that district are to be supplied by direct

current service as soon as the new sub station at Seventh and Adler streets is placed in operation. The change in the system will affect several thousand motors.

UNION, ORE.—The City Council has passed the ordinance authorizing an issue of $25,000 in bonds for establishing an electric light plant and calling for an election Aug. 16 to vote on the proposition.

EMAUS, PA.—Plans and specifications for the proposed plant to be erected by Messrs. Yeager & Chapin, who were recently awarded the contract for street lighting by the Borough Council, have been prepared, and if approved by D. R. Miller, borough burgess, work will commence at once on construction of the plant. The Allentown Electric Light & Power Company is furnishing the street lighting service at present.

IRWIN, PA.—Application will soon be made for a charter for the Irwin-Herminine Traction Company, which proposes to construct an electric railway along Sewickley Avenue in Herminine, to the Mt. Pleasant Pike, thence to Irwin and along the Guffey station road to Hahntown, a distance of about four miles. William S. Rial is solicitor.

PHILADELPHIA, PA.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until June 26 for motor generator sets, exciters, switchboard, etc., for U. S. Navy Yard, Philadelphia, Pa. Specifications can be obtained on application to the bureau or to the commandant of the navy yard named. The cost of the work is estimated at $17,550. R. C. Holiday is Chief of Bureau.

WOONSOCKET, R. I.—Plans are being made by the Woonsocket Electric & Machine Company to replace the present street lamps with luminous magnetite arc lamps. The change will be made without any additional cost to the city.

CHESTER, S. C.—The Chester Power Company has been chartered as subsidiary to the Southern Power Company, to take over the local electric lighting interests. The company is now overhauling the lines and making preparations to supply electricity for all purposes, including contracts for several industrial enterprises.

CLEMSON COLLEGE, S. C.—Clemson College, the state college, proposes to build a short electric railway from the college to Calhoun, to be used for both freight and passengers. Ninety-pound rails will be laid. Further extensions of the railway may follow.

SUMTER, S. C.—W. E. Brunson contemplates developing a water power to be utilized to generate electricity. It is proposed to develop about 360 hp at a cost of about $20,000.

LEAD, S.D.—The Homestake Mining Company, which has a large mining plant near Lead, is installing a new electric power plant, at a cost of about $1,000,000.

MADISON, S. D.—Contracts for additional equipment for the municipal electric plant have been awarded as follows: To the Minneapolis Steel & Machinery Company for producer-gas engine, at $16,000, and for dynamo to the Fort Wayne Electric Works, for $3,660. William Rae, City Auditor.

KNOXVILLE, TENN.—The People's Telephone & Telegraph Company contemplates installing a direct circuit from Sevierville to Knoxville.

WINCHESTER, TENN.—The citizens have voted to issue $7,000 in bonds to rebuild the municipal electric light and water plant. A new water wheel and generator will be installed. William J. Dodge, of Estill Springs, Tenn., is superintendent.

CALVERT, TEX.—The Calvert Water, Ice & Electric Light Company is planning to make extensive improvements to its system, which will involve an expenditure of about $40,000. G. W. Sonnerfield, of Dallas, Tex., has been awarded the contract for the construction of a new power house.

EL PASO, TEXAS.—Richard Caples and W. B. Latta, representing the stockholders of an interurban electric railway which is to be constructed from El Paso to Fabens, have petitioned the City Council for a franchise to construct an electric railway through the city.

GONZALES, TEX.—It is reported that the Gonzales Electric Light & Power Company has placed a contract with the Westinghouse & Manufacturing Company, Pittsburg, Pa., for a 350-kw generator. The company proposes to furnish electricity for cotton mills and other local industries.

MARFA, TEX.—The Marfa Power Company has changed its name to the Marfa Telephone Company and increased its capital stock from $3,500 to $5,000.

TOYAH, TEX.—The plant and holdings of the Toyah Light & Telephone Company have been purchased by a new company recently organized, with a capital stock of $15,000, which proposes to enlarge and improve the service. A contract has been let for the construction of a new power house in which the telephone exchange will also be operated. Orders have also been placed for a new engine and generator. The officers of the company are: B. P. Vanhorn, president; A. G. Vanhorn, vice-president and general manager, and J. V. Gage, secretary and treasurer.

MURRAY, UTAH.—Application has been made by Murray City to the State Engineer for 15 cu. ft. per second of water from Little Cottonwood Creek, to be utilized to generate electricity, which will be distributed in Murray for lamps and motors. A channel of 10,880 ft. will be built, with dam capable of developing 750 hp.

OGDEN, UTAH.—It is reported that the Utah Light & Railway Company will reconstruct its system and the generating division will be remodeled.

SALT LAKE CITY, UTAH.—The Utah Light & Railway Company is reported to have awarded a contract to the Allis-Chalmers Company, Milwaukee, Wis., for a duplicate of the 1250-kw motor generator in its plant furnished by the company last winter, at a cost of $25,000.

BRATTLEBORO, VT.—At a special meeting of the stockholders of the Connecticut River Transmission Company held recently the capital stock of the company was increased from $2,500,000 to $3,200,000. The company is constructing a large hydro-electric plant at Vernon, Vt., which is nearly completed. It is announced that the plant will be in operation early in June and will have an output of about 27,000 hp. Henry I. Harriman, president of the company, states that contracts have been placed amounting to about $275,000, which only represent about 30 per cent of the available primary power, and 60 per cent of the secondary power.

BURLINGTON, VT.—The price of electricity has been reduced to five cents per kw-hour to all consumers using over 100 kw hours per month. The commissioners of the electric light plant have also been authorized to make special rates for electricity for special illumination. The new rate takes effect from May 1, 1909.

CHARLES CITY, VA.—The Charles City Telephone Company is making arrangements to commence work on the erection of its telephone lines, and is securing rights of way to Roxbury and other points to be reached by the system.

MONTPELIER, VT.—The Corry, Deavitt & Frost Electric Company, which furnishes electricity to operate the Barre & Montpelier Traction Company's system, has decided to erect a second power plant for the purpose of furnishing electricity for power purposes. Its present plant is not quite completed, but has been in operation since the first of March. It is expected to develop 1000 hp under a 60-ft. head. P. S. Tirrill is superintendent.

NEWPORT, VT.—Arrangements are being made by the Newport Electric Light Company to increase the output of its plant, which will include the installation of a 750-hp Curtis steam turbine.

PORTSMOUTH, VA.—We are informed that the city of Portsmouth has abandoned the project to erect a municipal electric light plant, and has awarded a contract for electric lighting for a term of ten years from January 1, 1910, to the Portsmouth & Norfolk Corporation, under the terms of which the company is to have its plant in operation by January next. As yet no visible steps have been taken toward the construction of the plant. T. J. Wool, of Portsmouth, Va., is president of the company.

DAVENPORT, WASH.—The local electric light plant of the Big Bend Light & Power Company, which has been out of commission for some time, has been dismantled. Electricity for operating the local system is transmitted from Spokane.

ODESSA, WASH.—The Washington Water Power Company is contemplating extending its system to Odessa in the near future if a satisfactory franchise can be secured. The company agrees to install a system provided it is given a contract to operate the city pumping station and sufficient power contracts can be secured.

PROSSER, WASH.—The Benton Independent Telephone Company has purchased the franchise and equipment of the Prosser Telephone Company.

SEATTLE, WASH.—The City Council has passed an ordinance authorizing the installation of a system of cluster lamps on Union and other streets.

SEATTLE, WASH.—The Skagit Power Company, which was granted permission by the Government in March to construct flumes and conduits in the national forest reserve, through which the Skagit River passes, will soon be ready to commence work on its large power plant in a short time. The plant will be completed in four years and will develop from 50,000 to 60,000 hp. The water will be carried a distance of 17,000 ft. above the plant through a tunnel to be opened. C. H. Freeman is treasurer, and C. C. Conkle manager of the company.

SPOKANE, WASH.—The plant and holdings of the Spokane Falls Gas Company have been purchased by Henry L. Doherty, of New York, N. Y., and associates, who control various light and traction companies throughout the country. The franchises held by the company are considered especially valuable, and include water rights on the Spokane River.

TACOMA, WASH.—Surveys are being made by the Thunder Creek Transportation Company for the construction of a railway across the mountains, for which rights of way have been secured from the Department of the Interior.

FAYETTEVILLE, W. VA.—Application has been made by R. H. Dickinson for a franchise to build and operate an electric light system in Fayetteville. W. L. Lee is Mayor.

FORT ATKINSON, WIS.—The stockholders of the Jefferson County Telephone Company have decided to sell the local system to the Wisconsin Telephone Company. The Wisconsin company is to pay $967 in cash and $21,967 in stock, and is also to assume the $5,200 indebtedness of the Jefferson company. The system will be taken over July 1.

OCONTO, WIS.—Plans are being made by the Oconto Rural Telephone Company to commence work on the erection of seventeen miles of telephone line.

SHEBOYGAN, WIS.—The Mosel & Centerville Telephone Company has increased its capital stock from $5,000 to $15,000.

WATERTOWN, WIS.—Extensive improvements are under way by the Watertown Gas & Electric Company, which will include the construction of a new power house and dam at the Rough-and-Ready water power site. The equipment will include two water wheels direct connected to generators and a rotary converter and transformers. The transmission line will connect with the line from the Kilbourn dam.

WELCOME, WIS.—The Fox River Telephone Company, of Appleton, Wis., has been granted a franchise to erect a telephone system in Welcome. The company will commence work at once on the erection of a telephone line from New London to this village, a distance of 10 miles.

LETHBRIDGE, ALTA., CAN.—The Alberta Government has decided to install an automatic telephone system here. For further information address W. H. Cushing, minister of works.

LETHBRIDGE, ALTA., CAN.—Contracts for the construction of the municipal electric light plant have been awarded as follows: For mechanical draft and economizer to the Polson Iron Works, of Toronto, Ont., for $6,890; complete piping to Drummond, McCall & Company, of Montreal, Que., for $14,365; for crane to Mussen's Ltd., for $1,700; boilers and accessories to the Babcock & Wilcox Company, of Montreal, Que., for $25,410; feed pumps to the Canada Foundry Company, of Toronto, Ont., for $730; transformers to the North West Electric Company, of Calgary, Alta., for $1,320; electrical equipment to the Canadian Westinghouse Company, of Hamilton, Ont., for $1,449, and to Laurie & Lamb, of Montreal, Que., for engine and condensing sets, for $18,575.

CRESTON, B. C.—The Goat River Power & Light Company proposes to construct a power plant on the Goat River Canyon and will furnish electricity for lamps and motors and other purposes. The company also plans to construct an electric railway to extend from Creston to the Goat River, ten miles in length, work on which will commence within a year. The officers of the company are: R. S. Lennie, of Nelson, B. C., president; W. K. Essling, of Rossland, B. C., vice-president; J. B. Anderson, of Trail, B. C., secretary and treasurer, and W. F. Teetzel, Nelson, B. C., general manager.

HAMBURG, ONT., CAN.—Preparations are being made by the People's Railway Company for the construction of its proposed electric railway, which will connect Stratford, Woodstock, New Hamburg, Berlin, Guelph and intervening towns, work on which will commence in the near future. The proposed railway will be about 88 miles in length. Electricity for operating the road will be purchased from the Hydro-Electric Power Commission. A. N. Warfield, of New Hamburg, is construction engineer.

HAMILTON, ONT., CAN.—Preparations are being made by the Cataract Power Company for the new lighting contract which goes into effect July 1. Additional lamps are to be installed. It is said that there will be no gas lamps used after July 1.

OTTAWA, ONT., CAN.—The bill to incorporate the Michigan & Ontario Power Company has been passed by the Parliament.

TORONTO, ONT., CAN.—The Board of Control has awarded the contract for lighting the newly annexed district of Wychwood to the Toronto Electric Light Company at a rate of $69 per lamp per year.

TORONTO, ONT., CAN.—Tenders will be received by the City of Toronto, Ont., until June 30 for laying between 350,000 and 450,000 duct ft. of underground conduit. For specifications, form of tender, etc., apply to Electrical Department, City Hall. K. L. Aitken is electrical engineer.

GOVAN, SASK, CAN.—Sealed tenders will be received by T. Fargey until June 15 for the construction of approximately 60 miles of telephone line for the Govan Telephone Company.

JIMENEZ, MEX.—A. J. Warren and C. D. Norton, owners of the local electric light plant, contemplate extending their transmission line a mile or more to the south and installing a new boiler in their plant to provide power for a day service, and also installing several small direct-connected centrifugal pumps for irrigating purposes and furnishing power for [illegible] a couple of flour mills.

New Industrial Companies.

THE J. ALEXANDER MANUFACTURING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $30,000 to manufacture electric fixtures and apparatus, etc., by J. Alexander, A. S. Alexander, C. H. Cairns and I. H. Alexander, of New York, N. Y.

THE AMERICAN ACCUMULATOR COMPANY, of Camden, N. J., has been incorporated with a capital stock of $500,000 by E. E. McWhiney, S. Moor and F. A. Kuntz, all of Camden, N. J.

THE BRAUN-ELECTRA-AUTOMATIC WEIGHING MACHINE COMPANY, of Jersey City, N. J., has been chartered by W. F. Braun, H. O. Coughlan and S. A. Anderson, of Jersey City, N. J. The company is capitalized at $175,000 and proposes to manufacture automatic weighing machines.

THE COMMERCIAL TRACTOR COMPANY, of New York, N. Y., has been chartered with a capital stock of $100,000 for the purpose of manufacturing traction wheels, engines, motors, etc. The incorporators are: B. M. Beskow, of New York, N. Y.; C. S. Kellogg, of Montclair, N. J., and E. O. Kannofsky, of Brooklyn, N. Y.

THE COUPLE-GEAR COMPANY, of New York, N. Y., has been chartered with a capital stock of $[illegible] for the purpose of manufacturing motor vehicles, electric and other motors, cars, vehicles, etc. The incorporators are: W. H. Kennard, F. B. King, of New York, N. Y., and H. Greene, of Cranford, N. J.

THE GENERAL RAILWAY EQUIPMENT COMPANY, of Portland, Maine, has been incorporated with a capital stock of $3,000,000 to manufacture railroad supplies. The officers are: C. E. Eaton, president; T. L. Croteau, treasurer, and A. W. Tolman, clerk, all of Portland, Maine.

THE HILL-HUPFEL ENGINEERING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $200,000 to act as consulting engineers and to design and build steam turbines, gas engines, etc., by H. P. Hill, O. G. Hupfel and C. E. Whitney, all of New York, N. Y.

THE INTERNATIONAL ILLUMINATING COMPANY, of Newark, N. J., has been chartered with a capital stock of $1,000,000 for the purpose of manufacturing gas burners, chandeliers and electroliers. The incorporators are: Robert H. Smith, Gustave Oestrecheicher and Richard W. Cobb.

THE JERSEY CITY ELECTRIC COMPANY, of Jersey City, N. J., has been chartered with a capital stock of $25,000, to do a general electrical engineering business. The incorporators are: C. Thomas, E. Thomas and E. G. Thomas, all of Jersey City, N. J.

THE LINCOLN ENGINEERING COMPANY, of Portland, Ore., has been chartered with a capital stock of $10,000 for the purpose of manufacturing electrical machinery. The officers are: L. V. Walker, president; F. L. Pennell, treasurer, both of Portland, Maine; G. W. Craigie, of Westbrook, Maine, clerk.

THE MERCHANTS ELECTRIC COMPANY, of Wilmington, Del., has filed articles of incorporation with a capital stock of $150,000. The incorporators are: H. H. Ward, G. G. Steigler and A. C. Gray, of Wilmington, Del.

THE METAL BOILER CLEANER COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 to sell a metal compound for cleaning boilers, by J. J. Harper, E. J. Forhan and H. M. Browne, all of New York, N. Y.

THE MILES-WILDERMAN ELECTRIC COMPANY, of St. Louis, Mo., has been organized for the purpose of doing a general contracting business and to act as representatives for specialties in the electrical business by C. F. Miles and L. C. Wilderman. The company would like to receive catalogs from manufacturers with discounts to dealers.

THE NEWCOMB ENGINE COMPANY, of Harrison, N. Y., has been incorporated by W. B. Thompson, of Union Course, N. Y.; O. A. Hack, E. C. Chamberlain, of New York, N. Y. The company is capitalized at $200,000 and proposes to manufacture motors, engines, automobiles, etc.

E. A. OLLEY & COMPANY, of Syracuse, N. Y., has been chartered with a capital stock of $20,000 by Ellery A. Olley, Raymond H. Olley, Edwin A. Olley and Joseph C. Belle Isle, of Syracuse, N. Y. The company proposes to deal in electrical goods and to do electrical work.

THE OXFORD TELEPHONE HANGER COMPANY, of Fayetteville, Ark., has been incorporated with a capital stock of $500,000, and the following named officers: C. E. Oxford, president; Harold H. Tittman, of St. Louis, Mo., vice-president. The company proposes to manufacture the Oxford detachable cabinet telephone, using the Oxford hanger.

BERNARD F. PIEL, of Brooklyn, N. Y., has filed articles of incorporation with a capital stock of $10,000, for the purpose of manufacturing engines, boilers, machines, tools, hardware, etc. The incorporators are: A. M. Piel, George C. Schneider and Paul F. Stein, all of Brooklyn, N. Y.

THE P. & F. ELECTRIC COMPANY, of Chicago, Ill., has been chartered by Arthur F. Poole, Louis J. Flint and George C. Knauff. The company is capitalized at $2,500, and proposes to do a general electrical and engineering business.

THE PUBLIC SERVICE CONSTRUCTION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $5,000 by Charles C. Mann, John C. Bishop and James J. McMahon, all of New York, N. Y. The company proposes to manufacture mechanical and electrical apparatus.

THE RAE ELECTRIC VEHICLE COMPANY, of Wilmington, Del., has filed articles of incorporation with a capital stock of $150,000. The incorporators are: C. F. Clendennin, N. F. Griffin, of New York, N. Y., and S. A. Love, of Philadelphia, Pa.

THE TESLA PROPULSION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $1,000,000 to manufacture hydraulic, steam, gas and pneumatic machinery for vessels. The directors are: Nicola Tesla, Joseph Hoadley and Walter H. Knight, all of New York, N. Y.

THE WENTWORTH-DEAN COMPANY, of Lima, Ohio, has been incorporated with a capital stock of $10,000. The company proposes to manufacture and deal in electrical supplies. The officers of the company are: E. A. Dean, president; E. H. Wentworth, vice-president, and Walter Dean, secretary and treasurer.

WESTON MANUFACTURING COMPANY, of Binghamton, N. Y., has been incorporated with a capital stock of $10,000 by Marsh Miller, Frank T. Macey and Oscar W. Alston, of Binghamton, N. Y. The company proposes to manufacture mechanical appliances, devices, machines and machinery.

New Incorporations.

BARDSTOWN, ARK.—The Bardstown Telephone Company has been chartered with a capital stock of $2,000 by J. M. Ward, I. L. Ward, H. S. Portis and W. H. Davis, all of Bardstown, Ark.

MAMMOTH SPRINGS, ARK.—Articles of incorporation have been filed for the Mammoth Springs Electric Light & Power Company with a capital stock of $10,000, by Napoleon Hill, president; E. C. Parham, E. C. Bellamy and Frank P. Hill.

WILMINGTON, DEL.—The People's Light & Fuel Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are: I. W. Keere, Mason City, Ia.; O. B. Matthews, A. L. Childs, E. B. Grande, Grinnell, Ia., and H. W. Davis, of Wilmington, Del.

CHICAGO, ILL.—The Interstate Light & Power Company, a New Jersey Corporation, has filed articles of incorporation with the Secretary of State. The company is capitalized at $750,000, and proposes to operate light, heat and power plants.

CRAWFORDSVILLE, IND.—The Crawfordsville Heating & Lighting Company has incorporated for the purpose of constructing and equipping a heating, lighting and water plant. H. R. Ristine, W. P. Herron, James E. Evans and others are incorporators.

RUSHVILLE, IND.—The Lot Green Telephone Company has incorporated to construct and operate a telephone plant in Rush County, with home office in Rushville. The company is in the market for material and equipment for a new plant. Henry Schrader, Amos Blackledge and Thos. A. Dell are directors.

TOPEKA, KAN.—A charter has been granted to the Kansas-Colorado Construction Company, of Lawrence, with a capital stock of $100,000. The company proposes to construct a railway and electrical transmission plant from Western Kansas and Colorado, in the Arkansas Valley. J. D. Bowersock, of Lawrence, is president of the company and Charles Sutton is general manager.

HEATH, KY.—The Heath Telephone Company has been incorporated with a capital stock of $1,000 by T. M. McGee, D. W. Murphey, A. P. Hill, J. D. Rives, and others.

SPRINGFIELD, MASS.—Articles of incorporation have been filed for the Hall Tide Power Company with a capital stock of $500,000 for the purpose of producing power by means of tides. A. Wooley, of Chicopee, Mass., is president, and J. Hall West, of Somerville, Mass., treasurer.

JACKSON, MISS.—The Mississippi Home Telephone Company has been chartered with a capital stock of $250,000. It is said that the company will commence work at once on the construction of an automatic telephone system in this city, and will place its wires underground. The company has right of way to Meridian, a distance of 96 miles, and to Hattiesburg, 80 miles. George C. Graeber, of Shamokin, Pa., is president of the company, and N. D. Smith, of Jackson, local representative.

CLINTON, MO.—The Western Power & Transportation Company has been incorporated with a capital stock of $50,000 by William F. Hall, R. H. Pierce and L. H. Hall. The company proposes to construct and operate steam, water, gas and electric lighting and heating plants.

BLADEN, NEB.—The Bladen Rural Telephone Company has decided to consolidate with the Glenwood Rural Telephone Company, the change to take effect July 1.

CAMDEN, N. J.—The Phoenix Water Power Company has been chartered, with a capital stock of $150,000, for the purpose of developing water power to be utilized to generate electricity. The incorporators are: F. R. Hansell, G. H. B. Martin and J. A. MacPeak, all of Camden, N. J.

GLEN RIDGE, N. J.—The Telegraphatype Company has been incorporated, with a capital stock of $50,000, by W. M. Beard, of Glen Ridge, N. J.; W. F. Paret, of Essex Falls, N. J., and M. V. Moran, of Jersey City, N. J. The company proposes to maintain telegraph and telephone lines.

JERSEY CITY, N. J.—The Low Moor Conduit Company has been incorporated with a capital stock of $5,000 by C. R. Ganter, of New York, N. Y.; George H. Stover, of New Dorp, N. Y., and Edward H. Green, of New York, N. Y.

LAS VEGAS, N. M.—Articles of incorporation have been filed for the Las Vegas Light & Power Company, with a capital stock of $300,000, by J. M. Cummings, William G. Hayden and William S. Iliff, of Denver, Col.

CERES, N. Y.—The Kings Run Telephone Company has been chartered with a capital stock of $2,000 by H. N. Hackett, H. J. Butler and C. C. Faulkner, of Ceres, N. Y., and others.

HILLSDALE, N. Y.—Articles of incorporation have been filed for the North Hillside & Green River Telephone Company with a capital stock of $4,500 by E.Herrington, Frank J. Shaw and Frank Mercer, of Hillsdale, N. Y., and others.

NEW YORK, N. Y.—The Upper Broadway Railway Company has filed articles of incorporation with the Secretary of State for the purpose of constructing and operating a street railway in the Borough of Manhattan 3½ miles in length from Twelfth Avenue along Manhattan Street to Broadway to St. Nicholas Avenue to Fort George Avenue. The company is capitalized at $750,000, and the incorporators are: Morgan D. Wilson, Arnold F. Wainwright and Charles F. Heddin, all of New York, N. Y.

SPENCERTOWN, N. Y.—Articles of incorporation have been filed for the Spencertown Co-operative Telephone Company, with a capital stock of $1,000, by Henry W. Niles, of Chatham, N. Y.; D. O. Sawyer, David W. Lasher, of Spencertown, and others.

CLEARVILLE, N. C.—The Southport & Little River Telephone Company has been incorporated, with a capital stock of $1,000, by M. J. Corbett, N. W. Divine and R. R. Stone, all of Wilmington.

GIBSONVILLE, N. C.—The Gibsonville Telephone Company has been incorporated, with a capital stock of $5,000, by C. E. Jordan, J. V. Dick and others.

HERTFORD, N. C.—The Belvidere Telephone Company has been chartered with a capital stock of $1,000 by L. W. Norman, G. W. Gaither and W. G. Gaither, Jr.

BERLIN, N. D.—The Lakeview Farmers' Mutual Telephone Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: H. G. Fenno, S. H. Darby, A. D. Knapp and others, all of Berlin, N. D.

GRANO, N. D.—The Grano-Lockwood Telephone Company has been incorporated with a capital stock of $10,000 by Eugene Mead, of Grano; F. S. Randolph, J. M. Johnson and others.

VELVA, N. D.—Articles of incorporation have been filed for the Progressive Farmers' Telephone Company. The capital stock of the company is placed at $50,000 and the incorporators are: George F. Mills, H. F. Harms and M. E. Bowers, all of Velva, N. D.

COLUMBUS, OHIO.—The Harrison & Jefferson Telephone Company has been incorporated with a capital stock of $250,000. The directors are W. P. Moore, president; C. F. Branson, C. P. McMillen, Lewis Hall, R. Cunningham, M. Moorehead, W. W. Wright and C. M. Osborne. The company is a consolidation of the Adena Exchange Telephone and the Harrison County Telephone companies.

PORT WILLIAM, OHIO.—The Port William Mutual Telephone Company has been incorporated, with a capital stock of $10,000, by J. A. Vandervort and others.

ZANESVILLE, OHIO.—Articles of incorporation have been filed for the Muskinghum & Morgan Railway, Light & Power Company by Andrew W. McDonald, Rufus C. Burton, William H. Pierpont, W. Hunter Atat and John J. Adams. The company is capitalized at $10,000.

FORT COBB, OKLA.—Articles of incorporation have been filed for the South Side Mutual Telephone Company, with a capital stock of $1,000. The directors are Stephen P. Ratcliff, William L. Keever and J. A. Campbell, all of Fort Cobb.

IDABEL, OKLA.—The Idabel Light & Power Company has been incorporated, with a capital stock of $10,000, by H. C. Morris, Charles Smith, W. D. Hinton, of Idabel, and E. B. Herendon, of Millerton.

McCURTAIN, OKLA.—Articles of incorporation have been filed for the City Electric Light & Power Company, with a capital stock of $6,000, by S. A. Shaw and D. R. Branham, of McCurtain, Okla.; C. C. Glenn, of Chant, Okla., and F. A. Handlin, of Fort Smith, Ark.

SHAWNEE, OKLA.—A charter has been granted the Shawnee Electric Company with a capital stock of $100,000 to construct two interurban railways through central Oklahoma. The first railway will extend from Shawnee through Prague and Okmulgee to Muskogee, a distance of 120 miles, and will cost approximately $3,000,000. The second line will run from Shawnee touching the towns of Dale, McCloud, Harrah and Choctaw County to Oklahoma City, 40 miles in length, the cost of which is estimated at $1,000,000. The incorporators are: C. T. Edwards, A. Hargraves, C. E. Easterwood, R. E. Pugh and W. S. Pendleton, all of Shawnee. A construction company capitalized at $10,000 was also granted a charter, incorporated by the same parties.

WHITEHORSE, OKLA.—Articles of incorporation have been filed for the Whitehorse Rural Telephone Company, with a capital stock of $600, by W. C. Douglass, M. E. Smith, C. R. Maher, L. D. Romig, L. Romig and H. G. Bosworth.

PILOT ROCK, ORE.—The Independent Telephone Company has been incorporated, with a capital stock of $3,000, by A. R. Turner and others.

PORTLAND, ORE.—The Inland Oregon Electric Railway Company has been incorporated by M. W. Gill, H. J. Martin and C. D. Charles. The company is capitalized at $1,000,000 and proposes to construct an electric railway from Condon to Canyon City, via Fossil. Another branch is to be built from Fossil through Wheeler, Wasco and Crook counties to the confluence of Trout Creek and Deschutes, where it will join the main line of the Portland-Baker City & Butte Electric Railway.

TROY, ORE.—The Mercantile Milling & Power Company has been chartered, with a capital stock of $20,000, by R. W. Barkham and H. E. Merryman. The company proposes to construct an electric railway from Troy to Hurricane Creek, a distance of about 12 miles. The headquarters of the company are located in Enterprise.

CALIFORNIA, PA.—Articles of incorporation have been filed for the California & Centerville Street Railways Company for the purpose of constructing an electric railway five miles in length in Washington County. The company is capitalized at $30,000, and the incorporators are: W. H. Francis, president; W. J. Weaver, H. C. Dunn, Joseph McLain and Harris Booker, of California, Pa.

PITTSBURGH, PA.—The Hebron Street Railway Company has been granted a charter to construct a street railway out on Frankstown Avenue and from Oakwood Street, Pittsburgh, to the Sandy Creek Road, a dis-

tance of two miles. The company is capitalized at $50,000, and the directors are: John S. Hershey, president; B. M. Sharp, D. W. Hoffman, C. W. Van Artsdalen and John S. Hershey.

SOMERSET, PA.—The Somerset & Bakersville Railway Company has been granted a charter to construct a railway from Rockwood to Bakersville, a distance of nine miles. Charles F. Hood, of Connellsville, is president.

RIPLEY, TENN.—The Ripley Light, Water & Ice Company has been incorporated, with a capital stock of $15,000, by J. W. Sanford, H. D. Folts, F. A. Henry, C. R. Barbee and others.

Legal.

A 50-YEAR FRANCHISE UPHELD BY THE INDIANA SUPREME COURT.—The Indiana Supreme Court has decided in favor of the validity of the franchise granted to Hester *et al.* by the Town Board of Greenwood, Ind. The court held that town boards can grant a valid franchise to a water and lighting company for a term of 50 years, though it cannot make contracts for service for longer than 25 years. The tax levied to pay for light and water was also upheld.

Personal.

MR. E. A. LOF, of the engineering staff of the Western Electric Company, has sailed for a short trip in Europe.

MR. C. A. S. HOWLETT, of the Western Electric Company, has been elected president of the National Sales Managers' Association.

DR. JOHN W. PRITCHARD, of Cardigan, Wales, has arrived in this country, where he will make a study of water-power and other electrical plants.

MR. G. E. REIFF has resigned from the Western Electric Company in order to accept a position with the Allis-Chalmers Company as designing electrical engineer.

MR. HARRY SHOEMAKER presented a paper June 2 before the Wireless Institute, New York, entitled "The Production of High-Frequency Oscillations."

MR. E. M. ADDIS has been appointed in charge of the Brattleboro, Vt., division of the Twin State Gas & Electric Company, succeeding Mr. F. P. Woy, who recently resigned.

MR. DAY BAKER delivered a lecture, illustrated by lantern slides, on May 27, before the New York Electrical Society, on the "Practical Application of the Modern Electric Vehicle."

MR. C. L. DE MURALT presented a paper May 26 before the University of Michigan, branch A. I. E. E., entitled "The Choice of a System of Electrification for Trunk Lines."

PROF. JOHN C. SHEDD, of Westminster College, Denver, has been appointed head of the department of physics of Pittsburgh University (formerly University of Western Pennsylvania).

MR. ETIS V. THURESSON, of Stockholm, Sweden, and chief engineer of a Swedish electrical development company, is on a visit to this country in order to inspect the more notable electrical plants.

MR. WALTER DANDLIKER has succeeded to the position of mechanical designer in the direct-current department of the Allis-Chalmers Company, made vacant by the recent resignation of Mr. C. C. Coppin.

MR. E. G. HOLZER, superintendent of the Easton Gas & Electric Company, of Easton, Pa., has been elected president of the Pennsylvania Gas Association. It has been decided to hold the 1910 convention in Easton on April 20.

MR. F. JOHN BELL has resigned as director and secretary-treasurer of the Canadian Crocker-Wheeler Company, Limited, Montreal. Mr. Bell has been connected with various engineering and commercial branches of the electrical business throughout Canada for many years.

MR. DONALD C. BARNES, for the past two years electrical engineer of the Edison Electric Illuminating Company of Brockton, Mass., has been appointed manager of the Pawtucket Electric Company, of Pawtucket, R. I., one of the Stone & Webster properties.

MR. JEFFERSON D. KEARNEY, of Chicago, formerly connected with the Central Electric Company and Zenco Electric Supply Company, and more recently a manufacturers' agent in the Monadnock Building on his own account, is confined to his home by a serious illness, which excites the gravest apprehension of his friends.

MR. LOUIS DUCOR, engineer of the contracting firm of Gères & Loucheur, Paris, is in this country on a tour of inspection to study American developments in high-tension power transmission, and of single phase and high-voltage direct-current railways. Mr. Ducor will remain here about 10 weeks and will visit some of the far Western cities before his return.

MR. S. R. FARIS, for about 10 years connected with the Western Electric Company, of Chicago, and particularly active in extending the company's business in the South, has been elected president of the newly formed Continental Electric Company, at 334 Dearborn Street, Chicago. The members of this company will be sales engineers and represent Eastern manufacturers of electrical specialties.

MR. J. FRANK DOSTAL, superintendent of the electric department of the Denver Gas & Electric Company, of Denver, Colo., has been elected director of that company to take the place of Mr. Emerson McMillin. Mr. Dostal was graduated from Purdue University eight years ago. The greater part of his work has been under the direction of Mr. W. J. Barker, general superintendent of the company.

MR. C. C. COPPIN, who recently resigned as mechanical designer in the direct-current department of the Allis-Chalmers Company, has joined the staff of the Westinghouse Electric & Manufacturing Company, in a like position. Mr. Coppin previous to his association with the Allis-Chalmers Company, was with the Bullock Company, of Cincinnati, and also connected with electrical construction work on the Panama Canal.

MR. BAYARD S. STEWART, until recently with W. S. Barstow & Company, of New York, has formed a connection with the Standard Underground Cable Company, and is now in the Chicago office of that company, assisting Mr. J. R. Wiley, manager. Mr. Stewart is a technical graduate of Williamson School, Pennsylvania. Formerly he was sales manager for the Moore Electrical Company, of Newark, N. J., but has been with Barstow & Company for the last two years.

PROF. WILLIAM C. BAUER, of Denver University, has been appointed head of the new electrical engineering course of the Northwestern University, Evanston, Ill. Prof. Bauer was appointed to the chair of physics and electrical engineering of Denver University last year. Previously he had for 10 years been a member of the faculty of Baker University, Baldwin, Kan., and at one time was instructor in civil engineering at the University of Cincinnati.

MR. F. J. DOMMERQUE, for many years on the engineering staff and secretary of the Kellogg Switchboard & Supply Company, has accepted a position with the Stromberg-Carlson Telephone Manufacturing Company, of Rochester, N. Y., as general representative, and will act exclusively in the interests of that company in an engineering and advisory capacity. Mr. Dommerque was educated at the Mathematical Institute of Zurich and the Technical University of Munich, and after a practical experience in a German steam engine works and with an English electrical manufacturing company, came to this country in 1888, and for four years was with the Western Electric Company, Thomson Electric Welding Company, United Traction Company, and in the electrical department of the Singer Manufacturing Company. Following a year passed in Europe, he entered the engineering department of the Chicago Telephone Company in 1893, from which he resigned in 1899 to join the engineering staff of the Kellogg Company, of which he became secretary in 1903. During his connection of 10 years with this company he has had charge of many lines of work, including the planning and supervision of switchboard installations, commercial engineering, supervision of the foreign patent department, etc. Mr. Dommerque has made many contributions to electrical engineering literature through the technical press and transactions of electrical societies.

Trade Publications.

OUTLET BOXES AND COVERS of galvanized stamped steel are illustrated and listed in a bulletin issued by the Pratt Chuck Company, of Frankfort, N. Y. Galvanized boxes and fittings are recommended by the Underwriters in order to secure better contact. Other features of the company's boxes are clean knock-out holes and self-adjustable covers.

WHEELER REFLECTORS.—The Wheeler Reflector Company, Boston, Mass., has issued a bulletin showing the recent additions to its line of street fixtures, which are illustrated by excellent cuts. Most of the new fixtures shown are designed for use with tungsten lamps. Accompanying the illustration of a fluted street reflector is a photometric showing the distribution of light.

AUTOMATIC DRAFT CONTROL.—Bulletin No. 121, issued by the Green Fuel Economizer Company, of Matteawan, N. Y., sets forth the advantages of the Green system of automatic draft control for steam boiler furnaces. This system unites the desirable qualities of forced draft with those of induced draft or chimney draft, and aims to maintain a neutral pressure in the furnace.

CATENARY MATERIAL.—The Ohio Brass Company, Mansfield, Ohio, has just issued an attractive catalog of its extensive line of catenary material. Every detail part used in the construction of catenary lines is illustrated and properly described, tables of dimensions, price lists, etc., being also given. On several pages are shown views of several railway lines using catenary overhead construction.

COPPER-CLAD STEEL.—The Duplex Metals Company, of New York City, has issued a small catalog setting forth the features of copper-clad steel wire. This has an average conductivity of 40 per cent of the conductivity of the same size of copper wire, while the breaking limit is very much higher. In making the wire molten copper is welded to steel and the composite billet is hot-rolled to a wire rod.

POWER PUMPS.—A well-executed catalog has been issued by the Goulds Manufacturing Company, of Seneca Falls, N. Y., on power pumps. In it the principles of the triplex power pump are discussed and various pump installations described. The company has been actively engaged in the construction of pumps and hydraulic machinery for a great many years, and naturally its output is quite extensive. The products of the

company are illustrated and listed in the catalog, which contains besides much useful information.

"GREAT ELECTRICIANS" is the title of a new "King Booklet" issued by Moses King, of New York City. It contains the portraits of 52 pioneers dating from Gilbert and Franklin and coming so far down in the immediate present as to include on the last page Acheson, Hall, Fessenden and De Forest as new men in new arts. There is a prefatory page of condensed history and a final page of electrical statistics. Each portrait has a pithy note of biography. The pamphlet is 16 pages and cover.

THE PURIFICATION OF BOILER-FEED WATER is the subject of two charts reprinted from well-known authorities upon this subject by the Harrison Safety Boiler Works, Philadelphia, Pa. The charts show that by the proper application of heat and soda ash boilers may be entirely protected from corrosion and from the formation of hard scale. Since boiler-feed water should be heated in any case, and since heating water by spraying through steam takes the place of the caustic lime or caustic soda used in other processes for taking up carbon dioxide, this hot process system is claimed to be the rational method of converting cold, hard water into hot, soft water for boiler-feed purposes. The hot process apparatus designed and built by the above company is claimed to combine all the functions of an open feed-water heater with those of a softening system, and the fact that a feed-water heater should be installed in any case thus makes it comparatively inexpensive to secure softening in addition.

Business Notes.

GUINLE & CO., the Brazilian electrical engineering firm, have removed their New York offices to 42 Broadway. As is well known, they are largely interested in hydro-electric development in the South American Republic.

THE HOYT ELECTRICAL INSTRUMENT WORKS, Penacook, N. H., has removed its New York office from 1931 Broadway to 136 Liberty Street, where, with greatly increased space and facilities, it will be in a better position to give its rapidly growing business the best possible attention.

THE LINCOLN MOTOR WORKS COMPANY, Cleveland, Ohio, has changed its name to The Reliance Electric & Engineering Company. The management will remain the same. The company will continue the manufacture of the Lincoln variable-speed motor, but will add a complete line of constant-speed motors, and make all driving mechanisms necessary in applying the motor drive to any class of machinery.

GRIMSHAW WIRE NEW YORK STOCK ROOM.—An increased local demand for its rubber-covered wires and insulating tapes has made it necessary for the New York Insulated Wire Company to secure a new and larger stock room. This is ideally located at 80 Murray Street, in the immediate vicinity of most of the large jobbing and supply houses. The increased stock now carried in New York City enables all local, as well as out-of-town, orders to be filled the day they are received.

ELECTRIC STORAGE BATTERY SALES MANAGERS MEET.—The Electric Storage Battery Company held a convention of its sales managers at the Bellevue Stratford, on May 27, 28 and 29. An opening address was made by the president and general manager, Mr. Herbert Lloyd, and a paper was read by Mr. Charles Blizard, third vice-president and manager of the sales department. Papers were also read by Mr. J. Lester Woodbridge, chief engineer of the company; Mr. Carroll Hodge, manager of construction; Mr. Joseph Appleton, consulting engineer, and others. The following managers from the different sales offices were present: New York, Mr. Albert Taylor; Boston, Mr. Frank J. Stone; Chicago, Mr. G. H. Atkin; St. Louis, Mr. H. B. Marshall; Cleveland, Mr. H. B. Gay; Atlanta, Mr. H. H. Seaman; San Francisco, Mr. R. B. Daggett; Pennsylvania, Mr. E. L. Reynolds.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

ALABAMA LIGHT & TRACTION ASSOCIATION. Secretary, Lloyd Lyon, Mobile, Ala.

AMERICAN ASSOCIATION OF ELECTRIC MOTOR MANUFACTURERS. Secretary, W. H. Tapley, 29 West 39th St., New York.

AMERICAN ELECTRO-THERAPEUTIC ASSOCIATION. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, New York City, 1909.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 33 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September. Annual meeting, Hotel Frontenac, Thousand Islands, N. Y., June 28, 1909.

ARKANSAS ASSOCIATION OF PUBLIC UTILITY OPERATORS. Secretary, J. E. Cowles, Little Rock, Ark. Next meeting, Pine Bluff, Ark., 1910.

ASSOCIATION OF IRON AND STEEL ELECTRICAL ENGINEERS. Secretary, G. H. Winslow, 557 Frick Building Annex, Pittsburgh, Pa. Next meeting, Buffalo, N. Y., June 23, 24 and 25, 1909.

ASSOCIATION OF RAILWAY TELEGRAPH SUPERINTENDENTS. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago. Next meeting, Detroit, June 23, 24 and 25, 1909.

AMERICAN STREET & INTERURBAN RAILWAY ACCOUNTANTS' ASSOCIATION. Secretary, H. E. Weeks, Davenport, Ia. Next meeting, Denver, Col., Oct. 18-22, 1909.

AMERICAN STREET & INTERURBAN RAILWAY ENGINEERING ASSOCIATION. Secretary, John S. Corning, Boston Electric Railway Company, Boston. Next meeting, Denver, Col., Oct. 18-22, 1909.

AMERICAN STREET & INTERURBAN RAILWAY ASSOCIATION. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York. Next meeting, Denver, Col., Oct. 18-22, 1909.

ASSOCIATION OF CAR LIGHTING ENGINEERS. Secretary, G. B. Colegrove, Illinois Central Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

ASSOCIATION OF EDISON ILLUMINATING COMPANIES. Secretary, D. L. Hunting, Spokane, Wash. Next meeting, Briarcliff Manor, N. Y., Aug. 31, Sept. 2, 1909.

ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

CANADIAN ELECTRICAL ASSOCIATION. Secretary, T. S. Young, 104 Confederation Lift Building, Toronto, Ont. Next meeting, Quebec, Can., June 16, 17 and 18, 1909.

CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, A. L. Neereamer, Indianapolis, Ind. Next meeting, Fort Wayne, Ind., June 3, 1909.

COLORADO ELECTRIC LIGHT, POWER & RAILWAY ASSOCIATION. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, Denver, Oct. 12, 1909.

EASTERN STATES INDEPENDENT TELEPHONE ASSOCIATION OF PENNSYLVANIA, NEW JERSEY, MARYLAND AND DELAWARE. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

ELECTRIC CLUB, CHICAGO. Secretary, W. S. Taussig, 204 Dearborn St., Chicago. Meets every Wednesday noon at Chicago Automobile Club.

ELECTRICAL CONTRACTORS' ASSOCIATION OF NEW YORK STATE. Secretary, Geo. W. Russell, Jr., 500 Fifth Ave., New York.

ELECTRICAL CONTRACTORS' ASSOCIATION OF STATE OF MISSOURI. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo. Next meeting, Kansas City, June 10, 1909.

ELECTRICAL SALESMEN'S ASSOCIATION. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

ELECTRICAL TRADES ASSOCIATION OF CHICAGO. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meetings, San Francisco, second Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Thursday of each month.

EMPIRE STATE GAS & ELECTRIC ASSOCIATION. Secretary, Charles H. B. Chapin, 29 West 39th St., New York. Next meeting, New York City, October, 1909.

FLORIDA ELECTRICAL ASSOCIATION. Secretary, G. F. Doig, Gainesville, Fla.

ILLINOIS STATE ELECTRIC ASSOCIATION. Secretary, H. E. Chubbuck, Peoria, Ill.

ILLUMINATING ENGINEERING SOCIETY. Secretary, P. S. Millar, 29 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

INDEPENDENT ELECTRICAL CONTRACTORS' ASSOCIATION OF GREATER NEW YORK. Secretary, J. W. Fluckner, 503 Fifth Ave., New York.

INDEPENDENT TELEPHONE ASSOCIATION OF SOUTHERN INDIANA. Secretary, E. W. Landgrebe, Huntingburg, Ind.

INTERNAL COMBUSTION ENGINE ASSOCIATION. Secretary, Walter I. Sittig, 61 Ward St., Chicago.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., 1909.

INTERNATIONAL ELECTROTECHNICAL COMMISSION (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

INTERNATIONAL INDEPENDENT TELEPHONE ASSOCIATION. Secretary, A. C. Davis.

IOWA ELECTRICAL ASSOCIATION. Secretary, W. N. Keiser, Des Moines, Ia.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia.

IOWA STREET & INTERURBAN ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Sioux City, April, 1910.

KANSAS GAS, WATER & ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., October, 1909.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, James Maret, Mount Vernon, Ky. Regular meetings, second Tuesday in October, each year.

MASSACHUSETTS STREET RAILWAY ASSOCIATION. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

MICHIGAN ELECTRICAL ASSOCIATION. Secretary, A. C. Marshall, Port Huron, Mich.

MINNESOTA ELECTRICAL ASSOCIATION. Secretary-Treasurer, Ludwig Kemper, Albert Lea, Minn.

MISSISSIPPI ELECTRIC ASSOCIATION. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss. Next meeting, Jackson, Miss., June 15, 1909.

MISSOURI ELECTRIC, GAS, STREET RAILWAY & WATER ASSOCIATION. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, Jefferson City, Mo., April 14, 15 and 16, 1910.

MISSOURI INDEPENDENT TELEPHONE ASSOCIATION. Secretary, G. W. Schweer, Windsor, Mo.

NATIONAL ARM, PIN & BRACKET ASSOCIATION. Secretary, J. B. Magers, Madison, Ind.

NATIONAL ELECTRIC LIGHT ASSOCIATION. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York.

NATIONAL ELECTRICAL CONTRACTORS' ASSOCIATION OF THE UNITED STATES. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

NATIONAL ELECTRICAL INSPECTORS' ASSOCIATION. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

NATIONAL ELECTRICAL TRADES ASSOCIATION. Secretary, Fred P. Vose, 1343 Marquette Building, Chicago. Next meeting, Boston, Mass., June 10, 1909.

NEBRASKA ELECTRICAL ASSOCIATION. Secretary, Frank McMaster, Beatrice, Neb.

NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW ENGLAND ELECTRICAL TRADES ASSOCIATION. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

NEW ORLEANS ELECTRICAL CONTRACTORS' ASSOCIATION. Secretary, I. G. Marks, 312 Carondelet St., New Orleans, La. Meetings second and fourth Tuesday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Secretary, N. W. Brockett, Cataract Building, Seattle, Wash. Next meeting, Seattle, September, 1909.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis. Next meeting, Milwaukee, January, 1910.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Lima, Ohio, Nov. 19 and 20, 1909.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburgh, Pa., 1909.

PACIFIC COAST ELECTRIC AUTOMOBILE ASSOCIATION. Secretary, J. T. Halloran, 604 Mission St., San Francisco, Cal. Next meeting, Oakland, Cal., February, 1910.

PENNSYLVANIA ELECTRIC ASSOCIATION. Secretary, E. L. Smith, Towanda, Pa. Next meeting, Sept. 7, 8 and 9, 1909.

PENNSYLVANIA STREET RAILWAY ASSOCIATION. Secretary, Charles H. Smith, Labanon, Pa.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Colo. Meetings, second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y. Next meeting, Columbia University, New York, and Pratt Institute, Brooklyn, June 24, 25 and 26, 1909.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meetings, fourth Monday of each month.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, E. T. Moore, Dallas, Tex.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, care of J. G. White & Co., New York. Next meeting, Ft. Wm. Henry Hotel, Lake George, N. Y., June 29 and 30, 1909.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., Oct. 26, 27 and 28, 1909.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1, each year.

WIRELESS INSTITUTE. Secretary, Sidney L. Williams, 42 Broadway, New York.

WISCONSIN ELECTRIC & INTERURBAN RAILWAY ASSOCIATION. Secretary, Dudley Montgomery, Madison, Wis.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 25, 1909.

[Conducted by Wm. F. Bissing, Patent Law., 2 Rector St., N. Y. City.]

922,456. AUTOMATIC SPRINKLER SYSTEM; J. P. Casey, St. Louis, Mo. App. filed Feb. 9, 1907. For fires, for sounding an alarm when the sprinkler circuit is disabled.

922,462. TELEGRAPHY; T. B. Dixon, New York, N. Y. App. filed July 5, 1904. For multiplex telegraphy, transmitting three messages each way in which the neutral receiving instrument at each station is operated by successive current impulses which are too short to operate the ordinary receivers.

922,464. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; A. C. Eastwood, Cleveland, Ohio. App. filed Nov. 23, 1908. For protecting the windings of a motor by means of a controlling switch, a magnetically closed switch in the circuit of the motor and means for short circuiting the winding on the main switch when the switch is opened and the controlling switch is in any but off position.

922,470. ANODE ELEMENT; B. W. Gilchrist and G. L. Rice, Woodhaven, N. Y. App. filed June 2, 1908. Prolongs the life of the anode by using the scrap or pieces of anodes in a box through which the solution is free to circulate.

922,477. ELECTRIC LINE INSULATOR; R. Henry, Pueblo, Col. App. filed Oct. 5, 1908. An insulator cover threaded locking cap fits on the pin and is provided with exterior bosses for holding the insulator.

922,520. SHORT CIRCUITING DEVICE FOR ELECTRIC MOTORS; C. A. Schmitz, St. Louis County, Mo. App. filed May 9, 1908. Consists of an annular member of copper laminæ, which can be reciprocated to connect the individual members of the commutator.

922,541. ELECTRIC AIR HEATING AND DISCHARGING DEVICE; L. A. Siebert, Columbus, Ohio. App. filed March 28, 1908. For drying the hair. Supplies air under pressure to a small portable tank through which heating wires pass.

922,540. SYSTEM OF MOTOR CONTROL; H. F. Stratton, Cleveland, Ohio. App. filed Oct. 1, 1908. Magnetic switch controller for controlling motors by means of actuating coils and plungers, the latter operating contacts.

922,550. CLOCK WINDING MECHANISM; E. E. Yaxley, Chicago, Ill. App. filed April 2, 1908. Motors for operating clocks by means of a rat-bet and pawl mechanism worked from an [illegible] circuit.

922,556. INSULATING JOINT; A. F. Batchelder, Schenectady, N. Y. App. filed Sept. 28, 1908. For use in steam heating systems where steam is generated by passing currents through the pipe carrying the water. Comprises two heads with a tube between and means for clamping the parts together and insulating the tubes from the heads.

922,562. NOZZLE FOR ELASTIC FLUID TURBINES; J. G. Callan, Lynn, Mass. App. filed Nov. 21, 1904. The nozzle is formed of electro-deposited metal.

922,623. ATTACHING DEVICE FOR ELECTRIC FIXTURES; L. A. Parrish, Great Barrington, Mass. App. filed Feb. 1, 1909. For attaching to outlet boxes by means of a plate and collapsible locking members carried by the plate, engaging, when projected, the outlet box.

922,654. SAFETY ELECTRICAL CIRCUIT BREAKER; W. F. Wocher, R. L. Lemon and L. H. Mortsolf, Indianapolis, Ind. App. filed Feb. 19, 1908. For automobiles, to enable owner to leave machine unguarded. A conducting connector normally connects two [illegible] and a locking device holds the connector disconnected at will.

922,[illegible]. SPLICING SLEEVE; H. Frankel, New York, N. Y. App. filed Nov. 27, 1908. For trolley wire. A sleeve and clutch members to secure the ends of the wire and hold them together.

922,[illegible]. BATTERY ELECTRODE; C. B. Schoenmehl, Waterbury, Conn. App. filed June 10, 1908. A negative electrode for primary batteries consisting of annular compressed copper oxide sections arranged one above the other.

922,727. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl, Waterbury, Conn. App. filed June 10, 1908. An electrode supporting frame having side and cross pieces overlapping the four edges of an electrode and supporting rods thereto.

922,728. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl and W. G. C. Krause, Waterbury, Conn. App. filed June 10, 1908. An electrode for batteries having a top cross-piece and braces engaging a block, the block having pockets to receive the braces.

922,729. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl and W. G. C. Krause, Waterbury, Conn. App. filed June 10, 1908. A primary battery electrode, comprising an inverted U-shaped wire frame, with sheet metal strips secured thereto and attachable to a battery cover.

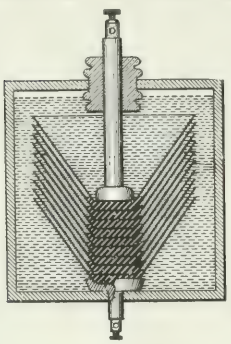
922,730. BATTERY ELECTRODE SUPPORT; C. B. Schoenmehl, Waterbury, Conn. App. filed June 10, 1908. Support for primary battery electrodes formed of wire engaging an oxide plate and having its ends arranged over the top of the plate.

922,731. BATTERY ELEMENT SUPPORT; C. B. Schoenmehl, Waterbury, Conn. App. filed Nov. 30, 1908. A metal frame for sustaining the positive and negative plates from a battery cover within a jar. Includes a wire top with an intermediate portion having an eye for the attachment of a binding post.

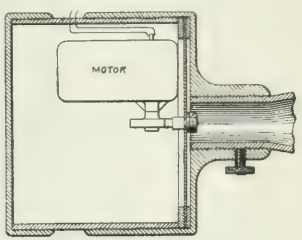
922,746. ELECTRIC SWITCH; C. R. Beebe, New Haven, Conn. App. filed Jan. 11, 1909. For starting the battery for preliminary sparking. Includes a box, a switch arm, contact plates and a bifurcated key, which may be removed to cut out the sparking mechanism.

922,752. ELECTRIC TRAIN OR VEHICLE; J. L. Creveling, New York, N. Y. App. filed March 26, 1903. Fuel is carried by the train, is burned under a boiler, producing steam, which runs a turbine which drive dynamos which supply current to motors which run the train.

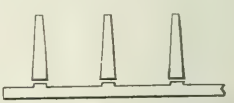
922,760. POLE PIECE FASTENING DEVICE; J. D. Firmin, Pleasant Ridge Ohio. App. filed Sept. 14, 1908. For fastening laminated



923,024.—Lightning Arrester.



923,122.—Mechanically Actuated Diaphragm Horn or Alarm.



923,128.—Process of Electric Welding.

pole pieces to fields by means of bolts, which are anchored in the pole piece.

922,781. PRINTING TELEGRAPH; I. Kitsee, Philadelphia, Pa. App. filed Aug. 25, 1908. Synchronism between transmitting and receiving apparatus is not necessary, the latter being controlled by a cable relay, which controls master intermittent mechanisms, each of which controls a plurality of printing surfaces.

922,780. CABLE RELAY; I. Kitsee, Philadelphia, Pa. App. filed Aug. 8, 1907. For submarine cable work. To avoid the shifting zero in a siphon recorder. The relay has two moving coils and each carries a movable contact.

922,794. ROTOR CONSTRUCTION; E. Mattman, Norwood, Ohio. App. filed May 31, 1907. Comprises a spider, a rim, and skewed fan blades around the rim for ventilating.

922,800. PROCESS IN MAGNETIC SEPARATION; W. B. Moore, Seattle, Washington. App. filed Aug. 31, 1906. Feeds the mass of material into a magnetic field and magnetically impels the extracted particles across a passageway, where they are subjected to a rapid reversal of polarity in a stream of water.

922,801. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed Nov. 9, 1908. A fused case-holder, having an upper member, a lower member with an opening, and a removable fuse case in the opening.

922,802. POWER TRANSMITTING DEVICE; F. R. McBerty, New Rochelle, N. Y. App. filed Feb. 27, 1908. Uses a clutch mechanism under the control of an electromagnet, for transmitting the movement.

922,823. MULTIPLE VOLTAGE CONTROLLER; E. W. Stull, Norwood, Ohio. App. filed Oct. 31, 1906. A drum controller, with suitable contacts so as to throw the motor from one set of mains to another without interrupting the circuit through the action of a translating device.

922,825. OIL SWITCH; H. L. Van Valkenburg, Norwood, Ohio. App. filed Aug. 25, 1905. A four-brake single-pole switch, having four rods with a movable oil tank operated by a lever for raising and lowering the tank.

922,839. DYNAMO ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed June 5, 1905. Direct current machine, provided with a compensating winding and a commutation winding, to avoid sparking.

922,849. INDICATOR FOR AUTOMATIC ELEVATOR SYSTEMS; A. H. Buckelew, Newark, N. J. App. filed March 29, 1907. A push-button controlled elevator, with an indicator to give the position of the car and the condition of the circuits.

922,883. ALARM SYSTEM; L. Greer, Fort Worth, Texas. App. filed July 16, 1908. A fire alarm system having a mercury circuit closer of particular construction.

922,917. ELECTRIC TERMINAL; G. C. Landis, York, Pa. App. filed April 3, 1907. For attaching a carbon electrode to the terminal, the terminal being cup shaped and hollow so that water may blow through it to keep it cool.

922,924. DYNAMO ELECTRIC MACHINE; C. E. Lord, Norwood, Ohio. App. filed May 3, 1906. For high-speed turbo generators, with means for ventilating them. The stator has parallel ventilating openings, which are blocked by laminæ of magnetic material at the inner periphery of the core.

922,946. DYNAMO ELECTRIC MACHINE; W. D. Pomeroy, Norwood, Ohio. App. filed July 27, 1906. For high speed turbo alternators. A ring prevents the end turns from being displaced by centrifugal force, and is provided with slots to make it expansible and to secure ventilation.

922,951. THIRD-RAIL INSULATOR; L. M. Randolph, Newark, N. J. App. filed May 2, 1907. Comprises a short section of channel iron, a short section of an I beam, and insulating material between them.

922,956. DEVICE FOR PREVENTING DOG NUISANCE; A. H. Roberts, Waverly, N. Y. App. filed Dec. 26, 1907. An electric guard for shocking dogs.

922,977. ROSETTE; E. Tregoning, Attleboro, Mass. App. filed Nov. 6, 1908. Electrical rosette for supporting lamps, having a base with a removable cap, and two strain receiving members overlying the boss formed on the base.

923,018. ELECTRIC FURNACE; F. M. Chaplet, Laval, and A. Remond, Paris, France. App. filed March 19, 1907. Furnace has two distinct compartments with a communicating passage. The open compartment receives a carbon electrode and the closed compartment receives an electrode, forming an arc with the molten metal.

923,020. DEVICE FOR AUTOMATICALLY STOPPING VEHICLES; S. H. Cluxton, Washington, D. C. App. filed Jan. 5, 1907. Makes use of electromagnets below the rails, which magnetizes the rails and causes the wheels to stick so as to check the speed of the train.

923,024. LIGHTNING ARRESTER; E. E. F. Creighton, Schenectady, N. Y. App. filed July 9, 1906. A high-voltage lightning arrester, including a discharge path, consisting of electrolytic condensers connected to a common point, the condenser plates being of aluminum.

923,033. TELEGRAPH TRANSMITTER; T. J. Dunn, Jersey City, N. J. App. filed Dec. 31, 1908. The transmitter includes a horizontal vibrator, a vertical plunger, and a pair of electrical contacts, one carried by the vibrator and the other fixed.

923,035. TELEPHONE SYSTEM; A. H. Dyson, Chicago, Ill. App. filed Jan. 20, 1902. Exchanges connected by trunk lines and employing clearing out signals. The hanging up of the receiver by the called subscriber lights two lamps, one at the switchboard of the trunking operator and the other at the originating operator's exchange.

923,071. ELECTRICAL CONNECTOR; G. E. Palmer, Boston, Mass. App. filed Nov. 21, 1906. A clip to embrace a pipe, one end having a wire receiving socket and the other bearing against the middle of the socket, with bolt and nut passing through the free ends to draw them together.

923,114. FIRE ALARM TELEGRAPH APPARATUS; F. W. Cole, Newton, Mass. App. filed Oct. 24, 1908. A signal box, with circuits for transmitting a drill signal and a fire alarm signal.

923,115. FRANGIBLE PROTECTING DEVICE; F. W. Cole, Newton, Mass. App. filed Oct. 27, 1908. For fire alarm boxes, in which a self-opening door with a glass plate and shield back of the plate are so arranged that the shield prevents the broken glass from entering the opening into the box.

923,122. MECHANICALLY ACTUATED DIAPHRAGM HORN, OR ALARM; M. R. Hutchison, Summit, N. J. App. filed March 14, 1906. Provides a case and resonator with a diaphragm and motor, the latter driving a cam which vibrates the diaphragm.

923,124. MERCURY OR OTHER VAPOR ELECTRIC LAMP; H. A. Kent, Bounds Green, and H. G. Lacell, Finchley, England. App. filed Oct. 3, 1908. A tube made of quartz glass contains mercury, which is vaporized in the tube, forming an arc and pressing back the liquid mercury which slowly passes through the tube, preserving a steady arc.

923,127. ELECTRIC ARC LAMPS; L. O. Kozar, Wilkes-Barre, Pa. App. filed March 17, 1909. For use with electric arc lamps to limit the separation of the electrodes by means of a dash pot, which tends to prevent their separation, and a spring secured to a dash pot, which is placed under tension when the electrodes move toward each other.

923,128. PROCESS OF ELECTRIC WELDING; M. Lachman, of New York, N. Y. App. filed Oct. 17, 1906. For electrically welding the end of one piece of metal to the flat surface of another by first providing the flat piece with a spur or lug of less cross section than the tooth to be welded to it, thus localizing the heat in the spur.

923,129. ELECTRIC SWITCH; E. O. Schweitzer and A. Herz, Chicago, Ill. App. filed July 19, 1906. An electric light snap switch, with an hour glass containing mercury, so that when the switch is operated the lights remain lighted until the mercury flows through the hour glass, which automatically extinguishes the lights.

CLASSIFIED INDEX—Continued.

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1 45	Westinghouse	900
1 50	Westinghouse, 2-phase	900
1 60	Westinghouse	900
1 60	Gen. Elec., A.S.	900
1 75	Ft. Wayne, W.A.L.	600
1 100	Gen. Elec., 550 volts, A.P., 3-phase	900
2 100	Gen. Elec., A.T., 3-phase	900
1 110	Ft. Wayne, 3-phase, revolving field, direct-con. to Ideal engine	257
2 150	Westinghouse, 2-phase	600
1 180	Westinghouse, 3-phase	514
1 200	Westinghouse, 3-phase, revolv. field, 440 volts	600
2 300	Gen. Elec., A.S.B., revolving field	450
1 300	Gen. Elec., A. T., 3-phase	720
1 400	Westinghouse, 3-phase	400

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K.W.		Speed
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1 130	Westinghouse, 3-phase, 440 volts, revolving field type	500
2 275	Westinghouse, 3-phase, revolving field, 6600 volts	375
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K.W.		Speed
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1 50	Ft. Wayne	1400
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1 60	Westinghouse	1650
1 70	T-H., A. 70	1070
3 90	Gen. Elec., A. S.	1250
1 90	Westinghouse, slotted armit	1143
1 100	Ft. Wayne	1050
2 120	Gen. Elec., A. 120	1070
1 120	Gen. Elec., A. S. 120	1070
1 120	Westinghouse	1375

Arc Machines

K.W.		Speed
2 50	lt. T-H., 9.6 amp., ring armit	820
1 100	lt. 9.6 amp., Ft. Wayne Wood, No. 9A, self-oiler	800
1 125	lt. 9.6 amp., Brush No. 11, with oil regulator	480
2 150	lt. 9.6 amp., Brush No. 13A, 4-circuit, with oil regulator	500

M. P. 250-Volt D. C Comp Generators

K.W.		Speed
1 8	Fairbanks-Morse, direct con. to Ames engine	375
1 12½	Milwaukee	850
1 12½	Northern	900
2 13	Crocker-Wheeler	950
1 13½	Gen. Elec.	900
1 15	Siemens & Halske.	1050
2 15	Western Elec.	700
1 15½	Card, M. P.	800
1 17½	Crocker-Wheeler	1400
1 17½	Northern	1100
1 17½	Gen. Elec.	1100
1 20	Siemens & Halske.	1100
1 20	Eddy, M. P.	800
1 20	Commercial	750
1 20	C. & C. comp., direct-con. to Chandler-Taylor engine	320
1 25	Westinghouse	600
1 30	Bernard, M. P.	575
1 60	Siemens & Halske, Churchward type	550
1 60	C. & C.	525
1 60	Milwaukee	550
1 75	Westinghouse	600
1 75	Ft. Wayne	600
1 100	Westinghouse	600
2 100	Ft. Wayne	550
1 100	Jenny, direct con. to Alfree engine	250

550-Volt M. P. Comp Generators

K.W.		Speed
1 15	Sprague-Lundell	1200
3 22½	Westinghouse	975
1 25	Triumph, M. P.	950
2 30	Westinghouse	900
1 55	Gen. Elec.	950
1 120	Westinghouse	625
1 150	Westinghouse	550
2 500	Westinghouse	350
1 500	Westinghouse	320

550-Volt Railway Motor

H.P.		
62 30	H.P. Walker, type 33 S, brand new, with gears and gear cases, 3¼ or 4-in. axles, ratio 14-67. Special bargain	

M P. 125-Volt D. C. Comp Generators

Lights.		Speed
1 50	Thompson	1400
1 80	Western Electric	850
1 100	Northern	1100
2 125	Triumph	1400
1 125	Westinghouse, M.P.	1200
1 135	Crocker-Wheeler	1300
1 150	Aaron, 8½ K.W.	1200
1 150	Peerless, M.P.	1450
1 150	Milwaukee	1300
3 150	Cincinnati	1100
1 150	Robbins & Myers	1250
1 150	Jantz & Leist	1150
2 150	Northern	900
1 180	Amer. Eng. Co.	1350
1 180	Robbins & Myers	975
1 200	Siemens & Halske.	1280
1 210	Western Elec.	1650
2 210	Milwaukee	1250
1 210	Sturtevant	1000
1 210	Westinghouse	1200
3 210	Gen. Elec., C.E.	1200
1 225	Nat'l. M.P.	1350
1 225	Ft. Wayne	1450
1 225	Gen. Elec., 13½ K.W.	850
1 270	Northern	1125
1 270	Westinghouse	1150
1 270	Bullock, M.P.	1050
1 270	National, M.P.	625
1 300	Milwaukee, M.P.	750
1 325	Amer. Eng. Co.	850
1 350	Columbian	1000
1 350	Sprague-Lundell	875
1 350	Fisher	850
1 350	Peerless	1000
1 350	Ft. Wayne	1200
2 400	Crocker-Wheeler	850
1 450	Quaker City	1000
1 540	Westinghouse	550
1 540	Northern, M.P., 30 K.W., comp., dir. con. Erie Ball engine	350
1 600	Card, M.P.	750
2 600	Gen. Elec.	1050
1 650	Westinghouse	900
1 650	Amer. Eng. Co.	700
1 700	Northern	825
1 800	Westinghouse, M.P.	850
1 800	Fisher, M.P.	685
1 900	Northern	825
1 1000	National, M.P.	950
1 1000	Western Elec.	450
1 1350	Bullock	850
1 1350	Gen. Elec., 75 K.W., d. c. to Ames comp. engine	270
2 1800	Eddy, 100 K.W.	650
2 1800	Triumph	700
1 1800	Gen. Elec., 100 K.W., 3-wire unit	275
1 2000	Gen. Elec., 120 K.W., comp., d.c. to Ideal engine	250
1 2500	Western Elec., 150 K.W., new, comp., d. c. to Ball & Wood engine	250

250-Volt D.C. Motors

H.P.		Speed
19	⅝ West. Elec.	1500
1	¾ Ft. Wayne, M.P.	1500
2	¾ Westinghouse	1300
3	1 West. Elec.	2400
1	1 Watson, M.P., vertical	900
1	1¼ Western Elec.	780
1	1½ Crocker-Wheeler	1200
1	1½ Ft. Wayne, M.P.	1000
1	1½ Gen. Elec., C.E.	800
1	2 Ft. Wayne, M.P.	1100
1	2 Northern, vertical	550
1	2½ Browning	1920
1	2½ Northern, M.P.	1500
1	3 Crocker-Wheeler	1000
1	3 Gen. Elec., C.E.	1100
1	3 Triumph	1200
1	3½ Roth, M.P.	1000
1	4 Crocker-Wheeler	1300
1	4 Bullock	725
1	5 Robbins & Myers	925
1	6 Amer. Eng. Co.	550
1	7½ Aaron, M.P.	1200
1	7½ Card, M.P.	775
3	7½ Northern, M.P.	1500
1	7½ Roth, M.P.	860
1	7½ Commercial, M.P.	540
1	10 Rockford, encl.	1100
1	10 Storey, encl., crane	600
1	10 Thresher	340
2	10 Northern, M.P.	800
1	10 Northern, M.P.	800
1	10 Northern, M.P.	1300
1	10 Gen. Elec., M.P.	1250
1	12 Barrett, M.P.	1400
1	13 Burke, M.P.	650
1	15 Thresher	760
1	15 Milwaukee, M.P.	700
1	15 Gen. Elec., formH.	800
1	15 Northern, M.P.	725
3	15 Roth, M.P.	775
2	15 Crocker-Wheeler	800
1	15 Northern, M.P.	1200
1	15 Gen. Elec., C.Q.	1000
1	15 Gen. Elec., C.Q.	625
1	18 Siemens & Halske, M.P.	950
1	18 West. Elec.	650
1	20 Sprague	1100
1	20 Willey, M.P.	750
1	20 Aaron, M.P.	750
1	20 Card, M.P.	750
1	20 Gibbs, M.P.	600
1	20 Crocker-Wheeler	1250
1	20 Gen. Elec., M.P.	950
1	20 Northern, M.P.	950
1	25 Thomson-Houston	1300
1	25 Siemens & Halske.	970
1	25 Bullock, M.P.	1400
1	25 Eddy, M.P.	725
1	25 Commercial, M.P.	650
2	25 Electron, M.P.	380
6	30 Walker, series, railway type	450–90
1	30 Westinghouse	950
5	30 Westinghouse	975
1	35 Gen. Elec.	975
1	40 Crocker-Wheeler	725
1	45 Westinghouse	750
2	50 Electron, M.P.	800
1	50 Gen. Elec.	900
1	65 Gen. Elec.	800
1	100 Ft. Wayne	700
1	80 Westinghouse	820
1	150 Westinghouse	590
1	35 Bernard, M.P.	525
1	40 Westinghouse, M.P.	360
1	75 Siemens & Halske, 6-pole	500
1	75 C. & C., 6-pole	450
1	75 Milwaukee, 6-pole	475
1	100 Westinghouse, M.P.	700

500-Volt D.C. Motors

H.P.		Speed
1	1¼ Crocker-Wheeler	1550
1	2 Holtzer-Cabot	1225
1	2 Gen. Elec., C.E.	1200
1	2½ Holtzer-Cabot	1450
1	2½ Browning	1390
1	3 Ft. Wayne, M.P.	2200
1	3 Gen. Elec., C.E.	1800
1	4½ Aaron, M.P.	1100
1	5 Barriett, M.P.	1050
1	5 Northern, M.P., var. speed	400–1600
1	5 Northern, back-geared	190
2	6½ Crocker-Wheeler	1325
1	7½ Wagner, M.P.	1450
1	7½ Bullock, enclosed	1650
1	7½ Paragon, M.P.	1500
1	10 Westinghouse, crane motor	750
1	10 Paragon, M.P.	1150
1	10 West. Elec., M.P.	1125
3	10 Gen. Elec., C.E.	1500
1	10 Holtzer-Cabot	1275
1	10 Gen. Elec.	800
1	10 Westinghouse	1250
1	12 Jenney	1600
1	12 Thomson-Houston	1400
1	12 Amer. Eng. Co.	1200
1	15 Commercial, M.P.	1200
1	15 Macgeorge, M.P.	1200
1	15 Gibbs, M.P.	725
1	20 Sturtevant	750
1	20 Sprague-Lundell	1080
1	20 Lundell, M.P.	725
10	30 Walker, series, back-geared	485–100
1	30 Triumph, M.P.	830
2	35 Bernard, M.P.	525

Rossiter, Mac Govern & Co.

ESTABLISHED 1893 (INCORPORATED)

Electrical Apparatus of All Kinds.

WEST STREET BLDG., 90 WEST STREET, NEW YORK TELEPHONE, CORTLANDT 6975-6

DIRECT-CONNECTED D. C. UNITS

110-125 Volts

1—150 K.W. General Electric direct connected to 14" and 21" x 36" Penn. Corliss engine.
1—100 K.W. General Electric direct connected to 16" x 16" Payne engine.
1—100 K.W. Crocker-Wheeler 240 R.P.M. direct connected to 15" x 14" Harrisburg engine.
1—100 K.W. Western Electric 270 R.P.M. direct connected to 16" x 16" McIntosh & Seymour engine.
1—100 K.W. General Electric Marine Set 350 R.P.M. U. S. Navy specifications engine 10" x 18".
1— 80 K.W. General Electric 270 R.P.M. direct connected to 15½" x 14" Watertown engine.
1— 75 K.W. Westinghouse 275 R.P.M. for direct connection.
2— 75 K.W. Westinghouse direct connected to 12" and 20" x 12" Westinghouse compound engines.
2— 60 K.W. General Electric direct connected to 13" x 12" Ideal engines.
1— 60 K.W. General Electric, type MP, 6-pole, 275 R.P.M. direct connected to 12" x 12" Harrisburg Ideal engine.
1— 50 K.W. General Electric, 6-pole, 300 R.P.M. direct connected to 12½" x 10" Armington & Sims vertical engine.
1— 50 K.W. Westinghouse 28 R.P.M. direct connected to 12" x 12" Russell engine.
1— 50 K.W. General Electric direct connected to 10" and 14" x 14" Russell tandem compound engine.
1— 50 K.W. Bullock direct connected to 13" x 12" Ames engine.
1— 40 K.W. General Electric 300 R.P.M. direct connected to 10" x 12" Armington & Sims engine.
1— 35 K.W. Eichmeyer direct connected to 11" x 12" McIntosh-Seymour engine.
1— 30 K.W. Eddy 300 R.P.M. direct connected to 40 H.P. double cylinder Walrath gas engine 290 R.P.M.
1— 30 K.W. Westinghouse direct connected to 11" x 12" Buffalo Forge high-speed automatic engine.
1— 27½ K.W. 15-volt Diehl direct connected to Sturtevant engine.
1— 25 K.W. 125-volt Diehl direct connected to Ball & Wood 10" x 10" engine.
1— 20 K.W. General Electric marine set 360 R.P.M.
1— 10 K.W. General Electric type MP generator, 450 R.P.M., direct connected to General Electric engine.
1— 2.4 K.W. Lundell 810 R.P.M. direct connected to Case automatic high-speed engine.

DIRECT-CURRENT MOTORS

110-125 Volts

1—105 H.P. Fort Wayne 700 R.P.M.
1— 80 H.P. Bernard 590 R.P.M.
1— 75 H.P. Edison 600 R.P.M.
1— 50 H.P. General Electric 525 R.P.M.
1— 40 H.P. General Electric 975 R.P.M.
2— 35 H.P. Crocker-Wheeler 700 R.P.M.
1— 25 H.P. General Electric 515 R.P.M.
1— 25 H.P. General Electric 600 R.P.M.
1— 20 H.P. General Electric 925 R.P.M.
1— 15 H.P. Holtzer-Cabot 1200 R.P.M.
1— 10 H.P. Crocker-Wheeler 850 R.P.M.
1— 10 H.P. Westinghouse 800 R.P.M.
1— 10 H.P. General Electric 1250 R.P.M.
2— 10 H.P. Wagner 800 R.P.M.
1— 10 H.P. Milwaukee 750 R.P.M.
1— 7½ H.P. General Electric 1150 R.P.M.
1— 7½ H.P. Westinghouse 1350 R.P.M.
1— 2 H.P. General Electric 1800 R.P.M.
1— 1¾ H.P. Westinghouse 1250 R.P.M.
1— ½ H.P. Eddy 2150 R.P.M.

In addition to the above, we have various other sizes in stock on which we would be glad to quote. Write us for particulars.

COMMONWEALTH EDISON CO.

REPAIR SHOPS

76 MARKET ST., CHICAGO. TELEPHONE RANDOLPH 1280.

FIRST-CLASS EQUIPMENT THROUGHOUT

DYNAMOS, ARMATURES, MOTORS, ARC LAMPS
INSTRUMENTS, HIGH GRADE MACHINE
WORK OF ALL KINDS

CORRESPONDENCE SOLICITED

SPARKING

reduces the working capacity of a motor or dynamo, wears out the commutator, wastes power and may cause a fire. All of this may be avoided if you use



The only article that will prevent sparking. Will keep the commutator in good condition and prevent cutting. Absolutely will not gum the brushes.

It will put that high gloss on the commutator you have so long sought after

Send for Stick 50c. PER STICK $5.00 PER DOZ.

For Sale by All Supply Houses or **K. McLENNAN & CO.** Sole Manufacturers

Room 411—130 Dearborn St., CHICAGO

POSITIONS WANTED

(Continued from page 73)

POSITION WANTED.—By a young man 30 years of age, having 12 years' experience in construction work and armature winding A.C. and D.C. apparatus, 10 years with last employers. Best of reference; will go anywhere. Address No. 5649, care of Electrical World, New York.

WANTED.—Position as superintendent or manager with electric light and power company in city from fifteen to thirty thousand inhabitants, have held position as superintendent eleven years with one company, and fifteen years' experience in all branches of the electrical business; have several thousand dollars to invest in good paying plant, and A1 references. Salary, $1,800 per year. Address No. 5648, care of Electrical World, New York.

POSITION WANTED.—Superintendent or manager of electric light and gas plant in town of 5000 to 20,000. One that is not giving satisfactory returns preferred. Only proposition in South, Central or West considered; references. Address No. 5672, care of Electrical World, 590 Old Colony Building, Chicago.

I AM familiar with construction and operation of large plants. Sober, practical, married man, age 40; 18 years' experience in large stations of high voltage. Am superintendent now of hydraulic plant for two years and wish a climatic change. Will take place as assistant. Address No. [illegible], care of Electrical World, 590 Old Colony Bldg., Chicago.

METER tester, now with a Massachusetts company, which sells out July 1, desires a similar position with electric light company. Familiar with Fort Wayne I. H. and Stanley meters. Position preferred with small company where there is a variety of work. Minimum salary, $15.00. Address No. 5664, care of Electrical World, New York.

WANTED.—Position as [illegible] chief electrician in large industrial establishment. Cornell graduate with extensive experience in this line of work. Propositions wanted only from large concerns requiring man of ability and experience. Address No. 5644, care of Electrical World, New York.

ELECTRICAL Engineer available for position as Manager, Superintendent or Electrical Engineer with lighting or railway company. Similar positions have been held and best of references can be furnished. Graduate of Mass. Institute of Technology. Address Box No. 5670, care of Electrical World.

POSITION WANTED.—By technical graduate with consulting engineer, construction company or assistant to municipal electrical engineer. Completed G. E. Testing Course. Experience in constructing and operating high-tension lines. Asso. member A. I. E. E. Canada preferred, but will go anywhere; moderate salary. Best references from present employer and others. Address No. 5674, care of Electrical World, New York.

(Continued on page 77)

ENGINES

1,000 H.P. Triple Expansion Corliss.
600 H.P. Triple Expansion Ver. Mcl. & S.
20" and 36"x48" Wetherill Cross Comp.
20" and 31½"x27" Russell Cross Comp.
18" and 30"x16" Westinghouse Ver.
16" and 30"x48" Hamilton Corliss.
16" and 30"x48" Cooper Corliss Tandem.
16" and 28"x16" Erie Ball Cross Comp.
15" and 24"x14" Russell Tandem Comp.
14" and 26"x42" Hamilton Corliss.
12" and 20"x24" Buckeye Tandem.
11½" and 23"x17" McIntosh & Seymour Tandem.
30"x48" Cooper Corliss.
24"x48" Sioux Corliss, Heavy Duty.
24"x48" Hamilton Corliss.
14"x36" Wright Corliss.
22"x42" Harris Corliss.
22"x42" Slater, Heavy Duty.
18"x24" Russell 4-valve.
16"x36" Putnam 4-valve.
14"x36" Lane & Bodley Corliss.
20"x36" Buckeye, Heavy Duty.
15½"x15" Armington & Sims.
14"x16" Straight Line.
14"x14" Harrisburg, Heavy Duty.
13"x12" Armington & Sims.

DIRECT-CONNECTED SETS

200 K.W. G. E., 125-volt and Corliss Engine.
2—125 K.W. Westinghouse 220-volt, Westinghouse Comp. Engines.
75 K.W. Sturtevant, 220-volt Unit.
75 K.W. 125-volt Unit.
50 K.W. 220-volt Unit.
40 K.W. Sprague 125-volt and Vertical Engine.
17 K.W. Eddy 125-volt—Westinghouse.
15 K.W. 125-volt—General Electric.

A. C. APPARATUS

450 K.W. G. E. 25 cy., 13,200-volt, 3-phase, Dir. Con. Slater Engine.
350 K.W. 2-phase Dir. Con. Set.
300 K.W. and 250 K.W. 3-phase Dir. Con. Sets.
300 K.W. and 250 K.W. Monocyclic, 60 cy., Dir. Conn. Units.
200 K.W. Westinghouse 3-phase, 60 cy., 2200-volt Alternator.
2—175 K.W. Stanley 25 cy., 5500-volt, 3-phase Alternators and Turbines.
75 K.W. Westinghouse s. p., 2200-volt, 60 cy.
60 K.W. Stanley 2-or 3-phase, 60 cy. Alternator.

Send for *complete* "Bargain List No. 7."

Joseph H. Thompson, Jr. 17 BATTERY PLACE NEW YORK

220-250 VOLT DIRECT CONNECTED AND BELTED UNITS.

Direct Current. Immediate Delivery.

One 100 K.W. Walker D.C. to Watertown engine.
One 75 K.W. General Electric D.C. to Harrisburg engine.
One 50 K. W. Walker D.C. to Watertown engine.
One 35 K.W. C. & C. D.C. to Payne engine.
Two 15 K.W. Crocker-Wheeler D.C. to gas engines.
One 200 K.W. Crocker-Wheeler—3 bearing—450 RPM.
One 125 K.W. C. & C.—6 pole—450 RPM.
One 100 K.W. General Electric—4 pole—form H—650 RPM.
Two 100 K.W. Crocker-Wheeler—6 pole—650 RPM.

We buy, sell, rent and repair.

YEARSLEY, LEVENE & CO.
211 North Third Street PHILADELPHIA, PA.

FOR SALE

$30,000 will purchase an established electrical supply business with complete catalog and first-class organization located in Chicago.

Present owner unable to devote sufficient time for proper management.

Lock Box 493, Chicago, Ill.

60 Cycle Motors for Sale

5 h.p., 3-phase, G.E. Form K. 110 volts, 1200 revs. with compensator-starter.	$110.00
1 h.p., 2-phase, G.E. Form K, 220 volts, 1800 revs.	40.00
7½ h.p., single-phase, Wagner, 110—220 volts, 1750 revs.	175.00
4 " " " " " " "	110.00
2 " " " " " " "	85.00
2—1 " " " " " " "	65.00

All in excellent condition, most of them just rewound.

P. K. GOODE, 143 Garo Street, Dallas, Tex.

HELP WANTED

(Continued from page 75)

The rate for "Help Wanted" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

Replies may be sent in care of Electrical World, 239 West Thirty-ninth Street, New York, or 590 Old Colony Building, Chicago, as advertisers may desire.

(In replying to a "Want" advertisement, original letters of recommendation should NOT be forwarded.)

WANTED.—One two or three first-class executive men as foremen in manufacture of transformers, particularly large type of transformers. Apply, stating experience and references, to Canadian General Electrical Co., Peterboro, Ont.

POWER salesman wanted; must be experienced in selling central station service or motors. In reply give experience, reference and salary expected. J. F. B., P. O. Box 801, Brooklyn, N. Y.

WANTED. — Men to take countyrights. Nucleus for lifelong business. Electric floor finishing machine that planes, grinds, sandpapers, oils and polishes. Glass surface—piano finish. Big money. Marvel for labor saving and beautiful workmanship. Easily operated. Address No. 5634, care of Electrical World, New York.

WANTED.—Manufacturers' agents and salesmen on commission by manufacturers of a high-grade incandescent electric lamp. Address No. 3320, care of Electrical World, New York.

METER MEN.—Wanted, men interested in meter and instrument work, to take up the course on "Electrical Measuring Instruments and Meters," as prepared by the Fort Wayne Electrical Correspondence School, Fort Wayne, Ind. Write for free catalogue giving information on meter testing.

WANTED.—A few draftsmen familiar with switchboards and station layouts. Apply engineer in charge, drafting department, General Electric Company, Schenectady, N. Y.

WANTED.—Good draftsmen for electrical machinery. State salary and particulars in full. Address No. 5669, care of Electrical World, New York.

WANTED.—Correspondent, engineer and general assistant by the executive sales department of one of the leading electrical manufacturing companies (not apparatus) in an important and growing branch of the industry, a young man with some experience and ability in systematic office methods; one not afraid of hard work, and preferably a technical graduate in electrical engineering. A responsible, permanent position to a man properly qualified and willing to work up. State age, nationality, education, previous experience, reasons for change and salary. Address No. 5671, care of Electrical World, New York.

WANTED.—Sales agents in Chicago, St. Louis, Pittsburg, Cleveland and Cincinnati for a well-known line of electrical power apparatus. For further particulars address Salesman, P. O. Box 1013, New York.

MISCELLANEOUS

The rate for "Miscellaneous" advertisements of forty words or less is one dollar and fifty cents an insertion; additional words three cents each, payable in advance. Remittances and copy should reach this office not later than Monday, 12 o'clock noon, for the next succeeding issue.

SNAP Switch Patents for Sale. Desirable novel features with strong selling points. No reasonable offer refused. Copies of patents supplied. Address No. 5675, care of Electrical World, New York.

YOUNG man with some capital and patent for an automatic charging regulator for storage batteries would like to become associated with some manufacturing company. Experienced engineer, electrician and machinist with qualifications to act as factory superintendent. Associate member A. I. E. E. Address No. 5657, care of Electrical World, New York.

ELECTRICAL INVENTORS should engage a *technical* patent attorney to apply for their patents, because Patent Office Examiners are *technical* experts. No Examiner, nor other attorney than undersigned is member of both A. I. E. E. and A. S. M. E. Mail invention for free advice, opinion, booklet and estimate. Delay dangerous. Edward P. Thompson, M. E., Registered Patent Attorney, McGill Building, Washington, D. C.

TO MANUFACTURERS, patentees or selling agents of small specialties. Having a well-equipped factory for our own needs, and with a view to increase production, we would be pleased to correspond with those having some article or specialty which they desire manufactured at low cost. Address BOSTON, No. 5645, care of Electrical World, New York.

STOCK, full paid non-accessible, guaranteed by a New York company and redeemable at par, in an electrical, lighting, power, telephone and industrial company. Now starting. Is offered at $1.00 per share. Morton, 161 Mackie St., Detroit, Mich.

WANTED.—The address of any persons who have been induced to take stock in a Delaware traction company on the representation of the president, that they would be given a position in the construction and operation of same. Address No. 5666, care of Electrical World, New York.

(Continued on page 77)

General Electric Company

G-I Flame Arc Lamps

Points of Superiority:



Rigid and strong in construction. Simple and efficient operation. Positive feed. Indestructible magnets. Cannot burn out the economizer. Insulation of non-inflammable material. Every part accessible when shell is lowered to the trimming position. Every iron or steel part heavily galvanized. Only 31 inches in length. Ninety per cent. of parts interchangeable. Can be operated on either A.C. or D.C. circuits, singly or in series.

In view of the rigid and strong construction of the G-I Flame Lamps, the mechanism is reliable and durable. The casing lock is positive and easily operated and when necessary to inspect the mechanism or trim the lamps, the removal of the casing is accomplished by one simple operation. These lamps may be adjusted by any arc lamp man.

G-I Flame Lamps are manufactured for any voltage and any frequency from 25 to 140 cycles and may be operated singly or in series. A special line of compensators have been designed for the A.C. lamps whereby they may economically be operated singly from 110, 220, 440 or 550 volt circuits. Ninety per cent. of the parts are interchangeable. This feature makes the lamps economical for central stations handling both A.C. and D.C. types. To change an A.C. lamp to D.C. or vice versa requires only new shunt magnets, one carbon holder, one carbon shifter.

If you contemplate buying flame lamps, we can furnish a lamp that is scientific in construction and reliable in operation.

18

New York Office:
30 Church Street

Principal Office:
Schenectady, N. Y.

Sales Offices In
All Large Cities

KERITE

Insulated Wires and Cables

For Telephone Telegraph Signal Electric Light and Power Electric Railway Aerial Underground and Submarine

DAYS KERITE 1850 1909

The Insulation which has withstood successfully the test of half a century

EFFICIENCY DURABILITY SAFETY ECONOMY

MANUFACTURED SOLELY BY

Kerite Insulated Wire & Cable Co.

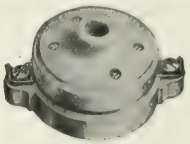
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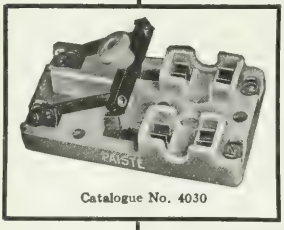
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GROUNDING OF THE SECONDARY.

It is most gratifying to note the free and full discussion which took place at Atlantic City on the report of the N. E. L. A. committee on the grounding of the secondary, and also that the part of the resolution of the committee presented last year and adopted, which would prohibit the grounding above 150 volts, was reconsidered and upon vote rejected. The opinion expressed in the discussion was practically unanimous that such a prohibition was entirely inadvisable, whether judged by policy, life risk or fire hazard. As pointed out by Dr. Steinmetz, the attitude of the committee on the question, if finally adopted by the association, would place that body in direct conflict on a technical question with the American Institute of Electrical Engineers, which favors grounding up to 250 volts, thereby injuring the prestige of both bodies with the public; and, moreover, since the standard voltage for secondary distribution in Great Britain is 220 to 250 volts, the association should realize the effect abroad, as well as at home, in the case of double voltage systems, of its official condemnation of such voltages as fatal to human life. As regards fire hazard, Dr. Steinmetz expressed the opinion that to reduce this to the minimum every circuit which enters a building, whether of 110 or 1000 volts, should be grounded.

The extraordinary position of the committee that alternating-current voltages in the neighborhood of 200 volts are fatal to human life received no support. To quote Dr. Steinmetz: "Fifty volts may kill if the contact is sufficiently good, but 250 volts, in my opinion, would hardly ever kill; it must be a very unusual condition and very perfect ground for a shock of 250 volts to kill." The final conclusion of Dr. Steinmetz was that safety with respect to both fire hazard and life risk lies in permanent grounding of secondary circuits regardless of the voltage, combined with a safe insulation of such circuits. A point brought out several times in the discussion was that, granting a danger normally from grounded secondaries, this can be provided for by insulation precautions, while no means are feasible other than grounding to protect against fatalities from abnormal voltages due to defective transformers, crosses, etc. This part of the discussion should have a good effect in directing attention to the proper insulation of alternating-current interior circuits of higher voltage in order to guard against the discomfort and possible danger of shocks from such circuits when grounded. Safe house wiring, even with low voltages, requires that one should not have a chance of being subjected to the circuit voltage. A proper precaution is that all lamps operated at high voltages should be installed in sockets having no exposed metal, and, so far as possible, controlled by wall switches, also without any exposed metal parts. The matter of the insulation of secondary circuits should, in fact, be made the subject of circuit study by a committee of the association or of the American Institute of Electrical Engineers, or better, by a

joint committee of the two bodies, with a view to laying down rules that should be rendered obligatory as soon after adoption as practicable.

An important matter in connection with grounding relates to the attitude of municipalities and water companies toward the use of water pipes for grounds. Unquestionably water pipes make the easiest and safest ground for secondaries, and there is no adequate reason whatever for forbidding their use. There is no record of the slightest trouble of any kind arising from such grounds, and it is difficult to see how any could occur. A ground that is unreliable is a source of danger, and when first-class grounds can be had upon water pipes, ordinary considerations of safety indicate their use. In cases where water pipes are unavailable, the committee makes in its report pertinent suggestions for good substitutes. Some, however, will not fully share the optimism of the committee in its statement that electric-lighting companies do not hesitate to ground on account of the cost, but on account of being unable to secure grounds that are always reliable. On the contrary, there will linger a suspicion that the cost of making such grounds as the committee recommends is the chief and almost the only obstacle to grounding. If such grounds could be installed for 50 cents apiece, ungrounded secondaries would be as rare as grounded ones are now. Somewhere between 50 cents and $15 or $20 lies the figure at which the consumer is allowed to take the chance. A company mulcted in heavy damages once or twice can generally be trusted to find a method of grounding sufficiently near "always reliable" for installation with startling promptness. We do not think central-station men are more heedless in such matters than are other business men. On the contrary, their knowledge of and frequent contact with the real dangers of the situation makes them on the whole more mindful of danger to the public. Yet they are too apt to let the grounding matter slide along from year to year on one inward pretext or another for the sake of the balance sheet. It is only human, but it is taking chances that no conscientious man should wish to assume. The central-station man is his brother's keeper whether he will or no.

Performance Specifications and Ratings.

Among the papers read last week at the N. E. L. A. is one by Mr. W. L. Waters on "Performance Specifications and Ratings" of generator units, a very interesting and important subject. The paper criticizes the existing standard specifications for alternator units in two particulars—first, in regard to rating by temperature, and, second, in regard to rating for power-factor. The paper points out that the operating engineer does not care about the exact temperature elevation under load of the different parts of the generator he has purchased. What he wants to know is how much load the generator can be guaranteed by the maker to carry, and then the temperature of the machine is the maker's affair. If the machine, after being subjected to this guaranteed load, becomes injured thereby, it is contended that the purchaser should, under the purchasing contract, secure redress from the maker.

This method of guaranteeing performance in a purchaser's contract might work excellently between particular makers and purchasers, but it would pave the way to endless disputes and litigation between other particular parties, since it would substitute unspecific measurable promise for a definitely measurable promise, and under stress of competition between makers, would prompt the offering of unjustifiable promises, based more on hopes than on observable facts. It is true that under the existing standardization rules of the American Institute of Electrical Engineers all ratings must conform to certain specified temperature-elevations, and that certain types of machine structure would be at their safe limits under those elevations, while other types of machine structure could safely carry higher temperatures. There is certainly, to this extent, good ground for the criticism given in the paper. The best way of dealing with the matter, however, is not to throw away the rules for temperature rating, but so to modify them, in the light of recent experience, that different types of insulation can be allowed different temperature-elevations. If the existing temperature ratings were abolished, it would be possible for a purchaser to contract for a generator that the manufacturer guaranteed to carry its assigned load indefinitely. If the station where the generator was installed were new, and the load of the machine were not immediately obtainable, it might be several years before the purchaser was actually able to find the rated load for the machine, and then only for, say, two hours daily. If the machine were unable to carry this load continuously, as guaranteed, it might well happen that the injury due to excessive temperature in the machine would not develop to a serious stage for, say, another two years. Under such conditions the purchaser could not secure redress under his contract in less than five years after his purchase. No maker would consent to a retention of any considerable amount of the purchase price until such time as the purchaser could comfortably find the full load for the machine and secure sufficient experience with it to feel satisfied about the durability of his bargain. On the other hand, there may be defects in the present standardization rules, but at least the purchaser is able to participate in tests before the machine leaves the factory. These tests are admittedly competent to demonstrate within a small range of error the temperature-elevations of the sensitive parts of the machine under continuous rated load; so that, if these elevations are conservative, the purchaser may be perfectly satisfied as to the normal behavior of his generator. Any dispute on the matter is thus brought to a climax before the machine is shipped.

The second criticism, in regard to power-factor, is well taken. Too little attention is paid to this matter. A single-phase alternator of, say, 5000 kw, at 5000 volts, is defined by standardization rules as capable of delivering continuously 1000 amp, non-inductive, under rated terminal voltage of 5000 volts, without excessive heating at any part. If, however, the load has a power-factor of 80 per cent, it is commonly supposed that the machine could still deliver 1000 amp at 5000 volts with 4000 kw real power-delivery and 5000 kilovolt-amperes. But the machine may not be able to do this. It could supply 1000 amp, but under the increased internal drop with lagging current it might not be able to maintain 5000 volts at terminals. At all events, there would probably be some power-factor at which the rated current would not be delivered at rated volts, unless the machine were specially designed for such work. It would thus be well to specify, with each generator, not only its rated non-inductive load-current, but also its maximum current under rated voltage at some particular power-factor or power-factors. In the example above assumed,

the rated non-inductive load current being 1000 amp, it might be, say, 950 amp at 80 per cent and 800 amp at 70 per cent power-factor. In fact, alternator specifications frequently contain such provisions at the present time. It is clearly the duty of the operating engineer to arrive at an estimate of the power-factor of the load that will be imposed upon his generator plant when installed. His specifications should call for a generator capable of supplying the actual load at that power-factor. As is pointed out in the paper, the mistake is too often made of neglecting the power-factor, and of ordering an alternator merely of an assigned power in kilowatts. The maker cannot be blamed for filling these specifications in the easiest way—that is, with a generator designed for substantially non-inductive load. Some generators actually work under conditions as favorable.

Protection from Lightning.

The report of the committee on this important subject may best be summarized by the following misquotation from the text of it: "The practice of installing ————, which has been followed by most companies operating transmission lines, is to be commended, although conclusive proof of their usefulness is lacking." In the original the space left blank above is occupied by the expression "choke-coils," for which almost any other item of protective apparatus may properly be substituted. In spite of this lack of precise conclusions, the committee has presented a report well worth consideration. Lightning is not a thing which can readily be submitted to experimental conditions, and hence protecting appliances as commercially installed cannot be expected to yield at once definite data as to their value. On the whole, the facts accumulated seem to indicate that trouble on distributing systems has been materially decreased within the past few years. How far this is due to improvements in protection, and how far to higher standards of insulation, is not so easy to determine. The growing practice of grounding the secondaries seems to have been productive of good results. The committee advises the use of pipe grounds for lightning arresters as adequate and convenient, and points out that so far as multiplicity of arresters goes, it can be grievously overdone. Two thousand feet is suggested as a good normal spacing for the arresters on distributing systems.

This matter of spacing is one of mere economics. A burned-out arrester may shut down service just as effectively as a burned-out transformer; besides the cost of replacement, and as a certain proportion of arresters are due to burn out in service, one may easily install too many. The experience of one large plant was that the cost of arresters in fixed charges and upkeep, and interruptions due to their burning out, exceeded the similar quantities for the transformers they were supposed to protect. It consequently has decided to use fewer arresters in the future. Yet no one is disposed to doubt that a moderate number of well-installed arresters forms a paying investment. One might go further and say that a few thorough installations do better in the long run than a similar investment put into cheaper apparatus installed less carefully. The committee calls particular attention to the importance of thorough inspection of line arresters. On transmission lines experience indicates that the chief troubles are on the lines themselves, and that the arresters as installed in stations are pretty effective in saving the other apparatus from damage. As to the lines, it would have been interesting had the committee carefully summarized the failures of the past year due to lightning. In particular it would be useful to know whether the grounded wire recommended has actually served to prevent breakdown in all or a vast majority of cases. How many lines having grounded wires as protection broke down from lightning, and what was the relation of the ground wire to such immunity as was observed? If the ground wire really does the work regularly and reliably, the minds of many transmission line operators will rest more easily.

Previous experience has shown the ground wire, like the choke coils mentioned by the committee, to be of probable but indeterminate usefulness, and the somewhat definite attitude of the committee regarding the former would seem to call for fuller explanation, as indicating a really important advance in the art. The suggestion of actual lightning rods in connection with the grounded wire seems to us an important factor in the situation, particularly if combined with a high factor of safety in the general line insulation. This of itself is a considerable protection, especially in case of the minor lightning discharges which form the vast majority of the total number. The difference between the breakdown voltage of an insulator and the maximum normal voltage on the line measures the applied extra voltage necessary to produce failure. If this difference amounts to 50,000 or 75,000 volts, as it does sometimes in case of a very high-voltage line, then all minor disturbances will be harmlessly discharged at the nearest arrester, while they might easily break down a 15,000-volt or 20,000-volt line with a correspondingly less margin of resistance. As a matter of experience, very high-voltage lines seem to have less than their share of trouble from lightning, though how far this is due to the cause just mentioned, and how far to the generally better protection given an important system, it is from present data impossible to state. The committee is wisely cautious in recommending new forms of lightning arresters, but has a good word to say for the electrolytic type, especially for station use. It seems to stand a long succession of discharges exceptionally well, though demanding, like other sensitive apparatus, frequent inspection. We earnestly hope that the committee will, as it suggests in closing, outline some definite form of record keeping which will enable a proper co-ordination of data to be attained. The chief difficulty with the whole subject is the scrappy kind of information on which judgments have to be formed.

N. E. L. A. Commercial Sessions.

The commercial work of electric-light companies has certainly been receiving enough attention the past three conventions of the N. E. L. A. to make up for the neglect of this subject in previous years. The commercial sessions this year broke all records in the matter of attendance, interest and number of papers presented. The launch of the business has now apparently passed through the effervescent stage, and settled down to good, hard work. Among the papers of most permanent value and timeliness is that by Mr. E. W. Lloyd, of Chicago, giving load factor and ratios of maximum to connected load compiled from the records of thousands of consumers. So in

information has a very important bearing on the making of rates. Heretofore conditions have been largely guessed at by companies in making rates based on the maximum demand of consumers, and every company that aims at an equitable system bases its rates in that way. The company at Chicago is one of the few which could furnish information of value on this subject, because it has made it a practice of installing maximum-demand meters on the services of all direct-current consumers for years. This has given it an opportunity to determine the actual maximum demand of consumers, while the large number of consumers connected to its lines makes available averages which are really worth something as a basis for calculation of power and lighting contracts generally. The whole industry is indebted to Mr. Lloyd for supplying this much-needed information.

Another feature of the commercial program which is gratifying is the testimony by the contract agents of various large companies as to the demonstrated value of illuminating engineering in securing and holding business. This has been realized and urged by us for years, but, owing to the difficulties of rapidly training men and in getting together in simple form the necessary facts and figures for rapid illuminating engineering calculations, it is only within the past year or two that the idea is really beginning to bear fruit in the way of practical returns. The benefits obtained from an illuminating engineering department are very tangible, and of considerable quantity as compared to a few years ago. Another matter of special interest brought out was that progressive central stations have found the tungsten lamp a valuable means of increasing their business, thus disproving the fears of those who anticipated a decrease in revenue due to the decreased consumption of the new lamp. Interest in the electric vehicle as a revenue producer has been revived the last year, and this fact was well shown by the part of the session devoted to this subject.

Convention Generalities.

All the expectations and predictions as to the success of the convention of the National Electric Light Association at Atlantic City were more than fulfilled in a week of useful work, a gathering of over 2000 attendants from all parts of the Union, and a display of earnestness and enthusiasm that augurs well for the discharge of all duties falling to the organization in the future. The exhibit of apparatus was large and varied and tastefully grouped. The entertainments were ample, but not unwisely excessive, and the weather did not become disagreeable till the end of the week. Probably no convention of the year at the famous seaside resort will make a better all around record than did this. President Eglin can look back with laudable pride over a memorable meeting and on a term of unusual merit and achievement, during which he laid the association squarely abreast of its great opportunities. And now he turns over his office and its cares to President Frueauff, in whom the association bids fair to find an executive of zeal and devotion, coupled with Western courage and progressiveness.

The program attempted at the convention was really ambitious, with over 60 papers, many of which, with the discussions, were of a high order. But it is unreasonable to expect that so many efforts can all be of equal or extreme value, in fact, they might well be important inversely as their number. The program committee did splendid work this year, but we submit as a tenable proposition that it would be well to lessen the number of papers and lengthen the time available for discussion. At more than one session the discussion came to an unfortunate end because the time was up, although much was left to be said. It is always a brisk controversy that brings out the facts, and a long, dreary mass of printed platitudes or stale facts, poorly thrown together and "elocuted" to death by poor delivery is not the "best buy" for an association whose members have spent over $100,000 in thus getting together. It costs the association and its attendants at least $5,000 an hour for the time spent in actual sessions, and the problem is to get that money's worth back. It was very satisfactory to see how the convention lived up to schedule, almost every paper and discussion being timed to a second. That is a great economy of time.

Undoubtedly the most notable of all the addresses was that of President Vanderlip, of the National City Bank, at the Public Policy session on Wednesday night. It was in admirable form and temper, sane and sober, making for conservative finance, advocating regulation, yet putting in forceful language all the strong arguments for consolidation of contiguous properties, unified management, and such proper accounting as will provide for depreciation and renewals. The sharp warning with which Mr. Insull followed as to the necessity for the members of the association to stand together agaipst the raiding of their properties must be read in the light of the fact that the public lighting art now needs some $200,000,000 of new capital every year, and the investor is not going to subscribe that amount if fierce competition is to put it in peril or wipe it out. On the other hand, the control of public utilities in any given territory brings with it the obligation or necessity for the best service at the lowest profitable rates; and it can only be held on those terms. That evening session, with two such remarkable addresses, with the oratory of Mr. Graham, the discussion by Messrs. McCarter and Burdett, and the magnificent ovation to Mr. C. A. Coffin before and after his eloquent little speech of reminiscence, will long endure in memory and serve as a landmark in association history.

Determination of the Efficiency, Regulation and Size of Transmission-Conductors.

In the predetermination of a transmission line, however short it may be, there is always some numerical work before the designing engineer in order to arrive at a safe and economical estimate of costs for a given delivery of power, at a given distance, under an assigned voltage and frequency. If the line is long and the power to be delivered is large, much computing work may be necessary in order to feel confident as to the outcome. It is possible to make a mistake in the size of wire, or in its spacing, or in the setting of the towers, which may be very costly to rectify. The article by Dr. Harold Pender, on page 1454 deals with this important part of the transmission-engineer's work. It contains a number of compact formulas for producing the required results with the minimum of calculation, and forms a sequel to the paper on the same gen

eral topic read by the same author before the convention of the American Institute of Electrical Engineers last year. It is interesting to observe that the method of dealing with the electrostatic capacity of the line is that of the Π diagram, which splits the capacity into two equal lumps or condensers, one at each end of the line. This is becoming a favorite method with transmission engineers. The article also comes out bravely for handling line e.m.fs. in kilovolts, and powers in megawatts, which is very sensible procedure.

Lighting the School Houses.

Considering the very large amount of care and money that is spent on public schools in this country, there is an astonishing amount of ignorance or indifference regarding the proper illumination of these buildings. It should be remembered that the public-school houses in our large cities are quite often utilized for evening classes, so that the question of proper lighting rises to an importance that it would not otherwise have. During the ordinary use of the schools by day, artificial light is only required during a part of the year when the days are very short, and on rare occasions at other seasons when the day is greatly darkened by storms, or in unfavorably located school houses in which the natural light is exceptionally poor. But while artificial light in the day schools is thus commonly needed only for brief periods, it is also true that when such light is needed, it is under the most trying circumstances—that is, just at the time when the natural light is failing and needs to be supplemented. This condition means one of two things: either that the artificial or natural light must be used together, or that the natural light must be shut out and the artificial used exclusively. In the latter case the installation for lighting needs to be in every way as extensive as if it were to be used for a large part of every day. In the former case at least as much light is needed, on account of the notorious difficulty of getting a satisfactorily mixed illumination, partly natural and partly artificial. Just why such a mixture should be so unsatisfactory as it is has perhaps never been fully determined. Possibly the usual difference in color between the natural and artificial lights makes their superposition trying, owing to the different focus of the eye for lights of different colors. Perhaps also the radical difference in direction of the natural and artificial lights, when the two are used together, creates confusion and cross-shadows, thereby making hard work for the eye.

Be this as it may, the lighting installation needs to be quite as effective to supplement artificial light as it does to replace it. In spite of this and in spite of the importance of good light in the rooms where children are working, it is rather rare to find a school house properly equipped for artificial lighting. The effect of improper or insufficient lighting in producing progressive myopia in the youthful eye is too well known to need comment here, so that the danger of such a defect is obvious. The trouble in the ordinary school house comes from three causes, sometimes independently present, sometimes acting in evil concert. First, the light may be altogether insufficient in quantity; second, it may be improperly located with reference to the work, and, third, it may be improperly located with reference to the eye of the victim. Very commonly all three faults co-exist. It is not at all unusual to find a schoolroom with only a single central outlet in the ceiling, for an area of 900 sq. ft. to 1200 sq. ft., and this outlet utilized by a chandelier of from four to six 16-cp lights. It goes without saying that such an equipment violates every requirement of decent lighting. It is insufficient in amount, badly placed with regard to the work on the part of the children, and poorly situated with reference to the eyes of the rest. It is a regrettable fact that the ordinary architect, up to within the past three or four years, has been either absolutely indifferent to or absolutely ignorant of the physiological requirements of artificial lighting, and this is nowhere shown with worse effect than within the schools.

Now, in point of fact, a schoolroom is one of the most difficult of rooms to light properly. It is not the amount of light required which causes the trouble, but the nature of the light with respect to the work. Two foot-candles or 2½ foot-candles properly applied give illumination enough for ordinary work in reading or writing. A little more than this will do no harm in schoolrooms, for the reason that under modern methods of instruction there is a very extensive use of pencil and paper, or ink and paper. The paper is usually bad, pencils inferior, and the pens too fine to give really legible writing, even assuming that the ink is good. Gray pencil marks on muddy paper, or the writing produced by bluish ink on a fine pen, make about the worst possible characters in point of legibility. Also, ordinary school work includes a considerable amount of blackboard instruction, and it is very difficult to find a schoolroom in which many pupils are so located as to be able to read readily from the blackboards, the surfaces of which usually reflect enough light to distribute an unpleasant glare. Hence a schoolroom requires rather more light than a room where ordinary reading or clerical work is going on. Furthermore, the pupils are distributed all over the room, and it is a matter of great difficulty to distribute the lighting units so that cross-shadows may be avoided.

It is a very easy thing to find a place in an ordinary school room where by artificial light one can see from two to six shadows of his pencil point, all fairly well defined and creating optical confusion. Now the remedy for this difficulty is pretty well known at the present time. It consists in placing the outlets for light unsymmetrically with reference to the rows and columns of desks, so there will be a general tendency all over the room toward reception of the light from the rear left direction. This unsymmetrical lighting was independently thrashed out both by committees including oculists in London and in Boston, Mass., but it is very difficult to get a school-house architect—or rather the third acting assistant draftsman to whom such trivial matters as lighting are too generally assigned—to depart from the beautiful symmetry he loves to cherish. Another very common fault is the use of lamps, sometimes even unfrosted lamps, fully exposed to the view, with the customary evil effects. A beginning of reform has already been made in a few cities, and there can be found, by anyone who wishes to study them, very excellent examples of lighting in this and other countries; but on the average it is bad, and will continue to be bad until the school committees realize that the eyes of the children committed to their charge are of more importance than the decorative scheme of the schoolroom or the alleged artistic effects of the lighting fixtures.

Meeting of Association of Car-Lighting Engineers.

The semi-annual meeting of the Association of Car Lighting Engineers was held in the Engineering Societies Building, New York, on Monday, June 7. The meeting was informal and preliminary to the annual convention of the association, which will be held in Chicago, Oct. 5 to 8. The greater part of the day was devoted to a discussion of standard voltages for train-lighting service; definite action on which subject is expected to be taken at the annual meeting. Experiences with the low-voltage tungsten lamp in train-lighting service were also given and from the trend of the discussion it would appear that the tungsten lamp will displace all others for this service. A committee on standard accounts, one on specifications and another on standards were appointed to report at the annual meeting. An interesting discussion took place on the merits of chain drive for axle equipments in preference to belt drive, and it was shown that the chain drive had withstood hard service in the West where belts had failed. The chief troubles with belt drive were found in winter and because of the tension maintained, the bearings on the pulley end of the generators wore rapidly, subjecting the commutator and winding to rubbing action against the brush holders and pole pieces. On the question of theft of tungsten lamps it was brought out that the lamp not being applicable to 110-volt circuits was of little use to the average consumer of electricity and that many companies, notably the Pennsylvania Railroad Company, use lock sockets. With the advent of an improved shade holder the use of shades on lamps is becoming more general. The rattling of the shades in their holders because of the flimsy construction of the latter caused so much complaint from passengers in sleepers that shades had to be discontinued until a better holder was forthcoming. This led to the use of husks and bare lamps which were objectionable. Greater attention is being given to the subject of illumination and the proper distribution of light in railroad coaches and Pullman cars on nearly all the roads, and it was suggested that where possible the members of the association visit some laboratory where tests can be made of lighting equipment with instruments suitable for that purpose. The officers of the association are as follows: President, Mr. A. J. Farrelly; vice-president, Mr. A. J. Collett; second vice-president, Mr. C. W. Bender, and secretary, Mr. G. B. Colegrove.

Meeting of the Railway Signal Association.

The regular stated meeting of the Railway Signal Association was held in the Engineering Societies Building, New York, on Tuesday, June 8. At the morning session the reports of the various standing and special committees were presented and a paper entitled "The Semaphore Arm," by Mr. C. H. Morrison, of the New York, New Haven & Hartford Railroad, was read and discussed. The afternoon session was devoted to the reading and consideration of a paper by Mr. W. K. Howe, of the General Railway Signal Company, on "Alternating Current for Railway Signaling." The association's annual convention will be held this year on Oct. 12, 13 and 14. Louisville, Ky., has been chosen as the meeting place and the Hotel Seelbach as the convention headquarters. The officers of the association are as follows: President, Mr. L. R. Causen; vice-presidents, Messrs. H. S. Balliet and C. E. Denney; secretary-treasurer, Mr. C. C. Rosenberg, *Times* Building, Bethlehem, Pa.

Prize Competition for Design of Ornamental Poles.

The Engineers' Society of Pennsylvania, which has an established fund to provide prizes for meritorious designs of engineering structures, has instituted a competition for the best design of ornamental poles for the support of lights and trolley wires. Plans, specifications and estimates of cost must be submitted. The competition is to close July 15, when the designs submitted will be opened by the board of award. Information in detail may be obtained from Mr. Paul A. Cuenot, chairman, prize committee, Engineers' Society of Pennsylvania, Harrisburg, Pa.

Ohio Electric Light Convention.

The sixteenth annual convention of the Ohio Electric Light Association will be held at Toledo, Tuesday to Thursday, July 13-15. Following is a list of the topics which will form the subjects of papers and discussions: Residential Lighting; Supply of Electricity to Other Towns from a Centrally Located Station; Engine-Room Management; Commercial Organization of Electric Lighting Companies and Their Relation to the Public; Boiler-Room Economy; Factors to be Considered in Making Street Lighting Contracts; Plans to be Followed in Supplying Lamps to Consumers; The Titanium Arc Lamp; Tungsten Lamp Experience.

The entertainment features of the convention will be more extensive than ever before, and will include the following rides, visits, etc.: Tuesday—Auto ride for the ladies; for all, a trip to the Casino, with 6 o'clock dinner and theater party. Wednesday—Trip to Fort Meigs for the ladies; for all, a trip to Toledo Beach, with frog-leg dinner and ball. Thursday Afternoon—Trip to Cedar Point, Ohio, with banquet, lagoon ride and ball in the evening. Transportation in the city and to Cedar Point, and the dinners, banquets, rides, balls and all other features of the entertainment will be free to all attending.

The association has provided an exhibit room, 40 x 70, in the Hotel Boody for the free use of associate members and others desiring to make an exhibit. Ample supply of single-phase, 60-cycle current will be available in the exhibit room, the voltage being 115 and 230. If the demand justifies, the electric light company will supply three-phase currents at the same voltage. D. L. Gaskill, of Greenville, Ohio, is secretary.

Reversal of Revocation of Foreign Patent in Great Britain.

As noted in these columns several months ago, the British Comptroller of Patents revoked certain patents on a flaming-arc lamp on the grounds that the said lamp was not manufactured to an adequate extent in Great Britain. In an appeal brought before a higher court this decision was reversed on the ground that the company had been, and was still making, a bona fide attempt to establish an industry for flaming-arc lamps, and that it had expended large sums with that object in view. The court believed that it was by no means easy to establish a new industry in the teeth of great competition, and it was satisfied that the company in suit was using its best endeavors to fulfil its obligations under the patent act, and that its want of success up to the present was due to circumstances over which it had no control.

Maclaurin Inaugurated at Boston "Tech."

Dr. Richard Cockburn Maclaurin was formally inaugurated president of the Massachusetts Institute of Technology at Symphony Hall, Boston, on June 7, in the presence of a large and distinguished gathering, including the Right Honorable James Bryce, Ambassador from Great Britain; Governor Draper, of Massachusetts; President A. Lawrence Lowell, of Harvard University; ex-President Henry S. Pritchett, head of the Carnegie Foundation; Chairman Arthur A. Noyes, of the faculty; Hon. Frederick P. Fish, former president of the American Bell Telephone Company; Mr. James P. Munroe, former president of the Alumni Association; Dr. A. E. Kennelly, of Harvard, and many other public officials and professional men. The addresses emphasized the great value of broad professional education in modern industry and pointed out the growth and prospects of the Institute as a center of progress in the training of the engineer.

Vanderlip on Electrical Securities.

One of the noteworthy features of the evening session of the National Electric Light Association at the Atlantic City convention on June 2 was the address of Mr. Frank A. Vanderlip, president of the National City Bank of New York City, whose subject was "Electrical Securities." Owing to Mr. Vanderlip's prominence as a financier the closest attention was given to his address by the large and representative audience of electrical men present.

The speaker discussed the attitude of investors toward electrical securities and said that in building new plants, in extending existing businesses, the question of financing was more fundamental than technical means. It is only by the creation of corporation securities that great enterprises can be developed.

Electric-lighting plants are among the newest of the enterprises brought before investors. Even as late as five years ago it was hard to find a market for central station securities, except in a few cases of large companies, because of the newness of the business and the fact that many of the factors connected with it were not sufficiently known and established to attract investment houses. Even at the present time but a comparatively small number of such securities are listed by large financial houses. The reasons for this state of affairs in the past are obvious. The rapid change and improvement in electrical apparatus and methods the first few years brought about changed conditions for the investor and caused a rapid throwing out of obsolete apparatus to make way for new and better. Companies using overhead distributing systems entirely were open at any time to competition which would impair the value of their securities.

These difficulties are now being removed. In the case of companies who have constructed extensive underground systems competitive companies will be slow about entering the field. Another tendency of the times which is helping to safeguard these investments is that of allowing one company to have a monopoly of the field and to regulate that monopoly rather than to attempt to regulate it by allowing competition as in former days. Funds for electrical development are now obtainable with greater ease and at lower rates than have prevailed heretofore.

Mr. Vanderlip emphasized the importance of having a security easily marketable if it is to be attractive to the investor, and to have a security marketable it must be well known. With many small companies it is impossible to have the character of their securities generally known to the investing public. The average investment of electric-light companies of the country in 1907 was about $200,000. The consolidation of a number of small companies gives a security and stability not otherwise possible and the securities will become more generally known and more marketable.

Among the conditions which Mr. Vanderlip outlined as being necessary to make the security attractive to the general investing public were the following:

The company should earn at least twice its interest charges over operating expenses, maintenance and depreciation. The depreciation fund should be in some equivalent of cash.

It should serve a population of 50,000 or over.

The securities should, in the main, net the investor 5 per cent.

Expenditures that should go under operating expenses should not be charged to renewals. The careful bond buyer will analyze accounts rigidly to ascertain that the temptation to do this has been resisted.

If the plant is modern, with reasonable rates, and if the conditions mentioned are met, a security will be created that will be in many ways attractive. If, in addition, the security is large enough to secure marketability, a bond will result that will compare favorably with any other returning a similar rate of interest.

Mr. Vanderlip advocated the combining of small companies into large ones for economic reasons. The diversity of location and operating condition of the small companies making up the combination gives strength to the whole. In his opinion the most important development of the next few years in the electric light and power field will be in the building of water-power plants and steam plants at the coal mines to generate electricity economically and to distribute it over large areas. Large corporation issues based on this development should be satisfactory to security holders.

The public is coming to recognize that competition between public utilities is bad and the tendency is now in the direction of allowing a monopoly of the business to one company in a community and regulating that monopoly in the public interest. Some have feared that regulation by commission may be carried to the point where the control of a property would be practically taken out of the hands of its owners and managers. Personally, however, the speaker has no fears that this will occur. The public generally is willing to accord capital a fair return and to allow private enterprise as much chance to take the initiative as possible. The public service commission which insists on good service at reasonable rates on the one hand, and on the other hand prevents the piratical attack of competitors, will in the end prove a bulwark to the security holder.

A business which doubles every five years, as the electric-lighting business has done, has in it vitality that is bound to carry it to enormous proportions. Given intelligent management, conservative accounting and fair rates which do not invite legislative attack, funds should be found in ample supply for financing the business. If the economies of corporate combinations are added, with single issues of large volume, then funds should be had for electrical development not only in ample supply, but at a moderate rate of interest.

Protection Against Theft of Electricity.

The Colorado Legislature has passed an act for the punishment of any person who makes any connection with any electric wire without the knowledge and consent of the owner thereof, or who wilfully injures, or interferes with the installation or operation of any electric meter. The penalty attached is a fine of from $50 to $300 and imprisonment of from 30 to 90 days, or both.

The act prescribes that any person who connects or changes any wire, cord, socket, motor or other instrument, device or contrivance, with any wire transmitting or supplying, or intended to transmit or supply electricity to any house, store or other building, without the knowledge and consent of the person or corporation owning said wire, in such manner that any portion of such electricity may be transmitted or supplied to any globe, lamp, heating apparatus or other instrument by or at which electricity is consumed, shall be deemed guilty of a misdemeanor and punished as above specified. Or any person who connects or changes any wire, cord, socket, motor or other instrument, device or contrivance with any wire, transmitting or supplying or intended to transmit or supply electricity to any house, store or other building, without the knowledge and consent of the person or corporation owning said wire, in such manner as to transmit or supply any such electricity to any globe, lamp, heating apparatus or other instrument by or at which electricity is consumed, around or without passing through the meter provided for measuring or registering the amount or quantity of electricity passing through it, shall be deemed guilty of a misdemeanor and similarly punished. Or any person who wilfully injures, alters or by any instrument, device or contrivance in any manner interferes with or obstructs the action or operation of any meter made or provided for measuring or registering the amount or quantity of electricity passing through it, without the knowledge and consent of the person or corporation owning said meter, shall be deemed guilty of a misdemeanor and similarly punished. Proof of the existence of any wire connection, or of any injury, alteration or obstruction of a meter, shall be taken as prima facie evidence of the guilt of the person in possession of the premises where such connection, injury, alteration or obstruction is proved to exist.

New Officers of the A. I. E. E.

The June issue of the *Proceedings* of the American Institute of Electrical Engineers announces the election at the May meeting of the following named officers for the ensuing year: President, Mr. Lewis B. Stillwell; vice-presidents, Messrs. John J. Carty, Paul M. Lincoln and Paul Spencer; managers, Messrs. A. W. Berresford, W. S. Murray, H. H. Norris and S. D. Sprong; treasurer, Mr. George A. Hamilton; secretary, Mr. Ralph W. Pope. The total recorded membership of the Institute on April 30 was 6400, a net increase of 726 for the year.

A. I. E. E. Frontenac Convention.

The current issue of the *Proceedings* of the American Institute of Electrical Enginers contains the final program for the annual Institute convention to be held at Frontenac, Thousand Isles, June 28 to July 1. The preliminary program as printed in our issue of May 6 has been lengthened by the addition of the following titles of papers:

"Method of Testing Transformer Core Losses by Giving Line-Wave Results on Commercial Circuits," by Mr. L. W. Chubb. "Testing Transformer Steel," by Messrs. M. G. Lloyd and J. V. S. Fisher. "The Current Locus of the Single-Phase Induction Motor," by Prof. A. S. Langsdorf. "Output and Regulation in Long-Distance Lines," by Mr. P. H. Thomas. "Corona Phenomena in Air and Oils and Their Relation to Transformer Design," by Messrs. W. S. Moody and G. Faccioli. "Surges on Cable Systems with Aluminum-Cell Protection," by Messrs. E. E. F. Creighton and S. D. Sprong. "Split-Pole Converters and Storage-Battery Regulator," by Mr. J. L. Woodbridge. "Function of Flywheel in Connection with Electrically Operated Rolling Mills," by Mr. H. C. Specht. "Alternating-Current vs. Direct-Current Motors in Steel Mills," by Mr. K. A. Pauly. "Rolling-Mill Motors," by Mr. E. W. Yearsley. "Electrically Driven Rolling Mills," by Mr. E. Friedlander. "Power Requirements for Rolling High-Carbon Steel of Small Sections," by Mr. B. Wiley. "Electrical Control for Rolling-Mill Motors," by Mr. C. T. Henderson. "Calculation of Iron Losses in Dynamo-Electric Machines," by Mr. I. E. Hanssen. "E.M.F. Wave-Shape in Alternators," by Prof. C. A. Adams. "The Modern Telephone Cable," by Mr. F. B. Jewett. "The Education of the Electrical Engineer," by Mr. C. R. Dooley. "The Value of the Classics in Engineering Education," by Dr. C. P. Steinmetz.

The convention committee announces the following social functions:

No entertainment has been planned for Monday afternoon, but boating, fishing, golf, croquet and other outdoor pastimes will be available for those wishing to make use of them. On Monday evening there will be a reception and dance at the Hotel Frontenac.

On Tuesday afternoon there will be a qualifying round in a handicap golf tournament. The first eight will qualify for the semi-finals. There will also be a women's "putting" contest, accompanied by first, second and third prizes. Tuesday evening there will be a women's bridge tournament.

Wednesday morning there will be a daylight excursion for women through the Thousand Islands on a large steamer. The semi-finals of the golf match and a driving contest will be held Wednesday afternoon. Wednesday evening there will be a searchlight trip of 50 miles among the islands on a large boat for both men and women. The finals of the golf tournament will take place Thursday afternoon.

It is proposed to have available a number of launches, which can take small parties around through the islands, these parties to be made up by the individuals wishing to take advantage of them. Golf will be available for men and women at any time, as the golf links are adjacent to the hotel and readily accessible.

Owing to the restrictions now incident to the granting of reduced railroad rates on the certificate plan and the cheapness of excursion tickets to the Thousand Isles, no steps will be taken to arrange for special convention rates of transportation.

Producer Gas from Texas Lignite.

It is now confidently expected that the vast lignite coal resources of the State of Texas will be made many times more valuable than at present through the adoption of a process which has recently been the subject of study at the Pittsburgh experiment station of the United States Geological Survey, the lignite used for the purpose being furnished by Texas mines. The manufacture of briquettes from lignite coal had been extensively tried in Texas, but never proved successful. It was in the making of briquettes that the experiments at Pittsburgh were devoted. Until lately the trouble has been that it was necessary to put something with the lignite to form a binder after forcing out the moisture and taking away the by-products. The average grade of lignite contains about 35 per cent of moisture. In the manufacture of briquettes, the process which the Government experts have just perfected calls for the use of a certain heat and pressure which extract about 70 per cent of the moisture, leaving the tar, or pitch, as a binder. In this way the necessity of adding something to agglomerate the fuel is obviated.

The lignite fields of Texas extend from Texarkana to Laredo, in a zigzag course across the State. The beds are practically inexhaustible. Mines are being worked at Lytle, Rockdale, Bastrop, Bear Grass, Evansville, Crockett and Alba. Excellent results are obtained in the manufacture of producer gas from lignite, and it is claimed that such gas makes the best fuel now known, although it is not an illuminant. In the experiments in the manufacture of producer gas from lignite the Government experts discovered a number of by-products. One of these is ammonia, which can be derived in such large quantities that Texans claim it will not be long until their State will be producing enough of that product to supply the world.

Some of the largest producer gas engines in the world are already in operation in Texas. It is stated that the largest lignite producer gas plant in the world is that of a cement company at Dallas. With this gas the company runs a 4800-hp engine. It is such a success that another large cement company in the same section is installing a still larger plant. In San Antonio a lignite producer-gas plant is able to run a 2500-hp engine.

Exclusive Telephone Service and Common Carriers.

The Indiana Railroad Commission, having been asked as to right of a common carrier to give the exclusive use of its baggage-room telephone to one patron, replied that so far as a railroad is concerned, there would seem to be no impropriety in so doing, provided it were willing to accord the same privilege to any other person who desired to install a telephone in its baggage-room. The commission says the question is a novel and interesting one, so far as relates to the duties of the telephone company, and seriously doubts whether the company could lawfully agree to refuse to call the baggage-room except when the installing concern asked to be connected. The general rule is that a telephone company must serve all its customers equally, affording to all patrons the same facilities for intercommunication. If it were permissible for a telephone company to give to one member of the public the right to call a larger number of places than it gives to another patron, there would seem to be a discrimination inconsistent with its public duties.

Electrification of Railroad Terminals.

Mr. H. H. Evans, secretary and engineer for the local transportation committee of the Chicago City Council, spoke on "The Electrification of Local Railroad Terminals" at the meeting of the Electric Club, of Chicago, on May 26. He referred first to the interest of the city authorities in the subject. The city of Chicago has conducted a campaign to abolish the needless production of smoke, and among other things attention has been drawn to the railroads because of their large contribution to the smoke nuisance. Since the successful electrification of the New York terminal of the New York Central Railroad there has seemed to be no reason why a similar system could not be applied to such of the steam railroads in Chicago as carry a heavy burden of suburban passenger traffic.

The speaker sketched the progress of the agitation in Chicago for the electrification of railroad terminals and said that investigation revealed the fact not only that the experimental stage had been passed, but that the newer method has many advantages both for the public and for the railroads, affording opportunities for economies which, with sufficient density of traffic, may be almost compelling. For the public there is greater comfort and convenience with an absence of smoke, odor, dust, cinders and much noise. This improvement applies both to those who travel on the railroads and to those who live near them.

To relieve congested central districts in large cities existing steam railroads may be utilized for suburban passenger service by electrically equipping them. These existing roads can be utilized in this way at a fraction of the cost of building new elevated railways or subways. These electrified roads should not compete with the local surface lines, but should be used in conjunction with the latter, supplying express service which is not now to be had, or exists only in insufficient degree.

To the railroad electrification offers opportunity for economies in various directions. The absence of smoke, noxious gases and dirt will lengthen the life of equipment; the equipment may be worked to greater capacity; long trains in rush hours and short trains in slack hours may be hauled at nearly equal economy per seat-mile. During the middle of the day short trains at frequent intervals may be substituted for long ones at infrequent intervals at the same gross cost and to the satisfaction of the traveling public and a consequent increase of receipts. Repair bills will apparently be less per train-mile, and there will be some saving in train labor.

But the satisfaction of the public is the most important consideration of all. The electrification of steam roads doing a suburban business in cities should be made with the purpose of making money rather than saving money. Electrification holds great opportunities for increasing patronage. Speaking particularly of the Illinois Central suburban service in Chicago, Mr. Evans said that this service offered good possibilities for electrification. The suburban traffic of this company in Chicago appears to be falling off by reason of the competition of the electrically operated South Side Elevated Railway, particularly since the completion of the Kenwood branch of the latter. The Illinois Central suburban service in Chicago represents about 6500 train-miles daily, and it is estimated that a power plant of about 12,000 hp will be necessary to provide electricity to operate it. It is probable, however, that the company can buy electrical energy as cheaply as it can make it. The local transportation committee has estimated that the cost of electrification with cheap construction would be $4,000,000 without a power plant. It is figured that a saving of $420,000 a year could be effected. The Illinois Central Railroad Company is working with the city of Chicago in the matter and making exhaustive studies of the electrification problem. The handling of freight trains and possible extensions of the suburban service complicate the situation, but electrification must finally come.

The speaker reviewed at some length existing electrifications of former steam railroads both in this country and Europe, giving the characteristics of the various systems employed. One interesting statement was to the effect that in an electrification extending out of Milan, Italy, it had been proposed to install a portable storage battery on a freight train, available for transportation to the scene of a disabled substation should necessity require. Mr. Evans was not sure, however, that this proposal had ever actually been carried out in practice.

Decision of Massachusetts Commission in Leominster Electric Rate Case.

The Massachusetts Gas and Electric Light Commission has issued a decision recommending a slight reduction in rates in the complaint case of the Leominster Selectmen against the Leominster Electric Light & Power Company. The previous net rates of the company for lighting varied from 18 cents to 10 cents per kw-hour, according as the consumption was less than 50 or over 499 kw-hours per month. The net rates for power varied from 6.7 cents per kw-hour below 100 kw-hour per month to 2.9 cents per unit for 5000 kw-hours and over, with a service charge for motors of approximately $1 per horsepower per month. Prior to Jan. 1, 1908, the maximum net rate for lighting was 19 cents per kw-hour.

The company is owned by the Massachusetts Lighting Companies of Boston, and was organized in 1888. Until it came into possession of its present owners in August, 1905, it paid dividends in only two years. Dividends have been paid in every year since June 30, 1905, although in the fiscal year ending June 30, 1908, there was no dividend earned. During the same period the present owners have expended about $60,000 in plant additions and improvements.

The board in its decision discusses at length the matter of its authority to order a reduction in the price of electrical energy supplied for power, and concluded that it possesses such authority. It is doubtful, however, whether the board should concern itself with the determination of any other than a fair price at which the company is bound to supply electricity to anyone who may apply for whatever use. If necessary to make differentials under exceptional circumstances, these should be made upon the initiative of the company rather than of the board. Such differentials are not to be justified merely by the size of the customer's bill; they should not be allowed except where business is not otherwise obtainable; they should be uniform to all persons for a like service; the price should never be unnecessarily low, and should always be high enough to avoid loss to the company. Referring to the company's list of differential rates, this is said to be long, and to vary slightly from step to step. At the time of the hearing no serious attempt was made by the company to show that these rates were designed to attract and develop a business not otherwise obtainable, or to increase the efficiency of the plant.

Referring to the fact that in the last fiscal year the company earned nothing for dividends, it is stated that the reduction of profits was almost identical in amount with the loss of income from the power business of the company, and that it may be fairly assumed that this loss was due to the general business depression, which affected Leominster in a marked degree. With the improvement of business, now well under way, there is every reason to believe that the company's profits will equal, if they do not exceed, those of any previous year.

The prices for street lights have been $72 a year for arc lamps of normal 1200 cp, burning on moonlight schedule until 1 a. m., $110 for similar lamps burning all night every night, $16 a year for incandescent lamps of 25 cp, burning on moonlight schedule until 1 a. m. The contract at these rates having expired, in negotiations for a new contract the company offered to supply these lights at $120 for all-night arcs; $83.50 for 1-o'clock arcs, and $18.50 for incandescents. The final recommendation of the board is that on and after June 1 the net price charged by the Leominster Electric Light & Power Company for electricity shall not exceed 16 cents per kw-hour; that the price of street lights shall remain as at present, except for 1200-cp arcs burning all night and every night, the charge for which shall be $105 per lamp per year instead of $110.

Chicago Street Railway Rehabilitation.

Another of the successful joint meetings of the Electrical Section of the Western Society of Engineers and the Chicago branch of the American Institute of Electrical Engineers was held at the rooms of the former in Chicago on the evening of May 28. Mr. W. L. Abbott, president of the Institute branch, was in the chair early in the evening, later yielding to Mr. W. B. Jackson, president of the Electrical Section of the Western Society. The subject of the evening was the important work now under way in reconstructing the surface street railway systems of Chicago, and the principal speakers were members of the Board of Supervising Engineers which has the work in charge.

Mr. Bion J. Arnold, chairman and chief engineer of the Board of Supervising Engineers, was the first speaker. He gave a brief outline history of the complicated traction controversy in Chicago which, after 10 years of agitation, culminated in the adoption of the traction settlement ordinances two years ago. He also gave a summary of the provisions of these ordinances and sketched the work of the Board of Supervising Engineers in putting these requirements into effect. The board consists of one engineer representing the city, one representing each company and one independent engineer (Mr. Arnold) representing neither nor both. It is arranged that each of the company members of the board shall have one full vote on matters exclusively referring to that company, the other not voting; but on matters where both of the companies are interested each company engineer has one-half vote. By this means there is always one city vote, one company vote and the vote of the chairman in this board of four members.

The valuation set on the street railway properties of the two principal companies at the time of the settlement was $50,000,000. Since then the rehabilitation has cost about $30,000,000. The expenditure of this money is certified to the board from time to time. It is assumed that the street railways may be maintained for 85 per cent of the first cost. A fund representing 8 per cent of the value of the new work is set aside from the operating receipts for renewals and depreciation. By this arrangement, according to the provisions of the ordinances, the city may purchase at certain predetermined times street railways which shall either be in good operating condition, or, if they are in poor condition, there will be money enough in the renewals fund to make them good. After all expenses are deducted and these are carefully enumerated in the ordinance, 55 per cent of the net receipts are turned into the city treasury, the companies retaining 45 per cent. As the rehabilitation goes on engineers inspect the actual construction work done and simultaneously auditors examine the bookkeeping accounts for that work. The work accomplished and the amount charged for that work must agree.

Mr. H. B. Fleming, representing the Chicago City Railway Company on the Board of Supervising Engineers, spoke on street railway car-house design and operation. He described a modern car house, such as has been approved by the board. The principal lighting is furnished by arc lamps wired five in series on 500-volt circuits. In the pits underneath the cars incandescent lights are used. Electric energy is used for operating tools and other machinery, and the power circuits are controlled from a switch room with direct access from the street, which may be used in case of fire to cut off the current. One interesting statement made by Mr. Fleming was that with the adoption of the improved design of car houses the Chicago City Railway Company's rate for insurance in the year 1909 was just one-half that prevailing in the year 1906, three years before.

Mr. John Z. Murphy, representing the Chicago Railways Company on the board, was not present, but, in his absence, Mr. Abbott paid a tribute to his ability as an engineer.

Mr. George Weston, representing the city of Chicago on the Board of Supervising Engineers, supplementing Mr. Arnold's [illegible] brief outline of the ordinance requirements for the rehabilitation of the properties and also an account of the work of the Board of Supervising Engineers in supervising and inspecting the enterprise. The work of the board is divided into divisions each in charge of a division engineer, and these divisions have to do, respectively, with tracks and roadway, electric power distribution, buildings and fixtures, power plant equipment, cars and car operation, tunnels and subways, drafting and accounts. The force under the direction of the board embraces 137 persons.

On June 17, 1907, actual track rehabilitation was begun. The railway feeders are placed underground in an area of about 40 square miles in the central portion of Chicago, and here about 6,500,000 duct-feet of conduit have been laid. Three types of track construction are used, differing principally as to foundations. The Chicago City Railway Company has completed about 98 per cent of the track reconstruction assigned to it, and the Chicago Railways Company has about 68 per cent of its work of this character to its credit. All new rails are made of open-hearth steel. The single-duct, square-bore conduit is standard for all classes of underground work. In overhead construction the maximum drop in voltage permitted in heavy-traffic sections is 50 volts.

Four new car houses are now under construction by the Chicago Railways Company, and the Chicago City Railway Company has a like number, counting those built and under construction. The Chicago City Railway Company buys practically all of its electrical energy from the Commonwealth Edison Company, and the Chicago Railways Company takes a large proportion of its power from the same source. The substations in which this electricity, bought "in bulk," is made available for use in railway operation are good examples of modern high-class engineering practice. Mr. Weston gave some details on the pay-as-you-enter cars which are in use in Chicago under the board's authority, and made the interesting statement that 50 all-steel cars will be in operation on the streets of Chicago within the next two months.

Before the discussion was begun there was a show of hands to determine the relative number of members of the two societies in attendance, and the count showed that there were 70 gentlemen present from the Institute and 44 from the Western Society of Engineers. Of these 16 are members of both societies.

Mr. B. I. Budd, general manager of the Metropolitan West Side Elevated Railway Company, asked if the track capacity in the center of the city had been nearly reached in the case of the surface railways.

Mr. Arnold answered to the effect that when the tracks are all reconstructed "downtown," the cars will be through-routed as far as possible, and it is believed that this expedient will relieve the congestion greatly by doing away with "downtown" loops. Single cars will be operated instead of trains of two cars or possibly more, as has been the case in past years. This also will tend to relieve congestion. A further source of relief is the fact that the new cars have more powerful equipments, increasing the speed of acceleration about 11 per cent as compared with the older cars. However, Mr. Arnold remarked that all space on the streets, under the streets and apparently above them would be needed to carry the traffic of Chicago in the years to come.

Mr. P. Junkersfeld, electrical engineer for the Commonwealth Edison Company, referred briefly to the manner in which his company supplies electrical energy for a large proportion of the railway operation in Chicago. Other participants in the discussion were Mr. E. M. Lake, division engineer for electric power distribution for the Board of Supervising Engineers, and Mr. D. W. Roper, assistant chief operating engineer of the Commonwealth Edison Company.

Answering questions and closing the discussion, Mr. Arnold said that since the ordinances have been in operation the companies, under the law, have paid into the treasury of the city of Chicago nearly $3,000,000 as the city's 55 per cent of the net profit. This sum is approximately 8 per cent of the gross receipts of the companies. During the progress of the

studies and investigations on which the ordinances were based some of the representatives of the city expressed the belief that the city should be guaranteed at least 10 per cent of the gross receipts, but Mr. Arnold found that it would be impracticable to give this guarantee and at the same time build such high-class substantial railway systems as the city should have. It is probable that the city's percentage of the gross receipts during the 20 years is about 8 per cent.

Mr. Arnold also said that he was inclined to the belief that, in general, in making settlements of this character between municipal corporations and public-service companies, promotion charges, legal expenses and the like should be put into a fund to be charged off through a series of years so that eventually this expense may not be a burden on the capitalization.

Meeting of Boston Section, A. I. E. E.

The May meeting of the Boston section of the American Institute of Electrical Engineers was held at the Edison Building on the evening of the 19th. An address, entitled "Demonstrations of Lightning Phenomena," was given by Mr. E. E. F. Creighton, of the General Electric Company, Schenectady, who also set forth the advantages of the electrolytic lightning arrester. The following officers were elected for the ensuing year: Chairman, Prof. D. C. Jackson; vice-chairman, Mr. John W. Corning; secretary and treasurer, Mr. A. L. Pearson. Executive committee: Messrs. J. F. Vaughan, N. J. Neill, L. L. Elden, M. V. Ayres and G. W. Palmer, Jr.

Domestic Production of Mica.

According to the figures reported by D. B. Sterrett, of the United States Geological Survey, the total production of mica in the United States in the year 1908 amounted in value to $267,925. The production of sheet mica amounted to 972,964 lb., valued at $234,021, which was a decrease of 87,218 lb., or $115,290, from 1907. The production of scrap mica amounted to 2417 short tons, valued at $33,904, a decrease of 608 tons, or $8,896 in value from 1907. The value of the imports to the United States fell from $925,259 to $266,058, due to the restricted electrical manufacturing output of the period. The imports for the past year were thus slightly less than the domestic production, although in years previous the imports had been several times greater than the domestic output. The mica produced in this country came from 10 States, the most important of which in the order of value were North Carolina, South Dakota, Colorado, Alabama and Virginia.

Massachusetts Legislative Notes.

The bill to authorize the Metropolitan Water and Sewerage Board to sell or lease certain land for the transmission of electricity has been passed by both branches and laid before Governor Draper. If it is approved it will facilitate the entrance of Connecticut River power into the State. The engrossed bill to authorize the town of Framingham to procure and use electricity for certain municipal purposes has been amended by the restriction of any erection of poles or wires, fixtures or apparatus upon State lands. The bill providing for the issue of additional capital stock by gas and electric light companies has been passed by the House and sent to the Senate.

New York Public Service Commission News.

The Board of Estimate of the city of New York has approved the application of the Hudson & Manhattan Railroad for a franchise to extend its lines under Sixth Avenue to the Grand Central Station at Forty-second Street and Park Avenue. Mr. McAdoo, president of the company, promises that work will be begun on the line as soon as sufficient consents of property owners can be secured, and he hopes to have the road ready for operation by the spring of 1911.

The Public Commission of the First District of New York has made a requisition upon the Board of Estimate for an appropriation of $1,500,000 for the purpose of lengthening the platforms of the present subway so that it can accommodate local trains eight cars long and ten-car expresses. This improvement was suggested by the Interborough management, and it is claimed that it will increase the capacity 25 per cent.

The Board of Estimate and Apportionment has approved of the change in plans suggested by the Public Service Commission providing the double decking of the proposed Lexington Avenue and Broadway route. This change was necessary owing to the narrowness of Lexington Avenue, which would not permit of the construction of four tracks on the same level.

The Public Service Commission has ordered the Staten Island Midland Railroad to exchange transfers at a number of points in Staten Island where they have been refused heretofore. The matter was only important to a few residents of the localities affected, but it is taken as a precedent that the commission may order transfers wherever it sees fit.

No bids have yet been filed with the Public Service Commission for the construction of new subways, but it is known that plans are being matured by both the Interborough company and the Bradley-Gaffney-Steers Company for the building of complete systems from the Bronx to Brooklyn.

Process of Making Hard Fiber.

Two patents were issued June 1 to Dr. Willis R. Whitney on a process for application in the manufacture of the insulating material commonly known in the electrical arts as hard fiber. As is well known, this material is somewhat similar to hard rubber in its electrical and mechanical properties, and is used for a great variety of purposes in the electrical arts. In the preparation of the fiber it is customary to treat sheets of cellulose by passing them through a strong solution of chloride of zinc, after which the sheets are piled up one on another and pressed into a homogeneous mass. The zinc chloride is then removed by washing, which is carried on in several distinct steps, as it has been found that if the material is placed directly in pure water, the osmotic pressure of the salt in the pores of the mass will draw in an excess of water and form water-blisters. On this account six weeks of washing by gradual treatment with more and more dilute solutions of the chloride is necessary for sheets of 1 in. or more in thickness, and this greatly increases the cost of the material when made in thick masses. The object of the patent is to improve the method of washing by utilizing as a solvent for the zinc chloride a solution having such a concentration that it will have the same osmotic pressure as the zinc chloride solution to be removed. By mixing a solution of glycerine or glucose in water the fiber mass may be used to wash, thereby removing the zinc chloride, in this way keeping the concentration of the zinc chloride low, and consequently its rate of diffusion from the mass into the wash water very high, the result being to prevent the forming of water-blisters in the fiber. An electric current may be used to increase the velocity of motion of the ions of the salt or impurity. The current causes the motion of zinc to the cathode and of chloride to the anode, and the two elements are thus separated at the electrodes. By a suitable addition of alkali and acid in dilute form to neutralize the products liberated at the electrodes and to preserve the isotonic condition of the washing liquid, the process practically amounts to the replacement of the zinc and chloride within the fiber by the components of the water, namely H and HO ions. The two patents contain 11 claims covering the removal of zinc chloride from cellulose. One of the claims is on a process for removing a solution of metallic salt from an organic material, which consists in washing the said material with a solution relatively high in organic content and relatively low in inorganic content, and still another is on a process of removing zinc chloride from cellulose, which consists in washing said cellulose with a solution having an appreciable osmotic pressure and relatively low zinc chloride content.

Convention of the National Electric Light Association.

General Report of the Proceedings at Atlantic City, N. J., June 1-4, 1909.

FOR the first time in its history the National Electric Light Association at the Atlantic City convention of 1909 passed the 2000 mark in attendance, the exact number registered being 2030, which may be compared with 1788 at the Chicago convention of last year. During the year, under the administration of President W. C. L. Eglin, the association has grown in membership from 1361 to 3215, so that it was not strange, perhaps, that this convention should be the largest in its history. Some, indeed, are so sanguine as to predict a membership of 6000 by the time of the next convention.

The character of the convention was in keeping with its size, the general tone of papers and discussions being distinctly good. There were no less than 57 papers and committee reports, and on Thursday of convention week there were three simultaneous sessions. The convention was held on the Million Dollar Pier at Atlantic City on June 1, 2, 3 and 4, and consisted of general, technical, commercial and accounting sessions. A large amount of data and material was presented at the 12 sessions of the convention. The report and exhibit of the meter committee were particularly complete, while much credit is also due to the members of the gas-engine committee for their personal investigations and report on gas-producer plants. Important action was taken on the subject of the grounding of secondaries, as reported below.

Amendments to the constitution were adopted by which it will be possible to hold national special sessions of men like lawyers, accountants, purchasing agents, commercial men and others who specialize in some department of the industry. Conventions may be held by these sections without necessarily being coincident with the date of the main convention. The commercial papers at Atlantic City were particularly numerous, and in this department of convention activities the discussions on the electric-vehicle situation and on load factors were of timely interest. Large attendance and much interest characterized the accounting sessions also.

A distinguished visitor to the convention was Mr. Frank A. Vanderlip, president of the National City Bank, of New York, who accepted an invitation to address the association on the subject of "Electrical Securities." His address, given in abstract elsewhere in this issue, was of much practical importance to all central-station men who have to solve the inevitable problem of finance.

In presenting the valuable report of the committee on public policy, Mr. Samuel Insull, chairman of that committee, quite overshadowed the interest in the report itself by his supplementary remarks on the "raiding" of electrical securities by electrical manufacturers. This protest, coming from such a source, naturally excited great attention. Other men of prominence in the electrical industry who spoke at the memorable Wednesday evening session were Messrs. C. A. Coffin, president of the General Electric Company; Thomas N. McCarter, president of the Public Service Corporation of New Jersey, and George S. Graham, of Philadelphia.

The entertainment features were not overdone, but were thoroughly enjoyed. Chief interest centered in a baseball game in which a team representing the West defeated one from the East by the close score of eight to seven. This was some alleviation for the defeat of two years ago at Washington, when the East was victorious by a decisive score.

The general arrangements for the convenience of those attending the convention were carried out in accordance with a carefully arranged plan. The registration booth and secretary's office were at the entrance to the Pier, and here accredited visitors were supplied with one packet containing badge and a book of tickets to entertainments and with others containing convention papers printed in advance. General and technical sessions were held in Marine Hall, farther out on the Pier, while the simultaneous commercial sessions and accounting sessions of Thursday were held in other halls on the Pier. In all three locations the noise of the sea formed an accompaniment to the discussions.

Mr. Frank W. Frueauff, of Denver, was promoted from the office of first vice-president to that of president, and the choice is universally commended. Mr. Frueauff has been active in the affairs of the association for the last year, supplementing the untiring efforts of Mr. Eglin, and has served as chairman of



GENERAL VIEW OF RECEPTION ROOM AND EXHIBITION HALL, ATLANTIC CITY CONVENTION.

the general convention committee, so that the honor is well deserved. Mr. W. W. Freeman, of Brooklyn, was elected first vice-president; Mr. John F. Gilchrist, second vice-president, and Mr. Frank M. Tait, of Dayton, secretary and treasurer. The new members of the executive committee are Messrs. Charles A. Stone, of Boston; Dudley Farrand, of Newark, and H. M. Byllesby, of Chicago.

The convention, with its excellent exhibition of the apparatus of associate members, was most successful in every respect.

STATE AND COMPANY BRANCHES.

Following the presentation of the report of the committee on State and company branches, on Tuesday morning, June 1, as mentioned at the conclusion of the introductory report in the *Electrical World* of last week, there was a discussion of some length. Mr. C. L. Edgar, of Boston, spoke first, advocating State sections rather than company sections. He was followed by Messrs. L. H. Conklin, of Connellsville, Pa., president of the Pennsylvania State association; H. W. Hillman, Grand Rapids, Mich.; S. Fred. Smith, Salem, Mass.; Dudley Farrand, Newark, N. J.; D. B. Rushmore, Schenectady, N. Y.; C. N. Stannard, Denver, Col.; M. S. Seelman, Jr., Brooklyn, N. Y.; B. W. Mendenhall, Salt Lake City; Harold Almert, Chicago; H. Goodwin, Jr., Philadelphia; Mr. Searle, the chairman of the committee; E. F. McCabe, Lewiston, Pa.; E. L. Smith, Towanda, Pa., and John F. Gilchrist, Chicago. All the gentlemen taking part in the discussion were agreed on the general principle of enlarging the scope of the association's work, but there was some divergence of opinion as to the best methods of bringing this result about. On motion of Mr. Frank W. Frueauff, of Denver, the president was instructed to appoint a committee to consider the subject of dues in the State sections. As announced later, this committee consisted of Messrs. W. W. Freeman, of Brooklyn; H. L. Doherty, of New York, and C. L. Edgar, of Boston.

AMENDMENTS TO THE CONSTITUTION.

There was no session on Tuesday afternoon, but on Tuesday evening there was a meeting of three hours' duration devoted mainly to lamps and lighting. Before the papers were taken up, however, Mr. W. W. Freeman offered some amendments to the constitution approved by the executive committee. These amendments relate to some changes in dues and provide for new members of the executive committee, but their principal purpose is to add a new article providing for national special sections of "lawyers, accountants, engineers, purchasing agents commercial men, or of any other class of persons connected with the conduct of the central-station business," subject to the ratification of the executive committee. To be a member of one of these sections a man must also be a member of the National Electric Light Association. It will be possible to hold national section conventions, subject to the approval of the executive committee or the president. The amendments to the constitution were referred to a committee appointed later by President Eglin, and consisting of Messrs. W. W. Freeman, H. L. Doherty, and C. L. Edgar. On Friday the amendments were adopted.

LAMPS AND LIGHTING.

Mr. J. W. Cowles, of Boston, abstracted his paper on "Developments in Street and Park Lighting." The general subject indicated by the title was treated by giving an account of recent developments in various cities, with illustrations. Mr. S. G. Rhodes, of New York, read a written discussion of the paper, and Messrs. Farley Osgood, of Newark; George H. Lukes, of Chicago, and others spoke on the subject.

A valuable report from the lamp committee was presented by Mr. W. W. Freeman, of Brooklyn, chairman of the committee. Mr. P. S. Millar, of New York, opened the discussion and described with the aid of lantern-slide diagrams tests which are now under way on tungsten lamps of foreign and domestic manufacture. These tests have gone far enough to show that the domestic lamps are certainly the equal and probably the superior of foreign lamps. One point of interest is the apparently longer life of 60-watt sizes. Others taking part in the lamp discussion were Messrs. F. W. Willcox, of Harrison N. J.; Cowles, of Boston; Seelman, of Brooklyn, and Edgar, of Boston. Mr. Cowles made the statement that the cost per lamp delivered by the systematic delivery of Boston was 1.4 cents.

"The Manufacture of Incandescent Lamps" was the subject of the paper presented by Mr. S. E. Doane, of Cleveland, and also bearing the names of Messrs. J. E. Randall and Glen C Webster as joint authors. Mr. Doane described the methods of lamp manufacture with the aid of pictures taken in a lamp factory and thrown on the screen. He said that the breakage of bulbs in the factory was from 6 to 10 per cent, of filaments from 20 to 30 per cent, and of tubing from 4 to 5 per cent, while there is a loss of 10 per cent on lamps not running to voltage.

An instructive illustrated lecture on the "Quality of Light" was given by Mr. Paul F. Bauder, of Cleveland. The different types of electric and gas incandescent lamps were considered and there were some interesting colored pictures to show color values. Dr. C. P. Steinmetz, of Schenectady, complimented the author of the paper and said that it would be interesting to study luminescent sources of light as well as incandescent sources of light in the matter of color values.

RECENT IMPROVEMENTS IN ELECTRICAL EQUIPMENT.

President Eglin called the third general session of the convention to order promptly at 10 o'clock on Wednesday morning. There was a large attendance from the outset, and the hall was soon filled. The papers of this session reflected the recent progress of the art in equipment, and indicated the probable development of the immediate future in both apparatus and methods. It was apparent that despite the great progress of the past, there is no cessation in the march of progress tending toward new and improved equipment.

The first paper was by Mr. Joseph Appleton, Philadelphia, of the Electric Storage Battery Company, on "Advance Information Regarding Developments in Storage Batteries." The paper was read in abstract by the author, who emphasized the importance of the new Exide plate for central-station service. This plate gives nearly twice the output of the old Manchester plates for double the time, with a higher terminal voltage, and is particularly attractive in stations requiring emergency capacity.

The next paper was on "The Regenerative Flame Lamp," by Mr. A. J. Mitchell, of the Adams-Bagnall Electric Company, Cleveland, who described this new illuminant, giving photometric diagrams and comparisons of its operating costs with those of street and commercial arcs.

The papers of Mr. N. R. Birge, of the General Electric Company, Schenectady, on "The Status of the Arc Lamp" was read by Mr. C. W. Stone, of Schenectady, and this was followed by the paper of Mr. C. E. Stevens, of the Westinghouse Electric & Manufacturing Company, Pittsburgh, on "Recent Types of Arc Lamps and Their Operation," read by the author.

Dr. C. P. Steinmetz, of the General Electric Company, Schenectady, opened the discussion. He emphasized the progress which has been made by the magnetite lamp in comparison with the regenerative and other types of flaming arcs, and pointed out the importance of proper selection of shades in securing the best results on the street. The most flexible service can be obtained by the use of opal globes, since by modifying the shape of the globe the light distribution can be changed to suit the local requirements. An important additional advantage in the luminous arc is the independence of the size of the electrode on the efficiency of the unit. Larger electrodes can be used without difficulty, and this means better light and longer life. Mr. E. W. Lloyd, of Chicago, stated that the impregnated carbon lamps did not satisfy the principles of scientific illumination, and are ill adapted for use in buildings with low ceilings. Mr. J. W. Cowles, of Boston, spoke on the value of the magnetite lamps in the solution of street lighting problems in that city.

The monumental and valuable report of the committee on meters was then presented by Mr. George Ross Green, of Philadelphia, who outlined the scope of this document—a volume of 278 pages, with 67 illustrations—calling attention to the im-

portance of meter maintenance and to the exhibit of the meter committee on the Pier. In discussing the report Mr. J. W. Cowles, of Boston, touched upon the importance of accuracy in meter tests on the system. Mr. C. D. Haskins, Schenectady, praised the work of the committee in preparing this exhaustive pamphlet. Others taking part in the discussion were Mr. J. T. Hutchings, of Rochester, N. Y.; Mr. Eichert, of Brooklyn; Mr. C. G. Durfee, of Rochester, and Mr. Samuel Insull, of Chicago. Mr. Insull spoke of the importance of meter first cost in connection with the use of tungsten lamps in small apartments.

Mr. Torchio, of New York, then presented his paper on "The Future Requirements of Central-Station Companies," which was discussed briefly by Mr. Insull, who pointed out the importance of securing a high-load factor by the combination of different classes of loads upon the station.

The paper of Mr. E. W. Allen, of the General Electric Company, Schenectady, on "Some Recent Developments in Electrical Apparatus," was then read by Mr. Stone, and followed by the paper of Mr. E. G. Reed, of the Westinghouse Electric & Manufacturing Company on "Distributing Transformers as of Interest to Central Stations." These papers were discussed by Mr. W. S. Moody, of Schenectady; Mr. H. W. Peck, Rochester, N. Y.; Mr. Ives, of Poughkeepsie; Mr. D. B. Rushmore, Schenectady, and Mr. M. A. Sammett, Montreal.

THE GREAT BASEBALL GAME.

With all the excitement and much more than the fun of a professional game the baseball championship of the association, for this year at least, was decided on Wednesday afternoon at the Atlantic City grounds in the presence of a thousand electrical "fans." Teams representing the East and the West



BASEBALL TEAMS—EASTERN ELECTRIFIERS AND WESTERN WINNERS AT ATLANTIC CITY.

battled for supremacy, and the West won by a score of 8 to 7. There was every accessory of an everyday league contest, with several others that were never dreamed of in professional baseball. The band of music and the policemen were genuine, but the fantastically attired coaches were costumed in a manner wonderful to behold. The players were in uniform, and every person present was a "rooter" either for the East or the West, red paper carnations distinguishing the West, and that unusual flower, the blue carnation, the East. Conspicuously displayed near third base was a large keg, apparently containing real beer, with a flaring placard announcing that it was presented with the compliments of a brewing company. A "fake" fight created uproarious laughter, and the belligerent "fans" were forcibly removed from the grounds by the police. A fine brass watch concealed in a bouquet of carrots was presented to Manager F. W. Frueauff of the Western team, and Manager F. G. Vaughen, of the Eastern nine, was similarly honored with a two-ounce "sparkler." Messrs. H. L. Doherty and Chas. R. Huntley were honorary umpires, but with rare discretion they did not have much to say, a professional making the actual decisions.

The two teams played to win, and the game was closely contested. The Westerners took the lead at the start, but when the East tied the score in the first half of the fourth inning there was tremendous excitement and cheering. Again the West forged to the front, and again in the seventh the East tied the score in the first half of the inning. Now the feeling ran high indeed, for it had been agreed that the game should be called at the end of the seventh inning. The crowd swarmed on the grounds, and there were continuous shouts of encouragement to the players, which culminated in a roar of cheers for the West when Mr. J. C. Manley, of Chicago, won the game for the Western team by driving in the winning run with his trusty bat. But one accident marred the afternoon's enjoyment, and that was when Mr. L. P. Sawyer, of Cleveland, catcher for the Western team, was forced to retire from the field in Umpire Doherty's automobile with an injured hand. A feature of the game was the batting of Mr. J. E. Davidson, of Montpelier, Vt., for the Eastern nine. The names of the players are as follows:

Effulgent Eastern Electrifiers—Mr. Kennedy, 2b.; Mr. McMaster, ss.; J. E. Hodgson, 3b.; Mr. Agnew, l.f.; A. E. Hitchner, c.; Mr. Garrett, p.; F. E. Vaughen, 1b.; J. E. Davidson, c.f.; R. B. McCreery, r.f.

Windy Western Winners—B. F. Dalgleish, 3b.; J. J. Miley, 2b.; P. S. Dodd, c.f. and c.; R. A. Brooks, 1b.; T. H. Ward, ss.; H. H. Scott, r.f.; J. C. Manley, l.f.; H. H. Cudmore, c. and c.f.; L. P. Sawyer, c.; H. C. Glaze, p.

The score by innings was as follows:

East	0	0	0	2	2	0	3	—7
West	2	0	0	4	1	0	1	—8

SECRETARY AND TREASURER'S REPORT.

At the evening session of Wednesday the report of the secretary and treasurer was presented by Mr. John F. Gilchrist, who said that the main object of the National Electric Light Association may be briefly expressed by the statement that it is to safeguard the many millions of dollars of capital invested in electric light and power industries and undertakings in America. The association includes in its membership representatives of a large percentage of the total investment in the electric light and power field in the United States; but there is still a large number of the smaller companies which are not members. During the year 22 company branches, with membership of over 1500, have been formed. The figures of membership showing growth during the year are as follows:

	1908.	1909.
Class A	680	728
Class B	422	2,152
Class D	166	203
Class E	93	132
Total	1,361	3,215

Three important standing committees were created by President Eglin—lamp committee, finance committee and library committee. The solicitor's hand-book has been edited and published. Secretary Gilchrist particularly commended the work of the meter committee and the public policy committee at this convention and the efficient labors of Miss Harriet Billings, assistant secretary.

ELECTRICAL SECURITIES.

The Wednesday evening session was in some respects the most important of the convention. Following the secretary's report came an address by Mr. Frank A. Vanderlip, president of the National City Bank of New York, which dealt with central-station securities from the viewpoint of the large financier and which was valuable both to the large and small companies represented. Mr. Vanderlip's address, which was brief and to the point, is presented in abstract elsewhere in this issue.

The next speaker was Mr. Thomas N. McCarter, president of the Public Service Corporation of New Jersey, who expressed appreciation of Mr. Vanderlip's courtesy in coming to Atlantic City and addressing the convention. That a man of Mr. Vanderlip's unquestioned eminence in the financial world should appear before the National Electric Light Association convention must be considered cause for greatest congratulation by all its members. As for himself, he thought that the sooner public-service companies get through with high-finance methods

and settle down to hard-pan operation on a steam-railroad basis the better for all.

President Chas. A. Coffin, of the General Electric Company, was then called upon, and his appearance was greeted with much applause. He spoke feelingly of his affection for the men present, all of whom had assisted in building up this great electric lighting and power industry. He had seen it grow from commercial lighting of a few downtown stores and saloons to the supply of nearly all the electric light and power needs of a great community, until no gentleman's home is now complete without at least several applications of electricity in addition to electric light. The assurances of Mr. Vanderlip, he said, should be a vast encouragement to those present. He cited the magnificent examples afforded by the properties built up by President Insull, of the Commonwealth Edison Company of Chicago; President McCarter, of the Public Service Corporation of New Jersey, and President Edgar, of the Edison Electric Illuminating Company of Boston, upon which properties there were millions of dollars in securities all coming within the high standards set up by Mr. Vanderlip. Furthermore, the work which had been carried on in these great centers is now being extended to the small hamlets of the country, which are being interconnected by transmission lines and brought into consolidated distributing systems.

Mr. Samuel Insull, president of the Commonwealth Edison Company of Chicago, said that he had found it easier and easier to get the money with which to finance central-station development each year, thus indicating the improving regard in which securities of this kind are held. He said that if central-station men would only profit by Mr. Vanderlip's address and consolidate their properties so as to both make them more secure and operate them more economically they could get a higher price for their securities or, in other words, would have to pay a less rate of interest.

The trend of the evening's discussion on this subject and of Mr. Vanderlip's address was to bring out the advantages to be gained from a financial point of view by the consolidation of numerous small properties under the ownership of one company.

OTHER ADDRESSES.

This discussion on finances was followed by an address by Mr. George S. Graham, of Philadelphia, on the "Electrical Industry." This was of an oratorical and historical nature, dealing with the development of electric science from the earliest times.

Mr. Everett W. Burdett, of Boston, thanked the speakers of the evening and indulged in some interesting reminiscences of the electrical business. In relation to the official regulation of public-service companies by commission he thought that this regulation had much to do with the present high standing of the securities of the Edison Electric Illuminating Company of Boston. This regulation as carried on in Massachusetts is a safeguard to the investor.

PUBLIC POLICY.

The committee on public policy made its report through its chairman, Mr. Samuel Insull, of Chicago. After reading a part of this report (which is abstracted elsewhere) and giving an outline of the remainder of the volume, Mr. Insull said:

"The only other subject that would seem to be of interest to our members, but which the committee thought it better not to mention in the report, is the signs that are becoming somewhat apparent in different parts of the country, of a tendency on the part of some of the electric manufacturing companies to raid the securities of our member companies by fostering the formation of opposition electric illuminating and power companies. I do not care whether the excuse is made that it is an effort to sell their apparatus, or whether you call it by the term that I have used, 'raiding our securities,' or whether you pick out an uglier name which I will not mention, the fact remains that those who have been in this business for a number of years look with great alarm at any tendency of the manufacturing companies in this direction.

"I first asked the president to consider the public policy report in executive session, but during the speech delivered by Mr. Graham I told him that if he agreed with me I would prefer that it should be considered in public session. My object in suggesting that was that necessarily there are representatives of the manufacturers present and I want them to hear what I have to say. The worst thing that they can possibly do is to start in and try to 'kill the goose that lays the golden egg,' and we happen to be the 'goose.' (Applause.) It has been stated here to-night on good authority that we have invested in our business a billion of dollars. I presume it would be fair to state that there is hardly as mush as one-third of that amount invested in the electric manufacturing business of the country. How is that, Mr. Coffin?"

Mr. Coffin: "About $300,000,000."

Mr. Insull: "I think that is naming a liberal amount. Now, if the investors of that $300,000,000 want to pull the house down over their heads, the best way and the quickest way for them to do it is to pursue a policy in selling their goods which will throw discredit on the billion dollars invested in our side of the business. I am speaking whereof I know. I understand that there is a well-defined plan to start this campaign in as it used to be carried on 20 or 25 years ago in the smaller communities of the country; but they are after larger game. The excuse made is, 'We do it because we cannot sell our goods any other way.' We have had fortunately very little of that kind of thing to deal with lately in the public policy committee. It was a well-defined policy of certain of the electric manufacturing companies 15 or 20 years ago. Many of us know that to our cost. I think that it is only fair that as an organization we should serve notice on some of the gentlemen who are responsible for the operation of several of the large electrical manufacturing companies, and who have not the benefit of the experience of 10 or 15 years ago, that such a course, while it might temporarily affect the values of our securities, must inevitably react on the manufacturing companies and must array against them, whether by organized effort or by spontaneous action, a thousand millions of capital invested in the electric illuminating business in this country. (Applause.)

"I had intended to ask to-night to be relieved of any further connection with the public policy committee, but with the possibility of such a movement coming to a head, I hope that I will have the privilege of serving this association in some capacity in connection with the public policy work during the ensuing year." (Applause.)

NOMINATING COMMITTEE.

The convention then went into executive session and heard the report of its insurance expert, Mr. W. H. Blood, Jr. A nominating committee was elected consisting of Messrs. N. F. Brady, of New York; W. J. Barker, of Denver; S. H. Conklin, of Scranton; C. H. Hodskinson, of Boston, and Charles R. Huntley, of Buffalo.

TECHNICAL SESSIONS.

The first technical session was held on Thursday morning. The president was obliged to leave the meeting soon after it began, and Vice-Chairman W. F. Wells, of Brooklyn, took charge.

In the absence of Chairman J. B. Klumpp, the report of the committee on gas engines was read by Mr. I. E. Moultrop, Boston. This report is an exhaustive document of 114 pages, containing four tables and 37 illustrations bearing upon modern gas-engine practice in a considerable number of installations. Mr. Moultrop reviewed this report and said that in addition to the material printed the committee had secured a large amount of operating data, which will be submitted in a supplementary report at some later time. Those who took part in the discussion were Messrs. M. R. Bump, New York, George R. Stetson, of New Bedford, Mass., F. F. McClure, Lawrence, Pa., and Mr. Moultrop. The general opinion was that the gas engine proper is a thoroughly reliable machine when supplied with the proper kind of gas. The producer plant offers the chief [illegible] at present. Special training is necessary

before a man accustomed to stoop-bodied living can be turned loose into a producer plant.

The next paper, "Some Features of Condenser and Cooling Tower Design and Operation," was read by the author, Mr. M. R. Bump, of New York. It was discussed by Mr. A. R. Cheyney, of Philadelphia, and Mr. H. C. Abell, of New York. The advantages of different types of condensing apparatus were considered at length.

Mr. P. Junkersfeld, of Chicago, read his paper, "The Use of Reactance Coils in Generating Stations." An extended discussion took place, participated in by Messrs. A. S. Loizeaux, of Baltimore; Mr. W. L. R. Emmet, of Schenectady, and Dr. C. P. Steinmetz, of Schenectady. All agreed that the use of these coils is a valuable and necessary precaution in large stations, and in plants of very large capacity it is desirable to install oil switches in sections of the busbars to provide a degree of protection which the reactance coils themselves cannot furnish.

The paper "Some Unique Features of Power House Design and Operation" was read by title by the author, Mr. G. L. Knight, of Brooklyn. There was no discussion.

The paper "Efficiency of Motor Generators and Synchronous Converters" was read by the author, Mr. F. M. Farmer, of New York, and discussed by Messrs. W. L. Waters, of Pittsburgh; L. L. Elden, of Boston; P. Torchio, of New York; J. L. Burnham, of Schenectady, and Mr. C. W. Stone, of Schenectady. The consensus of opinion was that the split-pole rotary stands in need of considerable improvement, and that there is not as much difference between the value of the motor-generator and rotary converter in central-station service as would appear from efficiency tests upon individual machinery.

"Recent Improvements in Transformers" was the subject of a paper read by the author, Mr. W. A. Layman, of St. Louis, and discussed by Dr. C. P. Steinmetz, of Schenectady; Mr. W. G. Reed, of Pittsburgh, and Mr. W. S. Moody, of Schenectady. The value of silicon steel was commented upon and the desirability of permitting greater magnetizing currents was emphasized. In conclusion Mr. Layman protested against the incorporation of 5 minute to 30 minute insulation tests in modern specification writing.

The paper "Low-Pressure Steam Turbines" was read by the author, Mr. C. H. Smoot, of New York, and discussed by Mr. C. B. Burleigh, of Boston, and Mr. Dreyfus, of Pittsburgh.

The second technical session opened on Thursday afternoon with a report of the committee on protection from lightning. This committee consists of Messrs. B. E. Morrow, of Albany, N. Y.; H. B. Gear, N. J. Neall, O. A. Honnold and J. F. Vaughan. The subject was discussed at some length by Mr. D. B. Rushmore, of Schenectady, and by Mr. Percy Thomas.

The report of the committee on "Overhead Line Construction" was read by its chairman, Mr. Paul Spencer, of Philadelphia. A paper entitled "Recent Developments in Secondary Distribution Work," by W. K. Vanderpoel, of Newark, N. J., was also read. Mr. A. S. Ives, of Poughkeepsie, N. Y., followed with a paper on "Requirements and Specifications for Extra High Potential Transmission Lines." The three previous papers were then discussed together. The discussion was participated in by Messrs. Farley Osgood, of Newark, N. J.; Wilkinson, of Schenectady, and others. At the close of this discussion, on motion of Mr. G. H. Lukes, of Chicago, it was voted to instruct the incoming president to appoint a special committee on the preservation by treatment of poles and cross-arms.

The report of the committee on "Grounding of Secondaries" was read by its chairman, Mr. W. H. Blood, Jr., of Boston. This report defended the action taken at the committee's recommendation last year in passing a resolution in favor of requiring the grounding of secondaries where the potential between any wire and ground would not be over 150 volts and prohibiting grounding when such potential would be over 150 volts. This brought out a lively and extended discussion over the point of prohibiting grounding where the potential of any wire would be over 150 volts to ground. Remarks adverse to this prohibition were made by Messrs. P. Junkersfeld, of Chicago; Philip Torchio, of New York; C. P. Steinmetz, of Schenectady; M. O. Troy, of Schenectady; George H. Lukes, of Chicago, and J. R. Cravath, of Chicago. Mr. L. L. Elden, of Boston, a member of the committee, defended its report. In view of the very evident sentiment against the prohibition of grounding above the 150-volt limit, Mr. Dudley Farrand moved that the report of the committee be accepted as to the grounding of circuits under 150 volts, but that a prohibition of grounding above 150 volts be not concurred in by the association, but referred back to the committee for further consideration. A report of the discussion following the presentation of this report will be found on page 1472.

Messrs. Spencer, of Philadelphia, and Lukes, of Chicago, suggested that since water pipe grounds were admittedly the best, and since water-works authorities seemed inclined to oppose such ground connections, the N. E. L. A. take some official action and communicate it to water-works associations. In order to put such action on record, Dr. Steinmetz moved that it be the sense of the National Electric Light Association that by far the best method of grounding is by connection to water pipes; that grounding is necessary for the safeguarding of life, and that by the connection of ground wires to the water pipes for protection no harm can come to the pipes by electrolysis. This was unanimously carried.

Mr. W. L. Waters, of Pittsburgh, read his paper on "Performance, Specification and Ratings," calling special attention to errors in rating of machinery at 100 per cent power factor. This was discussed by Messrs. Torchio, of New York; S. D. Strong, of New York, and H. L. Wills, of Savannah, Ga.

"Central Stations in Towns of Less than Four Thousand People" was the title of a paper read by Mr. J. S. Knowlson, of Schenectady, which took up in an interesting way some of the small central station problems seldom treated before the N. E. L. A. This was discussed by Messrs. E. D. Dreyfus, of Pittsburgh, and L. L. Elden, of Boston. This concluded the technical sessions.

COMMERCIAL SESSIONS.

The commercial program was opened in a parallel session on Thursday morning, with Mr. W. W. Freeman, of Brooklyn, as chairman. The first paper was one by Mr. W. H. Atkins, of Boston, entitled "Methods of Introducing Tungsten Lamps and Their Effffect on Central-Station Income." This was a compilation of information from various central stations on this subject and was read in abstract only. Discussion on this paper was participated in by Messrs. M. S. Seelman, of Brooklyn; J. T. Hutchings, of Rochester, N. Y.; Douglas Burnett, of Baltimore; J. F. Davidson, of Montpelier, Vt.; H. W. Hillman, of Grand Rapids, Mich.; Joseph D. Israel, of Philadelphia, and R. M. Searle, of Rochester, N. Y.

"Practical Illuminating Engineering in Connection with a Commercial Department" was the subject of a paper by Mr. G. A. Sawin, of Newark, N. J. Messrs. J. D. Israel, of Philadelphia; F. E. Smith, of Boston, and C. N. Stannard, of Denver, discussed the paper.

Mr. John C. Parker, of Rochester, N. Y., gave a paper on "Intensive Methods of Business Development," which told how a force of specialists had been brought together for the engineering problems of the commercial department, each man being a specialist in some line. These methods were discussed and indorsed by Messrs. E. W. Lloyd, of Chicago; Graves, of Brooklyn, N. Y.; H. W. Hillman, of Grand Rapids, Mich.; Mr. Jones, of New York, and Mr. Stevens, of Brooklyn. Mr. George N. Tidd, of Philadelphia, and Mr. R. M. Searle, of Rochester, N. Y., also made contributions to the discussion.

The next paper was on the subject, "Can a Display Room Be Conducted on a Profitable Basis?" As Mr. Frank B. Rae, Jr., the author of this paper, was unable to read it because he was hoarse from cheering at the ball game the day before, it was abstracted by Mr. J. F. Becker, of Brooklyn.

Mr. C. N. Stannard, of Denver, presented a paper on "Advantages to Be Derived from Uniform Commercial Department Forms and Methods." This closed the first commercial session.

The second commercial session (Thursday afternoon) was

called to order by Vice Chairman Percy Ingalls. Chairman Freeman coming in soon afterward.

The first paper, "Electricity for Domestic Purposes," by Mr. M. E. Turner, of Cleveland, was read by the author, and discussed briefly by Mr. H. W. Hillman, of Schenectady.

Three papers, "Compilation of Load Factors," by Mr. E. W. Lloyd, of Chicago; "Electric Power," by Mr. H. J. Gille, of Minneapolis, and "The Advantage of Group or Individual Drive," by Mr. C. A. Graves, Brooklyn, were discussed simultaneously. Mr. Gille said that the committee has in its possession about 100 typical load curves of different industries. Mr. H. W. Peck, of Rochester, N. Y.; Mr. E. W. Penrose, of Tyrone, Pa.; Mr. H. C. Alvord, of Long Island City; Mr. E. F. McCabe, of Lewistown, Pa., and Mr. Samuel Insull, of Chicago, together with Mr. Harold Almert, of Chicago, and Mr. Myers, of Philadelphia, discussed the paper. The importance of obtaining as high a low factor as possible, was recognized by all the speakers, as was the necessity of settling upon a standard definition of the term. Mr. Insull gave a valuable discussion of the manner in which the load factor of a small central station may be improved by securing electric pumping and interurban railway business.

Mr. Arthur Williams, of the New York Edison Company, then read his paper, the "New York High-Pressure Water System," and pointed out the value of an electrically driven fire pumping service to both the community and the central station.

A timely paper was that on "Relation of Electric Vehicles to Central Station Business," read by the author, Mr. James T. Hutchings, of Rochester, N. Y., who introduced his remarks by thanking the technical press for the light which it has thrown upon this subject on behalf of the central-station man. A prolonged and enthusiastic discussion of this subject then took place, in which it was generally recognized that a great future awaits the advent of the electric vehicle in general commercial and pleasure service. Vehicles are much improved to-day as compared with the equipment of a few years ago. The economies over the cost of horse traction are indisputable, and can be shown by figures drawn from hundreds of cases in practice. It is desirable to reduce the rates for electric-vehicle charging to as low a point as possible. There is still room for the education of vehicle users in the proper care of this class of equipment, and its maintenance cannot safely be neglected. The central station itself should specialize this class of work by employing one or more solicitors practically all the time in this field. The paper was discussed by Messrs. Day Baker, of the General Vehicle Company, Boston; Frank J. Stone, of the Electric Storage Battery Company, Boston; Newman, of the Woods Motor Vehicle Company; C. D. Hibler, of Rochester, N. Y.; Rice, of Indianapolis; W. P. Kennedy and J. H. Vail, of the Studebaker Company, New York; F. M. Tait, of Dayton, Ohio, and T. Commerford Martin, editor of *Electrical World*.

At the Friday morning commercial session the first feature was the reading in abstract of a paper on "The Adoption of Electric Heat for Industrial Purposes," of which Mr. Charles J. Russell, of Philadelphia, was editor. This paper contained information compiled from a number of companies on this subject.

A paper on "Electricity for National Advertising," by Mr. George Williams, of New York, was presented in abstract, the author not being present. This was discussed by Messrs. T. I. Jones, of New York; H. J. Gille, of Minneapolis; W. H. Gardner, of New York; C. N. Stannard, of Denver, and Frank M. Tait, of Dayton.

"The Development of Revenue from Existing Customers" was the subject of a paper by Mr. Theo. I. Jones, of New York, which was discussed by Messrs. H. J. Gille, of Minneapolis; Jos. F. Becker, of Brooklyn, and C. N. Stannard, of Denver.

The chairman announced at this point that the convention would listen to an address on a general commercial subject, such having been a custom established last year as a part of the commercial program. This address was given by Hon. Frank Bergen, of New Jersey, and was full of philosophical meat on the general subject of the pursuit of riches and its relation to the general public. The convention then went into executive session to transact its concluding executive business.

ELECTION OF OFFICERS.

On the report of the nominating committee the following officers were elected:

President—Mr. Frank W. Frueauff, Denver, Col.

First Vice-President—Mr. W. W. Freeman, Brooklyn, N. Y.

Second Vice-President—Mr. John F. Gilchrist, Chicago, Ill.

Secretary and Treasurer—Mr. Frank M. Tait, Dayton, O.

Members of the executive committee, to serve until July 1, 1912—Mr. Charles A. Stone, Boston; Mr. Dudley Farrand, Newark, N. J.; Mr. H. M. Byllesby, Chicago, Ill.

President-elect Frueauff was escorted to the chair, and made a few remarks to the effect that the active policy of the present administration in extending the usefulness of the association would be continued.

The new president of the National Electric Light Association, Mr. Frank W. Frueauff, was born at Columbia, Pa., on March 24, 1874. Seven years later his parents removed to Leadville, Col., and he received his education and early training in the



PRESIDENT F. W. FRUEAUFF.

western state. In 1891 he began his engineering career by entering the service of the Denver Consolidated Electric Company as meter reader and lamp clerk. His advancement was rapid, and in 1899 he was elected secretary of the Denver Gas & Electric Company on the organization of that powerful and progressive corporation. In 1904 he become its vice-president and general manager, and to him must be attributed much of its success. "Busy Frank" is a local epithet that fits the case very well.

This brief sketch of his commercial and professional relations by no means completes the record up to date, for he is also vice-president of the Pueblo (Col.) Gas & Fuel Company, the Lincoln (Neb.) Gas & Electric Light Company; the Lebanon (Pa.) Gas & Fuel Company and the Doherty Operating Company. He is also treasurer of the Summit County (Col.) Power Company, secretary of the Lacombe Electric Company, and partner in the financial and engineering firm of Henry L. Doherty & Company, as well as a director of the Massillon (Ohio) Electric & Gas Company.

In connection with all these interests in the electric and gas fields, Mr. Frueauff has taken an active and public-spirited part in the work of the national bodies representing them. He did much to make a success of the recent Denver convention of the National Electric Light Association, of which he has lately been serving as first vice-president. He is a past-president of the National Commercial Gas Association, and is also a member of the American Gas Institute and the Colorado Light, Power & Railway Association. His social leanings are indicated by his membership in the Lawyers' Club of New York, the Denver Club, the Denver Athletic Club, the Denver Country Club and the Overland Country Club of Denver, the Sons of Descendants of Lake Shore

OTHER EXECUTIVE BUSINESS.

Mr. Dudley Farrand introduced a resolution, which was unanimously carried, thanking Mr. W. D. Weaver, editor of the *Electrical World*, for the library contributed to the association. President Eglin expressed the hope that this gift of Mr. Weaver would be an incentive to others to contribute literature of a permanent value to the association.

Mr. Arthur Williams introduced a resolution thanking the various committees which made the convention such a success.

Mr. Henry L. Doherty, as chairman of the committee on the president's address, presented his report, and commented on the fact that the total membership of the association had been doubled during the administration of President Eglin, and said that the recommendations in the president's address, if carried out, will enable the association to accomplish the following desirable things: (A) Reach every part of the country and every company by means of State and geographical sections. (B) Reach every branch of the business, such as accounting, commercial, engineering, etc., by means of the national special sections. (C) Reach every man by means of the company sections. (D) Supply every need for the interchange of information by means of national conferences on special subjects.

Mr. H. M. Edwards, as chairman of the committee on uniform accounting, reported that the report of his committee, which had been made at the first general session of the convention, had been thoroughly discussed in the accounting sessions and approved, and he asked that the association formally adopt the recommendations in the report as to the classification of construction and equipment accounts. After some discussion it was voted to refer this report to the executive committee with power to adopt it, as it was not felt that the convention could intelligently vote on this report on account of the limited time given for its consideration.

Mr. T. C. Martin introduced a resolution, which was adopted, thanking the officers of the association for their conduct of the business of the association, which has brought about the wonderful growth of the past year. Mr. Frank W. Frueauff, chairman of the general convention committee, moved a vote of thanks to the local members of the convention committee, who, as he put it, "did the real work" of preparing for the convention. The executive session was then adjourned.

ACCOUNTING SESSIONS.

The first of the accounting sessions was called to order by Mr. Frank W. Frueauff, Denver, on Thursday morning, who called Mr. H. M. Edwards, New York, to the chair. The report of the committee on uniform accounting, which had been presented at the general session on Tuesday and referred to the accounting session, was again presented in abstract by Mr. Edwards. This report was discussed by a number of the delegates, and adopted. The action of the accounting session regarding the report of this committee was reported to the general session on Friday, as noted above. The report was referred to the executive committee with power to act.

Before presenting the report of the committee for discussion Mr. Edwards said that there had been an accounting committee for three years, and its work had developed that the most unusual and surprising differences in methods existed among the various member companies. It must be evident that all of these methods could not be right, and the committee wanted to see that the best were selected. In most companies it had been found that much of the accounting work was done outside of the accounting department. That was not economical. The accounting departments were equipped to do this work and should be in a position to furnish information whenever it was needed.

Mr. E. J. Allegaert, Newark, N. J., read his paper on "Branch Office Accounting." Mr. L. M. Wallace, Boston, then presented his paper on "Customers' Accounts, Including the Handling of Meters in Their Financial Aspect." The papers of Mr. Allegaert and Mr. Wallace were discussed together. At the conclusion of this discussion an adjournment was taken until afternoon.

When the session convened on Thursday afternoon Mr. W. E. Freeman, New York, read his paper on "Pay-roll Problem in the Electric Light Industry." It was followed by discussion. Mr. J. L. Baily, Baltimore, then read his paper on the "Care and Handling of Supplies," and it was followed by considerable discussion of various points of practice. Mr. H. R. Kerr, Philadelphia, read a paper on "Cost Accounting." The discussion on this paper included accounts of working-order systems. Mr. George W. Claflin, Boston, presented his paper on "Depreciation Accounting for Small Companies." This valuable contribution brought out accounts of other experience with the important subject of depreciation. Adjournment was then taken in the accounting section.

MEETING OF ASSOCIATE MEMBERS.

At noon on Wednesday, a meeting was held of the exhibitors in one of the smaller convention halls, when no fewer than 4 companies were represented by one or more officials. Mr. F. H. Gale presided as chairman of the exhibition committee. A very cheerful spirit pervaded the meeting on account of the great success of the show and the excellent financial condition. Mr. Gale spoke of the hearty co-operation of the association and pointed to the success of the plan of combining the opening of the exhibit with the "reception" under one roof, as the first night function, as contrasted with the plan of the Street Railway Association of separating these affairs. The improvement resulting was notable. Mr. Gale stated that the committee had held six meetings, and he called attention to the work done and the various responsibilities assumed in providing also for the meeting halls of the association, secretarial office, etc. Much credit was due to Mr. Paul M. Bauder for his taste and skill in the illuminations. The report of Treasurer H. M. Post showed a balance of about $1,500 this year, added to $900 from last year. The space sold amounted to $8,38[illegible]. Secretary W. Neumuller showed an increase from 41 to [illegible] in the number of exhibitors, 83 booths as compared with 5[illegible] and 10,800 sq. ft. provided as compared with 10,800. Outside the regular committee meetings, the chairman and secretary held several meetings in New York and Atlantic City. A nominating committee was then appointed of Mr. J. M. Wakeman as chairman, and Messrs. Ayer and Hunting, and on its report Messrs. Gale and Doane were elected to succeed themselves. Mr. H. W. Young was made a member of the committee, and Mr. H. G. McConnaughy was elected to fill the place of Mr. B. Wall for an unexpired term of two years. The exhibition committee as a whole then went into executive session and reëlected Chairman Gale, Treasurer Post and Secretary Neumuller for their respective positions. It was decided for general benefit and convenience to keep the exhibit open until 10:30 p. m., Friday, although the sessions closed in the afternoon.

CONCLUDING SESSION OF THE CONVENTION.

Much interest in the problems of isolated plant competition and steam heating marked the final session of the convention on Friday afternoon, which was also the end of the commercial program. The paper of Mr. T. I. Jones, New York, on "The Development of Revenue from Existing Customers," was first discussed. Those taking part in the discussion were Messrs. M. C. Osborne, Spokane, Wash.; Joseph A. Sutton, Baltimore; E. F. McCabe, Lewistown, Pa., and Douglas Burnett, Baltimore, Md. The discussion centered about the placing of flatirons on a free trial, a point of value being the introduction of flatirons to the housewife by the meter reader at the psychological moment, which is when the monthly reading is being made.

President Eglin took occasion to praise the quality and manner of preparation of the commercial papers, and expressed his personal thanks to Mr. Percy Ingalls, vice-chairman of the commercial session. Mr. Ingalls then took the chair.

Mr. R. S. Orr, Pittsburgh, then read his paper on isolated plants, which was discussed by a number of members, including Messrs. Joseph McKinley, Pittsburgh; H. W. Peck, Rochester, N. Y.; T. I. Jones, New York; E. W. Lloyd, Chicago; Paul Mueller, Erie, and M. F. McAlpin, New York. The discussion was largely devoted to the difficulties of competing with engine

in isolated plants driven by illuminating and natural gas. It was the general opinion that natural gas is a most formidable competitor of the central station dependent upon coal. With a rate of 4 cents downward, however, there is a good prospect of competing with illuminating-gas engines. The central station has in the tantalum and tungsten lamp a valuable weapon with which to produce economies in existing isolated-plant installations.

The next paper, "Central Station Operation of Steam Plants," was read by the author, Mr. S. M. Bushnell, Chicago. It was discussed by Messrs. Paul Mueller, Erie, Pa.; H. A. Denman, Detroit; Arthur Williams, New York; J. C. Brooks, Philadelphia, and J. F. Gilchrist, Chicago. This appears to be a growing branch of central-station service, and cannot be neglected where large business is sought.

The last paper of the session was read by Mr. A. L. Eustice, Pittsburgh, on "The Effect of Various Conditions of Maintenance on the Efficiency of Illumination." It was briefly discussed by Mr. E. L. Elliott, New York.

A pleasant feature of the session was the decoration of President-elect Frueauff with the badge of his new office by the retiring president, Mr. Eglin, who congratulated the new president on the character of the organization of which he is now the head. The convention was finally adjourned at 4:40 p. m. on Friday.

Convention Notes.

President Eglin manifested praiseworthy promptness in opening and closing sessions, and everything was run on schedule time.

During the evening session of Tuesday all the lights went out suddenly, and President Eglin created some amusement by saying: "Gentlemen, this is a private plant."

Among former presidents in attendance were Messrs. James I. Ayer, Samuel Insull, H. L. Doherty, E. A. Armstrong, Dudley Farrand, W. H. Blood, Jr., C. L. Edgar and Charles R. Huntley.

On Thursday evening 22 gentlemen connected with the Stone & Webster companies met at an informal dinner at the Hotel Chalfonte. Mr. W. H. Blood, Jr., representing the organization, was the host.

On Tuesday evening there was a slight fire in the St. Charles Hotel, where many convention people were guests. There was some excitement, but the fire was quickly extinguished, and no one was injured.

One of the pleasing features of the entertainment provided by the convention committee was ocean sailing. Informal parties were made up as time permitted, and roomy sail-boats were always at their disposal at the Inlet.

In front of the meeting hall, on the Million Dollar Pier, is a pool where a number of seals disport themselves, and the barking of these animals could be heard occasionally above the voices of the gentlemen engaged in the convention discussions.

Miss Edith M. Myers, of New York, was in charge of the registration bureau, as usual. She said that her duties were more onerous than at previous conventions, owing to the steady stream of visitors, there being no cessation on Wednesday, as in previous years.

Mr. Farley Osgood, of Newark, N. J., general superintendent of the Public Service Corporation, is authority for the statement that his company was represented by no less than 200 men sent to the Atlantic City convention. Of these 40 came from Mr. Osgood's individual department.

There was considerable speculation as to the location of the next convention. Rochester, Detroit and Denver were mentioned, the city first named being especially active in its efforts. The matter will be decided by the executive committee, following the usual convention. It would not be surprising if a Western city were chosen.

Mr. Dudley Farrand, of Newark, N. J., former president of the association, in his report as official representative on the national conservation commission, recommended that member companies practice the closest possible economies in routine operation. He said that there is more to be gained by economical use of natural resources than there is in effort to replace what has been wasted.

Thursday evening's entertainment feature was a "Café Chantant" in Marine Hall, Million-Dollar Pier. The interior of the auditorium was attractively decorated, the flags of all nations being conspicuous. Small tables were scattered about the floor, and refreshments were served. A large portion of the audience found room in the gallery. A vaudeville performance of several numbers was given. The music, by an orchestra under the direction of Henry Conrad, was good.

The Rochester (N. Y.) Railway & Light Company was represented by as many as 22 of its officers and staff, six of whom were accompanied by ladies, but the curious fact was that they did not all come as one party. Vice-President Searle explained that as accidents were still possible on railways, and as it was not desired to have the whole executive swept away at one blow, it was deemed better to divide the representation up into several traveling units, going and coming. The trip in a private car would be very agreeable, but "was not good business."

One innovation at the sessions of the convention was the distribution of "discussion notices." These were printed cards announcing that each speaker on rising was expected to announce his name and home city to the chair. Every person entering the hall was given one of these cards. On the back was a space for the name, company, city, Atlantic City address, and paper discussed. These blanks were to be filled in by any person taking part in a discussion, so that if the stenographer heard the name indistinctly a written record would be available for him.

Mr. George F. Porter is to be congratulated on the general success of his work as master of transportation, all the special trains and other arrangements being well run and well patronized. It is an arduous task, but not one could undertake it with more pleasure or enthusiasm. As former secretary of the association, Mr. Porter made a fine record, and he now remains one of its most loyal and devoted servants, giving time and thought freely for its welfare. There was only one element of sadness in the whole affair, and that was the absence of Mr. C. O. Baker, Jr., who under the Porter régime was the transportation manager, and who, it was reported, lay dangerously ill at his home in Newark.

On Thursday luncheon was given to the technical press, represented by Messrs. C. W. Price, J. M. Wakeman and T. C. Martin, in recognition of the work done to promote the welfare of the association. A long table was laid in one of the dining-rooms, and decorated with flowers, and in addition to the guests the following participated: Messrs. W. C. L. Eglin, S. Insull, C. L. Edgar, C. R. Huntley, W. H. Blood, D. Farrand, H. L. Doherty, F. W. Frueauff, E. A. Armstrong, N. F. Brady, T. E. Murray, A. Williams, J. F. Gilchrist, W. W. Freeman, F. W. Smith, T. N. McCarter, E. W. Rice, Jr., J. R. Lovejoy, R. A. Carter, W. J. Sefton, H. M. Edwards and A. J. De Camp. A couple of hours were spent very agreeably. Mr. Williams proposed the health of the guests, and Mr. Martin replied.

Several of the larger companies availed themselves of the convention to get their men together in separate conference, and the most notable example was that of the holding concern, the Susquehanna Light & Power Company, which held a special convention of its own on Friday afternoon and Saturday. A regular program was provided of papers and discussions, with a "Question Box." Some 30 men were present, including President George Bullock, Assistant to the President E. F. Witherby,

Secretary and Treasurer A. S. Cooke, the president's secretary, H. Morgan, Engineer G. K. Dustin, Manager Commercial Department A. V. Wainright, Manager Industrial Department H. L. Sterrett, and Advertising Expert F. E. Schornstein. The others were leading officials of the companies operated.

Mr. W. H. Harding, who was secretary of the association at a very early stage of its life, was at Atlantic City during the week and was literally stunned by the marvelous growth to 3200 members. He remembered the time when with great effort and pride he managed to lift it from 30 to about 125 members. He found but few of the veterans left, and was struck with the large proportion of young men. He was much impressed with the magnitude and efficiency of the work done at the convention by Miss Billings, as assistant secretary, and her staff.

The past presidents of the association are becoming numerous, and it is a good sign of healthy, sustained interest that so many are present. This year they numbered nine, including Messrs. Huntley, Insull, Armstrong, Blood, Edgar, Williams, Ayer, Farrand and Doherty. All took an active part in the proceedings, and this year a special badge was furnished for them, not superseding the time-honored gold button, but providing a gold name-strap and disk to which the much-coveted mark of distinction could be attached. To some of these were appended various ribbons indicative of special committee work. The convention had, by the way, 14 different colors for its badges, and few, if anybody, had memorized the list. Probably the new president, Mr. Frueauff, has the most. His ribbon bunch was a complete spectrum.

The presence of President Frank A. Vanderlip, of the National City Bank, and his forcible address were a notable event in the history of the association, while it was equally unusual that men like Mr. C. A. Coffin and Mr. A. N. Brady should be in attendance. The welcome accorded to Mr. Coffin at the meeting on Wednesday night will not soon be forgotten by anyone who saw and heard it. To greet these three gentlemen and Mr. George S. Graham before the meeting, President Eglin invited to dinner in the Forest Room of the Marlborough-Blenheim the following officers of the association, or operating managers of prominence connected with member companies: Messrs. S. Insull, C. R. Huntley, C. L. Edgar, H. L. Doherty, Dudley Farrand, N. F. Brady, T. N. McCarter, J. B. McCall, L. B. Gawtry, G. Urban, Jr., and E. W. Burdett. The occasion was not one for speech-making, and the dinner was both brief and served with swiftness, but it afforded a delightful opportunity for social intercourse among the leaders. It was Mr. Vanderlip's first visit to an N. E. L. A. convention, and Mr. Coffin was ready to confess that his average of attendance was not much higher.

The opening reception on Monday night found the exhibits, of which this year there were no fewer than 68 in 83 booths, in a remarkable condition of readiness. The arrangement of the exhibits in a large hollow square around three sides of the space on the pier added greatly to the effect, while giving a clear view of all at once. The central space made a most comfortable and luxurious lounge by day, and was available for dancing at night. The pier is brilliantly illuminated, with a ceiling and sides studded with incandescent lamps, supplemented in this instance by hundreds more around the booths, intermingling with the shrubbery and flowers. The excellent music of the Filipino band was once in a while a little too much for oratorical effort in an adjacent meeting room; but many preferred the band. At the entrance to the pier were the usual effective arrangements for registration, association headquarters, etc. The fine weather that prevailed almost the entire week rendered overcoats and umbrellas a superfluity, and it was not until breaking-up time on Friday that the rain became disagreeable. The only out-door event, that of the baseball game on Wednesday afternoon, fitted snugly between two very heavy showers on Tuesday and Wednesday nights. Altogether it was a comfortable week for work and recreation and the display of toilettes.

Accounting System of the New York Public Service Commissions.

The New York electric companies have rearranged their systems of accounting as of Jan. 1, 1909, to conform to the requirements of the classifications adopted by the two Public Service Commissions, and the following account of the new system is of particular interest as reflecting a central-station view of its merits.

While the rearrangement of accounting involved by the adoption of the system did not mean radical changes for all the companies, it did require considerable preliminary preparation, and also, in some important particulars, will prevent the possibility of comparisons with previous years. The schemes of accounting previously existing, however, had been in force for periods of years, varying with the practice of each company; and, as during these periods many changes had occurred in the production and distribution processes, it is undoubtedly true that the necessities of the individual companies would have required some changes in their accounting methods. On the other hand, no company would lightly disorganize its system of comparisons. Electric lighting statistics have principally a relative value and the various companies, if left to themselves, might have preserved some of their comparisons; but on the other hand, by adopting the Public Service Commissions' scheme the companies will profit by the ability to compare their statistics with their contemporaries. As a general proposition, therefore, the sum of the advantage may be conceded to be in favor of the adoption of the commissions' scheme of accounting and the discussion may proceed to the study of the details of that scheme as applied to the affairs of a company.

CAPITAL ACCOUNTS.

The sub-accounts provided by the commissions cover the capital expenditures occurring after the introduction of the system on Jan. 1, 1909. The capital accounts at Dec. 31, 1908, are to be combined in one account called "Fixed Capital, Dec. 31, 1908." It is idle to speculate now as to what action will ultimately be taken in the disposition of this account or what significance attaches to its creation. It is sufficient to know that it certainly facilitates the introduction of the new system, as it would be a huge task to analyze the existing accounts according to the new classification and would undoubtedly cause great delay and confusion.

The commissions recognize as proper subjects for capitalization the expenditures during construction of the following nature:

Engineering and superintendence.
Law expenses.
Injuries.
Taxes.
Interest.
Miscellaneous, including thereunder salaries and expenses of executive and general officers, or a suitable proportion thereof, clerks engaged on construction accounts, insurance and all expenditures of a special or incidental nature which cannot properly be provided for elsewhere.

These provisions of the commissions' scheme are broad and comprehensive, the intent being to capitalize the actual cost rather than that amount only which might at first glance appear in a survey of the item itself.

The scope of the capital account for meters, converters, arc lamps, etc., as defined in the classification, has, by recent action of the commissions, been extended. As originally outlined, such accounts included the cost of the devices actually in service, those in reserve to be carried in "supplies." Some companies do not capitalize the cost of setting meters and converters or connecting arc lamps in customers' premises, although the commissions allow the practice. It is desired, therefore, to charge these devices to capital account when purchased, providing suitable property records to show the location of each unit, whether in customers' premises or in store. This plan would permit meters to move freely between the storeroom and

customers' premises without requiring a financial entry in the books for each operation. The commissions were therefore requested to modify the rules covering these devices as originally promulgated, and this they have now done, stipulating, however, that in the annual report the companies shall show the number of units in service, the number in store and the number in process of repair.

The rule of the commissions that capital expenditures, in addition to being charged to the respective sub-accounts as provided, shall be further divided into original capital, additions, betterments and renewals and replacements, adds very substantially to the work of the accountants. About 34 accounts for tangible property are prescribed by the commissions, and, as each entry must show whether the property acquired is in the nature of an addition, a betterment or a renewal, the 34 accounts are multiplied by three, making 102. These requirements are purely of commission origin and purpose. They are in the nature of an ultra refinement and are one of the causes of the feeling of dismay and difficulty which some of the smaller companies in the State have experienced in endeavoring to adapt their accounting system to the commissions' scheme. The requirement seems to be peculiar to the New York State Commissions' scheme only, as it does not appear in the classification or text of the Wisconsin commission's system. In this connection also must be considered paragraph 16 of the classification, "First entries must enable identification," and paragraph 21, "Particulars required to be shown in entries."

FLOATING CAPITAL AND LIABILITIES.

The sub-accounts provided hereunder varied from those formerly in use by many companies and occasioned changes in methods. One important provision is the requirement that "investments" should be divided as to whether bound or free, by "bound investments" being meant those which have been deposited as collateral and by "free investments" those securities which might be readily translated into cash. The account "unamortized debt, discount and expense" is provided to include the discount on bonds and the expense of their issue, and the requirement is made that these accounts may not be capitalized but are to be amortized over the life of the security to maturity. In this respect the commisssions have departed from the usual practice, as the cost of procuring money has generally been regarded as a proper subject for "capitalization." It is so regarded by the Massachusetts Gas Commission and also by the Wisconsin commission. In Wisconsin, as a matter of fact, permission to capitalize discount and expense of bond issues is legalized by the law of the State, which permits such discount up to 25 per cent to be so capitalized. Public service utilities located in the State of New York will, to this extent, be at a disadvantage with their contemporaries in other States.

In general, it may be stated that the commissions' requirements as to floating capital and liabilities are clearly defined and so arranged that the balance sheet of any company will show its exact condition at the time when the balance is struck.

INCOME ACCOUNT.

This is identified in the commissions' classification as Schedule B, and includes the gross earnings from the sale of electric current and miscellaneous revenues, also the operating and non-operating expenses. The distinctions between operating and non-operating income accounts are clearly defined.

The expenses are divided into "operating expenses" and "expenses of outside operations," the latter caption including taxes and uncollectible bills. The commissions gave as a reason for making this separation that theoretically taxes and uncollectible bills hardly came under the designation of operating expenses, for the reason that they were not under the control of the operating company. On the other hand, it was recognized that such expenditures constituted part of the total cost of the electric current sold, and many companies have, therefore, never been convinced that this technicality was sufficient justification for making the separation. The companies would have preferred to classify uncollectible bills as a sub-account under "collection expense" and taxes as one of the division of "general and miscellaneous expense."

Many companies had been in the habit also of charging interest on consumers' deposits as part of the expense of collection, but the commissions require that this be charged to the account "interest accrued on other unfunded debt," one of the sub-accounts under "income deductions." This is open to question. It does not follow that because the item consists of interest it should be charged to interest account. Some consideration should be given to the circumstances under which the interest accrues. Companies do not borrow money from customers to conduct their operations. The law under which they are incorporated requires that they shall supply their product to every applicant located within 100 ft. of their mains. In other words, the companies are constituted by law "common carriers." This being the law, it was necessary to protect the companies, otherwise any individual, no matter what his business or what his previous financial history, could compel a company to extend to him credit. Therefore, the law provided that all consumers should pay to the companies a deposit approximating two months' bills, and the companies were required to pay interest on the amount of the said deposit at the rate of 6 per cent. The deposit being intended as a protection for the accounts receivable, and furthermore, as uncollectible bills were agreed to be a proper charge to the cost of supply, it would seem that the cost of this insurance of the debts, in this case the interest on the deposit, should be considered as part of the collection expense. This general principle appears to be recognized in the classification of fixed capital accounts, where interest on moneys borrowed for construction purposes is recognized as a proper charge to construction or to fixed capital account. Of the same general nature is the commissions' requirements in regard to discounts for prompt payment. The classification requires that charges to fixed capital and income accounts shall be cash costs and not costs based on credit. If a company keeps its money in a bank, the interest which the bank allows upon its balances becomes a credit to "interest revenues," but if because it gets better return from discounting its bills it withdraws the money from the bank for this purpose, the discount is not to be credited to interest revenues, but the net cash expenditure is to be charged to the account for which cash was expended.

The commissions' classification requires that the cost of the overhead pole lines and the underground conduits shall be divided as between transmission and distribution, unless the expenditure can be identified as belonging solely to one of these general divisions. If a company has a conduit system and has in the ducts a transmission cable and a distribution cable and is required to repair the manhole cover or pump gas or water out of the manhole, it is very difficult to apportion this expense as between transmission and distribution, nor is there any useful result achieved when this has been done. A better plan would be to treat the pole line and the underground conduit system as a unit, confining the transmission and distribution expenses to the conductors as attached thereto or drawn therein.

The commissions' rules in regard to amortization have probably attracted more attention than the remaining part of the classification as a whole. When the classification was in the tentative stage and hearings with the companies' representatives were occurring, the latter recommended that while amortization or depreciation accounts should be provided in the classification, the amount to be reserved and the method of arriving at that amount should be left to the discretion of the individual companies. This the commissions have done, except that the amount reserved during the month shall be lessened by the amounts charged that month to the various repair accounts. By this means, however, a double estimate is introduced which would not have been necessary had the original idea been followed of leaving the amount of the amortization and the method of its determination to the individual company. The classification furthermore required that the rules adopted by a [illegible] of the facts and exact condition-

and estimates upon which they are based should be filed with the commissions on or before Jan. 1, 1909.

One of the difficulties which companies are meeting is the requirement that charges against the reserve shall be identified with the original expenditure for the property replaced. The replacement itself is charged to "fixed capital account-replacements" and the commissions will naturally look for a corresponding credit to one of the other sub-classifications under fixed capital. If the thing replaced was installed years previously, as is frequently the case, and especially if the thing replaced was part of a continuous structure and was not an individual piece of apparatus, it is difficult to make the identification both as to the thing itself and its original cost. The classification, however, provides that in such instances the charge to the reserve may be based upon estimates. If, however, a company had not maintained a reserve account prior to Jan. 1, 1909, the original cost of the property replaced would have to be charged against its surplus account, it being intended in such an event that the amount reserved after Jan. 1, 1909, should apply to the depreciation accruing after that date only.

The Patent System in Its Relation to Industrial Development.

An abstract was given in these columns May 20 of a paper presented by Mr. Frederick P. Fish at the annual meeting last week of the American Institute of Electrical Engineers entitled "The Patent System in Its Relation to Industrial Development," and an abstract of the following discussion on the paper is given below.

Prof. F. B. Crocker, of Columbia University, said that the broad and clear statement of patent rights contained in the paper would do much toward putting the matter in its true light in the minds of electrical engineers, who are particularly affected by patents because of the novelty and rapid progress of their profession. He suggested that the board of directors of the American Institute of Electrical Engineers should appoint a committee to investigate and report upon what reforms in our patent system are desirable, and how they may be best brought about. On this committee there should be representatives, respectively, of the patent bar, manufacturers, operating companies and of engineers who do not act as patent experts, as well as of those who do. This same committee should also consider and report upon the establishment of a single United States Appellate Court in patent cases, as well as on reforms in the Patent Office, especially in securing prompt and competent examination of applications, simplification of interference and appeal proceedings, etc. Professor Crocker said that he considered the great bulk and complication of expert testimony as the worst of all the present evils. If two experts were appointed by the court from among specialists of experience and standing, the facts could be brought out in less than one-quarter of the time and space now required to mix them up. Most of the points should be settled with little or no controversy, and in case the two experts failed to agree on a certain matter, a third could be called in. Even if his decision were wrong, the case would be so boiled down that the court and counsel could see the precise issue. The need of this reform is particularly pressing for electrical companies, because the judges and lawyers have the greatest difficulty in understanding them, and the American Institute of Electrical Engineers is therefore the body most interested in and qualified to lead in bringing about the reforms proposed.

Mr. A. G. Davis, of the patent department of the General Electric Company, said that there has been noticeable, during the last two or three years particularly, a tendency on the part of a certain class of inventors or persons interested in inventions to criticize our present patent system and that there seems to be an impression that the patent situation is being handled by the patent lawyers, and that this is all wrong. The patent lawyers of the country, he said, are a unit in their desire to simplify the patent procedure wherever such simplification can be effected without risk to the litigant, and are a unit in their desire to see that a meritorious inventor receives adequate protection and adequate reward. The complexity of our present procedure, and the delay and expense attendant on any thoroughly tested patent litigation, are therefore not the fault of the patent bar, nor are they the fault of the judges, nor, broadly speaking, are they the fault of the system. The real trouble is that the questions necessarily arising in an ordinary patent suit are exceedingly complex, so that a patent litigation is necessarily one of the most difficult, and therefore one of the most expensive, sources of litigation in which a man can engage. While the patent system is, like any other product of the human mind, capable of improvement, and will be improved, this improvement will not be produced by any one radical change at one time, but rather by the slow growth by which all real legal reforms are attended. In conclusion Mr. Davis ascribed the discontent as due to patentees or patent owners who have failed to enforce rights because, as a matter of fact, they did not have any rights to enforce.

Mr. Arthur Von Briesen submitted a memorial being circulated by the Merchants' Association of the City of New York which advocates that measures be taken toward bringing about at the earliest possible date an international patents conference with a view to bringing the laws of all civilized nations into conformity with the principle that no restrictions shall be placed in the path of meritorious inventors who desire to have their inventions duly protected in any country.

Mr. Livingston Gifford said he thought that the sentiment of the bar is absolutely unanimous in favor of the patent law as it stands to-day, but that the system of administration, the taking of testimony and the hearing and deciding of cases are nevertheless, he believes, all wrong. He opposed the appointment of the committee suggested by Professor Crocker to revise a system which has existed for a half century unless it should base its work on definite propositions presented to it for action. He believed the practical course was, as suggested by Mr. Fish, the constitution of a court that will hear all patent cases as a court of last resort, and that as this court became acquainted with all the difficulties that arise in the different parts of the country, it might in time work out a solution of the problem and correct present evils.

Mr. E. W. Rice, Jr., vice-president of the General Electric Company, said that while he believes that an appellate court, such as Mr. Fish suggested, should have one member of first-class technical engineering training, nevertheless, his experience with lawyers has shown them to possess such a wonderful capacity for grasping abstruse problems in science and engineering and for restating them in such a clear and simple manner as to confuse a so-called expert, even without a technical expert sitting as a member of the court, the patent system would remain fairly safe. He believed that inventors, as a class, received their full share of reward as compared with men in other departments of life. The manager of a great works, or executive of a great business, must use the same originality and same skill in managing the business as the inventor, and yet has no means of obtaining a monopoly on his ideas. It is also true, as Mr. Fish states, that in many cases inventions are only valuable as incidents to the manufacturer and cannot be segregated and appraised separately. Others may have contributed to making an invention possible, and others may contribute to making it profitable, and it is impossible to segregate the value accruing to any individual inventor. He believes that something should be done in regard to the method of examination, as the waste of time in taking direct and indirect testimony is something unbearable.

Dr. C. P. Steinmetz in taking the floor said that he had made a few inventions himself, and that the direct financial gain which he had from all of his inventions amounted to about $500. On the other hand, he believed that indirectly in salary and reputation, he had received at least the value of his inventions, so that he cannot find any fault personally with the protection accorded to inventors. He disapproved a suggestion which has been made that a limit of one or two years should

be set within which an invention should be worked; such a requirement would offer very little handicap to the manufacturer, who could arrange to have a boy put to work on the invention, while it would be fatal to inventors, since most of them are not able to manufacture an invention themselves, and therefore would have to turn it over to the manufacturer at any price, or lose it altogether. To interest capital, an invention must be a commodity which has a market value; it must be made evident how far the invention can control the industry or part of the industry to which it is related, and how good the chances are that the patent will be sustained finally in court. Even with these questions decided, a patent has a very uncertain value, because it may never develop its promises owing to unforeseen difficulties. Again, just as it began to develop and become profitable, someone may invent something like it, or when it is ready for commercial exploitation some inventor may accomplish the same purpose in a much simpler manner.

The inventor needs capital to develop his invention, while the capitalist does not need the inventor, and since the latter is the stronger, the control must lie with the capitalist, and not with the inventor. Thus it is not a question of morals, but the results of an economic condition. The situation very much more favorable to the inventor is with respect to an established manufacturing company which a patent affects, for the inventor can hold back his invention until it is needed by the manufacturer, and the latter has to come to terms, or, as is more commonly the case, the manufacturer will realize that the invention offers a certain financial advantage in his field, and therefore is willing to share the advantage with the inventor. This is usually the method by which capital may be united with invention.

An inventor in some cases may be handicapped by the broad inventions of others, and thus be led to the idea that broad patents are objectionable; but he should realize that any limitation of a patent is an advantage to the exploiter of the invention and not to the inventor. If one is limited to a specific application, a patent is made worthless, and the inventor with a broad conception is deprived of the value of his work, since his first conception may be the crudest and least efficient, and further developments and modifications after the general method has been shown will naturally embody a better way of carrying it out.

If an inventor were debarred from the control of these later improvements the advantages of his invention would accrue to those who have improved in detail on his broad principle; this would not be fair, and would be very harmful to the value of inventions, because it would make it possible for one to reap the benefit by means of a modification of which the original inventor did not happen to think.

When an invention is finally adjudged by the court, and the ownership has left the original inventor, the outcome is of no moment to him, as he has no further financial interest in the question as to whether the invention is sustained or invalidated by the court. It should be realized that the invalidation of a patent by the court reduces the market value of all other inventions, while any patent broadly sustained increases the market value of all other inventions; consequently it is of especial advantage to the inventor to have his patent sustained, even though there is no immediate financial gain to him from that particular patent.

In considering the large manufacturer, the invalidation of a patent may destroy his monopoly in certain fields but at the same time would relieve him of the necessity of buying the control of the invention, and merely mean a readjustment of business methods without either gain or less. It is to the interest of all engineers to have patent law make every invention sufficiently broad to cover all modifications which may be of a fundamental idea, and have the patent sustained by the courts, because these are the two factors which make the market value of patents.

In closing the discussion, Mr. Dyer agreed with Mr. Stemmet that any provision requiring the working of an invention would be fatal to the inventor. He disagreed with the statement sometimes made that lawyers like to prolong litigation, which would be the most short-sighted policy imaginable on the part of the lawyer. In the case of himself and other lawyers the practice is to seek to stop litigation because of the expense and delay; if patent lawyers want big fees they should see that the method of procedure is simplified, so that they will not have to say to a client: "Yes, I think you have a good case, but I do not think you can afford to try it."

The one reform in the patent system most needed is the grant of more money to the Patent Office, which is the only department of the Government that is self-supporting. Mr. Fish said he was shocked and amused when he learned some years ago for the first time that to run the Patent Office of the United States cost about as much as to run one battleship; he now expects it costs two or three times as much to run a battleship as it costs to run the Patent Office. As to the cost of increasing judges, the Government of the United States cannot afford to expend on all the judges and all of the courts of the United States per year as much as is frequently involved in a single patent case. In the administration of the judicial system there is too little spent in proportion to the results of the interests involved. Mr. Fish disagreed with Prof. Crocker's statement that since patent cases all relate to science, three fair-minded men, or two fair-minded men, or even one fair-minded scientific man, should be able to settle a question. If anything like that were attempted the result would be even worse confounded, for unless the expert possessed judicial qualities his decision would not be good. Get an expert's presentation of the facts, he said, and then have a judge trained to decide controverted questions to pass upon the case.

Discussion of Technical Papers.

In a letter printed in several of our English contemporaries, Mr. Edward W. Cowan submits some suggestions on the subject of increasing the value of discussions of papers presented before the British Institution of Electrical Engineers. Might not, he asks all members desiring to take part in a discussion be required, when sending their names, to submit a very brief summary of, or at least the heads of, their proposed contributions? The president, having a list before him of the points which will be dealt with by each speaker, can "edit" the debate with due regard to the relative importance of the matter contribute rather than to his estimate of the importance of the matter which the speaker is capable of contributing. Thus interesting, but digressive discourse, may be curtailed, and time found for valuable contributions, some of which, though tendered, remained "ungotten" during the period of the last session. Of course, these contributions can always be sent to the *Transactions* to be printed. Instead of the author's reply being relegated to a few breathless minutes at or after closing time, it is asked if he might not be given an opportunity to reply at reasonable length to all the points of criticism which lend themselves to verbal treatment. The meeting wants to hear the author's defence. Debate has lost its best characteristic when criticism is not met with prompt reply. When papers lend themselves to such treatment it is suggested that their discussion might be "by compartments." The author or the editing committee could settle the divisions, and the president would introduce them to the meeting in the order of their importance to it.

With such an arrangement a [illegible] would be avoided, and, when time pressed, the points of relative unimportance would be crowded out instead of persons of relative unimportance. There would be a great advantage from a "debate" point of view, if at least a few minutes were reserved for general discussion as distinct from the contributions of those who have sent in their names, and if the author was given an opportunity of replying on each point before the next one was presented for discussion.

CURRENT NEWS AND NOTES.

WIRELESS TELEPHONY OVER 60 MILES.—In a trial of wireless telephony off Toulon, between the French warship *Condé* and land stations, the voices of the operators at the telephones were heard distinctly over a distance of 60 miles.

CLEARANCE OF ELECTRIC LINES OVER RAILROADS.—On inquiry of a number of mill companies as to the clearance of overhead wires and cables, the Indiana Railroad Commission has ruled that under the Indiana law the distance of electric wires and cables should be elevated above railroad tracks at least 25 ft., and in no case less than 22 ft.

BASEBALL BY ELECTRIC LIGHT.—According to a dispatch from Cincinnati the experiment is to be made there of playing baseball at night by the aid of electric light. The local National League team will play a game with a picked team on the night of June 19. The ball park has been fitted up with electric-light towers and other devices for lighting the field.

AIRSHIP WITH WIRELESS.—Experiments were recently conducted in Berlin, Germany, on an airship wireless equipment. The trials lasted for some hours while the craft maneuvred over the roofs of the city. An attempt was made to put the instruments in tune with those at the wireless land stations. The army officers who controlled the airship, however, declined to make any statement as to the results obtained.

GIFT TO LEHIGH.—The veteran ironmaster and metallurgist, Mr. John Fritz, of Bethlehem, Pa., in whose honor a gold medal was founded on his eightieth birthday by the four great national engineering societies, has just given $50,000 to Lehigh University for an engineering laboratory, which will be thoroughly equipped. He has been a trustee for over 30 years.

GUIDE FOR TELEPHONE TALKS.—The New York Telephone Company has issued to its subscribers a neat 16-page pamphlet containing information designed to facilitate telephonic communication and, incidentally, lessen friction with "Central." "Conversation is an art in which a man has all mankind for competitors," is the quotation from Emerson which adorns the cover.

TELEGRAPHY AND HIGH-TENSION LINES.—Judge Tuthill, of the Laporte (Ind.) Superior Court, has denied an injunction asked by the Western Union Telegraph Company against the Chicago, Lake Shore & South Bend Traction Company, which operates a high-tension trolley system, to restrain the use of such system on the ground that the high-tension lines seriously affect the telegraph wires and render them useless at times.

ENGINEERING CODE OF ETHICS.—At the annual meeting in May of the British Institution of Electrical Engineers, it was announced that the council had under consideration the issuing of a statement on the subject of professional conduct, a matter which has also recently engaged the attention of the Institution of Civil Engineers. It will be recalled that a committee, of which Dr. S. S. Wheeler was chairman, prepared a similar code for the A. I. E. E.

MODEL LAMP POSTS.—In *Electrical World* of May 6 sketches were shown of new lighting fixtures for possible use in the parks. It appears that at the desire of the New York authorities these new posts had been copyrighted, but we were not aware of this fact and the word "copyrighted" was omitted from our reproductions. We hasten to correct this by directing attention now to the copyright covering all the excellent drawings and illustrations prepared for the purpose and for the recent exhibition of the Municipal Art Society on "City Planning and Municipal Art."

PHILADELPHIA SECTION, A. I. E. E.—The annual dinner of the Philadelphia section of the American Institute of Electrical Engineers was held on June 2 at the Hotel Poinsettia, on the Boardwalk, Atlantic City, when no fewer than 95 members attended. Mr. Paul Spencer, chairman of the section, presided, and brief speeches were also made by Dr. Franklin, Mr. W. A. Layman, of St. Louis, and Secretary Sanville. A most enjoyable time was had, and the large attendance was the more remarkable in view of the strong counter attractions of the electric light convention.

TELEPHONE LINES OF INDIANA ELECTRIC RAILWAYS.—The Indiana Railroad Commission's annual report just issued shows that 32 electric railroads operating in Indiana have constructed and equipped 2968 miles of telephone wire for the use of dispatching trains and conducting the business of these roads. The least number of miles of wire operated by any one road is 18.26 miles and the greatest number 959.22 miles. This total number of miles of telephone wire reported does not cover the whole number of miles used by traction roads operating in Indiana, about 10 roads having made no report on this subject.

GERMAN CABLE MAKERS' TRUST.—Several months ago the combination which had existed among German cable makers was dissolved in consequence of inability to arrive at an agreement with an outside competitor, the Bergmann Electricity Works Company, which had recently started the production of cables for lighting and power purposes. The rivalry which immediately ensued became so keen that the price of cables for heavy work declined, it is stated, even to 30 per cent less than cost of production. The result has been the announcement of the reconstitution of the trust with the addition of the former outstanding firm as a member—presumably on terms satisfactory to the latter. The price agreement will only apply to German consumers.

BRITISH I. E. S.—At the general annual meeting of the British Institution of Electrical Engineers last month the total roll of that body was reported as 6097, consisting of 7 honorary members, 1136 members, 2375 associate members, 1036 associates, 1438 students and 105 foreign members. Mr. Oliver Heavisides and Hon. Charles A. Parsons were added to the list of honorary members. During the past year there were 16 general meetings of the body, and 45 meetings of the local sections at Birmingham, Dublin, Glasgow, Leeds, Manchester and Newcastle. Among the numerous annual premiums, ranging in value from $25 to $125, one was awarded to Mr. J. S. Peck for a paper entitled "Flywheel Load Equalizer." The Institution will occupy its new building in the fall. Its benevolent fund at present amounts to $15,000.

STEVENS INSTITUTE EXPANSION.—For some time past the authorities of the Stevens Institute of Technology have realized that if it did not soon go forward it must go backward, and they have now taken a resolute step forward by securing an option on the famous Stevens property at Castle Point, Hoboken, overlooking the Hudson. The amount involved is about $1,500,000, and it is reported that the Carnegie Foundation and Rockefeller Educational Fund will help finance the project. President Humphreys is quoted as follows: "I am happy to say we have just obtained an option on the 'castle' and its grounds, and we are about to commence an active campaign to purchase this property, pay off the mortgage on the athletic field, pay off the debt still resting on the Morton Laboratory, erect a new shop and a laboratory of electrical engineering, and add sufficiently to our productive endowment to enable us to maintain this large plant."

Central-Station Practice and Results from Waterloo, Ia.

FROM the various short articles which have appeared from time to time regarding the practice of the Citizens' Gas & Electric Company, operating in the cities of Waterloo and Cedar Falls, Ia., many readers are probably aware that an unusually progressive and painstaking management is in force there. It is the purpose of the present article to go into this company's work in a more comprehensive manner than in previous articles.

In 1902 the electric light properties of Waterloo and Cedar Falls, two neighboring cities, were operated independently of each other. Mr. Austin Burt, who is now general superintendent of the company, was called upon by the owners of the property at Cedar Falls to plan changes and improvements in operating methods which would enable that company to show more of a balance on the credit side of the ledger. The outcome of this was the building of a transmission line to supply Cedar Falls from the Waterloo station, and the consolidation of the Waterloo and Cedar Falls properties. The combined population of the two cities at that time was about 25,000, that of Cedar Falls being 5000. Following this consolidation notable

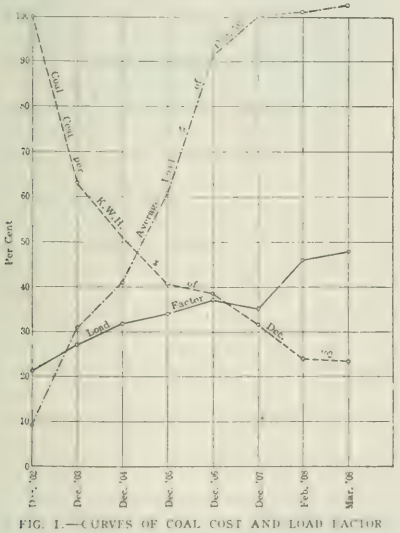


FIG. 1.—CURVES OF COAL COST AND LOAD FACTOR

economies and developments took place which this article will describe.

During the period of these changes the station at Waterloo has been rapidly growing from one operated entirely with high-speed compound condensing engines to one in which much of the output is obtained from condensing steam turbines.

IMPROVEMENTS IN PRODUCTION COSTS.

In 1904 the station had a capacity of 433 kw in cross-compound, high-speed condensing engines. The load factor for the year—that is, the ratio of the average to the peak load—was only 13 per cent, which indicated a condition fatal to economy, on account of the light load at which the station was being operated most of the time. Aside from this question of load factor, however, the station records month by month for 1903 show a remarkable reduction in fuel costs and are interesting as indicating economies which are sometimes possible without any change in apparatus or character of load. This economy during the year 1903 was brought about by greater attention to details in the operation of the station, in securing good men, in operating units as fully loaded as possible, in keeping boilers clean, and in proper firing.

Since 1905 further reductions in cost per kw-hour have been brought about by the use of steam turbines, and by the improvement of the load factor through taking on a large amount of power business. The development of power business has, in fact, been one of the notable points about the Waterloo station.

This article would not be complete without reproducing here for study in connection with other data presented the two

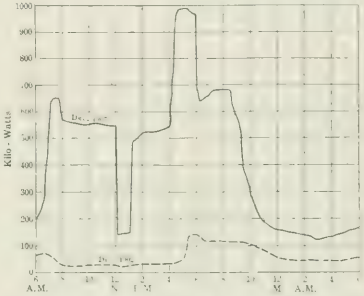


FIG. 2.—DECEMBER DAILY LOAD CURVES, 1902 AND 1907.

curves published in the issue of May 16, 1908, in connection with some remarks made by Mr. Burt before the Iowa Electrical Association convention. Fig. 1, which is taken from that article, shows how greatly the cost of coal per kw-hour has been reduced since December, 1902. The coal used per kw-hour in February and March, 1908, was only about 24 per cent of that used in 1902. Another interesting fact (not shown by this curve) is that the total cost of coal for the year 1908 was almost the same as that for the year 1907, while the output increased 367,000 kw-hours.

The increase in load is indicated by the typical December daylight load curves in 1902 and 1907, shown in Fig. 2, and also by the month-by-month output curves from 1902 to 1908, shown in Fig. 3. The improvement in load factor, shown by one of the curves in Fig. 1, is accomplished by the taking on of motor load.

POWER PLANT

The power station is located on a large tract occupied by both the gas and electric plants on the bank of the Cedar River and with railroad tracks alongside. Fig. 4 shows the plan of the electric power station part of the property. Fig. 5 is an exterior view of the building showing the coaling facilities, buildings and stocks.

The present station capacity is about 2100 kw, normal rating. There are two condensing turbines: one of 1500-kw maximum rated capacity, shown in Fig. 6, and the other of 750-kw maximum rated capacity. There is also a 300-kw engine-type generator.

The turbines are equipped with Edwards air-pumps with

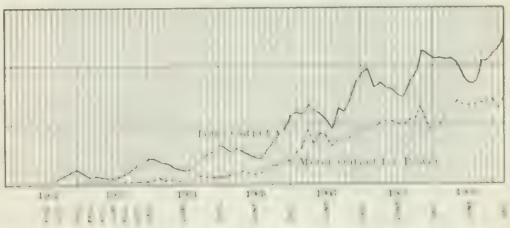


FIG. 3.—CURVES OF TOTAL OUTPUT AND POWER-MOTOR OUTPUT, 1902 TO 1908.

Wheeler condensers. One circulating pump is motor-driven and the other steam-driven. The motor drive is favored for circulating pumps as there is enough steam from turbo exciters, air-pump and feed pumps for heating feed water.

The plan has been rapidly followed in the growth of this station of getting the steam-turbine auxiliary apparatus on one

floor as nearly as possible. No apparatus is placed in the basement. The condenser pumps and oil and step-bearing pumps are all on the main floor. The beneficial effect of this is shown by the comparatively low cost of station labor.

Power-plant labor is performed by men working 10-hour shifts. There are three firemen, one of whom works as a helper six hours of his shift in the engine room. There are

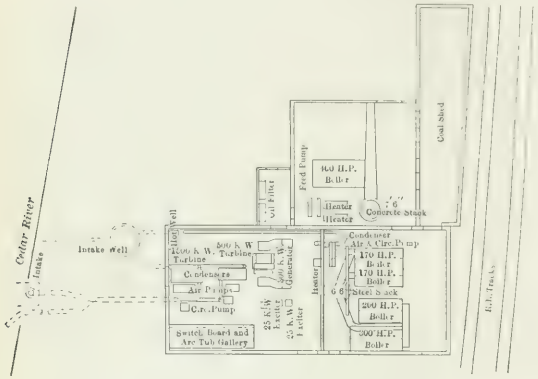


FIG. 4.—PLAN OF POWER-STATION PROPERTY.

two coal-passers and one man for boiler cleaning and repairs. In the engine room two engineers work 10-hour shifts and the chief engineer takes one four-hour run, with the helper. The entire power-house force is therefore nine men.

Excitation is furnished by two 25-kw Curtis turbines, direct-connected to exciters. All wires, including the 2300-volt lines, are run in iron-pipe conduit from the switchboard to the point where they leave the station on the opposite side of the turbine room. The step-up transformers for the Cedar Falls transmission are in a small brick room adjoining the turbine room. The 10,000-volt lines for this transmission leave directly



FIG. 5.—EXTERIOR OF STATION AND COALING FACILITIES.

from this transformer room and are kept independent of the 2300-volt pole lines.

The switchboard (Fig. 7), which was recently built, is more nearly complete than usually found in plants of this size. The generator panels are at the right end of the board and the feeder and arc panels at the left end. The totalizing panel in the middle is equipped with a curve-drawing wattmeter. The entire output is measured by recording watt-hour meters on the feeder panels. The power and lighting feeders are kept separate and are separately metered, so that the relative outputs for power and lighting purposes are known.

An interesting scheme used in connection with this board is that of having meter-testing terminals placed at the bottom of the feeder panels for calibrating the recording watt-hour meters. By means of these terminal posts a test meter can be

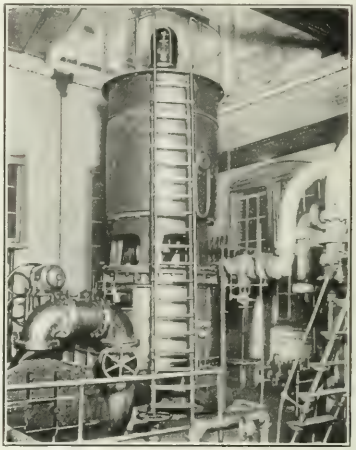


FIG. 6.—1500-KW TURBINE AND CONDENSER ON ONE FLOOR.

inserted in circuit so as to check the switchboard meter without interfering with the operation of the panel.

The field rheostats of the generators are of the "woodpecker" type, operated by ratchets with a reciprocating motion furnished by solenoids. The solenoid circuits are controlled by a push-or-pull switch which takes the place of the old rheostat handle on the switchboard. Pushing in operates the rheostat in one direction, while pulling out operates it in the opposite direction. The voltage regulation of the generators is provided for by a Tirrill regulator, which has a capacity for two 50-kw or four 25-kw exciter units.

Two of the single-phase lighting feeders are provided with double-pole overload relays. The object of this is to avoid the possibility of failure of a circuit-breaker to operate should a

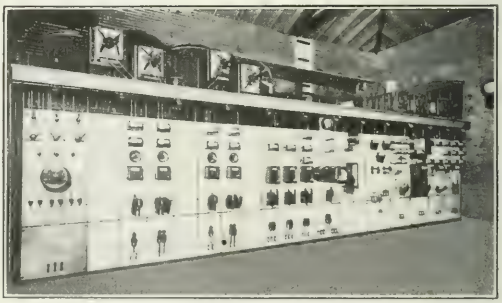


FIG. 7.—SWITCHBOARD WITH NEW FEATURES.

short-circuit occur between different single-phase lighting feeders which might not be protected were the relay inserted in only one leg of each single-phase circuit.

POWER-PLANT PERFORMANCE.

The yearly average for coal consumption is about 4.7 lb. per kw-hour. The coal used is from the Illinois Carterville district, and while it costs considerably more than that from the nearer Iowa fields, careful tests show it to be the lowest

in terms of cost per kw-hour. The total water evaporated per pound of coal averaged for the period of a month, without correction and with the present Illinois coal, about 6.3 lb. This coal costs in the bin about $2.93 per ton. With Iowa coal the evaporation was only 3.9 lb. of water per pound of coal. The difference in market price is not enough to make up for this difference in evaporation.

OVERHEAD LINES.

The distribution, which is all overhead, is in notably fine shape. Fig. 8 shows a typical example. All lines are run on Idaho cedar poles, varying in length from 35 ft. to 60 ft. All



FIG. 8.—TYPICAL OVERHEAD WORK.

poles, which are white at the top and black near the bottom, have been painted twice in the past five years. A larger separation of wires than usual is employed in most cases. The present standard is to use 6-ft. cross-arms for four pins, 5-ft. arms having previously been used for four pins. For power feeders the usual three-wire, three-phase, 2300-volt system is used. Lighting feeders are 2300-volt, single-phase, taken from three-phase busbars at the power station.

A record of the overhead lines of the city is kept by means of sectional maps. There is one general reference map of the city, with various sections indicated upon it. For each of these sections there is a map on an enlarged scale upon which poles, street lamps and transformers are indicated. On these plans heavy lines indicate primary 2300-volt lines, light lines indicate three-wire secondaries and light dotted lines two-wire secondaries, transformers and lightning arresters being shown by suitable symbols.

TUNGSTEN STREET LIGHTING.

In lighting the streets of Cedar Falls, some arc lamps and 233 40-cp series tungsten lamps are used. These tungsten lamps operate from the regular arc circuit and take the place of the 32-cp carbon-filament lamps formerly used. The change to higher candle-power has been made by the company voluntarily, and the price remains the same as before—namely, $12 per year per lamp on a schedule calling for operation about 2300 hours. One lamp is placed at each street intersection.

METERING.

There are about 2200 meters on the system, divided between the latest General Electric and Westinghouse induction types. One man gives his time to meter testing, testing meters on consumers' premises at the rate of about 10 per day. A lamp bank is carried for an artificial load on the meter during the testing. The company is equipped with portable rotating standard meters, one of Westinghouse and one of General Electric manufacture.

The lost and unaccounted-for energy, not including the loss on the transmission between Waterloo and Cedar Falls, was 24.15 per cent of the energy measured at the switchboard for the year 1907. For the year 1908 this was reduced to 18.95 per cent. This marked improvement is believed to be due largely to increase in load factor of individual consumers and better loading of the transformer system, so that there are not so many underloaded transformers. This is considerably less loss than on most alternating-current systems.

On the transmission line between Waterloo and Cedar Falls, which is 7.75 miles long, operated at 10,000 volts, with No. 6 semi-hard-drawn copper line wires, the loss in step-up and step-down transformers and line for the year 1908 was 21.9 per cent of the energy transmitted. As this line is operated lightly loaded many hours per day, the transformer core losses amount to a much larger per cent of total energy supplied than if the line were better loaded. The capacity of the step-down transformers on this line is 225 kw.

POWER BUSINESS.

One of the notable things about the Waterloo company is the large amount of power supplied to small and large manufacturers. These installations run all the way from one to several hundred horse-power per consumer. This power business, and the good load factor it makes possible, is partly responsible for the economy of power production. The yearly load factor was raised from 13 per cent in 1902 to 32 per cent in 1908.

In Fig. 2 are shown two curves, one of which gives the total output month by month in kw-hours for several years, and the other shows the output for power purposes. From this it is seen that the output for power in 1908 is a much greater proportion of the total than in 1903, and is now much higher than in the ordinary plant.

In 1908 the percentages of output for various purposes, as measured at the switchboard, were as follows:

	Per cent.
Street lighting	9.1
Commercial lighting	34.3
Power	54.5
Loss on Cedar Falls transmission	2.1
	100.0

NON-PEAK POWER.

The company has begun to take on power consumers under off-peak contracts, whereby the company can require the consumers to shut down their motors between the hours of 4 and 6 p. m. during the months of November, December, January and February, or if used during that period, to pay regular rates for all electricity supplied during the preceding 12 months. The company will not exercise this right unless it needs its capacity for carrying its regular peak business. It is only recently that the company has adopted this plan, but it already has 380 hp in motors connected under such contracts. The rates are considerably below those given regular consumers as regards the

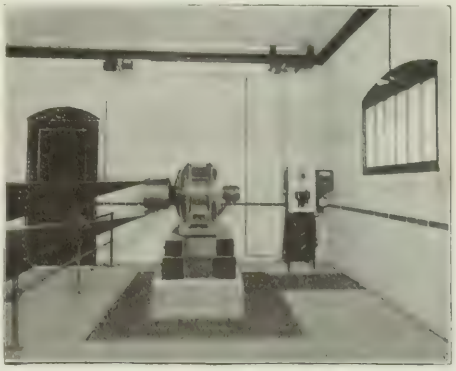


FIG. 9.—MOTOR AND DEEP-WELL PUMP STATION.

first few hours' use per month of the connected load. Otherwise they are about the same.

WATER WORKS PUMPING.

Among the off-peak contracts which the company has taken is that for pumping water at one of the deep-well pumping stations of the Waterloo Water Company. The deep-well pump used in this case is of the vertical-shaft, centrifugal type,

built by the Byron Jackson Machine Works, at San Francisco. This pump is placed 200 ft. below the surface. It is of small diameter, being placed within a 16-in. outside diameter well casing, ⅜ in. thick. Outside of this inner casing there is a 20-in. outside diameter casing. The pump runs 850 r.p.m.

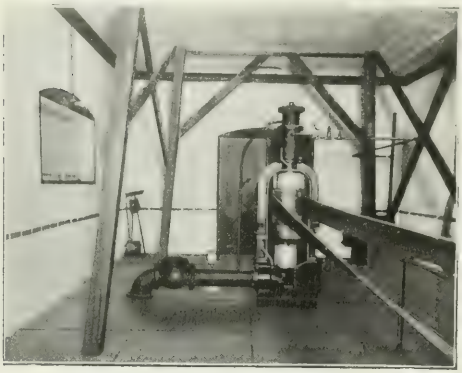


FIG. 10.—BELTED VERTICAL CENTRIFUGAL DEEP-WELL PUMP.

against an effective head of 78 ft., 60 of which is due to water lift and 12 to friction. This head varies somewhat, however, from day to day. The pump runs 850 r.p.m. and pumps 824 gal. per minute, or 1,200,000 gal. per day. It was installed under the supervision of Mr. C. R. Henderson, chief engineer of the Waterloo Water Company. On account of the uncertainty as to what would be the depth of water in the well and the consequent desirable speed, this pump was not direct-connected to a vertical-shaft motor, but was belted to the ordinary horizontal-shaft motor. The installation is shown in Figs. 9 and 10, which also show the interior of the pump house erected at this well. The exterior of the pump house is shown in Fig.



FIG. 11.—INTERIOR DEEP WELL PUMPING STATION.

11. This pump operates practically all of the time, except when the central-station company desires the capacity which it takes for other purposes during peak load. As with other off-peak contracts, it is allowed to operate during peak load as long as the company has sufficient reserve capacity to take care of it.

The lighting rates are 16 cents per kw-hour for energy supplied in excess of the turning point, less a discount of 1 cent per kw-hour if the bill is paid on or before the 10th of the month. The turning point is practically determined by the number of hours' use per month which the customer has made of his connected load. For lighting installation in commercial use this turning point is fixed at 2 kw-hours per socket connected, to which 6 kw-hours is added as a kind of service charge. In residences, installations of 10 lamps or less are counted as if they were four lamps. Twenty lamps or less are counted as five lamps. Above 20 lamps, 1 kw-hour is added for each 10 lamps installed. There is a schedule of minimum rates for residences as follows: Seven lamps, 50 cents; 13 lamps, 75 cents; 20 lamps, $1; over 20 lamps, 15 cents for each additional 10 lamps.

The power rate is 10 cents per kw-hour up to the turning point and 3 cents per kw-hour for current supplied in excess of the turning point. The discount for prompt payment is ½ cent per kw-hour. The turning point is reached on a 1-hp motor installation when 70 kw-hours per month have been consumed. Thus the rate would be 10 cents per kw-hour up to 70 hours, and 3 cents per kw-hour in excess of 70 hours. Motors of from 1 hp to 10 hp have 40 kw-hours added for each horse-power to make up the turning point. Motors of 10 hp to 30 hp have 30 kw-hours added per horse-power to make up the turning point. There is a minimum bill of $1.50 per rated horse-power, which is rigidly adhered to.

It will be seen by analysis of these rates that on lighting installations they are figured so that the consumer must use the equivalent of his connected load, 35 hours per month, before he reaches the turning point, beyond which he gets a low rate. On a motor installation this varies according to the size of the motor, but is approximately the same.

The property is one of those controlled by the Dawes syndicate of Chicago. The president and general manager is Mr. I. C. Elston, Jr. Mr. Austin Burt, past-president of the Iowa Electrical Association, is general superintendent, under whom the electrical department has been brought to such a high state of efficiency.

An Exact Method for the Determination of the Efficiency, Regulation or Size of Transmission Conductors.

By Harold Pender.

In view of the number of articles that have recently appeared on the calculation of transmission lines, giving various approximate formulas for this purpose—some of which may, under certain conditions, give quite erroneous results—the following exact formulas for the calculation of the various quantities from any set of premises that may be given should prove of interest. Except for the determination of the size of wire to be used for a given voltage drop the solution in each case is found directly by means of a comparatively simple formula; to determine the size of wire for a given drop, an approximation is first obtained and then the error involved in the approximation is determined; this error, however, will be found negligible in most practical cases. Moreover, the use of this particular approximate formula followed by a determination of the error involved, has a distinct advantage, since a large error immediately indicates that the drop for any size of wire within a wide range will differ only slightly from the permissible drop, and that therefore, either by allowing a slight increase in the drop, or by employing two separate circuits instead of one, a very considerable saving in copper can be effected.

All of the formulas given are readily derivable from the usual diagram of two impedances in series, namely, the impedance of the load and the impedance of the line—remembering that the ratio of power lost to power delivered is equal to

the ratio of line resistance to the load resistance, and that the ratio of the voltage at the generating end to the voltage delivered is equal to the ratio of the total impedance to the load impedance.

In addition to the formulas, complete data for the resistance, reactance, capacity susceptance, weight, etc., for both copper and aluminum stranded wires are given in the accompanying tables, for any size of wire likely to be used for energy transmission. The reactance tables will be found particularly convenient, as

TABLE I.

REACTANCE PER MILE OF A NO. 4-0 B. & S. WIRE = x_1.

Distance apart of wires in feet.	15 Cycles.	25 Cycles.	40 Cycles.	60 Cycles.	125 Cycles.
1.....	0.128	0.213	0.340	0.510	1.063
2.....	0.149	0.248	0.396	$.594	1.328
3.....	0.161	0.268	0.429	0.644	1.341
4.....	0.170	0.283	0.452	0.678	1.413
5.....	0.176	0.294	0.470	0.705	1.470
6.....	0.182	0.303	0.485	0.728	1.516
7.....	0.187	0.311	0.498	0.746	1.555
8.....	0.191	0.318	0.508	0.763	1.589
9.....	0.194	0.324	0.518	0.777	1.618
10.....	0.197	0.329	0.526	0.790	1.645
15.....	0.210	0.350	0.559	0.839	1.748
20.....	0.218	0.364	0.582	0.874	1.820
25.....	0.225	0.375	0.601	0.901	1.877

they show directly the reactance per mile of any size of wire from 1,000,000 circ. mil to a No. 6 B. & S. wire, for any spacing from 1 ft. to 25 ft. and for frequencies of 15, 25, 40, 60 and 125 cycles per second. The tables are based on the fact that the reactance of a wire for a given frequency can be considered as the sum of two quantities, one varying only with the spacing of the wires and the other only with the size. The resistances have been calculated for copper of 98 per cent conductivity and for aluminum of 62 per cent conductivity (Matthiessen's Standard—that is, one meter-gram of soft-drawn copper = 0.141729 international ohm at 0 deg. C.), both at 20 deg. C., plus an increase of 1 per cent on account of stranding, the temperature coefficient being taken as 0.42 per cent per degree Centigrade. The weights are the weights of solid wire of equal cross-section increased by 1 per cent on account of stranding.

Let E = pressure between adjacent wires at receiving end in kilovolts.

V = pressure between adjacent wires at the generating end in kilovolts.

W = power delivered in megwatts (thousands of kilowatts).

k = power factor of the load, expressed as a decimal fraction = $\cos\theta$.

t = $\tan\theta$ corresponding to $k = \cos\theta$. (Table III.)

k_0 = power factor at the generating end, expressed as a decimal fraction.

L = in case of a three-phase system, the length of each wire in miles; in the case of a single-phase system, the total length of both wires in miles.

r = resistance of each conductor per mile.

$x = x_1 + x_2$ = reactance of each conductor per mile, where x_1 is the reactance per mile of a No. 4-0 B. & S. wire (Table I) and x_2 the difference in the reactance per mile of a No. 4-0 B. & S. wire and that of the wire actually used (Table II).

Q = power lost in transmission, as a fraction of the delivered power.

P = pressure drop, as a fraction of the delivered pressure.

R = $\frac{(kE)^2}{1000\,W}$ = equivalent resistance of receiver per mile of line.

I = $\frac{1}{R}$

Case I.—Given the delivered pressure E, the power delivered W, the power factor of the load k, the length of the line L, the frequency, the size and the spacing of the wires. The following are exact expressions[1] for the quantities to be determined:

Power loss $Q = \frac{r}{R}$

Pressure drop $P = k\left(\sqrt{(1+Q)^2 + t^2} - t\right)$

Power factor at generating end $k_0 = \frac{1-Q}{1+P}\,k$

Case II.—Given the delivered pressure E, the power delivered W, the power factor of the load k, the length of the line L, the frequency and the allowable power loss Q. The size of wire to be used is determined by the following exact formula:

Resistance of each wire per mile, $r = RQ$,

the corresponding size of wire being given in Table II. The pressure drop and power factor at the generating end can then be determined by the formulas given in Case I.

Case III.—Given the delivered pressure E, the power delivered W, the power factor of the load k, the length of the line L, the frequency, the spacing of the wires, and the allowable pressure drop P.

An exact determination of the size of the wire to use in this case cannot be made directly, since this would require the solution of a logarithmic equation. However, since the reactance of commercial sizes of wire for a given frequency and spacing differ only slightly from one another, a close approximation to the exact size of wire to be used can be obtained by assuming that the reactance, for a given frequency and spacing, for any size between 1,000,000 circ. mils and a No. 6 B. & S. wire is equal to that of a No. 4-0 wire. It will be found that except when the line reactance is large compared to the line resistance, the error due to this assumption will not cause a change in the size of wire—that is, the error will be less than half the percentage difference—26 per cent—between successive sizes on the B. & S. gage. On the other hand, as stated above, a large error in the

TABLE II.

RESISTANCE PER MILE OF COPPER AND ALUMINUM STRANDED WIRES AND REACTANCE INCREMENT** x_2.

Size circ. mils. and B. & S.	Ohms per mile at 20° C.* Copper.	Alum'm.	Difference** in reactance per mile of any size wire and that of a No. 4-0 B. & S. wire = X_2. 15 Cy.	25 Cy.	40 Cy.	60 Cy.	125 Cy.
1,000,000	0.0566	0.0894	—.024	—.039	—.063	—.094	—.196
900,000	0.0629	0.0993	—.022	—.037	—.059	—.088	—.183
800,000	0.0707	0.1118	—.020	—.034	—.054	—.081	—.168
700,000	0.0808	0.1278	—.018	—.030	—.048	—.073	—.152
600,000	0.0943	0.1490	—.016	—.026	—.042	—.063	—.132
500,000	0.1131	0.1788	—.013	—.022	—.035	—.052	—.109
450,000	0.1257	0.1987	—.011	—.019	—.031	—.046	—.095
400,000	0.1414	0.224	—.011	—.018	—.029	—.039	—.080
350,000	0.1616	0.255	—.008	—.013	—.020	—.031	—.064
300,000	0.1886	0.298	—.006	—.010	—.14	—.021	—.044
250,000	0.226	0.358	—.004	—.007	—.011	—.016	—.031
No 0000	0.265	0.423	—.002	—.003	—.005	—.008	—.017
000	0.337	0.533	+.004	+.006	+.009	+.014	+.029
00	0.425	0.672	+.007	+.012	+.019	+.028	+.059
0	0.536	0.848	+.011	+.018	+.028	+.042	+.088
1	0.676	1.068	+.014	+.023	+.038	+.057	+.117
2	0.852	1.34	+.019	+.029	+.047	+.070	+.147
4	1.355	2.14	+.029	+.047	+.075	+.113	+.236
6	2.15	3.40	+.047	+.076	+.121	+.181	+.374

*Stranded wire, copper 98 per cent. conductivity, aluminum 62 per cent. conductivity, resistance increased 1 per cent on account of stranding, temperature coefficient [illegible] per cent per degree Centigrade.

**The total reactance of a wire is the sum of the reactance and [illegible] the reactance of the wire under the same conditions.

approximate formula for the size of wire indicates immediately that the drop is due chiefly to the line reactance, and that by allowing a very small increase in the permissible drop,

[1] These [illegible] can also be used to determine the exact efficiency, regulation and power factor of any number of circuits in parallel, the total load being considered as a single load, and to determine the size of the conductors and resistance and reactance respectively and the total equivalent resistance of the system.

or by employing two separate circuits instead of one, a very considerable saving in copper can be effected.

Put

$$T_1 = t + \frac{x_1}{R}$$

Where x_1 is the reactance of a No. 4-0 wire (Table I). Then, to a close approximation,

Resistance of each wire per mile:

$$r_1 = R\left[\sqrt{\left(1 + \frac{P}{k}\right)^2 - T_1^2} - 1\right]$$

the corresponding size of wire being given in Table II, as well as the difference x_2 between the reactance corresponding to this size and the reactance of a No. 4-0 wire.

By substituting for T_1 in the above formula the value $T = T_1 + \frac{x_2}{R}$ the error in the value of r caused by neglecting x_2 can be readily found. As stated above, in any practical case this will, as a rule, be negligible; however, should the error in

TABLE III.

VALUES OF t = TAN θ CORRESPONDING TO k = COS θ.

k.	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.5..	1.732	1.687	1.643	1.600	1.559	1.519	1.479	1.442	1.404	1.368
0.6..	1.333	1.299	1.265	1.233	1.201	1.169	1.138	1.108	1.078	1.049
0.7..	1.020	0.992	0.964	0.936	0.909	0.882	0.855	0.829	0.802	0.776
0.8..	0.750	0.724	0.698	0.672	0.646	0.620	0.593	0.567	0.540	0.512
0.9..	0.489	0.456	0.426	0.395	0.363	0.329	0.292	0.251	0.203	0.143

NOTE.—This table is to be used like a table of logarithms; that is, the value of t corresponding to $k = 0.83$ is 0.672.

the particular problem in hand be sufficient to give a new value for r for which the corresponding value of x_2 differs appreciably from the first value found, r should be again calculated, using this second value for x_2, and so on, until the difference in x_2 for two successive values of r as thus determined becomes negligible. In this way an exact determination of the size corresponding to the given drop can readily be made, although, as stated above, a large error in the first approximation immediately indicates that the feasibility of increasing the permissible drop or of dividing the circuit should be investigated.

Case IV.—Given the pressure at the generating end V, the power delivered W, the power factor of the load k, the length of the line L, the frequency, the size and spacing of the wires.

In this case R, the equivalent resistance of the receiver per mile of line, can be expressed in terms of the pressure at the generating end V.

Put

$$M = \frac{(kV')^2}{2LW} = (r + xt)k^2$$

$$e = \frac{k^2(r^2 + x^2)}{M^2}$$

Then

$$R = M[1 + \sqrt{1 - e}].$$

Using this value for R, the exact formulas given under Case I are immediately applicable.

Effect of Line Capacity.

The exact formulas for determining the effect of line capacity on the power loss and pressure drop are comparatively complicated. However, since the effect is usually small in such cases as arise in practice, a sufficiently close approximation can be obtained by assuming that the effect is the same as would be produced by two condensers, each having a capacity equal to one-half that of the line, shunted across the line at the receiving and sending ends respectively. The effect of the condenser at the receiving end is merely to modify the equivalent load power factor; the condenser at the sending end has no effect on the power loss and line drop, but merely increases the resultant power factor at the generating end.

In addition to the above symbols let

b = capacity susceptance[1] per mile of two parallel wires for a frequency of one cycle per second.

$B = nbL$ for a *three-phase* line or $\frac{nbL}{4}$ for a *single-phase* line, where n is the number of cycles per second, and L, as defined above, is the length in miles of *each* wire for a *three-phase* line or the length of *both* wires for a *single-phase* line.

Then the equivalent power factor at the receiving end is the cos k' corresponding to the tangent t', where

$$t' = t - \frac{BE^2}{W}$$

The above formulas for power loss and pressure drop (Case I) are then immediately applicable by substituting for k and t the values k' and t'; the formula for predetermining the size of wire in terms of the pressure drop (Case III) may also be applied, assuming the capacity susceptance equal to that of a No. 4-0 wire, an assumption which will introduce only a slight error, since the capacity susceptance varies only slightly with the size of wire. The power-factor formula, $k_0 = \frac{1 + Q}{1 + P}k'$, (see Case I) gives the power factor at the generating end *excluding* the second condenser, the actual power factor at the generator is the cosine k'_0 corresponding to the tangent t'_0 where

$$t'_0 = t_0 - \frac{BV^2}{W_0}$$

where $W_0 = (1 + Q)W$, the total power supplied at the generating end.

Alternating-Current Trolley Wires.

The resistance and reactance of various combinations of overhead trolleys and 100-lb. return rails are given in Table VI. This table is based on extended tests made by Mr. A. W. Copley on the New York, New Haven & Hartford Railroad, the results of which were published in the *Proceedings* of the American Institute of Electrical Engineers for December, 1908. Unfortunately there are no reliable data on rails of smaller sec-

TABLE IV.

SIZE AND WEIGHT OF STRANDED COPPER AND ALUMINUM WIRES.

Size B & S.	Circ. Mils.	Diameter Inches.	Lbs. per Mile* Copper.	Lbs. per Mile* Aluminum.
....	1,000,000	1.152	16,140	4,870
....	900,000	1.092	14,530	4,380
....	800,000	1.035	12,910	3,890
....	700,000	0.963	11,300	3,410
....	600,000	0.891	9,690	2,920
....	500,000	0.819	8,070	2,430
....	450,000	0.770	7,260	2,190
....	400,000	0.728	6,460	1,947
....	350,000	0.679	5,650	1,703
....	300,000	0.630	4,840	1,460
....	250,000	0.590	4,040	1,217
0000	211,600	0.530	3,420	1,030
000	167,800	0.470	2,710	817
00	133,100	0.420	2,150	648
0	105,500	0.375	1,703	513
1	83,690	0.330	1,351	407
2	66,370	0.291	1,071	323
4	41,740	0.231	674	203
6	26,250	0.183	420	128

*Increased 1 per cent over weight of solid wire on account of stranding.

tion. However, since the greater part of the resistance is in the trolley, and only a small percentage of the total reactance is due to the magnetic field in the rail, the values given for the combined resistance and reactance, respectively, may also be used with but a slight error in case the rail is of smaller size. It should be noted that the reactances for the three sizes of wire given are constant to within 5 per cent for any height from 15 ft. to 30 ft. above the track.

The figures showing the division of current between the track and the earth refer to intermediate portions of long

[1] $b = \pi C$ where C is the capacity in farads of the condenser formed by unit length of each pair of line wires.

sections—more than three miles; a greater portion of the current flows in the track near the load and the power house. The division of current between rails and earth also depends on the character of the soil; for rocky or dry soil less current would probably return through the earth. It will be noted that if p' be the ratio of the current in each trolley to the total current and p'' the ratio of the current in each rail to the total current, and the respective resistances be r' and r'', the total resistance of any combination of trolleys and rails, as measured by Mr. Copley, is approximately $p'r' + p''r''$; similarly the total reactance is $p'x' + p''x''$ where x' and x'' are the reactances of a single trolley and rail, respectively; using these formulas, a closely approximate value for the equivalent resistance and reactance for any other combination of trolleys and rails for any division of current between the wires spaced 4 ft. apart. To find the power loss, pressure drop and power factor at the generating end, use should be made of the following values:

$$E = 40$$
$$W = 5$$
$$k = 0.8$$
$$t = 0.75$$
$$L = 30$$
$$r = 0.852$$
$$x = 0.283 + 0.029 = 0.312$$
$$R = \frac{(0.8 \times 40)^2}{30 \times 5} = 6.83$$
$$T = 0.75 + \frac{0.312}{6.83} = 0.796.$$

TABLE V.

CAPACITY SUSCEPTANCE PER MILE OF TWO PARALLEL STRANDED AERIAL WIRES, FREQUENCY ONE CYCLE PER SECOND.

Size circ. mil and B & S.	SUSCEPTANCE BETWEEN WIRES = b_1. Distance apart of wires in feet. 1	2	3	4	6	8	10	12
1,000,000	9.3×10^{-8}	7.5×10^{-8}	6.8×10^{-8}	6.3×10^{-8}	5.8×10^{-8}	5.5×10^{-8}	5.3×10^{-8}	5.1×10^{-8}
500,000	8.3×10^{-8}	6.9×10^{-8}	6.3×10^{-8}	5.9×10^{-8}	5.4×10^{-8}	5.2×10^{-8}	4.9×10^{-8}	4.8×10^{-8}
250,000	7.5×10^{-8}	6.3×10^{-8}	5.8×10^{-8}	5.5×10^{-8}	5.1×10^{-8}	4.9×10^{-8}	4.7×10^{-8}	4.5×10^{-8}
No. 0000	7.4×10^{-8}	6.2×10^{-8}	5.7×10^{-8}	5.4×10^{-8}	5.0×10^{-8}	4.8×10^{-8}	4.6×10^{-8}	4.5×10^{-8}
1	6.6×10^{-8}	5.6×10^{-8}	5.2×10^{-8}	5.0×10^{-8}	4.6×10^{-8}	4.4×10^{-8}	4.3×10^{-8}	4.1×10^{-8}
6	5.8×10^{-8}	5.0×10^{-8}	4.7×10^{-8}	4.5×10^{-8}	4.2×10^{-8}	4.0×10^{-8}	3.9×10^{-8}	3.8×10^{-8}

NOTE.—The charging current per mile of *single-phase* line (2 miles of wire) is equal to $bnE \times 10^3$; for a *three-phase* line the charging current per wire per mile of line (3 miles of wire) is equal to $1.16 \times 10^3\ nbE$, where n is the cycles per second, E the *kilovolts* between wires.

rails and the earth can be obtained. In the case of a catenary suspension, a certain percentage of the overhead current is carried by the messenger cable; on account of the high effective resistance of a steel cable to alternating currents, this current will be quite small. (In a 7/16-in. messenger cable, carrying a No. 4-0 wire, Mr. Copley gives the messenger current as only 3.5 per cent of the total.)

To determine the power loss, pressure drop, etc., for a single-phase trolley system, the formulas given above under Case I are directly applicable by putting L equal to the distance in miles of the load from the power house—or substation—and r and x equal, respectively, to the combined resistance and reactance of the trolley and the track per mile, as given in Table VI. Similarly, the proper size of trolley for any given

TABLE VI.

RESISTANCE AND REACTANCE OF SINGLE-PHASE TROLLEY WITH 100-LB. RAIL RETURN

No. of Tracks.	No. of Trolley Wires.	No. of Return Rails.	Percentage of Current Returning in Rail.	Resistance Ohms per Mile—No. 4-0 Trolley. 25 Cy.	15 Cy.	3-0 Trolley. 25 Cy.	15 Cy.	2-0 Trolley. 25 Cy.	15 Cy.	Reactance Ohms per Mile. 25 Cy.	15 Cy.
..	1	..	..	0.26*	0.26	0.33	0.33	0.42	0.42	0.38	0.23
..	..	1	100	0.16*	0.13	0.16	0.16	0.13	0.44	0.44	0.26
..	1	1	87	0.30	0.29	0.37	0.36	0.46	0.45	0.49	0.30
1	1	2	49*	0.29*	0.28*	0.36	0.35	0.45	0.44	0.47*	0.282*
2	2	4	58*	0.155*	0.15*	0.20	0.19	0.24	0.23	0.269*	0.161*
4	4	8	75*	0.086*	0.082*	0.11	0.10	0.13	0.12	0.168*	0.101*

NOTE.—The figures marked thus * are taken directly from Mr. Copley's paper; the others are derived from these. At the point where the current enters the rail Mr. Copley found that 50 per cent of the current starts toward the power house on a single-track road and similarly 87 per cent on a four-track road, in each case the rail current falling to the values given in the table in a distance of about three miles and from that point on remaining practically constant until near the power house.

Then

Power loss $$Q = \frac{0.852}{6.83} = 0.125$$

Pressure drop $$P = 0.8\sqrt{(1.125)^2 + (0.796)^2} - 1 = 0.102$$

Generator power factor $$k_0 = \frac{1.125}{1.102} \times 0.8 = 0.817.$$

Case II.—A load of 5000 kw at 80 per cent power factor is to be delivered at 40,000 volts over a three-phase line of copper wire 30 miles long; allowable power loss, 12.5 per cent. The problem is to find the size wire to use.

$$E = 40$$
$$W = 5$$

set of conditions can be determined by the formulas given under Case III, taking from Table VI the reactance per mile x (constant for the three sizes of trolley specified and usually employed), and selecting the size of trolley from Table VI corresponding to the value of the resistance per mile given by the formula

$$r = R\left[\sqrt{\left(1 - \frac{P}{\quad}\right)} - 1\right]$$

Numerical Examples.

Case I.—A load of 5000 kw at 80 per cent factor is to be delivered at 40,000 volts over a three-phase line of No. 2 B. & S. copper wire 30 miles long, frequency 25 cycles per second,

$$k = 0.8$$
$$L = 30$$
$$Q = 0.125$$
$$R = \frac{(0.8 \times 40)^2}{30 \times 5} = 6.83$$

Then

Resistance per mile $r = 0.125 \times 6.83 = 0.854$,

whence from Table II the proper size is found to be No. 2 B. & S.

Case III.—A load of 5000 kw at 80 per cent power factor is to be delivered at 40,000 volts over a three-phase line of copper wire, 30 miles long, frequency 25 cycles per second, wires spaced

4 ft. apart, allowable pressure drop 10.2 per cent; to find the size wire to use.

$$E = 40$$
$$W = 5$$
$$k = 0.8$$
$$t = 0.75$$
$$L = 30$$
$$P = 0.102$$
$$x_1 = 0.283$$
$$R = \frac{(0.8 \times 40)^2}{30 \times 5} = 6.83$$
$$T_1 = 0.75 + \frac{0.283}{6.83} = 0.791$$

Then

Resistance per mile

$$r_1 = 6.83\left[\sqrt{\left(\frac{1.102}{0.8}\right)^2 - (0.791)^2} - 1\right] = 0.872$$

whence, from Table II, the nearest size wire is found to be No. 2 B. & S. The value of x_2 corresponding to $r_1 = 0.872$ is 0.029, which makes $T = 0.796$, and gives 0.854 as the corresponding value for r, showing that the error in the first approximation for r is less than 3 per cent.

The above example may also be used to illustrate an extreme case, in which the first approximation for r may be entirely erroneous, but by successive applications of the above formula a correct solution can be obtained.

Keeping the other conditions the same, suppose the frequency be increased to 125 cycles per second,

Then

$$x_1 = 1.413$$
$$T_1 = 0.75 + \frac{1.413}{6.83} = 0.957$$

First approximation

$$r_1 = 6.83\left[\sqrt{\left(\frac{1.102}{0.8}\right)^2 - (0.957)^2} - 1\right] = -0.060,$$

which shows that it is impossible to deliver power under the conditions stated, with a line having a reactance as great as that of a No. 4-0 wire.

As a second approximation, assume a reactance equal to that of a 500,000-circ. mil wire. The resistance per mile then works out 0.041 ohm, which is again too small a value for r, since the reactance corresponding to a wire having this resistance is less than that of a 500,000-circ. mil wire.

As a third approximation, assume a reactance equal to that of a 700,000-circ. mil wire. The resistance per mile then works out to 0.079 ohm, which is about 1 per cent less than that of the 700,000 circ. mil assumed. The nearest commercial size of wire corresponding to a drop of 10.2 per cent is then 700,000 circ. mil.

As a matter of fact, however, the drop for any size between a No. 4-0 wire and a 1,000,000-circ. mil wire would be substantially the same, as will be readily seen by calculating the drop for these two sizes by the exact formula of Case I, which gives a drop of 9.6 per cent for a 1,000,000-circ. mil wire and 13.0 per cent for a No. 4-0 wire, as against the 10.2 per cent specified. Therefore, by increasing the drop to 13.0 per cent, say, a saving of 70 per cent in copper could be effected. (Were the drop proportional to the resistance, the saving in the copper for the same increase in drop would be only 21.5 per cent.) Again, the use of two circuits of No. 2 wire each, would give a drop of only 9.5 per cent, and would effect a saving of 81 per cent in copper.

Case IV.—Take the example given under Case I, but assume the pressure at the generator 44,080 volts, the receiver pressure E being unknown.

Then

$$M = \frac{(0.8 \times 44.08)^2}{2 \times 30 \times 5} = (0.852 + 0.312 \times 0.75)^2 (0.8)^2 = 3.45$$
$$c = \frac{(0.8)^2 (0.852 + 0.312)^2}{(40)^2} = 0.044$$

Whence

$$K = 3.45\,[1 + \sqrt{1 - 0.044}] = 6.83,$$

which agrees with the value found in Case I. The power loss, voltage drop—as a fraction of the delivered e.m.f.—and power factor at generating end then work out the same as in Case I. The voltage drop as a fraction of the e.m.f. at the generating end is

$$\frac{P}{1 + P} = \frac{0.102}{1.102} = 0.0926.$$

Effect of Capacity.

Take the example given under Case I. From Table V

$$b = 5.0 \times 10^{-5}$$

whence

$$B = 25 \times 30 \times 5.0 \times 10^{-5} = 3.8 \times 10^{-3}$$

and

$$t' = 0.75 - \frac{3.8 \times 10^{-5} \times (40)^2}{5} = 0.738$$
$$k' = 0.805 \text{ (Table III.)}$$
$$R = \frac{(0.805 \times 40)^2}{30 \times 5} = 6.91$$
$$T = 0.738 + \frac{0.312}{6.91} = 0.783$$

Then

$$\text{Power loss} \qquad Q = \frac{0.852}{6.91} = 0.123$$

$$\text{Pressure drop} \quad P = 0.805\sqrt{(1.123)^2 + (0.783)^2} - 1 = 0.102$$
$$k_0 = \frac{1.123}{1.102} \times 0.805 = 0.821$$
$$t_0 = 0.683 \text{ (Table III.)}$$
$$t_0' = 0.683 - \frac{3.8 \times 10^{-5} \times (44.08)^2}{5.62} = 0.670$$

Generator power factor $k'_0 = 0.831$. (Table III.)

Alternating-Current Trolley Circuits.

Power of 2000 kw is to be supplied to a locomotive at 90 per cent power factor and 10,000 volts at a distance of 20 miles from the power house—or substation; No. 4-0 trolley, return circuit two 100-lb. running rails, frequency 25 cycles. The problem is to find the power loss, pressure drop and power factor at the power house.

$$E = 10$$
$$W = 2$$
$$L = 20$$
$$k = 0.9$$
$$t = 0.489$$
$$r = 0.29$$
$$x = 0.47$$

These values for r and x are on the assumption that only 40 per cent of the return current flows through the rails.

$$R = \frac{(0.9 \times 10)^2}{20 \times 2} = 2.05$$
$$T = 0.489 - \frac{0.47}{2.05} = 0.718$$

Then

$$\text{Power loss} \qquad Q = \frac{0.29}{2.05} = 0.141$$

$$\text{Pressure drop} \quad P = 0.9\sqrt{(1.141)^2 + (0.718)^2} - 1 = 0.213$$

$$\text{Power factor at power house } k_0 = \frac{1.141}{1.213} \times 0.9 = 0.847.$$

Taking the reverse problem, suppose that it is desired to determine the size of trolley to use for a drop of 21.3 per cent between the power house and the locomotive, the other conditions being the same as given in the preceding example. Then by the formula under Case III,

Combined resistance per mile of trolley and track,

$$r = 2.05\left[\sqrt{\left(\frac{1.213}{0.9}\right)^2 - (0.718)^2} - 1\right] = 0.29$$

whence, from Table VI, the proper size of trolley is a No. 4-0.

Power Plant of University of Washington, Seattle, Wash.

By GEORGE H. TINKER.

OWING to the addition of several new buildings and to meet the constantly growing demands of the University of Washington, the vigorous State institution of learning at Seattle, Wash., it was found necessary to increase greatly the mechanical equipment, and for reasons of economy and convenience of operation, as well as for the advantages it would offer along educational lines, it was decided to build a complete new power plant for furnishing light, heat and power.



FIG. 1.—POWER PLANT BUILDING.

The power-plant building, shown in Fig. 1, is located on the east side of the university campus, close to and overlooking Lake Washington, a large body of fresh water noted for its beautiful scenery. The building, which is of pleasing design and of modern brick and concrete construction, contains a complete equipment of modern mechanical devices for the economical generation of power, lighting, ventilating and heating and other requirements of a large educational establishment.



FIG. 2.—BOILER-ROOM.

The power house is divided into engine and boiler rooms, the latter being 60 ft. 8 in. x 46 ft. 4 in. in size, and provided with a brick chimney 54 in. diameter by 100 ft. high, erected on a concrete base.

A spur track of the Northern Pacific Railroad leads to the power plant, and coal is received in a concrete bin with a capacity of 500 tons. Coal is handled from the receiving bins to the bunkers, located above the stokers, by means of conveyors driven by a motor located in the building. There have been installed for present needs two Parker water-tube boilers set in one battery, each boiler having 2672 sq. ft. of heating surface and designed to operate at 160 lb. pressure. Pressed brick is used in the settings, which are laid in cement mortar. A grate area of 58½ sq. ft. active surface in a Green chain-grate stoker is provided in each boiler. (Fig. 2.) Almost perfect combustion is obtained in the regular operation of this plant, and it is only on very rare occasions, due to starting fire under boilers or something similar, that any smoke is visible. The driving power for the stokers is furnished by a small vertical Hallidie engine set on a light steel platform overhead, the engine being belted to a shaft over the stokers, which are eccentric driven.

As stated before, the coal is unloaded in the receiving bin. It is then elevated to the bunkers over the boilers, which have a capacity of 30 tons; from each a delivery spout, provided with cut-off gate, serves the coal to each stoker. The coal conveyor is driven by a 5-hp Westinghouse motor, with a starting box located on the boiler-room floor.

From the chain grates the ashes drop into a concrete tunnel under the boilers, from where they are "sluiced" out through the east wall of the boiler house and through a chute down the lake bank. Water is pumped by electric power from Lake Washington for the requirements of the university. But a surprisingly small quantity is required to "sluice" the ashes away, and as the water valves and nozzles are located in the boiler-room this makes an altogether convenient, clean and inexpensive method of getting rid of all ashes.

The boiler-feed water is mainly secured from the returns of the heating system, augmented when necessary from Lake Washington. A 750-hp Cochrane feed-water heater and receiver is provided, which is located in a corner of the boiler-room. The feed pumps are shown in Fig. 4. An average temperature of 210 deg. is maintained in the heater.

THE ENGINES

The engine-room presents a pleasing appearance. It is 32 ft. 3 in. x 46½ ft. in size, with lofty ceiling and plenty of light and ventilation. The floors are of concrete with smooth, hard finish.

Two horizontal, simple-generating units are installed, consisting of Rideway engines, direct-connected to 100-kw and 200-kw generators, respectively. (Figs. 3 and 4.) Each engine is fitted with Rideway improved tank-oiling system and Hills-McCanna lubricating devices, with nickel-plated piping. Two complete sets of Thompson steam-engine indicators, with reducing motion, all in handsome hardwood cases, are provided. The



FIG. 3.—VIEW OF ENGINE-ROOM.

engines are fitted with a complete synchronizing mechanism operating on the "Begtrup" inertia governors for adjusting speed from the switchboard.

The generators are of the Westinghouse alternating-current rotating-field, engine-type, three-phase, 60-cycle machines and operate in parallel at 2300 volts. The rotating parts are built upon a spider, which is solid and arranged to be pressed on the engine shaft. The external frame is solid and movable parallel to the shaft to allow of access to the windings, as can be noted in Fig. 4. The armatures of these machines are of the slotted-drum type, and the core is built of laminated steel of high magnetic quality. Throughout the armature spider, core and windings large and open ventilating ducts are provided, the design being such as to set up a forced circulation of air through these ventilating spaces. During the rigid test of the plant, continuing through several days, frequently with 50 per cent overload, these generators, as also the engines, ran remarkably cool.

The switchboard, consisting of seven panels, the rear of which is shown in Fig. 5, was also furnished the contractors by the Westinghouse Electric & Manufacturing Company. It is located in the engine-room and consists of seven panels, all of which are 24 in. wide by 96 in. high, except the two generator panels, which are 32 in. wide. All oil switches and circuit breakers are mounted separately back of the board, the operating handles only being mounted on the panels, connections being made by bell cranks and connecting rods.

The switchboard is arranged for the control of two 125-volt exciters, one the 100-kw and 200-kw generators previously described, seven single-phase lighting feeder circuits and three three-phase power-feeder circuits. All alternating-current instruments for the 2200-volt circuit are provided with series transformers, and all shunt instruments, such as voltmeters,

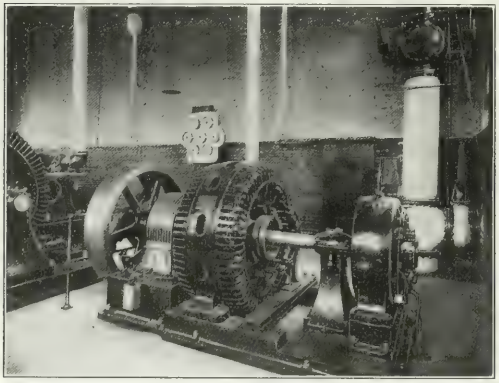


FIG. 4.—VIEW OF ONE OF THE GENERATORS.

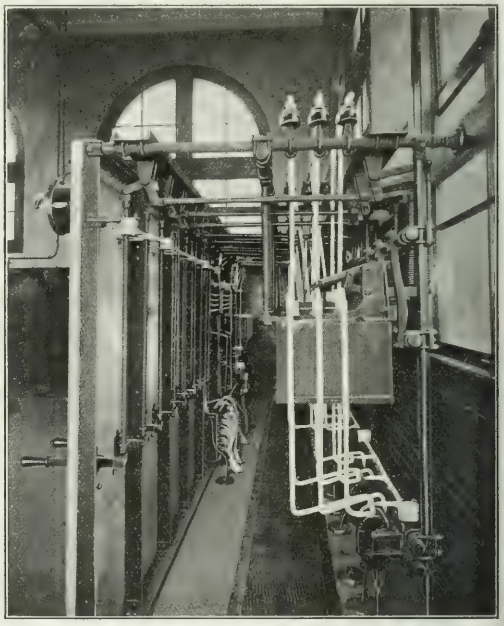


FIG. 5.—VIEW OF REAR OF SWITCHBOARD.

synchroscope and power-factor meters, are provided with shunt transformers.

All wiring for the generators, exciters, switchboards, etc., are placed in trenches with removable steel covers, and all the circuits leading to the various university buildings are installed in underground ducts, lead-covered cable being used. There are three 75-kw oil-cooled subway transformers with water-tight cases installed in concrete pits.

The entire power-plant equipment, including heating and return mains, electric circuits, etc., was installed by the Hallidie Machinery Company, of Seattle and Spokane, Wash., under the personal supervision of Mr. H. L. Weber, the contractor's superintendent of construction. Howard & Galloway, of San Francisco, Cal., were the supervising architects.

The appropriation made by the Washington State Legislature provided for the construction of several other permanent buildings besides the power house, to be used by the Alaska-Yukon-Pacific Exposition and subsequently to revert to the University of Washington. One of these buildings, Machinery Hall, will be occupied by the engineering college and in addition to class-rooms, drafting-rooms and offices, will contain the testing laboratories of the department of civil engineering, the steam laboratory of the department of mechanical engineering, and the laboratories of the department of electrical engineering.

The mechanical laboratory will contain a McEwen cross-compound engine; a McEwen single-cylinder engine; a Murray-Corliss engine; a Ball engine; a Foos gas engine and a De Laval steam turbine. Besides these principal machines the equipment consists of condensers, gages, indicators, gas apparatus, barometers, thermometers, pyrometers, steam calorimeters, fuel calorimeters, speed indicators, brakes, air compressors, air-brake outfit, and such devices as may be necessary for testing and calibrating the apparatus used.

The electrical laboratory is equipped with generators and motors for both direct and alternating current. In the direct-current section are located machines of the Westinghouse, General Electric, Bullock and Western Electric manufacture. Lamp-banks, switchboard, rheostats, storage batteries and other necessary apparatus are provided. In the alternating-current section are located a two-phase and a three-phase Fort Wayne generator; a three-phase Westinghouse rotary converter; Wagner, General Electric and Bullock single-phase and three-phase induction motors and a three-phase Fort Wayne synchronous motor; also transformers, lamp-banks, switchboards and numerous meters. The electric equipment of the power house formerly occupied will be added to these laboratories.

Near the Engineering Building and the new power house will be located the shops of the mechanical engineering department, which will include departments in wood-working, machine-shop and foundry practice. The foundry portion of this building will be equipped with a Whiting cupola, a Steele-Harvey brass furnace, crane, core ovens, mill, rattler, shaker, riddles, core machines and molding machines and other accessories. One wing of this building will contain a forge shop. The entire equipment of the pattern shop and machine shop will be moved to different portions of this building.

Report of the N. E. L. A. Committee on Grounding the Secondary.

The report presented at the Atlantic City N. E. L. A. convention by the committee on grounding of secondaries opens with a quotation of the resolution of last year recommending that the National Electrical Code shall make the grounding of alternating-current secondaries mandatory up to voltages of 150, and shall prohibit the grounding of such circuits when their voltage exceeds 150. This is followed by a quotation of the report of the electrical committee of the Underwriters' National Electrical Association, which rejected this recommendation on the grounds that, since the fire hazard must be as great from an undergrounded circuit in excess of 150 volts as from such a circuit carrying not over 150 volts, the Underwriters have no right to enforce a rule which they cannot defend on the ground that it lessens the fire hazard, but, on the other hand, that the Underwriters should use all of their moral influence in support of any rule which may tend to lessen the life hazard.

The committee expresses its belief that the grounding of secondaries is well recognized as the only effective means of preventing fatal accidents on defective secondary circuits, but that there are two matters of detail upon which great difference of opinion exists and upon which hinges the making of a safe rule because of easy compliance, or a dangerous one because of the impossibility of carrying out its provisions. These two matters relate, first, to the limiting voltage which should be grounded; and, second, as to how the connection with the ground should be made.

The committee adds that after three years' continuous study, and after having written and received hundreds of letters, and having been in conference with the leading engineers all over the country, it is unanimous in the opinion that secondary circuits up to 150 volts should be grounded, and above that voltage grounding should be prohibitive.

"Fatalities occurring with 150 volts, or under, have been so few that their occurrence may be actually ignored, while, on the other hand, at about 200 volts there are on record many instances where contact has resulted in a fatal accident. It follows, therefore, that to ground 150-volt circuits does not increase the danger, but, on the other hand, makes the handling of these circuits at all times safe. The grounding of 200-volt circuits does protect them against high-tension voltages due to breakdown of transformers and crosses with other circuits, which, however, are of infrequent occurrence, but, on the other hand, subjects the user to a constant risk of receiving a shock of 200 volts, or over, which experience has shown may be fatal. . . . It is, therefore, not only inadvisable to compel the grounding of 200 volts and upward, but almost criminal, for it would require one to do an act which might be the direct cause of an innocent user's death."

As to a suggestion that for 200 volts and upward grounding might be left optional, the committee believes this to be undesirable, for it evades the issue and puts the responsibility on the central-station man, who in some cases may not be able wisely to decide the safe policy. It considers that the grounding of 150-volt circuits will protect the lighting circuits in practically all of the cities of the United States, and knows of only three exceptions.

While recognizing the fact that 200/400-volt circuits for lighting mills, factories, parks, etc., are increasing, and that there are many thousands of motor installations using in excess of 200 volts which should be protected against high-tension voltages, the committee is also convinced that to ground these circuits presents a greater menace because it is always present, while the accidental cross or transformer breakdown is an unusual condition. It would gladly recommend a reliable method of protecting these circuits, but up to date no satisfactory scheme has been suggested. Thus far the only feasible method seems to be to install the apparatus in such a manner as to make it difficult for the user to stand on the earth or to be otherwise connected with the ground while touching lights or motors. This would mean installing lights so that they would be out of easy reach, controlling them with switches, and keeping them away from gas and water pipes, telephones, etc. It would also require motor equipments so placed that the attendant must stand on dry boards or rubber mats, and not be within reach of metal framework of buildings, metal floors, grounded pipe rails, etc.

In regard to the claim that electric lighting companies have failed to ground their circuits because of the cost, the committee believes this is not the reason, but rather that they are unable to secure grounds that are always reliable. The best ground, all admit, is a connection with an underground metallic water-pipe system. In many cities this exists, but its use is not always permitted, and in nine cities its use is prohibited. Members of this association should do missionary work in educating water-works engineers and managers and in proving to them that when secondary alternating-current wires are connected to water pipes no current flows unless a transformer breaks down or a cross occurs; that should such an accident occur it would, in nine cases out of ten, cause a fuse to blow and immediately cut off the current; and, further, that in the event of a current flowing it would be an alternating current which, it is generally believed, produces no electrolysis. In other words, the connecting of secondary alternating-current circuits to water mains places no additional burden upon the mains, but does render safe the use of such lighting circuits as are connected to them.

Where underground mains are not available other methods must be resorted to. The old method of a copper plate buried in coke, prescribed by the Underwriters, is not always reliable and in some cases has been found to be worse than useless. Iron pipes 1 in. or more in diameter, driven 8 ft. or 10 ft. into the ground have in some cases been found to be very satisfactory, while in other cases valueless.

A recent suggestion has been made to saturate the ground around the pipe at frequent intervals of time with salt water. Tests thus far made show that this is an excellent method and that after a few applications of the salt water the ground becomes permanently moist and a good conductor. The committee suggests the placing around the pipes, and rather near the surface, of a quantity of rock salt, which, because of its hygroscopic nature, will draw the water and thus produce a ground of low resistance and one that would also remain permanent. Users of this method are cautioned to take great care in making the connection between wire and pipe, as the presence of salt will tend to increase corrosion. The pipe itself will doubtless corrode, but a plain iron pipe will last perhaps 10 years, while one of galvanized iron will be good for several years longer. Brass pipe would last almost indefinitely and would not add materially to the total cost.

It is generally conceded that a solid connection with an underground water-piping system gives the best ground and that other methods suggested are, at best, substitutes. There are, however, places where for various reasons piping systems are not available. To meet these conditions other methods must be used. The committee does not feel sure as to the permanency of any of them, but thus far the tests indicate that under some conditions and in some soils they may be relied upon. Permanency of the ground is the great desideratum. It matters little whether the resistance is 5 ohms or one-fifth of an ohm, but if it is 5 ohms in winter and rises to 100 ohms in summer it can hardly be called reliable. The promiscuous grounding of ancient wiring installations regardless of their insulation resistance is not [illegible] installations be brought up to standard requirements and then grounded, for by doing this not only is the life risk improved, but the fire risk as well.

The placing of several grounds on an interconnected secondary network has in some cases caused trouble when paralleled by poorly bonded railway-track circuits; in such cases the numerous grounds should be removed and one ground installed, or two grounds located near together, which should be of larger area, permanent and easy of inspection. As to those

who believe that some of their transformers are so weak that they would not stand a ground connection without breaking down, the answer is that they are culpably negligent and that such apparatus should come off of their circuits at once. Fortunately, there is little of this kind of apparatus in use, and few managers who would willingly put themselves in this class.

Protection from Lightning.

The report presented at Atlantic City by the N. E. L. A. committee on protection from lightning deals with the subject under the heads of distribution and transmission.

It is stated that the returns on distribution service indicate a high degree of successful protection. There have been some transformer and meter troubles, but these appear to be mostly on small-sized apparatus. The meter failures appear to be proportionately less on the large distribution systems with secondaries grounded. The number of arrester equipments for plants of this class is comparatively large; the failures of the lightning arresters reported, on the other hand, are comparatively small. There appears to be reasonable care in the installation and maintenance of grounds for lightning arresters, which are of both the buried-plate and driven-pipe types. There is as yet no uniformity in the spacing of outside lightning arresters. Only a few cases of station apparatus failures have been reported. Station apparatus is protected by lightning arresters of types similar to those used for lines and, in many cases, by choke coils, though the use of the latter is not universal.

As to transmission systems, the troubles reported have been confined almost entirely to the transmission lines themselves, failures of station apparatus being comparatively few. The line damage reported has been principally shattering and puncturing of insulators, splitting and burning of poles and cross-arms and in certain cases the burning off of line wires. The insulator troubles and burning of conductors have occurred on both steel-tower and wooden-pole construction. The experience of the last year, both in experiment and practice, indicates the shielding value of overhead grounded-wire protection. The reports show that choke coils have been generally used in connection with station protection.

The following recommendations form the remainder of the report:

DISTRIBUTING SYSTEMS.

Grounds.—Pipe grounds are recommended in preference to plate grounds as being simpler and more convenient to install and just as effective for the purpose for line work. For station protection, a number of scattered grounds offer the best protection; these grounds do not necessarily have to be of the plate form. Scattered pipe grounds may be utilized to accomplish the same result. Secondary distributing lines should be grounded in order to minimize the danger from lightning to apparatus on the customer's premises. The arresters should be so located that they will protect station and substation apparatus, underground cables and line transformers. More protection should be provided where the transformer capacity is greater, and especial attention should be given to any points that are particularly exposed, such as connections between overhead and underground lines, junction points, and the like.

Spacing.—In general, arresters should be spaced approximately 2000 ft. apart, and closer together at especially exposed points. The experience of some of the larger systems seems to indicate that the use of a greater number of lightning arresters than this involves an investment that is not justified by the measure of protection secured. In certain cases where a higher degree of protection has been attempted it has been found that the fixed charges on the added investment in lightning arresters have been greater than the losses in apparatus.

Records.—The committee calls attention to the importance of keeping a careful record of the losses of apparatus and interruptions to service each year as a means of determining whether the propert amount of protection has been provided. As an example, one of the larger companies finds, after several years' experience, during which careful records were kept of damage to transformers and lightning arresters, that the dam age to line transformers was less than fixed charges on its lightning-arrester investment, and that the interruptions to the service caused by burning out of lightning arresters were much more serious and expensive than those due to damaged transformers. This company has decided, accordingly, to reduce the amount of protection on its distributing lines. This experience was gained on the basis of a spacing of arresters from 1000 ft. to 1500 ft. apart.

Inspection.—All arresters should be inspected frequently enough to insure their being kept in proper operating condition, and the occasional use of tell-tale papers in this connection is recommended as a check on their operation. This method often shows points that are insufficiently protected, as well as places where an unnecessary amount of protection has been provided. Where it has been found that the short-circuiting of an arrester has unduly disturbed the system or interrupted the service, fuses should be provided to cut out such arresters automatically.

TRANSMISSION SYSTEMS.

Stations.—General practice in station equipment shows the value of several types of lightning arresters working in multiple; for example, the multigap for ordinary disturbances and auxiliary horn equipments for surges. In certain cases the use of special arrangements of horn arresters has effectively passed off disturbances that otherwise would have been expected to seriously damage the standard protective apparatus. However, on account of the possibilities of this type of arrester thus setting up disturbances in the system, their general use cannot be recommended. The practice of installing choke-coils, which has been followed by most companies operating transmission lines, is to be commended, although conclusive proof of their usefulness is lacking. The multigap arrester has been giving good service, particularly on moderate voltages, but has its natural limitations. For instance, while it is sensitive and effective in taking care of momentary disturbances, it cannot be expected to discharge continuously for long periods as in the case of accidental ground on a normally ungrounded circuit. The recently developed aluminum cell type of electrolytic arrester, while not indestructible, has proved thus far to be capable of handling continuous discharges for much longer periods without damage. Although this type of arrester has not probably reached its final development, it is a definite improvement on the older forms of apparatus. In cases where the inherent limitations of the older types of arrester have proved them inadequate, the consideration of the aluminum cell-type arrester is recommended. In this connection, the aluminum cell-type arrester is particularly adapted for use on station buses.

Lines.—It has been found impracticable to attempt to protect transmission lines by the use of distributed arresters, on account of the intense concentration of lighting disturbances found to occur on such lines. It is evident that the cost of providing a sufficient number of arresters to properly protect the lines against such disturbances would be prohibitive, and the difficulties of proper inspection and care of arrester equipment would make it impossible. The most practicable method thus far found for protecting overhead lines from insulator failures and other damage due to the above causes has been by shielding them with grounded wires strung above them. A single steel cable strung well above the center of the operating lines, grounded at frequent intervals, has proved effective. Undoubtedly, ground wires on either side of the lines are an additional benefit, especially near stations, but the added expense of such construction must be considered in each case. On tower lines the overhead wire should be grounded at every tower, and on pole lines at least every 200 ft. or 300 ft. The pipe form of ground, above mentioned, is recommended. Some form of lightning rod should be extended several feet above the overhead ground wire at each of the points where it is grounded. Where overhead ground wire is not used, it has been found that even a small grounded conductor, running from a point near the top of the pole to the ground, tends to prevent splitting of poles.

ABSTRACTS OF N. E. L. A. CONVENTION PAPERS AND DISCUSSIONS

FOLLOWING will be found abstracts of 57 papers and reports presented at the Atlantic City convention of the National Electric Light Association. Where a paper or report was discussed, a resumé of the remarks follows the abstract. The order of presentation is not followed, the papers being grouped, so far as possible, by subjects. The running report of the proceedings of the convention, printed elsewhere, covers several subjects brought before the sessions which are not taken account of in this section.

Association Affairs.

PUBLIC POLICY.

The report of the committee on public policy, consisting of Messrs. Samuel Insull, chairman, Everett W. Burdett, Henry L. Doherty, Charles L. Edgar, George H. Harries, Joseph B. McCall, C. P. Steinmetz, Charles A. Stone and Arthur Williams, forms a volume of no less than 297 pages. The report proper of the committee consists, however, of only 11 pages, which is followed by the following papers and reports: "How the Pennsylvania Railroad Company Provides for the Welfare of Its Employees," by Mr. M. Riebenack, comptroller of the Pennsylvania Railroad Company, 18 pages; "Report on Profit Sharing and Mutuality," by Dr. W. H. Tolman, 38 pages; "Second Annual Report of the Philadelphia Electric Beneficial Association," 20 pages; "Rate Regulation," comprising the recent decisions of the United States Supreme Court in the cases of the Knoxville (Tenn.) Water Company and the Consolidated Gas Company of New York City, 30 pages; "Report of the Committee of the Chicago City Council on Local Transportation, and Ordinances of the Chicago City Railway Company and the Chicago Railways Company, passed by the City Council, Feb. 11, 1907," 175 pages.

The committee was gratified to report that the tendency toward municipal ownership has been lessened materially, although the movement is not dead. Whereas three years ago there was a tendency to rush headlong and thoughtlessly into this phase of socialism, without regard to cost or industrial or political effect, to-day any proposal for a municipal undertaking, if considered at all, would be received with little favor and subjected to the most careful investigation. This, in the opinion of the committee, was all that could be asked. The change in public opinion appears to be due to past and existing extravagance in municipal expenditure, to increasing reliance on public regulation and control and to more precise information about municipal undertakings in actual operation. The committee was of the opinion that the time will come when few municipally operated gas and electric plants will exist.

Public-service commissions direct the conduct of public-utility corporations in Massachusetts, New York and Wisconsin. Where the tendency is toward the creation of similar commissions in other States, the committee suggested that the attitude of the association should be favorable toward public supervision.

The street-railway settlement ordinances in Chicago, given in full in the appendix, were referred to as being novel and interesting.

The greater part of the report was devoted to an analysis of two decisions of the Supreme Court of the United States, rendered during the year, of such prime importance to the lighting interests of the country that they were given in full in the appendix. These are known as the Knoxville water case and the New York gas case. In the first, perhaps the most striking feature of the decision was the dictum and comment that while "the courts, in clear cases, ought not to hesitate to arrest the operation of a confiscatory law . . . they ought to refrain from interfering in cases of any other kind." Another leading feature of the decision was that in cases where the companies refuse to accept a statutory or official rate without testing its constitutionality in court, the financial result of such rates, as applied to a single year's business, is not conclusive. The court held, in this case, that the results of the operation of the company in any particular year were only of significance so far as they foretold the future. The committee pointed out other important features of the decision, one being the grave doubt of the court whether a demonstrated reduction of income to 6 per cent, or 4 per cent after an allowance had been made for depreciation, would amount to confiscation.

In the New York gas case the court said that there is no particular rate of compensation which must in all cases and in all parts of the country be regarded as sufficient for capital invested in business enterprises. Among other things the amount of risk in the business should be considered. The less risk, the less right to any unusual returns upon the investments. In the particular case under advisement the court thought the Consolidated Gas Company of New York entitled to 6 per cent on the fair value of its property devoted to the public use. This is significant as establishing, in at least one case, a particular rate of return to which corporations of this character are entitled.

In the Knoxville case the court held that it is the privilege and duty of the company to allow for depreciation out of current earnings. Other important features of these decisions were pointed out by the committee. One is an emphatic statement in the Knoxville case indorsing the sanctity of private property. But, said the court, in the same case, the companies "will find it to their lasting interest to furnish freely the information upon which a just regulation can be based."

In view of these decisions the committee suggested:

(*a*) A full and fair appraisal of each company's property, tangible and intangible, employed in its business. If never used except within the company, it will be of value, while under certain circumstances it may prove invaluable.

(*b*) Careful attention to charges for depreciation, and an effort to write off neglected past depreciation as soon as practicable.

On the subject of old-age pensions the committee did not give an opinion, although it called attention to the subject, for in its judgment this country will soon be confronted with the question. The burdens of any such movement should be placed so that "our industries would not be unfairly handicapped."

Welfare work, especially as revealed in reports in the appendix, was spoken of as worthy of careful study.

STATE AND COMPANY SECTIONS.

Chairman R. M. Searle presented the report of the committee on State and company sections, which gives a resumé of what has been accomplished up to the present; advances arguments in favor of this branch of the association's work, and includes a draft of a constitution for affiliated State associations and for company sections, respectively. At present there are three geographical sections, namely, the New England, Pennsylvania and New Hampshire. Twenty-one company sections have been organized in the following cities: New York, Brooklyn, Philadelphia, Chicago, Boston, Detroit, Altoona, Pa., Bennington, Vt., Rochester, N. Y., Denver, Col., Washington, D. C., Newark, N. J., Dayton, Ohio, Connellsville, Pa., Des Moines, Ia., Salt Lake City, Utah, Chattanooga, Tenn., Scranton, Pa., Mount Vernon, N. Y., and Savannah, Ga. The total of members in the company sections is [illegible], and the individual membership ranges from 7 to [illegible], the average being 71. The

number of meetings held up to April 1 varies from one to five, and the average attendance from 37 to 74 per cent. The Brooklyn, Denver, Chicago Commonwealth and Philadelphia sections print monthly bulletins.

As to geographic sections, it is stated that a State association on becoming affiliated with the national association may retain its own name, provided it is not inconsistent with its connection with the national association; but it recommended that in the use of such name some indication shall be given of the affiliation with the national body. There is nothing in such affiliation which shall prevent a State organization from electing its own officers, which officers may have as complete control over the State body as if it were not affiliated with the national body, except that the members of the State association, being also members of the association, cannot adopt any measures nor take any actions which are inconsistent with their individual membership in the National Electric Light Association. A State association, however, having members that are not private companies or are in no way interested in the production or sale of electrical energy for light and power purposes, or in the manufacture or sale of electrical supplies, cannot become affiliated with the national association as a State or geographical body, but an existing electrical section of such an association, or which may be organized for the purpose, may become so affiliated.

Discussion.

In presenting his report Mr. Searle said that the number of company sections brought down to date is 22; the number of geographic sections, 3; and the total number of individual members in the foregoing sections, 1843. The gain for the year resulting from the new movement was 136 per cent.

Mr. Chas. L. Edgar, of the Boston Edison Illuminating Company, felt that the State section organization should be pushed rather than the company section idea. His company had organized a section, but he thought perhaps this was a mistake, and that there was more benefit to the Boston men in meeting men from other companies than in meeting men in their own company. Mr. L. H. Conklin, president of the Pennsylvania Electrical Association, said that his association joined the N. E. L. A. at its last meeting. He thought the field for company and State sections was distinct. Local State conventions bring out discussions which the N. E. L. A. cannot bring out. Mr. H. W. Hillman, president of the Michigan Association, agreed with Mr. Edgar, of Boston, on the importance of first bringing the State association into the N. E. L. A. The membership of the Michigan Electrical Association was increased 125 per cent last year, mainly by individual memberships of company employees.

Mr. S. Fred Smith, president of the former Association of Electric Lighting Engineers of New England, which has become a section of the N. E. L. A., explained that the association had consisted of individuals and that it was merely necessary for these to transfer their membership to the N. E. L. A. He thought it frequently desirable to have municipal-plant managers in an association because they could recommend legislation which a company could not. Mr. Dudley Farrand said that the Public Service Corporation of New Jersey had organized a section, although previously there were several organizations within the company for various similar purposes of mutual benefit and discussion. He thought that possibly all these organizations would in future be merged into the company section of the N. E. L. A. Mr. D. B. Rushmore, of the General Electric Company, called attention to overlapping of effort on the part of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the N. E. L. A. on certain engineering matters. He favored a combined effort of these organizations in relation to purely engineering matters.

Mr. C. N. Stannard, on behalf of the Denver Gas and Electric section, reviewed some of the advantages of the meetings conducted by this section, the meetings of which are bringing about an exchange of views between the commercial and the technical men in the company, which was very desirable. Mr. M. S. Seelman said that in Brooklyn, where the company had 1600 employees, it was impossible for the higher officers to keep in close touch with all their employees. The organization of an N. E. L. A. section, and the holding of meetings have given an opportunity for bringing out and recognition of unsuspected talent among certain employees. Mr. D. W. Mendenhall, of Salt Lake City, said that his company had barely enough men to form a section, but had done so and thought that it would be successful. He urged other companies in the inter-mountain district to organize similar company sections as a foundation for an inter-mountain section of the national association.

Mr. H. Almert told of a club which he organized in a company to study the science of industrial success. This had brought out some unsuspected talent and was so successful that other concerns in the same city had formed similar clubs. General commercial topics were taken up at weekly meetings and technical subjects at a monthly meeting. Mr. H. Goodwin, of Philadelphia, called attention to the fact that the men lower down in a company do not have an opportunity to get much benefit from a State organization, but get considerable benefit from a company organization or section. Mr. R. M. Searle, of Rochester, emphasized the point that a company section offers an opportunity to train a given lot of men to a given policy, so that all the employees of the company will understand the policy of its management, and will explain it properly when coming in contact with the public. Sometimes even the employees of a company do not understand its policy; consequently they cannot talk it to the public, and there is no uniformity in the expression of its employees to the public. But few men can attend State or national conventions.

Mr. E. F. McCabe, of Lewistown, Pa., told of some of the difficulties encountered in making the Pennsylvania Electric Association a section of the N. E. L. A. Some companies are members of the N. E. L. A., and some are not. There is apparently no way of making these latter companies join. Mr. John F. Gilchrist said that officers of State associations were likely to shy at the proposition of merging with the N. E. L. A. As regards company sections, he thought that some companies having but few employees might not need an organization of this kind. In most large companies there is a need for some organization which will bring the men together occasionally, and N. E. L. A. company sections form a good basis upon which to accomplish this result.

QUESTION BOX.

In a paper on this subject Mr. Alex. J. Campbell considers the present and future status of the Question Box. He believes that it should be made most useful to members in comparatively small companies, as in large companies there are always specialists in each line, and occasionally company associations which conduct a question box of their own. As to obtaining answers to queries, the present plan is to distribute queries widely among the members, and an endeavor made to secure at least one answer from each member. There is now under way a revised question box which will cover current issues and all previous issues, and will be something in the nature of a hand-book. The author and Mr. Paul Lupke will be editors of the revised edition, but the work of revising all past material will be handled by a large number of co-editors, each an authority on a particular subject. The plan is to collate the material and information in all of the past issues of the Question Box, condense this and put it in such form as to be readily available for reference. It has been decided to adopt the form of a loose leaf book, each page being properly indexed and numbered. There will be a permanent revision committee, to which material in current issues of the Question Box will be referred as it appears, and this new material will be incorporated with the revision. From time to time pages in the hand-book containing obsolete material can be withdrawn and new sheets substituted, thus enabling the hand-book to be kept alive and up to date.

Power House Design and Operation.

FUTURE REQUIREMENTS OF CENTRAL-STATION COMPANIES.

Assuming that the types of apparatus will depend mainly upon the development of central-station practice in generating, distributing and commercial applications of electricity, Mr. Philip Torchio, New York, in his paper with the above title, makes a forecast of the technical trend of the industry during the next 10 years. He gives the conservative figure of 6,000,000,000 kw-hours as the total yearly output of the central stations in this country and estimates that the average load-factor is approximately 23 per cent. Future additions should be undertaken with a view to securing the greatest economy under poor load factors and heavy peaks of short duration. Fifty per cent of the generating apparatus should have the greatest possible efficiency regardless of cost, and the other 50 per cent should be of the cheapest kind regardless of operating efficiency. The guiding rule in the operation of combination systems should be that the longer the efficient operates and the inefficient is shut down, the greater will be the commercial returns.

In the generating equipment, Mr. Torchio says the steam turbine may be built in larger sizes than present 15,000 kw-units; but there is little to be gained in this direction. The present frequencies and voltages will persist; and direct-current turbo-units as small as 2000 kw are not improbable. Desirable improvement on existing turbo-generators are greater mechanical strength and rigidity of winding and supports, and means for promptly extinguishing fire on short-circuited generators. Forced ventilation on windings will play a great part, recourse being made to the same expedients adopted in the early "Jumbo" dynamos. Low-pressure turbines and gas engines will increase, and the elimination in the central station of lead-covered cables and iron conduit, the introduction of reactances in generator circuits and the development of a satisfactory overload relay for generators, will make multiple operation of generators entirely safe.

There will be little change in substation apparatus. Rotaries with a maximum output of 3750 kw will probably not be surpassed in size; but storage batteries giving from two to three times the output of the usual standard type of battery, occupying the same floor space and at a cost per kilowatt at high rate of discharge approximating one-half the cost of the former standard batteries, have already made their appearance. Underground distribution is standardized and will not change. With a cheap, reliable and not unsightly exposed system of wiring, cut-outs, etc., older buildings can be connected up with profit to both the central station and the consumer. Electrical refrigeration will replace the ice man, and artificial ice manufacturers should logically depend for power upon the central-station companies. A differential rate meter will make practicable the use of electricity for heating where lighting rates are now prohibitive, and improvements should be expected in electrical vehicles. The electrical industry will require professional, operating and business men of broad knowledge, sound views and superior ability.

Discussion.

Mr. Samuel Insull, Chicago, said that it would seem unnecessary for a large city to suffer from a poor load factor. If a greater diversity of business could be secured in New York it would seem that the load factor ought to exceed 30 per cent. In answer Mr. Torchio said that the average load factor of all the lighting plants of the United States a few years ago was 23 per cent, the load factor of the railway companies in the country being an average of 30 per cent. It is doubtful if the load factor under present conditions in New York can be made to exceed 35 per cent. Mr. Insull said that by combining the railway and lighting load in Chicago, the load factor had been raised to 40 per cent. The load factor here was defined as the average load divided by the maximum load, the latter being represented by the total output at normal rating in a year of 8760 hours.

SOME UNIQUE FEATURES OF POWER-HOUSE DESIGN.

The purpose of Mr. G. L. Knight's paper on this subject is to call attention to some of the features of recent central-station design that have been departures from general practice and which have been adopted because of economy, safety or convenience. The author, who is connected with the Brooklyn Edison Company, has unfortunately limited his observations and descriptions to large stations, so that the paper, although replete with interesting information, possesses very little that is at all applicable to the smaller stations. The paper is not burdened with details, but merely relates how a certain company, for instance, secured increased furnace economy with stokers by lengthening the arch over the stoker a certain amount. The information for the most part is indicative, with hints as to application in a general way, the actual working out being left to the reader who desires to apply them. In the boiler-room the following departures from ordinary practice are described: Deep grates for anthracite coal; ash and soot hoppers as part of concrete foundation for boiler setting; pneumatic ash ejector; spring joint for use on superheated steam lines; concrete air chamber under center aisle of boiler-room; blower engine regulated by pressure in air duct; centrifugal boiler feed pumps; application of Venturi meters for measuring water and steam; coal distributor for narrow aisles; searchlights on coal towers for night operation. The topics covered treating on other parts of the system are: Three condensers for two turbines; dry-tube condensers; turbine-driven circulating pump; auxiliary step-bearing pressure accumulators; elecrete, a cement for barriers; fireproof protection for cables not run in conduit; lock-bolt disconnective switch; auxiliary switch on oil switches to act as tell-tale in case switch falls in by gravity; use of wire of various colors for control wiring; improved method of bringing out armature leads; armature leads insulated with rubber and varnished cambric; 135,000 kw automatically synchronized; device for indicating speed of incoming induction motor-generators; transformer ground detector; selective ground indicators; printing attachment for indicating wattmeters; pop valve for bellows-type time-limit relay; test adapters for use in calibrating and checking station instruments; signaling systems; system for indicating to boiler-room conditions of load; signals to boiler-room indicating change of load; signaling system between high-tension switchboard and operating room; signaling system between operating room and turbine room; emergency system for signaling substations; transfer bus for two-phase circuits; design of direct-current switchboards; combined operator's desk and pressure wire switch; brushes for vertical rotaries; and automatic control of water to water-cooled transformers. Much of the work embraced in the foregoing titles is, of course, special and would probably only be applicable in a very limited number of stations.

CENTRAL STATIONS IN TOWNS OF LESS THAN 4,000 INHABITANTS.

Mr. James S. Knowlson, of Schenectady, prefaces his paper with the above title with the statement that while the number of electric light stations in towns of less than 4000 inhabitants comprise 65 per cent of the total number of stations in the country, they receive but scant attention from the engineering fraternity. The problems which they must solve in order to prove a financial success are not discussed with anywhere near the same fulness of details as those of the large stations, and while some engineers have doubts as to whether such stations are operated properly, very many of them are making as large returns on the investment as more pretentious stations. The author voices the need of [illegible] among small station managers for a broader and more analytical discussion of their problems; he outlines the factors that must be given weight in the design of such stations, touches on those policies that have helped to make some of them good financial propositions, and suggests a few methods of increasing business. Small central stations are essentially local institutions, and to be effective Mr. Knowlson suggests they should be a wide distribution of stock in the community, with the best business men of the town as executive officers. Such a company will receive the hearty

co operation of the people as a whole, and the attention which the best business men can give it.

On the subject of location and equipment the author gives some thought, restricting his remarks to stations using steam boilers and engines. He advises locating the station near the railroad and in close proximity to good water supply, and that sufficient ground be obtained to provide space for storage and stables. If the location is also reasonably close to the center of distribution, it may be declared to be ideal; but the last consideration is not as important as the other two. The power-house arrangement should combine simplicity, convenience for operating purposes and susceptibility to economic extension, not to mention reasonable compactness. An ideal layout for a 100-kw station is given, parallel engine- and boiler-rooms prevailing, and simple, non-condensing, high-speed engines belted to 50-kw generators being installed. In such a station, says the author, the engineer will have as fireman a rather unreliable helper, and at times he will probably act as fireman himself. With the arrangement mentioned, the engineer may stand in front of the switchboard and from that position be in full view of the gages on the end of the boiler, and from the boiler-room he may still be in full view of the switchboard. Twelve short steps will bring him from the firing floor to the engine-room. The station is provided with many windows; ample space is allowed on all sides of the generating apparatus; the steam piping is of the most economical length and interconnected, permitting utmost flexibility, and the auxiliary apparatus, heater and boiler-feed pump are conveniently located. In the boiler-room sufficient space is allowed for cleaning boilers and storing coal. The fuel is unloaded from cars into a bin at the end of the boiler-room and is fed automatically to the firing floor through an opening in the base of the building or may be wheeled in through the doors at either end, which also permits a ready exit for ashes. With such an arrangement the natural extension of the plant will cause the boiler and engine-room to grow side by side. In small stations tubular boilers are generally installed; for while water-tube boilers are capable of better economies, the efficiency of the boiler plant rests heavily upon the methods of firing and the higher first cost of water-tube boilers seldom pays for their use in small stations. Diagrams show the average first cost of horizontal tubular boilers, including setting, the first cost of brick and sheet-iron stacks, cost of high-speed engines and direct-connected and belt-connected generators. In small stations it seldom pays to operate condensing, but the decision will rest upon the capacity of the station, nature of the load, price of fuel, availability of water, etc.

High-speed engines or turbines are the only prime movers to be considered, and while from an engineering viewpoint direct-connected units are preferable, space is plentiful and belt troubles so small that belted sets may be best because of the lower first cost. The generators should be 60-cycle polyphase machines, the voltage depending on the distribution circuits. If the load is in the immediate vicinity of the station, a 220-volt, three-wire system with step-up transformers for outlying districts is the most economical. The switchboard should be of the simplest type. Outside the station the largest single item of first cost is the pole line. A curve shows the approximate cost of poles in six different localities; 30-ft. or even 25-ft. poles will suffice. In arranging the secondary distribution every attempt should be made to install transformers in as large units as possible. The saving per kilowatt in price, core and copper losses which may be effected by using a single unit in place of several small ones, is shown by a curve. A combination of arcs with a relatively large number of incandescent lamps will provide the most satisfactory street illumination in the average small town, and the author gives a table showing the first cost and operating expense of magnetite-arc lamps and series-tungsten lamps in various sizes. The table also shows the number of incandescent lamps necessary to provide the same street illumination as one arc lamp. Under the caption of economies and improvements in operating conditions, the author lays stress on the need of simple but adequate records, and on the necessity for inspection and repair of apparatus. Other features leading to economy are also touched upon.

Mr. Knowlson gives some shrewd advice on business getting, having in view a 24-hour service. He points out that it is possible to broaden the scope of the small central station by combining with it the sale of water, ice and heat. These do not add materially to the investment or labor costs if the plant operates 24 hours a day, and a table giving the gross revenue per capita in a number of typical central stations ranging from purely lighting stations to those furnishing water and ice also shows that they are prosperous.

Apparatus, Electrical and Steam.

PERFORMANCE SPECIFICATIONS AND RATINGS.

Mr. W. L. Waters, of the Westinghouse Electric & Manufacturing Company, in a paper entitled "Performance Specifications and Ratings," made several recommendations having in view an improvement in what is stated to be the present very unsatisfactory condition concerning the rating of generators and motors. After criticising the present system of temperature guarantees, it is stated that the most rational method of temperature rating is to specify the maximum continuous rating at which a unit can be safely operated with a certain room temperature—25 deg. C., for example; and where desirable, a safe two-hour or three-hour overload, with the same room temperature, can also be given. This reduces the system to a single guarantee of the maximum safe load which a unit will carry continuously with a specified room temperature; and this maximum load will be the greater the lower the temperature of the air which cools the machine. Referring to the influence of the power factor on the rating of a machine, it is stated that any method giving alternators a different rating for every operating power factor would probably be too complicated for practical work. A method, however, is quoted with approval whereby all machines shall be given a nominal rating in kilovolt-amperes at 100 per cent power factor, and in addition the maximum load given which they will carry at various lower operating power factors. The maximum load at low power factors is decided for some machines by holding up the voltage, and for others by the heating of the field coils. In the latter case this maximum load should be referred to a definite room temperature—25 deg. C., for example. This method gives for the purpose of comparison a nominal rating at 100 per cent power factor, and in addition gives the purchaser exact information as to the operative characteristics of the proposed unit under any particular condition of load.

As to rotary converters and synchronous motors, the power factor with these should be kept strictly at 100 per cent, unless for some special reason definitely specified and understood at the time a machine is purchased. If synchronous motors are used to correct the power factor of a line, the maximum kilovolt-amperes at the required power factor should be specified, exactly as in the case of the alternating-current generator. A synchronous motor designed to operate at 100 per cent power factor is just as unsuitable for operating at a low power factor as an alternator would be in a similar case.

Testing to determine if a unit meets specified detailed performance guarantees is always a very difficult question. Unless the test is made in the laboratory the input-output efficiency test of, say, a motor-generator cannot be made with greater accuracy than 2 or 3 per cent, and it is almost impossible to get an accurate direct test of the voltage regulation of an alternator. In both these cases the direct method of test has to be abandoned in favor of an indirect method, which will give more accurate results. Temperature tests are extremely difficult to carry out accurately, and unless careful precautions are taken by experienced observers it is often impossible to be sure of results to 5 deg. It is concluded that in general a customer will do better to spend his time in investigating the conditions of operation and specifying a machine suitable for these conditions

than make tests to determine regulation and temperature rise. By means of suitable performance specifications, which can be definitely checked in operation, a customer can hold the manufacturer.

Discussion.

Mr. Philip Torchio said that rating based on 100 per cent power factor was useless for ordinary practical conditions, probably 10 per cent of the generator capacity of the country has been wasted because of specifications drawn this way and the inability of generators to carry the load which their prime movers would enable them to carry. A 90 per cent power factor for 60-cycle apparatus, he thought, would be a better basis of rating.

Mr. Walters thought that 70 per cent power factor would be nearer correct for 60-cycle apparatus.

EFFICIENCY OF MOTOR GENERATORS AND SYNCHRONOUS CONVERTERS.

Converting apparatus at present employed in this country comprises motor-generators without step-down transformers and synchronous converters with step-down transformers. There are two standard types of motor generators and three of synchronous converters, and since all are generally applicable for the same class of service, the question naturally arises as to which is the best to install. Mr. F. M. Farmer, of the Electrical Testing Laboratories, in a paper essays the task of settling some of these questions from a series of tests made on 60-cycle motor generators and 25-cycle synchronous converters under normal commercial conditions. While the primary object of his paper is to present the results of these tests, the subject is of such importance and general interest that a brief discussion of the merits and demerits of the different types from standpoints other than that of efficiency is included. Before taking up the tests, the author outlines the principle of each of the five types of converting apparatus, namely: generator with induction motor and without step-down transformers; generator with synchronous motor and without step-down transformers; synchronous converter with induction regulator and step-down transformers; synchronous converter with synchronous booster and step-down transformers, and split-pole synchronous converter with step-down transformers. It is now generally conceded that 25-cycle converters are entirely satisfactory and that the use of 60-cycle converters is practically restricted to railway loads, since, as a rule, it has not been found possible to obtain satisfactory operation on the lower voltage required for lighting and power work. Motor-generator sets, on the other hand, operate equally well on both 25 cycles and 60 cycles and with practically the same efficiency. Synchronous converters operating on 25 cycles and motor generators operating on 60 cycles may very properly be compared since each would then be operating under normal and favorable conditions.

Unfortunately, the character of this excellent paper is such as not to admit readily of abstract. The results of the tests are all tabulated or plotted in curves and logical deductions drawn from them. The paper embodies probably the first disinterested comparison between apparatus made by rival companies and the general conclusions are interesting. Whether to use motor generators or synchronous converters for lighting and power work depends to a great extent on the circumstances in each individual case. The data given in the paper are held not to justify the use of motor generators except possibly on 60 cycles or where the alternating supply fluctuates badly. The principal advantage of the motor generator is its flexibility and the entire independence of the direct-current system from the alternating-current system. If the high-tension alternating-current supply is reasonably free from fluctuations, these advantages are of no value and are more than counterbalanced by lower efficiency and increased first cost. Comparisons of the various types of synchronous converters are at present in favor of the synchronous booster converter, but the split-pole machine is so recent a development that improvements in design, which will undoubtedly be made, may improve the efficiency curve and the operation of the machine to such an extent that this conclusion may be reversed. A table shows the kilowatt rating of motor generators and synchronous converters that each of eight large companies had installed on the first of the year. Only apparatus used for lighting and power has been included. The total kilowatt rating is 309,970, apportioned in percentages as follows:

		Per cent.
Motor generators	Induction motors	8.3
	Synchronous motors	21.4
Synchronous converters	Induction regulators	64.8
	Split-pole	1.6
	Synchronous booster	3.9

It should be remembered in connection with these figures that the split-pole and synchronous-booster types of converters have been developed only about two years, while induction regulator equipments have been in use for perhaps 15 years and motor-generators still longer.

Discussion.

Mr. W. L. Waters, Pittsburgh, commented upon the unfavorable operation of the split-pole rotary and noted that the paper of Mr. Farmer condemns it on the grounds of efficiency, synchronizing, power factor, hunting, range of voltage and the necessity of reserve current circuit-breakers. It is more accessible for repairs and cleaning than the synchronous booster, but this is a small advantage. It is doubtful if genuine sine waves can be obtained from the split-pole rotary. Mr. L. L. Elden, Boston, dissented from Mr. Farmer's conclusions as to the superiority of the rotary compared with the motor generator. First cost and efficiency are not the whole story. It is dangerous to make sweeping statements based on tests upon one machine of the class. The results in all-day service largely depend on the machine's load factors. The set tested by Mr. Farmer had an excess voltage of 5 per cent, and the manufacturer's guarantees were not attained. Mr. Elden cited the following results of efficiency determinations in certain substations of the Boston Edison system:

Equipment.	Kw-hours per year.	Yearly efficiency.
Two 1000-kw sets	6,500,000	82.73 per cent
Two 500 kw sets		
One 1000-kw set		83.07 per cent
Two 500 kw sets		
One 1000-kw set	4,000,000	84.93 per cent
Three 500 kw sets	3,000,000	83.48 per cent
Five 500-kw sets	4,000,000	83.50 per cent

The efficiency of the complete systems is 82.45 per cent.

The actual difference in efficiency between motor generators and rotaries installed under comparable conditions may be about 3 per cent. Assuming a difference of 5 per cent, this would mean at a generating cost of 0.5 cent per kw-hour only $10,000 saving per year, which is not a large sum to pay for the insurance against trouble which motor-generator equipment furnishes. Mr. P. Torchio, New York, then described the raising of the efficiency of the New York Edison system from 89 to 91 per cent in the past three years by the use of synchronous apparatus. Mr. J. L. Burnham, Schenectady, pointed out the importance of knowing the condition of the commutator, brush friction, bearing friction and windage in studying these machines. Differences in the station wiring and in the air-gap adjustment are significant. Mr. C. W. Stone, Schenectady, urged the necessity of comparing machines on the same basis, and cited the successful service of inverted split-pole rotaries at Gary, Ind. In conclusion, Mr. Farmer said that the tests had to be made under service conditions; that they checked with figures obtained locally, and that the data were taken between the high-tension and the low-tension busbar.

SOME RECENT DEVELOPMENTS IN ELECTRICAL APPARATUS.

That recent improvements in the manufacture of generating, converting and transforming apparatus have been attended by better methods of cooling and higher speeds for rotating machinery is the conclusion of Mr. E. W. Allen, of the General Electric Company, who is the author of the paper with the above caption. Mr. Allen describes a 14,000-kw. vertical-shaft turbo-alternator, the novelty of which is the high speed of rotation which has resulted in the production of a generator of small diameter, large output per pound of materials and smaller radiating surface, but without commensurate decrease in cost. In order to conduct the heat away the generator is enclosed except at the intake and discharge openings. When the machine

is running the revolving field acts as a powerful fan, and while the scheme is applicable to large generators, it does not apply to all sizes. Direct-current generators for high-speed work now have their commutator bars held in place by steel rings shrunk over the outer circumference of the commutator, thus affording great mechanical strength and ready insulation of the bars due to their plane shape. The difficulties encountered in the high frequency of commutation have been overcome by the adoption of auxiliary commutating poles. In the design of belt-driven generators many changes have taken place. As a result, it is possible by a change in the field coils to convert a direct-current generator into a constant or variable-speed motor suitable for machine-tool work. Full advantage is taken in the design of the benefits to be derived from the use of commutating poles and particular attention has been given to the ventilation and to assisting the movements of air through the field and commutator coils by means of a fan mounted at the end of the shaft opposite the commutator. In the converting apparatus the author describes the regulating-pole, synchronous converter and its operation. Vertical-shaft synchronous converters rated at 2500 kw are being built for locations where space is limited. No change has been made in the general design of frequency changers except that vertical-shaft construction is used here also. A 6666-kilovolt-amp, 0.75 power-factor, 25-cycle to 60-cycle set is now being built for the Commonwealth Edison Company, which in point of output will be the largest yet built. The author notes the improvement made in the methods of circulating the oil in transformers, and in this way providing a more efficient means of conducting the heat from the seat of its generation. Controlling and protecting apparatus have improved somewhat in design and contributed in a large degree to the progress that has attended the electrical industry. The aluminum-cell lightning arrester has increased in reliability on high-voltage transmission lines and may be termed one of the most important developments that has taken place in the design of protecting apparatus. The author records the commercial status and success which have attended its operation and which have caused the manufacturer to adopt and recommend it as a standard device for all classes of high-tension transmission lines.

STORAGE-BATTERY DEVELOPMENT.

Mr. Joseph Appleton, of the Electric Storage Battery Company, in a paper entitled "Advanced Information Regarding Development in Storage Batteries" dealt, among other things, with a new system of central-station storage-battery emergency service and the use of storage batteries for exciting service and for power service. In systems such as the New York Edison system, generating current at one or more stations, and distributing over wide areas, there are chances of interruption to service, usually of short duration. To provide for such emergencies a storage battery has been designed to give the maximum output of energy for short and infrequent periods with a minimum first cost, low up-keep and minimum space required. Such a battery installed in one of the New York Edison substations gives nearly twice the output of the old type of battery for double the time and with a higher terminal voltage. For the same space occupied, and with only 15 per cent increase in weight, the output of the new plate will vary from two to four times that of the old plate, according to the rate of discharge taken as a basis of comparison. Batteries of this kind used for emergency service are not called upon to discharge as many kw-hours per annum as in the former service, which makes a material difference in the cost of maintenance and in battery space occupied and means a saving both in real estate and cost of building.

Special auxiliary apparatus for this emergency service has also been designed. The end-cell switches travel at a high speed and are capable of carrying for short periods currents up to 20,000 amp. The switches can cut in or out one to three cells per point while carrying the maximum current, a voltage change of three cells per point being considered satisfactory for this kind of service. In the usual three-wire battery plant it is customary to have 20- or 25-point end-cell switches on each side of the system, cutting in 19 or 24 end cells, respectively. With the new type of switch 19 end cells are cut in or out with 12 points instead of 20, and yet giving one cell per point regulation for seven cells around the floating point. A method of applying the storage battery as a stand-by in connection with the exciting system of large alternators is described. The former objections to this application have been overcome by connecting the battery across the bus through a suitable resistance, which reduces the fluctuation in battery current to a negligible amount, with normal fluctuations in exciter bus voltage. In case of abnormal fluctuations, a switch is automatically closed which short-circuits the resistance, leaving the battery free to operate on the bus. Immediately after the switch is closed the exciters are automatically disconnected from the bus, and the batteries furnish all current to the bus until the cause of excessive variation has been removed and the exciter is again returned to service. For special cases a booster may be used with this arrangement to govern the charge and discharge rate, but as it would be out of service during the emergency discharge it can ordinarily be a very small machine.

As to the use of storage batteries in connection with central-station power contracts, two principal cases are mentioned—where the power demand is subject to frequent fluctuations and where there are peak loads of short duration. The installation of the storage battery in such cases will often turn a customer with a poor load factor into one with good load factor, and the method can be applied to both direct-current and alternating-current supply. Attention is called to the regulating features of the storage battery in connection with fluctuating direct-current and alternating-current loads, and with particular reference to the electrification of steam roads, and the increased use of electrical energy in manufacturing plants where large motors on fluctuating service are used. As an example of the latter, the storage-battery equipment of the Gary steel plant is referred to. This consists of two batteries of 125 cells each connected in parallel, and capable of discharging on regulating service at 17,280 amp, while the ultimate capacity of the battery equipment will be double this. As an illustration of the character of the load to be regulated, the rail mill alone requires to operate it three 6000-hp and three 2000-hp induction motors, besides auxiliaries, a total of about 25,000 hp. The load is subject to wide fluctuations, which are cared for by the storage battery. Rotary converters are used to convert the battery current into alternating current for the regulation of these fluctuations and enable a constant voltage to be maintained on the alternating-current end of the rotaries, while the direct-current end, which is connected directly across the 250-volt battery, has a varying voltage as required to enable the battery to attain its maximum rate of discharge or charge as the condition of the load demands. The advantages of the storage battery in connection with the operation of gas-engine-driven alternators in parallel are pointed out, and reference is made to the ideal means of charging storage batteries by the use of mercury-arc rectifiers.

GAS ENGINE REPORT.

The report of the committee on gas engines, consisting of Messrs. John B. Klumpp, chairman; Carleton A. Graves and Irving E. Moultrop, comprises 114 pages and 37 illustrations. The principal divisions of the report are under the heads of gas producers, their theory and operation; gas engines; heat diagrams; gases; calorimetry; plants visited; suggested producer lay-outs; representative installations; miscellaneous data; descriptions of gas producers; tests of gas producer and engine installations.

The committee reports considerable progress in the gas producer and states that there are now on the market producers that can gasify successfully fuels which cannot be burned economically under boilers. Referring to the operation of the modern gas engine, it is stated that its reliability cannot be questioned at this time, and that the committee has evidence of many plants, some of which were visited by its members, that have been operating over long periods without being shut down—even a month without intermission. Regulation has been so perfected by improved designs and methods of governing that

all reliable makers to-day will undertake contracts for installing gas engines of either the two-cycle or four-cycle type to operate in parallel alternating-current generators of 25 cycles or 60 cycles; and the committee adds that no member need hesitate to contract with any of such concerns on the score of reliability and regulation, as just as reliable results may be obtained as with the ordinary type of steam engine. As to the operation of gas producers, the personal equation enters largely and poor results are frequently the result of careless operation. Instructions for operation should be followed carefully, and a man of intelligence placed in charge of a producer installation. The report gives descriptions in greater or less detail of about a dozen plants visited.

The cost of these plants, including buildings, foundations and cost of erection, varied from $133 to $167 per maximum kilowatt capacity, the average figure being $152; the maximum capacity being about 20 per cent above the normal rating. The cost of the buildings varied from $16 to $44 per kilowatt, with an average of $33; of producer equipments, including piping, from $33 to $49 per kilowatt, with an average of $38; of the gas engines, from $38 to $55, with an average of $47; foundations, $5 per kilowatt; generators, $12 to $15, and switchboards, $3 per kilowatt. The maximum capacity of the plants ranged from 360 kw to 2700 kw, with an average of 1200 kw. Tests of short duration indicated a coal consumption as low as 1 lb. per hp-hour, which figure, it is stated, can be also obtained from units as low as 100 hp or even less.

Discussion.

The chairman opened the discussion by complimenting the committee on its very comprehensive and excellent report. Mr. M. R. Bump, of New York, emphasized the value of the report to central stations competing with natural-gas or producer-gas generated from low-grade fuel. The Western Chemical Company, of Denver, has a gas-engine plant in which Colorado lignite coal is used successfully. This is one of the poorest fuels to be found in this country. This company removes the carbon dioxide from the waste gases of the engine and uses it in the manufacture of carbonic acid gas for soda-fountain service. Mr. George R. Stetson, of New Bedford, Mass., then said that his company recently came into possession of a 500-hp gas engine which had been improperly applied to the local conditions surrounding its installation. An attempt had been made to use the engine on fuel derived from a peat bog, and the foundations were very poorly erected. The New Bedford Gas & Electric Company purchased this machine and installed a pressure-type producer. Experience has shown that if the engine can be supplied with the right kind of gas it will do proper, consecutive and regular work. The producer is the seat of most of the trouble. It is a difficult task to man the pressure producer, and the company has had from 20 to 30 men at work there during the past year. The cases are sometimes quite offensive. It is necessary to keep two sets of employees as the boiler tnders are of no use in the producer plant. Mr. E. F. McCabe, of Lewistown, Pa., said that he is in charge of a central station which will shortly be transformed into a hydro-electric substation. His company generates water-gas for local service at a manufacturing cost of 40 cents per 1000 cu. ft., and he is contemplating the installation of a 1000-hp gas engine as a stand-by. Mr. Moultrop closed the discussion by stating that the Denver plant is apparently very successful. The committee report discusses the cost of gas-engine plants on the basis of the maximum output of the station including buildings, foundations and apparatus. These investment costs run from $133 to $167 per kilowatt. There is a prospect of the gas-power installation's space requirements being cut down to the limits of modern steam-plant practice, and with this a reduction in initial cost is expected, so that the two types of station will be comparable in their investments. It is very important that the small stations shall be assisted in the measurement of their output by the larger company. A notable case of the successful use of the gas engine as a stand-by in connection with a hydro-electric transmission system is that of the Georgia Railway & Electric Company in Atlanta, where a 2000 kw gas engine is operated on city gas furnished by the company itself. This machine can be started cold and synchronized in less than one minute.

LOW-PRESSURE STEAM TURBINES.

Mr. C. H. Smoot, New York, in the above paper sets forth arguments in favor of the use of low-pressure turbines of the Rateau-Smoot type. This type is described in detail, and the advantages claimed for it are brought out by comparison with other types of similar turbines. The author states that it has now been thoroughly established that the most efficient steam engine is a compound unit, consisting of a reciprocating engine acting between boiler pressure and approximately atmospheric pressure and exhausting into a low-pressure turbine, which in turn discharges into a condenser. While it is still a mooted question whether the greater cost of a combined engine and low-pressure turbine plant over that of a turbine plant alone will compensate for the increased economy, there is no doubt that existing plants equipped with reciprocating engines will show an improved economy if run non-condensing in connection with a low-pressure turbine equipment. In conclusion the author strongly recommends that owners of non-condensing plants should consider the opportunity of utilizing the exhaust steam of reciprocating engines in low-pressure steam turbines.

Discussion.

Mr. A. R. Cheyney, Philadelphia, moved that a committee be appointed to consider the subject of lower-pressure turbines, condensers and cooling towers. The motion was carried and will go before the executive committee of the incoming administration. Mr. C. B. Burleigh, Boston, said that reliability is more important than high efficiency in steam-turbine operation. The success of the step-bearing in the vertical type of machine has been thoroughly demonstrated. Mr. Dreyfus, Pittsburgh, stated that the low-pressure turbine is valuable to increase both efficiency and capacity, minimizing investment cost. He figured an improvement in economy of from 20 to 50 per cent in the application of the low-pressure turbine to 1000-hp unit, with an increase in capacity of from 33 to 80 per cent for the same steam evaporation. A safe clearance is feasible with reduced economy. The regenerative system will hardly be required in central-station service.

In conclusion, Mr. Smoot stated that the low-pressure turbine of the Vandergrift installation, Pittsburgh, has been tested and shows about 28 in. vacuum, 13.7 lb. absolute admission, steam consumption, 38.3 lb. per kw-hour, when running at 700 kw. Its capacity is 800 kw. The steam efficiency of the conversion of heat into electric power is 57.3 per cent. The largest turbine at present operating in this country has 28 times the capacity of the Vandergrift machine, showing an efficiency of 59.5 per cent when compared on the same basis.

CONDENSER AND COOLING TOWER DESIGN AND OPERATION.

Mr. M. R. Bump, New York, treating certain points in the design and operation of condensers and cooling towers, shows that the cost of pumping the circulating water depends directly upon the amount of heat imparted to each pound of water in the condenser. For a minimum pumping cost, the water should leave the condenser exactly at the temperature of the steam entering the condenser. In the surface type of condenser it is necessary to allow for a certain difference of temperature between the steam and the water because of the metallic tubes and the amount of heat transferred is directly proportional to the differential temperature allowed. As the amount of surface is increased the cost will increase in definite proportion, while the differential temperature required will decrease. This permits of a reduction in the quantity of water to be pumped and therefore reduces both the size and first cost of the pumps and also the power required to operate them. With the jet condenser it should be possible to reduce the differential temperature [illegible] the difference greater than in the surface condenser. The greatest inherent advantage of the jet condenser is wasted by operating it with the discharge water at a temperature below 90 deg. when it should be at least 100 deg. There are many considerations which affect the selection of the type of condenser to be

used. Dirty and scaly water calls for a jet condenser, but if the scale is not thrown down in the condenser a surface condenser may be used to advantage if the water can be returned to the boilers and care is exercised not to have it pure distilled, which is believed to attack the iron in the boilers with avidity. It is often possible to effect a very material saving in cost and size of condenser by allowing for a reduced vacuum when the temperature of the water is high. It is then a problem of balancing the added cost of fuel, etc., against fixed and operating charges on the condenser equipment to determine the most economical installation.

With reciprocating engines the gain in economy by the last 1 in. or 2 in. of vacuum is relatively very much smaller than it is on the steam turbine, and the introduction of low-pressure turbines has emphasized the importance of high vacua, which are essential to their successful operation. The daily and annual load factor on the unit also have an important bearing on the condenser. Where the load fluctuates and is considerably below rated output, the question must be looked at in a different light. The important items outside the pump itself are, first, to keep the piping system from the point where the pressure goes below atmosphere to and including the condenser and its auxiliaries, as nearly bottle tight as possible, and, second, to cool the air entering the pump and remove from it as much of the water vapor as possible. In the jet condenser particular attention should be given to the air offtake, which should be so designed that all the air must pass in intimate contact with the cold water entering the condenser chamber. In the surface condenser, proper attention should be given to the distribution of the baffle plates in order to accomplish this result as nearly as possible. Mr. Bump is of the opinion that in many cases the air should be drawn off through a separate chamber in which it is cooled to a temperature almost that of the entering water. This would enable a considerable reduction to be made in the size of the air pump and in the work the pump does. The surface condenser is used almost exclusively on all large turbine installations and has given better results than jet condensers ordinarily show. There seems to be no inherent advantage, however, that would justify any appreciable difference between the two types of condensers. The selection of the pump-driven unit for any condensing installation must depend upon other plant conditions. If the exhaust is needed for feedwater purposes, steam-driven units are installed, and where this condition does not obtain the selection depends on the cost of motor- and steam-driven pumps and on the expenses for operating them.

Cooling towers are divided into two general classes: forced draft and natural draft, the former being used largely in this country. The comparison of the relative merits of the two types involves consideration of climatic conditions, ground space, cost per unit of surface as compared with the cost of fans plus the operation and of the adaptability of towers of varying capacities to the condenser. Temperature and humidity are of greatest importance in cooling-tower design. Mr. Bump gives information on the building of the various types of towers and their operation. Regarding cooling ponds with jets scattered through the pond and discharging into the air, he is of the opinion that unless the pond is already in existence the first cost is prohibitive and the power required for pumping water large. Promising results have been shown on a combination of condenser and cooling tower in which the steam discharged from the unit enters coils of pipes or chambers over which water is sprayed and air rapidly circulated.

Discussion.

Mr. A. R. Cheyney, Philadelphia, pointed out that a low temperature of injection water is necessary for economical operation when the temperature of the air is high. He described some of the investigations which have been made under his direction to study the action of air in the injection water of the condensing system of a 5000-kw Curtis turbine. Six-in bull's-eyes were inserted in the piping and the interior of the system was lighted by incandescent lamps properly waterproofed. The jet condenser has the advantage of low first cost, simplicity of operation and reliability of service. With it a 28-in. vacuum on injection water at 85 deg. Fahr. can be reached. It is cheaper to clean an 8000-kw condenser than the same plant capacity in boilers. Mr. H. C. Abell, New York, discussed at length the detailed types of condensing apparatus and emphasized the importance of considering the annual load curve, in calculating condensing plant economies. In closing, Mr. Bump said that the use of a liberal dimensioned sump under the cooling tower enables water practically free from air to be supplied, and in reference to a plant in Denver stated that the dryness of the air sometimes resulted in the water leaving the tower at a temperature from 6 deg. to 10 deg. below that of the surrounding atmosphere.

Transmission and Distribution.

HIGH-TENSION TRANSMISSION LINES.

The paper of perhaps highest electrical engineering interest presented at the convention was that of Mr. Arthur S. Ives, of Poughkeepsie, N. Y., entitled "Requirements and Specifications for Extra High-Tension Transmission Lines." The paper relates apparently to the transmission system of the Honk Falls Power Company, of Ellenville, N. Y. Several years ago the company with which Mr. Ives is connected constructed about 16 miles of line for 13,200-volt transmission, with the expectation of doubling this voltage in the future. When the matter came up for final decision last year it was decided, however, to use one of the standard transmission voltages recommended by the American Institute of Electrical Engineers, and 33,000 volts was adopted. The alleged difficulties relating to the use of a voltage as high as this were investigated, and it was found that the actual serious disturbances and troubles cited did not begin to develop until a voltage in excess of 40,000 was reached; that many of the difficulties and disturbances that have been experienced on 33,000-volt lines might have been obviated by the use of more substantial construction and design, and by selection of proper sags for the wires, and that the addition of overhead ground wires, properly located and properly grounded, would reduce the danger of troubles from lightning to the minimum even with a voltage as high as 33,000.

The paper includes a standard form of specification for a single-circuit, 33,000-volt, three-phase transmission line with private telephone line, and allowance for one 2200-volt, two-phase primary distributing circuit on the same poles. The specifications comprise 54 numbered paragraphs, following which are notes on such of the paragraphs as call for explanation or comment. Referring to the section on pins, metal pins are strongly recommended for all high-voltage work, and all pins should be threaded for a nipple to be screwed on and cemented into the insulator; by this means a broken insulator can be replaced by unscrewing the nipple and changing the pin. As to spacing of circuits, equilateral triangular spacing is recommended for three-phase lines with the qualification, however, that high-voltage lines seem to operate as satisfactorily with the right-angle triangular arrangement. Forty-eight in. between circuits is pronounced good practice for 33,000 volts. A note on the specification for sags and strains indicates that particular attention was given to this point in designing the line. The use of overhead ground wires is approved, and it is stated that in almost every case a single wire about 3 ft. above the high-tension transmission wire will be found satisfactory. The overhead wire was grounded at every alternate pole except at high and exposed points, where a ground connection is made at every pole. The method of grounding consists in coiling the ground wire several times around the butt of the pole, which is the simplest and probably the cheapest method that can be used, while almost any desired surface can be obtained by increasing the number of wraps around the pole. Sleeve joints are used on all power wires with excellent results, and are considered to be superior to the soldered joint. Aluminum conductors were used for half of the line and copper conductors for the other half, the former being over a section which crosses a particularly

rocky and difficult country. Very careful observations will be made in order to determine whether the use of aluminum will be of advantage in the future.

In conclusion the author recommends to anyone contemplating the construction of high-tension transmission lines the following fundamental rules: (1) Select one of the standard voltages adopted by the American Institute of Electrical Engineers. (2) Secure an adequate and permanent right-of-way, with ample cutting privileges. (3) Build your line with ample strength throughout all of its dimensions and with ample sag in the strains. (4) Use overhead ground wire with frequent grounds. (5) Maintain cordial relations with owners of property through which your line is built.

PROTECTION FROM LIGHTNING.

The report of the committee on protection from lightning, consisting of Mr. B. E. Morrow, chairman; Mr. H. B. Gear, Mr. O. A. Honnold, Mr. N. J. Neall and Mr. J. F. Vaughan, is confined principally to the work of previous committees and to general information available at the present time. Recommendations are given relating to distributing systems as follows: Grounds, spacing, records and inspection. An abstract at length of this report will be found on page 1462.

Discussion.

Mr. D. B. Rushmore, of Schenectady, said that manufacturing companies are more interested in selling arresters to protect the other apparatus which they sell than to make the profits on the arresters. He took exception to the intimation in the report that the aluminum-cell arrester is an experimental apparatus. He thought it out of the experimental stage. He referred to the paper given before the last convention of the Colorado Electric Light, Power and Railway Association, by Clay, giving the successful experience last summer in the protection of the Animas Power and Water Company's lines in Colorado.

Mr. Percy Thomas, of Boston, drew an analogy between fire insurance and lightning protection afforded by arresters and thought the time might come when tables showing the protection afforded by different arrangements might be prepared, and so the cost counted. He saw no use in adjusting aluminum arresters so as to discharge continuously when one line is grounded, thus heating the arrester. Such a low setting is unnecessary for protection.

OVERHEAD LINE CONSTRUCTION.

The committee on overhead line construction, consisting of Messrs. Paul Spencer, chairman; J. F. Dostal, Sidney Hosmer, G. H. Lukes, W. T. Morrison, Farley Osgood and Thomas Sproule, submitted an excellent report covering poles, pole setting and the stringing of line wires for circuit voltages up to 2300 volts. Sixty-eight pages of the report consist of formal specifications for material and methods of overhead line construction, based upon specifications used by the United Electric Company of New Jersey, the General Electric Company, Stone & Webster, Commonwealth Edison Company, American Telephone & Telegraph Company, Central District & Printing Telegraph Company of Pittsburg, and the New York, New Haven & Hartford Railroad. The committee states its belief that the methods given in its standard specifications are in general agreement with standard practice, but that it is not the intention of the committee in specifying any particular way to condemn methods not included, but rather to indicate a standard method where the choice might lie between two or three equally good. The committee then proceeds to discuss certain items of the specifications concerning which there is more or less pronounced difference of opinion, the subjects being cross-arms, soft versus hard-drawn copper wire, braces, strain insulators, guy wire, preservative treatment, galvanizing, pole settings, cross-arm gains, double arms, size of wire and guying. The committee is inclined in favor of annealed or soft-drawn copper line wire. It is pointed that no stranded line wire smaller than No. 6 be used, that up to and including No. 2-0 solid wire should be used, and above that, stranded conductor. There are 13 separate specifications for material, covering poles and fittings, guys, galvanizing, copper line wire with weatherproof insulation, aluminum line wire with weatherproof insulation and rubber-insulated tree wire. The specifications of methods of construction consist of 134 numbered sections, and include about 50 illustrations. Thirty sections are devoted to poles and pole setting, 5 to pole steps, 12 to cross-arms, 3 to insulators, 33 to pole guying and 48 to wire stringing. The construction methods apply to the running of series street-lighting circuits and constant-potential circuits with voltages up to 2300, and including four-wire, three-phase systems on which 2300 distributing transformers may be used.

RECENT DEVELOPMENTS IN SECONDARY DISTRIBUTION WORK.

Mr. W. K. Vanderpoel, of Newark, N. J., presented a paper devoted to relatively new practices in secondary distribution. The author points out the various methods of running primary and secondary mains through the streets, the difficulties often encountered and the methods of overcoming most of them. From the mains to the customer's meter is where divergence begins and to these problems the author devotes the greater part of his paper. He decries the crude forms of overhead service connection often seen, with kinky and crooked wires and haphazard attachment to buildings, and describes many preferable methods which possess besides the feature of tidiness, stability and advertising merit. The conditions back of each case govern the class of construction, and pecuniary reasons may particularly affect the choice of material; but security and continuity of service should rank before cheapness even in the smallest plants. The trend in subway work is also toward improvement in details—more capacious manholes to avoid an awkward mess of cables, transformers, boxes, etc.; properly shaped and drained manholes; ampleness in duct capacity and service copper; methodical separation of primary and secondary cables; discriminate location and direction of conduit; careful tagging of cables; frequent inspection, etc., are but a few of the practices that now prevail. Wasteful investment is not advocated; but advantage might be taken of the experience of installations that were stinted in such things. The author describes some methods in vogue for cutting in customers on subway service and then discusses the subject of transformers. Owing to the broadness of the subject, however, not much more than a general reference is attempted. The selection of insulators having some bearing on secondary-line construction, Mr. Vanderpoel makes mention of a few different practices. Porcelain is displacing glass for all except arc circuits where triple-petticoat, high-tension, glass insulators are employed to distinguish the circuits. Detachable porcelain pot-heads are coming into more extended use for many reasons. Mention is made of an oil fuse which has brought about marked improvement in operation at slight maintenance cost. A copper-fuse wire is placed on a slotted wooden block which is attached to the hinged lid of the iron fuse block. When the lid is closed suitable contacts engage in jaws attached to the line wire, the fuse being immersed in oil. An oil-sealed duct carries away the vapor generated when the fuse blows. The boxes have been used both overhead and underground at ordinary voltages. The author leaves the question of grounded secondaries to the committee having that matter in charge; but suggests that systems operated in closely settled places and having a large and well-distributed number of neutral wires on three-wire secondary mains should have a splendid opportunity to economize in their grounding work by installing a continuously grounded neutral throughout. Reliable grounds are insured by this means. The neutral not only connects to the neutrals of secondary mains, but to all neutrals of independent transformers and also to those of transformers located in vaults in buildings. A decidedly favorable feature is that it keeps all the company's property within its jurisdiction, thereby saving much trespassing and possibly some accidents on private property which might lead to complications. The paper concludes with descriptions of various interior block distribution systems, comprising back yard and basement and sidewalk systems. Absolute right of [illegible] with the back yard pole-[illegible] and also with the basement and sidewalk systems of distribution.

GROUNDING OF SECONDARIES.

The report of the committee on the grounding of secondaries, composed of Messrs. W. H. Blood, Jr., chairman; L. L. Elden, W. S. Moody, W. T. Morrison and R. S. Stewart, maintained its position of last year, when it presented a resolution, which was adopted by the association, making mandatory the grounding of alternating-current secondary circuits up to and including 150 volts, but prohibiting the grounding of such circuits having a voltage in excess of 150 volts. The arguments offered, however, apply not to 150 volts or over, but to 200 volts or over. The committee holds that the grounding of circuits of 200 volts or over does not protect against high-tension voltage, due to break-down of transformers and crosses with other circuits, which, moreover, are of infrequent occurrence; on the other hand, such grounding subjects the user to the constant risk of a shock of 200 volts or over, which experience has shown may be fatal. It not only believes it inadvisable to compel the grounding of circuits of 200 volts and upward, but considers such practice almost criminal, for it would require one to do an act which might be the direct cause of an innocent user's death. The paper discussed at some length the matter of securing good grounds. An abstract at length of the committee's report will be found elsewhere.

Discussion.

At the conclusion of his report, Chairman Blood said that the two principal things to be considered were, first, the limit of voltage of lines which are to be grounded, and, second, the method of grounding. As to the voltage limit, there is no difference of opinion on lines where less than 150 volts to ground would exist, as all concede grounding to be desirable on them. The dispute is over the higher voltages.

Mr. P. Junkersfeld, of Chicago, while endorsing most of the report, expressed his disapproval of prohibiting grounding where the voltage between any wire and ground exceeds 150 volts, as proposed by the committee and recommended by vote of the N. E. L. A. last year. It might be a serious thing and lead to danger to draw the line arbitrarily at 150 volts. He favored a conservative course, leaving grounding optional above 150 volts. Mr. Philip Torchio endorsed Mr. Junkersfeld's position. Dr. C. P. Steinmetz said that it would be extremely unfortunate should the National Electric Light Association prohibit grounding above 150 volts, because it would be against the recommendations of the American Institute of Electrical Engineers, which are that all circuits up to 250 volts be grounded. Contrary action by these two great associations would nullify or detract from the action of both. A conference by committee with the A. I. E. E. would be desirable. This question of dangerous voltage is mainly a relative one. Deaths caused by 220-volt shocks are rare. The standard distributing voltage in England is 220 volts. We should go slow about declaring the standard distribution voltage in England dangerous to life. It is easily possible to protect a grounded 220-volt circuit so that it will be safe to the user. That is merely a question of proper insulation. It is not possible, however, to protect interior circuits against voltages reaching into the thousands which may accidentally exist by connection with high-tension lines outside a building. The only protection against these abnormal voltages is grounding. As a protection against fire alone, he would insist upon the grounding of all circuits entering an insured building, because a voltage much above normal on an interior circuit not insulated for that voltage is very likely to cause leaks resulting in a fire. It is true that transformers are better insulated than formerly, but extremely high voltages are also more common, increasing the likelihood of line crosses, so that on the whole the danger is as great as ever.

Mr. M. O. Troy, of Schenectady, agreed with the previous speakers. Mr. L. L. Elden, of Boston, said that his company had followed the recommendations contained in the committee report and favored the 150-volt grounding limit. Mr. George H. Lukes, of Chicago, said that in his experience of 15 years there were almost no cases of injury by shocks of 250 volts or less; thousands had received such shocks without injury. Mr. J. R. Cravath, of Chicago, said that a known dangerous voltage of fixed amount caused by a 220-volt grounded circuit could be insulated against easily. A known danger is safer than the unknown danger introduced by the possible existence of several thousand volts on an ungrounded 220-volt circuit.

The convention finally accepted the recommendations of the committee as to the desirability of grounding where the potential to ground is less than 150 volts, but did not concur in the recommendation that grounding be prohibited where the potential between any wire and ground exceeds 150 volts. This latter part was referred back to the committee for further consideration.

Lamps and Illumination.

REPORT OF LAMP COMMITTEE.

The lamp committee of the association, consisting of Messrs. W. W. Freeman, chairman; W. H. Atkins, John F. Gilchrist, W. H. Johnson, Frank W. Smith and F. S. Terry, reported that 200 replies were received to queries sent out to members of the association relating to lamp methods and practices. More than 60 per cent of the companies reporting have in use a considerable portion of graphitized-filament or Gem lamps, and it is said that several of the larger companies propose during the coming year to substitute this lamp entirely for the ordinary carbon-filament lamp for all free renewals. About 75 per cent of the companies reporting have used the tungsten lamp, and about 20 per cent have used the tantalum, although the employment of the latter appears to be becoming less rather than greater. About 75 per cent of the companies reporting make extensive use of the tungsten lamp, and are encouraging its introduction generally. The reports indicate considerable difficulties with the early lamps, but later deliveries show a decided improvement, and there is an almost unanimous opinion that the tungsten lamp is the best possible means for making satisfied customers and producing additional revenue. The report gives considerable prominence to the Gem or graphitized-filament lamp, which, it states, has been adopted by some of the largest companies to the entire exclusion of the ordinary carbon lamp of corresponding units. The committee expressed its belief that this policy can be generally adopted by a number of companies to their advantage, and that notwithstanding the rapid increase in the use of tungsten lamps the Gem lamp will remain for at least several years to come the standard lamp furnished generally on a free-removal basis. The chief development during the year has been in tungsten lamps. It is stated that these can now be had in all reasonable quantities in standard sizes from 25 watts to 250 watts, and in several special sizes. The early trouble of breakage in handling and shipping, and early blackening, while still existing to some extent, have been greatly lessened, and the committee looks forward to a continued improvement in tungsten lamps, and also to lower prices. The committee advocates without hesitation the open policy of offering tungsten lamps to customers upon favorable terms, coupled with their use in aggressive campaigns for new business.

Discussion.

Mr. Preston S. Millar, of the Electrical Testing Laboratories, presented by means of lantern slides curves of tests being carried out on American and foreign-made tungsten lamps as referred to in the committee's report. While these tests are not finished, the results up to date, as presented by these curves, were very interesting. The American-made lamps are showing decidedly better uniformity and life. In the tungsten lamp, unlike the carbon-filament lamp, the decline in candle-power is due almost entirely to blackening of the bulb. The curves of candle-power at various numbers of hours burning are of the same general shape as those of carbon lamps; that is, there is a rise of candle-power the first few hours, then a gradual decline. Three makes of tungsten lamps which have been under test for 1000 hours are showing a decline in candle-power of the survivors of 3 to 19 per cent. One make of American lamps, of

THE EFFECT OF VARIOUS MAINTENANCE CONDITIONS ON THE EFFICIENCY OF ILLUMINATION.

Mr. A. L. Eustice, of the Nernst Lamp Company, notes in his paper the vast difference between laboratory performance of illuminants when everything is new, and the results obtained in actual practice when deterioration has set in and possibly the venerable dust of ages has accumulated on the glassware. As a result, a system does not in many cases come up to the owner's or designing engineer's expectations. The importance of periodic and systematic maintenance was appreciated by the author, who in order to arrive at definite conclusions made extended investigations, the results of which are embodied in his paper. The relation of the deterioration of a system of illumination due to the dirty condition of the glassware, the working efficiency or average illuminating results to the cost of maintenance are questions of importance which will receive more attention when the illumination actually produced is made the basis of payment. The author was unable to include information on some forms of commercial reflecting devices, such as opal, opalux, satin-finish, etc. Whatever may be said relative to the effect and loss of illumination due to lack of periodic maintenance, the great losses found in some cases, especially in the case of dirty *versus* clean prismatic systems, where by cleaning the glassware the contrast between the clean and sparkling and the dirty was unmistakably apparent, show the necessity of some inspection and indicate to what extent maintenance enters into illuminating systems.

Discussion.

A brief discussion was offered by Mr. E. L. Miller, of New York, who emphasized the importance of washing prismatic reflectors, rather than depending upon wiping with a cloth.

QUALITY OF LIGHT.

Prof. Paul F. Bauder, of Chicago, delivered an interesting lecture on the "Quality of Light," illustrated by lantern slides. The lecture consisted to a great extent in explanations of numerous pictures thrown on the screen and therefore does not admit of abstract. The latter portion of the lecture related specifically to artificial illuminants, in which the characteristic qualities of daylight were compared with similar qualities of the various types of incandescent, glower and arc lamps.

Transformers and Meters.

THE PRACTICAL ASPECTS OF RECENT IMPROVEMENTS IN TRANSFORMERS.

That a very great advance has been made during the last few years in the design and performance of transformers is generally known, and Mr. W. A. Layman, of the Wagner Electric Manufacturing Company, points out the way in which some of these improvements have been secured as well as the dangers involved in pursuing the possibilities of the present art to too great extremes. A comparison of the internal energy losses in transformers shows the great gain made because of the use of alloy steel. The weight of the transformer, core loss and copper loss have all been greatly reduced by the judicious use of the new material. If the transformer be designed for a density of magnetic induction above the limits considered desirable for high-grade apparatus, the labor and material cost may also be considerably reduced; but the author points out that such transformers will be subject to pronounced and serious objection by reason of the high magnetizing current absorbed. High induction inevitably leads to high leakage current, which rises rapidly under excess voltage. The natural effect of lower losses in present-day transformers has been to lessen the heating problem, which in turn has resulted in a reduction of dimensions. The latter proposition has given rise to the necessity for increased care in internal insulation, and the author directs attention to the ill effects of the application of test pressure, which, if unduly prolonged, results in a gradual impairment of the insulation. The author recommends that all users reduce the requirements for insulation testing for periods of 10 to 20 seconds, and that the prescribed pressures be double the normal operating pressure. This recommendation applies particularly to transformers wound for the higher voltages.

Discussion.

Dr. C. P. Steinmetz protested against any shortening of the high-voltage test, which would mean a lowering of standards. The A. I. E. E. recommendation of double normal voltage applied for two minutes is not hard upon the manufacturer. Mr. W. G. Reed, Pittsburgh, coincided with this view. Mr. W. S. Moody, Schenectady, pointed out that American companies overcame the difficulties in the way of producing silicon steel four or five years ago, in advance of the Germans. Silicon steel is especially valuable in current transformers, since it is more permeable at low magnetic densities and less so at high fluxes. High density at the joints of the magnetic circuit makes it necessary to provide for reduced permeability in transformers for constant-potential service. In conclusion, Mr. Layman said that he did not agree with Dr. Steinmetz regarding the two-minute voltage test, but protested against incorporating five to 30-minute tests in modern specification writing.

DISTRIBUTING TRANSFORMERS AS OF INTEREST TO CENTRAL STATIONS.

Mr. E. G. Reed, of the Westinghouse Electric & Manufacturing Company, traces the development of distributing transformers from the classic experiments of Henry to the present day, shows the essential requirements of transformers of this class, and then discusses their electrical and mechanical characteristics. The service requirements of transformers mounted on poles or in manholes are identical as to performance, but differ in other particulars. As to performance, it is admitted that the iron and copper losses should be low, the former being the lower of the two since it is continuous. Assuming a certain cost for energy, the author traces the effect of various iron and copper losses, and how one might be reduced and the other increased under certain conditions without jeopardizing satisfactory service. Taking up the new steel used in transformers, the author directs attention to the ill effects of high exciting current resulting in lower power factor. He points out the various factors which should be considered when purchasing transformers and the characteristics essential to parallel operation. The various tests are outlined and curves showing the operating characteristics of existing transformers are given.

Discussion.

Mr. H. W. Peck, Rochester, emphasized the relation of the copper loss and the peak load. The fact that about 50 per cent of the plant investment has to be charged to 3 per cent of the output tends to increase the cost of the copper loss. Mr. Ives, Poughkeepsie, stated that the temperature of the transformer coils is not necessarily given by the reading of the thermometer placed in the oil. The temperature gradient between the coil and the oil varies in proportion to the square of percentage of load. If there is a temperature drop of 10 deg. between the oil and the coils at full load, there would be 2¼ times this drop at 50 per cent overload. The discussion was concluded by Mr. M. A. Sammett, Montreal, who brought out the importance of reducing the exciting current. In a recent test of three 30-cycle, 100-kw, 2200-volt transformers the exciting current was 12½ per cent of the full-load current at 2200-volts and 19 per cent of it at 2420 volts.

METERS.

The report of the committee on meters, consisting of Messrs. George Ross Green, chairman; G. A. Sawin and L. E. Sinclair, is a voluminous document comprising no less than 278 pages and thus naturally not admitting of satisfactory abstract. Sixty-seven illustrations, some in half-tone, are included, and answers are printed to 108 questions submitted to members of the association. Two [illegible] were received in reply to a communication sent out by the meter committee on the subject of "The Rate versus Meter." About two pages of text [illegible] the principles of meters and methods of testing, written by Mr. Burleigh Currier. The above [illegible] the report. The main part of

the report occupies 103 pages, with the following heads for the various divisions: Introduction; accuracy of meters; meters; meter department; meter installation; meter testing; meter tester's tools and appliances; meter records; meter constants; reading meters; complaints; shop and laboratory; instructions; serially numbering meters; statistical information; flat rate versus meters; scope of the meter committee; conclusion. The report does not appear to give a resumé of the information received in reply to queries addressed to members, except in the case of those relating to flat versus meter rates. In regard to the latter it is stated that the consensus of opinion of replies received is that the meter basis is far superior to the flat rate. The committee does not consider that signs, arc lamps, window lighting and the like, controlled by time switches and charged for at a fixed rate per month, should be classed as on a flat basis, since it is actually on a measured basis. The committee believes that while the flat-rate basis may be desirable in exceptional cases, as in that of a small company with limited territory for expansion, whose total revenue does not greatly exceed the expenses, where the adoption of the meter basis might result in a decrease of the amount of business, in a great majority of cases the flat-rate system is far inferior to the meter basis. Some of the opinions received were to the effect that all companies recognize the practical necessity of installing meters, and, therefore, the flat-rate question is dead; some of the opinions, however, were that in view of the fact that many companies are still using the flat-rate system, especially since the introduction of high-efficiency lamps, the question is very much alive.

Discussion.

Mr. Green reviewed the contents of the report and laid special emphasis upon the importance of adequate maintenance for all meters in central-station service. He then called attention to the meter exhibit of the association on the pier, pointing out the great care with which it had been assembled and its educational value to all those in attendance at the convention. Mr. Green read a letter from Dr. E. B. Rosa, acting director of the Bureau of Standards, Washington, D. C., condemning the use of the term "wattmeter" and recommending that "watt-hour meter" be substitued for it in all future terminology. Mr. J. W. Cowles, of Boston, referred to the report in complimentary terms and touched upon the legal and moral responsibility of the central station for keeping meters in the best possible condition. Many companies are not yet awake to the importance of small improvements in the accuracy of meter registrations. Accurate tests of these instruments under service conditions are very important, and this work is greatly facilitated by recent improvements in portable measuring apparatus. Systematic tabulation, enabling comparisons to be made, are essential. Mr. C. D. Haskins, of Schenectady, said that the report is the world's first text-book on meters, and that it is extremely valuable. The accuracy of electric meters as compared with apparatus for the measurement of water and gas is now fully established.

Mr. J. D. Hutchings, of Rochester, N. Y., urged the larger companies to help the smaller ones in meter testing. The highly organized meter departments of the larger stations should be placed at the disposal of less favored companies at minimum expense. Mr. Eichert, of Brooklyn, pointed out the opportunity to save money by avoiding all but the most necessary meter tests. Variations in a customer's bill are a reasonably fair index of the conditions. Mr. C. G. Durfee, of Rochester, spoke upon the necessity of installing meters free from the possibility of tampering. Mr. Samuel Insull, of Chicago, said that the cost of meters is very important in connection with the use of tungsten lamps in small apartments. The consumer in some cases is now paying $30 per kilowatt of meter installation, f.o.b. cars, and this is something worth reducing if possible.

THE METER EXHIBIT.

One of the unique and valuable features of the convention was the exhibit of the meter committee, which occupied a space of about 12 ft. x 18 ft. in one corner of the exhibition hall. It is doubtful if as much information per square foot of exhibit space could be found in any other display in the hall. The object of this exhibit, which was the first of its kind that has ever been made, and which was entirely non-commercial in character, was to supply the convention with the latest and most complete information and educational matter available in relation to the broad subject of meters and their applications. No one could doubt the importance of the exhibit and subject who realized the facilities which were there available for sounding the subject to its depths. The exhibit was arranged at the expense of much time and money, and its success was largely due to the co-operation of several of the large manufacturing companies and central stations, and to the time which many gentlemen having an expert knowledge of meters freely accorded to visitors.

The New York Edison Company, Philadelphia Electric Company and Rochester Light, Heat & Power Company showed meters and equipment for preventing theft of current, including outfits for meter testing. The Washington (D. C.) Electric Light Company also showed portable testing equipment. A large number of modern meters and rotating standards were shown by the General Electric, Fort Wayne, Duncan and Westinghouse companies. An oscillograph, with negatives of alternating-current waves, was shown by the General Electric Company. A number of meters of different type and storage-battery testing sets and load boxes were shown by the Public Service Corporation of New Jersey.

At the front of the exhibit was an illuminated set of meter dials about 6 ft. long and 3 ft. wide, connected so that instruction could be given in reading. There was a display of armature winding lathes driven by small motors, and at one side of the exhibit was located a display of jewel bearings, including the Currier sapphire jewel and shaft end, the latter being shown under an electrically illuminated binocular microscope. A large collection of repairing and adjustment tools, stop-watches, testing switchboard panels, charts of meter department organization and test methods, diagrams of wiring with raised parts of meters attached, graphic records of instrument standardization, motor-driven disks to show eddy current generation through the voltmeter, a potentiometer, photographs of testing departments, copies of all the meter patents in the U. S. Patent Office, the best books on the subject of meters, fuses, forms and blanks from many companies were shown. Over 100 packing boxes were required for the transportation of the exhibit. The exhibit was arranged by Mr. George Ross Green, Philadelphia, assisted by Messrs. Sinclair, of Washington, and G. A. Sawin, of the Public Service Corporation of New Jersey. Mr. Currier, of Philadelphia, was in charge of the exhibit.

Miscellaneous.

REPORT OF THE COMMITTEE ON PROGRESS.

The report of the committee on progress, consisting of Mr. T. Commerford Martin, which covers 64 printed pages, opens with a statistical account of the central-station industry, compiled from the report just issued by the United States Bureau of Census for the year 1907, supplemented by data compiled for the *McGraw Electrical Directory*. The heads of the report are as follows: Foreign data and conditions; comparison of European methods; rates and franchises; conservation of natural resources; franchise questions; municipal ownership; newer central-station plants; special street lighting; metal-filament lamps; flaming arc; other lamps and illuminants; current-selling methods; electric automobile propaganda; refrigeration and ventilation; progress in electric heating; miscellaneous topics; electricity and public safety; fostering the contractor; central-station welfare work. The statistics show that there are 5111 American central-station plants, of which 1252 are municipal plants; 555,921 arc lamps are in service, and 41,807,944 incandescent lamps, while the total horse-power capacity of stationary motors connected is 1,649,026.

NEW YORK HIGH-PRESSURE WATER SYSTEM.

A paper with the above title by Mr. Arthur Williams, of the New York Edison Company, describes the high-pressure service for fire protection recently completed in New York City. The service is divided into three sections: Manhattan, Brooklyn and Coney Island. The last section is fed from gas-engine-driven triplex pumps, while the other two are fed from electrically driven centrifugal pumps, energy for which is supplied from the mains of the Edison Electric Illuminating Company in Brooklyn and from the mains of the New York Edison Company in Manhattan. The pumps are direct-connected to 800-hp, 6600-volt, 25-cycle induction motors and each of the stations has a capacity of 15,000 gal. of water per minute. Mr. Williams describes the feeder system for supplying the energy to the stations and the precautions taken to guard against failure in the supply in Manhattan. The contract with the city provides for the payment of a forfeit of $500 per minute for any interruption of over three minutes. The cost of the high-pressure water system on Manhattan was practically $4,000,000, and the cost of operation, including allowances for interest, the sinking fund, operating expenses and the electrical service, will probably not exceed $350,000 annually. The fire department will eventually discard the portable pumping engines and rely upon the high-pressure system in the sections where it is available. The maximum pressure at the hydrants is 300 lb. per square inch. The Oliver Street station was put in operation in January, and to date has consumed 55,000 kw-hours of energy. In the same period the Gansevoort station has consumed 9735 kw-hours.

Discussion.

In explanation Mr. Williams said that the charge for this service is $22 per year per kilowatt of maximum demand and 1½ cents per kw-hour. This system absolutely insures the community from serious fire loss. It is far superior to the old horse and engine method in a large city and when generally applied will bring about a great reduction in the fire waste. For this service the company cannot count upon large kw-hour sales. The system is used practically exclusively in the down-town section of New York. It is a kind of service which can only be supplied under some maximum-demand system. The company renders a great public service here at a fair percentage of profit. Normally the system is filled with fresh water and it supplies water at a pressure of 300 lb. per square inch compared with a maximum of 125 lb. from the ordinary horse engine.

PRIVATE POLICY.

Mr. Paul Lupke presented a characteristic paper with the title "Private Policy," in which he treated of a variety of subjects in a style that has made his contributions one of the features of convention sessions. At times humorous, and always clever in phrasing, the message conveyed is nevertheless always one of shrewd common sense. Referring to the stress now being laid upon the necessity of establishing and maintaining a correct public policy, it is pointed out that the most elaborate public-policy structure will in the end prove a mere castle in the air unless it rests solidly upon the rock bottom of an unassailable private policy, which latter is defined as the provision of the right plant and the right men. While advocating the adoption of the latest improvements, and warning that even these in a few short years may become obsolete, he advised that every reasonable effort should be put forth to confine new things that require new conditions to new plants, quoting in this connection the old injunction about plowing with an ox and an ass under the same yoke. Having provided the best plant warranted by conditions, it is next in order to maintain an operating force that will do it justice. There are two ways of making a station fool-proof—one is to make all of its apparatus proof against fools, and the other is to eliminate all the fools. Mr. Lupke expressed his belief that the first plan has been worked a little too hard, and the second not quite enough. A strong plea is then made for maintaining cordial relations with employees. When hired employees are held to certain obligations, which necessarily implies that the employer is himself under certain obligations to them, and the efficiency of an organization depends upon the degree in which every one connected with it recognizes and lives up to the mutual obligations their respective positions and relations impose.

With good men the accomplishment of a desired end is largely a matter of good example, but such example must not be superficial or spasmodic, but a sustained, quietly enthusiastic devotion to duty for its own sake. The effects of frantic revival peaks are not lasting, as too many reconversions will be found necessary. In reply to the objection, "What's the use? As soon as a man reaches the point where he is good for anything he quits," it is asked, what good to one is a man who cannot get a job anywhere else? He quoted with approval what a liberal-minded man, who is making a marked success of the education of employees, has to say on this point. "He (the employee) is told that if there are not sufficient vacancies to make promotions reasonably certain, better positions outside will be found for those who are qualified to fill them." The whole trouble of handling the employee might, he says, be pressed into one sentence—make a man of him and treat him like one. In conclusion, the author suggested that the National Electric Light Association might with benefit establish a certain well-defined standard of trustworthiness and faithfulness to duty, combined with a practical and theoretical knowledge for each and every class of men in the service of the central station—for firemen, engineers of various grades, switchboard men, meter men, linemen, lamp men, solicitors—up as high as you like, but be sure and start from the bottom; then if a man established competency under this prescribed standard there should be issued to him a certificate or diploma as a graduate National Electric Light Association fireman, engineer, or whatever the case might be. Such a plan, he states, is in line with the most progressive and practical ideas thus far advanced.

MEMORIAL.

Mr. T. C. Martin, committee on memorials, said that the association had been fortunate during the last year in losing no member who had been active in its work. He referred, however, to the death of Gen. A. K. Stiles, the financial backer of Mr. Charles J. Vandepoele, the famous inventor in electric lighting and railway fields. He also referred to the death of Mr. J. V. S. Church, for so many years connected with the *Electrical World*.

Commercial.

CENTRAL-STATION OPERATION OF STEAM PLANTS IN CONNECTION WITH LIGHTING COMPANY'S SERVICE.

It has been advocated time and again that if a central station supplied steam for heating purposes in addition to electrical energy, the chief cause for isolated plants would be removed. A different scheme is, however, described by Mr. S. M. Bushnell, of Chicago, who outlines the system adopted by the Commonwealth Edison Company of Chicago for supplying heat in that city. The company promoted the organization of an independent heating company which is named the Illinois Maintenance Company, because its function is to operate and maintain steam-heating plants, elevators, etc. The plan of operation differs somewhat from that which has been followed in most cities. No central heating station was installed and no general system of pipes and conduits was laid. The company has worked along the lines of a very simple policy. Where lighting customers are perfectly satisfied to operate their own steam-heating plants and where they are not inclined to over-exaggerate the cost of operation, no attempt is made to secure the heating business. In cases where the cost of steam for the building becomes a menace to the use of central-station energy, a careful estimate is made of the costs of operating the steam plant and the Maintenance Company offers to take the contract for a term of years, usually five, at a certain fixed price, or in a few cases, at a certain fixed price per 1000 lb. of steam. In a great many cases the mere fact that the customer is able to contract for his steam at a certain fixed price relieves him, or

his engineers, to figure that he can operate the heating plant himself at a cheaper price. Accordingly the contract is made for electricity and the customer reserves to himself the operation of his steam-heating system. Occasionally, however, the customer takes the position that if he is to omit any portion of the operation of his plant, he would like to be relieved of entire responsibility and makes contracts not only for electrical energy, but for heating also. In such cases the heating company steps in and closes the contract for the operation of the steam-heating plant, while the central-station company makes the corresponding contract for furnishing the electricity. The organization for taking care of the steam-heating contracts is simple. There are two men who act as visiting engineers and who keep a constant supervision on all the plants, employ the men, order supplies and visit the different plants during the day and night to see that they are kept in efficient operation. They report to the manager, who in turn reports to the vice-president. The strictest discipline is maintained in all the plants, and the fact that there are so many engineers and firemen employed in the various plants enables the visiting engineer at all times to have men at his disposal to fill the place of any man found to be incompetent. Some idea of the scope of the work is given by a description of the principal plants now being operated by the heating company. The method of estimating and contracting for steam, and also some of the principal formulas used in estimating the cost of steam in buildings, are included in the paper. For the 27 buildings now heated, the Edison company derives an income of more than $160,000 per annum from the sale of electricity at remunerative rates. More than 100 contracts for buildings in the downtown district have been secured, where the heating estimates of the Illinois Maintenance Company were important factors in securing favorable decisions for the central station. Considered apart from the lighting company, the proposition in Chicago is not a paying one; but when considered in connection with its effect on the business of the lighting company the venture is very profitable.

Discussion.

Mr. Paul Mueller, Erie, Pa., condemned the practice of supplying steam heat on a flat rate. The waste of steam is considerable under such conditions. His company uses the condensation type of meter, and heats all the large buildings in the city. The atmospheric system will sometimes save the consumer 40 per cent of his heat. It is imperative that the system shall be in perfect order if the customer is to be satisfied.

Mr. H. A. Denman, Detroit, cited the satisfactory use of a 100-lb. steam line to meet the high pressure requirements in the business district. Office building owners are usually willing to allow a rental valve to the space occupied by a local plant. A high pressure line means costly tunnel construction, however. It is wise to make an allowance for ventilation losses in figuring the heat losses in buildings of the hotel type. This sometimes runs as high as 40 per cent. By putting counters on pumps much can be learned. On account of condensation losses the pump consumption has to be multiplied by a factor of 1.67, for Mr. Denman's conditions. Tests show that this corrective factor runs from 1.13 to 3.3. The rate for steam is about 46 cents per 1000 lb.

Mr. Arthur Williams, of New York, voiced the need of competent steam engineers in this class of work, who can tell what it will cost the company to operate the steam service if necessary. The owner's engineers will inevitably try to go beneath the central station cost estimate, on account of self-interest. There is a great variation in the heat leakage around windows. The use of weather strips is a valuable point to note. To obtain roughly the boiler capacity necessary for steam heating a rule is to allow 100 hp in boilers for each 1,000,000 cu. ft. of building contents. This means a fair average coal use of 4 lb. per boiler hp-hour three-fifths of the time during the heating period. Perhaps the best offhand rule is to allow from 30 to 45 cents per 1,000 cu. ft. of contents for each heating month in the year. Mr. Williams cited an estimated saving of from $5,000 to $10,000 per year by the application of Edison service to a hotel where the steam for the lighting service had to be thrown away all the year through. This hotel uses about 800,000 kw-hours per year, and the rate would be about 3.5 cents. Tantalum lamps would be installed. Only 200 hp of the 800-hp boiler plant are needed for heating. Another plan for large service is to supply 6600-volt, three-phase current to consumers at $30 per year per 1 kw of maximum demand plus 1.5 cents for kw-hour. The customer in such a case would install his own translating apparatus.

Mr. J. C. Brooks, Philadelphia Electric Company, said that his organization does not make a flat steam heating rate per year, except for labor and maintenance. The consulting engineer and the architect naturally put the central station on the defensive; hence the central station must have facts based on actual experience, for successful business getting. Generalities are no longer accepted by prospective customers. If a company can deliver a heat, light and power proposal, the customer can often be approached to better advantage.

Mr. J. F. Gilchrist, of the Commonwealth Edison Company, Chicago, emphasized the importance of taking on steam heating at flat rates in large buildings in order to make business grow. It is well not to be too particular about the immediate profits in territory where there is a chance of large future business. He cited the taking of a large heating contract at a loss in Chicago in connection with a certain office building, but as a result several other important buildings have been secured for the company which might otherwise have been lost. In closing, Mr. Bushnell said that an excellent rough rule for estimating the cost of coal in a building to be heated on a central station contract is to allow $1 per year for each 1,000 sq. ft. of hot water service in the structure. In Chicago the reliability of coal deliveries by tunnel is a good talking point. The St. John steam heater is used in Chicago.

UNIFORM COMMERCIAL DEPARTMENT FORMS AND METHODS.

Mr. Clare N. Stannard, Denver Gas & Electric Company, presented a paper entitled "Advantages to be Derived from Uniform Department Forms and Methods," of which he was the editor, with the following as assistant editors: Messrs. Henry J. Gille, Minneapolis, Minn.; A. V. Wainwright, New York City; Douglas Burnett, Baltimore, Md.; E. N. Wrightington, Boston, Mass.; C. Willing Hare, Philadelphia, Pa.; E. J. Allegaert, Newark, N. J., and V. A. Henderson, Memphis, Tenn.

Following are the main points of this paper:

Advantages of Uniform Forms:

(a) Systematizing and standardizing forms, contracts, canvass books and rates.

(b) Making possible comparisons between the results secured by various companies.

(c) Solving the problem of keeping prospects classified, and following them up at the proper time.

Advantages of Uniform Methods in Securing

(a) Interior lighting, electric display advertising, and power.

(b) Popularizing the business, securing publicity through press agents, newspaper advertising, and personal letters.

(c) Mutually beneficial education for the consumer, the representatives and the company, through uniform representatives' meetings and the display and demonstration of electrical appliances.

(d) The services of an unexcelled board of commercial engineers.

Increased efficiency is the main object of uniformity. In order that a manager may get the best results from his plant he should be able to decide matters that come before him on the basis of his best judgment, but he will be more satisfied with his conclusion if he knows the results secured elsewhere and can make comparisons with conditions at his own plant. For comparisons it is necessary to have uniform or similar methods, and, it follows, uniform or similar forms. Systematic and careful study of conditions will produce settled opinion and give confidence in a certain policy. Concise and well-defined plans result in increased business, greater efficiency, less expense in operating, and, what is most important, greater satisfaction to consumers. The importance of the commercial de-

partment in cultivating a field of good-will on the part of customers cannot be denied, although until recent years this responsibility has not been given the proper weight.

It may perhaps be almost impossible for all forms to be absolutely uniform, but there is no question that a general uniformity would be most helpful. Forms, contract blanks, canvass books and all that pertains directly to the work of the salesman should be so designed, arranged and standardized that the consumer is not wrongly impressed through careless assembling or uncertain application of the information supplied to the salesman. Uniform contracts and applications give the best office records. This is particularly true if the same company has offices in operation in several large cities. Uniform forms and contracts appeal to people moving from one town to another. They are especially effective where there are two opposing companies, for in case of consolidation the records are easily combined, causing little expense or delay. Contracts should be terse, complete and binding, but, above all else, to the point. Canvass books should reflect thoroughness and exactness.

The rate controversy may result some day in uniform and standard methods of calculation. Electric light men strive to standardize their plants, distributing systems, metering systems, bookkeeping methods and systems of accounts, but they do not give a sufficient amount of detailed attention to the standardizing or uniformity of rates. It would seem advisable to have a more uniform policy as to the monthly minimum guarantee to be charged, the standard classes of service to be supplied, and as to whether it shall be on the basis of a long-hour schedule, a quantity schedule or a flat rate per kw-hour.

It is desirable to work out a system whereby general comparative results can be accomplished, classifying among other items the following: Number of residence-lighting consumers; number of contracts; residence lighting in watts; commercial lighting in watts; commercial power in watts; commercial elevator in watts; commercial sign and window lighting in watts; estimated revenue of residences, and estimated commercial lighting and the like.

One syndicate is reported to exchange daily statements between the sales departments of the various underlying companies; a plan which, if conditions be understood, adds materially to the effectiveness of the department of each company and promotes rivalry which otherwise would not be maintained.

If a uniform set of forms for the commercial department were adopted by any large number of member companies, comparative results would be available readily from year to year. Such data should cover information as to how many solicitors to employ per 1000 of population for different sizes of cities and towns, bearing in mind the necessity for specializing of electric power, electric signs and other branches of the business; and a manager would be able not only to analyze the results secured in any one company, but to say just what men should be employed, what their occupation should be, and how much business should be expected to come from the soliciting force.

A uniform card-index system, keeping classified accounts of all prospects, could contain the following information: Name. Business. Owner. Owner's address. Light used inside. Light used in windows. Is electric sign used? Kind of power used. Are premises wired? Is any heating apparatus used? Date for future call.

There should be a uniform method of developing business by education. At present this work is done largely by representatives and, if some plan could be worked out whereby the desire for service would be created by methods that would attract, great results would be accomplished. Interior lighting is perhaps one of the most interesting and perplexing problems and some uniform lighting system should, if possible, be worked out. Concentration of effort upon a given scheme of lighting brings confidence and enthusiasm to the salesman and gives it an advertising value, and becomes a talking point with the consumer. There are so many beautiful signs now to be purchased that it is indeed almost impossible for the up-to-date merchant to withstand the temptation of indulging in this most important branch of advertising, which need not be necessarily expensive. Are there not uniform ways of going after this class of business?

The electric power branch of the business requires constant and persistent work. The salesman's efforts could be reinforced by a vigorous advertising campaign. The press agent in a company or syndicate sufficiently large to warrant the expense accomplishes good by a logical and well-outlined plan of presenting the business conditions to the public, and in explaining the company's desires and aims. A campaign of education through the newspapers or other channels reflecting the attitude of the company does great good to the company, if it takes the position of plain-spoken truthfulness.

Representatives of the companies should meet together daily, or at least once a week, to keep in touch with what is going on. Much good has resulted from electrical shows and public demonstrations of all kinds. If it were possible for the association to have an organized electrical show, to be held periodically at central points throughout the country, it would be of great assistance in educating the public in the use of current-consuming devices and popularizing the business; although local shows in towns and in department stores and offices of the company have accomplished good results, if something could be worked out along this line it would give the business great impetus.

A board of National Electric Light Association commercial engineers would be beneficial to all central-station companies. Realizing that many individual companies could not afford a similar board, it is suggested that the board be sustained by the association.

COMPILATION OF LOAD FACTORS.

In a paper with the above title, Mr. E. W. Lloyd gives data relating to the load factor of different industries. It is stated that in one case out of 2900 consumers of power, with an installation aggregating 35,000 hp, the average maximum load was 53.5 per cent of the connected motor load. When reclassified on the basis of one motor, two motors, three to five motors and six to ten motors to the installation, the ratio of maximum to connected horse-power was respectively 73, 63, 64 and 50 per cent. A table is also given showing the results of an analysis of the load-factors of over 50,000 consumers of electric light, taken from actual reading of meters. In these cases the term load-factor is applied to the ratio of the average to the maximum load. The table also gives the ratio of the maximum to the connected load. Another table gives the load factors found to obtain in different kinds of manufacturing businesses, the factors applying to plants operating normally 54 hours a week. It is stated that if a central station were able to secure all of the business in a given city, the diversity factor of all customers would be such that the load factor on the station would probably be in the neighborhood of 50 per cent; as in some of the best central stations it is at present in the neighborhood of 40 per cent, some may question the possibility of raising this condition to 50 per cent, but it may be reasonably hoped that in the future the load factor will be considerably better as more business is secured. To increase the load factor above 50 per cent, central stations should encourage the making of by-products from electrical energy, such as ice and nitrates. It is suggested that the association should collect the load factors of different industries. In conclusion, the author points out that there is a difference of opinion as to the exact meaning of the word "load factor," which term he considers ought to be more clearly defined.

[illegible] POWER

A paper with the above title was presented by Mr. Henry J. Gille, as editor, who was assisted in the preparation by Messrs. L. B. Buchanan, Jas. E. Davidson, Thos. M. Gibbes, F. H. Golding, G. K. Hutchins, E. W. Lloyd, R. A. MacGregor and Norman T. Wilcox. A valuable feature of the report consists of [illegible] plants showing the [illegible] load at [illegible] of the day of a large number of [illegible] plants. For comparison in each case the station load curve is given, in order to show the relation at any hour between the [illegible] and the total station load. The [illegible] of

power loads is discussed under the heads of (1) the extent to which such loads overlap the peak; (2) the use of curve-drawing instruments; (3) the advantages of obtaining power load off the peak; (4) the use of electricity in the manufacture of nitrates or other products using large amounts of power off the peak. The various curves above referred to are used in discussing the relation of the power load to the station peak. The conclusion is that a considerable portion of power business does not come on at the time of the peak, but that a considerable improvement could be made by arranging with many companies for the operation of heavy machinery, used only such a short time each day, in the forenoon or early afternoon. Another suggestion is to get power users to reduce the noon shut-down from one hour to 30 minutes, and to shut down a half-hour earlier in the afternoon. In considering the use of curve-drawing instruments, which, it is stated, broadly cover maximum-demand indicators, reference is made to the considerable difference of opinion regarding the length of time average demand should be taken as a basis of charge. In some cases the rated capacities of motors are used as a basis, but the committee believes that some standard should be established, and recommends that the association appoint a committee to consider this subject. The subject of the use of central-station power in the manufacture of nitrates or other products using large amounts of power off the peak is discussed under the heads of cost of power; location with reference to raw materials and market for products; permanence and continuity of power and its output from a given investment. It is stated that in this country manufacturers using electric power in chemical- or electric-furnace processes pay from $10 to $25 per kw-year, on the basis of 354 days of 24 hours to the year. Some of the processes in question require continuous operation, while others could be operated intermittently. Among the latter are the manufacture of artificial emery, calcium carbide, carborundum, graphite, ferro-silicon and similar alloys, oxides of nitrogen and nitrates, and cyanamide. Other classes of processes that could be adopted for intermittent operation are the electrolytic refining of copper, recovery of tin from scrap and the manufacture of oxygen. Some of the above-mentioned processes are referred to in detail in the report. The conclusion reached is that if power companies can supply energy off the peak for 20 hours or more per day at a price below $10 per kilowatt per year, they should be able to dispose of energy for conducting some of the processes mentioned. Evidently, however, the information secured by the committee did not encourage the formulation of any specific recommendations.

GROUP VERSUS INDIVIDUAL DRIVE.

Mr. C. A. Graves, in a paper entitled "Advantage of Group or Individual Drive in Certain Installations," discusses conditions which determine whether the group or individual drive is preferable. The factors which determine the type of drive are given as follows: Installation cost; price of current; machine load factor; shaft friction; motor efficiency; maintenance; speed variation or uniformity; time to make change; floor space; character of work. Each of these factors is taken up and discussed separately. By load factor the author designates the ratio of the average number of hours the machine is run daily, to 10 hours. The conclusions of the paper are that each installation should be weighed individually, because the cost and relative value of the factors involved vary in different sections of the country and with the different requirements of a client. Considering economical operation only, the group-drive installation recommends itself when the shafting friction is low, rate for current low and machine load factor high. The individual motor drive shows a larger saving with a high rate for current, high shafting friction and low machine load factor, and also shows an increased output when used within its field.

Discussion.

The papers by Messrs. Lloyd, Gille and Graves were discussed simutaneously. Mr. Lloyd emphasized the definition of load factors as the quotient of average load divided by the maximum load. In reading his paper Mr. Gille said that the committee is in possession of about 100 typical load curves of different industries, which could not be printed on account of lack of space. Mr. H. W. Peck, Rochester, discussed the principles which apply to the installation of motors in industrial establishments, considering the details of shafting arrangement, necessity of rugged equipment for the average customer and the advantage arising from the equal reliability of the high-speed and the slow-speed type of induction motors. Many valuable papers on belting have been published in the proceedings of the American Society of Mechanical Engineers. In general, central stations must obtain their own motor data, as not one prospective customer in a thousand can supply necessary information. Further advantages of the individual drive are more light, less noise, less danger from accidental starting, simplicity of remote control and the ability to install the motor anywhere on the wall or ceiling. Mr. E. W. Penrose, Tyrone, Pa., urged the value of off-peak consumption as a central-station by-product. In one plant the coal consumption was reduced from 10.5 lb. to 4.5 lb. per kw-hour in one year by the cultivation of off-peak business. Analysis shows, however, that there is danger of laying too much stress upon having power consumers stop work at 4:30 p. m. Mr. H. C. Alvord, Long Island City, said that in no case of his experience has there been a change back from the individual to the group drive. It is a good plan sometimes to speed up a group drive by raising the voltage. In one case a gas-engine drive in a textile mill was replaced by an electric-motor installation and the output was increased by raising the speed through an elevation of the voltage. This could not be done by the less uniformly rotating gas engine. In the main the individual drive is strongest where direct current is available and the group drive often requires changing the location of the machine.

Discussing Mr. Lloyd's paper Mr. Samuel Insull, Chicago, emphasized the high interest cost per year in the average company, due to its poor load factors. A company with an output of 100,000 kw-hours per month may represent an investment of $500,000. Its city lighting, store and residence lighting and small power service may give an unfavorable load curve, but most of these places store city water and much is to be gained by pumping it electrically. The greatest consumption of water occurs during the part of the year when there is no lighting peak to speak of. It is an advantage to supply power to inter-urban railways also, since these exert their maximum demand in the middle of the summer. If such a plant has a load factor of 30 per cent under present conditions it may be raised to a possible 40 per cent by the assumption of the above load. This means 33 1/3 per cent more output over which to spread the fixed charges. The effect on the station costs is so beneficial that a company can take these contracts at a rate which would have been out of the question under the old conditions; further, the investment for the pumping service of the interurban line may be but $200 per kilowatt as against $600 to $700 per kilowatt of house lighting. If the income of a company earning $75,000 per year can be raised to $100,000 by aggressive work, and if $10,000 of the increase can be saved, there will be a gain of 2 per cent in the dividends, and this may make all the difference between a profitable and an unsatisfactory company. By a little discrimination one can choose classes of business which cannot affect the station at the peak time, and then a few large manufacturing establishments in one's locality may be approached with confidence. Mr. E. F. McCabe, Lewistown, Pa., said that his company had an output of 1,250,000 kw-hours per year and a load factor of 44 per cent, which was brought about by cultivation of non-peak loads. He cited silk-sewing mills as excellent loads, since the majority of them run 24 hours per day and do not close during the noon hour. Mr. Harold Almert, Chicago, cited an increase of 14 per cent in load factor in connection with a power gain of 141 per cent and a 65 per cent increase in station output. Mr. Myers, Philadelphia, emphasized the importance of standardizing the load factor definition.

DEVELOPMENT OF CENTRAL STATION REVENUE.

Mr. Theo. I. Jones, in a paper entitled "Development of Revenue from Existing Customers," presented a number of

methods to be pursued in increasing a company's yearly output without involving any material extensions to the company's system. Several forms of reports for use in this connection are reproduced in the paper. The subject is treated under the heads of rates, publicity methods and results obtained by the author in this line of work. In developing revenue from customers whose rate will not be lowered by increased consumption, the central-station representative must rely solely upon his ability to show the advantages from increased illumination or from the use of electric heating or power appliances without regard to the question of rate. In cases where additional consumption will result in a lower rate, a form of contract should be offered which seems best suited to each individual need; but if after a reasonable period of service the consumption indicates a better rate, a corresponding form of contract should be substituted, having the date of the original contract. Trial propositions are considered with favor, as it is the experience of the author that in 75 per cent of the cases where such propositions have been judiciously made the apparatus remained.

Referring to irons sent out on trial without previous solicitation, 88 per cent were retained. In this manner 200 irons have recently been delivered, and the records show that each gives an income of 70 cents per customer per month. A system of "development and inspection" is described, according to which each agent is given a stated territory over which he is supreme, and is required to write at the end of each day a report giving a full statement of the daily work done. In planning out this work, the customers whose bills average high per month are taken first, and as soon as these have been canvassed those giving less revenue will be taken up. The inspector calls on a customer with a view to obtaining his comments upon the service, explaining that he comes from the lighting company with a view to ascertaining the character of the service, whether it can be improved or not, and to receive any comments which the consumer may feel disposed to make concerning his service. In examining the installation any comments made by the customer are noted, and if any complaints are included the latter are later investigated. After the complaints, if any, are satisfied another call is made to ascertain the customer's view of the service at that time, when the agent has an opportunity to point out where additional service will be desirable, etc., etc. In the course of a week or 10 days a third call is made, and by this time the customer is ready to tell whether or not any of the recommendations as made by the agent will be accepted. As a rule some of the recommendations of the agent are usually accepted. If in calling the consumer has no complaint whatever to make as to service, the agent takes up at once the matter of recommendations and but two calls are then necessary. The paper includes a number of instances showing the benefit that has been derived from this plan of work.

Discussion.

Mr. H. J. Gille, of Minneapolis, thought that more might be done in the future in co-operation with manufacturers of electrical appliances by having the manufacturers send their advertising matter direct to central-station customers. In regard to the introduction of electric irons, his company had tried a plan, which worked very well, of having the meter man when he sets a meter for a new customer, or for one who has moved, ask the customer whether she has an electric iron. If she has not, he suggests that the company send one on trial, and that it is only necessary to sign the application card which he presents in order to get one. Almost invariably this results in a trial order. Mr. Joseph F. Becker, of Brooklyn, said the ambition of the solicitor is likely to be in the direction of an increase of the connected load, rather than an increase of consumption from existing consumers. To overcome this tendency the soliciting force of the city was divided into two divisions, and there was a chief over each division. One division of solicitors devotes its attention entirely to the increased use of electricity by existing customers. There are many customers using gas in part, both for lighting and power. Mr. C. N. Stannard, of Denver, said that after the conduct of a long campaign to increase the revenue from existing consumers, he was surprised at a recent morning meeting of the solicitors to have enumerated over 20 ways in which the revenue of the supposedly perfectly or completely equipped consumer might be increased. Some of these items were that switches or sockets are out of order so that lamps could not be used; fuses out; lamps burned out and sockets empty; increased candle-power of existing lamps; replacing of oil decorative lamps by electric.

Mr. M. C. Osborne, of Spokane, Wash., stated that his company had distributed electric flatirons as newspaper premiums. These were sold at cost to the papers. The papers made a great feature of the offering of the electric flatirons to their subscribers and advertised the feature lavishly, much more so than the central-station company would be apt to do if buying the space. Mr. Osborne's company found this a satisfactory way of introducing the irons. Mr. Joseph A. Sutton, Baltimore, Md., spoke of the advantages of keeping electric appliances before the public by the use of company signs changed weekly. Mr. E. F. McCabe, Lewistown, Pa., said that his station renews the heating elements of irons, and Mr. Douglas Burnett explained how irons are employed to satisfy customers.

INTRODUCING TUNGSTEN LAMPS.

"Methods of Introducing Tungsten Lamps and Their Effect on Central-Station Income" was the title of a paper prepared by Mr. W. H. Atkins, as editor, and the following gentlemen as assistant editors: Messrs. R. F. Bonsall, G. S. Cartwright, H. W. Chase, A. A. Dion, J. W. Hancock, O. R. Hogue, Joseph D. Israel, George B. Johnson, George H. Jones, E. A. Mills, C. F. Oehlmann, M. C. Osborne and R. W. Rollins. The subject was considered under the heads of different policies pursued; methods of introduction and renewal; use of large units in competition with gas arcs; the effect of the introduction of tungsten lamps on the income. Forty questions were sent out to members of the association, and such replies as were received are epitomized. The bulk of the paper consists of a number of reports in detail, principally from large central stations, giving their experience with the introduction of tungsten lamps. Several of these reports from the larger central stations are accompanied by illustrations and forms. In the introduction of the paper the action is criticised of those companies who have kept the tungsten lamp more or less in the background for fear that its adoption would mean a reduction in income. This fear is said to be a mistaken one, as is fully proved by the experience of those companies that have pursued an opposite course and welcomed the tungsten lamp. It is recommended that one of the best policies for central stations in introducing the tungsten lamp is to make a special effort to increase the lighting of buildings which are now wired, but not sufficiently illuminated.

The answers to queries indicate that many policies have been followed by the different companies, as stated below in the order of their importance: The introduction is encouraged in every possible way for all classes of business; used to displace gas, gasoline or kerosene lighting; recommended to customers complaining of high bills; installed on all original work in business districts. As to methods of introduction and renewals, these have generally been the same, differing only slightly in detail, comprising newspaper advertising, circular letters to customers and prospects; personal effort of solicitors; demonstrations of the lamp, both in exhibition-rooms and on the customer's premises. Some of the larger companies have established an illuminating engineering department, including competent men to furnish detailed specifications in the most effective manner to customers contemplating the use or substitution of the tungsten lamp. The universal policy has been to charge for lamps at cost or at a slight advance in cost, except where a maintenance contract is entered into; exception is also made in the case of the companies which furnished free carbon-lamp renewals, which companies make an allowance to the customer of the cost of the carbon lamp when he purchases the tungsten lamp. It is stated that no very definite or satisfactory information was obtained with respect to the use of the 250-watt tungsten unit, and that the consensus of opinion favors the use of the 100-watt size. Replies indicate an unanimous opinion that the central-station income is not adversely affected by the intro-

duction of the tungsten lamp, and, furthermore, that it is likely to be increased in the future when the benefits of the lamp are more generally known, accepted and appreciated, and that through this medium the standard of illumination will be greatly increased, with the result that electricity will be much more generally used. Reports in detail on the introduction of tungsten lamps are printed from the following cities: Boston, Chicago, Philadelphia, Baltimore, Hartford, Ottawa, Dayton, Spokane, Richmond, Va., and Montpelier, Vt.

Discussion.

Mr. M. S. Seelman told of the methods in handling tungsten lamps in Brooklyn. The Tungsten Lamp Specialty Company was organized independently of the central station, and the solicitors of the Specialty company went after business among consumers using gas. Business thus secured was turned over to local contractors. A standard price for wiring in molding was established at $2 per outlet. Eight to 10 solicitors were employed. No consumers were solicited except by instructions from the Edison company. At the beginning it was announced to the Edison company consumers that the tungsten lamp was available in limited quantities, but it was not pushed among such customers unless they were dissatisfied.

Mr. J. T. Hutchings, of Rochester, N. Y., expressed the opinion that where the tungsten lamp had been a benefit to the central station it was where the central station had "pushed the lamp" instead of being "pushed by the lamp." He preferred single lamps scattered over the ceiling to clusters, as yielding better revenue and giving better satisfaction. Where lamps are maintained by contract, inspection is made once a week and lamps and reflectors are washed once in four weeks.

Mr. Douglass Burnett, of Baltimore, had found that the central station must control the tungsten-lamp output. He had found that contractors if left alone would use the lamp to lower the wattage of existing installations. Carbon-filament lamps are now rare on Baltimore business streets. The same price is charged for the 25-watt and 40-watt sizes, which encourages the use of the larger size. Mr. H. W. Hillman, of Grand Rapids, Mich., recently had the candle-power of gas and electric lamps on the principal business streets counted in Grand Rapids (which is reputed to be quite a gas town). This figured out in the ratio of 680 electric and 28 gas.

Mr. Joseph D. Israel, of Philadelphia, spoke strongly in favor of using the tungsten lamp and illuminating engineering to economize for the consumer where it seemed best rather than to think always of keeping up the wattage of an installation. He favored making trial installations where necessary and best. Mr. F. M. Tait, of Dayton, Ohio, expressed the desire for an early supply of the new 150-watt tungsten lamps, the idea being that one of these lamps could be substituted for a gas arc where there is an electric outlet at each gas arc. Mr. R. M. Searle, of Rochester, N. Y., said that the consumer usually wants better service and better light, and is willing to pay for them if he gets them.

INTENSIVE METHODS OF BUSINESS DEVELOPMENT.

In a paper with the above title Mr. John C. Parker gave an account of one of the methods pursued by the Rochester Railway & Light Company in extending its business. Two years ago the company had but one man to take care of industrial applications, whereas it has now, in conjunction with its commercial department, a staff consisting of a head and seven thoroughly trained engineers. All of the men are college graduates, and with but one exception have had shop experience. Among the duties of the staff are to make studies of the customer's or prospective customer's processes of manufacturing in order that electric power may be applied to the greatest advantage. In a case where a customer is sceptical of the company's judgment or dubious concerning such an unique business attitude, the equipment is put in on approval, to be paid for at the end of a fair test period if it has proven satisfactory, and in every such case the outcome has been excellent. The problems encountered involved a great deal in the way of study of boiler efficiency and the efficiency of steam-driven apparatus in already existing plants, mechanical drive, etc., and for this reason emphasis is given to the mechanical features of the work. It is often necessary to decide between various types of gears and belted drive, and to undertake special designs in gearing, and in other cases it has even been found necessary to build motors into existing machines as an integral part of the unit. The paper gives a number of illustrations of the different classes of work handled by the station. At present it is handling over 80 different processes, some of them very large and complex, and involving a great amount of detail. A feature of the organization is that all members are encouraged to undertake correspondence over their own signatures and to appear personally before their prospective customers. The result is that the customer cultivates the habit of thinking of one certain man in connection with his work and of dealing with this man and looking to him for assistance in all sorts of problems. In conclusion the author suggested that the association might with benefit devise some means for collecting engineering data of the kind needed for meeting competition, which would be placed at the disposal of its members, and he recommended that a committee of the association should be formed to collect such information and disseminate it. The need of such data, he believed, is one of the most urgent necessities at the present time, and this is especially true in regard to reliable data in connection with gas and gasolene plants.

Discussion.

Mr. E. W. Lloyd, of Chicago, endorsed the idea of having bureaus of specialists in the various branches not only in power and the economical use of power, but in illuminating engineering, heating, etc. He believes in having an engineering corps for the study of these various problems. As it is not always easy to exchange information of value in the ordinary course of business during the day, it is a good plan to have clubs for meeting and the exchange of such information. Mr. Graves, of Brooklyn, told how the Brooklyn Edison Company had developed specialists in various lines, he suggested that information taken from various power tests might well be exchanged by central-station companies, and he thought that there should be a permanent solicitors' handbook committee to facilitate such exchange.

Mr. H. W. Hillman, of Grand Rapids, Mich., reported having connected 1339 motors of an aggregate of 17,025 hp or 1 hp to six of population. A printed list of motor installations both encourages solicitors and helps persuade prospective consumers. He urged the installation of curve-drawing watt-hour meters on large power consumers, as they tell the central-station company many things as to the character of the demand as well as helping the consumer to stop leaks in the operation of his plant. He gave several examples of this. In one case the manager found his machines were not being used within a half hour of opening or closing time; in another case the night watchman was unnecessarily using an electric elevator. Mr. R. M. Searle, of Rochester, N. Y., gave some very interesting figures on the cost of conducting the contract department. This had cost for the past year $38,000, had closed $100,000 worth of new business and had held $20,000 worth of business which might otherwise have been lost. Mr. George N. Tidd, of Philadelphia, regarding the suggestion that figures on power installations be exchanged, said that he would be glad to furnish the information obtainable from the considerable number of central stations controlled by his company.

In closing the discussion, Mr. Parker, of Rochester, said that barring the possibility of mistakes in calculations there could be no uncertainty about putting in trial installations of motors, if the job were carefully figured out in advance. A company should have nerve enough to guarantee an installation after figuring it out. He believes in placing curve-drawing watt meters on all installations.

ELECTRIC VEHICLES AND CENTRAL STATION BUSINESS.

Mr. James T. Hutchings, of Rochester, presented a paper entitled "Relation of Electric Vehicles to Central-Station Business," in which he detailed the experience of the Rochester Railway & Light Company in developing an electric vehicle storage-battery load. In the summer of 1906 the company sup-

plied 98 private and eight public charging stations, which figures had increased in December, 1907, to 140 and 14, respectively, with an increase in income of 59 per cent. The company has a department which gives the subject of electric vehicles special attention, and is in charge of a competent engineer of wide experience. Experience has shown that a low rate is not the greatest incentive to an increase in business, and it is apt to induce carelessness on the part of the customer as to the manner of use of the storage battery. What is most needed is a campaign of education, which shall increase the customer's knowledge of the proper methods to be pursued in charging his battery and handling his vehicle; it should be brought home to him that if the vehicle in operation uses twice the amount of current that is actually necessary to do the work, owing to friction, bad alignment and the like, not only is the performance of the vehicle decreased by more than 50 per cent, but the life of the battery is also shortened by more than that amount. Careful attention to minute details makes the success of the electric vehicle possible, and if these details are followed up there is no competitor of the electric vehicle in its own particular field.

The central-station manager is advised to take the electric vehicle situation seriously, and to give it the same attention as is given the sale of electric power, display lighting and heating appliances. If he does so he will find the electric vehicle a better medium for the sale of his product than anything that has previously been brought to his attention.

Discussion.

Mr. Day Baker, of the General Vehicle Company, Boston, said that the average central-station man has previously thought the electric vehicle a failure. The old-fashion, heavy equipments of a few years ago have been superseded by better apparatus, and men are now more generally educated to the proper operation of batteries. One prominent lighting company in the East had a three-ton electric machine for pulling cables. The battery was not charged regularly nor properly and the acid and voltage tests were infrequent. Two or three sets of plates were used per year, and the company was about to give up the electric machine when a new man took charge of the private garage. He changed the system of charging and installed a new battery in February, 1908. The machine has been in service constantly, often hauling cables 20 hours per day, and is still in first-class condition, with six months' wear of the plates remaining. The Anhaeuser-Busch Brewing Company, of St. Louis, has 52 electric trucks, which save 50 per cent of the previous cost of operation by horse, and none of these vehicles is of the latest economical type. A table was then presented showing that in two representative vehicles of the old and new design the cost of operation per mile for energy has been reduced from 3.6 cents to 1.1 cents, the latter being the lowest cost per mile ever obtained in a 1000-lb. vehicle. This table has been previously printed in the *Electrical World*. Mr. Frank J. Stone, of the Electric Storage Battery Company, Boston, advised the creation of a separate department in the central station for the handling of electric vehicle business. An incidental advantage is the picking up of considerable outside business by the solicitors while engaged in electric vehicle work proper. Mr. Newman, of the Woods Motor Vehicle Company, stated that "new brains" are the important part of the recent advance in electric vehicles. His company has found it necessary to open an operating inspection department to educate the central-station manager as to the causes of vehicle troubles. The kind of tire used, for example, affects the power consumption of the machine. This department now has a machine for measuring the internal feature in tires in terms of watts consumed per revolution, and is prepared to assist the central-station man in the determination of technical problems with the object of reducing maintenance cost. Charging rates should be made as low as possible, and too much emphasis cannot be laid upon the importance of proper charging of batteries. Mr. C. D. Hilder, Rochester, N. Y., said that in his experience batteries are destroyed by overcharging rather than by the service of the machines on the road. Mr. W. P. Kennedy, consulting engineer of the Studebaker Company, New York, called attention to the new magazine, *The Electric Vehicle and Central Station*, published in New England for the purpose of stimulating this branch of the industry. Mr. F. J. Stone corroborated Mr. Hibler on the effects of overcharging, and Mr. Samuel Scovill, of Cleveland, outlined the electric vehicle situation in that city. There are about 1500 machines in service at present. The mercury-arc rectifier is eliminating overcharging to a considerable extent. It is a disadvantage for the central station to attempt to do much repair work on electric automobiles. Mr. Rice, of Indianapolis, urged co-operation of the central-station interests with the manufacturers of batteries and vehicles and touched upon the advantage of the electric carriage as an off-peak load. Mr. M. E. Turner, of Cleveland, said that the average income from 338 charging stations, where the current is measured at the lighting meter, is $60 per station per year. Mr. J. H. Vail, of the General Vehicle Company, New York, presented a vast array of figures showing the enormous estimated cost of maintaining horses and mules in the streets of America. He estimated that the central stations of the country would secure an added annual revenue of $108,000,000 by displacing the horse. The cost of living is increased 10 cents per capita per day by the presence of the horse in the streets of a city like New York. The electric automobile will do twice the work of a two-horse team. A number of cases showing the actual saving of the electric vehicle over horse traction were also presented. Mr. T. Commerford Martin, editor of the *Electrical World*, stated that he had sent 4500 circulars of inquiry bearing upon the electric vehicle situation to all of the central stations of the country. Already 1400 replies had been received; 218 stations are already directly interested in this work, 234 furnished general data bearing upon the situation, and a large number of others are thoroughly aroused to its importance. The question of rates is a most vital part of the discussion of electric vehicles. A new era of transportation is at hand. In 1886 the speaker read a paper on electric vehicles before the 20 companies who comprised this association, and in the next year he read the first paper in this country upon the motor in electric traction before the 13 street railways comprising the American Street Railway Association. To-day there are 5000 central stations and 1300 electric railway systems in this country, and it is apparent that the future of electric vehicle transportation is equally bright. Mr. F. M. Tait, Dayton, Ohio, concluded the session by urging central stations to pay more attention to the electric vehicle business. Even where these machines are used to considerable extent there are only three in service for 1000 inhabitants. It is bound to be a paying business.

ELECTRICITY FOR NATIONAL ADVERTISING.

In a paper with the above title, Mr. George Williams sets forth the merits of the electric sign under 10 different heads, and in conclusion suggests that the association should collect the following information from Class A members and compile the same for the benefit of members, national advertisers, advertising agencies and sign builders: (a) List of available local roof locations, with their descriptions and terms of rental. (b) Flat rate of service for 4-cp per night of six-hour and 12-hour night burning. (c) Expense of lamp renewal and sign cleaning. (d) Names and brands of products already advertised by electric display, accompanied by photographs.

Discussion.

Mr. F. J. Jones, of New York, commented on the fact that the paper of Mr. Williams dealt only with the electric signs having letters made up of exposed lamps, the inference being that this class of sign business is the only kind to be cultivated on a large scale. In New York city [illegible] and that illuminated effects and signs had proved very successful and popular [illegible] advertisers and a good source of revenue. These usually are illuminated by concealed lamps with reflectors to conceal the lamps. Mr. H. J. Gilbert, of Minneapolis, thought that the members of the N. E. L. A. should co-operate with the National Posting Association, as the members of the posting association are the ones who are naturally most closely in touch with this kind of

work, and have the appropriations for advertising. Mr. W. H. Gardiner, of New York, told of the very remarkable building being erected on Broadway in New York. The first six stories of this building are like an ordinary office building, the remaining 14 stories will have a steel-frame construction, but instead of being used for offices will be used entirely to support electric signs. Mr. Henry Ives Cobb is architect for this building. It is figured that the rentals from the building as a sign space will be larger than it would be if rented for offices. Mr. C. N. Stannard, of Denver, endorsed what Mr. Gille had said about the desirability of getting in touch with the National Posting Association. He said that through two of the local representatives of this association in Denver his company had received orders for a number of electric signs. Mr. Frank M. Tait, of Dayton, told of some of his troubles in getting national advertisers to consider favorably electric advertising in towns of less than 100,000 population. The tendency seems to be to seek large centers, although he was convinced that in a city like Dayton, with its interurban railway facilities, electric advertising would be a very good proposition for the advertisers.

PRACTICAL ILLUMINATING ENGINEERING.

In a paper entitled "Practical Illuminating Engineering in Connection with a Commercial Department," Mr. G. A. Sawin gave the details of central-station illuminating engineering organization. The illuminating department should be a separate branch of the commercial or sales department, the engineer reporting to the chief commercial or sales agent. The department would consist of an illuminating engineer at the head, with sufficient engineers and inspectors to care for the business properly. The inspectors would visit customers who desired advice, learn their wishes and report to the illuminating department, where the engineer and assistants would lay out a lighting scheme which would be handed to the customer by the solicitor. The inspectors should preferably be trained solicitors, who combined illumination service with their other work. The paper gives details of the organization of such a department, with suggestions as to records and forms.

Discussion.

Mr. J. D. Israel, of Philadelphia, reviewed the work along this line by the Philadelphia Electric Company. Mr. F. E. Smith, of Boston, told of the commercial illuminating engineering division of his company started within the last year. It was based on the principle that one satisfied customer makes 10 new ones.

Mr. C. N. Stannard, of Denver, read a communication from Mr. C. F. Oehlmann, illuminating engineer of the Denver Gas & Electric Company, giving some suggestions as to the conduct of such a department. He thought that lamp exchanges and sales if made by the company should be reported through the illuminating engineering department so as to keep track of what the consumers are doing as to lamps. He also recommended that the company carry a stock of globes and shades, as these are almost to be considered a part of the lamp in modern practice. All salesmen should be trained in illuminating engineering.

ELECTRIC HEATING FOR INDUSTRIAL PURPOSES.

A paper entitled "The Adoption of Electric Heat for Industrial Purposes" was submitted by Mr. Charles J. Russell, as editor, who was assisted in the preparation of the paper by Messrs. James I. Ayer, E. R. Davenport, Frank H. Gale, W. S. Hadaway, Jr., Joseph D. Israel, George B. Johnson, G. M. Kebbe, C. K. Nichols, LaRue Vredenburgh and R. R. Young. The heads of the paper are as follows: Present status; supply of data; the field; rational development; heating units; existing applications; metal trades; printing and publishing trades; leather trade; wood-working establishments; celluloid industry; cloth and textile trades; laundries; paper industries; confectioners and bakers; automobile garages; branding devices; appliances for hospitals and surgeons; general. It is stated that at least 1000 distinct types of electric heating applications for various industrial purposes have been successfully made, and a conservative estimate would place at 300,000 kw the electrical capacity at present utilized in this country and Europe for electric heating purposes. Referring to electric furnace applications, it is stated that abroad several large central stations are furnishing electricity for the operation of electric furnaces. The load factor of this class of business is very high, and in some cases the amount of time and supply rests with the central station. The paper under the heads of the various industries gives much information as to the numerous applications of electric heat, together with data in many cases as to the consumption of electrical energy in various electric heating processes.

ISOLATED PLANTS.

The subject of isolated plants was treated in a paper prepared by Mr. R. S. Orr, of Pittsburgh, as editor, and Messrs. Paul H. Bate, F. B. Carter, T. I. Jones, R. B. Mateer, J. T. Maxwell, Joseph McKinley, R. C. Niles, Jr., and H. Spohrer as assistant editors. The text consists of an introduction of two pages and two papers prepared specially by Mr. F. B. Carter, of the Boston Edison Company, and Mr. J. T. Maxwell, of the Philadelphia Electric Company. Central stations are advised to make a thorough study of the isolated-plant situation and have on their staff an expert who understands the principles and best practice in the operation of steam engines and gas engines, who is familiar with the best methods of illumination and the latest and best practice in the application of power to machinery and who is able to marshal his facts and arguments with such clearness and force as to compel the acceptance of his conclusions. Lacking such an expert, good results can be obtained from the work of a carefully selected force of men, each with his specialty or specialties, who will be guided and directed in the work by a competent head. In any event, careful investigation, sustained effort and the application of common sense to every phase of the problem will bring good results, whether with one or with many men. The paper of Mr. Carter gives data and regulations that have been used by his company in combating isolated plants. Included is a tabulation for use in determining complete isolated-plant cost. The paper of Mr. Maxwell gives the organization of a department of the Philadelphia Electric Company which deals especially with the isolated-plant situation. Details are given, including forms, of the methods of conducting the department and its field work.

Discussion.

This paper was first discussed by Mr. Joseph McKinley, Pittsburgh, who said that the central station is weak in the possession of actual isolated plant operating cost data. Mr. H. W. Peck, Rochester, N. Y., confirmed this, and stated that many customers in Rochester are willing to pay from 10 to 20 per cent more for central station service than their own power costs, on account of the superior attractiveness of the latter. Mr. T. I. Jones, New York, emphasized the importance of studying the gas engine operated in the isolated plant from city mains. Mr. Lloyd, of Chicago, said that a rate of 4.5 cents per hw-hour is often sufficiently low to enable the company to displace such engines. Mr. Paul Mueller, Erie, Pa., cited the difficulties of trying to compete with natural gas of 1100 b.t.u. per cubic foot, costing 32 cents per 1,000 cu. ft. Mr. M. F. McAlpin, of New York said that the New York Edison Company has found the higher efficiency lamps very useful in displaying isolated plants. The economies obtained by the use of the 25-watt tantalum lamp in isolated plants which have been taken over have been very marked. Others who spoke along the same lines were Messrs. Morse, Johnson, Richter and Ehrlanger.

CENTRAL-STATION DISPLAY-ROOM.

A joint paper entitled "Can a Display-Room Be Conducted on a Profitable Basis?" was presented by Mr. Frank B. Rae, Jr., as editor, and Messrs. H. K. Mohr, D. W. Lloyd, John G. Leonard, George Williams and H. K. McConnell as assistant editors. The text of the paper, however, relates to the subject of a salesroom conducted for immediate profit. After discussing the arguments pro and con the conclusion is arrived at that there is evidence that a salesroom is not only a large city possibility, but is a small town necessity.

ELECTRICITY FOR DOMESTIC PURPOSES.

A paper entitled "Electricity for Domestic Purposes with Particular Reference to Electric Heating Appliances" was presented by Mr. Matthias E. Turner, as editor, who was assisted

in the preparation of the paper by Messrs. H. W. Hillman, C. Edgar Titzel and W. H. Wissing, as assistant editors. The principal subject discussed in the paper is electric cooking and its development. At present there are serious drawbacks to electric cooking apparatus—namely, lack of durability, slowness in heating and quantity of current required. The first-mentioned defect, it is stated, and most probably the second one, also, will soon disappear. The third defect has been partly overcome, and by a combination of an electric and steam cooker the current consumption may be reduced more than 50 per cent. It is stated that in Cleveland, where there are more than 40 complete cooking outfits used exclusively for providing the meals for as many families, the average cost of cooking for each person at 5 cents per kw-hour is $13.65 per year. The introduction of defective apparatus in the past, of which from 60 to 80 per cent was returned by customers, has made it more difficult to introduce the better appliances of to-day. Designs emanating from technical minds are criticized, and it is stated that central-station men are now determining the designs for apparatus from experience in its use, and the manufacturers are meeting this new condition. Where principles of design have not yet been fully agreed upon, and methods of manufacture are in an experimental stage, no satisfactory relations, it is stated, can be established between the consumer of current and the manufacturer except through the medium of a policy broader than immediate profit. Referring to the residence load, it is stated that this had received little attention up to a few years ago from central stations. At present it is realized, however, that to every 10 factories or 100 stores there are perhaps 1000 residences, and that the residence load will in time become an important part of the total business. With the increase of residence customers for electric light, a field for other uses of their electricity will then have been secured, and the use of electric heating and similar apparatus can be pushed as fast as the manufacturers provide them.

Discussion.

Mr. H. W. Hillman, Schenectady, stated that the electric heating business is now fully established. Flatirons are produced in lots of 100,000 at a time. He sketched the part that self-centered devices developed by the manufacturer have played in lowering the cost of operation, and referred enthusiastically to the work of Mr. A. C. Dunham in the electric cooking field at Hartford, Conn.

ADVERTISING IN SMALL TOWNS.

In a paper with the title "Novel Methods of Advertising in Small Towns" Mr. Alex. J. Campbell, as editor, and Messrs. J. W. Cartwright, Jr., Elizabeth C. Lewis, A. T. Lloyd, J. F. Matthias and J. S. Whitaker as assistant editors, give briefly the result of a canvass among central-station companies in small towns as to their advertising methods. A number of replies are quoted, which, however, do not indicate any special originality. The conclusions of the paper are that to get up something novel and original to attract attention is certainly an alluring idea, and makes the best sort of advertising provided—which is the important clause—that selling power is combined with the novelty. To attain this end is worthy a man's best efforts, but he should be clear-headed and not deceive himself into believing that he is doing successful advertising because he secures an audience or provokes a smile. In the opinion of the author, novel forms of advertising are usually short-lived. While they may attract attention for a day, they do not hammer home the vital facts nor are they able, as a rule, to embody the logic that carries conviction or the persuasion that creates a customer.

Accounting.

REPORT OF COMMITTEE ON UNIFORM ACCOUNTS.

The report of this committee was presented by the chairman, Mr. H. M. Edwards. The report contains a classification of construction and equipment accounts, giving the association a complete system of accounting, including both property and income accounts.

The committee renews its suggestion in the 1907 report that the association should develop its standards slowly, in order that it may have the benefit of the most modern practice, and leaves for future consideration the standardization of accounts embracing floating capital and liabilities, also departmental and subsidiary records.

The report then compares the New York Public Service Commission's system with that of the association.

The general accounts adopted by the commission follow the same lines as the association standard except that the distribution accounts are divided. The accounts covering the cost of bringing the service into customers' premises—including the setting of meters and converters—are grouped under distribution; and the accounts covering the cost in customers' premises—including first installation and renewal of incandescent lamps, trimming arc lamps and incidental repairs—are included in a new general account called utilization. There is the greatest variation in the practice of the different member companies in regard to what is supplied to consumers in connection with the electric current. It is a fact, also, that the legal obligation of an electric lighting company usually ends with the delivery of the current to the meter in customers' premises, and functions that the company assumes beyond the meter are voluntary and lie within the discretion of the company. For these reasons the accounting committee considers the division a good and logical one and recommends that the commission's plan of separating utilization accounts from distribution accounts be adopted and that the association's standard be amended to that extent.

The association standard included two general accounts—commercial expense and new business. The commission has one general account, commercial expense, with subdivisions to show the respective costs of each. In other respects the association and the commission have the same general accounts.

Four divisions of expense accounts are provided by the commission—one for companies with annual revenue of less than $25,000, one less than $100,000, one less than $500,000, and the fourth being the full classification. The companies which have adopted the association's standard will have a little fuller analysis than is contained in the first two divisions of the commission, and only slightly less analysis than the third division. The point of difference between the third division and the association standard is that maintenance-steam equipment is divided in the commission's plan into repairs to boilers and accessories and repairs to steam engines. There is also an account miscellaneous station repairs. The association's account for maintenance of transmission lines is divided by the commission into subway rent, maintenance-poles and fixtures, maintenance-underground conduits, and maintenance system repairs.

The association's schedule under general expense agrees exactly with the commission's system, except that the latter has added the following accounts: Relief department and pensions; franchise requirements; amortization; electric expense-transfer credit; joint operating expense credit; store and stable expense; undistributed adjustments; duplicate charges.

The accounting committee does not approve the separation of taxes and uncollectible bills from operating expenses, and their inclusion as part of the expenses of outside operations, holding that these items are a definite part of the cost of operation and that while they may not be within the control of the company, each constitutes one of the elements of cost.

The committee believes that the association's standard is preferable to the commission's scheme in the arrangement of the accounts included in production and distribution, which in the association standard provide for a total of the operating accounts and a total of the repair of maintenance accounts, the two totals then being combined into a grand total constituting the cost of the division. The commission's scheme lists all the accounts under one general caption and provides one total only.

The first report of the committee presented figures showing that over 75 per cent of all the electric lighting companies had annual revenues of less than $15,000, and it was suggested that [illegible] might be too extended and

uneconomical for their use. The experience of the last year has confirmed this impression, and the committee therefore recommends that for the use of the smaller companies a classification be adopted consisting of the main divisions only, as follows: Production. Transmission. Distribution. Utilization. Commercial. New business. General.

In the classification of construction or fixed capital accounts the committee has assembled the accounts by broad divisions, so that those companies not requiring extended analysis of their construction expenditures may be guided in their condensation. Companies located in New York and Wisconsin will not be able to avail themselves of this option, as the commissions' systems require the same analysis for small as for large companies. The classification of construction and equipment accounts, as reported by the committee, is as follows:

Division	Subdivision
Organization	
Royalties, franchises and licenses	
Generating plant—Steam	Land Structure Boiler plant Prime movers Electrical plant Miscellaneous
Generating plant—Hydraulic	Land Structure Dams, canal and pipe lines Turbines and water wheels Electrical plant Miscellaneous
Generating plant—Gas	Land Structure Gas producers and accessories Gas engines Electrical plant Miscellaneous
Underground conduits	
Pole and fixtures	
Transmission	Conductors—overhead, underground Land Structure Substation equipment
Storage batteries	
Distribution	Overhead conductors and devices Underground conductors Services Meters Line transformers
Arc and glower lamps	
Customers' installation	
Municipal street-lighting system	
General office and branches	Land Structure Furniture and fixtures
Other equipment	Land Structure Coal-storage equipment Shop equipment Storeroom equipment Stable equipment Laboratory equipment Tools and instruments
Miscellaneous—During construction	Engineering and superintendence Law expenditures Taxes Interest Injuries General

The committee has kept in touch with the situation in the various States so far as public service commissions were concerned, has procured copies of all State bills appointing public service commissions, and, wherever such bills have authorized the respective commissions to prescribe systems of accounts it has arranged to communicate with the local electric light association, tendering its services in any effort which might be made to bring about uniformity in the legislation of the various States in relation to electric light accounts. At the request of the Public Service Commission for the State of New York the committee has agreed to act in an advisory capacity to the commission in relation to questions which may arise under the classification of accounts as adopted, acting in this respect in conjunction with the Empire State Gas & Electric Association.

The report is signed by the following: Mr. H. M. Edwards, chairman; Mr. E. J. Allegaert, Mr. John L. Baily, Mr. E. L. Brundrett and Mr. F. L. Dame.

Discussion.

Chairman Edwards stated that several hundred copies of the classification of accounts adopted for public utilities by the Railroad Commission of Wisconsin had been received from Mr. W. J. Hagenah, statistician of the commission. This classification appealed to Mr. Edwards as a good working system of accounts. The decision of the committee to separate distribution and utilization expenses was a good and logical one because the legal obligation of the company usually ended with delivery at the consumer's meter and any work the company undertook beyond that point was voluntary and within its own discretion.

Mr. Charles R. Price, New Bedford, Mass., said that no one appreciated better than himself the desirability of a uniform system of accounting for comparative purposes. Companies found a great deal of good information and a great deal to guide them in their operations in the knowledge of what other companies were doing. Even in Massachusetts, however, it was found that the returns were not always uniform, because the information was not reached in the same way by each company.

Mr. C. N. Duffy, Milwaukee, Wis., expressed appreciation at the indorsement by Mr. Edwards of the Wisconsin classification. The commission judged the results of operations of the companies from the reports under the classification and based its conclusions as to rates thereon. The accounts would give an accurate and comprehensive basis of the cost of performing the various public utility services. Any company, large or small, ought to be able to use 63 primary operating expense accounts, the number provided for the smaller class in the Wisconsin classification. It was understood that if any company, however, could convince the commission that it was unable to do more than group the accounts, because of the excessive expense involved, no more would be required. The attitude of the commission had been broad and evidenced a desire to co-operate with the practical necessities of public utility corporate accounting. Since the classification had been printed several modifications and changes had been made, principally in terminology. The monthly reports of the Milwaukee Electric Railway & Light Company were exchanged regularly with the subsidiary properties of the North American Company in St. Louis, and the information presented was entirely satisfactory for the purposes of the technical and operating officials. Mr. Duffy regarded this as a strong compliment to the Wisconsin classification.

The report of the committee was then accepted by the accounting session on motion of Mr. G. W. Claflin, Boston. This action was reported by Chairman Edwards to the general session, which thereupon referred the report to the executive committee with power to act.

BRANCH-OFFICE ACCOUNTING.

Mr. E. J. Allegaert, auditor, Public Service Corporation of New Jersey, described in a paper with the above title the practices of a company with whose operations he was familiar. It supplies municipal street lighting and commercial lighting and power service to 133 municipalities, serving a population of 1,700,000 out of a total of 2,300,000 in the State, being 74 per cent. The organization includes a commercial department having charge of all relations with customers, and an operating department responsible for the production and distribution of the current. The territory is divided into six commercial and six operating divisions following the same territorial lines. Each commercial division is in charge of a "division agent," located at the most important city in the division. He reports to the general office. There are 23 commercial offices or districts, each in charge of a representative with title of "agent." The agent reports to his division agent. The district offices range in size from one serving 128 customers to the largest office serving 9737 customers. In the smallest office the force consists of the agent and a boy as assistant. Each operating division is in charge of a "division superintendent," who reports direct to the general office. There are 20 operating districts, each in charge of a local representative, who reports to the division superintendent. Each operating district covers the same territory as the commercial district, except that each of three operating districts is divided into two commercial districts.

To obtain the best results in branch-office accounting standardization of methods and practices are essential. The company has a uniform system of accounts and forms. To further

assist in this work, letters of instruction are issued by the general office from time to time and as necessity demands. These letters are addressed individually to each man in charge of a district. The company has a uniform lighting rate schedule, reducing from the base rate by steps and automatically, so to speak, giving an appropriate rate to the largest customer. It has a uniform power-rate schedule and a uniform rate schedule for municipal street lighting, arc and incandescent. It has a standard contract.

Each district office is a complete unit for the transaction of business with the customer, and the agent is authorized to execute contracts for supplying commercial light and power on the existing lines, reference to the general office not being necessary. Municipal street-lighting contracts are executed by the general officers of the company, but the business is secured by the agent or general agent.

Bills and the entry in the ledger are made out independently from the meter slips, the rule requiring a separate calculation. Comparison is then made, and delinquent balances shown on the ledgers are added to the bills. Bills are, generally speaking, delivered by collectors, and collections begin at once. Due to special requests, and for other reasons, a small proportion of the bills are mailed. The form of bill used has two coupons attached, one a cashier's coupon, the other a bookkeeper's coupon. Each day's cash receipts are deposited in the local bank in full on the morning following. The disbursements for the usual small expenses of conducting an office are not allowed to be made therefrom. A suitable amount of cash is advanced to each office as a petty cash fund from which small expenses are paid and deposits refunded. An attractive display of small appliances, irons and portables, is made at each office. Sales are made to customers, the accounting for which is taken care of by a system of sundry sales orders, sundry sales book for entering the charges, and sundry sales ledger. When business is offered that cannot be provided for on existing main lines, it is necessary to obtain the approval of the general office before the business can be accepted.

At the end of each month reports are made by the commercial offices to the accounting officer on the subject of "business," "cash receipts," "allowances," "sundry sales," "outstandings" and "new business." Each week there is forwarded from each office a report of solicitors. At the end of each calendar quarter a report of uncollectible bills is received from each office. The agent certifies that in his judgment the accounts listed are uncollectible, and recommends their transfer to a suspense ledger and asks for authorization to make the transfer. If approved, authorization is issued by the accounting officer, and the transfer of the accounts to the suspense ledger is equivalent to writing them off to the proper operating expense account. The traveling auditor is a very important factor in branch-office accounting. He reports direct to the accounting officer. His duties confine him to the field, and he visits each office as directed.

Each operating district is equipped to supply current either directly from a generating station or from a substation located in the district. Each operating district is also fully equipped to distribute the current to the customer involving the construction and maintenance of lines, the setting and removing of meters and transformers, the renewal of incandescent lamps, and the attention to trouble or complaint work. A supply of materials is kept at each point, all separately accounted for to the general office, and in charge of a storekeeper who reports to the local operating man. Complete meter, transformer, arc-lamp and other property records are maintained. Material is ordered by the local operating man by requisition, which is sent to the division superintendent for approval and transmission to the general office. Each district is also supplied with a local or emergency order form for ordering material, or work to be performed, from local dealers. This form of order is restricted to small hardware purchases, hay, feed, horse shoeing and the like. Each local operating man is furnished with a petty cash fund for the payment of small cash expenses and for freight charges. All freight charges except freight on coal for generating stations are paid in cash at the time material is delivered.

Materials are entered on the receiving and bill record book when received and bills are checked therefrom, recorded therein and passed. A separate book is kept for coal received at generating stations. Coal freight bills are sent to the general office for payment by voucher check. Materials purchased in excess of the current needs and those for which the account to be charged cannot be determined at the time of purchase, are placed in general stores and are recorded in a stock ledger at cost prices. Materials are issued on storeroom requisitions approved by the local operating man. Accounts benefited are charged at the average or composite cost prices.

The local operating man in each district makes up his own payroll and forwards to the accounting officer for audit. A voucher check is prepared payable to the agent of the district, who acts as paymaster.

The auditor's charge notice is to cover a charge to be taken up on the general books against an individual or company for the return of goods, the sale of scrap or abandoned apparatus, and for any work performed other than that for customers. Goods returned to shippers are treated as a sale. The exchange of goods on the same bill or the same order is not permitted. Before a sale of scrap material takes place local operating men are required to obtain authorization.

The company ships materials from one district to another and the accounting therefor is by means of an interchange charge and bill, which taken together become in effect a journal entry.

At the end of each month reports are made to the accounting officer by the operating officers on the following subjects: "Station production and output," "substation output," "fuel," "general stores," "stable inventory," "stable hours," "condemned apparatus and material," and "cost of extensions of electric lines."

Discussion.

Mr. W. E. Freeman, New York, said it was the practice of the New York Edison Company to centralize the work of rendering bills in the main office. While there were branch offices for the collection of accounts, the customers' accounts were kept at the main office and this had been found to be economical. The branch offices also secured contracts. The Hollerith system was used for tabulating earnings. It was entirely practicable to make an analysis of earnings by territory and by classes of business. The classification by territory permitted a comparison from month to month of the readings by trips. If there was any apparent discrepancy in the earnings for a month the differences could be located readily by comparison with the readings for the preceding month or the corresponding month of the previous year.

Mr. Allegaert, in closing the discussion, said that he did not use the loose-leaf ledger, but had many features of the accounting work where the loose-leaf system was used.

CUSTOMERS' ACCOUNTS, INCLUDING THE HANDLING OF METERS IN THEIR FINANCIAL ASPECT.

Mr. L. M. Wallace, auditor, Edison Electric Illuminating Company, of Boston, in describing the system of that company in handling these accounts, said that it was exemplified by the word "centralization," the responsibility for the performance of the duties in this connection being under one control, the auditor. Meters are read on every working day in the month. The average maximum number of meters installed determines the number to be read; the total, being divided by the number of working days, establishes the average number to be read each day and this number is called the daily load. Each day's load has its own meter slips, loose-leaf system, arranged in the geographical or consecutive order of reading and bound in covers, one for the meter reader for each route. Meters are read in accordance with the daily loads as determined by the billing department, after which the head meter reader makes a cursory examination of the readings, as recorded by the latter, for the purpose of detecting any abnormal change in consumption.

The meter-reading slips are then given to the billing department, when the calculators transfer the readings to the cus-

tomer's billing card. These cards then go to the bill clerks and, after the bills are made, to the earnings statistical division in the billing department, for record on the earnings journal sheet. The earnings journal is also the official record of the monthly gross earnings from the sale of electricity and total amount of bills rendered. Tabulating cards are punched corresponding with the information desired for statistical purposes, such information being supplied by means of the billing cards. At the close of each day's business the total amount of bills rendered (which is arrived at by means of the Burroughs adding and listing machine) and the amount of bills recorded on the earnings journal and the amount of earnings distributed to the different classes of income must agree with each other. This system permits of readily determining the total monthly gross earnings from the sale of electricity early in the following month, on the average by the third day. The completed bills are transmitted to the accounting department, where they are separated into groups corresponding to the number of ledgers in use. When the day's bills have been completed and compared by the ledger clerks, a junior clerk detaches the coupons by means of a regu- (No. 13 Pearl) lever paper cutter, capable of detaching approximately 350 coupons at one stroke of the lever. The customers' ledgers are of the loose-sheet, horizontal monthly balance form, eight in number. Ledger No. 8 is used solely for the purpose of handling discontinued account balances. The system followed in the collection of accounts is planned especially to handle the collection of bills that are rendered net. Loose collection sheets are used on which to record all payments made by customers.

The superintendent of collections personally interviews certain customers, whose accounts are large, when such attention seems necessary; the auditor likewise may give personal attention to certain accounts at certain times. When all of these efforts have proven unavailing, the account is turned over to the legal department for collection, and all that are thus handled are taken from the active ledger accounts and charged to the legal accounts receivable account, and there remain until a final disposition is made either by being collected or transferred to bad debt account. Personal effort and moral persuasion, coupled with diplomacy and gentlemanly demeanor, go a long way toward swelling the collections and at the some time not disturbing the otherwise friendly feeling the customer may have for the company. Collections promptly made are extremely essential, and it is the constant aim of the collection department to insist judiciously upon the prompt payment of bills.

Discussion.

Mr. F. L. Dame, New York, said that it had been very convenient in connection with collections in some places to use a cash register manufactured by the National Cash Register Company.

Mr. John H. Gulick, Chicago, said that the arrangement of the ledgers and the billing forms and the collections of the Chicago Edison Company were somewhat similar to those outlined by Mr. Wallace. The Hollerith system checked absolutely the extension of the bills, which were not checked by clerks at all.

Mr. Charles R. Price, New Bedford, Mass., said that all the bills in his company had coupons. Special collections and overdue accounts were given to two collectors, one for the north and one for the south end of the city, and these men followed the accounts that were in arrears.

Mr. H. R. Kern, Philadelphia, said that the bills were sent by the accounting department to the district managers for perusal and then forwarded to customers. Where cash discounts were allowed to consumers, the accounting department always questioned the action of the district managers in extending the time limit. Sometimes the district managers held bills for certain reasons. All accounting should be consolidated into one department.

Mr. E. H. Robinson, Schenectady, N. Y., had about 22,000 accounts and, since 1904, had used loose-leaf ledgers similar to those described by Mr. Wallace. The bills were made out on postal cards. If a customer is delinquent, a sheet was sent out in nine days and if the bill was not paid on the day following, it was handed to the collector. It had been found convenient to have the collector use a motor cycle. A few objections had been made by customers to the use of postal cards for bills, but when a balance from the previous month was unpaid the bill was always mailed in an envelope.

Mr. Kern said that over 95 per cent of the consumers in Philadelphia paid within the prescribed limit in order to get the discount.

Mr. E. C. Scobel, Rochester, had found that it meant additional work to arrange accounts according to account numbers. A more convenient way was to arrange the accounts by location. A discount period began on the fifteenth day of each month. About the eighteenth day a list of arrears was made up. From this list the first notices were sent out, giving until about the twentieth day for payment. In case of non-payment, a second notice followed, stating that if the account was not paid the meter would be shut off, and the customer was given until the twenty-second or twenty-seventh day. The number of first and second notices decreased each month.

Mr. Harry C. Schlegel and Mr. W. H. T. Jones, New York, spoke of the unsatisfactory experiences of the New York Edison Company with prepayment meters. The revenue from them was small and the expense of reading large. In addition the meters got out of order. The income from 125 meters in the Bronx did not average more than $100 a month and it took from one to two days to read them. The loss on the meters was due to the fact that they did not trip over properly.

Mr. Wallace, in closing the discussion, said that 4 per cent interest was allowed on customers' deposits, but every effort was made to keep them to a minimum.

PAY-ROLL PROBLEMS OF THE ELECTRIC LIGHT INDUSTRY.

W. E. Freeman, cashier, New York Edison Company, said that of the different methods of wage payment the day or hour rate plan was practically the only one adaptable to the electric light plant, as labor cannot be measured by articles produced. Because of this condition there is ever present the necessity for efficient supervision. Obsolete methods of timekeeping, preparing pay rolls and paying wage-earners are commonly used by both the large and small concerns, in disregard of the fact that they are suggestive of opportunity for irregularity, padding and collusion. Examples are numerous: (1) Where foremen or time clerks go among the workmen and ask when they arrived. (2) Where workmen enter at gates that are closed morning and noon so that late employees cannot get in. (3) Where the timekeeper checks the time of employees on sheet as they enter and depart. (4) Where the brass check is used, each employee being assigned a numbered check. (5) Where employees are supplied with time-slips on which they write down the time spent on each operation or job. (6) Where foremen or timekeepers make records of employees on the streets in time-books at the close of the day or on the following day. These methods admit of irregularity in charges against working jobs. Nearly all survive, because of the impression that time taken by an employee appointed for the purpose gives a more reliable and authentic report than that obtained by any other means.

This view, however, does not seem to be well founded. On the contrary, it appears to be certain that a mechanically made record is by far the less liable to err of the two because if the mechanism of the time-clock is regulated in its action, nothing could be more accurate than the record made by the workman himself, or made for him by the timekeeper in his presence. In the most advanced systems of plant and factory management mechanically made time records are universally employed, and it might be noted that in these cases such time is invariably accepted as correct and binding. In the introduction of new timekeeping methods and practice, the initial expense is necessarily considerable, but this is invariably more than offset by the stopping of leaks and economies effected within a limited period. The timekeeping is probably the most perplexing question for the largest plants to solve, because of operating conditions peculiar to the business. In applying the various mechanical aids for recording time it is not practical to borrow

a ready-made system. Each of the several mechanical aids has characteristics that make it peculiarly suited or adaptable to certain conditions; conversely, there is not one that would not be distinctly out of place under other circumstances. After an exhaustive study of the various mechanical appliances used for recording the time of employees, it was decided by the New York Edison Company to introduce the calculagraph as the one best adapted to the varying demands exacted.

The following statistics and information are furnished officials weekly in regard to the pay-rolls: (1) A separate detailed analysis and comparative pay-roll statement, giving the number of employees, wages and expenses as compared with the preceding week, and showing net changes and particulars for guidance of officials before approving and signing pay rolls and checks. (2) A combined weekly analysis and comparative pay-roll statement, giving the number of employees, wages, expenses and total amount of pay roll, department and division as compared with the preceding week of the same year and the corresponding week of the previous year, also giving the net changes with the percentages of increase or decrease. (3) A detailed distribution of labor charges to accounts and sub-accounts, jobs and sub-jobs. (4) A comparison between actual labor costs and original estimates, giving separate figures in each case for labor, material and indirect charges.

Discussion.

Mr. Charles R. Price, New Bedford, asked if there had been any friction between the employees and the company on account of the adoption of the mechanical devices for time-keeping.

Mr. H. R. Kern, of Philadelphia, inquired if the time of employees paid on a monthly basis was kept by mechanical devices.

Mr. W. E. Freeman, in answer, stated that some objection was raised by employees and particularly by some general foremen on the adoption of the mechanical system and it was necessary to discharge several men. The time of men on outside work was taken when they reported at the station morning and evening. Some exceptions had to be made and reliance in these cases was placed upon foremen, especially where men worked overtime. Men paid by the month were not in this system.

CARE AND HANDLING OF SUPPLIES.

Mr. John L. Baily, treasurer, Consolidated Gas, Electric Light & Power Company, of Baltimore, stated in his paper, with the above title, that his experience had shown that it is much less difficult to check and distribute labor costs than to supervise effectively the withdrawal and application of material. From the incoming of the material it is often the case, aside from such limited supervision as may be possible on the part of the superintendent, that stores representing an enormous outlay of money are practically left to take care of themselves so far as accounting for them by bookkeeping records is concerned. Apart from the question of integrity in handling material, other business considerations justify the labor and expense of keeping accurate and complete stock accounts, which form an essential part of cost records. Stores ledgers in the form of books or cards have been found the most convenient means of recording the receipt and the issue of material. The return of material drawn from stores and not used forms a most important part of the stores records. Another weak point in stock accounts is the inability to secure full and accurate reports of materials used. If the stock accounts have been kept properly a book inventory should obviate the necessity to a great degree of taking a complete physical inventory at any one time. It is probably the consensus of opinion among public accountants that in inventories materials should be valued at cost or at market, whichever is the lower. The use of stock accounts will permit judicious regulation of the stores. Storehouses should be controlled through the engineering department.

Discussion.

Mr. W. H. Bogart, New York, asked whether the stockkeeper checked incandescent lamps and described an experience of the New York Edison Company, which involved the loss of some lamps.

Mr. E. J. Allegaert, Newark, N. J., said it was necessary, first of all, to be very careful about men who were placed in charge of the storeroom or other position of trust.

Mr. Bogart said that as each package of lamps was sent out now it is checked at the gate by an inspector, who observed the destination.

Mr. Allegaert said that the storekeeper was required to make a monthly inventory and if there was a shortage or overage he was obliged to check back and try to trace it. He had paid more attention to accounting for the goods themselves than to the accounts to which they were charged, because the goods represented cash. Mr. Bailey, closing the discussion, said that the inventory should not be taken by a storekeeper, but by an independent force under the control of the auditor. An inventory of incandescent lamps was taken every three months and a daily record kept. Storeroom employees should be bonded. A storekeeper should deal with materials only and a memorandum bill, not the original, should be sent to him.

COST ACCOUNTING.

In a paper entitled "Cost Accounting," Mr. H. R. Kern, auditor, Philadelphia Electric Company, defined cost as being, in general, an "expenditure of any specified thing, as time and labor, or the equivalent, be it time, money or labor, for a thing purchased, paid for, manufactured or work done." The keynote of success in any business enterprise, especially when complicated, be it manufacturing or selling the finished product, is found in as thoroughly dependable and accurate a system of cost accounting as conditions, fixed or fluctuating, will permit. If the business is yielding unsatisfactory results, the first thought is: "Get a new machine or hire a new man," and many enterprises have failed because improved machinery was expected to accomplish what could be done only by means of an efficient accounting system. The greatest cost of production is labor and the more complex the product, the greater the difficulty to arrive at the exact cost. The second factor composing cost is burden or fixed charges. This brings in another inexact factor which is mainly concerned with (1) determination of burden; (2) apportionment of burden. The constituent elements of burden are: Indirect labor, heating, lighting, rent of buildings, taxes, insurance, depreciation and up-keep. There are three principal methods of apportionment—the percentage plan, the hourly plan and the machine-rate plan.

Reverting to the definition, cost may be summed up in two main constituents: labor and material. To compute correctly the labor cost in any case, records and systems should be so devised and kept that the total labor expenditure of a given unit is as accurate and accessible at all times as even the most interlaced and detailed working conditions may demand in factory organization and control. The cost of material is, as may be evident, more easily and correctly determinable on an average, as an expense factor, than the more or less changing and unstable labor feature. For purpose of direct addition to the first cost of material, all transportation charges, such as freight, expressage, cartage, extra handling and the like may be included. Correct records and system of supervision are essential. Owing to the rapid and constantly increasing expansion in the use of electricity in home and commercial life, necessitating enlarged equipment and extension of company lines to meet growing conditions and prompt introduction of service connections, it became necessary to know in more complete detail the exact cost of each separate job, and the working-order system was inaugurated to meet this requirement. The main contributing check on labor performed or material secured under the operation of the working-order system is that the routine be so arranged and inflexibly adhered to that before noon each day all of the previous day's charge slips pertaining to working orders be on the desk of the engineer-in-charge of each respective department, such as overhead, underground and electrical.

Discussion.

Chairman Edwards said that the classification of accounts in some States required some such system as Mr. Kern had discussed.

Mr. Alex. Holme, New York, described the job system used in the New York Edison Company. Its use was begun five years ago. Repair work was charged monthly and construction when the job was finished. Under the Public Service Commission system of accounting, requiring that the original cost be written off on replacement, it was almost a necessity that a system of this nature be followed.

Mr. W. H. Gardiner, New York, defined cost for a public service corporation as composed of operating expenses and fixed charges; the latter, representing the expense of hiring the money that created the enterprise, was just as much an item of expense as labor or coal.

Mr. E. H. Robinson, Schenectady, said that they had operated under the working order system for the last six years. A work-order number was given to each individual job and the men did not know to what account the expense would be charged.

Mr. E. J. Allegaert, Newark, thought it was very important to give a name as well as a number to a job. The system might be prohibitive in cost if made too fine.

Mr. W. E. Freeman, New York, said there was a tendency on the part of the operating department, when given the cost of a job "to date," if the total was excessive, to charge part of the cost to other jobs.

Mr. Allegaert was a strong believer in the practice of giving the local man all the information possible.

Mr. Paul Mueller, Erie, Pa., said that the accounting system was dependent entirely on the size of the company. The storekeeper sometimes commented on the prices charged for materials. He formerly kept a card record, but as this plan involved too much work in a small company, it was abolished. An inventory was taken every six months.

Mr. S. C. Rogers, Youngstown, Ohio, believed in keeping the heads of the operating departments informed as to the cost of work. All operating superintendents were furnished daily timesheets and disbursement sheets and also, from their subordinates, copies of requisitions on the storeroom.

Mr. Kern, in closing, said that the account to which a charge was made was determined by the engineering department. Competition between superintendents at one time had led to charges on account of time and material to construction instead of to repairs and renewals, where they properly belonged. In arriving at the cost of jobs engineering and draughting were not charged to construction, but to expense, always.

DEPRECIATION ACCOUNTING FOR SMALL COMPANIES.

In his paper on this subject, Mr. G. W. Claflin, United Electric Securities Company, said it would seem that few, if any, of the members contest the existence of depreciation or the necessity for some provision for it; the differences of opinion arise when the amount of the depreciation and the method of providing for it are discussed. Those differences are entirely proper and arise from the widely differing financial and physical conditions surrounding the member companies. A uniform rate or percentage allowance for depreciation for all companies cannot be accurate and reasonable. Methods by which the depreciation allowance in each case may be determined can be formulated only as the result of time and experience. Of the different methods advocated for taking care of the losses due to depreciation, it is now generally conceded that it is better, at least for small companies, to accumulate a reserve through monthly charges for depreciation, thus spreading the amount over the life of the property and avoiding large irregular charges which would prevent reasonable comparisons of operating reports. This is the system adopted by the New York and Wisconsin commissions.

The rules of the New York commission require a monthly charge to operating expenses for the estimated depreciation to tangible property for: (1) Wear and tear. (2) Obsolescence. (3) Inadequacy. (4) Extraordinary casualties. The total of these items is intended to be the total estimated depreciation of tangible property for the month; but since certain repairs have been made, the total estimated depreciation has been reduced by the amount of these repairs. The net depreciation charge, however determined, is the estimate of the depreciation of the tangible property from all causes and might perhaps be called accrued maintenance. It is credited to depreciation reserve and appears as a liability on the books. On this plan of handling depreciation, plant account is not affected until some item of property is displaced or is modified or improved in some way. This theory intends that a reserve shall be provided that, with the present value of the tangible property, will equal the book value. This could only be true in the case of a property constructed under this system of accounting or where full depreciation allowances had already been made. The operation of the system, however, will tend gradually toward this end. A displaced item of property is to be credited to plant account at its cost, determined from records or estimated, but only so much of this cost may be charged to the depreciation reserve as has been credited to that reserve since Jan. 1, 1909, plus such depreciation reserve as the company showed on that date; the balance must be charged to surplus or deficit.

Objections are made that this system takes no account of the appreciation of property and some say that the appreciation due to increase in value of the good-will of the business, the increase in real estate, and so on, will equal and offset the depreciation. Even if this be true, which the author doubts, it would certainly be better accounting to make definite allowances for both the depreciation and the appreciation. In the case of the smaller companies under consideration appreciation of tangible and intangible property will very rarely be an item of importance and no great injustice is done by neglecting it.

Neither the New York nor the Wisconsin law requires that the accumulated reserve shall be maintained as an actual cash reserve. In the case of large companies, or wherever possible, the reserve should be an actual reserve, rather than merely a book account, and should be held in cash or perhaps bonds of the company. Maintenance of this reserve in cash is not always possible, however. In two small companies, where a depreciation reserve has been maintained for more than five years, it is not maintained in cash, but the amount has been used in the regular extensions of lines and the purchase of meters, transformers and the like.

In the case of a large company, where the system has been tested, there have been extensive replacements and modifications, both at the power house and on the distributing system, so that during the past five years more than $200,000 has been released from the depreciation reserve by displacements and changes in property. At the power station a complete switchboard, three 300-kw engine-driven units and five 375-hp boilers were displaced, due to inadequacy, and turbines and larger boilers installed, together with numerous detail changes, such as the replacing of a wooden floor in the engine-room by one of concrete and tile. On the distributing system all of the overhead construction from the power station to the center of the city, covering nearly 100 city blocks, has been replaced with underground construction. Recently 1700 old-type meters have been replaced with new meters of the latest type, because even at heavy maintenance expense it was found impossible to keep the old meters within reasonable limits of accuracy. The new and improved meters cost considerably less than those displaced, so that while the company now has better meters than before, plant account has been reduced and free cash increased by the working of the system.

The larger companies can give the smaller companies no help in determining exactly what additional annual allowance, above the regular expenditures for repairs, should be made to cover the replacement of an item, since in the experience of the larger companies inadequacy and obsolescence have always compelled the replacement of apparatus long before it was worn out. Among the smaller companies, however, apparatus may be found, still giving good and regular service, which dates back to the pioneer days of the business. One small company is today operating regularly as part of its equipment four Thomson Houston H. I. spherical-armature, direct-current, 125-volt generators and an Armington & Sims engine, which were started up in that plant on Nov. 28, 1887, and have been in regular use

ever since. In regularity and quality of service this plant is making an enviable record, and its repair costs have not been unduly large as compared with other companies. Two boilers that formed part of the original plant were replaced about two years ago, after 20 years of service, and the manager complained that this need of replacement was principally due to the bad treatment these boilers had received in their youth. The old generators are apparently operating as well as ever, and indeed give less trouble than others in the same plant which are of 10 years' later design. In the same city there was displaced since Jan. 1, 1909, a 12-light Brush arc machine which is said to have been installed in 1880. This was regularly used for lighting a mill and was displaced from inadequacy and not because worn out.

The allowance for obsolescence and inadequacy must also be dependent upon local conditions, and among small companies will be lower in Eastern towns and cities, where the growth is slow, than in the rapidly growing cities of the West.

The tendency of the manager of a small property in first approaching the subject of depreciation due to extraordinary casualties is usually toward too high an estimate. He faces the condition of his property, with old apparatus perhaps already in need of replacement, and with no previous provision for this depreciation. If he makes his estimate upon the basis of accumulating in a year or two a sufficient reserve to provide for the depreciation of 10 years, he obtains a relatively enormous monthly charge. Such a charge would be impractical, if not fatal to his company, and he usually becomes discouraged and drops the matter entirely.

In a small company to which reference has been made, the monthly depreciation charge was made a fixed amount and entered as an operating expense item in addition to the charges for maintenance. This amount has not been changed. The maintenance and depreciation charges have equaled the following percentages of gross earnings in this case.

GROSS EARNINGS.

	Total maintenance, per-centage of gross.	Additional allowance, per-centage of gross.	Total depreciation, per-centage of gross.
1904	8.10	8.45	16.55
1905	9.35	8.15	17.50
1906	10 90	6 89	17.79
1907	9.56	6.84	16.40
1908	10.61	7.19	17.10

A larger company previously mentioned adopted a similar system of charging a fixed monthly sum for depreciation in addition to the regular maintenance expenditures. This sum has been increased during the period, and is to-day more than three times the amount originally charged. The total depreciation for the various years is a somewhat larger percentage of gross than was the case with the small company.

The two companies above mentioned have preferred to use the replacement value of their properties as a basis for their depreciation allowance, and have each continued to make the monthly charge a fixed amount in addition to the maintenance expenditures.

Five or six years is perhaps too short a period in which to form definite conclusions, but the experience with these two properties seems to show that, in addition to regular maintenance expenditures, an annual allowance of 3 per cent of replacement value in the case of this small company and of 5 per cent in the case of the large company would properly provide for the depreciation of tangible property.

Discussion.

Mr. F. L. Dame, New York, called attention to the decision of the United States Supreme Court in the Knoxville water case that provision should be made for depreciation as it accrues.

Mr. S. F. Smith, Salem, Mass., emphasized the importance of Mr. Claflin's paper.

Mr. Claflin said that the larger company mentioned in his paper had $110,000 in cash in its fund and borrowed from it rather than outside. During the panic the company borrowed from this fund to the fullest extent. The two smaller companies had used the cash, not removing the liability from the books, but more as the larger property did, as a source for borrowing.

New Telephone Patents.

SEMI-AUTOMATIC AND AUTOMATIC SYSTEMS.

Midway between the complete automatic system and the manual system there lies the very interesting semi-automatic system of telephone operating, in which a part of the necessary functions are carried out more or less automatically under the control of the subscriber and certain others under the control of the central-office operator. The proportions of manual and automatic working which can be introduced into such a system may be varied to such an extent that many different plans of operation can be devised. One class of semi-automatic systems is what has become known as the "Call Distributing System."

Mr. S. H. Browne, of Pittsburgh, Pa., has recently obtained two patents covering such a system, which patents he has assigned to the American Telephone & Telegraph Company. In this system the subscriber has only the usual manual type subscriber-station apparatus. As in the manual common-battery system, the mere removal of the receiver from the hook effects the operation of a line relay at the central office. This line relay does not, however, immediately effect the display of a line signal, but it sets in operation an automatic selector switch. The multiple terminals of this switch are connected to trunk lines, outgoing from it and terminating in plugs with signals in front of the operators. The automatic switch at once sets about selecting the first idle trunk, displaying before the operator a signal, indicating the arrival of a call upon the selected trunk. The operator responds upon the trunk, obtains the number desired and plugs into a subscriber's multiple before her to reach the desired subscriber. At the end of the conversation she receives a disconnect signal.

One of the patents granted to Mr. Browne describes an extension of this system where two central offices are involved, the first manual operator extending the call to the distant exchange to a second manual operator. The system is worked out to provide, of course, the necessary auxiliary busy test and other signals.

Another plan of semi-automatic working is provided for in a patent granted to Mr. E. Land, of Grand Rapids, Mich., who has assigned his patent to Mr. M. G. Kellogg, of Chicago. In this system the subscriber has the usual automatic dial device, by means of which he selects an operator having control of the particular group of subscribers with which he desires communication. The arrival of the call is made evident to this particular operator by a signal displayed at the trunk line. The operator responds by means of a listening key and obtains from the subscriber the number he desires. By means of keys furnished her she then operates the connector switch of the trunk from her position, by means of which she selects the particular subscriber of her group that is desired. The mechanism and electrical details of the keyboard switches of the operator are so arranged that their automatic release or their failure to automatically release gives the operator visual supervision of the connection. Upon the completion of a conversation the operator is signaled to effect a final disconnection by the restoration of her control key.

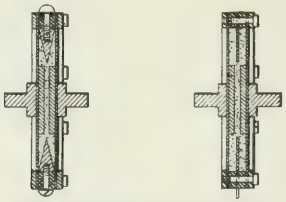
When automatic systems were first devised they were operated upon a local battery system. It was some years before any attempt was made to introduce the central-energy system in connection with them. A patent has recently been granted jointly to Messrs. J. W. Lattig, of Wyncote, Pa., and C. L. Goodman, of Philadelphia, Pa., for an application of this plan to the automatic system, their patent being assigned to the American Automatic Telephone Company. In order to accomplish the desired result they have included in the battery feed circuit two polarized differential relays, one coil of each of these relays being in series with a retardation coil and connected with what may be termed the "out side" of the line, and

the other two windings in series with a third relay being connected to the other side of the line. It will be seen that both polarized relays remain normal as long as equal currents are flowing in the two sides of the line. A ground at the subscriber's station, however, from one side of the line or the other unbalances both these relays, but they are so connected that but one responds at a time, the motion tendency of the other being with that of the polarizing magnet. One of the polarized relays controls the vertical motion of the selector and the other controls the rotary motion. It will thus be seen that by grounding one side of the line at a time the selector may be stepped into any desired position.

IMPROVEMENTS IN TRANSMITTERS.

We recently noted a patent for a transmitter in which the contacts between the movable electrode and the diaphragm were purposely distributed at some distance from the center of the latter. A patent has been granted to Mr. C. S. Chrisholm, of Marysville, N. B., in which the contact between the transmitter diaphragm and movable electrode is reduced to a point and made exactly at the center of the diaphragm. The contact is purely a pressure one, a pointed stud rising from the movable electrode and being held with some considerable pressure against the exact middle of the diaphragm. The diaphragm itself is made very heavy to avoid any flexure due to this pressure.

Mr. R. C. Brown, of Salem, Mass., has found that a transmitter becomes very effective the thinner the layer of granular carbon between the two electrodes and the more this layer is



BROWN TELEPHONE TRANSMITTER.

subjected to direct pressure. Because of this he has arranged baffle plates in his microphone button to prevent the granular carbon being squeezed out from between the electrodes during the operation of the transmitter. The cut shows in section two of the proposed arrangements.

Another suggested form of transmitter, also patented by Mr. Brown, uses a granular carbon film in which the electric circuit passes transversely to the line of pressure. In this transmitter one of the electrodes is a small central disk, while the other is annular and forms the cylindrical wall of the microphone button. The central disk is, of course, thinner than the ring electrode, so as to provide for free motion of the diaphragm. It will be understood that the electric circuit enters at the center electrode, passes through the film of granular carbon to the ring electrode and thus transverse to the line of pressure from the diaphragm.

NEW APPARATUS.

There have been several recent devices put on the market for providing an auxiliary ear-cap, connected by a sound-conducting tube to the regular telephone receiver. Most of these have effected little real gain in the received transmission because of the reduction of efficiency of the regular receiver and they have been a real detriment where the auxiliary ear-piece has been left tapped on and not used. Mr. J. L. Creveling, of New York, N. Y., has now patented a device of this type, which appears better designed than its predecessors. The means of attachment to the ordinary telephone comprises an auxiliary ear-piece which fits over the end of the receiver ear-cap, being held by means of a specially designed clamping ring. This ear-piece is the same shape as the receiver ear-cap and has merely the effect of thickening this latter a small fraction of an inch. An aperture extends within the body of this auxiliary ear-piece from the central hole to its edge, from which a tube extends to the auxiliary ear-cap, this latter being so designed as to cover one of the ears of the user and thereby feed sound to that ear, as well as to the one to which the receiver is presented. The leakage of sound when the auxiliary ear-cap is not used is prevented by means of a ball valve in the tube, which valve is closed whenever the auxiliary ear-cap is hanging down at the end of its tube.

Mr. F. R. Bigler, of Kansas City, has patented an antiseptic device for transmitters. This consists of a bulb, within which the disinfectant may be placed. This bulb has a stud at the end of it, which can be clamped to the perforated shield at the base of the transmitter mouthpiece, so that its center line is coincident with the center line of the mouthpiece. The bulb is of such size that a sufficient annular space is left between it and the walls of the mouthpiece to permit free access of the sound waves to the diaphragm.

As an improvement in harmonic ringers, Mr. W. M. Bruce, of Springfield, Ohio, has designed a ringer in which the moving system is supported upon a torsional wire. One end of this wire is secured to the armature of the ringer, while the other is secured to the frame, and in the vibration of the armature the torsion wire is twisted first to one side and then to the other, the torsional stress tending to assist in keeping the hammer in vibration.

LETTERS TO THE EDITORS.

Calibrating the Ballistic Galvanometer.

To the Editors of Electrical World:

SIRS:—The article by Prof. C. M. Jansky in your issue for April 8 and your editorial on the same present a very interesting and simple way for correcting the errors caused by changing the resistance of a closed circuit kept on a ballistic galvanometer during its swing.

I wish to call attention to the fact that certain careful writers on magnetic testing by the ballistic method have for a long time advised the use of a special discharge key when finding the quantity constant of the ballistic galvanometer by the condenser method. This key on first contact discharges the condenser through the galvanometer and then by the same movement, when pressed a trifle lower (and before the swing is well begun), short-circuits the galvanometer through either the same or an equivalent circuit to the one used in the magnetic tests. The galvanometer thus swings under the same conditions when used in the induction tests and while the calibration tests are made, and hence the correct constant is obtained without any secondary tests.

But it should be more generally understood than seems to be the case that the quantity-constant of any galvanometer suitable for ballistic work is always dependent upon the constant of the galvanometer for steady current, the period of the swing and the damping factor of the galvanometer. The quantity-constant may always be computed from these other properties. The exact relations are either stated or implied in nearly every standard work on electrical measurements. They are:

Constant for quantity $= 1/2\pi$; constant for current $\times$ period $\times (1 + \frac{1}{2}\lambda)$ in which λ is the well-known logarithmic decrement, and is found in the usual way.

Any change in the circuit used on the galvanometer cannot in itself affect the constant of the galvanometer for steady current, and hence the only change in the quantity constant that can be caused by adding, removing or changing the resistance of a closed circuit on the galvanometer terminals must be connected with, and must be proportional to, changes in the period and in the damping factor. If then the period and the damping factor be determined for the two different conditions, the ballistic or the quantity constant may be corrected from either condition to the other. Moreover, when the change is not too great, the period will remain constant and only the damping factor, or $(1 + \frac{1}{2}\lambda)$, need be determined in order to reduce the

quantity constant from one condition of use to another, or to compare ballistic throws that were obtained under different conditions; as, for example, when the resistance of the circuit on which the galvanometer was used did not remain the same at all stages of the test.

POTSDAM, N. Y. B. B. BRACKETT.

The Tariff on Mica.

To the Editors of Electrical World:

SIRS:—In your issue of May 20 there appeared an article entitled "Duty on Mica," in which Mr. W. J. Gibson attempts to point out the unfairness of the present or proposed tariff tax on this material. The writer desires to take exception to some of the statements, as follows:

Up until 1890 there was very little or practically no mica mined in the United States, even at points where it was known to exist, mainly due to the fact that Americans could not compete with India, where laborers and miners received the equivalent of 10 cents to 20 cents per day.

Mica is a product of nature, the same as all minerals, but Mr. Gibson's statement that it is easily taken out of the ground is not correct, as the mining of mica is fully as costly as that of any other mined mineral, and more so than coal, iron ore and a number of other minerals.

Mr. Gibson may not be aware that in the United States from 75 per cent to 90 per cent of the mined mica is waste, not suitable for other disposition than grinding; and that only 25 per cent as a maximum is secured in a cut state, so that the cost of working it after it is mined is great.

He also states that this country consumes 10 times as much mica as is found here. This I believe to be a mistake, as the United States is producing more mica every year, and it is being found in all sections of the country. A great deal more would be produced if the price would justify, but many mica industries in this country have been compelled to go out of business by reason of being unable to compete with the very low rate of wages paid in India.

Mica is now being produced in considerable quantities in New Hampshire, North Carolina, Virginia, Georgia, Idaho, New Mexico, Colorado, Wyoming and in very large quantities in South Dakota. When the time comes that the tariff duties reach a point to make its production profitable the entire demands of the United States can be supplied with mica mined within its borders.

RIDGEWAY, VA. FRANK N. MEYER,
Pittsburgh Mica Company.

[If our correspondent will refer to the statistics available on the subject, particularly to the publications of the United States Geological Survey, he will find that the greatest production of mica, in value, was in the year 1884; and that the production for the years 1881, 1882 and 1883 equaled or exceeded in value that of any year in the history of the industry except the year 1907. While the production, in pounds, in the years 1880 to 1884 is reported as very much smaller than in any year subsequent to 1900, the reason is that the process of building up mica from small sheets was not then used, only the larger sizes being put on the market. Of the mica now usable only from 10 to 20 per cent was formerly merchantable, and the actual output, therefore, in the years 1880 to 1884 was probably nearly as large as the recent output. The Ruggles mine, in New Hampshire, by far the largest and richest mica mine in the country, has lain idle since 1890, although worked for 60 to 70 years prior to that time. As to the waste in producing sheet mica, the percentage can vary slightly in different places, and is probably as large in India as in the United States. In an article on mica by Mr. Jos. Hyde Pratt, in "Mineral Resources," published by the United States Geological Survey, a statement is made that only 10 to 15 per cent of the mica mined can be cut into sheets, the rest being waste or scrap. As to a comparison of mica produced in the United States and that imported, an article in our issue of Dec. 19, how[illegible] increase of over 100 per cent in the price of mica led to only a small increase in production in this country. The reason for this is that our deposits are not sufficiently rich or numerous to admit of any great increase in the output. Even granting that it would be possible by a large duty to stimulate the production in the United States to an amount equal to the requirements, it would be extremely unjust to compel users of mica to pay what would actually be an enormous bonus to mine owners. There have never been as many as 1000 employed in mining mica in this country, and larger employment in the industries using mica can in no manner be affected by the question of home production or importation. The present duty on mica amounts to 100 per cent, and even 150 per cent on some sizes, which is a serious tax on the electrical industry, as may be evident from the fact that in the year 1907 one electrical manufacturing company imported alone over 1,000,000 lb. of mica.—EDS.]

Patent Abuses.

To the Editors of Electrical World:

SIRS:—The writer has noted with interest the various articles and communications appearing in your journal respecting the necessity of improving our patent laws, and it may not be amiss to direct attention also to some evils which have come to his attention in marketing patents here and abroad. These evils furnish examples of rascality which amount to petty thievery or worse; it is to be regretted, however, that it seems almost impossible to prosecute those engaged in the practices, and this furnishes a reason for making the subject public at this time.

An inventor is usually so situated financially that he cannot manufacture his creation from his own resources, in which case it becomes necessary for the disposal of his patents to be left to others. Immediately the announcement is made in the *Patent Office Gazette* that a patent has been issued, the inventor is the recipient of numerous letters from as many different parties setting forth marvelous opportunities for disposing of his invention. In most cases the common end sought by the writers is the exaction of a tribute in the shape of a "fee," upon receipt of which all interest in the inventor or his device too often ends. Another scheme very frequently worked is along these lines:

A patentee receives a letter reciting the fact that it has come to the notice of the writer that a patent has been allowed to him, that the writer believes the invention to be a meritorious one, and that it should be worth a fortune, the amount of which, of course, is placed at a figure the writer thinks the invention can stand. It is set forth, in addition, that special facilities for the quick and profitable disposition of patents are enjoyed by the writer and that he should be glad to undertake the same, etc.

This plausible bid for business generally brings a reply from the inventor, who, naturally, is anxious to realize from his labor. It is then, however, that the real purpose of the "agent" or "agents" becomes clear, it being set forth in the second letter of the "agent" that it will be necessary for the inventor to remit a preliminary "fee" of from $25 to $50 to cover the cost of investigating the patent and the possible market therefor. The remittance of this "fee" is often the final act in the farce.

Another very ingenious scheme for trapping the unwary inventor—the one against which the loudest warning should be sounded because it often results in the absolute loss to him of his patent—is that of the unprincipled "agent" or "attorney" who represents to the patentee that his invention is worth a fortune and that he, the "attorney," is in a position to obtain a large sum of money for it. He points out, however, that it will first be necessary to incorporate a company, the capitalization suggested being such an amount as to dazzle the inventor, the patentee to assign his patent to the corporation in consideration of a block of the stock. The underlying purpose of the whole transaction, however, is merely to secure from the inventor from $100 to $200 to cover "incorporation expenses," the larger part of which finds its way into the pocket of the "attorney" or the "attorney" of the "agent."

It is quite needless to say that parties who indulge in this sort of practice have not that standing, financially or otherwise, which is necessary to the raising of any considerable sum of money, no matter how meritorious the invention may be, hence the inventor not only loses his time and money, but sometimes his patent as well, for immediately upon the formal incorporation of the enterprise the promotion thereof languishes.

The reprehensible practices above referred to should be stopped somehow soon if the Government has to go to the extreme of sending a circular to inventors at the same time they mail the certificate of award.

The protection of the inventor by the Government is most essential. Civilization goes backward without him. Germany is doing so much to protect the producers of new ideas that it should put us to blush when we consider seriously our shortcomings. It used to be that almost everything new in England was called "the lastest Yankee idea." This order of things is passing, and now everything new, more or less, is "Made in Germany." Why is it? The answer is that our Government is not protecting the inventor properly and legal fights are so expensive as to be out of the realm of possibilities for the average inventor. Did you ever hear of representatives of large concerns saying: "It is better to infringe and then to fight"? They know the inventor's weak spot. Germany runs away with the persimmon.

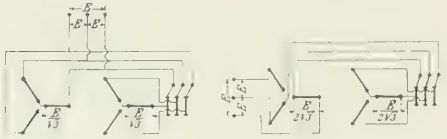
NEW YORK. FRANK Z. MAGUIRE.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Double-Field Generators.—E. ZIEHL.—The principle of double-field generators is that they can furnish electrical energy from the stator as well as from the rotor. The rotor is driven at a speed double the synchronous speed in the direction opposite to that of its own rotary field. The stator windings and the rotor windings are perfectly equivalent, voltages, currents and frequencies being the same, so that they can be connected in series or in parallel. Fig. 1 shows a three-phase, double-



FIGS. 1 AND 2.—DOUBLE-FIELD GENERATORS.

field machine with parallel connection. Fig. 2 shows the same machine for series connection. The parallel connection is suitable for machines with relatively low voltages, the series connection for high-tension machines. The generators have only one stator and one rotor winding, and are otherwise quite similar to ordinary three-phase motors. They are excited by three-phase currents, in general from ordinary synchronous machines, with which they are operated in parallel, or by synchronous motors excited with direct current. Compared with the ordinary synchronous generator, the double-field generator has certain advantages, especially for high speeds. It is easier to design the double-field generator to suit the high speeds of steam turbines. The author claims that the cost of making the turbo-double-field generator is now generally only one-half the cost of the ordinary generator excited with direct current. The double-field generator is especially suitable for three-phase installations. In such cases it is advantageous to install an ordinary synchronous machine in the central station to set the pace, while the other machines may be double-field generators. —*Elek. Zeit.*, May 20.

Interpole Motors.—W. SIEBERT.—The author distinguishes two main groups of interpole machines. In the first group the form and number of the interpoles are such that the commutation of all coils takes place in a homogeneous commutation field; and that the external field has no effect. In the second group the form and number of the poles are such that not only the commutation field but the external field has an influence on the commutation of the coils. The author's calculations show that the ordinary slotted motor, if it is to be provided afterward with interpoles, must always belong to the second group. It is then not suitable for reversal of the direction of revolution and for heavy variations of load. Perfect commutation can be obtained only with motors of the first group. From the constructive design of the same the author concludes that they would not be suitable as normal machines for small capacities, say, below 20 kw.—*Elek. Zeit.*, May 20.

Interpoles.—W. B. HIRD.—A paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng. The author dealt with the application of interpoles to machines of normal design, and pointed out that full advantage was not taken of the increased armature lengths made possible by this means. The consequent increased heating would, however, lead to forced ventilation, to which he saw no objection. In the discussion following the paper, W. W. Lackie referred to the difficulty of running interpole machines in parallel with ordinary shunt machines. H. A. Mavor and J. R. Barr were of the opinion that in most cases it would still be better to avoid interpoles.—Lond. *Electrician*, May 21; *Elec. Eng'ing*, May 20.

Polyphase Commutator Motors.—E. ROTH.—A continuation of his long theoretical serial. The author discusses the different losses and shows how to predetermine the behavior of a motor from the general circular diagram if the phase and value of the voltage impressed on the rotor are given. He further discusses the problem how to determine the phase and value of the voltage impressed on the rotor, if the torque and speed are given.—*La Lumière Elec.*, May 15 and 22.

Lamps and Lighting.

Popularity of Electric Lighting.—E. WIKANDER.—The author thinks that the introduction of metallic-filament lamps has cheapened electric light to such an extent that it can compete with the kerosene lamp. He thinks that the greatest obstacle to the general use of electric lamps by the middle class and the poorer people is the comparatively great expense of wiring. The author thinks that the central stations should themselves bear the cost of wiring, and that this cost should be covered by one of several methods which are discussed. The author proposes the use of the flat rate for small consumers in order to reduce the expense of meters. Finally it is urged that electric lighting should be favored officially for sanitary reasons and that fire-insurance companies should reduce the premium for electrically lighted buildings on account of less danger. In an editorial note it is questioned whether electric lighting can be called popular. In 1905 they had 26,438 buildings in Berlin with 522,558 dwelling places, while the Berlin Electricity Works had connections only to 7836 houses and 12,939 consumers. The editors think that the obstacle which prevents the general use of electric lighting is the present price of the electric current for lighting.—*Elek. Zeit.*, May 20.

Arc-Lamp Mechanism.—A note on a recent British patent (16,151, 1908; May 13, 1909) for an arc-lamp mechanism invented by the Jandus Arc Lamp & Electric Company and A. D. Jones. A lamp mechanism for vertically arranged carbons is described, in which two iron cores, controlled by shunt and series solenoids in the usual manner, are supported by a rocking lever pivoted near its center. The upper carbon is supported by a clutch, and connected by links to one end of the rocking lever. The entire weight of the mechanism is thus supported at the fulcrum of the lever, which, according to this invention, is provided with ball bearings. This, it is claimed,

will ensure close regulation and steady burning of the lamp.—Lond. *Elec. Eng'ing,* May 20.

Tungsten Lamp.—An announcement by a British manufacturing company that they are now in a position to deliver "Aegma" metallic-filament lamps (tungsten) from 16 cp for 100 to 130 volts with bulb of a similar size to those of ordinary carbon-filament lamps, at a list price of 75 cents each.—Lond. *Elec. Eng'ing,* May 20.

"Intensified" Enclosed Arc.—W. D'A. RYAN.—An illustrated article on the "intensified" enclosed arcs with two small-diameter upper positive carbons and one lower negative carbon. —*Gen. Elec. Review,* June.

Arc Lamps for Therapeutical Purposes.—The first part of an article on the special construction of arc lamps for treatment of skin diseases by the method of Finsen.—*Elek. Anz.,* May 20.

Power.

Refuse Destructor Plant.—J. A. ROBERTSON.—A paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng. giving the results of one year's operation of the refuse destructor plant at Greenock. The first condition for success is that the demand for energy shall be fairly steady, so as to obviate storage of refuse or by-passing the furnace gases to the chimney at times of light load. A residential district is, therefore, not very suitable for a combined installation; a power or tramway load is desirable. On the average, from 15 cwt. to 1 ton of refuse is collected at Greenock per day per 1000 inhabitants; its value varies with the district and season, ranging at Greenock from 86 units per ton in October to 24 in July, when the supply is also at its lowest. The fluctuation in the quality of the refuse is the greatest drawback to its use, necessitating stand-by, coal-fired boilers to maintain steady pressure. In Liverpool over 9,000,000 kw-hours were generated from refuse in 1907, using non-condensing engines that took 50 lb. of steam per kw-hour; in most cases the fuel costs of combined stations are lower than those of stations run on coal. Liverpool only pays 0.4 cent per kw-hour for energy generated from refuse. Generally it is exceedingly difficult to appraise the value of destructor steam accurately. At Greenock the generating station has been run on coal for three months before the destructor commenced working, so that an accurate comparison of running costs was possible. The allocation of costs was made on the basis of 4½ lb. of coal per kw-hour generated, with coal at $2.50 per ton, and after allowing for capital charges on boilers and pumps, 0.7 cent per kw-hour was paid to the cleansing department for steam. Fig. 3 shows the work done

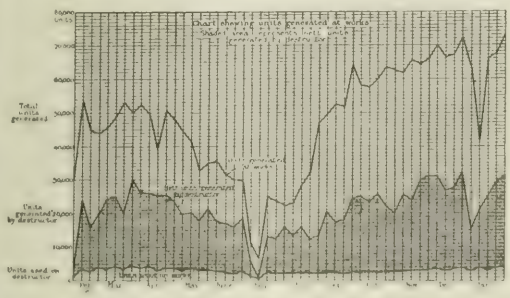


FIG. 3. OUTPUT OF GREENOCK DESTRUCTOR, 1908-9.

by the destructor during the 12 months ended Jan. 31 last. Of the energy generated by the destructor, 12 per cent was used for power and light, 8.5 for fan draught, 1.0 for cranes, 1.4 for clinker treatment, and 1.1 for lighting; the price charged for this energy was 0.61 per unit, on a 35 per cent load factor. On an eight-hour test, Oct. 29, 1908, with a pressure of 4.6 in., burning 324.72 tons of refuse per cell per 24 hours (103 lb per square foot of grate per hour), the water evaporated per pound of refuse was 1.41 lb. from and at 212 deg. Fahr.; the mean pressure was 195 lb. per square inch; superheat, 564 deg. Fahr.; feed-water temperature, 91.5 deg. Fahr., on entering economizer, and the electrical output 97 units per ton of refuse. The average result over a whole year's working was 67 kw-hours per ton, the highest output, including all stand-by losses on the station, that the author had met with. The capital cost of the destructor was $99,000; labor cost 28 cents per ton for operating the destructor, and 4 cents per ton for treatment of residue; other expenses brought the total to 54 cents per ton. Sale of steam and clinker brought in 51 cents per ton, leaving a net balance of 3 cents. The net cost of disposal was 43 cents per ton. During the year 16,985 tons of refuse were destroyed, 1,142,064 kw-hours generated from it, 5338 tons clinker produced, and 1286 tons sold.—Lond. *Electrical Review,* May 21.

Electric-Power for Rolling Mills.—W. F. MYLAN.—A paper read before the Leeds section of the (Brit.) Inst. Elec. Eng. on the electrification of steam-driven, non-reversing rolling mills. In Europe at the present time there are upward of 230 electrically driven reversing rolling mills in operation, the total horse-power exceeding 200,000. The electric driving of rolling mills is quite past the experimental stage, and it is not only possible to estimate with accuracy the size and other details of the equipment, but also to determine the actual cost of operation under any given conditions. The author gives a list of 28 installations in England and describes some typical equipments. "The crux of the whole question of rolling electrically is whether or not a reasonably cheap source of power is obtainable either from a private generating station or from an outside source, and this obtained, electrically rolling will be found to be considerably cheaper than steam."—Lond. *Electrician,* May 21.

Steam-Electric Stations.—H. M. HOBART.—The conclusion of his article on the rating and cost of steam-electric generating stations. In the former installments, the author has discussed the average cost at the generating station per kw-hour delivered from the station. This cost does not, however, serve, without further analysis, as a suitable basis from which to arrive at the equitable price to charge individual consumers. The charge for the energy delivered at the consumer's premises should depend on the power factor of the consumer and other matters. While the consumer's-load factor and the station-load factor are quite different matters, it is interesting to see that the average cost per kw-hour delivered from stations designed for various load factors bears a considerable resemblance to the prices to consumers with various load factors, which analysis and experience have indicated to be appropriate.—Lond. *Elec. Review,* May 21.

Electric Cranes.—H. H. BROUGHTON.—In a continuation of his long illustrated serial on electric cranes, the author discusses the lifting mechanism and describes in the present installment mechanical brakes and limit switches.—Lond. *Electrician,* May 21.

Power Transmission.—R. DE LA BROSSE.—A paper read before the French Association for the Advancement of Science on the principal features of the project of Blondel, Harle and Mahl, of power transmission from the Rhone River to Paris; three-phase transmission at 120,000 volts over a distance of 250 miles being contemplated.—*La Houille Blanche,* May.

Traction.

Effect of Single Phase Traction on Telephone Lines.—BEHN-ESCHENBURG.—An English translation of his recent paper which has already been noticed in the Digest. Though deduced primarily from experience gained with Oerlikon motors, the results given in the article are of quite general interest to all connected with single-phase traction, and show how both difficulties of design and outside disturbances set up in neighboring telephone lines have been successfully overcome until finally the single-phase series commutator motor bids fair to outrival any of its competitors for main-line railway work.—Lond. *Electrician,* May 21.

High Tension Direct Current Traction.—G. H. HILL.—An article on the advantage of a 1,500-volt, direct current railway, pointing out the possibility of using practically standard apparatus throughout.—*Gen. Elec. Review,* June.

Installations, Systems and Appliances.

Effect of Metallic Filament Lamps in British Central Stations.—The first of the annual accounts of British central stations for the year ending March 31 last have appeared. The most interesting are the Leeds and Burton-upon-Trent accounts. At Leeds the number of kw-hours sold for private lighting has decreased by over 530,000, or about 10 per cent, representing a loss in receipts of $39,210, while, in spite of an increase of 1563 hp, or 18 per cent, in the motors connected to the mains, the revenue from this source shows a diminution of $9,675, due to reductions in the scale of charges, the final result being a total reduction in revenue of $46,440. In spite of this discouraging feature, the gross profit and also the net surplus show increases, due to careful management and a reduction in the "exceptional" expenditure on renewals. Trade depression, of course, accounts for some of the loss of revenue, particularly as regards power users, but metallic-filament lamps have played an important part, since it is found that where these are installed consumers have reduced their energy consumption very considerably. The result of such reduced cost of electric lighting will certainly be a considerable addition of new consumers, but this takes time for its effect to be felt. At Burton-upon-Trent, the effect of metallic-filament lamps has also been very noticeable, the revenue from lighting consumers, in spite of a larger increase in the number of lamps connected than for several years past, being $30,485, a decrease of $1,830 compared with the previous year, and also a lower figure than that recorded in 1907. The restricted-hour system of power supply, which P. J. Pringle has advocated, has been, however, the mainstay of the undertaking, and, notwithstanding the depressed conditions of trade in the town, the revenue from power users has increased by $2,670, representing an increase of 33 per cent in the number of power units sold. The most interesting features, however, is the fact that the average price of all units sold for motive power is only 1.96 cents, which low figure should result in a considerable access of new business when the trade conditions once again improve. The development of the motor and heating and cooking loads seems to furnish the best results during the temporary reduction in output brought about by the introduction of high-efficiency lamps. —Lond. *Electrician*, May 21.

British Central Station.—An account illustrated by diagrams showing the development of the St. Marylebone Borough Council electricity undertaking during the past three years. The number of consumers has increased by 14.4 per cent, the rate of increase being practically constant; the number of kw-hours sold increased by 26.4 per cent in the first year, but by only 2.4 per cent in the last year, owing to the introduction of metallic-filament lamps. The total number of kw-hours sold for all purposes last year amounted to over 9,000,000.—Lond. *Elec. Eng'ing*, May 20.

Regulators.—An illustrated article by F. W. Shachelford on feeder regulators and their importance in alternating-current systems of distribution, describes the induction-type and switch-type of regulator. Another illustrated article by H. A. Laycock describes the principles of construction of regulators for alternators.—*Gen. Elec. Review*, June.

Wires, Wiring and Conduits.

Aluminum and Copper.—M. W. Franklin.—A chart giving for a given copper price directly the price of aluminum for which lines made of the above metals will cost the same. The chart is based on the following figures: The conductivity of aluminum is 63.3 per cent of hard-drawn copper. The specific gravity of aluminum is 30.20 per cent that of hard-drawn copper. The same chart also permits finding directly the savings in per cents, which can be obtained with aluminum or copper if the prices of the two metals are not equivalent.—*Gen. Elec. Review*, June.

Electrophysics and Magnetism.

Glow in Vacuum Tubes.—S. V. Gill.—A note on a Royal Society paper on the nature and causes of a phenomenon observed by the author when occupied with a research connected with a palladium foil. A piece of palladium foil, or platinum foil coated with palladium black, was heated to a white heat in air at a pressure of about 0.15 mm. A purple-blue glow was seen to surround the hot metal, while between the glow and the palladium there was a dark space. The thickness of the dark space varied with the temperature of the foil. The glow disappeared when the tube was heated to a high temperature, and returned when it was cooled. It was shown that the presence of the glow depended on a reaction between the gases introduced into the tube, when the palladium was heated, and the disintegrated particles of palladium. Water vapor has to be present in the tube, and the glow could be made to disappear by freezing out the vapor by means of a few drops of liquid air applied to the outside of the tube, or by introducing some phosphorus pentoxide into the tube. The spectrum of the glow showed certain regions which corresponded to portions of the spectrum of carbon monoxide gas. It was also shown that carbon monoxide was present in the tube which showed the glow. No effect was observed when electric and magnetic fields were applied to the glow. The probable cause of the luminosity is the union of carbon monoxide and oxygen brought about by palladium charged with hydrogen, in the presence of water vapor. A second effect was also briefly described; this appeared to be due to the causes which gave rise to thermo-luminosity.—Lond. *Electrician*, May 21.

Selenium.—A. H. Pfund.—An account of an investigation in which the author made a new determination of the conductivity or sensibility curve of metallic solenium. This curve is given in Fig. 4, in which the abscissas represent the wave length and

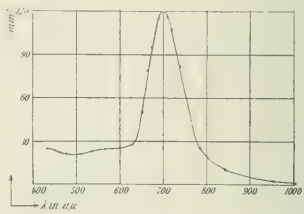


FIG. 4.—SENSIBILITY CURVE OF SELENIUM.

the ordinates the galvanometer deflection in millimeters. Absorption and reflection curves were also determined and a theory is proposed to explain the sensibility maximum and the fact that the position of the maximum is displaced toward shorter wave lengths if the intensity of the light is increased.—*Phys. Zeit.*, May 15.

Thermodynamics.—C. P. Steinmetz.—The conclusion of his serial on thermodynamics. The author considers the general steam characteristics of the expansion and impulse types of turbines and their relation to turbine velocity, leading up to a discussion of the combination turbines which are now in commercial use. The author comments on the equivalence of superheated steam and negative moisture, and concludes with a warning in reference to the application of the steam energy equations to turbines.—*Gen. Elec. Review*, June.

Electric Oscillators.—A. Montel.—A discussion of the field produced by electric oscillators of different types. The open oscillator of Hertz, the closed oscillator, and the semi-closed oscillator are discussed.—*La Lumière Elec.*, May 15 and 22.

Heat Conductivity.—M. Reinganum.—A theoretical paper on the question whether internal radiation has any essential influence on the heat conduction in metals. The result is that internal radiation is so small as to be negligible with respect to heat conduction.—*Phys. Zeit.*, May 15.

Electrochemistry and Batteries.

Fixation of Atmospheric Nitrogen.—Schoenherr.—An illustrated description of the new process of the Badische Company, which is in use on a large scale in Norway. It differs from the Birkeland-Eyde process in that a long, quiet arc is used, the air being passed along the arc. Very long alternating-current arcs are used having a length of 5 m (60 ft.) in 600-hp

furnaces and 7 m in the 1000-hp furnaces. The method of getting a quiet arc which will burn continually is very simple. If the air is passed in a helical path around the arc the alternating-current arc loses its unstable character and becomes as quiet as a candle; it is then possible to include it within a rather narow metallic tube without running the risk of the arc forming contact with the walls of this tube. The furnace construction is shown in Fig. 5. It consists essentially of a number of concentric iron tubes. To start the arc the artificial electrode *Z* is provided which can be brought in contact with the electrode *E*. On removal of *Z*, the arc starts and travels upward. The upper end of the arc always then travels around within the water-cooled upper part *K* of the iron tube through which the air is passed. The electrode at the bottom is an iron rod *E* within a water-cooled copper cylinder. The iron electrode is gradually consumed, but its life is about 2000 hours. The arc plays in the innermost iron tube 4 and through it the air is passed upward. The air which is subjected to the high temperature of the arc is introduced near the lower electrode through eight holes, which may be more or less closed by means of the slider *S*. When the air enters through these holes into the innermost tube it is already preheated. The path of the air through the furnace is indicated by arrows in Fig. 5. The air enters at *e*, rises upward in tube 2 and downward in tube 3 (being preheated in tubes 2 and 3), passes through the eight holes near the bottom into the innermost tube 4, where it is changed into a gas mixture containing nitrogen oxides. This gas mixture, after having risen to the top of the furnace, again passes down through the outer tube 1 and is withdrawn from the furnace through *d*. The methods of absorbing the nitrogen oxide gases for the manufacture of nitrites, nitrates and nitric acid are also discussed.—*Electrochemical and Met. Industry*, June.

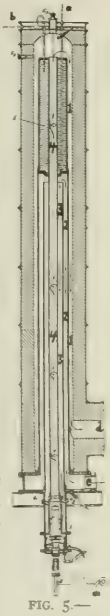


FIG. 5.—DIAGRAM OF FURNACE.

Ozone for Sewerage Treatment.—An illustrated description of the installation of ozone apparatus for the purification of drinking water in Nice. It is also suggested to apply the ozone process to the treatment of sewerage effluent. This is believed to be quite practical.—Lond. *Electrician*, May 21.

Electric-Steel Furnaces.—W. RODENHAUSER.—An Iron and Steel Institute paper in which the author first briefly considers electric-arc furnaces and points out what he considers the disadvantages of each type. He then passes on to the induction furnace and describes the Roechling-Rodenhauser combination furnaces installed at Völklingen. The capital cost of the various types of furnaces is also discussed.—Lond. *Electrician*, May 21.

Units, Measurements and Instruments.

International Candle.—An official announcement of the (British) National Physical Laboratory in London, on the change already discussed editorially in *Electrical World*, April 22, page 949. The unit of light at the Bureau of Standards (Washington) has been maintained through the medium of a series of incandescent lamps, the values of which were originally intended to be in agreement with the British unit, being made at 100/88 times the Hefner unit. The unit of light at the Laboratoire Central (Paris) is the bougie decimale, which is the twentieth part of the standard defined by the International Conference on units of 1884, and which is taken, in accordance with the experiments of Violle, as 0.104 of the carcel lamp. The unit of light at the Reichsanstalt (Berlin) is that given by the Hefner lamp burning at normal barometric pressure (76 cm), in an atmosphere containing 8.8 liters of water vapor per cubic meter. The unit of light at the National Physical Laboratory (London) is that given by the 10-cp Harcourt pentane lamp, which was described for use by the Metropolitan Gas Referees, burning at normal barometric pressure (76 cm) in an atmosphere containing 8 liters of water vapor per cubic meter. Extended and careful comparisons have shown that the pentane unit has the same value winthin the errors of experiment as the bougie decimale. It is 1.6 per cent less than the standard candle of the United States of America and 11 per cent greater than the Hefner unit. In order to come into agreement with Great Britain and France, the Bureau of Standards of America proposed to reduce its standard candle by 1.6 per cent provided that France and Great Britain would unite with America in maintaining the common value constant, and with the approval of other countries would call it the international candle. The National Physical Laboratory (London) and the Laboratoire Central d'Electricité (Paris) have agreed to adopt this proposal in respect to the photometric standardization which they undertake, and the date agreed upon for the adoption of the common unit and the change of unit in America was April 1, 1909. The following simple relations will, therefore, hold after that date:

Proposed new unit or international candle
= 1 pentane candle
= 1 bougie decimale
= 1 American candle
= 1.11 Hefner candle
= 0.104 Carcel unit

therefore, 1 Hefner unit = 0.90 of the proposed new unit.

The pentane and other photometric standards in use in America will hereafter be standarized by the Bureau of Standards in terms of the new unit. This, within the limits of experimental error, will bring the photometric units for both gas and electrical industries in America and Great Britain, and therefore the electrical industry in France, to a single unit, and the Hefner unit will be in the simple ratio of 9/10 to this international unit. In an editorial note the hope is expressed that Germany shall also give up the Hefner, mainly for commercial reasons in view of Germany's important position in the lamp industry. It is thought that the general public will not understand that 11 hefner candles and 10 international candles are the same and will prefer German lamps because they are marked with the higher figure of candle-power.—Lond. *Electrician*, May 21.

Tests of Dielectrics.—T. GERMANN AND S. M. HILLS.—The authors discuss the properties of insulating materials and describe the various tests they consider ought to be applied to the different substances. Particulars of a new method of testing are also given. This is called the "slot method" and is used for testing dielectrics which are to be used in the insulation of armature coils. The method essentially consists in testing a sample of the dielectric in a laminated iron slot, a sketch of the apparatus shown in Fig. 6, where *A* represents the alternating-current supply circuit; *B*, the iron laminations; *C*, clamping

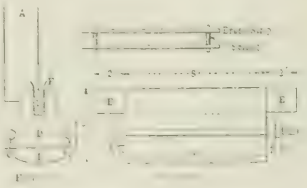


FIG. 6.—TEST OF DIELECTRICS.

bolts; *D*, iron plates; *E*, brass conductor; *F*, the dielectric under test. The authors consider that this method of testing more nearly approaches practical conditions than the parallel plate method (used at the Hermsdorf Porcelain Works) does, although they do not advocate the abolition of the latter method. At first, however, it seemed to possess the disadvantage that several conductors of various sizes were required. To obviate this the authors recommend the use of a conductor, as shown in the illustration, which consists essentially of two brass strips kept apart by two spiral springs. Electricity readily discharges from points, and as in a laminated slot there are several points or ridges, it was expected that there would be considerable difference between the results of the open-slot

system and the parallel plates. This was found to be the case, and figures given in the paper show a percentage of difference of from 17.5 to 59.5 per cent. The relation between dielectric strength and thickness does not follow a straight line law, but as the slope of the curve of the various dielectrics tested was about the same and not much different from a straight line, the authors adopted the term breakdown voltage per mil, as a convenient standard of comparison. Present methods of raising the voltage are of a jerky nature, and in order to obtain a smooth and yet rapid regulation the authors employed the

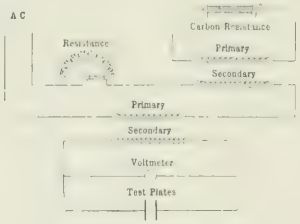


FIG. 7.—ELECTROMAGNETIC BALANCES.

method illustrated in Fig. 7. A long-range transformer is placed so that the secondary is in the supply circuit and the primary forms a circuit of its own through a variable resistance of carbon or water. This forms the regulation; another transformer is shown, being employed in the usual manner for stepping up the voltage. The transformer, which should be leaky and able to withstand a short-circuit, resolves itself into a choking coil, and as the actual regulation is done in a separate circuit the increase in voltage must be gradual. To avoid a rush of current at first switching on, a resistance is introduced into the main circuit.—Lond. *Electrician*, May 14.

Quadrant Electrometers.—E. ORLICH.—The conclusion of his illustrated paper on an investigation carried out in the German Reichsanstalt on the use of the quadrant electrometer for alternating-current measurements. The author describes methods and apparatus for making voltage and power measurements by means of the quadrant electrometer. The same apparatus is used for low as for high voltages and for low as for very strong currents. The measurement of the power is very exact even for a large phase difference. Finally, methods are described for determining the phase difference and the ratio of transformation of testing transformers for any secondary load. —*Elek. Zeit.*, May 20.

Exhibition of Instruments.—J. REYVAL.—The first part of a description of the different exhibits at the recent exhibition of the French Physical Society in Paris. In the recent article various electric measuring instruments (galvanometers, pyrometers, voltmeters, ammeters, the transportable photometer of Heller, three-phase precision wattmeter of Siemens, potential transformers for high-tension measurements, the frequency meter of Frahm, etc.) are described.—*La Lumière Elec.*, May 22.

Telegraphy, Telephony and Signals.

Pupin Telephone Lines.—F. BREISIG.—It is generally claimed that the damping of a telephone line loaded with Pupin coils is independent of the frequency, so that all frequencies are equally damped without distortion. The present author endeavors to shows that the damping of Pupin lines also depends in a greater or less degree on the frequency, even if the resistance and inductance of the coils do not change with the frequency.—*Elek. Zeit.*, May 20.

Wireless-Telegraphy Testing.—J. A. FLEMING AND G. B. DYKE.—An illustrated paper read before the Physical Society of London, in which the authors show that by using two closed oscillatory circuits placed, say, 50 ft. to 150 ft. apart, the equivalent for testing purposes of radio-telegraphic stations with open oscillators at very large distances can be obtained. A description is given of the apparatus at University College, London, and of tests on various detectors.—Lond. *Electrician*, May 14.

Fire-Alarm Regulations.—J. DOENITZ.—An illustrated article discussing the regulations of the Association of German Fire Insurance Companies on the installation of automatic fire-alarm systems. If such a system complies with the regulations a lower premium is charged for insurance.—*Elec. Zeit.*, May 20.

BOOK REVIEWS.

LA DEFINITION ET LA MESURE INDUSTRIELLES DE L'ACCELERATION DES TRAINS. By C. O. Mailloux, E.E., M.S. Paris: Gauthier-Villars. 12 pages. Illustrated.

This is a reprint of a paper presented by Mr. C. O. Mailloux at the International Electrical Congress held in connection with the Marseilles Exposition of last year. It deals with the subject of speed-time curves, the principles and applications of which are set forth, and embodies a plea for the adoption of a practical unit of acceleration in terms of kilometer, hour and second, instead of meter-second-second. With the paper are printed comments thereon by M. R. Legouez and Prof. J. Blondin, editor of *La Revue Electrique*.

PRINCIP UND WIRKUNGSWEISE DER TECHNISCHEN MESSINSTRUMENTE FÜR GLEICHSTROM. By Fritz Hoppe. Leipzig: Johann Ambrosius Barth. 64 pages, 81 ills. Price, 2 marks, 70.

An elementary and practical text-book on direct-current ammeters, voltmeters, wattmeters and ohmmeters. It is written from the standpoint of engineering practice, using only elementary algebra with abundant diagrams and illustrations. The instruments considered are of the D'Arsonval, hot-wire, electrodynamometer and electrostatic types. The volume is well adapted to the use of students of electrical engineering taking up laboratory work.

DAS REGULIERPROBLEM IN DER ELEKTROTECKNIK. By Dr. Ing. A. Schwaiger. Leipzig: B. G. Teubner. 102 pages, 28 ills. Price, paper, 2 marks, 80; linen, 3 marks, 60.

The engineering theory of machine regulation is developed in this book. The treatment is analytical, although the mathematics employed are not very difficult. The book is divided into three chapters. The first considers the general dynamical theory of direct-working regulators. The second deals with the corresponding theory of indirect-working regulators. The third chapter takes up the action of the Tirrill regulator. The book is clearly written and discusses its subject in a thoroughly exact manner. It is suitable for advanced students only.

DIE WASSERKRAFTMASCHINEN. By A. v. Thering. Leipzig: B. G. Teubner. 118 pages, 73 ills. Price, 2.25 marks.

This little volume deals with modern water-power machinery in an interesting way, from a descriptive and comparative standpoint. Very little mathematical exposition is attempted, but it is endeavored to offer a clear conception of the methods of construction and of operation in various modern plants. Some data as to costs and economical comparison are given at the end which will be useful to engineering students.

HANDBUCH DER ELEKTRISCHEN BELEUCHTUNG. By Herzog and Feldmann. Third edition. Berlin: Julius Springer. 766 pages, 707 ills. Price, 20 marks.

This is the third edition of a well-known work by the authors. The matter has, however, been largely recast and enlarged since the second edition appeared. The book is excellently presented, well illustrated and prepared for electrical engineering students specializing in the direction of electric lighting. For these it may well serve as a text-book, although there are a number of differences in detail between American and European practice. The work deals with electric lamps of all kinds, photometry, illumination, wiring and distribution, generators, generating stations, switchboards and installations. It will recommend itself highly to all students of electric lighting, especially those interested in European practice as presented in the German language.

DIE CHEMISCHEN STROMQUELLEN DER ELEKTRIZITÄT. By Dr. Curt Grimm. Munich: R. Oldenbourg. 201 pages, with appendix, 109 ills. Price, 6 marks.

This work is a strictly modern treatise on cells, both primary and secondary, containing concise and well-illustrated descriptions of all the more prominent batteries and many obsolete types, together with data on weight, capacity and discharge curves of the more prominent commercial types. American practice is not slighted, but, of course, where the Germans have developed similar types to our own, theirs is given preference. The thoroughness with which the subject is treated may be gathered from the titles of the 12 chapters composing the work: General theory; non-polarizable cells; completely depolarized cells; incompletely depolarized cells; dry cells; carbon cells and gas batteries; standard cells; lead accumulators; accumulator plates; accumulator construction; non-lead accumulators. An appendix is added to the work containing a list of all German patents of the past 15 years relating to cells and a bibliography of the chief works on the subject. It is the most modern and complete work on the subject of batteries and can be recommended to all interested in this branch of electrical science and application.

EINFÜHRUNG IN DIE MAXWELLSCHE THEORIE DER ELEKTRIZITÄT UND DES MAGNETISMUS. By Dr. Clemens Schaeffer. Leipzig: B. G. Teubner. 174 pages, 32 ills.

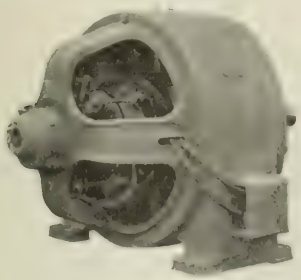
Maxwell's theory of electromagnetic wave propagation has received increased attention in recent years in view of the advances of wireless telegraphy and telephony. This little book, in the German language, forms an excellent introduction to that theory. As published by Maxwell himself, the theory was forbiddingly abstruse, being cast in such a form that only advanced mathematicians could follow it. Dr. Schaeffer has presented it in this book in such a manner that no extraordinary mathematical attainments are needed to grasp it.

The book opens with a fine frontispiece plate portrait of Clerk Maxwell. The treatment in the discussion is clear and logical. The book is of great interest to advanced students in physics and electrotechnics, giving the best elementary presentation of Maxwell's theory that we have yet seen.

NEW APPARATUS AND APPLIANCES

Protected Direct-Current Motor.

The British Thomson-Houston Company, Ltd., of Rugby, has brought out a line of protected direct-current machines, one of which is illustrated herewith. The standard machines are shunt and compound wound and are made in four styles. Attention has been given in the process of manufacture to the removal and permanent exclusion of moisture from the insulating material of the coils. The latter are subjected to a high potential test of alternating current at a pressure of 1500 volts applied between the coils and frame for a period of one minute, while the machine is hot. The armature core consists of laminations of sheet steel of high permeability slotted on the periphery to receive the windings and clamped under pressure between substantial end flanges. The cores are provided with radial ventilating ducts to allow of free circulation of air through the body of the armature. The teeth are supported by steel spacers. Form-wound coils are employed and secured by binding bands. The commutator has ample wearing depth and the shell, which is provided with ventilating ducts, is forced into position and keyed. A cast-iron magnet frame with poles of laminated steel is used and the field coils are wound on bobbins and held in position by the projecting pole tips. The bearings are carried either in end shields rigidly bolted to the frame or in pedestals. They are of the self-oiling type, lined with white metal and are self-aligning. The brushes are of carbon and are carried in brush holders of the clock-spring type, so constructed that the tension of any brush is uniform throughout the life of the brush and is readily adjusted without removing the brush from the commutator and without the use of any tool. The commutator end may be fitted with expanded metal covers, perforated metal covers, totally enclosing covers or enclosing ventilating covers with fan. By this means the motor can be applied to a variety of purposes without subjecting it to injury from iron chips, rain, water, paints, dust, etc.



PROTECTED MOTOR.

Transformer Fuse-Block.

The Pittsburgh Transformer Company has placed upon the market a new fuse-block which is furnished with the new Pittsburgh transformers. This block is of the plug and receptacle type and is all-porcelain. Very heavy and substantial construction is employed so that the block is durable and will handle short circuits or lightning discharges satisfactorily without breaking. An important improvement in the new block consists in finishing the same with a brown glaze which is fired on in the same manner as in the case of high-tension porcelain insulators. This brown glaze is, of course, permanent and greatly improves the insulating properties of the new fuse-block. Heretofore transformer fuse-blocks have usually been finished with a black paint or japan which very soon scaled off under the action of the weather, so that the porous porcelain became affected by moisture and dangerous to handle in wet weather. Furthermore, such painted fuse-blocks were very apt to ground upon the cross-arm and cause trouble. The all-glazed fuse-block described is claimed to possess many advantages over painted or japanned fuse-blocks, not only in point of safety and durability of finish, but also because its neat appearance is unaffected by the weather.



TRANSFORMER FUSE-BLOCK.

Electric Range.

The Westinghouse electric "Favorite" range, shown herewith, embodies a heating element which is claimed to combine in a high degree efficiency, simplicity and durability. The heating element is made of a practically indestructible material that converts the electric energy into heat at the exact point where it is wanted and in the most effective manner. It is so simple in construction that there is no possibility of its ever getting out of order or requiring repairs. The range corresponds in appearance with the most modern design of gas range. The cooking surface consists of six distinct heating units, each of which can be used independently of the other.

Both the oven and the broiler are located above the stove, so that no stooping is required. The oven is heated by five distinct heating units, so connected that any one or combination may be used without switching in the others. The broiler is heated by five units similar to the oven. This heating by separate units makes it possible to regulate the heat with great exactness and keep it at the temperature desired. Beneath the broiler is



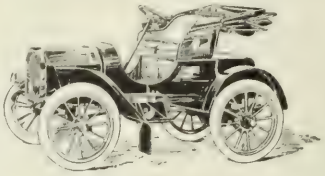
ELECTRIC RANGE.

located the reservoir, getting its heat from a double immersion coil. Under the cooking surface is an open plate warmer and beneath this is a shelf for cooking utensils. The combination is thus more complete than any gas range, as well as more convenient and practical.

The units in the oven and broiler are designed for 320 watts each, and those on the cooking surface for 500 watts each. The water heater takes 700 watts. All of the heating units are readily accessible for cleaning. The heat is always uniform so that cooking and baking can be done better and in less time than on another stove. As the range needs no chimney connection, it is not limited as to location.

Baker Electric Vehicles.

The line of electrics built by the Baker Motor Vehicle Company, of Cleveland, Ohio, embraces victorias, coupés, runabouts, roadsters, broughams, landaulets, surreys, stanhopes and commercial wagons. The general features of construction employed in the various pleasure vehicles do not vary widely so that a description of one is applicable to all. A series-wound motor capable of heavy overloads is employed in all of the vehicles, and Exide batteries are placed over the front and rear axles. The transmission from the motor to the rear wheels is by silent chain reduction, a single chain drive being used in the lighter vehicles and a shaft and beveled gear drive in

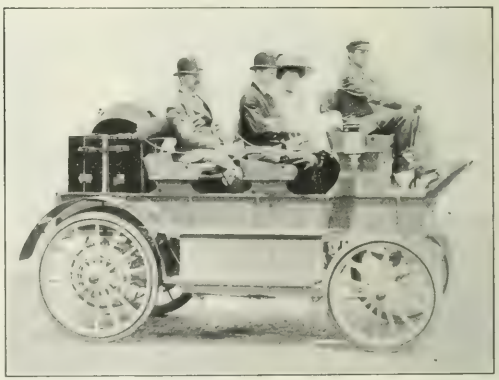


BAKER ELECTRIC RUNABOUT.

the heavy vehicles. The controller is of the continuous torque type, permitting six forward speeds and three reverse speeds on one lever, there being no extra reverse switch. The batteries are connected in series at all speeds, and four forward speeds of 12, 14, 16 and 20 miles per hour are obtained without resistance. By the use of annular ball bearings in all revolving parts the friction is reduced to the minimum and the general efficiency increased.

Combination Electric Vehicle.

In addition to seven designs of pleasure vehicles, the Studebaker Automobile Company, of South Bend, Ind., manufactures a line of electric commercial vehicles for all purposes. A combination passenger and merchandise-carrying vehicle mounted on the commercial-type running gear designed for normal-load service of from 1500 lb. to 2000 lb. is shown herewith. The body of this vehicle is equipped with removable seats, so that this type of machine may serve as follows: For electric-light companies, requiring emergency-service vehicles for the transfer of material or workmen; for mills and factories, located at a distance from railroad stations providing for the employment of this machine usually as a delivery wagon and occasionally for passenger transfer between factories and the railroads; for hotels, as either station or baggage wagon and for summer resorts as a sight-seeing vehicle. The running gear of this machine is provided with 42-in. driving wheels furnished with



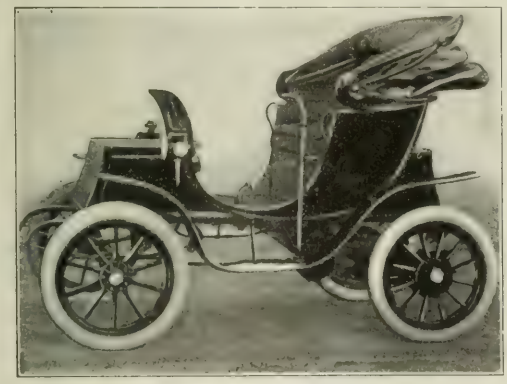
STUDEBAKER COMBINATION ELECTRIC VEHICLE.

independent Westinghouse motors; the large diameter insuring a reduction in power consumption; low tire maintenance and aiding in the easy riding qualities of the vehicle. The battery is suspended on supplementary springs within its compartment, thereby providing additional flexibility and minimizing the cost of maintenance. The lubrication is of the railroad waste-box

type now usually in use on street railways and considered to be absolutely reliable and requiring a minimum of attention. This running gear is said to exemplify the highest development of commercial vehicle design and the features mentioned are incorporated in all the larger sizes of vehicles now being manufactured by the Studebaker company.

Columbia Electric Victoria-Phaeton.

The Columbia electric victoria-phaeton manufactured by the Electric Vehicle Company, of Hartford, Conn., and illustrated herewith, embodies three important changes in the mechanism over previous models, although preserving the original outward design. These are an emergency brake worked on a drum on the motor countershaft in addition to the regular hub brake, the addition of two extra cells of battery and the use of Hess-Bright ball bearings in all four wheels. The body rests on four long semi-elliptical springs, and the motor and all mechanical parts are attached direct to the body. A reduction gear and enclosed chain connect the motor to the differential gear on the driven axle, which runs in a tubular casing, with all working parts housed to exclude dirt. The motor, which is of General Electric design, transmits its drive through a steel helical pinion and bronze helical gear to the countershaft, and thence by sprocket and chain to the rear axle. The controller provides four forwarding speeds of approximately 4, 7½, 12½



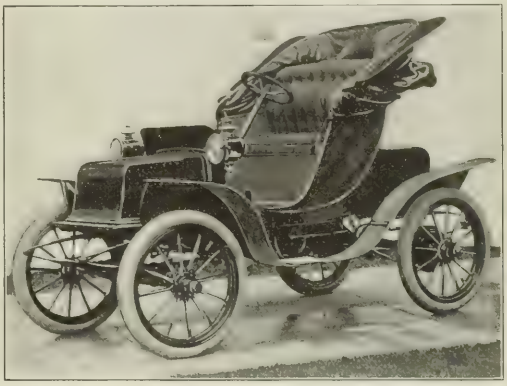
COLUMBIA ELECTRIC VICTORIA PHAETON.

and 16 miles per hour, and two reverse speeds. On the second backward position of the lever the motor develops its maximum pulling power at a low speed. A feature is the double-acting brake on the rear hubs with brake surface sufficient to bring the carriage to a quick stop on any grade by a light pressure of the foot. As a further means of safety, a third brake acting on the drum on the motor countershaft, but entirely independent of the regular brake, is provided. This also operates by means of a foot pedal. All running gear is of the reachless type, with a single motor drive. The battery used is made up of 32 Exide cells in two trays, divided so that the weight is distributed equally over the front and rear axles. Under normal road conditions, with standard tires, the company says that it is easy to make from 50 to 60 miles per charge if the batteries are properly cared for.

Babcock Electric Carriages.

The Babcock Electric Carriage Company, of Buffalo, N. Y., manufactures a complete line of electric vehicles in which many original features are embodied. The batteries are built by the company, as is also the controller. A double chain drive is used on all but the town car, which has a worm drive. Friction is reduced to the minimum by ball and roller bearings, and light

ness and graceful outlines are features of these cars. The weight of the battery is evenly divided over the front and rear wheels. An armored type of chassis is employed with a wheel base of 78 in. A powerful motor is suspended under the center of the chassis. A wheel-steering post with break joint so as to allow ingress to and egress from either side is a fea-

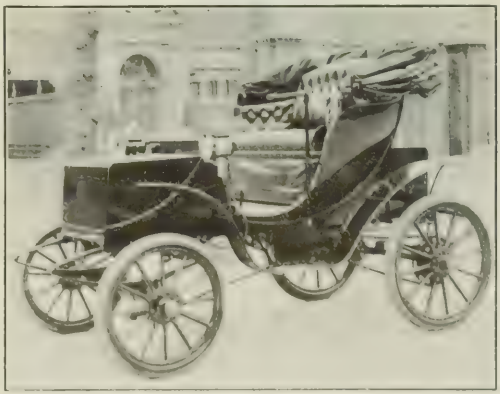


BABCOCK ELECTRIC VICTORIA.

ture of all the vehicles. Raymond brakes are provided in the hubs in the rear wheels and an auxiliary brake on the countershaft. The controller gives five forward and two reverse speeds; these speeds range from 6 to 25 miles per hour. The safety foot control is said to render accidents practically impossible.

Woods Electric Vehicles.

The Woods Motor Vehicle Company, of Chicago, Ill., manufactures a line of pleasure vehicles embodying many features which differ from regular practice. The vehicles are equipped with 40 cells of Exide battery and have solid rubber tires. Like other modern makes, each carriage is fitted with Hess-Bright ball bearings on wheels and motor and the transmission is one of the mechanical features of the cars. With the exception of the bearings, batteries, tires and raw materials, all parts of the



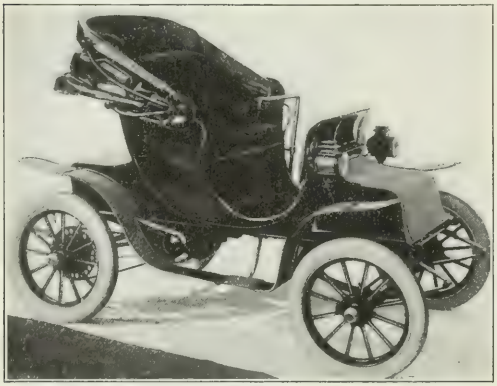
WOODS ELECTRIC VICTORIA.

Woods vehicles are made in its own factory. The motor frame is of Parsons malleable bronze, which gives maximum structural strength. A pinion on the motor shaft drives a large gear wheel mounted on the differential housing which is situated on the under side of the motor frame. Power is trans-

mitted from each end of the bevel gear differential through a universal joint shaft to the driving sprockets and thence by chains to the rear axle. By the use of double helical or herringbone teeth on the pinion and differential gear wheel, smooth running is obtained. The sprocket ends of the shaft are mounted on outboard bearings, the housings of which are supported on short transverse studs, so that they can swing in the longitudinal direction of the car. Each outboard housing is connected to the rear axle by a distance rod made in two sections joined by a turnbuckle, so that the chain tension may be adjusted without destroying the axle adjustment. By this means the side drag on the tires is eliminated. A four-pole, series-wound motor, designed with regard to economy in energy consumption and to mechanical excellence, is employed. The controller is of the drum type and follows street railway practice. Flexible wiring and accessibility are features of the connections and the lamps and bell are connected permanently to wires away from the battery compartment operating under a tension of 40 volts. Four speeds are provided by change in battery and motor connections. A maximum speed of 19 miles per hour is attained under favorable conditions and a radius of action of 50 miles on a single charge. The brakes are two foot-operated inclosed expanded brakes, one on each rear hub and a band brake on a pulley mounted on the armature shaft. The latter brake is operated by a reverse motion of the controller handle and remains locked until released by a latch on this handle. A side-lever steer is employed.

Columbus Electric Victoria.

The power plant of the electric automobiles manufactured by the Columbus Buggy Company, of Columbus, Ohio, is mounted on a sub-frame attached to the chassis, which can be dropped from under the car, clear of the chassis, by the removal of four bolts. The battery is equally divided in the front and in the rear, giving the car a perfect balance. The motor is mounted above the springs; the object being to eliminate vibration which is always present when the motor is suspended on the axle.

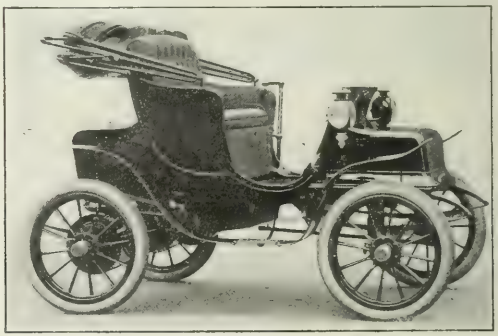


COLUMBUS ELECTRIC VICTORIA.

Moreover, the motor is enclosed beneath the seat making a good running organization throughout the entire car. A noticeable feature is the absence of foot pedals; the one pedal with which the car is equipped being provided for emergency use only and not for regular service. The wheelbase is 74 in. and the gage 4 ft. 2 in. from center to center of the wheels. Four-in. tires are provided on the rear wheels for the reason that the power and brakes are both applied to the rear wheels and bring most of the weight upon them. Twenty-four cells of Exide battery, assembled in six trays, are ordinarily employed, and the speeds provided in the car range from five to 20 miles per hour. The four speeds are attained by a continuous forward motion of the controller handle. The controller board is fitted with self-cleaning contacts and the arrangement is such that the position of the controller handle is automatically enforced when starting and when changing speeds, making necessary full contact of the blades on the different speeds and preventing burnouts. The simplicity of the controller is one of the strong points claimed for the machine.

Rauch & Lang Electrics.

Electric carriages are built in a range of sizes and styles from the runabout, stanhope and victoria in the smaller open sizes, and the coupé in the inclosed, to the surrey, brougham and landaulet in the larger and heavier cars by the Rauch & Lang Carriage Company, of Cleveland, Ohio. While the appearance, size and style of the various cars are widely different, the general idea as to details of body construction, trimmings and mechanical design is the same throughout. The chassis consists of a cold pressed steel frame, to which all of the machinery, springs, axles and other parts are attached. This permits of a change of bodies to suit seasons. The axles are made of nickel steel and Timken roller bearings are used in the wheels, all joints in the steering gear being of the ball and socket type, spring cushioned and adjustable for wear so as to avoid rattle. Two side chains drive direct to the wheels mounted on a stationary rear axle and give not only great strength but flexibility of motion. All parts of the power plant in the vehicle are placed above the springs, thus protecting them against road shocks. The countershaft, motor, controller and controlling devices are mounted on a single manganese bronze casting or sub-frame so designed as to hold each securely in alignment with the others, adjustments being provided for all contingencies. This sub-frame is suspended as a unit from the steel frame at three points. Annular ball bearings are used throughout, and these combined with the silent chain used to transmit power from the motor to the countershaft give a unit power plant of high efficiency. The motor employed is of the multipolar type of the company's own design and is said to possess a very high efficiency over a wide speed range. The controller is of the continuous-torque type, giving six speeds forward and three reverse. A single lever is employed which locks with a Yale type key. Besides the speeds mentioned the lever combines two of the most important brakes and the signal bell. Exide batteries are divided and assembled into suitable receptacles located over the front and rear axles, and doors are provided in the hubs of the body so that they can be inspected and cared for or removed if desired. The battery equipment of the various cars is so related to their weights that under ordinary conditions a radius of action of from 50 to 70 miles is expected. The car is controlled with the right hand, which rests on a bar fitted with a hand grip. The safety lock controller handle is operated by the left hand and by moving it forward all running speeds are obtained, and on an extreme backward pull all of the power is shut off and the brakes applied. Immediately under the operating hand



RAUCH & LANG ELECTRIC VICTORIA.

is a device for opening and closing the circuit. When the car is being operated all power can be instantly shut off by a slight downward move of the hand and the circuit cannot be closed again until the handle has been brought back to brake position. A key must be inserted in the face of the handle and turned before it can be operated in any manner with the one exception that the handle can be used to apply the brakes at any or all times. This simple device displaces the plug used in many cases.

Broc Electric Carriages.

In the pleasure vehicles built by the Broc Carriage & Wagon Company, of Cleveland, Ohio, the frame is of pressed steel and the mechanical parts, including axles, springs, motor frame, motor, countershaft, controller, batteries, brakes and steering post are either suspended or anchored to the frame. The motor used is of the series-wound, General Electric type, rated at 2 hp and possessing a very large overload capacity. Each machine is supplied with 24 cells of Exide battery and a Renold silent chain reduction is employed from motor to countershaft, Whitney roller chains being used from the countershaft to the rear wheels. A controller of the continuous-torque type,



BROC ELECTRIC VICTORIA

permitting five speed changes forward and reverse, from 5 to 20 miles per hour, forms part of the equipment. All speed changes are made without resistance and the design of the controller is such that freezing or welding of contacts is impossible. Hess-Bright annular ball bearings are used in mounting the armature shaft and also on the countershaft, and ball bearings are employed in both front and rear axles. The axles are constructed of nickel steel tubing and the rear hub brakes are of the internal expanding type with a specially designed locking device. The controller brake is of the positive friction type applied to the armature countershaft and easily operated by pulling the controller handle into a backward position. To prevent the insertion of the open-circuit plug in the socket except by deliberately throwing the controller handle back off of the neutral position a specially designed safety device is employed. A safety lock to prevent the theft of the machine is also provided.

Convention Exhibit Echoes.

In the June 3 issue of *Electrical World* a large number of descriptive notes were given with regard to exhibits at the Atlantic City convention of the National Electric Light Association on the new pier. These were prepared in the earlier part of the week and rushed through for that issue. A number of supplementary exhibit items of interest are now given below as to other features that attracted attention in the fine display:

RIDGWAY DYNAMO & ENGINE COMPANY was represented by Mr. Robert S. Beecher.

THE PHILADELPHIA STORAGE BATTERY COMPANY was represented by Mr. F. S. Marr.

THE H. T. PAISTE COMPANY, of Philadelphia, was represented by Mr. E. A. Jenkins.

MR. ROBERT E. MANLEY was looking after the interests of the Device Improvement Company, of Hanover, Pa.

OKONITE was represented by Messrs. George T. Manson and Romaine Mace, but was not made a separate exhibit.

HELIOS MANUFACTURING COMPANY, of Philadelphia, was represented by Mr. G. H. Rettew and Mr. Thomas Spencer.

H. H. CUDMORE, of the Brilliant Electric Company, Cleveland, was one of the busiest lamp men at the convention.

MR. JAS. G. BIDDLE, of Philadelphia, spent a day or two at Atlantic City with his many friends during the convention.

MR. JULIUS KRETZ was as usual looking after the interest of Walker & Kepler, of Philadelphia, among its many central-station friends.

MR. ARTHUR L. BOSLEY, general manager Lee Electric Company, of Baltimore, was present looking after the interests of his company.

INTERNATIONAL ELECTRIC METER COMPANY, of Chicago, was represented by its Eastern sales manager, Milton M. Kohn, of New York.

THE ELECTRIC SERVICE SUPPLIES COMPANY, with offices in all of the big cities, was represented by Mr. J. V. S. Titus and Mr. H. G. Lewis.

MR. N. L. NORRIS, the genial manager of the Banner Electric Company, Youngstown, Ohio, was on hand as usual, and up and doing every minute.

FOX BROTHERS COMPANY, of New York City, was represented by Messrs. H. T. Fox, H. C. Fox and F. F. Fox, as well as by Sales Manager G. A. Nisbet.

THE LINEMEN PROTECTOR COMPANY, of Detroit, Mich., manufacturers of a rubber shield for the protection of linemen, was represented by Mr. H. E. Marshall.

MR. FRANK M. HAWKINS, who represents the Crouse-Hinds Company, of Syracuse, in the New York district, was on hand as usual. He is among the "steadies" who rarely miss a convention.

MR. W. L. DEMING, of the Deming Company, Salem, Ohio, took advantage of this opportunity to visit Atlantic City and there extend his already large acquaintance among the electrical fraternity.

CHAS. WIRT & COMPANY, of Philadelphia, manufacturers of the Dim-a-Lite turn-down socket, was represented by Mr. Chas. Wirt himself. The apparatus is so handy a vest pocket is a good exhibition space.

G. I. LAMP COMPANY.—No convention would be complete without Harry Curtis Rice, of the General Incandescent Lamp Company, Cleveland. There was no question about this convention being complete.

MR. T. J. COPE, of Philadelphia, spent Wednesday at the convention and reported that during the past month he had booked more orders than at any time during the past year for his specialties in drawing-in apparatus, etc.

THE JANDUS ELECTRIC COMPANY, Cleveland, was represented by Messrs. I. C. Eshleman, secretary, Arthur Organ, New York representative, and G. A. Rumsey and L. J. Costa, of the Rumsey Electric Company, the Philadelphia agency.

DUNCAN ELECTRIC MANUFACTURING COMPANY, of Lafayette, exhibited a new multiple astatic switchboard meter showing an ideal and convenient arrangement for disconnecting the armature and removing it from within the field coils.

MR. HENRY J. BLAKESLEE, Syracuse, N. Y., exhibited for the first time his "Phantom Load" for alternating-current meters. The compactness and great convenience of this device appealed to the central-station men, and elicited much favorable comment.

EXCELLO ARC LAMP COMPANY of New York, was represented by Messrs. A. J. Thompson, secretary, and G. W. Armstrong, Western manager. For the first time in some years Mr

Hirschberg, the president of the company, was unable to attend, as he is abroad this summer.

Mr. Geo. L. Rowland, of James J. Murray & Company, Philadelphia, spent Wednesday and Thursday at the convention with his many friends in the central-station field who have used the Murray glassware for lamps for many years. Mr. Thos. V. Loughran also represented the firm.

The Locke Insulator Manufacturing Company, Victor, N. Y., had a fine exhibit of its well-known "Victor" high-tension insulators in the Pettingell-Andrews booth. Besides the more usual types of line insulators, tubes, etc., several large specimens of the suspension type were shown.

Mr. Milton Roach, formerly passenger agent of the New York Central, made a very welcome contribution to the comfort of the passengers on the special train to Atlantic City over the Pennsylvania Railroad by furnishing a large quantity of well-iced "Sunray" from his springs at Ellensville. The warm day made it very acceptable.

The Electrical Concrete Company, of Chicago, showed samples of "Electrete" products. This material is a cement composition which can be molded into barriers, compartments, insulators, cable terminal bells and other insulating articles. The exhibit was made in the booth of the Minerallac Electric Company in charge of Mr. A. Wakefield.

Habirshaw.—The interests of the Habirshaw Wire Company were looked after by Secretary J. B. Olson, who very rarely misses a convention. It is worthy of note that the report of the convention committee on memorials paid a high tribute to the technical standing and reputation of the late Dr. W. M. Habirshaw, who died during the year.

The Diamond Rubber Company, Akron, Ohio, had an interesting exhibit of rubber-covered wires and cables, rubber-insulated lead-encased cables, and igniter cables. These were all shown in great variety and small samples were distributed to visitors. The booth and exhibit were in charge of Mr. H. R. Sharkey, of New York, its Eastern representative.

The Central Laboratory Supply Company, of Lafayette, Ind., exhibited a portable graphic recording direct-current voltmeter and a combined edgewise indicating and graphic recording alternating-current voltmeter. The exhibit was in the booth of the Duncan Electric Manufacturing Company. Adrian Tobias and Wm. H. Sinks were in attendance.

The Adams-Bagnall Electric Company, Cleveland, exhibited its new regenerative flaming-arc lamp in the Price-McKinlock booth. The many new features of this lamp attracted much attention. The Adams-Bagnall Company was represented by A. J. Mitchell, of the home office; J. G. Pomeroy, Chicago, and G. A. Thompson, Eastern sales manager.

When the Chicago special train reached Harrisburg early on the morning of May 31, every man on the train received a message typewritten on a regular telegraph blank and enclosed in a yellow telegraph envelope. These "telegrams," addressed in care "Opalux Flyer," called attention to the "Opalux" reflectors used on the train, and to the display of these devices at the convention exhibition.

Mr. W. B. McVicker, president of the W. B. McVicker Company, could not exhibit his chemical engineering at the convention, but he held a reception Wednesday and Thursday afternoons at his room at the Marlboro-Blenheim at which souvenirs were distributed to his guests. The souvenirs consisted of imported jewel-cases, vases, flower-holders, candelabras, drawings, water-colors, and other objets d'art.

Buckeye Lamps.—It is needless to say that L. P. Sawyer, of the Buckeye Electric Company, Cleveland, was very much in evidence all through the convention. J. M. Smith and Mr. Conley, the Philadelphia representative, assisted him in waging "The Battle for Business." In the baseball game, "East v. West," Mr. Sawyer, as catcher for the West, had the misfortune to get a split finger and was taken off the grounds in an automobile. With a bandaged hand he was still "in the ring," if not "on the diamond."

The Rochester Electric & Insulation Company, Rochester, N. Y., exhibited the McDonald subway test block, a device which does away with cutting and splicing cables when making tests, and is a great time and money saver. Another device which attracted much attention was the new telephone protector. This is so constructed that if the fuse blows out, it is impossible to substitute a piece of wire. The only renewal possible is the fuse made for this purpose. The exhibit was in charge of P. J. McDonald, the president of the company and the inventor of these devices.

Westinghouse Literature was an exhibition in itself, and was in general demand. Apart from its excellence in getup, there was an attractiveness about its data and discussion of things that made central-station managers want to take it home. The booth was crowded all the time with applicants. A particularly effective folder was that devoted to the new Westinghouse electric range, which comprises several devices for cooking, heating, etc., in one, making it a really "hot" competitor of the gas range. But equally in demand were the brochures and bulletins devoted to fan motors, electric power for domestic purposes and the "general utility" sewing-machine motor.

Souvenirs were quite conspicuous by their absence this year, which was rather disappointing to those who with a fine scent spend part of their time at a convention hunting down the elusive article. One of the few given out, and it might be said the best, was that of the Wagner Electric Manufacturing Company. It consisted of dainty boxes of Huyler chocolates, labeled "Wagner Quality," and was much appreciated. Owing to the block of the holiday of Decoration Day, the boxes did not arrive until very late on the final day, without exterior covers or labels, and then some 400 or 500 of them had to be distributed in a rush to the various hotels. Where it was impossible to make direct delivery, the box was sent on by mail to the best address obtainable from the registry list. It was a neat piece of work, and the candy will doubtless be more appreciated, even in the retrospect, when this item is read.

The Minerallac Electric Company exhibited the "G. & W." line of potheads, or terminals for cables and subway boxes. A very attractive addition to this line is a large high-tension pothead for use on lines with a potential of 10,000 to 30,000 volts. The new subway boxes were shown, for either single or multiple conductors, comprising a combination subway junction box and pothead. The important features are: Filling the lower half of the box with compound; and its inverted-belt lid, which eliminates the possibility of the entrance of moisture into the boxes when entirely submerged. A large three-conductor fusible box was on exhibition designed for half-taps, which included these features. The G. & W. Company has recently issued a new and attractive catalog which was distributed, showing some typical installations of its products in several large plants in this country. Altogether nine types of potheads and four types of subway boxes were shown, attracting interest quite beyond the usual. Mr. A. Wakefield, of the Chicago office, was in charge.

The Stave Electrical Company exhibited outside the pier two of its new type vertical flaming-arc lamps, which dared the sunlight and attracted a great deal of attention. These lamps are 2500 cp, 350 watts, burning three in series on 110 volts at a current of 10 amp. They burn 26 to 28 hours. They give a bright white light and are particularly well adapted to street illumination. These lamps have recently been adopted by the city of Berlin, Germany. In the booth were on exhibition the Stave regular type flaming arcs, which were shown in such a manner as to illustrate admirably the accuracy of the feed, and the mechanism of the parts handled by the trimmer, in demonstration of the claim made for them of being "fool-proof." The miniature arc-lamp known by the trade name "Stavelco," which is suitable for store lighting, was also shown. A series of photographs was exhibited showing the different appliances of flaming-arc lamps in some important installations. In the convention hall were two Stave flaming arcs burning on the difficult 133-cycle circuit with great success. The exhibits were in charge of Mr. Theodore Stave, president, and Mr. Batterman, general sales manager of the company.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

One of the most striking features in the week's trade report is the remarkable activity in the building industry. The actual returns made by 62 of the principal cities for the month of May, as compiled by *Bradstreet's*, shows that there were issued permits for $68,480,397 during the month, as compared with $60,870,557 in April and with $36,073,823 in May last year. This is an increase of 89.8 per cent over last year's record. This record of activity means much to the electrical business because the present boom in building is largely in the direction of large structures for business purposes. It is probably not an exaggeration to assert that there is more high-class fireproof building projected at this time than ever before reported. The cheapness of structural material and the easy money market are responsible for this condition. Comparatively, steel and cement have been much cheaper than lumber, and the improvement in the character of buildings projected is a natural sequence. Outside of this feature it may be noted that there is a continuation of the gradual improvement in trade that has been observed for the past two months. Warm, moist weather throughout the West has improved the crop condition to a marked degree. While wheat and cotton acreages show small reductions from last year, the corn acreage is a record breaker and the crop has been given a most excellent start. Retail business is steadily expanding. The present prosperity among the farmers and the promise of future prosperity have done much to stimulate buying. The spring clearance sales, which for the most part are about over, have been very satisfactory, and the regular summer business is making a much better showing than last year. In the wholesale and jobbing business there is little doing. This, however, is the dull season for this branch of trade, and the fact that only reorders and filling-in orders are being received causes no discouragement. In the industrial field, and especially in the iron and steel industries, there continues to be a great awakening of activity. It is said that the product of finished steel materials for the month of May surpassed that of the same month in any previous year. The mills are now employed at full time, and while the prices for the finished product are less than they formerly were, raw material and labor are both reduced to some extent and the business will show a profit. Collections, while somewhat better than a few months ago, are still regarded as only fair. This in a measure is due to the strong sentiment of conservatism that has been developed in the business world. Many who have the money to pay prefer to let their accounts run rather than leave themselves without ready cash. Failures for the week ended June 3 as reported by *Bradstreet's* were 191, compared to 225 the previous week, 225 in the like week of 1908, 155 in 1907, 162 in 1906 and 104 in 1905.

THE COPPER MARKET.

Those consumers of copper who have failed to provide for their June and July requirements up to this time are finding the prices advanced. During the past week there was an advance of one-quarter cent per pound on all grades of copper, and even at this advance there was some reluctance on the part of producers and selling agencies to accept large orders for future delivery. The condition of the market is such that there is no pessimism to be found among any of the producers. During the past week the report of the United States Geological Survey for the year 1908 was made public. This report shows that there was a total output of refined copper in the United States for the year of 1,094,700,123 lb. The production of the mines of the United States, according to the smelter reports, was 942,570,721 lb., which is the largest production ever made, exceeding that of 1906 by 44,670,030 lb., and that of 1907 by 73,574,230 lb. According to the United States report the consumption of copper during the year was 1,020,054,318 lb. The Government figures of the stocks of refined copper on hand Jan. 1, 1909, in the hands of miners and producers, were 121,876,759 lb. This is a slight reduction over the Government's figures of the year previous. It is generally considered, from these figures that there must be considerable amounts of copper now in the hands of consumers. The takings of almost 480,000,000 lb. are within a few million pounds of the takings of the previous year. It is known, however, that the actual consumption by melters in 1908 was not more than 70 per cent of what it was during the previous year, indicating that not more than 400,000,000 lb. actually went into consumption. This would indicate that the consumers are now carrying about 80,000,000 lb. With the reports in the present uncertain condition, it is difficult to estimate the actual surplus stock of copper now in this country. It is known that during the past five months there have been considerable accumulations, and one statistician in the local market figures that stocks on hand in this country now amount to 342,000,000 lb. These figures are ridiculed by the producers and selling agencies. Buying during the week, both for foreign and domestic accounts, has been fairly active. Exports since the first of June have been 10,479 tons. Quotations on the New York Metal Exchange June 7 were:

Lake	13¾ @ 13¾
Electrolytic	13⅜ @ 13½
Casting	13¼ @ 13⅜

The London prices June 7 were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	61 15 0	61 7 0
Standard copper, futures	62 10 0	62 5 0
Market	Firm	Easy
Sales of spot		700 tons
Sales of futures		2,400 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	£ s d	£ s d
Lake	14 5 7	12 15
Electrolytic	14 2 5	12 12 6
Casting	14 1 2½	12 0 0
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

WESTINGHOUSE COMPANY EXTENDING ITS PLANT.—The Westinghouse Electric & Manufacturing Company has just purchased from the East Pittsburgh Improvement Company 43 lots or about 1,900 ft. frontage on Turtle Creek adjoining the present factory site at Wilmerding, Pa. The land extends to the Turtle Creek Valley railroad and the Westinghouse Inter-Works railroad and is the only railroad frontage adjoining the factory sites of the electric and air brake companies. The land was deemed necessary for the proper extension of the company's yard system, which has been cramped since the last additions were made to the factory buildings and power house some two years ago. The purchase was decided upon before the company went into the hands of a receiver, but was necessarily delayed until the financial affairs of the company were straightened out. The present activity and the present prospects of the company warranted the completion of the extension as originally planned.

CONSULAR CARD INDEX OF MANUFACTURERS.—The Bureau of Manufactures of the Department of Commerce and Labor has arranged for filing with United States consuls a card index whereby the consulates may forward the export of American goods. Major John M. Carson, chief of the Bureau of Manufactures, announces that any manufacturer desiring to take advantage of the plan should communicate with him. No fee is to be charged for the service in sending out cards to the consulates. All that is required of the manufacturer is that he print his cards in the language of the country to which they are sent, and in a prescribed and uniform size for assembling.

CROCKER-WHEELER BULLOCK LITIGATION.—A jury in the United States Circuit Court at Trenton, N. J., after a trial of 10 days rendered a verdict on March 29 in a suit for $500,000 instituted by the Crocker-Wheeler Company against George Bullock for failure to sell to the former his controlling interest in the Bullock Electric Manufacturing Company. During the trial the judge ruled that the Crocker-Wheeler Company was not entitled to recover for anticipated profits resulting from the proposed purchase of the Bullock company, thereby reducing the claim made by the plaintiff by $300,000.

GARWOOD ELECTRIC COMPANY.—In the issue of May 6 mention was made of the Garwood Electric Company, organized under the laws of New Jersey, and capitalized at $250,000, which took over the business and patents of the C & C Electric Company. The entire management of the Garwood company is in the hands of men who have a thorough knowledge of the electrical business in all of its branches. The directors are: William B. Elliott, president and acting treasurer; D. W. Barnes, C. H. Florandin, vice-presidents; Bernardo Ulmer, secretary, and Gustavus T. Kirby. Mr. Elliott has been connected in various capacities with the C & C Electric Company during the past 22 years as superintendent, works manager and general manager. Mr. Florandin has been associated with the same company during the past 14 years as purchasing agent and manager of its New York office. He was previously connected with the operating and engineering departments of the Brooklyn Heights Railroad Company. Mr. Barnes was formerly connected with the engineering department of the E. W. Bliss Company. His association with the C & C Electric Company dates back some 18 years, 15 of which he served in an engineering capacity at the works. During the past eight years he has been connected with the New York office. Mr. Ulmer has been connected with the C & C company during the past 12 years in various capacities and as assistant to general manager. Mr. Kirby, of Kirby & Wood, New York, has had considerable experience in the manufacturing line. The new company paid all of its $250,000, of capital stock, for the properties purchased and its assets are said to be far in excess of the amount paid. No cash went with the properties purchased, and the proceeds from the outside sale of stock is entirely for working capital. More than 90 per cent of the salesmen, engineers, office force, foremen, mechanics and other employees have become stockholders in the new company. The company's plant, which covers 5½ acres, is well equipped and is located at Garwood, N. J., 17 miles from New York. The company will continue the manufacture of the dynamos, motors and other appliances formerly manufactured by the C & C company, which have been on the market nearly 26 years. It will also pay special attention to the manufacture of electrical apparatus used in connection with modern heating and ventilating plants, to its line of special motors for driving large newspaper presses and to its system of electric welding. The New York office is at 149 Broadway.

LOW-PRESSURE TURBINES IN THE LUMBER INDUSTRY.—The Potlach Lumber Company, at Potlach, Idaho, has recently installed a Westinghouse low-pressure turbine of 600-kw capacity that will use the exhaust steam from the company's power plant now in operation. There are now at this plant one rope-driven Corliss engine and a 100-kw high-speed triple engine driving a generator. The low-pressure turbine will take steam at about 15 lb. pressure from both these units. The new unit will be used for lighting the town and the mill. The new equipment ordered includes a Westinghouse Le Blanc condenser for carrying a 28-in. vacuum. The entire fuel used under the boilers at this plant is refuse from the saw mill. The work of the exhaust turbine is being appreciated by every line of industry. The Westinghouse company has recently installed similar equipments for the Pressed Steel Car Company, Pittsburgh, and the American Iron & Steel Company, of Lebanon, Pa.

CUBAN CONTRACT FOR CABLE.—A resolution has been adopted by the Cuban Government authorizing the Director-General of the Post Office and Telegraph departments to contract for 10 miles of submarine cable, to establish telegraphic and telephonic communication between Cayo Christo and la Isabele de Sagua. The necessary appropriation for this purchase amounting to $8,250, has also been authorized and charged to the budget. The fact that the resolution authorizing this expenditure expressly states that the Director-General may contract, "without the formality of public bids, and without requiring bonds from the contractor" has caused some criticism among firms engaged in the Cuban trade in this country. It is claimed that this method of doing business is to favor a German contractor of Havana, who is a great friend of the President of Cuba, and entirely cuts out any competition from American firms. It is rumored that a protest may probably be sent to Washington.

WESTINGHOUSE TURBINES IN DETROIT.—The Detroit United Railways recently placed a contract with the Westinghouse Machine Company for another turbine unit. This company already operates Westinghouse turbines in three of its power stations. The new turbine, which is 1000 kw and is to operate at 150 lb. steam, 28 in. vacuum and saturated steam, will be installed at the Rochester station on the Detroit and Flint division. This station already contains engine type units but extensions of traffic have necessitated the installation of this new turbine unit. The Flint division is about 62 miles in length with central station at Rochester and substations at intervening points and operates heavy, high-speed interurban cars, reaching the center of Detroit over the city lines. The system is operated by high-tension alternating current transmission, originally supplied through inverted rotaries, but with the installation of the new unit direct from the turbo generator. The direct current equipment will then be used for feeding directly into local sections of the distributing system while the alternating current machine will carry the outlying portions of the line load.

DEMAND FOR LEAD CONTINUES HEAVY.—A director of the American Smelting & Refining Company says that the business of that concern continues to be very good. He says that the demand for lead is as heavy as ever in the history of the company, and that the copper metal situation is greatly improved. It is said that the immediate call for lead, both in the manufacturing business and by the paint makers, is so great that the company is having difficulty in filling all of its orders. All of the plants producing lead are running at full capacity, and there are still many orders that cannot be immediately filled. The earnings of the company are fully up to expectations, and the regular dividends will undoubtedly be declared. Copper plants are being operated at the present time upon a basis of 80 per cent, whereas a few months ago they were only running on a basis of 60 per cent.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in the present issue are announcements of proposed new plants or considerable extensions of present plants at Westfield, Mass.; Tilton, N. H.; Galveston, Tex.; Saskatoon, Sask., Can.; Palacious, Tex.; North Yakima, Wash.; Thersea, N. Y.; Grand Prairie, Tex.; Atlanta, Ga.; Caro, Tex.; North Adams, Mass.; Blackwell, Okla.; Copper Creek, Ariz.; Vancouver, B. C., Can.; Willimantic, Conn.; Kalispell, Mont.; Ukiah, Cal.; Providence, R. I.; Henning, Ill.; Tucson, Ariz.; Logan, Utah; Louisville, Ky.; Ellwood, Pa.; Noosack, Wash.; Fairfield, Ia.; Gregory, Tex.; Park City, Utah; Evansville, Wis.; Delphos, Kan.; University, Mo.: San Francisco, Cal.; Kenosha, Wis.; Prince Albert, Sask., Can.; Gouverneur, N. Y., and Searcy, Ark.

MILLIKEN BROTHERS REORGANIZATION PLAN.—The reorganization committee of Milliken Brothers has adopted a plan by which it is hoped that it will not be necessary to raise any additional capital. It is proposed that by putting the company's entire plant into operation enough profit will accrue to provide for the payment of all the outstanding obligations. It is not expected that it will be necessary to scale down either the capital stock or the bonded indebtedness. The company was placed in the hands of receivers in June, 1907. The receivers have not only succeeded in paying the interest on the $3,000,000 bonds but have accumulated a cash balance of $500,000.

DEVELOPMENT ON THE SAVANNAH RIVER.—The Twin-City Power Company is the name of a concern that has undertaken the development of the Savannah River, at Price's Island. The work has been commenced by the construction of a concrete dam that will cost between $3,000,000 and $4,000,000. The watershed for this dam extends back for 20 miles and it is believed that with a system of reservoirs there will never be any lack of water on account of dry weather. The company will operate an electric railway from Modoc, S. C., to the plant. It is expected that the plant will supply light and power to towns and cotton mills within a radius of 50 miles.

FEDERAL POWER SITES WITHDRAWN.—Acting under instructions from the Secretary of the Interior, the director of the United States Geological Survey has recommended the withdrawal of 11 water power sites on the public domain. These withdrawals aggregate 236,365 acres of public land in Utah, Colorado, Wyoming, Montana, Idaho and Oregon. Some of the more important sites withdrawn were upon the Salmon River in Idaho; the Owyhee River in Oregon, and upon the Flathead and Missouri, and their tributaries, in Montana.

MICA IMPORTS MUCH SMALLER.—The Geological Survey report for 1908 shows that the total domestic production of mica was 972,964 lb., valued at $234,021, which is a decrease of 87,218 lb. and $115,290 from 1907. The value of the imports into the United States fell off from $925,259 in 1907 to $266,058 in 1908. Speaking of these figures an importer and dealer in mica had this to say: "While the government report shows that the imports, for the first time in the history of the mica trade, have fallen below in value the domestic production, this condition has nothing to do with the tariff. Neither the high protection that is now given the domestic producer, nor the proposed rate that was adopted in the amended tariff bill by the House, is responsible for producing more mica than we imported. This is merely a condition of trade. During the depressed manufacturing times of 1908 there was very much less demand for mica than at any time in recent years. Just as soon as electrical manufacturing gets back to normal conditions the demand for mica will increase, and the majority of this mica will have to be imported. As pointed out in your columns heretofore, the manufacturers believe that the new rate of 5 cents per pound and 20 per cent ad valorem on uncut mica, and 10 cents and 20 per cent on manufactured mica, is a hardship upon the consumers in this country, and we do not believe that the domestic producers need this amount of protection. The duty mostly falls upon qualities of mica that cannot be produced in this country under any circumstances. This makes the consumer pay a tax upon a commodity which must be purchased abroad. In ordinary times the value of imported mica is about four times the value of domestic mica."

ISTHMIAN CANAL PURCHASE.—Bids have been asked for by the general purchasing officer of the Isthmian Canal Commission at Washington, to be opened June 21, for several surface condenser pumps, packing, pipe covering, brass and copper tubing and copper wire.

Financial Intelligence.

THE WEEK IN WALL STREET.

There is no denying the fact that the activity in steel issues was the feature of the stock market during the past week. This was not only apparent in the fact that the two stocks of the United States Steel Corporation led in the advance movement of the week, but in the fact that all of the independents also showed considerable gain. The remarkable activity in the industrial steel business would necessarily be reflected in the steel stocks. It is hardly correct, however, to say that the striking advance in steel common is entirely attributable to the industrial activity. For many months there has been a persistent and constant tip that steel common would before the middle of fall sell at 75. This has been laughed at, and also has been believed, and the advance of last week shows that it is not at all beyond the realm of the reasonable. Steel common to-day paying 2 per cent would actually be worth as an investment security less than 50. The business of the corporation, however, and the promises of future business indicate that the common stock may reasonably expect to earn a 5 per cent dividend in the near future. It took a long time for the investing public to appreciate the fact that steel preferred was a good security. For many years, while this stock paid 7 per cent, it was below par. At the present time it begins to be apparent that the public understands that the preferred dividend is reliable, and that on a proper basis the stock should be worth considerably above par. The buying of preferred last week, which advanced the quotations 5⅞ points, was principally from investors. Outside of the iron and steel issues in the market last week everything was more or less strong. Amalgamated Copper, for instance, made an advance of more than 2 points, which is considerable when it is known that the advance of copper metal was only a fraction of a cent. All of the industrials were notably active. American Locomotive common advanced more than 3 points, and the preferred almost 2 points. The Mackey securities advanced more than 3 points for the common, while the preferred showed a small advance. General Electric advanced 2 points, and New York & New Jersey Telephone was in greater demand than it has been for a number of weeks. Taken altogether, the stock market during the past week is one of the best we have had since the time of depression. There were almost 6,000,000 shares sold during the week, and in almost every instance the net change was an advance. One of the features of the week which is particularly interesting, in any review of the market, is the fact that outsiders appeared to be buying. From the start to the finish commission houses had orders from investors, and possibly from speculators, who wanted to buy stocks. In many instances these orders were sent in with a limit that prevented their execution in the open market. This in itself shows that the outsiders believe in the advance of the market, but were not willing to take the chances of getting in at top figures. In the meantime, the bond the money market has been remarkably easy; there has been no trouble about placing bonds, and every issue that has been offered has been over-subscribed. The money market has been as easy as for several months past, and the evidences that the banks are overstocked with cash are still with us. Call money on June 7 was 1½ @ 2 per cent, and 90-day paper could be had at 2¾ @ 3 per cent. The quotations in the table are of the close June 7.

NEW YORK.

	May 28.	June 7.	Shares sold.		May 28.	June 7.	Shares sold.
All.-Ch.	16	15¼	1,000	Int.-Met., pfd.	40	45¾	20,250
All.-Ch. pfd..	52¼	52⅜	3,000	Mackay Cos...	79¾	82⅜	7,500
Amal. Cop....	85¼	87	131,590	M'c'ky Cs., p..	73⅞	74¾	1,400
Am. D. T....	29*	29*	.....	Man. Elev...	147	146½*	400
Am. Loc....	58⅞	61⅝	24,500	Met. St. Ry..	27*	29*	1,100
Am. Loc. pfd.	115*	117	1,400	N.Y. & N.J.Tel.	123*	124	300
Am. Tel.&Cbl..	77¾*	79	.....	Steel, com....	63⅜	67¼	720,687
Am. T. & T..	140⅜	140⅝	11,980	Steel, pfd.....	120	125	108,795
B. R. T.....	79½	81¼	66,175	W. U. T.....	75¼	76½	4,125
Gen. Elec.....	160¾	160	8,900	West'h. com...	83¾	85	13,350
Int.-Met. com.	16½	16½	19,248	West'h. pfd...	121	123	300

PHILADELPHIA.

	May 28.	June 7.	Shares sold.		May 28.	June 7.	Shares sold.
Am. Rys.....	45¾*	45¾	.....	Phila. Elec...	12	11⅞	.....
Elec. Co. of A.	12½	12½	.....	Phila. R. T...	33⅛	32	.....
Elec. St. B'ty.	48½	52½	.....	Phila. Trac...	92¾*	92*	.....
E. S. B'ty, pfd.	49*	49*	.....	Union Trac...	56¾*	56¾	.....

CHICAGO.

	May 28.	June 7.	Shares sold.		May 28.	June 7.	Shares sold.
Chi. City Ry...	180*	180*	.....	Chi. Tel. Co..	133	133¼	.....
Chi. Rs., Ser.1.	109½*	107½	.....	Met. El., com.	10*	10*	.....
Chi. Rs., Ser.2.	38⅛*	38½	.....	Met. El., pfd.	50*	54*	.....
Com. Edison..	119½	119½	.....	Nat'l Carbon .	87*	93	.....
Chi Sub'ys...	26	24½	.....	Nat'l C., pfd .	110*	119*	.....

BOSTON.

	May 28.	June 7.	Shares sold.		May 28.	June 7.	Shares sold.
Am. T. & T..	140¼	140⅜	.....	Mex. Tel....	3*	3*	.....
Cum. Tel....	136*	136¼	.....	Mex. Tel., pf.	5½*	5½*	.....
Edison. E. Ill..	249	248	.....	N. E. Tel....	132¾	133	.....
Gen. Elec....	161¼	160	.....	W. T. & T...	12	11¾	.....
Mass. E. Ry .	12½	12½	.....	W. T. & T., p	8*	8*	.....
Mass. E. R., p.	60½	67½	.....				

*Last price quoted.
Shares sold are for week June 1 to June 5.

DIVIDENDS.

American Smelting & Refining Company, quarterly, common, 1 per cent, payable July 15; preferred, quarterly, 1¾ per cent, payable July 1.

Canadian General Electric Company, Ltd., common, quarterly, 1¾ per cent, payable July 1.

Interborough Rapid Transit Company, quarterly, 2¼ per cent, payable July 1.

Portland (Ore.) Railway, Light & Power Company, preferred, quarterly, 1¼ per cent, payable June 15.

Safety Car Heating & Lighting Company, quarterly, 2 per cent, payable July 1.

APPLICATION FOR RECEIVER FOR RAILWAY AND LIGHT COMPANY.—A bill in equity has been filed with the Supreme Court at Augusta, Maine, asking for the restoration to the stockholders of the property of the Waterville & Fairfield Railway & Light Company, Waterville, Maine, and for the appointment of a receiver to take charge of the affairs of the company. A hearing has been ordered to be held July 6. It is alleged that interest on $75,000 in bonds has not been paid.

PETITION FOR APPOINTMENT OF RECEIVER.—Dane A. Pearson, claiming to represent the majority of stockholders, has brought a suit in the United States Circuit Court asking for a receiver for the Citizens' Electric Light, Heat & Power Company, of Altoona, Pa., and an injunction restraining the directors from rescinding its contract with the Juniata Water & Power Company.

METROPOLITAN STREET RAILWAY CERTIFICATES.—The New York City Railway and the Metropolitan Street Railway have sold to William A. Read & Company a new issue of $3,500,000 receiver's certificates. These certificates are preferliens, and are issued to take up an equal amount of notes maturing June 15. They are being offered to the public at 100¼

MONTREAL LIGHT, HEAT & POWER COMPANY.—The annual report of the Montreal Light, Heat & Power Company for the fiscal year, which ended April 30, 1909, shows that the gross revenue of the company was $4,079,769, and that the net profits, after paying fixed charges, were $1,745,847. During the year there was charged for depreciation $393,380, and a charge of $25,000 was added to the insurance fund. This liberal amount charged to depreciation emphasizes the strong financial basis of the company. According to the report of President H. S. Holt the company added two large gas holders and a considerable amount of trunk mains to its gas equipment, and also constructed upward of 30 miles addition to its conduit system, and approximately 10 miles to its cable system. As a consequence of these additions a large amount of overhead lines have been discontinued and taken down. It is the policy of the company to further extend the underground system, and even at this time all of the congested districts of the city are practically free from overhead wires. Additions in the way of new business, both in the gas and electric departments, are reported as thoroughly satisfactory.

AMALGAMATED COPPER COMPANY'S REPORT.—The annual report of the Amalgamated Copper Company for the fiscal year ended June 30, 1909, shows that the net earnings of the company were only $3,663,000. This compares with net earnings of $14,154,000 in 1906, and $6,680,000 in 1907. The net earnings shown in the report are barely enough to pay the 2½ per cent dividend on the company's capital stock. In the meantime, the company has produced during the year more copper than ever before in its history, the total amount, according to the report, being 234,000,000 lb. In speaking of the physical condition of the company's plants, the report points to the fact that a number of improvements and extensions are being carried forward, among them being the installation of electric pumps and other electrical devices. It also states that investigations are now being made to determine the feasibility and economy of operating all the hoisting plants of the company by compressed air generated by electric power. At the annual meeting J. Horace Harding and James Jourdan were elected directors to succeed the late A. R. Flower and the late H. H. Rogers.

NIAGARA FALLS POWER COMPANIES.—At the meeting of the Niagara Falls Power Company and its subsidiary the Canadian Niagara Power Company on June 1, in addition to authorizing a $25,000,000 bond issue, as stated in the last issue, the old boards of directors were re-elected. In the former company Charles D. Dickey, of New York, was chosen to fill a vacancy in the board. The only portion of the new bond issue that will be put out at this time is $9,075,000 required for refunding purposes. The remainder will be issued from time to time as money is required for improvements and extensions. The security for these bonds will be the entire issue of bonds by the Canadian Niagara Power Company, secured by a first mortgage on its plant and distribution system and a mortgage on some 1100 acres of land suitable for manufacturing sites and all the plants and distribution systems of the Niagara Falls Power Company. The only prior lien on the property is that securing the issue of $10,000,000, 5 per cent, mortgage bonds.

BONDHOLDERS COMMITTEE FOR DENVER INTERESTS.—Emerson McMillin, who recently resigned from the chairmanship of the board of directors of the Denver Gas & Electric Comapny, has formed a bondholders protective committee to look after the interests of the holders of the $900,000 bonds of the Lacombe Electric Company which has been absorbed by the Denver company. The principal and interest of these bonds have been guaranteed by the Denver company with a provision for their exchange for the bonds of the larger concern. It is said that some of the bondholders are dissatisfied with the ratio of this proposed exchange and that is the reason for the formation of the committee. It is understood that Mr. McMillin is entirely out of the Denver company, but it is denied that there has been any rupture between him and the Doherty interests. The new financial plans of the Denver Gas & Electric Company have not been officially announced as yet, but they were fully outlined in the issue of last week.

RUMOR OF WESTERN UNION ABSORPTION REVIVED.—Wall Street was again saturated this week with rumors to the effect that the Western Union Telegraph Company was about to be absorbed by the American Telephone & Telegraph Company. This rumor was probably responsible for the increased activity of the stock on June 7, there being 3598 shares traded in, and a net gain for the day of two points. At the high point the stock reached 77½, which is the high record since 1907. President Robert C. Clowry of the Western Union said that he knew nothing of any deal to absorb his company and bankers who have been identified with American Telephone & Telegraph also denied knowledge of any such deal.

BOSTON, LOWELL & LAWRENCE ELECTRIC RAILROAD.—A certificate of public exigency has been applied for in Massachusetts by the Boston, Lowell & Lawrence Electric Railroad. The company has been organized with a capital stock of $400,000, and proposes to construct a line 25 miles long, with its southern terminus at Sullivan Square, Charlestion, and its northern terminus at Lowell, Mass. A branch line is proposed with the southern terminus at Tewksbury, and the northern terminus at Lawrence. It is said that all of the money is ready to construct this new line just as soon as the legal formalities have been complied with.

ELECTRICAL VEHICLE COMPANY'S AFFAIRS.—The Electrical Vehicle Company, of Hartford, Conn., has obtained an order from the United States Court to show cause why an offer of a reorganization committee to take over the entire assets, except the cash on hand, should not be accepted. Under this offer the general creditors will get about 20 per cent of the $800,000 they claim and the holders of the $2,500,000 bonds will waive their mortgage rights and also accept the 20 per cent offer. The company went into the hands of a receiver in December, 1907, but has been allowed to continue business ever since.

CHICAGO RAILWAY REHABILITATION.—Reports that have just been issued by the Chicago Railways and Chicago City Railway companies, under date of April 30, show that these interests have expended in the rehabilitation of their lines $27,654,806, in compliance with the terms of the new ordinance. Since February, 1908, the Chicago Railways Company has expended $11,565,205, and in the same time the Chicago City Railway Company has expended $15,753,901. These expenditures do not include the expenditures for the Calumet division, which were $335,700.

AMERICAN TELEPHONE STOCK LISTED IN PHILADELPHIA.—Application has been made to the Philadelphia Stock Exchange to list $232,587,600 capital stock of the American Telephone & Telegraph Company. This is the largest application ever made in the history of the Philadelphia Exchange. The stock is already listed in both New York and Boston.

GRAYLING ELECTRIC COMPANY.—The Grayling (Mich.) Electric Company reports that it has had a good year's business, and that it will be easily enabled to pay a dividend of 10 per cent on its stock from this year's operations. It does not at this time contemplate any extensive improvements or additions.

REPORTS OF EARNINGS

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
New York Gas, Electric Light & Power Company, New York:					
Year ended April 30, 1908	$547,897	$29,501	$518,396	$414,366	$104,030
Year ended April 30, 1909	585,122	17,348	567,774	414,370	98,404
Associated Bell Operating Companies:					
Month ended April, 1909	11,093,600	7,972,500	3,121,100	603,700	2,517,400
Month ended April, 1908	10,288,400	7,293,500	2,988,500	641,800	2,346,700
Auburn (N. Y.) & Syracuse Electric Railroad Company:					
Quarter ended March 31, 1909	81,948	59,993	21,955	25,625	*3,669
Quarter ended March 31, 1908	70,711	50,847	19,894	23,021	3,127
Metropolitan Street Railway, New York:					
Quarter ended March 31, 1909	2,927,503	2,036,103	891,400	.....	.....
Quarter ended March 31, 1908	3,000,641	2,913,320	447,025	.....	.....
Twin City Rapid Transit Company, Minneapolis:					
Month ended April, 1909	537,019	261,714	275,325	140,367	134,968
Month ended April, 1908	493,197	246,325	247,172	126,075	121,097
United Electric Companies (Maine Trust), New York:					
Quarter ended March 31, 1909	174,760	105,210	159,040	83,521	86,800
Quarter ended March 31, 1908	443,702	363,709	129,993	74,999	70,703

*Deficit.

GENERAL NEWS

Construction News.

COPPER CREEK, ARIZ.—Preparations are being made by the Copper Queen Mining Company to double the output of its electric power plant at its mines. An additional 300-hp engine will be installed.

JEROME, ARIZ.—The Council has granted a 25-year franchise to the Arizona Telephone Company for the erection of a telephone system. It is said that the company will commence work at once on the construction of its system.

TUCSON, ARIZ.—John Metz, of Tucson, is interested in a company which has purchased the controlling interest in the water works system of Benson and has also purchased the Benson gas works. The company is planning to install an electric lighting plant in the near future.

MORRILLTON, ARK.—The Russellville Water & Light Company is contemplating furnishing electricity in Morrillton for lamps and motors. A. Brewster is president.

SEARCY, ARK.—Plans are being considered by the Searchlight Power & Electric Company for the construction of a power plant and street railway system. The cost of the plant is estimated at from $250,000 to $300,000. The street railway will extend from Gallaway College to Searcy, through the city and suburbs. As yet no engineer has been secured. Louis Lorch is president.

ALAMEDA, CAL.—Plans are being made by the Pacific Telephone & Telegraph Company for extensive improvements and extensions to its system in Alameda, which will involve an expenditure of nearly $200,000. The work will include the installation of new instruments and switchboards and placing its overhead wires in cables and the removal of the wires from Park Street.

AUBURN, CAL.—It is reported that William Mayer contemplates the installation of an electric plant to furnish electricity for domestic and other purposes.

DOWNEY, CAL.—Plans are being made by the Downey Light, Power & Water Company to extend its transmission lines to Rivera. J. R. Gordon is proprietor of the plant.

DOWNIEVILLE, CAL.—Walter Painter and Homer Gould have appropriated 15,000 cu. in. of water of the North Yuba River, just below Downieville, which will be utilized to generate electricity for mining and lighting purposes.

GLENDALE, CAL.—The City Council has passed an ordinance calling for a special election to be held June 22 to vote on the proposition of issuing $60,000 in bonds, the proceeds to be used for the purpose of establishing a municipal electric light plant.

LOS ANGELES, CAL.—M. J. Nolan has been granted a franchise by the Board of Supervisors to construct and operate an electric street railway on the extension of Washington Street.

OAKLAND, CAL.—The Central Oakland Light & Power Company has petitioned for authority to increase its bonded indebtedness by $800,000. The company is planning to enlarge and extend its systems.

RED BLUFF, CAL.—W. F. Luning has filed notice of appropriation of 12,000 cu. in. of water in Mill Creek to be utilized to generate electricity.

SAN DIEGO, CAL.—I. J. Wilde, president of the American National Bank, is reported to have donated $10,000 to the Park Commission for the erection of an electric fountain in the city plaza.

SAN FRANCISCO, CAL.—The United Railroads of San Francisco expects to purchase motor-generator sets with a total rating of [illegible] kw for sub-stations.

SAN FRANCISCO, CAL.—The City Council has passed an ordinance calling for the removal of overhead wires which are to be placed under ground at the rate of [illegible] miles a year.

SAN FRANCISCO, CAL.—The Great Western Power Company is reported to have closed a contract with the Southern Pacific Railroad Company to furnish electricity for operating all the suburban lines of the railroad company about the metropolis, such as the broad-gage and its Alameda lines. H. H. Sinclair, vice-president of the Edison Electric Company, has been appointed manager of the Great Western Company. Mr. Sinclair states that $[illegible] will be expended by the power company within the next two years, in addition to the $8,000,000 already invested. A dam which will cost $[illegible] is to be erected on the Feather River, work on which will be started next fall.

UKIAH, CAL.—Plans are being considered by the Santa Rosa Mountain Power Company to enlarge its generating plant on Eel River. Another dam is to be erected and [illegible] machines installed in the power house.

DENVER, COL.—It is reported that the Colorado & Southern Railway Company is reported to have entered into a contract with the Colorado Central Power Company to furnish electricity to operate its famous Georgetown Loop. This is the initial road to be equipped for electrical operation. It is said that [illegible] will be made to convert other lines of the Colorado & Southern Railway Company to be operated by electrical power.

DENVER, COLO.—The stockholders of the Denver Gas & Electric Company have authorized the organization of a new company to be called the Denver Gas & Electric Light Company, which will consolidate the various properties and subsidiary companies owned by the present company, and to issue $25,000,000 general mortgage 5 per cent bonds. The action is taken owing to the necessity of providing for the capital requirements of the company's rapidly growing business and with a view to an ultimate extension of operations. Of the $25,000,000 in bonds, $7,000,000 will be set aside to retire the present outstanding bonds of the company, and the remainder will be used as required for the needs of the company.

DURANGO, COL.—The property of the Animas Power & Water Company, which was purchased recently by W. N. Vaile, of Denver, Col., for $750,000, for the bondholders, has been transferred to the San Juan Water & Power Company, which has been incorporated, with a capital stock of $1,000,000. S. Z. Mitchell, of New York, N. Y., is interested in the new company.

BRISTOL, CONN.—The C. J. Root Company, manufacturer of wrought brass hinges and counting machines, it is reported, will erect a new factory building together with a power house. The company expects to purchase a boiler and engine, which later may possibly be direct connected with generator.

DANIELSON, CONN.—The Cochrane Power Company has applied to the Legislature for a charter. The new company is a subsidiary of the Danielsonville Cotton Company and has been formed for the purpose of constructing a transmission line to the mills of the Danielsonville company from the plant of the Cochrane Power Company located on the Quinebaug River, a distance of about five miles. It is to be capitalized at $100,000 and is authorized to issue bonds to the amount of 75 per cent of its outstanding capitalization.

HARTFORD, CONN.—The Universal Machine Screw Company has purchased a site at the north end of the city, on which it will erect a new plant in the near future. The plant will be electrically driven, the energy being secured from the local electric company.

NEW HAVEN, CONN.—The State Board of Railroad Commissioners has approved the plans of the proposed electric railway to be constructed by the Shore Line Electric Railway Company from Saybrook to Madison, passing through the towns of Westbrook and Clinton.

NORWICH, CONN.—The Gas and Electric Commissioners have voted to reduce the price of electricity for power purposes. Under the new schedule beginning Aug. 1, the rates are to be as follows: From 1 to 500 kw used in one month, five cents per kw-hour, and all over 500 kw used in one month at two cents per kw-hour. The minimum charge on motors will be $2 per month for one-horse power motor or less and 50 cents per month for each additional horse power while connected with the city lines. Under the existing schedule the prices range from 2½ cents to nine cents per kw-hour.

WILLIMANTIC, CONN.—The plant and holdings of the Willimantic Gas & Electric Company have been purchased by a syndicate in which A. M. Young, of Waterbury, Conn., is interested. Arrangements have been made to secure electricity from the hydro-electric plant of the Uncas Electric Company at Scotland Station. The change will require some alterations in the plant and station and the installation of new machinery. The distributing systems of both the gas and electric plants will be thoroughly overhauled and repaired, work on which will begin in the near future. F. C. Slade has been appointed local manager.

WASHINGTON, D. C.—The Bluemont division of the Southern Railway Company, recently acquired by Stephen B. Elkins and John B. McLean, of Washington, is to be equipped to be operated by electricity and extended to Winchester. At present the road extends from Washington to Bluemont.

WASHINGTON, D. C.—President Taft on May 29 sent two short messages to Congress transmitting ordinances recently approved by the executive council of the island of Porto Rico. One granted an extension of time to the Ponce Railway & Light Company in which to complete certain extensions, and the other granted the San Juan Light & Transit Company permission to operate an electric railway between San Juan and Rio Piedras, and to supply electricity for lamps to the public.

DEFUNIAK, FLA.—At an election held recently the citizens defeated the proposition to issue $10,000 for the construction of an electric light plant.

PORT ST. JOE, FLA.—[illegible] the contract for the erection of an electric light plant at this port was awarded to the Electrical Construction Company, of Jacksonville. The plant [illegible] and will be operated by the Jacksonville Electric Company, of which [illegible] is president.

TIGER BAY, FLA.—The Pelham Development Company is reported to have closed a contract with the Westinghouse Company, of Milwaukee, Wis., for [illegible] to be direct connected to [illegible].

ATLANTA, GA.—Plans are being prepared by the Piedmont Power Company for the erection of transmission lines for the distribution of electricity in this city, for which the City Council has granted the company a 50-year franchise. Louis B. Magid is president of the company.

ATLANTA, GA.—The National Manufacturing Company, recently incorporated, has purchased the plant of the Georgia Plow Works in this city, which will be utilized for the manufacture of cotton ties. The company is said to be in the market for three 5-hp, 220-volt, low speed, 3-phase, alternating-current motors. R. M. Freeman is president of the company.

COVINGTON, GA.—The City Council has granted a 5-year franchise to the Oxford & Covington Street Railway Company to construct and operate an electric railway in Covington.

SALMON, IDAHO.—G. B. Quarles, secretary of the Salmon Electric Company, writes that the plant and holdings of the Salmon Electric Company have been purchased by the Andrews Light & Power Company.

ELGIN, ILL.—It is said that arrangements have been made with the Aurora, Elgin & Chicago Railway Company, whereby the old street arc lamps now in use will be replaced with new and modern lamps.

FREEPORT, ILL.—W. T. Raleigh is reported to be interested in a project to construct an electric railway from Freeport, Ill., to Madison, Wis., via Cedarville, Rock Grove, Oakley and Brodhead.

HENNING, ILL.—The village has entered into a contract with R. C. Wilson & Company for electric light service in Henning. It is expected to have the system installed within 90 days.

MATTOON, ILL.—The Decatur, Sullivan & Mattoon Transit Company has filed a deed making the Windsor Trust Company, of New York, N. Y., trustee in an authorized bond issue of $2,500,000. The company proposes to construct an electric railway from Decatur to Mattoon, Ill., a distance of 48 miles.

HUNTINGTON, IND.—The contract for installing new boilers in the municipal electric light plant has been awarded to the Bass Foundry & Machine Company, of Fort Wayne, Ind.; the Fort Wayne Electric Company will furnish the generators.

INDIANAPOLIS, IND.—The capital stock of the Citizens' Telephone Company has been increased from $50,000 to $100,000.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company is making a display and demonstrating various electrical devices for household uses, at its office, ranging from an electric shaving mug to an electric grate. C. E. Pruyn, of the General Electric Company, has charge of the demonstration.

ROANOKE, IND.—The Fort Wayne & Wabash Valley Traction Company has been granted a franchise by the Town Council to furnish electricity for lamps and motors in the town. Under the terms of the franchise the maximum charge for electricity is to be 10 cents per kw-hour. The franchise does not include street lighting service.

BRITT, IA.—The Hancock County Telephone Company is planning to purchase the Western Electric Company's telephone line and extending it to Crystal Lake.

DES MOINES, IA.—Arrangements are being made by the Mutual Telephone Company for making improvements to its system, which will involve an expenditure of about $85,000.

FAIRFIELD, IA.—The Fairfield Gas & Electric Company contemplates rebuilding its plant, which will involve an expenditure of about $20,000. The company has recently completed a gas tank with a capacity of 30,000 cu. ft.

GRINNELL, IA.—Arrangements are being made by the Interior Telephone Company for extensive improvements to its system, which will involve an expenditure of from $20,000 to $30,000.

KEOKUK, IA.—H. L. Cooper has been in this city recently making investigations with a view of building a dam on the Mississippi River and constructing a power plant with an output of 200,000 hp. John R. Freeman, consulting engineer, of Providence, R. I., is assisting Mr. Cooper in his examinations.

LAWTON, IA.—The capital stock of the Lawton Telephone Company has been increased from $2,000 to $9,000.

DELPHOS, KAN.—The City of Delphos is reported to have sold an issue of bonds amounting to $30,000, the proceeds to be used for the construction of a municipal electric light plant. It is said that bids will be asked in about 30 days for machinery and equipment for the plant.

PLAINVILLE, KAN.—Bids will be received by the City of Plainville for the construction of a water works system. An electric motor or gasoline motor will be purchased for operating the pump.

WICHITA, KAN.—A company is being organized to construct an interurban railway from Wichita to Hutchinson and thence to Newton by the way of Burton and from Newton via Valley Center and Sedgwick. Capital stock to the amount of $100,000 has already been subscribed by Wichita business men.

LOUISVILLE, KY.—The George G. Fetter Power & Lighting Company has secured a site on Bullitt Street for its proposed power station. Work will soon commence on construction of the plant, which when completed will cost about $200,000. In addition to furnishing electricity for lamps and motors, the company proposes to manufacture ice on a large scale.

BELGRADE LAKES, MAINE.—The power plant of the Union Gas & Electric Company, of Waterville, was destroyed by fire May 31, causing a loss of about $10,000. The plant furnished electricity for operating the novelty mill and for lighting the Belgrade House and surrounding places. Temporary arrangements have been made to furnish electricity for lighting the hotel.

BUCKSPORT, MAINE.—Arrangements are being made by the Penobscot Bay Electric Company to extend its transmission line to the town of Searsport and the city of Belfast. The company will commence work on the extension as soon as possible after the special act of the last Legislature giving the company the right to enter these two municipalities becomes effective, which is July 1. The company has a plant at the Toddy Pond at East Orland, and has extended its transmission lines across the Penobscot River at Bucksport through Prospect to Stockton Springs and furnishes electrical service all along its lines.

BOSTON, MASS.—The Old Colony Street Railway Company is preparing plans to increase the efficiency of its service by providing for a secondary high-tension circuit the entire distance from the main power house in Quincy to Fall River. The secondary system will be erected over the same route and the same poles used as for the primary service, passing through Bridgewater to Taunton and Fall River. The same transforming stations will be used.

HOLDEN, MASS.—At a special election held May 27 the proposition to establish a municipal electric light plant was defeated.

MANSFIELD, MASS.—The municipal electric light and power plant, which was installed five years ago, has proven a success and now furnishes electricity for lighting 26 miles of streets at a cost of about $5,000 per year.

NORTH ADAMS, MASS.—Preliminary plans have been prepared by the Massachusetts Lighting Company, which owns and controls the North Adams, Adams, Williamstown (Mass.) and Stamford (Vt.) companies for the construction of a steel power house which will be erected on the site of the present plant. It is said that turbine engines will be installed.

SHREWSBURY, MASS.—The lighting committee has awarded the contract for extending the municipal street lighting system to the Delta Electric Company, of Worcester, Mass., for $7,040. The work will include the erection of eight and one-quarter miles of wire and 107 lamps. F. H. Smith, of Worcester, will have charge of the construction work.

UPTON, MASS.—At a special town meeting held May 28 the citizens voted to accept the report of the special committee recommending the town to enter into a contract with the Upton Electric Light Company for lighting the streets of the village for a period of three years. Under the terms of the contract the company is to furnish 91 street lamps at $16.50 each per year.

WESTFIELD, MASS.—Specifications have been prepared for enlarging the municipal electric light plant. It is stated that bids will soon be called for the installation of an engine rated at 500 or 600 hp.

ANOKA, MINN.—It is reported that the Anoka Electric & Water Works Company has accepted the tentative offer of the city to purchase the plants and holdings of the company for $40,000.

JORDAN, MINN.—Plans are being made by the Jordan Electric Light & Heating Company to increase the capacity of its storage battery.

MAZEPPA, MINN.—The Goodhue County Telephone Company has been granted a franchise to construct and maintain a telephone system in Mazeppa.

STILLWATER, MINN.—It is reported that plans are being considered to organize a company to take over the Stillwater electric light plant and the power plants at Apple River, Wis.

PRENTISS, MISS.—A company is being organized to install a telephone system in Prentiss. E. L. Gressitt, of Meridian, Miss., is interested in the enterprise.

MOBERLY, MO.—The City Council has granted the franchise for construction of an electric railway from Moberly to Huntville, for which most of the right of way has been secured. Manning, Wellman & Company are promters of the project.

ST. LOUIS, MO.—The Downtown Lighting Association has adopted the report of the Executive Board and will solicit subscriptions toward the $30,000 fund for the purchase of the lamp standards for the new lighting system, which the Union Electric Light & Power Company has agreed to manufacture and deliver for $50 each in connection with the new luminous arc lamp the company proposes to install. As the company is now furnishing direct-current lamps, the change in the service will cost about $100,000. Under the new contract 322 new lamps are to be installed at a cost of $50 per lamp per year, and with the lamps now in use will make a total of 470 to be supplied at the rate of $98 each per year until September, 1910, when the new contract will take effect.

UNIVERSITY (P. O., ST. LOUIS) MO.—Plans are being prepared by B. H. Colby, Security Building, St. Louis, Mo., for an electric light plant for University, to cost $100,000. E. G. Lewis is Mayor.

ABSAROKEE, MONT.—We are informed that G. M. Hawkins, of Absarokee, is interested in a project to construct an electric railway 12 miles long, in the vicinity of Absarokee.

KALISPELL, MONT.—The Northern Idaho & Montana Power Company, which recently took over the electric light and power plants and sites at Sandpoint and on Moyie River, formerly controlled by J. L. Drumheller, of Spokane, Wash., has purchased the plant and holdings,

including the local telephone and water service, from the Kalispell Water & Electric Company, on which it has held an option for 60 days. The company recently purchased the Big Fork power plant of the Flathead Valley Water Power Company. Extensive improvements are contemplated to the local systems, which will involve an expenditure of about $200,000, and about $100,000 will be expended on the Big Fork plant, which will include the construction of a concrete flume to carry water from the Big Fork River to the power house. The telephone lines will be entirely rebuilt and a long-distance line built to connect with the Bell system to the south. It is said that work will commence at once on improvements. O. A. Farrar is manager.

MILES CITY, MONT.—It is reported that James A. Murray, owner of the Hunter's Hot Springs resort, contemplates the construction of an electric railway to connect the hotel with the Northern Pacific Railway. The railway will be 2½ miles long. Electricity for operating the railway will be furnished by the Madison River Power Company or from a plant which it is proposed to install at Hunter's.

CENTRAL CITY, NEB.—A petition has been circulated asking for a special election to be held to vote on the proposition to issue bonds for construction of a municipal electric light plant. The cost of such a plant is estimated at $20,000, and if established, would also furnish electricity for the municipal water-works system.

AUSTIN, NEV.—Plans are being considered by the Austin Manhattan Consolidated Mining Company for the construction of a power plant on Big Creek, for which surveys have been completed. It is estimated that 500 hp can be developed.

GOLDFIELD, NEV.—Plans are being considered by the Codd Mines Company for the installation of a power plant and mill on the East Walker River.

TILTON, N. H.—The Tilton Electric Company has purchased the interests of the Tilton Mills in the lower dam and will commence work at once on the development of the water power. John Dresser, engineer, of Franklin, N. H., will have charge of the construction work.

CAMDEN, N. J.—It is reported that the Armstrong Cork Company has awarded a contract to the Allis-Chalmers Company, of Milwaukee, Wis., for a 1500-kw, gas-driven electric unit and seven standard 30,000 cu. ft., gas-driven blowing engines for various blast furnace plants.

JERSEY CITY, N. J.—Bids will be received until June 22 by the new county building committee at its office, 573 Newark Avenue, Jersey City, N. J., for furnishing and installing electric lighting fixtures in the new county court house. Frederick Rippe is president of the committee.

MORRISTOWN, N. J.—The Morris County Traction Company will soon let contracts for additional equipment for its power plant.

PORTALES, N. M.—At a recent election the citizens voted to issue $75,000 in bonds for municipal ownership of water works, electric plant and sewerage system.

ALBANY, N. Y.—Application has been made by the New York State Railways to the Public Service Commission, Second District, for permission to increase its capital stock from $23,140,200 to $23,860,200, and for authority to purchase the stocks of various street railroad corporations and to execute a first consolidated and refunding mortgage to secure $35,000,000 in bonds and to issue at present $6,500,000 under this mortgage. With the $720,000 increase in capital stock, $674,000 will be utilized to purchase from the New York Central and the Central syndicate their holdings of stock of the Rochester & Suburban Railway Company, the Rochester Electric Railway Company and the Ontario Light & Traction Company, giving an equal amount of new stock at par in exchange, and to acquire from time to time the remaining outstanding stock of the Rochester & Suburban Railway and the Rochester Electric Railway Company, amounting to $45,300. The $6,500,000 in bonds to be issued are to refund outstanding bonds and notes of the companies owned and controlled by the company. In addition provision is made for $1,693,366 in bonds, to provide funds for the acquisition of property, construction and extension.

BUFFALO, N. Y.—The contracts for furnishing and installing electric lighting fixtures in the city hall in connection with the new electric light plant for the building, was awarded to Wahle-Phillips, of New York, N. Y., for $27,000.

BUFFALO, N. Y.—Bids have been opened for the construction of conduits for the police and fire departments to connect with existing conduits, which call for 6400 ft. of creosoted wood conduit and 800 ft. of tile duct to be laid. Proposals will soon be asked for cables to be laid in the conduits, which will cost from $15,000 to $20,000.

COEYMANS, N. Y.—The Public Service Commission, Second District, has refused the application of the Upper Hudson Electric Light & Power Company, of Newburgh, N. Y., for the institution of legal proceedings to enjoin the Atlantic Light & Power Company from doing business in Coeymans and New Baltimore, the Hudson company alleging unlawful exercise of franchises in the town of Coeymans by the Atlantic company. According to the decision handed down by the Public Service Commission, the Atlantic Light & Power Company is exercising its franchises in both places in good faith.

GOUVERNEUR, N. Y.—Plans are being prepared for the construction of a large power plant at South Edwards on the east branch of the Oswegatchie River, 13 miles from Gouverneur, contracts for the construction of which, it is said, will be awarded within a short time. The plans call for the construction of a concrete dam and a large power house. The plant will furnish electricity for the Diana Paper Company's mill at Harrisville, which will require about 1500 hp. A high-tension transmission line will be erected to Carthage and surrounding towns. It is said that eventually the plant will furnish electricity to operate the Carthage and Watertown electric railway.

MEDINA, N. Y.—The A. L. Swett Electric Light & Power Company has been granted permission by the Public Service Commission to extend its transmission lines to Yates to furnish electricity in that town.

MUMFORD, N. Y.—The town, which has been without electric service since the closing down of the Hyde plant some years ago, is again lighted by electricity furnished by the L. H. Gardiner Paper Company. The company recently installed a dynamo in its plant and is now furnishing electricity for several business places and residences in the town.

NEWFANE, N. Y.—The Bell Telephone Company has purchased the plant and holdings of the Lakeside Telephone Company, including its lines in the towns of Newfane, Lyndonville, Waterport and Morton, and will soon take possession of the system.

NEW YORK, N. Y.—The Board of Estimate and Apportionment has appropriated $100,000 for preparation of plans for a new fire alarm system, and $750,000 was appropriated for extension of high-pressure service in South Brooklyn.

NEW YORK, N. Y.—The Board of Estimate has approved the application of the Hudson & Manhattan Railway Company for permission to extend its tunnels to the Grand Central Station. The extension has already been favorably passed upon by the Public Service Commission and as soon as the Mayor signs the franchise steps will be taken immediately to begin work on the new tunnel. It is expected to have the extension ready in 1911. William G. McAdoo is president.

NEW YORK, N. Y.—Plans are nearly completed for reorganizing the Third Avenue Railroad Company, although the properties are not to be sold until next fall. Under the plan of reorganization the stockholders will be asked to authorize an expenditure of $7,500,000, of which $1,000,000 will be spent for new tracks; $2,500,000 will be required to take up the receiver's certificate, which was given by Frederick W. Whitridge, receiver, when appointed by Judge Lacombe. The remaining $4,000,000 will be used for new cars, extensions and improving the power service.

NIAGARA FALLS, N. Y.—It is reported that the United States Light & Heating Company contemplates locating its plant in Niagara Falls. The company is capitalized at $17,500,000 and proposes to manufacture car lighting equipment, including a system in which the power is obtained from the car axle. The company also owns a patent roller-bearing power transmission system. W. H. Silverthorn is president and J. A. Smith, general manager.

ONEIDA, N. Y.—Application has been made to the Public Service Commission, Second District, by the Oneida Railway Company, for permission to construct an extension from Sherrill to Kenwood.

ROCHESTER, N. Y.—The Rochester Railway & Light Company is contemplating the installation of a 1,500-kw transformer in its substation at Mill and Commercial streets.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has made a reduction of 10 per cent in the price of electricity. In view of the reduced rates, the company is issuing a new form of contract, known as the "Constant Demand Contract." Under this contract the company will sell to large consumers electricity at less than $30 per horse-power per year on the outskirts of the city. To consumers in the center of the city the rate for the same service will be $41 per horse-power per year. The higher cost of the service in the city is due to the more expensive transforming and distributing apparatus required. C. J. Parker is consulting engineer.

SYRACUSE, N. Y.—It is reported that the George V. Fowler Realty Company is preparing plans for the construction of a 10-story apartment building in this city. It is proposed to install a high pressure power plant, an electric generating plant to furnish electricity for lamps and elevators; also refrigerating and vacuum cleaning plants. The company has an office at 220 Broadway, New York.

[illegible], N. Y.—George P. [illegible], secretary of the Hydro Electric Power Company, writes that the company is contemplating the installation of a pair of twin water wheels and generator in the near future.

KERNERSVILLE, N. C.—The Kernersville Light & Power Company, recently organized to establish an electric light plant, has been granted a 25-year franchise. C. C. Sapp is president; R. R. Clinard, vice-president; Charles S. Swann, secretary and manager, and D. W. Harmon, [illegible] of the company.

BLACKWATER, N. D.—Plans are being [illegible] for the construction of a concrete [illegible] exchange at Dawson. Mr. Mathews is interested in the enterprise.

GRAND FORKS, N. D.—The Grand Forks Street Railway Company is considering the purchase of second-hand equipment for its power plant as follows: One 200-kw belted railway generator, [illegible] valve, one 200-kw 500-volt generator, direct connected to a [illegible] condensing engine; boilers, heaters, switchboard, etc., complete.

GRANVILLE, N. D.—The County Board has granted David Olstad and others a franchise to construct a telephone system in this county.

LANSFORD, N. D.—The First Farmers' Telephone Association is said to be planning to erect 50 miles of new telephone line this season.

NEW SALEM, N. D.—Arrangements are being made to erect a telephone line to Rosebud, a distance of about 30 miles.

RYDER, N. D.—Arrangements are being made by the Queen City Telephone Company to erect a telephone line to Minot.

WASHBURN, N. D.—The contract for the erection of a telephone line to Turtle Lake, 25 miles in length, has been awarded to Roy Joslin.

AKRON, OHIO.—The Northern Ohio Traction & Light Company is said to be considering the question of constructing an electric railway between Akron and Massillon, over a right-of-way that was purchased and partly graded several years ago.

CINCINNATI, OHIO.—The Cincinnati, Lawrenceburg & Aurora Electric Street Railway Company, it is said, is preparing plans to extend its railway to Rising Sun, and also to Scottsburg, with a view of connecting with the Indianapolis & Louisville Traction Company, affording direct connection to Indianapolis and Louisville.

CLEVELAND, OHIO.—The Cleveland, Barberton, Coshocton & Zanesville Railway Company is considering plans for the construction of its proposed electric railway entering Zanesville, and securing the right of way in the city. The company will soon apply to the City Council for a franchise. It is said that work on construction of the road will be started at Coshocton by the middle of this month. A power plant will be erected at Otsego.

COLUMBUS, OHIO.—The contract for the construction of an addition to the power house at the Ohio State University has been awarded to George Abernethy, of Columbus, Ohio, for $3,888. Plans were prepared by Herbert Edwards.

COLUMBUS, OHIO.—The City Council has granted the Ohio Electric Railway Company a 25-year blanket franchise over the streets of the city to secure a new $175,000 union interurban station at South Third and Rich Streets and also to establish a new electric light rate of 7 cents per kw-hour for a term of five years.

RICHWOOD, OHIO.—Bids will be received until June 19 by Ray L. Jordan for lighting the streets with not less than 35 arc lamps of not less than 200 cp for a term of ten years. Specifications are on file at the office of the village clerk.

SPENCERVILLE, OHIO.—The Jennings Telephone Company has secured a franchise to extend its telephone system to Spencerville.

BLACKWELL, OKLA.—The citizens on May 25 voted to issue $25,000 in bonds for extensions to the electric light plant and $30,000 for extending the water-works system. Burns & McDonnell, of Kansas City, Mo., are consulting engineers.

CHICKASHA, OKLA.—Plans are being considered by S. J. Lee, of the electric planing mill, to enlarge the plant.

EL RENO, OKLA.—The El Reno Gas & Electric Company is rebuilding its entire electric lighting system, erecting new poles, wires, etc.

OKMULGEE, OKLA.—The citizens have voted to grant the Okmulgee Interurban Railway Company a franchise to construct an electric railway in Okmulgee. J. B. Jones, of Muskogee, is interested in the company.

OKMULGEE, OKLA.—The Pioneer Telephone Company is contemplating making improvements and extensions to its system, involving an expenditure of about $28,000.

TEXHOMA, OKLA.—John F. Allison, town clerk, writes that the town would like to grant a franchise to some one who would install an electric light system, ice plant and water works, for which he states there is a good opening.

WAPANUCKE, OKLA.—The city is contemplating the installation of an electric light plant and water works system. The proposition to issue $50,000 in bonds for construction of same will be submitted to the vote of the people.

EUGENE, ORE.—The McKenzie Valley Irrigation & Power Company has been granted a franchise to furnish electricity for lamps and motors in Springfield and this city.

PORTLAND, ORE.—Application has been made to the City Council by Dr. Henry Waldo Coe, president of the St. Helena Public Service Company, for a franchise to enter the City of Portland by the way of Tenth Street East and West.

PANAMA.—Proposals will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until July 19, for furnishing machinery for a central pumping station and three pumping units for hydraulic excavating and sluicing, including pumps and motors, engines, boilers, monitors, pipe and fittings, etc. Blanks and general information relating to this circular (No. 516) may be obtained at the above office or at the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 316 Hibernia Bank Building, New Orleans, La., and North Point Street, San Francisco, Cal. Capt. F. C. Boggs is general purchasing officer.

BUTLER, PA.—The residents of North Butler are considering the question of lighting the streets in that section of the town.

CARLISLE, PA.—Bids will be received by W. Friedman, superintendent U. S. Indian School, Carlisle, Pa., for furnishing and delivering as required 1,200 electric lamps during the fiscal year ending June 30, 1910.

ELLWOOD, PA.—It is reported that arrangements have been completed by the Pennsylvania Power Company for equipping its power station with a turbo-generator.

JOHNSTOWN, PA.—Notice has been given by Wallace Sherbine, Thomas J. Pearce, Alvin Sherbine and H. W. Storey that they will apply to the Governor of Pennsylvania for a charter for the Johnstown & Gallitzin Railway Company, which proposes to construct and operate a street railway from Johnstown to Gallitzin.

MIDDLEBURG, PA.—The Borough Council has granted the Middleburg Light, Heat & Power Company a franchise to construct and maintain an electric transmission system for the distribution of electricity for lamps and motors in Middleburg.

PHILADELPHIA, PA.—It is reported that the Philadelphia Electric Company has entered into a contract to furnish electricity to the Delaware County Electric Company, recently organized, which supplies electrical service to a large part of the towns in Delaware County. Under the agreement the Philadelphia Electric Company will furnish electrical energy for the territory between Philadelphia and Media, including the towns of Swathmore, Morton and Wallingford, which will be distributed by the Delaware County Electric Company.

PLYMOUTH, PA.—The Commissioners are considering the question of lighting the streets of the town by electricity.

READING, PA.—The 1000-hp engine recently installed in the Metropolitan Electric Company's plant on South Seventh Street has been placed in service. This addition will enable the company to supply all the electricity needed in the city until the new plant on the west side of the Schuylkill is ready. It is expected to have one 5000-kw generator in the new power station in service by Nov. 1. When the new plant is placed in operation a new system will be adopted which will include 14 rotary converter stations in different parts of the city and country, four of which will be located in Reading, two at the new plant to supply electricity for the Mohnsville railway and the Womelsdorf lines. Others will be placed at Robesonia, Mohnton, two in the vicinity of the Mt. Penn, Oley line, Shanesville, Ringing Rocks and other points. In addition to the rotary stations, there will be one portable station, which will be built on a car to be used in cases of emergency. The equipment of the present plant will be removed to the new power station when completed.

YORK, PA.—The York Railways Company is said to be contemplating extensions and improvements to its system in this city, involving an expenditure of $100,000, provided it can obtain certain concessions from the city.

ALTON, R. I.—Plans are being made to light the village by electricity, which will be furnished from the plant in the mill of the Richmond Lace Company. Eight arc lamps will be erected for lighting the streets, and 22 tenement houses belonging to the Richmond Lace Company will be wired for electric lamps. Several of the residences, the church and store will have electric lamps installed. The Whitall Electric Company, of Westerly, R. I., has been awarded the contract for the work.

PROVIDENCE, R. I.—Arrangements are being made by the Narragansett Electric Lighting Company to install another 3500-kw Westinghouse-Parsons steam turbine in its power plant. The turbine will replace Corliss engines now in use in the power station.

SPARTANBURG, S. C.—The Southern Power Company, of Charlotte, S. C., has been granted a franchise to furnish electricity in Spartanburg for lamps and motors.

ABERDEEN, S. D.—The Dakota Central Telephone Company is planning to extend its system through the new county west of the Missouri River. The lines will be extended to new towns along the Milwaukee extension and to the new reservation towns as soon as they are platted. The cost of the proposed work is estimated at $30,000.

CARTHAGE, S. D.—H. R. Potter has made application for a 20-year franchise to install an electric light system.

HURON, S. D.—The local electric light plant, owned by C. I. Bowe, has been purchased by Coler Campbell, secretary of the Huron Light & Power Company, who has been granted a 20-year franchise by the city. Through the change of ownership the control of the electric plant passes to the gas company.

LAKE PRESTON, S. D.—A franchise has been granted to the Lake Preston Milling Company to install and operate an electric light plant.

PIERRE, S. D.—Bids will be received by the State Capitol Commission until June 29 for furnishing and installing electric fixtures in the new capitol. John Hirning is secretary of the commission and C. E. Bell, Northwestern Building, Minneapolis, Minn., is the architect.

WEBSTER, S. D.—Plans are being made by the Dakota Central Telephone Company to erect a circuit to connect with the Missouri River Telephone Company's lines, at a cost of $30,000.

CHATTANOOGA, TENN.—It is stated that the Chattanooga & Tennessee River Power Company will increase its capital stock from $3,000,000 to $5,000,000.

KNOXVILLE, TENN.—Charles Dawes, representing the Knoxville-Kingston Interurban Railway Company, has applied to the City Council for an electric railway franchise.

NASHVILLE, TENN.—The Nashville & Crocker Springs Rapid Transit Railway Company, it is said, will let contracts for the construction of its proposed electric railway as soon as the right of way is secured. The company is capitalized at $50,000 and proposes to construct an electric railway between Nashville and Crocker Springs, a distance of 10¼ miles. Lee Guggenheim is president and general manager.

CARO, TEX.—The Saner-Whiteman Lumber Company is planning to rebuild its power plant which was destroyed by fire. A 40-kw, 250-volt, direct-current generator will be installed. John C. Saner is president of the company.

EDNA, TEX.—It is reported that an electric light and ice plant will soon be established in Edna.

GALVESTON, TEX.—Bids will be received until June 17 by V. E. Austin, commissioner of streets and public property, for the purchase in whole or in part of a complete city arc lamp lighting system, consisting of 200 series 9.6 amp, open arc lamps; 64 series 9.6 amp, enclosed arc lamps; two cylinder, Buckeye engines 15.5 in. cylinder, two foot stroke, 196 r.p.m., shafting, pulley wheels, belting, etc.; six electric constant current transformers of 60 lamp capacity each, with automatic current regulators. One Ball engine single cylinder direct connected to a 220-volt Western Electric generator; one switchboard, consisting of two Western Electric marble arc panels of three circuits each; one Western Electric marble arc panel for incandescent service, containing volt meter, ammeter, circuit breaker and switches.

GALVESTON, TEX.—Bids will be received by V. E. Austin, commissioner of streets and public property, until June 17 for furnishing one direct connected steam engine generator set with a rating of 150 kw, including condenser, condenser pump, switchboard and other accessories to be installed in the municipal electric power plant. Bids will also be received at the same time and place for 300 series direct-current arc lamps of the luminous magnetite or metallic flame type and accessories, including constant current transformers, mercury arc rectifiers, panels, etc., as may be necessary to operate and control the above lamps on six circuits of 50 lamps each, from 2300 volts, 60 cycles. Plans and specifications are on file at the office of John D. Kelly, city secretary, and W. D. Masterson, city superintendent of electricity.

GATESVILLE, TEX.—The Gatesville Electric Light Company has awarded the Minneapolis Steel & Machinery Company, of Minneapolis, Minn., a contract to install a 75-hp Muenzel gas engine and lignite producer for its plant.

GEORGETOWN, TEX.—Plans are being considered for improvements to the light and water plants of the Georgetown Water, Light & Power Company, which will involve an expenditure of about $20,000.

GRAND PRAIRIE, TEX.—It is said that an electric light and power plant will be installed in connection with the establishment of a town near Grand Prairie. George D. Allen, of St. Louis, Mo., is interested in the enterprise.

GREGORY, TEX.—The Coleman-Fulton Pasture Company, it is said, contemplates the installation of an electric light plant with sufficient output to supply 1000 lamps, and possibly a few small motors.

PALACIOS, TEX.—Plans are being made by A. C. Randolph to construct an electric light plant to be operated in connection with his ice plant. The initial cost of the plant will be about $10,000 and will have an output sufficient to supply 1500 16-cp lamps. Work will commence at once on construction of the transmission lines, which will be extended to the Baptist Young People's Union Encampment grounds so as to light the grounds for the coming encampment in July.

ROTAN, TEX.—It is stated that Mr. Harris, of Comanche, Tex., is contemplating installing an electric light plant in Rotan.

SAN ANTONIO, TEX.—The St. Anthony Hotel Company has purchased a site on which it will erect a new power house for the hotel. Equipment will be installed for generating electricity for lamps and for pumping water for the hotel.

TEXAS CITY, TEX.—The Texas City Company, which has awarded the contract for extensive port improvements in Texas City, including the construction of a system of seven warehouses which will be equipped with electric freight conveyors. An electric power plant will be installed to operate these conveyors. The cost of the entire work will be approximately $2,000,000.

WACO, TEX.—The Central Texas Development Company, which was organized to promote the building of an electric interurban railway between Waco and Temple, has under consideration the matter of extending the proposed line north to Hillsboro and south from Temple to San Antonio by way of Austin.

LOGAN, UTAH.—It is reported that Jesse Knight, of Provo, Utah, is planning to establish power plants in several canyons throughout the State to furnish electricity for lamps and motors in many of the towns that are now supplied by the Telluride Power Company, as well as to towns that are without electrical service at present. It is said that it is proposed to operate in the district from Logan on the north to Nephi on the south, a belt 200 miles long and 100 miles wide through the most thickly populated portion of the State.

PARK CITY, UTAH.—Jesse Knight, of Provo, Utah, is said to be installing a hydroelectric plant on Snake Creek, a few miles from Park City to furnish electricity for enterprises in this city in which he is interested. Another hydroelectric plant will be located on the Santaquin Canyon Company to supply electricity for a smelter in Eureka. Mr. Knight is also contemplating the installation of a power plant on the Weber River to furnish electrical power to the mining industries in Park City and vicinity.

LEESBURG, VA.—The Loudoun Telephone Company has taken over the property and holdings of the Old Dominion Telephone Company, of Wheatland, Va., and the Farmers' Telephone Company, of Waterford, Va. It is proposed to rebuild the entire plants, installing new switchboards, erecting new trunk lines between important points, and furnish metallic service equipment. The company has acquired the telephone line between Leesburg and Aldie, which is being rebuilt. The plant of the Herndon & Leesburg Telephone Company has also been acquired by the company. The entire system will be operated under one management after July 1.

BELLINGHAM, WASH.—The Washington Mining & Developing Company contemplates the construction of a power plant on Collins Creek, to cost $200,000. W. N. Bath is one of the directors.

NOOSACK, WASH.—The Washington Mining & Developing Company, of Noosack, Wash., is said to be preparing plans for the construction of a large hydraulic power plant.

NORTH YAKIMA, WASH.—We are informed that A. N. Mougins is interested in a project to erect a hydro-electric plant on the Yakima River, near North Yakima, where about 10,000 hp will be developed. The cost of the work is estimated at about $750,000.

OLYMPIA, WASH.—The State Board of Control has awarded contracts for four complete rock-crushing plants to the Austin Manufacturing Company, of Chicago, Ill., for $13,899. The Allis-Chalmers Company, of Milwaukee, Wis., has the contract for furnishing engines, boilers, electrical machinery and pumps, to cost $36,000.

SOUTH BEND, WASH.—The Willapa Harbor Telephone Company is contemplating the installation of a new switchboard and new instruments.

SPOKANE, WASH.—Announcement has been made that the Spokane & Inland Empire Railway Company is planning to construct a branch railway 20 miles long into the Cœur d'Alene Indian Reservation, which is to be opened in August. The proposed road would leave the main line near Ochlare, Wash., and run to Plummer, Idaho, on the Milwaukee's main line.

VANCOUVER, WASH.—Plans are under consideration by the Vancouver Traction Company for extending its railway from Vancouver east to Camas, a distance of about 12 miles.

WENATCHEE, WASH.—The City Council has granted the Entait Light & Power Company a franchise to enter the city to supply electricity for lamp and motors.

ASHLAND, WIS.—The Ashland Light, Power & Street Railway Company has purchased the plant and holdings of the White River Power Company, which includes water rights, dam and power house at White River, transmission lines and poles, substation at Ashland, franchises and other rights, for a consideration of $150,000. The company, it is said, will soon commence work on the construction of the Prentice Park line. The company will eventually extend the street railway to Odanah and Washburn and also extend the lines in the city.

EVANSVILLE, WIS.—The Baker Manufacturing Company is planning to erect an addition to its factory and will install an electric power and lighting system. The equipment to be purchased includes engine, generator, boilers, motors, etc.

KENOSHA, WIS.—The Kenosha Electric Railway Company has secured a site on which it will erect a new power house, at a cost of $75,000.

FORT D. A. RUSSELL, WYO.—The contract for remodeling the electric light system at Fort D. A. Russell has been awarded to the F. E. Newberry Electric Company, of St. Louis, Mo., for $34,644.

EDMONTON, ALTA., CAN.—The Provincial Government has entered into an agreement with the Automatic Telephone Company, of Chicago, Ill., to install automatic telephone systems in East Calgary and Lethbridge. It is understood similar equipment will be placed in other cities in the province during the summer.

EDMONTON, ALTA., CAN.—A French syndicate, represented here by Short, Cross & Biggar, attorneys, has applied to the City Council for franchises for the construction of radial railway lines from this city with a total mileage of 160. The franchises will, in all probability, be granted, the Council being strongly in favor of the proposition.

VANCOUVER, B. C., CAN.—The British Columbia Electric Railway Company has awarded the contract for the enlargement of its hydraulic tunnel connecting Lake Coquitlam and Buntzen, to Naylor Brothers, of Huddersfield, Eng. The capacity of the tunnel will be trebled and the improvement is being made in connection with the construction of the new dam at the mouth of Lake Coquitlam, for which the company recently received permission from the Provincial authorities of British Columbia.

VANCOUVER, B. C., CAN.—The London board of directors of the British Columbia Electric Railway Company has voted to appropriate $2,500,000 for extensions and improvements to its system in Vancouver during the next [illegible] R. H. Sperling, general manager of the company, [illegible] that [illegible] amount appropriated would be used for the construction of new tram lines in Vancouver. A new [illegible] power plant [illegible] at the operating end of the Nor[illegible] A new dam will be [illegible] Lake Coquitlam, to cost $[illegible] In connection with [illegible] New Westminster, [illegible] line between Vancouver and Central Park, [illegible] an expenditure of [illegible] $[illegible] The company will also [illegible] railway recently built to the Coquitlam Lake, [illegible] Company from New Westminster to Fraser River via Nicol Arm at the Fraser, to be operated by electricity [illegible] to the company by the [illegible]

VICTORIA, B. C., CAN.—Owing to the delay of the City Council on acting on the recent proposition submitted by the British Columbia Electric Railway Company, the plans for the development of water power on Jordan River have been held up. The company is willing to continue to take power from Goldstream if the city buys out the Esquimalt Company's works. It is endeavoring to secure the endorsement of the Board of Trade in connection with its proposed plans.

WINNEPEG, MAN., CAN.—It is reported that the city has decided to ask for bids for electrical equipment in connection with the civic power development at Point du Bois, the cost of which is estimated at $500,000. Cecil B. Smith is engineer in charge of the work.

BRIDGEWATER, N. S., CAN.—Plans are being considered by the Canadian Mines Company for the construction of a hydro-electric power plant to supply electricity to operate the mines and to supply the City of Bridgewater with electricity for lamps and motors. The company also proposes to furnish the surrounding territory with electrical service.

MONTREAL, QUE., CAN.—Contracts have been placed by the trustees of the McGill University for the installation of a power plant for the university, at an approximate cost of $150,000. Prof. R. J. Durley, of McGill University, will have charge of construction of the plant.

ALLAN, SASK., CAN.—The town has taken advantage of the government offer of assistance to build a local telephone system and has ordered 8 miles of wire.

NORTH BATTLEFORD, SASK., CAN.—The citizens at a recent election voted in favor of the by-law to issue $75,000 to establish an electric light plant and water-works system. It is stated that work will commence on construction of the plant within 30 days.

PRINCE ALBERT, SASK., CAN.—The city is planning to construct a power plant at La Colle Falls, on the North Saskatchewan River, 26 miles north of the city, where it is proposed to develop 10,000 hp. C. E. Mitchell, of Toronto, Ont., is engineer.

SASKATOON, SASK., CAN.—Sealed tenders will be received until June 22 by J. H. Truesdale, city clerk, for one 500-kw, 2200-volt, 60-cycle, 150 r.p.m., two-phase generator, exciter and switchboard installed complete, and a 750-hp, 150 r.p.m., vertical Corliss engine, with necessary condensing apparatus, installed complete.

WOLSELEY, SASK., CAN.—At a recent meeting of the shareholders of the Ellisboro Rural Telephone Company it was decided to make a call of 50 per cent on the shareholders for new construction. For further information, address J. H. Berry, Wolseley, Sask.

CHIHUAHUA, MEX.—The Mexican Northern Electric Power Company has practically completed negotiations for the purchase of the concession for the establishment of a large hydro-electric plant and system of transmission lines in the State of Chihuahua. This company is composed of Canadians who are largely interested in the electric power and transmission system at Necaxa and Mexico City. The company has a capital stock of $10,000,000 and already owns a concession for the installation of a large hydro-electric plant at La Jara, State of Chihuahua. The concession which it has just purchased was owned by Governor Enrique C. Creel, of Chihuahua; Paul Ginther, of Santa Rosalia, and others. It authorizes the installation of a hydro-electric plant on the Conchos River about 17 miles above Santa Rosalia, State of Chihuahua. A large dam will be built across the river, by means of which about 24,000 hp will be developed. It is proposed to build transmission lines from the proposed hydro-electric station to the city of Chihuahua and the mining districts of Parral, Santa Eulalia, Almolaya, Naica and others. The concession also embraces the right to irrigate 150,000 acres of the Conchos River vallay land from the water of this storage reservoir. The site of the proposed dam and reservoir has been surveyed by the company's engineers. G. F. Greenwood, of Montreal, is president of the company; F. M. Brookfield, W. D. Ross, B. F. Pearson and L. A. Campbell, all of Montreal, Canada, are also interested in the enterprise.

GUADALAJARA, JALISCO, MEX.—The Southern Pacific Company is reported to be considering the question of constructing an electric railway about 16 miles in length to connect Guaymas with Aurora, San José de Guayma and Empalme.

GUADALAJARA, MEX.—The first shipment of iron towers for building the electric transmission line from Guadalajara to the mining districts of Etzatlan and Hostotipaquillo, State of Jalisco, have arrived and work will soon be started on erection of line. It is stated that 1000 of these towers will be required. Electricity will be obtained in the beginning from the Las Juntas plant of the Compania de Tranvias, Luz y Fuerza, of Guadalajara, but the contract has been let for the installation of a new hydro-electric plant on the Santiago River, near Guadalajara, from which electrical service will eventually be obtained. The new plant will have a capacity of 12,000 hp. It is planned to have the transmission line erected so that electricity can be furnished the two mining districts by Oct. 1, 1909.

GUAYMAS, MEX.—An American syndicate, headed by Epes Randolph, of Tucson, Ariz., head of the Cananea, Yaqui River & Pacific Railroad Company in Mexico, is planning to build an electric railway 16 miles long to connect Guaymas with suburban towns of Aurora, San Jose de Guaymas and Empalme.

MATAMORAS, MEX.—A stock company composed of Brownsville, Tex., and Matamoras men, to be capitalized at $20,000, is being organized to install an electric light plant in Matamoras, for which franchises and rights-of-way have already been obtained.

MEXICO CITY, MEX.—The recent explosion at one of the stations of the Mexican Light & Power Company, at Necaxa caused a damage of about $1,000,000.

MEXICO CITY, MEX.—The electric railway which the Canadian syndicate, headed by Dr. F. S. Pearson, proposes to build between Mexico City and Puebla, will be one of the greatest scenic routes in Mexico. The route selected for the proposed line runs between the two volcanes, Popocatepetl and Ixtaccihuatl. The railway will be about 90 miles long, and will pass through the town of Amecameca, situated at the foot of Popocatepetl Mountain, which is the starting and outfitting point for persons who attempt to climb the mountain. Electricity for operating this road will be obtained from the hydro-electric plant of the Mexican Light and Power Company, at Necaxa.

NEUVA LAREDO, MEX.—The Neuva Laredo Light & Power Company has awarded the contract for the installation of a large electric light and power plant. This company is said to also have under consideration the construction of an electric street railway in the town. Heretofore the city has been receiving electricity for lamps and motors from the plant of the Laredo Electric & Railway Company, of Laredo, Tex., situated on the other side of the Rio Grande River.

New Industrial Companies.

THE ALBIN GUSTAFSON COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $20,000, for the purpose of carrying on an electrical contracting business. The incorporators are Albin Gustafson, Harry R. King and Frederick E. Piper, of New York, N. Y.

THE AMERICAN ELECTROPLATING COMPANY, of Brooklyn, N. Y., has been chartered, with a capital stock of $25,000, by W. F. Kruse and C. H. Furgang, of New York, N. Y., and E. D. Kenyon and H. L. Huber, of Brooklyn, N. Y. The company proposes to do electroplating and reclaiming all metals.

THE AUTOMATIC WELDING COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $50,000, to manufacture automatic machinery. The incorporators are E. J. Forhan, H. M. Browne and J. J. Harper, of New York, N. Y.

THE BOONVILLE COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $5,000. The incorporators are: Frank Senoir, of Montgomery, N. J.; Frederick J. Parker, of New Canaan, Conn., and Frank M. Talbot, of Glen Ridge, N. J. The company proposes to do a general contracting and engineering, quarrying and building business.

THE ELECTRO-CHEMICAL PULP & PAPER COMPANY, of Auburn, Mass., has filed articles of incorporation to handle patents and patents rights. The company is capitalized at $500,000, and the officers are: H. W. Oakes, president, and E. M. Hatch, treasurer, both of Auburn, Mass.

THE ILLINOIS POLE & POST COMPANY, of Mattoon, Ill., has been incorporated by Charles Taylor, John Merchant and James Vause, Jr. The company is capitalized at $35,000 and proposes to manufacture poles and posts and other timber products.

THE INDICATOR ELECTRIC COMPANY, of Chicago, Ill., has been chartered with a capital stock of $30,000 to manufacture electrical appliances by M. R. Leahy, A. A. Radtke and E. Gorman, of Chicago, Ill.

THE JONES REFRIGERATING MACHINE COMPANY, of Elgin, Ill., has been incorporated with a capital stock of $100,000 for the purpose of manufacturing engines, motors and machines by C. E. Zollars, R. B. Clark and B. Taylor.

THE KENNEBESTOS VALVE COMPANY, of Clinton, Mass., has been chartered, with a capital stock of $25,000, for the purpose of manufacturing and selling machinery. D. E. Purbeck, of Boston, Mass., is president, and H. E. Whitcomb, of Worcester, Mass., is treasurer.

JOHN H. LAMSON & BROTHER, of New York, N. Y., has been incorporated with a capital stock of $150,000 by E. Lamson, of Summit, N. J.; J. D. Baker, of Summit, N. J., and G. A. K. Sutton, of New York, N. Y. The company proposes to deal in manganese, asphaltum, pitch, carbons and chemicals.

THE PRIME ELECTRIC COMPANY, of New York, N. Y., has been incorporated by H. M. Underwood and J. Marvin, of New York, N. Y., and C. E. Whitney, of Hastings-on-Hudson, N. Y. The company is capitalized at $50,000, and proposes to deal in steam and electrical specialties.

THE J. W. A. RICHARDSON COMPANY, of New Orleans, La., has been incorporated by Joseph W. A. Richardson, Morris Marshall and Henry D. Richardson. The company is capitalized at $10,000 and proposes to do electrical work.

DE RUYTER VAN ORDEN has filed articles of incorporation, with a capital stock of $9,000. The incorporators are De Ruyter Van Orden and Ella B. Van Orden, of New York, N. Y., and Robert C. Striker, of Brooklyn, N. Y. The company proposes to do an electrical contracting business.

THE STEAM-GASOLINE ENGINE MANUFACTURING COMPANY, of Brooklyn, N. Y., has been incorporated, with a capital stock of $5,000, by George McDowell and John Fraas, of Brooklyn, N. Y., and Edward Effinger, of New York, N. Y., and others. The company proposes to manufacture engines, boilers, etc.

THE STERLING ASBESTOS COMPANY, of New York, N. Y., has been chartered, with a capital stock of $10,000, by George P. Fall and Armand DeR. Meyers, of New York, N. Y., and Herbert S. Fitzgibbons, of Brooklyn, N. Y. The company proposes to manufacture packing for steam and other engines, manufacturing heavy and shelf hardware, etc.

THE TOBACK LOCK COMPANY, of New York, N. Y., has been incorporated by Moses B. Cohen, of New York, N. Y.; Leopold Toback, of Union Hill, N. J.; Harry Toback, of Bayonne, N. J., and Frederick Hermann, of New York, N. Y. The company is capitalized at $500 and proposes to manufacture appliances for shutting off water, gas and electricity.

Company Elections.

CONDON, ORE.—At the annual meeting of the Waco County Electric & Water Power Company the following-named officers were elected: George S. Carpenter, president; H. I. Keeney, first vice-president; C. W. Lord, secretary; C. S. Graves, assistant secretary; F. T. Hulbert, treasurer; W. H. Hurlbert, general manager, and H. C. Smith, superintendent. The trust deed for the $15,000,000 bond issue of the company, as approved by the Carnegie Trust Company, was approved by the stockholders.

BLOOMSBURG, PA.—The Columbia Power, Light & Railways Company has been organized and the following-named officers elected: E. R. Sponsler, of Harrisburg, Pa., president; Myrom I. Low, of Lime Ridge, Pa., vice-president; A. W. Duy, of Bloomsburg, Pa., secretary, and M. Milleisen, of Bloomsburg, Pa. The company has absorbed 30 miles of electric railways, four electric light and two gas plants, consolidating six independent light and power plants.

New Incorporations.

CRESCENT CITY, CAL.—A charter has been granted to the Smith River Electric Company, which proposes to construct two power plants on Smith River to generate electricity, which will be distributed in Humboldt County, California, and portions of Josephine County, Oregon.

LOS ANGELES, CAL.—The Westside Electric Company has been chartered, with a capital stock of $75,000, by C. W. Anderson, R. C. Shippee, J. F. Stratton, Jacob Feiber and F. V. Gordon.

LOS ANGELES, CAL.—Articles of incorporation have been filed for the Surf Light & Power Company by C. W. Hicks, Charles Kraft, J. L. Haley, J. L. Kroeger, J. H. Maurice and others. The company is capitalized at $1,000,000.

NEWPORT BEACH, CAL.—Articles of incorporation have been filed for the Newport Bay Electric Light & Power Company with a capital stock of $50,000.

SAN GABRIEL, CAL.—The San Gabriel Valley Home Telephone Company has filed articles of incorporation, with a capital stock of $200,000. The incorporators are H.F. Metcalf, H. V. Carter, Edgar O. Fawcett, E. E. Bailey and W. M. Northrup.

HOLLYVILLE, DEL.—The Indian River Telephone Company has been incorporated, with W. J. Hunter as president; J. W. Hunter, vice-president; Harry Prettyman, secretary, and Harry J. Anderson, treasurer.

ELBERTON, GA.—The Interstate Power Company has been chartered, with capital stock of $3,000,000, by J. J. Spalding, of King & Spalding, of Atlanta, Ga.; Thomas J. Brown, of Elberton, and E. Marvin, of Underwood, Ga.

LENZBURG, ILL.—The Hickory Grove Telephone Company has been incorporated, with a capital stock of $150,000, by Herman M. Eckert, Michael Muser, Fred Huth and William Muser.

OBLONG, ILL.—The Oil Belt Traction Company has been incorporated by C. E. Groves, D. W. Odell, D. J. Odell, George P. Purrin, F. D. Willard, all of Oblong, Ill. The company is capitalized at $100,000, and proposes to construct a railway from Charleston to Bridgeport, Ill.

CRAWFORDSVILLE, IND.—Articles of incorporation have been filed for the Crawfordsville Heating Company by Moses H. Ristine, W. P. Herron, William B. Lynch, James E. Evans, Dumont M. Peck, Rankin C. Walkup and George B. Luckett. The company is capitalized at $100,000, and proposes to supply light, heat, water and power in Crawfordsville.

OSKALOOSA, IA.—The Oskaloosa Home Telephone Company has been chartered, with a capital stock of $150,000, by J. S. Appelman and H. H. Evans.

GEORGETOWN, KY.—The Georgetown Telephone Company has been incorporated, with a capital stock of $9,000, by A. P. Goodner and others.

BROWNVILLE, MAINE.—The Brownville Telephone Company has been chartered, with a capital stock of $5,000, and the following-named officers: E. M. Johnston, president and treasurer, and W. H. Monroe, clerk, both of Brownville.

FALMOUTH, MASS.—The Buzzards Bay Electric Company has been incorporated, with Allen A. Bessom as president and Eugene [illegible] center treasurer. The treasurer's office will be located in Falmouth from June 1 to Sept. 30, and in Newton from Oct. 1 to May 31.

HOXEYVILLE, MICH.—The Hoxeyville & East Lake Telephone Company has been organized to construct a telephone line from East Lake to Hoxeyville, a distance of [illegible] miles.

PIPESTONE, MINN.—The Aitona-Fountain Prairie Rural Telephone Company has been formed to construct a telephone line from Luctor and Verdi, thence to Pipestone, where connection will be made with the Northwestern Telephone Exchange Company's system.

PIPESTONE, MINN.—Another rural telephone company has been organized in Pipestone, under the name of the Midway Telephone Company. The telephone line will be nine miles long and will connect with the Northwestern Telephone system at Pipestone. J. E. Morgan is president; John Danneker, vice-president, and George McCarter, secretary and treasurer.

VIRGINIA, MINN.—Articles of incorporation have been filed for the Virginia Electric Power & Water Company by W. K. McLennan, Arthur H. Brown, William Elder, Arthur Howell and M. E. Riley. The capital stock of the company is placed at $200,000.

LICKING, MO.—The Missouri Inland & Southern Railway Company has been chartered with a capital stock of $400,000 to construct an electric railway from Rolla to Licking. The directors are: Albert Campbell and C. H. Evers, of Spokane, Wash.; A. E. Young, E. C. Comstock, A. H. Bradford and D. M. Meadows, all of Licking, Mo.

MOUND CITY, MO.—The Mound City Electric Light & Ice Company has been incorporated, with a capital stock of $25,000, by E. M. Miller, R. W. Neill, T. W. McCoy and others.

NEW YORK, N. Y.—The Third Avenue Bridge Company has been incorporated by Alfred D. Sage, Walter J. Quinn, John E. Quinn, William P. Seaver, James F. Feeley, Raymond O'Neill and Edwin Goodwin, of New York, N. Y.; Walter C. Burrows, of Brooklyn, N. Y., and Louis Kayer, of Mount Vernon, N. Y. The company is capitalized at $20,000 and proposes to construct a street railway about two miles in length over the Queensboro Bridge, extending from Third Avenue and Fifty-seventh Street, Manhattan, to the Queens terminus of the bridge at Jackson avenue, Long Island City.

NEWBERN, N. C.—The Newbern Power Company has filed articles of incorporation, with a capital stock of $500,000. The incorporators are R. P. Foster, J. W. Stewart, R. A. Nunn and M. D. Lane.

MT. JOY, OHIO.—The Scioto County Independent Telephone Company has been incorporated with a capital stock of $7,500 by Mark Crawford and others.

HOLLISTER, OKLA.—The Hollister Mutual Telephone company has been chartered with a capital stock of $5,000, by J. W. Farrington, C. A. Noder, G. O. Winningham and others.

JEFFERSON, OKLA.—Articles of incorporation have been filed for the Jefferson Power & Improvement Company by D. E. McNeff, E. L. Quigley and A. B. Ginter. The capital stock of the company is placed at $100,000.

EUGENE, ORE.—Articles of incorporation have been filed for the Eugene-Pacific Western Railroad Company, with a capital stock of $300,000, to construct an electric railway from Eugene to Florence. The company will take over the franchise and privileges of the Eugene & Pacific Electric Railway, recently organized to build an electric railway to the coast. The incorporators are: F. J. Bergot, F. A. Anderson and Joseph Fellman, of Eugene, Ore.

MEDFORD, ORE.—The Medford & Butte Falls Telephone Company has been incorporated with a capital stock of $5,000 to construct a telephone line from Butte Falls to Eagle Falls, and thence to Medford. B. F. Harris and others are interested in the project.

BEDFORD, PA.—Articles of incorporation have been filed for the Friend's Cove Telephone Company, with a capital stock of $10,000, by C. P. James, of Rainsburg, Pa.; John C. Koontz and D. P. England, of Everett, R. F. D. No. 2; S. T. Diehl, of Charlesville, Pa.; Clayton Smith and M. A. Diehl, R. F. D. No. 4, Bedford, Pa.

CENTERVILLE, S. D.—Articles of incorporation have been filed for the South Dakota Interurban Railway Company, with a capital stock of $1,000,000, to construct an electric railway from Sioux City to Bijou Mills, a distance of 160 miles. The directors are: William E. Miller, Fred E. Graves, Ralph W. Thwing and Charles E. Todd, of Bijou Hills, and George A. Miller, of Academy.

HURON, S. D.—The Huron Municipal Telephone Exchange has been chartered, with a capital stock of $50,000, by F. H. Kent, S. P. Malone, Charles F. Koepp, J. R. Hinman and others.

DRESDEN, TENN.—The Farmers' and Merchants' Telephone Company has been organized with the following-named officers: C. C. Wells, president; W. T. Killebrew, secretary and treasurer. The company has taken over the equipment of the old rural telephone company, which will be thoroughly overhauled and put in good condition. Extensions will be made immediately to Gleason, Sharon, Martin and other points in the county.

HILLSDALE, TENN.—The Hillsdale Home Telephone Company has been granted a charter. The company is capitalized at $400, and the incorporators are J. P. Cothron, T. J. Thompson, W. C. Gregory, J. B. [illegible] and L. E. [illegible].

LEXINGTON, TENN.—The Home Telephone Company [illegible] ized to give complete telephone connection with the exchange at Sardis, Saltillo, Henderson, Scott's Hill, Decaturville and Lexington. The central office will be located at Lexington. The promoters of the company are Dr. J. C. Stinson, of Center Point, Tenn.; E. L. Fesmire and J. F. Haw[illegible] of Lexington.

MEADOW VIEW, VA.—The Rural Telephone Company has been chartered, with a capital stock of $5,000. The officers are: W. H. Gresler, of Meadow View, Va., president; J. B. Greever, of Meadow View, vice-president; G. H. Hayter, of Abingdon, Va., secretary, and J. W. M. Whitten, treasurer.

ALDERDALE, WASH.—The Columbia Telephone Company has been chartered, with a capital stock of $10,000, by Alexander B. Robert, William Warner and Robert W. Bryan.

MILES, WASH.—The Spokane & Columbia Rivers Farmers' Telephone Company has been organized. The line will connect Spokane and Columbia valleys with central exchanges at Miles and Peach.

SEATTLE, WASH.—The Puget Sound Power Company has been incorporated, with a capital stock of $80,000,000, as a holding company to take over all the electric light, power and street railway systems in the northwestern part of Washington. Besides holding existing plants and properties, it is the intention of the company to continue interurban and power extensions now planned and to promote further extensions that will culminate in a continuous line of interurban railway from Vancouver in British Columbia to Portland, Ore., with a service to the Grays Harbor towns.

SPOKANE, WASH.—Articles of incorporation have been filed for the Big Bend Light & Power Company, with a capital stock of $300,000. The Montana office is located at Whitefish. E. Meesinger is the Montana agent.

WALLA WALLA, WASH.—The Washington Traction Company has been chartered, with a capital stock of $3,500,000 to construct a system of electric railways radiating out of Walla Walla to various towns in the eastern parts of Washington, Oregon and Idaho. The incorporators are Gilbert Hunt, B. C. Holt, J. B. Catron, J. C. Armstrong and J. L. Hundro.

HINTON, W. VA.—The Hinton Street Car & Transportation Company has been chartered with a capital stock of $50,000 by James T. McCreery, W. H. Sawyers, and others, of Hinton. The company proposes to construct a railway from Hinton, via Union, Avis and Red Sulphur Springs, to the N. & W. and Virginia railways, at the mouth of East River, Mercer County.

MARLINTON, W. VA.—The Marlinton & Stony Creek Mutual Telephone Company has been chartered to construct and maintain a telephone line between Marlinton and Laurel Creek. The incorporators are P. L. Carter, T. S. Dulany and others of Onoto, W. Va.

WHEELING, W. VA.—The Warwood Water & Light Company has filed articles of incorporation with a capital stock of $50,000. The incorporators are: B. W. Peterson, R. J. McCullogh, John A. Logan, and others.

ALAMENA, WIS.—The Alamena Farmers' Telephone Company has been incorporated, with a capital stock of $8,000, by G. R. Walter and others.

BOARDMAN, WIS.—The Boardman Rural Telephone Company has been incorporated with a capital stock of $3,000 by H. Robinson, James McHenry, Thomas Tobin and August Swanke.

LADYSMITH, WIS.—The Rush County Rural Telephone Company has been incorporated, with a capital stock of $8,000, by S. M. Alvey, E. C. Campbell, C. Joyner, Alden Laidlaw and G. B. Goocher.

NEW AUBURN, WIS.—The New Auburn Telephone Company has filed articles of incorporation, with a capital stock of $4,000. The incorporators are H. McCormick, G. M. Engebretson, A. J. Amundson, G. E. Hutchinson and C. E. Bitney.

DRUMMONDVILLE, QUE., CAN.—The Drummondville Telephone Company has been incorporated with a capital of $20,000. The directors are N. Garceau, A. O. Duclos and O. Brouillard, all of Drummondville, Que., Can.

Personal.

SIR EDWARD CLOUSTON, of Montreal, Que., Can., has been elected a director of the Kaministiquia Power Company, of Fort William, Ont.

MR. JOHN J. CARTY has received from the Emperor of Japan the decoration of the Order of the Rising Sun in recognition of engineering services rendered to Japan.

MR. J. G. GLASSCOE, of Hamilton, Ont., Can., has been appointed assistant power engineer in connection with the civic power development at Point du Bois, now being undertaken by the city of Winnipeg, Manitoba.

MR. RAY H. TABER has been elected chairman of the Worcester Polytechnic branch of the American Institute of Electrical Engineers, and will attend the Frontenac Convention as a delegate of the branch. Mr. Taber is a post-graduate student in electrical engineering.

MR. NICHOLAS I. QUINT, who has been superintendent of the municipal light plant in Peterboro, N. H., for the past three years, has resigned. Mr. Carey A. Walbridge, who has been assistant at the plant for some time, has been appointed superintendent to succeed Mr. Quint.

PROF. KENGO MAKINO, of the department of electrical engineering, University of Waseda, Tokyo, Japan, is now on his way home via Europe, after about a couple of years spent at Cornell in post-graduate work. He sails this week, but has been visiting Columbia, Stevens and other institutions before his departure.

DR. A. E. KENNELLY was one of the delegates representing Harvard University at the inauguration on Monday of Dr. MacLaurin as president of the Massachusetts Institute of Technology. Dr. Kennelly served in a similar capacity for the Finsbury Technical School, London, at the inauguration of Dr. Pritchard some years ago.

MR. KENNETH W. ENDRES, who for the past four and one-half years has been with the engineering department of the American Telephone & Telegraph Company in Boston and New York, has resigned from that company to accept a position in the Pennsylvania sales office of the Electric Storage Battery Company at Philadelphia.

MR. M. B. HUFF has been appointed general sales agent of the Garwood Electric Company. Mr. Huff is a well-known power engineer in central station circles, having been for six years connected with the Philadelphia Electric Company, and for the past two years with the United Electric Company. Mr. Huff's office will be at Garwood, N. J.

MR. MARTIN J. INSULL, general manager of the Louisville & Northern Railway & Lighting Company, has been appointed operating manager of the Indianapolis & Louisville Traction Company, with headquarters in New Albany. He succeeds Mr. W. S. Kuhn, of Pittsburgh, who has been the operating manager since the resignation of Mr. A. A. Anderson a year ago.

MR. KARL M. WAY, E. M., formerly assistant engineer, Fuel Testing Branch, U. S. Geological Survey, engaged in mine inspection, mine sampling and studies of coal preparation in all important coal fields of the United States, has recently been appointed assistant mining engineer upon the staff of the Fuel Engineering Department of the Arthur D. Little Laboratory of Engineering Chemistry, Boston, Mass. Mr. Way is a graduate in mining engineering of the Ohio State University.

MR. ARTHUR WILLIAMS, of the New York Edison Company, has been elected a director of the Museum of Safety & Sanitation, his colleagues being Judge Elbert Gary, Richard Watson Gilder, Professor Irving Fisher and Commissioner of Health Darlington. He and Mr. T. C. Martin have also been made members of the American section of the Ninth International Congress of Improved Dwellings, to be held at Vienna, May, 1910; and a special request is made for all data bearing on the use of electricity affecting the home comfort of artisans.

MR. R. H. MANAHAN, the city electrician of Los Angeles, Cal., is now visiting the East and is making a special expert study of all the new developments in street lighting as exemplified in Chicago, New York and particularly in Boston. He finds much that is new and interesting. Los Angeles has some 6 miles of low-post lighting with 616 post, of carbon lamp clusters averaging about 700 watts per cluster, the posts varying in style. Mr. Manahan will spend two or three weeks before going home. The street lighting contract of Los Angeles is renewable next year.

MR. PERRY BARKER, M. S., member of the American Chemical Society, recently assistant engineer U. S. Geological Survey at the fuel-testing plants at St. Louis and Jamestown, and later at the experimental gas plant, Ann Arbor, in charge of tests of gas coals, has been made assistant chemical engineer on the staff of the Fuel Engineering Department of the Arthur D. Little Laboratory of Engineering Chemistry, Boston, Mass. Mr. Barker, who is a graduate in chemical engineering of the University of Illinois, was formerly chemist to the Peabody Coal Company, Chicago, and research chemist at the Illinois State Engineering Experiment Station.

MR. LEWIS B. SHARP, who resigned recently as general manager of the Queens Borough Gas & Electric Company, of Far Rockaway, L. I., was given a banquet at the Manhattan Beach Hotel on June 1, when 40 of the officers and force were present. Mr. Sharp has of late been very successful in real estate development in the Rockaways, and is now giving his whole time to such work. At the dinner he was handed a very substantial check by President Carleton Macy on behalf of the company, accompanied by a handsomely engrossed record of his work in the lighting field since 1884. Then his fellow-employees presented him with a beautiful silver loving cup bearing an appropriate inscription.

MR. C. F. PARKER, general purchasing agent for the Illinois Central Railroad, was the speaker at the meeting last week of the Chicago Electric Club and discussed the effect of recent extreme action by the interstate commerce commissions. He made the statement that the surplus of one of the most prosperous railroads had been entirely wiped out in 1908 and that its earnings barely paid the interest on its bonds and the dividends on the stock. He also touched on the general movement which is now taking place to educate the public to remedy this condition of affairs. He solicited the earnest co-operation of the business men whose livelihood is so largely dependent on the railroads for their business.

MR. J. R. BIBBINS, who since 1902 has been associated with the Westinghouse interests at Pittsburgh, Pa., recently serving the Westinghouse Machine Company as commercial engineer, after June 18, will become associated in the work of the Public Service Commission of New York as assistant to Mr. B. J. Arnold, consulting engineer and director of appraisals. Mr. Bibbins is a graduate of the University of Michigan, and has served in various technical capacities with the Detroit Public Lighting Commission, the Detroit Edison Company and the Detroit United Railways Company, in operating and construction work. During his late connection with the Westinghouse Machine Company Mr. Bibbins' work

has included an intimate association with the development of prime movers at East Pittsburgh, including gas engines, producers, turbines and condensers. His new offices will be in the Tribune Building, City Hall Square, New York.

Obituary.

MR. CHARLES W. DOUGLAS, who is said to have been the first telegrapher to receive messages by sound, died in Wayne, N. J., May 31, at the age of 75 years. In 1851 he was appointed train dispatcher for the Erie Railroad, and in later years held important positions on other railroads.

MR. IRVING LOVERIDGE.—A cable dispatch from Berlin announces the death in that city June 4 of Mr. Irving Loveridge, general European superintendent for the Western Electric Company, at the age of 49 years. Mr. Loveridge was born in Rochester, N. Y., in 1860 and was graduated from the University of Rochester in 1882. He was employed by the Western Electric Company from 1882 to 1892, and was afterward manager of the Bell Telephone Manufacturing Company in Antwerp. Mr. Loveridge's headquarters were in London, and he was on an annual inspection tour of the Western Electric Company's continental offices at the time of his death. The remains will be taken to Rochester for burial. Mr. Loveridge was a member of the A. I. E. E. He is survived by his wife.

MR. CHARLES L. BUCKINGHAM, well known as an inventor in the field of telegraphy and as a patent lawyer, died at his home in New York City May 31, after an illness of about five weeks. Mr. Buckingham was born at Berlin Heights, Ohio, Oct. 14, 1852, and was educated at the University of Michigan and Columbia University. He was for many years counsel for the Western Union Telegraph Company, and was the inventor of a typewriting system of telegraphy which was used on that company's lines for a time. He was also counsel for the General Electric Company, the Westinghouse Electric & Manufacturing Company, the Edison companies, and other electrical interests, and was one of the counsel in the suits involving the Tesla patents. Mr. Buckingham was one of the five who purchased for donation to the Library of the American Institute of Electrical Engineers a valuable classified collection of all U. S. electrical patents issued down to 1891, numbering over 100 volumes. Two sons survive him.

Trade Publications.

FIREPROOF WIRING SYSTEM.—A. I. Goldschmidt, of New York, has patented a type of wiring system, consisting essentially of rigid uncovered conductors continuous throughout the building to be wired, permanently separated from each other and from a rectangular metal conduit resembling a mail chute, in which they are contained, and in which are also mounted the distributing, controlling and safety appliances. He describes his system in an eight-page pamphlet.

STORAGE BATTERIES.—The Standard Electric Accumulator Company of New Jersey in its latest bulletin describes the S. E. A. battery. This has the same chemical properties as well as the good qualities of the lead accumulator; but instead of grids, has thin and very porous porcelain plates which completely enclose the active material and its electrode. Some general instructions on the care and operation of storage batteries are included in the bulletin.

Business Notes.

THE LORD ELECTRIC COMPANY [illegible] a contract for nearly $500,000, which includes among other material its laminated soldered rail bonds. This is one of the largest contracts ever closed by this company.

MR. ALEX. HENDERSON is just home in New York after an 18,000-mile circular trip in the interests of Circular Loom. He begins circulating again on Wednesday. Altogether he brings back a cheerful report of the general outlook, especially in the Southwest.

TAYLOR MECHANICAL STOKERS.—The Stone & Webster Engi[illegible] Windlass Company, Providence, R. I., for three Taylor mechanical stokers for installation at the Dallas Electric Light & Power Plant, for which six similar stokers were previously purchased.

THE O'BRIEN ELECTRIC COMPANY.—The property of the O'Brien Electric Company, of Philadelphia, Pa., was sold at a receiver's sale May 20 to William P. Fairman, of Fairman & Company. The company was capitalized at $1,500,000 and was incorporated under the laws of Arizona in 1906 for the purpose of manufacturing a new tubular electric light bulb. It is said that Mr. Fairman proposes to continue the manufacture of the lamps. Harry D. Wescott acted as receiver.

THE MOORE ELECTRICAL COMPANY has just finished an installation in the United States Government Bureau of Standards, Washington, D. C., consisting of two tubes, one white and the other yellow. Various tests will be made, the most important of which, however, is to test the claim that the average color values of the Moore white tubes are as nearly the equivalent of average daylight as will ever be obtained, and that it should, therefore, be adopted as the standard light for color values.

THE FEDERAL SIGN SYSTEM has recently opened a branch office at 1230-1231 Syndicate Trust Building, St. Louis, Mo. This makes eight offices in all which this company now maintains—one in each of the following cities: New York, Cincinnati, Kansas City, Philadelphia, Louisville, New Orleans, St. Louis and Chicago. In each of these cities the Federal Sign System (electric) has developed a considerable sign-renting business as well as a large sales business of electrical fixtures of all kinds.

THE BOSTON INSULATED WIRE & CABLE COMPANY has its new factory in the Dorchester district, now building by the Aberthaw Construction Company, of Boston, well under way. On account of its location on a soft marsh, it was necessary to drive piles. These were capped with reinforced-concrete footings and piers, which support the first floor. The latter serves as a platform for carrying the superstructure of the building. This design saves the expense of all wall foundations and the whole structure is carried on well-distributed piers.

ALFRED T. MOORE, Philadelphia, has established a sales agency with Mr. Frank W. Pardee, 56 Fifth Avenue, Chicago, who will carry a stock of insulated wire, telephone cords, etc. Mr. Pardee has been connected with the telephone and electrical business for about 12 years, during which he has formed a wide acquaintance in the trade. Alfred F. Moore's concern is one of the oldest manufacturers of insulated wire in the country and it will doubtless be gratifying to many Western companies to know that they can obtain from Chicago stock Moore's standard line of telephone receiver cords, switchboard cords, jumper wire, junior jumper wire and other classes of well-known Moore goods.

THE MACBETH IRON COMPANY, of Cleveland, engineers, founders and machinists, builders of blowing engines, etc., and the Bruce-Meriam-Abbott Company, also of Cleveland, builders of gas engines, were consolidated on June 1, the name of the new company being The Bruce-Macbeth Engine Company. The Macbeth Iron Company dates from the year 1870, having been known until late years as Macbeth & Company. The Meriam-Abbott Company, predecessors of The Bruce-Meriam-Abbott Company, was organized in 1900, and has been one of the pioneers in the manufacture of commercial gas engines and its development. It is the purpose of The Bruce-Macbeth Engine Company to continue the business of both of the former companies on a much larger scale than before. The manufacture and development of the gas engine will be continued and the former line of work of The Macbeth Company will be conducted as heretofore. The new company will concentrate the two present plants at the former plant of The Macbeth Iron Company, on Center Street, N. W., Cleveland. Alterations to the present buildings will be made and several new buildings will be erected to accommodate the enlarged business, and the combined equipment of the two companies in one plant will make a very complete and modern shop. The officers of the company are as follows: President, W. C. Bruce; vice-president, C. W. Kelly; secretary and treasurer, C. J. Snow; manager, C. E. Curtiss. The above, with A. D. Macbeth, J. B. Meriam and F. B. Abbott, constitute the board of directors. Mr. Bruce, president, was formerly president of The Bruce-Meriam-Abbott Company; Messrs. Kelly, Snow and Curtiss retain the [illegible]

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE [illegible]

[illegible] Wm. P. [illegible] Pat. Atty. Rooms 58 N. Y. City.

923,[illegible]. STARTING DEVICE FOR ELECTROMOTORS. K. Von Dreger, Berlin, Germany. Makes use of an operating handle with a [illegible]

923,[illegible]. SEPARABLE ELECTRICAL PLUG. H. Hubbell, Bridgeport, Conn. [illegible]

923,[illegible]. CIRCUIT CLOSER FOR RECORDING ANEMOMETERS. [illegible]

923,[illegible]. AUTOMATIC MOTOR CONTROL. H. [illegible] Schenectady, N. Y. [illegible]

923,[illegible]. [illegible] CURRENT COLLECTOR FOR ELECTRIC CARS. [illegible] Mertens, Blasewitz, near Dresden, Germany. App. filed Feb. 12, 1908. Comprises an arm with a wide flat curve collector bar rigidly [illegible]

923,202. RELAY AND METHOD OF MAKING THE SAME. J. S. Peveart, Schenectady, N. Y. App. filed Aug. 24, 1907. A current [illegible] other.

[illegible] LIGHTNING ARRESTER. MAURICE W. WEST, Albany, N. Y. [illegible]

923,276. KLEAN, A. S. Cubit, Schenectady, N. Y. App. filed May 22, 1908. The actuating coil is energized from a circuit in which the current varies and a second coil produces a field in opposition to that of the first coil.

923,284. SOCKET LOCK FOR INCANDESCENT LAMPS; A. L. Lowe, Denver, Col. App. filed May 13, 1907. To avoid stealing incandescent lamps by providing a locking device which locks them to their sockets.

923,296. AUTOMATIC ELECTRIC BLOCK SIGNAL SYSTEM; H. W. Price, Toronto, Ontario, Canada. App. filed March 21, 1907. The block is divided into sections and a signal is carried in the engine cab.

923,311. ELECTRIC MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed March 1, 1907. The motor is of the commutator type with series field. Makes use of a laminated stator with polar projections magnetizing coils in the spaces between the poles, a distributed winding on the pole faces and a rotor with coils of a fractional pitch.

923,312. SINGLE-PHASE MOTOR CONTROL; E. F. W. Alexanderson, Schenectady, N. Y. App. filed Aug. 6, 1908. The motor is of the commutator type with exciting and compensating windings on the stator, and is provided with a suitable controller, with auxiliary controller for short circuiting the armature when starting under heavy load.

923,319. ROTARY ORE EXTRACTOR; J. O. Blackburn, Chloride, Ariz. Ter. App. filed Nov. 28, 1908. A rotary drum horizontally arranged carries the gold or silver which is to be extracted by amalgamation with mercury.

923,327. ELECTRICAL CONNECTION ROSETTE; J. L. Burton, Plainville, Conn. App. filed Oct. 17, 1908. The upper member is threaded externally and the lower member is connected thereto by a threaded coupling sleeve.

923,338. GROUND LEG CONNECTION FOR ELECTROLYTIC ARRESTERS; E. E. F. Creighton, Schenectady, N. Y. App. filed July 9, 1907. For high-voltage lines, in which an electrolytic condenser is placed in each phase connection and an auxiliary condenser of smaller capacity is connected in the ground connection.

923,385. TELAUTOGRAPH; G. S. Tiffany, Summit, N. J. App. filed July 6, 1906. Improvements on 668,889, etc.

923,411. MANUFACTURE OF ZINC-DUST; S. O. Cowper-Coles, London, England. App. filed Aug. 2, 1907. Electro deposits zinc in a spongy form and dries it in a reducing atmosphere.

923,425. DEVICE FOR SINGEING THREADS; G. Gin, Paris, and V. Courtecuisse, Lille, France. App. filed March 22, 1907. Makes use of a series of wires which are heated electrically and passed over the cloth to singe it.

923,439. ELECTRIC CUT-OUT; T. E. Murray, New York, N. Y. App. filed Jan. 13, 1909. The locking seal may be released and the fuse cases removed simultaneously or separately.

923,466. COMBINED FUSE AND SWITCH BOX; W. R. Vanaman, Atlantic City, N. J. App. filed June 10, 1908. A combined fuse and switchbox which permits of ready insertion and removal of a fuse without spading the third-rail shoes.

923,484. SUPPORT FOR CONTACT PLOWS; S. T. Bole, Philadelphia, Pa. App. filed June 24, 1908. Secures the plow in any desired position without interfering with the brake or motor mechanism.

923,488. PRINTING TELEGRAPH; H. W. Bull, Springfield, Mass. App. filed April 17, 1908. Improvements in the transmitting and receiving devices of a printing telegraph.

923,499. SIGNALING MEANS FOR TELEPHONE SYSTEMS; F. S. Davenport, Atlanta, Ga. App. filed April 30, 1907. Common battery private line telephone system having a plurality of signaling devices and an interrupter at the subscriber's instrument acting to cause a single tap at the bell.

923,508. VIBRATOR; M. K. Golden, San Francisco, Cal. App. filed March 28, 1908. The solenoid is bodily movable and rapidly vibrated so as to strike against the inside of a spherical shell producing the sound.

923,540. TROLLEY; H. Lietz, Pittsburgh, Pa. App. filed Jan. 9, 1909. A trolley replacing device, having replacing arms pivotally carried by the sides of the harp and extending above the wheel.

923,581. PROCESS FOR THE PRODUCTION OF CARBON-COVERED METAL SHEETS FOR DYNAMO BRUSHES; J. F. P. Ringsdorff, Essen-on-the-Ruhr, Germany. App. filed July 14, 1908. Produces carbon-covered metal sheets by smearing a carbon paste on the surfaces of the sheets and subjecting them to high pressure.

923,597. ELECTRICAL CONTROLLER; H. A. Steen, Edgewood, Pa., and A. J. Logan, Wilkinsburg, Pa. App. filed Sept. 3, 1907. An operating arm with a manually actuated latch and means for actuating the same carried by the arm for preventing the movement of a controller past the "off" position without bringing the handle to stop at said position.

923,598. INSULATED HANGER; L. Steinberger, New York, N. Y. App. filed April 28, 1903. Comprises a bell-shaped support open at the top and having a flange at the bottom and also having lugs forming a circle, with insulating material mounted therein.

923,601. TROLLEY STAND; E. W. Stull, Norwood, Ohio. App. filed Feb. 13, 1908. Has a low base with three sets of springs to hold the trolley to the wire.

923,603. TELEPHONE APPARATUS; W. H. Taylor, Stamford, Conn. App. filed Aug. 22, 1908. Provides an auxiliary magneto receiver which can be used in addition to the main receiver with a long-distance line.

923,614. ARMATURE CONSTRUCTION; B. A. Behrend, Norwood, Ohio. App. filed Sept. 19, 1904. Provides for the flux passing through the armature between any two field poles, paths of different lengths, but of equal reluctances, so that a substantially uniform flux density in the armature is obtained.

923,615. DYNAMO-ELECTRIC MACHINE; B. A. Behrend and E. Matt man, Norwood, Ohio. App. filed March 31, 1906. The dynamo has a stationary armature and a rotary field member comprising a spider with a rim and outwardly projecting field magnets secured thereto with fan segments secured to the rim to ventilate.

923,627. VOLTAGE REGULATOR; F. Conrad, Swissvale, Pa. App. filed Jan. 5, 1907. For supplying constant voltage by adjusting the field strength of the exciter of the generator.

923,637. TELEPHONE APPLIANCE; M. P. Flack, New York, N. Y. App. filed Dec. 16, 1908. Surrounds the transmitter with a seal for the mouth so as to prevent the sound from reaching others in the room and overhearing the conversation.

923,642. FUSE-PLUG; G. W. Goodridge, Bridgeport, Conn. App. filed Dec. 22, 1908. Relates to the Edison fuse plug so as to eliminate strain upon the joint between the shell and the fuse strip.

923,646. SAFETY GAS APPLIANCE; F. Grott, New York, N. Y. App. filed Jan. 18, 1909. Oppositely disposed self-closing valves are carried by the casing and an inflammable thread connects the valves and holds them open and an ignitable pellet is located within the casing near the thread. Is placed in a mine to give warning of fire damp.

923,653. AIR OR WATER BLAST MAGNET; J. D. Hilliard, Jr., and C. L. Parsons, Glens Falls, N. Y. App. filed Jan 29, 1906. A lifting magnet is provided with means for blowing air or water through it so as to clean off the face of the magnet.

923,666. PROTECTIVE DEVICE FOR COMMUTATOR TYPE ALTERNATING-CURRENT MOTORS; B. G. Lamme, Pittsburgh, Pa. App. filed June 30, 1904. In combination with a constant-speed commutator type of motor, of an interrupter, of a field magnet circuit which is opened quickly after a predetermined interval of time after the armature circuit is broken.

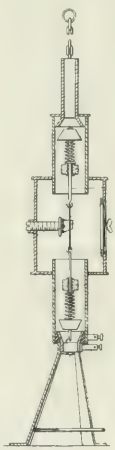
923,667. WINDING FOR ELECTRICAL MACHINES; B. G. Lamme, Pittsburgh, Pa. App. filed June 2, 1905. Winding for magnetizable cores having partially closed slots, the conductors being arranged in the slots in a plurality of layers separately insulated with an uneven number of groups per layer.

923,673. DYNAMO-ELECTRIC MACHINE; C. E. Lord, Norwood, Ohio. App. filed May 17, 1906. Dynamos with inwardly extending field poles, the poles having parallel ventilating passage ways at right angles to the axis of the machine.

923,686. PROTECTIVE CONDUIT HOLDER FOR ELECTRICAL CONNECTIONS; J. F. McElroy, Albany, N. Y. App. filed Sept. 11, 1908. An electric heater having insulated ends, with a heating coil between the ends and a rod extending through the coil and binding the parts of the heater together.

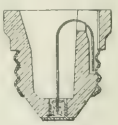
923,699. WIRELESS TELEGRAPHY; G. W. Pierce, Cambridge, Mass. App. filed Oct. 17, 1906. A tuning apparatus for wireless having a variable inductance coil connected with the antenna and a high-frequency transformer having a variable primary coil in series with the inductance coil.

923,700. RECTIFIER; G. W. Pierce, Cambridge, Mass. App. filed Feb. 20, 1907. For rectifying alternating-currents for charging storage batteries by using an interrupter and a symmetrically conductive solid in a derived circuit to rectify and distort the alternating current therein.

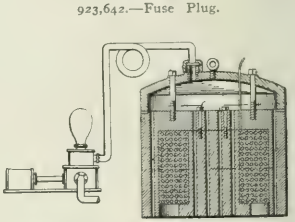


923,646. — Safety Gas Appliance.

923,702. INTERLOCKING SWITCH AND SIGNAL SYSTEM; E. K. Post, Harrisburg, Pa. App. filed July 29, 1908. The combination of a power interlocking switch lever and connections and a mechanical switch or signal lever or connections using the same common machine for interlocking.



923,642.—Fuse Plug.



923,653.—Air or Water Blast Magnet.

923,745. PURIFICATION OF POROUS MATERIAL; W. R. Whitney, Alplaus, N. Y. App. filed Jan. 17, 1906. Removes zinc chloride from celluose by washing the latter and passing a current through the solution.

923,753. ALTERNATING-CURRENT MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed May 1, 1907. Dynamo of the commutator type. Connections short circuit the rotor on a definite line and the stator winding has coils arranged in conjunction with the rotor to produce a flat-topped field in the direction of the line of the rotor short circuit and other coils produce a cross field.

923,754. ALTERNATING-CURRENT MOTOR; E. F. W. Alexanderson, Schenectady, N. Y. App. filed July 15, 1907. For commutation over a wide range of speed. Starts it as a repulsion motor with the armature short circuited, including an inductive winding in the armature short circuit for low speeds and a shunt voltage in the short circuit for high speeds.

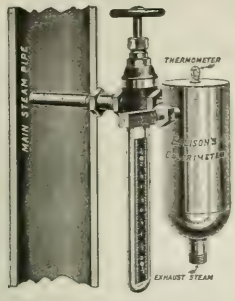
923,774. ELECTROLYTIC CELL OR CONDENSER; E. E. F. Creighton, Schenectady, N. Y. App. filed Sept. 18, 1907. Comprises a plurality of oxidizable cups separate by an electrolyte containing citric acid.

923,796. BLOCK SIGNAL SYSTEM FOR ELECTRIC RAILWAYS; M. E. Launbranch, Chicago, Ill. App. filed Dec. 14, 1905. For electric railways making use of a single signaling wire between the blocks.

923,797. INCANDESCENT LAMP; R. McNeill, New York, N. Y. App. filed March 19, 1908. An anchor for a stretched filament having an eye with an extension yieldingly engaging the interior of the tube.

923,800. TRACK CONSTRUCTION AND ELECTRIC SIGNALING AND CONTROLLING EQUIPMENT THEREOF; G. Thompson, Milton, Conn., and W. H. Merchant, New York, N. Y. App. filed Feb. 27, 1905. For communicating to a second conveyance passing along the track and equipped with an electric signal-receiving device a primary danger signal indicating the occupancy of the track by the first conveyance.

12,924. PROCESS OF MAKING GRAPHITE; E. G. Acheson, Niagara Falls, N. Y. App. filed April 9, 1909. Introduces into the electrical furnace a mass of petroleum coke and also introduces therein oxide of iron, heats by means of a current which vaporizes the iron, forming a carbide, and graphitizes the carbon.



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Future Requirements of Central Stations.

Prophecy after the fact is somewhat dangerous, but Mr. Torchio in his Atlantic City paper dealing with future conditions in central stations, has conservatively confined his forecasts to a period within relatively easy reach. He brings out some extremely interesting facts, especially with respect to probable improvements in load factor as based on present practice. It is somewhat startling to realize that in a great system like that of the New York Edison Company, 97 per cent of the total yearly output is produced by 50 per cent of the total generating apparatus, while the remaining 50 per cent is necessary merely on account of peak loads amounting to but 3 per cent of the annual output. The general public is very slow to realize the burden which these peak loads put upon the central station, and the consequent reasonableness of systems of charging which take account of the severe requirements of this peak service. The improvement in the general load factors for this same company, as tabulated by Mr. Torchio, is discouraging, and indicates very plainly the direction which active efforts should take in the near future to improve so bad a condition. In a large way this is the basis of Mr. Torchio's most important forecast, which is the organization of combination systems involving perhaps water-power, steam and gas engines with accumulators, so as to decrease the cost of power during the peak and to facilitate operation under more efficient conditions. One interesting bit of prophecy is the suggestion that gas engines with producer gas may become important factors in large central-station work. Though the smaller central stations now generally recognize the value of such plants, they appear to be looked at askance by the larger central stations. Nevertheless, they present excellent possibilities in the way of stored energy as an aid in carrying the peak and cannot longer be put aside without serious consideration. The steam accumulator to serve a similar function has not been so thoroughly tried, although Mr. Torchio speaks of it encouragingly, as he also does of considerably increased storage-battery installations for the same object. It would have been most interesting had he been able to give us, so far as could be ascertained from present data, a comparison based on cost between a given storage capacity for use during the peak as obtained by accumulated steam and accumulated electricity.

The Accounting Department.

While the first separate accounting program was presented at the 1908 convention of the National Electric Light Association, the accounting department, by holding separate sessions, assumed more importance in the proceedings this year than last. This is apparently due in part to the realization by company officials of a need for better accounting methods and in part to the conditions which have arisen as a result of the greater participation of State commissions and other public authorities in corporate affairs. The central-station accounting department should be placed on a plane in accordance with the importance of its

functions; and in view of the increasing understanding of this fact, it is not surprising that discussion has already been started concerning the advisability of creating a distinct section of the association to consider the problems that arise, not only in office accounting management, but also in the public relations which recent laws and the attitude of investors and consumers promise for the future. Why the work of the men especially concerned in the accounting department has not always received in the past the recognition which it deserves may be ascribed to one or more of several reasons. Undoubtedly, the management of many companies failed to comprehend in the early history of the industry the fundamental principles of accounting and the importance of their practical application. The average general manager is interested chiefly in the departments which produce direct revenue. This is not an unnatural trait of humanity because one of the simplest facts of life is that without gross revenue, no business or no individual can be maintained. With gross revenue obtained, it then becomes a question of proper regulation of expenditures and the preservation of a surplus above expenses and interest on the investment. But those who look beyond the success which gross revenue appears to assure, understand the necessity for equally close study of the expenditures and the methods of accounting therefor.

Although it should no longer be countenanced, the practice of figuring gross revenue, calculating the necessary outgo and assuming that the balance is profit, is still followed. Like everything else in this world, accounting, after all, is governed by common sense. Yet accounting methods may be so lax that no information will be available to indicate the real standing of a property. It is, of course, due to stockholders and bondholders of enterprises that no statement of accounts should be rendered that is not as nearly perfect as a management of integrity can make it. While many questions that arise in the accounting work of a large corporation are for the executives or board of directors to determine, it may be found to be the fact that these men are misled by the statements presented to them. It is for the accountant to explain the meaning of the figures which he arrays. If the management is informed that an apparent showing of net earnings is not a true statement because of a failure to take into account a liability for depreciation, it will have information of a character which, although vital, was not appreciated by some companies in the early years of the electrical industry. If any proof were needed of the importance of the accountant in electrical properties, it would be furnished by the articles which have appeared recently in these columns regarding the accounting systems prescribed for public utilities of Wisconsin and New York, and particularly by the article in last week's issue discussing the merits of the classification prescribed by the New York commission.

If the commissions assume control over the issue of securities and questions of service and rates, their action on every vital aspect of these topics must find its justification or the reason for its rejection in a final analysis of the accounts. If these have been kept in accordance with the prescribed system or follow correct and approved methods, they provide evidence that is incontrovertible. Whether the authority of the accounting department is great, as it should be, or is seriously abridged as is unfortunately still the case in many properties, no company that is in touch with the movement for regulation which has attained such power can afford to neglect to effect reformation that will place it in step with the new standard of corporate integrity.

The Efficiency of Asynchronous Machines by the Hopkinson Method.

The great advantage of the Hopkinson method of testing direct-current generators and motors is that it operates them under rated-load conditions, without having to waste the actual power. If a direct-current generator of one megawatt capacity (1000 kw) is tested alone, under conditions of rated load, the full megawatt has to be absorbed, somehow, in machines or dead resistance, and the full energy plus losses have to be supplied to the generator shaft from a prime-mover. The same conditions apply to a direct-current motor of one megawatt under the modifications pertaining thereto. But if the megawatt generator be coupled mechanically and also connected electrically to the megawatt motor, the combination machine can be run under rated-load conditions, but with only the losses, or, say, 100 kw, supplied to the system from an external source. The generator will give its rated megawatt at terminals, and the motor will take this megawatt at its terminals, while a relatively small machine will serve to drive the pair. This is the well-known Hopkinson method. It requires the use of two similar machines. When only one machine has to be tested it is necessary to fall back upon test by losses, or else a full input-output test. The Hopkinson method was originally designed and published by its inventor in connection with direct-current shunt machines. It has since been extended both to synchronous alternators and to transformers, by Hopkinson himself. It has likewise been extended by others to direct-current series machines, and to synchronous alternating-current machines. An excellent article on its application to synchronous induction machines is contributed by Mr. Stanley P. Smith, this week, on page 1533. The article deserves careful reading, as an interesting extension of the Behrend circle diagram of the induction machine to the particular case of a pair of like machines mechanically and electrically coupled.

The article develops the circular diagram of the test as a mere ladder to the details of the method resulting therefrom. After this method has been reached, the ladder is dispensed with, and the test on a pair of coupled induction machines may safely be conducted without preparation of, or reference to, such a diagram. The two machines are electrically connected on the primary sides to each other and to the supply mains. They are also coupled asynchronously—i.e., by a belt driven over a pair of pulleys having slightly unequal diameters. Power given to the motor is measured, as well as that yielded by the generator, and that consumed in the generator external secondary circuits. From these data, after correcting for belt losses, the efficiency of each machine is very easily computed. Incidentally, it may be noted that the method offers an excellent opportunity for determining belt losses at different loads. It is pointed out in the article that there is always a small slip in even the best regulated belt. Only a sprocket-chain is slipless, and that has troubles of its own. Ordinarily, electrical engineers are accustomed to measure belt losses under no-load conditions, and then to assume, with grateful complacency,

that these belt losses are practically the same under all loads. Bending power and windage may be nearly constant under all loads; but a steadily increasing loss in friction, both internal and against the driving pulley, occurs in the belt as the load comes on. The methods indicated in the article seem to lend themselves very well to the measurement of such load losses in belts, and there is room here for a large engineering research.

On the other hand, it is true that the belt-loss test could be carried on by the aid of the Hopkinson method on synchronous machines, say, direct-current shunt machines, provided that the difference in the speeds of generator and motor is measured with sufficient care. Either a differential mechanical arrangement might be used, or a stroboscopic fork could be employed. A stroboscopic fork, when used to measure with precision the speed of a pair of belt-connected machines, indicates that the speed of the driven machine is less nearly uniform than that of the driver. The speed of the driving machine, if operated on a storage battery, may be practically uniform, whereas the speed of the driven machine, if it carries load, is seen to be not only slightly less than that of the driver, but also tremulous, due to the repeated slipping and gripping of the belt. This tremulousness may naturally be greatly increased by slackening the belt, but it exists usually to a clearly perceptible extent even with the tightest belts.

The Use of Reactance Coils in Generating Stations.

When alternators were first employed industrially it was found they had so much internal inductance that not only was their automatic regulation of terminal voltage much poorer than that of direct-current generators under working conditions, but also their short-circuit current was only about twice their rated load current. Since the advent of steam turbo-alternators this condition of affairs has changed to some extent. The standard frequency of alternation has lowered, while the inductance of the machines has also lowered. The result is that the reactance of the machines has lowered doubly. This is an advantage so far as it goes, because it reduces the reactive drop of voltage in the armature and improves the regulation of the machines. On the other hand, it brings about a correspondingly more powerful short-circuit current if the machines are accidentally short-circuited at their terminals. An alternator is found to possess two kinds of reactance—namely, (1) the simple reactance of self-inductance, and (2) synchronous reactance, which consists of (1) plus the effects of armature reaction, or the demagnetizing influence of its active armature ampere-turns. The synchronous reactance of a modern alternator may be 20 times its self-induction reactance. When a short-circuit occurs suddenly, it is only the self-induction reactance that counts for the first second or so, after which the machine adapts itself to the new condition and the synchronous reactance reasserts its full value. Consequently, a sudden short-circuit at armature terminals may mean a momentary current strength and a torque perhaps 50 times the normal.

The above facts were presented to the recent N. E. L. A. convention in a brief paper by Mr. P. Junkersfeld. The suggestion is made therein that in some cases choking coils should be used in the armature circuits of large alternators to limit short-circuit current and power, as they are used in particular plants already. The objection to these choking coils is their large size, clumsiness, and detrimental effect on the regulation and efficiency of the system. It is much to be hoped that they may not have to be used extensively. If automatic circuit-breakers are inserted in concrete at the base of each alternator all short-circuits in cables to the switchboard should be rendered incapable of destroying the machine.

The Damping of Oscillations by the Resistance of the Air.

In a great variety of electric apparatus, and especially in measuring apparatus, we have suspended systems that are deflected from their initial positions by electromagnetic forces, their motions being checked, either in whole or in part, by the frictional resistance of the air. It is commonly assumed that this frictional resistance is simply proportional to the angular velocity of the motion. The working theory of galvanometers in general, and of ballistic galvanometers in particular, is based on this assumption. One consequence of this assumption is that the ratio of successive swings should be constant, and that the period of swing should also be constant. In a paper recently published by the American Academy of Arts and Sciences, Prof. B. O. Peirce gives the results of a number of photographic records of the oscillations of suspended systems moving in air. It is shown, in the paper, that the behavior of a swinging system is much more complex than is ordinarily supposed. Strictly speaking neither the ratio of successive swings nor the periodic time remains constant.

To fix ideas we may consider the case of a metal globe suspended in draught-free air by a thin torsion wire, and suppose that after the globe has come to a steady position of equilibrium, we start it swinging by a simple impulse of deflection. It is known that if the air were a perfect fluid, without viscocity, the air would offer no resistance to the motion. The air is, however, an imperfect fluid, and possesses viscosity. A certain layer thickness of air adheres to the globe, and swings to and fro with it. The globe behaves then not only as a body whose movement is retarded and whose energy of torsional displacement is gradually given off as heat in the surrounding air, but also as a body whose mass and moment of inertia are virtually increased by the adhering layer of air accompanying the motion. The amount of the increase in mass will vary with the surface character of the globe and also with the speed of the swing. It will be different in long swings at the outset of the motion from that which accompanies very short swings near the end.

If we now substitute for the globe a system of more complex geometrical form, such as a magnetic needle and attached mica vane, the same general conditions apply; but with yet greater complexity. If we suddenly deflect such a needle by an electromagnetic impulse, a system of air particles is built up, mainly during the first swing, so that the behavior during this swing may be very different from that during subsequent swings, when the moving air system has settled down into substantial regularity of form. Consequently, the ordinary assumptions of ballistic galvanometer deflections, above referred to, may hold fairly well after one or two swings have been completed, but the initial impulse cannot safely be inferred from the observations made on subsequent swings. This deduction, arrived at in the paper, should be borne in mind by those who have occasion to use ballistic galvanometers.

Proposed Consolidation of Chicago Elevated Roads Abandoned.

Messrs. Samuel Insull, Ira M. Cobe and E. K. Boisot, constituting the committee having in charge the proposed leasing of all the elevated railroads in Chicago by a new company to be formed for the purpose, have issued a statement in which they say that they do not think it advisable to proceed further with the negotiations, for the present at least. The Northwestern and Oak Park roads were apparently willing to enter into the arrangement, and substantial progress had been made with the Metropolitan Company, but the South Side Company refused to accept the terms offered in the proposed consolidation, and negotiations with that company have been terminated. Inasmuch as the committee does not think it advisable to attempt unification of the elevated roads unless all of the lines are included, the project has been dropped.

Supplementary Report on Chicago Subways.

The final report of the Subway Bureau of the city of Chicago, supplementing the elaborate preliminary report abstracted in the issue of April 1, 1909, has been made public. The report contains four sets of plans for subways for street railways in the central downtown district of Chicago, ranging in estimated cost from $100,000,000 to $112,000,000. Each of the plans is so arranged that it may be made to include, besides the subway itself, galleries for public utilities. The plan which appears to meet with most favor provides for the construction of six through routes. Two of these will connect the North Side and South Side, two the North Side and West Side and the others the South Side and West Side. This plan also contemplates a so-called "depot loop"—a subway which will run around the heart of the city in close proximity to nearly all of the railroad stations. The plans provide for a seating capacity of about 500,000 passengers in the subways. This capacity should provide for the growth of the population of Chicago, at the present rate of increase, until the year 1932. Including standing room, the system will not reach its ultimate maximum capacity until 1950. The plans are not worked out in detail, and as it will be some time before an actual decision is reached in the matter of constructing street-railway subways in Chicago, the proposals are largely tentative in form.

Power Development on Proposed Waterway from Lakes to Gulf.

In a report to Congress from the War Department on the subject of the proposed ship channel from Lake Michigan to the Gulf of Mexico by way of the Chicago Drainage Canal, Illinois River and Mississippi River, a board of army engineers estimates that it will cost $128,600,000 to construct a 14-ft. channel from St. Louis to the mouth of the Mississippi without making an estimate of the remaining part of the route. A waterway 8 ft. or 9 ft. deep is recommended as much more practicable. The board goes into the question of the development of water-power along the channel, particularly in Illinois. It considers that the property owners along the Drainage Canal and the Illinois River are equitably entitled to water-power due to the natural flow alone of the Desplaines and Illinois rivers, and holds that any added power which results from water diverted from Lake Michigan belongs to the people of the United States and Canada.

The army engineers who have studied the subject do not agree in relation to it, however. The board of review, for instance, does not concur in the views of the survey board in relation to ownership by the people of the United States and Canada of the power resulting from the water from Lake Michigan. This board suggests that this matter and also the subject of compensation are subjects for judicial determination, and says: "Should it be determined that the United States owns any water used in the development of water-power, any Government charge made for such use should commence with such use, and should not be deferred until the cost of the plan by which such use is made possible shall have been collected from consumers of the power. Compensation, if any, should be fixed by Congress." It is estimated that 100,000 hp can be developed by the diversion of 10,000 cu. ft. per second. This power is estimated to be worth $2,500,000 a year.

The advocates of the deep waterway are not satisfied with the report, which they say is not only a blow at the project itself, but to water-power development as well. Those who have been opposing the proposal say that the findings of the engineers will have great weight with Congress against the feasibility of the project.

Northwest Electric Light and Power Association.

The Northwest Electric Light and Power Association, recently formed "to foster and protect the interests of those engaged in the commercial production of electricity for conversion into light, power and heat," will hold its first convention Sept. 7, 8 and 9, in the Auditorium Building of the Alaska-Yukon-Pacific Exposition in connection with a district convention of the American Institute of Electrical Engineers. The association has fitted up space in Machinery Hall for the convenience of electrical men visiting the exposition, and has established an information bureau which among its duties arranges for the reservation of accommodation in hotels and private families for electrical visitors.

Membership in the association is confined to Washington, Oregon, Idaho, Montana and Alaska. There are five classes of members, namely: A, private electric lighting companies; B, invited members; C, associate member companies; D, associate members, and E, honorary members. Class B, or invited members, are confined to officers and employees of member companies, elected yearly upon the written recommendation of their respective companies. The officers of the association are as follows: President, Mr. Arthur Gunn; vice-presidents, Messrs. A. Welch, Francis Rotch and Henry Adams; secretary, Mr. Norwood W. Brockett, Cataract Building, Seattle, Wash.

Meeting of National Gas and Gasoline Trades Association.

The National Gas and Gasoline Engine Trades Association will hold a meeting, June 22, 23 and 24, at South Bend, Ind. This association was organized some months ago to advance the interests of the gas and gasoline engine trade, and to promote an acquaintanceship among all those interested in the internal combustion engine. Among the papers to be presented at the meeting are the following: "The Suction Gas Producer for Small Power Plants," by Mr. C. J. Atkinson; "Storage Batteries for Ignition Purposes," by Mr. G. L. Chandler; "A Running Test of a Gas Engine, With Data," by Mr. J. C. Miller; "Water, Its Uses and Abuses in Relation to Gas Engines," by Mr. H. W. Jones; "Gas Engine Construction for Producer Gas Use," by Mr. H. L. Smith; "Science of the Jump Spark Coil," by Mr. J. A. Williams.

There will be opportunity at the Oliver Hotel for the display by manufacturers or dealers of small accessory articles which will not be too bulky to place on tables in the meeting room. An invitation has been extended to the American Gas Power Society and the Gas and Gasoline Engine Manufacturers' Association to attend the meeting. By way of entertainment there will be a trolley ride from South Bend to St. Joseph, Mich., and return. The local Chamber of Commerce has also arranged for an automobile ride and inspection of the factories of the Studebaker Manufacturing Company and the South Bend Watch Company.

Hydro-Electric Development in Sicily.

A paper presented recently before the Italian Electrotechnical Association by Sig. E. Vismaro gives details of a broad scheme of hydro-electric development for the Island of Sicily. The author, who is general manager of the Societa Elettrica della Sicilia Orientale, gives the result of a thorough study of the watersheds and geological formation of Sicily, and arrives at the conclusion that by means of artificial lakes or storage basins the entire island can be supplied with electrical energy generated in a series of hydro-electric plants working in parallel at 40,000 volts. Two generating stations are now being built by the above-mentioned company, one near Syracuse and the other near Taormina. When completed, the former station will contain four 2000-hp units and the latter three 2500-hp units, each unit consisting of a water-wheel direct-coupled to a 50-cycle, three-phase alternator. These two plants will supply the whole eastern coast of Sicily by feeding in parallel a 40,000-volt line extending from Modica to Messina. The distance between the two generating stations is about 72 miles.

Society of Automobile Engineers.

The Society of Automobile Engineers was incorporated last week under the laws of the State of New York. The object of the society is "to promote the arts and sciences connected with engineering and the mechanical construction of automobile vehicles; to hold meetings for the reading and discussion of papers relating to the construction and improvement of automobiles, and to promote social intercourse among its members; to publish and distribute papers and literature relating to the construction of automobiles, and to maintain an engineering library."

There are to be 12 directors and the principal office will be in New York. The incorporators are: Messrs. Russell Huff, of the Packard Motor Car Company, of Detroit, Mich.; Andrew L. Riker, of the Locomobile Company, Bridgeport, Conn.; Henri C. Chatau, of the General Electric Company, Schenectady, N. Y.; B. D. Gray, of the American Locomotive Works, Providence, R. I.; R. C. Carpenter, of Sibley College, Cornell University, Ithaca, N. Y.; Henry Hess, of Philadelphia; F. J. Newman, of Chicago; Alexander Churchward, Horace M. Swetland and Thomas J. Fay, New York.

Helena (Mont.) Hydro-Electric Plants.

Mr. A. C. Pratt, electrical engineer for the Missouri River Power Company, Helena, Mont., recently gave an interesting lecture before the electrical engineering students of the University of Minnesota on "Hydro-electric Plants." His company has in operation, or under construction, three dams in the Missouri River, having heights of 30 ft., 60 ft. and 110 ft., and making reservoirs of 4000 acres, 6000 acres and 7000 acres, respectively. The Missouri River has a minimum flow of about 3000 cu. ft. per second and the reservoirs created by the three dams provide storage capacity of about 21,000,000 hp-hours, which would maintain a steady load of 15,000 hp for more than a month. This makes the company safe in connecting with a load considerably larger than the minimum power of the river.

An interesting phenomenon is that the heat from the sun received in the winter and caught in the reservoirs keeps the water under the ice about 2 deg. above the freezing temperature. A practical point in transmission is to have the transformers for the receiving end of the line wound for a voltage about 15 per cent lower than that at the power house.

The most desirable kind of load in mining districts is given by motors for pumping and crushing. The hoists give a rapidly varying load similar to that of a street railway. Some hoists in the mines at Butte run up to 3000 hp, lifting cars weighing 6 to 12 tons, at a speed of each as 2000 ft. per minute.

Steam power for the mines at Butte costs about $25 per hp-year in large plants and about $200 in small plants. With power at $30 per horse-power per year land can be irrigated profitably, even pumping water to a height of 150 ft. Thus land costing $10 per acre can be made worth $100 per acre at a cost of $5 to $6 for pumping. The yearly evaporation in Montana is about 50 in.

The plant at Canyon Ferry has been in continuous operation since it was built in 1897, power being transmitted 20 miles to Helena and 65 miles to Butte. There are from six to eight short-circuits per year caused by lightning. The trouble from lightning always originates on the plains and never in the canyons. The trouble almost always comes on the topmost wire. About 70 per cent of the line troubles come from outside interference. The insulators on the line are supported by wooden pins boiled in paraffine at 115 deg. C. to 120 deg. C.

Railroad Men Study Electrification.

The New York Railroad Club has appointed a special committee to study the subject of steam railroad electrification, which will render a report of their work for consideration at the annual electrical meeting of the club next March. Following are the members appointed: Mr. W. J. Harahan, assistant to the president of the Erie, New York, chairman; Mr. L. F. Fritch, consulting engineer of the Illinois Central, Chicago; Mr. H. H. Vaughan, assistant to the vice-president of the Canadian Pacific, Montreal; Mr. J. H. Davis, electrical engineer Baltimore & Ohio, Baltimore; Mr. George Wildin, mechanical superintendent of the New York, New Haven & Hartford, New Haven; Messrs. William McClellan, C. O. Mailloux and H. M. Warren, electrical engineers, New York.

The committee is to collate and tabulate such general data as may be of interest to railroad men, and make such suggestions as may appear pertinent to them with reference to the direction in which it would be desirable to have further investigation and information. The Maintenance of Way Association and the American Railway Association are considering the subject of electrification along substantially the same lines, so that within a year there will be available a large collection of practical data on the subject.

A Novel Turbo-Generator Arrangement.

The Albert Lea (Minn.) Light & Power Company is installing a 300-kw Westinghouse steam turbine under rather unusual conditions. This plant has heretofore given only direct-current service. A hot-water heating system is also operated in connection with the plant. As it seemed desirable to put in an alternating-current distribution system for reaching the outskirts of the town with light and power service, the following arrangement of turbo-alternator and rotary converter is being installed:

The 300-kw alternator of the turbo-generator set is a low-voltage machine, the terminals of which are connected through the switchboard to the alternating-current terminals of a 200-kw rotary converter which gives 250 volts direct-current at its commutator. The turbo-generator and rotary converter can be started from a state of rest together. The low-voltage alternator on the turbine shaft will also supply step-up transformers giving 2300-volt, three-phase current for general distribution. This will make a very flexible combination, and one which it is believed will operate more satisfactorily as regards direct-current output than would a direct-current generator of sufficiently high speed to be mounted on the turbine shaft. The turbo-generator when in operation can supply alternating current to the alternating-current distribution system and also can feed into the direct-current distribution system through the medium of the rotary converter. When the turbo-generator is not running, direct current from the other generators in the plant will operate the rotary converter which can feed alternating current through the step-up transformers into the alternating-current distribution system. The steam turbine is to be operated condensing during the summer and in the winter will supply steam at atmospheric pressure to the hot-water heaters for the heating system.

British Illuminating Engineering Society.

As previously noted in these columns, at an inaugural dinner in London on Feb. 9 of this year, it was decided to form a British Illuminating Engineering Society, and an executive committee was appointed to consider the drafting of the constitution of the society, etc. This committee reported at a meeting of the supporters of the society held at St. Bride Foundation Institute, Bride Lane, London, E. C., on May 25, Mr. Charles Hastings being in the chair. The constitution and by-laws drafted by the committee were formally ratified by those present, and the executive committee, forming the nucleus of the first council of the society, was reappointed with the power of adding to its numbers as might be expedient in order that it might proceed with the affairs of the society during the summer vacation. It was also decided that this committee should approach a number of gentlemen, the names of whom were submitted to and approved by the meeting, with a view to their being invited to act as officers or on the council of the society. It was also agreed that the council should be free to elect as members any who intimated their desire to become members of the society, and were duly proposed and seconded in the prescribed manner, without the formality of ballot, up to the beginning of the first session of the society. Mr. L. Gaster, editor of the *Illuminating Engineer*, 32 Victoria Street, London, S. W., is honorary secretary of the society.

Cleveland Industrial Exposition.

The Cleveland Industrial Exposition, which opened on Monday evening of last week, has proved a success far beyond the expectations of the committee of the Chamber of Commerce which promoted it. Not only are the displays far more creditable than anticipated, but the attendance has exceeded expectations, running from 15,000 to 30,000 daily. Had the matter been taken up three months earlier, it is believed that there would have been a large attendance from many States. As it is, visitors from other cities are numerous. Boards of trade and chambers of commerce, as well as civic organizations of other kinds, in a number of cities have sent delegates to the exposition. Several representatives from foreign countries have also been in attendance for the purpose of learning what they could about the products offered in their markets.

The city was handsomely decorated for the occasion and lighting schemes played no small part in this. Lines of electric lamps extend around the Public Square and out both Superior and Euclid avenues to East Ninth Street on both sides. From Superior Avenue they lead down Bond Street to the exposition buildings. The lamps are placed about a foot apart and are connected directly with the lines stretched temporarily between the street lamp-posts. In the middle of the Public Square is a globe made of incandescent lamps, with lines radiating in several directions from it.

The lighting system in the temporary exposition building is also unique. This building has a tent covering, somewhat resembling a circus tent, and the lamps are arranged in what might be termed undulating or serpentine lines. The effect upon one on first entering the building from the balcony is striking. In the Central Armory Building, which contains the textile displays, arc lights are suspended from temporary wood frames attached to the roof beams. In addition incandescent lights are arranged about the building and among the displays in such a manner as to increase the lighting effect. Both buildings are well lighted, and this adds much to the beauty of the display.

Displays of interest to men engaged in the electrical business compare most favorably with those in other lines, both in number and taste in arrangement. Cleveland has grown more prominent during the past few years in the manufacture of electrical equipment and appliances than many other places, and bids fair to remain well abreast in this line in the future. Manufacturers of miscellaneous articles used in this line of work are well represented, also.

One of the handsomest booths in the exposition is that of the Cleveland Electric Illuminating Company. It is located in the Central Armory Building and takes up quite a little space. Extending above the framework that encloses the space is a sort of canopy made of vines and branches, among which are placed hundreds of incandescent lamps. This canopy extends well up to the roof of the building and the lighting effects may be seen from almost any part of it. The display consists of small household machines and appliances operated by electric power. In making the display the company sought only to call attention to the importance of using electric energy and the various uses to which it can be applied. It handles articles only until they are well introduced and makes a point of extending the use of energy thereby. This is the whole aim of all the advertising that is done, the policy of the company being to sell only its own output.

A complete telephone exchange, with two operators, is maintained by the Cleveland Telephone Company. All booths are furnished with telephones, so that direct communication may be had with any other point in the city, and with long-distance lines. The exchange is kept busy all the time. Photos of exteriors and interiors of the main and branch exchanges are shown, as well as a full line of instruments in use.

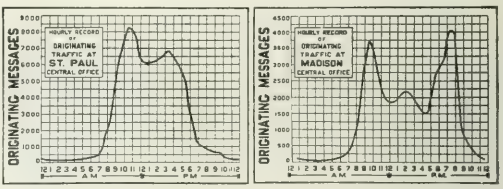
A handsome little booth is used by the Cleveland Engineering Society, which is maintained for the purpose of showing what the organization is for and what is being accomplished.

Descriptions of other exhibits will be found elsewhere in this issue.

Telephone Exchange Traffic Curves.

The Chesapeake & Potomac Telephone Company is conducting through the advertising pages of Baltimore newspapers an excellent campaign of public instruction as to telephone service, including business and operating methods, exchange organization and plant. The large announcements are tastefully designed and illustrated, and the text, while brief, is always to the point. As of general interest, the accompanying curves of exchange load are reproduced from one of the advertisements.

The text explains that in the business district served by the St. Paul exchange, 72 per cent of the day's traffic is handled between 10 a. m. and 4 p. m. Between 9:30 a. m. and 10:30 a. m. the business man answers his correspondence and con-



TELEPHONE EXCHANGE LOAD CURVES.

ducts the details of his business by telephone. The highest peak of the day is reached at 10:30 a. m. The number of messages drops at luncheon hour, and then immediately starts upward, reaching the afternoon peak at 3:30 p. m. The closing of the business day is readily determined by the chart. Newspaper office and hotel traffic prevent the evening curve from dropping suddenly. The curve of the Madison station, which is in a residence district, tells a different story. The greater part of the day's shopping and marketing is done between 9 and 10:30 o'clock in the morning. Following the drop at luncheon time is a rise representing the social messages of the women folk. It is remarkable that the highest peak of the day is reached at 7:30 p. m., showing the importance of the telephone in the preparation of the evening's entertainment. The curve given is for an average day; a storm shows instant effect on the amount of traffic and increases it in proportion to the severity of the weather.

Valuation of Indiana Telephone Properties.

According to the annual report of the Indiana State Tax Board just issued, telephone properties in the State showed a total valuation of $10,201,519 as against $10,572,987 for 1908. These companies are taxed on the valuation of their corporate property, the assessments being made on reports made to the board during the month of May each year. There is considerable speculation over the fact that the chief decreases were made in the property of the Central Union Telephone Company and the Cumberland Telephone Company, both Bell concerns, and that conspicuous increases occur in the values of the Independent telephone properties. The Indianapolis (Independent) Telephone Company's property is valued at $79,000 and the New Long-Distance (Independent) Telephone Company's property at $41,000, more than last year. The only increase in valuation assessed against the Bell property was $5,873 against the American Telephone Company and the only decrease of any material amount given to an Independent company was $20,480 in favor of the Citizens Telephone Company, of Fort Wayne, due to great loss by storm.

Detroit River Tunnel Electric Locomotive.

The first of six direct-current locomotives for the tunnel under the Detroit River has been finished, and the acceptance test completed. The locomotives are designed for hauling both freight and passenger trains through the tunnel, and also for switching service at the terminal. The tunnel will connect the Western Detroit yards of the Michigan Central Railroad and the new Windsor yards, Windsor, Ont., the electrified zone embracing the tunnel with its approaches, terminals, tracks and sidings extending over approximately 33,000 ft. The specifications demand a maximum service consisting in hauling an 1800-ton trailing train up a 2 per cent grade at a speed not less than 10 miles per hour, with two locomotives operating as multiple units; and the capacity must be such as to enable them to repeat the trips with this weight of train continuously with a lay-over of 15 minutes at each end, and without undue heating of the motors. The total weight of the locomotive is 199,000 lb.

The motor equipment consists of four 300-hp commutating-pole motors. The gearing between meter and axle has a 4.37



FIG. 1.—GENERAL VIEW OF DETROIT RIVER TUNNEL LOCOMOTIVE.

reduction, and the driving wheels are 48 in. in diameter. With this reduction each motor will develop a tractive effort of 9000 lb. at the rail head, which gives a total tractive effort for the four motors of 36,000 lb. at 12 miles per hour. The motors have an overload capacity sufficient to slip the driving wheels, and the locomotive can develop at the slipping point of the wheels an instantaneous tractive effort of 50,000 lb. to 60,000 lb. The maximum speed of the locomotive running light upon a level track is about 35 miles per hour.

There are two gears and pinions per motor, one at either end of the armature shaft. This construction was adopted on account of the unusually heavy torque and excessive overloads that the motors will be called upon to carry. In large sizes of motor equipments, with a gear and pinion at only one end of the shaft, it has been asserted that a large proportion of the wear and breakage of pinions is due to the tilting of the motors under heavy loads, which concentrates the pressure at one end of the tooth. The form of construction adopted in the Detroit locomotives will eliminate any such danger.

The motors are designed for forced ventilation. Air is delivered into the motor frames at the end farthest from the commutator, passes between the field coils and around the

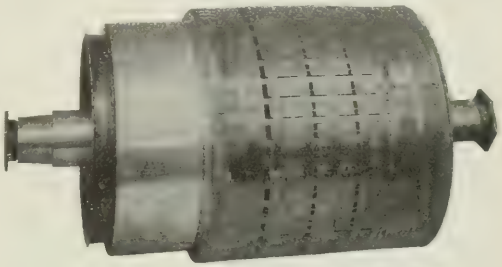


FIG. 2.—ARMATURE OF COMMUTATING POLE MOTOR.

armature, and finally escapes through suitable discharge openings over the commutator. The blower used for this purpose has a capacity of 2000 cu. ft. of air per minute of 2¼ in. of water pressure, and is driven by a direct-current series motor. This blower delivers air to the passage between the two center sills above described, from which the ventilating ducts are tapped off to the motors at appropriate points.

The control system used is the Sprague-General Electric multiple-unit type, with two master controllers in the main cab and the contactors in the auxiliary cab. Multiple-unit connections are fitted, so that three locomotives may be operated in unison if necessary. The problem of starting and accelerating a train of from 1000 tons to 1500 tons weight, which may consist of 40 or 50 cars, is a rather difficult one. Such a train is not a rigid mass, but a long elastic body, and any inequality in the starting torque results in waves of jerking and buffing strains which may reach abnormal values in some parts of the

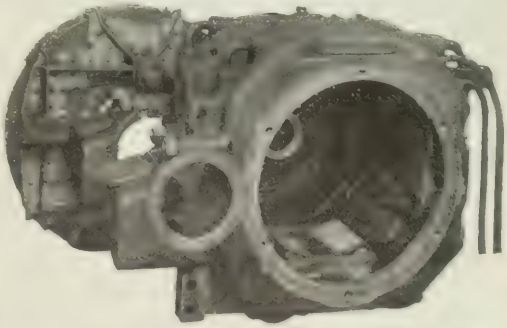


FIG. 3.—[illegible] COMMUTATING POLE COILS.

train. Consequently the control for these locomotives was designed especially to produce a uniform increase of speed and torque during the period of acceleration. The control combinations are so arranged that the motors may be operated four in series, two in series and two in parallel, or four in parallel. There are nine resistance steps in series, eight in series-parallel and seven in the parallel position. In a test run with a train of 1578 tons weight, consisting of one locomotive and 26 freight cars, the acceleration from a standstill to 10 miles per hour was accomplished with marked smoothness. The maximum increase of draw-bar pull was about 6500 lb. on the first few

steps, after which the maximum throughout the remainder of the acceleration was from 2000 lb. to 3000 lb. To an observer standing in the caboose of such a train, the rear end of the train is started so gradually that the beginning of the motion is almost imperceptible; the contrast with the results obtained with a steam locomotive is thus very striking. The locomotive is equipped with third-rail shoes to take current from an inverted third-rail. It is also fitted with an overhead trolley, which can be raised or lowered by a foot-operated valve in front of the motorman. The electrical part of the equipment was supplied by the General Electric Company, the locomotive having otherwise been built at the Schenectady works of the American Locomotive Company.

Commercial Development of Wireless Telegraphy.

Mr. Cloyd Marshall presented a paper at the June meeting of the New York Electrical Society, held at the Waldorf-Astoria on June 16, entitled "The Commercial Development of Wireless Telegraphy." After sketching the history of wireless telegraphy, which is dated from 1842, when Professor Morse sent signals across the Susquehanna River without wires, the fundamental principles of wireless transmission were simply explained. Referring to later developments, it is stated that in the plain aerial system the oscillations are heavily dampened, and that the system is also limited to the amount of energy which can be used, owing to the small capacity of the antenna. Consequently the close oscillating circuits have been brought into use, which consist of a condenser, a variable inductance and a spark gap, the condenser being charged from the secondary of a transformer or a large induction coil. As such a condenser can be made of any size, it is possible to use many times more energy than can be used with the plain aerial system. In the latter the capacity is as low as 0.00025, and never higher than 0.002 excepting in extremely large stations. On the other, capacities used in closed oscillating circuits range from 0.0075 to 0.01 and even higher. The condenser generally has a fixed value, and it is adjusted with the secondary of the transformer, which is closed to charge it. The variation of the frequency of the oscillations is caused by varying the amount of inductance in the closed oscillating circuit.

With instruments now in use, known as wave meters, it is possible in a few seconds to determine the exact frequency, as well as other characteristics, of the oscillating circuits, these instruments being called wave meters. Returning again to a comparison of the closed and open oscillating circuits, it was stated that while the former is capable of holding energy for a considerable time, and the oscillations produced by it are not nearly so heavily dampened as those produced by the plain aerial system, on the other hand, the closed circuit is a very poor radiator of energy, while the reverse is true of the plain aerial systems. Consequently the two systems have been combined, the closed oscillating circuit for the production of electrical oscillations, with the plain aerial or open circuit for the radiation of energy.

The following statistics were given as to the use of wireless telegraphy in the Government departments: The Bureau of Equipment of the Navy Department operates 56 land and shore stations in navy yards and in subject countries. The Army Signal Corps operates stations at the principal seaboard fortifications and in Alaska and the Philippine Islands. The Lighthouse Board maintains wireless stations on three of the lightships, the Treasury Department on 17 of the revenue cutters, the army on six of its cable ships and transports and the navy on the principal armored vessels. The United States Wireless Telegraph Company now maintains 277 stations on the Atlantic seaboard, 26 stations on the Pacific Coast and 7 on the Great Lakes. It also operates 163 stations on shipboard. The latest list of wireless equipments as compiled by the Bureau of Equipment of the Navy Department gives a total of 782 land and floating stations for the world.

A Swedish Radium Enterprise.

According to the London *Electrical Review*, it is announced from Stockholm that the preliminary notice has been locally registered for the formation of the Culm Company, which proposes, according to various inventions of Dr. G. Hellsing, to win uranium and radium from the mineral culm and other raw materials, and to dispose of patents and licenses. The minimum share capital has been fixed at 700,000 crowns and the maximum at 2,100,000 crowns.

The promoters of the company are Profs. J. G. Andersson, Svante A. Arrhenius and Sten, A. Hj. Sjogren, Dr. G. H. Hellsing and C. U. Waern, the names being said to be apparently a guarantee that the scheme rests upon a scientific basis. Professor Andersson is the manager of the State authority known as Sweden's Geological Investigation; Professor Arrhenius is the celebrated physicist and Nobel prize winner, and Professor Sjorgen is the superintendent of the Government Mineralogical Collections and successor to the discoverer of the North-Eastern passage. It appears that Professor Nordenskjold, Dr. Hellsing and other founders have for several years past investigated the mineral culm, which is a kind of impure pit coal existing in the Alaun schist, for the winning of uranium and oils. After it had been discovered abroad that most minerals embodying uranium also contain radium, the latter has likewise been discovered in culm, which exists in an inexhaustible quantity in the Swedish province of Vastergotland.

The promoters of the company have assured themselves of considerable fields in this province, one alone containing 100,000 tons of culm. As a result of previous experiments it has been found, it is stated, that 1 ton yields 4 mm of radium bromide, a combination which is said to be admirable for the market.

Cornell University Engineering Graduates.

The forty-first annual commencement of Cornell University was held on Thursday, June 17. In the absence of President Schurman, degrees were conferred by Prof. T. F. Crane, who retires this year from the headship of the department of romance languages. More than 225 men received the degree of Mechanical Engineer, including about 75 who have specialized in electrical engineering.

Two years ago the electrical course was improved by the addition of a junior laboratory course. The present class is the first to graduate from this complete course—namely, eight hours of required electrical work weekly in the junior year and twenty hours in the senior year. This complete course comprises (1) a junior laboratory course with one experiment per week throughout the year; (2) a senior laboratory course with two experiments and one recitation per week throughout the year; (3) a junior recitation course on the elements of electrical engineering with two recitations per week throughout the year; (4) a senior recitation course on the theory of electric circuits and machines with two recitations per week throughout the year; and (5) a senior problem course with two computing periods per week throughout the year. In addition a number of elective courses were offered, one or more of which were taken by the electrical seniors. Last year these were: (1) design of electrical machinery; (2) electric-power generation and distribution; (3) telephone engineering; (4) wireless telegraphy; and (5) elementary and advanced electric railways.

The senior problems form the main portion of the course. They consist in the prediction of the performance of electric circuits and machines when the dimensions of the various parts and the properties of the materials are given. In order to make such calculations the student must be familiar with the theory and the operation of the electrical device studied. The solution of these problems prepares students also to take advantage of the advanced courses offered during the second term. By means of these courses he may follow out any particular inclination toward a special electrical subject. While these courses

are of a somewhat practical nature, the theory is not forgotten. The courses are not intended to fit students directly for practical work, but rather to show the application of electrical principles to particular fields.

The appointment of a permanent head for the department has permitted a rearrangement of the details. Beginning next fall there will be three main divisions of the department, each under the charge of a professor or assistant professor. The divisions are: (1) Introductory (junior) courses; (2) advanced laboratory courses; (3) advanced theoretical courses. In the junior year the same range will be covered as heretofore, but in somewhat different order. The first term work will comprise three recitations and one illustrated lecture per week. In the second term there will be one laboratory period, one recitation and one illustrated lecture per week. In abbreviated form the same course (omitting the laboratory) will be given to the civil engineers during the first term. No change will be made in the required senior courses next year. The elective courses will be adapted to the needs of mechanical and electrical engineers who wish to carry their studies farther than the regular course permits. In addition to those already mentioned there will be illuminating engineering, applications of electrical machinery and current electrical topics.

Power Cost in a Turbo-Engine Railway Plant.

The following figures have recently come to hand in connection with the cost of producing electric power in a generating station devoted to interurban railway service, covering a period of one year. The plant is a turbo-engine alternating-current station equipped with two 650-hp and three 500-hp water-tube boilers, and three generating units. One unit is a 2000-kw, 13,200 volt, 25-cycle, three-phase, Curtis steam turbine set, and the other two are Rice & Sargent engines direct connected to General Electric alternators of 500-kw and 1000-kw rating. The plant is hand-fired, natural draft being used. The operating steam pressure is 150 lb. per square inch. The current generated at the station is delivered to transmission lines supplying rotary converter and step-down transformer substations, the cars being served with direct current at 600 volts. The road is about 30 miles long from end to end, most of the line being double tracked, with several single-track branches aggregating a total length of track in the property of 76.5 miles. The car mileage during the year was 1,820,985.

The total kw-hours generated during the year and delivered at the alternating-current busbars of the power plant were 10,050,616. Of this energy, 8,095,060 units were delivered at the direct-current busbars of the four substations, giving a transmission and reduction efficiency of about 80 per cent. The individual substations utilized from 1,500,000 to 3,000,000 kw-hours each, according to their locations and loading. The total expenses of station and substation operation were as follows:

	Station Operation.	All Substations
Coal	$58,295.52	.....
Wages	13,620.20	$1,840.50
Supplies	3,539.61	208.28
Repairs, steam	3,500.35	.....
Repairs, electrical	1,663.62	.....
Total	$80,619.30	$2,048.78

The cost of coal in this station for the year averaged $4.80 per ton. The plant is located about 22 miles from tide water, and the fuel had to be teamed to the storage yard before it could be wheeled into the boiler-room. The total operating force consisted of three engineers, four oilers, nine firemen, and four coal passers. The engines and turbine were operated condensing, with a cooling-tower installation having motor-driven fans and pumps to make up the water supply by repeated use of the condensation. Jet condensers were used on the engine sets, which were cross-compound units. The turbine outfit is not operated during the times when the station is running under light or average loads. The usual surface condenser installation is provided for the turbine, with an extra large allowance of cooling surface on account of the high tem

	Cost per kw-hour, alternating at generating plant, cents.	Power station, cost per kw-hour, direct current at substations, cents.
Coal	0.581	0.720
Wages	0.155	0.216
Supplies	0.035	0.045
Repairs	0.051	0.064
Total	0.822	1.045

peratures sometimes reached by the water in the summer season. The total coal consumption of the plant during the year was 12,150 tons, New River being the kind of fuel used.

The unit cost of operation is given in the above table.

The Relation of Car Weights and Operating Costs.

An interesting technical analysis of the relation of car weights to operating costs was presented June 10 at the meeting of the Massachusetts Street Railway Association by Mr. Milan V. Ayres, electrical engineer of the Boston & Worcester Street Railway Company. Taking a 28-ton semi-convertible car equipped with four motors, Mr. Ayres found that on a run of 880 ft., with a maximum speed of 20 miles per hour, the energy consumed was 528 watt-hours, of which 345 watt-hours were consumed in acceleration, 70 watt-hours in rheostatic losses, 81 watt-hours in motor losses, 5 watt-hours in windage, and 27 watt-hours in track and bearing friction. Making the same run with a 16-ton car in the same time, the acceleration energy consumed was 173 watt-hours; rheostatic losses, 37 watt-hours; motor losses, 42 watt-hours; windage, 5 watt-hours; friction, 19 watt-hours; total, 276 watt-hours, or a reduction of 47.8 per cent. With power costing 1.5 cents per kw-hour at the car, and a daily run of 150 miles, the cost of operating the car represents a current expense of $100 per ton per year.

Among other figures submitted was a statement of the total cost of operating a car per year on the pound basis, including fixed charges and repairs. With a daily run of 150 miles, and power at 1 cent per kw-hour, the yearly power cost per pound is 3.42 cents; the fixed charges on the power plant (0.7 cent per kw-hour), 2.4 cents; and the repairs (0.0875 cent per ton-mile), 2.4 cents, making a total of 8.22 cents. This means, on an annuity basis, that a company can afford to pay 85.5 cents for every pound of weight in permanent parts that can be cut from its rolling stock. Through the use of steel and aluminum, with special efforts on the part of operating companies to have weights cut down, and the diminished use of wood, future progress in this direction will be attained.

New York Public Service Commissions' Accounting System.

A joint meeting of the accounting committees of the National Electric Light Association and the Empire State Gas and Electric Association was held at the office of Mr. H. M. Edwards, auditor, New York Edison Company, on June 10. The meeting was held for the purpose of considering questions regarding the system of accounts prescribed by the New York Public Service Commissions for electrical corporations. The questions had been submitted to the respective commissions and answered by their statisticians, Mr. A. F. Weber and Mr. W. J. Meyers, and referred, in turn, to the two committees. Twelve questions and answers transmitted from the commission of the First District were submitted and 67 from the commission of the Second District. The following, in addition to Mr. Edwards, attended the meeting: Messrs. F. L. Dame, Electrical Securities Corporation; E. J. Allegaert, Public Service Corporation of New Jersey; E. C. Scobel, Rochester Railway & Light Company, and Robert A. Carter, Westchester Lighting Company.

New York Public Service Commission News.

The Board of Estimate and Apportionment, of New York, has taken issue with the Public Service Commission over its refusal to sanction the charter of the South Shore Traction Company which asks the right to lay tracks through Queens Borough and across the new Blackwell's Island Bridge. This charter had been formerly granted by the Board of Estimate, but was turned down by the commission. The Board of Estimate claims that the commission exceeded its powers and usurped those of the board. A resolution has been passed condemning its action and calling on the corporation counsel to take all legal remedies to maintain the powers of the board. It is the plan to bring a suit that will throughly test section 53 of the public service commission law. The matter is considered important as establishing the status of the commission with regard to the franchises of surface lines.

In response to an application, the Public Service Commission has decided that the bondholders may operate the old Fulton Street Crosstown Car Line in New York. Before the Metropolitan Street Railway Company abandoned this line it was used by horse cars. The bondholders hope to make some arrangement by which the line can either be leased or operated electrically by some other company.

Mayor McClellan has signed the franchise of the Hudson & Manhattan Railroad for its tunnel under Sixth Avenue to Grand Central Station, and the work of getting the property consents has already begun. Mr. McAdoo, president of the road, says that all legal matters will be out of the way within six months.

The South Flatbush Railroad Company, recently organized, has made application to the Public Service Commission of the First District for permission to construct a line three miles long in South Brooklyn and also for permission to issue $30,000 of stock. The company does not contemplate the issue of bonds at this time.

Hearing by Massachusetts Commission on Consolidation of Lighting Properties.

The Massachusetts Gas and Electric Light Commission gave a hearing on June 8 at its offices in Boston on the petition of the Edison Electric Illuminating Company of Boston for permission to purchase the electrical properties of the Boston Consolidated Gas Company, the Newton & Watertown Gas Light Company, the Waltham Gas Light Company, and the Chelsea Gas Light Company. Counsel Everett W. Burdett for the Edison Company stated that the prices agreed upon are as follows: Boston Consolidated (Brookline), $1,300,000; Chelsea, $350,000; Waltham, $600,000; Newton, $500,000. The gas property of the Waltham company is to be purchased by the Newton company at a price of $500,000. Mr. Burdett said that the money will be borrowed on the Edison Company's credit and that later an issue of stock will be asked for, including several other prospective uses of capital.

Mr. Burdett then stated that the Edison Company feels that great advantages will accrue to all concerned in the line of economical operation, as a result of the consolidation. The above prices were reached after negotiations extending through many months. In all cases they are in excess of the property values totalized, since they are all going concerns. Good will is not included in any of the figures. The book values of the companies are: Boston, $963,000; Chelsea, $265,000; Waltham, $470,000; and Newton, $459,000. The total book values are $2,157,000, and the total purchase price for the properties, $593,000. The gross earnings of the companies are at present $569,000 per year.

The effect on the public, it was stated, will be lower prices and better service, without increase in the outstanding securities. If the approval of the board is given to the purchase, the Boston Edison rates will be placed in effect in all the communities affected on July 1, 1909. The arrangements now before the board are but the extensions of a policy of expansion which has long been successfully applied by the Edison Company, to the general improvement of economic conditions in the case of each property that has been taken over.

The estimated saving to the city and residents of Waltham per year by the consolidation will be from $14,000 to $17,000. The present 24-cp street lights, costing $20 per year, will be superseded by 40-cp lamps at $17; and the present $83.95 arc lamps per year will be supplanted by lamps of an improved type costing the city $65. No opposition has developed in Waltham to the proposed consolidation. In Chelsea there will be a saving of about $15,000 a year to the city and its residents. The city of Newton also favors the purchase. There the Boston Edison prices are already in effect, current having been supplied to the Newton & Watertown Gas Light Company for several years from the L Street station. Recently the rates in effect in Newton were greatly reduced by the application of the Boston prices. The estimated saving to the town and residents of Brookline is about $45,000 per year. All these estimated savings are figured on the basis of one-year contracts and are not contingent upon long-time contracts. If the latter can be arranged the economies will be still more advantageous to the municipalities.

Former Chairman Humphrey, of the Brookline Board of Selectmen, then spoke in favor of the purchase, and stated that there is no doubt that the Boston Edison Company can supply electricity to Brookline at a rate much lower than the Boston Consolidated Gas Company can afford to give in its electrical department. An appraisal was made, with a subsequent report, by Prof. D. C. Jackson, of Boston, advising the town to purchase electricity from the Boston Edison Company. This report has been abstracted in these columns, and the decision of the town to buy Edison energy was reached after about two years of investigation.

Mr. Burdett then stated that not a cent had been allowed in Brookline for good will, since the good will toward the Edison Company was already considerable, as compared with the feeling against the service rendered by the Boston Consolidated Gas Company in its electrical department. The latter organization is obviously handicapped by its inability to generate electricity on a large scale and to make a specialty of its distribution. Mr. Burdett stated that the purchase price cuts no figure in relation to the rates to be charged in the communities served by the Edison Company, since any securities issued later must be based on the property value rather than upon existing capitalization. There are also some presumptions in favor of the view that the price is not excessive, since it is for the interest of the Edison Company to buy at the lowest feasible terms. If a purchaser pays a gross price in excess of what is fair and later expects to capitalize it, he is only borrowing trouble. President James L. Richards, of the Boston Consolidated Gas Company, then took the floor and stated that the deal is for the best interests of all parties, including the public. He touched upon the economies incidental to the gas business in the way of consolidation, saying that he believed his company can serve the community better if the business is entirely divorced from the manufacture and sale of electricity. It is impossible for the gas people to serve the communities as low as can the Edison Company in electrical supply. In the book charges which Mr. Burdett cited there are no figures covering engineering and incidental costs during construction. The estimated saving in gas bills through the consolidation of gas properties directly or indirectly resulting from this deal is $36,000 per year.

President C. L. Edgar, of the Edison Electric Illuminating Company, Boston, was then called. He stated that the figures which are being paid are relatively no higher than the company has paid in the past in its absorption of local properties. The details of the Newton and Chelsea plants have already been laid before the board in connection with a previous petition. As for the prices to be paid for the Brookline and Waltham properties, Mr. Edgar stated that the company had asked Mr.

Herbert A. Wagner, a widely known central-station expert making a specialty of plant valuations, to inspect these properties and give his opinion of their worth. He estimated the Waltham plant to be worth $600,000, which is precisely the price that the Edison Company is paying for the Waltham electrical department; and the Brookline plant, Boston Consolidated Gas Company, to be worth between $1,400,000 and $1,500,000, whereas the price of the latter is $1,300,000. These concerns are all of the "going" variety, earning about $600,000 per year, and the price to be paid is therefore about 4.5 times the annual revenue, which is a moderate cost, since in many cases the revenue of public service properties is only one-seventh or one-eighth the purchase price. When the Legislature authorized the purchase of the Boston Electric Light Company by the Edison Company, the purchase price was in excess of the structural value, since the company was a going concern. The fact that the systems in Waltham and Brookline are of the same engineering type as that of the Edison Company makes it possible to coalesce them at less cost than as though the technical characteristics of the systems were different. Mr. Edgar said that it may easily occur that these properties may be worth substantially $3,000,000 to both parties, and yet be a bargain to both. The Boston Consolidated Gas Company cannot afford to do a picayune business; it must either drop its electrical service entirely or expand it, in order to approach economy. Hence the provision that the deal can be nullified if it does not go through in its entirety.

The British Patent Revocation Case.

In referring to the recent reversal, noted previously in these columns, of the decision of the British Comptroller-General revoking a patent to a foreigner on a flaming-arc lamp on the grounds that the invention covered was not manufactured to a sufficient extent in Great Britain, our London contemporary, the *Electrical Review*, says that the result of the appeal in this case will be received with general satisfaction. "Just what the law of 1907 was meant to do is the subject of more or less conflicting statements by rival claimants to the credit for its introduction and passing, but in Mr. Justice Parker's opinion it 'was never meant to penalize want of success when the patentee has done his best,' nor do we believe that it was intended to bestrew with rose leaves the path of the defendant to an infringement suit on imported apparatus, although it must be recognized that in certain cases an application for revocation may be very properly made by such a defendant.

"In time the drawbacks in the administration of the law may be removed. The new rules issued with commendable promptitude by the new Comptroller-General at the suggestion of Mr. Justice Parker, prevent the use of the law for merely 'fishing' purposes, and we do not doubt that, as further changes are shown to be necessary, they will be made, but no changes in the details of administration can alter the general character of the law, and its detrimental tendency. Lord Alverstone, the Lord Chief Justice of England, who, as Sir Richard Webster, was the leading patent counsel of his day, expressed his opinion of the law before the recent International Congress on Applied Chemistry.

"While presiding over the section for the discussion of law, political economy, and legislation affecting the chemical industry, he said that 'a real step backward had been made in the revoking clause of the new patent law. It would only result in people keeping their inventions secret and not taking out an English patent. The patent law should give protection to the inventor, and also secure the interests of the public. The inventor should have a fair and reasonable reward for his labors.' Lord Alverstone added that the new law had been made against his will and wish, and he thought that 'if it were changed to a more liberal standard, viz., the standard of a compulsory license, there would be no temptation to inventors to keep their invention secret.'

"It will probably need more hard cases than have yet arisen, and more definite evidence of detrimental operation than can yet have been possible, before any change will be effected in the law itself. We do not doubt that the expediency of such a change will in the course of time be sufficiently demonstrated, and in the meantime patentees must be content with a 'more liberal standard' in the methods of its administration, an example of which is to be found in Mr. Justice Parker's decision revoking the revocations."

CURRENT NEWS AND NOTES.

NON-MAGNETIC YACHT LAUNCHED.—The non-magnetic survey yacht, built for the Carnegie Institution, Washington, was launched at Brooklyn last week. The vessel will be used for ocean research in terrestrial magnetism, and contains no magnetic material in its structure. The vessel is 155 ft. long with 33 ft. beam and 12 ft. draft, and has a displacement of 568 tons.

TIME ENDORSEMENT ON TELEGRAMS.—Governor Draper, of Massachusetts, has approved a bill requiring that the time of sending and of receipt shall be endorsed on all telegraph messages transmitted within the boundaries of Massachusetts. The telegraph companies have announced that a charge will be made for the additional words and figures necessitated by this law.

NEW HAVEN RAILROAD ELECTRIC FREIGHT SERVICE.—Final action was taken this week by the board of directors of the New York, New Haven & Hartford Railroad on the extension of its electric service, whereby the Stamford-New Haven branch of the road will be electrically equipped for freight service initially, and later for passenger service. At present the New York-Stamford section is operated electrically only for passenger service.

WIRELESS TELEPHONY OVER 100 MILES.—In tests made at Toulon, France, June 8, of the Colin-Jeance system of wireless telegraphy between the cruiser *Condé* and the shore, conversation was maintained over a distance of 165 km (100 miles). It is stated that the tests established the fact that telephonic transmission without wires is hardly influenced by the electrical phenomena of the atmosphere, which hinder so seriously wireless telegraphy.

COMPULSORY MARINE WIRELESS.—Senator Frye, of Maine, chairman of the Committee on Commerce, introduced a bill in the Senate on June 9 providing that all ocean-going steamships carrying more than 50 passengers shall carry efficient wireless apparatus. Steamships which make trips of less than 200 miles from starting point to destination are exempted from the operation of the proposed bill. A fine of $2,000 is provided for all violations of the measure, which is to take effect one year after the date of its passage. The penalty clause of the bill contains this proviso: "That it shall constitute a good defence to a prosecution under this act for the defendant to show that the corporations supplying efficient apparatus for radio-communication have entered into a combination for the purpose of maintaining or enhancing the rental or price of such apparatus."

DAMAGES AWARDED TO THE INDIANAPOLIS LIGHT & HEAT COMPANY.—Judge Carter, of the Indiana Superior Court, has decided that the Board of Public Works had quasi-judicial powers, and rightfully awarded $25,000 damages to the Indianapolis Light & Heat Company, of Indianapolis, Ind., on account of the elevation of railroad tracks on Kentucky Avenue. This damage was divided in certain amounts against the city, the county, the street railway company, the Vandalia and the Big Four railroad companies. Judge Carter holds it the duty of the Board of Public Works to proceed to collect the several amounts and pay the same to the lighting company, but that the city alone cannot be held for the entire amount.

AMERICAN STREET RAILWAY CONVENTION.—The date of the Denver convention of the American Street and Interurban Railway Association and affiliated bodies has been changed from the week of Oct. 18 to the week of Oct. 4. One of the reasons for the change is that the earlier date will enable members to take advantage of low railroad excursion rates, and allow an opportunity to visit the Seattle Exposition.

NEW YORK STATE ELECTRICAL CONTRACTORS' ASSOCIATION.—The regular semi-annual meeting of the New York State Electrical Contractors' Association was held in Syracuse on June 15. Only routine business was transacted. After the business sessions the members were entertained at dinner by the entertainment committee of the Syracuse local branch of the association, of which Mr. James Hilton is chairman.

PUBLIC LIGHTING RESPONSIBILITY.—In a case brought before a court in Scotland, in which damages were asked for a death caused by an accident claimed to be due to darkness in a street in which the public gas lamps had not been promptly lighted, the judge ruled that the municipality was liable. "As soon as the sun ceases to give light," he said, "you must provide it; if you do not, you are responsible for the results."

ELECTRICAL MIND CURE.—A Pittsburgh paper reports that a young girl taken to an Eastern physician for electrical treatment pronounced herself greatly relieved after one experience, but the doctor's faith in his apparatus and his sense of humor were both challenged when he found that, through inadvertence, the electrical energy had not been utilized at all, and that such electrical effects as the patient experienced were simply those of imagination.

I. E. E. LIBRARY.—An English contemporary in referring to the library of the British Institution of Electrical Engineers said that the collection of electrotechnical books was so nearly perfect that the Institution took some pains to find out the exact distance from perfection, and the answer was that some 1600 works were wanting. Most of these have now been obtained, so that the I. E. E. library is now probably unsurpassed by that of any other technical society in the world.

NATIONAL ELECTRICAL TRADES ASSOCIATION.—The annual meeting of the National Electrical Trades Association will be held at the Exchange Club, Boston, June 21. This association has a total membership of 450 electrical manufacturers and jobbers in the principal sections of the country. Mr. Fred. P. Vose, of Chicago, is general secretary. Delegates will be present from the local associations in Philadelphia, Boston, Chicago, New York and San Francisco.

TELEPHONE SERVICE AT PANAMA.—Telephone communication has been established with the quarantine station on Culebra Island, Isthmus of Panama, by means of an old cable laid several years ago by the Central and South American Cable Company. This cable extended originally to Naos Island, but the shore end of the cable at that island was recently transferred to Culebra Island, and a few weeks ago telephone connections were made, and the line is now working satisfactorily.

CHICAGO ELECTRIC CLUB.—Mr. Francis T. Simmons, president of the Lincoln Park commissioners, of Chicago, addressed the noonday meeting of the Chicago Electric Club June 9 on "Lincoln Park, Its Ambitions, Its Progress and Its Effect Upon the City." Mr. Simmons showed some of the plans for the extension of Lincoln Park to the northward along the shore of Lake Michigan. He spoke incidentally of the recent contract which the Lincoln park commission made for drainage-canal power for the lighting of the park and boulevards. He also said that the commission had designs for ornamental concrete lamp-posts, which would probably be used for future work.

ELECTRIC TOWAGE FOR PANAMA CANAL.—In referring to the recent accident at the Canadian Soo Canal, in which the lock gates were badly damaged, one vessel sunk and two others injured, an official of the Panama Canal said that a similar disaster could not occur at a lock of the Isthmian canal, for there vessels will not make the passage with their own power, but will be towed through by electric power. The electric towing machines will run over a specially constructed track on the brink of the canal.

UNIVERSITY OF PITTSBURGH SCHOOL OF ENGINEERING.—With appropriate ceremonies the cornerstone of the School of Engineering of the University of Pittsburgh was laid on June 9. The exercises took place at commencement, and there was a number of engineering graduates, including three in electrical engineering. In an address at the cornerstone laying, Mayor Magee, of Pittsburgh, said that the event marked a forward step not only on behalf of rich men's sons, but also for the benefit of Pittsburgh's poor boys. Since the name of the institution has been changed to that of the University of Pittsburgh, it has come closer to the hearts of the people of the city, the Mayor added.

ILLINOIS TUNNEL COMPANY'S TELEPHONE FRANCHISE.—The Chicago City Council committee on gas, oil and electric light has extended until June 1, 1911, the time in which the Illinois Tunnel Company must have 20,000 telephones in operation under its franchise. The company is forbidden to sell out to any other interests than the Chicago Telephone Company before Dec. 1, 1910, and consideration of the proposed sale to the telephone company was set for June, 1910. Mr. H. D. Critchfield, representing the International Independent Telephone Association, told the committee that the interests he represented would not cease trying to obtain entrance to Chicago. He predicted a demonstration in favor of this grant of entry to the Independents that would make the council "sit up and take notice."

ELECTRICITY IN PORTO RICO.—A very interesting bulletin has just been issued by the Bureau of the Census on the electrical industries of Porto Rico, with statistical data to the end of 1907. The historical portion has been compiled by Mr. W. F. Willoughby, Secretary of the island. A considerable amount of information is given as to telegraphs and telephones, and as to electric lighting and electric railway development in the territory before and since American authority became controlling. The total cost of all electrical plants to 1907 is given as $2,373,258, with a total income of $663,031. Curiously the telephone investment was $255,041 and the electric lighting $146,795 only, while the street and electric railway cost was $1,971,512. The telegraphs and telephones are in the hands of the Porto Rico Bureau of Insular Telegraphs. No data are given as to isolated plants.

ELECTRIC LIGHTS AS MEMORIALS TO THE DEAD.—A church in New York has adopted a novel means to raise money to pay off a debt, which consists in the use of electric lights as memorials to the dead. A huge altar electrolier includes name-plates as part of its winding vine decoration, about each of which is a cluster of 10 incandescent lamps. Subscribers desiring the prayers of the congregation for their dead pay $1,000 for each light. The name of the deceased is then inscribed on the plate above the cluster of lights and one light is lit, to be kept burning at all services. The payment of each successive $1,000 means the lighting of another light, the maximum amount being $10,000 for each name. Eighteen of the name-plates have already been subscribed for and 30 lights purchased. The memorial is so constructed that it can be lengthened and enlarged almost endlessly, and the pastor of the church is reported to be looking forward to the day when it will reach the high vaulted ceiling and start twining its way along the sides of the chancel.

High-Tension Transmission System at Gaucin-Seville, Spain.

BY FRANK KOESTER.

FOR utilizing the water of the river Guadiaro, a central station, "El Corchardo," has recently been built between the stations Gaucin and San Pablo of the Bobadilla-Algécircas Railway, in the province of Malaga, situated in the southern part of Spain. The minimum water available is 53 cu. ft. per second throughout the year, and 140 cu. ft. per second for eight months, the total head being 450 ft., while the net head is 421.5 ft. To harness the water, a dam 82 ft. long was built across the river. It is 12 ft. high, and 2.6 ft. thick at the top. The upstream side has a batter of 1 to 5, and the downstream side a batter of 2 to 5.

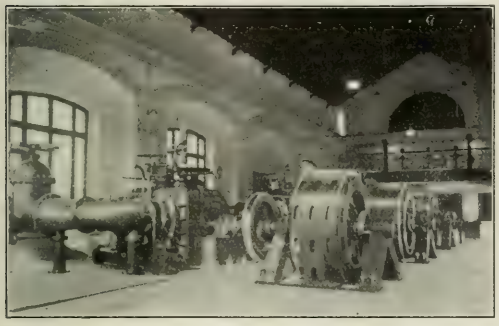


FIG. 1.—INTERIOR OF STATION.

The intake to the head-race is well provided with sluice gates and racks. The total length of the head-race is 18,695 ft., of which 3600 ft. runs through a tunnel. The remainder is built in an open trench form. It is 7.4 ft. wide and 4.7 ft. high, and has a pitch of 0.5 ft. in 1000; the tunnel has double the pitch.

The collecting basin is triangular in shape. The gate wall is 52.5 ft. wide, with provision for three penstocks, of which two are installed. It has a total storage capacity of 12,350 cu. ft. At the junction of the head-race is an overflow gate. Screens and gates are provided only for the two penstocks; the third is cut off by a temporary wall. The penstocks are 3.28 ft. in diameter. For a length of 650 ft. and up to a head of 160 ft. they are made of reinforced concrete; the remainder are made of Siemens-Martin steel, shipped in sections 19.7 ft. long. The sections are butt-jointed and riveted together.

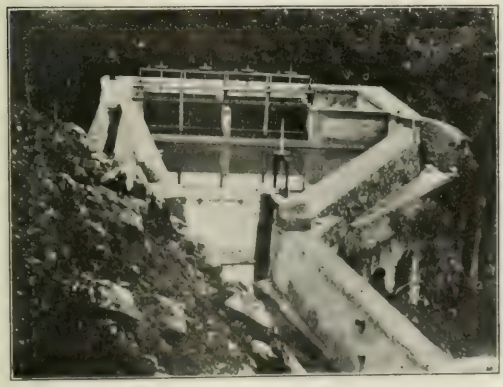


FIG. 2.—COLLECTING BASIN.

The power house, shown in Fig. 1, is designed to accommodate four main turbines of which there are at present three installed. The turbines are of the impulse wheel type, and have a capacity of 1500 hp each, making 410 r.p.m. There are two 100-hp exciter turbines of the same type, connected to 65-kw, 110-volt generators making 1000 r.p.m. One exciter is sufficient for the four main units, while the other is kept in reserve, also for lighting the station. Each generator is rated at 1300 kva, 5000 volts, 40 cycles and 400 r.p.m. The machines are of the Oerlikon revolving-field, three-phase type, and are coupled to the horizontal turbine shaft by a flywheel coupling.

The switchboard and controlling gallery are located at the end of the generating room, in the switch house, from where the generating room is easily overlooked. It occupies practically the whole width of the generating room. In front of the switchboard are the generator columns, each bearing the instruments and levers for controlling a generator. There are installed seven single-phase, oil-insulated, water-cooled transformers arranged for two circuits in groups of three; the remaining transformer is kept in reserve, and in case of emergency can be thrown on either group. Each transformer has a rating of 600 kva. The primary is wound for 5000 volts and the secondary for 30,000 volts. By connecting the secondaries of the groups in star, 52,000 volts is obtained across each phase of the circuits. The busbar connections are such that each group can be thrown on either of the outgoing lines, or else both operated in parallel when necessary.

The total length of the transmission line is 75 miles. For a distance of 10.8 miles it runs through the province of Malaga, then 30 miles through the province of Cadax, and the last 34.2 miles run to the city of Seville. The highest point in the line is the crossing at Mt. Burrueco, 2525 ft. above sea level, while the lowest is in crossing the river Guadaira at Seville, where the elevation is 36 ft. above sea level.

All the transmission towers, of which there are 1550, are of structural steel; with few exceptions, they are made of two channels with transverse bracing. The average spacing of the towers is 260 ft.; however, the spans frequently exceed this, varying from 328 ft. to 400 ft., while there are other spans of 655 ft., 985 ft. and 1475 ft. The special steel towers are made of angle iron and are of the four-legged type, as shown in Figs. 4 and 5. The insulators are of the triple-petticoat type, and are carried on steel pins bolted to wooden arms clamped to the angle-iron guides at the towers. By

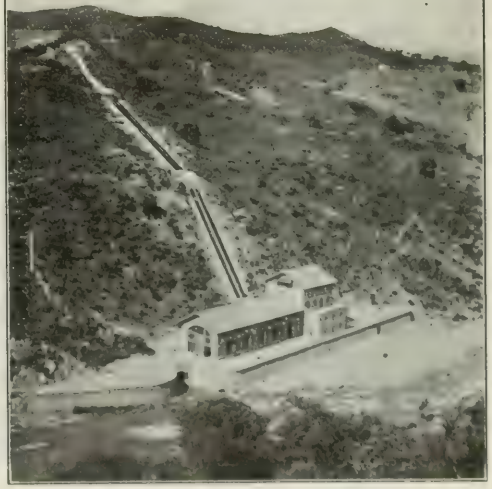


FIG. 3.—POWER HOUSE AND PENSTOCK RUN.

Wattless component $I_{awl} \quad I_{owl}$: 15.8 amp approx.

(III.) *Measurements at Zero Speed.*

Measured: Current, 95 amp.
E.m.f., 920 volts
Loss, 28.5 kw.

Then, power factor at zero speed

$$\text{Cos } \Theta_k = \frac{28.5 \times 1000}{\sqrt{3} \times 95 \times 920} = 0.19$$

Zero-speed current:

$$I_k = \frac{2750}{920} \times 95 = 284 \text{ amp.}$$

Watt component of zero-speed current:

$$I_{kw} = I_k \cos \Theta_k = 284 \times 0.19 = 54 \text{ amp.}$$

Wattless component of zero-speed current:

$$I_{kwl} = \sqrt{I^2_k - I^2_{kw}} = \sqrt{(284 + 54) \cdot (284 - 54)} = 279 \text{ amp.}$$

The points P_o, P_a and P_k were then set off to scale in Fig. 1.

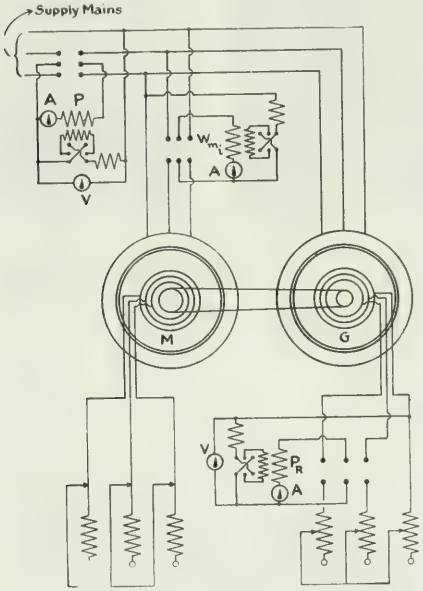


FIG. 2.—CONNECTIONS FOR TESTING INDUCTION MOTORS.

To find the line on which the center M of the circle lies,

$$\tan \beta = \frac{I_{ow} \sin \Theta_k + I_{owl} \cos \Theta_k}{I_k + I_{owl} \sin \Theta_k - I_{ow} \cos \Theta_k}$$

$$= \frac{2.4 \times 0.98 + 15.8 \times 0.19}{284 + 15.8 \times 0.98 - 2.4 \times 0.19}$$

$$= \frac{2.35 + 3.0}{284 + 15.5 - 0.45} = \frac{5.35}{299.05} = 0.0179$$

whence $\beta = 1°$.

Then draw $O\,M$ to make an angle of 1 deg. with the abscissa axis and determine the position of M by bisecting the line $P_k P_o$. The circle can now be drawn and the characteristic curves of the motor determined in the usual way.

Motor input				Total loss in Kw $= P$.	Generator output, $W_{g_1} = W_{m_1} - P$.	Loss in inserted resistance in generator secondary.	
Volts.	Amps.	Kw$_{m_1}$	Cos Θ_m.			Volts $= E_2$.	Kw $= P_r$.
2760	59.6	218	0.9	60.5	157.5	33	11.5

Consider now the above set of readings taken from a Hopkinson test of these machines. The power factor for the motor, cos Θ_m, at the input W_{m_1} is obtained directly from the readings, but to what load do these readings refer? This, of course, involves the question of efficiency, which is always difficult to calculate from such test results owing to the uncertainty of the belt losses, etc.; use can now be made of the diagram. In passing, it may be noted that, if there is any inaccuracy in the method about to be employed, it is entirely negligible compared with that which has already gone before, namely, the experimental error in taking the readings or when compared with any of the generally used methods of computing the efficiency from these results. Indeed, it may safely be said that not only the efficiency but also the slip and power factor can be found more readily from the diagram, provided only that the above power readings can be relied on.

Now the motor efficiency is obtained at once from the diagram by setting off the point P_m, as shown in Fig. 1, the ordinate representing the motor input $W_{m_1} = 218$ kw and $O\,P_m$ the current = 50.6 amp. As is seen, the power factor cos $\Theta_m = 0.9$; the slip $s_m = 1.7$ per cent; while the efficiency $\eta_m = 91.6$ per cent, and therefore the output $W_{mo} = \eta_m W_{m_1} = 200$ kw. Thus the output to which the above efficiency, power factor and slip of the motor correspond is accurately determined from the diagram and equals 200 kw = 268 hp.

It is equally simple to determine the efficiency of the machine as a generator also, but in doing so it must not be forgotten that the generator secondary resistance is greater than the normal owing to the inserted resistance r_1, which will make the efficiency η_g much less than if the machine were working normally. This fact, however, introduces no difficulty provided the new zero-speed point P'_k corresponding to this case is located. It is necessary merely to ascertain the inserted resistance per phase from the above set of readings:

$$r_1 = \frac{3 E^2_2}{1000 P_r} = \frac{3 \times 33^2}{11{,}500} = 0.284 \text{ ohm.}$$

Reducing this value to primary terms.

$$r'_1 = 0.284 \times 3.62^2 = 3.73 \text{ ohm.}$$

where turns on primary/turns on secondary = 3.62. Hence the total resistance per secondary phase reduced to primary:

$$= r'_2 + r'_1 = 0.47 + 3.73 = 4.2 \text{ ohm.}$$

Before finding the current, however, one must also know the reactance. Now from the readings for the zero-speed constant P_k the impedance per phase at zero speed is found to be

$$Z_k = \frac{E}{\sqrt{3}\, I_k} = \frac{2750}{\sqrt{3} \times 284} = 5.6 \text{ ohm.}$$

whence reactance per phase

$$X_k = \sqrt{Z^2_k - r^2_k} = \sqrt{5.6^2 - 0.94^2} = 5.5 \text{ ohm.}$$

where

$$r_k = r_1 + r'_2 = 0.47 + 0.47 = 0.94 \text{ ohm.}$$

Hence with the resistance r_1' inserted in the secondary circuit, the impedance per phase will be:

$$Z'_k = \sqrt{\{r_1 + (r'_2 + r'_1)\}^2 + X^2_k}$$

$$= \sqrt{(0.47 + 4.2)^2 + 5.5^2}$$

$$= 7.2 \text{ ohm.}$$

From this value the zero-speed current at P'_k is found to be:

$$I'_k = \frac{E}{\sqrt{3}\, Z'_k} = \frac{2750}{\sqrt{3} \times 7.2} = 220 \text{ amp.}$$

Now, provided the motor is not working in the neighborhood of synchronism, the magnetizing current will not introduce any appreciable error, and P'_k can be set off directly on the circle.

The point P'_k, representing I'_k, is thus shown in Fig. 1, while P_g, the point corresponding to the generator output, is drawn on the lower half of the circle. To obtain the power factor, efficiency and slip for this condition it is necessary merely to find the corresponding lines just as in the case of a motor. In this case, of course, the abscissa axis represents the line of zero output, while the line $\overline{P'_k P_o}$ represents zero input, the conditions being just the reverse to those of a motor. The efficiency line is then drawn parallel to the line $\overline{P'_k P_o}$

where the mechanical input is zero, and is bounded by the abscissa axis representing zero efficiency and the no-loss line passing through T_g representing 100 per cent efficiency. As seen from the diagram, the efficiency of $\eta_g = 86.7$ per cent and the power factor $\cos \Theta_g = 0.85$. For the slip—which is negative—a line parallel to $\overline{P_a P_\infty}$ is drawn to pass through P'_k. This line $\overline{P'_k O_2}$ (Fig. 1) is produced backward beyond the tangent at Pa, and a length $= \frac{1}{2} \overline{P'_k O_2}$ is divided into 50 parts in a similar way to the slip line for the normal motor. The the slip s_g is thus $= 6.4$ per cent.

It is thus seen that the diagram affords a complete insight into the behavior of the machines during the above test, and at once gives the efficiencies, etc., without requiring any correction whatsoever for belt slipping and similar difficulties encountered in calculations. It must be remembered, of course, that η_g represents the efficiency of the generator at an output of 157.5 kw with respect to the zero-speed point P'_k, that is, the efficiency of the generator as on test, and not under normal conditions. Had the inserted resistance been zero, then, of course, the machine would have been working normally with P_k as its zero-speed point. With a given ratio of pulleys, however, this desideratum is not always easy to be obtained.

CALCULATION OF EFFICIENCY FROM MODIFIED HOPKINSON TEST OF INDUCTION MOTORS.

As seen from the foregoing, it is quite easy to measure the motor input and the generator output; the difficulty is to determine the loads to which these correspond. Now, although the above graphical method gives in a simple manner results the reliability of which only depends on the accuracy of the readings, yet it may not always be desirable or possible to construct such a diagram for obtaining these results. Since, however, there is at hand a useful check on any analytical method that may be deduced, it is well to find some such means whereby the efficiency can be properly calculated. To do this, proceed as follows:

After adjusting the pulleys, etc., until the induction motor is able to drive the induction generator under the required conditions—the losses and wattless current being supplied from an independent electric source—let resistance be inserted in the rotor circuit of the generator until the input to the motor is as much above the load at which the machines are to be tested as the output of the generator is below this load. Since then the efficiency curve of an induction machine is practically a straight line over the working range, it is obvious that the efficiency of both the generator and the motor with respect to this mean load would be about the same if both machines were working under normal conditions.

Then measure:*

I. Total losses = power taken from supply mains $= P$.
II. Motor input $= Wm_i$.
III. Losses in resistance inserted in the generator secondary circuit $= P_r$.
IV. Speeds of the motor and the generator and the frequency of the supply current.

Starting then from the definition that the combined efficiency of the two machines is:

$$\eta_{mg} = \frac{\Sigma \text{ outputs}}{\Sigma \text{ inputs}} = \frac{\Sigma \text{ outputs}}{\text{motor input}}$$

Then

$$\eta_{mg} = \frac{Wg_o + Pb_o + Pb_1 + Pr}{Wm_i}$$

Where Wg_o = generator output $= Wm_i - P$.
Pb_o = belt loss at no-load.
Pb_1 = additional belt loss under load.
Pr = loss in resistance inserted in the generator secdary circuit.

*In addition to these measurements, it is also well to measure the generator output Wg_o, if instruments are available. In certain cases it may be better to measure Wg_o than P, in the present test the generator output Wg_o was obtained by deducting the total loss P from the motor input Wm_i.

It is necessary now to ascertain how these several quantities can be determined.

To find the *no-load belt loss Pb_o, measure:*

(a) the loss P when the motor is driving the generator and secondary circuit of the latter is open, but its primary is connected to the mains. Denote this loss by P'. Any small iron loss in the generator rotor will be usually quite negligible.

(b) The loss P when the belts (or ropes) are thrown off and both machines are running light. Denote this loss by P''.

The no-load belt loss is

$$Pb_o = P' - P''.$$

To find the *additional belt loss under load Pb_1:*

For the additional belt loss which occurs under load due to the increased belt-slip, proceed as follows: Let d_m and d_g equal the effective diameters of the motor and generator pulleys respectively, after the thickness of the belt has been taken into account. Now if there were no belt slip under load,

$$\frac{\text{speed of generator}}{\text{speed of motor}} = \frac{d_m}{d_g}$$

Actually, however,

$$\frac{\text{speed of generator}}{\text{speed of motor}} = \frac{d_m}{d_g} \cdot \frac{1 - c}{1}$$

where c is a constant representing the slip of the belt and is < 1.

Further, let s_g and s_m denote, respectively, slips from synchronism as measured on the generator and the motor under test.

Then

$$\frac{\text{speed of generator}}{\text{speed of motor}} = \frac{1 + s_g}{1 - s_m}$$

By substituting these two expressions for the ratio of the speeds the value of c is found.

Thus

$$\frac{d_m}{d_g} \cdot \frac{1 - c}{1} = \frac{1 + s_g}{1 - s_m}$$

that is,

$$1 - c = \frac{d_g}{d_m} \cdot \frac{1 + s_g}{1 - s_m}$$

or

$$c = 1 - \frac{d_g}{d_m} \cdot \frac{1 + s_g}{1 - s_m}$$

In the present case, which was a rope drive—there being eight 1¾-in. ropes to transmit the power—the effective diameter of the motor pulley was 45 in. and that of the generator 40 in., whence

$$c = 1 - \frac{d_g}{d_m} \cdot \frac{1 + s_g}{1 - s_m} = 1 - 0.89 \cdot \frac{1 + s_g}{1 - s_m}$$

Now c represents the amount by which the generator speed is reduced owing to the belt slip, and since this is practically zero at no-load it may be taken as the correction for the reduced speed of the generator caused by the slipping or creeping of the belt under load. Since then only the $(1 - c)$th part of the motor output is conveyed to the generator, it is obvious that a cth part of the motor output must be consumed in producing heat at the pulleys. Hence for the additional belt loss under load:

$$Pb_1 = cWm_o = cWm_i \eta_m$$

The efficiency of the motor can be estimated quite accurately enough for the purpose of finding Pb_1, since c is always very small when the belts are properly tightened.

In this way the combined efficiency η_{mg} can be found, and it now remains to split up η_{mg} into the separate efficiencies η_m and η_g. Before doing this, however, the combined efficiency η_{mg} for these machines will be calculated from the test results in the above table.

For the slips use will be made of the values as given by the diagram, though these can equally well be measured

Then, motor slip s_m = 1.7 per cent and generator slip s_g = 6.4 per cent,

whence, const. $c = 1 - 0.89 \frac{1 + s_g}{1 - s_m} = 1 - 0.89 \frac{1.064}{0.983} = 0.04$

Motor Input:

Pressure = 2760 volts. Current = 50.6 amp. Input Wm_1 = 218 kw

whence $\cos \Theta_m = \frac{218 \times 1000}{\sqrt{3} \times 2760 \times 50.6} = 0.9$

Total losses supplied to system

$$P = 60.5 \text{ kw.}$$

Hence, output of generator is

$$Wg_0 = Wm_1 - P = 218 - 60.5 = 157.5 \text{ kw.}$$

Measured loss in resistance inserted in the generator secondary circuit:

$$Pr = 11.5 \text{ kw.}$$

No-load belt loss

$$Pb_0 = 10 \text{ kw.}$$

Additional belt loss

$$Pb_1 = c.\ Wm_1 \eta_m = 0.04 \times 218 \times 0.9 = 7.5 \text{ kw.}$$

Hence,

$$\Sigma \text{ outputs} = Wg_0 + Pb_0 + Pb_1 + Pr$$
$$= 157.5 + 10 + 7.5 + 11.5 = 186.5 \text{ kw.}$$

Then, combined efficiency

$$\eta_{mg} = \frac{\Sigma \text{ outputs}}{Wm_1} = \frac{186.5}{218} = 0.85.$$

It is necessary now to analyze this combined efficiency.

To do this, consider the *losses in the two machines*—these are $Wm_1 - \Sigma$ outputs $= 218 - 186.5 = 31.5$ kw. Now, if one-half of these losses occur in the motor and the other half in the generator, it is clear that the motor efficiency will be higher than that of the generator. But it is not known how these losses are distributed between the two machines and the simplest procedure is not to trouble about the *actual* loads, but to take the load corresponding to which the generator efficiency equals the motor efficiency, so that $\eta_m = \eta_g = \sqrt{\eta_{mg}}$. Now if there were no external losses (outputs) in the belts, etc., the *corresponding mean load would be* ½ $(Wm_0 + Wg_0)$, but under actual conditions it will be better to find this load from the machine working under normal conditions, namely, the motor, by deducting from the output of the latter half the losses in the two machines. This procedure, though not strictly accurate, is quite good enough for all practical purposes. Taking then the corresponding mean load $\eta_m Wm_1 - ½ (Wm_1 - \Sigma$ outputs) we have with respect to this load:

$$\eta_m = \eta_g = \sqrt{\eta_{mg}} = \sqrt{0.85} = 92.2 \text{ per cent}$$

where η_m and η_g both refer to the machine working normally with an output of $\eta_m Wm_1 - ½ (Wm_1 - \Sigma$ outputs$) = 0.922 \times 218 - ½ (218 - 186.5) = 201 - 15.75 = 185$ kw or $= 247$ hp.

From the diagram Fig. 1, the efficiency at this load is η_m = 91.5 per cent, consequently the agreement between calculation and the diagram is within 1 per cent.

It is seen, therefore, that the above method of calculating the efficiency gives results which are in good agreement with those yielded by the diagram, and may, therefore, together with the latter method, be regarded as a satisfactory way of determining the efficiency of induction motors when tested by the modified Hopkinson method.

It may be useful to summarize briefly the above method for calculating the efficiency:

(1) Measure, in the way above described, the motor input Wm_1, the generator output Wg_0, the no-load belt loss Pb_0, the additional belt loss Pb_1, the loss in resistance inserted in the generator secondary Pr.

(2) Determine combined efficiency:

$$\eta_{mg} = \frac{\Sigma \text{ outputs}}{\Sigma \text{ inputs}} = \frac{Wg_0 - Pb_0 + Pb_1 + Pr}{Wm_1}$$

(3) Then the separate efficiencies η_m and η_g of the two machines is $\sqrt{\eta_{mg}}$ with respect to the corresponding mean load Wm_0 losses in machines $\eta_m Wm_1 - ½ (Wm_1 - \Sigma$ outputs) as output.

Recent Improvements in Underground Conduit Construction.

By S. B. Way.

THE city of St. Louis has, during the past two or three years, witnessed some radical departures from accepted methods of conduit construction. During the year 1906 the electric light and power interests of that city found it desirable to install considerable conduit incidental to an extension of the system of distributing electricity for general use and for extending high-tension feeders to reach distant street-railway substations. A fairly large stock of multiple-duct tile conduit was on hand, but not in sufficient quantity for the requirements of the work contemplated. An investigation of the conduit market developed a condition not at all encouraging to those responsible for the completion of the work in hand within the required time, in that all of the conduit manufacturers were then already sold out of the kind of duct desired. This state of affairs made it necessary for the engineers in charge of the work to choose between completing the work with such conduit as could be purchased and delivered within the time limit or to devise some means of building a conduit without the usual tile or other pipe. The engineers chose to make an attempt to get along without the pipe, and incidentally save money in the cost of construction. This resulted in building a conduit entirely of concrete.

Upward of 170,000 duct-ft. of all-concrete or monolithic conduit has been laid in St. Louis within the last three years; fulfilling every requirement for all uses, from single-duct runs with frequent junction or service boxes, to replace Edison tube, to heavy isolated runs for high-tension cable.

The ideal conduit, or housing, for underground conductors must have smooth, clear, jointless, fireproof duct openings, free from pockets or depressions in which water may lodge; should be laid to true grade to drain to manholes; must be constructed of a material of high electrical resistance, and which will be homogeneous and not deteriorate with age; must be strong and able to sustain itself and a considerable load over fairly long spans, and it must be cheap.

The almost universally accepted practice in this country of constructing conduits of single or multiple clay tile, fiber wood, cement or iron pipe, with a jacket or supporting armor of concrete, obviously falls far short of the ideal construction. Any of these methods of constructing ducts depend on the concrete armor for strength and ability to withstand the usual cuts, excavation and city improvements continually met with in the streets of large cities; and if the concrete armor is weakened or carelessly applied, the pipes of various kinds resemble beads strung upon a wire and serve no useful purpose except to provide a hole or duct of uncertain size, smoothness and continuity between manholes.

In constructing a conduit with clay or other pipe as a means of obtaining the duct openings, a bottom layer of concrete is thrown into the trench and leveled off, after which the pipe structure is built up on the concrete, necessitating the presence of workmen in the trench and the handling of a large amount of heavy material, which, even with the most careful methods, causes quantities of earth to be carried into the trench and deposited onto the concrete, seriously interfering with the bond between the bottom layer of concrete and the sides and top of the concrete armor or envelope, materially weakening the structure. In laying the pipes it is difficult to obtain perfect alignment and sealing. Each new section of pipe must be fitted to the preceding one, which jars or moves the pipe already laid to a greater or less extent, depending upon the skill of the workman and the quantity of the material he is using. After the pipes are laid there is no absolute inspection

of the ducts possible, and the only information the owner can obtain relating to the presence of foreign matter, alignment and sealing is derived from the passage of a short mandrel through the various ducts. Drawing a mandrel through a duct can do no more than demonstrate that there exists a hole sufficiently large and straight to permit the mandrel to pass through it. It is desirable in any conduit that the ducts be completely isolated from each other and that the ducts be free from water-pockets or depressions and present a large and smooth surface as a bed for the cable, in order that ground currents may be

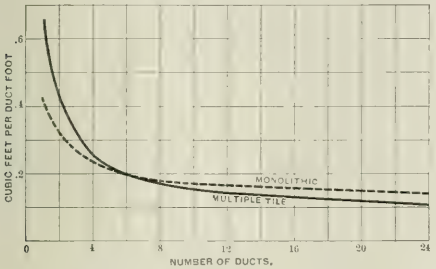


FIG. 1.—CURVE OF CONCRETE PER DUCT-FOOT.

equally distributed over the greatest possible area of the cable sheath, so that local electrolytic action may be minimized. Conduits built up of single-duct tile or pipe offer greater isolation of individual ducts, but are more expensive to construct than conduits built up of multiple-duct tile. Multiple-duct tiles afford communication between all of the ducts in the tile at

becomes homogeneous; occupies less space for a given number of ducts of equal size; permits perfect inspection of each duct from end to end incidental to the laying of each tier; pro-

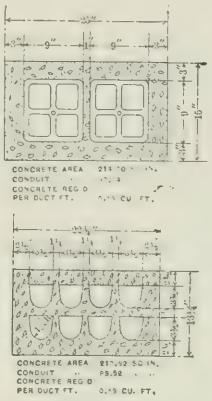


FIG. 3.—AVERAGE DIMENSIONS OF STANDARD TILE CONDUIT.

vides smooth, straight, clear, jointless and fireproof duct openings from manhole to manhole; eliminates handling, fitting, breakage and cost of pipe; requires no factory, and but few and simple special tools; and for average duct sections uses no more material (concrete) than is required for the armor or envelope of pipe construction. The amount of concrete per



FIG. 2.—TRENCHES WITH FORMS READY FOR CONCRETE.



FIG. 4.—OPEN TOP DUCTS WITH CONCRETE COVERS.

every joint, or at points 3 ft. apart, and such construction permits a burning cable to throw fire and hot metal through the joints to the other ducts in the tile, even though the tile partitions between the ducts are not melted or evaporated by the arc, which is the usual result following a cable burn-out in tile construction.

It has been found that all-concrete or monolithic conduit possesses many advantages over a conduit built up of pipes of whatever nature, in that with such construction the structure

duct-foot required for various duct sections for multiple-duct tile and for monolithic conduit and the cost per duct-foot of completed work, exclusive of trenching, refilling and repaving, are shown by curves in Fig. 1. These curves were plotted from results obtained in actually laying a considerable quantity of each type of conduit under the same supervision and by the same men. The multiple-duct tile was laid with a 3-in. armor of concrete and with the interstices between the tiles filled with fine concrete, while the monolithic conduit was provided with

2½ in. of concrete between the ducts and the bottom and sides of the trench, with a cover or top 3 in. thick. The items of trenching, refilling and repaving are nearly constant for each type of conduit, except a small differential of about ½ cent per duct-foot in favor of monolithic conduit due to the smaller trench and consequent reduced excavation and hauling of displaced earth required by the monolithic construction. Typical cross-sections of multiple-duct tile and monolithic conduit are shown in Fig. 3.

The construction of monolithic conduit involves only the comparatively simple methods of good concrete work. After a trench of suitable width and depth has been excavated, duct-form supports are set to grade and perfect alignment on 16-ft. centers in the bottom of the trench. These duct-form supports serve to hold the forms or molds for producing the duct openings rigidly in place and in true alignment while the concrete is worked into place in the bottom of the trench. The duct forms or molds consist of 16-ft. sections of clear, straight-grained lumber previously dressed to the shape of a "U," and are held down in the duct-form supports against the buoyancy of the plastic concrete by suitable cast-iron, or other, weights. When the duct forms are set, concrete of the proper mixture for good concrete work is dumped into the trench and suitably rammed and puddled around the forms and finally struck off level with the tops of the molds. The concrete is then allowed to take its initial set, which in favorable weather requires about three hours, when the duct forms may be removed by simply

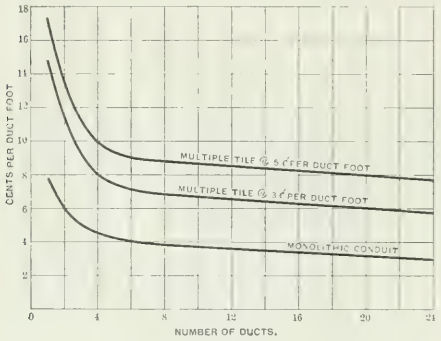


FIG. 5.—DUCT CONNECTION COSTS.

lifting them upward and out of the concrete, leaving smooth, straight, continuous U-shaped grooves in the bed of concrete just laid, which, when covered, constitute the duct openings. Fig. 2 shows the trench with forms set ready for the concrete to be dumped in.

After the duct forms are removed from the concrete, the smooth, continuous grooves molded in the concrete by the forms are open to the daylight for the full length of the construction and every possible facility is afforded for perfect and rapid inspection. Any faults in the work may be instantly detected, and this in itself is a potent factor in securing first-class work.

The open top ducts are closed in by laying across the top of the structure thin, smooth plates, or slabs, of concrete molded on the site of the work. These slabs, or plates, of concrete are made of just sufficient width to lap over each outside duct a short distance, and are laid as illustrated in Fig. 4, with a small quantity of mortar to seal the joints. The thin concrete slabs, or plates, serve the double purpose of closing in the top of the newly formed ducts and as a foundation or support for the next layer of concrete in which an additional tier of ducts may be formed in the same manner as the preceding tier, this operation being repeated as often as necessary to produce the required number of duct openings. The top of the conduit is closed in in the same manner, with the exception that the top layer of concrete contains no duct forms and acts simply as an armor or envelope to protect the conduit construction from future excavators.

In addition to its lower first cost and other important advantages, monolithic conduit is especially well adapted to be used as a conduit for local distribution. "Blind" handholes, or service boxes, are readily molded in the concrete structure intercepting any desired number of ducts. In molding these handholes or service boxes, the duct forms are allowed to pass through and the concrete flowing around the duct forms is stopped off by suitable forms arranged to fit closely around the duct molds. Such handholes or service boxes can be installed at as frequent intervals as desired without increasing the cost of the construction, inasmuch as no additional material is required. The top of the handhole or service box is closed in after the conduit is finished by a suitable cast-iron or concrete cover, made loose so as to be removed readily in case it is desired to open the box for taking off services. Monolithic conduit has been laid under a great variety of street conditions and during all seasons of the year with perfect success and with a material saving in cost over the various pipe methods of duct construction.

Niagara Energy in Syracuse.

The energy reaching Syracuse from Niagara is transmitted over two separate three-phase, 60,000-volt lines from the generating station of the Ontario Power Company. It is received at a switching station, located at Solvay, a suburb, through which it passes directly at 60,000 volts to a converter substation of the Syracuse Rapid Transit Railway Company, and indirectly through stationary transformers to the 11,000-volt circuits of the Syracuse Lighting Company, and to the 33,000-volt circuits of the Rochester, Syracuse & Eastern Railway, the Syracuse, Lake Shore & Northern Railroad, the Syracuse & South Bay Electric Railroad and the Oswego River Power Transmission companies. The switching station proper contains two separate sets of three-phase, 60,000-volt, 500-amp Westinghouse oil-break switches, which are closed and tripped by solenoids receiving energy from a 220-volt storage battery. Both the incoming and the outgoing 60,000-volt lines are equipped with horn-gap lightning arresters, of which there are three to each wire. In series with each arrester is a cement resistor. The three arresters are given different adjustments of sparking distance and series resistance, from long gap with low resistance to short gap with high resistance; the latter, which handles the mild disturbances, is assisted by the other arresters in succession as the disturbances become more violent. The leads enter and leave the building by way of circular glass windows in the center of which is placed an insulating tubing surrounding the conductor.

The energy for the Syracuse Rapid Transit Railways Company passes over aluminum wires to the city limit, from which point it is conveyed for 11,000 ft. by plow-steel cable to a converter substation. This substation contains three oil-insulated, water-cooled, 1000-kw transformers for reducing the e.m.f. for application to the slip-rings of three 1000-kw, six-phase rotary converters, which deliver direct current at 550 volts for the railways of the city. The converters are brought up to speed by means of directly connected squirrel-cage induction motors and are connected in parallel when the proper speed is reached by means of automatic synchronizers. The above-described machinery is of Westinghouse manufacture. An old reciprocating steam-engine station containing direct-current generators is retained as emergency reserve and to carry peak loads.

The energy for the 33,000-volt circuits passes into a transformer-room containing four 300-kw Westinghouse single-phase, self-cooling, oil-insulated transformers, three of which are in service, with the fourth held in reserve. Even at the present time the load demanded exceeds the rating of the three transformers. A fifth transformer will soon be added, so that the two "reserve" transformers can be joined in open-delta to assist in carrying the load. With the latter arrangement a load

of 1400 kw can safely be carried continuously. The outgoing lines are provided with combined expulsion fuses and air-break disconnecting switches, and with aluminum-cell lightning arresters. Indicating devices serve to show to the attendant when the temperature of the transformer oil is excessive or a fuse has blown. The gap which separates the arresters from the lines is short-circuited at regular intervals in order to maintain the surface film in operating condition.

The energy for the Syracuse Lighting Company passes from the 60,000-volt oil switches through open-air disconnecting switches into an adjacent substation building, where the e.m.f. is reduced to 11,000 volts by means of three 1000-kw, water-cooled General Electric transformers. These transformers are placed in separate fireproof compartments and provision is made for emptying the oil from any transformer into a cistern when necessary. The circulating water is pumped out of and allowed to flow into an open-air cooling tank. A fourth 1000-kw transformer in its fireproof compartment is held as reserve. By means of busbars and disconnecting switches this transformer can readily be paralleled with either of the other three transformers, which can then be removed from service for repairs, etc. The outgoing 11,000-volt lines are equipped with multigap lightning arresters with shunting resistors of graded resistance, while motor-operated oil switches serve for protecting the circuits from overload.

At the lighting substation there are two 1000-kw motor-generator sets for changing the frequency from 25 cycles to 60 cycles, two 500-kw synchronous converters for delivering direct current and 32 oil-insulated, water-cooled mercury-arc rectifiers with constant-current regulating transformers for operating 1560 magnetite arc lamps joined in 32 separate series circuits. This apparatus was supplied by the General Electric Company. In connection with this substation equipment there is available for use during emergency and to carry peak loads two 1500-kw Curtis steam turbo-generators, three 500-kw reciprocating-engine generator sets and 25 series arc-lighting generator sets, some of which can be driven by motors and others by belts from line shafting driven by reciprocating engines.

The boiler equipment is rated at 7200 hp. Some of the furnaces are fed with coal by hand, others by automatic stokers, while a few of the furnaces are arranged for the use of oil fuel. The oil fuel is particularly advantageous for "stand-by" purposes.

Protective Features of a High-Tension System.

In an interesting paper presented before the Chicago section of the American Institute of Electrical Engineers, Mr. R. F. Schuchardt gave the results of experience with the protective devices used on the Commonwealth Edison system of high-tension underground transmission with rotary converter and frequency-changer substations. The system consists at the present time of three generating stations having a maximum continuous rating of 15,000 kw, 120,000 kw and 42,000 kw respectively, of 23 rotary converter (Edison) substations aggregating 54,700 kw in normal rating, nine frequency changing substations with 32,000-kw rating, and about 350 miles of three-conductor underground cable. Of the latter about 300 miles is operated at 9000 volts, the balance at 20,000 volts, which pressure is obtained from 5000-kw step-up transformers at a generating station. Eleven of the rotary converter substations also have storage batteries and there are in addition three large substations containing batteries only. The total battery rating at the one-hour discharge is 18,000 kw. A subsidiary 60-cycle steam plant with a rating of 2500 kw should also be mentioned. Energy is also supplied to 19 substations, aggregating over 80,000 kw, of the various elevated and surface railway lines. The three-phase generators are Y-wound and operate at 9000 volts between terminals. The neutral of the system is grounded. The substations are connected on the radial system, though a number of interconnecting lines are provided for emergency use. Fig. 1 shows diagrammatically the component parts of the system.

In the development of a suitable system of protection for such a system there is danger of providing so many devices that instead of protecting the system one is actually overloading it with danger points which may seriously impair the service. The watchword must be simplification. The system should be made thoroughly sound and use should not be made of protective devices that introduce complications or that are not a positive necessity. In other words, it is not how much protective apparatus should be installed, but how much can be avoided. This is the position of the Commonwealth Edison Company, and in the following will be shown how it is carried out and also the evolution to the present system.

The original transmission line, which was started in August, 1897, at 2250 volts, and which had a length of about three miles and fed energy to two 100-kw rotary converters, was provided with aluminum fuses in spring-expulsion blocks. The next year the voltage was doubled, but the fuses still continued in service, though pneumatically operated wood-vessel oil switches were then introduced on the line. About three years later, in February, 1902, the voltage was again doubled and alternators of large rating were installed. The transmission lines had increased to six in number, and remotely controlled, electrically operated oil switches were installed. The proper

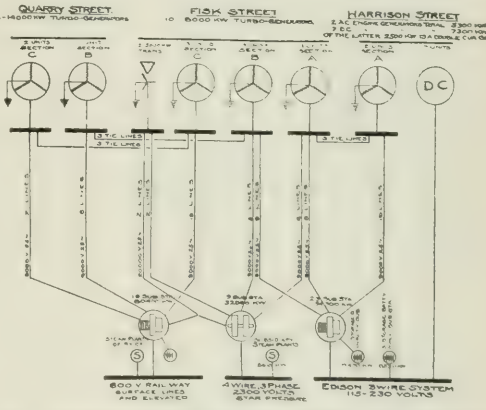


FIG. 1.—INTERCONNECTIONS OF QUARRY STREET, FISK STREET AND HARRISON STREET STATIONS.

protection for this system was the subject of much study, and finally the simple solenoid-and-plunger type of overload relay combined with a fixed time-limiting device was adopted. At the substation the relays were installed without the time-limit. The time-limit was originally set for six seconds, but experience soon showed that this was much too long and the setting was reduced to two seconds. Cable trouble, however, continued to cause quite severe disturbances and the fallacy of a fixed time-limit soon became apparent. It was, therefore, abandoned, leaving only the plain relay with practically instantaneous action.

The system grew rapidly and in 1903 the first two 5000-kw turbo-generators at the new Fisk Street station were put into service and by the next summer a third had been added and the length of the transmission lines was increased to a total of 68 miles. The necessity for obtaining selective action of the relays so that in the larger system the proper switches, and those only, would operate was, of course, recognized. The devices on the market at that time were few and none was very promising. Thus the plain overload relay still reigned alone. It was attempted to get selective action by having the setting of the relay at the substation end considerably lighter than that at the station end. Where a line was continued from one substation to another a gradient was adopted for the settings of the relays at the various switching points, the heaviest setting being, of

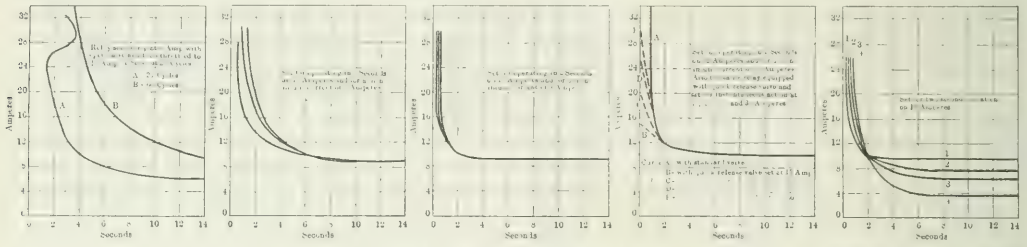
course, at the generating station. However, the current which flowed into a cable breakdown was never limited to that of the minimum relay setting and the general opening of lines resulting from cable trouble caused as much disturbance as formerly.

The demand for a selective action became more insistent, and experiments were started to develop a suitable device containing the desired features. The bellows attachment to the coil-and-plunger type of relay had been produced and when experienced proved it to be satisfactory it was adopted in Chicago. The effect of the bellows was to make the time of action of the relay inverse to the amount of the overload; moreover, with two bellows relays having equal current setting, but unequal time adjustment, the one with the shorter time adjustment would always open first when tested in series. The bellows relay was thus found to have features necessary for selective action. As it plays an important part in the solution of the protective problem its characteristics as shown in tests, and improvements prompted by experience, will be dealt with in some detail.

In the early bellows relays the plunger when drawn upward returned to its "at rest" position very slowly. An improvement was made by adding a quick-recovery valve. This valve was intended to prevent the plunger from being picked up by light swinging grounds, thus gradually bringing it to the contact position with an intermittent overload lower than its setting. On a system such as the one under discussion these intermittent overloads do not occur, and the quick-recovery valve on 25-cycle circuits actually introduced a weakness, as will be pointed out shortly.

The vibration at 25 cycles is due to the fact that this frequency is somewhere near the natural period of vibration of the suspended plunger. When during trouble the frequency of the system drops one or two cycles the chattering becomes more pronounced. When the valve is throttled down fairly far—for instance, for a six-second adjustment—then the retardation of action may be considerable. With light throttling—for two-second adjustment—the resistance to the rising plunger is comparatively low and the vibration does not become harmful. The probable explanation of the pumping is as follows: When the heavy overload suddenly comes on the relay the core is violently jerked upward, thus compressing the air in the bellows and the spring in the stem under the contact cone. A small amount of air is driven out of the orifice at the top, but when the current wave falls to zero there is sufficient energy in the compressed air and in the compressed spring to cause a recoil of the core. The inertia of this movement causes air to be drawn into the bellows through the quick-recovery valve and this is the weakness of that valve referred to above. When the current wave again rises the plunger meets a condition in the bellows similar to that at the beginning and this cycle is repeated for the successive waves. The closing of the relay contacts is thus greatly delayed or even hindered.

It was found during the investigation that when a relay is adjusted to operate in six or more seconds at its minimum current setting—that is, when it requires six seconds to operate when the current rises to the minimum setting valve and will not operate at all with a lower current—then there is considerable non-uniformity between curves of different relays on 25 cycles, as shown in Fig. 3. This lack of uniformity entirely disappears when the adjustment is made at two seconds—Fig. 4. The lesser time required to operate at excessive overload with a two-second adjustment is clearly illustrated in this curve. The 0.3 second minimum time shown here is about as short a time as can be obtained on the standard form of the relay. This shows the desirability of adjusting for the two-second value of the curve. However, the curve of Fig. 4 is not the ideal one for a protective relay. The desideratum for such a relay is to operate instantly when the overload is in the nature of a short-circuit and to operate only after several seconds if the overload, though dangerous if prolonged, is not of the short-circuit kind. As continuity of service is always the first aim, the switches should not be opened by an overload until it is positively unsafe to hold on longer. On the other hand, when a cable breaks down the switch should be opened instantly, for the breakdown—which usually is on one wire only, the neutral being grounded—will otherwise spread to the other wires and then the shock to the system may be very severe and the switches of sound lines may be opened. Where the load consists of railway lines occasional current rises may occur which would be dangerous if continued, but which last for only two seconds or less. The switch should remain closed under these swings, therefore the two-second point of the relay curve should be as high as is consistent with safety. Based on heating only, the theoretical curve would be that of an inverse square very similar to the curve of an ordinary fuse, and this is actually the curve of the relay when the minimum current setting is adjusted for a long-time period. The



FIGS. 2, 3, 4, 5 AND 6.—TESTS OF BELLOWS TYPE OVERLOAD RELAYS

condition just mentioned, that the relay act instantly on a short-circuit, requires that the curve come to zero time at and beyond a definite load. From this point it should drop gradually to the two-second value and then continue at a lesser slope until the minimum-current value is reached, which should properly be at as long a time as can be obtained on the relay. This minimum setting is fixed by the danger limit for a robust system or apparatus, a comparatively small factor of safety being applied on the principle that it is better to risk an occasional burn-out than to be frequently shutting down part of the service. The load at which the switch should open instantly is approximately twice that of the minimum current setting, the two-second point being about half-way between the two.

On the bellows relays received from the manufacturer it was impossible to obtain a curve giving the points just defined. This is due to the construction and the type of air valve used. One of the engineers of the testing department of the Commonwealth Edison Company designed a very simple device which, when substituted for the manufacturer's air valve, overcomes the trouble due to vibration and enables practically a zero time

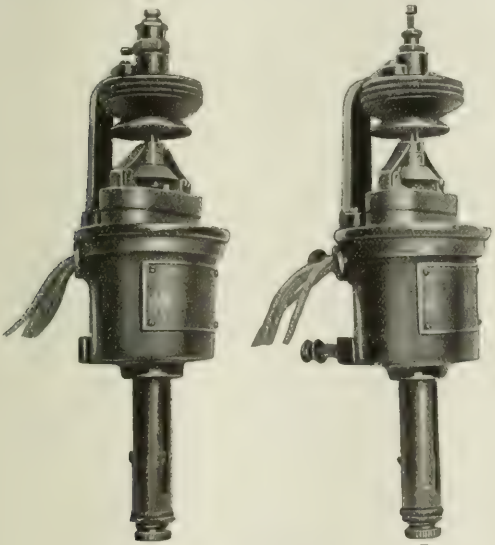


FIG. 7.—BELLOWS-TYPE OVERLOAD RELAYS.

point to be obtained with the standard relay. The device is a combination of a needle valve and a pop valve; it is shown applied to a relay at *A* in Fig. 7. The standard valve is shown at *B* in Fig. 7. The effect of the new valve is clearly shown in Fig. 5, in which *A* is a curve of a relay with standard valve, and *B*, *C*, *D* and *E* the same relay with the new device, the quick-release part of which is set respectively at 15 amp, 20 amp, 25 amp and 30 amp. The two features, insurance against vibration-trouble and a practically zero time-point, recommend the new valve and it has been adopted for all 25-cycle bellows relays of the company.

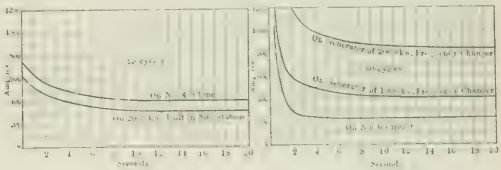
The method followed in setting a relay equipped with this new valve is as follows: The valves are first opened wide and the plunger is adjusted so that the desired minimum current will positively pull it to the contact position. The needle valve is then closed and the quick-release or "pop" valve is adjusted for instantaneous operation at the desired current value. The last step is then the adjustment of the needle valve for the two-second point.

In the discussion of the time action a distinction must be made between the time in which the switch will open after the overload comes on and the time required for the relay to close the tripping circuit. The time taken by the switch itself varies with the design of the switch. Tests on the oil switches used by the Commonwealth Edison Company have shown times varying from approximately 0.2 sec. to 0.6 sec. The trip switch will operate in about 0.03 sec. The ideal switch would open instantly the trip switch has acted. Because of the comparatively slow-acting switches the time setting of the relays should not be too high.

In describing the setting of a time-limit relay at least two points of the curve should always be stated, otherwise the description defines only the point stated and this may fit any number of curves. In Fig. 6 are shown four curves, any one of which might be meant if described merely as a 10-amp, two-second setting.

Having described the development of the relay itself, it is well now to discuss briefly its application and also that of other protective devices and features of the system.

In the generating station overload relays are used on transmission lines only. American engineers are practically unanimous regarding the undesirability of automatic devices on the generator switches. In some of the stations occasionally trouble has occurred at the generator. In every case the switchboard operator promptly disconnected the correct unit. The transmission lines with a few exceptions consist of three-conductor No. 4-0 cable. The relays on these lines are based on a continuous carrying capacity of 250 amp, which is 3900 kw at unity power factor. A 300 per cent load on this basis is considered sufficiently high for instantaneous action of the relay and 225 per cent load for two seconds. The minimum current on which the relay will operate is taken at 160 per cent of rated capacity. A No. 4-0 line may be loaded up to 4000 kw, and therefore the minimum setting is increased somewhat above one-half of the instantaneous setting. In the substations the line relays have been removed or omitted entirely. Instead, all of the lines feed energy to separate buses in the substation and are not ordinarily connected in parallel at that end. Dependence is thus placed on the relays of the units themselves for disconnecting the line from the load in case of trouble on that line. A 2000-kw unit, either rotary converter or frequency changer, on which the full-



FIGS. 8 AND 9.—TESTS OF BELLOWS-TYPE OVERLOAD RELAYS.

load input current at unity power factor is 155 amp, has its relays set at 310 amp minimum, 465 amp in two seconds and 620 amp instantaneous. Smaller units are set on this same basis in proportion to their rating. In Fig. 8 are shown the curves of a No. 4-0 line and of a 2000-kw substation unit. The settings just described were recently adopted after a careful study of the entire situation. The previous line setting was 500 amp, or 200 per cent load in six seconds, the minimum current then being about 490 amp. This is the setting which was found on some relays to have unreliable action on heavy overload, as was the case in curve *A* of Fig. 2.

The relays on the 60-cycle circuits and generators of the frequency changer substations do not have the instantaneous attachment, and the overload settings are higher in proportion than on the 25-cycle relays. The principal reason for this difference is that the short-circuit characteristics of the generators are different from those of the 25-cycle turbo-generators and the possible energy which can flow into a short-circuit is not sufficient to endanger the machines. Moreover, on 60 cycles the relay acts fairly promptly on excessive overloads. The e.m.f. of these 60-cycle, four-wire, three-phase generators is 4150 volts between wires, and their full-load rating is based on

75 per cent power factor. A 2000-kw generator would thus be rated at 372 amp at full load. On this unit the relays are set at a minimum of 840 amp and 1200 amp for two seconds. Other sizes of 60-cycle generators have their relays set similarly in proportion to their rating. The 60-cycle circuits, which are of No. 0 conductor and partly overhead, have their relays set at 225 amp minimum and 300 amp for two seconds. The full scale ammeter reading on these circuits is 150. These curves are shown in Fig. 9.

The bellows relays connected as just described constitute the entire protective apparatus connected on the alternating-current part of the system. In the new zone being reached by the 20,000-volt lines new problems will be encountered. Some of the substations will at the beginning probably be joined on the "ring" system and then the straight time-element overload-relay protection, with which the first of these lines to a single substation has been equipped, must be modified. This problem is being anticipated now and it would be readily solved if a reliable adjustable, alternating-current, reverse-power relay were obtained. It is possible that a scheme somewhat similar to that devised in England by Messrs. Merz and Price will have to be adopted.

On each rotary converter there is attached a speed-limit device set to trip the direct-current circuit-breakers when the speed reaches from 12 per cent to 15 per cent in excess of normal. These devices, which are of the ordinary mechanical centrifugal-switch type, have proved quite satisfactory. The rotary converters located in the basement of down-town office buildings are equipped in addition with direct-current reverse-power relays operating on the direct-current circuit-breakers. This departure from the rule of "least protective devices" is here made for reasons of policy. The relay is of the ordinary armature-and-magnet type, the magnetic circuit being closed at a contact at the direct-current ammeters. It might be added that each steam turbine is provided with a speed-limit device which closes a butterfly valve in the steam supply at a 10 per cent excess of speed.

The experience of the Commonwealth Edison Company with the various overload relays and with the different time settings on the bellows type leads us to the belief that the present adjustments will give a maximum of protection or, in other words, a minimum of disturbance during trouble in the system. Since changing from the six-second setting and replacing the air valve, the few cases of cable trouble which have arisen produced no more than a slight jolt on the system. If subsequent experience dictates further changes they will undoubtedly be in the direction of higher current settings. The action of the relays in the substations has been carefully watched. In every case of line trouble the units feeding energy from the bus connecting with the damaged line have been automatically disconnected either by the speed-limit device or by the alternating-current overload relay. In the substations which have the reverse-power relays, the circuit-breakers have at times tripped during a system disturbance while units without these relays continued to run. The advisability of having the reverse-power relay operate only the direct-current breakers has frequently been demonstrated when, during a heavy system disturbance, the alternating-current switch remained closed and the unit continued to run. When equilibrium was restored only the closing of the direct-current switches was required to replace the unit in service.

The operation of the high-tension system in sections was again started more than two years ago, and the advantage and great importance of such operation in limiting the extent of a disturbance on the system have been emphasized on several occasions. At present there are only two sections, but during the heavy winter loads another division is made, so that there are then three sections. The independent operation of the transmission lines at the substation end permits the omission of protective devices at that point. During emergency operation the lines may be in parallel at times, but this happens too infrequently to have any weight in the problem.

Of the central-station companies in the five largest cities of the United States the Chicago company is the only one that operates with a grounded neutral, but among the large railway companies the practice of grounding the neutral is common. Originally every generator was grounded. When the four-pole, 8000-kw units were installed, the neutral cross-current between them and the six-pole, 5000-kw units was found to be undesirably high, so that a resistance was inserted in the neutral of the new units. Incidentally this arrangement gave an opportunity to study the effect of a neutral resistance. Experience thus far has not been very decided either way. With the growth of the system and the addition of large units it was found that the effect of cable breakdowns increased in severity and therefore the grounding of all units was discontinued. The advisability of installing reactance coils in series with each generator is now also being seriously considered; in fact, a trial installation will soon be made. At present the neutral is grounded on one unit of each section, and the neutral bus of each section is connected to the ground bus through a 2.5 ohm resistance. There is as yet much difference of opinion among engineers as to the most desirable method of operating in this regard. Unanimity of opinion will not be reached until extended experience with each method has definitely pointed the way. However, in order to profit by that experience it is necessary that no opportunity be missed to study in detail every case of system trouble, and to record all facts and conditions which have any bearing whatsoever.

DISCUSSION.

Mr. L. L. Elden, of the Edison Electric Illuminating Company, of Boston, in discussion of this paper said that the experiences of his company with protective apparatus had been along the lines indicated by Mr. Schuchardt. Trouble had not been as serious as in Chicago, due, no doubt, to the smaller size of the system. Reverse-current relays are used only on alternating-current generators for single purposes. They are adjusted for 50 per cent reverse current and will operate at 70 per cent normal voltage. Bellows-type relays are used on transmission lines from the main generating station, adjusted for 600 amp with three seconds time limit. At the substation ends of these lines the bellows-type relay is also used, but with a lower adjustment. These adjustments in time and ampere capacity have been found to work out very satisfactorily in obtaining selective action of the relays on individual lines to each substation. In the substations where motor-generators are installed for conversion of current for the three-wire, direct-current system, instantaneous overload relays are used on the alternating-current side of the motor-generators. These are adjusted to three times the normal current capacity of the motors. On the direct-current side of such sets circuit-breakers are adjusted to twice the normal ampere rating of the direct-current generator. These adjustments satisfactorily take care of fluctuations caused by synchronizing or momentary disturbances on the direct-current system. These motor-generators have both synchronous and induction motors. Bellows-type relays are used on the high-tension side of the static transformers, being adjusted to three times the normal rating of the bank of transformers they protect. Instantaneous overload relays are used on all distributing circuits, whether single or three-phase. Troubles with the relay-type protective apparatus have been mainly confined to details, such as hardening of the bellows and clogging of air-valve passages. Frequent adjustment and inspection prevent such troubles. The comparatively excellent operation of the bellows-type relay on 60 cycles as compared with 25 cycles, as shown in Fig. 2 of the paper, probably largely explains the Boston freedom from difficulty on 60 cycles. Nevertheless, the action of the relay with the new attachment commends itself very strongly. The practice in Boston has been to operate the alternating-current system as a unit, but the company has seriously considered subdividing the system on the lines followed in Chicago.

Mr. W. G. Carlton, superintendent of power of the New York Central & Hudson River Railroad, discussed the operation of a system in two sections not connected, as against operating the entire system as one in synchronism. The operation in two

sections means an additional chance for trouble, because of mistakes in switching and also means that more generating capacity will ordinarily be kept in service than with one system. On the other hand, the one-system method has the objection that any short-circuit occurring in or near the power station is more likely to produce serious results. Short-circuit troubles are more severe the greater the capacity of the machines in service. In large stations busbar chambers in switch-rooms should be left with openings sufficient to provide for the rapid expansion of air due to heat liberated from short-circuits.

Mr. S. B. Way, of the Union Electric Light & Power Company, St. Louis, stated that he had found the same defects in bellows-type relays as were mentioned in Mr. Schuchardt's paper. The addition of the pop valve to the relay bellows produces just the desired effect, and his company intends equipping all of its bellows-type relays on 25-cycle lines with this device.

Mr. W. L. Abbott compared the result of short-circuits on a large direct-current lighting system with those on an alternating-current system. Whereas a short-circuit on the direct-current system could be burned off leisurely and without noticeable disturbance to the system, it was soon found with the higher voltages of the alternating-current system that the entire energy from all generating apparatus and storage batteries was all poured into the one point of disturbance, resulting in the general disorganization of the service. After recovering from their astonishment at the apparent delicacy of the new system everyone set to work devising protective devices. Naturally, the systems were loaded up with devices of such number and design that instead of protecting the system they only added further points of danger. It is now a question of the simplification of these devices.

Mr. F. A. Vaughn, of the Milwaukee Electric Railway & Light Company, described a relay developed there for the protection of constant-current series arc light systems against trouble due to open-circuiting of the outside lines. When the circuit is opened, a high potential is developed which usually means one or more breakdowns in the cable or elsewhere. With this relay, when the circuit opens there will be a jump across a spark-gap placed at the terminals of the circuit and the current flowing across that gap also flows in series through the windings of a relay. This relay raises a plunger that closes the gap permanently and short-circuits the arc circuit.

The Cost of Underground Conduit Systems for Electrical Distribution.

BY SYDNEY W. ASHE.

IN an article which appeared in the issue for June 3 various types of conduits and manholes for underground circuits were described. The present article deals with a recently developed junction box and cost data are discussed in detail.

1908 Junction Box.—The function of a junction box is to receive the feeders from the manhole and to distribute the electrical energy to the distributing mains, the separate mains being equipped with copper fuses in the junction box. An excellent improvement in junction-box construction has been recently brought out to supersede the Edison stub junction box. It is the purpose to locate this box near the manhole so that two sets of pipe connections may connect the junction box directly to the manhole; feeders and distributing mains may then enter the junction box, irrespective of their size, through these uniform connecting pipes. Comparing this box, Fig. 1, with the stub junction-box it may be noted that the box is rectangular in shape, having a maximum width from center of box to side of top of manhole of 2 ft. 2.5 in. The stub connections on the side of the box are of pipe 3½ in. in outside diameter, and, as previously mentioned, of uniform size so that any feeder may enter directly from the manhole. Mounted upon double fiber supports in the top of the 1908 junction box extends a double rectangular bus for the 240-volt service, in place of the rings in the old type of stub junction-box. The neutral feeder does not enter the box, but is joined directly to the distributing mains. Between the two buses is mounted a projecting fiber support so as to prevent a workman's tools from slipping over and thus short-circuiting the system when he is adjusting the fuses. Mounted upon the top of this strip of insulation are binding posts for the pressure leads which extend to the substation to indicate the potential at the point of distribution. Another important feature in connection with this box is that all of the terminals of the same potential come

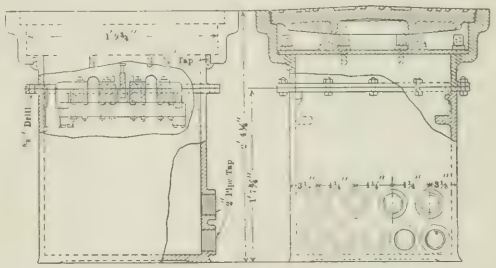


FIG. 1.—JUNCTION BOX OF 1908 TYPE.

to the same side of the insulation support, thereby completely separating the positive and the negative wires. With the old type of stub junction-box it was necessary to connect a certain feeder in a certain place in the box. This trouble has been obviated in this new box by having the terminals of all lugs, irrespective of size of cable receptacle, of the same dimensions so that any feeder may be connected to any part of the bus.

Service Mains.—The service mains are installed in the street through underground fiber conduits surrounded with concrete. Should occasion arise when it is necessary to reinforce these fiber ducts, iron rods are embedded in the concrete, as shown in Fig. 2. These conduits terminate in manholes so that the distributing mains may come from the junction boxes nearby to the distributing ducts. These ducts pass down a street, the conduit system being interrupted at frequent intervals by service boxes installed for every five or six houses. From the service box, iron-pipe conduit enters the cellar in the customer's premises. The details in connection with these service connections have been previously mentioned. Referring to Fig. 3 it may be noted that the internal dimensions of the service boxes are not very large, being of sufficient size merely to accommodate the cables and to allow the proper connections to be made. When fiber ducts are laid unprotected a special lining of concrete is employed. This is for light sidewalk construction, concrete not being used except for the joints. The standard F_8 service-box head is used wherever possible, being supported on 10-in. side walls with 3-in. bottom of concrete. (See Fig. 3.) The service boxes do not have individual sewer connections, but they should be graded so that one box when partly filled with water will flush into another, and so on down the street until the last one empties into a manhole where there is a sewer connection, the water passing through the fiber ducts between junction boxes. The service

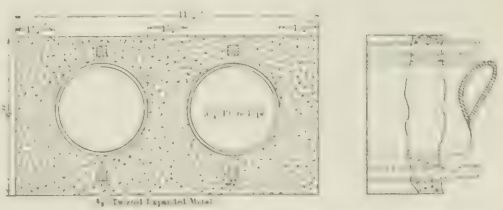


FIG. 2.—REINFORCEMENT FOR FIBER PIPE.

wires coming from the customer's premises are not fused in the service boxes, but are soldered directly to the service mains. A pocket is built in the sides of the service box, as shown in Fig. 3, and the cables are supported with clamps to wooden uprights. When making a joint in a cable great care must be exercised. With a large feeder, for instance, paper-insulated, both ends of the cable to be joined are bared for a distance of 3 in. A tinned copper connector is slid over both ends of the feeder and molten solder is poured over the joint. While the joint is hot rags are used to wipe off the excess of solder. When the joint has cooled it is wrapped with paper tape which has been previously boiled in paraffin until the insulation is as

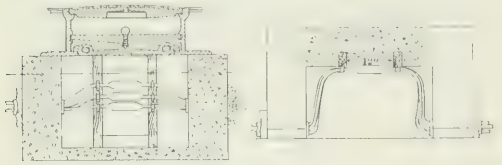


FIG. 3.—ARRANGEMENT OF SERVICE BOX.

thick as that of the original cable. The joint is then covered with a lead sheath of much greater diameter (shown in Fig. 3) and the ends of the sheath are soldered to the lead. This sheath has been previously slid over one of the cables before the joint was made. A small hole is then punched in this sleeve and it is filled with insulating compound, the opening being closed up and soldered. This form of joint is so satisfactory that when trouble occurs on the underground system it is usually due to some defect in the cable instead of in the joint.

COST DATA.

The element of cost is such a variable quantity—changing with so many variable factors, such as location of work, the relations between demand and supply, the general prosperity of the times, the demand for labor—that it is questionable whether values given at one time can be used at another time except in making approximate estimates. The values given apply to general conditions in New York on Oct. 1, 1907.

Cable.—Three-phase cable, paper insulation, 250,000 circ. mil, lead sheathed, costs $1.36 per foot, the length being made from 200 ft. to 400 ft. according to order. The hauling of cable through the ducts costs from $0.05 to $0.06 per foot, depending upon the length of the cable, being the greater for short lengths.

Vitrified Conduit.—Four-duct vitrified conduit costs $0.0525 per duct-foot delivered, 5 per cent to be added for storeroom handling; 3-in. fiber conduit costs $0.045 per duct-foot, and 3.5 in. costs $0.0525 per duct-foot.

Subway.—Six-duct subway costs $0.50 per trench-foot, including excavation, filling, laying duct, concreting, wrapping joints with muslin. To be added to this is $0.15 per trench-foot for framing, making a total cost of $0.65 per trench-foot complete.

Replacing Asphalt.—The price per square yard for replacing asphalt varies from $2.70 to $4 depending upon the original cost of installing, and upon the length of time of unexpired contract. The replacing work is done by asphalt companies. It might be stated here that in letting the original contract for asphalting a street, the contract usually covers maintenance for a period of from 5 to 10 years. The longer the term of contract obviously the better the asphalt must be laid. As to amount of charge for replacing, suppose that asphalt has been laid on a 10-year contract and that two years of the unexpired contract remain when the street is opened, it would not cost so much to renew the asphalt as if it had to be renewed when it had been in place only three years. Each year the asphalt throughout the city in large places like New York is inspected and the results are published in book form by the city for each borough and are distributed to the public-service companies. From this book can be determined for any street the cost to replace the asphalt. Quite recently a new system of making a uniform charge for replacing asphalt has been introduced.

Manholes.—Excavation for manholes costs $1.25 per cubic yard, the amount of excavation varying from 12 to 18 cu. yd. for a manhole 6 ft. deep. Concrete costs $6 per cubic yard; allowing for shrinkage and waste the amount of concrete required varies from 7 to 10 cu. yd. where concrete manhole construction is used instead of brick. The cost of a manhole head depends largely upon its weight. A round head 12 in. in depth weighs about 1800 lb.—intended for use with cobble and granite—costs $0.0214 per pound, making the total cost slightly over $40. What is known as an F_3 head weighs 1240 lb.; and an F_4 head, 6 in. in depth, intended for asphalt pavement, weighs 1040 lb. The total cost of a manhole is usually divided into excavation costs, framing and setting of frames which cost from $10 to $15, setting of head which costs $6 and miscellaneous costs for I-beams, cable rocks, etc. The average total cost for a manhole is about $150.

Service Boxes.—The average cost of a service box of the F_3 type is $38.50.

Sewer Connection.—The average cost for installing a sewer connection is $17.50. The system used is to let the contract for the sewer connections to a licensed plumber, as is required by the city ordinance. In letting the contract it is a good plan to have a fixed charge whether the sewer connection is long or short. With each sewer connection must be installed a trap to prevent the sewer gas from entering the subway; a 4-in. trap costs $6.

Service Connection.—The average cost for installing a customer's service connections is supposed not to exceed $60. In reality it varies from $50 for a small connection to $300 for a 500,000 circ. mil connection.

Junction Boxes.—A 6-stub Edison junction box, type 93, for feeder and main, costs $372.40. A 4-stub sub-feeder junction box, type 93, for feeders and branch feeders, costs only $315.88.

Cartage.—The cost of cartage and handling depends upon the local cost of labor, two men being required in addition to the truck and driver. A fair price for truck and driver is $5; for each laborer, $1.75. A two-horse truck can carry 2500 ft. of fiber conduit, or 70 pieces of 4-duct multiple tile 3 ft. long, per load. At five loads per day the cost of cartage and handling would be $0.00068 per foot of fiber, or $0.00202 per foot of tile.

Paving.—The cost of paving is based on the area paved The value per square foot ranges from $0.30 to $0.75 for cobble, $0.90 to $2 for granite on sand, $2.50 to $5 for granite on concrete, $2.50 to $7.50 for asphalt.

Trenching.—A fair average price for trenching, back-filling and cartage of excess material is $0.75 per cubic yard.

Laying of Conduit.—Common laborers may be used in laying fiber; three men—two in the ditch and one on the bank—

COST OF A 4-DUCT SUBWAY.

	Multiple tile.	Single tile.	3x¼" fibre.	3x⅛" fibre.
Cost of ducts at factory	$0.16	$0.16	$0.18	$0.148
Freight—fibre, 30c. per cwt.; tile, 22c. per cwt.	.0704	.0704	.0144	.0144
Cartage and handling to trench	.008	.008	.0027	.0027
Paving, at $1.50 per sq. yd.	.239	.2573	.2207	.2141
Trenching, backfilling, cartage excess material, at 75c. per cu. yd.	.1290	.1457	.1163	.1110
Laying of conduit	.01	.012	.004	.004
Cloth for joints	.0052	.0244	....	....
Lumber for sides	.0012	.0012	.0012	.0012
Breakage of conduit 5% tile; 1% of 1% fibre	.0015	.0015	.0009	.0008
Concrete, $6 cubic yard	.2222	.2126	.2310	.2195
Mortar, $8.50 cubic yard	....	.0109	....	....
Supt. and incidentals, 5% of total	.0428	.0457	.0385	.0357
Total = Cost per trench foot	.9002	.9597	.8097	.7514
Total ÷ 4 = cost per duct-foot	.2250	.2399	.2024	.1878

are sufficient for one gang. Tile requires one tile layer and three helpers; the pay of a tile layer averages $2.50 per day. In general multiple tile costs to lay per duct-foot $0.0025; single tile, $0.003; fiber, $0.001.

The values in the above table have been based on the detailed estimates discussed previously.

Concrete.—Mixtures of concrete vary according to the location and the relative prices of the constituents. A mixture of one part of cement, three parts of sand and five parts of broken stone would cost as follows:

1 cu. yd. of cement—0.75 bbls., at $2.00	$1.50
3 cu. yd. of sand, at $1.50	4.50
5 cu. yd. of broken stone, at $3.50	17.50

Since the sand and cement fill voids in the stone, the final volume is 5 cu. yd., which costs $7.10 per cubic yard. The mixing of this material will cost from $0.35 to $0.50 per cubic yard.

Mortar.—The cost of mortar varies according to the cost of cement and sand. A mixture of one part of cement and two parts of sand, which is generally used, costs $8.25 per cubic yard, to which must be added approximately $0.50 for mixing.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Changing Denver Window Lighting to Tungsten.

Some interesting figures on 18 window-lighting installations in Denver which have been changed from common carbon-filament lamps to tungsten are given us by courtesy of Mr. C. N. Stannard, secretary of the Denver Gas & Electric Company. Of these 18 installations there is a net gain to the company of $768 per year in gross revenue, or 26 per cent. The old lamps paid an average of 6.2 cents per kw-hour, and the new installations pay 9 cents per kw-hour. The old installation wattage was 20,776, and that of the new is 18,120, a decrease of 9.4 per cent. The candle-power of the old installation was 6022 and that of the new installation is 14,016, a gain of 132 per cent. Out of the 18 installations, two show losses in gross revenue, so that the net gain came from the other 16. The consumer buys and maintains the tungsten lamps. The company sells tungsten lamps at the following prices for clear bulbs: 25-watt, 65 cents; 40-watt, 85 cents; 60-watt, $1.05; 100-watt, $1.40; 250-watt, $2.75. The energy for window-lighting installations is sold on a Doherty readiness-to-serve rate. Under this rate 15 cents per month per 16-cp lamp as a flat readiness-to-serve charge is made in addition to an operating charge of 5 cents per kw-hour. The readiness-to-serve charge is figured on the basis of candle-power, so that the tungsten lamps pay a higher readiness-to-serve charge per watt connected, which accounts for the increased revenue per kw-hour noted.

Grounding of Secondaries Through Lamps.

Grounding of secondary lighting circuits by the grounding of the neutral wire of three-wire circuits or one wire of two-wire circuits has come to be generally accepted, although not universally practised as the best method of making interior lighting circuits safe from high voltages caused by crosses with high-tension lines outside the building or by defective transformers. In one Western city where there is considerable competition in the downtown district between two rival central-station companies, one of the companies wished to insure itself against fatal accidents to consumers by this accepted expedient of grounding the neutral of its secondary circuits. However, much of the interior wiring in the downtown district was in very bad condition, and after the grounding of the neutrals it was a frequent occurrence to find a consumer's place in darkness because defects in the wiring had caused a short-circuit. Of course, if wiring is in such a precarious condition as to cause short-circuits when one side of the circuit is grounded, it is not fit for continued use, and the occurrence of such troubles is no argument against the practice of grounding. Nevertheless, these troubles were annoying to the central-station company, especially in competing with a rival which did not make it a practice to ground its neutrals. In order to make it possible to give continuous service without interruptions and to give the company some warning, the expedient was adopted of inserting a lamp in series with the ground wire where transformer neutrals were grounded. This lamp was placed high on the pole. The lighting of one of these lamps was then an immediate warning to the company's trouble-men that either there was a cross between high-tension and low-tension wires, or a ground on the ungrounded side of the secondary circuit. The trouble could then be found and remedied without putting a consumer's premises in darkness without warning. As a temporary practice, if the lamps in the ground wires are closely watched, this is much better than running without grounds altogether, although it cannot be considered a desirable way to operate permanently. As an indication of the bad condition of the wiring in the city referred to, a number of cases occurred where consumers attempted to replace fuses with heavy copper wire, one side of the circuit being grounded intentionally at the transformer and the other side of the circuit being grounded accidentally by contact of a wire with a gas pipe. By the insertion of these heavy fuses a sufficient arc was established to melt through the gas pipe and start a fire.

Sign-Lighting Business Criticized.

At the recent Dallas convention of the Southwestern Electrical & Gas Association a discussion on the profitability of electric sign-lighting business developed some doubt as to the desirability of a sign load. Mr. F. M. Legge, Jr., of Galveston, did not favor pushing sign-lighting business, because it was a peak-hour current consumer and therefore might be unprofitable. Also, if a customer is using light for other purposes the addition of sign lights might be an undue burden. It would be far better to use equal energy in getting additional motor load or regular lighting customers. The company, in other words, should show the customer that it desires to give him all it can for his money rather than lead him to think that the company tries to get all the money it can and give the customer as little as possible in return. Mr. H. S. Cooper, of Galveston, said that one bad feature of sign lighting was that it resulted in selling current at cut rates and no business could remain strong if that was done. The customer wonders why he should pay 10 cents for current inside the store and 5 cents for that used in a sign outside, and then he complains. Mr. Legge said that sign lighting in Galveston was done at regular rates and the customers furnished the installation and service wires to the pole. By close accounting of the current cost for each hour of the day, he had found that while current could profitably be sold some hours of the day at 1 cent per kw-hour, at others it would not be profitable to sell it at 10 cents per kw-hour on account of the generating cost. Mr. Jas. C. Woodcome, of Dallas, was not attracted by sign lighting for several reasons, and particularly if rates must be reduced to get the business. It was a short-time load at peak hours, and the generating cost was then at a maximum. Sign lamps, although small, cost as much as larger ones and made a much smaller load. He did not favor making a special rate on any sign unless it were to burn all night. Mr. Wm. G. Carroll, of Beaumont, said that his company was doing considerable sign lighting. The company purchased the signs and spread their cost over one or two years in addition to the regular monthly lighting bills, for which the regular sliding scale rates were charged. The store lights usually were turned out on or before 7:30 p. m., but the signs burned until 10:30 p. m. and 11 p. m., so this special sign business lengthened the peak hour and increased gross receipts. He favored the sale of current for sign lighting and agreed with his customers that illuminated signs were excellent advertisements.

Co-operative Vacuum Cleaning.

All central-station companies which operate day service in residence districts should be interested in ways of furthering the popularity of vacuum cleaning by electric motor-driven machines. Many central-station companies have purchased small outfits of this kind which are rented to the users at prices ranging from 75 cents to $2.50 per day. Machines rented in this way are mostly of the smaller types which can easily be used by any housekeeper with a few simple instructions, and they are doing much to make electric service popular.

A plan which has been successfully worked at Beverly Hills, a suburban district of Chicago, where a heavier machine is used, may be of interest. The machine in this case was purchased by a man of established reputation who was making a regular business of house and carpet cleaning in the community. He saw that a vacuum-cleaning machine of sufficient power to do fairly heavy work would be a good business proposition and would prove popular with his customers. After investigation of the conditions it seemed best to purchase as heavy a machine as could be handled by one man and taken around the community on a strong hand-cart. The machine selected was one made by the Milwaukee Vacuum Machinery Company, equipped with a ¼-hp, single-phase, 60-cycle motor driving a triplex pump. The pump has grease-packed pistons and the air is drawn through two centrifugal separators and one dust bag or strainer. The weight complete is something less than 200 lb. A vacuum as high as 18 in. or 20 in. can be obtained, but the relief valve on the machine is ordinarily set for 10 in., this being the maximum desirable for ordinary work.

The money for the purchase of the machine was advanced by residents of the community who wished to secure the services of the machine. To those who thus advanced money a receipt was given which stated that the person named in the receipt was entitled to the services of the machine at 60 per cent of the price charged to non-contributors. In this way an inducement was offered to householders to loan or advance money for the purchase of the machine. It was agreed that the rates to contributors for the use of the machine should not be over $3 per day for machine rental, in addition to which the owner and operator was to receive $3 per day for his services, which was the regular rate he had been getting for his work before he purchased the machine. About $300 was raised in this way from persons advancing money. The operator and owner receives cash for his personal services at the rate of $3 per day, and the remaining $3, which is charged for the use of the machine, is credited to the contributor. Most of the contributors advanced $10, although a few advanced more.

The rate to non-contributors, in accordance with the agreement, is $5 per day for the use of the machine and $3 for the services of the operator. The machine was put in operation about March 15, 1909, and has been in constant use ever since. It can be used, of course, only in houses having electric service and consequently is proving a powerful popularizer of electric service. The amount of dirt removed from a house in a day's work is usually a shock to the housekeeper.

The machine is taken from house to house in a heavy cart, easily wheeled by one man. As the machine is entirely too heavy to be taken up and down stairs by one man, 50 ft. of vacuum hose is provided. A couple of planks are carried on the cart with the machine, and the machine is rolled from the cart into the front door or on the porch over these planks. Electric current is obtained from any lamp socket. On account of the high starting current required, the circuit on which the machine is used must be equipped with 15-amp fuses, consequently on connecting up for work, the first precaution is to see that the main line or service fuses are of at least 15-amp capacity. The lamp is turned on in the socket from which it is desired to obtain current for the motor, and the operator determines, by unscrewing the fuses in the branch fuse cut-out cabinet, which circuit supplies that socket. The regular fuses on that circuit are taken out and 15-amp fuses temporarily substituted for use while the motor is being operated. Upon leaving the house, the fuses are left in the condition in which they were originally found.

The Essentials of Electrical Salesmanship.

By Eugene Creed.

In a recent article by one of New York's great merchants it is stated that a salesman's personality has much to do with the marketing and distribution of commodities; that, in fact, the "personal factor" is paramount in merchandizing. The writer of the article in question is a retail merchant. The public goes to his store without solicitation other than that which is called advertising. After the advertising has aroused interest, then the salesforce must turn the interested ones into actual buyers, not for the time being, but as long as commodities are for sale. Only through the pleasing personality of the salespeople does he believe it possible to gain and retain trade.

In marketing the product of an electric lighting and power company it is necessary to arouse the interest of the public through some agency. The most effective means are through advertising in the daily press or by circularizing through the mail (direct by mail advertising) and personal solicitation. The whole- or half-page announcement is of proved assistance to the retail merchant, and in like proportion is the whole or half column to the central station, not forgetting the well-printed booklet. Advertising opens the door to the salesman and increases his sales record.

Through the work of able, conscientious, painstaking, tactful, intelligent and "likable" men only is a corporation having a commodity to sell best able to introduce its product and afterward hold its customers. A "likable" man is he who impresses you as a pleasant, honest fellow, who is careful never to violently disagree with you, and who, though he may be as intellectual as Bacon, as great a mathematician as Newton, or as brilliant an engineer as Steinmetz, carries himself as an ordinary individual who has the interests of his prospects at heart as well as those of his company. In approaching a prospect this "likable" man states his business courteously, uses his keen knowledge of human nature in judging whether the prospect is in a mood to listen to the many virtues of electricity as an illuminant, a heating agent, or as a driving agent, and hear of its superiority to wind, water, steam or gas.

The electric company's solicitor should have a very broad knowledge of the use of gas as a heating, lighting and driving factor. The gas men are not asleep. The great argument in favor of the gas engine is its economy in operating. The gas engine, so the manufacturers claim, can be operated for less than 2 cents per hp-hour, while the electric lighting company cannot sell energy at so low a rate. Not once but a hundred times in a month has the writer been told that gas is so much cheaper than electricity that the latter agent would not even be considered.

An answer to such an assertion is imperative. When a man is interested to the extent that he will argue the price with a salesman he is a good prospect. He must be answered intelligently. Now, I submit the following arguments against the gas engine:

The gas engine of a very popular type has over 140 parts. These 140 parts are subject to wear and tear. The internal-combustion engine signs its own death warrant just as soon as the first explosion takes place. It pounds itself to pieces. The engine requires skilled attention. It is obtaining money under false pretences to say that the gas engine can "run itself."

Let us quote a catalog of a leading manufacturer: "To start the engine: 1. Light the lamp and place it under the igniter ball. 2. Oil bearings of engine all around. Fill oil wells, draw oil from crank case by opening cock and rocking wheels back and forward several times. Allow lamp to burn with a strong flame about 15 minutes, when the igniter should be hot

enough (a dull red heat)." Following are three additional directions, all to start a gas engine.

In favor of the electric motor are very few parts, and in the case of the induction motor but two bearings. No pounding, snorting or wheezing, no water-jacketing, and, to start, simply throw a switch.

No customer appreciates the convenience and economy of electricity until he has tried it, and there are many who hesitate a long time before making a trial. These are the people the "likable" salesman must convince. After electricity has been used the price will gladly be paid rather than go back to the old troubles with gas. Admitting the lower cost per hp-hour of the gas engine, nevertheless the convenience and durability of the motor are unanswerable arguments in its favor. The man who has the knowledge of the superiority of his wares is the man who will convince his prospect, not only in the case of the gas engine, but in all similar matters.

A salesman employed by one of the leading central stations was met by a producer-gas-plant argument lately. The producer-gas-plant manufacturers claimed that the cost per hp-hour would be but 1 cent. Naturally the prospect told the salesman of the offer of the producer people. Salesmanship was necessary here. It was not a case where psychology could get in its fine work. It was strictly a matter of price. Common-sense and knowledge were the essential requisites. The argument against the producer was the necessarily large investment for the plant, the labor cost of operation and the utter impossibility of operating a producer-gas plant economically on intermittent load. This was clearly and forcibly shown, with the result that no producer plant is going to be installed at this particular point.

It might be interesting to give a brief sketch of the visit a central-station solicitor recently paid to a planing mill. The owner was a sharp old fellow. When the subject of electric power was broached—the prospect, by the way, was using steam—immediately came the reply, "But what am I going to do for heat?" Electric heat was out of the question, so a low-pressure boiler was suggested, and arguments were offered showing that the present steam plant required skilled attendance at a high cost, a waste of money six months in the year when steam for heating was not required, while with the electric motor and a low-pressure boiler used only during the winter months the labor cost was saved, and the plant operated as satisfactorily, yet more economically.

In 15 years steam power has increased in manufacturing but 136 per cent, while electric power has increased 7292 per cent, and a considerable portion of this steam-engine increase is for driving electric generators.

In putting forth the arguments suggested it is imperative that all the faculties of the salesman be thrown into the work. If the salesman is the "likable" fellow all the more impressive will the effect be upon the prospect. An earnest, whole-souled, telling address, a forceful and logical way of stating the case, readiness to combat rebuttal arguments, and to clinch his own with facts and figures, are the essentials of a salesman.

One danger of fervid salesmanship was recently told by Mr. C. C. Hoyt, the prominent Boston shoe manufacturer, to a class of young men of the Tuck School of Administration and Finance of Dartmouth College:

"Many of the younger men, in presenting the merits of their lines, as salesmen forget that, as on the stage, there can be eloquent pauses as well as impassioned declamation. The hot metal of enthusiasm is of great value to its fortunate possessor in entering a business career, but it must be tempered with the oil of judgment in order to make a keen-cutting and effective weapon for its owner.

"Some years ago a young clerk brought in from the street a phlegmatic German jobber to look over his sample lines. The boss knew him and would ordinarily have taken a hand in the game, but, never having been able to do much with him, thought he would keep out and await developments. The enthusiastic salesman handed Mr. German a boot and gave him a full description at length of all its good qualities. As Mr. German laid it down another was handed him, and a third and fourth, with similar long and gorgeous eulogies. Finally, after saying little or nothing, Mr. German took his leave, and the manufacturer said as he passed him, 'Well, I hope you left a good sample order, Mr. German.' To which he replied, 'Thunder! I didn't get no chance.'"

The salesman of electrical energy must be able to hold his customer for many months ere he becomes a source of profit to the company. The meter is a well-trained monitor. The salesman worthy of the name will follow the Golden Rule.

The average prospect knows nothing of gas or electricity. The electric company must show to the public that it has the best. Only through cleverly written advertisements and personal solicitation can this be done, and in no part of the country is this work so necessary as in the Eastern States.

INTERIOR WIRING AND ILLUMINATION

Central-Station Illuminating Engineering Department at Denver.

Mr. C. N. Stannard, secretary and contract agent of the Denver Gas & Electric Company, is very much pleased with the results accomplished by the illuminating department of the Denver Gas & Electric Company, which has been doing some very active work the past six months in connection with the introduction of the tungsten lamp and the increase of standards of illumination. The illuminating engineering work of this company dates back to the fall of 1905, when Mr. J. R. Cravath, of Chicago, was retained as consulting illuminating engineer for a period of six months to direct correspondence in a course of study of illuminating engineering for a club of six men of the new-business department of that company. For some time the company had no regular illuminating engineering department under that name, but illuminating engineering problems were usually referred to the members of this club. The final outgrowth of this, however, was a regular illuminating engineering department, which is now under the direction of Mr. C. F. Oehlmann.

Mr. Stannard says that the work of this department has been especially valuable in driving out gasoline competition. Strange to say, even in a city so thoroughly impregnated with electric lighting as Denver, there are, nevertheless, a number of gasoline lighting plants. The illuminating engineering department goes to the users of such plants with carefully prepared plans for an installation of tungsten lamps. The department even goes to the length of having a sketch prepared of the store showing how it will look with the new fixtures installed. The result of this in many cases has been to win the customer over to electric lighting. The work which the illuminating engineering department puts on such a job carries weight with the customer, as he feels that it is not the mere haphazard, off-hand assurance of an electric lighting solicitor, and that the results will be satisfactory. This, together with the fact that the illuminating engineering department can point to a number of successful and very satisfactory examples of work it has designed, carries the day.

Branch Lines Without Buckarms.

The accompanying figs. 1 and 2 illustrate some very neat line construction recently done by the Mount Carmel Gas & Electric Company, Mount Carmel, Ill., of which Mr. A. R. Manley is manager. In this construction the plan extensively used by the Union Electric Light & Power Company, of St. Louis, has been adopted. Instead of placing a buckarm at right angles to the main line crossarms, as is the most common practice, the branch lines are taken off from the main line

by means of malleable cast-iron brackets. This construction can be used both for taking off branches from a main line and for running service wires to consumers. On the whole, it is claimed by companies using this construction that it is cheaper than buckarm construction, and it is certainly neater in appearance. It does away with the loose connecting loops of wire which must be used with buckarms. The branches are carried parallel with the crossarm rigidly supported by insulators, making a very substantial construction not likely to get misplaced. It is also said to be easier for linemen to work on a line with this construction than where a buckarm is used. The plan would not be suitable for locations where more than



BRANCH LINES WITH AND WITHOUT BUCKARMS.

four branch wires are to be taken off from a single crossarm, but where the possible number of such branch wires is four or less, as in the case of service wires and in many outlying parts of a primary distributing system, the plan is well adapted. In the pole seen in Fig. 1, four wooden pins are used on each crossarm. The branch pins are all double malleable cast brackets bolted through from one crossarm to the other with long bolts. These double pins carry the branch line wires rigidly over and under the main line wires at a safe distance.

Concrete Poles.

As noted in the account in these columns of the recent meeting of the Oklahoma Electric Light, Railway & Gas Association, a paper on the construction of concrete poles was presented by Mr. J. M. Brown, superintendent of the Oklahoma Gas & Electric Company. An abstract of this paper appears below:

The poles are made hexagonal in shape and hollow in the center. A 35-pole is 7 in. across the corners at the top and 16 in. across at the butt. The forms are arranged so that by adding sections 5 ft. long to either end, poles of any length can be molded. The forms are made of heavy timber to avoid warping and are built in two halves which are clamped together and accurately lined up to insure the pole being straight. High-carbon-steel, 12¼-in. deformed-section reinforcing rods are then put in place symmetrically about the central axis. At the top of the pole the rods are secured by passing them about 2 in. through holes in a steel plate, bending over the ends and then bolting down a second plate on the bent-over ends with four small bolts. The rods are then stretched and anchored in the butt as follows: The ends of the rods project about 6 in. through holes in a steel plate fastened in the form. Pieces of ½-in. steel rod 10 in. long with an eye formed in one end and threads on the other end are used for stretching. The ends of the reinforcing rods are bent over and hooked into the eyes of the stretchers and short pieces of pipe are passed over the stretchers butting against the steel plate. A nut and washer bearing on the outer end of the piece of pipe is screwed down on the threaded end of the stretcher, giving any desired tension to the rods. The form is then ready for placing the core, which is made in two sections, telescoping with each other. The core is wrapped with one thickness of building paper and is hung in the center of the mold by suspension wires placed at intervals along the length of the form.

The concrete used consists of a mixture of one part cement, two parts sand and three parts chats or zinc tailings, which can be obtained in large quantities from the zinc mines of southwestern Missouri. With cement costing $1.50 per barrel, sand at $2 per cubic yard, chats at $2 per cubic yard and labor at $2 per day of eight hours, the cost of manufacturing a 35-ft. pole 7 in. across at the top averages $10. Three men can make three poles per day. Poles have been molded, hauled 3½ miles and set in five days' time, but this requires very careful handling and a longer time should be allowed for the concrete to set thoroughly. A 35-ft. pole molded, hauled to place and set, with steel cross-arms and pins mounted ready for stringing wires, costs $18.

The advantages for concrete poles are numerous. They are more rigid than wooden poles and wires do not swing as much as when mounted on wooden poles. The maintenance cost and depreciation are practically negligible. They resist lightning discharges and accidental grounds, can be erected with no more trouble than wooden or steel poles and can be climbed for



PLACING A CONCRETE POLE IN POSITION.

inspection or repairs as easily as a steel pole. Being hollow, wires can be run down inside, where they are protected from the weather and mechanical injury. The accompanying illustration shows a pole on a track and another in process of erection.

New Telephone Patent.

CALL-A-PHONE.

It frequently becomes necessary, especially in public places, such as hotel lobbies, etc., to call out the name of some person

sought. This is usually done by call boys, but Messrs. A. G. Kaufman and L. J. Lippmann, of New York City, have invented a telephone device for this purpose. They propose to establish loud-speaking telephones here and there about the premises, these to be wired to a transmitting station through a special switch. This special switch is so devised that the circuit of any one loud-speaker may be connected with the transmitter, or so that, by a single motion, all may be connected. For general calling all will be connected and will, therefore, announce simultaneously throughout the room whatever is spoken in the transmitter. For transmission to an individual locality, of course, one of the individual switches only will be used. Another use suggested for this device is for announcing to all rooms of a hotel general information for the guests. This will be especially applicable in case of fire. This patent is assigned to the American Call-a-phone Company, of New York.

LETTERS TO THE EDITORS.

Illumination Calculations.

To the Editors of Electrical World:

SIRS:—I find that several errors have crept into the article on "Elementary Illumination Calculations" which appeared in the issue dated June 3.

On page 1394, in fourth paragraph from the top, read "light source and accessories, which may be under consideration." In the second following paragraph read "Polar paper, devised by Mr. Norman Macbeth" instead of ". . . by Mr. A. A. Wohlauer . . . who devised the "Flux-o-light paper," not the "polar paper" mentioned.

On page 1395 the second paragraph should read, "the heights and distances are given for 6 ft. to 9 ft. height, and from a point directly under the unit to 24 ft. distance." In the following paragraph, insert the word "the" before "15 deg. and 5 deg. lines."

CHICAGO, ILL. N. WHITNEY.

To the Editors of Electrical World:

SIRS:—Allow me to endorse the remarks in your editorial commenting on the article on "Calculation of Illumination" by Mr. N. Whitney, as published in your issue of June 3. The real aim of illuminating engineering is there logically set forth, and illuminating engineers would rapidly gain ground and recognition if they heeded the practical precepts set forth.

At the same time I should like to call attention to an oversight in the article itself. The polar diagram paper which is described in the article and stated to be that of the writer, is not his "Fluxolite" paper, but seems to be the diagram paper copyrighted to Mr. Norman Macbeth.

NEW YORK. ALFRED A. WOHLAUER.

Steam Turbine Clearances.

To the Editors of Electrical World:

SIRS:—In the report in your columns of the discussion of Mr. C. H. Smoot's N. E. L. A. paper on "Low-Pressure Turbines," my remarks on low-pressure turbines are given in such condensed form that the sense of some of the statements has been entirely transverted. I am quoted as saying: "A safe clearance is feasible with reduced economy." This is incorrect, as my remarks were that "Redesigned cylinders in some of the Parsons type of turbines made it feasible to obtain perfectly safe clearances and at the same time improved economies."

PITTSBURGH, PA. E. D. DREYFUS.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Artificial Cooling of Dynamo Armatures.—G. OSSANNA.—A mathematical paper on possibilities of radial cooling of dynamo armatures. The author thinks that the effectiveness of radial cooling by means of air ventilating slots is now often underestimated, but that this method can be rendered very effective if provision is made for passing a fresh air current through the ventilation ducts and if the number of the latter is not too small.—*Elek. und Masch.* (Vienna), May 23.

Constant-Torque, Direct-Current Generators.—P. GIRAULT.—A note on the self-regulating properties of series and shunt direct-current generators, operated at constant torque. A constant-torque series machine gives a practically constant current, whatever the apparent resistance of the external circuit, and independently of the portion of the magnetic characteristic curve within which the dynamo operates. When a shunt dynamo is operated in the straight-line part of its magnetic characteristic curve it does not furnish constant electric power at constant speed, independently of the current in the external circuit. But operated at constant torque its electric torque is constant between limits of angular speed which may be quite near together, independently of the current.—*L'Industrie Elec.*, May 25.

Centrifugal Force.—H. LORENZ.—For use in electrical drawing offices, for calculating the centrifugal forces acting on the various parts of the armatures, windings, commutators, etc., the author finds the following formula most suitable:

$$F = WRN^2 \div 35,340$$

where F is the centrifugal force, W the weigh: in pounds, R the radius in inches, and N the number of revolutions per minute. If the radius R is given in feet, the formula becomes

$$F = WRN^2 \div 2941$$

Finally a table is given which facilitates the calculation of centrifugal force.—*Lond. Electrician*, May 28.

Transformers.—H. W. TOBEY.—A second article on recent developments in electric transformers with special reference to recent designs of lamp transformers and the tungsten lamp compensator, and with a description of the transformer testing equipment of the General Electric Company.—*Gen. Elec. Rev.*, June.

Lamps and Lighting.

Metallic-Filament Lamps.—LAPORTE.—An account of tests of metallic-filament lamps in the Central Laboratory of Electricity in Paris. Nine different types of lamps for 100 to 125 volts and 220 volts were tested. The metallic filament of a 110-volt lamp can already be observed in the dark at 4 volts, and at 5 volts it becomes incandescent. With 110-volt carbon-filament lamps, incandescence can be observed not below 20 volts. The specific consumption of the tungsten lamp in commercial operation was found to be 1.3 watts per candle-power, that of the tantalum lamp 2 watts, and that of the carbon-filament lamp 3.5 watts. The following tables give the relation between change of voltage in per cent and changes of candle-power in per cent, and the relation between change of resistance in per cent and change of voltage in per cent:

Per Cent of Normal C.P.	Per Cent of Normal Voltage. Tungsten.	Tantalum.	Carbon.
[illegible]	96	99	[illegible]
[illegible]	83	88	[illegible]
[illegible]	100	100	[illegible]
[illegible]	112	113	[illegible]
[illegible]	122	128	[illegible]

Per Cent of Normal Voltage.	Per Cent of Normal Resistance. Tungsten.	Tantalum.	Carbon.
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

The candle-power is proportional to the nth power of the voltage. For tungsten lamps $n = 3.6$ to 3.8; for tantalum lamps,

3.9 to 4.3, and for carbon-filament lamps, 5.8 to 6.5. The candle-power is the bougie-decimal. None of the metallic filaments investigated had a specific consumption as low as 1 watt per candle at normal voltage; the consumption varied between 1.25 and 1.8. A series of tests was made concerning the uniformity of lamps bought from the same factory, with respect to specific consumption and candle-power. The greatest deviations which were observed on five different types of 110-volt metallic-filament lamps were between 2.4 and 6.6 per cent with respect to candle-power and 2.4 and 5.2 per cent with respect to specific watt consumption. The ratio of the mean spherical candle-power to the horizontal candle-power is between 0.74 and 0.8 for metallic-filament lamps; it is smallest for tantalum lamps.—*Bull. Soc. Int. Elec.* (Paris), February; abstracted in *Elek. und Masch.* (Vienna), May 23.

Metallic Filaments from Colloids.—A note on a recent British patent of H. Kuzel (25,443, 1908; May 20, 1909). In the formation of filaments from colloidal mixtures, it is necessary to raise the threads to a white heat to destroy the colloidal formation and reduce them to pure metal filaments. It has been usual to perform this operation in an atmosphere of an inert gas at, or slightly below, atmospheric pressure, but the filaments produced in this way frequently contain cavities which, besides causing an irregular resistance, make the filaments liable to break. According to this invention, the heating is carried out in a stream of gas containing 20 per cent of hydrogen and 80 per cent of nitrogen at a pressure of about 30 mm. An absolute vacuum would be better, but is not practicable; the gases are kept flowing so as to prevent a harmful rise of pressure due to the gases given off by the filaments. Filaments formed in this manner are rarely porous, as the gases escape before cavities can be formed. The filaments are brought up gradually to a white heat, and are subjected to tension during the heating by hanging weights or other suitable means. The gases given off increase the pressure somewhat, but it should not rise above 150 mm.—Lond. *Elec. Eng'ing*, May 27.

Illumination Cost Factors.—M. Harris.—An article in which the author first discusses the cost of the current consumed in electric illumination as depending on efficiency and conditions of illumination. He compares five different systems of an assumed case in which it is desired to light an area of 100 ft. x 100 ft., used for commercial purposes and wired one outlet per bay, the intensity on the plane of reference to be four candle-feet. The author's conclusion is that the wattage required to illuminate the space considered would be as follows:

	Watts.
1—Nern-t lamps with light opal ball	108,000
2—Tungsten lamps with clear prismatic reflectors	108,000
3—Tungsten lamps with enameled prismatic reflectors	124,000
4—Tungsten lamps "I" comfort system	144,000
5—Direct-current enclosed arc lamps	148,500

Although in cases 2, 3 and 4 lamps having a specific consumption of 1.62 watts per mean spherical candle were employed, on account of their treatment in cases 3 and 4, the consumption of power required was greater than in case 1, where Nernst lamps were considered having a consumption of 2.25 watts per mean spherical candle. For all practical purposes, therefore, the author concludes that the efficiency of the 220-volt Nernst lamps for interior illumination may be placed as being equal to that of the tungsten system consisting of a combination of clear prismatic glassware and tungsten lamps operating at 1.25 watts per mean horizontal candle-power. The cost of renewals or maintenance is a very important factor when considering the relative cost of operation of the high-efficiency systems, whose illumination efficiencies are approximately equal. It is the author's belief that the proper method of computing renewal costs is on the basis of cost per kw-hour. In the cost of maintenance the labor item for cleaning the lamps and reflectors, etc., is an important one. First cost or investment should be considered purely from a standpoint of earning power.—*Elec. Jour.*, June.

Illumination of Streets.—C. E. Stephens.—An article giving some general considerations on street lighting, especially by different kinds of arc lamps, giving curves of the light distribution. Tungsten incandescent lamps can be used very successfully in cases where the results obtained are to be at a minimum expense, and where the conditions will not permit of high candle-power units of the arc type.—*Elec. Jour.*, June.

Illumination.—T. W. Rolph.—A lecture giving a general outline of the fundamental principles of the theory and practice of illumination.—*Journal Franklin Inst.*, May.

Power.

Self-Starting Synchronous Motors.—J. Bache-Wiig.—The use of synchronous motors for service previously performed almost exclusively by induction motors has largely increased recently owing to the beneficial effect of synchronous motors on systems having low power-factors. The author discusses at some length the starting action of self-starting synchronous motors and shows that it approximates that of induction motors with fairly low resistance, cage-wound rotors. It may be taken as a general rule, therefore, that self-starting synchronous motors can be applied where it is possible to apply cage-wound induction motors with small slip, with the additional limitations in the case of the synchronous motor imposed by the necessity of overcoming the "slip," and pulling into synchronism. Where a phase-wound induction motor with external secondary resistance must be used because a cage-wound induction would not be satisfactory, then for the same reason, a synchronous motor of the self-starting type would not be satisfactory and should not be used.—*Elec. Jour.*, June.

Cost of Motor, Power and Product.—C. F. Scott.—An article pointing out that while first cost of the motor and the cost of the power which drives it are elements in the total cost of production, yet the cost of the motor and of the power are often in themselves of so little importance that to economize in them may be wasteful and foolish. In general the problem is not how to use as little power as possible, but how to apply as much power as can be used effectively. It is the cost of labor and the quantity of output which can be secured from a given factory equipment which are usually the large factors in the cost. When the annual fixed charge for an ordinary motor is $5 per year for a production amounting to $500 per year, it would be profitable to invest several times as much if an equipment can be secured which will enable the total cost of the production to be reduced by even a relatively small per cent. Efficiency in power consumption of a motor, important in itself, is of trivial consequence compared with effectiveness in performance.—*Elec. Jour.*, June.

Water-Power Plant in Switzerland.—F. Loppe.—An illustrated description of the water-power station at Wangen, utilizing the fall of the Aar River, and supplying energy to the adjoining districts and also to the city of Basel and to the power plant at Rheinfelden. There are seven Francis turbines, each driving a 1500-hp, 11,000-volt, three-phase alternator. At the end of 1907 the complete network had a length of 333 km (200 miles), partly at 25,000 volts, partly at 10,000 volts, and partly at 6400 volts or less; besides 200 km (120 miles) of low-tension lines. The total rating of motors connected to the plant at that time was 3450 kw and that of lamps 3800 kw.—*L'Industrie Elec.*, May 25.

Mexico.—A former article described general conditions of electric railway operation in Mexico City. In this issue the track, overhead line, power generating and transmission system, shops and car houses of the tramway system are illustrated and described, together with the principal features of operation. The tramway company in Mexico manufactures nearly all of the material and supplies, and its shops are completely equipped with modern machinery. Current is brought from the water-power station at 60,000 volts to the main substation in the city and from there distributed to four substations, all receiving the current at 20,000 volts and distributing it at 600 volts. Two of these substations contain two 500-kw motor-generator sets each and the other two contain each two 1000-kw sets with the necessary transformers and accessories. In addition the company has built a portable substation of 500-kw capacity.—*Elec. Rail. Jour.*, June 5.

Water-Power Plant.—K. Thien.—An illustrated description of the electricity works of Karlstadt in Austria-Hungary. A

waterfall with a 9-m head is utilized. There are two 900-hp turbines driving 780-kva, 5000-volt alternators, the frequency being 50. For transmission the voltage is raised to 20,000.—*Elek. und Masch.* (Vienna), May 16.

Electric Hoisting in Mines.—C. V. ALLEN.—An illustrated article on the operation of mine hoists by electric motors, with special reference to the installation of the El Oro Mining & Railway Company, Ltd. Power for this camp is supplied by the Mexican Light & Power Company. It is located 171 miles from the source of power, there being a total of about 4000 hp in motors installed for hoisting service alone. Of these hoisting outfits, there are four motor-generator flywheel sets in use, with a fifth under construction. The largest of these five flywheel sets consists of a 350-hp, 50-cycle, three-phase, 3000-volt induction motor, and a 320-kw, direct-current, 250-volt, interpole generator, with a 40,000-lb. flywheel, 9 ft. in diameter, mounted on a common shaft between the two machines; the no-load speed of this set being 480 r.p.m. The operation is described in detail and various curves showing the conditions of operation are given. The cost of the hoisting of this outfit has been very satisfactory, amounting to but seven cents, Mexican money, per 1000 foot-ton; the former cost of hoisting by steam having been many times the present cost by electric power.—*Elec. Jour.*, June.

Tilting Furnaces.—I. DEUTSCH.—An illustrated article on the automatic control of motors operating four 225-ton open-hearth tilting furnaces at the works of the Jones & Laughlin Steel Company, Pittsburgh, Pa. Four 30-hp, 220-volt motors are used

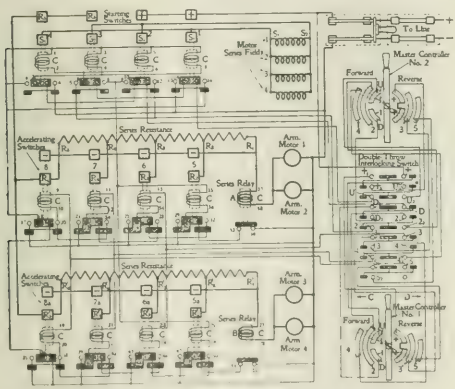


FIG. 1.—DIAGRAM OF CONNECTIONS.

with each furnace and are operated and controlled by an automatic magnetic switch controller, provided with two master switches and an interlocking switch. Each master switch is so connected that when its handle is turned in one direction the furnace is tilted, and by reversing the furnace may be restored to the normal level position. One of the master switches is located on the front side of the furnace so that the operator will be in a position to watch the pouring of the cast. The other master switch is at the rear where the operator can watch the tilting of the furnace to run off slag and facilitate charging with hot metal. The interlocking switch is so arranged that only one master switch is in circuit at one time. This makes it impossible for two operators, located at the respective master switches on the opposite sides of the furnace and out of view of each other, to operate both switches at the same time. Referring to the diagram of connections of the outfit, Fig. 1, it may be seen that the armatures of motors 1 and 2 are connected in parallel and included in the circuit with a series limit relay, A, and a starting resistance, R_3R_1. The armatures of motors 3 and 4 are similarly interconnected with a relay B, and a resistance $R_3'R_1'$. The fields of all four motors are connected in parallel. When it is desired to tilt the furnace forward at minimum speed, the handle of the master controller No. 1, for example, is thrown to the forward contact $U-1$. In the diagram of the interlocking switch is shown a "developed" drum controller, all shaded rectangular contacts being mounted on the drum and moving with it. With it set in position C, magnet switches 2 and 4 will close and current will pass from the positive line to contact S_2 on switch 2, through the four fields to S_1, on switch 4, then through the starting resistances, limit relays, and motor armatures to the negative line. The motors will now run at lowest speed forward. To obtain moderate acceleration, the handle of the master switch No. 1 is thrown into contact 2, when switches 5 and 5_a will close and cut out sections R_2R_1 and $R_2'R_1'$ of the starting resistance. This operation may be continued, if desired, until all of the starting resistance is cut out or, as is customary, the master switch handle may be thrown from the off position to full-on (contact 5), and the motors will automatically accelerate to full speed as follows: Line switches 2 and 4 close first, as already mentioned, and the motors start. The starting current is sufficient to lift the relays A and B and open circuits 33-34 and 51-52. As the motors accelerate, the current decreases, until the relays drop and again bridge the contacts 33-34 and 51-52. Switches 5 and 5_a then close and cut out sections R_2R_1 and $R_2'R_1'$ of the starting resistance, which causes a current rise sufficient to again lift the relays. When the current reaches the normal value, the relay drops and switches 6 and 6_a close, thereby short-circuiting sections R_3R_1 and $R_3'R_1'$ of the starting resistance, lifting the relays and accelerating the motors to still higher speed. When the current peak caused by the closing of these switches has passed, the relays drop and the cycle is automatically continued until switches 8 and 8_a have been closed and the motors are connected across the line and running at normal speed. The motors are reversed by throwing the master switch handle to the reverse position, when switches 1 and 3 will close, instead of 2 and 4, which remain open, and the current passes from the positive line to contact S_1 on switch 1; through the four fields in the reverse direction to S_3 on switch 3; then through the resistance relays and armatures to the negative line. The relays are so wound that they will respond to small variations from normal current, and are accurately adjusted for uniform load. If the motors do not possess the same inherent accelerating characteristics—i.e., if one set has a tendency to run ahead of the second and take a greater current from the line—the relay governing the first set will lift and prevent further acceleration until the second set has had a chance to catch up.—*Elec. Jour.*, June.

Variation of Angular Velocity of Flywheels.—V. R. HORNE.—An illustrated description of a method of determining the variation in angular velocity and the angular lag and lead of an engine flywheel from the diagram of crank effort by means of a planimeter.—Lond. *Eng'ing*, May 28.

Turbine Regulation.—A. RENARD.—A mathematical note on the principles of the regulation adjustment of turbines.—*La Houille Blanche*, February.

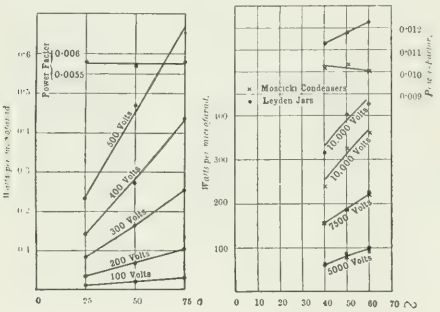
Traction.

St. Paul and Minneapolis.—The Twin City Rapid Transit Company, operating the city and suburban system of St. Paul and Minneapolis, obtains electrical energy from three generating stations, the old hydraulic station at St. Anthony Falls on the Mississippi River, a large steam-power station, and a new hydraulic station on Hennepin Island which utilizes the overflow from St. Anthony Falls. This article describes the new station which contains four generating units, each of 2250 kw capacity and includes a great many statistical diagrams showing the power output of all three stations, together with other data on their combined operation.—*Elec. Rail. Jour.*, June 5.

Overhead Construction for Railways.—P. DAWSON.—The continuation of his long illustrated serial on electric traction on railways. In the present installment, the author describes various details of catenary construction and gives some rules to be considered in the design of overhead construction for railway work.—Lond. *Electrician*, May 28.

Application of Condensers.—W. M. MORDEY.—A paper read before the (Brit.) Inst. Elec. Engineers. The general question

is discussed whether condensers can be used commercially instead of over-excited synchronous motors for the improvement of power factors in distribution networks. Tests are given of Mansbridge low-tension paper condensers, and of Moscicki high-tension condensers. The author has determined the losses in both types of condensers, the results being given in Figs. 2 and 3, the former giving the results of tests of low-voltage Mansbridge paper condensers, and the latter of high-voltage glass condensers, both of the Moscicki type and of the Leyden jar type. These diagrams give the loss in watts per microfarad at various voltages and frequencies, and the power factor at various frequencies. The capacity, as shown by the proportionality of current to pressure, and to frequency, was almost constant. As to the Moscicki condensers and the Leyden jar type it will be seen that at 5000 volts and at 7500 volts the loss in watts per microfarad in the Moscicki condenser and in the Leyden jars is the same, but at 10,000 volts there is a marked difference. In comparing low-voltage and high-voltage condensers it must be remembered that the power factor, and not the watts per microfarad, is the proper basis, seeing that the loss (as well as the kilovolt amperes per microfarad) appears to rise as the square of the pressure in any given condenser. The proper basis of comparison is the loss in a paper condenser, made up in sections for high-pressure use in one case, against the loss in the special high-voltage glass condenser of the same capacity. From the results shown, a 10,000-volt Mansbridge condenser would lose about 190 watts per microfarad at 50 periods; and the Moscicki 10,000-volt condenser would lose



FIGS. 2 AND 3.—CONDENSER TESTS.

about 320 watts per microfarad, the loss in the latter case being less accurately measured than in the former. It is satisfactory to find that the losses are so small. They are respectively about 0.6 per cent and about 1 per cent of the kilovolt amperes dealt with. These losses are of the same order as the magnetizing losses in transformers of good design. With such small losses as these, no difficulty should be experienced in preventing objectionable heating. Condensers lend themselves very well to arrangements giving large cooling surface. In the Moscicki type, the tubular form ensures this. The Mansbridge type can be subdivided to give any desired cooling surface. The author finally attempts to compare the use of condensers with that of over-excited synchronous motors for the pupose of improving the power factor. The comparative figures for the compensation of a circuit requiring 1000 kw at 10,000 volts, 50 periods, with a power factor of 0.8, are as follows;

	Synchronous Motor.	Condenser.
Capital cost	$5,000	$3,600
Annual cost of energy wasted	685	171

The author thinks that condensers used for such purposes might prove quite useful. He finally describes some experiments on the use of condensers for preventing or stopping the formation of arcs under certain conditions. In investigating the action in a surface-contact tramway system recently, the author found that trouble was experienced due to the formation of persistent arcs at the underground contacts. When the road was wet and dirty a small leakage current passed from the live contact stud under the car over the surface of the road to the rails. When the car has passed and the underground contact-piece had separated its proper distance from the live conductor, this leakage current was sufficient to maintain an arc across the air-space of the contact-maker, thus keeping the stud alive so long as the arc persisted. It was found that with a terminal voltage of about 560 volts, the voltage between the studs and the rail was usually about 400 to 440 volts, and the voltage across the arc about 120 to 160 volts. Sometimes, arcs would persist for a few seconds with not more than 0.6 amp, and they would often persist when the leakage current was over 1 amp—this latter condition, it will be seen, corresponds to a resistance of the leakage path from the stud to the rail of a maximum of 440 ohms. A suitable condenser placed across the gap prevents any arc being formed, however small the gap—for example, it was not possible to maintain an arc across a gap of even 1/64 in. If the arc is formed and it is then shunted by a suitable condenser, it will at once go out. It was found quite practicable to extinguish the arcs by shunting them by a condenser carried on the car, one terminal being connected to the collector, or skate, the other to a small wire brush hanging down under the rear platform of the car, and making successive contacts with the studs.—Lond. *Electrician,* May 28.

Day Loads for Central Stations.—S. A. Fletcher.—A brief discussion of various profitable day loads for central stations. The author first speaks of the domestic use of electricity, electric flatirons, sewing-machine motors, electric toasters, luminous radiators, coffee percolators, washing-machine motors, vacuum cleaning apparatus, etc. With respect to selling electric power to manufacturers, he discusses pumping of water, electrically driven blowers for blacksmiths, cash carriers in stores, electrically operated refrigerating machines, ventilating and exhaust fans, electric driving in machine and repair shops, in printing plants, and in bookbinders' shops and wood workers' establishments, etc.—*Elec. Jour.,* June.

Protection of Networks.—Grosselin.—A long report made to the Marseilles Congress on the different methods in use for protection of transmission lines, against sudden dangerously high voltages.—*La Houille Blanche,* April.

Line Construction.—Le Roy.—A paper presented to the Congress at Marseilles on the construction of transmission lines. The author thinks that for some time to come wooden poles will continue to be used exclusively in small distribution systems in cities and for transmission lines of moderate size (1200 to 1500 kw). Metallic poles (galvanized steel) appear to be now in Europe generally employed in large transmission lines. A few notes are finally given on reinforced concrete poles, but it is thought that they have not been long enough in use to form a conclusive opinion about them. Some comparative figures are given on the cost of construction.—*La Houille Blanche,* March.

The Earth as Return Circuit.—A long report by E. Brynlinsky to the Congress at Marseilles on the use of the earth as part of a commercial transmission circuit. Another paper by Barbillion gives an account of experiments made in 1906 and 1907 on the same subject. Both papers, which have already been briefly noticed in the Digest, are here printed in full.—*La Houille Blanche,* March.

Aluminum Conductors.—Dusaugey.—A paper read before the Marseilles Congress on the use of aluminum as an electric conductor. The author gives various data and formulas useful for aluminum line calculations.—*La Houille Blanche,* April.

Underground Cables.—De Marchana.—A paper presented to the Marseilles Congress on underground cables, their construction, method of laying, and testing.—*La Houille Blanche,* May.

Units, Measurements and Instruments.

Limit Switch.—H. Andre.—An illustrated description of an automatic switch for use in such installations in which the contract made with the customers does not permit the latter to take more than a certain maximum amount of power from the line, with the penalty of being cut off. Of course, the limit switch used for this purpose should have a time factor permit-

ting brief overloads; it should also indicate by some alarm device that the danger limit has been passed. And after the switch has acted and the consumer goes back to the permitted load, connection should be easily re-established. The instrument of the author is shown diagramatically in Fig. 4. A small induction motor consists of two primary windings 7 producing a rotary field, and the disk 6 which is thereby caused to rotate. While rotating it raises, by means of the thread 9, the vessel 1 containing water. This vessel has a hole 2 in the bottom and is itself suspended in another vessel 5, also filled with water.

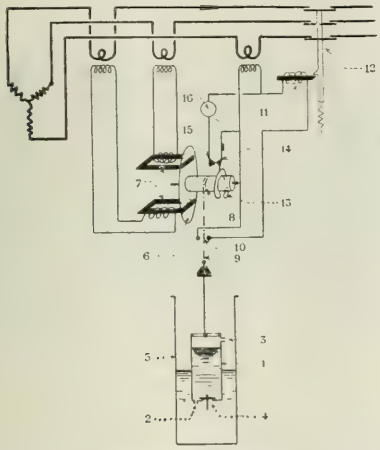


FIG. 4.—LIMIT SWITCH.

The electromagnetic torque exerted on the disk 6 raises the inner vessel 1 until a position of equilibrium is reached. But this equilibrium is disturbed again by water flowing out of the hole 2 in the bottom into the outer vessel. The vessel 1 is therefore again raised and this goes on continually, so that the inner vessel 1 slowly rises upward until it is entirely out of the water. After that it will rise more quickly (if the torque on disk 6 continues). The total time of this rise of the vessel 1 will be the shorter, the greater the torque of the disk 6. When the vessel 1 reaches its highest point, the contact piece 9 at 10

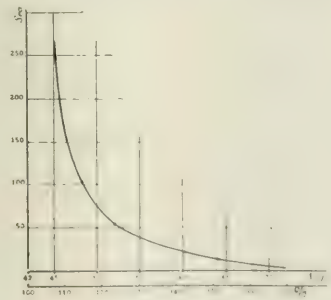


FIG. 5.—TEST CURVES.

closes a circuit which contains the electromagnet 11 which acts on the circuit-breaker 12. The valve 4 at the bottom of the vessel 1 permits the latter to drop down again quickly if the current diminishes before the vessel 1 has reached its highest point. The spiral 13 during the rise of the vessel 1 produces at each revolution of the axle a contact between 14 and 15, whereby the alarm bell 16 is operated. On the other hand, while the vessel 1 drops down, the spring does not make contact and the bell is not set in operation. According to the weight of the vessel 1, its volume, and the size of the hole 2, it is possible to adjust the time factor of the instrument. Fig. 5 gives test curves showing the time within which the instrument acted for a certain overload. The ordinates represent the time in seconds within which the circuit was broken. The upper scale of the abscissas gives the amperes, the lower scale the overload in per cent of the load to which the instrument is adjusted. The instrument was set to a maximum permissible current of 42 amp. It will be seen that at 45 amp (7 per cent overload) the current was broken after 250 seconds; at 55 amp (31 per cent overload) it was broken after 40 seconds, and at 72 amp (71 per cent overload) it was broken within four seconds. When the circuit-breaker 12 has operated the current acting on the disk 6 ceases and the vessel 1 falls down again. The circuit containing the electromagnet which acts on the interrupter is thereby opened, and the interrupter may therefore be reset and the circuit closed again.—*La Houille Blanche,* February.

Testing Bureau.—BOYER-GUILLON.—A long and fully illustrated description of the department for machine testing of the testing laboratory of the Conservatoire National des Arts et Metiers in Paris. Various apparatus for testing of steam machinery are first described, followed by full descriptions of hydraulic tests (equipment and apparatus, tests of centrifugal pumps and turbines, and of water meters of different types).—*La Houille Blanche,* January, March, April and May.

Telegraphy, Telephony and Signals.

Telegraph Cables.—An illustrated description of two submarine cables recently laid in Australia from Victoria to Tasmania. The conductor of the cable is formed of strands of 7 in. x 0.032 in. high-conductivity copper wires, weighing 130 lb. per nautical mile. The insulation consists of three layers of best gutta percha, also weighing 130 lb. per nautical mile. The layers of gutta percha were applied without intervening coatings of Chatterton's compound. The conductor resistance of the cable is 11.65 ohms and the inductive capacity 0.37 microfarad per nautical mile at 75 deg. Fahr. The insulation resistance of the completed cable is 2300 megohms per nautical mile at 75 deg. Fahr.—Lond. *Elec. Eng'ing,* May 27.

Miscellaneous.

British Patent Law.—The appeal by the British Westinghouse Company and Körting & Mathiesen against the decision of the Comptroller-General of Patents to revoke the Bremer and Högner flame-arc-lamp patents, respectively, under section 27 of the new British patent act has been successful. The proceedings were suspended in March in order that fresh evidence could be put in by the Westinghouse company, the owners of the Bremer patent. This evidence is to the effect that considerable trouble and expense have been gone to in the efforts to establish the manufacture of the lamps in this country. On the other hand, Mr. Braulik, the applicant for revocation, asserted that he intended to manufacture in this country; that he had applied for a license under the Bremer patent, but could only have obtained it by paying a higher royalty than Körting & Mathiesen. It was urged that there was no true competition between the Westinghouse company and the Union Electric Company, as by the agreement the former company could not undersell the latter. In giving his decision against the revocation of patents, Justice Parker upheld the contention of the Westinghouse company that satisfactory reasons had existed for their not having been able to manufacture the lamps to an adequate extent in this country. He ruled that each side should pay its own costs.—Lond. *Elec. Eng'ing,* May 27.

Electrical Industry in Switzerland.—M. GUELER.—Some statistical notes on electrical imports and exports to and from Switzerland. The importations to Switzerland of electric generators, machinery, appliances, etc., were 13,000 kg ($1,007,500) against 12,144 kg ($963,750) in 1907. The exportations of electrical machinery, etc. (principally dynamos), from Switzerland to other countries were 85,854 kg ($4,874,440) against 78,440 kg ($4,290,000) in 1907. The importations of copper, wires and cables into Switzerland in 1908 were 93,160 kg ($4,780,000) against 78,683 kg ($3,955,000) in 1907.—*Schweiz. Elek. Zeit.,* April 17; abstracted in *Industrie Elec.,* May 25.

NEW APPARATUS AND APPLIANCES

Marshall Chain-Pull Socket.

The popularity of lamp sockets operated with a chain pull has so stimulated designers and inventors that improvement in this line has been constant, and one of the latest is shown in the accompanying engraving. There has been a demand for a socket uniform in size with standard sockets and with means for adjusting the chain pull in relation to the fixture. These requirements are claimed to be completely realized in the present socket, known as the "Smooth Idea" socket. This consists of the standard snap-fastened cap and shell used in the standard Marshall socket. There are three variations, however, in the cap, one being provided with an insulating bushing for cord work, another with a standard form of set-screw cap, while the third is especially designed for fixture work and has a swiveling nut which permits the adjustment of the chain pull in any position. The cap is put on with a wrench and can be secured in place in a fraction of the time required to put on ordinary sockets.

The chain pull, which is attached to the body of the socket, can be easily removed for refinishing by unscrewing with the fingers. The chain can be detached and inserted in a few seconds, a pair of forceps being enclosed in each box of sockets



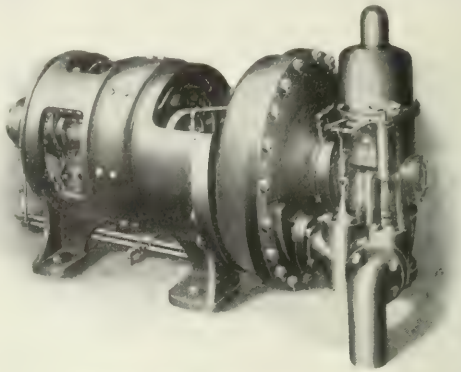
CHAIN-PULL SOCKET.

for doing this. There are no crevices in the cap and shell fastening to catch acid or other objectionable material in refinishing the shells. The shell and cap are lined with a one-piece "Elastoid" fiber lining. The socket, which is shipped out properly adjusted, can be wired without removing the chain guide. It is manufactured by the Marshall Electric Company, of Hyde Park, Mass.

Train-Lighting Turbo-Generator Set.

The new Westinghouse train-lighting turbo-generator set shown in the accompanying illustration has been designed to meet the exacting requirements of a small steam-driven generating outfit for train-lighting, excitation, or other small-power, direct-current service, where a compactness and minimum weight are essential. The generator output is 25 kw at 125 volts, and the machine is designed to run at 3600 r.p.m. The turbine element is of the impulse class, but of novel construction. A single wheel is employed, involving a re-entrant path for the steam, which is expanded practically to exhaust pressure in the nozzles.

The generator is compound wound, insuring close voltage regulation, while its 4-pole field structure, with auxiliary commutating poles, makes possible diminished weight and length of commutator, and thus, shortened over-all dimensions. The compact structural connection between the turbine case and generator frame also contributes to shortening the over-all



TRAIN LIGHTING TURBO-GENERATOR SET

shaft length, adapting the outfit admirably for installing, in the restricted space of the baggage car, where, in train-lighting service, it is intended to be placed. On account of the possible oscillation and vibration of the car, oil rings are not relied upon for lubrication of the two bearings, an oil pump, attached to the turbine, being provided to insure circulation of oil in ample quantity while the outfit is in operation. Provision is also made for accurately balancing the rotating part, avoiding any possible vibration that might occur.

A specially designed fly-ball governor geared directly to the turbine controls a nickel-bronze balanced puppet valve. The governor mechanism is unique in design, insuring excellent regulation, stability and certainty of operation. With the turbine is furnished a combined automatic and hand throttle valve, the automatic feature of which is operated by a weight held by a spring against centrifugal force, and entirely independent of the main governor. The apparatus is exceedingly simple and hence certain in its operation. The device may be regulated to come in at any predetermined speed.

The new Westinghouse train-lighting turbo-generator set, embodying superior advantages of lightness, compactness and efficiency, as above noted, is being exhibited for the first time in the Westinghouse space at the conventions of the Master Mechanics' and Master Car Builders' Associations, at Altantic City, June 16 to 23.

Exhibits at the Cleveland Industrial Exposition.

The Cleveland Industrial Exposition is scoring a great success, and probably will give rise to similar shows in other progressive cities. The general attendance is unexpectedly large from without the Cleveland district, and one of the features is the large number of delegations from boards of trade and chambers of commerce. Following is a list of the exhibits from the electrical and allied industries:

A large machine motor, small motors for various purposes, generators of all capacities, fan motors, small machines electrically operated and a number of other appliances were shown by the Westinghouse Electric & Manufacturing Company. Men from the city office are in charge of the display.

An interesting feature of the Lincoln Electric Company's

display is the operation of a motor under water. This is done to show the perfection of the insulation. A motor with a new idea in governors is also shown in operation, as well as long-pull solenoids and other products of the factory.

A full line of rheostats, switches, panels and switchboard appliances comprises the exhibit of the Leonard-Bundy Electric Company. In addition the company is showing some of the instruments manufactured by the Weston Electrical Instrument Company and the Wagner Electrical Manufacturing Company.

Steel shafting of various sizes, cables, wire, rail bonds, flat wire, springs, spikes, nails and staples are arranged in an attractive manner by the American Steel & Wire Company, whose booth occupies a position just at the entrance of the temporary building. All kinds of wire fences, in rolls and erected, are also to be seen. The display is complete and worth seeing by those who use any of its products.

The Forest City Steel & Iron Company is showing a sample of its structural steel work and in addition a large number of photos of structural work which it has erected.

The display of the American Ball-Bearing Company consists largely of automobile axle gearings. The only portion of it that may be called live is the ball sorting and counting machine, which attracted a great deal of interest.

A Porter switch, switch stands, guard clamp rail, square and angular crossings, rail joints and various kinds of specialty work are shown by the Cleveland Frog & Crossing Company.

The G. C. Kuhlman Car Company is showing a section of a pay-as-you-enter car, such as is now seen in operation in many cities. The rear platform, with floors and dividing rail, gives a general idea of the manner in which the car is constructed. It is cut through a few feet in front of the rear end doors, showing the construction and the arrangement of seats. Plush-covered and rattan seats are displayed on the outside.

The Chisholm & Moore Company is showing a large line of trolley hoists, high-speed chain hoists and other appliances used in shops where heavy articles are handled. The display was sufficient to give a good idea of the product of the factory. A small model of a track drilling machine is arranged on a platform, so that a close inspection may be made of it.

The Sherwin-Williams Company showed a full line of effects secured from the use of its paints and varnishes. The company makes colors, paints and varnishes for almost every conceivable purpose, but instead of filling its handsome booths with canned products, it used panels arranged on frames to show results. Street-car work was displayed in a series of panels, showing the process of finishing from the dressed wood to the varnished surface. Paints for railroad coaches and interior work were also displayed.

Multiple Starters for Large Direct-Current Motors.

For starting small motors face-plate rheostats are used extensively and give a high degree of satisfaction, but for motors of large size it is very difficult to build a satisfactory rheostat of this type which will be free from sparking under the large current handled; moreover, large motors are capable of producing far more damage when handled by a careless operator than small motors are, and it is therefore particularly advisable to have starting devices which are proof against careless and ignorant operators. To meet this situation the Westinghouse Electric & Manufacturing Company has constructed a line of multiple-switch starters for motors from 50 hp to 600 hp, which are made up of a number of single-pole, butt-joint switches mounted on a slate panel with a separate resistance. The general appearance of a double-pole starter for low-voltage circuits is given in Fig. 1. The motor is started by closing the switches, one at a time, in regular consecutive order from right to left. In the double-pole type, as shown in Fig. 1, the closing of the first switch connects one side of the motor circuit to the line, and closing the second establishes the shunt-field circuit and the armature circuit, the latter through the entire starting resistance. Each succeeding switch short-circuits a section of resistance and the last one also provides a permanent circuit for no-voltage and overload release coils.

It is impossible to close the switches except in the proper order, as they are interlocking. The switch on the extreme right, facing the board, must be closed first, and each switch when closed permits the closing of only the one next on the left and is itself locked until the first switch is opened. Thus

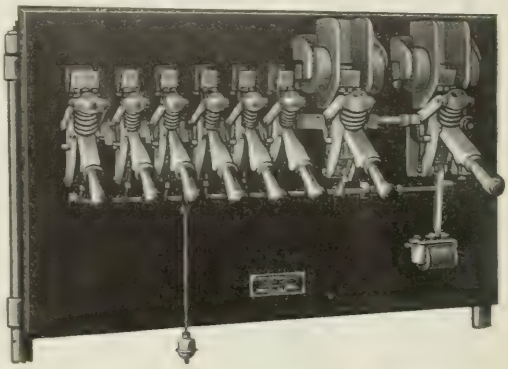


FIG. 1.—DOUBLE-POLE STARTER.

the motor cannot be started and thrown across the line in a shorter time than is required to close all of the switches one by one. To limit the current to full-load value, one minute should be allowed for starting; if started in half this time the current will be 50 per cent greater.

As an additional protection in starting the low-voltage release device which operates the first switch is not connected permanently to the line until the last switch is closed, and the first switch will remain closed only while the no-voltage release magnet is excited. If current is cut off from this coil for any reason, the switch will open and release all the others. Therefore, in order to be able to keep the switches closed while starting, an auxiliary circuit for the no-voltage release magnet is closed by pressing a push-button until the entire starting resistance is short-circuited. This insures against an operator inadvertently leaving part of the switches open.

On the double-pole starters the first two switches are single-pole circuit-breakers, but on the single-pole starters the first

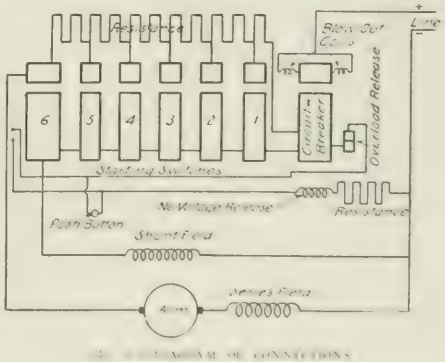


DIAGRAM OF CONNECTIONS.

switch only is a circuit-breaker. Powerful blow-out coils are provided on these breakers to prevent injurious arcing when the circuit is opened. The overload release opens the circuit of the low-voltage release magnet, and since this magnet must be excited while starting as well as while running, the motor is protected [illegible] at all times. Fig. 2 shows a diagram of connections for a single-pole starter with six sections of resistance.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The condition of trade during the past week continues to show a distinct improvement. Reports from the West indicate that, in spite of very unfavorable weather, retail business has been fair. In the central markets the wholesalers and jobbers have been receiving a few orders, these, of course, being mainly for filling in purposes. Inquiries for the fall are beginning to come in, and the general sentiment is one of optimism. The publication of the Government estimate of the crop values for the year has had a distinctly encouraging effect. According to the figures compiled by the Government statistician, the combined values of the crops of wheat, oats and barley will amount to $100,000,000 more than that of last year. Crop conditions are about average, and the acreage in almost all directions has been increased. In the industrial world there continues to be a distinct improvement. Iron and steel companies all over the country are so busy that they confidently predict they will be delivering normal output by the middle of the fall. There has also been a decided betterment in the pig iron situation, and the production is now running at a rate of 23,000,000 tons a year. The average price for finished steel materials is about $4 per ton lower than at the beginning of the year. There is also considerable more activity in the copper and electrical industries, and this is reflected in the betterment of the copper market. In textiles and in boots and shoes orders are reasonably plentiful. Collections continue to be only fair. Business failures for the week ended June 10, as reported by *Bradstreet's*, were 197 compared to 191 the previous week, 253 in 1908, 161 in 1907, 170 in 1906 and 175 in 1905.

THE COPPER MARKET.

The features of the past week in the copper market have been the very heavy speculative transactions and the heavy purchases, presumably by domestic consumers. Although official prices of copper show no change for the week, there was a downward tendency during the last few days. Strange as it may seem, a decline always checks the buying of local consumers. They appear to prefer purchasing on an advancing market, and immediately stay out when a decline begins. There is no doubt, however, that producers have disposed of large quantities of copper to dealers, speculators and consumers. The actual consumption is, of course, greater than it has been during the past few months, but is not anything like sufficient to utilize the quantities of copper that are now being purchased. The output continues to be unprecedented, and the fact that the statistics of the producers show a decrease in the surplus is due principally to the shifting of the stocks into the possession of second hands. It is estimated by some of the selling agencies that the total sales during the month of May in this market aggregate between 175,000,000 and 200,000,000 lb. If this be true, there must be some very heavy stocks in other hands than those of the producer. Imports continue to be liberal, and exports are very heavy. During the month of May the exports amounted to 31,473 tons, as compared with 22,640 tons in May, 1908. The tone of the market is very satisfactory to the producers, and there is no longer any talk current of combinations for the purpose of curtailment. Prices on the Metal Exchange June 14 were:

Lake	13⅝ @ 13¾
Electrolyte	13⅜ @ 13½
Casting	13¼ @ 13⅜

The London prices May 14 were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	59 12 6	59 10 0
Standard copper, futures	60 10 0	60 7 6
Market	Weak.	Easy.
Sales of spot		1,100 tons
Sales of futures		1,400 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Lake	14.88	12.55
Electrolyte	14.25	12.12½
Casting	14.12½	12.00
London, spot	£63 2 6	£51 12 6
London, futures	64 17 6	55 10 0

MR. WESTINGHOUSE REVIEWS EUROPEAN CONDITIONS.—George Westinghouse returned from Europe last week after a trip that lasted more than three months. Regarding conditions in the electrical and engineering trades he had this to say: "There has been a notable improvement within 60 days in Germany, France, Belgium, Italy, Austria and Great Britain as well as a fair degree of improvement in most of the markets to which those countries export electrical engineering products. Engineers in charge of very large hydro-electric undertakings and the electrification of steam railroads told me that work in process will require something more than 125,000,000 lb. of copper within a twelvemonth. So far as I could learn stocks of high conductivity copper in Europe are small. In Germany much is being done in the making of ocean cables. One concern in Cologne will work up 15,000 tons of American copper this year in ocean cables. Italy and Switzerland are doing a great deal of work in hydro-electric power plants for industrial purposes and in the electrification of steam railways. A dozen nations in Europe that until lately were large importers of coal are carrying out hydro-electric plants that will reduce their imports of coal for steam power making at least 75 per cent."

GENERAL ELECTRIC BUYS GERMAN TUNGSTEN PATENTS.—Although no formal announcement of the fact has been given out, the General Electric Company has purchased the patent rights to the Just-Hanaman and Kuzel tungsten lamps for America and certain other countries outside of Europe. Negotiations for these purchases have been pending for several months, and were finally brought to a successful conclusion a few weeks ago. These lamps, which have been imported for some time, will hereafter be manufactured in this country by the General Electric Company. The contracts for the sale of these lamps which already exist in this country will not be interfered with. The Electrical Accessaries Company, 1135 Broadway, New York, which has heretofore handled the Just lamp, will continue to import under license. The customers of this company have already been notified of the change. As far as could be learned, no special arrangement has as yet been agreed upon for the importation of Kuzel lamps to the United States.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in the present issue are announcements of proposed new plants or considerable extensions of present plants at Minneapolis, Minn.; Walla Walla, Wash.; Northfield, Minn.; Hazleton, Pa.; Pittsburgh, Pa.; Ainsworth, Neb.; East Jordan, Mich.; Claresholm, Alta., Can.; Portland, Ore.; Salt Lake City, Utah; Graniteville, Cal.; Allentown, Pa.; Dayton, Ohio; Jefferson, Okla.; Orange, Tex.; Kernersville, N. C.; Dothan, Ala.; Mackay, Idaho; Broken Bow, Neb.; Kenton, Ohio; Monette, Ark.; Murfreesboro, Ark., and Delphos, Kan.

MARKET FOR POWER-TRANSMISSION MACHINERY.—An American consul in Africa reports that there is a demand in his district at the present time for power-transmission machinery of various kinds, and firms in the United States desiring to compete for the business in this line of equipment should lose no time in communicating with and sending catalogs and other information to the mining companies and local supply houses, a list of which has been forwarded by the consul and may be obtained by manufacturers and dealers interested in exporting electrical apparatus for power-transmission from the Bureau of Manufacturers, Washington, D. C. The record number of this inquiry is 3501.

ELECTRICAL NOVELTIES FOR FRANCE.—M. Henri Rousseau, 225 rue de la Victorie, Brussels, Belgium, writes that he has taken up the importation of electrical novelties and accessories, and desires to receive the catalogs of manufacturers in these lines.

CATALOGUES WANTED.—C. Norton Parsons, 19 Terryville Avenue, Bristol, Conn., desires to receive catalogs pertaining to his business, which relates to electrical, mechanical and heating engineering.

NEW WIRELESS STATIONS.—The United Wireless Telegraph Company has issued lists of the commercial stations equipped with its system, which include 72 land stations, 171 boats and 51 steamship lines. In addition the company has equipped a large number of war vessels, and several army and navy shore stations. The company has recently fitted up five warships, and has also contracted with the Government to build three high-power stations along the Yukon River in Alaska. The apparatus for these stations will be shipped from Seattle Aug. 1. The installations will be of 5 kw each, and will complete a chain of Government Alaskan wireless stations. The company has recently equipped the *Joseph Henry* cable ship of the United States Signal Service, with a wireless outfit. Speaking of the reported developments in South and Central American states, an official of the company said that while it was true that negotiations had been pending for some time with Venezuela for the erection of stations along the coast, and that Samuel Greenbaum, who was representing the Venezuelan interests, had been in the city discussing the matter, no contract for this work had yet been made. An American company has been organized in Porto Rico, and expects to be granted a concession for telegraphic service on July 15. This service will be equipped by the United Wireless Company, and Frederick W. Midgeley, one of the engineers of the company, is now in San Juan preparing for the installation. The company has recently sold to the Salt Lake Railroad a 2 kw apparatus for its plant at San Pedro, Cal. The Los Angeles station of the wireless company, is about to be enlarged by the addition of a 5-kw installation.

ORDERS FOR LARGE DIRECT-CURRENT GENERATORS.—The Crocker-Wheeler Company has recently received several orders for large direct-current generators. One of these is for a 1500-kw, 550-volt generator to be used in the machine shop department of the Union Stock Yards of Armour & Company, Chicago. A similar machine of 800 kw, 575 volts, goes to Landers, Frary & Clark, New Britain, Conn. Warner Brothers Company, of Bridgeport, Conn., has ordered two generators, one 150 kw and one 329 kw, each 235 volts. Among the other sales of apparatus that the same company has made are: One 150 kw, 125-volt to the Keystone Steel & Wire Company; one 140 kw, 240-volt, and six 15-hp 230-volt motors to the Napier & Mitchell Manufacturing Company, Belleville, N. J.; one 125-kw, three-phase, 60-cycle, 240-volt alternating-current generator to the Cleveland Worsted Mills Company, Cleveland, Ohio; one 165-kw, three-phase, 60-cycle, 240-volt generator to the Miami Valley Works, Hamilton, O.; two 110-hp, 230-volt direct current motors have been sold to the Illinois Steel Company, South Chicago, Ill. A sale amounting to 247 hp in 220-volt, direct-current, series wound crane motors has been made to the Northern Engineering Works at Detroit. A number of sales of smaller apparatus have been made by the same company to manufacturing concerns throughout the West.

DENIAL OF GENERAL ELECTRIC COMPANY DEAL.—There has been recently revived in the daily newspapers the report which from time to time seems to go the rounds that the General Electric Company had either purchased or was negotiating for the heavy machinery manufacturing department of the Western Electric Company at Hawthorne. Regarding this deal, an official of the General Electric Company had this to say: "You may deny that story in toto; there is no such deal either completed or pending. That is all that it is necessary to say about it." The same expression was obtained at the headquarters of the Western Electric Company, where a representative of the company declared that there was nothing at all in the rumor. "Every time the Western Electric sees fit to turn down an order," said he, "or to refuse to bid for an order of extra heavy machinery, simply because our plants are busy making lighter apparatus, some one comes forward with this report that we have sold out. There is nothing in it, and as far as the published story is concerned that a number of our old employees in this department had been laid off, that also is untrue. So far as I know, only two old employees have quit, and they did so because they were offered better positions elsewhere."

BRITISH WESTINGHOUSE ELECTRIC COMPANY.—The annual meeting of the British Westinghouse Electric & Manufacturing Company, Ltd., was held May 24 in London. The chairman of the board of directors announced that the profits from the year's business had been more than absorbed by the interest charges, owing to the falling off of orders, due to the universal depression in business. The volume of orders, he stated, had been smaller, and the severe competition for business had greatly reduced the profits. As to the prospects for the coming year, he said that at the present time Great Britain was manufacturing electrical apparatus largely in excess of the demand of the home markets, and that the hoped for increase in the volume of orders depended almost entirely upon the export business. This, he stated, at the present time was not very bright, as there seemed to be a general depression all over the world, and as the competition was so sharp among the various exporting countries. He spoke urgently in favor of the standardization of electrical manufactures in Great Britain, and claimed that this tendency had done much to develop the industry in Germany and America.

NEW HAVEN ELECTRIFICATION PLANS.—W. S. Murray, electrical engineer of the New York, New Haven & Hartford Railroad Company, announces that it is the intention of the company to electrify its entire line from New York to New Haven; the electric zone now runs only to Stamford. Mr. Murray also says that the company intends to electrify the Harlem River branch, which runs from the Harlem River at 129th Street to New Rochelle. It is proposed that four tracks on each of these roads will be electrified. The Public Service Commission, it is said, will offer no objections when application is made for the electrification of the entire system in New York. It is expected that work will be completed in about 18 months. It was decided at the directors' meeting June 12 that the electrical extension should first be operated for freight, and later for passengers. The directors voted at the same meeting to contract for the work, which will cost $20,000,000, by open competition. It was expressly denied that any contract had been made with the Westinghouse company.

MISSISSIPPI RIVER DEVELOPMENT.—H. L. Cooper, of the engineering firm of Cooper & Powelson, of New York, has recently been making investigations with a view to building a dam and constructing a power plant on the Mississippi River near Keokuk, Iowa. John R. Freeman, of Providence, R. I., is consulting engineer of the enterprise. It is stated that there is water-power available at this point which may ultimately reach an output of about 200,000 hp. When a statement was asked from Mr. Cooper concerning the possibilities of this project, he said that at this time he was not prepared to give out any definite information.

SMALL VACUUM CLEANING MACHINE.—An American consular officer in a city of Western Europe reports that a local hardware dealer has applied to him for the names of American manufacturers of a small vacuum cleaning machine. The inquirer desires catalogs, price lists and full particulars regarding this article and forwards a cut representing the type of machine in which he is particularly interested, which can be obtained by interested firms from the Bureau of Manufactures, Washington. The record number of the inquiry is 3504.

LOUISVILLE-CINCINNATI TROLLEY PROJECT.—Announcement has been made by J. M. Andrews, president of the Indianapolis & Louisville Traction Company, that plans have been perfected for the immediate construction of a branch line from Scottsburg, Ind., to Madison, Ind., where connection will be made to Aurora, Lawrenceburg and Cincinnati. This company already operates a through service from Louisville to Indianapolis, Scottsburg being one of the points upon this line.

ELECTRIC TRAMWAY SUPPLIES.—A report has been received from an American consular officer in an European country, advising that a new electric line is to be constructed in his district. For the installation of this new electric tramway, which is to be completed within the next two years, all supplies are needed, and correspondence regarding the same should be addressed to the firm named in the report. The record number of the inquiry is 3490.

NEW WATER-POWER ENTERPRISE IN ARKANSAS.—The Garland Power & Development Company has been chartered at Little Rock, Ark., with a capital of $1,500,000, to establish a hydro-electric plant on the Ouachita River. It is proposed that the new company shall furnish power to the counties of Pulaski, Saline, Garland and Hot Springs.

WESTERN ELECTRIC COMPANY'S BUSINESS.—The business of the Western Electric Company, it is reported at the New York headquarters, is practically up to the normal capacity of the plants. The business, it is claimed, is particularly satisfactory from the fact that it is running largely to numerous orders of small apparatus rather than to large orders of heavier stuff. This class of business, it is said, is much more profitable. The company is kept busy making generators of less than 500-kw capacity, and small motors for individual machines in various factories are being very generously ordered. In addition to this, the telephone companies all over the country are making improvements and additions, and the number of orders for switchboards that have been received recently are very gratifying. Some good-sized orders for telegraph appliances have also been received, one from a Western railroad for wire, insulators and such material amounting to more than $100,000. The hydro-electric power plants are also buying equipment. Preliminary returns for May show that business is running at a rate of about $47,000,000 per year.

WHITNEY COMPANY'S AFFAIRS IN BETTER SHAPE.—A telegram from Salisbury, N. C., announces that an order has just been filed in the case of T. A. Gillespie & Company, of Pittsburgh and New York, against the Whitney Company, which allows the claim of Gillespie & Company in full, establishes the lien of $300,000 as a prior lien over the mortgage held by the Bankers' Trust Company, of New York, and practically amounts to a settlement of the claim. This is taken to mean that work will at once be resumed upon the water power plant, which, it is said, will be one of the largest in the United States when completed. In the meantime, the sale of the apparatus upon which the General Electric Company had a lien, which was announced for June 14, at Schenectady, has been postponed until June 28 at the same place, and an order of court has been issued to this effect. The postponement was made in order to give prospective purchasers more time to examine the apparatus that is to be offered.

BERGMANN WINS IN GERMAN CABLE WAR.—In February of the present year a combination which had existed among German manufacturers of insulated wire and cables for electric lighting and power purposes, was dissolved in consequence of inability to arrive at an agreement with an outside competitor, the Bergmann Electric Works Company, which had shortly before entered this field of manufacture. The rivalry which followed became so keen that prices were reduced below cost of production. It is now announced that the combination has been restored, with the Bergmann company as a member, under an agreement which holds until Dec. 31, 1914. The terms of the agreement affect only German consumers.

FRENCH WESTINGHOUSE COMPANY.—An official of the Westinghouse Electric & Manufacturing Company who has recently returned from abroad announces that the French Westinghouse Company has enjoyed a profitable business during the past year, and that the prospect is correspondingly bright for the coming year. At the regular meeting of this company this week it is expected that the annual 5 per cent dividend will be declared on the preferred stock. The recent increase of this stock by the addition of $5,000,000 does not decrease the available surplus for dividends, as the proceeds of this sale of stock was used to take up a like amount of notes upon which interest was being paid.

SALE OF ANIMAS POWER & WATER COMPANY.—The recent sale at Durango, Col., of the plant of the Animas Power & Water Company, on the Animas River, between Durango and Silverton, is made the occasion of an attack by the *Denver Times* on the General Electric Company, the purchase being stated to be part of the plan of that company, and interests allied with it to form a gigantic monopoly of the water-power resources of the country. No facts, however, to support the charge, are given. The Central Colorado Power Company is stated to be controlled by the same interests that purchased the Las Animas plant.

ELECTRICAL SUPPLIES WANTED BY THE ISTHMIAN CANAL.—The general purchasing officer of the Isthmian Canal Commission at Washington has advertised for various electrical supplies, the bids to be opened June 22 in Washington. These include distribution boxes, fuses, plugs, cut-outs, switches, etc. Also lamp fittings for marine use, incandescent lamps, enclosed arc lamps, carbons, insulated cable, copper wire, enameled iron conduits, wire solder, copper cable and various other small electrical appliances.

MILWAUKEE WESTERN ELECTRIC RAILWAY.—A contract has been awarded for the construction of the Milwaukee Western Electric Railway, which will run northwest from Milwaukee. Work upon this line will begin in September. The road will be 55 miles long between Milwaukee and Beaver Dam, with a branch of 10 miles from Sussex to Waukesha.

Financial Intelligence.

THE WEEK IN WALL STREET.

The stock market in Wall Street during the past week was one of the most active that we have had since the beginning of the time of depression. Sentiment from the beginning to the end was strong, but this does not mean that all stocks advanced. The highly professional character which has been developed in the recent market within the past year continues to be in evidence, and under such circumstances on every advance there appears to be a considerable amount of selling in order to take in profits. This selling always results in temporary reactions, and while last week some stocks advanced, others declined. The tone, however, is upward, and whether a security advanced or declined was simply due to whether the speculators had loaded up at a low figure, and were anxious to get out, or whether the stock had been originally taken by investors. Steel stocks were not quite so active as they were during the previous week, but this is due to the fact that they are largely handled by manipulators, who were ready to take their profits. General conditions in Wall Street are very favorable to a strong and advancing market. The Government crop report while unsatisfactory in spots, indicated that the total amount of money to be received by the farmers this season would be larger than in any year in the history of the country. Of course, it is the total results that interest Wall Street. The market for securities, especially mortgage bonds, was never better than at the present time, although proposed issues are not as largely oversubscribed as they were a few months ago. In the first five months of the year $172,000,000 of industrial bonds had been floated, while in the same period of 1908 less than $50,000,000 were floated. This shows that the country not only has plenty of money, but that it is willing to take hold of industrial investments. The money market has shown no change. It continues to be remarkably cheap as to rates, and remarkably plenty as to cash. Quotations on June 14 were call 1½ @ 1⅞ per cent, 90-day 2½ @ 2¾ per cent. The quotations in the table are those of the close May 14:

NEW YORK.

	June 7.	June 14.	Shares sold.		June 7.	June 14.	Shares sold.
All.-Ch.	15¼	16	2,500	Int.-Met.. pfd.	45¼	46⅝	9,720
All.-Ch., pfd...	52⅛	54	3,450	Mackay Cos...	82⅜	81½	1,900
Amal. Cop....	87	85⅞	118,770	M'c'ky Cs., p.	74¾	75⅛	750
Am. D. T.....	20*	20*	———	Man. Elev....	146½*	144	.....
Am. Loc.....	61⅝	60½	13,400	Met. St. Ry..	29*	29*	.....
Am. Loc., pfd.	117	117⅜	1,210	N.Y.&N.J. Tel.	124	124	425
Am. Tel. & Cbl.	79	80*	200	Steel. com....	67¼	69½	547,767
Am. T. & T..	140⅝	142½	55,222	Steel. pfd.....	125	125¾	36,718
B. R. T.....	81¼	80¼	36,680	W. U. T.....	76½	75	12,244
Gen. Elec.....	160	163½	13,500	West'h, com...	85	863⅛	16,120
Int.-Met. com..	16½	17	6,300	West'h, pfd...	123	122*	300

PHILADELPHIA.

	June 7.	June 14.	Shares sold.		June 7.	June 14.	Shares sold.
Am. Rys.....	45¼	45¼*	———	Phila. Elec...	11⅞	11⅞	———
Elec. Co of A.	12½	12½*	———	Phila. R. T....	32	27⅞	———
Elec. St. B'ty.	52½	54½	———	Phila. Trac...	92*	91	———
E. S. B'ty. pfd.	40*	49*	———	Union Trac...	56¾	52⅞	———

CHICAGO.

	June 7.	June 14.	Shares sold.		June 7.	June 14.	Shares sold.
Chi. City Ry..	180*	180*	———	Chi. Tel. Co..	133¼	134	———
Chi. Rs., Ser.1.	107½	107*	———	Met. El., com.	19*	19*	———
Chi. Rs., Ser.2.	38½	36½*	———	Met. El., pfd.	54*	54*	———
Com. Edison..	119½	119½	———	Nat'l Carbon...	93	93½	———
Chi. Sub'ws...	24½	25*	———	Nat'l C., pfd...	119*	118	———

BOSTON.

	June 7.	June 14.	Shares sold.		June 7.	June 14.	Shares sold.
Am. T. & T...	140⅝	142¼	———	Mex. Tel.....	3*	3	———
Cum. Tel.....	136¼	136*	———	Mex. Tel. pfd.	5½*	6⅜	———
Edison, E. Ill..	218	219	———	N. E. Tel....	133	133	———
Gen. Elec.....	160	163½	———	W. T. & T....	11¾	11½*	———
Mass. E. Ry...	12½	12*	———	W. T. & T., p.	87*	87	———
Mass E. R., p.	67½	67¼	———				

*Last price quoted.
Shares sold are for week June 7 to June 12.

DIVIDENDS

Boston & Worcester Electric Company, preferred, semi-annual, 1 per cent, payable July 1.

Detroit Edison Company, quarterly, 1 per cent, payable July 15.

Duluth (Minn.) Edison Electric Company, preferred, quarterly, 1½ per cent, payable July 1.

Fonda, Johnstown & Gloversville (N. Y.) Company, preferred, annual, 6 per cent, payable June 15.

Louisville Traction Company, quarterly, 1 per cent, payable July 1.

Manila Electric Railway & Lighting Corporation, quarterly, 1 per cent, payable July 1.

Otis Elevator Company, preferred, quarterly, 1½ per cent, payable July 15.

Reading (Pa.) Traction Company, semi-annual, 1½ per cent, payable July 1.

St. Joseph (Mo.) Railway Light, Heat & Power Company, preferred, quarterly, 1¼ per cent, payable July 1.

Union Traction Company, Philadelphia, semi-annual, 3 per cent, payable July 1.

United Gas Improvement Company, Philadelphia, quarterly, 2 per cent, payable July 15.

United Traction & Electric Company, Providence, R. I., quarterly, 1¼ per cent, payable July 1.

Washington Water Power Company, quarterly, 1½ per cent, payable July 1.

Western Union Telegraph Company, quarterly, ¾ per cent, payable July 15.

Winnipeg Electric Railway Company, quarterly, 2½ per cent, payable July 15.

McCALL FERRY POWER COMPANY REFINANCING.—A plan has been announced for refinancing the McCall Ferry Power Company, by the committee which has had the reorganization in charge. The plan provides that either the present company be readjusted or that a new company be formed which will be known as the Southern Pennsylvania Power Company. It is proposed to issue $12,500,000 first mortgage 5 per cent bonds to run 30 years. An amount not to exceed $4,250,000 of these is to be sold at 90 to obtain additional money for the completion of the plant. The plan proposes that the present bondholders shall receive 40 per cent of their present holdings in the new issue, amounting to $3,330,000. This will leave $4,920,000 in the treasury for future purposes. It is also proposed to issue new capital stock to the amount of $8,500,000, of which $3,500,000 will be used as a bonus to the purchasers of the new bonds. Under this arrangement the present bond holders will receive about 60 per cent. It is proposed that the new stock shall be placed in a voting trust which will not terminate until Nov. 1, 1912, It is claimed that this plan not only gives the present security holders ample bonus for the protection of what has already been invested in the enterprise, but it provides for future needs by retaining a satisfactory amount in the treasury. It is stated that outsiders, not now interested in the company, have agreed to take $4,170,000 of the new bonds. If this refinancing plan goes through it is promised that the dam and power stations will be completed early next year. A transmission line will then be immediately constructed into Baltimore.

JOHN D. RYAN HEADS AMALGAMATED COPPER.—At the meeting of the board of directors of the Amalgamated Copper Company last week, John D. Ryan was elected president, to succeed the late H. H. Rogers. No other changes in the officers of the company were made. Mr. Ryan has for many years been managing director of the company, and has practically had entire charge of all Mr. Rogers' copper interests. He is one of the best posted and most capable copper men in the country, his entire life having been devoted to the industry. Following his election Mr. Ryan resigned as president of the Anaconda Copper Company, and was succeeded in that position by Benjamin B. Thayer, who had been the assistant of President Rogers of the Amalagamated Company. Mr. Ryan has for a long time been associated with Thomas F. Cole in a number of mining enterprises in Montana, and recently organized the International Smelting & Refining Company, of which he is president, to compete with the American Smelting & Refining Company. He has given notice that it is the intention of his new smelting company to construct plants all over the West, and to be able to handle ore from almost every camp.

CONSOLIDATION AT CHATTANOOGA.—The plan for the consolidation of the Chattanooga Electric Company and the Chattanooga Railways Company, which has been heretofore referred to, has been officially given out by E. W. Clark & Company, Hodenpyl, Walbridge & Company and Graham & Company. It is stated that more than 90 per cent of the preferred stock and more than 90 per cent of the common stock of the railways company have assented to the plan. The Trust Company of North America, New York, will receive the deposits of stock. The capitalization of the new company will represent $2,690,000 railways bonds, and $1,038,000 electric company bonds, for which the proposed new mortgage issue will be made. There will also be $2,000,000 of 5 per cent cumulative preferred stock and $3,000,000 of common stock. The Chattanooga Railways preferred stock will be replaced by the new preferred stock share for share, and the common stock will be replaced with $25 in cash and $50 in the new common stock.

THIRD AVENUE REORGANIZATION PLAN.—A plan for the reorganization of the Third Avenue Railroad system has been submitted informally to the Public Service Commission, and is now under consideration. It was prepared by the bondholders' committee, of which J. N. Wallace is chairman. While the details of the plan were strictly guarded, it is understood that it involves rather heavy assessments upon the stockholders, and provides for an exchange of the present outstanding bonds on a basis of part bonds and part stock in the reorganized concern. F. W. Whitridge, receiver of the road, estimates that the betterments, which are absolutely necessary to put the line in good physical condition, will cost about $7,500,000, a portion of which has been already spent. In addition to this, the city has a claim of almost $1,250,000 for franchise taxes. Between 85 and 90 per cent of the bonds of the company have been already deposited with the protective committee.

TOLEDO RAILWAYS & LIGHT COMPANY.—It is given out by the bondholders' committee of the Toledo Railways & Light Company that the plan for reorganizing the property and for taking care of the indebtedness which matures in July has been successfully carried out. Under the plan as announced, the maturing bonds will be extended two and one-half years at a higher rate of interest, while a protective committee will look after the interests of the stockholders. The banking firm of Blair & Company, which is a large holder of the two batches of bonds, is practically backing the reorganization, and there appears to be no longer any doubt that the indebtedness of the company will be so well cared for that no litigation will be possible. It is also believed that there will be no serious difficulty about securing an extension of the various franchises, the trouble over which has caused the company its present embarrassment.

MASSACHUSETTS ELECTRIC COMPANIES EARNINGS.—For the first five months of the current year the earnings of the Massachusetts Electric Companies have shown an increase of $53,544, or 1.6 per cent. This improvement has all been made in the past three months as the first two months fell below the same months last year. Thus far the operating companies have applied to the railroad commission for permission to issue $2,800,000 of new securities. A portion of the money thus raised has been used to pay off floating indebtedness but the bond issues now pending are to provide for betterments and improvements. When the work now in hand is completed the total expenditure of the company will amount to upward of $21,000,000.

AMALGAMATION PLAN AT SPRINGFIELD, ILL.—Announcement has been made that E. W. Clark & Company, of Philadelphia, and Hodenpyl, Walbridge & Company, of New York, have recently acquired control of the stock of the Rockford (Ill.) & Interurban Railway Company, and expect to make a consolidation of that property with the Springfield Railway & Light Company, the Peoria Light Company and the Evansville Light Company. A plan has been perfected to this effect, and the new company will be known as the Union Railway, Gas & Electric Company. The Bankers' Trust Company, of New York, is one of the depositories for the transfer of stock.

NATIONAL CARBON STOCK LISTED IN BOSTON.—The recent listing of the preferred and common stock of the National Carbon Company on the Boston Stock Exchange was done because the securities are largely held by New England [illegible]. At least 40 per cent of the company's shares are placed in that section. The stability of the company's business makes it popular. As the majority of the customers are municipalities or public service corporations the earnings are little affected by periods of depression.

NEW YORK STATE RAILWAYS CAPITAL INCREASED.—Application has been made to the Public Service Commission of the Second District of New York by the New York State Railways Company, which controls a number of trolley properties in central New York, for permission to increase its capital stock from $23,140,200 to $23,850,200, to purchase and acquire the stock of several other railroad properties. Application has also been made to execute a consolidated and refunding mortgage on its property rights and franchises to secure a $35,000,000 issue of bonds. It is proposed to issue at this time only $6,500,000 of these bonds, which will be used for refunding the outstanding bonds of the Rochester & Eastern Rapid Railway Company, and to acquire the Rome City Railway Company and the notes of a few other companies. This financing is a part of the plan for the consolidation of all the trolley interests in central New York.

POPE MANUFACTURING COMPANY IN GOOD SHAPE.—Having completed the sale of unnecessary properties and concentrated its manufacturing in the two plants at Hartford, Conn., and Westfield, Mass., the Pope Manufacturing Company is now said to be in excellent financial condition. Of the $800,000 6 per cent notes issued under the reorganization plan, $267,000 maturing in 1911 have been redeemed, and now the property sale has made it possible to take up the remaining $533,000. The company's business has recently shown a vast improvement. The demand for automobiles has increased, and it is claimed that the output of cars for the current year will be double that of 1908. With the notes retired, the company has to earn only $150,000 to meet the requirements of its $2,500,000 cumulative 6 per cent preferred, and all above that can be devoted to dividends upon the $4,000,000 common stock.

BUTTE ELECTRIC & POWER COMPANY.—It is reported from Montana that the Butte Electric & Power Company, of which C. W. Wetmore, of St. Louis, is president, has acquired a half interest in the $2,500,000 stock of the Great Falls Water Power & Townsite Company, in which John D. Ryan and Thomas F. Cole are heavily interested. The Great Falls company has established a hydro-electric plant of 8360 hp, and is building a second plant which it is estimated will net 36,000 hp. These plants will furnish power to the mines and smelters of the Amalgamated Copper Company. The Butte Electric & Power Company is also furnishing energy in this field, and the purchase above referred to is in the nature of a consolidation of interests. The purchase which the Butte Electric Company has recently made also gives it control of the electric railway and lighting systems of Great Falls, Mont.

LACLEDE GAS LIGHT DEAL CARRIED THROUGH.—Official announcement has been made that the North American Company's holdings of the common stock of the Laclede Gas Light Company, of St. Louis, have been sold to G. H. Walker & Company, St. Louis, and William Salomon & Company, of New York. These firms represent a purchasing syndicate, made up of St. Louis men, among whom are Adolphus Busch and John I. Beggs, of Milwaukee, the present head of the company. The syndicate is closely identified with the North American Company. Alanson Lathrop, president of the American Light & Traction Company, says that his company is not interested. It is said that John I. Beggs will remain as president of the company.

WESTERN UNION EARNINGS GROWING.—At a meeting of the Board of Directors of the Western Union Telegraph Company last week, an estimate of the income from operations for the present quarter was made, which shows that it will probably exceed $1,700,000; this compares with $1,684,000 for the first quarter of the year, and $1,579,000 for the corresponding quarter in 1908. After paying interest on the bonds there will be left $1,266,000, or 1¼ per cent on the company's stock. This stock has been paying quarterly only ¾ of 1 per cent. In a statement made to the board of directors, President Clowry estimated that the net earnings of the company for the fiscal year would amount to 5½ per cent on the stock.

ELECTRIC VEHICLE SETTLEMENT ACCEPTED.—An order has been entered in the United States Court at Trenton authorizing Halsey M. Barrett and Henry W. Nuckels, receivers of the Electric Vehicle Company, to accept the offer of $430,000 cash from the receivership committee, of which Herbert Lloyd is chairman. The offer provides that the committee will also pay all of the accruing debts of the present receivership until its termination. Under this plan of reorganization the bondholders will receive 20 cents on the dollar, which it is claimed is double the amount that would have been received had the company been liquidated.

COMPLETING STANISLAUS ELECTRIC POWER DEAL.—Articles of incorporation have been filed in San Mateo County, California, for the Sierra & San Francisco Power Company. This is the new concern that has been organized by the United Railways interests to absorb the recently purchased Stanislaus Electric Power Company. The capital stock authorized is $20,000,000, of which $1,000 was subscribed. The organizers named are members of the law firm that has handled the deal for the United Railways Investment Company. The new company takes over the Stanislaus and its subsidiary companies.

AMERICAN PNEUMATIC SERVICE COMPANY.—At the annual meeting of the American Pneumatic Service Company in Chicago last week W. H. Ames was elected president, and the date of the annual meeting was changed from the last Friday in May to the last Friday in June, so as to allow more time to prepare the annual report. It was voted at the meeting to appropriate the money to build a tunnel under the Chicago River for the purpose of re-establishing the mail service of the Chicago & Northwestern Railway.

HAVANA ELECTRIC RAILWAY.—At the monthly meeting of the directors of the Havana Electric Railway last week a plan for retiring $5,000,000 of 6 per cent preferred stock was considered. After the meeting it was announced that the details of the plan had not been worked out, but that some action was likely to be taken in this direction before the end of the year. It was stated that the company's affairs showed a steady improvement, and that conditions in Cuba were generally satisfactory.

REPORTED CONSOLIDATION OF ELECTRICAL CONCERNS.—A financial paper in New York published last week a report that a number of the smaller electrical manufacturing concerns were likely to enter into a combination, financed by London and Berlin bankers. It was expressly stated that these concerns did not include any of the large companies. Investigation of the story developed no confirmation of the report, which does not appear to have even a basis in rumor.

TO CONTEST INCREASE OF FARE.—The City Council of Philadelphia has adopted a resolution directing the city solicitor to begin legal proceedings at once to determine the right of the Philadelphia Rapid Transit Company to discontinue the sale of six for a quarter tickets without the consent of the city. The Council also adopted a resolution demanding that the old rate of ticket sales be restored.

EASTHAMPTON (MASS.) PLANT SOLD.—Boston financiers connected with the Connecticut River Power Company have notified the Easthampton Gas Company that they will exercise their option on the company's stock. They agree to pay $200 a share, par $100. The capital stock is $50,000. The electrical plant will be connected with the Connecticut River plant at Turners Falls.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
Amalgamated Copper Company:					
Year ended April 30, 1909	.....	.....	$3,663,980	$3,077,758	$586,222
Year ended April 30, 1908	.....	.....	6,080,557	6,155,516	*25,041
Geneva, Waterloo, Seneca Falls & Cayuga Lake(N. Y.) Traction Company:					
Quarter ended March 31, 1909	$18,002	$14,260	3,742	6,300	*2,479
Quarter ended March 31, 1908	17,412	13,733	3,679	4,500	*1,130
Montreal Light, Heat & Power Company:					
Year ended April 30, 1909	4,079,769	1,844,053	2,235,116	489,268	1,745,848
Year ended April 30, 1908	3,792,318	1,651,656	2,140,562	493,090	1,647,467
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

GENERAL NEWS

Construction News.

DOTHAN, ALA.—J. B. McCrary & Company, of Atlanta, Ga., have been engaged by the City Council to prepare plans and supervise the construction of the proposed municipal electric light plant and water works system, for which $20,000 in bonds was recently voted.

PHOENIX, ARIZ.—The Phoenix Railway Company is considering the question of extending its Indian School line for a distance of about 2½ miles.

HIGGINSON, ARK.—The Searchlight Power & Electric Company, recently incorporated, it is reported, will establish an electric light plant either in Higginson or Kensett. The company also proposes to establish a street railway system in Searcy. Louis Lorch is president.

MURFREESBORO, ARK.—The Pike County Water Power Company is preparing plans for the construction of a concrete dam across the Little Missouri River. It is proposed to develop from 20,000 to 40,000 hp for transmission by electricity to various cities. Claudius Jones, of Little Rock, Ark., is president.

MAMMOTH SPRINGS, ARK.—The Mammoth Springs Electric & Power Company, recently incorporated, is planning to construct a power plant and develop 950 hp, contracts for which have been awarded as follows: For electrical equipment, to the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa.; water wheels, to James Leffel & Company, of Springfield, Ohio. J. A. Omberg, Institute Building, Memphis, Tenn., is engineer in charge.

MONETTE, ARK.—Plans have been completed for the installation of an electric lighting system in Monette. It is said that the Monette Lumber Company is interested in the project.

DEL MONTE, CAL.—The Del Monte Townsite Company has completed surveys and secured capital for the construction of an electric railway, three miles in length, from Monterey to Del Monte Heights. Contracts for the construction of the railway will soon be let. F. M. Fairchild, of Oakland, Cal., is chief engineer, and George W. Phelps, of San Francisco, president.

GLENDALE, CAL.—The Glendale & Eagle Rock Railway Company is negotiating with the Pacific Electric Railway Company for the purchase of its franchise for the distance between the terminus of its Glendale line and the terminus of the Glendale & Eagle Rock Railway. The last-named company has recently completed a railway between Glendale and Eagle Rock, 2½ miles in length, where it connects with the Los Angeles Railway running from Eagle Rock to Los Angeles. The Glendale & Eagle Rock Railway Company purchases electricity for operating its road from the Pacific Light & Power Company, of Los Angeles, Cal. E. D. Goode is president and treasurer of the Glendale company.

GRANITEVILLE, CAL.—Surveys are being made on the Middle Yuba River below Graniteville for the proposed electric plant to be installed by Dr. A. H. Tickell. It is said that the plant will be located above the Plumbago power house and will furnish electricity to the mines in Allegheny and Graniteville. Edward C. Uren, of Grass Valley, Cal., is engineer.

LOS ANGELES, CAL.—The Surf Light & Power Company, recently incorporated, with a capital stock of $1,000,000, proposes to erect a generating plant on the coast, probably between Santa Monica and Redondo, which will be operated by power obtained from the waves of the ocean. The plant will furnish electricity for lamps and motors to coast towns. Charles W. Hicks, J. L. Haley and others are interested in the project.

OAKLAND, CAL.—H. L. Boyle, representing the citizens of Fitchburg, has applied to the Board of Supervisors to have a lighting district formed in that place.

PASKENTA, CAL.—W. D. Russell, of Paskenta, has filed a notice of appropriation of 500 cu. in. of water from Bennett Creek to be utilized for irrigation and domestic purposes, and also for the generation of electricity.

POMONA, CAL.—The Pacific Electric Railway Company will construct a one and one-half mile extension to its railway in Pomona.

RED BLUFF, CAL.—E. W. Stores, of Tehama, has filed notice of appropriation of 20,000 cu. in. of water in Mill Creek to be diverted about 14 miles above the junction of Mill Creek with Little Mill Creek. The water will be utilized to generate electricity.

REDDING, CAL.—The Northern California Power Company, Consolidated, has taken over the C. W. Hamilton ranch and water rights, which includes 540 acres of land and about 850 in. of water running out of Battle, Mill and Brush creeks, which run through the property. Work has commenced on the construction of a new power plant which is designated "South," where 6000 hp will be obtained. The plant is located five miles south of the Volta power plant, where 9000 hp is generated. It is expected to have the plant in operation in July. Another plant will be erected further down the stream which will be known as "Inkskip," where about 8000 hp will be obtained. The company expects to have all its installations completed by the end of 1910, which will give it a combined output of 51,000 hp.

SAN FRANCISCO, CAL.—It is reported that the Golden States Mines & Iron Works is planning to install a new electric generator in its plant.

SAN JOSE, CAL.—J. T. Burke, president of the San Jose, Los Gatos Interurban Railway Company and Peninsular Railroad Company, has secured a franchise on First Street for $11,000. It is said that the owner of the new franchise cannot construct a railway unless it can purchase the property of the San Jose Railway Company. The franchise of the San Jose Railway Company still has 13 years to run.

SANTA ANA, CAL.—Application has been made to the Board of Supervisors for a 25-year franchise to construct and operate transmission lines along certain highways in Orange County for the distribution of electricity for lamps and motors. Sealed bids for the franchise will be received by the Board of Supervisors until July 7. W. B. Williams is county clerk.

TRINIDAD, COL.—The power plant of the Southern Colorado Power Company was destroyed by fire June 5, putting the electric lighting system and street railway out of commission. The leading coal mines and coke ovens of the Colorado Fuel & Iron Company throughout the county are idle, owing to lack of power. The loss is estimated at $300,000.

NEW HAVEN, CONN.—The United Illuminating Company has submitted a proposition to the trustees of Yale University for furnishing electricity for lighting the campus and college buildings. The college authorities are considering the question of enlarging the two electric plants now maintained by the university.

LEWES, DEL.—The Board of Public Works is extending the municipal electric lighting system to the beach front.

WASHINGTON, D. C.—The Commissioners of District of Columbia have granted the Baltimore & Washington Transit Company permission to construct the extension of its railway within the District of Columbia.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 10, for furnishing generating equipment and ceiling fans at the naval hospital, Canacao, P. I. Plans and specifications can be obtained on application to the bureau. R. C. Hollyday is chief of bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until June 29 to furnish at the navy yard, Mare Island, Cal., one electric traveling hoist and one electric freight elevator. Applications for proposals should refer to schedule 1304. Blank proposals furnished upon application to the Navy Pay Office, San Francisco, Cal., or to the above bureau.

WASHINGTON, D. C.—Bids will be received until June 26 at the Bureau of Yards and Docks, Navy Department, Washington, D. C., for furnishing and installing three 5000 cu. ft. air compressors and accessories at the navy yards at New York, Philadelphia and Mare Island, Cal. Specifications can be obtained on application to the bureau or to the commandants of the navy yards named. R. C. Hollyday is chief of bureau.

WASHINGTON, D. C.—Bids will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 10 (an extension of date from June 26) for furnishing and installing piping, pumps, condensers, heaters, etc., in the central power plant, navy yard, Puget Sound, Wash. Plans and specifications can be obtained on application to the bureau or commandant of the Navy Yard named. R. C. Hollyday is chief of bureau.

WASHINGTON, D. C.—Sealed proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 10 (an extension of date from June 26) for furnishing one 1000-kw and two 1500-kw turbo-alternators for the navy yards at New York, Philadelphia and Boston. Specifications can be obtained on application to the bureau or to the commandants of the navy yards named. R. C. Hollyday is chief of bureau.

WASHINGTON, D. C.—The Washington, Baltimore & Annapolis Electric Railway Company has engaged the Cleveland Construction Company, of Cleveland, Ohio, to take charge of the reconstruction of its power system, changing it from 6600-volt alternating-current to 1200-volt direct-current. The work will include the construction of a new substation and installing new equipment at the present transformer stations, and also the erection of high-tension transmission lines and feed wires.

WASHINGTON, D. C.—The Commissioners of the District of Columbia have accepted the proposition of the Potomac Electric Power Company to light the streets of the city for a term of three years. The company offers to replace the present arc lamps [illegible] to keep the [illegible] the same rate that is now being paid; to maintain the present 40-cp lamps, reducing the price from $24 to $20 per lamp per year; to maintain the present 1200-cp lamps at $60 each per year, instead of $120, as paid under the present contract, by reducing the price of these lamps from $60 to $45 per lamp per year, and to furnish and maintain [illegible] Nernst

lamps on Connecticut Avenue Bridge at the rate of $65 each per lamp per year, and arc lamps at $85 per lamp per annum.

JENNINGS, FLA.—K. K. Powell is reported to be interested in a project to establish a telephone system in and around Jennings.

BAINBRIDGE, GA.—The Bainbridge Telephone Company has purchased the plant and holdings of the Brinson Telephone Company and is constructing a small exchange at Climax, and also many rural lines in all parts of this and Miller counties.

BRUNSWICK, GA.—The Mutual Light & Water Company, recently organized, will begin work in four months on a street railway system. The company has completed a boiler house and has ordered equipment for the same.

DOUGLASVILLE, GA.—Contracts for the construction of the proposed municipal electric light plant have been awarded as follows: For construction of plant, to Carter & Gillespie, of Atlanta, Ga.; electrical apparatus to the Fort Wayne Electric Works, Ft. Wayne, Ind., and to the Harrisburg Engine Company, of Harrisburg, Pa., for all steam equipment. The cost of the plant is estimated at $10,000.

ELBERTON, GA.—The Interstate Power Company, recently incorporated by Thomas J. Brown and E. Marvin Underwood, with a capitalization of $3,000,000, proposes to build a dam across the Savannah River in Elbert County.

LAWRENCEVILLE, GA.—The North Georgia Electric Company is reported to be considering the question of furnishing electricity in Lawrenceville from its plant at Gainesville. The company proposes to construct a cable line supported by steel towers, at a cost of about $15,000. W. A. Carlisle, of Gainesville, Ga., is president.

ROME, GA.—Arrangements are being made by the Rome Railway & Light Company to extend its railway system farther into the suburbs. The first extension will cost about $15,000.

SUMMERVILLE, GA.—The city is contemplating the installation of an electric light plant. C. D. Rivers is mayor.

WARRENTON, GA.—At an election to be held July 12 the proposition to issue $12,000 in bonds for the construction of an electric light plant will be submitted to a vote.

MACKAY, IDAHO.—The Mackay Light & Power Company, recently organized, is making preparations for the construction of a hydro-electric plant near Mackay. The initial equipment will include a 500-kw generator and turbine.

AURORA, ILL.—The Western United Gas & Electric Company, it is reported, will install an additional steam turbine, jet condenser, electric generator, exciter, etc., in the near future.

MONMOUTH, ILL.—Plans are being made by the Central Union Telephone Company to erect a new exchange building in this city at a cost of $60,000. The central energy system will be installed.

OTTAWA, ILL.—It is reported that W. D. Boyce, of Chicago, Ill., contemplates making application to the City Council for a franchise to furnish power to manufacturers in Ottawa.

VERMILION, ILL.—Plans are being made by the Vermilion Telephone Company for rebuilding the local telephone exchange and its lines throughout the country.

BRAZIL, IND.—The capital stock of the Citizens' Telephone Company has been increased from $50,000 to $100,000. M. J. Murphy is secretary and treasurer.

CHRISMAN, IND.—The Portage Home Telephone Company has increased its capital to $50,000, the proceeds to be used to make general improvements. J. J. Robinson is president and E. G. Miller secretary of the company.

KNIGHTSTOWN, IND.—Local business men are interested in a project to construct an electric railway from this city to Shirley, a distance of 23 miles.

LINTON, IND.—It is reported that the municipal electric light plant is to be sold to a Chicago company for $25,000. It is said that a majority of the Council is in favor of selling the plant and that a special meeting will probably be called soon to take action on the matter.

PERU, IND.—The Miami County Commissioners, it is reported, have decided to install an electric light, heat and power plant at the court house and jail, at a cost of about $40,000.

TERRE HAUTE, IND.—The Vandalia Railroad Company is planning to enlarge its terminal in this city and construct a large engine shop, which will involve an expenditure of over $500,000. The shops will be equipped to be operated by electricity.

BOONE, IA.—The Boone County Telephone Company has awarded a contract to the Automatic Electric Company, of Chicago, Ill., for a complete equipment of its plant, at a cost of $125,000.

CORNING, IA.—Plans are being made by the Middle Valley Mutual Telephone Company to rebuild its entire telephone lines.

HOUGHTON, IA.—The German-American Telephone Company has increased its capital stock from $3,000 to $50,000 and has changed its main office from Hamil to Houghton.

SPIRIT LAKE, IA.—The Midland Telephone Company is contemplating the erection of a new telephone exchange building.

DELPHOS, KAN.—Bids will be received by the city clerk of Delphos until June 23 for furnishing material and constructing a system of water works [illegible] plant, separate bids being entertained as follows: 1. For furnishing material and labor (except cast-iron pipe, hydrants, valves, machinery and water tower) and constructing a complete water works system. 2. For furnishing cast-iron pipe and special castings. 3. For furnishing hydrants and valves. 4. For furnishing material and erecting steel tower and tank, capacity 50,000 gal., height 80 ft. to the bottom of tank. 5. For furnishing and erecting on foundations furnished by the city, one 25-hp and one 50-hp gasoline engines and accessories. 6. For furnishing and erecting on foundations furnished by the city one 20-kw and one 35-kw generator with exciter, switchboard and accessories. 8. For furnishing material and erecting electric light distributing system. Plans and specifications for the above work are on file at the office of the city clerk, Delphos, Kan., and at the office of the J. S. Worley Company, engineers, Kansas City, Mo. J. R. Adams is mayor.

JAMESTOWN, KAN.—Plans are being prepared for the construction of an electric light plant and water works system in Jamestown. Burns & McDonnell, Scarritt Building, Kansas City, Mo., are engineers.

ST. JOHNS, KAN.—The citizens at an election to be held June 18 will vote on the proposition to issue $37,500 in bonds for the construction of an electric light plant and water-works system, plans for which have been prepared by Burns & McDonnell, consulting engineers, Kansas City, Mo.

ALEXANDRIA, LA.—The electric light and water works committee has recommended a bond issue of $45,000, the proceeds to be used for extension and improvements to the electric light plant and water works system.

NEW ORLEANS, LA.—The New Orleans Railway, Light & Power Company is contemplating an extension of its railway to Spanish Fort, via the West End. Hugh McCloskey is president.

ALFRED, MAINE.—Bids will be received by the Alfred Embroidery Company, of Alfred, Maine, until July 1, for the installation of 35 electric street lamps, electricity to be supplied by a generator in its plant. For further information address R. S. Stanley, president.

DAMARISCOTTA, MAINE.—The Twin Village Water Company is contemplating enlarging its plant and extending its service. A holding company has been formed under the name of Portland Investment & Development Company with Col. H. M. Castner, of Portland, as president and E. E. Philbrook, of Damariscotta, treasurer. The company is capitalized at $100,000 and is negotiating for the property of the Centrifugal Leatherboard Company, which is in the hands of a receiver. If the new company acquires the property it will utilize power from the falls to generate electricity to operate lighting plant and pumps, and discard the present Deisel engine now in use. The company would also be able to supply electricity to the towns between Bath and Rockland and to furnish a 24-hour service.

LEWISTON, MAINE.—The Union Water Power Company has recently acquired control of certain privileges on the Androscoggin River, above Lewiston, owned by the International Paper Company, which are known as the Babbit and Googin dam and the Clark Rips privilege. It is estimated that 10,000 hp can be developed. Walter H. Sawyer is engineer.

LUBEC, MAINE.—The Lubec Sardine Company is rebuilding its plant, which was destroyed by fire in 1908. A power plant will be installed, the equipment of which will include one 85-kw, alternating-current generator; one 35-kw, alternating-current, three-phase generator for auxiliary purposes, both direct connected to engines. The electrical equipment will be installed by O. R. McKay, of Calais, Maine.

BALTIMORE, MD.—Henry J. C. Hoffman and others are interested in a project to build an electric railway between Brooklyn, a suburb of Baltimore, and Glenburnie, a distance of about five miles. The company will be known as the Brooklyn, Cedar Hill & Furnace Creek Electric Railway Company.

ATTLEBORO, MASS.—Application has been made to the Board of Selectmen to extend its street lighting system from the North Attleboro line to the Pawtucket line. It is said that there is no appropriation for the lamps this year, but that the question will be presented to the votors at some future meeting. With lamps in South Attleboro the entire distance between North Attleboro and Pawtucket will be lighted.

BOSTON, MASS.—The Edison Electric Illuminating Company has submitted a proposition to Guy Emerson, superintendent of streets, offering to install new tungsten street lamps throughout the city to replace the present gas and naptha lamps. Under the terms submitted, the city would save approximately $50,000 a year. If the contract should be awarded to the Edison Company, it would be necessary for the company to erect poles and wires to replace the present gas lamp posts.

CHICOPEE, MASS.—The residents of Willimansett have applied to the Board of Aldermen for electric lamps in that district. At present gas lamps are in use.

EASTHAMPTON, MASS.—The officials of the Connecticut River Power Company have notified the stockholders of the Easthampton Gas Company that they will exercise their option of the company's stock, for which they agree to pay $200 a share, par value $100. The company is capitalized at $50,000. The electrical plant will be connected with the Connecticut River plant at Turner's Falls.

EAST LEE, MASS.—It is reported that plans are being prepared for extensive improvements to the plant of the Mountain Mill Paper Company, at a cost of from $35,000 to $40,000, and will include the construction of a trunk and dam. A large generator is being installed to furnish electricity to operate the machines, all of which will be operated

by electric motors, except that which is on the main driving shaft. Turbines will replace the old overshot wheel.

PLYMOUTH, MASS.—Extensive improvements are being made to the power plant of the Plymouth Electric Light Company, which was badly damaged by fire a few weeks ago. A new 500-hp Harris-Corliss engine will replace the McIntosh-Seymour tandem, compound engine, and the 120 and 240-hp Ide engines in the old engine room will be discarded and other important changes made. The Plymouth Electric Light Company is using the temporary machinery in the power station of the Brockton & Plymouth Street Railway Company while repairs are being made to its plant.

SPENCER, MASS.—The Spencer Gas & Electric Light Company has been awarded the contract for lighting the streets of the town for five years commencing June 1, 1909. The company is to furnish 186 40-cp tungsten lamps at $17 each per year and 24 arc lamps of 1200-cp at $75 per lamp per year, making the total cost $4,962 per year.

CADILLAC, MICH.—The R. G. Peters Salt & Lumber Company and the farmers in the vicinity of East Lake and Hoxieville are constructing a new telephone line between the two places, a distance of 25 miles. The company will be known as the Hoxieville & East Lake Telephone Company.

DETROIT, MICH.—The Detroit Iron & Steel Company has placed an order with the Allis-Chalmers Company for a Reynolds-Corliss engine and a 250-kw direct-current generator.

EAST JORDAN, MICH.—The East Jordan Electric Light & Power Company contemplates improvements to its system, including a water power development and extensions to its transmission lines to meet the increasing demand for electricity for lamps and motors. W. A. Lovejoy is secretary.

GLADSTONE, MICH.—The Escanaba Electric Street Railway Company has been granted a 30-year franchise in Gladstone.

ST. LOUIS, MICH.—Arrangements are being made by the Union Telephone Company to install a complete metallic system in this city. The cost of the work is estimated at $20,000.

SUMNER, MICH.—The Sumner Rural Telephone Company contemplates extending its telephone lines to Riverdale to connect with the lines of the Union Telephone Company at that place.

AITKIN, MINN.—The Aitkin Telephone Company has commenced work on the construction of a telephone line to the new town of Cuyuna. The company will also transfer the Deerwood telephone line to new poles, which heretofore were strung on the railroad company's poles.

DEERWOOD,, MINN.—Plans are being considered by the Bay Lake Telephone Company to extend its telephone line on the west side of Bay Lake to connect with the Horace Mann system. It is said that the Aitkin Telephone Company will construct another telephone line into Deerwood.

FAIRMONT, MINN.—The Jay Center Telephone Company is planning to extend its telephone line to Dunnell.

MINNEAPOLIS, MINN.—Plans are being considered by Dr. P. M. Hall, health commissioner, to install a generator at the garbage crematory to furnish electricity for additional lamps in North Minneapolis. At present the crematory furnishes light, heat and power for the workhouse, Hopewell Hospital, and a number of other municipal buildings, saving the city about $8,000 a year. An appropriation of $5,000 will be asked for the purchase of a generator which will enable the plant to generate about 1000 hp. It is proposed to furnish electricity for 200 arc lamps in North Minneapolis, which would save the city about $15,000 per year.

MOTLEY, MINN.—The Laurel Telephone Company is making arrangements to build a telephone line about 10 miles in length.

NORTHFIELD, MINN.—Plans are being prepared by Edward P. Burch, engineer, Guaranty Building, Minneapolis, Minn., for a heating and lighting plant for the college, to cost about $30,000. Harlan W. Page is secretary and treasurer.

PAYNESVILLE, MINN.—Plans are being considered by the Village Council for extensions to the municipal electric light plant.

PINE RIVER, MINN.—The Pine River Rural Telephone Company will soon commence work on the installation of its local exchange and the erection of a telephone line to Emily.

WILLMAR, MINN.—An election will be held June 22 to vote on the proposition to purchase the local telephone exchange of the Northwestern Exchange Company. The value of the system is estimated at $15,000.

VICKSBURG, MISS.—Mayor Hayes has signed the contract between the City of Vicksburg and the Vicksburg Lighting Company for lighting the streets of the city for a term of five years. The contract calls for 150 arc lamps at $85 per lamp per year and 50 incandescent street lamps at $25 each per year with an all-night service. Under the old contract the lamps burned under the moon light schedule.

COLUMBIA, MO.—Plans are being made by the Columbia Telephone Company to install a new central energy system and to place its wires in underground conduit, which will involve an expenditure of about $[illegible].

ST. LOUIS, MO.—It is reported that the Kinloch Long Distance Telephone Company will increase its capital stock from $[illegible] to $[illegible], the proceeds to be used for extension and development of the properties owned by the company.

BUTTE, MONT.—It is reported that the Butte Electric & Power Company has acquired the water rights of the Great Falls Water Power & Townsite Company, in which John D. Ryan and Thomas F. Cole are interested. The Great Falls Company has already constructed a hydro-electric plant and will build a second plant which will develop 36,000 hp, and which will furnish electricity to the mines and smelters of the Amalgamated Copper Company. C. W. Wetmore, of New York, N. Y., is president of the Butte Electric & Power Company.

GREAT FALLS, MONT.—The Smith River & Castner Coulee Telephone Company, recently organized, is planning to construct telephone lines along the Missouri River to Flood and thence across the river to Truly. From Truly a branch will be erected to Castner Coulee and along the Smith River to Hound Creek. H. B. Ellis is president.

SPRINGDALE, MONT.—James A. Murray, of Butte, Mont., is reported to be interested in a project to construct an electric railway from Springdale to Hunter's Hot Springs, a distance of 2½ miles.

AINSWORTH, NEB.—Plans are being prepared by the Ainsworth Electric Light & Power Company for the construction of a dam across Plum Creek.

AINSWORTH, NEB.—Arrangements have been completed for installing an electric light plant in Ainsworth. Final surveys have been made for the construction of a dam across Plum Creek, 14 miles above Ainsworth, work on construction of which will commence immediately. It is estimated that 400 hp can be developed. A company has been incorporated to construct and operate the plant. The officers of the company are: F. W. Sellors, president; R. F. Osborn, vice-president; W. H. Williams, secretary, and R. S. Rising, treasurer.

BROKEN BOW, NEB.—Preparations are being made by John W. Early, of Columbus, Neb., for the installation of an electric light plant in Broken Bow. The equipment will include a four-valve or belted Corliss engine of 150 hp direct connected to a 100-kw, 2300-volt, three-phase generator.

SALMON FALLS, N. H.—The Berwick & Salmon Falls Electric Company has petitioned the Selectmen for permission to extend its transmission line from Rollinsford Junction to the Dover line and on other streets in the town.

JERSEY CITY, N. J.—Bids will be received by the New County Building Committee of the County of Hudson at its office, 373 Newark Avenue, Jersey City, N. J., until June 30 for furnishing and installing the electric lighting fixtures for the new county court house. Specifications for the work may be procured from Hugh Roberts, architect, 1 Exchange Place, Jersey City, N. J., or at the office of the committee. Frederick Rippe is president of the committee.

CARTHAGE, N. M.—Plans are being prepared by the Carthage Coal Company for an electric power plant to supply electricity to its own and surrounding properties.

GENEVA, N. Y.—The Rochester & Eastern Rapid Railway Company is contemplating extending its railway from Geneva to Penn Yan.

MEDINA, N. Y.—The Public Service Commission, Second District, has refused the application of S. Cook & Company to construct and operate an electric and steam heating plant in Medina. The granting of the franchise was opposed by the A. L. Swett Electric Light & Power Company, which now furnishes electricity in Medina. Setley A. Cook, D. J. Bigelow and others are interested in the Cook company.

NEW BALTIMORE, N. Y.—The Town Board of New Baltimore, it is stated, is ready to receive bids for lighting the streets of the town.

NEW YORK, N. Y.—Plans are being made to replace 600 of the old-style gasoline lamps in Central Park with 1400 electric lamps. The installation of the new lamps will call for an expenditure of about $32,000.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, Park Avenue and Fifty-ninth Street, New York, N. Y., until June 21 for installing electric equipment in new Public School 101, located on East 111th Street, near Lexington Avenue.

NEW YORK, N. Y.—The Public Service Commission has refused to approve the franchise of the South Shore Traction Company granted by the Board of Estimate and Apportionment permitting the company to construct an electric railway from Jamaica to and across the Queensboro Bridge. The commission explains its refusal on the ground that the franchise would give the company absolute control of Thomson Avenue and Hoffman Boulevard, two of the most important highways in Queens.

NYACK, N. Y.—The Public Service Commission has granted the Rockland Railroad Company permission to construct and operate its railway in Rockland County and to exercise franchises in the villages of Grand-View-on-Hudson, Nyack, South Nyack, Haverstraw, West Haverstraw, Spring Valley and Suffern, and in the towns of Clarkstown, Stony Point, Orangetown and Ramapo. The company has also received a franchise from the Board of County Supervisors. At the present time there are no electric railways in Rockland County.

PAINTED POST, N. Y.—The citizens are considering the question of establishing a municipal electric light plant.

ROCHESTER, N. Y.—The Rochester Railway & Light Company has entered into a contract to supply electricity for operating the system of the Rochester, Charlotte & Manitou Beach Railway Company.

SMITHTOWN, N. Y.—The North Shore Electric Light & Power Company of Port Jefferson, N. Y., has applied for a franchise to furnish electrical energy in Smithtown.

SYRACUSE, N. Y.—The Syracuse, Lake Shore & Northern Electric Railroad Company is erecting a feed wire tower at power house at Lakeland to the substation near Phoenix, which will supply the additional energy necessary for the operation of the new Lake Shore cars, and also

for the proposed extension of the railway from Fulton to Oswego, when completed. Electricity will be supplied from the company's plant and also from the transmission lines of the Niagara Power Company.

UTICA, N. Y.—The Utica Gas & Electric Company has submitted a proposition to the special committee of the Board of Supervisors appointed to investigate the question of installing a plant to light the county buildings, offering to supply electricity for lighting the court house, armory and jail at a reduction of about 40 per cent from the present price, which is 10 cents per kw-hour. It is said that the committee will recommend the Board of Supervisors to accept the offer and lay aside the proposition to install an electric plant for the present. According to the report of the committee it would cost the county $27,000 to install the plant. It is estimated that the plant would furnish the service for 5 cents per kw-hour, which the Utica company now offers to furnish at 6 cents.

ANSONVILLE, N. C.—A. H. Richardson, of Ansonville, writes that he has completed surveys for a water power project near Wharftown, where from 5000 to 6000 hp can be developed in the heart of the Piedmont section of the manufacturing district of the south. He states that he would take stock in a large cotton mill to locate there or sell his rights. A. S. Lyman, of Filesville, N. C., is engineer.

ASHEVILLE, N. C.—Plans are being made by the Asheville Telephone & Telegraph Company for improvements to its system, which will include the erection of a copper metallic circuit from Asheville to Morganton by the way of Marion to connect with circuit running to New Orleans, La. The cost of the work is estimated at $7,400.

KERNERSVILLE, N. C.—The Kernersville Light & Power Company, which was recently granted a 25-year franchise to establish an electric light plant, it is reported, will erect a power plant which will be equipped with boilers of 100 hp, a 75-hp engine and a 50-kw, 2300-volt, three-phase generator. C. S. Swann, of Kinston-Salem, N. C., is engineer in charge of the work.

MONROE, N. C.—The town has voted to issue $20,000 in bonds to fund a debt on the municipal electric light plant, and to meet the financial requirements of an agreement with the Southern Power Company, which is extending its transmission lines to Monroe from its hydro-electric developments along the Catawba River in South Carolina. The Southern Power Company is now ready to furnish electricity for lighting the town and for manufacturing purposes. Several large private contracts have already been secured by the company.

NEW BERN, N. C.—A franchise to operate a local street railway system has been granted to R. P. Foster and R. A. Nunn for a period of 30 years. A company has been chartered under the name of the New Bern Power Company, with an authorized capital of $500,000, to construct and operate the railway.

SALISBURY, N. C.—An electric railway franchise has been granted to a syndicate to build a 5 or 10-mile line to Granite Quarry, Faith and nearby points, reaching the large granite quarries of Rowan County, North Carolina.

YANCEYVILLE, N. C.—This town is negotiating with the Burgrahaw Traction Company with a view of persuading the company to extend its plans so as to include an electric railway to this point, through Caswell County, from Burlington and Graham, N. C. J. H. Harden is secretary of the traction company.

ALMONT, N. D.—Hiram S. Goff is interested in a project to construct a telephone line to Carson.

FARGO, N. D.—The State Supreme Court has declared the $100,000-bond issue voted by the city for the purpose of installing an electric light plant and water-works system illegal, reversing the findings of the county court.

GLENBURN, N. D.—Preparations are being made by the Lone Star Telephone Company for the erection of about 20 miles of rural telephone lines.

GRAND FORKS, N. D.—The City Council has adopted a resolution to employ an engineer to prepare plans and specifications for installing an improved system of lighting the business portion of the city.

TOLNA, N. D.—Arrangements are being made by the Cheyenne Telephone Company for extending its telephone line from Mapes into Lakota, which will require the erection of about 20 miles of wires, contracts for which, it is said, will soon be let.

VALLEY CITY, N. D.—The contract for installing a central steam heating and lighting plant for the normal school was awarded to the Andrews Heating Company, of Minneapolis, Minn., for $26,000. G. McFarland is president state normal school.

WAHPETON, N. D.—F. L. Strum has applied to the City Council for a franchise to construct a street railway in Wahpeton, which will be extended to Breckenridge. Mr. Strum has also applied to the Council in Breckenridge for a franchise.

WILLISTON, N. D.—Plans are being considered by J. J. Delaney and H. C. McCartney for extensions and new equipment to their local exchange which will involve an expenditure of about $40,000.

CANTON, OHIO.—The City Council has appointed a committee to investigate the question of installing a municipal electric light plant in connection with the water-works.

CLEVES, OHIO.—The contract for lighting the streets of the village has been awarded to P. M. Hans for a term of ten years. Arc lamps of 2000 cp are to be furnished at $60 per lamp per year.

COLUMBUS, OHIO.—The Columbus, New Albany & Johnstown Traction Company has awarded the contract for the extension of its railway from its present terminus at Gahanna to Johnstown, a distance of 14 miles, to the Dominion Construction Company, of Pittsburgh. An appropriation of $650,000 has been made to cover the cost of the work.

DAYTON, OHIO.—Sealed proposals will be received at the office of W. A. Budroe, clerk of the Board of Public Service until June 24 for one direct connected engine and generator rated at 40 kw. The engine to be side crank type, the cylinder 10 in. in diameter, 12 in. stroke working at 100 lb. pressure not exceeding 300 r. p. m. to develop 65 hp. Bidders must use printed forms provided by the Department of Water. J. C. Ely is president of the Board of Public Service.

KENTON, OHIO.—The Kenton Gas & Electric Company is planning to change its plant from 125 cycles to 60 cycles and also making other improvements with a view of furnishing electricity for motors as well as for lamps. The cost of the work is estimated at $20,000.

YOUNGSTOWN, OHIO.—The Youngstown Sheet & Tube Company has awarded the contract for the installation of eight large electric traveling cranes to the Morgan Engineering Company, of Alliance, Ohio, at an approximate cost of $50,000.

YOUNGSTOWN, OHIO.—The Lake Erie & Youngstown Railway Company has awarded the contract for its proposed electric railway, to extend from Conneaut through Andover and other points to Youngstown, to the Stanley Construction Company. The cost of construction and equipment of the road is estimated at $3,000,000.

ARDMORE, OKLA.—The proposition recently submitted by Oscar Ayers to the citizens of Ardmore for the construction of an electric interurban electric railway from Ardmore to Chickasha has been accepted and work on a preliminary survey of the route will begin at once. The terms include a bonus of $50,000 and a right-of-way from Ardmore to Springer, a distance of 12 miles.

CHICKASHA, OKLA.—The City Council has granted Lawrence Martin a 25-year franchise to construct and operate a street railway in Chickasha, subject to the vote of the people.

HOBART, OKLA.—The Oklahoma Midland Electric Railway Company has awarded the contract for the construction of its proposed electric railway, which is to extend from Sayre to Oklahoma City, via Hobart, a distance of 150 miles, to the J. A. Kauffman Company, of La Fayette, Ga. The contract also includes the construction of two 8000-hp hydro-electric plants.

JEFFERSON, OKLA.—The Jefferson Power & Light Company, recently incorporated, contemplates the construction of a hydro-electric plant at a cost of from $125,000 to $150,000. D. E. McNeff, of Jefferson, is president, and W. T. Croslen, of Chicksha, Okla., is engineer.

PORTLAND, ORE.—The stockholders of the Portland Railway, Light & Power Company have authorized an expenditure of more than $6,000,000 for extensions to its system. The work will include the construction of a new 30,000-kw power plant on the Clackamas River, three miles above the site of the present plant, which will cost ultimately $2,500,000. Actual work on construction of the plant will begin next year. Preliminary to the construction of the plant the Cazadero line will be extended to the site for transportation of material for the plant. The dam will be 160 ft. high and 450 ft. wide, and will be of solid concrete construction. A new steam plant is also to be erected on the east side near the Inman-Poulsen property at a cost of $400,000, which will be used as an auxiliary plant. The rest of the work contemplated by the company includes the construction of underground conduits at a cost of $1,250,000; new substations at Seventh and Adler Streets and at other locations and extension to its railway lines, some of which are already commenced.

PANAMA.—Bids will be received until June 22 at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., for furnishing electrical supplies, including fixtures, fittings, lamps, cable, wire, line material, sheet copper, hardware, cross-arms, solder, tape, etc., according to Circular No. 517. Blanks and general information pertaining to the above circular may be obtained from the office of the general purchasing officer or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; 316 Hibernia Bank Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

ALLENTOWN, PA.—Bids will be received by J. S. Troxell, chief clerk, of the Board of County Commissioners of Lehigh County, Court House, Allentown, Pa., until June 23 for the construction of an electric light and power plant at the County Home at Wescoesville, Pa., as follows: (1) For furnishing and erecting two 150-hp boilers, 150 lb. pressure of the water tube or combination water tube and return tubular type. (2) For one 40-hp, horizontal, single cylinder, direct connected, high speed, automatic cut-off, non-condensing engine. (3) For one 80-hp, horizontal, single cylinder, direct connected, high speed, automatic cut-off, non-condensing engine. (4) For one 250-hp feed water heater. (5) Two feed water pumps. (6) For one 25-kw generator. (7) One 45-kw generator. (8) For furnishing and erecting all steam piping, stack connections, separators and valves, inside and outside wiring, switchboards, pole lines, lamps and fixtures and all necessary appurtenances and appliances for a complete electric plant. The power house and foundations will be furnished by the county. Plans and specifications may be examined at the office of the County Commissioners or copies may be secured from them by depositing the sum of $25 with the clerk, which will be returned to the depositor if he presents a bid for the work. If no bid is submitted the deposit will be retained by the county.

BIRDSBORO, PA.—The capital stock of the Conestoga Telephone Company has been increased from $15,000 to $40,000.

DUNMORE, PA.—The promoters of the proposed electric railway between this city and Lake Ariel have applied to the Borough Council for a franchise over certain streets in Dunmore to connect with the Scranton Railway Company's line. W. L. Connell, Valentine Bliss and A. G. Rutherford are interested in the enterprise.

HARRISBURG, PA.—Plans are being considered by the Central Pennsylvania Traction Company for several extensions to its system, which will include the construction of a railway to Dauphin and car barns.

HAZLETON, PA.—The Harwood Power Company is making arrangements to extend its transmission lines to Berwick, where it will furnish electricity for lamps and motors in the territory served by the companies recently consolidated. The company will enclose its wires in aluminum cables. The cost of the line is estimated at about $25,000. The company has entered into a contract with the Berwick Car Works to supply electricity to operate its plant, to replace steam power now in use.

HILLSDALE, PA.—The capital stock of the Hillsdale Western Telephone Company has been increased from $2,000 to $5,000.

JOHNSTOWN, PA.—The Johnstown & Gallitzin Railway Company, it is said, will award contracts in August for steam power equipment for its plant to be located near St. Michaels, which will be equipped with two units of 750 kw each.

KUTZTOWN, PA.—The Kutztown Rural Telephone Company is erecting a telephone line from Krumsville to New Smithville, and is planning to extend the line to Lenhartsville and later to Hamburg.

MEDIA, PA.—The stockholders of the Citizens' Electric Light & Power Company, of Clifton Heights; the Faraday Heat, Power & Light Company, of Morton; the Philadelphia Suburban Electric Light Company and the Media Electric Light, Heat & Power Company, of Media, will vote June 21 on the adoption or rejection of an agreement for the merger and consolidation of the companies. If the various companies agree to the merger, the International Gas & Electric Company will assume control of the properties. It is said that a large plant will be constructed in the central section of the county to serve the territory covered by the various companies. W. Roger Fronefield, of Media, and Harry Rhodes, president of the Media Title & Trust Company, are interested in the enterprise.

PHILADELPHIA, PA.—Proposals will be received at the Bureau of Yards and Docks, Navy Department, Washington, D. C., until July 10 (an extension of date from June 26) for motor-generator sets, exciters, switchboard, etc., at the navy yard, Philadelphia, Pa. Specifications can be obtained on application to the bureau or to the commandant of the navy yard named. R. C. Hollyday is chief of bureau.

PITTSBURG, PA.—The public works committee of the Councils have recommended the following measures: Authorizing the contracts for purchase and installation at the Southside pumping station of a traveling electric crane to cost $4,000; boilers and stokers, at $20,000; two pumping engines, at $180,000; electric light plant, $4,000, and pumping station, $70,000.

WINDBER, PA.—The Berwind-White Coal Mining Company, it is stated, will install additional motors, transformers, etc., in its mines and yards this summer.

LAKE PRESTON, S. D.—The Lake Preston Milling Company is planning to install a 50-kw generator in connection with its flour mill to furnish electricity for lamps in the city. The company was recently granted a franchise by the City Council.

LITTLE BEND, S. D.—A company has been organized to erect a telephone line to connect Little Bend with Onida, the county seat, a distance of 30 miles. H. P. Knox, of Little Rock, is president; W. E. Jenkins, of Okobojo, secretary, and M. L. French, of Onida, treasurer, of the company.

PIERRE, S. D.—Bids will be received by the State Capitol Commission until July 28 for furnishing and installing electric fixtures in the new capitol. C. E. Pell is architect and Governor R. S. Vessey, chairman state capitol commission.

TYNDALL, S. D.—It is reported that negotiations are under way for the purchase of the local electric light plant by the city. If the deal goes through, the city will install a larger engine in connection with the water works, which will furnish power to operate the lighting system.

CHATTANOOGA, TENN.—Mayor Crabtree has vetoed the ordinance granting C. F. James and others an extension of 18 months' time in which to begin work on the erection of its transmission lines on the streets of the city for the distribution of electricity for lamps and motors. The time limit expires June 19.

MEMPHIS, TENN.—The contract for lighting the new Shelby County court house has been awarded to the Merchants' Light & Power Company at a cost of $6,570.

AMARILLO, TEX.—Plans are being considered by C. F. Hacker to establish a glove factory, which will be operated by electricity.

CLIFTON, TEX.—The new electric power plant will soon be placed in operation. It is an auxiliary to the plant now in use and will insure a 24-hour service.

ORANGE, TEX.—Arrangements have been completed by the Yellow Pine Paper Company for enlarging its plant, which will involve an expenditure of about $200,000. An electric power plant will be installed to furnish electricity to operate the works.

FORT DOUGLAS, UTAH.—Bids will be received at the office of the chief quartermaster, Denver, Col., until July 6 for furnishing electricity at Fort Douglas, Utah, for illuminating and small motor purposes. Distributing system will be ready for electrical energy about Jan. 1, 1910. Information will be furnished on application to this office or to the post quartermaster. J. W. Pope is chief quartermaster.

SALT LAKE CITY, UTAH.—We are informed that the Salt Lake & Ogden Railway Company contemplates placing contracts during the next five months for the construction of a 2500-kw power station and equipment for the same.

CHARLES CITY COURTHOUSE, VA.—The Charles City Telephone Company is planning to extend its telephone line from Roxbury to Bradley's Store and thence to Granville. The new line will be built this summer.

FRIDAY HARBOR, WASH.—The Pacific Electric Company, of Port Townsend, Wash., has applied to the City Council for a franchise to furnish electricity for lamps in Friday Harbor.

HANFORD, WASH.—The Hanford Irrigation & Power Company has awarded the contract for machinery and equipment for its electric substation and water works system in Hanford to the Allis-Chalmers Company, of Milwaukee, Wis. Electricity for operating the system will be transmitted from its plant at Priest Rapids. The water works pump will be operated by an electric motor.

WALLA WALLA, WASH.—Plans are being prepared by the North Western Gas & Electric Company for the construction of a new power plant and substation, at a cost of $100,000, and a new office building to cost $30,000.

FAYETTEVILLE, W. VA.—R. H. Dickinson has applied to the City Council for a franchise to construct and operate an electric light system and street railway from Fayetteville to Stuart, connecting with the White Oak Railway.

OAK HILL, W. VA.—Application has been made to the city by J. P. Staton for a franchise to construct and operate an electric light and power plant in Oak Hill. M. Van Pelt is mayor.

FOREST JUNCTION, WIS.—The Forest Junction Telephone Company has awarded a contract to the Fox River Valley Telephone Company for the erection of eight miles of telephone line through Dundas and Holland to connect with the Wrightson exchange.

NEWTON, WIS.—The English Lake Telephone Company has increased its capital stock from $21,000 to $42,000.

CLARESHOLM, ALTA., CAN.—Plans are being considered for the construction of a municipal electric light plant and water-works system. At an election held recently the citizens voted to issue $76,000 in bonds to pay for the same. P. Turner Bone, of Calgary, is engineer.

WINNIPEG, MAN., CAN.—The Provincial Government has purchased the telephone system from the Municipality of Turtle Mountain, the latter finding it could not operate the system as satisfactorily as the government.

BURLINGTON, ONT., CAN.—Bids will be received until June 21 by the city clerk for construction of water works system as follows: Contract B—Pump house. Contract C—Electrically operated pumping machinery. Contract I—Steel pump well. Plans and specifications may be seen at Burlington, or at the office of Willis Chipman, chief engineer, 103 Bay Street, Toronto, Ont. O. T. Smith is secretary.

HAMILTON, ONT., CAN.—At an election held June 6 the citizens voted for the third time in favor of the Hydro-Electric Power Commission's scheme, rejecting the proposition of the Cataract Power Company.

INGERSOLL, ONT., CAN.—The Ingersoll Electric Light & Power Company has refused an offer of $35,000 for its plant made by the City Council.

NIAGARA FALLS, ONT.—Contracts have been signed for the equipment and machinery for the 12 transformer stations of the Hydro-Electric Power Commission transmission belonging to the province, which will involve an expenditure of about $1,000,000.

ST. CATHERINES, ONT., CAN.—The Niagara, St. Catherines & Toronto Railway Company is reported to have agreed to extend its railway from Welland to Port Colburne, provided satisfactory terms can be made with Port Colburne. It is expected that the railway will eventually be extended along the shore of Lake Erie from Port Colburne to Buffalo.

TORONTO, ONT., CAN.—The citizens on June 7 voted in favor of the by-law appropriating $400,000 to provide electrical pumps and extensions of water mains into the newly annexed districts.

TORONTO, ONT., CAN.—The contract for the materials and equipment for the transformer station and engines has been awarded to the Westinghouse Company, of Hamilton, Ont., and the General Electric Company, of Peterboro, Ont.

WELLANDPORT, ONT., CAN.—H. Lloyd, of Dunnville, has been awarded the contract for the construction of the first 10 miles of the proposed electric railway of the Dunnville, Wellandport & Beamsville Railway Company. The railway when completed will be about 23 miles in length. James A. Reed, of Wellandport, is president.

WHITBY, ONT., CAN.—The Town of Whitby is advertising for bids for $16,000 water works and electric light debentures, approved by the Ontario Railway and Municipal Board.

DRINKWATER, SASK., CAN.—Sealed tenders will be received for the construction of a telephone system for the Golden Plat Telephone

Company. All materials are supplied except poles. The estimated length of the line is 11 miles.

MOOSEJAW, SASK., CAN.—The Saskatchewan Government has purchased the plant, franchises, equipment, lines, etc., of the Saskatchewan Telephone Company, with headquarters in Moosejaw, for a consideration of $1,250,000. The system includes exchanges at Moosejaw, Rouleau and Estevan, with 275 miles of long distance line. This gives the Province complete control of virtually all the telephone lines in Saskatchewan.

PRINCE ALBERT, SASK., CAN.—The Board of Trade has written a suggestion to the Dominion Government that the proposed railway to Hudson's Bay be operated by electricity developed from the water power to the north of Prince Albert.

New Industrial Companies.

THE EAST COAST EQUIPMENT & CONSTRUCTION COMPANY, of New York, N. Y., has been chartered with a capital stock of $50,000 to do a general contracting business. The incorporators are: Leo W. Wertheimer, Edward C. Mulligan and Fred Cook, of New York, N. Y.

THE ELECTRO-CHEMICAL PULP & PAPER COMPANY, of Auburn, Maine, has filed articles of incorporation with a capital stock of $500,000 to handle patents and patent rights. W. H. Oakes is president; E. M. Hatch, treasurer, and F. R. Ludden, clerk, all of Auburn, Maine.

THE ENGINEERING SUPPLY & ERECTION COMPANY, of New York, N. Y., has been incorporated with a capital stock of $3,000 to manufacture and deal in contractors' supplies. The incorporators are: Graham B. Moore, Benjamin L. Shafer and John T. Reilley, all of New York, N. Y.

THE EUROPEAN REGENERATOR COMPANY, of New York, N. Y., has been chartered with a capital stock of $5,000 to manufacture steam regenerators or accumulators by Charles A. Wendell, Lucius Varney, of New York, N. Y., and Signono C. Munoz, of Montclair, N. J.

THE JEWEL ENGINEERING COMPANY, of Paterson, N. J., has been incorporated with a capital stock of $20,000 by Edmund Whitaker, of Haledon, N. J.; Edward Livingstone, Frederick W. Johnson and George A. Fischer, all of Paterson, N. J. The company proposes to carry on a mechanical and electrical engineering business, tool making, etc.

THE NORTHWESTERN BATTERY COMPANY, of Winnipeg, Man., Can., has been incorporated, with a capital of $200,000. A. K. Dysart, of Winnipeg, is attorney.

THE UNION LIGHT COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 by Augustus S. Houghton, of Greenwich, Conn.; Glenn S. Williamson, Henry Houghton, of New York, N. Y. The company proposes to manufacture lamps, burners, mantels, chimneys, etc.

THE UNITED ELECTRIC LAMP COMPANY, of New York, N. Y., has filed articles of incorporation with a capital stock of $10,000 for the purpose of doing electrical work of all kinds. The incorporators are: B. P. Heide, of Brooklyn, N. Y.; O. A. Heide and A. Lotz, both of New York, N. Y.

THE WABASH ELECTRIC COMPANY, of Chicago, Ill., has been incorporated with a capital stock of $10,000 to manufacture electrical fixtures and appliances by O. L. McCaskill, of Chicago, Ill.

New Incorporations.

GARLAND, ARK.—Articles of incorporation have been filed for the Garland Power & Development Company with a capital stock of $1,500,000 to construct a hydro-electric plant across the Ouchatita River. The officers of the company are: Henry Dalhoff, of Little Rock, Ark., president; P. J. Harmon, vice-president; J. A. Stalcup, treasurer. Parrett & Beard, Dwight Building, Kansas City, Mo., are the engineers.

REDWOOD CITY, CAL.—Articles of incorporation have been filed for the Sierra & San Francisco Power Company with a capital stock of $20,000 for the purpose of dealing in water rights and electricity by J. S. Thornton, of Sonoma; Winfield Dorr, of Oakland; H. J. P. Jackson, of Berkeley; George H. Whipple, of San Francisco, Cal., and Warren Gregory, of Berkeley. It is said that the company has been formed for the merger of the Stanislaus Electric Power Company with the United Railways Investment Company, of San Francisco.

SAN FRANCISCO, CAL.—Articles of incorporation have been filed for the Win Power Company with a capital stock of $499,800 and the following-named directors: J. M. Agar, Ferdinand Butterfield and W. A. Lotspeich. The company proposes to deal in electricity, gas and water power.

SAN FRANCISCO, CAL.—The Municipal Light & Power Company has been incorporated with a capital stock of $1,000,000 by Rudolph Spreckels, Claus A. Spreckels, Percival S. Scales, J. H. Sanford and Frank Harold. The company proposes to furnish electricity and gas and to purchase and install gas and electric plants.

SAN FRANCISCO, CAL.—The Fresno Power Company has filed articles of incorporation with a capital stock of $1,000,000, for the purpose of doing a general power, lighting and irrigating business. The directors are: George A. Knight, J. M. Ough, A. M. Wooley, Charles J. Heggerty, William H. Madden, all of San Francisco.

WINCHESTER, CAL.—The Winchester Pleasant Valley Telephone Company has been chartered to construct and operate local rural telephone lines to connect with the Home and Sunset Telephone companies' long-distance service. M. L. Howell is president and C. W. Patterson is secretary.

MACON, GA.—The Georgia Lighting Company has been chartered with a capital stock of $10,000. A. J. Smith is at the head of the enterprise.

OLIVER, GA.—The Farmers' Telephone Company has been organized to construct local telephone lines. The officers of the company are: R. D. Farr, president; O. H. Marsh, vice-president, and H. E. Ezell, secretary and treasurer.

COLUMBIA, ILL.—The Cahokia Telephone Company has been incorporated with a capital stock of $2,400 by C. R. Harris, E. B. Rauch and A. C. Bollinger.

MODESTO, ILL.—The Modesto Telephone Company has been incorporated with a capital stock of $7,000, by Augustus Zetmer, R. L. Corrie and C. Van Winkle.

NEW MINDEN, ILL.—The New Minden Mutual Telephone Company has been chartered with a capital stock of $2,400 by H. W. Meinert, C. G. Rinne and W. C. Colimeyer.

PORT BYRON, ILL.—The Port Byron Telephone Company has been incorporated, with a capital stock of $2,500, by A. Saddoris, W. H. Groth and Samuel L. Woodburn. The company proposes to construct and operate telephone lines in Rock Island and other parts of the state.

EVANSVILLE, IND.—It is reported that the stock of the Evansville Lighting Company, a $3,000,000 corporation which owns the Evansville Gas & Electric Light Company, is being bought up preparatory to a merger to include the Evansville Light Company, the Springfield (Ill.) Railway & Light Company, the Rockford (Ill.) Railway & Light Company and the Peoria (Ill.) Light Company. A new company, to be known as the Union Railway, Gas & Power Company, has been formed to take over the properties. The new concern proposes to issue $8,000,000 in bonds and preferred stock and $6,000,000 in common stock.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the Indiana Union Telephone & Telegraph Company by F. A. De Peyster, C. A. McNaughton and D. F. Williams. The company is capitalized at $100,000, and proposes to construct and operate a telephone line in Benton, Warren, White, Jasper, Newton, Lake, Porter and other counties.

PLYMOUTH, IND.—The Plymouth Mutual Telephone Company has been chartered with a capital stock of $2,000 by A. T. Bartell, R. L. Cloud and S. H. Aldridge.

SULLIVAN, IND.—By order of Judge Anderson, of the Federal Court, the plant of the Sullivan Lighting Company will be sold at public sale at the Courthouse July 1. The plant is valued at $100,000, and is in the hands of the Marion Trust Company, of Indianapolis, as receiver.

WASHINGTON, IND.—The Farmers' Washington Township Telephone Company has been incorporated to build and operate a telephone system in Washington Township and throughout Allen County. J. Oswald, William E. Miner and John Kariger are directors.

LELAND, IA.—The Leland Mutual Telephone Company has filed articles of incorporation with a capital stock of $5,000. The officers of the company are: E. E. Branstad, president; O. Michaelson, vice-president; E. G. McGreevey, secretary, and W. P. Buren, treasurer.

WATERLOO, IA.—The Big Rock Telephone Company has been incorporated with a capital stock of $1,000 and the following named officers: J. T. Allen, president; and E. E. Sage, secretary. The business address of the company is Waterloo, R. F. D., No. 3.

KANSAS CITY, MO.—Articles of incorporation have been filed for the Kansas City, Lawrence & Topeka Electric Railway Company for the purpose of constructing an electric or steam railway between Topeka and Kansas City, a distance of 67 miles. The company is capitalized at $1,000,000, and it is stated that it proposes to take over the Kansas City-Olathe Railway, now in operation. The incorporators are: P. W. Hocker, F. P. Dickson, J. A. Stewart, F. B. Glover, of Kansas City, Mo.; D. B. Johnson and R. O. Larson and George Holsinger, of Rosedale.

CHINOOK, MONT.—The Co-operative Telephone Company has been incorporated with a capital stock of $40,000 to construct a telephone system from Chinook to Paradise Valley. The incorporators are: Rudolph Hermes, John Brummer, James N. Cook, W. D. Smotherman and R. L. Morris.

THOMPSON, MONT.—Articles of incorporation have been filed for the Western Montana Telephone Company with a capital stock of $12,500 by A. S. Ainsworth and others.

DORSEY, NEB.—The Dorsey Telephone Company has been chartered with a capital stock of $3,000 by D. D. Miles, William Carlson, John T. Brady and others.

PAWLING, N. Y.—The Pawling Electric Light, Heat & Power Company has filed articles of incorporation with a capital stock of $20,000 for the purpose of furnishing electricity for lamps and motors in the towns of Pawling, Dover and Patterson. The directors are George W. Chase, Frederick L. Gamage, John G. Dutcher, Charles E. Baker, Henry A. Holmes and others, all of Pawling, N. Y.

BISMARCK, N. D.—The Rosebud & Youngstown Telephone Company has been formed to construct a telephone line to connect with the North Dakota Independent Telephone Company's line at New Salem. About 30 miles of wire will be erected, material for which has been purchased.

Robert Rusch is president, John Holle, secretary, and Charles Klusman, treasurer.

FLORENCE, OKLA.—The Boone Telephone Company has been chartered by C. E. McIntosh, A. P. Sparks and T. R. Effiatt.

FT. COBB, OKLA.—The South Side Mutual Telephone Company has been chartered with a capital stock of $1,000, by Stephen P. Ratcliff, William L. Keever and J. A. Campbell, all of Fort Cobb.

OKLAHOMA CITY, OKLA.—The Crutcho Telephone Company has been incorporated with a capital stock of $600 by E. A. Wagner, L. M. Warner and G. B. Alguire.

Personal.

PROF. C. E. BRACKETT has resigned as director of the School of Electrical Engineering of Princeton University.

MR. ROBERT HAMILTON has been appointed Dominion of Canada inspector of electricity and gas for the Winnipeg district, with headquarters at Winnipeg, Man., Can.

MR. R. W. CLARK, of the Minneapolis General Electric Company, recently gave a lecture before the electrical engineering students of the University of Michigan upon "Home Lighting."

MR. FREDERICK DARLINGTON will deliver an illustrated lecture on "Electrification of Railroads" at the meeting in Harrisburg, Pa., this week of the Engineers' Society of Pennsylvania.

MR. P. McNIVEN BINNIS will present a paper on the "Relation of Electric Furnaces to Siderurgy" at the meeting this week in Harrisburg, Pa., of the Engineers' Society of Pennsylvania.

MR. H. C. SLEMIN, sales and advertising manager of the Stromberg-Carlson Company, was married June 9, at Rochester, N. Y. to Miss Rosa Emma, daughter of Mr. and Mrs. Gustav Erbe.

MR. V. D. MOODY, of Hamner & Moody, 25 Broad Street, New York, has left for Mexico City in connection with the interests of Dr. F. S. Pearson, comprising The Mexican Light & Power Company and The Mexican Tramway Company.

MR. E. J. BERG.—At the commencement exercises at Union College, Schenectady, N. Y., on June 9, among the honorary degrees conferred was that of Doctor of Science on Mr. E. J. Berg, electrical engineer of the General Electric Company.

MR. SHIGERU KONDO, electrical engineer to the Japanese Department of Communications, and who represented Japan at the recent meeting in London of the Electro-technical Commission, is spending some weeks in this country prior to sailing for home.

MR. GEO. W. CRAVENS, consulting engineer, Chicago, Ill., has removed his office to the First National Bank Building, where he will have larger quarters. He reports his business as increasing, especially along the line of power plant promotion, design, appraisal and betterments.

MR. SAMUEL D. FOWLER, for many years designing engineer for the Sterling Electric Company, of Lafayette, Ind., has resigned his connection with that company. Mr. Fowler has invented three different common battery systems which are noted for their simplicity and practicability, and has also been active in other lines of electric design.

BENJAMIN-DOREMUS.—On June 9, in New York City, Miss Katherine W. Doremus, daughter of Dr. and Mrs. C. A. Doremus and granddaughter of the late Prof. R. O. Doremus, was married to Park Benjamin, Jr., son of Mr. Park Benjamin, the patent expert, and grandson of the well-known author of the same name. On both sides the happy pair are widely acquainted in the electrical field.

Obituary.

MR. JEFFERSON D. KEARNEY, of Chicago, whose serious illness was mentioned recently in this paper, died on June 3. The cause of death was tuberculosis of the lungs. Mr. Kearney was formerly connected with the Central Electric Company and the Zenco Electric Supply Company, of Chicago, and more recently he acted as a manufacturers' agent. He had many friends among the electrical men of the West, and his death [illegible] sincerely regretted by all who knew him.

MR. M. D. BARR died suddenly from heart failure in Sandusky, Ohio, on May 29. Mr. Barr had been connected with the electrical industry for the past [illegible] years, being for a number of years [illegible] Stanley Electric Mfg. Company of Pittsfield, Mass., as manager of the New York office, and subsequently general sales manager. When the Stanley Company was acquired by the General Electric Company Mr. Barr was made vice-president. In this [illegible] the General Electric Company decided to discontinue the manufacturing [illegible] the Stanley Electric Mfg. Company and the Pittsfield factory became the Pittsfield works of the General Electric Company. Mr. Barr [illegible] and resumed business in the exploitation of street railway properties in New England. A year or more ago, when the [illegible] of the Western Electric Mfg. Company of Sandusky, Ohio, were looking about for someone to manage that property, Mr. Barr was [illegible] and made general manager of the company. When [illegible] [illegible] deemed [illegible] for the company to go [illegible] evitable. Mr. Barr was appointed first trustee for the bondholders, and in February of this year he was made special master of the property by the local Common Pleas Court. He had been engaged since that time in winding up its affairs. Mr. Barr had numerous friends in the electrical industry, especially in Toronto, New York, Pittsfield and Boston. His home was in Spencer, Mass., in which place his remains were interred on June 2.

Trade Publications.

GRAPHITED GREASES. A new folder issued by the International Acheson-Graphite Company is devoted to Graphited Greases, products which are designed for gear, cup and ball-bearing use. In the manufacture of its graphited greases, this company uses the world's purest and best graphite, which is a perfect lubricant in itself. The graphite and grease are thoroughly blended, and it is claimed that the resultant product will do far more work than any other grease product on the market, great value being given the combination by the superior lubricating qualities of the graphite.

PORCELAIN POTHEADS.—The C. & W. Electric Specialty Company, 128 West Jackson Boulevard, Chicago, describes its various products in a recent issue of bulletins. These porcelain potheads are made in a great variety of forms for the connection of overhead and underground cables, arc lamp disconnecting switches and subway junction boxes. Illustrations of the great electrical plant of the Gary (Ind.) steel mills are given, in which plant these potheads are used throughout. One bulletin illustrates the pipe cap which serves the double purpose of a driving head and an electrical connection for ground pipes. A safety line disconnector for high-tension lines is also shown.

SPAULDING & PAYOR COMPANY, 17 State Street, is representing in this country the Plania carbons for enclosed miniature and flaming arcs and is issuing a catalog of such carbons for alternating-current and direct-current circuits with prices. The concern has distributed to its customers a very ingenious and neat fountain pen in pocket case, the pen being made as an exact copy of a Plania carbon. It it difficult to detect the imitation until the cap is taken off the pen, which is a regular stylograph equal to all the emergencies of correspondence—light or otherwise. The same firm is introducing the ingenious Armstrong ozone generator attachable to any electric lamp socket.

MEASURING INSTRUMENT BULLETINS.—The Industrial Instrument Company supplies data on its instruments in the form of engineering bulletins, each bulletin being devoted to a certain line or class of meters, or to those instruments of different classes that group themselves conveniently for a certain industry. This method shares much of the elasticity of loose-leaf catalogs without involving the trouble of their maintenance. It furthermore eliminates the formidable general catalog, only a small part of the contents of which is of interest to the average customers. The engineering bulletin treats one type or class of instruments exhaustively, without including irrelevant matter. The various bulletins published by this company are 8x11 in size and punched for binding together in substantial covers. These covers, or binders, and any bulletins will be sent to engineers interested in instruments upon application to The Industrial Instrument Company, Foxboro, Mass.

Business Notes.

F. F. QUIRKE, of the New York office of the H. W. Johns-Manville Company, who has been representing the office in the South, has resigned.

THE HARRISBURG FOUNDRY & MACHINE WORKS have appointed Mr. F. W. Jackson manager for the Baltimore district with headquarters in the Continental Trust Building. Mr. Jackson has been connected with the [illegible] and sales departments of the company for a number of years.

MR. JOHN H. BARKER, who has been connected with the sales department of the Northern Electrical Manufacturing Company for the past two years, during [illegible] years of which he had charge of the New York office, has associated himself with the Diehl Manufacturing Company, Elizabeth, N. J.

MR. FRED HAAS, purchasing agent for the Inter-State Railways Company, has resigned his [illegible] position, in order to engage in the [illegible] business, dealing [illegible] supplies as may be essential to the [illegible] of [illegible] companies. The name of the firm is to be the Atlantic Supply Company.

MR. CLARENCE E. DILLENBECK, [illegible] manager of the Ideal Electric & Manufacturing Company, [illegible] office in Lansing some time in the last [illegible] has severed [illegible] connection with the company and has [illegible] the [illegible] of the Lansing Electric Supply Company, [illegible] handling and dealers in electrical supplies.

C. W. & C. CO. [illegible] has [illegible] a contract in connection with the [illegible] for the [illegible] Mfg. & Gas Supply Company, [illegible] N. J. [illegible] a complete [illegible] of wires and here [illegible] The C. W. & C. Co. has [illegible] [illegible] one great object [illegible] and time consumed in

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 9, 1908.

[Conducted by Wm. F. Bissing, Pat. Law, 2 Rector St., N. Y. City.]

923,839. MEANS FOR CONTROLLING THE SUPPLY OF ELECTRIC CURRENTS, G. Henry, Lemoyne, Que., Can. App. filed Feb. 21, 1907. Automatically opens and closes the circuit by a thermo-expansive wire connected to a lever.

923,851. TROLLEY HANGER; W. H. Kempton, Hartford, Conn. App. filed Feb. 18, 1908. A trolley hanger provided with a slotted supporting strap attached to the cable and having clamping plates to which the trolley wire is to be attached.

923,864. PROCESS FOR THE ELECTRIC DISSOCIATION OF METALS BY THE WET METHOD; A. Levy, Paris, France. App. filed Feb. 3, 1908. For cleaning metal articles electrolytically and coating them by means of an alkaline bath of cyanide of copper.

923,874. RELAY; E. McClintock, St. Paul, Minn. App. filed April 30, 1907. For steam railroads in which a relay has circuit closers actuated by a motor so as to close the circuit for a predetermined period.

923,882. ATTACHMENT FOR TELEPHONES; R. E. Pedigo, Chariton, Ia. App. filed July 13, 1908. Attachments for party lines. Provides a means so that the removal of any of the receivers from the hooks will not interfere with the transmission of signal currents over the line by means of a condenser in series with a telephone receiver and bridging terminals.

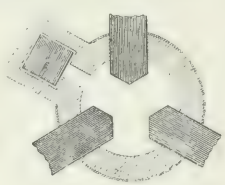
923,887. ELECTRICAL ROSETTE; C. D. Platt, Bridgeport, Conn. App. filed Nov. 28, 1908. The rosette has a base with a recess holding terminals having locking springs, engaging with locking projections so constructed as to permit the cap and base to be assembled and separated by a rotary movement of the cap.

923,889 CONDENSER; A. Pruessman, Chicago, Ill. App. filed April 1, 1907. The process of making condensers which consists in rolling the strips of coil and insulating material in an elliptical cylinder pressing in a rectangular mold so as to shorten the longer diameter of the cylinder forming a prism.

923,901. ELECTRIC RAILWAY SIGNAL; W. A. D. Short, Chicago, Ill. App. filed Sept. 6, 1907. The signal blade is operated by an electric motor and clutch controlled by a brake.

923,933. DISTRIBUTING TERMINAL FOR TELEPHONE CABLES; F. J. Beaucond, New Albany, Ind. App. filed Nov. 20, 1907. Supporting bracket, carrying a box for the terminal ends and clamping blocks on the bracket having an adhesive compound for holding the cable.

923,949. ELECTROMAGNETIC SIGNAL-CONTROLLING DEVICE; F. B. Craft, Chicago, Ill. App. filed Sept. 11, 1906. Telephone



924,603.—Electric Furnace.

exchange having a combined line and cut-off relay, with a magnetic extension for the core of the magnet of the relay.

923,950. ANTISEPTIC ATTACHMENT FOR TELEPHONE TRANSMITTERS; E. B. Crosby, Lockport, N. Y. App. filed Jan. 11, 1909. Disinfecting appliance in which a pad is supported by its clip in contact with the interior face of the mouthpiece so that it can be wiped around the mouthpiece.

923,962. WIRELESS TELEGRAPHY; R. A. Fessenden, Washington, D. C. App. filed Dec. 31, 1905. For transmitting speech and simultaneously receiving it on the same antenna by means of a commutator adapted to alternately connect the antenna with the receiving and sending devices and having a periodicity above the limits of hearing.

923,963. WIRELESS TELEGRAPHY; R. A. Fessenden, Washington, D. C. App. filed Jan. 9, 1907. An apparatus for generating high-frequency oscillations in which the discharge gap is contained in a medium formed of the gases of the argon and helium group.

923,973. ELECTRIC MOTOR CONTROL; D. C. Jackson, Madison, Wis. App. filed April 14, 1906. For protecting electric motors during starting by means of a plurality of electromagnet solenoid switches controlling the circuits of the motor.

923,993. TELEPHONE EXCHANGE SYSTEM; J. L. McQuarrie, Oak Park, Ill. App. filed Sept. 15, 1906. Operator's keyboard equipment with a signal and key adapted to connect the telephone lock circuit with a connecting circuit and a locking circuit for the signal controlled by the key.

924,020. METHOD OF FORMING DESIGNS BY ELECTRODEPOSITION; F. A. Walter, Rochester, N. Y. App. filed Sept. 28, 1907. Makes a sign by first providing a mold having a base of conducting material and then a matrix from the mold, and then by electroplating on the coating of conducting material and the bottom plate of the mold.

924,030. TELEPHONE RINGER; J. A. Birsfield, Chicago, Ill. App. filed Nov. 20, 1906. A polarized telephone bell in which the armature is formed of a single sheet of metal having a loop clamping a tapper rod.

924,040. ELECTRIC LIGHT BATH APPLIANCE; E. Collins, Chicago, Ill. App. filed March 5, 1908. An arched reflector placed under a blanket and over the body and carrying electric lights.

924,072. MOUTHPIECE FOR TELEPHONE TRANSMITTERS; M. S. Hufschmidt, San Francisco, Cal., and C. F. Wagner, Oakland, Cal. App. filed Nov. 10, 1908. Gives off antiseptic vapors and absorbs a liquid disinfectant by means of a non-porous coating covering the [illegible] of the mouthpiece.

924,077. ELECTRIC CUTOUT; T. E. Murray, New York, N. Y. App. filed April 13, 1908. A fuse plug with locking means for preventing removal of the cover. The base has an internal threaded socket and the fuse plug is threaded to enter the socket.

924,093. ELECTRIC FUSE CASE; T. E. Murray, New York, N. Y. App. filed Sept. 28, 1908. A tubular fuse case formed of a single piece of porcelain in which the fuse is enclosed in pulverized magnesia, etc.

924,095. THERMOSTAT CONTROLLER; J. McCartin, Brooklyn, N. Y. App. filed Jan. 29, 1909. The thermal member consists of a compound metallic bar, with which a pivoted armature engages, controlled by an electromagnet.

924,126. ELECTRICALLY CONTROLLED LOCK; A. Armel and C. M. Legrand, Paris, France. App. filed March 26, 1908. For operating carriage of motor cars, etc., from a distance by means of a push exerted on a spring in the lock. It is controlled by a pushbutton near the driver.

924,130. F. M. Becket, Niagara Falls, N. Y. App. filed Jan. 21, 1909. For making chromium, etc., by using boron as a reducing agent in the smelting.

924,168. WIRELESS SIGNALING SYSTEM; G. Marconi, London, England. App. filed Nov. 27, 1905. A signaling system having an antenna parallel with the surface of the earth and coincident with the line of transmission of the signals, the antenna being grounded at its end nearer the distant station.

924,180. ELECTRIC BELL; W. J. Murray, Leavenworth, Kan. App. filed Sept. 3, 1907. Avoids making a spark by sending the current through different paths alternately without breaking the circuit.

924,195. ELECTRIC POWER HAMMER; W. Scribner, Columbus, Ohio. App. filed Jan. 22, 1908. A solenoid magnet with its coils in sections. The hammer is attached to the coil of the solenoid.

924,227. RAILWAY SIGNAL OPERATING DEVICE; A. S. Hickley, Manasquan, N. J. App. filed April 24, 1908. Utilizes alternating currents by changing them into direct currents through the medium of an electrolytic rectifier, the direct current working the signals without using storage battery.

924,295. ELECTROLIER SWITCH; C. Tomschik, New York, N. Y. App. filed June 26, 1908. Operated by a chain and pulley for giving the circuit controller a step-by-step movement to switch on the lights.

924,403. SIGNAL; D. B. Utt, Newcastle, Ind. App. filed May 12, 1908. An illuminated signal controlled by a train including a semaphore blade. The blade is worked mechanically from the track by the train.

924,463. CONTROLLER OPERATING HANDLE FOR ELECTRIC CARS; E. K. Hofmann, Andover, Mass. App. filed April 8, 1909. A controller shaft with a clamp fitting against the upper end of the shaft so as to prevent removal from the controller shaft by boys tampering with the mechanism.

924,489. SEMAPHORE CONTROLLER; T. F. McAndrews and J. E. Bleibtrey, Waterford, N. Y. App. filed Oct. 19, 1908. A signal operating rod and operating lever; a link having a lost motion connection and a motor for operating the parts, the lost motion giving the motor time to acquire momentum.

924,499. THERMOSTATIC CIRCUIT CONTROLLER; H. F. Rice, Espy, Pa. App. filed July 25, 1908. For protecting vessels against fire, the contact device consisting of a diaphragm and screw pin striking the diaphragm.

924,503. CYLINDRICAL POSITIVE ELECTRODE; E. O. Schneider, Dresden, Germany. App. filed Sept. 1, 1908. Consists of a number of rings parallel with each other and connected by bars.

924,512. TELAUTOGRAPH; G. S. Tiffany, Summit, N. J. App. filed May 16, 1907. A shifting mechanism controlled from a distant instrument to feed the paper and to store up the strip for record.

924,538. TELEGRAPHIC RECEIVING TAPE; P. B. Delany, South Orange, N. J. App. filed March 23, 1904. A chemical tape having projections in arbitrary sequence formed by depressing the face of the tape.

924,566. WIRELESS SIGNALING SYSTEM; G. Marconi, London, Eng. App. filed Aug. 9, 1906. An antenna having two parts parallel with the surface of the earth, the length being substantially one quarter of a wave length and the antenna being in a vertical plane passing through the distant station.

924,573. BATTERY AND HOLDER THEREFOR; G. L. Patterson, New York, N. Y. App. filed May 26, 1908. For mechanically and electrically connecting a battery to a holder by means of a socket and two terminal cases attached thereto, the cell fitting the socket and having electrodes for electrical connection with the socket terminals.

924,574. BATTERY AND HOLDER; G. L. Patterson, New York, N. Y. App. filed May 26, 1908. The holder includes a socket with two terminal pieces, one receiving the cell and the other extending laterally to constitute the opposite terminal of an adjacent socket.

924,575. BATTERY; G. L. Patterson, New York, N. Y., and G. H. Hopner, Brooklyn, N. Y. App. filed Oct. 16, 1908. A battery of the socket type convertible into the binding-post type, having a cupped member forming one electrode.

924,576. BATTERY BOX TERMINAL CONNECTION; G. L. Patterson, New York, N. Y. App. filed Dec. 1, 1908. A box for shielding the batteries in automobiles and permitting the group of batteries to be removed bodily from the box.

924,577. BATTERY BOX; G. L. Patterson, New York, N. Y. App. filed Dec. 1, 1908. A separate cell backet for the batteries removably carried by the box and fitting in the interior of the box.

924,603. ELECTRIC FURNACE; Louis D. Fransworth, Palo Alto, Cal., and Max J. Bartell, San Francisco, Cal. App. filed April 3, 1908. The current is distributed vertically in the crucible, thereby regulating it by changing the height of the metal level. The inner ends of the electrode are wedge shaped.

924,609. ROTARY SNAP SWITCH; G. W. Goodridge, Bridgeport, Conn. App. filed Jan. 3, 1908. A simple binding post for rotary snap switches, made of sheet metal secured to the switch.

924,616. DRIVING MECHANISM FOR CASH REGISTERS; C. F. Kettering, Dayton, Ohio. App. filed June 11, 1906. Comprises an electric motor connected with the cash register, the motor circuit being controlled by the keys of the register.

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THE NEW YORK EXCHANGES.

The special committee appointed by Governor Hughes on the subject of speculation in securities and commodities has made its report in a document that, taken broadly, cannot fail to have a reassuring effect on the public mind. The doubts and questions raised when the committee was appointed were somewhat disquieting, but a careful persusal of this report, made with evident painstaking and conscientious study, shows that, as usual of late, most of the fears were exaggerated or unfounded. This is evident from the fact that the committee has so few "reforms" to recommend and that these are all of a minor nature so far as the New York Stock Exchange is concerned. It is there that public utility securities and leading industrials are dealt in, and as these are of increasing volume and value, it would have been seriously unfortunate if the market methods of reaching trustworthy quotations had been found fundamentally improper. It is true that the committee expresses its conviction that only a small part of the transactions are of an investment character, but it wisely refrains from suggesting any more governmental interference with individual liberty along those lines, holding that the exchange itself has ample power to apply such correctives as might be needed. Hence its recommendations are limited to changes in rules, changes that can be easily adopted. Even the *al fresco* "curb market" is clearly proved to have its uses.

In discussing the Metal Exchange the committee is quite plain-spoken, the methods of making quotations being flatly described as "deceptive." It says bluntly: "Prices are manipulated up and down by a quotation committee of three," and this is alleged in plain language to be done "mainly for the profit of a small clique." Such being the case, the committee is of the opinion that both the Metal and the Mercantile exchanges do harm, and that their charters should be repealed. This would probably be a sensible course to adopt. The point may be raised, however, whether a thing is "deceptive" that does not actually deceive anybody, and the Metal Exchange has hardly succeeded in doing that.

One or two incidental matters of importance are touched. For example, it is recommended that there should be legislation controlling the "tipster" evil, under which stocks are boomed or depressed or other fake securities are floated. Of course the effect would be rather to drive such advertising out of New York than to suppress it; but papers used by such investment touts could be kept out of the mails. It is a difficult subject, and we have often grown weary answering inquiries as to fake electrical schemes thus being foisted on the unwary. Difficult, also, is the question of the sale of exchange quotations and the use of tickers. The committee goes so far as to propose a change in the common carrier law, enabling telegraph companies to refuse the transmittal of quotations or the lease of tickers where there is reason to suspect the criminal intentions of the applicants for service. This is obviously

tinkering with the law, but it would at least put the telegraph companies in a position to show that they mean what they say in regard to this old dispute.

Relative Merits of Core and Shell Transformers.

Alternating-current transformers may be divided structurally into two classes, namely (1) core transformers, in which the iron forms the core and the coils overlie it; and (2) shell transformers, in which the coils are overlayed by the iron, which is in the form of a shell, or cover. A typical form of core transformer is made of a Gramme-ring iron core completely concealed by the coils of wire applied to its surface. A typical form of shell transformer is made of coils of insulated wire completely enclosed by a mass of laminated iron. When, however, we vary the construction from these typical ancestors, we may arrive at half-breeds, in which it is difficult to say whether a core or a shell transformer is produced; and in fact, there are essentially similar transformer structures made in this country by different makers, one of which calls it a shell transformer, while the other calls it a core transformer. An interesting paper by Messrs. Fleming and Faye-Hansen, recently read in England on transformers, arrives at the conclusion that there is hardly any essential difference between the cost, efficiency or relative behavior of core and shell transformers. This is a comfortable conclusion, and it certainly fits the fact that there may be no difference in appearance between these types.

The Design of Spark Coils.

We publish in the current issue another paper by Prof. F. W. Springer, dealing with the design of jump-spark coils, which furnishes a continuation of some of his earlier papers on the same subject and leads to some interesting and practical conclusions. As a result of many experiments on such coils made by the aid of the oscillograph, Prof. Springer was enabled to get a quite clear idea of the various varieties of spark obtainable under different conditions. For the practical purposes of ignition the discharges produced by such coils are of three kinds: First, a mere break; second, a discharge similar to that of the Leyden jar, and third, a spark approximating the characteristics of a momentary arc. Of these obviously the brush has small igniting value. As regards the other two, Prof. Springer's experiments indicate nothing that may be accepted as decisive, although it is his opinion that a discharge of the third type is probably the most efficient under the most ordinary circumstances, particularly when the mixture is not very rich. This is obtained best with a rather short spark-gap and without a condenser in the secondary. Discharges of this kind may last several thousandths of a second. With a condenser of fairly large capacity and a considerable spark-gap, a very brilliant, thick-looking spark is produced, noisy and apparently very powerful. Its heating effect, however, is relatively small, owing to the fact that it is extremely brief. The concentration of energy is large, but in spite of the apparently powerful spark, the discharge will not ignite paper, although it will blow holes in it. Without the condenser, the discharge is spread over a longer period and has, upon paper at least, a considerably greater power of ignition. It is easy to see, therefore, that one may overdo the condenser in a spark coil and obtain weaker ignition effects than if there were no condenser at all. On the other hand, if the condenser be too small the result may be a series of sparks dividing the total energy of the discharge among them.

There would seem to be opportunity for still further experimentation on the exact conditions best suited to obtaining proper ignition of the gaseous mixture in an engine. In particular, the effect of the heating produced by compression must be taken into account. A very small spark will set off an explosive gas mixture, but practically all the experiments which have been tried upon such ignition have been tried with cold gas, and extremely little seems to be known about the generation of the explosion in gas which is both compressed and hot. Speaking generally, compression would imply somewhat greater difficulty in sparking between the terminals of the spark plug, and hence the additional jumping power of the condenser spark may be useful in spite of its brief duration. To get a complete notion of the practical conditions, such discharges should be studied under conditions of temperature and pressure somewhat similar to those in the engine. It is valuable, however, to know that it is not the noisy and fat-appearing spark that is always likely to produce the most efficient ignition. The ordinary spark coil as generally used gives too thin and weak a spark in the effort to produce so rapid a succession of sparks as to make sure of the timing of the explosion correctly. If it were possible to use a single spark with the concentrated energy now applied to a series and properly timed, the chances are that there would be better results in ignition. Prof. Springer points out that the improvements in the last few years have been in the direction of securing a more rapid break, which is good; but he thinks that a very much swifter break than is customarily used, concentrating the discharge into a single flash, would greatly improve the efficiency of the spark-coil system. The very violent spark obtained with the condenser has one advantage over the more prolonged and apparently hotter spark produced without the condenser, in that it is capable of breaking through greater resistance at the terminals, which may at times be useful. Most trouble in sparking is associated with dirty terminals, especially the formation of a conducting film, due to the carbonization of the engine oil and gas. It would be interesting to know under just what conditions a discharge circuit would be least affected by the tendency to form such a film around the sparking terminals of the plug. We trust that Prof. Springer will continue his interesting experiments with the view of passing from his very judiciously determined general principles of design to the production of a sparking apparatus that shall be able to break through obstructions and work through all kinds of adverse conditions. The increasing use of magnetos for sparking purposes has considerably changed the situation with respect to ignition, so that battery endurance is of much less importance than formerly and more attention can be put upon the problem of providing a spark that will work reliably even when the terminals are in bad condition and the mixture not what it ought to be.

Boiler and Engine Load Factors in Small Plants.

In an article elsewhere in this issue on "Engine and Boiler-Room Routine in Small Plants," attention is directed to the general tendency in small plants to operate machinery underloaded and thus make inherently uneconomical plants still more uneconomical. The average small plant is severely enough handicapped by the apparatus which it must use without introducing another source of loss in operating engines and boilers much too large for the loads which are being carried. Some small plants have no units small enough to be well loaded during 20 hours of the 24, which furnishes a reason why a

company should go very slow about discarding small old units when enlarging a plant. Very often the old units, if properly overhauled and with pistons and valves made tight, will operate with far greater economy than the larger new units, and this is true both in steam and gas-engine plants. The case may be cited of a gas-engine plant in which the coal consumption is about four times greater than was expected, due very largely to the very much underloaded condition of the engine. In another plant the coal consumption for the same cause was about double that which it should have been with properly selected sizes of engines. In the boiler room the working of boilers much underloaded is in itself likely to be uneconomical, because the fireman is not obliged in self-defense to stop waste and get the most possible out of his fires, as he would be if his boiler were run at nearly full load.

Overhead Line Construction.

The report of the N. E. L. A. committee on overhead line construction, presented at the recent convention, is a very satisfactory example of the technical committee report, in that it is logical in arrangement and rich in positive specifications as to material and methods. This is an unusual virtue and one to be duly appreciated, in view of the chaotic and padded character of many N. E. L. A. reports. It not only describes approved methods of doing things with sufficient detail for all practical purposes, but also gives an admirable set of subjects for specifications for the purchase of various materials. In particular we would call attention to the specifications for wire, which seem admirably adapted to securing a good and uniform article. The matter of poles is also treated in considerable detail, particularly with reference to depth and method of setting, points which have frequently been left somewhat to chance. In particular, line constructors will appreciate the details regarding pole location and guys on curves which embody a reasonably sound rule for general practice in a case where previously too much has been left to chance and individual judgment, sometimes of irresponsible men. The subject of guying, in fact, is taken up in admirable detail and if the advice of this report is followed the average pole line will be considerably improved, particularly as to its capacity of standing up under severe storms. The pole line is the vital point of electrical distribution and the more thoroughly standardized the better.

In one matter of policy in regarding pole lines the committee appears perhaps over-cautious—namely, in its reference to pole lines on private property. However useful a pole line may be, it is not a beautiful object, and there are cases in which a suitable right of way is greatly to be preferred from the standpoint of the public, to the right of way along the street. It is on the whole better for high-tension transmission lines, and indeed is frequently the only way of carrying such lines to many points desirable to be reached by them. There is another instance in which a private right of way is often needed, and this is the case of suburban line distribution through residence districts. It is possible in some places to get a back alley or back yard right of way which enables most of the distribution to be done without disfiguring the street with pole lines. We know in some instances in which comparatively all suburban districts have been supplied by pole lines located on the division lines between lots. The ordinary householder, if the subject is brought to his attention, would prefer to have an electric-light pole in his back yard on the division line between his yard and that of his neighbor, rather than have it planted squarely in front of his house; and where rights can be secured for this kind of distribution, it seems greatly to tend toward those pleasant relations between the electric light companies and the customers, which are so valuable to the former. It is true, as the committee indicates, that poles so located are not available for supporting street lights, but street lights in suburban districts are not usually placed so closely that special carrying poles for them are a severe burden, while the transformers are far less unsightly when located on poles out of sight than when thrust fairly upon the street. The adoption of alley or division pole lines sometimes requires considerable variations to be made in the length of span, which is at times inconvenient, but the general result in improving the appearance in the district served is worth a struggle to obtain.

Properly bearing on this same general subject of overhead line construction and to be taken in connection with this committee report, is Mr. Ives' well-written paper giving specifications for extra high potential lines, such lines being for the purpose of this paper set at a standard of 33,000 volts. This is perhaps a fair average, although not reached in the practice of many electric lighting companies even at the present time. Mr. Ives' specifications for poles and their setting are very similar to those recommended by those of the general committee. It may strike the casual observer, however, that Mr. Ives' specifications do not call for poles quite so sturdy and quite so deeply set as those of the committee. For example, for a 35-ft. pole, which Mr. Ives regards as standard for his purpose, the material being chestnut in each case, he recommends a minimum circumference of 22 in. at the top and 36 in. 6 ft. from the butt, while the committee report calls for a pole of the same circumference at the top, but 40 in. at the butt. Mr. Ives suggests a minimum depth of setting of 5 ft. for his 35-ft. pole, where the committee suggests 5½ ft. The fact is, however, that a transmission line intended as Mr. Ives specifies, to carry one three-phase line, a private telephone line and a single 2300-volt distribution line, does not require as heavy poles as would have to be broadly recommended for a distribution circuit which might carry a larger number of circuits and much heavier wires. The strains on a pole line are merely those imposed by the wires which it carries. In the extreme condition which pole lines have to meet—that is, the combined effect of wind and sleet—the number of wires is a very important matter, and it frequently happens that electric light lines with comparatively few wires will stand successfully where comparatively strong telephone poles burdened by a multiplicity of lines will give way. For high-voltage transmission service, however, a 40-ft. pole is preferable to one of 35 ft. through enabling one to use somewhat greater sag in the wires and somewhat wider spacing of the poles, both desirable from the standpoint of reducing the wire tension and the number of insulators, respectively. Mr. Ives' table of sags is a very useful one and he has a proper appreciation of the subject; but 20 ft. as the minimum height of the wire above grade appears a trifle low for a high-voltage line, and 25 ft. would be a more conservative figure, readily obtained by using the higher poles to which reference has been made. On the whole, the two papers under consideration form very valuable contributions to the standardization of line construction, and may also be recommended as models for the preparation of committee reports.

St. Louis Electrical League.

On May 8 a preliminary meeting was held in St. Louis to discuss the organization of the electrical interests of that city, at which the character of bodies formed elsewhere for a similar purpose was considered, with the final conclusion that an organization of the nature of a league is better for the purpose than the establishment of a club. At a meeting held June 15 definite action was taken, and a body known as the League of Electrical Interests was formed. Among the purposes of the new body is to bring together in a fraternal and co-operative spirit all those interested in or identified with the electrical industry in the city of St. Louis; to make the scope of the organization such as to interest not only those engaged on the commercial side, but also those interested in the legal, patent, professional and financial sides; to establish a channel and means through and by which questions of public interest affecting the welfare of the city of St. Louis may receive the considerations of the united electrical industries of the city, and to provide such educational and social features as will maintain the organization in a healthful state for efficient service, and along the lines for which it was organized.

The meeting was presided over by Mr. W. A. Layman, of the Wagner Electric Manufacturing Company, and was opened by an address from Mr. C. A. Houts, one of the leading attorneys of the city, who was followed by Mr. Jewett, who dwelt on the benefit to be derived by the formation of such an organization as that proposed. A committee, as follows, was then appointed to complete the plans for the organization: Capt. Robert McCulloch, chairman; Messrs. S. A. Hobson, H. H. Humphrey and F. E. Newbury; Mr. W. Robbins, secretary. In accepting the election as secretary Mr. Robbins said that, in discussing the object of the league with the heads of several large houses, he was informed that these would be willing to give from $100 to $500 each toward a fund if any particular campaign were necessary. In assuming the chair Capt. McCulloch, who is vice-president and general manager of the street-railway system of St. Louis, delivered a vigorous speech showing his active interest in the organization. Considerable publicity was given to the formation of the league by the newspaper press, and two civic associations have already entered into relations with it.

Enclosed Fuse Litigation.

Justice Brown, of the Circuit Court of the United States for the District of Massachusetts, rendered a decision on June 11 in a case involving alleged infringement of an enclosed fuse patent granted to Carl Thalacker Aug. 1, 1893. The point at issue was whether the Thalacker patent covers broadly the use of an auxiliary indicating fuse in connection with an enclosed fuse. The Thalacker invention consists, as described in the specification, in combining with a strip of fusible metal, completely enclosed in a non-conducting box or case, an auxiliary fusible strip so located and connected as to be seen at all times, and which will be destroyed when the main fuse, which is out of sight, is blown. The device which was alleged to infringe this patent is one in which the main fuse is entirely surrounded by loose powdered insulating material, and is provided with a shunt indicating circuit, by means of which the blowing of the main fuse is made known by a visible indicator at the surface. The court held that the defendant's auxiliary circuit is not like that of Thalacker, a simple metallic strip of low resistance, but contains a very fine wire of German silver of high resistance, which does not melt or fuse, but which, upon the blowing of the main fuse, acts as a shunt and serves to conduct current to a paste indicator of high resistance and of a special composition that ignites only when upon the blowing of the main fuse sufficient current is forced through the German silver wire. The court considered it quite clear that the structure of the defendant's auxiliary circuit is not suggested by the Thalacker patent, and that it does not embody the Thalacker idea of operating an auxiliary metallic fuse of such small size that it could be safely exposed and left uncovered. Auxiliary circuits for signaling purposes had previously been used in connection with unenclosed safety fuses, as in the device by Mordey, described in a London electrical journal dated Feb. 3, 1893. Thus in the prior art, an enclosed main fuse had been provided with an external indicator operated by the main fuse, and unenclosed main fuses had been provided with auxiliary circuits to which indicating means were attached. In conclusion, the court held that, limiting the claim of the Thalacker patent to a scope commensurate with his specification, and regarding the inventions claimed as unitary structures designed for practical use as safety fuses, it is of the opinion that though the patent is valid, the defendant had borrowed nothing from Thalacker, and that the defendant's safety fuses are distinct combinations, both in respect to fuse protection and to exterior indication of the main fuse, and are not infringements. The parties to the above suit were the General Electric Company, complainant, and Fred B. Smith, defendant, the device in suit being the Sachs fuse.

Second Lighting Contract for Boston.

Superintendent of Streets Emerson, of Boston, will shortly call for bids for the lighting of streets and parks by small lamps for a five-year period beginning Sept. 15. Proposals will be received up to June 28, at noon, and it will then be determined whether the lighting will be done by gas or by electricity. At present this work is done by some 14,000 small lamps lighted by gas or naphtha. Under the new conditions the naphtha illumination will be eliminated and the service performed by either gas or electricity. The present cost of this lighting is about $350,000 per year, but the Edison Electric Illuminating Company, of Boston, has offered to do the work with tungsten lamps for about $50,000 a year less than is now paid. This new contract will not in any way interfere with the lately executed contract for the lighting of the important streets and squares, which was fully described in these columns. The work now in hand covers the illumination of streets of small traffic, where smaller units at frequent intervals are installed in place of high-powered lamps.

A Patented Subway.

Discussion of the project of building street-railway subways in Chicago has directed attention to the fact that a United States patent was granted recently to Mr. George W. Jackson, constructing engineer of Chicago, for an "Underground Subway for Street Railways, Etc." Mr. Jackson is reported to have said that his patent covers the most practicable way of building a subway under the conditions in Chicago, but other engineers believe that the essential features of a subway are not patentable, and that the granting of this particular patent, referring to a particular combination with public-utility service galleries, will not interfere with the city's plans.

The patent in question is No. 922,768, and was issued May 25, 1909. The application for it was filed on July 6, 1908. The fourth claim, which seems to fairly indicate the scope of the patent, reads as follows: "A subway for traction purposes comprising a floor, sidewalls and a roof, and posts supporting the roof from the floor and arranged in rows to divide the subway into centrally located passages to receive car tracks, and two lateral passages having means for supporting therein public-utility appliances, and a horizontal or sub-roof between said car-track passages and the main roof, and said aisles being provided in line with said horizontal partition with horizontal supports, the whole dividing the upper part of the subway into a space through which is adapted to extend public-utility appliances of streets which intersect the subway, and into which are adapted to be carried or deflected certain of the public utilities carried in the lateral passages or aisles."

Annual Meeting of New York Electrical Society.

The New York Electrical Society brought its successful 1909 season to a close on the evening of June 15 at a meeting in the "Sun Parlor" of the Waldorf-Astoria. The secretary's report showed that during the year the society has elected 92 members. There have been seven deaths and 25 resignations, and 102 names have been dropped for non-payment of dues. The year closed with a net membership of 835. The election of officers for the season 1909-10 resulted as follows: President, Mr. Theodore Beran; vice-presidents, Messrs. John Bottomley, Frederick A. Scheffler and Charles H. Hadlock; secretary, Mr. George H. Guy; treasurer, Mr. Henry A. Sinclair. After the election Mr. Cloyd Marshall gave an informal address on "The Commercial Development of Wireless Telegraphy," an abstract of which was printed last week, and the station of the United Wireless Telegraph Company on the roof of the hotel was thrown open for inspection.

Telephone Contract Agents in Convention.

The annual meeting of the commercial representatives of the Bell telephone companies of the country was held at the Auditorium Hotel, Chicago, on June 15 to 18, inclusive. About 90 delegates were present. Mr. George C. Brooks, of Indianapolis, chairman of the executive committee of the association, presided, and Mr. A. M. Ramsay, contract agent for the Chicago Telephone Company, was the host on behalf of the Chicago company. The delegates discussed subjects of importance in their branch of the telephone business during a busy four-day convention. Particular attention was paid to consideration of ways and means for the further expansion of business and of methods for increasing toll traffic. Papers on correct advertising and publicity campaigns and the extension of lines into rural communities were also read. The visitors inspected the Main exchange of the Chicago Telephone Company and the Hawthorn works of the Western Electric Company. The "wind-up" was a complimentary banquet in the "gold room" of the Congress Hotel on Friday night. Mr. Bates, of New York, was toastmaster, and speeches were made by Mr. B. E. Sunny, of Chicago, vice-president of the American Telephone & Telegraph Company and president of the Chicago Telephone Company; Mr. A. S. Hibbard, vice-president of the Chicago Telephone Company, and others.

Space Between Passing Street Railway Cars.

Mr. Bion J. Arnold, chairman and chief engineer of the Board of Supervising Engineers, Chicago, which has in charge the street railway rehabilitation in that city, advocates a greater distance between track centers than is the case in the new street-railway work in that city. In a letter to the City Council committee on local transportation, he says that he would issue no further permits for track construction, if he were a commissioner of public works, unless the distance between track centers was 10 ft. 2 in. As the present standard distance between track centers is 9 ft. 8½ in., with clearance of 8½ in., this would increase the distance between passing cars to 14 in. In addition, the cars might be narrowed to an over-all width of 8 ft. 6 in., and this would leave a space of 20 in. between passing cars without lessening the space between the sides of the cars and the curbstone. With a space of 20 in. between passing cars, a person caught between cars in the middle of the street would have sufficient room to stand without being crushed, and for that reason Mr. Arnold urges that all tracks laid henceforth shall be spaced 10 ft. 2 in. between centers and that no cars shall be operated [illegible] which are more than 8 ft. 6 in. in over-all width. "As time went on," says Mr. Arnold, "cars of the present width could be eliminated, and ultimately we would have a reasonably safe traction system, so far as the danger of persons being crushed is concerned."

Under the present standard several fatalities have occurred by persons being caught between cars and crushed to death; and it is to prevent accidents of this character that the change in the plans is advocated. Mr. Arnold says that his original position was in favor of the wider space, but that he was overruled by the other members of the board.

Convention of Iron and Steel Electrical Engineers.

The second annual convention of the Association of Iron and Steel Engineers is being held in Buffalo the present week. The principal sessions will be held on Wednesday, when the business of the association will be considered, and papers will be presented and discussed by members. Thursday and part of Friday will be devoted to a program of papers to be presented by representatives of electrical manufacturing companies. The Westinghouse Electric & Manufacturing Company is represented on this part of the program by Messrs. C. F. Scott, B. Wiley and Edwin Gawger; the General Electric Company by Messrs D. B. Rushmore, Pauly and Whiting; Electric Controller & Manufacturing Company by Mr. C. Pirtle; C. J. Toerring Company by Mr. C. J. Toerring; American Fuse Company by Mr. Lynde Bradley. Place on the program is also reserved for representatives of the Crocker-Wheeler Company, Westinghouse Machine Company, Adams-Bagnall Company and Wagner Electric Company. On Friday and Saturday visits will be made to various steel works and to other plants in Buffalo and vicinity, and in Niagara Falls.

Electricity in the Production of "Joan of Arc."

Electricity played a most important part in the successful presentation of Schiller's "Joan of Arc" by Miss Maude Adams at the Harvard Stadium on June 23, under the direction of Mr. Charles Frohman, for the benefit of the Germanic Museum of Harvard University. The performance was scheduled to be given in the open air and after dark, and the problems of producing the requisite grades of illumination over the extensive area upon which the action took place were of extreme difficulty. Aside from the auxiliary equipment necessary to produce the effects of lightning, thunder and rain, sunrise, and other natural phenomena, it was necessary to hold the organization of about 2000 performers in strictest control. The work was done electrically, with many special and unique devices used here for the first time on a large scale.

About 60 per cent of the seating capacity of the Stadium was utilized, accommodating an audience of over 18,000 persons. Power was derived from the Allston electric plant of the Boston Consolidated Gas Company, four two-phase 2300-volt circuits being run to the grounds on a special overhead line erected for this performance. One unit in the power house, which is located about a mile from the Stradium on the south bank of the Charles River, was reserved for the "Joan of Arc" service. The full load demand of the performance was about 350 kw. The supply of energy from the power plant was brought by the lines into a power enclosure underneath the Stadium seats, where were mounted main switchboards, step-down transformers, and a motor-generator set for direct-current service supply. The motor-generator installation consisted of a 125-hp, two-phase Westinghouse induction motor, 785 r.p.m., belted to a 100-kw, 125-volt general electric generator making [illegible] rpm. The motor was started by a compensator and had to be run at 50 per cent overload during the peak load of the play. A [illegible] switchboard was erected near the generator with its [illegible] controlling 78 stage arc lamps, a 30-in. 24-m., four 9-in. and two 12-in. searchlights, with 15 stage effects by sky-spiece lamps. A second switchboard was also erected for controlling the alternating-current distribution from the secondary sides of the transformers. The service

supplied small induction motors and both arc and incandescent lighting installations. Twelve transformers were installed, ranging in capacity from 15 to 45 kw. The motor and the generator were erected upon concrete foundations.

The Harvard Stadium is of horseshoe shape, and the control of the performance was from the stage manager's box, located in the center of the horseshoe. Four cue stations were established at different points on the edge of the arena, with a white, red, green and yellow incandescent lamp located at each. Different combinations of these lamps were utilized to indicate the various commands of the manager in connection with the movements of the personnel. A telephone service was also instituted between the stage manager's quarters and the cue stations, for use in case of emergency. The colored lights at each cue station were controlled by knife switches at the manager's box, there being two lamps of the same color in series in each 250-volt circuit, one being at the manager's box and the other at the cue stations. The manipulation of the lamps was a quicker process than telephoning. A similar system of signaling was used by the chief electrician in controlling the various moves of men in his department behind the scenes. The electrical controlling stand was located on the east side of the Stadium, while at different points on the structure were massed four batteries of 12 6-in. electric spotlights, controlled individually and also from the direct-current switchboard frame in the power room. Six flaming arcs hung above the different sections of the structure were used to enable the audience to find their seats, and a separate circuit of four emergency arcs wired to the operating board and thence connected by special line with the power station was provided to prevent the audience being in darkness in case the supply of power from the regular service failed. Twenty alternating-current enclosed arcs were installed underneath the Stadium in the passageways to facilitate ingress and egress. The searchlights were mounted on the upper part of the Stadium, with the carbon somewhat out of focus and near the reflectors, with frosted gelatine screens to secure the proper diffusion of light. Lightning flashes were produced by the striking of 125-volt arcs by electromagnets, carbons and files set in hoods on two high points of the scenery, and the effect of forked lightning on a distant sky was obtained by quickly capping and uncapping the lens of an electric projector lamp with a slide traced with zigzag lines. Cloud effects and the appearance of a rising moon driven by clockwork also depended upon the electric projector lamp for success. About 300 colored incandescent lamps of 32 cp each were installed on a frame behind the scenes and connected with dimmers, to simulate a sunrise effect. A 50-amp moving-picture machine was used to produce the effects of the famous spirit advisers of the play, upon a tree 50 ft. distant from the lamp. To save overloading the generator, the upper batteries of direct-current spotlights were connected with the resistances of each pair in multiple and the carbons in series.

The production of "thunder" was effected by a car with corrugated wheels running over a strip of boards over a hollow trough 170 ft. long, a 3-hp Wagner 220-volt induction motor being connected with the car by pulleys. There was also a thunder drum composed of a hollow cylinder with small baseballs attached to the surface by ropes, the device being revolved by a 2-hp, 220-volt General Electric induction motor, with the balls striking against canvas. A 1-hp Roth motor wound for 125 volts direct-current was direct-connected to a fan blower which forced air through two sets of "devilines" in funnels, to represent the whistling of the wind. The speed and intensity of the sound was regulated by a starting box. A rain drum 3 ft. in diameter and partially filled with birdshot was provided, the ordinary drive being by a 1-hp, direct-connected motor. About 70,000 ft. of wire were used, ranging from No. 4 stage cable and No. 1 copper to No. 16 wire, for cue board signaling. About five weeks were required to develop and install the electrical equipment, which was specially designed and applied to the production by Mr. Jack Mayer, who was ably assisted by Mr. Al Jenkins, with Charles Frohman, New York.

Convention of the Canadian Electrical Association.

The nineteenth annual convention of the Canadian Electrical Association was held at Quebec on Wednesday, Thursday and Friday (June 16-18) of last week, with headquarters in Chateau Frontenac. A local committee, of which Mr. E. A. Evans was chairman, furnished an admirable program of entertainment, which included a special performance at Rustic Theater, Montmorency Falls; a visit to the Royal Mail steamship *Empress of India* to witness a fire and collision drill, and a trip in a Government vessel to points of interest in the harbor. Below are given abstracts of some of the papers presented, which will be supplemented next week by other abstracts, together with details of the meeting.

An interesting paper was presented by Prof. L. A. Herdt of McGill University, and Mr. N. J. Dalemont, of *La Lumière Electrique*, Paris, entitled "Electrolytic Lightning Arresters." After referring briefly to some of the well known types of lightning arresters, the liquid electrode arrester and the aluminum cell arrester are described in detail. The former consists of two metallic electrodes either dipping in an electrolyte of high conductivity placed in an earthenware vessel or arranged with a small air gap between the electrolyte and the electrodes. As current passes, in either case it throws the electrolyte away from the electrodes, thereby increasing the resistance in the path of the discharge, breaking the arc and also the dynamic current, and finally automatically resuming contact with the electrodes upon return of normal conditions. Experiments have shown that this action is so rapid that little deformation of the e.m.f. wave of the line takes place, even when the discharge occurs when the e.m.f. is at or near its highest value. This arrester has a well-defined critical voltage, below which arcs are suppressed, and above which passage of the dynamic current is interrupted. The aluminum-cell arrester described consists of aluminum disks stamped in the form of annular cups and covered with a thin film of oxide, which are placed one on top of the other to form a column, and separated by insulating disks or washers. The cups are filled with an electrolyte, consisting of an acid solution, either citrate of magnesium or citrate of aluminum; the whole combination is placed in earthenware jars, a certain amount of insulating oil being placed on top of the electrolyte to prevent evaporation. A number of such arresters can be placed in series in case of high line voltages. The critical voltage per disk varies from 380 to 400, depending on the voltage used when the disks are formed. At a high potential, due to static discharge, the film of oxide of the aluminum is punctured, but when the voltage becomes normal the film is reformed automatically, and the arrester is again ready to operate. Aluminum cells are built for 4,000 volts up. When the line voltage is higher than about 13,000 volts, multigap arresters are used placed in series, and for still higher voltages horn-gap lightning arresters are used.

Some experiments with aluminum cell batteries are detailed as follows: In a bath containing 6 per cent of bicarbonate of ammonia two plates of aluminum were used as anodes, and a plate of nickel as cathode. The two aluminum plates were electrically connected together and current was obtained from a storage battery. The film of oxide formed on the plates was at first thin, but thicker formations were obtained by increasing slowly and gradually the voltage and again later by lowering it to smaller values than at first used. The ohmic resistance of the film of oxide found as high as 21×10^5 ohms per sq. cm. It is not constant and diminishes when the applied voltage is increased. The resistance, however, depends on the voltage used when the plates were formed, so that at a given voltage the higher the voltage of formation, the larger will the resistance be. In experiments made with such plates used as condensers, the film of oxide weakened after operating continuously for some time, and finally gave out. It was found necessary in such cases to provide a formation circuit

in the shape of direct current to form the oxide film again. It would, therefore, seem advisable, in view of the above facts, to use horn-gap or other type of air-gap protection in series with this type of arrester, as when placed directly between wire and ground a condenser action must necessarily take place. The paper closed with the statement that aluminum cell batteries should provide excellent safety valves against line disturbances.

In a paper entitled, "Accounting for Electrical Companies," Mr. R. F. Pack, accountant of the Toronto Electric Light Company, presented the details of a system of accounting for central stations. In opening he said that while at present Canadian central stations are not compelled to make drastic changes in their accounting systems by any process of law, the advantages to be gained by a proper system of accounting are beginning to be realized more and more, particularly as the time may arrive when the provincial legislatures will require reports similar to those prescribed by the State governments in the United States and by the Board of Trade in Great Britain. The paper gives in complete detail a classification of main central station accounts suitable for smaller central stations, together with a classification of sub-accounts to suit the requirements of these and of larger central stations. This classification, which is largely based upon the N. E. L. A. classification and those of the New York and Wisconsin Public Service Commissions, does not admit of abstract.

Mr. L. W. Pratt, of the Hamilton Electric Light & Power Co., presented a paper entitled, "Power Rates for Central Stations," which gives schedules of motor rates based upon those in use by several central stations. One of these is a schedule of flat rates, and the others are based partly upon meter rates, and partly upon minimum charges, discounts, etc.

Mr. B. T. McCormick, of the Allis-Chalmers-Bullock Company, in the paper "Synchronous Motors Used for Power-Factor Correctors," sketches the principles of the use of synchronous motors for power factor correction, and gives several curves and diagrams whereby the capacity may be determined of a synchronous motor for the regulation of a given circuit. A motor with a weak armature, or in other words one with relatively few turns on the armature, is best adapted to the improvement of power factor, as such a motor will draw a large leading current from the line and give an increase in speed strength. This characteristic of a weak armature is one of the elements which goes to make an alternator of good regulation, but it is stated to be a poor criterion when issuing specifications for synchronous motors to specify a certain regulation for a motor when used as a generator, as a generator may be designed with a strong armature and a large air gap, and thus be unfit for use for the correction of power factor, owing to the poor corrective power of the strong armature, and to the tendency toward field heating.

A paper by Mr. S. E. Doane, chief engineer of the National Lamp Association, entitled "The Conservation of Our Natural Resources Through the Use of High-Efficiency Lamps," after giving statistics as to the coal consumption of the United States and other countries, estimates that by a liberal replacement of carbon by metallic-filament lamps, the rate at which fuel is being consumed for incandescent lighting could be reduced by at least one-half, thus enabling $8,000,000 worth of coal to be saved in the United States alone. In order to introduce metallic filament lamps without loss, however, it is necessary to change the present methods of charging for current by the kilowatt-hour, which is declared illogical. A proper system of rates should be based upon all of the factors entering into the actual cost of serving the consumer. The Doherty readiness-to-serve rate rests on this sound principle, and covers the three items of expense entering into service by three corresponding charges to the consumer. An illustration of this system is a total charge consisting of 15 cents per month for every 16-cp lamp or equivalent connected, as a capacity charge, 75 cents per month regardless of current consumed or lamps connected, as a consumer's charge, and 5 cents per kw hour as an output charge. A discount of 10 per cent is usually allowed on a bill if payment is made before the specified time. It is stated that the multiple rate system seeks to reach the same end, and that almost every rate system which makes any pretense at covering fixed charges is a modification of the readiness-to-serve system. Mr. Cole, in his paper, described the several standard forms of shell type and core type transformers, and pointed out the advantages and disadvantages of each of these types. The conclusion of the discussion is that, as far as weight and efficiency are concerned, there is very little choice between the two types. Close regulation is much easier obtained in the shell type, and to obtain an equivalent close regulation with the core type involves a construction that may sacrifice such features as good insulation and mechanical strength. He also stated that while the main advantage of the core type lies in the fact that the top yoke may be made removable, and the individual coils easily taken out for repairs, it has been the experience of some engineers with these "simple" repairs that the more simple method of returning the transformer to the manufacturer to be fixed up is easier and better in the end. Since three-phase systems are usually laid out with a view to motor loads, the question of regulation on inductive lines is an important one where three-phase transformers are considered and the shell type would in a large majority of these cases be preferred. Mr. Cole, in ending his paper, said that the time is not yet ripe to relegate the shell type in the background, in view of the satisfactory work that this type is still doing every day on high-tension systems.

Some Chicago Central-Station Statistics.

Addressing the ways and means committee of the Chicago Association of Commerce recently, Mr. John F. Gilchrist, assistant to the president of the Commonwealth Edison Company, Chicago, gave a brief illustrated survey of the central-station service of Chicago. The Chicago Edison Company, the predecessor of the existing company, began business in August, 1888, with a station capacity of 800 hp and a connected load of approximately 20,000 16-cp equivalents, serving about 250 customers in the down-town district. In those days the lighting rate was 1 cent per 16-cp lamp hour, with a sliding discount of from 5 to 20 per cent on monthly bills of over $50. At the end of 1908, a little over 20 years from the beginning, the connected load had grown to the impressive figure of 4,500,000 16-cp equivalents. The total generating and battery capacity is now about 300,000 hp, and the number of customers is about 86,000.

During the last five years the company has expended for investment, operation, repairs and renewals a total of $41,600,000, exclusive of bond interest, dividends and depreciation. The daily consumption of coal is about 2000 tons. The rates have been steadily reduced; for instance, in 1905 the monthly bill of an average residence customer using 30 kw-hours per month was $4.50. Under the same conditions his bill to-day would be $2.70, a reduction of 40 per cent. Another fact of much interest cited by Mr. Gilchrist is that the Commonwealth Edison Company is actually selling power in Chicago produced by steam generating plants at a cheaper rate than the Niagara Falls power companies sell their hydro-electric power in the city of Buffalo.

The company employs on an average 2500 men, exclusive of the large construction force employed by contractors on new work. There are over 5000 electric signs in the city. The company has done more, said the speaker, to purify the atmosphere of Chicago by putting out of business and preventing the erection of over 4000 smoke-producing chimneys than all the smoke-nuisance fines imposed by the municipal courts. "It is a part of our business," said Mr. Gilchrist, in conclusion, "to convince the man who generates his own power by means of a small steam plant, or who contemplates doing so, that we can sell energy to him cheaper than he can manufacture it. We have been so successful along this line that there are now less than 1500 isolated plants in the city of Chicago, whereas we have 10,000 power customers in our system."

High-Voltage Metallic Filament Lamps.

The English electrical journals report the appearance on the British market of several new metallic-filament lamps of 100-130 volts and 16 hefners, and 230-260 volts and 32 hefners. The former take 17 watts and give 14.4 British candles, a consumption of 1.18 watts per candle. The latter take 40 watts and give 28.8 candles, a consumption of 1.39 watts per candle.

Recent tests at the National Physical Laboratory on older types of 222-volt, 50-cp metallic-filament lamps showed an average consumption of 1.4 watts per candle. Of nine lamps tested five were burning at the end of 2000 hours, the life of the others having been 600, 800, 1350 and 1760 hours, respectively. The candle-power of the lamps increased up to 400 hours, and then gradually declined until at 2000 hours it was 87 per cent of the initial value. During the first 950 hours the consumption fell as low as 1.33 watts per candle, and at the end of 2000 hours was 1.6 watts per candle, the average being 1.4 watts.

Telegraph Companies Oppose Massachusetts Telegram-Filing Act.

The committee on mercantile affairs of the Massachusetts Legislature gave a special hearing on June 18 on an amendment to the recently passed telegram-filing act. This act, as previously noted in these columns, provided that the times of filing and receiving should be placed upon all telegraph messages sent within the State to points within the State, and it became a law without the signature of the Governor. Immediately after the law went into effect the companies instituted a charge for the words added, and the average number of words required to transmit the filing time was four or five. The proposed amendment to the law was that no charge should be imposed upon the customer of the company for the filing of the times.

For the Western Union Telegraph Company, Counsel Arthur Lord stated that the law necessitated the transmission of more than 50 per cent additional words, which would be without compensation if the amendment passed. Problems of this character, he believed, should be brought before the tribunal which has been created by the Legislature for adjudicating precisely these questions, namely, the Massachusetts Highway Commission. There are over 230 telegraph offices in Massachusetts where the gross monthly revenue does not exceed $10; 65 offices where it runs from $3 to $5 per month, and 98 offices where it is not over $2 per month. The business is by no means the sinecure that many persons suppose. By the law the Legislature either imposes an intolerable hardship upon the company or else places an unnecessary burden on the consumer. In other places where the filing time has been included the extra words have been paid for. There is no practical code system for different times of day known to operators in Massachusetts. The law imposes a penalty of $100 for an error in or the omission of a single letter or figure, and the only safe course for the company is, therefore, to transmit the filing time in full. Many operators in Massachusetts are employed by the railroads, and it is hard to run chances of the errors of other than regular employees of the telegraph company. The Western Union, said Mr. Lord, ought not to be held responsible for mistakes committed in railroad telegraph offices. The company does its best, but the traffic fixes the limitations of possible service. Such legislation is unnecessary and ought to be considered instead by the Highway Commission. So far as he knew, no customer has ever made the request that the filing time be put upon the message, and nothing has been introduced to show that anyone would suffer hardship or be injured if the filing time should not be included. Unless an additional burden like this is paid for, it may be confiscatory in its nature. If such a law should be passed all over the United States it would cost the companies millions of dollars a year. About 60 per cent of the Western Union messages are stock-exchange telegrams, or else messages closely associated with financial dealings; 20 per cent of the dispatches are for newspapers; 15 per cent are railroad messages, and 5 per cent are for all other kinds of business and social purposes. Less than 3 per cent of the telegrams are private or social in nature.

Counsel Wardner, for the Postal Telegraph-Cable Company, stated that his organization is willing to send the filing time free of charge for any customer who asks for it in writing. The Legislature has an undoubted right to take up these questions, but they are complex, and its actions, like those of all other law-making bodies, are subject to the test of constitutionality. The companies are clearly entitled to a reasonable return upon their investments.

Electrical Engineering at the Massachusetts Institute of Technology.

As indicating the trend of electrical engineering study at the present time, it is notable that 40 per cent of the students just graduated from the electrical engineering course at the Massachusetts Institute of Technology already bore degrees of bachelor of arts or bachelor of science, conferred, as a rule, in classical or literary courses. The colleges conferring these degrees are spread over the land from Nova Scotia to the State of Texas and the State of Washington, and include some of the most important universities of the East and the West, besides a number of the lesser colleges. These men are going into a wide variety of activities, from the manufacture of electrical instruments and of incandescent lamps to electric transmission of power and heavy electric traction.

Mr. H. S. Osborne and Mr. W. S. Rodman, who are candidates for the degree of doctor of engineering in the electrical engineering department, have recently been appointed fellows by the faculty of the institute. Mr. R. L. Jones has been appointed graduate scholar in electrical engineering.

The course of electrical engineering research and the advanced instruction of gradute students in electrical engineering has been advanced by the appointment of Dr. Harold Pender—who is the subject of a personal notice in another column—to the chair of theoretical and applied electricity. Dr. Pender's teaching at the institute will consist of a course for third-year undergraduate students and courses for graduate students in the more advanced theories of electric current flow and the electric transmission of power, in addition to the direction of experimental research by advanced students.

The advanced lectures on the organization and administration of public-service companies, on the design of power stations and systems, and on electrical measurements heretofore carried on by Professor Jackson, Professor Shaad and Professor Laws will be continued by the same professors. This organization makes a remarkably favorable one for graduate students of adequate preparation who propose to spend one, two or three years in advanced study of the greater problems of electrical engineering.

The Telephone in Emergency Construction Work.

The use of the telephone in emergencies justifies the cost many times over. It is difficult to place a money value upon such service, for it makes possible activities which would otherwise extend over protracted periods, if, indeed, they could be accomplished at all. One of the latest examples of the supreme importance of the telephone in a time of crisis is afforded by the recent fire at the Norumbega Park Theater, at Auburndale-on-the-Charles, Massachusetts. The fire broke out at 2 o'clock in the morning, and General Manager Brush of the Boston Suburban Electric properties was on the scene within 20 minutes. A hasty inspection of the situation showed that nothing could be done to save the theater, and it was at once decided to rebuild it, in order to save a revenue of upward of a thousand dollars a day for the remainder of the season. Headquarters were immediately established at a special

telephone set located on the scene of the fire, and insurance adjuster, architect, engineers, contractors, structural steel men, and over a hundred men from the railway company's own organization summoned to the spot. Two hours after the fire started the designing engineer was on the ground planning for the erection of a new structure, and in another hour carpenters and contractors were present to figure upon the cost of rebuilding. At 5 in the morning the ruins were cool enough to permit beginning the work of removing the debris, and at 10 o'clock the first lumber arrived for the new structure. New plans were drawn, with specifications, and the contract was awarded for the new theater within 48 hours of the time when the fire occurred. Construction started on the next day, and in just seven days the theater, seating 3000 persons, was completed.

The telephone was literally indispensable in this work, since the park, which is in a beautiful residential district, is located 10 miles west of Boston. The control of the entire situation was maintained by this means, and the ordering of materials and labor accomplished in the shortest possible time. During the entire period from his arrival on the ground to the completion of the theater, the general manager was practically always at the end of this telephone line. Without the telephone the work could not have been done; the company would have suffered an extraordinary loss of revenue, and only after weeks, if not months of slow and trying delay, would it have been possible to open the new structure to the use of the public. Electrical connection with the outside world enabled orders to be placed and deliveries hastened without the usual tedious course of waiting for the mails to go their appointed round, and permitted the chief executive of the organization to keep in touch with the regular work of the system so far as necessary, while the emergency construction was going forward. Such a situation could not possibly have been handled by correspondence, and even the automobile would not have annihilated distance quickly enough to permit the creation of a theater of this size within a single week. Even the advertisements of the work, drawing large crowds of people to the spot, were placed by telephone, and the results showed the wisdom of the choice. Although the regular telephone station of the park was located within 800 ft. of the fire, another station was established directly at the theater to save time. Thus, the telephone was perhaps the most important auxiliary, next to the food provided the workmen, that made it possible for such a triumph of executive ability to be realized.

New York Public Service Commission News.

A definite proposition has been made to the Public Service Commission by the Bradley-Gafney-Steers Company to build an elaborate system of subways in New York. This work is to be done under the new law which provides for the construction of subways by private capital. The company proposes to build the Broadway-Lexington Avenue route, as mapped out by the commission, running from the Battery to the Harlem River, thence dividing and running in two branches to Van Cortland and Pelham Bay parks, also to operate the bridge loop which the city has almost completed, to build the Broadway-Lafayette Avenue route in Brooklyn and the Fourth Avenue, Brooklyn, route as far as Fortieth Street in Bay Ridge. Altogether, this is the most comprehensive subway plan that has yet been formulated, and entails the expenditure of about $101,000,000. Of this amount the city will be called on to spend only about $26,000,000, which would be for the completion of the work already begun. The company is ready to take the work under the indeterminate franchise arrangement proposed by the commission. It is generally understood that the commission will approve the application and that the franchise will be passed on to the Board of Estimate and Apportionment before it adjourns for the summer. The company bidding for this work promises to have the construction completed within three years.

The Public Service Commission, after a rehearing, has refused to approve the franchise asked by the South Shore Traction Company for a line over the Queensboro Bridge. This franchise has already been allowed by the Board of Estimate, and the company now proposes to carry the matter to the courts to test the legality of the commission's refusal.

The Public Service Commission has approved the franchise of the New York & North Shore Traction Company for an extension of its line from the New York city line at Little Neck through Flushing to Chestnut Street in Whitestone. This permit has already been granted by the Board of Estimate.

Some Recent Costs of Electric Power Production.

In the following paragraphs are given some notes recently taken of the cost of generating electricity, excluding fixed charges, in three plants located in New York State, as deduced from the returns filed with the Public Service Commission of the Second District. At present it is difficult to analyze the cost of production in many of the plants of this State from the returns filed, for the reason that many of the companies are fortunate enough to use hydro-electric power in addition to the steam-plant service which they furnish. The number of stations of even moderate capacity which operate steam plants exclusively is greatly limited. The absence of figures extending over several years of operation also precludes technical comparisons of the conditions and results obtained by individual companies throughout a considerable period. Nevertheless, data from single plants covering short periods are suggestive as to the cost of manufacturing electricity under definite conditions of equipment and fuel supply.

The first plant considered is the Utica station of the Hudson River Electric Power Company. This plant has a rated capacity of 6000 kw. It has eight Heine boilers of 488 hp each, and four Cahall boilers of 509 hp each, operated at 175-lb. pressure, the total boiler rating being 5940 hp. The electric generating equipment consists of two 1000-kw and two 2000-kw Curtis-General Electric turbo-alternators wound for 2300 volts and transmitting power to substations at Amsterdam, Oriskany, Frankfort and Little Falls through step-up transformers located in the station at Utica. A large percentage of the output of the Utica station is devoted to electric railway service. In the calendar year 1908 the station at Utica generated 19,751,300 kw-hours and sold a total of 15,750,930 kw-hours. Of this, 15,502,095 kw-hours were delivered for electric railway service, including the operation of the electrified section of the West Shore Railroad between Utica and Syracuse.

The operation of the Utica plant required the services of 7 engineers, 2 pumpmen, 5 switchboard men, 25 boiler-room men, 3 mechanics and carpenters, 25 coal-passers and miscellaneous employees, with one clerk and superintendence by three officials having general oversight of the company's electric power-plant equipment. Only a small part of the time of the superintendents was assignable to the Utica station. The following table gives the cost of manufacture per kw-hour delivered at the station bus, the average cost per ton of fuel being $2.14. During the year the company burned at Utica 29,045 tons of anthracite and 5361 tons of bituminous coal.

COST OF PRODUCTION AT UTICA PLANT, 1908.

Station superintendence	$185.14
Other [illegible]	[illegible]
[illegible]	[illegible]
Oil, waste and [illegible]	[illegible]
Water	[illegible]
Repairs, buildings	69.05
Repairs, [illegible]	[illegible]
Repairs, [illegible]	[illegible]
Station [illegible]	[illegible]
Total [illegible] per kw-hour	$0.[illegible]

The average output of this station per day was 54,097 kw-hours, the maximum load on the plant during the year being 6000 kw., deeming the load factor as the quotient of the average kw-hours per day divided by the maximum possible output at normal station capacity for the same period the result is 37.5

per cent for the year. The company reports the cost of the station building to be $337,273.43; the cost of the steam equipment, $268,126.74, and the cost of the electrical equipment, $187,440.10. The excellent cost of production at the station is clearly made possible by the good load factor of the plant and the low cost of fuel per ton.

The second plant is that of the Jamestown Lighting & Power Company, at Jamestown, N. Y. The rating of the station at normal output is 908 kw, and the figures cover the year 1908.

The steam-generating equipment consists of one 150-hp, one 125-hp and two 150-hp boilers of the horizontal return-tubular type, the average steam pressure being about 125 lb. The total boiler rating is 575 hp. There are five engines and 12 generators in the station. The engine equipment consists of one 12-in. x 21-in. Buckeye compound condensing outfit, rated at 250 hp; one Armington & Sims 100-hp engine; one 15¼-in. x 26½-in. 300-hp Buckeye, and two 11-in. x 20-in. Dick & Church 175-hp engines. The total generator capacity is 908 kw. During the year the plant generated 878,140 kw-hours, or an average of 2406 kw-hours per day. The maximum load was 487 kw. The labor requirements of the plant were four engineers one oiler, two firemen and one machinist. Bituminous coal was burned, costing the company an average of $2.74 per ton the total quantity consumed being 3750 tons during the year. The coal consumption per kw-hour was 8.54 lb. The operating cost of the station for the year was as follows:

COST OF PRODUCTION AT JAMESTOWN PLANT, 1908.

Station labor, .515 ct. per kw-hour, or	$4,533.20
Fuel, 1.16 cts. per kw-hour, or	10,283.42
Oil, waste and sundries	838.78
Water	46.45
Repairs, building	187.35
Repairs, motive power	1,487.93
Repairs, electrical apparatus	264.45
Total, 2 cts. per kw-hour, or	$17,641.58

Defining the station load factor as in the case of the Utica plant, the Jamestown station had a ratio of 11 per cent between the average daily output and the total energy which might have been generated in 24 hours had it been possible to operate the plant at full load for that period. The conditions afford considerable contrast between those prevailing at Utica. In the Jamestown case the company is handicapped by a somewhat higher cost of coal, but the two chief points against a high station efficiency are the smallness of the demand upon the plant for service in relation to its capacity and the operation of apparatus which to a considerable extent represents a type which would not be installed if a new station were built. It appears that the power load of the company is small, and this, with the use of belted apparatus to some degree, makes it difficult to generate current at specially low figures. The relative importance of the fuel consumption and cost per unit of output is indicated. With an increased load upon the plant, it is probable that a noteworthy improvement in economy would result, even with no change in the equipment.

The third station considered is that of the Binghamton Light, Heat & Power Company. This station has a normal capacity of 2000 kw, and in the fire-room are three Stirling water-tube boilers rated at 375 hp each and built for operation at 200-lb. steam pressure. The record covers the last half of 1907. In the engine-room are one 700-hp Corliss engine, direct-connected

COST OF PRODUCTION AT BINGHAMTON PLANT, LAST HALF 1907.

Station labor and superintendence, .252 ct. per kw-hour, or	$4,298.75
Fuel, .54 ct. per kw-hour, or	9,186.92
Oil and waste, sundries	807.99
Building repairs	1.99
Repairs, motive power	222.04
Repairs, electrical equipment	92.27
Repairs, station sundry equipment	97.86
Total, .87 ct. per kw-hour, or	$14,707.82

type; one 500-kw Curtis turbine; one 500-hp Erie-Ball belted engine, and one 500-kw Allis-Chalmers turbine. The electric generating units consist of two 500-kw General Electric three-phase alternators, two General Electric belted alternators rated at 200 kw each, a 500-kw Allis-Chalmers alternator, and a 150-kw Westinghouse motor-driven, 500-volt generator. The station was operated by a force of four engineers, two switchboard men and five boiler-room attendants. The company burned 3752 tons of coal during the half year, costing on the average $2.44 per ton. The output during the period under consideration was 1,700,268 kw-hours, and the maximum output in any one day was 17,610 kw-hours. The load factor was 19.4 per cent, which, with the modern equipment and load coal cost, secured excellent station economy. The operating expenses for the half year are as given in the table.

Railroad Company Compelled to Maintain Telephone Service.

The citizens of Skedee, Okla., filed a complaint against the Atchison, Topeka & Santa Fé Railway Company to compel the railroad to become a subscriber of the local telephone exchange and to install an instrument in its depot at Skedee. The complaint alleged that many persons receiving consignments of freight from time to time resided at a distance from the railroad depot and were compelled, under existing conditions, to depend upon the mails for notification of freight on hand for them, a system which often resulted in delay and even in the payment of demurrage. The real objection of the railroad company to becoming a telephone subscriber does not appear in the case, but in their answer the attorneys for the company set forth as the only reason for not having a telephone the fact that it would cost the company $2 a month, notwithstanding that the cost of notifying receivers of freight by mail would exceed $2 a month. It was held that under the constitution of Oklahoma, authorizing the Corporation Commission to require railroad companies to establish and maintain all such public service facilities and conveniences as might be reasonable and just, the commission was warranted in requiring the company to install telephone service. As to the telephone the court, quoting from People's Telephone Company vs. Eastern Railway Company of Minnesota (decided by the Railroad Commission of Wisconsin, Oct. 12, 1908) said: "The telephone is at present an indispensable aid in the conduct of almost every business and calling of any importance. No railroad company could manage its business at any center of population economically or satisfactorily without telephonic connections between its stations, warehouses and grounds and the mercantile, manufacturing and other places of business in the community. The duty of furnishing the public with adequate telephonic service for the purpose of transacting business with the railroad has been self-imposed in many instances by reason of usage and necessity. It has, therefore become a necessary facility in such cases for the proper discharge of transportation business of the railway company, within the rule of the common law as well as in contemplation of the express legislative enactments. While a carrier may select the agencies by which to serve the public, it may not select an agency exclusively which for any reason is incapable of fully discharging the duty of the carrier to the public. The right of selection of facilities is limited by the condition that those selected are adequate and efficient for the purposes required."

Fleming on Wireless Telegraphy.

In an address delivered before the Royal Institution, London, June 5, Prof. J. A. Fleming gave a popular exposition of the latest advances in wireless telegraphy. In opening he outlined the functions of the antennæ in radiating and absorbing the electric waves employed in radiotelegraphy. It had long been known that radiotelegraphy was conducted with greater facility over sea than over land, and the first part of the lecture was an exposition of recent investigations into the causes of the difference. It was shown by a simple experiment with iron, copper, and galvanized iron spirals, that a zinc-covered or galvanized iron wire conducted high-frequency oscillations almost as well as a copper wire, but that if the zinc skin was burned off the wire then acted as an ordinary iron wire.

This proved that the high-frequency currents were confined

to a surface skin. The penetration into the metal was greater the worse the conductivity. The same was true of electric waves passing over the earth. They penetrated into it and dissipated their energy. In the case of sea water, the penetration of waves 1000 ft. long was about 4 ft. or 5 ft., but if propagated over very dry soil, the penetration and, therefore, loss of energy was much greater. Curves were exhibited derived from a recent research by Dr. Zenneck, of Brunswick, showing the relative effect of sea water, fresh water, damp soil, and dry soil, on the depth of penetration.

It was shown that for a certain soil conductivity represented by very dry sand, the abstraction of energy from a wave of 1000 ft. in length was a maximum. The superior facility of transmission over sea water was as much due to its high dielectric constant as to its good conductivity. Some questions were next discussed connected with new modes of setting up oscillations in the antennæ. A new form of oscillograph vacuum tube was exhibited, the invention of Dr. Gehrcke, by means of which it was possible to examine and analyze optically the oscillations existing in a wireless telegraph circuit.

Photographs of oscillations taken by this means by Dr. Diesselhorst at the Berlin Reichsanstalt were shown. It was proved that when the oscillations in the antennæ or radiating wires were produced by the inductive action of other oscillations in a coupled condenser circuit, the result was to radiate from the antennæ waves of two-wave lengths. In general only one of these was utilized, but the lecturer described means by which both waves could be absorbed and made effective. The method due to Wien of quenching the primary spark so as to prevent this reaction of one circuit on the other was then described, and new methods of exciting the oscillations in the antennæ due to recent German discoveries were explained and illustrated.

The property of certain types of antennæ of radiating waves more strongly in some directions than others, was then discussed. The interesting inventions of MM. Bellini and Tosi for locating the direction of the sending station were described. In the next place new oscillation detectors or devices for detecting electric waves were described. Mr. Walter's tantalum detector, consisting of a fragment of tantalum wire out of an incandescent lamp dipping into mercury, was mentioned. The new crystal detectors, such as Dunwoody's carborundum detector and Pierce's anastase and molybdenite detectors, were exhibited and worked.

The curious and marked property of carborundum and molybdenite of conducting electricity better in one direction than another was discussed and its application to the construction of wireless telegraphic receivers explained. Dr. Fleming then exhibited experiments with a new detector of his own, consisting of an incandescent lamp with a metallic filament of tungsten having a copper cylinder around, but not touching it. When the filament was in action the space between the filament and the copper possessed a unilateral conductivity, and like the crystal detector this glow lamp detector could be used to receive radiotelegraphic signals. It was a detector of great sensibility.

Finally a reference was made to the problem of wireless telephony. It was shown that by means of the recently invented oscillation detectors, articular speech and not merely signals could be transmitted, provided that the radiating antennæ were made to radiate persistent or undamped waves. Some of the newer methods of producing these oscillations were considered, including the high-tension aluminium arc of Ernst Ruhmer.

CURRENT NEWS AND NOTES.

NEW N. E. L. A. COMPANY SECTIONS.—Company sections of the National Electric Light Association have been organized at Baltimore, Md., San Antonio, Tex., and Salt Lake City, Utah.

MICHIGAN ELECTRIC ASSOCIATION CONVENTION.—The 1909 convention of the Michigan Electric Association will be held at Detroit, Aug. 17, 18, 19. Mr. A. C. Marshall, of Port Huron, is secretary.

SHOW-WINDOW ILLUMINATION.—Some photometric measurements of show-window illumination recently made in Denver gave a mean illumination of 10 ft.-candles at the window as viewed from the outside, and a maximum of 17.7 ft.-candles.

ARMY WIRELESS TELEPHONE.—According to advices from Washington, the War Department, through the Signal Corps, is putting up a mast on the Mills Building annex there and another at Fort Myer, five miles away, for the purpose of trying out wireless telephony as a preliminary step to tests at longer range.

PATRICK CALHOUN JURY DISAGREES.—The jury in the trial of Patrick Calhoun, president of the United Railways Company, on a charge of bribing San Francisco supervisors, failed to reach an agreement and was discharged. The trial has been going on since January. It is said that 10 of the jury stood for acquittal and two for conviction.

MASSACHUSETTS ASSOCIATION OF MUNICIPAL ELECTRICAL INSPECTORS.—At the recent annual meeting of the Massachusetts Association of Municipal Electrical Inspectors Mr. Walter B. Randlett, of Newton, was elected president, and Mr. William Lincoln Smith, of Concord, secretary-treasurer. Messrs. James E. Cole, of Boston, and Eugene N. Davis, of Brookline, refused re-election to these respective positions, which they had occupied since the organization of the association.

A. I. E. E. FRONTENAC CONVENTION.—On and after June 30 there will be a through passenger service to Frontenac, Thousand Isles, where the A. I. E. E. convention will be held the latter part of June. A sleeper will leave New York (New York Central) at 7:15 p. m. daily, arriving at Clayton at 6:28 a. m. and connecting with a steamer leaving there at 7:10 a.m., arriving in Frontenac at 7:20 a. m. There will also be a parlor-car service on a train leaving New York at 7:45 a. m. daily except Sunday, arriving at Clayton at 5:10 p. m., and connecting there with a steamer arriving at Frontenac at 5:20 p. m.

CHICAGO SECTION ILLUMINATING ENGINEERING SOCIETY.—The last meeting of the Chicago section of the Illuminating Engineering Society for this season was held at noon on June 17 in the Great Northern Hotel. There was a good attendance, and the meeting was prolonged for three hours. On the report of a nominating committee, the following officers were elected for the ensuing year: Chairman, Mr. Albert Scheible; secretary, Mr. T. R. Beebe; managers, Messrs. J. R. Cravath and E. W. Lloyd. The speaker of the occasion was Mr. Albert Frank Horton, of the Electric Shop of the Commonwealth Edison Company, who delivered an illustrated lecture on artistic interior lighting, particularly relating to fixtures. Mr. Horton displayed a number of lantern-slide pictures contrasting the effect of good lighting and bad lighting.

MANUFACTURE OF CALCIUM CARBIDE.—At the International Congress of Applied Chemistry, held in London recently, Mr. Samuel R. Tucker presented a paper dealing with "The Relative Efficiency of the Arc and Resistance Furnace for the Manufacture of Calcium Carbide." Calcium carbide was prepared in two types of furnaces under conditions which would give the best yield, and comparisons made of the product as to its carbide content and its weight obtained per energy unit. The results showed that, for the scale on which the experiments were conducted, the resistance furnace was much superior to the arc. The best result obtained with the arc furnace was 1170 watt hours per 100 grams of pure carbide, while with the resistance furnace the same quantity of pure carbide was obtained with 324 watt hours.

LARGE ORDER FOR RADIUM.—A special dispatch from London states that an order has just been given for radium to the value of $150,000 by Lord Iveagh and Sir Felix Cassel for an institute recently founded by them for the investigation of cures for cancer. Possibly Sir Ernest Cassel is meant. The quantity is said to be a little less than a quarter of an ounce, which would make the market price of radium about $8,000,000 a pound, troy weight.

N. E. L. A. NATIONAL SPECIAL SESSIONS.—At the Atlantic City N. E. L. A. convention a new article was added to the constitution of the association providing for national special sessions, which may hold their meetings at other times than during the annual convention. The formation of such sessions will be authorized upon the application of 10 Class A (central station) members. While the new article specifies special sessions of lawyers, accountants, engineers, purchasing agents or commercial men, its terms authorize the similar organization of other classes connected with the conduct of central-station business. All members of the special sessions must be members of the N. E. L. A.

WISCONSIN SUMMER ELECTRICAL CONVENTION.—The Wisconsin Electric and Interurban Railway Association and the Northwestern Electrical Association will hold a meeting at Grand View Hotel, Chain o' Lakes, Waupaca, Wis., June 28 and 29, 1909. This meeting will give an opportunity for an enjoyable outing combined with business. It is expected to have papers or addresses on legislation, purchasing of coal, and other subjects. Both associations are composed mainly of electric railway and electric lighting companies in Wisconsin. Mr. Clement C. Smith, Stevenson Building, Milwaukee, Wis., is secretary and treasurer of the Wisconsin Electric and Interurban Railway Association, and is making the arrangements for this joint meeting.

BOILER FIRING.—The best treatise thus far printed on boiler firing has been issued by the United States Geological Survey in Bulletin No. 373, with the title "The Smokeless Combustion of Coal in Boiler Plants; With a Chapter on Central Heating Plants." The pamphlet comprises 188 pages, of which 88 deal with boiler plants with mechanical stokers, and 40 with hand-fired furnaces. Both of these sections are accompanied with illustrations of furnaces, and with tables of data of some hundreds of mechanically and hand-fired plants. The final section contains data relating to 57 steam and hot-water central heating plants. The practical and other information contained in the bulletin will be found invaluable by all interested in fire-room economy, entirely aside from the question of smokeless combustion.

GERMAN ELECTRIC LIGHTING TAXATION.—Some months ago the finance committee of the German Reichstag rejected a Government proposal for taxing the consumption of electricity. Recently, however, the same committee has presented a bill of its own providing for a similar system of taxation, whereby incandescent and glow lamps, arc-lamp carbons, mercury-vapor and other lamps would be taxed. The tax on incandescent-filament and glow lamps ranges from 5 cents per lamp for lamps between 25 watts and 60 watts, to 12 cents for lamps of 100 watts or over. The tax for arc-light carbons is 11 cents per pound, and for mercury-vapor and similar lamps 25 cents per lamp up to 100 watts, and 25 cents extra for each excess of 100 watts or portion thereof. Mantles for incandescent gas and similar lamps are taxed at 2½ cents per lamp. The tax is to be paid by manufacturers by the employment of revenue labels attached at the factory, or by importers on clearing from the custom house or within three days after.

PROPOSED PUBLIC UTILITIES COMMISSION FOR INDIANA.—The recent contention between Governor Marshall and the Indiana Railroad Commission over the power of the commission, will, it is believed, give rise to a strong movement to have a public utilities law passed by the Legislature similar to that in several other States. It is pointed out that the powers of the present commission are, by law, practically confined to the fixing and regulation of freight and passenger traffic on steam and interurban roads, preventing discrimination and compelling the interchange of traffic between railroads. It is claimed the commission has gone farther and farther beyond its functions; and while it has done many things, steam and interurban roads, though not admitting the commission had the power to make certain orders, have obeyed them because the suggestions were good ones. It is now proposed to enact a public utilities law that will control not only railroads, but include the tax board, the labor commission, factory inspector, central station, electric railways, telephone and similar public services.

UNLOADING PASSENGERS IN ELEVATED-RAILWAY ACCIDENTS.—The Northwestern Elevated Railroad in Chicago, having had an unfortunate experience in several recent accidents, has issued instructions to prevent delay to passengers in case of future accidents. Trainmen are instructed in case of delay or blockade to have one train go ahead or back up to a station platform. Adjacent trains are to pull up close to the first one so that passengers can step from one car to the other and thus reach the station platform. Where it is necessary to transfer passengers from the middle or express-train tracks to local station platforms, the express train is to be pulled up alongside of the train standing by the platform track. The two trains are to be connected by one or two bridge planks long enough to fit from one car to the other. Each station is to be provided with two bridge planks of this description placed in receptacles on the front of station platforms. By this means it is planned to provide an easy exit for passengers and to prevent them from alighting from the cars to the structure, obviating the possibility of stepping on the third-rail.

REMINISCENCES OF OTHER DAYS.—Owing to the illness of Mr. Forée Bain, there was no regular speaker at the meeting of the Electric Club of Chicago on June 16. Mr. Bain's subject was to have related to the early days of electrical development, and President Howlett said that in his absence he would call on some of the members of the club to talk informally on the same subject. Mr. W. D. Ray, of the Sanitary District, spoke of the old Edison station at 139 Adams Street and referred to the interest excited by the experimental electric railway in the old Exposition Building on Michigan Avenue some 22 years ago. Those were the days, he said, of "undertakers' wire." Mr. Donald M. Carter, now a lawyer, gave some amusing reminiscences of the building of an isolated plant in the Grand Central Railroad station which "acted up" just at the time a large party of railroad officials made a formal inspection of it. Mr. John W. Mabbs, chief engineer for the Board of Trade, said that he worked for the M. C. Bullock Company, which put in the first electric lights in Chicago back in 1880 or 1881. These were Brush arc lamps and were installed in the old Exposition Building like the electric railway to which Mr. Ray referred. Speaking of incandescent lighting, Mr. Mabbs said that the first switchboard in the Board of Trade plant was made of maple flooring and was considered to be rather fine. Mr. A. L. Millard, of the Westinghouse Electric & Manufacturing Company, told of the starting of the Cicero & Proviso Electric Railway in the western suburbs of Chicago some 20 years ago. Those were the days when 7½-hp railway equipments were sold for $4,800 and "something in common stock." Mr. Millard recalled several amusing incidents connected with that installation. Mr. Albert Scheible could remember the time when 16-cp incandescent lamps were sold for 60 cents each. When the price was suddenly dropped in 1891 to 44 cents, it was thought that a revolution had been accomplished in the electric-lighting industry. It was decided that the club should have a picnic to which ladies would be invited on July 17 at some place to be selected by the entertainment committee. A baseball game, fat-men's race, swimming race and other pastimes will be features of the outing.

Electricity at the Harvard College Observatory.

BY HOWARD S. KNOWLTON.

IN the research work of the modern laboratory, electricity is one of the most important aids to investigation. The delicacy, accuracy and flexibility of electrical methods are unsurpassed, and nowhere do these advantages appear more clearly than in the astronomical observatory. Until quite recently the uses of electricity in this field have been largely confined to the transmission of time signals in some form or other between observatories and outside points, the furnishing of time intervals to local apparatus within the observatory walls, various applications of electric lighting, and telephone service. In a few cases electric power has been used for the winding of weights operating clockwork for telescope driving. Within the past two years, however, the problem of applying the motor drive directly to the telescope has been solved at the Harvard College Observatory in Cambridge, Mass., and the success attained indicates that electricity will play an important part in future work of this character. In the following paragraphs some of the principal applications of electricity at the Harvard College Observatory will be described, this particular installation being selected on account of the fact that electrical methods have been more completely worked out here than in any other existing astronomical research station.



FIG. 1.—POWER ROOM.

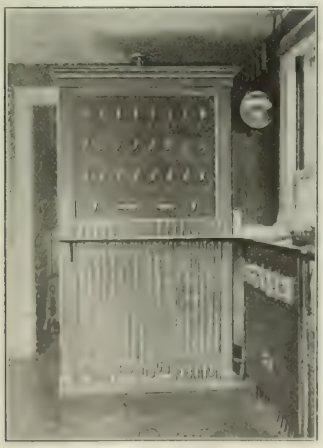


FIG. 2.—SWITCHBOARD FOR SIGNALING SERVICE.

The supply of energy for the different applications of electricity at the observatory is derived from the local central station company. In one wing of the laboratory building a room has been set apart for the introduction and control of the power supply. The lighting of the different buildings on the property is handled by a 110-volt alternating-current service taken from a standard transformer. The power service is derived from the regular 500-volt, direct-current lines of the Cambridge Electric Light Company, but the various motors are operated at 110 volts, direct current, through the medium of a motor-generator installation in the observatory power room. The distances of transmission about the grounds are short and the service essentially intermittent. The signaling work of the observatory is handled by storage batteries, and there has been adopted recently a standard potential of 8 volts for all electromagnetic apparatus. The present installation of separate storage batteries is now being centralized in a single battery-room. The use of this standard voltage will increase the flexibility of all the signaling equipment, and enable the complete advantages of the unit principle in arrangement and combination to be enjoyed. Special care has been taken at the observatory to sectionalize the various circuits in such a way that the maximum number of experimental combinations can be secured without interrupting apparatus in service.

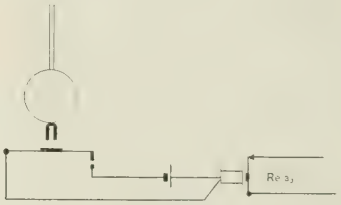


FIG. 3.—CLOCK-CONTACT SCHEME.

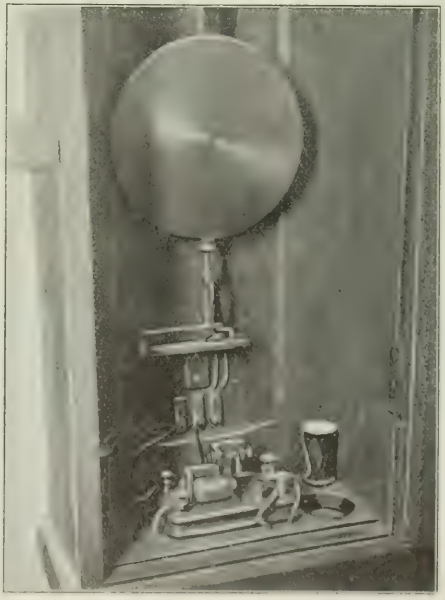


FIG. 4.—PENDULUM CONTACT ARRANGEMENT.

The power-room contains a 110-volt, alternating-current lighting panel board, with meter, fuses and knife switches; a 500-volt, direct-current panel, with similar equipment; a 500/110-volt Crocker-Wheeler direct-current motor-generator set; a 110-volt power-service switchboard panel with controlling

switches and combination volt and ammeter, and a 5-hp, 500-volt Crocker-Wheeler motor driving through a lineshaft and belting an adjoining shoproom equipment; and a shunt wound Edison bipolar dynamo having a potential range of 25 volts to 125 volts, used exclusively for storage-battery charging. There are also several motor-starting boxes located at this place, and the wiring is so arranged that the motor-generator set can

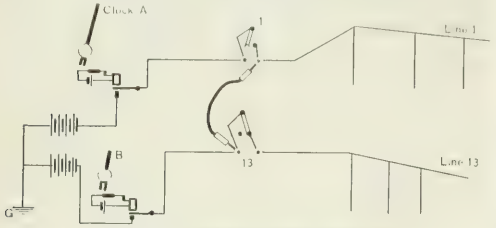


FIG. 5.—TRANSFER OF CLOCK SIGNALS.

be started from a distance when desired without the necessity of anyone entering the power-room.

A separate room is provided in the laboratory building of the observatory for the manufacture of time signals and their distribution throughout the premises. A bank of clocks, the majority of which have pendulums with a period of one second, is mounted on the wall of this room, and close by is a switchboard controlling 24 circuits which run to various points on the grounds. By means of this switchboard any clock can be connected to any of the outgoing circuits and its impulses electrically transmitted to any apparatus that may be in need of such service. The contacts which the clock pendulums make are entirely without friction, the scheme used being illustrated in the accompanying drawing (Fig. 3). Attached to the bottom of the pendulum is a small steel horseshoe magnet, which passes close above an armature at every swing. The armature is mounted upon a small spring which is fitted with a platinum tip at its end, which makes a contact with a platinum stop piece all the time except when the pendulum is directly over the armature. As the pendulum reaches the middle of each swing, it pulls the armature and spring away from the platinum stop, breaking the circuit of a sensitive relay, which in turn sends a corresponding electrical impulse through the main circuit leading to the switchboard and apparatus which happens to be connected at the time. The absence of friction and the location of the armature directly beneath the center of gravity of the pendulum enable the electric contacts and breaks to be made

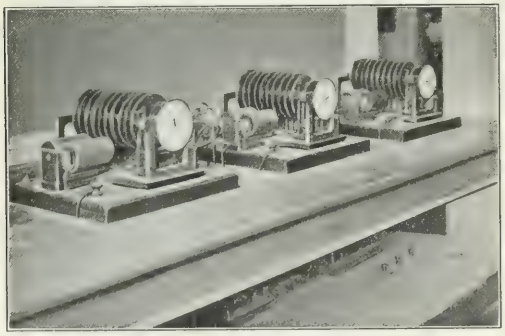


FIG. 6.—PROGRAM INSTRUMENT.

with the least possible interference with the accuracy of the clock mechanism.

The general arrangement of the switchboard includes a pair of jacks in each principal circuit and a two-point switch which closes or opens the path between the two jacks. At the bottom of the board is provided a row of flexible cords with plugs at their ends, the cords being used as jumpers between any of the jacks desired when it is necessary to combine different circuits or to substitute the signals of one clock for those of another on a line which is in service. The flexible cords resemble those used in telephony, except that each line consists of a simple loop with one plug at each end. Further flexibility is secured by the connection of several relay contacts with corresponding cords, enabling the functions of different actuating mechanisms to be exchanged with the utmost freedom. The sketch (Fig. 5) illustrates in diagrammatic form how one clock may be substituted for another on a time-signaling circuit. Here, clock *A*, for example, has been supplying circuit 1 with signals at two-second intervals, while clock *B* has been furnishing line 13 with signals at one-second intervals. Assuming that one-second signals are desired on line 1, the switch 1 is thrown off and a flexible cord introduced into the jacks as shown, leaving the switch of line 13 intact. Both lines now receive signals every second from clock *B*. If desired, a cord can be inserted in the left-hand jack of the switch 1 and carried to any other terminal on the switchboard where signals are desired at two-second intervals without interfering in any way with the operation of the circuits 1 and 13. These circuit arrangements are not complex, but they illustrate the principle of unit operation which is carried out through the entire plant. Maximum independence of all apparatus results from the establishment of permanent terminals on the switchboard. In addition to the contacts shown in the sketch, blank contact bars are provided, with suitable holes drilled in the metal, so that any two cords can be joined in case of necessity without uncertainty or delay. No temporary twisting of wires or establishment of irregular and loose connections is required with this arrangement.

Mounted on the table in the switchboard-room just mentioned are four program instruments which can be set to furnish signals at any interval which is a multiple of the primary

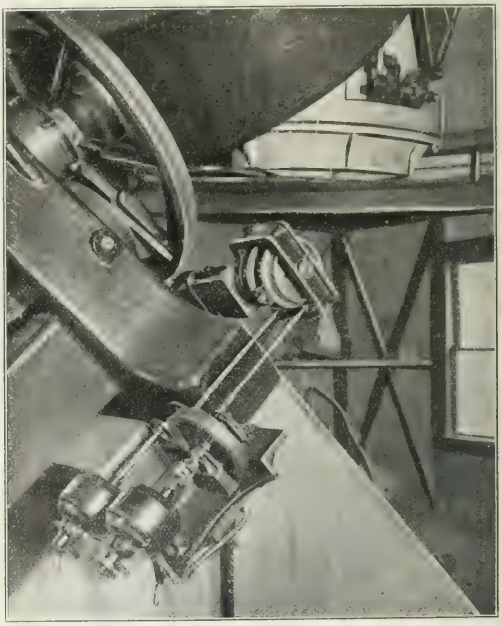


FIG. 7.—MOTOR DRIVE OF 24-IN. TELESCOPE.

impulse applied to the driving mechanism. Each instrument consists of a spindle carrying a row of parallel brass disks or contact cams driven by an electromagnet. The electromagnet may be connected with one of the clocks or any other impulse-providing circuit-closer. When impulses are admitted to the magnet of a program instrument every second the row of contact cams makes one complete revolution in a minute. Ac-

cording to the number of notches on the disks of the individual cams, that number of contacts will be made per revolution, and in the case above cited, with a cam having four notches spaced evenly around the circumference of the disk, a signal will be sent out from the cam every 15 seconds. The next cam, for example, may have five regular notches on its surface, and the impulses which it permits will pass out every 12 seconds. Each



FIG. 8.—OBSERVING-ROOM 60-IN. TELESCOPE WITH CONTROLLING SWITCHBOARD.

cam contact is made mechanically, no current passing in or out of the disks. For each cam is provided a terminal connection on the base of the instrument, so that the circuit-closing im-

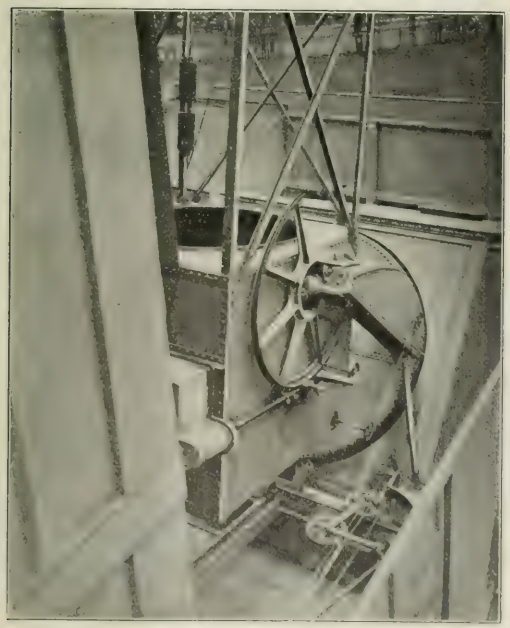


FIG. 9.—60-IN. COMMON TELESCOPE SHOWING METHOD OF DRIVING IN RIGHT ASCENSION.

pulses from any one or group of cams may be transmitted to any desired point. The cams are detachable, and the observatory has a large collection of disks milled to give different time intervals which have been found desirable in its work. By using three of the program instruments in series and connecting the driving magnets so that one will make one complete revolution and contact in 24 hours, the second one revolution contact per minute, with the third making a contact every second it is easily possible to pick out any second of the day and obtain a signal from the apparatus at that time and at no other. Such a signal can then be transmitted to any point in the observatory where it may be needed. By the use of the proper cams the most irregular combinations of signals can be made and repeated at predetermined intervals. The separation of the different cam circuits on the same program instrument again illustrates the independence of similar parts, which permits so much flexibility in the conduct of experimental work at this observatory.

Aside from the above signaling apparatus, the observatory is provided with a complete fire-alarm system, with repeating boxes giving numbered calls for the different stations on the premises. A private telephone system is also in service between the different buildings and departments. Among the other minor uses of electricity may be mentioned the illumination of transparencies and the application of miniature incandescent lamps to instrument fields in setting cross-hairs on stars. The observatory library contains a number of photographic positives of different constellations and heavenly bodies, with views of the Arequipa branch of the observatory, in the Peruvian Andes. These plates are mounted on the sides of a room which can be darkened easily, and behind the transparencies are mounted incandescent lamps in such a manner that when the current is applied in the darkened room the natural appearance of the sky is reproduced and the beauty of the transparencies much heightened.

The most advanced electrical applications at the observatory are in the field of telescope driving. The old method of driving telescopes automatically, and the one still followed elsewhere, is by the so-called driving "clock," which is a more or less intricate system of weights, levers, springs and gears,

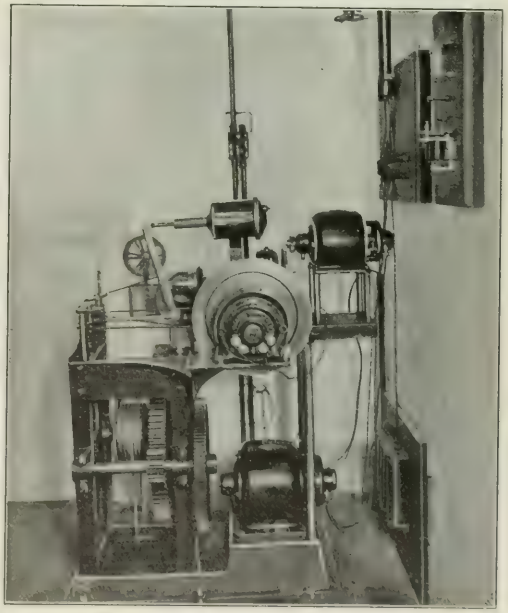


FIG. 10.—DRIVING MECHANISM FOR 60-IN. COMMON TELESCOPE.

operated by gravity after suitable winding has been effected. This apparatus is costly, liable to derangement, and subject to inaccuracies, requiring the most careful attention. With the electric drive, however, the cost is moderate, the mechanism comparatively free from disturbing complications and the control entirely automatic. The first telescope in the world to be driven by an electric motor was a 24-in. reflector belonging to this observatory. This instrument is illustrated in the ac-

companying Fig. 3, the method of driving being shown. Two motors are provided, one for giving the telescope a comparatively slow motion, and the other for keeping it pointed to any star with automatic compensation for the motion of the earth on its axis. The driving is accomplished by means of a plant wheel and bevel gearing, so that both motors can be in operation at once without interference, the resultant motion of the telescope being the algebraic sum of the movements imparted by the motors. In normal operation the right-hand motor shown in the photograph is the only one in motion, power being applied to it at intervals of one second for a length of time determined by an automatic governor mounted on the driving mechanism. The success of this application was so immediate that the principle was adopted for the driving of the 60-in. Common reflecting telescope, lately purchased by the observatory from the heirs of the English astronomer of that name. This instrument is one of the two largest in the world, and in the new electrical system of control which has been applied to it all of its motions, forward and backward, in right ascension and declination, are operated by independent motors.

The polar axis of the Common telescope is floated in a tank of water instead of being supported by a pier of masonry or steel, as in the usual installations. The entire telescope weighs about 22 tons. The accompanying Fig. 9 shows the frame of the instrument, with the floating tank and sector which moves it in right ascension, and a small railroad track below upon which a car is run carrying the principal mirror, the weight of the glass being about 1200 lb. and its value approximately $15,000. The lens is housed in the building adjoining when the instrument is not in service. The reflected rays from the heavenly body under observation are thrown into the house

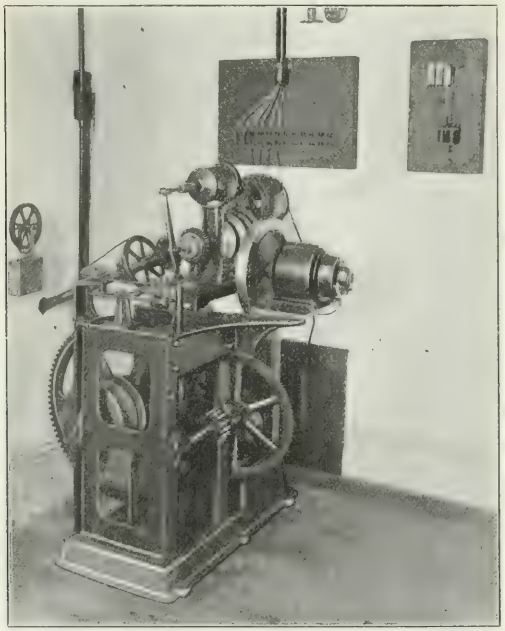


FIG. 11.—END VIEW OF DRIVING MECHANISM OF 60-IN. COMMON TELESCOPE.

by appropriate mirrors, and the observer carries on his work in a comfortable room, shown in illustration (Fig. 8), all motions of the telescope being readily controlled by switches mounted on a table at the observer's right. The movement of the telescope in right ascension is effected by a motor installed to give it a rapid motion through a drum and steel cables, and also through a sector, not shown in the illustration, which may be driven slowly by a separate motor or in synchronism with an astronomical clock through an automatic governor and relay circuit. The exact position of the telescope in both right ascension and declination is indicated on two scales shown in the observing-room photograph above the table where the operating levers for the telescope are located. These scales are moved by piano wires attached to the telescope, the wires being installed on drums with a sheave and weight compensation which maintains a constant length of wire under all conditions of position and temperature.

The mechanism by which the Common telescope is driven is

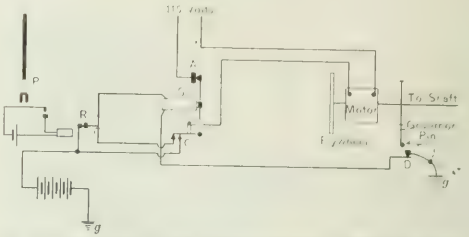


FIG. 12.—METHOD OF SYNCHRONIZING 60-IN. TELESCOPE DRIVE.

shown in Figs. 10 and 11. Five motors are installed. For movements in declination two motors are mounted in a box on the outside of the frame. One is a 1/16-hp motor in a ¼-hp frame, for slow motion, and the other is a ¼-hp motor in a ¾-hp frame, for fast motion. Inside the building is the main driving machinery for right ascension movements. For giving the telescope fast motion either with or against the rotation of the earth, a ¼-hp motor in a ¾-hp frame is provided. The drive is through gearing and a windlass, shown in the illustration, the motor being the one mounted on the bottom of the machine frame. The slow motions of the telescope in right ascension are handled by a 1/16-hp motor in a ¼-hp frame, shown in the uppermost corner of the machine. The motion of the telescope in synchronism with passing heavenly bodies is effected by a ⅛-hp motor in a ¼-hp frame. This motor is provided with a flywheel, shown in the illustration, and it, together with the slow-motion motor, drives the telescope by means of a planetary and bevel-gear combination leading ultimately to the main steel driving shaft of the reflector. Near the top of the machine is a solenoid which cuts out the slow-motion and synchronized-motor gearing when it is desired to turn the sector of the telescope back to zero, and outside the building a similar solenoid disconnects the sector from the telescope. When the observations have ceased on any given object, it is expedient to bring the sector back to zero to allow for two or three hours' forward run, on other work, and the accomplishment of this task by the clock-motor through a belt tightened by the solenoid, while the telescope is being turned by the windlass motor, illustrates a convenience which would be difficult to obtain in any other way than by electricity.

The vital part of the problem of telescope driving is the question of governing the motion to secure practically perfect accuracy of rotation as the earth revolves away from the object under observation. This is accomplished by synchronizing the governor with the controlling clock. The general arrangement of the apparatus is shown in the above sketch (Fig. 12). Current to the motor is supplied by the 110-volt circuit through the contact *A*, which in reality consists of six breaks of ⅛ in. each in series. The switch *A* is operated by an electromagnet *S* in an auxiliary circuit of low potential supplied by a battery. This auxiliary circuit also includes a contact *R* operated by a relay in the circuit controlled by the pendulum *P*, which makes one vibration per second, and a releasing contact *D* or governor, which is momentarily opened at each revolution by a wheel in the telescope machinery, which should, when driven at the proper rate, revolve one turn per second. The relay contact *R* is provided with a locking contact *C* so arranged that when the circuit through the magnet *S* is once closed by the clock

contact *R* it cannot be opened except by the releasing contact *D* on the governor.

The method of operation is as follows: The clock pendulum closes the auxiliary circuit through the magnet *S*, the armature of which turns on the power at the motor. The motor frames are larger than necessary to enable the machines to start without rheostats. The motor starts and accelerates until the telescope is moved far enough to operate the releasing pin on the governor wheel, when the power is cut off at *A*. The machinery continues its motion by virtue of its inertia, to which is added that of the motor flywheel. The clock again closes the circuit on the return of the pendulum, and the cycle is repeated, with impulses applied each second. If the telescope should run a little too fast, the interval between the closing of the circuit by the clock and its opening by the governor wheel pin decreases, and a correspondingly shorter interval of power is applied, causing an immediate reduction in speed. If the speed of the telescope is too low during any given second, the interval of power application is correspondingly increased and the speed increases. The governor with the aid of the flywheel soon establishes a mean speed which corresponds exactly to the beats of the pendulum, and the small variations which occur during the second intervals are too minute to be appreciable.

The above work has been done under the general administration of Prof. E. C. Pickering, director, by Mr. Willard P. Gerrish, mechanical and electrical engineer of the observatory, who is the designer of the apparatus here described.

Auxiliary Steam-Driven Electric Station at Rome, Italy.

By S. B. Jones.

THE greater part of the electricity used in Rome, Italy, at the present time, both for lamps and tramways, is furnished from three plants of the Società Anglo-Romana per l'Illuminazione di Roma. Two of these are hydraulic and one steam. The largest is situated at Tivoli, about 28 km from the city, and has an output of 12,000 kw at 10,000 volts. Further into the mountains, at Subiaco, is the second hydraulic plant with two 3500-kw generators, and generating 30,000 volts direct. The third and oldest, a steam plant, is within the city walls and on the site of the ancient Circus Maximus. In this plant are four 850-hp non-condensing reciprocating engines, direct connected to alternators wound for 8800 volts. The system throughout is operated at approximately 44 cycles. At the peak of the load the machines are speeded up to give better regulation in the city. For various reasons, among which is the desire of the authorities to continue the archæological exploration in this direction, the company decided to change the position of the steam plant and to enlarge it at the same time. Since the steam plant had always been used as a standby for peak loads and in case of trouble, the construction of a modern plant in a location allowing for expansion was decided upon, this course permitting the old station to be kept in readiness.



FIG. 1.—GENERAL VIEW OF POWER HOUSE AND INTAKE CANAL.

The site of the new plant is on the bank of the Tiber between the city wall and the church of San Paolo. Being on the river and near the railway, coal can be brought to the power house either by water or rail, since the Tiber is navigable for coal barges to this point. At present the coal is brought up the river and discharged into small cars on a temporary railway running to the coal-storage building. The building itself runs parallel with the engine-room, the boiler-room being at right angles to the engine-room and extending toward it. The inside dimensions are; Length, 148 m (485 ft.); and width, 16 m (52 ft.), which allows a depth of coal of about 6 m (19.6 ft.) over the entire floor. Commanding the floor is an electric bridge crane with a clam-shell bucket. The crane discharges the fuel into the filling bin which feeds it into a bucket chain conveyor. The conveyor passes through a tunnel for about 10 m (32.8 ft.), and then rises vertically to a level above the ash-bin and storage-bins in the boiler-room. Passing to the back of the engine-room, to the driving gear and motor, it drops vertically to the cellar and runs horizontally to the storage building, completing the cycle. When not in use for handling coal, the conveyor is used to discharge the ashes, which are shoveled into the conveyor on its way through the cellar. At normal working

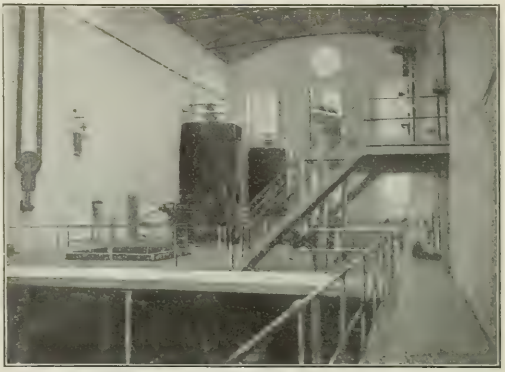


FIG. 2.—GENERAL VIEW OF ENGINE ROOM.



FIG. 3.—SWITCHBOARD GALLERY.

the conveyor will handle approximately 30 to 35 tons of coal per hour.

The storage-bins in the boiler-room are directly over the firing aisle between the two rows of boilers. From these bins the coal goes into mechanical stokers furnished by the Düsseldorf Mechanical Stoker Company. The stokers are of the top-feed type, the movement of the coal being produced by the grate bars moving alternately outward and then altogether inward, the rate of feed being controlled by changing the speed on cone

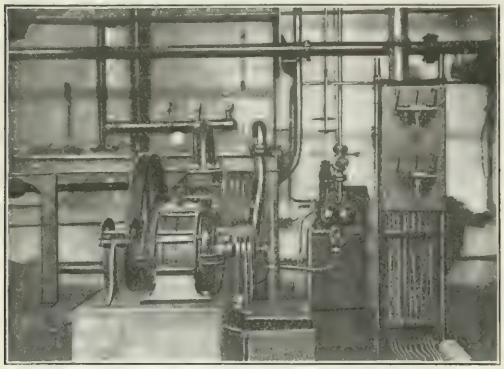


FIG. 4.—OIL PUMPS AND FILTER.

pulleys. The grate bars extend the length of the furnace, and have a surface of 6.5 sq. m (69.5 sq. ft.). For smokeless combustion the boilers are furnished with "Dutch ovens."

The boilers are of the water-tube type, furnished by Clarke, Chapman & Company, Gateshead, Eng. There are six batteries at present, three batteries on either side of the boiler-room, two boilers to the battery, with ample space between batteries to allow for cleaning, and between rows for a firing aisle. Each boiler is designed to evaporate 5000 kg (11,025 lb.) per hour, and has a sufficiently large superheater installed in each setting to give steam at 300 C. at full load on boiler. The boilers differ somewhat from the ordinary type of water-tube boiler. They resemble the Stirling type, but have six steel drums, three above and three below. All the vertical tubes are straight and are arranged under manholes in the top drum in elliptical nests, so that it is possible to remove any tube without disturbing any of the others by removing two manhole covers.

Running around the boiler-room is a 10-in. closed circuit header of rectangular shape, with a steam separator at each of the angles next the engine-room, and an 8-in. tap running to the turbines in the engine-room. On each of the connections between the boilers and the header are two valves, a gate valve next the header, and a non-return valve next the boiler to prevent the pipe from filling with water when cut out of service. In the header itself are valves for sectionalizing it. The valves throughout are of cast steel with brass gates, and are made with the gate of reduced area—that is, the area of the passage through the valve is reduced to one-quarter of the area of the pipe, the approach and discharge being designed to give theoretically the least resistance to the steam. On valves with steam flowing only in one direction, the inlet angle is wider than the outlet, but where the valve is used for steam passing in both directions both sides are equal and of the same angularity as the discharge of the other valves.

Under normal conditions the feed water for the boilers is taken from a small stream flowing through an underground canal near the plant. In dry weather it may also be taken from the Tiber or the city water mains. The water is taken from the river to two tanks mounted on steel towers at each side of the boiler-room, by means of two single-stage centrifugal pumps, direct-connected to motors. From the tanks the water passes through two filters to the boiler-feed pumps. The latter are five-stage, centrifugal pumps and each is large enough to feed all the boilers. In addition each boiler is fitted with an injector. Before entering the boilers, the water goes through Green fuel economizers. The gases from the boilers after passing through the economizers follow a concrete breeching to the stacks at the end of the boiler nearest the coal storage. Each row of boilers discharges into a separate concrete stack 55 m (180 ft.) high and 3 m (9.8 ft.) internal diameter. Between each stack and boilers is installed an induced draft fan, which under normal conditions is cut out; but when forcing fires for a quick start, or under heavy overloads, it may be cut in by dampers. For sampling the gases a CO_2 apparatus permanently connected to all boilers is used.

The engine-room is 60 m (196.8 ft.) long and 14 m (46 ft.) wide, with space for 20,000 kw of electrical equipment. At present there are two 3500-kw units installed, leaving space for about 13,000 kw more. The two present units consist of Curtis turbines direct connected to 3500-kw, 8800-volt, three-phase alternators, giving normally 42 cycles, but with a governor allowing regulation from 40 to 44 cycles. The turbines take steam at 275 deg. C., 12-kg (170 lb.) pressure.

The condensing equipment of each turbine consists of a surface condenser with the necessary circulating and wet vacuum pump. The circulating pump is direct connected to an induction motor. The wet vacuum pump is belted to an induction motor. The circulating water comes from the Tiber through two intake canals, which may be used separately or together, or as a cooling tank by taking from one and discharging into the other; the discharge water normally returning to the Tiber through a tunnel. Since the canals are above the level of the river, the water is lifted by two single-stage centrifugal pumps in a pump-house near the river. Each pump has a capacity of 1500 cu. m per hour against a 7 m head. The pumps are vertical and direct connected to induction motors. On leaving the condenser, the circulating water is discharged through a tunnel to the river. In order to get full advantage of the vacuum due to the draft tube formed by the discharge of the condenser, an air trap is fitted on the top of the discharge of the condenser for removing any air that might become entrained in the circulating water. In starting the air is removed by a steam injector, but after the air pump is started the injector is cut off and the pump takes care of the air by means of a small pipe fitted for the purpose.

The oil for the middle bearing, top bearing and governor of the turbine is furnished by two electric and one steam pump at 10 kg (142 lb.) pressure, any one of the pumps being large



FIG. 5.—BOILER ROOM SHOWING AUTOMATIC STOKERS.

enough for both machines. The oil for the step bearings is furnished by two electric and one steam pump at 55 kg (782 lb.) pressure, each pump being of sufficient size to care for both machines. Although the steam pump is arranged to start automatically, for greater safety an accumulator is also used, having sufficient capacity to furnish oil for both machines for

five minutes. Each oiling system has a combined Turner oil tank and filter. Within each tank are a set of coils for cooling the oil, and the cooling water after passing through the coils goes to the hot well. The motors for the induced draft and stoker pumps are direct-current machines operating either from the exciter circuits, or in case of absolute shutdown of the other stations, from storage batteries. This method is used so that the plant can be put into commission at any time without external power. The storage battery furnishes excitation for the alternators also when starting. The other auxiliaries throughout are driven by three-phase, 220-volt induction motors with external resistance in the rotor. The direct-current motors were furnished by the General Electric Company, and the induction motors were supplied by the British Thomson-Houston Company.

On a gallery near the center of the engine-room are the switchboards. The benchboard is on the front of the gallery overlooking the generators; the exciter and feeder board being at the back of the gallery next the wall. The benchboard is of blue Vermont marble. Two panels on each end control four alternators, two already installed and two future units. The center panel carries the control switch for paralleling the two sets of busbars, and indicating lamps showing how many feeders are connected and to which set of bars. The vertical board is of blue Vermont marble also, and is made up of 10 three-section panels; five panels carry control switches for feeders, four control outgoing feeders and one controls the auxiliaries within the station. The feeders to the city take a current of 8800 volts.

The station feeder connects to three single-phase transformers stepping down to 220 volts. One panel is a combination booster and battery panel, with direct-current feeders to the induced draft fan and stoker pumps. Two panels control the exciters, only one pole being brought to the switchboard; the remaining panel is blank and is intended for a future exciter. The excitation of the alternators is controlled from the generator panels on the benchboard, through remote-control field switches and solenoid-operated rheostats. A Tirrill regulator with connections for four alternators is mounted on a bracket at the end of the benchboard. On the basement floor beneath the switchboard are placed the exciters and booster. The exciters are motor-generator sets. The motors are rated at 135 hp, 220 volt, alternating current; the generators are rated at 90 kw, 125 volts. For charging the storage battery a motor-generator booster set is installed alongside of the exciters. The motor is a 125-volt, direct-current, variable-speed machine, and the generator is rated at 400 amp and 55 volts.

Immediately back of the switchboard are the oil switch, busbar, storage battery and transformer rooms. The 8800-volt oil switches are motor operated. Below the switches are the busbar-rooms with two entirely separate sets of busbars installed in concrete cells, with their sectionalizing and disconnecting switches. Adjoining this room on the right is the transformer room for the station service, also the low-tension switchboard for supplying the individual apparatus. Each motor or group of motors in the station has its own panel with ammeter, voltmeter or indicating lamp, and three-pole circuit-breaker. The wiring for the engine-room auxiliaries runs beneath the floor in troughs, and the wires for the boiler-room and other auxiliary apparatus are run overhead. Further to the right of the transformer room is the storage-battery room. The storage battery consists of 60 elements with a capacity of 400 amp hours.

The feeders for the city run underground, three-phase, lead-covered cables with steel armor being employed. They are laid in trenches with no further protection than a thin creosoted wooden box. The joints are made with cast-iron junction boxes and filled with compound. The feeders for the pump-house at the Tiber are of the same type, but carry low-tension current. All of the switchboard, including the oil switches and individual panels, was furnished by the General Electric Company, the engineers and contractors being the Cie. Française Thomson Houston.

The Design and Operation of Jump-Spark Coils.

BY F. W. SPRINGER.

SOME of the points involved in the design and operation of jump-spark coils have been touched upon in former articles[1] by the present writer. The article below represents an attempt to distinguish between the "arc" and the "spark" as generated by jump-spark coils of the vibrating and non-vibrating types.

In order to investigate all of the factors concerned, the complete cycle of events occurring during the operation of a coil will be enumerated.

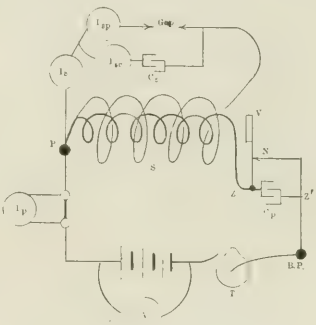


FIG. 1.—VIBRATING JUMP-SPARK CIRCUITS.

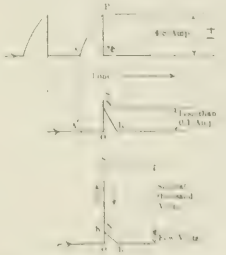
A diagrammatic sketch of the common vibrating jump-spark coil is given in Fig. 1. By eliminating the condenser C_p and vibrator V, there would be obtained the common non-vibrating coil. In the latter case a condenser C_p should be connected around the timer T.

The data given with the figures are those of the Loiseaux Brunet Frères coil, which have been previously described in these columns.[2]

The cycle of events is as follows:

The current, I_p, rises in the primary on the curve AP (Fig. 2). Generally this curve will be nearly straight, as it should be in order to obtain a high core charging efficiency.

The counter e.m.f. generated during the increase in current, I_p, will be a maximum at A (Fig. 2). At this point it will just



FIGS. 2, 3 AND 4. PRIMARY CURRENT, SECONDARY CURRENT AND SPARK VOLTAGE.

equal the battery voltage. Since the total lines of force also cut the secondary coil of Ns turns, the e.m.f. in the latter will be equal to the battery voltage multiplied by $Ns \div Np$.

The secondary e.m.f. occurring at A^1 (Fig. 3), etc., will usually be of the order of 500 volts, which is not sufficient to jump any ordinary spark gap, but it will cause a surge of current in

[1] Electrical World, Dec. 8 and 29, 1906; Dec. 14, 1907.
[2] Electrical World, Dec. 8, 1906.

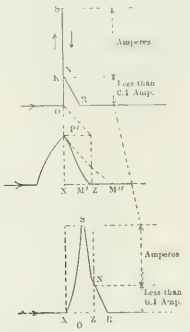
the secondary coil, S, charging the spark terminals, etc., as a condenser.

There should result a surge in the secondary circuit whose effects will be $I^2_s R_s$ losses and a tendency to cause the primary current to build up on a more nearly vertical line; that is, to reach its full value more rapidly. There may be several surges as the voltage falls, but they will be of high frequency and correspondingly weak.

At P, Fig. 2, the vibrator (or timer) opens the circuit, the primary current, falling on the line PM. If there is no arcing at the vibrator (or timer) the flux will decrease at a maximum rate near point P, Fig. 2. The sudden change in flux will produce a high voltage E_s in the secondary coil S, and establish the secondary, or spark, current ONR, Fig. 3. The secondary voltage curve will be as indicated in Fig. 4, OSN (double line) being the jumping voltage and ONR the potential between the spark points which maintains the "arc."

Since the spark points are first statically charged by the voltage OS, Fig. 4, the static discharge current, or the "spark," may be shown as $OKSN$, Fig. 5.

If the vibrator opens with no arcing—that is, with an absolutely instantaneous break—the primary current will fall on a line, PM, Fig. 2, which corresponds to a charging curve of a condenser. If, then, we imagine the time of PM to be widened



FIGS. 5, 6 AND 7.—SPARK RECORD, TIME OF BREAK MAGNIFIED AND STATIC DISCHARGE MAGNIFIED.

to XZ, Fig. 6, to represent perhaps millionths of a second, while AM represents thousandths of a second, Fig. 2 will appear as Fig. 6.

If there is arcing at the vibrator, or if a primary condenser of very large capacity is used, $P'M'$ might appear as is shown by the dotted line $P'M''$. In this case the form of PM would be affected by the secondary coil conditions.

By widening OKS of Fig. 5 in a similar way, XSN of Fig. 7 is the "spark" and ZNR is the "arc" of the secondary current, shown by $OSNR$ of Figs. 3 and 5.

The condenser C_p will be charged at $P'M'$, Fig. 6, by a pressure of the order of 100 volts and about equal to the battery voltage plus $\frac{N_p}{N_s}$ times the secondary voltage OS, Fig. 4, although it is possible that this pressure will not be maintained long enough on XZ, Fig. 7, to charge the condenser fully.

Since at some point below P, Fig. 2, the secondary current is established, the primary ampere turns, $N_p I_p$, are replaced by $N_s I_s$, and the discharge of the electroc-magnetic energy $\frac{L_p I_p^2}{2}$ of the core takes place in the secondary coil on the line NR of Fig. 5. During or immediately following the discharge the charge in the primary condenser C_p is released, and flows back through the battery, etc.

If the secondary gap is too long to be jumped, all the secondary magnetic energy will appear only as static electricity, which will charge the spark points and wires of the secondary coil and then surge back and forth until frittered out. At the same time the charge in the condenser C_p will also surge in the primary coil, the primary and secondary surges affecting each other in a way depending upon the natural resonance periods of the two circuits. A primary coil back surge charges the battery.

If the secondary coil has no gap, being short circuited, a secondary current will be produced, both during the make and break, of practically the same quantity, although of differing half-wave forms. (See *Electrical World*, Fig. 5, p. 1242, Dec. 25, 1906.) There will be no static charge in this case in the secondary circuit.

It is to be noted that XSN of Fig. 7 represents the static discharge in the spark-gap of the "spark," OS representing the maximum spark current in amperes. ZNR is the "arc"that follows. The first is so rapid as to be detonative in character and has a value depending on the capacity of the condenser C_s or upon the capacity of the spark-gap, etc.

Beginning at some point on XS, Fig. 7, a brush discharge occurs, the gap becoming filled with ionized particles, which finally establish a "spark" at S, liberating the static energy. The electromagnetic discharge then follows. The part XSN is too rapid to be recorded by the oscillograph, while NR lasts a few thousandths of a second or until the arc breaks at R. When the arc breaks no doubt there is some energy still in the core. This energy is frittered away by primary and secondary coil surges, which are damped by the copper, iron and condenser losses of the primary and secondary circuits.

Repeated oscillograph and other tests of many spark coils lead the writer to believe that the conditions mentioned in connection with PM and ON above, Figs. 2 and 3, are very important ones in the design and operation of spark coils. All electrical, magnetic and physical constants and their inter-relations are involved therein. For instance, the capacity of the condenser C_p affects the character of the spark by its back surge, as well as enabling the spark to be produced by allowing the vibrator to open without arcing. Upon the capacity of the condenser depends also the rapidity with which the primary current I_p is stopped, and thus also the maximum value of the secondary voltage E_s.

An interesting accident led to the study of the static discharge. Most of the records of the writer were made by means of a Duddell oscillograph, which has metal fuses. Several years ago a General Electric instrument was put into service on spark-coil tests because it was more easily adjusted than the older type. Gold-foil fuses on paper were used in series with the oscillograph strips. These would not last long enough to obtain a record of the secondary or spark current, burning up in one or more seconds, and stopping the secondary current by introducing a large gap. This current was measured at I_s, Fig. 1, and the fuse burning occurred in spite of the fact that the current actually recorded by the primary-coil galvanometer was several times as large; also notwithstanding that the fuses carried 0.5 amp direct current without burning out. The latter test was made at 500 volts with a lamp resistor.

A special test of gold-strip fuses, placed in clamps and connected in series with an adjustable spark-gap connected to the secondary of a Loiseaux coil operated by three storage cells, gave the following results:

With spark-gaps varying from 0.3 in. to 0.02 in., the fuses burned in a few seconds after starting the coil, the flame beginning at either end, depending upon the direction of the secondary current. The length of time required to burn the fuse varied with the length of the spark-gap, and some other conditions not as yet understood.

When the spark-gap was closed so that there was no storage of static charges the fuses lasted indefinitely, showing no signs of burning, although the average current, as recorded by the oscillograph, was found to be many times as large as when the spark-gap was open. On opening the spark-gap slowly while the coil was in operation, it was found that the fuse also held indefinitely, until the spark reached a length of approximately 0.02 in., with the particular coil and existing conditions.

In an endeavor to explain the burning of the fuses, all previous spark records were studied to find out whether there had

been a ballistic throw of the oscillograph. Out of more than 100 records, two plates were discovered which showed a faint line at *SN*, Fig. 3. One of these plates was made with a Duddell and the other with a General Electric oscillograph, using the same spark coil (Loiseaux Brunet Frères). Any very wide movement of the strip and mirror at a speed approaching that of its natural period (5000 to 8000 per second), such as that caused by a large momentary current, would not be likely to be seen at all on the plate, and it required some imagination to see the ballistic record on the two plates above. This result will be referred to again later.

The energy appearing in the spark-gap may be classified as follows: 1. Brush discharge. 2. Spark or static discharge, like that from a Leyden jar. 3. Arc or electromagnetic discharge. 4. Heat energy from the brush, static and arc discharges. 5. Electromagnetic wave, as in wireless telegraphy, largely from the static discharge. 6. Sound wave, largely from the spark (2) above, consisting of a very short, dense wave, spreading out from the gap like an enlarging shell.

It should be evident that, by the use of a variable secondary or spark-gap condenser, C_s, Fig. 1, connected in parallel, and by varying the length of the gap, the form and characteristics of the spark-gap energy may be varied at will as follows:

(a) A long spark-gap and a condenser C_s of as large a capacity as may be used without absorbing all of the spark will produce a brilliant white, *fat-appearing* spark and giving forth much sound.

Its duration is so brief that its image cannot readily be spread out when viewed in a revolving mirror. Blowing upon it has no effect. It will not readily ignite paper, but will explode or burst holes in the paper. It is estimated by Thomson that the pressure in the path of a "spark" is more than 660 atmospheres. This is due, no doubt, to the sudden heating of the medium in the spark path and to the pinch effect of the magnetic lines of force.

Investigations have been made along these lines during the past three years in order to devise a spark coil to be used with a spark recorder (*Electrical World*, July 21, 1906, page 134). With certain coils, a short gap and a condenser C_s of large capacity, spark records have been obtained which a blind man could interpret. Resonance is not necessary to obtain these results.

(b) With the proper adjustment of the capacity of the condenser C_s, consisting of a few square inches of tin-foil on opposite sides of window glass, resonance sparks may be produced. Sometimes five or six may be counted in a rocking or revolving mirror. These sparks will have the characteristics of the static sparks mentioned above, the total energy being divided among a number of sparks.

(c) If no secondary condenser is used, and especially with a rather short gap, an arc will occur lasting several thousandths of a second. This "arc" is violet, yellow and red in color, much less brilliant than the "spark" noted above, and when its image is viewed in a revolving mirror it appears spread out into a long band of flame. It is greatly changed by blowing upon it. It will readily ignite paper—that is, it burns, but does not explode the holes. In general, this "arc" has the characteristics of the common direct-current arc.

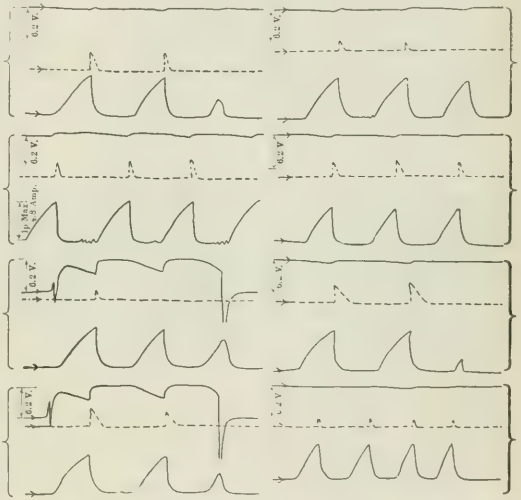
A number of oscillograms were made, shown in Figs. 8, 9, 10, 11, 12, 13 and 14, using the Loiseaux coil with parallel secondary condensers about the spark-gap, a three-cell storage battery and different lengths of spark-gap. Fig. 15 was obtained with a series condenser, the capacity of which was adjusted to produce resonance. There were between 100 and 125 vibrations per second.

In the accompanying oscillograms, Fig. 8 shows the battery voltage, the spark current and the primary current, the arrangement used being that indicated in Fig. 1; the spark-gap measured 0.25 in. and the secondary capacity zero. Fig. 9 refers to conditions similar to those of Fig. 8 except that the secondary capacity C_s had the value given by a condenser formed of two conductors 20 sq. cm in area separated by window glass. In Fig. 10 the condenser area was increased to 50 sq. cm; the e.m.f. in this case was measured between P and BP, Fig. 1. In Fig. 11 the capacity was decreased to zero and the spark-gap was decreased to 0.05 in. Fig. 12 shows the results for conditions similar to those of Fig. 11 except that the condenser had an area of 25 sq. cm. In Fig. 13 the spark-gap was decreased to 0.004 in. and the condenser area was increased to 670 sq. cm. Fig. 14 was obtained when the capacity was zero and the spark-gap length 0.004 in. Fig. 15 shows the results when the secondary condenser was given such a capacity as to produce resonance.

A study of the spark records shows that the shorter the gap, the larger will be the recorded electromagnetic discharge (longer and higher records); and the larger the capacity of the secondary condenser C_s, the less will be the secondary *recorded* current.

A few calculations were undertaken in order that the maximum static discharge current OS, Fig. 7, might be estimated, as follows:

The time, XZ, must be less than the width of the line ON, PM, etc., or of the order of 0.000001 second. The maximum voltage OS, of Fig. 4, may be taken in an illustrative case as 6000 volts. The secondary capacity might be, for example, 0.00001 microfarad or more. The resistance of the spark varies



FIGS. 8, 9, 10 AND 11.—OSCILLOGRAMS.

FIGS. 12, 13, 14 AND 15.—OSCILLOGRAMS.

from infinity at X to a few ohms at Z, Fig. 7. According to Slaby, the resistance of a 3 mm spark gap is 2.3 ohms. On the basis that the time record of a spark should be as shown in Fig. 5 and illustrated in Fig. 7, the secondary energy J may be divided into two parts, as illustrated in Fig. 7, into the "static," $C_s E^2_{max}$

$$J_{cap} = \frac{C_s E^2_{max}}{2} = \frac{6000^2}{2} \cdot \frac{0.00001}{1,000,000}$$

$$= 0.00018 \text{ joule or watt-second.}$$

Since $J = I_{av} \times t \times \frac{E_{max}}{2}$

then $0.00018 = I_{av} \times 0.000001 \times \frac{6000}{2}$ and $I_{av} = 0.6$ amp, and the maximum secondary current, I_s, would be much larger.

Again, since the discharge of a condenser when time t equals zero, gives $I = \frac{E}{R}$ where I is the initial discharge of the condenser as at OS, Fig. 7, and E is the maximum voltage OS, Fig. 4, there results $I = \frac{6000}{R}$. Inasmuch as the gap is broken down at this point, R is small, thus making I very large. This

current is that in the gap and not necessarily in the secondary coil.

There seems to be little *experimental* evidence as to which form of energy is the most efficient in ignition. In regard to a pure static discharge, everyone is familiar with the ignition of a gas flame by rubbing the feet on the carpet and permitting a spark to jump from one's finger to the fixture. Moreover, it is well known that a Leyden jar discharge will blow grains of gunpowder to pieces without igniting them, and that they will be ignited if the discharge is passed through a wet string of high resistance. Lightning strokes similarly have great explosive and bursting power, but generally fail to ignite solid combustibles, although an electric arc of small power and energy will generally do so.

Just what relative igniting effect *XSZ* (Fig. 7) has as compared to that of *ONR*, is thus not absolutely known. It would seem, however, that a very explosive mixture would respond to the detonative effect of *XSZ* and that a weak mixture would be more readily ignited by energy in the form of a slow arc (0.001 second) as *ONR*. Therefore, in a gas engine a *hot arc* is what is desired and not a brilliant and apparently hot, fat "spark"; the hot arc should, however, be bunched as much as possible.

A very excellent conception of the distinctions noted above may be obtained by watching the image of the spark in a rapidly rocking mirror or in a cube-shaped mirror mounted on a motor-shaft. One may also use a double-plane mirror mounted across the diameter of rotation and perpendicular to the plan of rotation, meanwhile varying the length of the spark-gap, with and without different amounts of series and parallel secondary capacity. The length, size, shape, colors, amount of flame, noise, amount of ozone generated, brush discharge, ability to puncture paper, and whether holes are burned or burst out, ability to ignite the corner or middle of a sheet of paper, oscillations of the spark, duration of the spark and arc, and other characteristics may be noted.

The length of the arc may be determined by a micrometer-screw fitted with conical-shaped brass spark-points. The amount of flame may be determined by color of the arc, by blowing upon it while viewing it in a mirror rocked rapidly by hand, or by using a mirror mounted on a motor-shaft. The duration of the arc and spark, and the presence of oscillations, can be determined by the use of the revolving mirror. If the speed of the mirror is known, the duration of the visible arc in seconds may be calculated, or in case of resonance, the time between sparks may be measured and the frequency calculated.

Another simple way to determine the duration of the "arc" is to mount the spark-gap on the end of a revolving wheel spoke, thereby noting its apparent length.

DESIGN AND RESONANCE.

If the vibrator opens the primary circuit instantaneously at *P*, Fig. 2, the core will be charged with $J_p = \frac{LI^2}{2} = 0.048$ watt-second or joule of energy, and the circuit will be as shown in Fig. 16. If there be no secondary coil, the above magnetic energy will be changed to dynamic energy which will charge the condenser C_p. Assuming that there are no appreciable hysteresis or eddy currents in the core, no copper losses in the coil *P* and circuit, and no dielectric losses, the 0.048 watt-second will appear as static energy.

$$J_{cap} = \frac{CE^2}{2} = 0.048 = \frac{0.16\,E^2_p}{2{,}000{,}000}$$

from which $E_p = 784$ volts.

Another way of calculating the maximum primary e.m.f. is:

$$E_p = I_{max}\sqrt{\frac{L}{C}} = 4.7\sqrt{\frac{0.0043}{0.16}} = 722 \text{ volts}$$
$$1{,}000{,}000$$

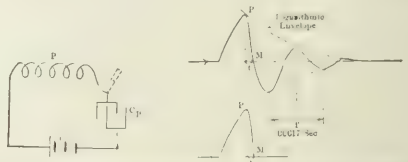
This static energy again changes to the current form, then into magnetic energy with $I_p = 0$, etc., surging back and forth indefinitely. The battery e.m.f. affects the form of the surge [illegible].

If, however, there is resistance in the coil and circuit, iron and dielectric losses, some of the energy will disappear during each surge, as in Fig. 17. All causes of loss of energy may well be expressed as an *equivalent resistance*, R_p. From the standpoint of design, the above losses during one surge should never exceed a small per cent of the total energy.

The period T_p of the above resonance surges may be readily calculated from the simple equation $T_p = 2\pi\sqrt{L_pC_p} = 0.00017$ second, shown in Fig. 17. The frequency, $f = \frac{1}{T} = 6020$ complete oscillations per second, which is rather too high for the ordinary oscillograph.

If the equivalent resistance, R_p, of the above primary circuit is such that R is greater than $\sqrt{\frac{4L}{C}}$, or if R_p is greater than 316 ohms, the surge will be unidirectional and the primary current will continue in the same direction, dying out without passing through zero. A secondary coil would absorb energy from the primary during each surge, and would, therefore, act as an equivalent resistance R_p in the primary circuit, as in Figs. 2 and 18.

Referring again to Fig. 17, it is seen that if the frequency f be made very great and T very small, then the speed of cutting lines of force, shown by time t, will be great. The problem then is to reduce t to as near nothing as possible and to have a unidirectional half-surge, as shown in Fig. 18. Moreover,



FIGS. 16, 17 AND 18.—CIRCUITS AND OSCILLOGRAMS FOR RESONANCE.

large losses in the primary circuit are not permissible so that R_p should represent only the absorption of energy by the secondary coil.

Since the self-induction L_p of the primary coil is fixed by considerations taken up in previous papers, concerning I_p and J_p, or the energy of the spark, it is evident that f cannot be increased except by reducing the capacity of the primary condenser C_p. This, however, cannot be done without arcing at the vibrator, which would tend to prolong the surge or increase t. Hence, there must be more speed in the vibrator in order that C_p may be reduced and f increased.

The above discussion regarding the capacity of C_p also applies to the use of a condenser, C_p', in parallel with the timer of a non-vibrating coil. Hence, a snap-break timer, with a condenser, should be used on motor cycles with a non-vibrating coil for high battery efficiency.

With the above desirable features in the primary coil, it would require comparatively few turns (N_s) on the secondary to cause a spark to jump the gap. The resistance R_s could be made small, and practically all of the energy, transferred to the secondary coil as dynamic energy, would appear as heat in the spark-gap.

$$E_s = E_p\frac{N_s}{N_p} = E_p\sqrt{\frac{L_s}{L_p}} = 722\sqrt{\frac{20.8}{0.0043}} = 50{,}000 \text{ volts},$$

a voltage which is practically unattainable because of the *slowness* of the break at the vibrator. About 15,000 volts were obtained from the coil used by the author. A vibrator should be designed which would open with the speed of a rifle bullet.

SECONDARY-COIL RESONANCE.

By placing a condenser C_s consisting of two sheets of tin-foil, each approximately 25 sq. cm in area, on opposite sides of a sheet of glass of about 0.25 cm in thickness, in parallel with the spark-gap, resonance sparks were produced.

$$C_s = \frac{KAN}{4\pi d\,900{,}000} = \frac{7 \times 25 \times 1}{4\pi\,0.25 \times 900{,}000} = 0.00006 \; mf.$$

The secondary capacity which would produce resonance of

the same frequency (T_p) as that of the primary circuit of the coil is calculated thus:

$T_s = 2\pi\sqrt{L_s C_s}$, from $2\pi f L = \frac{1}{2\pi f C}$, which is the condition for resonance for a frequency f.

$$0.00017 = 2\pi\sqrt{20.3\, C_s}$$
$$C_s = 0.00004\ mf.$$

This capacity is so small as to be comparable with the capacity of the secondary windings, spark coils and spark points.

CONCLUSIONS.

The method of designing spark coils have greatly inmproved during the past few years, mainly by securing a more rapid break, as by using hammer blows, vibration waves in a thin metal spring, etc. It would seem from the considerations of the above conditions that, by the use of a single spark and a still more rapid break, the spark-coil efficiency might easily be increased to 50 or 60 per cent.

Long Distance Transmission in Wisconsin.

The Southern Wisconsin Power Company is hurrying to completion its hydro-electric generating station near Kilbourn on the Wisconsin River, and its 110-mile, 66,000-volt transmission

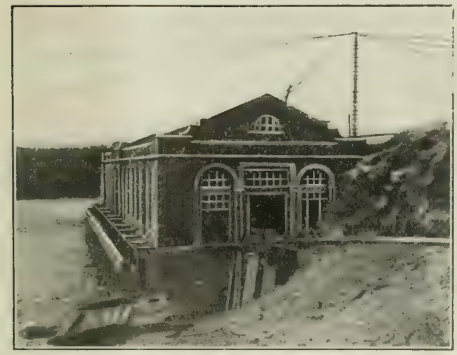


FIG. 1.—KILBOURN HYDRO-ELECTRIC POWER HOUSE.

system for supplying energy to the 13,200-volt distributing system of the Milwaukee Electric Railway & Light Company. It is probable that the installation will be completed and in operation during this month.

The generating equipment at the Kilbourn plant comprises four 2300-volt, three-phase, 25-cycle alternators having an aggregate rating of 10,000 kw. These machines, with the transformers for raising the e.m.f. to 66,000 volts, and the auxiliary electrical apparatus, are of General Electric manufacture.

The transmission circuits consist of six wires having the equivalent conductivity of a No. 0 copper wire. One-half of the conducting material is copper and the other aluminum. The two three-phase circuits are erected in separate vertical planes, being suspended by Thomas disk-type insulators from cross-arms on Aermotor steel towers. The height from the ground at the lowest wire is 40 ft. The towers are of the lattice-work windmill type erected on four reinforced concrete bases. A view of the transmission line erected along the route of a railway system to which it feeds energy is shown herewith.

The substation for lowering the e.m.f. from 66,000 to 13,200 volts for the Milwaukee system will contain six 2000-kw Allis-Chalmers transformers. The energy will be employed for supplementing the present supply from the steam-engine-driven generating station in Milwaukee. One of the uses to which this energy is now being put is the operation of a single-phase, 25-cycle railway. This railway is now being equipped with



FIG. 2.—DOUBLE THREE-PHASE 6600-VOLT TRANSMISSION LINE AND RAILWAY CIRCUIT.

1200-volt, direct-current apparatus, the energy for which will be obtained through 600-volt, rotary-converters connected in series. Both the older and the new equipment were built by the General Electric Company, which suggested the change from single-phase to direct current.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

Shop Window Lighting in Fort Smith, Ark.

At the May meeting of the Associated Retailers of Fort Smith, Ark., the question of window lighting was taken up, with the result that a resolution was adopted to the effect that all members of the association should light their windows at dusk and keep them lighted until 11 or 12 o'clock. Owners of some of the larger stores spoke very strongly in favor of this resolution, giving results of their own experience in window lighting. The resolution was adopted unanimously, and a committee appointed to interview Mr. J. Walter Gillette, manager of the Fort Smith Light & Traction Company, in regard to securing a flat rate upon this class of lighting. The attractive appearance of stores in other large cities is responsible for this effort of the merchants of Fort Smith to bring their city up to the highest possible standard of decorative illumination. It is felt that decorative window displays and increased installations of electric signs will attract the people to the main streets in the evening and result in a largely increased business for the merchant, as well as stamping those promoting the scheme as champions of a more beautiful and desirable city.

Electric Street Signs in Spokane, Wash.

Mr. M. C. Osborn, contract agent of the Washington Water-Power Company, of Spokane, Wash., exhibited to his friends at the recent National Electric Light convention a book of photographs showing the numerous handsome electric signs on the streets of Spokane. One feature shown, which in his opinion is capable of considerable development in the down-town districts of the larger cities, is an electric sign on the corner of each building. Merchants having buildings on corners will find that an electric sign giving the name of each street, placed on the corner of the building, will not only be appre-

ciated by the public, but will help impress the location of the store on visitors in the town and bring them back to that corner to make purchases. It is thus not only a good movement from a civic standpoint, but good business for the merchants and commercial houses which put these signs up.

Central-Station Facts and Factors.

In the *Electrical World* of April 29, 1909, page 1032, a table was printed giving central-station facts and factors from seven central stations. In the issue of May 6, 1909, was another table giving similar data compiled from the reports of 26 Iowa central stations by Mr. Austin Burt, chairman of the "Fact and Factors" Committee of the Iowa Electrical Association and reported at the Cedar Rapids convention of that association April 21. Accompanying this article is a continuation of the table published in our issue of April 29, which gives data from

TABLE OF CENTRAL-STATION FACTS AND FACTORS—II.*

	8	9	10	11	12	13	*f* 14	15
A.—General Information.								
Number of company								
Kw rating of stations	400	160	3,200	1,000	835	505	200	260
Total population of district served	5,000	1,500	85,000	15,000	15,000	7,500	3,500	5,000
B.—Utilization of Investment and Apparatus.								
Total liabilities per kw of station rating	$250	$300	....	$380	$329	$171.70	$200	....
Gross yearly income per kw of station rating	*a* $67.50 *b* $82.50	$90	$99	$89.32	$124.42	$96.48	$93.48	$88.40
Gross yearly income per $100 liabilities	*a* $27.00 *b* $33.00	$33	....	$23.50	$34.98	$56.20	$46.73	$36.00
Per cent of gross yearly income spent for operation (including everything but interest and depreciation)	....	....	54%	50%	51%	46%	56%	....
Yearly operating expenses per $100 liabilities	....	....	....	$11.90	$17.71	$26.23	$27.07	....
Average income per consumer	....	....	$97	$58.27	$78.07	$66.88	$41.91	....
Total connected load in kw per kw of station capacity	....	....	2.8	1.56	1.45	1.65	1.23	....
Connected kw-load in lamps per kw of station capacity	....	....	1.6	1.05	0.99	1.42	1.23	....
Connected per kw-load in motors per kw of station capacity	....	....	1.1	0.51	0.46	0.23	...	0.28
Connected kw-load in heating apparatus per kw of station capacity	0.67	....	0.1	...	...	...	...	....
Kw-hours sold or accounted for per 100 kw-hours generated	....	....	*c* 0.85 *d* 0.80	76.7	75.4	*e* 75	81.1	....
Kw-transformer capacity per kw of a. c. station capacity	....	....	....	*e* 0.82	*e* 0.78	*e* 0.85	0.88	....
Kw-transformer capacity per kw of connected load	....	....	....	*e* 0.78	*e* 1.01	*e* 0.61	0.77	....
Kw-station capacity per employee, all departments	....	....	....	50	59	56	40	32.5
Yearly load factor (average load divided by maximum)	17%	....	24%	22%	28%	24%	33	....
C.—Development of Territory Served.								
Gross yearly income per capita of population	*a* $5.40 *b* $6.60	$6	$3.80	$5.95	$6.92	$7.27	$5.34	$4.60
Investment per capita	$20	....	....	$25.33	$18.33	$12.93	$11.43	....
Watts station capacity per capita	80	66	41	67	56	75	57	52
Number of consumers per 100 of population	....	....	4	7	6	11	12	....

*Table I was presented in the *Electrical World* of April 29, 1909, on page 1032. *a.* Electric revenue only. *b.* Electric plus heating revenue. *c* On direct-current system. *d.* On alternating-current distribution. *e.* Lighting transformers only. *f.* No day service.

eight more central stations. For obvious reasons, the names of companies are not published. An explanation of the various items which make up this table and the reasons for their adoption were given in connection with the first article, April 29.

In the accompanying table, Company 8 operates an electric-light and steam-heating plant. Figures are given on the earnings, both with and without steam heat revenue. Companies 11 to 14 are located in various Western towns, all being west of central Nebraska. They are under efficient management and show the usual high earnings of Western plants properly managed.

Boiler and Engine-Room Routine in Small Central Stations.

In the smallest central stations with only one boiler and engine unit there is left no choice to the operator as to what the daily routine in the shape of starting and stopping different units shall be. However, as soon as a plant has two or three engines and boilers the question comes up of the best handling of these for different loads.

Beginning with the boiler-room, the practice of small companies differs considerably as to the cutting in and out of boilers according to load. For example, if we take the case of a small plant in which two boiler units will carry the peak load, one boiler is sometimes shut down except during the peak, being completely cut off when the fire is banked. Another method of handling is to leave the boiler cut in on the steam line, but to bank its fires. This, of course, keeps the boiler under pressure and reduces somewhat the time which would be necessary to put it in service when needed. The third method is to keep both boilers in service during the 24 hours, running them at very light load most of the time. Very conflicting testimony can be found among small central-station operators as to the relative merits of these methods. Some claim that it is just as economical to maintain in operation more boilers than are necessary to carry the load during light-load periods, as it is to reduce the number of boilers to just the capacity which will carry the load. The practice and experience of the larger central stations indicate, on the other hand, that the best results are to be expected when boilers are worked at nearly full load unless there are some very abnormal conditions in the plant. To illustrate this point, some fairly large central stations make it a practice to watch the cutting in and out of boilers closely, and to require that the feed-water consumption shall be at a rate in excess of the normal rating of the boilers in service before additional boilers can be cut in.

The reason for the higher boiler efficiency when furnaces are worked at nearly the full load of the boilers is that fires are usually under such conditions worked in such a way as to secure the better combustion of the coal burned; and in order to maintain steam the fireman is obliged, without realizing it, to keep his fires in good condition and avoid allowing an excess of air to pass in the furnace, which excess seriously affects economy. Indeed, the very fact that the fireman must manage his fires so as to get the most out of a boiler when the boiler is fully loaded, of itself helps economy. If there is an excess of boiler capacity, the boilers may be handled in a very inefficient manner and still produce steam enough to keep the plant going.

Coming to the engine-room, the routine of starting and stopping different units is necessarily dependent on the number and size of the units in the station. There is a general tendency among the smaller central stations both to purchase units much too large for the loads to be carried, and to operate large units on light loads when smaller units would give much better economy. A large unit running much underloaded many hours a day is sure to be uneconomical and to take much more steam than would be required by a smaller unit in good condition. It is a common mistake among the smaller central stations when enlarging their plant to displace small units with large ones, leaving no small units to carry the light load. The most economical stations are those which have units of such a size

that the generating equipment can be fairly well adjusted to the load to be carried at different hours of the day. It costs more per kilowatt to install small than large units, and the full-load efficiency of the former is not as good as that of large units; but it is only a few hours per day that the full-load economy of a plant is of value. Another advantage of subdividing the generating equipment of a plant is that there is less danger of interruption to the service by necessary repairs to one of the units.

The usual tendency of station operating engineers is to run units underloaded for the reason that the engines require less attention in this way. Frequently the smaller units in a plant, which are the ones which should rightly be run during light loads, are those which have been in use the greatest number of years. Consequently they are worn and not in the best of condition for economical or reliable operation. The result is that the newer larger units are run underloaded instead of the small units being operated. In such cases, of course, the thing to do is to put the small units in good condition. The general tendency not to run engines fully loaded was well illustrated a few years ago by a medium-sized plant where the plan was adopted of giving the engineers and firemen a premium for the reduction of kw-hour cost below a certain established figure. The plan worked well and a considerable premium was earned by the operating force, due to watchfulness and to station economy. One of the points which the force found by experience had a most important influence was the operation of engines well loaded, and as soon as the load fell off so that larger engines were no longer needed they were immediately shut down.

Meter Committee's Exhibit at N. E. L. A. Convention.

The exhibit made by the meter committee of the N. E. L. A. at the Atlantic City convention was the first of its kind ever given. Supplementing the voluminous report on meters made by the committee, its purpose was to bring central-station managers to a realization of the importance of meter work, and the necessity of having a well-organized meter department. To accomplish this, the most modern apparatus and equipment manufactured and the best standards obtainable were shown, and practical and technical men versed in meter practice and meter problems demonstrated the use of the apparatus and explained the theory of the various meters and devices. The exhibit contained all recent types of all makes of electrolytic, mercury commutator and induction motors for single-phase and multiphase alternating-current and direct-current circuits, in addition to special meters, such as the Wright demand meter. Representative meter installations with various types of service boxes, protective devices, etc., were set up for demonstration purposes. The testing equipment shown comprised stop watches, standard portable indicating instruments, rotating standards, standardized resistances, portable load boxes, carbon and water rheostats, portable storage cells, test racks, special testing sets; together with tools, carrying cases, tool belts and special devices for facilitating the work of meter men. In addition to the above, suitable laboratory apparatus was shown. In this collection were recent types of primary and secondary laboratory instruments, including precision instruments, portable instruments, standard cells, standard resistances and potentiometer with accessories, experimental apparatus for demonstrating the principles of meters, an oscillograph for showing the potential and current wave forms, a binocular microscope for the inspection of jewels and pivots, power-factor meters, etc. Copies of patent specifications for meters, all books published on meters, samples of printed forms for meter departments, photographs, outlines of systems for testing meters and laboratory work were also available for the perusal of interested parties. Along one side of the exhibit space were installations typical of the present meter practice of the New York Edison Company, United Electric Light & Power Company, Philadelphia Electric Company and the Rochester Railway & Light Company. The installation and service cut-outs included all forms of devices for protecting the service and meters until the lines reach the consumers' house switch or cut-out, thus making the installations tamper-proof. Different types of lead, porcelain and metal seals for sealing cut-out boxes, service boxes, etc., were shown. These seals and sealing devices were collected from manufacturers throughout the country, and descriptions, photographs, etc., gave complete information concerning the methods of sealing. Test racks were connected to the service and arrangements for demonstrating the methods of testing in all of the 25 or 30 assorted types of meters in the exhibit were furnished in the center of the exhibition space. The meters were mounted on test racks to demonstrate the methods of testing with portable instruments, rotating standards, standardized resistances and other testing equipment. A number of meter installations were also connected to the direct-current and alternating-current service for demonstrating the methods of testing the meters when in actual service. The meters mounted on the test racks were connected in various ways, and various coils and parts were open-circuited and short-circuited to show the effect on the meter accuracy of possible troubles which may develop in service.



FIG. 1.—METER EXHIBIT.



FIG. 2.—METER EXHIBIT.

The exhibit was the most interesting feature of the convention, and indicated how thoroughly the meter committee had entered into its work. Only those who were in attendance at the convention and visited the exhibit can appreciate the monumental task involved in the collection of all the apparatus on exhibition, and the thought and care displayed even to the smallest details, so that nothing would be lacking in making the meter exhibit complete and representative of the very latest practice.

Valuation of Public Utility Properties.

An interesting paper by Mr. H. C. Abell, chief engineer of the American Light & Traction Company, printed in the *Armour Engineer*, contains a discussion of several of the difficult problems which public utility commissions are now endeavoring to solve, namely, the total value of a property, proper rates of return on this valuation, equitable rates for consumers, and the London sliding scale.

The total valuation of such properties is considered to be made up of two factors, physical values and so-called intangible values. As to the former, engineers can estimate, at prevailing prices, what it costs to replace a certain piece of apparatus, or a collection of pieces concentrated on one portion of ground or under one roof, which may be called the plant or power house, but they cannot, with the same accuracy, estimate the following factors:

a. The average price paid since the utility first commenced serving the public, including the increased cost of new apparatus installed when just developed, over the later prices after the apparatus becomes standard and patents have expired.

b. The cost of necessary changes, due to the ill fitting together of these parts.

c. The changes in the art during construction, necessitating changes in plans and construction.

d. The increased cost, due to climatic or labor conditions.

e. The kind of soil and quantity of water to be encountered in all excavations.

f. The cost of accidents, employers' liability, public liability, fire, wind, water, etc., breakage of machinery, temporary work, such as coffer dams being washed out during construction, and various other items.

g. The increased cost of construction during operation, due to idle labor waiting for an opportunity to work, and to temporary work installed (in order to avoid interruptions to service) which is removed after permanent work is finished.

h. The increased operating expenses, which are unavoidable due to construction work going on.

i. The length of time necessary to construct a plant, which would affect interest while building, taxes during construction, engineering, etc.

j. The cost of obtaining all the actual necessary money to build the plant, and to put it on a self-sustaining basis.

k. The unforeseen litigation, injunctions, etc., which frequently increase enormously the original estimated cost.

l. The cost of the corporate organization of the company.

m. What the actual cost will be over the estimated cost, due to increased cost of material and labor since estimates were made, and to omissions, etc.

n. The necessity of laying out works, purchasing property, erecting buildings, etc., in order to provide for future extensions at a minimum cost for the future.

o. The present value of the plant, after depreciating the various items to allow for obsolescence, inadequacy and decay, and the enhanced value, which will be considered under intangible valuation.

As to intangible valuation, it is held by the author to be also impossible for engineers to estimate with accuracy the intangible valuation, which involves a consideration of

a. The expense of obtaining a proper and efficient operating organization.

b. The expense of maintaining an operating organization to develop business and to popularize the utility and the use of its product during the construction period, so that the plant can commence operating with the greatest possible revenue.

c. The cost of advertising—including newspapers, posters, periodicals, personal solicitation and practical demonstrations of various kinds.

d. The cost of appliances which are given away, or loss on their sale which includes free installation.

e. The loss due to operation until the utility is on a paying basis.

f. The loss in interest and profits on the investment, from the first operating period to a time when expenses and interest are earned.

g. The enhanced value of the utility due to the increased value of its real estate, location of plant, accessibility of water, railroad facilities and sewerage, location of pipes, conduits, etc., in the streets, the latter costing much less for installation, special fittings, moving of manholes, etc., when no obstructions are met, to the extent that these items are not given full consideration in making the physical valuation.

h. The enhanced or decreased value due to the utility while operating having assisted and participated in the loss or development of the town or city. The utility having been an active participator in the development of the city, must be entitled to at least the same recognition as any active merchant or banker, whose business, as a going concern, is worth something; and the utility is entitled to even more consideration, since it cannot pick up its pipes, conduits, and plant and move to another city. The inactive land owner is much better off than the utility in that although he takes the same chances in the development of the city, he takes no other chances and assumes no responsibility; whereas, the utility has actively assisted in all developments, taking the many chances of loss to which only a utility is heir, including the risks involved in the work of construction, development, and financiering.

i. The loss in the chance of apparatus, due to obsolescence or inadequacy, which could not be charged as an operating expense and still maintain rates which would hold the customers and permit the financing of the company for necessary changes and extensions. One of the many examples was the changing of monocyclic generators which had been installed but a short time. As an example, the difference between the purchase price and the price obtained after abandonment (a change having been essential), may amount to a depreciation of 40 per cent per annum. The utility company could not possibly maintain its rate and finance this change due to evolution and development, no more than could a manufacturing concern which may experience the same rapid change in the art as utility companies, if it were not permitted to add a charge for the cost of experiment and development to the sale price of its commodity. In the case of the utility, it is the development of the art for more efficient and reliable service in competition with other sources of supplying heat, light, etc.

j. The expenditures in replacing the appliances free of cost to the consumers, due to a change in the art. An example would be a change of motors from direct to alternating, from one cycle to another, or that of operating voltage, necessitating the change of all lamps and appliances. All utility companies have experienced this expense, though it does not show in a replacement inventory.

The tentative method, now used by one of the commissions to arrive at reproduction and present physical values, is as follows:

Reproduction Value.—Five-year averages are obtained from the various units which go to make up a whole; then the freight, estimated cost of installation and handling are added. To the sum of these items, which are supposed to make a completed whole, is added a percentage for engineering, interest while building, and incidentals. To the above two items is added the stock (coal, appliances, etc., on hand), and to this, the cost of paving, making a grand total for replacement.

Present Value.—The present value is arrived at as follows: By consultation, discussion, and investigation, a tentative life of each unit is taken; then the junk value is ascertained from values of old copper, iron, etc.; by deducting the junk value from the reproduction value, the depreciating value of the unit is obtained. The present value, if in first-class operating condition, is obtained by taking the age of the unit and deducting the amount which would have accumulated in a reserve fund had an amount been set aside each year, bearing a certain per cent interest, which would, at the end of its life, have equaled the total depreciating value; its junk value is then added. If in fair operating condition, 10 per cent is deducted from the

present depreciating value and, if operating, but in poor condition, 20 per cent is deducted from its present depreciating value; to either of the above values would be added the junk value.

To illustrate this method of arriving at present values, assume that the reserve fund is to be set aside at 4 per cent compound interest; that the cost of the unit is $1,200 new; that the tentative average life is 20 years; and that the junk value is $200, and that we wish to determine the value at the end of 10 years—first, when in first-class condition; second, when in fair condition; and third, when operating but in poor condition. Deducting $200 junk value leaves $1,000 as the cost of the depreciable portion of the unit new. The amount to be set aside each year at 4 per cent, compound interest, to equal $1,000 at the end of 20 years, would be $33.58. The amount set aside each year for 10 years, together with its accumulated interest, would be $403.

Deducting $403 from $1,000 leaves $597, to which must be added the junk value, $200, making a present value of the unit, if in good operating condition, of $797; if in fair operating condition, 10 per cent is deducted from $597, making the total present value $737.30; if operating but in poor condition, 20 per cent is deducted from $597, making the present value $677.60.

Minimum service values are allowed for the various units which, from point of age, might make the value of the unit equivalent to junk only, though it would be in useful operation. For instance, electric meters, which are subject to state or municipal inspection, or both, and have to be kept in a certain state of repair at all times, are allowed a minimum service value of 80 per cent of the reproduction cost; whereas, with a steam engine that has been in service a number of years but which may be in a good state of repair though not having the same efficiency as a more modern engine, or sufficiently good to be put in a newly built plant, only 25 per cent of its reproduction value is allowed.

There is a great diversity of opinion among engineers as to the approximate correctness of the above method of arriving at present value. Some engineers claim that each unit should be gone over, first obtaining its reproduction value, and then depreciating it in proportion to the cost of making the unit practically new. Other engineers think that in addition to the above, a further amount should be deducted for depreciation in proportion to the change in the art. Still others think that the present value of a plant should be estimated on a basis relative to most modern apparatus.

As an example: Suppose it is the desire to obtain the value of a water-power plant of 1000 kw capacity, with a load factor of 40 per cent. A figure would first be obtained for the most economical steam plant of this capacity, which, for illustrative purposes, we will assume to cost $100,000. Further assuming that the cost per kw-hour is 1 cent, not including interest, and that the water-power plant can develop current at 0.5 cent per kw-hour on the same basis as that taken for steam, then the saving per kw-hour, by using the water-power plant, would be 0.5 cent, or on a 40 per cent load factor (3,504,000 kw-hours per year), the saving would be $17,530. This sum capitalized at 10 per cent (the allowable rate of return on the investment) would make the value of the water power $175,200 more than that of the steam, or give the water power a total value of $275,000. The depreciation is assumed to be included in the operating expenses.

As to depreciation and the amount to be set aside therefor, the line of demarcation between depreciation and maintenance is difficult to follow. Some engineers and managers think that maintenance and depreciation should all be an operating expense, as it is essential to keep a plant up to a certain point of repair at all times. They think when a piece of apparatus is replaced, the difference between the amount received for it, either as junk or an old piece of apparatus, and the cost of the apparatus replacing it, should be charged to plant account. Others think the difference between the actual cost of the old apparatus and the new should be charged to the plant account, and that the cost of the old apparatus should be charged off to an operating maintenance account. They also think that the utility enhances in value as the city develops in a larger proportion than the depreciation occurs.

Others think that an amount should be set aside each year sufficient to cover the depreciation according to assumed lives. For instance, to take the example of $1,200 previously mentioned, $50 would be set aside each year for 20 years, if the apparatus should last that long. There are also various opinions as to how the fund should be treated and financed.

The commission previously referred to when obtaining present values, used a 4 per cent compound interest curve, knowing that the apparatus had actually reached its present life. As to the future, however, it is difficult to prognosticate what these lives will be; in fact, we are certain that a portion of the plant will not reach the estimated lives of its several parts, and that a portion may be in useful operation long after it has from point of age reached the junk value. Mr. Abell believes that an amount should be allowed that would cover the probable depreciation without reference to any specific financing of the fund, and the amount be changed, either reduced or increased, as necessity requires and actual experience teaches. If in every case an amount be set aside each year to cover the probable depreciation, some properties would soon be in the hands of a receiver, as they would be unable to meet necessary obligations. Commissions will have to use their judgments in this matter.

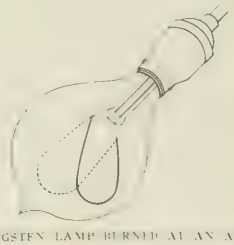
INTERIOR WIRING AND ILLUMINATION

Street Series Tungsten Lamps Burned at an Angle.

BY GEORGE T. HANCHETT.

There is probably no field where the tungsten lamp has a better opportunity to give satisfaction than in street series lighting service, for the circuit may be so designed that the voltage on the lamps can be chosen without reference to the existing source of supply. A recent experience of the writer's may be of some interest in this connection.

In the instance in question, 250 carbon lamps of 3 amp at 25 volts were replaced by an equal number of tungsten lamps taking 5½ amp at 6 volts. The lamps were installed in fixtures which supported them at an angle of about 45 deg., and it was



TUNGSTEN LAMP BURNED AT AN ANGLE

believed that the short, stumpy filament was abundantly strong to withstand the vibration and retain its position within the bulb. The sockets employed were the usual spring-clip, paper cut-out, weather-proof receptacle, with a large screw base, while the bulb of the lamp was very large, about the size of the 100-watt, 110-volt standard tungsten bulb.

As soon as the lamp had been installed it was immediately noted that the filaments began to droop, as shown in the diagram, which was somewhat disconcerting, for it indicated that there would soon be a considerable percentage of loss. The droop was anxiously watched and it presently seemed to attain a permanent condition, the filament hanging in a little catenary between the two leading-in wires. The expected failures did not come. The lamps seemed to be entirely satisfied with the

new conditions and continued to give good service; in short, they automatically adjusted themselves to a 45 deg. angle. As the filament is too short to touch the sides of the glass under this condition, there seems to be no further cause for apprehension.

It would seem to me a wise measure of precaution, however, in view of this experience, to direct the linemen who have to care for the lamps to install all street series lamps burned at an angle in such a way that a line drawn through the tips of the leading-in wires will be as nearly horizontal as possible; and that if it be found that the pitch of the filament with relation to the threads on the sockets is such that the position of the leading-in wires can only be vertical, to select another lamp for that particular socket and use the troublesome lamp elsewhere.

Experience seems to show that a considerable angle from the horizontal with respect to the filament plane is permissible; in short, any angle in which the droop, when it occurs, shall be such that there shall be no short-circuiting.

It is hardly necessary to say that in case the lamp should be removed for any purpose after it has once drooped, and reinstalled, care must be taken that it be restored to the exact position in which it was found; for it is obvious that if the filament has to droop to a new position its chances of failure are considerably enhanced.

The Use of Fish Wire in Conduit Work.

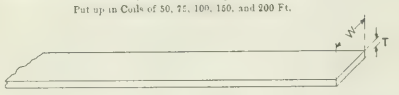
By Arthur Gillman.

Assuming the wrought-iron conduit in a wiring installation in place, the operations toward the completion of the wiring may be given in the order of their performance, as follows:

(1) "Fishing" the conduit. (2) Fastening the fishing wire to the electrical conductors to be drawn into the conduit, if conditions will admit of their being drawn in thereby, or to a pulling-in line if such is necessary. (3) Drawing the pulling-in line into the conduit with the fishing line (if a pulling-in line is necessary) and fastening the pulling-in line to the conductors to be drawn in. (4) Drawing the conductors into the conduit with the fishing wire, if this is feasible, or with a pulling-in line. The first two operations will be discussed at length in the present article and the methods employed for their performance described.

OIL TEMPERED, FLAT STEEL, FISHING WIRE

Put up in Coils of 50, 75, 100, 150, and 200 Ft.



W WIDTH INCHES	T THICKNESS INCHES	WEIGHT PER 100 FEET	APPROXIMATE PRICE CENTS	
			PER POUND	PER FOOT
1/8	.015	11oz.	90.0	.62
1/8	.030	1lb. 4oz.	60.0	.75
3/16	.030	1lb. 14oz.	60.0	1.13
1/4	.030	2lb. 8oz.	60.0	1.50
5/16	.035	3lb. 8oz.	55.0	1.93
3/8	.035	3lb. 12oz.	55.0	2.06

FIG. 1.—PROPERTIES OF STEEL FISHING WIRE.

FISHING THE CONDUIT.

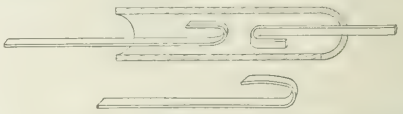
"Fishing" (a term analogous to "rodding," which is used in connection with underground conduit work) consists of pushing through the conduit a stiff wire to which can be fastened and thereby drawn through the conduit another line (either a pulling-in line or a copper conductor), which by reason of its flexibility could not itself be pushed through. A tempered, flat-steel ribbon wire is generally used for the purpose. In the table (Fig. 1) are given the principal properties and costs of the wires most frequently used for fishing. The prices will vary with the quantity purchased. Those noted are a fair average for small lots. The 1/8-in. wide by 0.030-in. thick size is used much more generally than any of the others and many electrical supply houses stock only this size, which will be found to satisfy all the requirements necessary to interior conduit fishing.



FIG. 2.—KNOB ON END OF FISHING WIRE.

So that the wire will slide easily through the conduit, past the joints between lengths and around the elbows, a metallic knob, preferably of brass to prevent rusting, is frequently riveted to one of its ends, as shown in Fig. 2. The best dimensions for the knob depend upon the size of conduit in which it is to be used. It must not be of too great diameter or too long or it will bind in the elbows. If much fishing is to be done, the cost of providing knobs on the ends of fish lines will be a good investment.

Where knobs cannot be arranged for in lieu of such the end of a fishing wire, which is to be pushed into the conduit, can be bent into a hook, as shown in Fig. 3. This makeshift will give good service. Hundreds of feet of conduit have been fished with wire thus prepared. If it is impossible to push fishing wire from one outlet to the next, due to some binding or obstruction within the conduit, often two fishing wires are fed into the conduit, one from each end, each having a hook formed on its extremity, as shown in Fig. 4. The hooks will engage and one fishing wire can be pulled through the conduit by the other.



FIGS. 3 AND 4.—HOOK ON FISH WIRE AND METHOD OF FISHING FROM BOTH ENDS.

Patience is required to effect such an engagement. Two men are required, one at the outer end of each fishing wire. Each must push in for a foot or so and then slightly withdraw his wire. This is repeated until, by the sound, it is apparent that the two hooked ends are close together. Then it is a matter of trial and luck; but persistence is always rewarded. If it happens that a run to be fished is longer than any available fishing wire, two wires can be used, one fed in from either end and hooked together within the conduit as above described. Then, a pulling-in line, or the conductors to be drawn in, if they are small, can be secured to the outer end of one fishing wire and the whole pulled into the conduit by the other.

No. 10 or 12 B. W. G. galvanized-steel wire has been used quite successfully for fishing, particularly through larger-size conduit, say, 1 in. and over. It has the advantage of being readily obtained and of cheapness, and a further advantage that it can also be used for a pulling-in line. This point will be taken up in detail later. Galvanized-steel wire, which is more commonly, though incorrectly, called galvanized-iron wire, is regularly carried by most hardware stores and is used for wire fences, baling, etc. To prepare such a wire for fishing, it is only necessary to hook over one end after the manner shown in Fig. 3.

FASTENING THE FISH WIRE.

If a steel-ribbon wire has been used for fishing a conduit, electrical conductors, if they are small, say, No. 12 or 14

B. & S. gage, can be attached to one end of it in the manner indicated in Fig. 5. A loop is formed in the end of the fishing line and copper wire sewed around the end of the loop. This sewing should be soldered for best results. The bared conductors are "made up" into the loop and the whole sewed with friction tape, as shown in Fig. 6. The tape sewing should taper regularly from the size of the fishing wire to that of the two conductors, so that the joint will slide easily into the conduit and past irregularities therein without seizing. If the conduit into which wires are to be pulled is small in proportion to the



FIG. 5.—ATTACHMENT OF CONDUCTORS TO FISH WIRE.

over-all size of the pair of wires, it is advisable to compress the loop in the fishing wire, making it flatter than shown in Fig. 5. One bared conductor is "made up" into this flattened loop. The other bared conductor is sewed around its bared mate from which the insulation has been trimmed for a distance of about 3 in. This method provides a long, tapering attachment which, if carefully sewed with tape, will draw into any conduit sufficiently large to receive the wires. The illustration and description treat of but two wires. If there are three, the

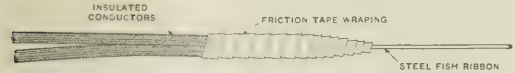


FIG. 6.—CONNECTION TAPED OVER.

general methods are the same and if not understood from the above they will be apparent upon trial.

It is not wise to pull wires larger than No. 12 or 14 into conduit with a steel-ribbon fishing wire unless conditions are such that the wires pull into the conduit very easily, which might be the case in a short run without elbows or if the wires were very flexible or small in relation to the size of the conduit.

If heavy wires are pulled in with a ribbon fishing wire there is a possibility of straining the fishing wire beyond its elastic

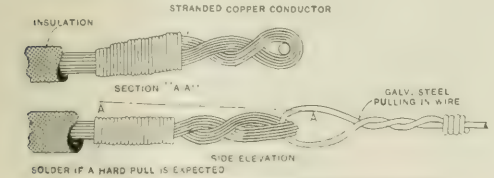


FIG. 7.—CONDUCTOR FASTENED TO FISHING WIRE.

limit, and, as the wiremen say, "it loses its life." That is, it loses its original tendency to assume the form of a long, straight ribbon and tends to roll into twists and curls. This makes it very difficult to push into a conduit, and for rapid, serious work almost worthless. A steel-ribbon fishing wire severely stressed by being used as a pulling-in line is also apt to become brittle and to break when partially pushed in a conduit. If a round galvanized-steel wire has been used for fishing, rather large conductors can be pulled in with it. There is

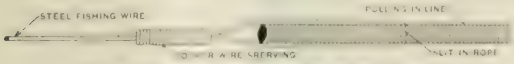


FIG. 8.—ATTACHMENT OF RIBBON WIRE TO ROPE.

not the danger with this as with steel-ribbon wire of straining it unduly because of the greater cross-section of the galvanized wire, and even if it is so stretched as to render it useless as a fishing wire it can be discarded with little loss.

Fig. 7 shows one method of attaching a stranded conductor to a galvanized-steel pulling-in wire. The engraving is self-explanatory. If two conductors are to be pulled in one of them is "made up" into a loop in the end of the pulling-in wire, as shown in Fig. 7. The insulating covering is trimmed when this conductor and the bared end of the other conductor are made up about the first one, forming a long connection. If a hard pull is expected it is advisable to solder the connection. The whole should then be served with tape as shown in Fig. 6. If three wires are to be drawn in instead of two, the process is the same with the addition that the bared end of the third conductor is made up around the other two. The points to be watched in connecting conductors to a pulling-in wire or line are that the diameter at any section of the con-



FIG. 9.—ATTACHMENT TAPED OVER.

nection shall not exceed the over-all diameter of the wires connected and that the connection shall gradually taper from the size of the pulling-in wire or line to the over-all size of the wires to be pulled in. If these points are observed the connection will form a conical wedge. Sometimes to meet the conditions outlined above it is necessary to cut off possibly half of the strands from the bared end of the conductor and "make up" the connection from the strands that remain.

If conduit has been fished with a steel-ribbon fishing wire and conductors larger than No. 12 are to be drawn in, it is best to pull in a drawing-in line with the fishing wire rather than to attempt to pull in the conductors with the fishing wire for the reason already mentioned. If a rope is to be used for a pulling-in line a ribbon fishing wire can be attached to it, as shown in Fig. 8. A slit is cut in the rope, the end of the ribbon wire passed through it and then bound down with a copper wire, serving as shown. Tape should be applied also, the joint looking like that shown in Fig. 9 when finished.

Galvanized-steel wire (No. 10 or 12, B. W. G.) makes an excellent pulling-in line. It is better than rope for heavy work.



FIG. 10.—ATTACHMENT OF RIBBON WIRE TO GALVANIZED STEEL.

Fig. 10 indicates how an attachment should be made to this material. For very heavy pulls two or more strands of galvanized wire should be used. Fig. 11 illustrates how an attachment should be made where two strands of galvanized wire are to be used for a pulling-in line. Braided rope is usually used for pulling-in line, although, as above suggested, it is believed that galvanized-steel wire is better. Twisted manila rope is sometimes utilized, but it tends to untwist when subjected to stress and in doing so twists the conductors within the conduit causing them to pull hard around the elbows. Braided rope, or as it is called by the trade, "cord," is manufactured in a variety of diameters from 7/36 in. up to ½ in. The smaller sizes are frequently used for sash cords, bell ropes and arc-lamp cords. Comparing cord with galvanized-steel wire as a pulling-in line material, it is very much more bulky for the same strength, is more expensive, wears out much more quickly under severe usage and it is difficult to tie it to the hook of a set of tackle blocks with a knot that will not cut and



FIG. 11.—ATTACHMENT OF RIBBON WIRE TO TWO GALVANIZED STRANDS.

thus sever the cord. Furthermore, it does not appear to be possible to buy a cord sufficiently strong to pull in very heavy runs. The latter respond nicely to several strands of galvanized-steel wire. Galvanized-steel wire can be very quickly and positively secured to a tackle block hook through the agency of a wire grip similar to that shown in Fig. 12. Steel hoisting cable, such as that used on cranes, has been tried, but

...ough cost and tendency to cut when tied to a ...lock, has not been found satisfactory. Methods

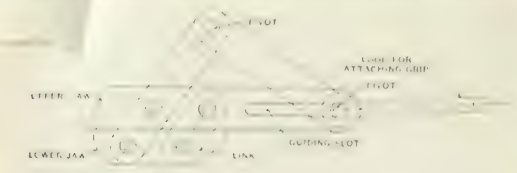


FIG. 12.—PARALLEL JAW WIRE GRIP.

of drawing conductors into the conduit will be described in a subsequent article.

New Telephone Patents.

NEW CIRCUITS.

With the earlier multiple switchboards the busy-test contact and one of the line contacts were the same. This introduced so many chances for trouble and false test that when the first branch terminal and common-battery systems were developed busy-test circuits were planned entirely isolated from the line circuits. This overcame the former difficulties to so great an extent that when the two-wire common-battery system was put forth it was necessary to take many precautions and to provide many special means to keep from falling back into the difficulties of the earlier day. These various special means have resulted in numerous patents, two of which have recently been issued to Mr. H. G. Webster, of Chicago, Ill., and assigned by him to Mr. M. G. Kellogg.

One of these provides an arrangement of cord circuits such that only when the listening key is thrown is the tip of the testing or calling cord connected to the busy-test circuit. At this time it is cleared from the line circuit entirely and is led through one of the relays individual to the cord circuit, thence through the special contacts of the listening key and thence through a high non-inductive resistance to a busy-test relay common to the position. This latter, through its contacts, controls the busy-test signal associated with the operator's head telephone. It will be seen that when two listening keys are thrown at once, one connected to a circuit in use and the other connected in the circuit used for testing, were it not for the resistance inserted between the listening key contacts and the busy-test relay, there might be a tendency to a cross effect between the two cord circuits. The high resistance, however, is inserted to prevent any such action. Of course, in the act of testing, provided there is a battery on the test ring of the line tested, this will flow through the circuit outlined and through the busy-test relay to ground, causing this latter to operate, thereby effecting an audible test in the operator's telephone.

Mr. Webster's second patent provides a busy-test circuit wherein, as before, the tip of the calling or testing plug is severed from the line circuit and connected to the test circuit when the listening key is thrown. In case a listening key is thrown after a connection is established it will not do for the tip strand to be severed. Because of this, an auxiliary relay is introduced which operates provided the calling plug is connected to a line the receiver of one of the stations of which is off the hook. This auxiliary relay, through its contacts, so shunts out the auxiliary listening-key contacts that the tip strand is not severed.

Three other patents have been recently granted to Mr. Webster for adaptations of what may be termed "two-stage" or "double-acting relays." These patents are also assigned to Mr. Kellogg.

The first one relates to a two-wire common-battery switchboard system, in which a single relay serves the purposes of both line cut-off relays. The removal of a receiver from the hook energizes the relay sufficiently to cause it to move through the first stage, thereby closing the circuit of the line lamp. The insertion of a plug in the jack through a secondary winding energizes the relay sufficiently to cause the second operation to take place, thereby performing all the functions of a cut off relay.

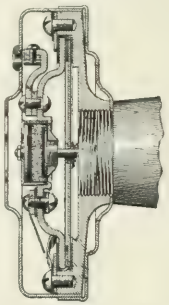
The two other adaptations are to a system of signaling, wherein an automatic dial device is associated with the telephone line, this device being arranged to send in to a common recorder code signals of the messenger-call type. It will be seen that if any one of the numerous branch lines of such a system becomes grounded the whole system will be deranged. By means of the two-stage relay, associated with a slow-acting relay, Mr. Webster has arranged a system by means of which not only will the normal signals be received, the relay operating through its first stage only in response to each current impulse, but also, when a sufficiently prolonged current exists due to a defect, and the slow-acting relay has, therefore, time to act, the auxiliary winding will be brought into play. This results in the two-stage relay completing its operation through its second stage, permanently severing and locking the defective branch out of service.

The second patent for this class of circuit dispenses with the slow-acting relay, combining all the functions in the double-acting relay by means of an unbalancing effect of two differential coils.

TRANSMITTERS.

The cut below shows a transmitter, the patent of Mr. H. F. Albright, of New York City; the patent is assigned to the Western Electric Company. The transmitter is founded upon a heavy front piece somewhat different from the usual one because it is not exposed to view, but is covered by a sheet-metal casing clamped on by the transmitter mouthpiece. This heavy front supports the diaphragm and also the bridge, which in this case takes the form of a pressed sheet-metal disk, saucer-shaped. This is shown in section in the cut. The microphone button is supported in a recess in the bridge, it having threads upon its periphery to engage internal threads on the walls of the receptacle. Provision is also made for rather heavy terminal plates of sheet metal secured to the bridge.

A number of years ago it was suggested that more efficiency could be obtained from a transmitter were the vibrations of its diaphragm caused by direct contact with some vibrating part of the voice mechanism, rather than by impinging sound waves. One of the suggestions at that time was a button to be attached to the diaphragm and to be pressed against the side of the throat of the user. With a similar idea, Mr. E. Koehler, of Philadelphia, Pa., has produced a transmitter, the vibrations for which are to be received from the body of the speaker. A spring shoulder clamp is provided, one arm of the clamp passing over the back of the user and the other over his chest, the hinge being above the shoulder. A spring forces these two arms toward each other, and from a point near the hinge a bar arises, upon the top of which the receiver is mounted. The transmitter is upon the end of the front, or chest side arm, and through the action of the spring is held tightly against the chest of the user, and thereby receives vibrations directly from the body.



ALBRIGHT TRANSMITTER.

LETTERS TO THE EDITORS.

Ballistic Galvanometer Constant.

To the Editors of Electrical World:

SIRS:—The printer's improvement of the punctuation in my letter on "Calibrating the Ballistic Galvanometer" in your issue of June 10 entirely spoils the statement of the way in which the "throw" or the quantity constant depends upon the "deflection" or the steady current constant of any galvanometer. The value of $1/2\pi$ is a coefficient, or factor, to the expressions following, and the semicolon does not belong there. To avoid all possibility of misunderstanding the relations, the form might be restated as follows:

$$\text{Constant for quantity} = \text{constant for current} \times \text{period} \times (1 \div \tfrac{1}{2}\lambda) \div 2\pi.$$

One may, therefore, get the constant of a galvanometer for ballistic use by finding the current required to give a unit steady deflection, the time required for a complete oscillation of the moving parts while connected to a circuit exactly like the one used in the ballistic work, the logarithmic decrement when on the same circuit, and then inserting these values into the above expression. In this case, only standard resistances and a known e.m.f. are required to calibrate the galvanometer for ballistic use.

POTSDAM, N. Y. B. B. BRACKETT.

Self-Induction.

To the Editors of Electrical World:

SIRS:—In your issue of May 20, page 1195, I read: "Self-induction may be defined as that property of a circuit by virtue of which changes in current strength can only be brought about by electromotive forces."

In opposition to this, I should like to say that we may define self-induction as the property of an electric current in a certain circuit by which *electromotive forces are generated* when changes in current strength are being brought about. And we may add, that these electromotive forces of self-induction are always such that they tend to produce changes in the current opposed to those which produce the self-induction. This is an extension of the well-known Lenz law. Moreover, we know that these electromotive forces are due to the changes in the flux of magnetic induction corresponding to the changes in current strength. Or in other words, the electromotive forces of self-induction are nothing else than electromotive forces of electrodynamic induction, and therefore the general laws of electrodynamic induction (Faraday's and Maxwell's laws) are applicable to determine the electromotive forces of self-induction.

Though some effects of the electric current appear as if it (the electric current) had material inertia, we know, since Hertz's experiments of 1879-1881[1], confirmed by all investigations up to the present time, that the *electric current has no material inertia* and that it is *solely the electro-dynamic induction* which produces the phenomena observed.

SCHEVENINGEN, HOLLAND. C. L. R. E. MENGES.

[The question as to whether the e. m. f. of self-induction brings about the change in current, or whether the change in current brings about the e. m. f. of self-induction, verges upon metaphysics, and would form an interesting topic for debate. The question is likely, however, to be of more interest to physicists than to electrical engineers. The proposition, stated by Mr. Menges, that "the electric current has no material inertia," is also a fitting matter for debate, because it is now very generally believed that all mechanical inertia in matter may be attributable to the electromagnetic inertia of moving charges (*i. e.*, electric currents of displacement.) This question also is of much interest, but rather to physicists than to engineers for the present.—EDS.]

[1]See "Hertz gesammelte Werke," Vol. I, "Einleitung," p. XII-XIII, and the reprinted papers, p. 1 and p. 145. For an excellent review, see von Helmholz's preface to Vol. III, pp. XII-XIII.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Armature Reaction.—G. KAPP.—An illustrated note on the experimental analysis of armature reaction. The author describes two tests for separating the reactance voltage and the drop produced by armature back excitation in a polyphase armature. The machine is worked short-circuited and the excitation regulated so that the current in one phase remains the same, while the number of phases included in the circuit is varied.—Lond. *Electrician*, June 4.

Single-Phase Commutator Motors.—J. FISCHER-HINNEN.—The first part of a mathematical paper in which the author gives formulas and numerical examples for the predetermination of the dimensions and windings of single-phase commutator motors. He discusses the series motor with windings distributed over the surface, the series motor with pronounced poles without a compensation winding, means for suppressing the formation of sparks (especially the calculation of interpoles and the use of resistances in the leads to the commutator), and finally the graphical treatment of the series motor. The paper is to be concluded.—*Elek. Zeit.*, May 27 and June 3.

Lamps and Lighting.

Two-Hundred-and-Twenty-Volt Osram Lamps.—A 16-cp osram lamp for pressures between 100 and 130 volts, and a 32-cp lamp for pressures up to 260 volts, have been put on the market by the General Electric Company, of London. The former consumes 17 watts and the latter 40 watts. Results are given of tests made in the (British) National Physical Laboratory on nine 220-volt 50-cp osram lamps, which were not selected, but taken from stock. Before the life tests were commenced an initial test showed that the mean horizontal (British) candle-power varied between 43.6 and 48.2, the average being 46.6. The watts consumed averaged 65, and the watts per candle 1.4. The lamps were then tested in a pendant position at a constant pressure of 220 volts, and readings taken at intervals over a period of 2000 hours, at the end of which time five of the lamps were still burning. On the occasion of a filament breaking no attempt was made to re-fuse the limbs together; and if fusion occurred automatically, the lamp was counted as having broken. The points where the four lamps broke down are marked by arrows in the accompanying curves, Fig. 1, which shows the average results for the nine lamps.

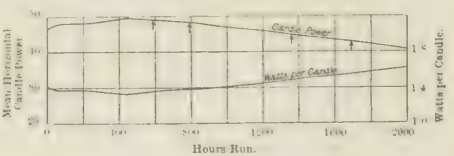


FIG. 1.—AVERAGE CURVES OF LIFE TESTS ON OSRAM LAMPS.

The behavior of the lamps was strikingly uniform. All the lamps reached a maximum candle-power (which varied between 47.5 cp and 50.5 cp) shortly after 400 hours, and the candle-power of the remaining lamps at the end of the 2000 hours' run of lamps burning at any time was 46.2 cp and the average watts per candle over the same period 1.45. It is also stated that the Allegemeine Elektricitäts-Gesellschaft, of Berlin, is already advertising in the German papers a 25-cp, 200-volt to

250 v 1 tungsten lamp, and the Sunbeam Lamp Company, of Gateshead, will be in a position to deliver 22 cp tungsten lamps for pressures up to 250 volts in the course of a few weeks.—Lond. *Elec. Eng'ing*, June 3.

Tungsten Lamp.—A note on a recent British patent (25,854, 1908; May 27, 1909) of the Siemens & Halske Company. Powdered tungsten is treated chemically or electrochemically so that each particle of tungsten receives a deposit of 10 to 20 per cent of a ductile metal such as silver or nickel. The product is pressed and rolled, and the mixture becomes so intimate that a ductile metal that can be drawn into filaments is obtained. The nickel or silver is removed by heating the finished filament in a vacuum. In a modification, the treated powder is first stamped into a tube of ductile metal and then drawn into fine filaments, the foreign metals being removed afterward as in the first case.—Lond. *Elec. Eng'ing*, June 3.

Tungsten Lamp.—A note on a recent British patent (14,942, 1908; May 27, 1909) of the Westinghouse Metallic Filament Lamp Company. Tungsten trioxide is reduced by means of zinc at a red heat, and the product treated with a hydrochloric and nitric acid solution to remove the excess of zinc and the zinc oxide. The product is then thoroughly washed and concentrated by evaporation. The pasty mass obtained without the addition of any binding agents is formed into filaments. These, after being heated in a muffle furnace at about 800 deg. C. for half an hour, are raised to a white heat in an atmosphere of hydrogen and nitrogen by passing a current through them.—Lond. *Elec. Eng'ing*, June 3.

Supports for Metallic Filaments.—A note on a recent British patent (23,069, 1908; May 27, 1909) of the British Thomson-Houston Company (General Electric Company of this country). In the arrangement described the lower end of the loops are welded to metal arms radiating from the base of the pedestal. A number of short copper wires fixed vertically on the top of the pedestal support horizontal pieces of nickel wire. Each nickel arm carries at its extremity a small loop of tungsten or molybdenum, through which the filament passes. The nickel wire acts as a spring holding the filament in tension, and can be joined to the supporting loop by winding the end round the crossed legs of the loop. The other end is welded to the copper support. The supporting loop and the nickel wire spring should have diameters slightly larger than the diameter of the filament.—Lond. *Elec. Eng'ing*, June 3.

Gas Versus Arc Lamps at Bradford.—An account of the results of comparative tests of gas and flame-arc street lighting in a street in Bradford. Although the distribution of light is not so uniform with the arc lamps as with the gas lamps, owing to the latter being placed close together, the average and the maximum illumination were much greater in the case of the electric lighting, notwithstanding the fact that the cost of the electric lighting works out at 6s. 5d. per yard, as against 7s. 5¾d. per yard for gas (taking gas at 2s. 1d. per 1000 cu. ft., less 12½ per cent). Owing to reasons, however, which are not immediately apparent, gas lighting has been chosen. The results of the tests are given graphically in Fig. 2. Curve 1 refers to Excello flame-arc lamps fitted with dioptric globes, curve 2 refers to the same arc lamp fitted with ordinary globes, and curve 3 to gas lamps with three incandescent mantles. One of the possible reasons which have influenced the decision against arc lamps is thought to have been the yellow color of the flame arcs used. Further, "the general impression that the gas installation gave the better light," the writer thinks was due to the fact that the gas lanterns were so near to the road that the sources of light were very near the eyes, whereas in the case of the arc lamps they were well above the head, and only the effects of the light on the road were observed.—Lond. *Electrician*, June 4; *Elec. Eng'ing*, June 3.

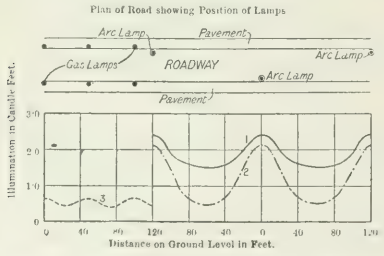


FIG. 2.—TEST CURVES OF EXPERIMENTAL GAS AND ELECTRIC STREET LIGHTING.

Carbon Arcs.—M. ROSENMÜLLER.—An account of an experimental investigation of the light emission and absorption of carbon arcs. The author used homogeneous carbons, 13 mm long, and consuming 13.5 amp at 68 volts. The chief emission of the arc is at 385 $\mu\mu$. Regions of strong emission are also regions of strong absorption. Such wave lengths, for which the emission is not considerable, are not absorbed in a measurable degree. This agrees with the assumption that the radiation of the arc is pure "temperature radiation." From the ratio between emission and absorption the "black-body temperature" of the arc is found to be 3800 deg C. This figure agrees with the results of other investigators.—*Elek. Zeit.*, May 27.

Ultra-Violet Rays from Lamps.—W. VOEGE.—An article in which the author replies to various criticisms of Schanz and Stockhausen concerning the necessity of protecting the eyes against the ultra-violet rays from artificial sources of light. On the basis of new experiments, in agreement with the opinions of oculists, he shows the incorrectness of the alleged bad effects of the ultra-violet rays of artificial lamps. The author finally discusses the use of various sorts of glass for the protection of the eyes in exceptional special cases against ultra-violet light.—*Elek. Zeit.*, June 3.

Power.

Printing Press.—An illustrated description of a large octuple rotary press, electrically driven and controlled on the Crompton-Kohler system of multiple push-button control which has recently been installed in the printing office of *The Times*, of London. The press can be controlled from 16 different points, and a very gradual start and a wide range of speed are obtained. A small motor is used for the lowest speeds, the load being transferred to a large motor when a certain speed has been attained.—Lond. *Elec. Eng'ing*, June 3.

Electric Power in Theaters.—SCHALLENMÜLLER.—A paper read before the Electrical Society of Karlsruhe on the use of electricity for power purposes and lighting on the stage.—*Elek. Zeit.*, June 3.

Cranes.—H. H. BROUGHTON.—A continuation of his long illustrated serial, the present section dealing with the mechanical equipment of cranes. The author describes the "free-barrel" system in use in nearly all the harbors and docks in England, and then deals with lifting magnets.—Lond. *Electrician*, June 4.

Cranes.—C. MICHENFELDER.—The first part of an illustrated article on electromagnetic cranes for loading and unloading.—*Elek. Zeit.*, June 3.

"Vacuum Turbines."—The application of steam turbines to the utilization of exhaust steam, either from condensing or non-condensing engines, is discussed in an article which also contains illustrations of machinery of this class manufactured by a British manufacturing company.—Lond. *Elec. Eng'ing*, June 3.

Exhaust Steam.—E. W. LEHMANN-RICHTER.—An article giving examples from practice on the economies obtainable from the use of exhaust steam for heating.—*Elek. Zeit.*, May 27.

Traction.

Railway Signals.—An illustrated description of the signal and dispatching system of the Mimico division of the Toronto & York Radial Railway. This line, which is single track and carries very heavy traffic, is equipped with a system of block signals and telephone dispatching apparatus which gives a continuous record of the location of every car on the line in the dispatcher's office, displays danger signals in the motorman's cab when the dispatcher desires to communicate with the train

crew or the block ahead is occupied, and embodies telephone communicating apparatus in each car which is automatically placed in circuit with the dispatcher's line when the car arrives at reporting points.—*Elec. Railway Jour.*, June 12.

Wires, Wiring and Conduits.

Wiring Rules.—A note on a new issue of the Wiring Rules of the Phoenix Fire Office, which is thought to be the most widely adopted in England with the exception of the Wiring Rules of the Institution of Electrical Engineers. The following two rules are noticed, viz.: (1) that all joints in tubing should be treated with aluminum paint, and (2) that flexible cords not provided with an efficient flame-proof outer covering must not be used in shop windows containing inflammable goods.—Lond. *Electrician*, June 4.

Electrophysics and Magnetism.

Effect of Temperature on Hysteresis.—W. P. FULLER AND H. GRACE.—An abstract of a London Physical Society paper on the effect of temperature on the hysteresis loss in iron in a rotating field. The rotating field was produced by means of two-phase currents. One phase was connected to a coil of long rectangular section and of sufficient length to produce a uniform field within a radius of 2 cm from the center. The second phase was connected to a similar coil enclosing this one and causing a flux at right angles to it. The resultant field at the center was uniformly rotating. An iron disk, 4 cm diameter, 0.027 cm thick, was supported by a bifilar suspension and the torque measured by a mirror and scale in the usual way. The specimen was heated by means of nickel-wire heaters placed above and below it, and the temperature measured by means of a thermo-junction placed close to the disk. The flux in the iron was measured by the voltage induced in a coil of eight turns of bare wire wound round it. To measure the voltage, the maximum value of which was of the order of 0.03 root mean square volt, a special galvanometer was constructed. This depends for its action on the forces exerted by a rotating field on a suspended coil carrying alternating currents. If E be the e.m.f. applied to the moving coil, and E_1 the e.m.f. due to the field on the coil, then, by turning the coils producing the field round until the deflection is a minimum, this deflection is proportional to E-E_1. The results of the experiment show that the effect of increasing the temperature of iron is to reduce the hysteresis loss at a given induction and to cause the maximum loss to occur at a lower value of the induction. In one specimen the maximum value of the loss at 220 deg. C. was 12,300 ergs per cubic centimeter per cycle at an induction of 16,000 c.g.s. units. At 580 deg. C. the maximum loss was 2600 ergs at an induction of 10,700. The frequency in the experiments was 42 cycles per second.—Lond. *Electrician*, June 4.

Electrons.—J. H. JEANS.—The first part of a theory of the motion of electrons in solids. Former electronic theories make use of the conception of a motion consisting of free paths and collisions. The present author endeavors to develop a theory which is free from all such suppositions. In the present paper he discusses electric conductivity, Kirchhoff's law and radiation of great wave-length. One of the results of this investigation is that the author derives Kirchhoff's law as a consequence purely of the electron theory. It appears that the law is true quite independently of whether the ether is in equilibrium with matter or not—in fact, the law is seen to be entirely independent of thermodynamic conditions of all kinds. It is consequently illegitimate to draw any thermodynamical inferences from the fact that Kirchhoff's law is observed to be true in nature.—*Phil. Mag.*, June.

Thermionics.—O. W. RICHARDSON.—The term "thermionics" is applied by the author to such phenomena as the emission of ions by hot bodies, the leak from hot wires, and a number of other phrases. The ions emitted by hot bodies are called "thermions." The paper of the author is a general and highly mathematical theory of this branch of physics.—*Phil. Mag.*, June.

Electrochemistry and Batteries.

Water Purification.—H. C. H. SHENTON.—A paper read before the (British) Institution of Municipal Engineers on the practical sterilization of water and of sewage effluents. Both ozone sterilization and hypochlorite sterilization are discussed. Ozone is made by high-tension electric discharge through air, hypochlorite by electrolysis of salt solutions. The author concludes that hypochlorite sterilization is much more economical than ozone treatment.—Lond. *Electrician*, June 4.

Units, Measurements and Instruments.

Measuring the Self-Inductance of a Coil.—E. C. SNOW.—In Pirani's method of measuring the self-inductance of a coil it is assumed that the self-inductance of the galvanometer used may be neglected. That this assumption is legitimate in the case in which the discharge of the condenser employed (which is of the same nature as the discharge through the galvanom-

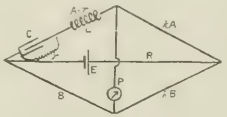
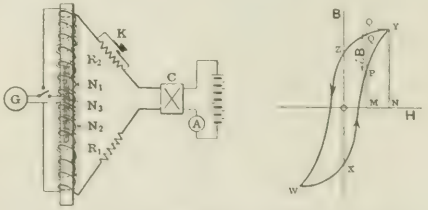


FIG. 3.—MEASURING INDUCTANCE OF A COIL.

eter) is continuous has been proved. The object of the present analysis is to investigate the case in which the discharge of the condenser is oscillatory. A condenser of capacity C, the "internal" resistance of which can be neglected, is placed in series with the coil whose self-inductance is to be measured (Fig. 3). The condenser is shunted by a non-inductive resistance r. This combination forms one arm of a Wheatstone bridge, the resistances of the other arms of which are adjusted so that a steady balance holds between the four arms. One or the other of two methods can now be used. (1) Keeping r constant, C can be varied until there is no throw on closing the galvanometer-key before the battery-key; or (2) keeping C constant, r can be varied, the total resistance of the arm being kept constant, until the same result is arrived at. The result of the author's analysis is that in the case of the oscillatory discharge of the condenser, with a constant e.m.f. the relation $L = Cr^2$ holds. Hence the expression for the inductance of the coil is independent of the inductance of the galvanometer.—*Phil. Mag.*, June.

Hysteresis Loss Measurements.—R. BEATTIE AND P. M. ELTON.—Ballistic methods of measuring hysteresis are very accurate, but have the disadvantage that they are generally troublesome. The authors describe a method that is quick in operation and has the advantage that it refers to short test pieces. Instead of obtaining the B-H curve, the δB-H curve is found by a differential measurement, the method preferred being that of momentarily short-circuiting a resistance in the magnetizing



FIGS. 4 AND 5.—MEASURING HYSTERESIS LOSSES.

circuit so that H is brought up to its maximum value and immediately returns to its previous value, a single specimen being used. The conditions for the interval of short circuits are examined. The results are satisfactory, but the authors find that the loss in a ring is 16.5 times that found in strips, whether by the differential or the step-by-step method. Finally, some differential methods involving two specimens are described. The arrangements in the differential method are shown diagrammatically in Fig. 4. Essentially they are the same as for an ordinary ballistic test, except as regards the means employed for varying the magnetizing current. For this purpose a tapping key K is connected up so as to permit the short-circuiting

of a part R_2 of the resistance in series with the magnetizing coil. The course of an experiment is to start by rocking the commutator C, the key K being held down meanwhile. After one or two reversals the commutator is stopped in its mid position, which interrupts the current and leaves the magnetism at the point X (Fig. 5). Next K is opened and the commutator thrown over in the direction in which it was last moving. This carries the magnetism to the point P, which corresponds to a magnetizing force $OM = H$, measured by the observed reading of the ammeter A. These preliminary adjustments having been made K is closed momentarily and the resulting ballistic throw noted. During the short interval that K is closed the induction has time to rise from PM to YN, and, on opening K, it falls to QM; hence, the total change of induction during the operation is $PQ = \delta B$, which, therefore, is what the throw of the ballastic galvanometer measures. In this way two related values of H and B are obtained. To obtain others the whole of the above process is repeated with different values of R_2, the value of R_1, which determines the size of the hysteresis loop, being kept fixed. The conditions for the success of the method are described. The article is to be concluded.—Lond. *Electrician*, June 4.

Exhibition of Instruments; Flux Meter.—J. Reyval.—A continuation of his illustrated description of the various instruments exhibited at the recent exposition of the French Physical Society of Paris. They include an absolute electrodynamometer of Pellat and Carpentier, the "hysteresigraph" of Abraham and Carpentier, the monophone receiver of Abraham, new transformers of Rochefort and Jaiffe for wireless telegraphy, and the flux meter of Grassot. The latter is shown in Fig. 6. It is intended as a substitute for the ballistic galvanometer and permits the measurement of the quantity of electricity passing through a small non-inductive resistance of a known value; or the measurement of the intensity of a uniform magnetic field, when the apparatus is connected to a coil of a known number of turns and of known surface. B is a galvanometer of the Desprez d'Arsonval type, with a moving coil in uniform magnetic field, the current being introduced through the spirals r and r' of very fine silver wire. An exploring coil G of a known number of turns and of known surface is connected to the terminals of the apparatus. When this coil is placed in a magnetic field the magnetic flux will be indicated by the needle of the flux meter. The needle returns to its original position

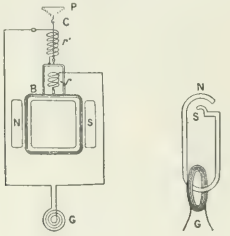


FIG. 6.—FLUX METER.

when the coil G is removed from the field. For experiments which last only a few seconds the indications are practically errorless.—*La Lumière Elec.*, May 29.

Series Transformer.—K. A. Sterzel.—An illustrated article on a series transformer for measuring instruments, giving details of the corrections which are to be applied on account of the change of the ratio of transformation with the load and on account of the phase difference which is to be noted.—*Elek. Zeit.*, May 27.

Braun Cathode-Ray Tube.—F. Giesel and J. Zenneck.—The well-known Braun cathode-ray tube has the disadvantage that the light intensity of the luminescent substances used in the tube is not sufficient for photographical instantaneous pictures in the case of relatively rapid varying currents. The authors have found that the use of zinc sulphide is useful for such purposes.—*Phys. Zeit.*, June 1.

Induction Meter.—An official note of the Reichsanstalt by which an induction meter for three-phase and two-phase systems is admitted for calibration and its construction and calibration are described.—*Elek. Zeit.*, June 3.

Telegraphy, Telephony and Signals.

Telegraph Cables.—The submarine cables of the world have increased during the last 10 years by 594 cables with 163,921 km length. The total cable network of the world at the end of March, 1908, was 1651 cables owned by the governments of different countries, with 84,155 km length, and 402 cables owned by private companies, with 380,697 km length. The total is, therefore, now 2053 cables with 464,852 km length. How the different countries participate in this total is shown in the following table:

England, incl. Pacific c'bl	253,898 km.	Japan	8,084 km.
United States, incl. P. I.	92,818 km.	Netherlands	5,721 km.
France	43,115 km.	Spain	3,565 km.
Germany	30,167 km.	Italy	1,989 km.
Denmark	17,771 km.	Sundry countries	7,724 km.

Some notes are given on the progress of Germany in cable construction during the last years.—*Elek. Zeit.*, June 3.

Protection of Telephone Installations Against Induction Effects.—M. Hoechstädter.—To protect telephone installations against the disturbing effects of induction from alternating-current transmission lines, a method is useful in which by

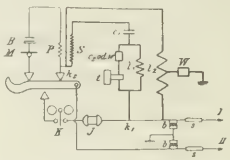


FIG. 7.—DIAGRAM OF ARRANGEMENT.

means of very small condensers a certain selection is made between the disturbing low-frequency induction current and the telephone current with a much higher frequency. The most suitable arrangement is shown in Fig. 7, where B is the battery, M is the microphone, K is a bell, J the inductance coil, c_1 is the small condenser which is intended to keep off the disturbing low-frequency current from the telephone receiver t. To take care of that part of the disturbing current which nevertheless passes through c_1 the inductance coil l_1 is provided in parallel with the telephone receiver t which is in series with a larger capacity c_2 or preferably a suitable resistance w. The method has proved very useful in connection with a 10,000-volt, three-phase transmission line of 30 km length. In this case the capacities, etc., had at the following values: $c_1 = 0.06$ microfarad, $w = 1000$ ohms, $W = 0.1_1 = 0.25$ henry, $l_2 =$ one or more henrys, $c_2 = 1$ microfarad.—*Elek. Zeit.*, June 3.

Protection of Telegraph and Telephone Lines.—The official regulations of the German Government for protection of telegraph and telephone lines from electric transmission lines other than for traction.—*Elek. Zeit.*, June 3.

Wireless Telegraphy.—H. M. Macdonald.—A mathematical note on the theory of directed wireless telegraphy by means of horizontal receivers and transmitters. The essential feature of the various systems of directed wireless telegraphy is the interference of two sets of waves differing in phase and proceeding from sources at a distance apart.—Lond. *Electrician*, June 4.

Wireless Telegraphy and Telephony in a Certain Direction.—E. Bellini and A. Tosi.—An illustrated description of their method of direct wireless telegraphy which has already been noticed in the Digest.—*Elek. Zeit.*, May 27.

Miscellaneous.

Slide Rule for Calculating Boiler Efficiency.—A note on a novel type of slide rule designed to facilitate comparison of actual figures of water evaporated per pound of coal, when the feed water and also the stream are at temperatures other than 212 deg. Fahr. The percentage over-all working efficiency of boiler and furnace can also be ascertained. There are four

logarithmically graduated scales, and the method of operation is as follows: The known feed-water temperature is set opposite the actual evaporation per pound of coal burned; this allows the equivalent evaporation—from water at 212 deg. Fahr. at a boiler pressure of 150 lb., and also from water at 212 deg. Fahr. at atmospheric pressure—to be read off from two pointers. If the rule is then turned over, the thermal units transmitted to the water and steam for each pound of coal burned and the percentage efficiency (with coal of 14,000 b.t.u.) are indicated on the scales at the back. Corrections are provided for differences of boiler pressure, for superheat or wetness of the steam, and for coal of other quality.—Lond. *Electrician*, June 4.

Finsen Treatment.—The first part of an article on the construction of arc lamps for the use in the Finsen treatment of skin diseases. The light rays of wave lengths from 490 to 390 (blue and violet) and the longest waves of the ultraviolet rays (with wave lengths from 390 to 350) are effective. The green, yellow and red rays on one side and the shorter ultraviolet waves on the other side must be filtered out.—*Elek. Anz.*, May 20.

Marseilles Congress.—A full account of the proceedings of last year's International Congress of Applied Electricity held at Marseilles. The proceedings at the sessions of the different sections were summed up and such resolutions as were adopted are given.—*La Houille Blanche*, January and February. Descriptions of various exhibits in connection with the congress in *La Houille Blanche*, March, April and May.

BOOK REVIEWS.

CONTROLE DES INSTALLATIONS ÉLECTRIQUES (APPENDIX). By A. Monmerqué. Paris: Ch. Béranger. 310 pages.

This book forms the Appendix to a previously published volume of the same author, subject and title. The appendix contains a digest of the various laws, ordinances and decrees that have been promulgated in France and are still in force on the installation of electric plants and conductors. A good index is provided at the end of the volume as a key to the mass of material included. To those interested in municipal and government regulation of electric installations the material collected in this work should prove useful.

LOGARITHMS FOR BEGINNERS. By Charles N. Pickworth. New York: D. Van Nostrand Company. 47 pages. Price, 50 cents.

This little manual contains tables of four-place logarithms and antilogarithms, together with simplified explanations of their use and examples for practice. Particular emphasis is laid on the facts upon which logarithms are based, so that the beginner learns to use the tables by ascertaining the significance of the values contained therein. The book is now in its second edition and is free from certain numerical errors which appeared in the first edition. Its use by any one familiar with algebra should cause him to understand logarithms thoroughly and use them with ease.

AMERICAN ELECTRIC RAILWAY PRACTICE. By A. B. Herrick and E. C. Boynton. New York: McGraw Publishing Company. 403 pages, 223 ills. Price, $3.

This book presents a compilation of matter relating to the construction, operation and maintenance of street and interurban railways in America. The subjects covered are preliminary estimates, field engineering for interurban roads, railway track construction, location of power station, overhead circuit, timetable and schedules, train dispatching and signals, rolling stock, car houses and repair shops and the maintenance of tracks, overhead lines and rolling stock. The treatment is almost wholly descriptive, practically no theory being discussed, and mathematical equations are completely avoided. The book can be considered as recording those constructive features and operating practices that at present are found most satisfactory in street railway service.

EINFÜHRUNG IN DIE THEORIE DES MAGNETISMUS. By R. Gans. Leipzig: B. G. Teubner. 108 pages, 40 ills. Price, 2.40 marks.

The book is a mathematical treatise on the theory of magnetism, and deals with the subject from the standpoint of Gauss and his contemporaries. It does not pay much attention to the modern development of magnetic theory, since the advent of the dynamo machine. Very little appears about magnetic flux generally. The fact that metallic reluctivity in iron is a linear function of magnetic force does not appear. The work is more suitable for the mathematical physicist as a study than for the applied physicist as an up-to-date text-book.

THE ELECTRIC FURNACE IN IRON AND STEEL PRODUCTION. By John B. C. Kershaw, F. I. C. London: The Electrician Printing & Publishing Company. 68 pages, with appendix, 24 ills. Price, $1.50.

This is a reprint of a series of articles which originally appeared in *Iron Trade Review* and *The Electrician* (London) in 1906. The opening chapter is a brief historical review of the work done in this line, followed by chapters devoted to the processes of Héroult, Keller, Kjellin, Stessano and others. They present but the main features of each of the processes and contain some good illustrations. The best feature of the whole is the chapter on yields and costs, in which the author has collected in an easily comparable form the chief data of the report of the Canadian Commissions and the well-known papers of Neumann and Goldschmidt. An appendix contains a brief description of the Colby induction furnace and, of more importance, the numbers of the British, Canadian and American patents granted each of the four principal workers in this field. The whole gives a good presentation of the subject.

DUMB NO LONGER. Romance of the Telephone. By Fred. De Land. Washington: Volta Bureau. 285 pages, ills.

The preface states that the object of this work is to trace the steps that led to the invention of the telephone in Massachusetts. To this end a history is given in great detail of the evolution of the methods of teaching deaf-mutes, the greater portion of the volume being devoted to this subject. This matter is introductory to an account of the connection of Alexander Graham Bell with the invention of the telephone, though the relation of the two sections appears rather slight. The account of Professor Bell's work is highly laudatory, this section, in fact, reading far more like a brief of the days of telephone patent litigation than as an impartial contribution to the history of telephone invention. Reis and Gray thus naturally fare badly; Wilber, the Patent-Office examiner, for example, is accused of perfidy in behalf of Gray. The work, nevertheless, will be found of interest as setting forth in minute detail an ex-parte account of the Bell invention, which may also be accepted as an authoritative version in view of the book bearing the imprint of the Volta Bureau.

THE METALLURGY OF IRON AND STEEL. By Bradley Stoughton. New York: Hill Publishing Company. 487 pages, 311 ills. Price, $3.

This book of Professor Stoughton occupies an intermediate position in the literature of iron and steel. It hardly goes deep enough into the details of the art to make the book useful to the active steel metallurgist, but rather is intended as a text-book for college and university work, or as a general reference book for the mechanical, electrical or civil engineer who desires to familiarize himself with the manufacture and properties of these two materials. While the text presumes a knowledge of physics and chemistry, as an after-thought, apparently, an elementary chapter on these two subjects was added at the close of the book. Separate chapters are devoted to the manufacture of pig iron, wrought iron, Bessemer and open-hearth steel. Excellent chapters deal with the founding and mechanical treatment of steel. The theoretical side of the subject, including metallography, is briefly touched upon. The crown-

ing feature of the book is its illustrations, which, for care in selection and excellence of reproduction, are probably not surpassed by any book on the same subject in any language. As a general and modern work on the subject the book deserves a place in the library of every engineer who comes in contact with these [illegible]

ALTERNATING-CURRENT MACHINES. By Samuel Sheldon, Hobart Mason and Erich Hausman. New York: D. Van Nostrand Company, 353 pages, 236 ills. Price, $2.50.

The book has been rewritten and modernized in many ways. Brief descriptions are given of the recently developed single-phase commutator motors. Alternators, transformers, induction motors, synchronous motors and transmission systems are discussed at some length. In each case the treatment is arranged with special reference to the needs of the student.

Approximately one-third of the volume is devoted to introductory matter relating to the properties of alternating currents and characteristics of alternating-current circuits. While the matter is, as a rule, handled in an instructive manner, the explanation of "resonance" is more apt to mislead the reader than to instruct him. The statements that when capacity and inductance are in parallel a surging once started between them receives periodical increments of energy from the line, and that the action is "analogous to the well-known mechanical phenomena that a number of gentle, but well-timed, mechanical impulses can set a very heavy suspended body into violent motion," will certainly not be properly interpreted by an uninformed reader. The average student would believe that if a condenser taking, for example, 10 amp at 100 volts and a purely inductive reactance taking the same value of current at the same e.m.f. were joined in parallel and subjected to 100 volts, the circuits would gradually build up current to a destructive value, when as a matter of fact the condenser acts just as though the reactance were not present, and the action of the reactance is independent of the connection of the condenser, just as is true of any two receivers joined in parallel. The difficulty encountered by students in understanding the so-called "resonance" phenomena would be greatly decreased if writers would omit the confusing reference to mechanical analogues.

The authors have given excellent outlines of the characteristics of the various types of alternating-current machines. The descriptive matter relating to the various types of apparatus is somewhat brief, but it is to the point and covers the features of interest sufficiently for the ordinary needs of the engineering student.

NEW APPARATUS AND APPLIANCES

Variable-Speed, Single-Phase Motor for Organ Bellows.

One of the interesting power distribution problems of alternating-current central stations has been that of satisfactorily driving church organ-bellows with single-phase motors. In general, the most satisfactory means so far applied has been a low-pressure blower of some form driven by a constant-speed motor, the movement of the organ-bellows regulating the admission of air to itself. Such arrangements have, however, been considered inapplicable in some of the smaller churches, due to the cost of the equipment. The illustrations herewith show a simpler type of installation in the German Reformed Church of New Brooklyn, at Brooklyn, N. Y. It consists of a 2-hp, variable-speed, single-phase motor belted to the driving shaft of the bellows through a simple countershaft. Speed variation is secured by means of an ordinary regulating rheostat in the field circuit of the motor, the amount of resistance in circuit being determined by the position of the bellows. This equipment has been running for two years or more, and has been found entirely adequate to all requirements, being simple, quiet running and practically self-controlling and automatic in every feature. The organist closes the main line switch, and the equipment thereafter regulates itself to the needs of the organ. The motor was built by the Wagner Electric Manufacturing Company, of St. Louis, Mo.



FIG. 1.—ORGAN BELLOWS DRIVEN BY SINGLE-PHASE MOTOR ON CEILING BELOW

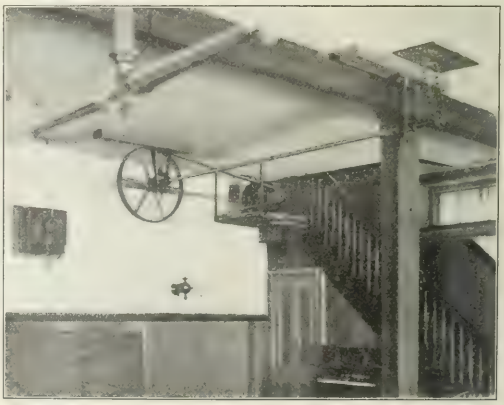


FIG. 2.—SINGLE-PHASE MOTOR FOR DRIVING ORGAN BELLOWS.

Tungsten Anti-Vibrator and Shop Cluster.

The American Arc Lamp Company, Kalamazoo, Mich., has added to its specialties a device named "Tungsten Life-Saver," having for its object to prevent injurious shocks from vibration to the delicate filament of tungsten lamps. The arrangement of the parts admits of a free lateral or oscil-

lating motion within a limited area, and the helically coiled spring used is extremely sensitive. The device is made in suitable sizes or strengths to suspend fixtures or clusters weighing from 4 lb. to 15 lb. or more. It can be readily installed with any standard fixture, and where used in stores or offices it may be entirely concealed by a ceiling canopy. It is

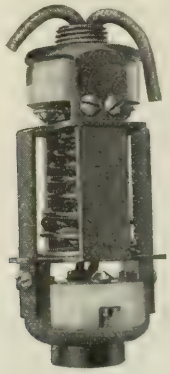


FIG. 1.—TUNGSTEN LIFE-SAVER.

attached to the ceiling by means of an ordinary crowfoot, and in steel buildings by an insulating joint.

Following its established plan of making shop lighting a specialty, the same company has developed and placed on the market an inexpensive tungsten shop cluster, made entirely from steel, with a plain black finish. The special features of this cluster are the 18-in. steel, porcelain-enameled shade, and the light distributing cone. The latter extends down from the center of the receptacle plate to a point about midway of the lamps, and being enameled in white porcelain presents a high reflecting surface, distributing the light downward and outward



FIG. 2.—TUNGSTEN SHOP CLUSTER.

into the zone where most needed. This cone also prevents the light of one lamp from being screened by the other. The tungsten shop cluster, in connection with the tungsten "Life-Saver," are offered by the manufacturers as a complete arrangement for shop lighting.

Exhibits at Cleveland Industrial Exposition.

Officials of the committee of the Cleveland Chamber of Commerce who had the Cleveland Industrial Exposition in charge state that at least 300,000 people visited the show during the two weeks that it was open and that 215,000 of these were paid admissions. The others were exhibitors, representatives of commercial and civic bodies from other cities, guests of the Chamber, press representatives and employees and deliverymen. Several million dollars' worth of business resulted from the exhibits, aside from the prospects secured and the advertising received. Exhibitors in electrical lines, especially in the automobile class, took quite a large number of orders, and in many ways profited through the exposition. In addition to the concerns previously mentioned in these columns, the following were among the exhibitors:

The A. & W. Sign Company had a magnificently lighted booth, in which a number of interesting flashing signs were shown in operation. The booth was enclosed with a framework of four white pillars, one at each corner, surmounted by illuminated globes. Curved beams extended from these pillars to a center ball, upon which was mounted a flagstaff with floating banner effect. In a case at the front of the display all the apparatus used in producing lighting effects was shown in operation. This proved of great interest to the people at large. This company furnished all the electric signs used in the exposition.

The General Incandescent Lamp Company had a booth built of dark wood studded with lamps of all kinds, sizes and capacities. The effect of the white light on the dark woodwork was excellent. Within the enclosure all the lamps produced by the company were shown in cases, so that the visitors could examine them or talk business without being disturbed. Most of the lamps used in the two buildings occupied by the exposition were furnished by this company.

Regenerative flame arc lamps in various styles of enclosure, and opened up for the examination of those interested; lamps for blue print and photographic work; apparatus used in installing and operating arc lamps, as well as other products of the factory, were shown by the Adams-Bagnall Electric Company in the armory building.

In addition to a full line of batteries and the smaller products of the factories, the National Carbon Company had two immense blocks of carbon at the entrance to its booth. From the display made by this company a good general idea could be obtained of the various uses to which carbon and its products are put.

The Domestic Vacuum Cleaner Company displayed samples of its floor cleaners, which are in the shape of small portable machines to which the apparatus taking up the dirt is attached by a short hose. They are operated by electric motors and energy may be secured from an electrolier or bracket socket.

To carry out the idea of operation by electric energy, the Brock Carriage & Wagon Company had its booth decorated with lights in a very creditable manner. These with trailing vines and artistic arrangement of pillars and lattice produced a good effect. A coupé and stanhope comprised the exhibit, and they were excellent specimens of the company's product.

The Reliance Electric & Engineering Company exhibited several of its variable-speed motors, both individual and attached to machines where their use could be judged from operation. The speed of this motor is regulated by increasing or decreasing the field by moving the armature in or out. A new speed indicator was also shown in connection with a motor-operated planer. A variable speed reversible motor and several constant speed motors made up the remainder of the exhibit.

The Baker Motor Vehicle Company showed two very handsome specimens of its product in the shape of a stanhope and a coupé. This company started in the manufacture of small runabouts, but is now producing many styles of electrically operated automobiles.

One of the largest automobile exhibits was that of the Rauch

& Lang Carriage Company, which had a victoria, a stanhope, two coupés, a surrey and a chassis. It is understood that the company did a very successful business at its booth, besides the prospects secured for the future.

The National Ticket Company showed all the styles of strip and single tickets turned out in its plant, as well as a turnstyle and ticket destroyer, with motor in the base. The latter machine is a very useful one for any company using a large number of tickets, as they may be destroyed and the scraps sold for old paper.

The Bruce-Macbeth Engine Company had in operation a 4-cylinder 135-hp gas engine. Its product may be adapted to any operation using power.

The Brown Hoisting Machine Company had a very creditable display of trolley and chain hoists of various kinds and capacities. Photos of some of its large installations were shown on the walls, and rough castings were displayed in other portions of the booth.

The Mechanical Rubber Company had both a merchandise and working display, which showed the wide range of its products, including belting, washers and rubber articles used for almost all purposes.

A large and handsome display of its products was made by the Cleveland Twist Drill Company. Drills of all sizes and for almost every conceivable purpose were to be seen in the cases in that booth.

The Standard Tool Company had an excellent display of twist drills and other articles turned out in its factory. The products were shown in glass cases and were arranged in such a manner as to attract much attention.

A welding machine was kept in continuous operation by the Standard Welding Company. This proved of great interest to people who are not acquainted with the methods used in electric welding.

New Type of Locke High-Tension Insulator

Fred. M. Locke, Victor, N. Y., announces that he has succeeded in making a new material for insulators which he calls "Transparent Porcelain," and which possesses a number of remarkable qualities. The base is aluminum silicate, and the material can be melted and cast in the same manner as glass. Two of its most remarkable features are the temperature changes it will withstand, and its high specific inductive capacity. These, together with great mechanical strength and high resistivity, ideally fit the material for all classes of insulation.



FIG. 1.—HIGH-TENSION INSULATOR.



FIG. 2.—PIN.

The insulation shown in the accompanying illustration has been submitted to the following tests: Dry arcing at over 105,000 volts per section; wet arcing at over 55,000 volts per section; breaking test, 10,700 lb.; sudden change of temperature from 40 deg. to 200 deg. Fahr. without cracking. Its specific inductive capacity was found to be 10 as compared with air as unity, the corresponding figures for glass and porcelain being 2 and 4 respectively.

The bushing shown in the illustration was tested to 100,000 volts, its flash-over point, with scarcely any evidences of static effect. It is stated that a large number of the new insulators have been tested to 100,000 volts for several hours without any failures.

"Universal" Electric Flat-Iron.

The Central Electric Company, Chicago, is placing on the market a new type of electric flatiron known as the "Universal" iron, in which the desired heat distribution is secured by so locating the heating element that the edges and points of the ironing plates are initially hotter than the center. The location and construction of this heating element are clearly shown in



FIGS. 1, 2 AND 3.—ELECTRIC FLAT IRON.

Fig. 1 and the heating effect is illustrated by the burned paper diagram of Fig. 2.

Following are the results of some tests made with (1) the new "Universal" iron; (2) with a second type of iron on the market; and (3) the average of tests of seven other irons which have been on the market for the past two or three years:

	1.	2.	3.
Efficiency	60%	50%	39%
Consumption, watts	400	475	533
Time required to heat bottom plates to 250 deg. F., min	2	3½	4½
Temperature of top at same time, deg. F.	72	100	137
Time required to heat bottom plate to 500 deg. F., min	5	8	13
Temperature at top at same time, deg. F.	150	250	398

An iron "snaps" at approximately 250 deg. Fahr. The ordinary domestic iron is better at 400 deg. Fahr. and the average laundry iron at approximately 500 deg. Fahr. Referring to the above data it will be noted that on the basis of 250 deg. Fahr. at the bottom of the iron, the temperature at the top of various types of irons varied from 72 deg. to 137 deg. Fahr.; and with a temperature of 500 deg. at the bottom of the iron the temperature at the top of the same irons varied from 150 deg. to 398 deg. The new iron was found much superior to the other



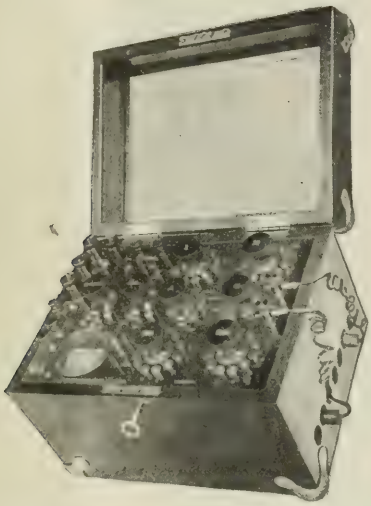
FIGS. 4 AND 5.—ELECTRIC FLAT IRON.

irons tested in that the top of the iron ran much cooler, less heat being thus radiated and wasted from this surface.

Fig. 3 illustrates the improved iron, and Fig. 4 the various elements. It will be noted that the heating element is firmly clamped between the body of the iron and the ironing plate, which in the cut is shown in the reverse position, illustrating the method by which it is bolted to the upper element. Fig. 5 shows the method of operating the heat-regulating switch, by the use of which the operator can keep the iron at a definite temperature with a minimum consumption of energy. The 6½ lb. "Universal" iron requires approximately 400 watts, which low consumption of energy meets the objection sometimes urged against other types of electric irons on the score of cost of operation.

A New Dial Decade Set.

The illustration herewith shows a new type of portable testing set being placed on the market by Queen & Company, Philadelphia. This set is very small and compact, measuring but 9¼ in. long by 7 in. wide by 7½ in. deep and weighing about 11 lb. It is equipped with a new form of rheostat consisting of four complete dials of 10 coils each, of the capacity of units, tens, hundreds, and thousands, so arranged that the revolving laminated brush may be changed from the highest to



DIAL DECADE SET.

the lowest coils without revolving backward over the intermediate contacts, thereby saving considerable time in manipulation. The bridge arm *A* has coils of 10, 100, 1000 and 10,000 ohms and also a block "infinity" or no resistance. The *B* arm has coils of 10, 100, 1000 and 10,000, and also a zero block, which short-circuits the *B* side when switch is on zero. It will thus be seen that a very wide range is allowed.

The type of brush designed for this set is of the tripod form, with two legs of the tripod resting on the central contact ring, thus doing away with the annoying and variable stud contact as usually made in switch-type sets. The third leg rests on the block as indicated by the position of the brush. It will be noticed that by this arrangement no flexible lead or variable stud can enter into the resistances of the rheostat or bridge. Each of the necessary switches and binding posts is plainly marked and conveniently arranged so that the operator may quickly make Wheatstone bridge, Murray and Varley loop tests for insulation measurements, and numerous other tests.

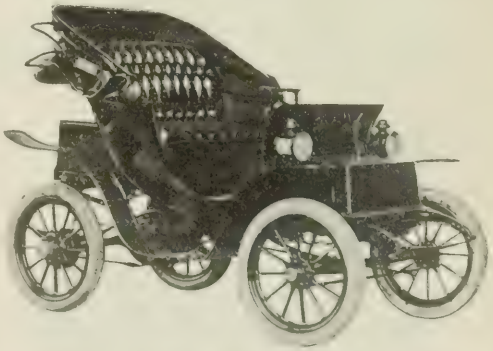
The scale on the galvanometer is so calibrated as to make the readings for insulation uniform throughout the entire range of the scale. The resistance coils are wound with manganin wire, of zero temperature coefficient, shellacked, and backed; the resistance, therefore, requires no correction over very wide ranges of temperature. The galvanometer is of the D'Arsonval type, with a long narrow coil, securing thereby a high sensibility, with dead-beat action.

The magnets are made of the finest grade of magnet steel, carefully aged and tested, and are permanent and uniform. A specially arranged Ayrton shunt allows a very wide range of application, making it possible to allow full current to go through the galvanometer or 1/10 or 1/100 part of the same. Keys in series with both battery and galvanometer circuits are so arranged that they can be kept locked down when it is desired to make permanent contact, by means of a thumb nut at the back of the strap; or both keys may be depressed with the same finger when necessary. Provision is made by means of binding posts for the use of an outside battery of higher e.m.f. than that furnished with the set, when stronger battery power is needed. An outside galvanometer may be used when an instrument of higher sensibility than that furnished in the set is desired. The battery consists of six special dry cells mounted in the base. For the renewal of the batteries it is only necessary to remove four small screws from the base of the case, thereby opening the cell compartment, and the battery can then be renewed without soldering or rewiring any connections. This cell compartment is made entirely separate from the rest of the case and securely sealed, there being no danger when changing the battery of getting any dust or dirt into the interior of the set, or around the galvanometer or resistance coils. The card of direction in the lid describes the connections of the set and also the diagram of the wiring as used in the different tests, together with printed descriptions and formulas. The case is of polished mahogany, highly finished, with nickel-plated corner straps to protect from injury. This set is being placed upon the market under the name of the "Queen Dial Decade Set."

Electric Pleasure Vehicle.

Among the various electric pleasure vehicles manufactured by the Studebaker Automobile Company of South Bend, Ind., the phaeton illustrated herewith is one of the most popular. The vehicle has a wheel base of 71 in. and a gage of 48 in. The tires on the front and rear wheels are 3½ in. Semi-elliptical and full elliptical springs are used on the front and rear axles, respectively. A Westinghouse motor rated at 48 volts and 26 amp is suspended from the chassis frame and is controlled by a Studebaker type, continuous-torque controller giving four speeds and shunt forward and three speeds reverse; a cut-out switch also being assembled in the starter. Ball bearings are used on the motor and axles so as to limit friction to a minimum.

Two brakes are provided; one a constricting brake on the armature shaft drum, operated by the controller, and the other is of the internal expanding type, operating through a foot



ELECTRIC PLEASURE VEHICLE.

pedal on both rear wheels. A side lever is used for steer
The battery equipment comprises 26 cells of Exide bat
two trays holding five cells each being placed over the
wheels and two trays holding eight cells each being place
the rear wheels. The weight of the vehicle complete wi
is said to be 2170 lb. The minimum charging voltage es
is 67.75 and 28 amp is required when starting to charg
minimum number of amperes which should be available
charging circuit is 42 and the kw hours required f
charge is 11.3 net, or 18.4 from a 11 volt circuit

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Adjustable Rheostats.

The Central Laboratory Supply Company, Lafayette, Ind., has recently placed on the market a line of adjustable rheostats adapted especially for meter testing, photometry work, lamp manufacture and other purposes where a continuous and close regulation of current is required. The complete line comprises several hundred rheostats of different capacities and resistances, covering sizes for almost any purpose designed.

The resistance wire is wound on a sheet-metal cylinder which has been previously covered with a thin layer of fireproof insulating material. The wire is wound under tension, and is afterward enameled, which, combined with the elasticity of the

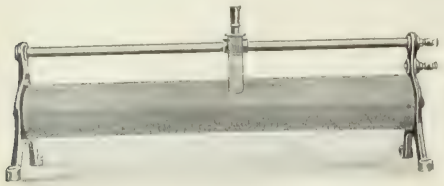


FIG. 1.—ADJUSTABLE RHEOSTAT.

insulating material, keeps the wire tight at all temperatures. The tube is mounted on ornamental cast-iron brackets placed at the ends, and held by a bolt passing through the tube. The openings in the brackets admit of a passage of air through the tube, which materially assists in the radiation of heat. The feet of the rheostat are fitted with rubber tips to prevent marring the desks or tables. They are also drilled through and countersunk, so that the rubber tips can be removed and the rheostats mounted in either a horizontal or a vertical position, and fastened with screws. A round bar extends the full length of the tube and carries a sliding contact of special design. The contact portion is made of a number of thicknesses of thin copper and tension applied by a phosphor-bronze spring, so that there are several independent contacts present on the wire at all times. The contactor, which is fitted with an insulated handle, has a smooth and even sliding motion, making it possible to make accurate adjustments without difficulty. Two brass binding posts, mounted on the frame, are connected to the ends of the resistance coil and the third to the contactor. This arrangement makes it possible to use the rheostat as a series

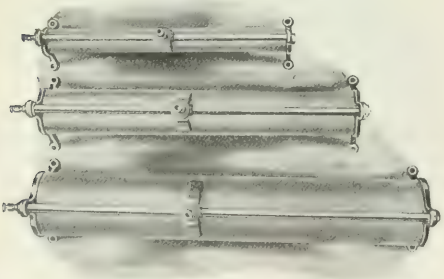


FIG. 2.—THREE SIZES OF RHEOSTATS.

ance or to place it across the circuit of a given potential btain between one end of the coil and the contactor any of e.m.f. from zero to the voltage across the coil.

FIG. rheostats are at present made in three sizes, as follows: rial can, 16 in.; diameter of tube, 1½ in.; weight, 2¾ lb.; reits most of ½ ohm, with 60 steps to 525 ohms and 575 steps. withstan 20 in.; diameter of tube, 2¾ in.; weight, 6 lb.; regether v of 1 ohm and 80 steps to 1300 ohms and 650 steps. ideally fi 24 in.; diameter of tube, 4½ in.; weight, 10½ lb.; resistance of 4 ohms and 135 steps to 2000 ohms and 735 steps. The three sizes are made in current capacities from ½ amp to 15 amp.

The wire with which these rheostats are wound has a negligible temperature coefficient, and is guaranteed not to deteriorate under repeated heating and cooling. The contactor, rod, and binding posts are polished and lacquered; the rest of

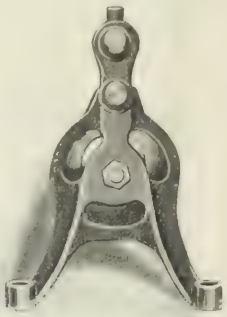


FIG. 3.—END VIEW OF RHEOSTAT.

the parts, including the coil, are finished in black baked enamel. The bar which carries the sliding contact also makes a convenient handle. These rheostats are intended for commercial and technical laboratories for controlling currents, calibrating instruments, and in various lines of commercial and experimental work.

Small and Large Tungsten Lamps.

In addition to the usual standard type of tungsten lamp heretofore imported, the Electrical Accessaries Company, of New York, is placing on the market an 18-watt tungsten for 100 to 120-volt multiple circuits. A view of this lamp, which is the smallest at present made for such service, is shown in the accompanying engraving. The company is also bringing out a 40-watt tungsten lamp for 200 to 250-volt circuits, which will doubtless be welcomed by users of high voltage current who have been obliged heretofore to burn two lamps in series, because no high-voltage lamp of low wattage was obtainable. Another

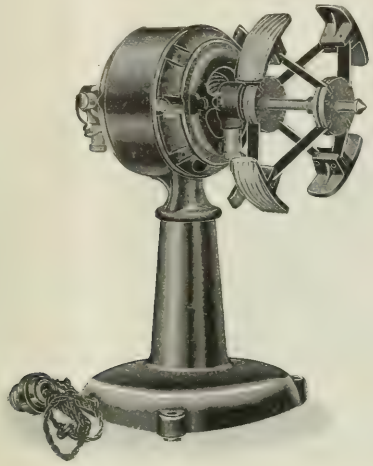


TUNGSTEN LAMP.

tungsten lamp which the company is importing for distribution here is rated at 400 cp. This lamp is intended for replacing arc lamps. Its specific consumption per candle-power is about the same as that of the arc lamp, while the upkeep and maintenance are considerably less. The lamps have been tried out abroad and have given satisfaction. The company has adopted a new trade name for its line, which will hereafter be known as "Justram" lamps, a contraction of "Just Wolfram," by which the line has heretofore been distinguished.

Electric Hat Chuck.

A novel and labor-saving device for holding and rotating hats is shown herewith. The device is manufactured by the Saylor Electric Company of Pittsburgh, Pa., and its main feature is that it fits any size of hat automatically and requires no adjusting whatsoever. The four shoes shown operate just like the

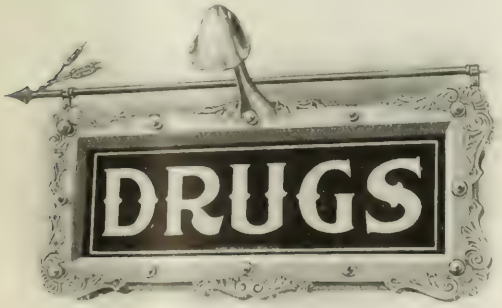


ELECTRIC HAT CHUCK.

weights on a fly-ball governor under the action of centrifugal force, and hold the hat firmly as long as the motor is running. When the motor stops the hat is released. Direct-current or alternating-current motors with large and rigid bases are employed. These are designed for 110-volt circuits, and in the case of the alternating-current motor for 60 cycles.

Electric Sign with Reflector Arm.

A recent addition to the familiar electric sign made by the Federal Electric Company, of Chicago, is a type provided with reflector arms, as illustrated herewith. The frame of the sign is studded with 2-cp carbon lamps in the usual manner, but in



ELECTRIC SIGN WITH REFLECTOR ARM.

addition there is provided for each face of the sign a 40-watt or 60-watt tungsten lamp placed in a shell-shaped reflector attached to an arm projecting out about 2 ft from the upper part of the sign, as shown. The reflector arm is of metal and painted white, the inner surface of the reflector being of white enamel. Two reflectors are required, of course, where the sign is of the type shown in the cut, having two surfaces and intended to be supported over the sidewalk. The light from the large tungsten lamp is directed down on the lettering, and makes the latter especially brilliant. With this arrangement it is quite practicable to use lamps of low candle-power in the border outline. For longer signs than that illustrated two or more reflectors are provided for each surface.

Reflector Bowl Unit.

A new reflector bowl unit is being placed on the market by the Holophane Company, which consists of a strong concentrating type of reflector above the lamp with a special Holophane hemisphere below. The prisms of the hemisphere are



FIG. 1.—REFLECTOR BOWL UNIT.

quite shallow so as to reduce to the lowest possible degree any accumulation of dust. As will be seen from the accompanying photometric curves, the new unit gives a very desirable distribution of light, ranging from 70 cp at 45 deg. angle to 55 cp directly under the unit when equipped with 60-watt clear tungsten lamps. The manufacturers consider that the complete unit has a wide field of usefulness in office buildings, stores,

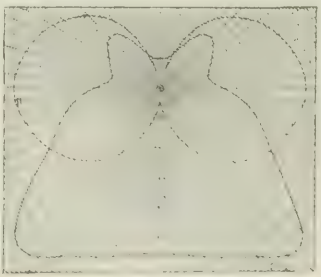


FIG. 2.—PHOTOMETRIC CURVES.

clubs, etc., where beauty, efficiency and diffusion of light are of about equal importance. In offering these fixtures the Holophane Company announces that it is not entering into competition with established fixture houses, but aims only to furnish equipment for some of its special glassware which other fixture manufacturers are not as yet ready to supply.

Philadelphia Office Building Installation.

The 10-story Lafayette Building recently erected at Fifth and Chestnut Streets, Philadelphia, is of modern construction, and serves as a striking illustration of the important place which electricity now holds in office buildings. Electricity is used not only for operation of the elevators and for illumination, but for floor cleaning throughout the building, for maintaining a supply of iced drinking water, and for insuring against the danger of fire. The energy required for the motors and lamps is furnished by a power plant on the premises, working in conjunction with another situated nearby in the Mariners' and Merchants' Building on Orianna Street. Both of these plants are owned by the Girard Estate and it is planned by combining the two to secure the greatest efficiency of operation and to provide against the possibility of interruption of service.

The Lafayette Building plant supplies electrical energy for over 5000 lamps on a three-wire, 110-volt system. The unbalance is taken care of by two small balancing sets. An idea of the extent of the system can be obtained from the fact that it requires over 5000 lb. of copper and 100,000 ft. of conduit.

One of the features of the plant is a board from which all the pumps are controlled. These are arranged to start and stop automatically and this, in addition to the fact that the controlling devices are concentrated on one board, does away with a large amount of attendance, which would otherwise be necessary. This board is entirely distinct from the main switchboard. Directly behind the pump control board and in another room are situated the pumps, surge and pressure tanks, and filters. The elevators, while they are propelled directly by hydraulic machinery, depend on electric drive to maintain the necessary pressure. This is supplied by three compound-wound motors, connected by belts to three Laidlaw-Dunn-Gordon horizontal triplex pumps. The sets operate almost noiselessly, a necessary feature for this class of service. The pumps are controlled by the regulating devices on the board to a variation in water pressure of not more than 10 lb. There are two pumps to supply the house tanks. These are Deane, triplex, driven through chains by 15-hp motors, and are furnished in duplicate to insure steadiness of service.

An ammonia refrigerating machine, driven by a 15-hp motor, is used to cool the drinking water. A system of heavily insulated pipes supplies iced drinking water to all rooms in the building, and the water is kept constantly in motion by means of a motor-driven circulating pump. With this arrangement the temperature of the water is kept down to 38 deg. or under, even in the hottest weather. The fire pump, which is also electrically driven, is of the rotary type manufactured by Rumsey & Company, and is capable of delivering 750 gal. of water per minute. The pipes carrying the normal supply are cross-connected with the fire lines, so that a supply of water may be taken from the latter at a lower pressure up to the time the pump is started.

For cleaning purposes a machine of the vacuum-air type is located in the engine room. This machine is driven by a 20-hp motor, and is connected by pipe lines to all the rooms in the building. The pipe lines are further connected by means of flexible hose to attachments either for sweeping or scrubbing the floors. The former attachment permits the dust to be sucked through the piping to the machine, and afterward cremated by suitable apparatus situated on the premises. The scrubbing device, which is of more complicated construction, is adapted to cleaning marble floors with water and does away with a large amount of labor.



FIG. 2. 4-HP MOTOR DRIVING BLOWER

Electrical energy is generated in both plants by 250-volt, compound-wound generators. In the Orianna Street plant, which has a rating of 550 kw, the generators are driven by Rice & Sargent engines. The Lafayette Building plant, of 300 kw rating, employs two 250-hp side-crank Harrisburg engines as prime movers, taking their steam from two 250-hp Parker boilers. As the requirements of both buildings are just sufficient to load the Orianna Street plant up to its most efficient operating point, this plant alone is used during the summer months, while during the winter the plant in the Lafayette Building is also employed, its exhaust steam being used for the heating system. The entire electrical equipment was furnished by the Crocker-Wheeler Company, of Ampere, N. J.

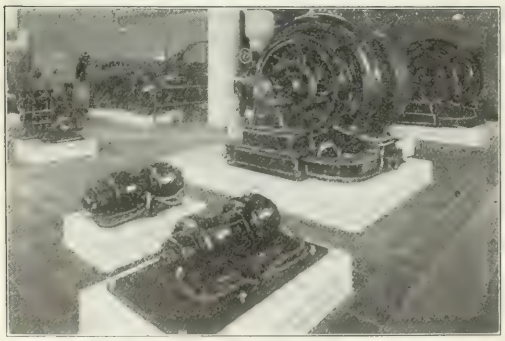


FIG. 1.—VIEW OF ENGINE ROOM.

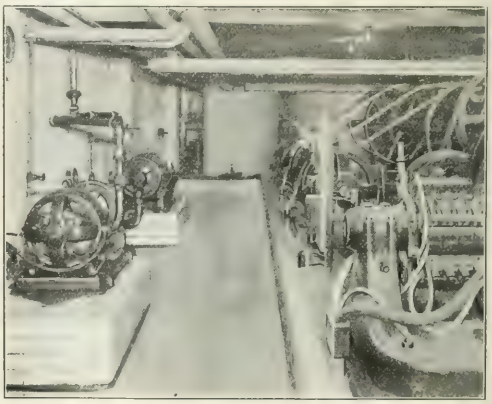


FIG. 3.—ELECTRICALLY DRIVEN PUMPS.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The tendency during the past week in general trade has continued to be toward improvement, and, especially in manufacturing lines, the books for fall are showing substantial gains. The retail business is only fair, but is practically as heavy as had been expected. Among the wholesalers and jobbers there is very little doing in the way of new orders, and the reorder business is not of great importance. Many inquiries, however, are coming in, and the general sentiment is that the fall business will be up to the standards reached before the period of depression began. The crop situation is generally satisfactory. The cold, rainy weather throughout some sections of the West during the past week was unfavorable to growing crops, but the effect is more a matter of delay than of positive injury. Cereals have practically held their own, and there is a distinct improvement in the condition of the cotton crop. It is in the industrial lines, however, that the greatest improvement is to be noted. In numerous places the cuts that were made in wages earlier in the year have been restored, and in almost every section more help is being employed. Steel conditions continue to be very propitious. The United States Steel Corporation is now shipping to customers at the rate of a little more than 9,000,000 tons of finished products for the year. The actual shipments in 1907 were below 10,500,000 tons, and this shows that operations at the present time are almost normal. The manufacturing companies are making no effort to force up prices, and this policy is certain to result in liberal building and in expansion. One of the chief features of interest in this line is the heavy specifications which are now coming forward from the railroads for cars and other equipment. Fair sized orders for rolling stock were placed last week, and a very heavy volume is expected at an early date. Purchases of steel rails are better than they have been, and it is understood that during the past week 36,000 tons were taken by domestic consumers, and orders for 49,000 tons were entered for shipment to Argentina. Business failures for the week ended June 17, as reported by *Bradstreet's*, were 213, against 197 the previous week, 254 in 1908, 165 in 1907, 173 in 1906 and 157 in 1905.

THE COPPER MARKET.

There has been a sharp reaction in prices of copper during the past week both in this country and in Europe. The disclosure that since the middle of May there has been an apparent accumulation of 25,000,000 lb. in standard warehouses in Europe has revealed the fact that recent heavy exports from the United States have not been going into consumptive channels as heavily as has been claimed by the selling agencies. This has caused a material reduction abroad and in consequence a recession in this market. The break in the London price for the week has been a little less than £2 per ton, but since the high point on June 7 the recession has been £3 5s. Domestic producers did all in their power to resist the decline in this market, but were finally forced to accept bids below the quoted figures, and eventually the official quotations had to be marked down. As is usually the case in the home market, the recession in price was attended by the withdrawal from the market of domestic consumers. It has been well known for years that our consumers prefer to buy on an advancing rather than a declining market. It is said that sales of electrolytic were made in this market within the past few days at less than 13 cents although the official quotation has not been below that mark. One interesting feature in the local copper market during the past week was the report of the committee appointed by Governor Hughes to investigate New York exchanges. This committee spoke very plainly with regard to the Metal Exchange and expressed the opinion that it served no good purpose either for the metal trade or the public. The report showed that the quotations were arbitrarily fixed by a committee and did not represent actual transactions. The fact that these quotations were deceptive has been frequently referred to in these columns. In speaking of the exchange the report says: "In spite of the apparent activity of dealings in this organization in published market reports, there are no actual sales on the floor of the Metal Exchange, and we are assured that there has been none for several years. Prices are, however, manipulated up and down by a quotation committee of three, chosen annually, who represent the great metal selling agencies as their interest may appear, affording facilities for fixing prices on large contracts, mainly for the profit of a small clique, embracing, however, some of the largest interests in the metal trade. These practices result in deceiving buyers and sellers. The making and publishing of quotations for commodities or securities by groups of men calling themselves an exchange, or by any other similar title, whether incorporated or not, should be prohibited by law, where such quotations do not fairly and truthfully represent any bona fide transactions on such exchanges. Under present conditions, we are of the opinion that the Metal Exchange does actual harm to producers and consumers, and that its charter should be repealed." The actual production of copper continues at a record rate and the accumulation in second hands must be as great in this country as it is in Europe. Imports continue heavy, and since the first of June have been 4420 tons of copper, 785 tons of matte and 22,560 tons of ore. Actual exports, mostly representing sales made several weeks ago, are also large. Since the first of the month up to and including June 21 the exports have been 22,242 tons. Quotations on the Metal Exchange June 21 were:

Lake	13⅜ @ 13⅝
Electrolytic	13 @ 13¼
Casting	12¾ @ 13

The London prices June 21 were as follows:

	£ s d	£ s d
Standard copper, spot	58 7 6	58 13 9
Standard copper, futures	59 5 0	59 12 6
Market	Easy	Firm.
Sales of spot		1,400 tons
Sales of futures		1,600 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.55	12.55
Electrolytic	14.25	12.12½
Casting	14.12½	12.00
London, spot	£64 2 6	£54 12 6
London, futures	64 17 6	55 10 0
London, best selected	67 15 0	59 0 0

LIBERAL ORDERS FOR STEAM TURBINES.—Since the beginning of June the orders for steam turbine equipments which have been received by the Westinghouse Machine Company at its shops in East Pittsburg have been practically as numerous as during the busy times of 1907. All indications point to a great improvement in business for the summer months. Among these orders are one for a 1500-hp steam turbine and condenser from the Stark Electric Railway Company, of Alliance, Ohio; a 500-hp turbine from the Goodyear Lumber Company, of Tomah, Wis.; a 3000-hp turbine from the Nichols Copper Company, of Laurel Hill, L. I.; a 1500-hp low pressure turbine from the Utah Light & Railway Company, of Salt Lake City; a 5000-hp turbine from the Rochester, Syracuse & Eastern Railway Company, of Lyons, N. Y.; a 500-hp turbine from the Red Oak Electric Company, of Red Oak, Iowa; a 5000-hp turbine and Le Blanc condenser from the Narragansett Electric Light & Power Company, of Narragansett, R. I., and one for an 1800-hp turbine from the West Virginia Pulp & Paper Company, of Covington, Va.

DUNCAN ELECTRIC MANUFACTURING COMPANY ADDS TO ITS PLANT.—Plans have been completed for an extension of the Duncan Manufacturing Company's plant at Lafayette, Ind., consisting of a five-story building 113 ft. x 130 ft. The new factory will be fitted for turning out Duncan meters and new lines to be added, while the present plant will be used in the manufacture of Duncan transformers, which are now made in rented shops. The Duncan company has steadily employed from 100 to 150 men since 1901 with no shutdown, and when the new factory is completed 225 to 250 men will be on its pay roll.

LIGHTING CARBON IMPORTERS CONTINUE HOPEFUL.—Although the Senate has adopted the Smoot amendment, fixing the proposed tariff on lighting carbons at 65 cents per 100 ft., the importers in this city are inclined to believe that there will be a modification of this rate when the tariff bill gets into conference. The fact that the carbon schedule, which is such a small part of the general tariff bill, attracted enough attention to require almost five hours' discussion, shows that the matter has been to some extent studied, and is being considered by the members of Congress. Speaking of this matter, one of the largest importers of carbons in this country had this to say: "Although it seems on the face that the importers have not been successful in their endeavor to secure a cheaper rate on lighting carbons, we feel yet that we have won a distinct victory in bringing the matter to the attention of the Senators, and we feel that when the bill goes into conference a compromise will be made that will give us a better chance to do business. I have received assurances from authoritative powers in Washington that our interests are in good shape, and intimating that when the final schedule is adopted, we will be in a position to continue in business and at a profit. The main difficulty we encountered from the start was in attracting attention to a matter which was relatively so insignificant. Very few people were interested in carbons, or knew anything about them, but we have succeeded in having the matter thoroughly threshed out, and we have interested a number of prominent Senators and Represenatives in the situation. We feel, therefore, that it will bear fruit when the final consideration of the bill comes up."

NO NEW HAVEN ELECTRICAL PLANS SETTLED.—In speaking of the New York, New Haven & Hartford electrification plans, George MacCullough Miller, a director in the company, had this to say: "Although the New Haven will undoubtedly electrify the road from Stamford to New Haven sometime in the future, only preliminary estimates have as yet been made and the directors have called upon Vice-President McHenry and the chief engineer for revised estimates. No actual definite decision in the matter has been reached. This is only one of many problems that are under consideration; among others, the projected New York, Westchester & Boston line to handle freight traffic on easy grades from New Rochelle to Danbury. We have ordered an electric freight locomotive and are building a mile of track on which to give it a trial, to see whether electrical freight locomotives are more economical and serviceable than steam." The cost of electrification already completed, from Woodlawn Junction to Stamford, four tracks of approximately 22 miles each, has amounted to about $5,000,000. Work is under way on the six-track line from the Harlem River to New Rochelle, a distance of about 11⅛ miles. The cost of electrifying this line as well as the yards at the Harlem River, about 160 miles of track in all, has been estimated at approximately $13,000,000.

SAFETY CAR HEATING & LIGHTING COMPANY.—An official of the Safety Car Heating & Lighting Comapny states that the improvement in the equipment situation has been greater within the past two months than in any similar period in the history of the industry. In most lines the demand is as good at the present time as it was in 1907. The company now has in operation 70 Pintsch light gas plants in various parts of the country and the increase in this branch of the company's business averages about 10 per cent per year. The company is rapidly developing its system of electric lighting by means of an axle driven dynamo together with the lamp voltage regulator. Among the recent orders which the company has received for equipping cars with this system are: Chicago, Rock Island & Pacific, 157; Southern Railway, 125; New York Central, 25; Lehigh Valley, 15, and Pullman Company, 10. The use of electricity for car lighting is growing in popularity with the big companies.

PROPOSED ELECTRICAL PLANT IN FAR EAST.—An American consul in the Far East reports that an electric light and power plant will be constructed in his district within two years, to cost about $500,000. No machinery or material has yet been purchased, but an agent of the company will leave shortly to consider the purchase of the necessary equipment. The plant, while it is designed to furnish electric light for a municipality, will later furnish the energy for an electric street car line. A copy of the complete report can be obtained by interested firms from the Bureau of Manufactures, Washington. The file number of the record is 3535.

SIX THOUSAND HP NORTH CAROLINA WATER POWER IN THE MARKET.—A. H. Richardson, of Ansonville, N. C., writes that engineers have just investigated a water power owned by him in the Piedmont region of North Carolina, and report that 6000 hp can be developed. The owner believes that all of this power can be disposed of within 30 miles of the generating point, as there are more than 60 cotton mills within that radius. Mr. Richardson wishes to open negotiations with any parties interested in such a development with a view to financing or selling the property.

ELECTRIC RAILWAY EXTENSION IN CHAUTAUQUA COUNTY, N. Y.—After three years' delay all difficulties in the way of the extension of the electric railway from Westfield, N. Y., to Barcelona Harbor on Lake Erie have been removed, and cars are now running to the lake, or will be very soon. The electric line is owned by the Chautauqua Traction Company, and the delay was caused by negotiations with the Lake Shore steam railroad over a bridge crossing. Finally the Business Men's Association of Westfield took a hand in the affair, and an agreement was reached.

ELECTRICAL CONSTRUCTION.—Among the items printed under Construction Notes in the present issue are announcements of proposed new plants or considerable extensions of present plants at Fairfield, Iowa; Pawtucket, R. I.; Oakland, Cal.; Johnstown, Pa.; Milwaukee, Wis.; Philadelphia, Pa.; McGregor, Iowa; Mason City, Iowa; Vancouver, B. C., Can.; Nevada City, Cal.; Yreka, Cal.; Siloam Springs, Ark.; Battle Mountain, Nev.

FREIGHT LOCOMOTIVES FOR THE NEW YORK, NEW HAVEN & HARTFORD RAILROAD.—The New York, New Haven & Hartford Railroad has placed an order with the Westinghouse Electric & Manufacturing Company for two electric freight locomotives to be employed on its main line. One of these locomotives is to be equipped with side rods and the other is to be of the geared type.

ELECTRIC AND GAS FIXTURE TRADE ASSOCIATION.—A movement is under way to organize a national association to represent the interests of the electric and gas fixture trade. A meeting for this purpose will, it is stated, be held within the next few months. John F. Byrnes, 324 Dearborn Street, Chicago, is closely identified with the movement.

CATALOGS WANTED.—The Wind-Power Electric Company, Madison, Wis., recently incorporated to carry on the business of installing electric lighting plants in farms, dairies and suburban homes, desires to receive catalogs of electrical apparatus, storage batteries, wiring material and electrical supplies in general.

Financial Intelligence.

THE WEEK IN WALL STREET.

The past week in the New York stock market has been one of sagging prices but fairly active trading. This condition was not unexpected after the rather remarkable advances which occurred the latter part of May. When the stock market is in the hands of professional manipulators to the extent that has existed for the past year, it is but reasonable to expect liquidation and profit taking as soon as any considerable advance is recorded. The present reaction was expected, and it is claimed by many close observers in the street that it was not as extensive as was anticipated. However this may be, there have been general recessions in prices of all active issues of from three to seven points, and there has been a disposition to sell stocks whenever prices appeared to remain firm, or whenever there appeared to be any buying interest in the market. It is hardly proper to say that there has been developed any distinct bear element, although no doubt a number of professional dealers, after unloading at the top, went short for quick turns. It is always the outsider who is the last to perceive the tendency of the market, and who is the first to become alarmed over any reaction. The news developments of the week were very few, and were not particularly important. A great deal was made over the reports from Paris of the hitch in the proposed listing of Steel common on the Bourse. This, as a matter of fact, was a very unimportant event. It was only proposed to list a limited number of shares as a start, and the fact that this listing was denied can have no effect on the general market for Steel common. The plan, however, to place the stock upon the Paris market was largely used to help along the advance movement,

and was no doubt more responsible for pushing the price of the stock up to new high records than the actual prosperity of the steel company. Conditions as a whole are satisfactory, and favorable to a continued healthy market. There has as yet been no check in the public eagerness to take good bonds, whether they be railroads or industrials. This in itself assures successful financing of all legitimate enterprises. Call money on June 21 was 1½ @ 1⅞ per cent, while 90-day loans were 2½ @ 2¾ per cent. The quotations in the table are those of the close June 21

NEW YORK.

	June 14.	June 21.	Shares sold.		June 14.	June 21.	Shares sold.
All.-Ch.	16	15¼	3,770	Int.-Met. pfd.	46⅝	44⅝	89,680
All-Ch., pfd.	54	51⅞*	13,950	Mackay Cos.	81½	79½	1,500
Amal. Cop.	85⅞	78⅜	184,045	M'c'ky Cs., p.	75⅛	74*	750
Am. D. T.	29*	29*	——	Man. Elev.	144	143	510
Am. Loc.	60½	58½	12,800	Met. St. Ry.	29*	27	400
Am Loc. pfd.	117⅛*	117¾*	505	N.Y.&N.J. Tel.	124	129	800
Am. Tel.&Cbl.	80*	80*	——	Steel, com.	69½	64¼	885,756
Am. T. & T.	142½	140⅛	24,517	Steel, pfd.	125¾	121	44,921
B. R. T.	80¼	77¾	28,925	W. U. T.	75	72⅝	3,850
Gen. Elec.	168½	160	8,700	West'h, com.	86⅛	83	8,860
Int.-Met. com.	17	15¾	53,550	West'h, pfd.	122*	121*	100

PHILADELPHIA.

	June 14.	June 21.	Shares sold.		June 14.	June 21.	Shares sold.
Am. Rys.	45¾	45¾	——	Phila. Elec.	11⅞	11¾*	——
Elec. Co. of A.	121*	121*	——	Phila. R. T.	27⅞	28⅜	——
Elec. St. B'ty.	54½	53½	——	Phila. Trac.	91	91*	——
E. S. B'ty. pfd.	49*	49*	——	Union Trac.	52⅞	52	——

CHICAGO.

	June 14.	June 21.	Shares sold.		June 14.	June 21.	Shares sold.
Chi. City Ry.	180*	180*	——	Chi. Tel. Co.	134	132½*	——
Chi. Rs., Ser. 1.	107*	107*	——	Met. El., com.	19*	19*	——
Chi. Rs., Ser. 2.	36½*	36½*	——	Met. El., pfd	54*	54*	——
Com. Edison.	119½	118	——	Nat'l Carbon.	93½	93*	——
Chi. Sub'ws.	25*	24¼*	——	Nat'l C., pfd.	118	118*	——

BOSTON.

	June 14.	June 21.	Shares sold.		June 14.	June 21.	Shares sold.
Am. T. & T.	142⅝	140¾	——	Mex. Tel.	3	2¾*	——
Cum. Tel.	126*	123½	——	Mex. Tel., pfd.	6⅜	6*	——
Edison, E. Ill.	249	249	——	N. E. Tel.	133	132	——
Gen. Elec.	163½	160	——	W. T. & T.	11½*	10*	——
Mass. E. Ry.	12*	12	——	W. T. & T., p.	87	87*	——
Mass E. R., p.	67¼	67½	——				

*Last price quoted.
Shares sold are for week June 14 to June 19.

DIVIDENDS.

American Cities Railway & Light Company, preferred, quarterly, 1½ per cent; common, 1 per cent, both payable July 1.

American Telegraph & Telephone Company, quarterly, 2 per cent, payable July 15.

Bell Telephone Company, of Canada, semi-annual, 13 per cent, payable July 1.

Cumberland Telephone & Telegraph Company, quarterly, 2 per cent, payable July 1.

Electric Storage Battery Company, quarterly, ¾ per cent, both common and preferred, payable July 1.

Germantown Passenger Railway, Philadelphia, quarterly 2.62½ per cent, payable July 8.

Michigan Light Company, quarterly, preferred, 1½ per cent; common, 1 per cent, both payable July 1.

Philadelphia Company, quarterly, common, 1½ per cent, payable Aug. 2

Sao Paulo (Brazil) Tramway, Light & Power Company, quarterly, 2½ per cent, payable July 1.

Shawinigan (Que.) Water & Power Company, quarterly, 1 per cent, payable July 1.

Tri-City Railway & Light Company, Davenport, Iowa, preferred, quarterly, 1½ per cent.

United Traction Company, Philadelphia, semi-annual, 2½ per cent, payable July 20.

Westinghouse Air Brake Company, quarterly, 2½ per cent, payable July 10.

Wilkes-Barre Gas & Electric Company, 1 per cent, payable July 1.

NEW ORLEANS RAILWAY & LIGHT REFINANCING.—The directors of the New Orleans Railway & Light Company have issued a statement in the form of a letter to the stockholders, setting forth their reasons for the issuance of a large new bond issue of $50,000,000, for which approval of which issue the stockholders have been called to meet. The resolution of the directors asks the approval of the authorized issue of $50,000,000, 40-year, first and refunding 5 per cent mortgage bonds, of which $30,000,000 are to be set aside to retire existing obligations, and $20,000,000 are to be available for extensions. It is the opinion of the board that if such an issue is approved, enough bonds be issued and sold to take and pay the $1,266,000, 6 per cent gold debenture notes due on Nov. 1, 1909, if in the judgment of the board it is deemed advisable to do so, and that all bonds to be issued further for the purposes of extensions, improvements shall only be issued for 75 per cent of the cost of such improvements. The plan is to limit as far as is practicable the issuance of additional bonds on the company's property. It is also set forth that the rapid growth of the city, and extensive paving to be done, in which the company will have to make considerable expenditures, and the contemplated improvements of the company, could hardly be met by the net earnings wholly, should they be sufficient, and at the same time allow the company to meet its franchise obligations, and as much of the work, including paving, will be permanent, the directors do not believe that the shareholders of the next few years should be burdened with the entire expense, as stockholders of 10 to 30 years' record will be benefited thereby.

HUDSON RIVER WATER POWER COMPANIES.—Counsel for the several bondholders' committees of the eight Hudson River Water Power companies which went down in the failure of E. H. Gay & Company, of Boston, have agreed to formulate jointly a petition asking for a foreclosure sale of the property. The present status of the companies is that injunctions have been issued preventing various trust companies from foreclosure on the mortgages which they hold. Counsel for the various bondholders' committees have had a hearing before Judge Ray, of the United States District Court in New York, preliminary to asking for the foreclosure. The judge expressed the opinion that before making any formal application counsel should get together and agree upon some plan in regard to the proceeding. He said that an appraiser had gone over the properties and placed a value of between $9,000,000 and $10,000,000 on them, but that owing to the different interests represented it seemed practically certain that there would be a conflict if sales of the properties individually were ordered. Charles H. Tyler, representing the Boston bondholders' committee, has announced that plans for the reorganization of the properties were being prepared and that all eight of the companies would be included in these plans.

BUTTE ELECTRIC BONDS OFFERED.—Lee, Higginson & Company are offering to the public $1,650,000 of first mortgage 5 per cent bonds of the Butte Electric & Power Company. The offering price is 98 and interest, which yields the investor a trifle over 5 1-10 per cent. The net income of the Butte company after paying all fixed charges in 1908 was $390,700. It is claimed that the future of the company is very bright, and that the high cost of steam coal in the territory in which the company operates makes it one of the best markets in the world for electric power. The company has recently purchased a half interest in the Great Falls Water Power & Townsite Company, which is now developing 35,760 hp at its hydro-electric plants and contemplates improvements which, it is claimed, will add 57,000 hp.

PENNSYLVANIA LIGHT COMPANY SOLD.—The entire capital stock of the Mifflin County Gas & Electric Company has been purchased by the Utilities Company of Philadelphia. The same purchasers bought a month ago the stock of the Lewiston & Reedville Electric Railway Company. It is proposed to build a trolley line 32 miles long between Bellfonte and Lewistown. It is promised that in a short time there will be through trolley service between Harrisburg and Altoona.

BALTIMORE ELECTRIC COMPANY'S BONDS SOLD.—The Consolidated Gas, Electric Light & Power Company, of Baltimore, has sold to Drexel & Company, of Philadelphia, and E. H. Rollins & Sons, of Boston, $3,584,500 general mortgage 4½ per cent bonds of the Consolidated Gas Company, a subsidiary. This makes $6,553,500 of the authorized issue of $15,000,000 that are now outstanding.

CHICAGO RAILWAYS BONDS SOLD.—N. W. Harris & Company and the National City Bank, of New York, have purchased $5,000,000 of Chicago Railways Company's first mortgage 5 per cent bonds, the proceeds of which will be used for rehabilitation and extensions. The bankers will probably offer the bonds to the public within a few days.

KINLOCH LONG DISTANCE TELEPHONE INCREASES STOCK.—The capital stock of the Kinloch Long Distance Telephone Company, of St. Louis, Mo., has been increased from $3,000,000 to $5,000,000. The company has 18 exchanges and 30,000 phones. It serves a population of 3,000,000 people.

BERGMANN ELECTRICITY WORKS COMPANY.—This company in its report to stockholders says that the works have been fully employed during 1908, the invoiced goods having amounted to $5,757,500, $500,000 in excess of 1907, which in turn exhibited an advance of $1,250,000 over 1906. Owing to keener competition, the sale prices realized were substantially less than in the preceding year, but it was possible to counteract these conditions by the purchase of raw materials on favorable terms and by the production in the company's own metal works of semi-finished articles at a lower rate and independently of other firms. The accounts indicate the following figures for the past two years:

	1908.	1907.
Capital paid up	$4,182,500	$3,500,000
Gross profits	2,668,900	1,781,250
Depreciation provision	328,990	338,050
Net profits	792,000	689,950
Dividend	630,000	540,000
Dividend, per cent	18	18

During 1908 the share capital was raised by $1,750,000 to $5,250,000, but the time has not yet arrived for the payment of the remaining instalments on the former. In addition, an issue of $2,500,000 in bonds is in contemplation, so as to provide funds for dealing with large transactions in a similar manner to that projected by the recently created electrical banks. The report gives particulars of the work accomplished by the different departments, and states that the new cable factory was started at the beginning of 1909, although only minimum profits are obtainable in view of the dissolution of the cable syndicate. The various departments employed 5000 workers at the end of 1908, as against 4,000 at the close of 1907. It may be added that recently the Bergmann Company made arrangements and favorable terms for itself for the reconsideration of the cable combination.

LACLEDE GAS LIGHT COMPANY SALE.—Details of the sale of the ownership of the Laclede Gas Light Company, of St. Louis, to the banking firms which represent a syndicate of St. Louis capitalists, have been given out. The investors include Adolphus and August A. Busch, W. K. Bixby, Thomas H. McKittrick, Charles H. Huttig, L. E. Dennig, E. H. Everett and G. H. Walker. These parties bought 74,000 out of the 85,000 shares of the company for a cash consideration of $7,480,000, or $101.08 per share. The best offer, it is said, that Emerson McMillan, chairman of the board of directors of the American Light & Traction Company, would make for this stock was on the basis of $93.50 per share. The Laclede Gas Light Company was incorporated in 1857, and had a perpetual charter from the State of Missouri, and perpetual right to use the streets of St. Louis for pipes and mains, and for "any appliances for conducting a substitute for gas." Its gross capitalization is $30,100,000, consisting of $19,100,000 of bonds and $11,000,000 in stock. Of this, $8,500,000 is common stock and $2,500,000 preferred. It controls the St. Louis County Gas Company, with a capital of $300,000, and is authorized to supply electricity to St. Louis. The reason for the sale, as explained by an official of the North American company, was the question whether or not the company could legally own the Laclede company and the Union Electric Light & Power Company. The attorneys for the company were of the opinion that the charter of one of the minor companies might be jeopardized by the joint ownership, and so the sale was decided upon as a way out of the difficulty. Officials of the North American Company in this city deny that there was any popular opposition sufficiently strong to cause the sale.

ELECTRIC VEHICLE REORGANIZATION.—Details of the plan for the reorganization of the Electric Vehicle Company, the approval of which was noted in the last issue, have now been made public. The plan contemplates the formation of a new company, to be known as the Columbia Motor Company, with a capital stock of $3,000,0000, of which $2,000,000 will be 6 per cent non-cumulative preferred stock and $1,000,000 common stock. The company will be organized under the laws of Connecticut. The old company has now outstanding $814,500 of 8 per cent non-cumulative preferred stock and $10,450,000 common stock. The bondholders of the present company will receive for each $1,000 par value of bonds preferred stock to the amount of $620 par value in the new company. The present preferred stockholders will receive one share of common stock for each 20 shares of preferred stock which they now hold. The present holders of common stock, upon payment of $1 for each share of such stock, will receive one share of common stock in the new company for each 20 shares which they now hold. The unsecured creditors will receive all dividends which may be declared out of the proceeds and effects of the company, or will receive preferred stock on the basis of one share for each $100 of dividends. The creditors secured in whole or in part by pledges of bonds will receive preferred stock of the par value of $620 for each bond of $1,000. The order of the court authorizes the receivers to sell the property, except the cash in bank, to the committee of which Herbert Lord is chairman for $430,000. The receivers are to reserve $150,000 for distribution among the creditors.

METROPOLITAN STREET RAILWAY REORGANIZATION.—No definite plan for the reorganization of the Metropolitan Street Railway system has yet been given out, but it is known that several are being formulated. During the past week the committee representing the holders of the 4 per cent refunding mortgage bonds of the company has issued a circular which says that, after a careful examination, the committee has found that under existing conditions the company is not able to earn the interest charges on either the 4 or 5 per cent bonds. The committee gives two reasons for this condition; one is that the transfer system imposed by the public authorities has reduced the average fare from 5 cents to practically 3 cents, while under existing laws, based on the theory that the property produces large profits, the taxing officials maintain that more than 35 per cent, and even 40 per cent, of the net earnings must be paid by way of special franchise and other public charges. This condition, the committee claims, practically amounts to confiscation. The committee further says that unless legislative relief can be had it would probably be the wisest course to foreclose and sell, even though that action would disrupt the system. The circular is signed by Edwin S. Marston, chairman, John W. Castles, Dumont Clarke, Robert Y. Hepden and Otto H. Kahn. There seems to be no doubt that the Interborough-Metropolitan Company intends to protect its interests in the surface lines, even though such protection will involve an assessment amounting to $10,000,000 on the shares which it now holds.

CHESTER COUNTY (PA.) ELECTRIC COMPANY.—A circular has been sent to the board of directors of the Chester County (Pa.) Electric Company by R. B. Rhodes, the manager, which urgently sets forth the necessity for reorganization of the concern, and which declares that the present condition is serious. The circular says that at a foreclosure sale everything the company owns or controls would not bring $50,000, although it would take that much to replace it. It points out the fact that there are outstanding $190,000 in first mortgage bonds, of which $165,000 have been sold, and $24,000 are in the treasury. There are also said to be outstanding $27,000 in unpaid notes and $4,000 in other bills. The capital stock issued amounts to $300,000. The circular also refers to court investigations which have been begun to look into the manner in which the company was financed.

HARRIMAN BUYING POWER PROPERTIES.—News is received from California that E. H. Harriman has bought the electric power and electric railroad properties in and around the town of Fresno, Cal. This is considered to be a part of a general plan adopted some time ago by Mr. Harriman for acquiring control of power rights and electric railways in California. The consideration paid for the recent purchase was in the neighborhood of $2,000,000, and payment was made partly in cash and partly in Southern Pacific Railroad Company's 4 per cent bonds. One of the properties purchased was the plant of the San Joaquin Light & Power Company near Fresno, and another being the Fresno Traction Company, with about 22 miles of road.

ASK STATEMENT FROM CONEY ISLAND RAILROAD.—The Public Service Commission has held up the application made by the Coney Island & Brooklyn Railroad Company for permission to issue $372,000 additional bonds, until a statement is made by the company as to what was done with the proceeds of the $900,000 new stock which was authorized in May, 1908. This new stock was authorized for improvements, and the new issue is now asked for the purpose of renewing the road bed and rails on about eight miles of the line.

MORE INTERBOROUGH RAPID TRANSIT BONDS.—The Interborough Rapid Transit Company has made an application to the Public Service Commission for permission to issue $10,000,000 of new 5 per cent bonds to take up a like amount of 5 per cent notes which fall due in March, 1910. These bonds are a portion of the $55,000,000 issue which has been authorized by the stockholders.

GENERAL NEWS

Construction News.

DOTHAN, ALA.—D. G. Zeigler, of Zeigler & Company, of Jacksonville, Fla., has submitted a proposition to the City Council to supply electricity in Dothan. It is proposed to utilize the water power of Abbey Creek, in Heney County, 22 miles from Dothan, and develop 4300 hp to furnish electricity in Dothan, Headland, Abbeville, Eufala and other towns within a radius of 60 miles. It is said that a site has been secured for the plant and if satisfactory arrangements can be made with the city work will commence on the project immediately.

LITTLE ROCK, ARK.—A permit has been issued by the Department of Public Works for the erection of a power plant at the Union Station. The plant will furnish light and heat for the depot and will cost about $60,000.

PARAGOULD, ARK.—The Marmaduke Telephone Company has been granted a 25-year franchise to construct and operate a telephone system in Paragould.

SILOAM SPRINGS, ARK.—Plans are being made for the extensions to the municipal electric light plant and water works system, which will involve an expenditure of about $30,000. W. W. H. Davey is secretary of water works improvement district.

FRESNO, CAL.—The contract for the construction of the proposed electric railway of the Fresno, Hanford & Summit Lake Interurban Railway Company from Fresno to Hanford, has been awarded to the Franklin Construction Company. F. S. Granger is vice-president and general manager.

LOS ANGELES, CAL.—Plans are being prepared by the aqueduct commission for the erection of hydro-electric plants along the aqueduct way in connection with the Ownes River water project for the city. It is said that the commission will apply to the City Council for an appropriation from the general fund to cover the cost of preparing plans for the power development and inspection of hydro-electric machinery in connection with the project.

LOS GATOS, CAL.—The Los Gatos Ice, Gas & Electric Company has applied to the Board of Supervisors of Santa Clara County for a franchise to erect transmission lines over the roads, streets and highways of the county for the distribution of electricity for lamps and motors. The Supervisors have agreed to grant such a franchise, bids for which will be received until July 12 at the office of the Supervisors, San Jose, Cal. Henry A. Pfister is clerk of the board.

NATIONAL CITY, CAL.—The City Trustees are considering the question of improving the street lighting system in this city.

NEVADA CITY, CAL.—Plans are being considered for the construction of a large electric power plant to furnish electricity for the mines in Sierra County. C. York and W. A. Lotspeich have filed a notice of appropriation of 15,000 cu. in. water rights in the south fork of the North Yuba River, between Downieville and Sierra City. A large dam is being erected two miles above Downieville. A site for a power house has been selected on Durgan Flat. The water will be carried in a pipe a distance of 9000 ft., where a sufficient fall will be secured to generate 4000 hp. Two units of 2000 hp each will be installed. It is said that the company will soon commence work on the construction of a transmission line to Allegheny and Forest City. The cost of the plant is estimated at $250,000.

OAKLAND, CAL.—The Central Oakland Light & Power Company has applied to the Board of Public Works for a permit to construct a power house on First Street.

SAN DIEGO, CAL.—The Grossmont Park Company, recently incorporated with a capital stock of $50,000, proposes to take over part of the lands owned by Col. Fletcher and W. B. Gross, and will construct buildings, pipe lines and also generate electricity, etc. W. B. Gross, Col. E. Fletcher and others are interested in the project.

SANTA PAULA, CAL.—The Board of Trustees has decided to replace the present street lighting system with tungsten lamps and has authorized the president and secretary to enter into a contract with the Ventura County Power Company to install the new system immediately.

VENTURA, CAL.—Negotiations are under way to have the electric light and water service extended to the Beach tract this summer. J. A. Driffill is president of the Ventura County Power Company.

YREKA, CAL.—Surveys have been completed for the new transmission line of the Siskiyou Electric Light & Power Company from the Fall Creek power house as far as Sisson, and will be extended to Dunsmuir. The line will be about 55 miles in length and will furnish electricity to pump water for irrigation purposes. The company is building an addition to its Fall Creek power house to provide for another 1000 kw generator. The new transmission line will be operated at a potential of 50,000 volts.

COLORADO SPRINGS, COLO.—The Golden Cycle Mining Company has purchased the controlling interests in the Pike's Peak Fuel and Central Fuel Companies. The Golden Cycle Mining Company proposes to construct a power plant near the Pike View mine, the initial cost of which is estimated at $200,000. The plant will furnish electricity to operate the Golden Cycle mill, which will utilize about 1500 hp. The Colorado Springs Electric Company now has the contract for furnishing power for the mill, which will expire next year. John T. Milliken, of St. Louis, Mo., controls the Golden Cycle Mining Company; Harvey McGarry, of Colorado Springs, is vice-president and manager.

DENVER, COL.—The power plant of the Denver Gas & Electric Company was damaged by a boiler explosion June 15, causing a loss of not less than $250,000. Electricity for operating the system is now supplied from the plant of the Central Colorado Company.

HARTFORD, CONN.—The House of Representatives has passed the bill amending the charter of the Northern Connecticut Light & Power Company permitting it to issue bonds to the amount of $350,000.

SOUTHINGTON, CONN.—The Legislature has granted an extension of time until July 1, 1911, to the Litchfield & Torrington Tramway Company in which to commence the construction of its proposed electric railway between Torrington and Lake Boston, 6 miles in length. T. H. McKenzie, secretary and treasurer, states that the company is planning to construct the railway this summer.

WILMINGTON, DEL.—The Board of Education has awarded the contract for furnishing electricity for lamps and motors to the Wilmington Light, Power & Telephone Company for a term of three years at the rate of 4 cents for lamps and 2¾ cents for motors.

FORT PIERCE, FLA.—The City Council has granted the St. Lucie Ice Company a franchise to construct an electric light and power plant.

JACKSON, FLA.—The City Council has adopted an ordinance under which the lighting committee of the Council is directed to enter into a 10-year contract with the Jackson Light & Railway Company on a basis of $87.50 per lamp per year under an all-night schedule, which is $26.40 less than the price of the present contract. The city now pays $114 for each arc lamp. It is expected that the company will refuse to accept the terms of the ordinance.

MACCLENNY, FLA.—A special election will soon be called to vote on the proposition to issue $5000 in bonds to light the streets of the town.

PENSACOLA, FLA.—Application has been made to the City Council by C. F. Dobson, C. C. Goodman and R. O. Hoffman for a franchise to construct an electric railway in this city.

QUINCY, FLA.—Preparations are being made to construct a new power house for the municipal electric light plant and to enlarge the water-works system.

ATLANTA, GA.—The City Council has granted a franchise to the Georgia Railway & Electric Company to construct a street railway on West Peachtree and Ponce De Leon Avenues.

BREMEN, GA.—At an election to be held June 26 the citizens will vote on the proposition to issue $8,000 in bonds for the construction of an electric light plant.

COLUMBUS, GA.—The Columbus Manufacturing Company is planning to build an addition to its plant, which will double the output of the mill. The cost of the work is estimated at $500,000. Electrical power is used to operate the mills which is furnished by the Columbus Power Company. F. B. Gordon is president.

UNION POINT, GA.—The Union Manufacturing Company, of Union Point, is reported to be in the market for 250, 200, 150 and 100-kw second-hand alternating generators.

CENTRALIA, ILL.—The Vincennes, Centralia & St. Louis Transit Company has filed a mortgage at Lawrenceville in favor of the Illinois Trust Company, of East St. Louis, Ill., for $2,500,000. The company proposes to construct an electric railway from St. Louis, Mo., to Vincennes, Ind. Burns & Company, Isabelle Building, Chicago, Ill., are said to be interested in the project.

CHARLESTON, ILL.—The Charleston, Westfield, Marshall & Terre Haute Electric Railway Company is planning to commence work soon on its proposed 12-mile electric railway.

CHATSWORTH, ILL.—The Chatsworth Electric Company has purchased the electric plant at Piper City, Ill., and has dismantled the same. Electrical service in Piper City is furnished from the Chatsworth plant. The company is contemplating establishing a day service, but has not yet fully decided upon it. L. A. Walter is secretary and treasurer.

CHICAGO, ILL.—The Northern Illinois Gas & Electric Company has filed a certificate of increase of capital stock from $2,500 to $600,000.

MOLINE, ILL.—The Tri-City & Northeastern Interurban Railway Company has applied to the Village Boards of Watertown, Rapids City, Hampton, Port Byron, Cordova and Albany for 50-year franchises, for its proposed electric railway, which will extend from Watertown to Albany.

MT. MORRIS, ILL.—The plant and holdings of the Mt. Morris Electric Company has been purchased by the Kane Brothers, of Mt. Morris. The new owners contemplate establishing a 24-hour service and furnishing electricity for motors.

MURPHYSBORO, ILL.—The capital stock of the Murphysboro Telephone Company has been increased from $10,000 to $20,000.

ROCHELLE, ILL.—The Chicago, DeKalb & Western Interurban Railway Company has applied to the City Council for a franchise in Rochelle for its proposed electric railway now under construction between DeKalb and Dixon.

CRAWFORDSVILLE, IND.—The Home Telephone Company is making extensive improvements and extensions which will include new equipment for exchange and considerable conduit work.

INDIANAPOLIS, IND.—The Board of Public Works will soon call for bids for electric wiring and conduits for the new city hall, for which bids were rejected when the general contract was let.

INDIANAPOLIS, IND.—W. S. Blatchley, State Geologist, is making a survey of Eel River through Putnam County with a view of utilizing the water power to generate electricity.

INDIANAPOLIS, IND.—The Board of Public Works has authorized the Indianapolis Light & Heat Company to commence work on the installation of the new lighting system in part of the business district. Under the plan proposed the Indianapolis Traction & Terminal Company will at its own expense replace the present street car poles with heavier ones. There will be 10 lamps to the square, for which the city will pay $74 each per year.

LIBERTY, IND.—The streets of this town will soon be lighted by electricity furnished from Richmond by Robert Asche, who has a 25-year contract for lighting the town at the rate of $48 per lamp per year.

MARTINSVILLE, IND.—The Citizens' Telephone Company is constructing a new exchange building in which considerable new equipment will be installed.

TERRE HAUTE, IND.—The New Long Distance Telephone Company, of Indianapolis, is installing an additional toll line. This company connects with the Citizens' Independent Telephone Company of this city and by means of this connection gives all other independents in this and adjoining counties an outlet for toll service.

TIPTON, IND.—The managers of the municipal electric light plant are considering the question of extending the electrical service to the farmers in the north and west sections of the towns.

DES MOINES, IA.—The City Council is considering an ordinance requiring all electric wires to be placed underground in the city.

EARLHAM, IA.—The Hawkeye Telephone Company is making improvements to its plant in Earlham. A new switchboard will be installed and the wires placed in cabies.

FAIRFIELD, IA.—H. C. Stevenson, superintendent of the Fairfield Gas & Electric Company, writes that the company is planning to make improvements and extensions to its plant, which will involve an expenditure of about $25,000, for which bids will soon be asked.

GRUNDY CENTER, IA.—The Grundy Center Electric Company is planning to change the street lighting system to series tungsten lamps and to install a small engine. J. B. Calderwood is owner and manager.

MASON CITY, IA.—Plans are being considered for utilizing the water power of Lime River, at Portland, and the Sheel Rock at Nora Springs, to be utilized to generate electricity to operate an electric interurban railway between Mason City and Rockford, Ia.

MASON CITY, IA.—The Mason City & Clear Lake Railway Company is planning to erect a new power plant, which will have an output of 3000 kw. The equipment will include two steam turbines rated at 1500 kw each. The present power plant at Emery will be discontinued when the new power station is completed.

McGREGOR, IA.—Preparations are being made by the McGregor Light & Power Company to increase the output of its plant. A new engine and dynamo will be installed.

STORM LAKE, IA.—The capital stock of the Northern Telephone Company has been increased to $20,000.

WILTON JUNCTION, IA.—Plans are being considered for the installation of a new 100-hp boiler in the municipal electric light plant. F. C. Wickes is secretary and manager.

WHITESBURG, KY.—Plans are being made for extensions and improvements to the system of the Whitesburg Telephone Company. James P. Lewis is manager.

ALEXANDER, LA.—J. P. Turregan, mayor, writes that no extensions are contemplated to the electric light plant and water works system at present.

DENTON, MD.—Arrangements are being made to wire the business houses and residences in Denton preparatory to installing electric lamps. The town is now lighted by acetylene gas. Henry C. Hawkins, formerly with the Consolidated Gas & Electric Company, of Baltimore, is manager of the new electric light plant.

DENTON, MD.—It is reported that Thomas F. Garey, Jr., of Baltimore, president of the Peninsular Light & Power Company, has sold his interest in the enterprise to Harvey L. Cooper and Albert G. Towers, who were associated with him in the project. They will proceed with the construction of the electric light plant at Garey's mill, on Chapel branch, three miles from Denton, which will supply electricity in Denton, Greensboro and Ridgely. The contract for the construction of the plant has been awarded to J. L. Livers, of Lancaster, Pa. It is expected to have the plant in operation within a year.

FEDERALSBURG, MD.—The Idlewild Electric Light Company has extended its transmission lines to Preston to furnish electrical service in that place.

ATTLEBORO, MASS.—Plans are being considered by the Frank Mossberg Company for the construction of a new plant to be equipped for electric drive. It is proposed to install a plant capable of developing 150 hp.

BOSTON, MASS.—Contracts have been awarded for furnishing central power plant equipment for three army posts as follows: For boilers to E. Keeler Company, of Williamsport, Pa., for $17,378; Simplex Electric Company, of Boston, Mass., for cable, at $54,997; engines to Buffalo Forge Company, of Buffalo, N. Y., for $9,027; Walker Electric Company, of New York, N. Y., for switchboard, $2,234, and for generators to the Western Electric Company, of New York, N. Y., for $6,659.

BOSTON, MASS.—Bids will be received by Guy C. Emerson, superintendent of streets, for lighting the streets and parks with small lamps, for a term of five years, which costs the city approximately $350,000 a year. At present there are 14,000 lamps lighted by gas or naphtha, while the contract calls for gas incandescent mantle lamps; bids will also be received for electric lamps. Under the new contract the service will be furnished by either gas or electricity. The naphtha lamps will be discarded.

BOSTON, MASS.—Negotiations have been completed whereby the Worcester & Blackstone Valley Street Railway Company will take over the property and holdings of the Bridge & Blackstone Valley Street Railway, and the Worcester & Southbridge Street Railway Company agrees to purchase the property and holdings of the Hartford & Worcester Company. The consolidation of the four railways under two heads are subject to the approval of the State Railroad Commission.

BOSTON, MASS.—The Boston, Lowell & Lawrence Electric Railroad Company has petitioned the State Railroad Commissioners for a certificate of authority to construct an electric railroad between Lowell and Lawrence and connecting both cities with Boston. It is proposed to construct the railway over private right of way with no grade crossings. Paul Butler, Spencer Borden, Jr., Butler Ames, Oakes Ames and John Burnett are directors.

FISKDALE, MASS.—Work has commenced on the street lighting system in Fiskdale by the Webster & Southbridge Electric Light Company, and it is expected to have the system in operation by Aug. 1. The town voted to have the lamps installed three years ago and appropriated $900 for that purpose, the company agreeing to furnish 72 incandescent lamps of 25 cp for one year for that amount and $1200 per year thereafter. It now agrees to furnish lamps of 40 cp for the same price and to have them in place by Aug. 1.

WESTFIELD, MASS.—Bids will be received at the office of the Westfield gas and electric light works until June 30, for both 500 and 750-kw units, comprising engine and dynamo, also switchboard, exciter and condenser. The engine may be either of the horizontal turbine or the cross compound type (reciprocating) type. William H. Ensign, William E. Atwater and Lewis C. Parker are selectmen.

DETROIT, MICH.—The contract for the construction of the conduit on Grand River Avenue, from Washington Avenue to Twelfth Street, was awarded to Charles B. Cole. The cost is estimated at $14,803.

GRAND RAPIDS, MICH.—The City Council has revoked the franchise of the Thornapple Electric Company to furnish electricity in Grand Rapids. The company is now in the hands of a receiver. The above action was taken by the Council for the purpose of protecting the city in the pending litigation into which the company has become involved, and because it has failed to live up to the terms of its franchise, under which it was to furnish electrical service by May 1, 1909. The city did not wish to have the franchise named as one of the assets of the company.

INTERNATIONAL FALLS, MINN.—A franchise has been granted to the American Suburbs Company, of Minneapolis, Minn., to construct an electric railway from Ranier to International Falls.

NEW ULM, MINN.—Clarence E. Poynter, of New Ulm, writes that he and his father own a controlling interest in a flour mill and light plant in a Texas town of about 1500 population which they would like to sell or exchange for an electric light plant or for a combined electric light and ice plant in a town of from 3000 to 6000 inhabitants. For further information address Clarence E. Poynter, P. O. Box 382, New Ulm, Minn.

ST. PAUL, MINN.—The question of raising the lower dam located a short distance above the Soldiers' Home is under consideration. The proposition includes raising the dam from 15 to 30 ft. at a cost of about $300,000. It is estimated that about 15,000 hp could be developed. The dam, which is partially completed, is being built by the United States Government to deepen the channel as far as the Washington Avenue Bridge. The proposition involves raising the extra money by the Twin Cities to pay for additional construction and utilize the power to generate electricity for municipal purposes.

MARSHALL, MO.—The plant and holdings of the Saline County Telephone Company have been purchased by the Missouri and Kansas Telephone Company. It is said that the plant will be extended and improved. E. T. Purcell is local manager.

LINCOLN, NEB.—The Lincoln Telephone & Telegraph Company has purchased the independent telephone systems at Beatrice and Wymore, together with considerable mileage of toll and rural telephone lines in

Gage County. The companies will operate under a separate name, but will be controlled by the Lincoln company.

SUTTON, NEB.—A special election has been called by the City Council to be held July 23 to vote on the proposition to issue $39,000 in bonds, the proceeds to be used to acquire the local electric light plant and for extensions to the water-works system. It is proposed to enlarge the electric light plant if taken over by the city.

VALENTINE, NEB.—The citizens have voted to issue bonds to the amount of $42,000 for the installation of an electric light plant and water-works system in Valentine.

BATTLE MOUNTAIN, NEV.—The Lander County Power & Light Company, recently organized, proposes to install a light and power plant in Battle Mountain. It is stated that the main purpose of the company is to furnish power to the Golconda Consolidated Mining Company, which is planning to install a plant at Galena. The Lander Company proposes to furnish electricity within a radius of 20 miles of Battle Mountain.

LAS VEGAS, NEV.—The Rio Virgin Telephone & Telegraph Company has been granted a franchise by the County Commissioners to construct a telephone line in Muddy Valley.

HOBOKEN, N. J.—The Common Council has adopted a resolution recommending an ordinance be adopted granting the Citizens' Light, Heat & Power Company a franchise, and also a resolution to defer the awarding of the contract for lighting the city indefinitely, but announced that it would continue to purchase electricity for street lamps until further notice from the Public Service Corporation at $80 per lamp per year. Up to the present time the city has paid at the rate of $100 per lamp per year. The company offered to furnish street arc lamps at $70 per lamp per year and to supply electricity to private consumers at 8 cents per kw-hour. It is expected that the new company will be formally awarded the contract at the next meeting of the Council.

IRVINGTON, STA., NEWARK, N. J.—The Town Council has decided to advertise for bids for the installation of a municipal electric light plant, the bids to be opened at the September meeting of the Council. It has also decided to advertise for proposals for furnishing electricity and gas for lighting the town on a one, three and five-year contract.

BROOKLYN, N. Y.—The South Flatbush Railroad Company has applied to the Public Service Commission for permission to issue $30,000 in capital stock and for a certificate of necessity. John C. Langan is president.

BROOKLYN, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, New York, N. Y., until June 28, for furnishing and installing electric equipment for Girls' High School, on Nostrand Avenue, Borough of Brooklyn. Blank forms, plans and specifications may be obtained or seen at the office of the superintendent, and at the branch office, 131 Livingston Street, Borough of Brooklyn.

NEW YORK, N. Y.—Bids will be received by C. B. J. Snyder, superintendent of school buildings, Department of Education, corner of Park Avenue and Fifty-ninth Street, until June 28 for repairs, alterations and addition to the electric equipment in Public Schools 4, 27 and 36 Borough of Bronx. Plans and specifications may be obtained at the above office.

NEW YORK, N. Y.—The Third Avenue Railroad Company has applied to the Board of Estimate and Apportionment for a franchise to build a double-track electric railway from the intersection of Third Avenue and Fifty-seventh Street, Manhattan, along Fifty-seventh Street to Second Avenue to Sixtieth Street and across the Queensboro Bridge to Jackson Avenue, Long Island City.

NEW YORK, N. Y.—Bids will be received by John F. Ahearn, borough president, for furnishing material and labor required for extension of electric lighting equipment, electric light fixtures, ventilating system, furniture, etc., for the eighth and attic floors in the Hall of Records Building, in accordance with plans and specifications prepared by Horgan & Slattery, architects, 41 West Twenty-third Street, New York, where plans may be obtained with blank form of contract.

NEW YORK, N. Y.—Bids will be received by the Department of Public Charities, foot of East Twenty-sixth Street, New York, N. Y., until June 28 for furnishing and delivering two 250-hp internal furnace boilers for the power house at the Metropolitan Hospital, Blackwells Island, New York. Blank forms and further information may be obtained at the office of the supervising engineer of the department, foot of East Twenty-sixth Street, where plans and specifications may be seen. Robert W. Hebbard is [illegible]

HICKORY, N. C.—Following the reported opposition of the Thornton Light & Power Company to the entrance of the Southern Power Company into the town, an agreement has been made whereby the Thornton company will receive electricity from the Southern Power Company, which will be permitted to enter Hickory. The Thornton Light & Power Company, it is stated, will distribute electrical power furnished by the Southern Power Company.

LAURINBURG, N. C.—The promoters of the Waverly Cotton Mills, at Laurinburg, have decided to equip the new mill to be operated by electricity. A power plant is now being erected.

MARION, N. C.—Plans are being made by the Marion Light & Power Company to construct a tunnel 100 yards long and a 40-ft stone dam to create more power for its electric plant.

ROANOKE RAPIDS, N. C.—Samuel F. Patterson, of Roanoke Rapids, N. C., is interested in a project to erect a large gunpaper mill at Roanoke Rapids, which will be operated by electricity. The cost of the plant complete is estimated at $650,000. A company will be organized under the name of the Patterson Mills Company.

STATESVILLE, N. C.—The Iredell Telephone Company has bough a site on which it is proposed to erect a telephone exchange.

SHERWOOD, N. D.—The Sherwood Electric Company is contemplating extending its telephone line ten miles west from Barber.

CLEVELAND, OHIO.—The Cleveland Electric Illuminating Company has awarded the contract for the construction of an addition to its plan on Canal Road to John Gill & Sons.

DELAWARE, OHIO.—Bids will be received by the Board of Trustees of the Girls' Industrial Home, Delaware, Ohio, until July 16, for furnishing material for the construction and installation of steam and electrica machinery and equipment, changes and additions in steam heating, piping trenching, conduits, etc., for the Girls' Industrial School at Rathbone Ohio. Plans and specifications are on file at the office of Harold M Bush, engineer-in-charge, Broad-Oak Building, Columbus, Ohio. Proposal must be made upon blank forms, which can be secured from the engineer Separate proposals must be made for materials and labor, as required b law. T. F. Day is secretary of Board of Trustees.

CHEROKEE, OKLA.—Extensive improvements are being made to th system of the Pioneer Telephone Company, which will involve a expenditure of about $10,000.

CLINTON, OKLA.—Preparations are being made by the Deer Cree Telephone Company to extend its telephone line from Arapaho to Custe City, a distance of 14 miles.

KONAWA, OKLA.—The citizens have voted to issue $35,000 in wate and light bonds.

SAYRE, OKLA.—The citizens have voted to issue $15,000 electric ligh bonds.

TULSA, OKLA.—The City Commissioners have granted the Oklahom Traction Company a franchise to construct and operate its railway i this city. Tulsa will be the center of the system, which will conne with Sapulpa, Broken Arrow and other nearby towns.

COQUILLE, ORE.—The City Council has granted a new franchise t Frank Morse, owner of the local electric light plant. The old franchis under which the plant has been operating, recently expired. A franchi was recently granted to Clark & Somers, but as yet they have done nothir toward the construction of a system.

HERMISTON, ORE.—Application has been made by the Rose Ci Electric Company, of Portland, Ore., for a franchise to install a electric light plant in this city. It is proposed to erect a plant at cost of about $15,000.

MARSHFIELD, ORE.—J. M. Blake, who it is said represents Easte capitalists, has applied to the City Council for a franchise to construct an operate an electric railway in Marshfield.

MILTON, ORE.—The citizens have voted to issue $25,000 in bonds f extensions to the municipal electric light plant and water-works system.

ST. HELENS, ORE.—The McCormick Company has applied to t City Council for a franchise to construct and operate an electric lig plant. It is proposed to install a plant at a cost of about $12,000.

BEAVER, PA.—It is reported that work has commenced on the co struction of the proposed electric railway between Woodlawn a Sheffield by the Woodlawn Electric Railway Company. J. A. Newell, Newell, W. Va., is president.

HARRISBURG, PA.—The City Councils on June 7 awarded the co tracts for electric lighting (contracts do not include street lighting) follows: For lighting city offices, fire engine houses, pumping station a filtration plant to the Harrisburg Light, Heat & Power Company 7 cents per kw-hour, and to the Paxtang Electric Company for light subways at 6½ cents per kw-hour. The Harrisburg company submit a bid at 7 cents to light the subways; the Paxtang Electric Company only on the subways, owing to its inability to reach other points.

JOHNSTOWN, PA.—It is stated that the Johnstown & Gallitzin R way Company will award contracts in August for equipment for its ste power plant to be located near St. Michaels, which will be equipped w two units of 750 kw each. One substation will be located at the m power station near South Fork, Pa., and an additional substation will erected at each end of the railway. George Holman, of Johnstown, I is general manager and engineer.

LEWISTOWN, PA.—The Utilities Company, of Philadelphia, has p chased the stock of the Mifflin County Gas & Electric Company. I said that this company is controlled by practically the same parties purchased the stock of the Lewistown & Reedsville Electric Rail Company about a month ago. Dodge & Day, of Philadelphia, Pa., interested in the company.

PHILADELPHIA, PA.—Bids will be received until July 24 at Bureau of Yards and Docks, Navy Department, Washington, D. C., furnishing at the navy yard, Philadelphia, Pa., three vertical compou condensing steam engines, with a normal rating of 700 hp each, to direct connected to 500-kw General Electric direct-current genera Also complete stairways and operating platforms for these engines an oiling system with a capacity for six engines same as the above. cost of the work is estimated at $61,800. Plans and specifications be obtained on application to the bureau or to the commandant of [illegible] yard, [illegible] R. C. Hebbard is chief of bureau.

READING, PA.—The committee authorized by the Council to prepare specifications for street lighting has recommended that proposals be called for street lighting for five or ten years for 700 or more magnetite arc lamps and 500 or more tungsten lamps with an all-night and every-night service.

SCHUYLKILL HAVEN, PA.—The contract for installing a 250-hp boiler, 300-hp engine and generator at the municipal electric light plant has been awarded to Jeremiah Woodbury & Company, of Hazleton, Pa., for $10,020. George E. Runkle is secretary.

PAWTUCKET, R. I.—Plans have been prepared by Charles T. Main, mill architect and engineer, of Boston, Mass., for a power plant for the Royal Weaving Company, of Pawtucket, R. I. The plans call for the construction of a power house 98x64 ft. and boiler house 93x47 ft. and smokestack 175 ft. high. The equipment will include three 500-kw Allis-Chalmers steam turbine units and four 350-hp Babcock & Wilcox boilers.

COLUMBIA, S. C.—The Southern Power Company is planning to extend its transmission lines to Columbia and will apply to the City Council for a franchise to erect its wires in this city for the distribution of electricity.

GREENVILLE, S. C.—Preparations are being made by the management of the Monaghan Mills, Greenville, for equipping the mills for electric drive, although the change will not be made at present. The large Cooper-Corliss cross-compound engine now in operation will be held for use in emergencies after the new equipment is installed.

GREER, S. C.—Plans are being prepared for the erection of a print mill at Greer, which will be equipped with 10,000 spindles and 300 looms. The plant will be equipped to be operated by electricity.

NEWBERRY, S. C.—It is said that the Newberry Cotton Mills will soon commence work on the construction of another mill, which will be equipped with 10,000 spindles and 300 looms. Electricity generated by steam power will be the motive power. Contracts for machinery have not yet been awarded. Lockwood, Greene & Company, 93 Federal Street, Boston, Mass., are engineers.

SPARTANBURG, S. C.—The Beaumont Manufacturing Company is planning to erect an addition to its building and will add 16,000 spindles and 350 looms to its equipment. Contracts for machinery have been awarded. The mill is operated by electricity.

MILBANK, S. D.—Plans are being considered for the installation of an electric lighting system in Milbank.

BELLEVILLE, TEX.—The First National Bank is reported to be interested in a project to establish an electric light and ice plant in Belleville.

DALLAS, TEX.—Arrangements are being made by the Dallas Independent Telephone Company for the installation of a telephone system in Dallas, which will involve an expenditure of $1,200,000. The contract for the construction of the entire plant has been awarded to the Jones & Winter Company, of Chicago, Ill.

TRINITY, TEX.—It is reported that the Trinity Electric Company is planning to install an electric light plant in this town. A. R. McDonald is interested in the enterprise.

TULIA, TEX.—The Tulia Light & Ice Company, recently incorporated, is planning to erect a power house. It is stated that machinery for the plant has been purchased. The company is capitalized at $10,000. J. W. Schwartz is president.

UVALDE, TEX.—It is reported that the property and holdings of the Uvalde Street Railway Company have been taken over by Charles Peter-son, A. M. Avart and M. M. McFarland. It is said that the railway will be eventually extended to Batesville, a distance of about 20 miles.

VELASCO, TEX.—Thomas M. Morrison, of Robinson, Ill., is reported to be interested in a project to establish an electric light plant at Velasco.

PORTSMOUTH, VA.—The Portsmouth & Norfolk Corporation, which recently secured a franchise from the city of Portsmouth to erect transmission lines in this city, has been given permission by the Board of Supervisors of Norfolk County to install and operate an electric system on the streets of the county.

RICHMOND, VA.—The Common Council has sustained the action of Mayor Richardson in vetoing the award of the contract to the General Electric Company for equipment for the municipal electric light plant. It will now be necessary to call for new bids for the entire equipment of the proposed plant.

RICHMOND, VA.—The purchasers of the properties of the Virginia Passenger & Power Company have made arrangements, subject to the court's order, to take over the properties June 30. The new company will be known as the Virginia Railway & Power Company, of which Frank J. Gould is head. The company's plans, while not announced definitely, are said to include large expenditures for increased facilities and improvement of the service.

WINCHESTER, VA.—The Virginia Woolen Company has commenced work on the construction of the addition to its building, in which additional machinery will be installed at a cost of $8,000. The mill will be equipped for electric motor drive.

NORTH YAKIMA, WASH.—It is stated that the Northwest Light & Power Company, of which Robert E. Strahorn, of Spokane, Wash., is president, has offered to sell its plant to the town of North Yakima for $75,000. It is said that the town favors the purchase.

NORTH YAKIMA, WASH.—It is stated that the Hydro-Electric Power Company will soon apply to the City Council for a franchise to erect transmission lines on the streets of the city for the distribution of electricity. The company proposes to utilize the water power of the Yakima River north of the city and carry it in a flume into the Moxee Valley, where a plant will be erected.

PROSSER, WASH.—Plans are being prepared by the Prosser Power Company for the construction of a new power plant, which will utilize the wasted energy of the Prosser Falls and the rapids of the Yakima River to generate electricity, which will be transmitted to Prosser and surrounding section for lamps and motors, and also to operate pumps for irrigating the lands above Sunnyside. The initial equipment will include two units of 500 hp each.

GLENDALE, W. VA.—The Wheeling & Metal Manufacturing Company, it is said, will erect a new building at Glendale, and will be in the market for a gas engine and electric equipment for the same.

WHEELING, W. VA.—Plans are being made by the Sands Electrical Company to erect a 7-story building. A power plant will be installed in the building.

KENOSHA, WIS.—The Kenosha Gas & Electric Company is reported to have surrendered its franchise to the city and, in lieu of it, has taken an indeterminate permit under the public utility law of the State.

MILWAUKEE, WIS.—The Milwaukee Electric Railway & Light Company, it is reported, will build an addition to its power plant at West Allis.

MILWAUKEE, WIS.—The Nordberg Manufacturing Company is reported to have secured the contract for the engine for the new power plant of the Joseph Bach Estate, of Milwaukee; the Fort Wayne Electric Company for generator and the Ames Iron Works for boilers.

RICE LAKE, WIS.—The capital stock of the Rice Lake & Northwestern Telephone Company has been increased from $10,000 to $25,000.

WAUPUN, WIS.—Preparations are being made to rebuild the entire local telephone system this summer. A metallic system will be installed and 16,800 ft. of new cable will be erected.

WAUKESHA, WIS.—It is reported that the Waukesha Motor Company is asking for bids for part of its new plant, which is to be equipped to be operated by electricity. It is stated that the company has not yet decided whether to install its own generating plant.

CALGARY, ALTA., CAN.—The Calgary Power & Transmission Company is preparing plans for a power development this year at a cost of $700,000. Smith, Kerry & Chace, civil engineers, of Winnipeg, Man., and Toronto, Ont., are in charge of the work.

KELOWNA, B. C., CAN.—The municipal power plant which was recently destroyed by fire will soon be rebuilt.

VANCOUVER, B. C., CAN.—The Western Canada Power Company, recently incorporated with a capital of $5,000,000, has taken over all the holdings and franchise of the Stav Lake Power Company, which is building a plant 35 miles from this city. The company will increase the proposed development and promises to be ready to deliver 30,000 hp in Vancouver within 18 months.

VICTORIA, B. C., CAN.—The British Columbia Telephone Company has decided to place all its wires in Victoria under ground. In return for certain privileges the city will bear one-tenth of the cost of the work. The city also finances the scheme and the company pays interest and sinking-fund charges.

EMERSON, MAN., CAN.—It is reported that the Great Falls Power Company is contemplating the construction of a transmission line from Emerson to Grand Forks, N. D., for the purpose of supplying electricity in that city.

BROCKVILLE, ONT., CAN.—Mr. Conroy, of Aylmer, Que., has submitted a proposition to the Board of Light Commissioners to supply electricity in Brockville. Mr. Conroy represents a company which is prepared to utilize the water power of the Gatineau River and develop 50,000 hp, of which 20,000 hp would be delivered to Brockville at the rate of $20 per hp.

COBALT, ONT., CAN.—The contract for the construction of the proposed electric railway between Cobalt and Haileybury has been awarded to the Nova Scotia Construction Company, of Sydney, for $125,000. The railway will eventually be connected with North Bay.

HENSALL, ONT., CAN.—Tenders are now being received for the construction of a telephone system in Tuckersmith Township consisting of 100 miles of line and 230 telephones. For further information address A. G. Smilie, clerk.

NIAGARA FALLS, ONT., QUE.—The managers of the municipal electric light plant are making a test of a 25-cycle arc lamp and should it prove satisfactory it is said that the entire system will be changed, and that Superintendent G. E. Foster will be given authority to purchase transformers without the formality of applying to the Board of Aldermen, as heretofore.

OTTAWA, ONT., CAN.—It is reported that options are being taken on water powers about the City of Ottawa to be utilized to generate electricity for the proposed Morrisburg & Ottawa Railway. Under the present plans it is proposed to transmit electricity to Ottawa, where it will be used to operate the railway from Ottawa to Morrisburg; also for lamps and motors to villages along the route.

TORONTO, ONT., CAN.—Bids will be received until July 6 by Adam Beck, chairman, Hydro-Electric Power Commission, Continental Life Building, Toronto, Ont., for the following work: 1, For construction of transformer station at Niagara Falls, Ont. 2, Transformer and interswitching station at Dundas, Ont. Plans and specifications may be obtained at the above office upon a deposit of $5 for each station, which will be returned upon receipt of bid or plans and specifications.

MONTREAL, QUE., CAN.—The Saraguay Electric & Water Company has submitted a proposition to the City Council offering to supply electricity in four city wards, and also agreeing to make a start on the municipal electric light plant at advantageous terms. The company is willing to furnish electricity for lighting the whole city if sufficient time is given them to make preparations. The company offers to furnish the city with electrical service until the city is ready to install a municipal electric plant without further cost other than the annual cost of the lamps, the city to purchase the lamps then installed in the streets at their actual value, and also offers the use of its poles in case it decides to take over the street lighting system, the price for same to be fixed by the Public Utility Commission. The company will be prepared to furnish electricity in Duvernay, St. Jean Baptiste, St. Louis and Lafontaine wards within three or four months.

HANLEY, SASK., CAN.—The Hanley Rural Telephone Company, recently organized, has decided to build 40 miles of telephone line this year. D. M. Dilley has been appointed organizer and manager of the company.

HANLEY, SASK., CAN.—The Council is negotiating with the Saskatchewan Government for a local telephone system to be built this year either by the province or by the town with provincial assistance. For further information address G. F. Daintree.

MELVILLE, SASK., CAN.—The Council has appointed a deputation of ratepayers to wait on the Provincial department of telephones for the purpose of securing a local telephone system and long-distance connection. For further information address Leon Benoilt, of Melville, Sask.

REGINA, SASK., CAN.—The ratepayers have voted in favor of the proposition to issue $78,000 in bonds, the proceeds to be used for the construction of a municipal electric light plant.

CHIHUAHUA, MEX.—It is reported that the Mexican Northern Electric Power Company will commence work within 60 days on the construction of a large dam on the Conchos River, about 17 miles above Sta. Rosalia, Chihuahua, to utilize the water power for a hydro-electric plant and for irrigation purposes. It is estimated that 40,000 hp can be developed, which will be transmitted to the mining districts of Parral, Almoloya and Sta. Eulalia and to Chihuahua and other towns. C. F. Greenwood, of Montreal, Que., Can., is president of the company.

New Industrial Companies.

THE ALTON LIGHT MANUFACTURING COMPANY has filed articles of incorporation with the Secretary of State at Wilmington, Del., with a capital stock of $30,000. The incorporators are F. J. Forhan, H. M. Browne and J. J. Harper, of New York, N. Y.

THE DOTHAN PLUMBING & ELECTRIC COMPANY, of Dothan, Ala., has been chartered with a capital stock of $20,000 by J. E. Wise, W. C. Fenn and F. A. Koepetke.

THE ELECTRIC CONSTRUCTION COMPANY, of Atlanta, Ga., has been incorporated with a capital stock of $12,000 by Charles M. Coyne, William M. Gregory, J. Prince Coyne and others. The company proposes to do general electrical construction work.

THE ELECTRICAL ENGINEERING & SUPPLY COMPANY, of Richmond, Va., has filed articles of incorporation with a capital stock of $10,000 for the purpose of dealing in electrical supplies. F. J. Whybrew is president; E. M. Thomas, vice-president and J. A. Hoofnagle, secretary and treasurer.

THE ELMWOOD CONSTRUCTION COMPANY has filed articles of incorporation with the Secretary of State at Wilmington, Del., with a capital stock of $100,000. The incorporators are M. McNulty, T. P. Smart and G. H. B. Martin, of Philadelphia, Pa.

THE GULF MACHINE & ENGINEERING COMPANY, of Tampa, Fla., has been chartered with a capital stock of $10,000 for the purpose of doing a general engineering business. The officers are: C. J. Belgau, president; H. C. Gordon, vice-president and G. P. Anderson, secretary and treasurer.

THE INTERNATIONAL ELECTRIC SUPPLY COMPANY, of El Paso, Tex., has been incorporated with a capital stock of $[illegible] by J. D. Campbell, J. E. Townsend, M. Weber, A. L. Sharpe and M. E. Gill.

THE K. E. AUTO ELECTRIC MANUFACTURING COMPANY, of Gadsden, Ala., has been incorporated with a capital stock of $10,000 to manufacture automobiles. The officers are: Kyle Elliott, president; I. G. Erwin, vice-president and L. C. Kyle, general manager and secretary.

ARTHUR D. LITTLE, of Boston, Mass., has filed articles of incorporation with a capital stock of $[illegible], for the purpose of doing a general electrical and mechanical engineering business. A. D. Little is president and H. S. Mack, treasurer.

THE MARINE POWER SYNDICATE, of New York, N. Y., has been incorporated, with a capital stock of $500,000, by H. S. Graves, R. M. Miles, Jr., and C. S. Towger, all of New York, N. Y. The company proposes to manufacture power machinery.

THE NORTHWESTERN CONSTRUCTION COMPANY, of Milwaukee, Wis., has been incorporated by C. B. Holder, A. E. Reichert and E. M. Daniell.

THE PHILADELPHIA LAMP MANUFACTURING COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $100,000 by R. N. Kerr, of Philadelphia, Pa.; M. E. Smith and T. J. Smith, both of Wilmington, Del.

THE RICE GAS ENGINE COMPANY, of Jersey City, N. J., has been chartered, with a capital stock of $1,000,000, by Arthur J. Denshan, Robert D. Harma and J. D. Baker. The company proposes to manufacture engines, tools, machinery, etc.

THE W. B. SMITH COMPANY, of Montpelier, Ind., has been incorporated to manufacture and deal in electrical supplies. The incorporators are: W. B. Smith, T. J. Driscoll and F. C. Neal.

THE SONORA CONSTRUCTION COMPANY, of Kerhonkson, N. Y., has filed articles of incorporation with a capital stock of $100,000 for the purpose of doing a general contracting, engineering and construction business. The incorporators are: C. H. Marshall, F. M. Van Wagoner and K. A. Fox, of New York, N. Y.

THE TEMPLE ELECTRIC-LIGHT GARAGE COMPANY, of Temple, Okla., has been incorporated with a capital stock of $5,000 by W. S. Brown, W. F. Evans, D. S. Tandy and J. C. Tandy.

THE YOUNG & TALBOT COMPANY, of Boston, Mass., has been chartered with a capital stock of $50,000 for the purpose of manufacturing and dealing in machinery. E. A. Young, of Boston, Mass., is president, and J. N. Talbot, of Dorchester, Mass., treasurer.

New Incorporations.

MOLINA, COL.—The Plateau Valley Telephone Company has been incorporated with a capital stock of $50,000 by K. C. Hill, John G. Hill, John H. Jenson, John S. Peugh and Claude W. Moore.

WILMINGTON, DEL.—The Merchants' Electric Company has filed articles of incorporation with a capital stock of $150,000. The incorporators are: H. H. Ward, G. G. Steigler and A. C. Gray, all of Wilmington, Del.

ALDRIDGE, ILL.—The Preston Union Telephone Company has been incorporated with a capital stock of $2,500 by Dr. C. D. Gardiner, of Grand Tower, Ill.

EUREKA, ILL.—The Eureka Telephone Company has been incorporated with a capital stock of $5,000 by C. J. Gibson, D. H. Schertz and A. L. Wood.

HARRISBURG, ILL.—The Saline County Light & Water Company has filed articles of incorporation with a capital stock of $5,000. The incorporators are: A. C. Murray, Walter L. Murphy and W. M. Timmons.

ANDERSON, IND.—The Batesville Gas & Light Company has incorporated with a capital stock of $50,000. C. M. Hoover, J. C. Vance and B. D. Emanuel are directors.

WASHINGTON, IND.—Articles of incorporation have been filed for the Farmers' Washingtown Township Home Telephone Company by John Kariger, John Oswald, William E. Miner, Leonard Stolte, William Kammier and others. The company is capitalized at $1,000.

BRIDGEWATER, MAINE.—Articles of incorporation have been filed for the Bridgewater Electric Company. The company is capitalized at $10,000 and proposes to install an electric light plant in Bridgewater. J. H. Farley is president; K. J. C. Burt, treasurer, and E. B. Morton, clerk, all of Bridgewater.

MILO, MAINE.—The Milo Telephone Company has been chartered with a capital stock of $5,000 and the following named officers: F. W. Hamlin, president; H. W. Hamlin, treasurer, both of Milo, and W. H. Monroe, of Brownville, Maine, clerk.

CAMDEN, N. J.—The Eastern Light & Fuel Company has been incorporated with a capital stock of $200,000 by William B. McDonald, of Camden, N. J.; William E. Stokes and Benjamin L. Van Schalck, of Philadelphia, Pa. The company proposes to generate electricity for light, heat and power.

NELSONVILLE, OHIO.—Articles of incorporation have been filed for the Hocking-Sunday Creek Traction Company by E. B. Young, J. Gaston Coe, M. A. King, Charles A. Vorhes, Warren N. Badger, H. H. Coe and Charles F. Bester. The company is capitalized at $[illegible] and proposes to construct an electric railway from Nelsonville to Athens with branches to Chauncey and from Sugar Creek to the Sugar Creek [illegible].

BARTLESVILLE, OKLA.—The Bartlesville Light & Power Company has been incorporated with a capital stock of $200,000 by L. A. Rowland, [illegible] and R. I. Bartle.

HACKBERRY, OKLA.—The South Persimmon Telephone Company has been chartered with a capital stock of $[illegible] and the following named directors: Samuel Halley, Silas Phillips, E. J. Healey, G. L. Jones, E. P. Burdick, D. H. Keller, James Stewart and Sherman Johnson, all of Hackberry.

PHILADELPHIA, PA.—A charter has been granted to the Philadelphia Suburban Traction Company to construct an electric railway from South Hampton through Davisville and Johnsville to Hatboro, 3½ miles in length. The company is capitalized at $25,000 and the incorporators are: W. E. Watts, of Dubois, Pa., president; John L. Grogan, H. C. Case, and J. A. Bonnell, of Philadelphia, Pa.; and W. A. Merrick, of Newton, Pa.

SALTSBURG, PA.—The Eldersridge & West Lebanon Telephone Company has been formed to erect a telephone line between Saltsburg and Nowrytown. The incorporators are: J. F. Hood, C. Hood, Dr. J. T. Cass, J. T. McLaughlin, J. H. Henderson, of Saltsburg, and others.

ALTAMONT, TENN.—Articles of incorporation have been filed for the Citizens' Telephone Company by J. P. D. Hobbs, W. S. Cain, W. A. Hobbs and others. The company is capitalized at $4,000.

BUTLER'S LANDING, TENN.—Articles of incorporation have been filed for the Butlers' Landing Home Telephone Company, with a capital stock of $6,000, by T. W. Roberts, V. B. Mayfield, J. A. Roberts, J. M. Lynch and W. B. Clark.

WESTMORELAND, TENN.—The Westmoreland & Red Boiling Springs Railroad Company has applied for a charter to construct an electric railway from Westmoreland to Red Boiling Springs. The company will be capitalized at $5,000, and the incorporators are A. R. Dean, H. C. Smith, E. K. Laneb, W. A. Smith and J. B. Kemp.

WOODBURY, TENN.—Articles of incorporation have been filed for the Home Telephone Company, of Woodbury. The capital stock is placed at $5,000 and the incorporators are: Jesse Davenport, L. H. McCrary, J. P. Wood, Walter Hancock and others.

CRYSTAL CITY, TEX.—The Crystal City Telephone Company has been incorporated with a capital stock of $10,000 by William Cook, B. F. Cook and J. B. Dennis.

Personal.

MR. T. D. COGGSWELL, formerly of the commercial department of the Denver Gas & Electric Company, has been appointed commercial manager of the Electric Bond & Share Company.

MR. HARMAN S. SALT, 114 Liberty Street, New York, N. Y., has been appointed New York representative of Mathias Klein & Sons, Chicago, manufacturers of linemen's and construction tools.

MR. H. M. HIRSCHBERG, president of the Excello Arc Lamp Company, has returned from Europe, where he found a general satisfactory condition in the flaming-arc-lamp field and many developments of great interest.

MR. FRANK D. MURPHY has been appointed manager of the commercial department of the Elmira Water, Light & Railway Company, of Elmira, N. Y. Mr. D. F. Harrington has been made assistant superintendent of the distribution system.

MR. FRED J. POSTEL and MR. HOMER R. LINN, constituting the engineering firm of Postel & Linn at 279 Dearborn Street, Chicago, have dissolved partnership by mutual consent. A new firm known as F. J. Postel & Company will practice engineering at the old office.

MR. JOHN E. ERICSON, city engineer of Chicago, has been decorated with the Order of Vasa by the King of Sweden in recognition of his professional work. Mr. Ericson is a native of Sweden and has several times refused flattering offers to return to his native country.

MR. HENRY FLOY, consulting engineer, has been retained by Mr. B. J. Arnold in direct charge of the appraisal of the street railways in Greater New York and the elevated railways in Brooklyn, which Mr. Arnold is making for the Public Service Commission of the First District.

MR. H. H. SINCLAIR, vice-president of the Edison Electric Company, of Los Angeles, has been appointed vice-president and general manager of the Great Western Power Company, with offices in the Crocker Building, San Francisco. Mr. Sinclair will continue as vice-president of the Los Angeles company.

MR. ALTON S. MILLER, general manager of the Consolidated Gas, Electric Light & Power Company, of Baltimore, Md., has resigned and has accepted the position of general manager and vice-president of the Union Electric Light & Power Company, of St. Louis. Mr. Miller has held his Baltimore position since 1902.

MR. W. J. HAMMER represented the American Institute of Electrical Engineers on the occasion of the presentation of the gold medals of the Aero Club of America to Messrs. Wilbur and Orville Wright by President Taft in the East Room of the White House on June 10, 1909. Mr. Hammer also represented the Aeronautic Society of New York. The Franklin Institute was officially represented on this occasion by Messrs. Emile Berliner, of Washington, D. C., and Mr. Charles Day, of Philadelphia. All three of the delegates are members of the Aero Club of America.

MESSRS. R. PFEIL, A. HETTLER and H. MEYER, of the Siemens & Halske Company, of Berlin, sailed for home on June 19 by the *Amerika* after a very brisk and crowded trip of three weeks around the country. They visited a number of plants, factories and installations, and were greatly pleased with all the interesting things they saw, though by no means dissatisfied with the results of the comparisons natural to occur between their own country and this. There are always pleasure and profit in the visit of such trained observers. On the Friday evening before their departure a dinner party was given in the pergola of the Hotel Astor which lasted pretty well until the hour for going aboard. Director Pfeil had not been here for several years, but hopes soon to make another [illegible]

DR. HAROLD PENDER has been appointed [illegible] of theoretical and applied electricity in the department of electrical engineering of the Massachusetts Institute of Technology. Dr. Pender was graduated from the Johns Hopkins University in 1901 and took the degree of Ph. D. and the latter part of the year and [illegible] the classical experiment of Prof. Rowland which demonstrated the magnetic effect of a moving charge of electricity. M. Cremieux, of Paris, having challenged the accuracy of the Rowland method, and devised an experiment which appeared to substantiate his criticism, Poincare, the eminent French mathematical physicist (recently elected a member of the French Academy), suggested the desirability of demonstrating the two experiment which appeared to substantiate his criticism, Poincaré, the Cremieux. An arrangement was then made whereby the expense entailed would be divided between the French Academy of Sciences and the Carnegie Institution, and Dr. Pender was sent to Paris on the part of the Carnegie Institution, where he established the inaccuracy in the Cremieux experiment, which the author acknowledged, and also established to the satisfaction of the latter the accuracy of the Rowland experiment. Upon returning from France Dr. Pender entered the employ of the Westinghouse Electric & Manufacturing Company. He has since been engaged in regular engineering work, having recently been associated with Dr. Cary T. Hutchinson.

Trade Publications.

MOTORS FOR SHOP AND OFFICE USE. [illegible] Westinghouse Electric & Manufacturing Company [illegible] No. 4132, showing the application of [illegible] small motors [illegible] 1/20, 1/12, 1/8, 1/6 and 1/4 hp for domestic and commercial purposes.

ELECTRIC SPECIALTIES.—Catalog No. [illegible] of the Crescent Company, of Valparaiso, Ind., contains descriptions and illustrations of the specialties made by the company. These include incandescent lamp guards, cord adjusters, lamp cleaners and lamp removers, coloring fluids, torches, soldering salts and paste, time switches, clusters, etc.

EXCELLO DI-ELEK ARC LAMP.—The Excello Arc Lamp Company has a bulletin (No. 102) devoted to its new Duplex arc lamp. This is a double-trim lamp burning 30 hours per trim and has been favorably received in England and Germany, and has already attracted a great [illegible] among the American engineers.

ELMER P. MORRIS CO., 90 West Street, New York City, has just published a handsome broadsheet in colors, brass bound, of the Panama Canal, and of the Western Hemisphere in its relation thereto. A profile of the canal is also given, and a cross section of the Culebra Cut. Mr. Morris will be glad to furnish this on application.

RESISTANCE UNITS.—The Di-el-ite Manufacturing Company, of Philadelphia, Pa., has issued a small leaflet in which are listed the various resistance units made by the company. The insulation used in these units is an artificial stone peculiarly adapted for electrical work. High-grade resistance wire or strip is employed, which is embedded in the di-el-ite, forming a solid unit.

PASTE LUBRICANT.—Oildag is a mixture of deflocculated, unctuous graphite and oil which possesses excellent lubricating properties. The properties of this paste are set forth in a folder issued by the Acheson Oildag Company, of Niagara Falls, N. Y. The company has also issued in pamphlet forms the reports of Prof. C. F. Mabery and committees of the Automobile Company of America on the lubricant.

LIGHTNING ARRESTERS.—The General Electric Company has issued Bulletin No. 4663 covering lightning arresters for both alternating and direct-current circuits. The arresters consists of a series of spark gaps shunted by graded resistances but without series resistance. The bulletin gives detailed information with regard to the various types of multi-gap arresters together with curves, illustrations, dimensions and connections, covering not only the arresters, but the auxiliary apparatus as well.

ELECTRIC VENTILATING SETS.—The B. F. Sturtevant Company, of Hyde Park, Mass., has issued Bulletin No. 106 describing its ready-to-run fans for household and other uses. The fans are of the multivane type, each fan wheel being made up of 60 spooned blades and attached to the shaft of a direct-current or alternating-current motor. The three sizes exhaust 150, 300 and 450 cu. ft. of air per minute and weigh 25, 35 and 50 lb., respectively. The outfits are applicable for ventilating rooms and offices and may also be used for blowing furnaces during the winter months.

ALUMINUM LIGHTNING ARRESTERS.—The General Electric Company's Bulletin No. 4661 is devoted to aluminum lightning arresters for alternating-current circuits of from 4600 to 110,000 volts. The arresters are built up of a number of aluminum plates immersed in an electrolyte. An hydroxide film on the surface of the plate allows a low current flow up to a certain voltage, and at a higher voltage the flow is limited only by the internal resistance of the cell which is stated to be very low. The arresters have large discharge capacity and take care of continuous and recurrent discharges.

Business Notes.

THE KUHLMAN ELECTRIC COMPANY, of Elkhart, Ind., has opened a New York office at 30 Greenwich Avenue, New York City, where all information in regard to its transformers will be supplied.

THE WATSON MACHINE COMPANY, Paterson, N. J., announces that, in addition to the cordage machinery which it has manufactured for the past 20 years, it has now added a complete line of wire-stranding, cabling, armoring, insulating and wire-rope making machines, having effected a combination with Mr. Thomas A. Aiton, who has made a specialty of this class of machinery for the past 12 years, both in this country and Europe. Mr. Aiton has entered the firm as general manager and is giving his special attention to this business.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JUNE 15, 1909.

[Conducted by Wm. F. Bissing, Pat. Law, 2 Rector St., N. Y. City.]

924,628. SYSTEM OF ELECTRICAL DISTRIBUTION; R. Braun, Manchester, Eng. App. filed Oct. 3, 1906. A load equalizer for alternating current, including a rotary converter, a direct-current dynamo electrically coupled thereto and having a flywheel, with means for varying the field strength of the dynamo as the load varies.

924,666. SYSTEM OF CONTROL; H. D. James, Pittsburgh, Pa. App. filed Oct. 3, 1906. A plurality of separately actuated main switches and automatically operated relay and interlocking switches which cause the main switches to operate in either forward or reverse order.

924,667. CONTROL SYSTEM FOR ELECTRIC MOTORS; H. D. James, Pittsburgh, Pa. App. filed Oct. 3, 1906. A generator and motor with their armatures electrically connected and resistances in the circuits of the respective fields which are operated to prevent too rapid acceleration in the speed of the motor.

924,670. SIGNAL SYSTEM; W. H. Kirnan, Bayonne, N. J. App. filed Feb. 10, 1909. A plurality of street circuit relays actuating circuit controllers which disconnect the contacts of other street circuit relays from the circuit.

924,680. AUTOMATIC VALVE CONTROLLER; N. C. Locke, Salem, Mass. App. filed Oct. 15, 1907. For an automatic engine stop in which the valve is electrically controlled.

924,712. POLE CHANGER; N. L. Wine, Polo, Ill. App. filed July 10, 1907. For producing pulsating direct currents of positive and negative polarity from the same source, and also alternating currents, by means of a rotary pole changer.

924,714. TELEPHONE SYSTEM; E. E. Yaxley, Chicago, Ill. App. filed Jan. 18, 1909. The common source of direct current supplies magnetism to the telephone receivers instead of using permanent magnets therefor.

924,716. BRUSH HOLDER FOR DYNAMO ELECTRIC MACHINES OR MOTORS; C. E. K. Zachau, Muskegon, Mich. App. filed Jan. 10, 1907. A bracket having a cam surface, a brush-holding frame and a link pivotally connecting bracket and frame with a spring to hold the frame against the cam.

924,725. SINGLE-PHASE MOTOR; S. R. Bergman, Lynn, Mass. App. filed June 5, 1908. Self-starting motor having an open-slotted stator with the main winding in some of the slots and the starting winding in the remaining slots, magnetic wedges to close the main slots and non-magnetic wedges to close the starting slots.

924,727. TARGET SIGNAL; E. F. Bliss, Schenectady, N. Y. App. filed July 15, 1908. A three-position target signal consisting of two targets pivotally mounted on a common axis, means for actuating each target independently of the other.

924,735. AUTOMATIC ELECTRIC INTERLOCK SYSTEM; J. F. Clark, Christopher, Ill. App. filed July 27, 1907. Intersecting railway tracks are provided with side tracks, switches and signals, the switches having circuits closed by an approaching train so as to side track the train and then return the switches.

924,782. FLEXIBLE CONDUIT; O. Hoppe, Brookline, Mass. App. filed June 15, 1908. For electrical conductors in which the tube is formed of a strip of spirally wound resilient material.

924,784. TROLLEY-POLE GUIDING AND FINDING DEVICE; J. J. Jagolin, Paterson, N. J. App. filed March 7, 1908. A finder is provided with a casing having converging cam slots that control forwardly and backwardly yielding fingers normally pressed out by springs.

924,785. SYSTEM OF ELECTRIC MOTOR CONTROL; H. D. James and W. A. Dick, Pittsburgh, Pa. App. filed Oct. 18, 1907. Means for governing the field resistance of a generator driven by an induction motor, the action of the field governor being delayed.

924,786. SYSTEM OF ELECTRIC MOTOR CONTROL; H. D. James, Pittsburgh, Pa. App. filed Nov. 8, 1907. For electric motors operating large variable loads which are provided with a limit switch for brinnging the motor to rest and means for slowing down the motor by weakening the field of the generator.

924,799. ELECTRICAL EQUALIZING SYSTEM; B. G. Lamme, Pittsburgh, Pa. App. filed Sept. 3, 1907. The dynamo has a mechanically coupled flywheel and is connected with the distributing circuit without the intervention of a rotary converter.

924,800. ELECTRIC SIGNAL MECHANISM FOR OVERHEAD TROLLEY SYSTEMS; H. A. Lines, West Haven, Conn. App. filed Dec. 23, 1908. Throws the lights on or off at the end of the block when the trolley car passes by means of an arm in the path of the trolley pole which controls a circuit.

924,804. ELECTRIC SLIDING OR OTHER CONTACT; V. Lowendahl, Stockholm, Sweden. App. filed March 16, 1908. For brush holders in which the metallic part is formed of metal and the second part of carbon and metal, the latter being inserted in a groove in the former.

924,826. BATTERY CONNECTION; O. E. Pettee, Rockland, Me. App. filed Oct. 14, 1908. Consists of a pin, a pocket and a pair of clamping jaws located between the pin and the pocket.

924,827. OSCILLATION RECEIVER; G. W. Pickard, Amesbury, Mass. App. filed Sept. 16, 1907. A pair of electrical conductors, brass and oxide of zinc possessing rectifying properties are placed in contact with a small thread contact between them.

924,844. FUSE BOX; H. W. Sheehy, Akron, Ohio. App. filed May 5, 1908. Consists of a casing with a reversible cutter and a fuse wire on each side of the cutter.

924,857. CONSTANT-CURRENT REGULATOR; A. A. Tirrill, Schenectady, N. Y. App. filed Nov. 4, 1907. Boosters in series with a storage battery are controlled so that the battery takes its share of the load, the booster being provided with differential field coils, one of which is varied so that the resultant of the two gives the proper magnetic flux.

924,860. RENEWABLE FUSE FOR ELECTRIC CIRCUITS; J. A. Volk, Jr., South Norwalk, Conn. App. filed March 25, 1908. Has an insulating tube with plugs having peripheral channels and a low melting fuse passing diagonally through the tubes and through the channels.

924,868. ELECTRIC WELDING MACHINE; W. C. Winfield and A. C. Taylor, Warren, Ohio. App. filed Feb. 17, 1908. For welding the seams of pipes and wheel rims. The machine has two lower work clamping and conducting jaws and two upper jaws, between which the pipe is placed.

924,910. SAFETY DEVICE FOR RAILROADS; J. W. Ledwon, South River, N. J. App. filed Oct. 27, 1908. For preventing collisions between two trains. Levers rocked by wheels of the locomotive and located along the track control electric circuits so as to give a signal in the cab of the other locomotive.

924,916. ARC LAMP; B. Monasch, Berlin, Germany. App. filed July 9, 1908. Arc lamps with converging electrodes; prevent creeping up of the arc by providing a magnet traveling downward with the electrode, which when it approaches the arc blows it out.

924,927. ELECTRICAL EQUALIZING SYSTEM; J. S. Peck, Manchester, Eng. App. filed Nov. 8, 1907. A dynamo has a flywheel mechanically coupled thereto and is connected with the distributing circuit without the intervention of a rotary converter.

924,952. SNAP SWITCH; J. H. Wyatt, Philadelphia, Pa. App. filed April 28, 1908. The contact carrying member is restrained in both positions by a detent actuated by a spring.

924,968. ELECTRICAL SIGNALING SYSTEM FOR RAILWAYS; C. Crandall, Newport, R. I. App. filed July 2, 1908. For signaling engineers of locomotives by means of semaphores, and wireless transmission from the line to an aerial on the locomotive.

924,975. VAPOR ELECTRIC LAMP; S. Ferguson, Schenectady, N. Y. App. filed June 29, 1904. A solenoid with a vapor electric device having a contact making cap and a spring contact in the interior of the solenoid for engaging with the cap.

924,977. ELECTRICAL APPARATUS; W. J. Foster, Schenectady, N. Y. App. filed Feb. 1, 1906. Short-circuiting collars for the pole pieces of dynamos having ribs to diminish the transfer of heat from the conductor to the collar.

924,989. MERCURY METER; F. Holden, London, Eng. App. filed March 19, 1907. Improved construction of paddle wheel for a mercury meter containing a mercury chamber in which the wheel is located.

924,991. ALTERNATING-CURRENT, DYNAMO-ELECTRIC MACHINE; D. C. Jackson, Madison, Wis. App. filed Feb. 23, 1904. For controlling the speed and torque of an alternating-current motor by having a field magnet supplied with alternating-current, a commutated winding and a second set of brushes which reduces the sparking and provides a more accurate speed regulation.

924,992. DYNAMO-ELECTRIC MACHINE; D. C. Jackson, Madison, Wis. App. filed Oct. 23, 1905. An armature with a commutated winding, a resistance in the conductor connecting the winding with the commutator, and induction coils bridged between adjacent conductors at a point between the resistances and the armature winding.

925,026. BLOCK-SIGNAL SYSTEM; F. Rhea, Schenectady, N. Y. App. filed April 6, 1909. Inserts a reactive winding in the track circuit and employs the voltage drop produced thereby for actuating the track relay to initiate an additional signal movement.

925,050. ELECTRIC HEATING DEVICE; W. Sprenger, Lynn, Mass. App. filed March 30, 1908. An electrically heated tool, a supporting stand, and connections whereby the heating current is cut off the tool and applied to the stand when the tool is placed on the stand.

925,054. PROTECTIVE DEVICE FOR ELECTRIC CIRCUITS; J. B. Taylor and D. S. Carpenter, Schenectady, N. Y. App. filed March 15, 1907. The switch has a movable blade for each side of the circuit; a line discharge terminal is mounted on each blade and a grounded discharge terminal co-operates with both line terminals when the switch is closed.

925,055. MEASURING INSTRUMENT; E. Thomson, Swampscott, Mass. App. filed May 11, 1908. Hot-wire instrument for measuring alternating current by means of the tone produced by the currents passing through the wire.

925,056. ELECTRIC SOLDERING IRON; T. Van Aller, Schenectady, N. Y. App. filed March 25, 1908. A soldering iron having an electric heating unit and a separable tip in heat-conductive relation to the unit.

925,060. VAPOR-ELECTRIC APPARATUS; E. Weintraub, Schenectady, N. Y. App. filed Dec. 21, 1903. A vaporizable cathode, a receiver for wireless waves and means controlled by the waves for starting the lamp or cathode to act as a receiver.

925,064. ELECTRIC METER; W. R. Whitney, Schenectady, N. Y. App. filed March 16, 1907. An electric meter whose electrolyte is permanently changed in color by reaction with ions and a source of electromotive force to cause the ions to migrate through the electrolyte.

925,069. RHEOSTAT; P. H. Zimmer, Schenectady, N. Y. App. filed April 6, 1908. A rheostat having a series of contacts with a controlling arm biased to initial position, a member frictionally engaged with the arm and a no-voltage magnet for holding the member.

925,093. SUPPLY SYSTEM FOR TELEPHONE CIRCUITS; J. L. Hall, Schenectady, N. Y. App. filed June 8, 1906. Current supply systems for telephone circuits using a dynamo having a uniform homopolar field to avoid pulsations.

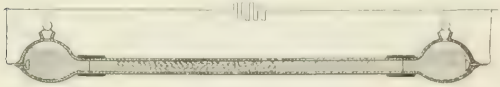
925,131. TROLLEY HARP AND WHEEL; F. F. Hancock, Sherman, Cal. App. filed April 20, 1908. The harp has side plates having slots in which the wheel arbor moves.

925,100. CUT-OUT CABLE FOR COMMON BATTERY TELEPHONES; R. S. Hayes, C. E. Johnson and H. W. Scott, Fort Wayne, Ind. Assignors to Home Tel. Co. A number of telephone apparatus, a common battery and an exchange connected, with the connections so arranged that a ground on the outgoing current will operate the cut-out coil, and upon the called subscriber to make the proper connection.

925,104. ELECTRICAL DISTRIBUTION SYSTEM; H. M. Hobart, London, Eng., and F. Creed, Bremen, Germany. App. filed Jan. 4, 1909. A distributing transformer provided in connection with a traction line, the transformer primary being put in circuit with a fraction of the total primary winding.

925,108. MOTOR CONTROLLING DEVICE; R. M. Klein and D. R. Sperry, Madison, Wis. App. filed March 23, 1908. Motors are used in connection with automatic machines for varying their speed and have automatic starters, such as a rheostat with means for automatically varying the resistance of the rheostat to cause the motor to rotate at different speed.

925,110. CAR-LIGHTING SYSTEM; S. Krohn, Charlottenburg, Germany. App. filed Feb. 28, 1907. A lighting system for electric cars



925,264. Electric Meter.

having a plurality of sets of lamps, a source of current varying in potential and means for automatically changing the currents of the lamps from series to parallel as the potential supplied varies.

925,113. ELECTRICAL MEASURING INSTRUMENT; W. J. Lloyd, Rugby, Eng., and L. Wilson, Denver, Col. App. filed May 21, 1907. A measuring instrument having a high torque and uniform scale in which a current-carrying conductor moves in a magnetic field of varying strength and a magnetic control responsive to variations of strength in the field provides a counter torque to a spring acting on the conductor.

925,123. SIGNAL MECHANISM; W. V. Moak, Schenectady, N. Y. App. filed Nov. 18, 1908. A semaphore three-position signal worked from an electric motor. Details.

925,125. ELECTRIC METER; P. C. Morganthaler, Fort Wayne, Ind. App. filed Jan. 17, 1908. Improvements in shipping devices for meters to avoid breaking the jewel. The lower thrust-bearing is controlled by a lever, so that the shaft may be raised from the bearing.

925,132. DYNAMO-ELECTRIC MACHINE; H. G. Reist, Schenectady, N. Y. App. filed Feb. 29, 1908. For driving rolling mills in which a breakable spindle is placed between the dynamo-electric machine and the rolling mill.

925,137. AUTOMATIC BRAKE SYSTEM; W. U. G. Shaw and O. Johnson, Lafayette, Ind. App. filed Jan. 22, 1908. Electrically operated brake system for railways employing sectional ground conductors which close a circuit when two cars or engines are in the same bolck, shut off the power and apply the brakes.

925,155. ELECTRIC FLUID HEATER; C. C. Chesney, Pittsfield, Mass. and H. B. Wilson, Schenectady, N. Y. App. filed March 12, 1908. A continuous flow heater for heating water provided with a reservoir and pipe connections for maintaining a circulation between the reservoir and heater.

925,160. ELECTROMAGNETICALLY CONTROLLED SWITCH; A. S. Cubitt, Schenectady, N. Y. App. filed March 30, 1908. The operation of the switch is retarded for a time interval after the coil is energized. Details.

925,165. CONDENSER; A. R. Everest, Lynn, Mass. App. filed Aug. 7, 1905. A high-potential, large capacity condenser consisting of a box-like frame supporting pins of insulating material with plates of conducting material supported at their edges by the pins.

925,166. ARC LAMP; W. C. Fish and R. Fleming, Lynn, Mass. App. filed May 29, 1903. For flaming arcs in which the chimney can be readily removed for cleaning.

925,168. FASTENING FOR ELECTRICAL SIGN RECEPTACLES; E. H. Freeman, Trenton, N. J. App. filed Feb. 4, 1909. An electrical sign receptacle in which the supporting element has a plain round hole into which the receptacle can be inserted and is provided with keeper notches, a fastening device and binding screws.

925,171. CIGAR LIGHTER; A. C. Gruhlke, Waterloo, Ind. App. filed April 23, 1908. A torch cigar lighter which can be saturated with alcohol and ignited by an electrical spark.

925,179. TELPHER SYSTEM; B. W. Harris, Buffalo, N. Y. App. filed June 18, 1908. The cars are run by individual motors and travel on suitable tracks supplying current to the motor and supplied with current from a suitable generator.

925,185. ELECTRICITY METER; S. H. Holden, Birmingham, Eng. App. filed July 18, 1908. A continuous-current, watt-hour meter having an electromagnet, a mercury chamber and a disk armature in said chamber, a socket in the armature, a spindle in the socket and a removable brake disk on the spindle.

925,187. ELECTRICITY METER; G. Hookham, Birmingham, Eng. App. filed July 18, 1908. A motor mercury meter in which the armature revolves in a mercury bath and in which additional space for the mercury is provided and the mercury sealed up in transit to prevent loss by means of an auxiliary chamber.

925,225. SWITCH; L. Quattlebaum, Decatur, Miss. App. filed Oct. 29, 1908. A knifeblade switch in which the blade has a pivoted and sliding connection with a central terminal post so as to permit its engagement with either one or both of the end posts.

925,254. DYNAMO-ELECTRIC MACHINE; J. B. Wiard, Lynn, Mass. App. filed April 29, 1907. A dynamo having a distributed winding and a separate connection ring comprising an annular support and a plurality of independent conductors carried thereby for connecting between the coils.

925,270. ELECTRIC GEAR CHANGING MECHANISM FOR AUTOMOBILES; F. Beemer, Philadelphia, Pa. App. filed Aug. 5, 1907. A speed gear changed mechanism operated by solenoid magnets which throw the change gears in and out.

925,271. CORE SPACING MEMBER FOR DYNAMO-ELECTRIC MACHINES; B. A. Behrend, Norwood, Ohio. App. filed Aug. 31, 1906. For ventilating laminated cores by means of spacing members comprising

925,272. DYNAMO-ELECTRIC MACHINE; B. A. Behrend, Norwood, Ohio. App. filed May 31, 1906. A dynamo having a housing with the housing for cooling.

925,[illegible]. RECEIVER FOR WIRELESS SIGNALING; H. C. [illegible], Pa. App. filed April 21, 1908. [illegible]

925,[illegible]. CABLE CONDUIT FOR H. W. Cooper, Norwood, Ohio. App. filed [illegible]

925,[illegible]. CENTRIFUGAL ELECTRIC SWITCH; F. L. Dyer, Cincinnati, Ohio. App. filed April [illegible]

925,[illegible]. PROCESS FOR FACING STEREOTYPE METAL; W. R. Fisher, San Francisco, Cal. App. filed Dec. 14, 1908. Facing stereotype [illegible] electrodepositing the copper.

925,322. RAILWAY SIGNAL AND TRAIN CONTROLLING MECHANISM; E. E. Flora and R. J. Zorge, Chicago, Ill. App. filed May [illegible] combination of torpedo-placing mechanism with a train-controlling means located between the point to be protected and the torpedo placer and having a stop arm.

925,[illegible]. RHEOSTAT AND CONTROLLING DEVICE; H. D. [illegible], Pittsburgh, Pa. App. filed March 31, 1909. A supply circuit, with two resistances in parallel thereto and a distributing circuit connected to the resistances and shunts for one-half of each of the resistances.

925,343. SWITCH FOR RAILWAYS; F. H. Kaiser, Buffalo, N. Y. App. filed Oct. 2, 1907. A switch for electric railways controlled by the current propelling the car, by means of a motor driving the switch point through a worm gear.

925,345. SWITCH AND DETECTOR BAR THROWING MECHANISM; C. R. Keeran, Bloomington, Ill. App. filed Feb. 19, 1908. For throwing switch points by electrical means, such as a motor, and for automatically locking the switch points during the initial part of the movement of the detector bar, the motor being connected to the switch by means of a clutch.

925,353. ELECTRIC SIGNALING SYSTEM FOR RAILWAYS; F. Lacroix, San Antonio, Tex. App. filed Jan. 24, 1907. A cab signal with means for sending signals from the cab, as well as receiving them.

925,355. METHOD OF AND MEANS FOR OPERATING DYNAMO-ELECTRIC MACHINES; B. G. Lamme, Pittsburgh, Pa. App. filed Aug. 2, 1906. For operating dynamos as generators or motors particularly. Alternating-current motors of the commutator type are employed to propel vehicles and to act as braking generators.

925,356. ELECTRICAL LOAD EQUALIZING SYSTEM; B. G. Lamme, Pittsburgh, Pa. App. filed Nov. 6, 1908. See 925,357. The field magnets are supplied with electromotive forces differing in phase from those of the circuit with which the armatures are associated, and the electromotive force of the armature circuits are associated in accordance with variations of amount of current required of the distributing circuit.

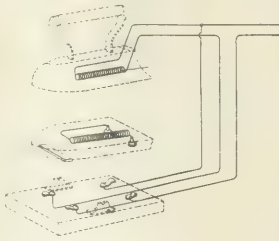
925,357. ELECTRICAL EQUALIZER SYSTEM; B. G. Lamme, Pittsburgh, Pa. App. filed Nov. 30, 1908. For polyphase system. Combines a two-phase distributing circuit with two mechanically coupled dynamos, each having its armature associated with one pair of conductors of the circuit and its field with the other pair.

925,365. METALLIZATION OF VITROUS CERAMIC SURFACES; O. Marino, London, Eng. App. filed July 31, 1908. Deposits silver and a copper salt on earthenware.

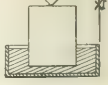
925,385. SYSTEM OF TRANSMISSION; E. Riecke, Berlin, Germany. App. filed March 20, 1908. For transmitting power to mills in which a flywheel motor generator is used, the flywheel acting on excessive loads. The voltage of the generator is decreased when the motor of the fiywheel motor generator is overloaded.

925,392. DYNAMO-ELECTRIC MACHINE; G. B. Schley, Norwood, Ohio. App. filed Oct. 31, 1906. Particularly for three-wire systems in which a three-wire dynamo is provided with suitable field windings to prevent sparking at the brushes.

925,403. ELECTRICAL INDICATING INSTRUMENT; H. L. Van Valkenburg, Norwood, Ohio. App. filed Sept. 20, 1906. A movable



925,050.—Electric Heating Device.



925,827.—Oscillation Receiver.

scale and indicator, the scale remaining stationary until the indicator has moved a predetermined amount.

925,412. ELECTRIC INSTRUMENTS; H. G. Addie, Cresco, Ia. App. filed Feb. 5, 1908. For testing fuses to be carried in the pocket. A buzzer is located in the casing and also an electric lamp, the casing carrying contact members to complete the circuit.

925,420. MEANS FOR DISCONNECTING TELEPHONE LINES; M. Bowman, McHenry, Md. App. filed July 7, 1908. Makes and breaks the connection within the house by a controlling chain, on account of an approaching storm, etc.

925,439. GONG-STRIKING MECHANISM; H. E. Reeve, New York, N. Y. App. filed Jan. 22, 1909. An electromechanical bell driven by a spring train and checked by a stop having a rotatable hammer.

925,441. CIRCUIT BREAKER; H. W. Cheney, Norwood, Ohio. App. filed Sept. 25, 1905. For railways in which a pair of stationary contacts are bridged by a movable contact consisting of a bundle of laminæ, a holder having a pair of slotted ears, with a lever having projections engaging the slots and a spring between the lever and holder.

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